ARTHROPODS OF FLORIDA

And Neighboring Land Areas

VOLUME 8

THE SCARAB BEETLES OF FLORIDA

(COLEOPTERA: SCARABAEIDAE) PART I. THE LAPAROSTICTI (SUBFAMILIES: SCARABAEINAE, APHODIINAE, HYBOSORINAE, OCHODAEINAE, GEOTRUPINAE, ACANTHOCERINAE)

By
ROBERT EUGENE WOODRUFF
Taxonomic Entomologist

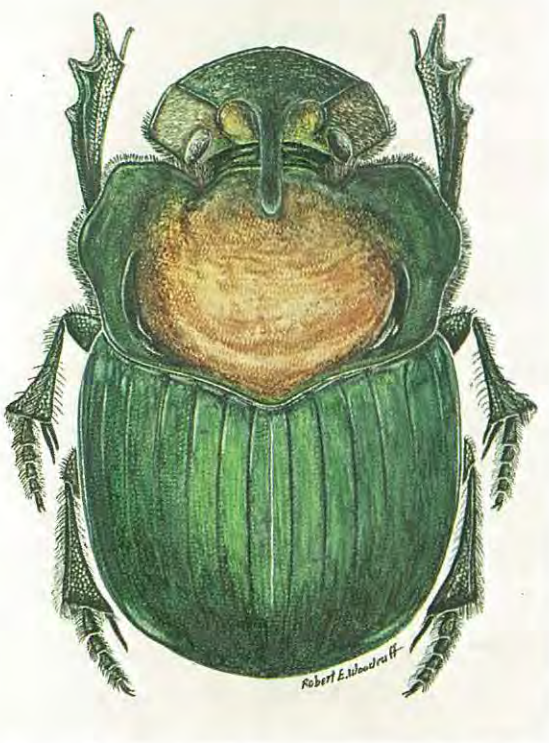

Fig. 1 **Phanaeus igneus floridanus** d'Olsoufieff (male)
(actual size = 18mm)

FLORIDA DEPARTMENT OF AGRICULTURE
AND CONSUMER SERVICES
Doyle Conner, Commissioner

DIVISION OF PLANT INDUSTRY
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FOREWORD

Beetles of the family Scarabaeidae are both destructive and beneficial. Many, like the Japanese beetle and Asiatic garden beetle, along with the larvae or "white grubs", cause millions of dollars damage annually. Others are economically important because they are intermediate hosts for parasites of domestic animals. Most of the dung beetles are important elements in the pasture ecosystem where they annually break down tons of animal dung. By doing so they incorporate much of it into the soil, increasing fertility, and at the same time destroying the habitat for the larvae of many pest flies.

This group of beetles is one of the largest in the animal kingdom, represented by perhaps 30,000 species. Scarabs have been subjects of interest throughout recorded history. They were worshipped by the ancient Egyptians, and their images are found in precious stones of both ancient and modern jewelry. Many of the early naturalists (e.g., Fabre) found their behavior unique and fascinating, but it is still poorly understood today. Few generalizations can be made, because of the specific nature of the biology, ecology, and behavior of each species.

The present faunal study is provided as a manual to assist in the identification of the Florida species. The specific identity of an organism is paramount to an understanding of the role it plays in the environment. The name is the "key" to the published literature, and an absolute must before controls are attempted. It is unfortunate that we do not have adequate guides for insect identification as we do with birds, mammals, fish, reptiles, and amphibians. There are inherent difficulties because of insects' small size; but the primary reason for the lack of such identification manuals is that thorough faunal studies have not been conducted on much of our planet. Dr. Woodruff's manual is based on an extensive survey over a 15 year period and on the examination of over 1 million specimens. He brings together all the existing information about each species, provides drawings and photographs, and presents keys for the identification of the Florida scarabs.

Dr. Woodruff was born on 20 July 1933 at Kennard, Ohio. He has been interested in the natural sciences since childhood, and he entered the Junior Science Fairs of the Ohio Academy of Science, in 1950 and 1951, receiving superior awards both years and a scholarship to any of the 10 state universities. He enrolled at Wabash College (Crawfordsville, Ind.) in 1951, and the following year he transferred to Ohio State University from which he received the B.S. degree in 1956.

From 1952 to 1955 he was an assistant in the Dept. of Natural History of the Ohio State Museum where he gained valuable experience and training under Dr. Edward S. Thomas and Mr. Robert Goslin. From 1955 to 1957 he held a graduate assistantship in the Dept. of Zoology and Entomology at Ohio State University, under Prof. J. N. Knull. It was this experience which led him to specialization on the beetle family Scarabaeidae. Prof. Knull introduced him to the "scratch board" technique of beetle drawings which he has used in most of his publications and for the 32 habitus drawings presented herein.

From 1957 to 1958 he was employed as a medical entomologist with the Kentucky State Health Dept. (Louisville) working on St. Louis Encephalitis and related mosquito projects. He attended special courses of instruction on insects of medical importance from the U. S. Public Health Service, Communicable Disease Center, Atlanta, and from the Tennessee Valley Authority, Wilson Dam, Alabama.

In March 1958 he joined the staff of entomologists at the State Plant Board of Florida (now Division of Plant Industry). He was initially employed as the "Survey Entomologist" to coordinate the federal-state Cooperative Economic Insect Survey which he fulfilled until 1963. His taxonomic responsibilities are for the insect orders Orthoptera and Coleoptera. His current duties include the identification and curatorial responsibilities for these orders and the development of the entomological portion of the DPI library.

In September 1963 he entered the Graduate School of the University of Florida, from which he received the PhD degree in 1967. As a part of his studies he attended a session of the Organization for Tropical Studies at the University of Costa Rica. His research for the dissertation culminated in the original version of the present study. In the subsequent 5 years much study and collecting has resulted in more than doubling the data on Florida scarabs.

His research has taken him to much of the U. S. and the following countries where he has collected and studied specimens: Argentina, Australia, Bolivia, Brazil, Colombia, Costa Rica, Cuba, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Peru, and Venezuela.

He has attended more than 20 national and international scientific meetings, including the recent 14th International Congress of Entomology in Canberra, Australia. He has presented papers at meetings of the Entomological Society of America, Florida Entomological Society, National Pest Control Association, Ohio Academy of Sciences, and Sociedad Mexicana de Entomologia.

He is a member of the Association for Tropical Biology, Coleopterists Society, Entomological Society of America, Florida Entomological Society, Gamma Sigma Delta, Phi Kappa Psi, Sigma Xi, Sociedad Mexicana de Entomologia, and Society of Systematic Zoology.

He has been a Research Associate in Natural Sciences of the Florida State Museum since 1962. He was recently elected to the Board of Directors of the "North American Beetle Fauna Project." He has served as merit badge counsellor for the Boy Scouts in all Natural History subjects. He has received grants from the Ohio Academy of Sciences, United States Public Health Service, National Science Foundation, Smithsonian Institution, United States Department of Agriculture, Australian Academy of Sciences, and the

Florida State Museum. In 1971 he attended the Summer Institute for Systematics at the Smithsonian Institution. He is listed in American Men of Science, Directory of Coleoptera Collections, Directory of Zoological Taxonomists, International Scholars Directory, Personalities of the South, and Who's Who in the South and Southwest.

He served as Editor for the "Journal of the Newell Entomological Society" when he was President in 1965-66. He was Editor of the "Coleopterists Newsletter" in 1970. He has been Associate Editor of the "Florida Entomologist" since 1969. He has been Editor of the "Coleopterists Bulletin" since 1971. He was recently appointed as Managing Editor of "Insect World Digest."

He has published over 80 scientific papers, most of which deal with his primary research interests on the systematics, biology, and ecology of the beetle family Scarabaeidae, with special emphasis on dung beetles and those inquilines associated with ants and termites. Recently his design was chosen in competition as the symbol for the XV International Congress of Entomology to be held in Washington, D. C. in 1976.

Harold A. Denmark
Chief of Entomology
Division of Plant Industry
Florida Department of Agriculture
and Consumer Services

PREFACE

This study began in 1958 when I joined the staff of the Division of Plant Industry, Florida Department of Agriculture and Consumer Services (formerly Florida State Plant Board). My interest in the family Scarabaeidae dates back to 1954 when I started a similar study of the fauna of Ohio. Most of the earlier years were devoted to extensive collecting in order to become acquainted with the species and to obtain distributional data. Only in the past few years has this information been organized into the present study. The original manuscript for this study was submitted in 1967 as a dissertation to the Graduate Council of the University of Florida in partial fulfillment of the requirements for the degree of Doctor of Philosophy. The general format remains the same, although the basic information has been up-dated and the number of records has more than tripled.

Faunal studies are fairly complete for most of the vertebrate animals, but they are woefully lacking for most invertebrate groups. In Florida there have been several noteworthy exceptions in the insects: Odonata of Florida (Byers, 1930), Mayflies of Florida (Berner, 1950), Water Beetles of Florida (Young, 1954), and the previous volumes in the present series [e.g., Lepidoptera of Florida (Kimball, 1965); Armored Scales of Florida (Dekle, 1965)]. Other similar volumes are in preparation as a part of this series on the Arthropods of Florida.

Herbert Osborne, one of our greatest pioneer entomologists, once said (1912:63): "While the preparation of such [faunal] lists may by some be considered as a rather easy part of entomological investigations, it appears to me that accurately done work of this kind [faunal studies] becomes of the highest scientific value, and that we may very well encourage it to the greatest extent possible." In a paper presented to the Florida Academy of Sciences on the opportunities for research in Florida, Kurz (1937:8) stated that ". . . it becomes readily apparent that we need local or regional 'floras' and 'faunas' by which naturalists can readily and with certainty identify species of particular interest." His statement is equally applicable 35 years later.

Our ecological problems and the fragility of our environment, of which the general public has recently become aware, has long been well-known to natural history students. I am convinced that faunal and floral studies, verified by permanently preserved museum specimens, are just as important a part of "environmentalism" as anti-pollution campaigns. We should at least know what we have destroyed!

Florida is an ideal state for faunal studies because it is a peninsula and is delimited on three sides. It is an important area from a zoogeographic standpoint because of the proximity of the West Indies and because of the high percentage of endemic species. A symposium on Floridian-Antillean zoogeography, held at the 1960 meetings of the Entomological Society of America, suggested that only a few groups of insects had been sufficiently studied in both areas to draw general conclusions. This study should help fill that need.

The present study is not merely taxonomic, nor is it ecological, biological, ethological, or zoogeographical; it is faunal in nature, encompassing all of these disciplines. It is a compilation of all existing information, including both published and original data. It is probably based on a greater number of specimens of this family than have been studied from any other state in the U. S., or in fact any comparable geographic area in the New World. It should be primarily useful to those who wish to identify Florida specimens and then to determine what is known about a particular species. If it serves this purpose and stimulates additional studies, I will be adequately rewarded for the efforts involved in its preparation.

ACKNOWLEDGMENTS

As an entomologist with the Division of Plant Industry, Florida Department of Agriculture and Consumer Services, I have been able to pursue several aspects of this work over a period of 15 years. For their encouragement and understanding I thank the following administrators of this organization: The Honorable Doyle E. Conner, Commissioner of Agriculture; H. L. Jones and the late W. G. Cowperthwaite, Directors, Division of Plant Industry; and H. A. Denmark, Chief, Bureau of Entomology.

I have also had the benefit of close association with my colleagues on the staff of the Division of Plant Industry: G. W. Dekle, F. W. Mead, and H. V. Weems, Jr. They have provided specimens, advice, and companionship on many field trips.

In addition to support from the Florida Department of Agriculture, I have received several grants which provided funds for travel, technicians, and general assistance from: 1) the National Science Foundation (for a summer traineeship through the Organization for Tropical Studies in Costa Rica and for participation in the Summer Institute for Systematics at the Smithsonian Institution); 2) the University of Florida (for field work in Jamaica through National Institute of Health grants and for study of the scarab inquiline associated with the imported fire ant in the United States and South America, through USDA grants); and 3) the Australian Academy of Sciences, the Commonwealth Scientific and Industrial Research Organization, the University of Florida, and Dr. H. E. Hinton for aid in attending the International Congress of Entomology in Australia, and for field work in Australia.

I am indebted to several museums for the loan of specimens and for the use of their facilities during personal visits. Letters in parentheses in the following list are abbreviations used in the text when citing material; the name of the curator(s) who provided assistance is listed after the abbrevation: Academy of Natural Sciences of Philadelphia (ANSP), S. S. Roback; American Museum of Natural History (AMNH), M. A. Cazier, Patricia Vaurie; Canadian National Col-

lection (CNC), H. F. Howden; Chicago Natural History Museum (CNHM), R. L. Wenzel, H. S. Dybas; *Florida State Collections of Arthropods (FSCA), H. V. Weems, Jr.; Museum of Comparative Zoology (MCZ), P. J. Darlington, J. F. Lawrence; North Carolina State University (NCS), T. B. Mitchell; Ohio State University (OSU), J. N. Knull, F. J. Moore, C. A. Triplehorn; Purdue University, Blatchley Collection (PU), Leland Chandler; United States National Museum (USNM), O. L. Cartwright, R. D. Gordon, P. J. Spangler; University of Florida (UF), T. J. Walker, L. C. Kuitert; University of Miami (UM), H. F. Strohecker; University of Michigan Museum of Zoology (UMMZ), R. D. Alexander, and T. H. Hubbell.

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Light traps were one of the greatest sources of material for this study. Samples were obtained from a network of stations throughout the state with the aid of the following individuals: W. W. Baker, A. H. Boike, P. E. Briggs, R. E. Brown, S. H. Brown, F. A. Buchanan, T. W. Boyd, F. S. Blanton, E. M. Collins, Jr., H. W. Collins, L. Collins, E. E. Crooks, G. W. Desin, C. F. Dowling, H. M. Faircloth, E. H. Frederic, J. C. Hanlon, D. L. Harris, E. I. Hazard, L. A. Hetrick, J. Hayward, E. W. Holder, Jr., E. G. Kelsheimer, R. L. King, J. H. Knowles, M. Lutrick, D. L. Mays, E. S. Mercer, R. T. McMillan, E. P. Merkel, M. L. Messec, T. Morris, A. L. O'Berry, J. W. Patton, J. W. Perry, A. M. Phillips, W. H. Pierce, J. E. Porter, W. C. Rhoades, R. W. Swanson, W. B. Tappan, L. W. Taylor, J. W. Wilson, D. P. Wojcik, and D. O. Wolfenbarger.

The greatest number of specimens, from a single location, was received from Tall Timbers Research Station, Leon County, Florida. I take pleasure in thanking the Tall Timbers Foundation and particularly the following personnel for various favors: E. V. and Roy Komarek, W. W. Baker, D. L. Harris, Leroy Collins, W. H. Whitcomb, Awinash Bhatkar, and R. H. Arnett, Jr.

I wish to thank a great many individuals, especially inspectors of the Division of Plant Industry and U. S. Department of Agriculture, for providing assistance and specimens. Space does not permit a full listing here, but their names are included in the appendix as collectors. For photographic assistance I am indebted to the Division of Plant Industry photographers, E. M. Collins, Jr., Mildred Eaddy, Jerry Messec, and E. L. Wells. I wish to thank the following librarians of the Division of Plant Industry for assistance in locating references: Marguerite Batey, Louise Henley, Irene Ayres, and Andrew Kolesar. I am grateful to W. A. Auffenberg, Curator of Natural Sciences, Florida State Museum, for providing unpublished data for the distribution map of the gopher tortoise in Florida. P. S. Callahan and Patricia Carlisle (USDA, Basic Behavior Lab, Gainesville) provided assistance in the form of stereoscan photos. For assistance in nearly all aspects of the work, I thank my technician, Brenda Beck, and my secretary, Irene Ayres.

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Last, but not least, I wish to thank my wife, Evelyn, for her constant encouragement and great care and perseverance in typing the manuscript.

*The Florida State Collection of Arthropods is composed of several collections which were previously maintained as separate: Univ. Fla., Agr. Exp. Sta.; Univ. Fla., Dept. Entomology; Florida State Museum; Florida State Plant Board; and Division of Plant Industry. My private collection (REW) of Scarabaeidae is located with this collection which is housed by the Division of Plant Industry, Florida Dept. Agr., Gainesville, Fla. 32601.

ABSTRACT

In this faunal study 248 species and subspecies of Scarabaeidae are recorded from Florida. Only the Laparosticti, representing 115 species and subspecies, are treated in detail, although a checklist is provided for the entire family. Keys are presented for the identification of all taxonomic units, with many of the morphological characters illustrated by line drawings or stereoscan photographs. Habitus drawings are presented for one representative of each of the 32 genera of Florida Laparosticti.

Data are presented for each species in the following format: synonymy, diagnosis, taxonomic notes, distribution and zoogeography, biology, specimens examined, and selected references. Distribution maps, showing detailed Florida records and the general range, are provided for all species. Data from well over 1 million specimens are presented in tabular form in the appendices. The bibliography contains 643 references. Numerous habitat photographs are included.

The following taxonomic changes are made: *Aphodius geomysi* Cartwright is synonymized under *Aphodius aegrotus* Horn; *Peltotrupes profundus dubius* Howden is synonymized under *Peltotrupes profundus* Howden; *Phanaeus vindex cyanellus* Robinson and *Phanaeus difformis magnificens* Robinson are synonymized under *Phanaeus vindex* MacLeay.

INTRODUCTION

The family Scarabaeidae is one of the largest families of beetles in the world. Arnett (1966:166) estimated the number of species at 18,000, although this is probably a conservative figure. In America north of Mexico there are approximately 1,400 described species, of which only about 600 were recognized in 1910 (Blatchley, 1910:910). Thus the number has more than doubled in the past 60 years.

The taxonomy of the U. S. species is relatively stable—that is, few species are described each year. Several taxonomists (e.g., Cartwright, Dawson, Gordon, Hardy, Howden, Matthews, Sanderson, Vaurie, and myself) are actively engaged in revising certain portions of the family. Numerous generic revisions, during the past 15 years, have clarified many of the problems, but much remains to be done. Many genera of Melolonthinae and Rutelinae have been so incompletely studied that it will be several years before their taxonomy is on a par with the better studied groups.

Although taxonomically the family is one of the better known of the larger families, the literature is voluminous, scattered, and often difficult to secure. The family has never been monographed for North America or the U.S., and as Arnett (1962:410) stated, "A comprehensive survey of this group is badly needed." Such an undertaking would be a worthwhile but extremely time consuming proposition, and such an opus is not imminent. I therefore believe that local or regional faunal studies such as this will help fill this void.

Many of the gaps in our knowledge become especially apparent after a detailed local faunal study. And unfortunately, because of the large number of species involved, it has not been possible to pursue and clarify many of the problems encountered. However, I have tried to point them out in the species discussions, hoping they will stimulate future work along these lines.

The family is one of the most diverse in the order Coleoptera, not only in morphology, but in biology, ecology, and behavior. On the basis of morphology and habits it has been divided into two groups—the Laparosticti and the Pleurosticti. The former was characterized by having the abdominal spiracles situated in a line on the membrane between the sternites and tergites (Fig. 3), and included the dung-feeding and scavenger species. These are represented in Florida by the following six sub-families: Scarabaeinae, Aphodiinae, Geotrupinae, Hybosorinae, Ochodaeinae, and Acanthocerinae. The Pleurosticti were characterized by having most of the abdominal spiracles situated on the upper portion of the sternites (Fig. 2, 4), and included primarily the plant feeders and chafers. These are represented in Florida by the following four subfamilies: Melolonthinae, Rutelinae, Cetoniinae, and Dynastinae. Although current concepts indicate that the division into Laparosticti and Pleurosticti is probably untenable (Ritcher: 1969a), they are used here for convenience (see discussion under morphology).

Due to limitations of time and space I have treated the family in two parts, the first of which deals only with the Laparosticti. However, data have been accumulated for the Pleurosticti during this study, and a similar volume is in preparation on that group. A preliminary checklist of the Florida species in both groups is included.

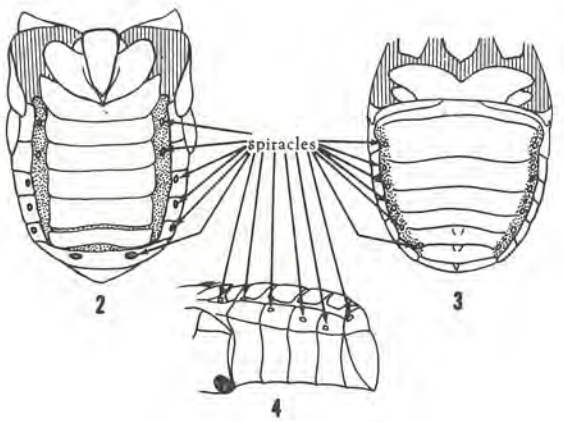


Fig. 2-4. Spiracle location in the Laparosticti and Pleurosticti: 2) Dorsal view of the abdomen of **Euphoria sepulchralis** (Fab.) with the elytra and wings removed. Note the characteristic positions of the spiracles found in the Pleurosticti. 3) Dorsal view of the abdomen of **Copris minutus** (Drury) with elytra and wings removed. Note the characteristic position of the spiracles found in the Laparosticti. 4) Lateral view of the abdomen of **Euphoria sepulchralis** (Fab.).

Any faunal study obviously will not be up-to-date when it is published. Specimens are constantly being added to the collections which will modify the statements made under the species discussions. Nearly all material on hand has been recorded, except in the subfamily Aphodiinae. In this subfamily over 1 million specimens have been sorted from light trap samples and await processing. The time required to sort, identify, and record this number would unduly delay completion of the manuscript, and more material would accumulate in the meantime.

Historical Resumé

There have been scattered records of Florida Scarabaeidae since the beginning of binomial nomenclature (Linnaeus, 1758). Aside from the descriptions of new species, the first list of Florida species was that of Schwarz (1878). In this list of Florida Coleoptera, based on previous records and 12 locations visited by the author, he recorded 84 species of Scarabaeidae. Schaupp (1878) added four species to this list. Horn (1880) recorded a single species in his treatise on the Coleoptera of the Florida Keys. Hubbard (1894) described three new dung feeding species in his classic study of the guests of the Florida land tortoise. Slosson (1893) recorded one species from Pensacola and eight species from Suwannee Springs. Hamilton (1894) recorded 11 species from Lake Worth and added 6 species later (1895). Slosson (1895) added two species to the Lake Worth list. Castle and Laurent (1896) listed 14 species from the vicinity of Enterprise. Wickham (1909) reported 26 species from 7 Florida localities.

Blatchley, between 1902 and 1927, published numerous notes on the Florida fauna, culminating in his "Scarabaeidae of Florida" (1927-30). In this study he listed 194 species and subspecies for the state, although he included all records regardless of their validity. More will be said about this paper later.

C. C. Goff studied the arthropods in the burrows of the Florida pocket gopher and gopher tortoise. In the first he found five scarabs, three of which were undescribed (Hubbell and Goff, 1939), and in the latter he recorded seven scarabs (Young and Goff, 1939). Young and Thames (1949) listed 42 species of *Phyllophaga*, and Dawson (1952 & 1967) recorded 15 species of *Serica*. Frost (1964) recorded 23 species from blacklight traps at Archbold Biological Station (Highlands Co.). In the present study I have recorded 248 species and subspecies, excluding all previous erroneous records but including 11 questionable species (indicated by an asterisk on the checklist).

There have been only three extensive faunal studies of the family Scarabaeidae in portions of the U. S. These are: Blatchely (1910) in his "Coleoptera of Indiana"; Dawson (1922), the "Scarabaeidae of Nebraska"; and Blatchley (1927-30), the "Scarabaeidae of Florida." The latter was less comprehensive than the other two, containing no keys to separate the species nor any illustrations. It was based on most of the available collections at the time, but the State had been poorly surveyed. One of the major advances in collecting, the blacklight trap, has come about since that study.

Collecting Techniques

The diversity of food, habitats, and behavior of the many species requires a similar diversity in collecting techniques. Nearly every habitat, except aquatic, has some species of Scarabaeidae, and the various techniques must be tried in each of these habitats to secure the maximum number of specimens and species.

Most of the species of Laparosticti are coprophagous or necrophagous, and, by searching for such foods, one can often obtain large numbers of some species. Cow dung is one of the most universally present foods, and it hosts many species. However, a few species appear to be found only on the dung of one animal (e.g., pocket gopher, gopher tortoise, deer). It is sometimes difficult to locate dung of such wild animals, and most of the beetles associated with these hosts remain rare in collections. Although some species complete their life-cycle in dung or carrion, many species bury the food beneath the source (e.g., *Copris* spp., *Phanaeus* spp.) or transport it some distance away (e.g., *Canthon* spp.). It is therefore often necessary to dig beneath the food source or search the immediate vicinity for specimens.

Trapping offers an excellent method for securing specimens of certain species, with a minimum amount of effort from the collector. The food material (e.g., dung, carrion, etc.) can be used with some success, but often artificial baits are more readily obtained and easier to use. The bait traps, which I have used, consisted of any convenient container (usually tin cans or pint glass jars) sunk into the ground, level with the top (Fig. 5). The soil was packed tightly around the rim to permit easy access by the beetles. In the case of liquid baits, the trap was about half filled with bait. The traps were normally checked about every two days, the bait strained through a tea strainer, returned to the trap, and the trap reburied. The specimens were washed in water to remove the bait and dirt and then were transferred to 70% isopropyl alcohol.

Liquid baits (containing a small amount of the attractant in water) that produced specimens include proprionic acid, butyric acid, asafoetida, amyl acetate, and fermenting solutions of malt, molasses, and yeast. For certain species, combinations of the above proved more effective (e.g. malt and proprionic acid for some Geotrupinae). Preliminary testing suggested that a bait consisting of one teaspoon of powdered yeast in one pint of water is effective for several species. In the case of malt and molasses, the bait appeared to be more effective after fermentation had begun; usually within two days after mixing. Bait trapping (especially with malt) was the only convenient method for collecting large numbers of many burrowing groups for which the food habits are unknown (e.g., *Mycotrupes*, *Peltotrupes*). The use of specific attractants offers a fertile field for future investigation.

Fig. 5. Bait traps in place in a wooded area. Such traps, using fermenting malt as bait, are especially useful in collecting **Bolboceras, Geotrupes, Mycotrupes,** and **Peltotrupes.**

Matthews (1972:6) found that the most effective bait in Australia was marsupial entrails. He stated that: "It may be surmised that the beetles respond most strongly to complex organic molecules of elaborate structure, and least strongly to simple decomposition products such as scatole or proprionic acid. Excrement while still in the intestine has undergone least decomposition and therefore contains the highest proportion of complex molecules. The adaptive significance of this response is obvious, as it enables the beetles to locate the food with the highest energy content. For this reason it is impossible to substitute any artificial

baits for excrement or entrails, as the complex substances needed, even if they could easily be obtained, would decompose too rapidly."

Many of the Scarabaeidae are attracted to light, and various designs of light traps are effective in collecting specimens. Blacklight (actually ultraviolet) is much more effective than white or visible light. The traps which I have utilized are modifications of those originally designed by the USDA for European chafer (*Amphimallon majalis* Raz.) surveys. Specimens were collected in 70% isopropyl alcohol placed in the collecting container. For a discussion of the nature of light sources, trap designs, and additional information on light trapping, the reader is referred to the following papers: USDA (1961); Hollingsworth, Hartsock, and Stanley (1963); Frost (1952, 1958, 1963, 1964, 1966). The advent of the blacklight has nearly revolutionized collecting in this group of beetles and has resulted in more specimens and records than all other methods combined. The ecology and ethology are still poorly known for many species attracted to blacklight, but this attractant has provided much useful seasonal and geographical distribution data in addition to abundant specimens for morphological study.

Other mass collecting methods used were modified Berlese or Tulgren funnels and Malaise-type traps. Some of the larger species (e.g., *Deltochilum, Dichotomius*) have been trapped occasionally in mist nets used for birds and bats.

Specimens were often floated from cow dung, leaf litter, plant roots, etc., by placing the material in a pail of water. Digging was often the only known resort for collecting some species, especially those which were found in the burrows of pocket gophers and the gopher tortoise. The Geotrupinae often burrow to great depths (e.g., 6 to 10 ft. in *Mycotrupes* and *Peltotrupes*. These burrows are usually marked by a large "push up" of soil at the entrance (Fig. 6), and they can be followed by inserting a straw into the hole and digging along side. Fortunately for the collector these deep burrows are usually vertical.

Fig. 6. Typical "push-up" marking the burrow of **Peltotrupes profundus** Howden. The burrows often exceed six feet in depth. (Photo by Alvah Peterson)

Several species, especially Aphodiinae, occur in leaf mold or pine needles and were found by scarping away the surface litter and inspecting the soil surface. Many of these also were taken in the Berlese funnel. The genus *Psammodius* often occurs near beaches, and

Fig. 7. General view of the habitat at Cape Sable, Fla. (Everglades National Park). Note the dominance of cacti, yucca, and agave.

Fig. 8. The beach area at Cape Sable, Fla. Scarabs found in such habitats include **Ataenius rudellus** Fall, **Ataenius miamii** Cartwr., and **Psammodius** spp.

specimens were found by pulling up plants in such habitats (Fig. 8). They were sometimes found under boards and the windrows of debris behind the high tide marks.

Nearly all specimens were collected into 70% isopropyl alcohol which permitted easy genitalic dissections later. Specimens can be preserved indefinitely in this solution and are available for future mounting or dissection. The immature stages often were found

Fig. 9. **Geotrupes egeriei** Germar after just emerging from the pupal cell composed of cow dung.

in dung or in the soil and usually were reared easily in salve tins. They were killed in boiling water and preserved in 70% isopropyl alcohol.

Format of Presentation

Keys:—Dichotomous keys are presented for all of the taxonomic units (subfamily, tribe, genus, species) found in Florida. The keys to species within a genus follow the general discussion of the genus. In cases where there is a single species, it is keyed out with the genus in the key to genera of each subfamily or tribe. All of the keys are reversible, with numbers in parentheses indicating the rubric to consult for retracing one's steps. The keys are artificial in the sense that they use morphological structures which are easily seen or by which specimens are easily separated, without regard to any phylogenetic importance or scheme. Most of the keys are original, but where they are not, the source is indicated. Free use has been made of existing keys, but they have been modified for Florida forms and will not necessarily apply to other regions. Every effort has been made to make them as clear, concise, and easy to use as possible. They are all dichotomous, with the couplets reading parallel. References are made to illustrations wherever pertinent.

Generic treatment.—The genera are arranged as nearly as possible in phylogenetic order. The following standard format is used for each genus: 1) Reference is made to a figure which illustrates one species of the genus; in most cases a typical species, but not necessarily the type species. 2) Synonymy: includes only the different names, including misspellings and *nomina nuda*, under which the genus has been placed. The citations include only the original use of the name and not subsequent usage. 3) Listing of the type species (formerly called genotype, but not to be confused with this term in genetics); by whom and how designated (e.g., monotypy, subsequent designation,

Fig. 10. Third instar larva of **Dichotomius carolinus** (L.). Note the "hump-backed" appearance characteristic of many dung beetle larvae.

Fig. 11. Dung cell containing a mature larva of **Dichotomius carolinus** (L.). Note the area around the opening which is being repaired by the larva.

etc.). 4) Diagnosis: usually a short synopsis of the most distinctive features of the genus, but confined to characters applicable to Florida species. 5) Taxonomic Notes: discussion of the synonymy; listing of subgenera; status of the classification (e.g., recently revised, in need of revision, etc.); variation; subspecies. 6) Distribution and Zoogeography: general zoogeographic region occupied (e.g., Neotropical, Nearctic,

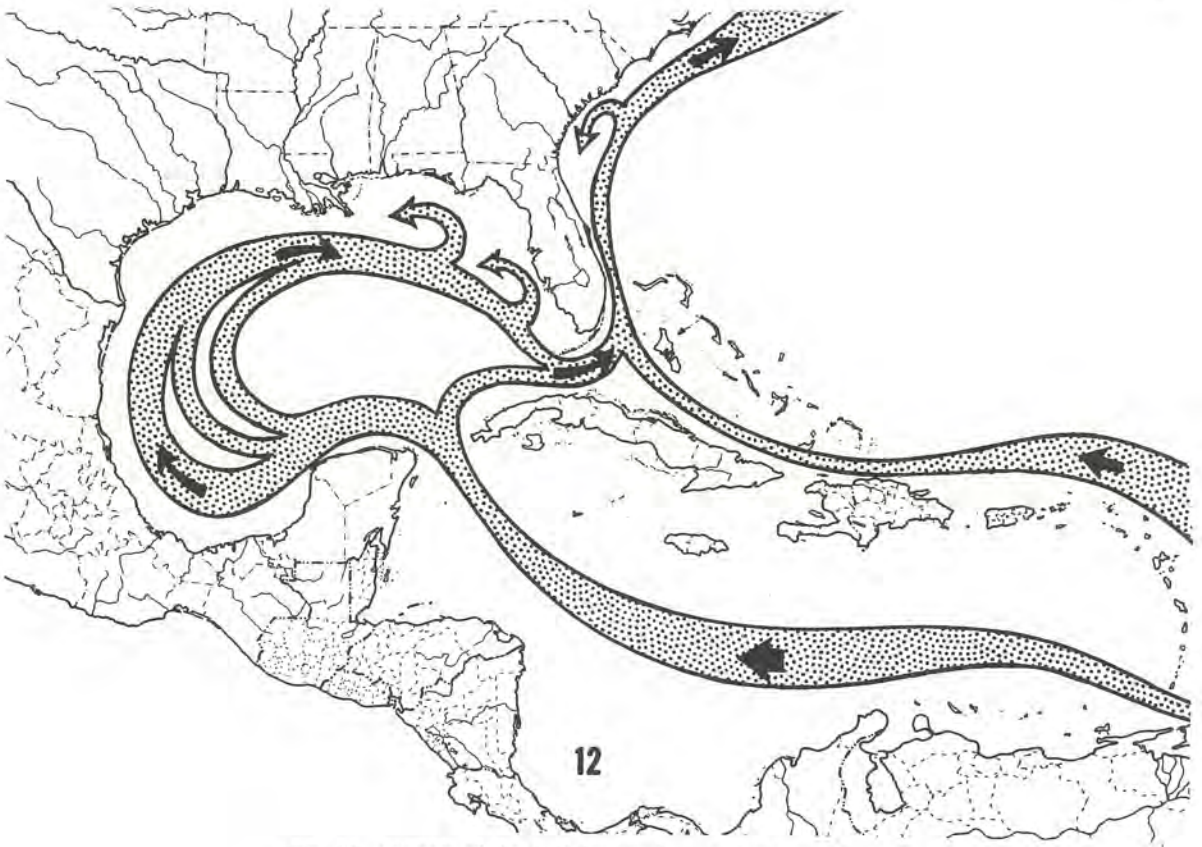


Fig. 12. Currents of the Gulf Stream. Such patterns are significant in interpreting the zoogeography and possible origin of the Florida fauna.

etc.); number of species in the world, U. S., and Florida; discussion of introduced species. 7) Biology: food habits of adults and larvae; ecological notes (e.g., limiting factors such as soil type, climate, vertebrate associations); behavior, including nidification, mating, and stridulation; information on the life cycle; indication of the immature stages known and a brief characterization of the larvae of the genus. 8) Selected References: includes author, date, and page citation to the most important papers on the genus; complete citations are presented in the bibliography. 9) Key to the Florida species of the genus.

Species treatment.—The species are arranged under each genus in alphabetical order. The information on each species is presented in the following format: 1) *Synonymy:* includes all different combinations of names under which the species has been known. Only the original citation for each combination is cited, but additional information on synonymy is discussed under "Taxonomic Notes." During the course of preparing the synonymy, a complete list of all known references was prepared, but it was not included in the manuscript due to space limitations. 2) *Diagnosis*: a brief resume of key features separating the species from other Florida species. In many cases reference is made to characters distinguishing it from closely related species, even though they are not found in Florida. It was felt that complete morphological descriptions were not appropriate for this study and would unduly lengthen the manuscript. The latest generic revision can be consulted for such complete descriptions. Reference is made to drawings where pertinent. 3) *Taxonomic Notes:* the status of the species and reasons for any synonymy are explained. Variation, subspeciation, and relationships are discussed. 4) *Distribution and Zoogeography:* reference is made to a distribution map for each species, except for a few species with single records or for those that were discovered too late and for which fragmentary information was known (e.g., some of the *Ataenius*). Included is a detailed map of the Florida records and a generalized map showing the broader distribution in the New World. The previous literature records for Florida are listed and discussed. Both literature records and personal records are plotted on the map. When only county records are known, they are plotted in the center of the county (this can be determined by reference to the data listed in the appendices). Any questionable records are discussed, and the specimens which I have seen are listed either in the section under "Specimens Examined" or in the Appendices. The generalized distribution also is based on literature records and on specimens I have examined. In many cases the records are not sufficient to present a true

picture of the distribution, but I feel that any map is better than none. The data I have summarized here should form a basis for future detailed studies. Inadequate as they may be, these are the only maps published for a great number of the species. 5) *Biology:* this is essentially a "cacth all" category for nearly all other aspects of the species. It includes data on abundance, seasonal distribution, food habits, habitat preferences, collecting notes, nidification, stridulation, and any inquilinous relationships. Notation is made of whether the immature stages are known, and if so, they are briefly characterized. 6) *Specimens Examined:* includes the total number of specimens personally examined, the number of Florida localities represented and the number of collection records. If less than 10 records are known, the label data is included here; if there are more than 10 records, these data are presented in the appendices (to which a reference is made). Abbreviations for the various museums and collections are listed under the acknowledgments. 7) *Selected References:* these include all the pertinent taxonomic and biological references, not repeating those listed in the synonymy under each species. Abbreviated citations (author, date, page) only appear here. Only those papers which contain significant data are included, and catalogues, or state lists are generally excluded. Complete citations are included in the terminal bibliography.

Some new species (discovered during this study) are listed here by number only, with a brief notation about them, pending formal description elsewhere. They are not included in the keys at present. They are listed at the end of each genus, after the alphabetical arrangement of described species, so the reader will be aware of their existence.

Florida Biogeography

Studies on a diversity of plant and animal groups have indicated that peninsular Florida has been an important area for the evolution and dispersion of the flora and fauna of the southeastern Coastal Plain. This situation is due to many factors, among which are the geographical position, the physical shape, and the geological history of the state. Not only was the peninsula a refugium for certain species during glacial periods, but its unique geographical position and geological history appear to have been conducive to the establishment of groups of endemic, closely allied, allopatric species of apparently recent origin (Hubbell, 1961).

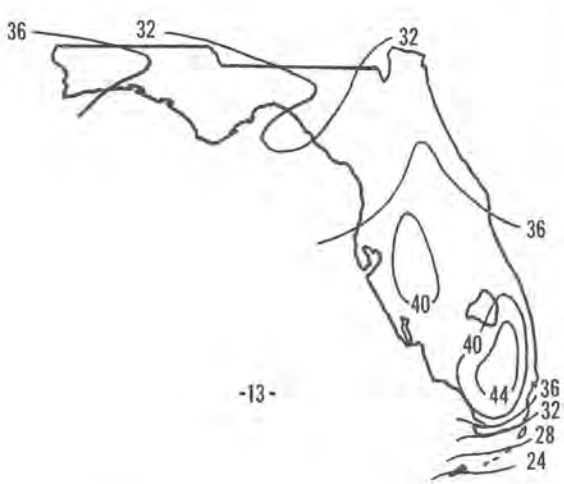


Fig. 13. Average summer rains in inches (from Atlas of Florida).

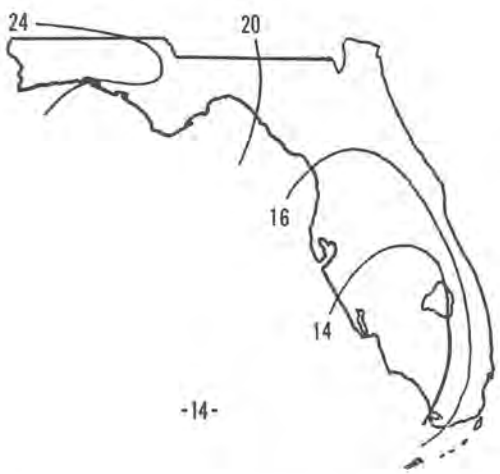


Fig.14. Average winter rains in inches (from Atlas of Florida).

There is little doubt about the importance of the Florida peninsula as a refugium and an area with a high percentage of endemic forms. Many of the relict species occupy the sandhills and sand-pine scrub as defined by Laessle (1958). It appears that these dry areas often represent fossil dunes or prehistoric shorelines. They are now arranged in a pattern of faunal and floral islands throughout the state, characterized by well drained soils, often surrounded by swampy areas of lower elevation. The age of the marine terraces is not firmly established, but several of those previously considered of Pleistocene age are probably Pliocene or Late Miocene (Alt and Brooks, 1965).

Small (1929), Blatchley (1932), and Barbour (1945) have all discussed the general natural history of southern Florida and the precariousness of the habitats and their associated endemic faunas. McCluney and others (1971) pointed out how rapidly the environmental destruction is taking place. In many cases the fauna already has been severely affected. In a review of this book (Woodruff, 1971) I stated: "There is probably no area of comparable size in the U.S. which is more likely to have its flora and fauna depleted than south Florida."

It is also apparent that our present knowledge about the distribution of most insects, including the Scarabaeidae, is too fragmentary to draw many significant conclusions. In most cases the known distri-

Fig. 15. Average July temperature (from Atlas of Florida).

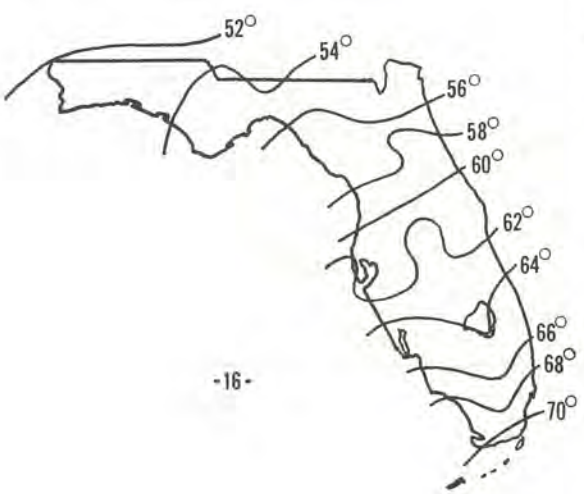


Fig. 16. Average January temperature (from Atlas of Florida).

butional patterns are based on such meager data that they cannot be interpreted with any degree of confidence. This situation became very apparent when I tried to analyze the data on the genera *Mycotrupes* and *Peltotrupes* (see the discussions under these genera). With a few rare exceptions, it appears too premature to base elaborate conclusions and speculations on the inadequate, fragmentary data which we now have. When we find what appears to be a disjunction in the distribution of a species, we cannot determine if this is a natural situation or if it is due to incomplete sampling. If we arbitrarily decide that this is a natural pattern, then we can further speculate about such things as limiting factors, geological history, isolating mechanisms, etc. Even in Florida, where the Scarabaeidae probably have been collected more intensively than any other state, there are large areas which have only barely been sampled. This is especially true for the western panhandle, although this is a critical area and appears to be a zone of overlap between several northern and southern populations. States such as West Virginia and Wyoming have been so poorly studied that nearly every distribution map has a void of records from them. Considerable field work will be necessary before the distributional patterns can be used as if they reflected a natural situation.

In the present work I have attempted to present the distributional information available, pointing out any factors (soil, climate, host association, sampling error, etc.) which might be limiting. However, the data are not sufficient to allow for many generalizations.

Space does not permit a detailed discussion of this interesting, but complicated, subject of biogeography. Considerable work being conducted on other groups of animals and, in paleontology, will undoubtedly produce new and critical data on the past and present distributions of Florida animals. For additional information on speciation in the southeastern Coastal Plains, the geological history of the area, and the biogeography of Florida, the reader is referred to the following papers: Alt and Brooks (1965); Berner (1950); Byers (1930); Carr (1940); Carr and Goin (1955); Clench and Turner (1956); Cooke (1939, 1945); Davis (1942, 1943, 1960); Gano (1917); Goin (1958); Harper (1914, 1921, 1926, 1927); Henderson (1939); Hobbs (1942); Howden (1963, 1966a); Hubbell (1932, 1954, 1961); Hubbell, Laessle, and Dickinson (1956); Kurz (1942); Laessle (1942, 1958); Landsberg (1949); MacNeill (1951); McCrone (1963); Mitchell (1963); Mount (1963, 1965); Neill (1957); Safford (1919); Schuchert (1910, 1929, 1935); Schwarz (1888); Vaughan (1910); West and Arnold (1956); Young (1954).

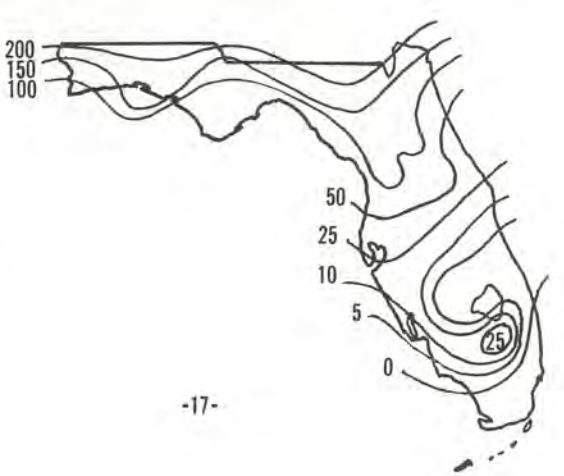


Fig. 17. Average approximate hours of frost per year (from Atlas of Florida).

Fig. 18. General soil distribution (after Atlas of Florida). 1) Northern upland types: well-drained loams and sands on undulating uplands; forests of long-leaf pine, loblolly pine, and hardwoods. 2) Northern slope types: well-drained to overly drained sands and loamy sands; rolling, sloping, forested land. 3) Central upland types: well-drained to overly drained sands; rolling uplands, some sinkholes; slash pine and hardwood forests. 4) Central upland potash types: like 3 but rich in potash. 5) Flatwood lowlands: poorly drained sands or loamy sands; level land with many ponds and swamps; mostly flatwoods or grass. 6) Southern limestone types: poorly drained sands and loamy sands over limestone; flatwoods or grass. 7) Swamp marsh and bottom lands; cypress, gum, or marsh grass.

Illustrations

Nearly all of the drawings were made by the author with the aid of a grid in the ocular of a stereoscopic miscroscope (10X and 15X oculars, .66, 1.3, 2.5, 4.0, and 5.0X objectives). The exceptions are Fig. 372-379 which are modified from published figures, and they are appropriately acknowledged in the legends. The scale lines indicate length in relation to the beetle size, regardless of reduction.

A general habitus drawing is presented for each of the 32 genera treated in this volume. The representatives were selected primarily because they are typical for each genus, or, in some cases (e.g., *Ataenius saramari*), because the species had not been illustrated previously. If they serve their purpose, most Florida genera of Laparosticti can be identified by a perusal of these 32 drawings. They are made on a pebble-surfaced scratchboard (Ross Board #2, C. J. Ross Co., Philadelphia) with India ink. The shading was done with scalpels, and the fine lines and white setae were made with a fine steel point set in a wooden handle. Most of them are reduced from one-half to two-thirds of the original.

Additional line drawings are provided for characters which clarify the keys or text. Near the completion of the manuscript I had access to a Cambridge Instruments "Stereoscan" (SEM) through the courtesy of the USDA (P. S. Callahan and Patricia Carlisle). The illustrations from this source have enabled me to clarify various taxonomic characters and to distinguish some closely related species which could be conveyed by no other means. The original photographs were taken on a Polaroid camera attached to the SEM.

Various other photographs, especially of typical habitats, are included. Most of these were taken by the author, but the source for the others is acknowledged in the legends.

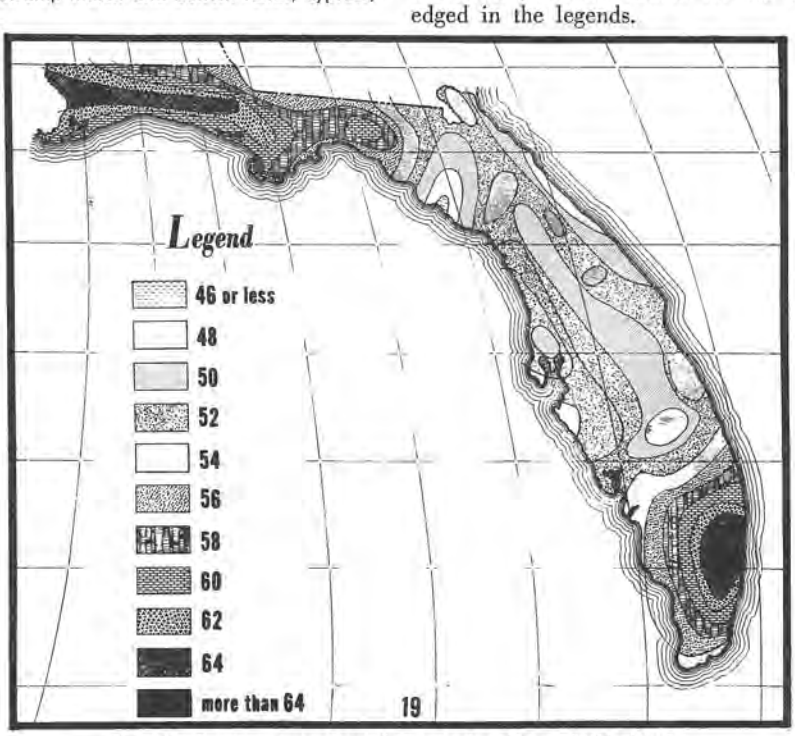


Fig. 19. Average annual rainfall in inches (from Florida Wildlife Magazine).

GENERAL ACCOUNT OF THE FAMILY

Taxonomy

Although the family is one of the better known of the larger families of beetles, many genera need revising. For example, the large genera *Aphodius* and *Ataenius* have not been revised, even for the U. S., since the time of Horn (1887) (although a revision of *Ataenius* by Cartwright is in press). I have indicated the status of the classification under each genus treated here and suggested the need for generic revision where it is apparent.

The higher categories (i.e., subfamilies, tribes, subtribes, and genera) of the Scarabaeidae have rarely been studied on a world basis, most authors limiting their work to one geographic area. For this reason it is very difficult to establish a good general scheme of higher categories with any degree of phylogenetic arrangement. The family is so large that it would be an overwhelming task to study critically the entire assemblage. Recently there have been some attempts to establish a phylogenetic arrangement within certain subfamilies (e.g., Scarabaeinae by Halffter and Matthews, 1966).

Many European authors, including Crowson (1955), have treated as families several of the groups recognized here as subfamilies. Basically I have followed the arrangement of families and subfamilies of the superfamily Scarabaeoidea listed by Arnett (1962), with the exception of recognizing the Trogidae as a full family:

Families	Subfamilies of Scarabaeidae
Lucanidae	Scarabaeinae
Passalidae	Aphodiinae
Scarabaeidae	Ochodaeinae
Trogidae	Hybosorinae
	Geotrupinae
	Pleocominae
	Glaphyrinae
	Acanthocerinae
	Melolonthinae
	Rutelinae
	Dynastinae
	Cetoniinae

The arrangement of the superfamily in several major references is presented in the following discussion. The most recent catalogue of the Coleoptera of America north of Mexico is that of Leng (1920), with five supplements (Leng and Mutchler, 1927, 1933; Blackwelder, 1939; Blackwelder and Blackwelder, 1948). The superfamily Scarabaeoidea is arranged as follows:

Families	Subfamilies of Scarabaeidae
Lucanidae	Coprinae
Passalidae	Aegialiinae
Scarabaeidae	Aphodiinae
	Ochodaeinae
	Hybosorinae
	Geotrupinae
	Pleocominae
	Glaphyrinae
	Acanthocerinae
	Troginae
	Melolonthinae
	Rutelinae
	Dynastinae
	Cetoniinae

Boving and Craighead (1931), in their synopsis of the larval forms of Coleoptera, treated the superfamily Scarabaeoidea as follows:

Families	Subfamilies of Scarabaeidae
Lucanidae	Coprinae
Passalidae	Aphodiinae
Geotrupidae	Glaphyrinae
Trogidae	Pleocominae
Acanthoceridae	Melolonthinae
Scarabaeidae	Sericinae
	Macrodactylinae
	Rutelinae
	Dynastinae
	Trichiinae
	Valginae
	Cetoniinae

Edwards (1949a), in treating the beetles east of the Great Plains, arranged the Scarabaeoidea as follows:

Families	Subfamilies of Scarabaeidae
Lucanidae	Coprinae
Passalidae	Aegialiinae
Geotrupidae	Aphodiinae
Acanthoceridae	Ochodaeinae
Trogidae	Melolonthinae
Scarabaeidae	Rutelinae
	Cetoniinae
	Dynastinae

In the "Coleopterorum Catalogus" (1910-37), a world catalogue authored by various specialists, the Scarabaeoidea are arranged as follows:

Families	Subfamilies of Scarabaeidae
Lucanidae	Aphodiinae
Passalidae	Aegialiinae
Scarabaeidae	Chironinae
	Coprinae
	Termitotroginae
	Pachypodinae
	Pleocominae
	Aclopinae
	Glaphyrinae
	Ochodaeinae
	Orphninae
	Idiostominae
	Hybosorinae
	Dynamophinae
	Acanthocerinae
	Troginae
	Melolonthinae
	Taurocerastinae
	Geotrupinae
	Euchirinae
	Phaenomerinae
	Rutelinae
	Dynastinae
	Trichiinae
	Valginae
	Cetoniinae

Crowson (1955), in his treatise on the natural classification of the families of Coleoptera, treated the Scarabaeoidea as follows:

Families	Subfamilies of Scarabaeidae
Lucanidae	Taurocerastinae
Passalidae	Hybosorinae
Trogidae	Orphninae
Acanthoceridae	Ochodaeinae
Geotrupidae	Allidiostominae
Scarabaeidae	Aphodiinae
	Scarabaeinae
	Glaphyrinae
	Rutelinae
	Dynastinae
	Cetoniinae
	Pachypodinae
	Melolonthinae

In the present work, of a limited faunal region, no attempt has been made to reevaluate the status of the higher categories between subfamily and genus. In most cases the latest, and presumably the most thorough, arrangement is provisionally followed. Where obvious inconsistencies have been noted they are pointed out.

Ritcher (1969a) in an extensive survey of the abdominal spiracles, suggested that the ". . . terms

Fig. 20. Habitat along the Tamiami Trail near Ochopee. Much of southern Florida is similar to this area where few scarabs occur except in the hammocks shown in the distance.

Fig. 21. A view looking west from the bluffs on the east side of the Apalachicola River at Torreya State Park. This river appears to be the dividing line between several subspecies of insects as well as a corridor for the southern extension of many northern elements.

Laparosticti and Pleurosticti should be abandoned." He concluded that, within the Scarabaeoidea and even within subfamilies, repeated evolutionary changes in structure and number of functional spiracles do not indicate the presence of two series. His evidence is strong, and the two groups are probably not at all natural. I had used the term Laparosticti in my original manuscript primarily to avoid listing all the subfamilies each time they were to be mentioned. Unfortunately Ritcher proposed no new classification, and therefore there is no other convenient term to use for this group. I have maintained the use of the terms here for convenience only, fully cognizant that they may not reflect natural groupings.

The posterior procoxal bridge has been studied by Ritchter (1969b) and used to interpret some higher categories. He found that the Passalidae were so distinctly different from other Scarabaeoidea that, along with larval differences, this structure suggested that they ". . . may have arisen from an earlier offshoot

Fig. 22. Dune habitat at St. Andrews State Park, Fla., characterized by scrub oak (**Quercus virginiana maritima**) and rosemary (**Ceratiola ericoides**).

Fig. 23. Close up of a rosemary bush, showing the roots exposed by wind and shifting sands of the active dunes. This is a characteristic plant of many scrub habitats on fossil dunes.

of the ancestral scarabaeiform stock, not as a direct offshoot of Lucanidae as suggested by Crowson." The procoxal cavities are closed posteriorly in all Scarabaeoidea studied, except in *Pleocoma*. He suggested that the open procoxal cavities, as well as larval differences, ". . . indicates that *Pleocoma* is probably the least specialized genus of the Scarabaeoidea."

In larvae, Hinton (1967) stated that a closing apparatus for the spiracles is present in the Trogidae, Lucanidae, Passalidae, and Glaphyrinae but absent in the Geotrupidae and Scarabaeidae. He also stated that the ecdysial process of the spiracles is of the elateroid type in primitive Scarabaeoidea, whereas it has a bulla that carries the ecdysial tube in specialized Scarabaeoidea. For the latter he coined the term "pseudopanorpoid." Larval spiracles are cribriform (Fig.

Fig. 24. General view of the habitat of **Mycotrupes cartwrighti** Ols. & Hub. Location: about six miles east of Tallahassee, Fla. in the "Red Hills" region. Specimens were collected in bait traps placed in the roadway.

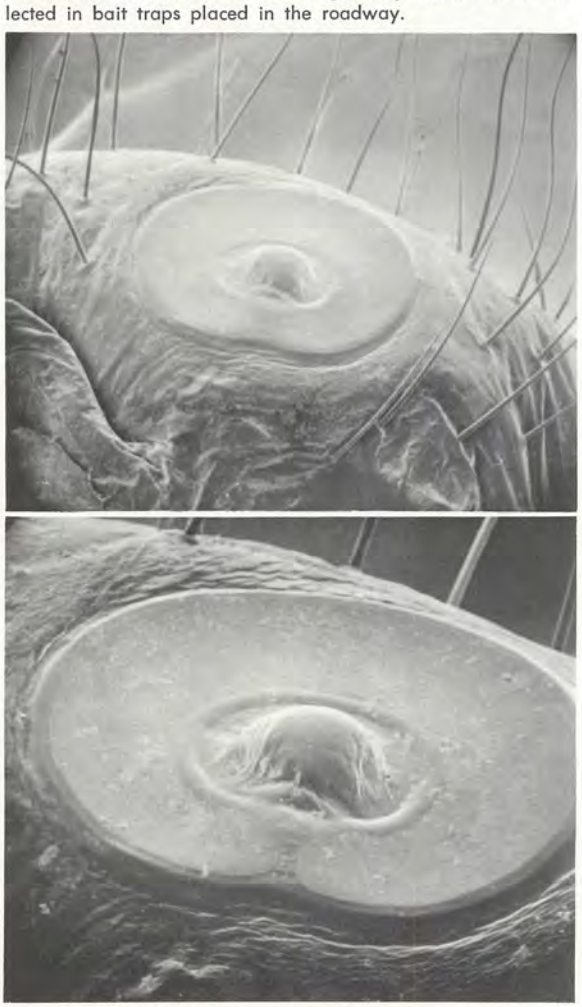


Fig. 25-26. Stereoscan photos of larval spiracles of **Strategus antaeus** (Drury). 25) magnified 39X, 26) 83X.

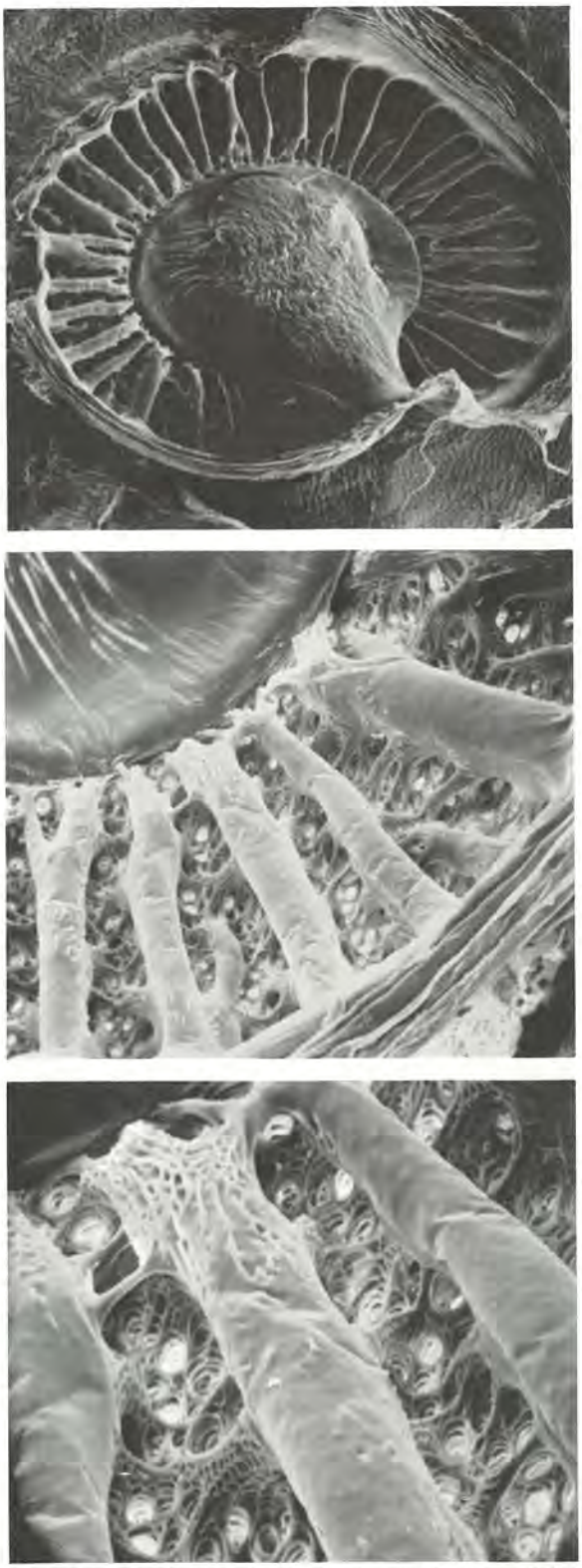


Fig. 27-29. Stereoscan photos of an interior view of the larval spiracle of **Strategus antaeus** (Drury) shown in Fig. 25-26. 27) note pattern of tracheal tubes, 81X, 28) 274X, 29) 713X.

25-29) in all scarabaeoid larvae except one group of Trogidae. Baker (1968) revived the generic name *Omorgus* for the *Trox suberosus* group of Vaurie (1955) for the species of *Trox* having larvae with cribriform spiracles, and those with biforous spiracles are retained in *Trox*. Hinton (1967) stated that this biforous condition is more primitive and resembles the elateroid spiracles of other beetle larvae. Using this criterion (larval spiracles) the genus *Trox* would then appear to be the most primitive scarabaeoid type.

Baker (1968:2), while studying larvae of *Trox*, stated that he believed this group was a subfamily of the Scarabaeidae. This is the conservative approach, and yet he proceeded to elevate one of the subgroups of *Trox* to generic status. Unfortunately no complete phylogeny is known for any insect, and the relative positions of higher taxonomic categories will always be merely subjective opinions.

Virkki (1957) discussed the evolutionary significance of the testis follicle in the Scarabaeoidea (Fig. 30). He concluded that three main form groups were recognized: 1) differences in follicle length (typical Scarabaeinae), 2) follicles always spherical, but varying in size (typical representatives are Aphodiinae), 3) follicles differing also in relative breadth (higher phytophagous scarabs).

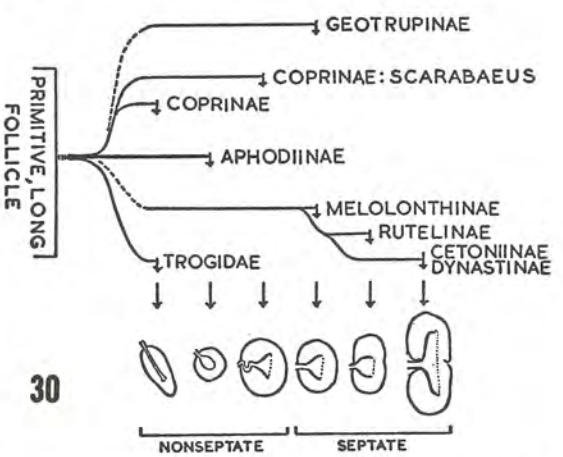


Fig. 30. Relationships of scarab groups according to follicle structure (after Virkki, 1957). The representatives studied of Melolonthinae were **Hoplia, Melolontha, Amphimallon,** and **Serica**; Rutelinae were **Anisoplia** and **Blitopertha**; Cetoniinae were **Cetonia, Potosia, Oxythyrea, Tropinota,** and **Trichius.**

In a study of scarab spermatogenesis Virkki (1966) reported that *Psammodius* and *Aegialia* had similar appearing karyotypes, but their extrachromosomal cytology was quite different. *Aegialia* has conspicuous diplocentric growth of the spermatozoa, suggesting " . . . a close relationship with *Aphodius* and *Onthophagus*, and especially to *Aphodius*." He (1966:340) reported that the scarab, *Lichnanthe rathvoni* (Lec.), has the earliest spermatogenesis known to occur in beetles. The process probably begins in the prepupa, because it was completed and no gonia remained in nine-day-old pupae.

Generic names contribute to considerable nomenclatural confusion since they are a part of the binomial system. I believe that genera do not exist in nature (although species do) and are merely subjective categories that assist in organizing the species into groupings ("pigeonholing"). In some cases there are clear-cut dividing lines between such groups, but more often there is a gradual transition. Because of the subjective nature of the generic concept, many species have been moved back and forth from one genus to the next, creating numerous nomenclatural problems, especially homonymy. This is one of the factors which led Michener (1964) to suggest the idea of "uninomial nomenclature."

No revolutionary procedures will be adopted here, but the problem becomes a very real one when trying to decide what generic name to use for some of the Florida species. This is especially true in the subtribe Canthonina, where the large genus *Canthon* recently has been fragmented, particularly by Martinez, Pereira, and Halffter. Other recent authors, such as Howden and Matthews, have suggested that many of these new genera represent only "species groups" and should not be accorded generic status. As long as there are two schools of thought on this subject, and these authors are publishing contemporaneously, there will be no real solution to the problem, and nomenclature will suffer. This situation is discussed further under the tribal treatment.

Many nomenclatural problems were encountered during the course of this work, several of which could not be resolved because of the unavailability of type specimens or literature. Certain others will require submission to the International Commission on Zoological Nomenclature for an official opinion. Good examples of the several kinds of problems can be found under the discussion of the genus *Ochodaeus*.

Morphology

Like nearly all other aspects of the family Scarabaeidae, the morphology is quite diverse and it is difficult to make many generalizations. The family was divided into two sections—the Laparosticti and Pleurosticti—based on the position of the abdominal spiracles and the relative positioning of the posterior legs, as has been discussed earlier.

The family varies tremendously in size of individuals, from 1.9mm (.075 inch) for *Pleurophorus longulus* Cartwr. to nearly 15cm (6.0 inches) for *Goliathus*. The latter is probably the largest insect known (based on bulk). In Florida, the maximum size of 5.7 cm (2.25 inches) is attained by *Dynastes tityus* (L.). Although most of the species are dull colored, the family contains many with beautiful metallic colors, rivaling the showiness of the most colorful Lepidoptera. Some scarabs even have scale-like setae on the elytra similar to those of butterflies (Fig. 31). The general body shape is also variable, from the globular Acanthocerinae to the elongate Aphodiinae. Some idea of the diversity, in the Laparosticti alone, can be determined by a perusal of the habitus drawings of the genera treated here.

Fig. 31-32. Stereoscan photos of scale-like setae on the elytra of **Polyphylla occidentalis** (L.): 31) 85X, 32) 750X.

Beetles of this family have been popular with collectors because of their bright colors and the great development of horns in several groups (especially in males of Dynastinae, Scarabaeinae, and Geotrupinae). Although some of the horns are fantastically large and bizarre, and have been the subject of much admiration and speculation (Arrow, 1951), little information is available on the functional significance of these structures.

Beebe (1947), in a study of the largest horn-bearing scarab in the New World, *Dynastes hercules* (L.), found that the male horns were used in combat and in transporting the opponent and, less frequently, the female. He also studied minor and major males in captivity and concluded that ". . . . copulations of the minor were as complete and successful as those of the majors." There is therefore little to suggest that those with maximum horn development have much evolutionary (selective) advantage over those with minor

Fig. 33. Stereoscan photos of right antenna of **Polyphylla occidentalis** (L.). The lamellate antenna is typical of the Scarabaeidae (Lamellicornia); the maximum of seven lamellae is found in **Polyphylla.** Arrow indicates area enlarged in Fig. 34-35.

horn development. On one occasion he found a male successfully lifted and transported twice his own weight. He concluded that encounters between male hercules beetles were ". . . usually rather brief, and are dependent on the willingness of each to fight.", and that there was a ". . . complete absence of any courtship or display by the male in respect to the female."

All species have a lamellate antennal club arranged so that the lamellae can be expanded (Fig. 33) or appressed (Fig. 46) to form a compact club. The antennae, inserted in front of the eyes below the frons, contain from seven to eleven segments, the first of which is often enlarged, elongate, and covered with elongate, stiff setae. The club is usually composed of three segments (Fig. 45, 53, 54), but contains as many as seven in the genus *Polyphylla* (Fig. 33, 46). The club is variously shaped, from ball-like in *Bolboceras* (Fig. 54) to asymmetrical in *Phanaeus* (Fig. 45) or somewhat cup-shaped in *Hybosorus* (Fig. 317-18). The antennae are the principal olfactory receptors (Fig. 33-35), although the maxillary palpi serve at least as secondary receptors (Landin, 1961).

The legs, especially the anterior ones, of nearly all species, are adapted for digging (fossorial) (Fig. 49, 52, 179-80, 354-55, 362-63). The tarsal formula for the family is given as 5-5-5, but the anterior tarsi are wanting in a few cases (e.g., *Deltochilum* and male *Phanaeus*). The posterior legs of the Laparosticti are situated behind the middle of the body, usually nearer the tip of the abdomen than to the middle pair of legs. As a consequence, the metathorax is often enlarged and elongate. In the Pleurosticti the posterior legs are situated near the middle of the body, sometimes very close to the middle pair of legs. In this group the metathorax is often broader and shortened.

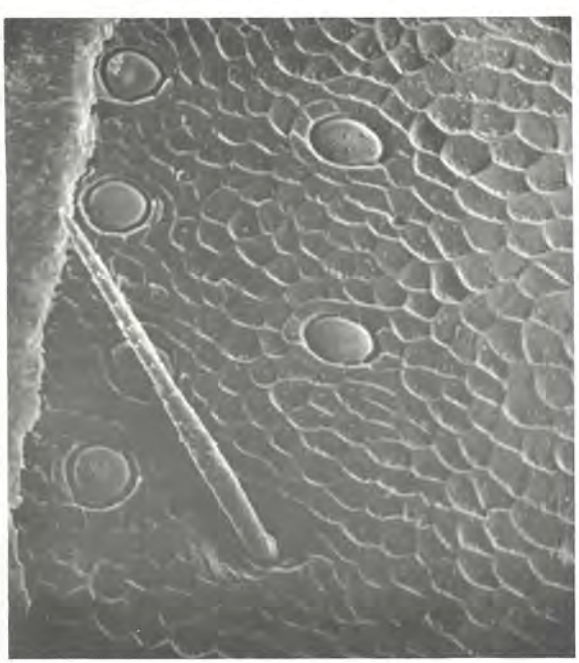


Fig. 34-35. Stereoscan photos of **Polyphylla occidentalis** (L.) antenna. Enlargement of area shown at the arrow in Fig. 33: 34) 128X, 35) 257X. The numerous sensors probably perceive various physical and chemical stimuli (e.g., odors, infrared and ultra-violet radiation, sound).

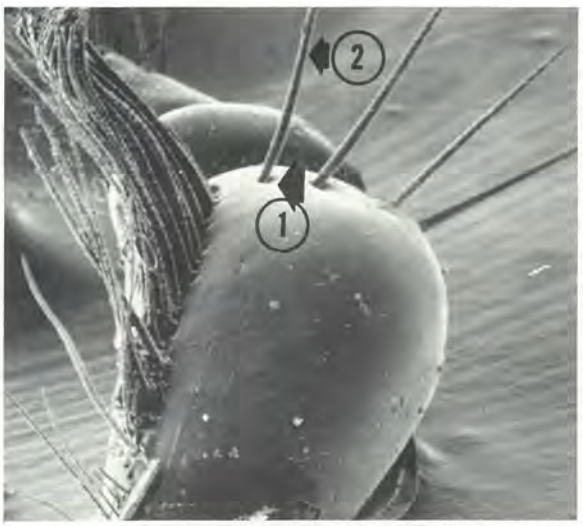


Fig. 36. Stereoscan photos of basal antennal segment of **Polyphylla occidentalis** (L.) (133X). Arrow 1 indicates area enlarged in Fig. 37; arrow 2 indicates area enlarged in Fig. 38.

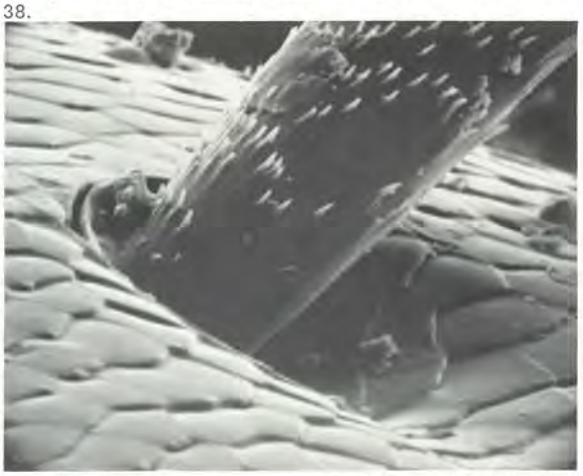


Fig. 37. Stereoscan photos of **Polyphylla occidentalis** (L.). Base of sensor on basal antennal segment (enlargement of arrow 1 in Fig. 36) (127X).

Fig. 38. Stereoscan photo of **Polyphylla occidentalis** (L.). Middle area of sensor on basal antennal segment (enlargement of arrow 2 in Fig. 36) (2475X).

The anterior coxae are large, transverse, and sometimes prominent and conical. The anterior tibiae are usually broad, flattened, and dentate on the outside. The apex of the anterior tibia, on the inside, contains a single spur which is often modified in the males. The middle coxae are relatively large and transverse, but not prominent. The posterior coxae are flat and transverse. The middle and posterior tibiae are variable in form; they are narrow, curved, and fitted for ball rolling in the Scarabaeini (Fig. 51, 84); flattened and sickle-shaped, and the surface covered with incised lines in the Acanthocerinae (Fig. 392-95, 400-401); in all other groups they are generally expanded at the apex or nearly straight and parallel. The posterior tibiae have two apical spurs except in the Scarabaeini (where only the genus *Melanocanthon* has two). The tarsal claws vary from simple to toothed (Fig. 47-48). Although there is usually a bisetose onychium, it is wanting in the Acanthocerinae, Aphodiinae, and some Scarabaeinae.

Matthews (1972) discussed the interesting modifications of tarsal claws of the group of *Onthophagus* previously known as *Macropocopris*. He found that the prehensile claws (used for holding on to hairs of wallabies, kangaroos, and goats) were derived in two ways: 1) the last tarsal segment bears a double row of stiff bristles ventrally which act in apposition to the claws; pulvillus present; 2) the last tarsal segment bears a spur ventrally which acts in apposition to the claws; pulvillus absent or greatly reduced.

The mouthparts are highly variable in form, from the nearly membranous type of the Scarabaeinae and

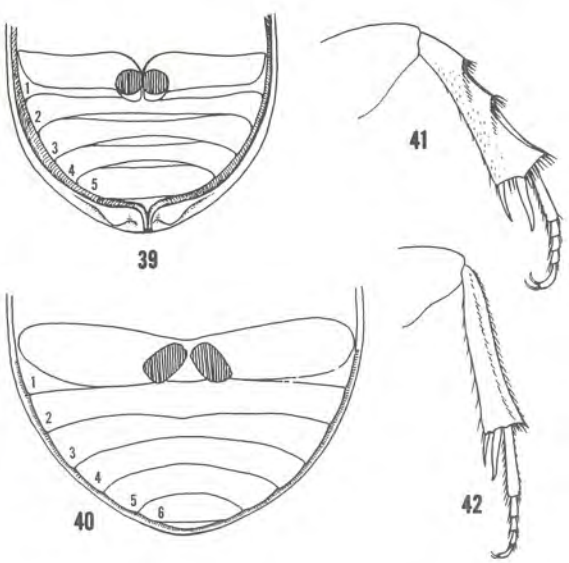


Fig. 39-42. Key characters for subfamilies, tribes, and genera: 39) Ventral view of the abdomen of **Cloeotus aphodioides** (Ill.). Note the five visible segments. 40) Ventral view of the abdomen of **Geotrupes egeriei** Germ. Note the six visible segments. 41) Dorsal view of right posterior leg of **Aphodius fimetarius** (L.). 42) Dorsal view of the right posterior leg of **Ataenius alternatus** (Melsh.). Note the absence of scalloping and transverse carinae.

Aphodiinae, to the hard, well-developed mandibles of the Geotrupinae and Dynastinae. The mouthparts are described in detail by Hardenberg (1907) from examples throughout the family. Landin (1961) discussed these organs in the Aphodiinae, and Miller (1961), and Halffter and Matthews (1966) considered these structures in several Scarabaeinae. The maxillary palpi are slender, four-segmented, with the apical segment the largest. They often contain odor and, probably, taste receptors. The labial palpi are three-segmented. Halffter and Matthews (1966:243) stated that ". . . the mouthparts [of Scarabaeinae] as a whole must have an extraordinary ability to taste, sort, and screen very small particles down to the size of bacteria." Miller (1961) found the gut to contain particles in suspension, varying in diameter from two microns (*Onthophagus*) to 16 microns (*Dichotomius*).

There has been little work done on the internal anatomy of the dung beetles, except for the few papers that are summarized by Halffter and Matthews (1966).

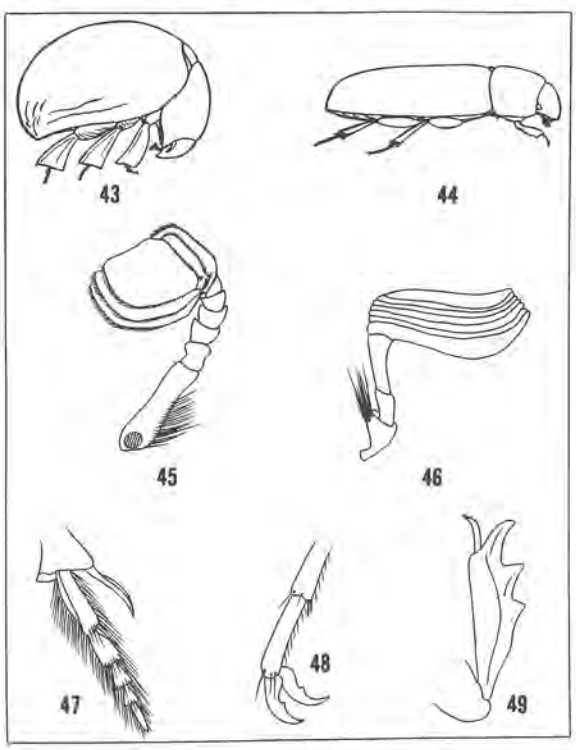


Fig. 43-49. Key characters for subfamilies, tribes, and genera: 43) Lateral body outline of **Cloeotus globosus** (Say). Note the compact, globular shape characteristic of the Acanthocerinae. 44) Lateral body outline of **Ataenius alternatus** (Melsh.). Note the elongate, cylindrical shape of the Aphodiinae. 45) Dorsal view of the right antenna of a male **Phanaeus igneus floridanus** d'Ols. Note the three-segmented club. 46) Dorsal view of the right antenna of a male **Polyphylla pubescens** Cartwr. Note the seven-segmented club. 47) Ventral view of the right posterior tarsus of **Phanaeus igneus floridanus** d'Ols. Note the absence of terminal claws. 48) Lateral view of the tip of the left posterior tarsus of **Phyllophaga latifrons** (Lec.). Note the cleft tarsal claws. 49) Dorsal view of the right anterior tibia of a male **Phanaeus igneus floridanus** d'Ols. Note the absence of the tarsus.

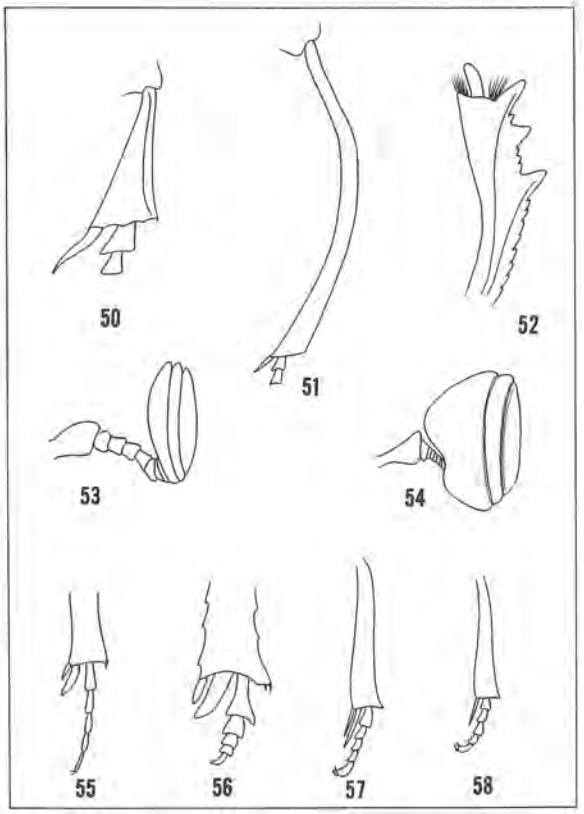


Fig. 50-58. Key characters for subfamilies, tribes, and genera: 50) Dorsal view of right posterior tibia of **Dichotomius carolinus** (L.). Note the expanded apex. 51) Dorsal view of right posterior tibia of a male **Deltochilum gibbosum** (Fab.). Note the long, slender form, and the apex is not noticeably expanded. 52) Dorsal view of anterior tibia of a female **Deltochilum gibbosum** (Fab.). Note the absence of a tarsus. 53) Dorsal view of right antenna of **Geotrupes egeriei** Germ. 54) Dorsal view of right antenna of **Bolboceras floridensis** (Wallis). 55) Dorsal view of right posterior tibial apex and tarsus of **Pleurophorus longulus** Cartwr. 56) Dorsal view of right posterior tibial apex and tarsus of **Psammodius malkini** Cartwr. 57) Dorsal view of right posterior tibia and tarsus of **Melanocanthon granulifer** Schmidt. 58) Dorsal view of right posterior tibia and tarsus of **Boreocanthon depressipennis** (Lec.).

These authors discuss the morphological adaptations for coprophagy in the adults and larvae of the Scarabaeinae. Becton (1930) described the alimentary tract of *Phanaeus vindex* MacL., and Miller (1961) described the same structure in *Canthon pilularius* (L.).

The female reproductive system has been examined only for a few representative genera. It is similar to that of other Coleoptera in general, but in all Scarabaeinae examined, there is only one ovary, and it is reduced to a single ovariole on the left side. Robertson (1961) indicated that this is the only group of Coleoptera showing such a degree of ovarian reduction.

The male genitalia are useful for distinguishing species of certain genera (e.g., *Melanocanthon*, *Bolbocerosoma*, and *Phyllophaga*). However, there has been no extensive comparative study within the family.

There are a few studies comparing these organs between families of Coleoptera (Sharp and Muir, 1912; Snodgrass, 1957).

Although the female genitalia probably are diagnostic, they have been studied only in a few cases (e.g., *Phyllophaga*). Tanner (1927) discussed these organs throughout the Coleoptera, but few examples of Scarabaeidae were studied. I have been interested in this subject for some time, having accumulated several hundred slides for future studies. It is premature to make many broad generalizations, but it appears that a great many species can be separated easily on the basis of the female genitalia.

There are no comparative morphological studies on the family as a whole. The subfamilies Scarabaeinae, Aphodiinae, and Geotrupinae were studied comparatively by Mohr (1930), but using only a single species from each. Much more is needed in the way of comparative morphology before there can be a logical treatment of the higher categories within the family.

Scarab larvae are usually C-shaped white grubs (Fig. 59), with the head capsule fairly large, hard, and dark colored (Fig. 61). However, many of the Scarabaeinae and Geotrupinae have a "hump-backed" appearance (Fig. 10). It is not within the scope of the present study to discuss the immature stages in detail. However, I have indicated under each species treatment whether they are known and, if so, I have briefly characterized them. The most useful taxonomic characters are found on the mouthparts (especially the epipharynx) (Fig. 62, 64) and the venter of the last abdominal segment (raster) (Fig. 60). During the latter part of this study an excellent book appeared,

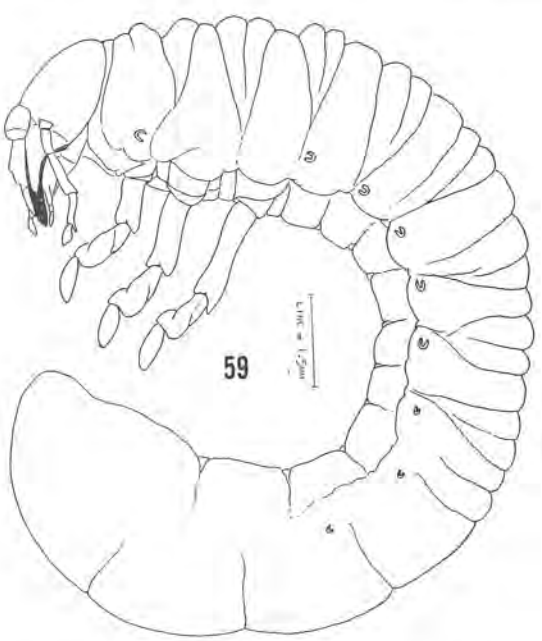


Fig. 59. Typical C-shaped scarab larva. Lateral view of third instar of **Phyllophaga bruneri** Chapin (setae omitted).

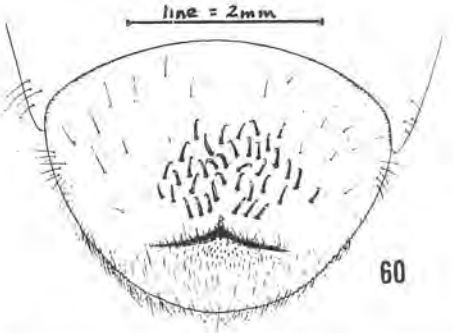


Fig. 60. Larval raster of the last ventral abdominal segment, a character useful in distinguishing larvae of many species. **Phyllophaga bruneri** Chapin.

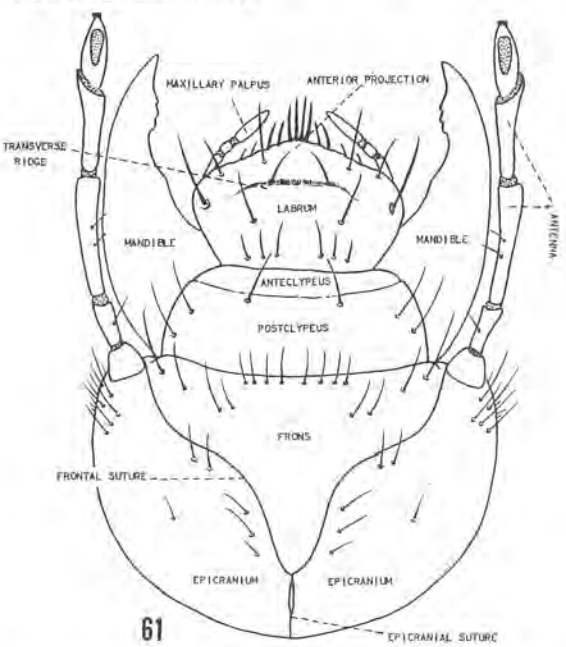


Fig. 61. Typical scarab larval head, showing morphological structures. **Phyllophaga bruneri** Chapin.

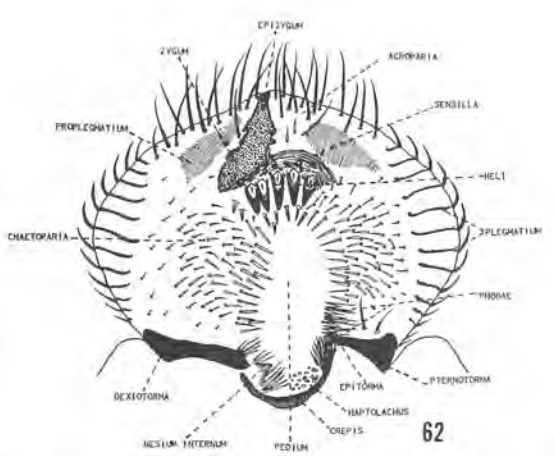


Fig. 62. Larval epipharynx, showing taxonomic structures used to distinguish species. **Phyllophaga bruneri** Chapin.

summarizing the described North American scarab larvae (Ritcher, 1966).

Puchkova (1966) reported pupal structures in Scarabaeidae which apparently correspond to rudimentary tergopleural glands and others corresponding to an external ovipositor. He also discovered structures on many scarab pupal abdomens that help clarify the morphogenesis of the pygidium. He suggested that the shape of the pupa indicates that scarab ancestors had campodeiform larvae, and that their present C-shape arose secondarily in connection with an increase of larval body mass.

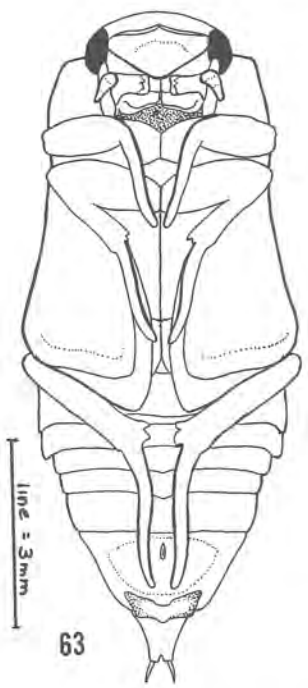


Fig. 63. Typical scarab pupa. Ventral view of **Phyllophaga bruneri** Chapin.

Biology

The area encompassed by this subheading includes ecology and ethology, but they are so interwoven as to be nearly impossible to discuss separately. Ecology in its broadest sense includes all aspects of the habits and behavior of an organism in relation to both its abiotic and biotic environment. An attempt is made to summarize our knowledge of this subject under the individual species treatments, and only brief generalizations will be made here.

The family, as mentioned earlier, can be divided on the basis of food habits into two major groups which once were thought to coincide with morphological divisions. The Pleurosticti feed primarily on live plant materials as adults, and the larvae usually feed on plant roots or rotting wood. As they are not to be treated in this work, they will not be discussed further here. The Laparosticti, on the other hand, feed primarily on dung or decaying plant and animal materials as adults, and in many cases larval food of the same materials is provisioned by the adults.

Matthews (1963), in referring to the common *Canthon pilularius* (L.), stated "The autecology of this species has not been properly investigated (nor has that of any other American coprophage)." The same statement could apply to nearly all members of the family, with the possible exception of a few economically important species such as the Japanese beetle (*Popillia japonica* Newm.).

Even though we are far from knowing the details about the ecology of most scarabs, the literature on the subject is extensive. Ritcher (1958) briefly reviewed 174 papers on the "Biology of Scarabaeidae." Landin (1961 & 1968) published the excellent books on the ecology of the subfamily Aphodiinae, but these works involved only European species. However, much of the general information on ecology of the dung-feeding species is applicable to Florida species. The most recent and most significant publication on the subject is the volume by Halffter and Matthews (1966) on "The Natural History of the Dung Beetles of the Subfamily Scarabaeinae." This work provides an exhaustive review of the literature of the group, as well as much valuable original data. Howden, in a series of papers (especially 1955a & 1964), has done an outstanding job of summarizing our knowledge of the North American Geotrupinae. The remaining three subfamilies of Laparosticti treated here (Ochodaeinae, Hybosorinae, Acanthocerinae) are very poorly known biologically. The food habits of both adults and larvae of the Florida species are unknown.

Fig. 64. Stereoscan photo of larval epipharynx of **Strategus antaeus** (Drury) (43X).

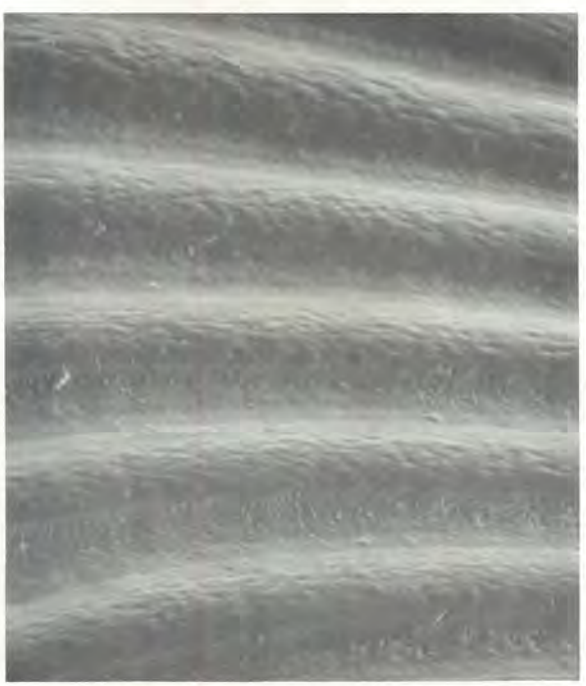


Fig. 65-66. Stereoscan photos of stridulatory area on left mandible of **Strategus antaeus** (Drury): 65) 45X, 66) 190X.

BEHAVIOR: DIEL FLIGHT ACTIVITY

Landin (1968) has published the only extensive study of this aspect of behavior, but he treated only the genus *Aphodius* in Sweden. He reached the following conclusions based on field studies and laboratory experiments:

1) Temperature is limiting in two directions. High temperatures cause immobilization and death; low temperatures cause inactivity and cold stupor; the average optimum is between +14 degrees and —17 degrees C., with a wide tolerance range.
2) Relative humidity is limiting in one direction. Low humidity causes decreasing flight activity, and dessication can be fatal. High humidity favors flight activity, with the optimum between 70 and 100% RH.
3) Light (solar radiation) does not seem to have a limiting effect. They seem to "prefer" darkness, but are able to adapt from flight in darkness to daytime flight.
4) An endogenous system ("internal clock") appears to maintain some control, especially under optimum conditions.
5) The optimum climatic factors for flight, reflected by response from the endogenous rhythm, are: a) moderate temperature, b) high relative humidity, c) and darkness.
6) The "wide ecological amplitude" of most *Aphodius* ". . . considerably adds to the ability of the species to disperse, often over wide areas, and even to settle down in new, often far distant continents."

BEHAVIOR: ASSOCIATIONS

In Florida there are few species for which any details of the ecology or ethology are known. There are some interesting close associations between some

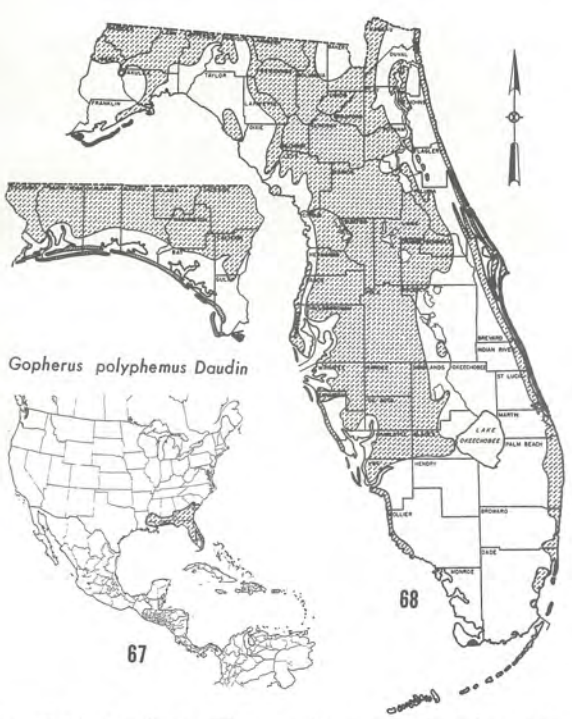


Fig. 67-68. Distribution of the gopher tortoise (based on data supplied by W. Auffenberg).

Fig. 69. Habitat of packrats (**Neotoma floridana floridana**) in a small cave in Florida Caverns State Park. Scarabs found in packrat droppings here were **Onthophagus orpheus** Panz. and **Aphotaenius carolinus** (Van D.).

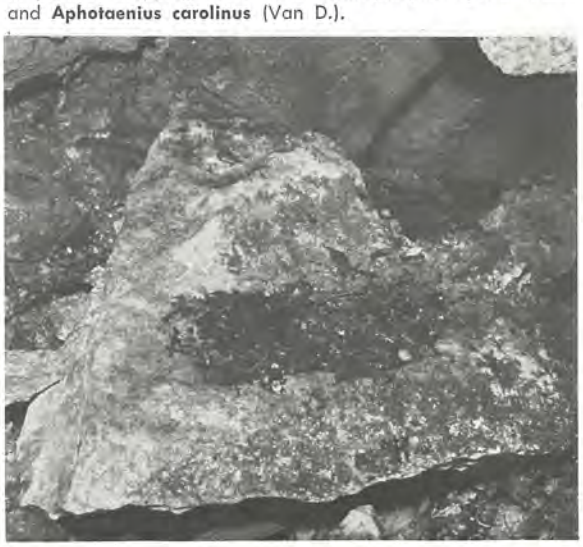


Fig. 70. Close up of packrat droppings on a rock at the habitat shown in Fig. 69, in which the two scarabs mentioned above were found. (Both photos by F. W. Mead)

Scarabaeinae and Aphodiinae and other animals which should provide valuable information once they are more thoroughly understood. There are three species (*Onthophagus polyphemi* Hubbard, *Copris gopheri* Hubbard, and *Aphodius troglodytes* Hubbard) found only with the gopher tortoise (*Gopherus polyphemus* (Daudin) (Fig. 67-68). Three species (*Aphodius laevigatus* Hald., *Aphodius aegrotus* Horn, and *Aphodius haldemani* Horn) are found only with pocket gophers (*Geomys* spp.) (Fig. 74-75, distribution map based on unpublished data provided by C. H. Handley and E. V. Komarek). Three species (*Onthophagus orpheus* (Panz.), *Pseudocanthon perplexus* (Lec.), and *Ataenius brevicollis* Wollaston) have been found in packrat (*Neotoma* spp.) nests (Fig. 69-73), although only the latter seems to be confined to such habitats. One species (*Ataenius* new species near *brevinotus* Chapin) has been found in fox squirrel (*Sciurus niger* L.) nests. One species (*Ataenius insculptus* Horn) has been found only in deer droppings, and another (*Aphotaenius carolinus* (Van D.)) is found primarily in deer droppings. Two species [*Euparia castanea* Serv. and *Myrmecaphodius excavaticollis* (Blanchard)], are myrmecophilous, and they occur respectively in the nests of the fire ants *Solenopsis geminata* (Fab.) and *Solenopsis invicta* Buren (Fig. 76-77).

BEHAVIOR: NIDIFICATION

In many of the Scarabaeinae and Geotrupinae the adults provision the larvae with food in a subterranean chamber (nidification) (Fig. 9-11). This behavior is carried to the ultimate in some species of *Copris*, in

Fig. 71. Stick nest of packrats (**Neotoma floridana smalli**) on North Key Largo, Fla. **Onthophagus orpheus** Panz. and **Ataenius brevicollis** Wallaston were found in this nest.

Fig. 72. Packrat nest shown in Fig. 71, after removal of the stick covering. Most of the scarabs were found in droppings in the cavity at the base of the tree.

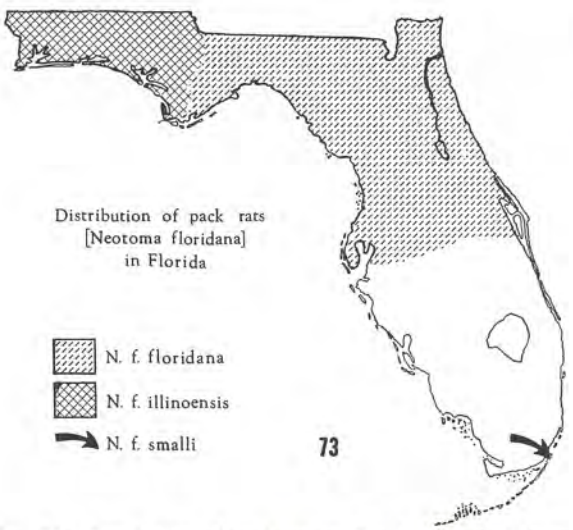


Fig. 73. Distribution of packrats in Florida (modified from Hall and Kelton).

Fig. 74. Mounds of the pocket gopher (**Geomys pinetis austrinus**), in the burrows of which are found **Aphodius aegrotus** Horn (= **geomysi**), **Aphodius laevigatus** Hald., and **Aphodius haldemani** Horn. Location: about 10 miles north of Ocala, Fla.

which the adult female stays with the brood ball through pupation. The dung mass is continually smoothed on the outside, preventing the growth of mold. Halffter and Matthews (1966) discussed nidification in the Scarabaeinae, and Howden (1955a) reviewed this behavior in the Geotrupinae.

BEHAVIOR: SOUND PRODUCTION

Many of the Laparosticti are subsocial or colonial, especially the Geotrupinae. Most of the dung-feeding species are often found together in a single pile of cow dung. A great many of the species stridulate (Fig. 78), but the behavioral significance of sound production has not been thoroughly investigated. Arrow

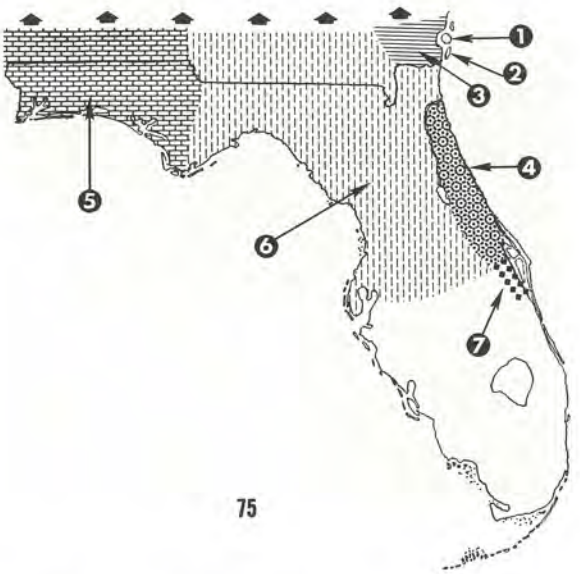


Fig. 75. Distribution of Florida pocket gophers (based on data supplied by C. H. Handley and E. V. Komarek). 1) **Geomys colonus** Bangs, 2) **Geomys cumberlandius** Bangs, 3) **Geomys pinetis pinetis** Rafinesque, 4) **Geomys pinetis floridanus** (Aud. & Bach.), 5) **Geomys pinetis mobilensis** Merriam, 6) **Geomys pinetis austrinus** Bangs, 7) **Geomys pinetis goffi** Sherman.

(1904) described the sound producing organs for a number of species in the family, and the evolutionary significance of sound production of beetles was discussed by Alexander, Moore, and Woodruff (1963). This area of investigation offers a fertile field for future research.

BEHAVIOR: ORIENTATION

Anyone who has spent a few hours in a pasture, witnessing the speed at which a cow dropping is colonized by dung beetles, cannot help wondering about the sense of smell in these beetles. Mohr (1943) reported 1,097 specimens of *Aphodius distinctus* Mull. in a single cow dropping within 2 hours. Lindquist (1935) found 1,113 specimens of *Aphodius lividus* (Oliv.) in a single cow dropping. I have collected as many as 12 species of scarabs in a single cow dropping, within 2 hours after deposition.

In Finland, Rainio (1966) found that there were species of dung beetles which preferred each of the following kinds of dung: horse, human, cow, and sheep. However, he found that none were wholly specialized to one type. Successionally he found that the numbers of beetles reached a peak in: 1) horse dung after one day, 2) sheep and pig dung after two days, and 3) cow dung after three days. Although certain species preferred shaded habitats, he found that most species were more abundant in exposed situations.

Although the perception of, and orientation to, odors is one of the most important aspects of dung beetle behavior, it has received very little attention. For the Scarabaeinae, Halffter and Matthews (1966) have stated, "Such aspects as the pattern of search

Fig. 76. A pasture containing numerous mounds of the imported fire ant (**Solenopsis invicta** Buren). Location: Lowndes County, Alabama. (Photo by F. W. Mead)

Fig. 77. A cross section of an imported fire ant nest. **Myrmecaphodius excavaticollis** (Blanch.) is found in such nests. **Euparia castanea** Serv. is found in similar nests of the related ant, **Solenopsis geminata** (Fab.). Photo by F. W. Mead)

flight, territory covered by a single beetle, altitude of flight, distances at which the smell of food is first perceived, etc., are nearly unknown." The same statement is equally applicable to the dung-feeding species of Aphodiinae and Geotrupinae.

The olfactory organs have been studied only in a few cases (Warnke, 1934). It has been determined by experimentation that the principal seat of olfaction is found in the antennal club, and to a much lesser degree in the maxillary and labial palpi. The two general types of receptors consist of small conical cells which penetrate the cuticula and end externally as pegs (sensilla basiconica), or as short setae (sensilla trichodea). Another type, in the form of conical pegs arising from small pits (sensilla coeloconicum), is found on the ultimate segment of the maxillary palpi.

It is likely that the initial odor stimulation may be at a great distance from the source, but orientation is confined to short distances. There are probably considerable specific differences in the ability to perceive and orient toward the food source. In general, stimulation is accompanied by an "alarm" reaction, the head being raised, the antennae extended, and the lamellae of the club being spread apart. Flight is usually toward the wind, and initially the track twists and turns. Once a sufficient odor gradient is perceived, the track is nearly a straight line to the source. We have very little information on this aspect of behavior, but the straight part of the track has been reported as 10 meters for *Scarabaeus* and 50 cm for *Geotrupes* (Fraenkel and Gunn, 1961:279), and 40 cm for *Aphodius* (Landin, 1961:182). Some species land within short distances and walk the rest of the way, while others land directly on the dung. Although the details are mostly unknown, there can be no doubt about their success and speed of finding a food supply of dung. It would be especially interesting to learn how those species associated with certain mammals and ants find their hosts.

Dung beetles are interesting subjects for ecological studies for several reasons: 1) dung is a rapidly changing microcommunity which forms a suitable subject for succession; 2) dung, along with decaying plants and animals, is one of the most universal habitats, being found under a wide range of environmental conditions; 3) dung beetles have a wide geographical range and occur nearly worldwide except for Antarctica and a few oceanic islands; 4) they often occur in large numbers, making the study of populations feasible; 5) many species have evolved unique commensal relationships with other insects and mammals.

PASTURE ECOSYSTEMS

Several dung beetles have been introduced into Australia from Africa to: 1) free pastures from accumulated dung, 2) fertilize the soil, and 3) control pests. The idea of improving pastures with introduced species was proposed by Bornemissza (1960), and his work continues at present. During the International Congress of Entomology at Canberra, Australia (August, 1972) much emphasis was placed on this work, and an excellent educational film entitled "Dung down

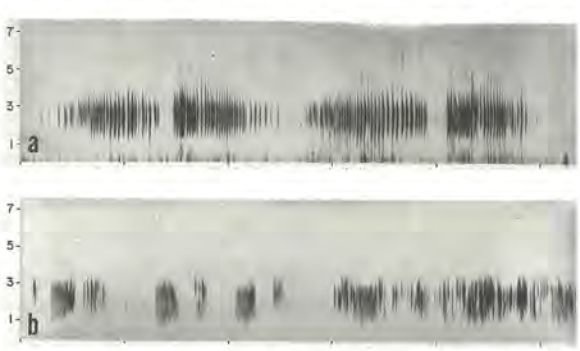


Fig. 78. Audiospectrograph tracings of scarab sounds (disturbance at 80-85° F.): a) **Geotrupes blackburnii** (Fab.), b) **Cloeotus aphodioides** (Ill.).

under" was shown. The Commonwealth Scientific and Industrial Research Organization (CSIRO) has spent much time and effort on this project and maintains a laboratory in South Africa. Here Bornemissza is searching for species with the proper ecological requirements to fill specific niches in Australia.

Woodruff (1972) summarized much of the CSIRO work. In dry climates, dung often remains on the surface for months. It is estimated that 200 million dung pats are deposited daily by Australian cattle, annually covering hundreds of thousands of acres of potential pasture. Beetles can bury the dung within 48 hours and thus increase soil fertility by incorporating it into the soil. The beetles' mechanical disturbance of the dung prevents completion of development of several pest flies. The burial of dung reduces the number of parasitic worm eggs and the resultant infective larvae which reach grass blades on which they might be ingested by cattle.

The most successful introduced species is *Onthophagus gazella* (Fab.), a species earlier introduced into Hawaii to assist in hornfly control. In Australia it had colonized 400 kilometers in 2 years and appears to be rapidly expanding its range. In the first year it crossed 7 miles of water to colonize an island, and the following year it reached an island 30 miles away. Mass releases are still being made under carefully controlled conditions. Eggs are collected from dung balls in Africa, surface sterilized with a 3% formaldehyde solution, air freighted to Australia in special containers, washed on arrival, and placed in hand-made dung balls. The adults of this generation are used for egg production only, and adults of the second generation are used for the mass releases.

Colonies of some African species (e.g., *Onthophagus gazella*) are maintained in the USDA laboratory at Kerrville, Texas, and specimens very recently were released in Texas (Drummond, personal communication). The only introduced (accidental) dung beetle in Florida is *Onthophagus depressus* Har. Although it is well-established, it appears to be of little consequence in the pasture ecosystem (see discussion under this species in the text).

Gillard (1967) has also discussed the role of coprophagous beetles in the pasture ecosystem. He pointed out that most native, tropical, and subtropical pastures have a relatively low nitrogen content compared with improved temperate pastures. He found that unburied dung dried by the sun had an 80% loss of nitrogen, while that which is buried loses 5 to 15% by volatilization. Although there are many complicated factors to measure and assess, there is little doubt that the dung beetle fauna contributes to conservation of nitrogen, resulting in increased soil fertility.

PARASITES

In general the dung beetles are seldom attacked by parasitic Hymenoptera or Diptera. They often harbor mites of many kinds, but this association is thought to be primarily phoretic. Halffter and Matthews (1966:171-176) presented a list of the mites associated with various species of Scarabaeinae. In many cases the mites are thought to be predators on fly larvae (Axtell, 1963) or nematodes (Stewart and Davis, 1967). They represent several families, chief of which are the Macrochelidae. These are actively being studied by several workers, among whom are Costa and Krantz.

Fig. 79. A burrowing owl **(Speotyto cunicularia floridana)** at the entrance to its burrow. Location: Sun Springs, Gilchrist County, Fla. (Photo by C. T. Collins)

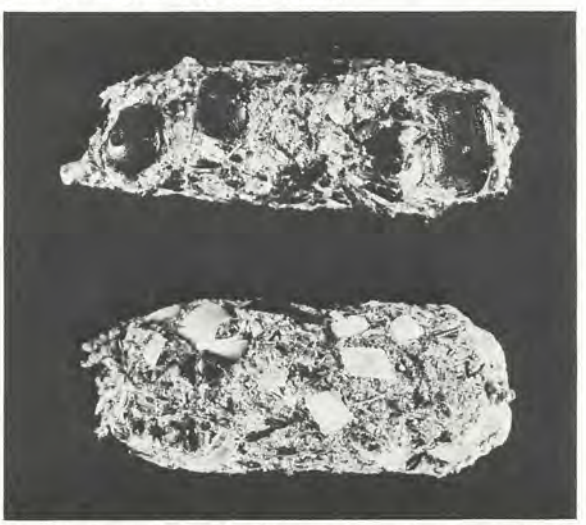


Fig. 80. Burrowing owl pellets containing insect remains. A high percentage of the owl's diet is composed of dung beetles, especially **Dichotomius, Phanaeus, Canthon, Copris, Peltotrupes,** and **Mycotrupes.** (Photo by E. M. Collins, Jr.)

Costa (1969) reported 183 species of gamasine mites from Scarabaeidae, the greatest number from any group of insect hosts. Among these were representatives of the following six mite families (the number of species indicated in parentheses): Dermanyssidae (17), Eviphiidae (36), Macrochelidae (118), Pachylaelapidae (19), Parasitidae (8), and Rhodocaridae (3). He found that various stages of the mites were found on the beetle hosts. All stages were found in Otopheidomenidae, deutonymphs only in Parasitidae

and *Digamasellus* spp., and female mites only in *Macrocheles* spp., *Dinogamasus* spp. and *Coleolaelaps* spp. In the genus *Coleolaelaps* (on phytophagous scarabs), female mites are usually carried on the beetle, whereas male and immature mites are found on the beetle larvae (white grubs) underground. He recorded 19 species of mesostigmatic mites from a single species of dung beetle [*Copris hispanus* (L.)], of which 3 appear to be host specific.

Krantz and Mellott (1968) studied an interesting group of parasitic mites of the family Macrochelidae which I found on two genera of burrowing beetles (*Peltotrupes* and *Mycotrupes*) in Florida. They described one new species from each genus of beetle with the following statement regarding their relationships: "There can be little doubt that one of the two macrochelids to be described below evolved from the other or, less likely, that both evolved from a common ancestor." These beetles are considered relictual (*Mycotrupes* has lost the hind wings and contains disjunct populations), and a study of the beetle-mite associations should produce interesting evolutionary information on both groups.

Several animals are predaceous on scarabs, the most notable being the Surinam toad (*Bufo marinus* L.) which is successful in controlling May beetles (*Phyllophaga* spp.) in Puerto Rico (Wolcott, 1937). There is little doubt that other toads and frogs consume their share of scarabs in Florida. In fact, one of the few records of the rare *Acanthocerus aeneus* MacL. is of a specimen from the stomach of a frog (*Rana sphenocephala* Cope). Two skinks (*Eumeces egregius* (Baird) and *Neoseps reynoldsi* Stejn.) were frequently found in "push-ups" of *Mycotrupes* and *Peltotrupes*, but they are not known to feed on the beetles (Mount, 1963). Animals such as skunks, opossums, and armadillos undoubtedly feed on some scarab larvae and adults, but little information is available on the quantities involved. One of the most important predators on dung beetles, in the limited areas where it occurs, is the burrowing owl (*Speotyto cunicularia floridana* Ridgway). Their pellets (Fig. 79-80) contain abundant remains of *Dichotomius, Phanaeus, Canthon, Copris, Peltotrupes* and *Mycotrupes*. During this study, C. T. Collins and W. Courser supplied numerous owl pellets, the data from which will form the basis of a joint paper on the food habits of this owl in Florida.

Zoogeography

Two things are immediately apparent when one begins to analyze the distributions of Florida Laparosticti: 1) the high percentage of species endemic to the state, and 2) the paucity of overlap in both genera and species with the West Indian fauna.

Of the 115 species and subspecies of Laparosticti recorded from Florida, there are 24, or slightly more than 20%, not recorded outside the state. It is likely that some of these will eventually be found in southern Georgia or Alabama, but they probably have a fairly narrow range. There are 10 additional Florida species that barely range outside the state. The endemics are probably the result of many factors, including insular isolation during past geological periods and unique environmental conditions (e.g., subtropical climate). Only one genus of Laparosticti (*Peltotrupes*) is entirely endemic to Florida.

Only 16 species (including the questionable Florida record of *Oniticellus cubiensis* Lap.) are common to Florida and the West Indies. All of these, except the questionable species just mentioned and *Hybosorus illigeri* Reiche, are in the subfamily Aphodiinae, and most of them have a fairly wide distribution. One of these species was thought to be *Ataenius brevinotus* Chapin. Cartwright (in litt.) now believes that the Florida specimens represent an undescribed species. Another species, *Ataenius luteomargo* Chapin, known from 11 islands of the West Indies, was recorded in my dissertation for the first time from Key West, Florida, where it was thought to be a recent introduction. However, Cartwright (in litt.) has now indicated that these specimens represent a Cuban species, *Ataenius waltherhorni* Balth., previously recorded from the U.S. only from a questionable specimen from "Everglade." *Psammodius bidens* Horn has been recorded from several areas from New Jersey to Florida, and there is a single specimen known from Puerto Rico. *Hybosorus illigeri* Reiche was recorded from Jamaica by Howden (1970).

Of the 32 genera of Laparosticti known from Florida, only 12 have representatives in the West Indies. The subfamilies Geotrupinae and Ochodaeinae have no genera or species common to both areas.

Ten of the Florida species, representing seven genera, presumably have been introduced. One of these (*Onthophagus depressus* Har.) has also been found in Georgia and is from Africa. It was recently recorded (Matthews, 1972) from Australia. Interestingly, a related African species has been introduced into Martinique in the Lesser Antilles (Matthews, 1966: 25). *Oniticellus cubiensis* Lap. occurs in the Bahamas, Cuba, and Jamaica, and if the single Key West, Florida, record (Blatchely, 1928:13) is valid, it was probably introduced there. Another species (*Myrmecaphodius excavaticollis* (Blanch.)), here definitely recorded from the U.S. for the first time, was described from Argentina in the nests of the fire ant *Solenopsis saevissima* Fr. Smith). This ant and a similar, recently described species (*S. invicta* Buren) were introduced into the U. S. probably after 1915, and presumably the beetle was introduced with its ant host. Two other species (*Ataenius simulator* Har. and *Psammodius cruentus* Har.)were described from South America and are presumed to be fairly recent introductions to the U. S. *Hybosorus illigeri* Reiche is widespread in the Old World, from southern Europe to Africa, and it was probably introduced into the U. S. at a very early date (before 1848, when LeConte described it as *H. carolinus*). The remaining four species are in the genus *Aphodius* [*fimetarius* (L.), *granarius* (L.), *haemorrhoidalis* (L.), and *lividus* (Oliv.)]. These are all presumably European in origin, although they now have wide ranges, probably as a result of distribution by commerce. The many introductions of Aphodiinae around the world have been discussed by Lindroth (1957) and others.

For further details on distribution and zoogeography, the reader should consult the discussions under each species in the systematic account which follows.

Paleontology

There is a single report (Wickham, 1919) of a fossil scarab from Florida. This is based on an elytral fragment and a smaller fragment of *Copris inemarginatus* Blatchley from a Pleistocene deposit at Vero, Florida. There has been considerable discussion of the nature and age of these deposits (Sellards, 1916; Weigel, 1962; Young, 1959). Until further specimens are discovered in the undistributed portions of Stratum 2 (Weigel, 1962), I view this single record with scepticism. None of the insects from this deposit are replaced by minerals, and all appear as if they had recently died. Only one species, a grouse locust, is not known to occur in the vicinity of Vero today.

Many of the early collections from this site (including the fragments of *Copris inemarginatus*) were ". . . carried out without stratigraphic control . . ." and "Instead, bones and artifacts were picked from the sides of the canal banks." (Weigel, 1962:12). In addition, animals such as pocket gophers, tortoises, and even the beetles themselves can readily dig through deposits without causing noticeable disturbance in the beds. It is quite likely that at least some of the insects were deposited in this manner. Regardless of the evidence for other insects at this site, it is unwarranted at this time to attach any great significance to the two fragments of *Copris inemarginatus*. It is certainly too premature to suggest that ". . . perhaps *Copris inemarginatus*, a sort of living fossil, did once utilize the dung of *Equus*, *Mammut*, and *Mammuthus* which are also found as fossils with it at Vero." (Young, 1959:106).

Economic Importance

The family Scarabaeidae contains some of the most destructive beetles known, including the Japanese beetle, Asiatic garden beetle, and European chafer. However, nearly all of these are in the Pleurosticti which well be treated later. The Laparosticti, with very few exceptions, are believed to be either beneficial or of little consequence to man.

Since the groups treated here are primarily dung-feeders or scavengers, they are very useful in ridding the countryside of waste materials. We often are not aware of the numbers of species and individuals constantly at work at this tremendous task. Hingston (1923) remarked about the role played by this group in Hindustan:

> Were it not for Nature's scavengers the East would be the cesspit of the world. Man assuredly would annihilate himself in the emanations from his own filth . . . But incomparably the chief of this great array are the members of the enormous family of Dung-beetles, the Scarabaeidae. They seek the excrement of men and cattle, gather it into nodules or rounded pellets, and bury it beneath the surface of the soil. Since the greater part of their life is spent hidden in the earth or lodged in the substance of some faecal mass, they are not obvious to every eye. Nevertheless, they exist in prodigious numbers, and the quantity of refuse which they remove is immense, almost beyond belief. So far as I can estimate by rough observation, I believe that in certain active seasons of the year two-thirds of the excrement of this vast country must be carried by these scarabs into the substance of the soil. Without their valuable aid the land would be an open sewer. Remember that it supports a teeming population of some 300 million souls. And, save for the few collected in the cities, the whole of this great multitude of people depends on the work of Nature's scavengers to clear its filth away. I will not enter into numerical details, but, taking into account human ordure alone, I believe that in India during May and June as much as forty or fifty thousand tons of excrement must be carried by scarabs each day into the soil. And this does not include the dung of animals, which may easily double or treble the amount. It seems an almost incredible number. I advance it with no claims to the strictest accuracy, but I think it gives us a just impression of the incalculable value of this tribe of beetles as the leading scavenging army of the East.

Although little research has been conducted on the benefits accrued by the incorporation of dung into the soil, there can be no doubt about the increased aeration and fertility as a result of this behavior. Lindquist (1933) measured the amount of dung buried by certain species, and Bornemissza (1960) suggested that dung beetles could improve pastures in Australia. (For further discussion of this aspect of dung beetles see the earlier section on Biology).

One of the beneficial aspects of dung beetles is a result of the speed with which they can locate and disrupt the dung. Larvae of the horn fly (*Haematobia irritans* (L.) can survive only in undisturbed cow dung. The feeding and tunneling of many scarabs often render the dung unsuitable for complete development of the fly larvae. There have been several attempts to introduce dung beetles for this purpose into areas where they were not abundant (e.g., Hawaii and Puerto Rico). However, there have been no attempts to thoroughly evaluate the results.

Many Laparosticti serve as intermediate hosts for a variety of helminths (primarily Spiruroidea). Halffter and Matthews (1966) summarized the literature on this aspect of the Scarabaeinae. Some important animal parasites which have one or more scarab intermediate hosts are: *Raillietina cesticillus* (Molin) and *Hymenolepis carioca* (Magalhaes), intestinal parasites of chickens and certain wild galliform birds; *Ascarops strongylina* (Rudolphi), a stomach parasite of domestic and wild swine; *Spirura rytipleurites* (Deslongchamps), a stomach parasite of cat, dog, fox, skunk, and hedgehog; *Spirocerca lupi* (Rudolphi), a parasite of dog,

wolf, jackal, and fox; *Physocephalus sexalatus* (Molin) and *Gongylonema pulchrum* Molin, parasites of a variety of wild and domestic animals; *Macracanthorhynchus hirudinaceus* (Pallas), an intestinal parasite of swine, carnivores, monkeys, and in one case, man.

Miller (1954, 1961) studied the dung beetles found on human feces in Georgia and concluded that ". . . . dung beetles may constitute an important factor in the epidemiology of hookworm and other enteric parasites of man." Stewart and Davis (1967) discussed the "consortisms" which exist between swine, nematodes, dung beetles, and mites. It appears that there are many complicated close associations of this sort which will require detailed studies before any conclusions can be reached.

Although dung beetles serve as intermediate hosts for some vertebrate parasites, they are also involved in the destruction of eggs, cysts, and larvae of many parasites. Miller, Chi-Rodriguez, and Nichols (1961) studied several dung beetles which had ingested human dung containing eggs of hookworm, *Ascaris*, and whipworm, and cysts of *Entamoeba coli*, *Endolimax*, and *Giardia*. No eggs and few cysts were recovered from *Canthon pilularius* (L.) and *C. vigilans* Lec., and no *Ascaris* were found in *C. pilularius* after the ingestion of embryonated eggs. Unaltered whipworm eggs and cysts, but no hookworm and few *Ascaris* eggs were recovered from *Phanaeus vindex* MacL. and *P. igneus* MacL. Our largest dung beetle, *Dichotomius carolinus* (L.), regularly contained and excreted ingested eggs. These authors concluded that "Although dung beetles may be significant in other ways in dissemination of hookworm, the species most abundantly attracted to human stools destroy ingested eggs of this parasite and of *Ascaris* and do not transport them internally."

PRELIMINARY CHECKLIST OF FLORIDA SCARABAEIDAE

(Only subfamilies I-VI are treated in Part I)

Subfamily I. Scarabaeinae

Tribe I. Scarabaeini

Genus 1. *Deltochilum* Eschscholtz
gibbosum gibbosum (Fabricius)

Genus 2. *Canthon* Hoffmansegg
chalcites (Haldeman)
pilularius (Linnaeus)
vigilans LeConte

Genus 3. *Boreocanthon* Halffter
depressipennis (LeConte)
probus (Germar)

Genus 4. *Melanocanthon* Halffter
bispinatus (Robinson)
granulifer (Schmidt)
punctaticollis (Schaeffer)

Genus 5. *Glaphyrocanthon* Martinez
viridis viridis (Beauvois)

Genus 6. *Pseudocanthon* Bates
perplexus (LeConte)

Tribe II. Coprini

Genus 1. *Ateuchus* Weber
histeroides histeroides Weber
lecontei (Harold)

Genus 2. *Dichotomius* Hope
carolinus (Linnaeus)

Genus 3. *Copris* Muller
gopheri Hubbard
howdeni Matthews and Halffter
inemarginatus Blatchley
minutus (Drury)

Genus 4. *Phanaeus* MacLeay
igneus igneus MacLeay
igneus floridanus d'Olsoufieff
vindex vindex MacLeay

Tribe III. Onthophagini

Genus 1. *Onthophagus* Latreille
aciculatulus Blatchley
concinnus Laporte
depressus Harold
hecate blatchleyi Brown
oklahomensis Brown
orpheus orpheus (Panzer)
pennsylvanicus Harold
polyphemi polyphemi Harold
polyphemi sparsisetosus Howden and Cartwright
striatulus floridanus Blatchley
subaeneus (Beauvois)
tuberculifrons Harold

Tribe IV. Oniticellini

Genus 1. *Oniticellus* Serville
**cubiensis* Laporte

Subfamily II. Aphodiinae

Tribe I. Aphodiini

*Those species preceded by an asterisk are questionably recorded from Florida; for further details, see the individual species discussions.

Genus 1. *Aphodius* Illiger
aegrotus Horn
bicolor Say
campestris Blatchley
crassulus Horn
cuniculus Chevrolat
fimetarius (Linnaeus)
floridanus Robinson
granarius (Linnaeus)
haemorrhoidalis (Linnaeus)
haldemani Horn
laevigatus Haldeman
**lentus* Horn
lividus (Olivier)
lutulentus Haldeman
parcus Horn
rubeolus (Beauvois)
**rusicola* Melsheimer
stercorosus Melsheimer
stupidus Horn
troglodytes Hubbard

Tribe II. Eupariini

Genus 1. *Euparia* Serville
castanea Serville

Genus 2. *Myrmecaphodius* Martinez
excavaticollis (Blanchard)

Genus 3. *Ataenius* Harold
abditus (Haldeman)
alternatus (Melsheimer)
apicalis Hinton
brevicollis Wollaston
brevinotus Chapin (n.sp., near)
cylindrus Horn
erratus Fall
exiguus Brown
fattigi Cartwright
figurator Harold
gracilis (Melsheimer)
havanensis Balthasar
imbricatus (Melsheimer)
insculptus Horn
integer Harold
languidus Schmidt
miamii Cartwright
ovatulus Horn
picinus Harold
platensis Blanchard
rhyticephalus Chevrolat
rudellus Fall
saramari Cartwright
simulator Harold
spretulus (Haldeman)
strigatus (Say)
waltherhorni Balthasar
wenzelii Horn
n. sp. #1
n. sp. #2
n. sp. #3

Genus 4. *Pseudataenius* Brown
n. sp. (near *socialis* Horn)

Genus 5. *Aphotaenius* Cartwright
carolinus (Van Dyke)

Tribe III. Psammodiini

Genus 1. *Psammodius* Fallen
armaticeps Fall
bidens Horn
cruentus Harold
malkini Cartwright

Genus 2. *Pleurophorus* Mulsant
longulus Cartwright
micros (Bates)

Genus 3. *Rhyssemus* Mulsant
**scaber* Haldeman

Subfamily III. Hybosorinae

Genus 1. *Hybosorus* MacLeay
illigeri Reiche

Subfamily IV. Ochodaeinae

Genus 1. *Ochodaeus* Serville
frontalis LeConte
**musculus* Say

Subfamily V. Geotrupinae

Tribe I. Bolboceratini

Genus 1. *Bolboceras* Kirby
floridensis (Wallis)

Genus 2. *Bradycinetulus* Cockerell
ferrugineus (Beauvois)

Genus 3. *Bolbocerosoma* Schaeffer
hamatum Brown

Genus 4. *Eucanthus* Westwood
alutaceus Cartwright
impressus Howden
subtropicus Howden

Tribe II. Geotrupini

Genus 1. *Geotrupes* Latreille
blackburnii blackburnii (Fabricius)
egeriei Germar

Genus 2. *Peltotrupes* Blanchard
profundus Howden
youngi Howden

Genus 3. *Mycotrupes* LeConte
cartwrighti Olson and Hubbell
gaigei Olson and Hubbell
pedester Howden

Subfamily VI. Acanthocerinae

Genus 1. *Acanthocerus* MacLeay
aeneus MacLeay

Genus 2. *Cloeotus* Germar
aphodioides (Illiger)
globosus (Say)

Subfamily VII. Melolonthinae
Tribe I. Sericini
Genus 1. *Serica* MacLeay
aemula Dawson
aspera Dawson
atracapilla (Kirby)
delicata Dawson
floridana Dawson
frosti Dawson
georgiana georgiana Leng
georgiana lecontei Dawson
intermixta Blatchley
iricolor (Say)
panda Dawson
parallela Casey
peleca Dawson
pusilla Dawson
rhypha Dawson
sericea (Illiger)
spicula Dawson
tantula Dawson
vespertina (Gyllenhall)

Tribe II. Liparetrini
Genus 1. *Hypotrichia* LeConte
spissipes LeConte

Tribe III. Melolonthini
Genus 1. *Diplotaxis* Kirby
bidentata LeConte
frontalis LeConte
languida LeConte
liberta (Germar)
punctatorugosa Blanchard
rufa Linell
subcostata Blanchard
subcostata n. ssp.
Genus 2. *Polyphylla* Harris
gracilis Horn
occidentalis (Linnaeus)
pubescens Cartwright
Genus 3. *Phyllophaga* Harris
aemula (Horn)
bruneri Chapin
**calceata* (LeConte)
clemens (Horn)
clypeata (Horn)
crenulata (Froelich)
cupuliformis Langston
debilis (LeConte)
diffinis (Blanchard)
dispar (Burmeister)
elizoria Saylor
elongata (Linell)
ephilida (Say)
floridana Robinson
forsteri (Burmeister)
glaberrima (Blanchard)
hirticula (Knoch)
ilicis (Knoch)
infidelis (Horn)
knochii (Schoenherr and Gyllenhal)
latifrons (LeConte)
lota Luginbill
luctuosa (Horn)
marginalis (LeConte)
mariana Fall
micans (Knoch)
okechobea Robinson
ovalis Cartwright
parvidens (LeConte)
profunda (Blanchard)
prununculina (Burmeister)
quercus (Knoch)
schaefferi Saylor
submucida (LeConte)
subpruinosa (Casey)
tecta Cartwright
tristis (Fabricius)
ulkei (Smith)
uniformis (Blanchard)
youngi Cartwright
new species (Eustis)
new species (Chumukla)
Genus 4. *Plectris* Serville
aliena Chapin

Tribe IV. Pachydemini
Genus 1. *Gronocarus* Schaeffer
autumnalis Schaeffer
multispinosus Howden

Tribe V. Macrodactylini
Genus 1. *Macrodactylus* Latreille
**subspinosus* (Fabricius)

Tribe VI. Hopliini
Genus 1. *Hoplia* Illiger
equina LeConte
floridana Fisher
meridionalis Boyer

Subfamily VIII. Rutelinae
Tribe I. Anomalini
Genus 1. *Anomalepta* Casey
flaccida Casey
semilivida (LeConte)
Genus 2. *Anomala* Samouelle
exigua (Schwarz)
flavipennis Burmeister
innuba (Fabricius)
ludoviciana Schaeffer
minuta Burmeister
nigropicta Casey
parvula Burmeister
undulata Melsheimer
Genus 3. *Pachystethus* Blanchard
floridana Robinson
marginata (Fabricius)
oblivia (Horn)
Genus 4. *Strigodermella* Casey
pygmaea (Fabricius)

Tribe II. Rutelini
Genus 1. *Pelidnota* MacLeay
lutea (Olivier)
punctata (Linnaeus)
Genus 2. *Cotalpa* Burmeister
lanigera (Linnaeus)

Genus 3. *Rutela* Latreille
formosa Burmeister
Genus 4. *Parastasia* Westwood
brevipes LeConte
Subfamily IX. Dynastinae
Tribe I. Cyclocephalini
Genus 1. *Dyscinetus* Harold
morator (Fabricius)
Genus 2. *Cyclocephala* Latreille
borealis Arrow
immaculata (Olivier)
miamiensis Howden and Endrodi
parallela (Casey)
puberula (LeConte)
Tribe II. Oryctini
Genus 1. *Euetheola* Bates
rugiceps (LeConte)
Genus 2. *Bothynus* LeConte
cuniculus (Fabricius)
morio LeConte
neglectus LeConte
subtropicus (Blatchley)
Genus 3. *Aphonus* LeConte
castaneus (Melsheimer)
variolosus (LeConte)
Genus 4. *Strategus* Hope
antaeus (Drury)
julianus Burmeister
splendens (Beauvois)
Tribe III. Dynastini
Genus 1. *Dynastes* Kirby
tityus (Linnaeus)
Tribe IV. Phileurini
Genus 1. *Phileurus* Latreille
castaneus Haldeman
truncatus (Beauvois)
Subfamily X. Cetoniinae
Tribe I. Gymnetini
Genus 1. *Cotinis* Burmeister
nitida (Linnaeus)
Tribe II. Cetoniini
Genus 1. *Euphoria* Burmeister
inda (Linnaeus)
limbalis Fall
sepulchralis (Fabricius)
Genus 2. *Stephanucha* Burmeister
areata (Fabricius)
**thoracica* Casey
Tribe III. Cremastocheilini
Genus 1. *Cremastocheilus* Knoch
**canaliculatus* Kirby
**harrisi* Kirby
squamulosus LeConte
Tribe IV. Trichiini
Genus 1. *Trigonopeltastes* Burmeister
delta (Forster)
floridana (Casey)
Genus 2. *Trichiotinus* Casey
lunulatus (Fabricius)
piger (Fabricius)
rufobrunneus Casey
Tribe V. Valgini
Genus 1. *Valgus* Scriba
**canaliculatus* (Fabricius)

SYSTEMATIC ACCOUNT

Key to the Florida subfamilies of Scarababaeidae

1. Abdominal spiracles situated in the membrane connecting the dorsal and ventral corneous plates, the last spiracle being covered by the elytra (Fig. 3); ligula always separate from the mentum (visible only after dissection); tarsal claws, when present, simple; antennal club always of three segments; primarily dung feeding species.....LAPAROSTICTI—2

1'. Abdominal spiracles partly situated in the superior portion of the ventral plates, the last spiracle usually visible behind the elytra (Fig. 2,4); ligula sometimes free, usually connate with the mentum (visible only after dissection); tarsal claws always present and often toothed; antennal club sometimes with more than three segments; primarily plant feeding species.... ..... PLEUROSTICTI—7

2(1). Body globular, capable of contracting into a ball (Fig. 43); middle and posterior tibiae flattened and dilated (Fig. 392-395); abdomen with 5 visible ventral segments (Fig. 39); antennae 10 segmented....ACANTHOCERINAE

2'. Body not globular nor capable of contracting into a ball; middle and posterior tibiae never flattened nor dilated (Fig. 41-42, 50-51); abdomen with 6 visible ventral segments (Fig. 40); antennae 8-11 segmented 3

3(2'). Antennae 11-segmented (Fig. 53-54); mandibles prominent from above; posterior tibiae with 2 apical spurs .....GEOTRUPINAE

3'. Antennae 8-10 segmented; mandibles prominent or hidden from above; posterior tibiae with 1 or 2 apical spurs 4

4(3'). Posterior tibiae with a single apical spur (Fig. 50-51, 58) (except for *Melanocanthon*, in which case the clypeus is quadridentate); pygidium exposed; mandibles hidden from above ..... SCARABAEINAE

4'. Posterior tibia with two apical spurs (Fig. 41-42, 55-57); clypeus bidentate or without teeth, never quadridentate; pygidium exposed or hidden; mandibles hidden or prominent from above 5

5(4'). Mandibles not visible from above (Fig. 178, 212, 220, 222, 290, 292-293, 306, 309); antenna 9-segmented; epimera of metathorax covered .....APHODIINAE

5'. Mandibles prominent, visible from above (Fig. 310, 319, 321-23); antennae 10-segmented; epimera of metathorax covered or visible....6

6(5'). Body densely pubescent dorsally (Fig. 321); antennal club with 3 normal segments, the first not excavated for reception of the second; color light yellow to brown; longer middle tibial spur pectinate (Fig. 324-26, 330)..OCHODAEINAE

6'. Body glabrous, shining dorsally (Fig. 310); antennal club with the fiirst segment hollowed for reception of the second which is nearly concealed (Fig. 317-18); color black; both middle tibial spurs entire.....HYBOSORINAE .....*Hybosorus illigeri* Reiche

7(1'). Tarsal claws unequal; posterior tibiae with 2 apical spurs; labrum visible from above..... ..... RUTELINAE

7'. Tarsal claws usually equal (if unequal, then posterior tibiae without apical spurs); labrum visible or hidden from above 8

8(7'). Mandibles concealed by the clypeus; antennae 7-10 segmented; tarsal claws usually cleft, bifid, or toothed (Fig. 48) not more than one pair of abdominal spiracles exposed below edges of elytra; color yellow-brown to black, never metallic or green .....MELOLONTHINAE

8'. Mandibles usually visible from above; antennae 9-10 segmented; tarsal claws variable, often not cleft or toothed; usually at least two pair of abdominal spiracles exposed below edges of elytra; color variable, often with metallic green 9

9(8')'. Front coxae transverse, not prominent; mandibles bent, expanded and leaf-like, often notched; head and/or pronotum armed with horns or protuberances; scutellum as wide as long, rounded behind; color brown to black, never metallic nor green.....DYNASTINAE

9'. Front coxae conical, prominent; mandibles not bent or leaf-like; head and/or pronotum rarely with horns or protuberances; scutellum longer than wide, pointed behind; color variable but often metalilc and/or green....CETONIINAE

Subfamily SCARABAEINAE (=COPRINAE)

(Fig. 1, 81, 84, 100, 107, 122, 125, 128, 133, 136, 145, 155, 177)

TYPE GENUS: Scarabaeus Linnaeus, 1758: 345 (by tautonomy).

DIAGNOSIS: Variable in form and size (length 2 to 30mm), but usually oval and rounded. Color variable from shining metallic green, blue or bronze, to dull, matte black or brown; rarely with spots or maculations of red to orange (in two species of *Onthophagus*). Mouthparts primarily membranous, only the outer margin of the mandibles corneous. Clypeus expanded, concealing the mouthparts from above. Antennae eight or nine segmented; club always three segmented. Epimera of metathorax covered; mesosternum very short; middle coxae oblique, widely separated; posterior tibia with a single spur (except in *Melanocanthon* which has two). Pygidium exposed and usually triangular in shape. Six visible abdominal segments.

In some genera *(Phanaeus* and *Deltochilum)* the anterior tarsi are usually missing, a feature not found in other subfamilies. In some species the males have well developed horns on the head and protuberances and excavations on the pronotum (never in the tribe Scarabaeini).

TAXONOMIC NOTES: This is a large subfamily of several thousand species (no accurate count available) representing 5 tribes, 14 subtribes and 201 genera (Halffter and Matthews, 1966). The group as a whole is fairly well known, with modern revisions in several genera. The status of the classification has been summarized by Halffter and Matthews as follows:

> While in some groups—those which have been revised by recent workers with modern concepts—knowledge is almost at the beta level, in certain others the generic concepts are very confused and no real progress has been made since the time of Harold, 100 years ago. In the first (beta) category we have the Oniticellini, Onitini, Gymnopleurina, some of the Scarabaeina, and the Madagascan and American Canthonina. The latter—the group of the subfamily in which the most work is being done at present—are in the process of revision, and their classification

is approximating a phylogenetic scheme. All of the American canthonine genera included in our list represent natural groups of species, although in some cases it is likely that their rank will be lowered to the level of subgenera in the future. At the other extreme, among groups at the lowest alpha level of study, we have the remaining Canthonina, some of the Coprina, and especially the Dichotomina.

All of the tribes (except Onitini: Oriental, Ethiopian, and Palearctic) are represented in Florida, although the single record of the Oniticellini is doubtful. Only 5 of the 14 subtribes are represented (i.e., Oniticellina, Dichotomina, Phanaeina, Coprina, and Canthonina) by 12 genera with about 36 species and subspecies.

The name Coprinae has been used for this group by many authors (e.g., Gillet, Harold, and Peringuey). It has been called Coprophagi (Latreille, 1802; Laporte, 1840); Coprophaga (Burmeister, 1842), and Coprides (Erichson, 1847; Lacordaire, 1856). It was considered a full family by Balthasar (1963) and by some other European authors. However, recent American authors have usually considered it of subfamily rank, and they have used the name Scarabaeinae (e.g., Arnett, 1962; Halffter and Matthews, 1966).

BIOLOGY: Nearly all members are dung feeders in both the adult and larval stages, but a few are necrophagous or saprophagous. Although practically none of the species is harmful, the group has been the subject of considerable interest for centuries; beginning with their worship by the ancient Egyptians, through the early classic behavior studies by the French naturalist Fabre, to the wave of interest of the present day.

The literature on the biology of dung beetles is therefore quite extensive, much of it appearing in scattered journals and in numerous languages. This situation has long been a handicap to anyone working on the group, but it has been alleviated by the recent monumental review, in English, by Halffter and Matthews (1966). They have reviewed the entire literature on the biology of Scarabaeinae, along with considerable original data on the subject. This publication is the most significant modern contribution to the biology within the family Scarabaeidae, and should greatly enhance future work and create considerable interest in dung beetles. Therefore, I will not dwell on the subject further here, but the reader is urged to read the above paper for a thorough and enlightening account of the biology of this fascinating subfamily.

Key to the Florida tribes and genera of Scarabaeinae (=Coprinae)

1. Middle and posterior tibiae slender, curved, scarcely enlarged at the apex (Fig. 51); head and pronotum without horns or protuberances; elytral striae obsolete, poorly defined ..... (Scarabaeini)—4

1'. Middle and posterior tibiae enlarged at the apex (Fig. 50); head and pronotum often with horns and/or protuberances; elytral striae obvious or obsolete 2

2(1'). Third segment of labial palpi distinct; elytral striae distinct, or if not, the intervals reticulately punctate; color black or bronze, elytra never maculate; length 5-29 mm.... ..... (Coprini)—9

2'. Third segment of labial palpi inconspicuous; elytral striae obsolete; color black to metallic green, the elytra sometimes maculate with small orange to red spots; length 2-8 mm.. 3

3(2'). Antennae 9-segmented; scutellum hidden; several common Florida species; length 2-8 mm; (Fig. 155)...(Onthophagini)—*Onthophagus*

3'. Antennae 8-segmented; scutellum small but visible; single Florida record doubtful; length 5-7 mm; (Fig. 177)..... (Oniticellini) ..... *Oniticellus cubiensis* Lap.

4(1). Anterior tarsi absent (Fig. 52); elytral epipleural fold broad; male with enlarged "hump" on anterior one-third of elytra; length 20-25 mm; (Fig. 81)..... ..... *Deltochilum g. gibbosum* (Fab.)

4'. Anterior tarsi present; elytral epipleural fold very narrow or absent; neither sex with enlarged hump on elytra; length 2-22 mm...5

5(4'). Posterior tibia with two terminal spurs; (Fig. 57, 107) ..... *Melanocanthon*

5'. Posterior tibia with a single terminal spur (Fig. 58) 6

6(5'). First segment of posterior tarsus equal to or longer than the second; surface dull, granular, or shining; color gray to bronze, if green then dull granulate, not shining; clypeus bidentate or quadridentate; length 5-22 mm 7

6'. First segment of posterior tarsus shorter than the second; surface shining, never granulate (although minutely pebbled); color usually bright green, shining, but sometimes purple bronze, never gray or black; clypeus bidentate; length 2-4 mm; (Fig. 122) ....*Glaphyrocanthon viridis* (Beauv.)

7(6). Base of pygidium without margin; clypeus quadridentate; dorsal surface shining not granulate; color bronze to black with green sheen; length 3-4 mm; (Fig. 125)..... .....*Pseudocanthon perplexus* (Lec.)

7'. Base of pygidium margined, clypeus bidentate or quadridentate; dorsal surface granulate, not shining; color dull gray to green; length 4-22 mm; (Fig. 84, 100) 8

8(7'). Clypeus bidentate; anterior border of posterior femur margined; length 11-22 mm; (Fig. 84, 105) ..... *Canthon*

8'. Clypeus quadridentate; anterior border of posterior femur without margin; length 4-10 mm; (Fig. 100, 106) ..... *Boreocanthon*

9(2). Anterior coxae very transverse, not prominent; head and pronotum without horns or protuberances; color bronze to black, never bright green; length 5-7 mm; (Fig. 128) ..... *Ateuchus*

9'. Anterior coxae short, conical and prominent; head and pronotum often with horns or protuberances; color black to bright metallic green; length 8-29 mm 10

10(9'). Anterior tarsi absent in males (Fig. 49), the females lacking claws on these tarsi; color metallic green or blue, often with reddish reflections; elytral striae not prominent, the intervals reticulately punctate; (Fig. 1, 145). ..... *Phanaeus*

10'. Anterior tarsi and claws present in both sexes; color black, never green or metallic; elytral striae deeply impressed, the intervals smooth, convex 11

11(10'). Elytral striae seven; clypeus not notched medially; length 20-30 mm; (Fig. 133) ..... *Dichotomius carolinus* (L.)

11'. Elytral striae eight; clypeus usually notched medially; length 8-15 mm; (Fig. 136) ..... *Copris*

Tribe SCARABAEINI

(Fig. 57-58, 81, 84, 100, 105-107, 122, 125)

This tribe was divided into seven subtribes by Halffter and Matthews (1966), but only one (Canthonina) is represented in Florida. This subtribe was treated as a tribe, the Canthonini, by Vulcano and Pereira (1964). It was called Canthonides by Paulian (1938), Gillet (1911), Peringuey (1901), and Blackwelder (1944). LeConte and Horn (1883) treated our species under the tribe Coprini and subtribe Ateuchini.

The American species have received considerable attention recently (e.g., Martinez, Pereira, Halffter, Matthews). The subtribe Canthonina was recently catalogued for the western hemisphere (Vulcano and Pereira, 1964). In this catalogue 39 genera are listed, of which the following 6 occur in Florida: *Boreocanthon, Melanocanthon, Canthon, Deltochilum, Glaphyrocanthon,* and *Pseudocanthon.*

All of the Florida species, except *Deltochilum gibbosum* Fab., have been listed in the genus *Canthon* in previous papers on U. S. species. Arnett (1962), in his "Beetles of the United States," does not recognize the genera *Boreocanthon, Glaphyrocanthon, Melanocanthon,* and *Pseudocanthon.* The process of fragmenting the old genus *Canthon* is still underway, and generic concepts are not firmly established. Two of the U. S. workers (Howden and Matthews) have raised some doubts about the validity of several recently described genera (e.g., *Boreocanthon* and *Nesocanthon).* There undoubtedly will be considerable shuffling of names for a few years. The entire subtribe appears to have its center of origin in the American tropics, with only a few species entering the U. S. Howden (1966b), expressed doubt about the validity of certain genera, but he admitted that he ". . . cannot properly assess . . ." them at this time. Therefore, I am inclined to follow the treatment derived by the workers in South America and Mexico.

The tribe is characterized by the slender, often curved, middle and posterior tibiae. The dorsal surface is often granular, and the elytral striae are poorly defined. The head and pronotum are both without horns or protuberances, although the clypeus is bidentate or quadridentate. The posterior legs are often elongate and used in rolling balls of dung. The size range is from 2 mm *(Glaphyrocanthon)* to 22 mm. *(Canthon).*

All of our species are coprophagous as adults and larvae. The adults roll and bury balls in which a single egg is laid, thus providing food for the larvae. Details of the nidification behavior probably vary somewhat in our species, but in general it may be similar to that reported for *Canthon pilularius* (L.) (Matthews, 1963). These beetles are familiar to most farm boys and are called "tumble bugs."

Genus DELTOCHILUM Eschscholtz

(Fig. 81)

Deltochilum Eschscholtz 1822:37.
Anamnesis Vigors 1826:510.
Hyboma Serville 1828:352 (not *Hyboma* Huebner, 1820:200).
Deltachilum Esch., LeConte 1863b:36 (misspelling).
Meghyboma Kolbe 1893:192.
Annamesis Vigors, Gemminger and Harold 1869:995 (misspelling of *Anamnesis*).

TYPE SPECIES: D. (*Deltochilum*) *dentipes* Eschscholtz 1822:38 (by monotypy).

DIAGNOSIS: Large for the tribe (length to 25 mm, width to 19 mm); dull black; anterior tarsi lacking; middle and posterior tibiae long, slender, the posterior ones bent inward abruptly at the middle, scarcely enlarged at the tip. Sexual dimorphism pronounced; males with prominent swellings (tumescences) on the

anterior one-third of the elytra; posterior tibiae more strongly bent; anterior tibiae with a median tooth projecting ventrally, more strongly developed in the male. Clypeus quadridentate; inner pair of teeth acute with a carina extending from the tip back onto the clypeus; outer pair obtusely angulate, not prominent. Inner pair of teeth separated by nearly 2 mm, arcuately emarginate between. Elytra descending abruptly near apex with three to five variably shaped (mostly longitudinal) carinae at this point. Humeral carina short and longitudinal. Epipleural fold broad (unlike other Canthonini), the elytra bordered laterally by a sharp carina. Surface finely alutaceous, matte, shining only at tumescences, posterior elytral carinae, and humeral carinae. Normally dull black, occasionally with a faint dark purple caste; never metallic. Museum specimens often "greased" and encrusted with soil or carrion. Middle tibia with two apical spurs; posterior tibia with one apical spur. Anterior tibia tridentate, anterior two teeth nearer each other than the posterior one. Metasternum anteriorly depressed at middle in male only. Pygidium large, flattened, not noticeably convex, nearly vertically oriented.

TAXONOMIC NOTES: In a recent catalogue of the Canthonini, Vulcano and Pereira (1964) listed 73 species in the genus which is divided into 9 subgenera as follows: *Aganhyboma* (4), *Calhyboma* (11), *Euhyboma* (1), *Telhyboma* (1), *Hybomidium* (7), *Parahyboma* (2), *Rubrohyboma* (1), *Deltohyboma* (43), and *Deltochilum* (3). Howden (1966b) added two new subspecies, one new species, and synonymized one species to bring the total to 75 species and subspecies currently recognized. The synonymy cited above is mostly from Vulcano and Pereira (1964).

Our single species, *D. gibbbosum* (Fab.), is the type of the subgenus *Hybomidium* Shipp (1897:195). This name was proposed to replace *Hyboma* Serville (1828:352) which was preoccupied by *Hyboma* Huebner (1820:200) in the Lepidoptera. Paulian (1938: 259) subsequently described the new subgenus *Tetraodontides* with *D. gibbosum* as the type species, although in the same paper (p. 238) he listed *D. gibbosum* as the type species of *Deltochilum*. Since *D. dentipes* Esch. was previously selected as type of the genus, and *Tetraodontides* is a synonym of *Hybomidium*, our species becomes *Deltochilum (Hybomidium) gibbosum* (Fab.)

DISTRIBUTION & ZOOGEOGRAPHY: The genus is almost exclusively Neotropical, with only two species entering the United States. Of these two, *D. scabriusculum* Bates is known from Bronwsville, Texas, south to Guatemala and Costa Rica. The other, *D. gibbosum* (Fab.), is known from Kentucky south to Florida and west to Texas, with disjunct subspecies from Panama and Mexico. Ten of the species and subspecies occur in Mexico and Central America, with the remainder of the 75 being South American. The origin of the genus appears to be northern South America, possibly coincidental with that of the genus *Canthon*, for which Halffter (1961) postulated "Arquibrazil."

BIOLOGY: This genus contains the largest species of North American "tumble bugs." As the name implies, they roll balls of food material which are used primarily for egg deposition and in which the developing larvae feed. It is not known if some of these balls are also used as adult food as they are with some species of *Canthon*. The food materials are quite varied and include nearly any kind of decaying plant or animal substance. However, there appears to be a decided preference for carrion. Specific foods observed are: dead crabs, chicken feathers, dog carrion, decaying cantaloupe, decaying fish, human dung, horse dung, fermenting malt, and decomposing fungi. Walker (1957) found *D. gibbosum* at decaying fish and decaying cantaloupe in the three forested habitats investigated, but none was taken on the same baits employed in an old field. Many of the species seem to be more abundant in wooded areas, but at least some species are common in semi-arid regions (Howden, 1966b). Fungi do not appear to be attractive except in the late stages of decomposition. Blatchley (1928a:62) mentioned several specimens of *D. gibbosum* in a ". . . putrid, extremely foetid mass of fungi.", and Howden and Ritcher (1952) stated that fungi seem attractive only in the fall. Walker (1957) reported that *D. gibbosum* was attracted to dead fish within one day after the fresh bait was deposited, but cantaloupe was not attractive until after the 7th day when the flesh was ". . . very soft, much liquid." My own experiences in Mexico and Central America indicate that, although the habitats are variable, specimens are rarely encountered in open pastures. Gibson (*In* Howden, 1966b: 738) found *D. scabriusculum montanum* Howden active around horse dung, but none was utilizing readily available cow dung nearby. At least some of the species are attracted to lights.

The brood balls, in which eggs are deposited, are not round as are those of most species of *Canthon*. They have been described as "narcissus-bulb" or "pear-shaped," although they have been discovered for very few species. Their shape implies that they are rolled in a spinning fashion rather than over and over like a ball as is the case in *Canthon*. The posterior tibiae are especially suited for this task. It is not known if both sexes participate in construction and/or rolling and deposition. The sexual dimorphism of the posterior tibiae (males more curved, Fig. 51) is a possible reflection that the male plays a more active role than the female. The balls are often made of the food material with dirt and leaves packed on the outside. Their general appearance is quite unlike that of the smooth, round ball of *Canthon*. They are most frequently deposited at shallow depths near some natural feature such as a rock or log. Howden and Ritcher (1952) reported a two-inch deep, circular, cup-shaped depression made by the adult, in which a brood ball was found. These balls are the largest known to be constructed by New World dung beetles (this is excluding the dung plugs formed by species of *Dichotomius* and *Phanaeus)* and they often exceed two inches in diameter and height. The balls of our related *Canthon* rarely exceed three-fourths of an inch in diameter. The behavior has not been observed in any detail but should provide some interesting comparative data when it is recorded.

The larvae of few species are known, but they are probably all similar in general appearance. Those known are large, gray-white, "hump-backed" grubs similar to other genera of Scarabaeinae. The most useful taxonomic character for separating them from other genera appears to be the setal pattern of the venter of the last abdominal segment. Larval development is very rapid in those species which have been studied, taking as little as 20 days from egg to third instar (Howden and Ritcher, 1952).

SELECTED REFERENCES: Blatchley, 1928a:62; Cartwright, 1949b:38; Howden and Ritcher, 1952:53-57; Howden, 1966b:733-740; Halffter and Matthews, 1966 (numerous pages referring to biological notes on 15 species); Paulian, 1938:296; Pereira and Martinez, 1956:120-125; and Vulcano and Pereira, 1964:639-660.

Deltochilum gibbosum gibbosum (Fabricius)

(Fig. 81-83)

Scarabaeus gibbosus Fabricius 1775:28.
Copris gibbosus (Fab.), Olivier 1790:141, 172.
Ateuchus gibbosus (Fab.), Fabricius 1801:57.
Hyboma gibbosa (Fab.), Serville 1828:353.
Deltochilum gibbosum (Fab.), Burmeister 1848:134.
Deltachilum gibbosum (Fab.), LeConte 1863b:36 (misspelling).
Deltochilum g. gibbosum (Fab.), Bates 1887:36.

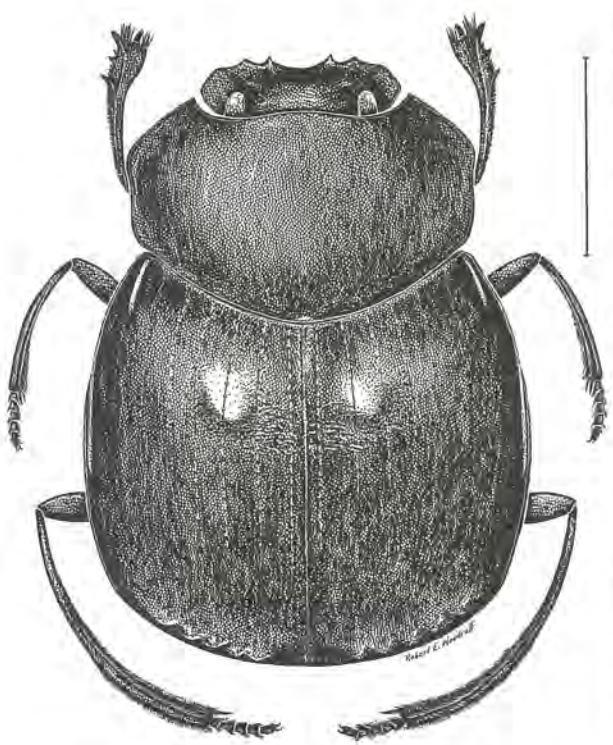
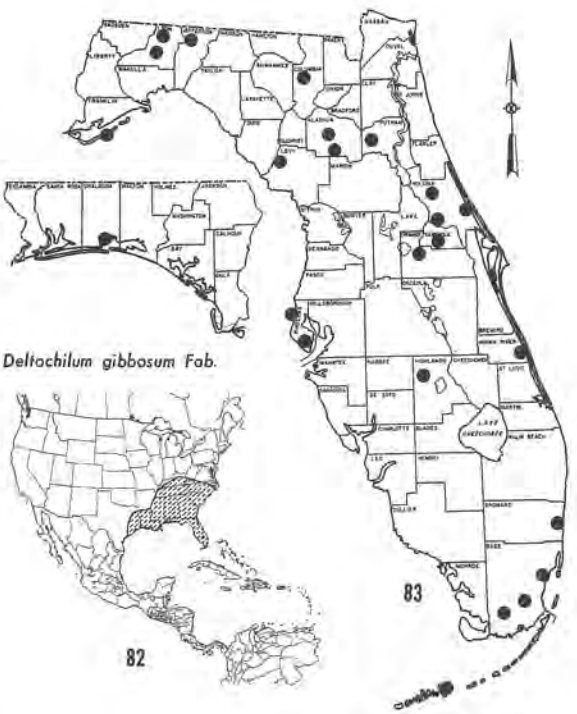


Fig. 81, **Deltochilum g. gibbosum** (Fab.), line = 8 mm.



DIAGNOSIS: Easily distinguished from other Florida Canthonini by the lack of anterior tarsi, broad epipleural fold, large size (up to 25 mm in length), shape and position of the clypeal teeth, anterior elytral tumescences of the male, carinate elytral margins, and the longitudinal humeral carina.

TAXONOMIC NOTES: Typical *gibbosum* is apparently confined to the southeastern U. S. Howden (1966b: 736) stated, ". . . the species is represented by a complex of related forms extending through Mexico and Central America into South America. Several seemingly disjunct populations show constant differences, but, because of the paucity in collections of specimens from critical areas, these differences are difficult to assess. For the present I have treated the various populations as subspecies, partly to indicate their close relationship, and partly to indicate the possibility of interbreeding." He recognized two additional subspecies: *sublaeve* Bates from Mexico and *panamensis* Howden from Panama.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 82-83). Recorded from Alabama, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and I have also seen specimens from southeastern Kentucky (new state record). In Florida it occurs from Pensacola to Big Pine Key, the spotty records probably reflecting its secretive habits, and it probably occurs throughout the state.

BIOLOGY: (see remarks under the genus). This species is probably much more abundant than the records

would indicate, but it is secretive in its habits. It is possible that it is primarily active at night (as is *Canthon vigilans*). Specimens are readily attracted to chicken feathers, especially in forested areas. I have taken two dead specimens apparently trapped in a box in which dead blue crabs had been deposited. Other hosts include dog carrion, fermenting malt, Japanese beetle trap, decaying fish, decaying cantaloupe, human dung, and decomposing fungi. There is a single record at light (Frost, 1964:142). In Florida it apparently occurs throughout the year, with records from January through November. No behavioral observations have been recorded.

SPECIMENS EXAMINED: 85, of which 70 were from 22 Florida localities (for complete data see Appendix 1).

SELECTED REFERENCES: Angell, 1913:169, Blatchley, 1920b:43, 1828a:62; Cartwright, 1949b:38; Frost, 1964:142; Hebard, 1903:261; Howden, 1966b:736, Fig. 17-18; Howden and Ritcher, 1952:53, 11 Fig.; Paulian, 1938:259-262, Map; 1939:Fig. 1, 10; Pereira and Martinez, 1956:125; Vulcano and Pereira, 1964:648-649; Walker, 1957:Table 5, 7, Fig. 6, 9-11.

Genus CANTHON Hoffmannsegg

(Fig. 84-99)

Canthon Hoffmannsegg 1817:38.
Coprobius Latreille 1829:535.
Coeloscelis Reiche 1841:213.

TYPE SPECIES: Scarabaeus pilularius Linnaeus 1758, by subsequent designation of Paulian (1938-39:22).

DIAGNOSIS: Typical Scarabaeinae; medium sized (10-22 mm long); at least part of dorsal surface granular; clypeus bidentate; posterior femur margined anteriorly; pygidium margined at base; anterior tarsi present; middle and posterior tibiae slender, scarcely enlarged at tip; sexual dimorphism not noticeable; head and pronotum unarmed, without horns or protuberances: color black to brown, greenish to bronze but never shiny metallic. Anterior part of the prothorax below not excavated to receive the fore femora, and no transverse carina delimiting this area. Anterior tibial spur variable, often bifurcate in the male, simply acute in the female. Middle tibia with two spurs; posterior tibia with one spur.

TAXONOMIC NOTES: The genus, in its narrow sense, has been recently monographed for North America (Halffter, 1961) and catalogued for the world (Vulcano and Pereira, 1964). In these papers 98 species are recognized for the world. Until recent years this genus was more broadly applied and included all of the species treated here under the genera *Glaphyrocanthon*, *Pseudocanthon*, *Boreocanthon*, and *Melanocanthon*. Numerous other genera have also been split from the old genus *Canthon*, especially for the South American species, and this process is still going on. Some doubts have been raised concerning the validity of some of these divisions (Matthews, 1966; Howden, 1966b), but they are provisionally accepted here until a complete revision of the tribe is made (currently in progress by Halffter and Martinez, 1966-70).

Fig. 84. **Canthon pilularius** (L.), line = 7mm.

Our Florida species are similar in appearance and often difficult to determine without comparative material. However, the characters mentioned in the key and the illustrations should serve to distinguish the species. Characters of the male genitalia are useful but not greatly different among our species. The internal sac has been used for distinguishing many of the South American forms. No subspecies are recognized for the U. S. species, although several have been described for Mexican and Central American species (Halffter, 1961). Our species vary primarily in color (from black to blue or green) and size (10 to 22 mm in length). Variation in the labrum of one species (*vigilans*) is described as clinal by Halffter (1961). The Florida species are generally larger than many of the Central and South American species, and one of our species (*vigilans*) attains maximum size for the genus (22 mm).

DISTRIBUTION & ZOOGEOGRAPHY: Nearly all of the 98 species listed by Vulcano and Pereira (1964) are Neotropical, with only 8 species being found in North America. The genus appears to have had its origin in South America. Four species are recorded from the Antilles (Matthews, 1966), although the three previously described species were placed in their new

genus *Nesocanthon* by Pereira and Martinez, and the fourth was described by Matthews (1966) as occupying a ". . . taxonomically highly isolated . . ." position in the genus. Only three of the eight North American species occur in the Eastern U. S., and all three have been recorded from Florida. In Florida, only one species (*pilularius*) appears to occupy the entire state, although I have not personally seen specimens from south of Miami or from the Keys. Blatchley (1928:61) listed a single specimen from Key West. Of the remaining two species, *chalcites* is known only from four isolated localities (Welaka, Ocala Nat. For., Torreya St. Pk., and Miami), and *vigilans* probably occupies the northern two-thirds of the state as far south as Ft. Myers.

BIOLOGY: These are the so called "tumble bugs" which are a familiar sight to every farm boy. All of our species are primarily coprophagous and feed commonly in cow and horse dung; although there are some records indicating a slight trend for sarcophagy. All of our species roll balls of dung away from the source, and these may be utilized for adult food (food balls) or for egg deposition and subsequent larval food (brood balls). They occur more abundantly in open pastures and are normally associated with the grassland biome. Only one of our species (*pilularius*) has been studied in any detail (Matthews, 1963). Only general behavior, probably common to all of our species, will be discussed here. For further detail see the discussions under each species.

Food balls are constructed, rolled from the source, and buried by a single beetle of either sex and later consumed underground. Brood balls are usually more carefully constructed, sometimes by both sexes, but the subsequent rolling and burial are executed by the male only (in *pilularius*, the only species fully observed); the female accompanies the male, either walking behind or riding on the ball, but apparently not assisting in any way. A single egg is laid on each ball and covered with dung, rendering the ball more pear-shaped. The brood balls are usually rolled to greater distances and buried deeper than the food balls. Comstock (1940:516) offered a teleological explanation thusly, ". . . as many predacious insects frequent the masses of dung from which the balls are obtained, in order to prey upon the larvae which live there, the more intelligent tumble bugs remove the food for their larvae to a safe distance." Little data is available on the parasites of dung beetles, but such behavior would seem to offer an evolutionary advantage to the "tumble bugs." Other stages of this behavior are found within the genus, from those which have lost (?) the ability to construct balls, to those which construct balls but do not roll them from the source (Matthews, 1966). Certain Central and South American species are strictly necrophagous.

Most of the species are diurnal, but a few are strictly nocturnal. One of our species *(vigilans)* is nocturnal, possessing enlarged eyes, and it is the only U. S. species attracted to light.

SELECTED REFERENCES: Balthasar, 1939; Blanchard, 1885; Brown, 1928a; Halffter, 1961; Harold, 1863c; Paulian, 1939; Pereira and Martinez, 1956; Robinson, 1948b; Schmidt, 1922b; Vulcano and Pereira, 1964.

Key to the Florida species of Canthon

1. Eyes large for the genus (Fig. 85); body larger (length 15-22 mm); color uniform black; often attracted to light..... *vigilans* Lec.

1'. Eyes normal for the genus (Fig. 86); body smaller (length 11-18 mm); color usually bronze, bluish or greenish, rarely black; never attracted to light.....2

2(1'). Head, pronotum, and pygidium with uniform minute granules, never with enlarged granules as are present on the elytra (Fig. 92); uniformly bronze (rarely black), never bluish or greenish; rare in Florida.... *chalcites* (Hald.)

2'. Head, pronotum, and pygidium with enlarged granules similar to those of the elytra (Fig. 93); color variable from bronze to bluish, greenish, or dull matte gray; common Florida species ..... *pilularius* (L.)

Canthon chalcites (Haldeman)

(Fig. 89-92)

Coprobius chalcites Dejean 1836:151 (nomen nudum).
Coprobius chalcites Haldeman 1843:304.
Canthon chalcites Hald., LeConte 1859a:10.
Canthon chalcides Hald., LeConte 1863b:36 (misspelling).

DIAGNOSIS: Easily distinguished from the two other Florida species by the lack of coarse granules (like those of the elytra) on the head, pronotum, and pygidium (Fig. 92). It differs further from *vigilans* Lec. in the narrower eyes (as in *pilularius*). It differs further from *pilularius* by its generally larger size (length 13-21 mm) and uniformly bronze (or rarely black) color. Anterior tibial spur sexually dimorphic (Fig. 89-91).

TAXONOMIC NOTES: Harold (1868c) synonymized this species under *laevis* (a synonym of *pilularius*), but he was clearly in error in doing so, as was pointed out by Horn (1870a). Although the two species are closely related, the differences in pygidial granulation are very apparent on comparison of the two. Occasionally a specimen will show only traces of the normal bronze color, and variability exists also in the size and shape of the elytral granules. Robinson (1948b:95) mentioned a form from southern Florida which had these granules ovate rather than round as in typical specimens from northern localities. He also mentioned two specimens from the mountains of Pennsylvania which had the granules reduced to shining spots without any height. He further postulated that these two forms ". . . may prove to be sub-

specific races when more material becomes available." Halffter (1961) could find little correlation between the slight amount of variation and geography and thus did not recognize any subspecies. Although large series of specimens are available from Missouri and Nebraska, this species is rarely collected elsewhere. Until this material is available in numbers, a proper evaluation of the variability cannot be made.

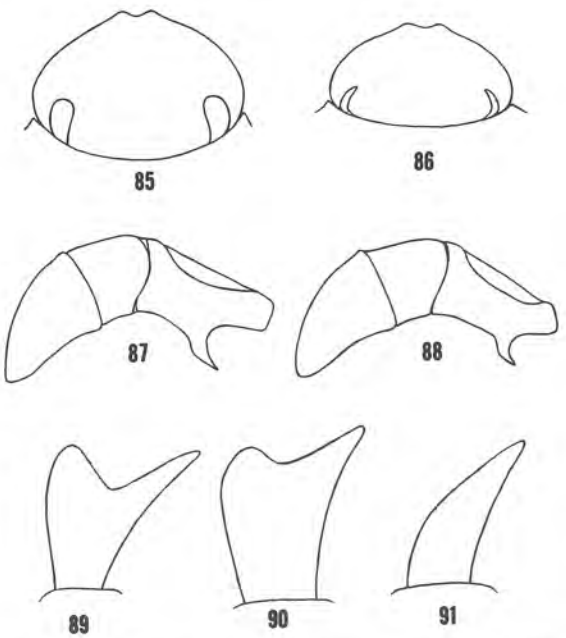


Fig. 85-91. **Canthon** spp.: 85) Dorsal view of the head of **Canthon vigilans** Lec. Note the enlarged eyes. 86) Dorsal view of the head of **Canthon pilularius** (L.). Note the narrow eyes. 87) Lateral view of the male genitalia of **Canthon vigilans** Lec. 88) Lateral view of the male genitalia of **Canthon pilularius** (L.). 89) Anterior right tibial spur of male **Canthon chalcites** (Hald.) from Miami, Florida. 90) Anterior right tibial spur of male **Canthon chalcites** (Hald.) from Oconee County, South Carolina. 91) Anterior right tibial spur of female **Canthon chalcites** (Hald.) from Welaka, Florida.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 94-95). The type is from "Missouri." Halffter (1961:300) recorded it from Alabama, Florida, Georgia, Illinois, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Virginia. In Florida it has a very spotty distribution, although this is probably a reflection of its rarity. The northernmost record is Torreya State Park, and the southernmost is Miami. It was not recorded in the "Scarabaeidae of Florida" by Blatchley (1927-30).

BIOLOGY: Practically nothing has been published on the habits of this species. Presumably it is a dung feeder and rolls balls similar to those of *C. pilularius*. I have taken a single specimen in an arbor vitae bog in Ohio on the carcass of a fox in deep woods. I have seen a fair series from the mountains of Georgia and Tennessee, but it also occurs at sea level in Florida and in the plains of Kansas, Missouri, and Nebraska. It has been collected from March through November, but most records are for June or July. The immature stages are unknown.

SPECIMENS EXAMINED: 110, of which only 6 were from Florida as follows: (1) Dade Co., Miami, 12-IX-34, F. N. Young (USNM); (1) Liberty Co., Torreya St. Pk., 13-VI-66, H. V. Weems, III; (1) loc. cit., 14-VIII-68, G. W. Rawson; (1) Putnam Co., Welaka, 1-XI-39, J. J. Friauf, PH-10 (USNM); (1) Volusia Co., Enterprise, III-23 (OSU); (1) Youkon, Fla., Acc. 23983 (USNM). The only other Florida record is that of Halffter (1961:300) as follows: (3) Marion Co., Ocala Nat. For., 21-IX-30, T. H. Hubbell (UMMZ).

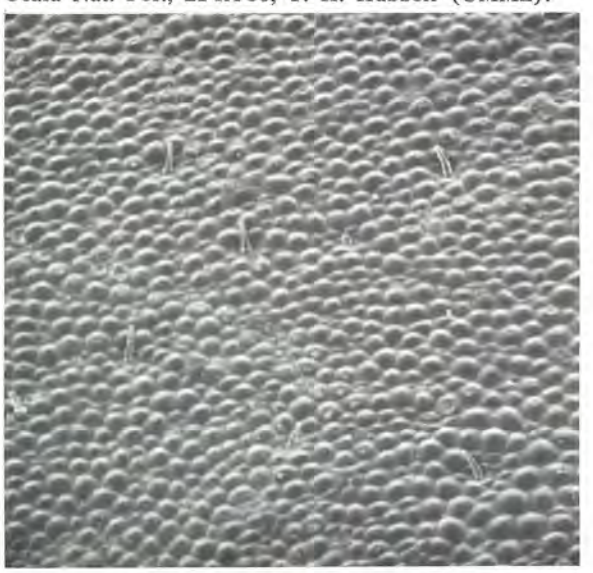


Fig. 92. Stereoscan photo of central area of pygidium of **Canthon chalcites** (Hald.) (197X). Note granules similar in size.

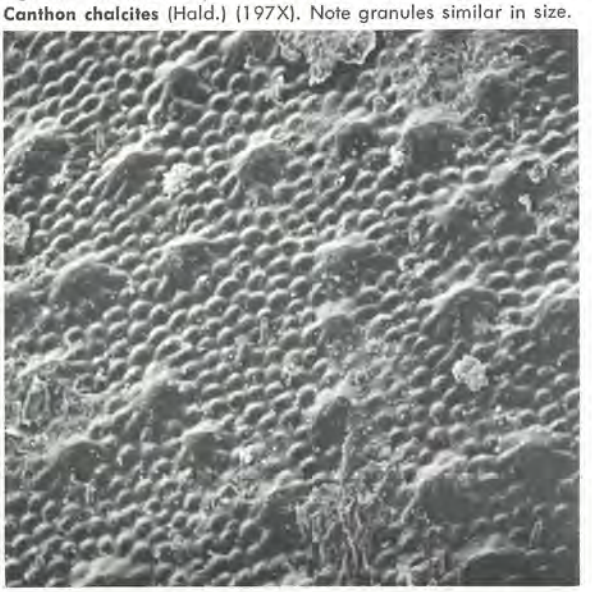
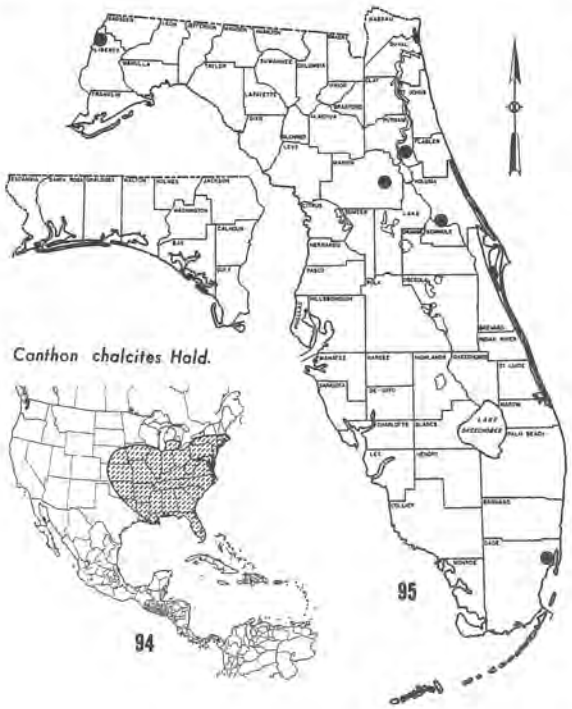


Fig. 93. Stereoscan photo of central area of pygidium of **Canthon pilularius** (L.) (197X). Note two sizes of granules.



SELECTED REFERENCES: Blanchard, 1885:166; Dillon and Dillon, 1961:508, Pl. 49, Fig. 7; Halffter, 1961:297-301, Fig. 8-9, 71-73; Robinson, 1948b:95, Fig. 3-4; Vulcano and Pereira, 1964:606.

Canthon pilularius (Linnaeus)
(Fig. 84, 86, 88, 93)

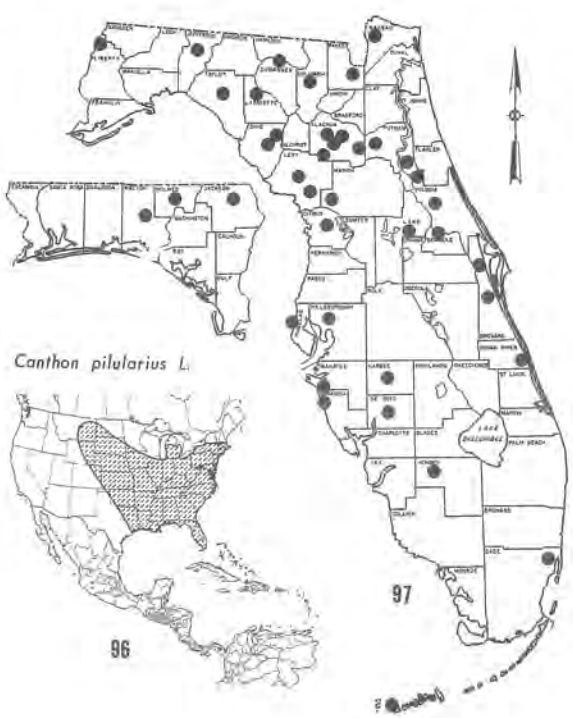
Scarabaeus pilularius Catesby 1731-1743: Pl. 11 (Pre-Linnean name).
Scarabaeus pilularius Linnaeus 1758:349.
Scarabaeus laevis Drury 1770:79, Pl. 35, Fig. 7.
Scarabaeus hudsonias Forster 1771:24.
Scarabaeus volvens Fabricius 1792:66.
Coprobius obtusidens Ziegler 1844:45.
Canthon laevis viridescens Horn 1870a:47.

DIAGNOSIS: Typical for the genus but generally smaller (length 12-17 mm) than the other species. Of the Florida species it is most similar to *chalcites*, but differs in the coarse granules of head, pronotum, and pygidium (Fig. 93). The color is coppery to black in *chalcites*, where it is bronze to green or dark blue in *pilularius*. It is similar also to *vigilans* but differs in the narrower eyes (Fig. 86).

TAXONOMIC NOTES: In the above synonymy I have listed only the species synonyms in their original generic combinations. For a fairly complete list of over 100 citations see Vulcano and Pereira (1964:623-625). Considerable differences of opinion exist about the proper name to apply to this species. For many years it was called *laevis* Drury in nearly all American literature. Much of the confusion revolves around the ambiguous original description of Linnaeus, because he cited previous references by Catesby (obviously North America), and he listed the locality as "America." However, he also cited references to *pilularius* by Pliny and Aristotle (presumably European and thus a member of *Gymnopleurus* and not *Canthon)*. Numerous papers have been written on the subject, and these are summarized by Halffter (1961).

This species and *C. imitator* Brown are very closely related, although distinct species. *C. imitator floridanus* Brown was described from Gainesville, Florida, and later synonymized by Halffter (1961). I am personally convinced that the subspecies was based on mislabeled specimens, and *imitator*, in any of its variations, does not occur in Florida. The types of *floridanus* and the 180 specimens examined by Halffter (1961:311) are all labeled: Gainesville, Fla., 1920, F. W. Walker. I have searched for nearly ten years for anything resembling *imitator* around Gainesville, and, although I have taken several hundred *pilularius*, I have found no *imitator*. I have examined the type of *imitator floridanus* in the U. S. National Museum and part of the series mentioned by Halffter in the University of Michigan Museum of Zoology and concur that they are *imitator*.

The collector of this long series, F. W. Walker, was normally very meticulous about keeping field notes, for which a number was usually attached to the labeled specimen. Since these specimens do not carry a specific date nor a field number, their status is immediately questionable. A check of Walker's field notes, by Dr. T. H. Hubbell and later by myself, revealed no reference to these specimens. Hubbell stated (in litt.) that, "I think your surmize that they were mis-



labelled is probably correct, but how it could have happened is hard to understand. If you are right, the chances are that Walker had nothing to do with this material."

The subspecies *viridescens* Horn was synonymized by Halffter (1961) and others. The green form on which it was based is common only in north central Florida and southern Georgia. The color is quite variable in specimens taken at a single locality in the southeast, although those from the north (e.g., Ohio) are exceptionally uniformly bronze, with no green or blue reflections. Those from south Florida (e.g., Zolfo Springs) are uniformly dark blue. Additional studies should be conducted with this common, wide-ranging species, in order to ellucidate the status of these color forms.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 96-97). It apparently occupies nearly the entire area east of the Rocky Mountains. Previous records from Mexico are probably all referrable to the closely related *imitator*. The record of Blanchard (1885:166) for "S. Cal." is probably also incorrect since no subsequent specimens have been seen from west of the Rockies.

In Florida it has been found in nearly all areas except the Everglades and the Keys (with the exception of a doubtful record from Key West by Blatchley, 1928). The original description mentioned only "America," but Robinson (1948b:93) listed the type locality as "New York."

BIOLOGY: As the common name "tumble bug" implies, these beetles roll balls of dung. The adults and larvae feed primarily on horse and cow dung, although they have been found on a variety of other types. They are not normally necrophagous, but Bragg (1957) reported a situation where dead tadpoles of *Scaphiopus holbrooki hurteri* were used in constructing the balls. Since this presumably occurred in Oklahoma, this record could refer to either *pilularius* or *imitator*. The life history was described by Lindquist (1935), Cooper (1938a), Ritcher (1945), and Miller (1954). The behavior has only recently been studied in detail by Matthews (1963). From this study it was determined that the brood balls are rolled solely by the male, with the female often riding atop but not participating in the rolling operation. Previously it had often been reported that the sexes cooperate in this chore. Matthews also discovered that there may be some sun orientation in rolling the balls. Further study in this area would be very interesting. Two kinds of balls are formed; one for adult food and the other for provisioning the larva. For a general discussion of ball rolling in dung beetles, see the discussion on nidification in Halffter and Matthews (1966).

The larval epipharynx was first described by Hayes (1929), but the figure is based on a broken specimen, as pointed out by Ritcher (1945:4). The third instar larva was subsequently described and figured by Ritcher (1945:6-7).

The larva of none of our other species has been described for comparison. It can be separated from the other known larvae of the subfamily Scarabaeinae by the following combination of characters: prothoracic shield with an anteriorly projecting, angular process on each side; legs with a single terminal seta; venter of last abdominal segment with a single, broad, caudal, median lobe; median portion of venter of last abdominal segment with two inconspicuous patches of very short setae.

Although there is probably more published information on this species than any other dung beetle, much is yet to be learned about behavior and morphological variation.

MORPHOLOGY: The internal anatomy was studied by Cooper (1938b), and it is this study which is the basis for most generalizations on dung beetles. The abdominal ganglia of the nervous system are coalesced with the meso- and metathoracic ganglia to form a single ganglionic center. The stomodaeum has neither crop nor proventriculus. The mesenteron is exceptionally long, with projecting gastric caeca for its entire length. All body cavities are lined with sausage-shaped fat bodies formed around tracheal branches. The reproductive system of the female has only the left ovary developed, with a single ovariole. The respiratory system shows no air sacs arising from abdominal tracheae, but seven pairs arise from the metathoracic spiracles and form a group caudad to the heavily muscled thoracic region. Air sacs from the mesothoracic spiracles extend forward into the head.

The external morphology was described by Mohr (1930) and Halffter (1961). The mouthparts were described in detail by Hardenburg (1907) and Miller (1961).

SPECIMENS EXAMINED: Over 600, of which 332 were from Florida (for complete data see Appendix 2).

SELECTED REFERENCES: The more important references are cited in the above discussions. Since there are over 100 citations for this species, no attempt is made to list them here, but the reader is referred to the catalogue of Vulcano and Pereira (1964) for a nearly complete listing.

Canthon vigilans LeConte

(Fig. 85, 87)

Canthon vigilans LeConte 1858:16.

DIAGNOSIS: Distinguished from the two other Florida species by the greater width of the eye as seen dorsally (Fig. 85). It differs further from *chalcites* by having the head, pronotum, and pygidium with coarse granules as on the elytra. The color is fairly uniform black with very slight blue to purple reflections; never bronze or green as in the other species. It is exclusively nocturnal. It reaches the maximum size for the genus (length 22 mm).

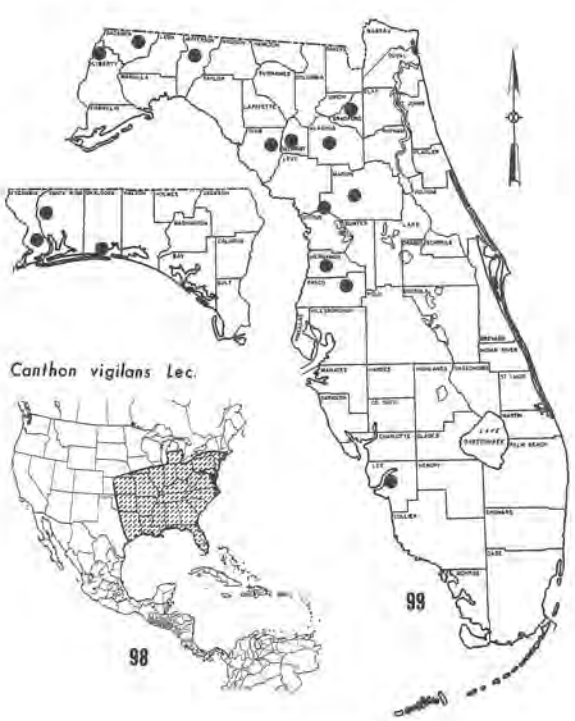
TAXONOMIC NOTES: Halffter (1961) indicated that this was the least variable of the North American

Canthon, but he showed (Fig. 40 and 41) north-south clinal variation in two mouthpart characters. Additional specimens will be required to determine the full extent of this variation.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 98-99). Originally described from Georgia, Missouri, and Texas, without specific designation of a type locality. Robinson (1948a:95) listed the type locality as "Texas," and he was followed by Halffter (1961). It has been recorded from the following states: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Illinois, Kansas, Massachusetts, Michigan, Missouri, Mississippi, New Jersey, New York, North Carolina, Texas, and Virginia. I have also seen specimens from Kentucky and Tennessee (new state records).

It was first reported from Florida (Ft. Myers) by Blatchley (1928a:68-69). I have not seen specimens from that part of the state, my southernmost record being Pasco County. It is probably more widely distributed than the few records indicate.

BIOLOGY: Practically nothing is known about this species except that it is nocturnal. It has been taken from March through September in Florida, nearly always at light. The two other Florida species are not attracted to light. Brown (1928a:25) recorded it from Oklahoma in excrement of horses and cattle on soil that contained little or no sand. Obviously such a situation does not exist in Florida, indicating a range of edaphic tolerances. Miller (1954:Table 1-2) found this species attracted to traps containing human feces at night in Georgia. The immature stages are unknown.



SPECIMENS EXAMINED: About 125, of which 84 were from 18 Florida localities (for complete data see Appendix 3).

SELECTED REFERENCES: Blanchard, 1885:166; Blatchley, 1928a:68-69; 1928:61; Brown, 1928a:25; Halffter, 1961:294-297, Fig. 34, 68-70, 17; Horn, 1870a: 47; Robinson, 1948b:94-95, Fig. 4; Vulcano and Pereira, 1964:635-636.

Genus BOREOCANTHON Halffter

(Fig. 58, 100, 106)

Boreocanthon Halffter 1958:208-209.

TYPE SPECIES: Canthon ebenus (Say), by original designation.

DIAGNOSIS: Similar in general appearance to *Canthon*. Dull gray, matte, granular, clypeus with four teeth (the genal angles sometimes resembling two more teeth). The main character for separating this genus from *Canthon* (sensus strictus) is the absence of a marginal line on the anterior part of the posterior femur (Fig. 106). It is easily separated from *Melanocanthon*, which it closely resembles superficially, by the single spur on the posterior tibia (Fig. 58).

TAXONOMIC NOTES: Halffter (1958) indicated that he was only describing the genus, and no attempt was made at a generic revision. Vulcano and Pereira (1964) listed 12 species in the genus, and Howden (1966b) added another. Many of the species are variable, and they are not well known. The genitalia are sometimes useful in distinguishing closely related species. The two Florida species are easily separated by the characters given in the key.

DISTRIBUTION & ZOOGEOGRAPHY: The genus, composed of nine species, appears to be exclusively North American. The distribution given by Halffter (1958:208) is as follows: British Columbia to Alberta in Canada; United States; northwest of Mexico (Baja California, Sonora, and Chihuahua).

BIOLOGY: Very little has been published on the habits of the species except that they are coprophagus. Presumably they roll balls of dung, as does the related *Canthon*, but there are no published records to this effect. At least one of our species *(probus)* appears to be more abundant on rabbit pellets. The immature stages are unknown.

SELECTED REFERENCES: Halffter, 1958:208-210, 1961:234; Howden, 1966b:729-730; Robinson, 1948b; Vulcano and Pereira, 1964:595-600.

Key to the Florida species of Boreocanthon

1. Head, pronotum, elytra, and pygidium with enlarged granules scattered over the minutely pebbled surface; anterior tibial spur of the male elongate, pointed, not bifurcate; larger (length 7-10 mm) ..... *depressipennis* (Lec.)
1'. Head, pronotum, elytra, and pygidium without enlarged granules on the minutely pebbled surface, instead they are replaced by small shining spots; anterior tibial spur of the male bifurcate; smaller (length 4-6 mm) ..... *probus* (Germ.)

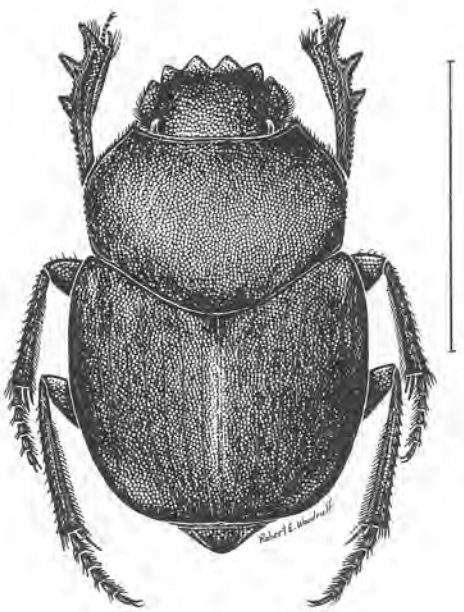


Fig. 100. **Boreocanthon depressipennis** (Lec.), line = 5mm.

Boreocanthon depressipennis (LeConte)

(Fig. 100, 106)

Coprobius depressipennis Dejean 1836:152 (nomen nudum).
Canthon depressipennis LeConte 1859a:11.
Canthon depressipenne Lec., Blackwelder 1944:199.
Boreocanthon depressipennis (Lec.), Halffter 1958:208.

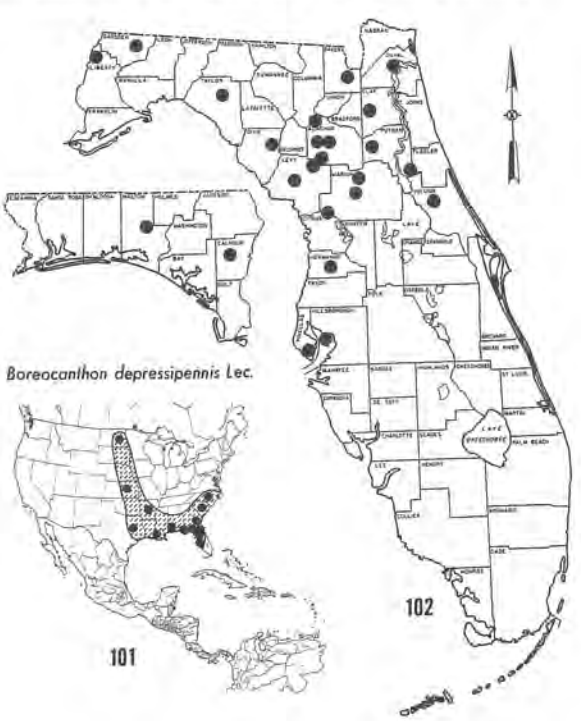
DIAGNOSIS: Easily distinguished from our only other species by the characters in the key. In addition specimens sometimes have green or blue reflections. The male genitalia is also distinctive. It is most similar to *B. ebenus* (Say) of the southwest, but differs by the less coarsely granulate pronotum, external elytral striae less deep than those of the disc, posterior femur with scattered punctures and fine setae, and the shape of the male genitalia.

TAXONOMIC NOTES: A readily recognized species, with no taxonomic confusion or synonyms.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 101-102). Originally described from Kansas, although Robinson (1948b:92) erroneously listed the type locality as Georgia. It has been recorded from the following states: Louisiana (Summers, 1874:87); "Da., Fla., Ga., Kans." (Blanchard, 1885:165); Ohio (Dury, 1902:153); North Carolina (Brimley, 1938:199); Alabama (Loding, 1945: 98); South Carolina (Robinson, 1948b:92); Gillet (1911:92) erroneously listed it from "Sudamerika." It is also listed from Mexico by Blackwelder (1944:199) and Vulcano and Pereira (1964:596), although I have been unable to verify these records. I suspect that they refer to *B. ebenus*.

In Florida it was first recorded from Tampa as rare by Schwarz (1878:449). Slosson (1893:150) reported it from Suwannee Springs, and Castle and Laurent (1896:303) listed it from Enterprise. Dozier (1918 and 1920) listed it as common at Gainesville. Blatchley (1928:61) reported it "Throughout the State" and mentioned a manuscript record by Schwarz from Key West. I have been unable to verify the latter record by specimens, and I doubt its validity, since I have seen no specimens from south of St. Petersburg. It probably occurs throughout the panhandle and as far south as the center of the peninsula.

BIOLOGY: A fairly common species in cow dung in open sandy pastures. Dozier (1918:332) mentioned that it was common around dung in roads from April to September. My records are for February through September. Nothing else seems to have been published on its habits, and the immature stages are unknown.



SPECIMENS EXAMINED: 224 from 24 Florida localities (for complete data see Appendix 4).

SELECTED REFERENCES: Blanchard, 1885:164-165; Blatchley, 1928:61; Halffter, 1958:208-209, Fig. 2; Horn, 1870:46; Vulcano and Pereira, 1964:596.

Boreocanthon probus (Germar)

Ateuchus probus Germar 1824:98.
Canthon minor Sturm 1843:104.
Canthon probus (Germ.), LeConte 1863b:36.
Canthon probum (Germ.), Blackwelder 1944:201.
Boreocanthon probus (Germ.), Halffter 1958:208.

DIAGNOSIS: Easily distinguished from our only other species by the characters in the key. In addition to the large granules being replaced by shining spots, the head and pronotum are minutely, very shallowly punctate (often only visible at an oblique view at high [90X] magnification). It is superficially similar to *melanus* Robinson, but the pronotal punctures are smaller, shallower, and more widely scattered, and the male genitalia are different.

TAXONOMIC NOTES: Horn (1870:45) synonymized *abrasus*, stating "I have no hesitation in uniting the species of LeConte to that of Germar, and although some slight differences exist between the description and LeConte's unique, it must be remembered that both species have been described from single specimens."

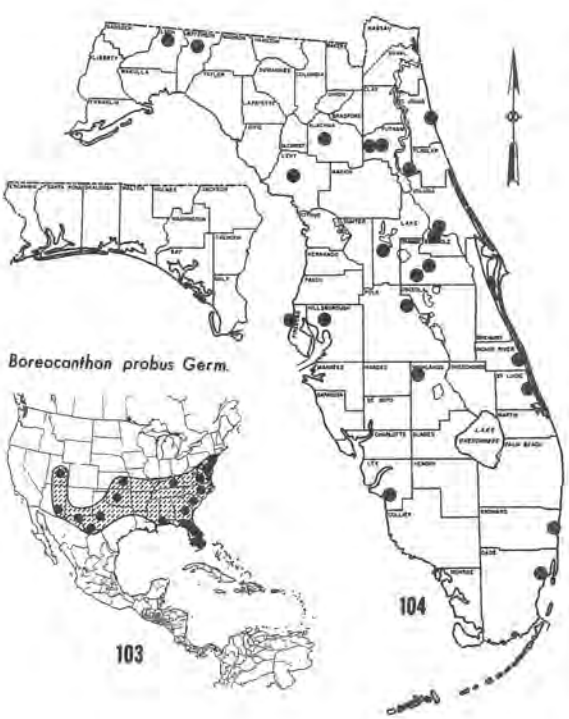
There is some variation in size (length 4-6 mm) and in the coarseness of the pebbled surface of the head, pronotum, and elytra. The single specimen I have seen from Texas has the pebbles more noticeable and in greater relief, although I can find no further differences.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 103-104). It was originally described from "America septentrionali," and Kansas was the type locality for the synonym *abrasus*. In addition it has been recorded from the following states: Florida, Georgia, Kentucky, South Carolina (Blanchard, 1885:165); New Jersey (Smith, 1910:313); North Carolina (Brimley, 1938:199); Alabama (Loding, 1945:98); Oklahoma, Texas, Utah, and Virginia (Robinson, 1948b:90). I have also seen specimens from Arizona (new state record).

It was first recorded from Florida (Enterprise) by Schwarz (1878:449). Blatchley (1918:54) added Crescent City and St. Augustine, and later (1928:61) included Centerville, St. Mary, Marion Co., and Dunedin. My records include nearly the entire peninsula, but there are no records west of Leon Co. However, this is probably an artifact of collecting, since it was recorded from Mobile Co., Alabama (Loding, 1945).

BIOLOGY: I have found this species to be rather uncommon in Florida. However, this observation is based on collecting in cow dung in pastures. It appears to be more abundant in sandy, wooded situations. Several specimens were taken at Gainesville in rabbit pellets, and Miller (1954:Table 1) reported 277 specimens from can traps using human feces as bait. Of this total, 28 were taken in the daytime, and 249 were taken at night. There is a single specimen labeled "at light," but I suspect this is an incidental record. I have taken specimens on two occasions in malt bait traps, but this does not appear to be a good attractant. It has been taken in Florida every month except September and December. The immature stages are unknown.

SPECIMENS EXAMINED: 61, of which 48 were from 22 Florida localities (for complete data see Appendix 5).



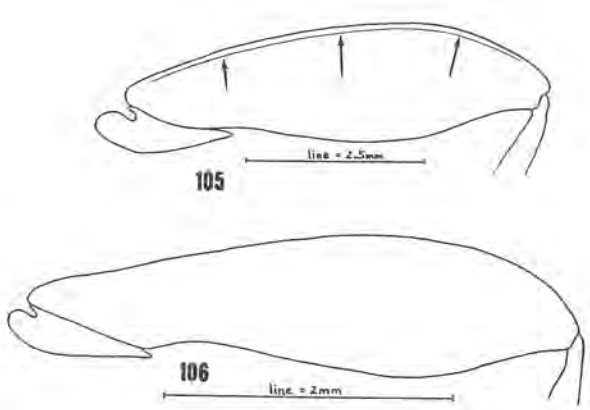


Fig. 105-106. Ventral view of left posterior femur: 105) **Canthon pilularius** (L.), note marginal line at arrows. 106) **Boreocanthon depressipennis** (Lec.), note lack of marginal line.

SELECTED REFERENCES: Blanchard, 1885:165; Blatchley, 1918:54, 1928:61; Halffter, 1958:210, Fig. 3; Horn, 1870:45; Miller, 1954:380-381, Table 1-2; Robinson, 1948b:89-90, Fig. 19-20; Vulcano and Pereira, 1964:598-599.

Genus MELANOCANTHON Halffter

(Fig. 57, 107)

Melanocanthon Halffter 1958:210-211.

TYPE SPECIES: *Canthon bispinatus* Robinson, 1941:128 (by original designation of Halffter 1958:210-211).

DIAGNOSIS: Superficially similar to *Canthon* and *Boreocanthon*, but differing from both, and from all other members of the subfamily Scarabaeinae, in possessing two spurs on the posterior tibiae. Clypeus quadridentate, the genal angles often acute and resembling a third pair of teeth. Medium sized (length 6-10 mm), dull, matte, gray to black, dorsal surface granular. Setae separating the submentum from the gula forming a V-shaped line, elongate posteriorly at the middle. Posterior femur without anterior marginal line. Elytral striae obsolete. Pygidium with a basal transverse carina.

TAXONOMIC NOTES: Most of the species are not well known, and the genus needs revision. In many cases the male genitalia are the only reliable characters for identification. Only four species were listed by Halffter (1958) and Vulcano and Pereira (1964).

DISTRIBUTION & ZOOGEOGRAPHY: The genus is confined to the U. S. east of the Rocky Mountains, from New Jersey to Florida and Texas to Nebraska. Three of the four species are found in Florida, the remaining one (*nigricornis* Say) is essentially a Great

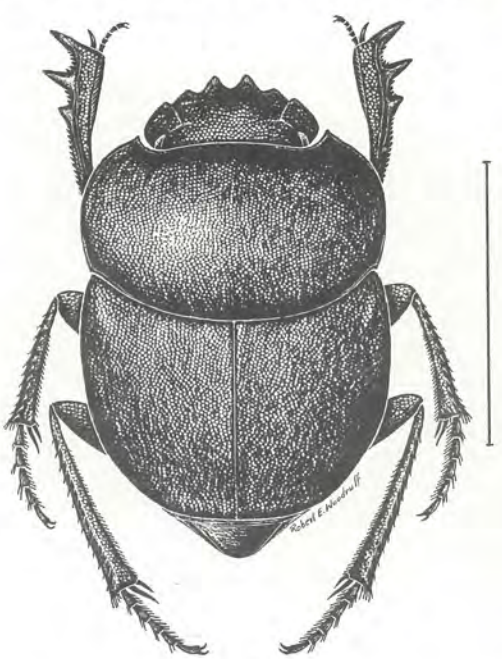


Fig. 107. **Melanocanthon punctaticollis** (Schffr.), line = 5mm.

Fig. 108. Stereoscan photo (30X) of **Melanocanthon granulifer** (Schm.) head (caudal view).

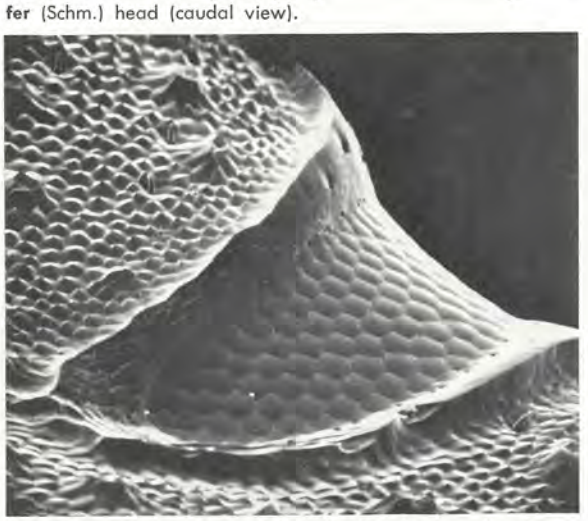


Fig. 109. Stereoscan photo (244X) of right eye of **Melanocanthon granulifer** (Schm.) (dorsal view). Note carina surrounding eye and granules of head enlarged in Fig. 110.

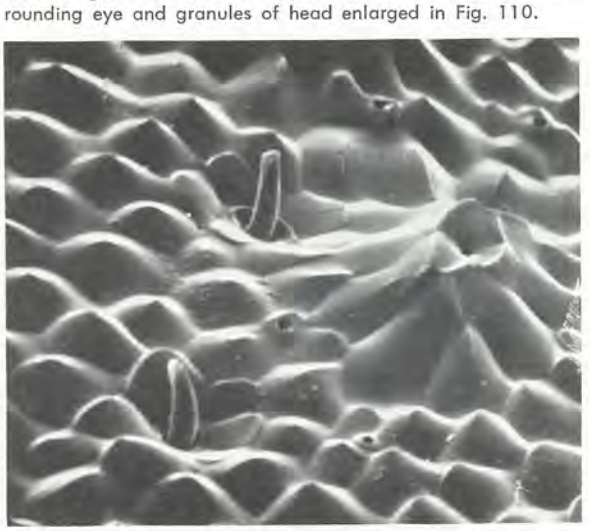


Fig. 110. Stereoscan photo (1090X) of head granules of **Melanocanthon granulifer** (Schm.).

Plains species.

BIOLOGY: The species usually are rarely collected. For instance, when Robinson (1941) revised the group he saw only 86 specimens in the 5 collections studied (including USNM, ANSP, and AMNH). He mentioned that most of his specimens of *bispinatus* were taken in the autumn, usually on old, partly dried toadstools in the pine barrens of New Jersey. At least some of the species feed also on cow dung, and I have collected all three of the Florida species in malt bait traps.

SELECTED REFERENCES: Halffter, 1958:210-212, Fig. 7-11; Robinson, 1941:127-130, Fig. 1-8; Vulcano and Pereira, 1964:594-595.

Key to the Florida species of Melanocanthon

1. Pronotal granules reduced to shining spots in central area, none in relief; head and pronotum noticeably punctate; Fig. 119-121 .... *punctaticollis* (Schaeffer)
1'. Pronotal granules in relief (Fig. 108), although sometimes reduced in the antero-median area; pronotum not noticeably punctate 2
2(1'). Granules of dorsal surface more dense, in greater relief; punctures of head barely noticeable; male genitalia as in Fig. 113. .... *granulifer* (Schmidt)
2'. Granules of dorsal surface less dense, less raised; punctures of the head as noticeable and as evenly distributed as the granules; male genitalia as in Fig. 114. . *bispinatus* (Robinson)

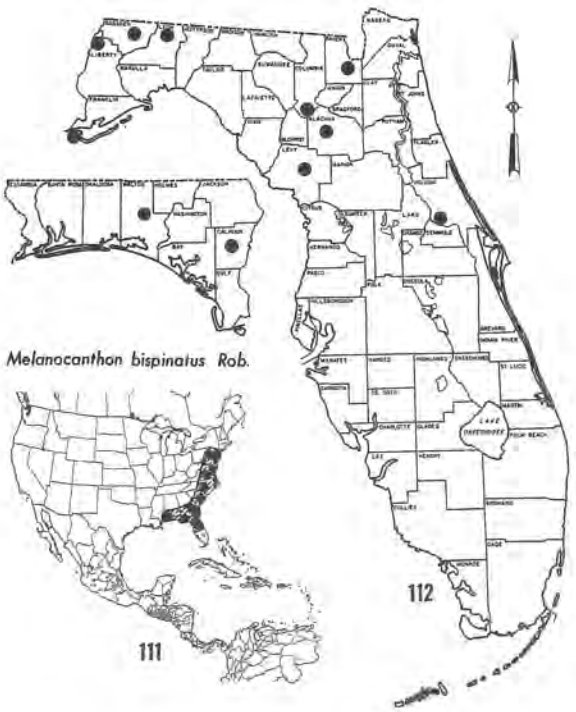
Melanocanthon bispinatus (Robinson) (Fig. 114)

Canthon bispinatus Robinson 1941:128-129, Fig. 2-3. *Melanocanthon bispinatus* (Robinson), Halffter 1958: 210-211.

DIAGNOSIS: Although the male genitalia (Fig. 114) are very distinctive, this species is otherwise often difficult to separate from *granulifer* without comparative material. In general the granules are less pronounced and often reduced to elongate, shining, black spots in the antero-median area of the pronotum. The punctures of head and pronotum, although perhaps no more numerous, are more noticeable because of the greater space between the granules.

TAXONOMIC NOTES: A certain amount of variation occurs in the extent of granulation and punctures, but the male genitalia seem to be constant. I can see no differences between the genitalia of Florida specimens when compared to Robinson's figure of the type from New Jersey. Some of the older records of *nigricornis* (Say) probably refer to this species. Although originally described in *Canthon*, *bispinatus* was made the type of the genus *Melanocanthon* by Halffter (1958: 210).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 111-12). The type locality is Warren Grove, Burlington Co., New Jersey. Paratypes were recorded from the following states: Alabama, Florida, Georgia, New Jersey, North Carolina, Rhode Island, South Carolina, and Virginia.



In Florida it has been reported from DeFuniak Springs and Enterprise (Robinson, 1941:129). My records add eight additional localities, all in the northern one-third of the peninsula. It is possible that part of the records for *nigricornis* of Blatchley (1928: 60-61) refer to this species or to *granulifer*. *M. nigricornis* is known from Texas to Michigan and Nebraska, but it is not definitely known from the southeast.

BIOLOGY: The only published note on this species is by Robinson (1941:127) who stated: "I have collected most of my specimens of *bispinatus* in the autumn, usually on old, partly dried toadstools in the pine barrens of New Jersey. Only once have I seen a specimen rolling a ball and this particular ball was composed of deer excrement." My Florida specimens were taken primarily in malt bait traps and unbaited pitfall traps. Two specimens were taken by Wilson Baker on a dead roach on a mammal snap trap. Specimens have been taken from February through September, but in Florida they seem to be most abundant in April. The immature stages are unknown.

SPECIMENS EXAMINED: 122, of which 106 were from 11 Florida localities, representing 74 collection records (for complete data see Appendix 6).

SELECTED REFERENCES: Blatchley, 1928:60-61 (as *nigricornis?*); Halffter, 1958:211-212, Fig. 11; Vulcano and Pereira, 1964:594.

Melanocanthon granulifer (Schmidt)

(Fig. 108-10, 113, 115-16)

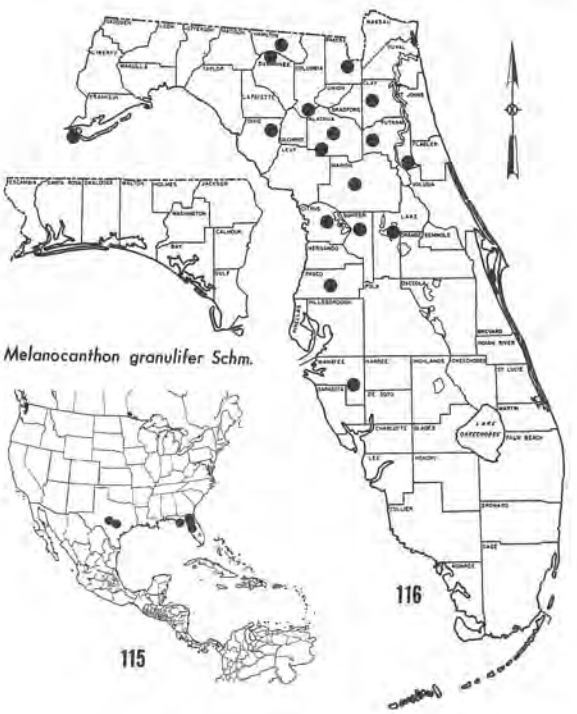
Canthon granulifer Schmidt 1921:126.
Melanocanthon granulifer (Schmidt), Halffter 1958:211.
Melanocanthon granulifera (Schmidt), Howden 1966b: 730 (misspelling).

DIAGNOSIS: Although the male genitalia (Fig. 113) are very distinctive, this species is otherwise often difficult to separate from *bispinatus* without comparative material. In general the granules are everywhere more dense and with greater relief. Antero-median area of the pronotum densely granulate as the remainder, never with any extensive areas where the granules are reduced to shining spots. Punctures of head and pronotum, although perhaps no less numerous, not as noticeable because of the density of granules.

TAXONOMIC NOTES: I have seen only a few specimens from Texas (type locality), and they seem to differ slightly from those from Florida. Further study of additional material will be necessary to determine if the two disjunct populations are distinct. At least some of the early records for *nigricornis* refer to this species.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 115-16). It has been recorded only from Texas and Florida (Robinson, 1948b:87). At least part of Blatchley's records of *nigricornis* (1928:61) probably are referable to this species. My records for Florida include Manatee Co. in the south to Franklin Co. in the north. Howden (1966b:730) recorded a specimen from "Mexico" without exact locality.

BIOLOGY: Robinson (1948b:87) collected several specimens of this species in a cow pasture on April 15, at Romeo, Florida, where they were all rolling balls of dung over the ground. Miller (1954:380, Table 1) reported nine specimens in the daytime and five at night from traps containing human feces. I have taken specimens in malt bait traps, in fungi, cow dung, on dead bird, and on dead cottonmouth. Other habitat data includes under rotten citron and in Japanese beetle trap. In Florida it probably occurs throughout the year, although records are lacking for November and December.



SPECIMENS EXAMINED: Three from Texas and 129 from 18 Florida localities, representing 34 collection records (for complete data see Appendix 7).

SELECTED REFERENCES: Balthasar, 1939:180; Blatchley, 1928:61 (as *nigricornis?*); Halffter, 1958: 211-212, Fig. 9; Howden, 1966b:730; Miller, 1954:380, Table 1, Fig. 5; Robinson, 1941:130, Fig. 7-8; 1948b: 87, Fig. 43-44; Schmidt, 1922b:61, 75; Vulcano and Pereira, 1964:594.

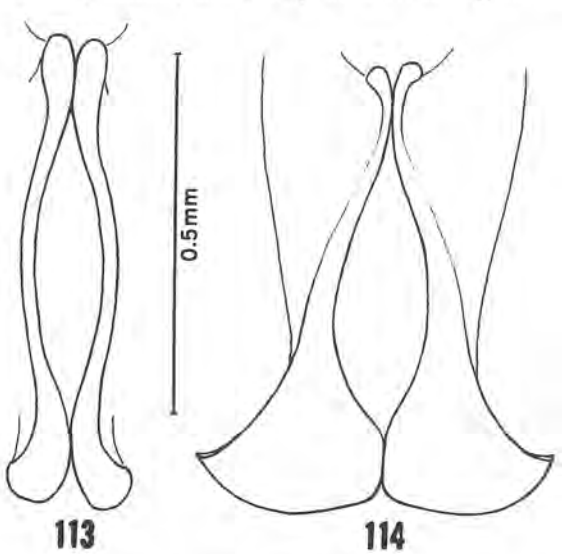


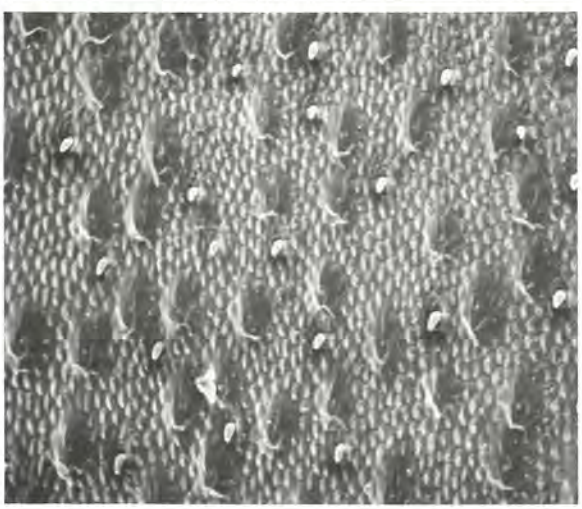
Fig. 113-114. Caudal view of male genitalia: 113) **Melanocanthon granulifer** (Schm.), 114) **M. bispinatus** (Rob.).

Melanocanthon punctaticollis (Schaeffer)

(Fig. 107, 117-21)

Canthon nigricornis var. *punctaticollis* Schaeffer 1915: 50.
Canthon punctaticollis Schffr., Blatchley 1928:61.
Melanocanthon punctaticollis (Schffr.), Halffter 1958: 211-212.

DIAGNOSIS: Easily distinguished from the other three species of the genus by the reduction of the pronotal granules to bare, shining spots and the dense punctation. The male genitalia are also distinctive.



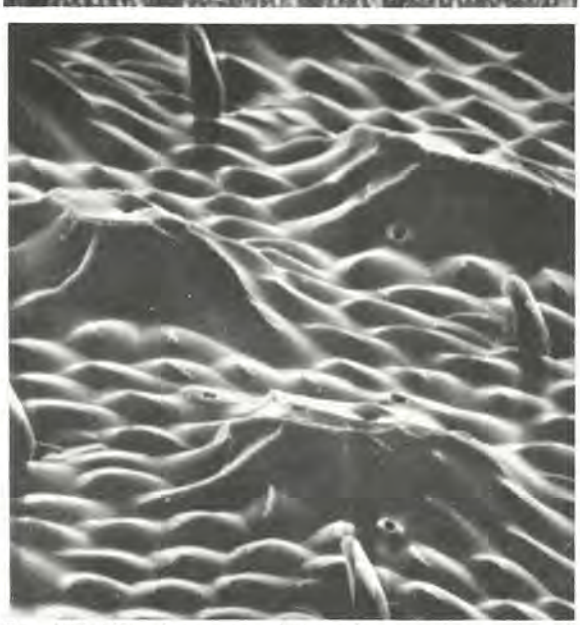
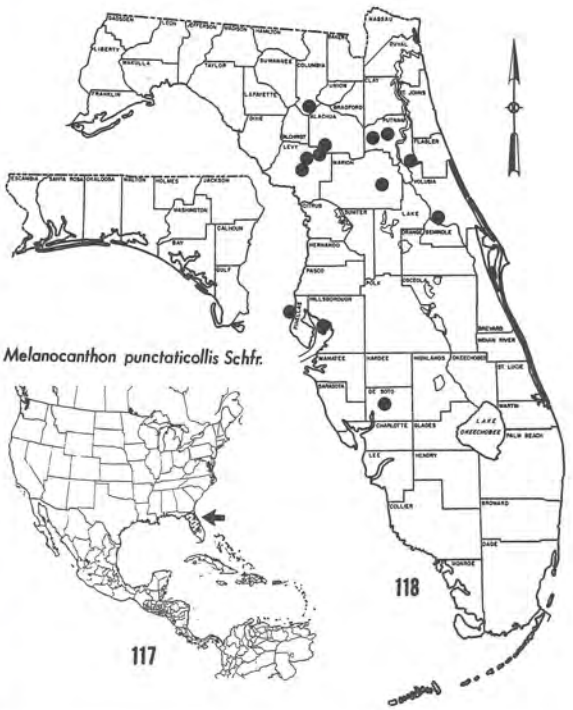


Fig. 119-121. Stereoscan photos of pronotal granules of **Melanocanthon punctaticollis** (Schffr.): 119) 85X, 120) 180X, 121) 855X.



TAXONOMIC NOTES: Although it was originally described as a variety of *nigricornis*, it is a distinct species, as pointed out by Blatchley (1928:61) and Robinson (1941:128).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 117-8). It is apparently confined to north-central Florida from High Springs in the north to Arcadia in the south.

BIOLOGY: Nothing has been published on the habits of this species, except the record by Blatchley (1928a: 68) of a single specimen beneath cow dung. I have taken it in fair numbers in malt traps set in turkey oak scrub, where large numbers of *Peltotrupes profundus* and *Mycotrupes gaigei* were found. Specimens have been taken from February through July. The immature stages are unknown.

SPECIMENS EXAMINED: 270 from 14 Florida localities representing 24 collection records (for complete data see Appendix 8).

SELECTED REFERENCES: Blatchley, 1928:61; 1928a: 68; Halffter, 1958:211-212; Robinson, 1941:128, Fig. 1, 2; 1948b:86, Fig. 41-42; Vulcano and Pereira, 1964: 595.

Genus GLAPHYROCANTHON Martinez

(Fig. 122-24)

Glaphyrocanthon Martinez 1948:41.

TYPE SPECIES: *Glaphyrocanthon variabilis* Martinez 1948 (by original designation).

DIAGNOSIS: Characterized in our fauna by the small size (length 2-4 mm), usually bright, shining metallic

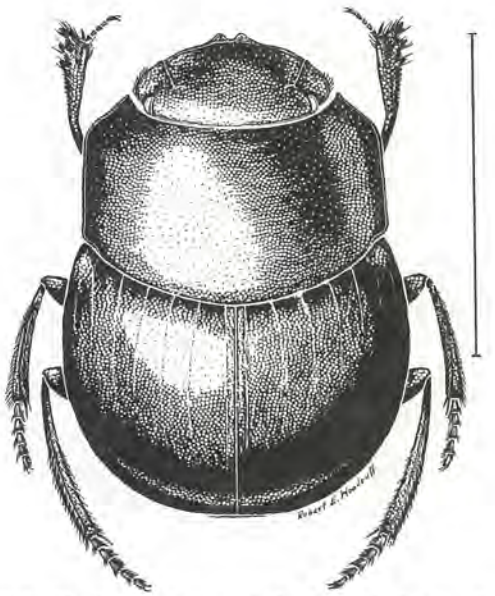


Fig. 122. **Glaphyrocanthon v. viridis** (Beauv.), line = 3mm.

green color, bidentate clypeus, and more oval body shape. The smallest member of the tribe in Florida, but approached in size by *Pseudocanthon perplexus* Lec. and *Boreocanthon probus* (Germ.). Distinguished from both genera by the bidentate rather than quadridentate clypeus.

TAXONOMIC NOTES: The genus was divided into two subgenera (*Glaphyrocanthon* and *Coprocanthon*) by Martinez (1950:160). *Coprocanthon* contains four species, none of which extends to North America. The nominate subgenus is the larger of the two and contains our only U. S. species. The most recent treatise on the genus is that by Martinez, Halffter, and Halffter (1964), in which 28 species are included. Our single species is divided into seven subspecies. Howden (1966b) added a new species from Mexico, to bring the known species to 29.

DISTRIBUTION & ZOOGEOGRAPHY: The genus is primarily Neotropical, with only a single species extending north into the U. S., and only one other species is known from Mexico. The genus is absent from the West Indies.

BIOLOGY: The species are nearly all confined to forests (selva) where they have a variety of feeding habits. Some species are associated with the dung of tapirs and monkeys. *G. viridis leechi* has been found in a hymenomycetous fungus (Halffter, 1959:170). Most of the species are diurnal, although there are a few records of *G. v. viridis* at light. Specimens of some species can be collected with traps using rotten meat or malt with proprionic acid. The immature stages are unknown for all the species.

SELECTED REFERENCES: Halffter, 1961:232; Howden, 1966b:728-729, Fig. 1-2; Martinez, Halffter, and Halffter, 1964:1-42, Fig. 25; Pereira and Martinez, 1956:125-134; Vulcano and Pereira, 1964:660-666.

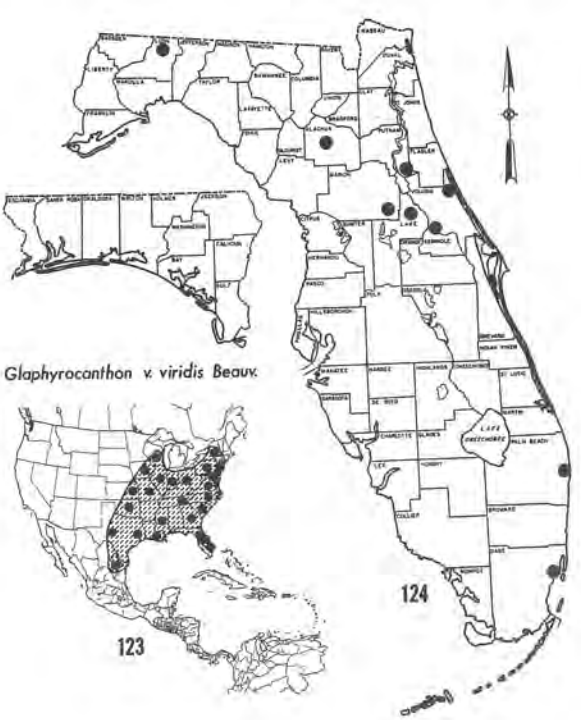
Glaphyrocanthon v. viridis (Beauvois)

(Fig. 122)

Copris viridis Palisot de Beauvois 1805:24, Pl. 3, Fig. 2.
Ateuchus obsoletus Say 1823:208.
Onthophagus viridicatus Say 1835:173.
Canthon viridulus Dejean 1836:152 (nomen nudum).
Canthon metallicus Sturm 1843:104.
Canthon viridis Beauv., LeConte 1859b:11.
Canthon viride Beauv., Blackwelder 1944:202.
Glaphyrocanthon viridis (Beauv.), Pereira and Martinez 1956:127.
Glaphyrocanthon v. viridis (Beauv.), Martinez, Halffter, and Halffter 1964:21-24, Fig. 3-5.

DIAGNOSIS: Small (length 2-4 mm), bright metallic green or copper colored, shining, the clypeus bidentate. Our only representative of the genus, which can be readily distinguished by the characters in the key.

TAXONOMIC NOTES: The species is extremely variable, and seven subspecies were created by Martinez, Halffter, and Halffter (1964). However, Howden (1966b:729) suggested that some of these are full species, but more material is needed before the problems can be resolved. Typical *viridis* is the only subspecies reported from the U. S. It is quite variable over its broad range here, and perhaps other subspecies could be described. Large series of specimens are not available and, until they are, the variation cannot be properly evaluated. The color is normally a shiny green, but occasionally specimens are coppery and less



shiny. All such specimens that I have seen are from northern localities.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 123-24). The type locality of this subspecies is "caroline du Sud des Etats-Unis d'Amerique." It is possible that this refers to either North or South Carolina. It has been recorded from nearly all of the eastern U. S. from New York to Florida, and from Minnesota to Monterrey in Mexico.

The Florida distribution is spotty, with nearly all records being from the north central and eastern portion. The two records from the southern half of the state are based on the literature; Lake Worth (Blatchley, 1928:61) and Miami (Martinez, Halffter, and Halffter, 1964:24). The species is seldom collected, and the few records probably do not reflect the true distribution.

BIOLOGY: This is one of the few Florida dung beetles which seems to be confined to densely wooded areas (hammocks). Although Martinez, Halffter, and Halffter (1964:11) reported collecting specimens at light at Monterrey and Apodaca, Mexico, I have never taken it in over 1000 Florida light trap samples examined. Blatchley (1910:914-915) found it scarce in Indiana ". . . beneath flat stones on hillsides near Wyandotte Cave." Three specimens were taken in malt traps to which a few drops of proprionic acid were added. I collected a single specimen rolling a pellet of rabbit dung along a path in dense woods near Citico, Tennessee. This was a mountainous area where a good series of *Ataenius brevis* Fall was taken along the same path. Halffter and Matthews (1966:21) reported an unpublished record by Cartwright of this species being found on leaves around bird droppings. The greatest number of Florida specimens was taken in unbaited pitfalls at Tall Timbers Research Station (Leon Co.). In Florida it has been collected from March through September, with a single record for December. Cartwright (1934b:238) recorded it in South Carolina from February through August. The immature stages are unknown.

SPECIMENS EXAMINED: 280, of which 223 were from 8 Florida localities, representing 96 collection records (for complete data see Appendix 9).

SELECTED REFERENCES: Bates, 1887:30-31; Blanchard, 1885:167; Blatchley, 1910:914-915; Dillon and Dillon, 1961:509, Pl. 49, Fig. 1; Halffter, 1961:246; Horn, 1870a:47; Robinson, 1948b:97, Fig. 15-16; Vulcano and Pereira, 1964:665-666.

Genus PSEUDOCANTHON Bates

(Fig. 125-127)

Pseudocanthon Bates 1887:35.
Opiocanthon Paulian 1947:30.

TYPE SPECIES: *Canthon perplexus* Lec., 1847 (by monotypy).

DIAGNOSIS: Small (length 3.5-5 mm), oval, black, sometimes with slight green or purple reflections, shining. Clypeus with four reflexed teeth, the middle two larger; slight angulation at the geno-clypeal suture. Eyes prominent, elongate dorsally. Pronotum appearing subparallel-sided from above, the sides margined, but the base without marginal line. Anterior part of prothorax excavated beneath to receive antennal club and anterior tibia, the excavation bounded posteriorly by a transverse margin. Mesosternum elongate. Elytra with nine weakly impressed striae. Pygidium without basal transverse carina (in our single species). Dorsal surface minutely alutaceous (or pebbled) but not roughly granular as in *Canthon*, *Boreocanthon*, and *Melanocanthon*.

Only two other Florida members of the tribe (*Glaphyrocanthon viridis* and *Boreocanthon probus*) approach the small size of this species. From the first it can be distinguished by the quadridentate (Fig. 125) rather than bidentate (Fig. 122) clypeus; from the latter it differs by having only a slight angle at the geno-clypeal suture, by the lack of a basal transverse carina on the pygidium, and by the presence of a posterior carina bordering the excavated area of the prothorax.

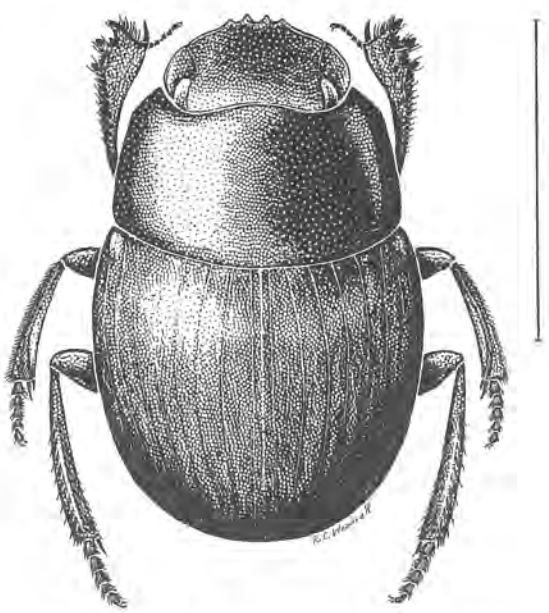


Fig. 125. **Pseudocanthon perplexus** (Lec.), line = 3mm.

TAXONOMIC NOTES: Although this genus was described long ago, it was supressed under *Canthon* by most authors until recently. It was recognized as valid by Arrow (1903), but not amplified until Martinez (1947a). Although several authors doubt the validity of other recently described genera of this tribe, they are all in agreement that *Pseudocanthon* merits generic status. Matthews (1966:85) stated that "In spite of the disagreement among specialists as to which features are of generic importance, there can be no doubt that *Pseudocanthon* is a valid genus, with an unmistakable facies." He synonymized *Opiocanthon* Paulian in the same paper.

The males have the spur of the anterior tibia bifurcate, elongate on the outside and rounded on the inside; the female has this spur elongate and curved, but not bifurcate.

The genus is not well known and, as evidenced by several new species recently being found in the West Indies, there will probably be others discovered.

DISTRIBUTION & ZOOGEOGRAPHY: Three species are listed by Vulcano and Pereira (1964), one of which (*P. perplexus*) occurs in the U. S., Central America, Colombia, Venezuela, and Brazil. Of the other two, *chlorizans* Bates is found in Mexico, the West Indies, and Colombia. The remaining species, *xanthurus* Blanchard, is recorded from Colombia, Brazil, and Argentina. Matthews (1966) described four new species from the West Indies and transferred another West Indian species from *Opiocanthon* to *Pseudocanthon*. Thus, there are now eight species in the genus.

BIOLOGY: All of the species apparently are coprophagous, some species (not *perplexus*) being common in cow and human dung. Our single species is rarely collected except at light, but has been taken in packrat (*Neotoma* sp.) nests, carrion, and rotting cantaloupe. For additional information see this section under *perplexus*.

SELECTED REFERENCES: Bates, 1889:386; Halffter, 1961:232-233; Martinez, 1947a:263-267; Matthews, 1966:83-99; Pereira and Martinez, 1956:109; Vulcano and Pereira, 1964:591-592.

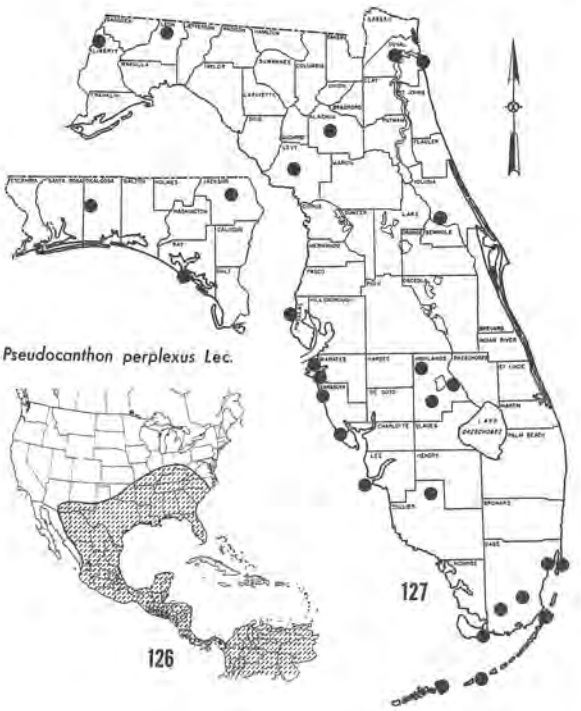
Pseudocanthon perplexus (LeConte)

(Fig. 125)

Canthon perplexus LeConte 1847:85.
Pseudocanthon perplexus (Lec.), Bates 1887:35.
Canthon perplexum Lec., Blackwelder 1944:200.

DIAGNOSIS: Readily distinguished from the other Florida members of the tribe Scarabaeini by the characters in the key and those listed under the generic diagnosis. It can be separated from all the West Indian species, except *chlorizans* Bates, by the lack of a basal transverse carina on the pygidium.

TAXONOMIC NOTES: This species is variable in color, from black with practically no metallic reflections to extensive green or purple reflections. Variation is also notable in the punctation of the pronotum and elytral intervals, and in the degree of alutaceousness. In some specimens the elytral intervals are completely alutaceous and almost granulate, and in others there is hardly a trace of this sculpture. It is very similar to *chlorizans* Bates, and, as Howden (1966b:733) suggested, the two may represent geographical races of a single species. I have examined a specimen determined as *chlorizans* by Bates, and I am unable to separate it from examples of *perplexus* from Texas. Further study of a large series of specimens, from all parts of the range, will be necessary before the exact status of this species can be determined.



DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 126-27). It was orginally described from Quincy, Illinois, although Robinson (1948b:97) erroneously listed the type locality as Texas. It was recorded by Vulcano and Pereira (1964:592) from ". . . North and Central America, Colombia, Venezuela, and Brazil (Amazonian region)." Published records have been found for the following states: Alabama (Loding, 1933:147); Arkansas, California, Illinois, Texas (Blanchard, 1885: 167); Florida (Blatchley, 1918:54); Indiana (Blatchley, 1910:915); Louisiana, Arizona (Robinson, 1948b:97). In addition to these states, I have seen specimens from Kentucky, Mississippi and Missouri (new state records). The record of "Cal." by Blanchard (1885:167) is questionable, even if it refers to Baja California.

In Florida it has been previously reported from Dunedin, Royal Palm Park, and Enterprise (Blatchley, 1928:62). My records include nearly the entire state as far south as Grassy Key (Monroe Co.).

BIOLOGY: Although a fair number of specimens was examined (85), the species is not often collected. The greatest number collected at one time was four in a light trap. Very little is known about the biology, since nearly all specimens have been taken at light. Blatchley (1928:62) reported taking several specimens in ". . . bottle bait of amyl acetate and molasses." I collected a dead specimen on the carcass of a cow and four specimens in a dung chamber in the nest of packrats (*Neotoma floridana smalli* Sherman) on Key Largo, Fla. I have seen a single specimen collected on rotting cantaloupe. From these limited observations it appears that this species has a wide variety of foods,

but it has not been found in human or cow dung. It has been taken on eight occasions in unbaited pitfalls at Tall Timbers Research Station (Leon Co.). Specimens have been collected in Florida every month except November, January, and February. The immature stages are unknown.

SPECIMENS EXAMINED: 85, of which 71 were from 29 Florida localities, representing 48 collection records (for complete data see Appendix 10).

SELECTED REFERENCES: Bates, 1887:35; Blanchard, 1885:167; Blatchley, 1928:62; Horn, 1870a:46; Robinson, 1948b:97, Fig. 17-18; Vulcano and Pereira, 1964: 591-592.

TRIBE COPRINI

(Fig. 1, 128, 133, 136, 145)

According to Halffter and Matthews (1966:256-259) the tribe contains 63 genera in the world, a great many of which are tropical. Only four genera are known from the U. S., all of which are found in Florida: *Ateuchus*, *Phanaeus*, *Copris*, and *Dichotomius* (=*Pinotus*). The tribe is represented in Florida by 10 species.

There have been various attempts to divide the tribe into subtribes. Halffter and Matthews (1966) listed four subtribes: Dichotomina (*Dichotomius* and *Ateuchus*), Phaneina (*Phanaeus*), Coprina (*Copris*), and Ennearabdina. Only the last tribe, containing a single endemic Argentinean genus, is not represented in Florida. There is little agreement about the placement of some genera, and until a thorough study of the higher categories within the subfamily has been made, the divisions appear too artificial for consideration here.

The tribe is characterized by the shining appearance of most species, and the nearly glabrous dorsal surface. The middle and posterior tibiae are expanded at the apex, and all tarsi are present. The males of most species have horns and/or protuberances on head/or pronotum. Except for *Phanaeus*, the elytral striae are distinct, and the intervals are smooth and shining. The Florida representatives vary from 5 to 29 mm in length. The third segment of the labial palpi is distinct.

In Florida the tribe contains our largest dung beetle, *Dichotomius carolinus* (L.); two species of *Ateuchus* which superficially resemble members of the family Histeridae; the genus *Phanaeus* (Fig. 1) with beautiful metallic red and green colors, as well as the greatest male head horn development of any member of the subfamily; and four species of *Copris*, three of which are endemic to the state.

Taxonomically the tribe is fairly well known in the U. S., with a recent revision of the genus *Copris* (Matthews, 1961). The genus *Phanaeus* is especially in need of a thorough revision; the status of many color forms is open to question.

Biologically the group has received more attention than some others because of the stimulating early work by the French naturalist Fabre (1918). Nearly all the species are coprophagous or necrophagous. In contrast to the Scarabaeini, their legs are not well adapted for ball rolling, and the larval food usually is provisioned in a wad packed at the bottom of a burrow. The details of parental care of our species are not well known, but at least some species of *Copris* exercise some care of the dung wad until after pupation has taken place.

Genus ATEUCHUS Weber

(Fig. 128)

Ateuchus Weber 1801:10.
Ateuchus Fabricius 1801:54.
Choeridium Serville 1828:356 (often cited as 1825)

TYPE SPECIES: *Ateuchus histeroides* Weber, 1801 (by monotypy).

DIAGNOSIS: Small (length 5-7 mm), shining, black to bronze, oval convex, resembling members of the framily Histeridae. Clypeus bidentate, the teeth separated by a broad "V" (these teeth sometimes worn down). Antennae nine-segmented. Scutellum absent. Pronotum convex, posterior marginal line absent, punctures variable. Eight elytral striae, the intervals convex, minutely punctate. Sexual dimorphism not obvious, the spur of the anterior tibia broad and/or truncate in the male. Posterior tibia without transverse carinae. Pygidium with a basal transverse carnia. Easily separated from the other Florida members of the tribe Coprini by the transverse, non prominent anterior coxae, lack of head or pronotal horns and protuberances, and the small size (the other species 8-20 mm in length).

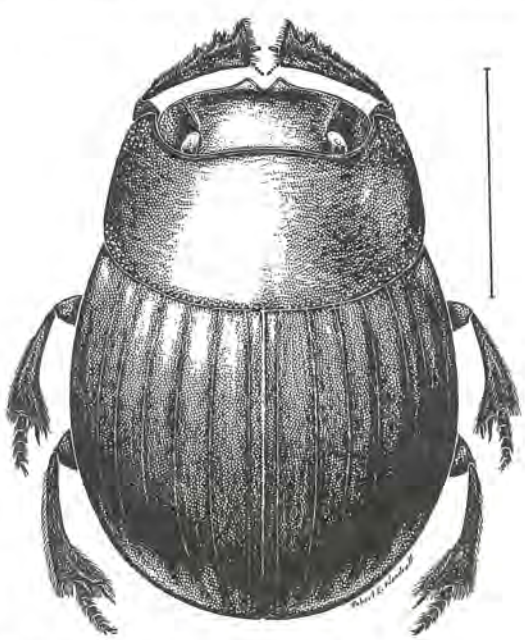


Fig. 128. **Ateuchus lecontei** (Har.), line = 2.5mm.

TAXONOMIC NOTES: The name *Ateuchus* was used almost simultaneously by Weber and Fabricius, both descriptions appearing in 1801. Chapin (1946:79) discussed this situation and concluded that Weber's paper had priority. Fabricius included in his *Ateuchus* several Old World species, most of which are now placed in the genus *Scarabaeus*. The name *Choeridium* was used in most North American literature before 1946, when Chapin established the synonymy, although Robinson (1948d:37) continued to use *Choeridium* without reference to Chapin's paper or to the problem of synonymy.

Blackwelder (1944:204-205) listed 70 species for Latin America, and Robinson (1948d:37) recorded three species and one subspecies from the U. S. Matthews (1966) described one new species and listed one other from the West Indies.

Members of the genus are very similar morphologically and are not well known at present. Although Robinson (1948d) reviewed the U. S. species, his treatment is not totally satisfactory. It is nearly impossible to identify the Mexican, Central American, and South American species with the existing literature. A generic revision is badly needed. The male genitalia appear to offer valuable characters, at least in part of the genus.

DISTRIBUTION & ZOOGEOGRAPHY: Of the approximately 75 described species, all but 3 inhabit the Neotropical region. The Antilles have two species, one of which is endemic to St. Lucia, and the other is found also in Mexico and Central America. In the U. S. the three species and one subspecies are found only east of the Rocky Mountains. One of these occupies most of the eastern U. S., one is primarily southeastern, and one is found in Texas and northern Mexico. Two species are found in Florida.

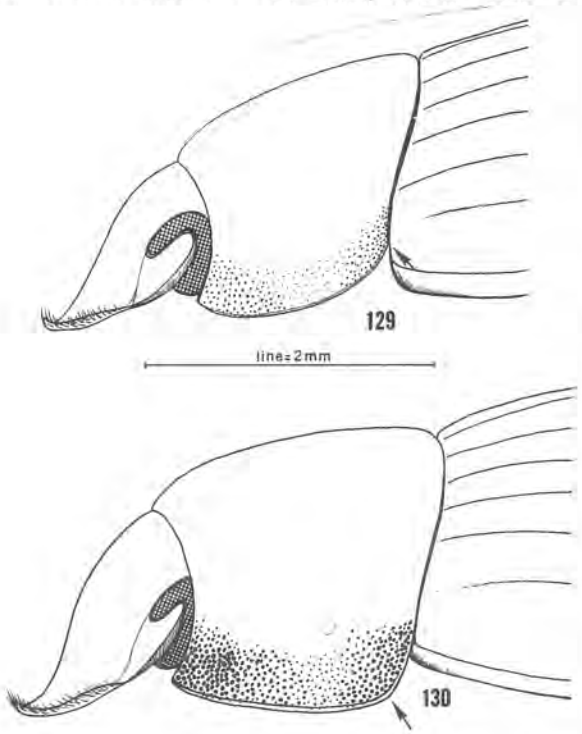


Fig. 129-130. Lateral view of head and pronotum of **Ateuchus** spp.: 129) **A. lecontei** (Har.), 130) **A. histeroides** (Web.). Compare position of posterior pronotal angle (at arrow).

BIOLOGY: Most of the species are coprophagous or necrophagous, although at least two are known to be myrmecophilous. The Florida species are also sometimes found in fungi. The life histories and habits are not well known. The larva is known for only a single species (see characterization under *A. histeroides*).

SELECTED REFERENCES: Blackwelder, 1944:204-205; Blanchard, 1885:170; Blatchley, 1910:915; 1928:9; Brown, 1928a:25; Chapin, 1946:79; Gillet, 1911:52-53; Horn, 1875:137; Matthews, 1966:44-51; Ritcher, 1945: 7-8 (larva); Robinson, 1948d:37-40.

Key to the Florida species of Ateuchus

1. Posterior angle of lateral pronotal margin formed below the level of the elytra (Fig. 130); head punctures coarse, at least anteriorly separated by less than their diameter; male anterior tibial spur rounded, that of the female elongate, acute; coarse pronotal punctures present along nearly the entire lateral margin; more northern species, rare in Florida ..... *histeroides* Weber
1'. Posterior angle of lateral pronotal margin formed at the level of the elytra (Fig. 129); head punctures fine, usually separated by at least twice their diameter; male anterior tibial spur truncate, that of the female broadest at the tip; coarse pronotal punctures rarely present medially at the lateral margin; a common Florida species (Fig. 128) .... *lecontei* (Harold)

Ateuchus h. histeroides Weber

(Fig. 130)

Ateuchus histeroides Weber 1801:37.
Ateuchus capistratus Fabricius 1801:62.
Choeridium histeroides (Weber), LeConte 1863b:36.
Choeridium histeroides histeroides (Weber), Robinson 1948d:39.

DIAGNOSIS: Generally larger, bronzer, and more densely punctate than *lecontei*. Most specimens can be separated easily by the shape of the lateral pronotal margin and the other characters mentioned in the key. The margin is usually reflexed wider and more convex, but these are relative characters. The anterior tibial spurs can be worn down, especially in the female, so this character should be used with caution.

TAXONOMIC NOTES: Robinson (1948d) distinguished two subspecies, based primarily on the head and pronotal punctation. The nominate subspecies has a fairly wide range and appears to be the one present in Florida. The other subspecies, *punctatus* Rob., is more northern (Mich., Ill., Pa.). Robinson's treatment is inadequate, and a generic revision will be required

to ellucidate the situation. It is likely, judging from the variability, that there are several entities masquerading under this name.

DISTRIBUTION & ZOOGEOGRAPHY: It probably occurs throughout the eastern U. S., although much more commonly in the northeast. Robinson (1948d:39) recorded it from New Jersey, North Carolina, Oklahoma, Pennsylvania, and Texas. I have also seen specimens from Kansas, Kentucky, Indiana, and Ohio.

In Florida, Blatchley (1928:9) reported it from Enterprise, S. Jacksonville, Lakeland, and Gainesville. I have not been able to locate any of these specimens, either in the Blatchley collection at Pudue University or in any of the collections examined. It is possible that these represent misidentifications of *lecontei*. I have seen specimens only from Torreya St. Pk., Florida Caverns St. Pk., and Newnan's Lake.

BIOLOGY: Apparently this species has a range of food, from various kinds of dung to rotting fungi. I collected about 30 specimens in the burrow of a woodchuck and several from packrat droppings in Ohio. Other label data includes human feces, cat carcass, malt trap, carrion trap, and at light. Apparently light is not a good attractant. They are most abundant in wooded situations.

The adults provision the larva with a dung wad packed into the bottom of a vertical burrow about 10 to 12 inches beneath cow dung. A single egg is laid near the upper end. Most activity occurs between April and September.

The larva has been described by Ritcher (1945: 7-8) and is characterized as follows: prothoracic shield without anteriorly projecting process; third abdominal segment without a prominent, conical, dorsal gibbosity; venter of last abdominal segment with two monostichous, longitudinal palidia; width of head capsule of third instar 2.0-2.1 mm.

Adult mouthparts were described by Hardenberg (1907), and their role during ingestion of helminth eggs was discussed by Miller (1961). Cram and Jones (1929) reported studies on these beetles as intermediate hosts for tapeworms (*Raillietina cesticillus* and *Hymenolepis carioca*) of poultry and game birds.

SPECIMENS EXAMINED: Over 100, of which only 9 were from 3 Florida localities as follows: (4) Alachua Co., Newnan's Lake, 15-XII-31, T. M. Little (USNM); (1) Jackson Co., Florida Caverns St. Pk., 7-VII-58, T. J. Walker, Jr. (FSCA); (4) Liberty Co., Camp Torreya, 9-IX-29, T. H. Hubbell #70 (USNM).

SELECTED REFERENCES: Blanchard, 1885:170; Blatchley, 1910:915, Fig. 361; 1928:9; Chapin, 1946: 79; Cram and Jones, 1929:49-51; Davis, 1966:213; Dillon and Dillon, 1961:509, Pl. 49, Fig. 2; Edwards, 1949a:143; Hardenberg, 1907:562, Pl. 31, Fig. 17; Harold, 1868b:50-52; 1873:107; Horn, 1875:137; Ritcher, 1945:7-8, Fig. 2, 4, 12, 19, 30, 37, 43; Robinson, 1948d:39.

Ateuchus lecontei (Harold)

(Fig. 128-9)

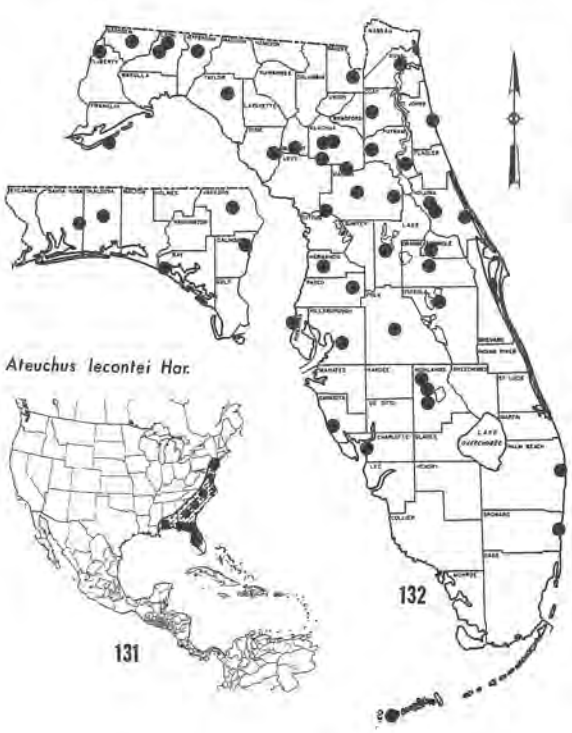
Choeridium lecontei Harold 1868b:52-53.
Ateuchus lecontei (Har.), Blackwelder and Blackwelder 1948:30.

DIAGNOSIS: Generally smaller, blacker, and less densely punctate than *histeroides*. Most specimens can be separated easily by the shape of the lateral pronotal margin and the other characters mentioned in the key. The margin is barely reflexed, narrow, and less convex, but these are relative characters. The anterior tibial spurs can be worn down, especially in the female, so this character should be used with caution.

TAXONOMIC NOTES: As is true with *histeroides*, this is a variable species. Further study will be necessary to determine whether this is a "composite" species and whether the variability is correlated with geography or behavior.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 131-2). Robinson (1948d:38) reported it from Florida, Georgia, New Jersey, and South Carolina. The type locality was listed as "Vereinigten Staaten," without precise locality. Leng (1920:248) listed it from "Fla., Ariz.," but I have been unable to substantiate the Arizona record. If any species of *Ateuchus* occurs there it is probably *texanus* Robinson and not *lecontei*. It has also been reported from North Carolina (Brimley, 1938:199) and Alabama (Loding, 1945:99).

In Florida it was recorded from Ft. Capron and Enterprise (Schwarz, 1878:449); Ft. Worth (Hamilton,



1894:252); Gainesville (Dozier, 1918:332); and from St. Augustine to Key West (Blatchley, 1928:9). My records include most of the area between Santa Rosa Co. and Punta Gorda. I have not seen specimens from the southern one-fourth of the peninsula.

BIOLOGY: Practically nothing has been published on the habits of this species. It is extremely common in Florida under a variety of situations. It is most abundant at light and in cow dung.

Additional label data include armadillo carcass, dog dung, dead fish, dead crabs, fleshly fungus, under oak leaves, horse dung, chicken feathers, Steiner trap, McPhail trap, human feces, Jap beetle trap, *Persea americana* (presumably rotting fruit), and bait traps with malt, yeast, and proprionic acid. Unbaited pitfall traps at Tall Timbers Research Station (Leon Co.) produced 338 specimens in 94 weekly collections. Young and Goff (1939:60) reported trapping specimens in the mouth of a gopher tortoise burrow at Leesburg, but indicated that they were probably "casual."

SPECIMENS EXAMINED: Over 1,500, of which 1,451 were from 54 Florida localities, representing 276 collection records (for complete data see Appendix 11).

SELECTED REFERENCES: Blanchard, 1885:170; Blatchley, 1928:9; Edwards, 1949a:143; Horn, 1875: 137; Miller, 1954:379, 382; 1961:737, Table 1; Robinson, 1948d:38-39.

Genus DICHOTOMIUS Hope

(Fig. 133)

Dichotomius Hope 1838b:321.
Holocephalus Hope 1838b:323 (in part).
Homocopris Burmeister 1842:77 (cited as 1846 by Martinez, 1951:140, but fide Blackwelder, 1957:995, the date for volume 3 should be 1842).
Selenocopris Burmeister 1842:77 (in part).
Pinotus Erichson 1847:108.
Brachycopris Haldeman 1848b (often cited as 1846).

TYPE SPECIES: *Copris boreus* Olivier, 1789 (by original designation).

DIAGNOSIS: Contains the largest North American species of the subfamily Scarabaeinae (length 20-30 mm). Our single species can be readily distinguished from the related genus *Copris* by the seven elytral striae and the large size.

TAXONOMIC NOTES: The above synonymy was established by Martinez (1951:140). Prior to that time our common species was placed in *Pinotus* in nearly all the U. S. literature. Even some of the recent literature (e.g., Dillon and Dillon, 1961:512) continued to use the name *Pinotus*. There are only two species known from the U. S.: *carolinus* (L.) and *colonicus* (Say). The latter has two horns or tubercles on the head of the male, while the former has a single horn. The group is in need of study to determine if the specimens from Mexico and Central America are conspecific with those of the U. S. The genus is listed in the subtribe Dichotomina by Halffter and Matthews (1966: 256).

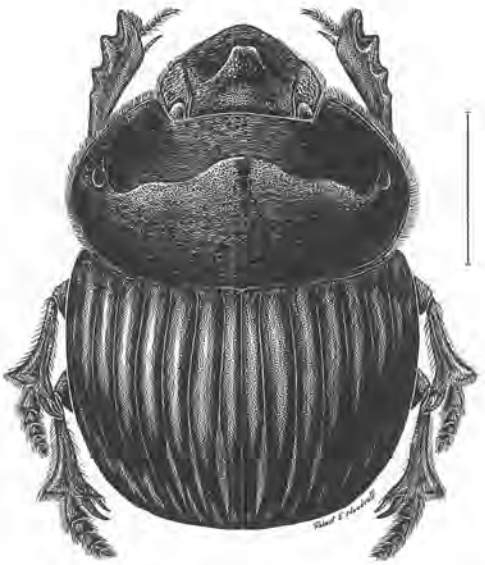


Fig. 133. **Dichotomius carolinus** (L.), line = 8mm.

DISTRIBUTION & ZOOGEOGRAPHY: The genus is Neotropical, except for two species entering the U. S. One of these (*colonicus*) is known from Arizona to Mexico; the other (*carolinus*) is found throughout the eastern U. S. and reported by Blackwelder (1944) from British Honduras, Guatemala, Nicaragua, Costa Rica, and Panama. There is no accurate count of the number of species, but Blackwelder (1944) listed 141 species.

BIOLOGY: Most of the species are coprophagous, but a few have necrophilous tendencies. Little information is available on the habits of any except our single species.

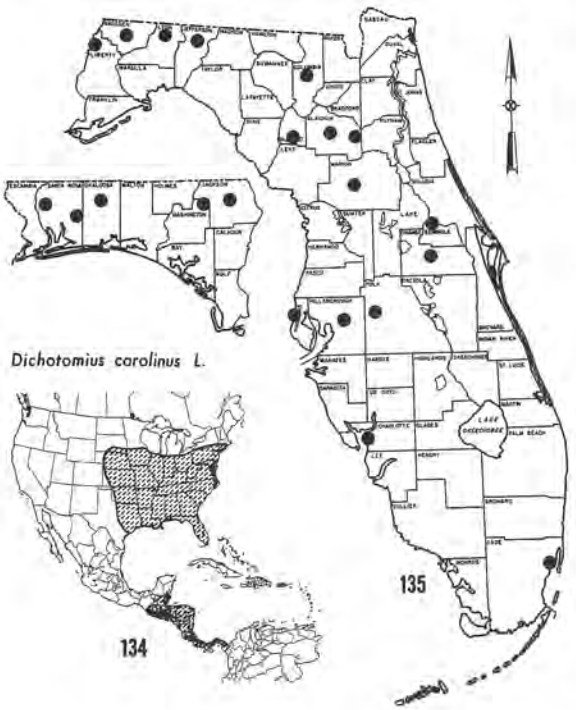
SELECTED REFERENCES: Martinez, 1951:138-142; Schaeffer, 1906:256.

Dichotomius carolinus (Linnaeus)

(Fig. 133)

Copris carolina Linnaeus 1767:125.
Copris monacha Dejean 1836:154 (nomen nudum).
Brachycopris carolina (L.), Haldeman 1848b:125.
Pinotus carolinus (L.), Gemminger and Harold 1869: 1009.
Pinotus bituberculatus Harold 1869b:127.
Dichotomius carolinus (L.), Martinez 1951:140.

DIAGNOSIS: Large (length 20-30 mm), black, shining, very convex, bulky. Head contains a horn or tubercle, nearer the base in the female and nearer the apex in the male. Pronotum margined with elongate, curved setae; extremely convex on basal one-half, and abruptly descending to the head on the anterior one-half. Pronotum with a deep depression on each side at the carina behind the declevity. Elytra notice-



ably striate, striae usually filled with dirt for part of their length posteriorly. This area, actually an enlargement of the striae fitted with minute stiff setae to which dirt adheres, broader and more noticeable in the female. Middle and posterior tibiae greatly expanded at the apex, the spurs elongate and flattened on one side. The general facies (Fig. 133) should permit easy recognition of this, our largest dung beetle.

TAXONOMIC NOTES: The nearest relative is *colonicus* from the western U. S. and Mexico. This species was originally described as a variety of *carolinus*, and its status needs to be reevaluated. In fact these two forms probably represent a complex of species, for which additional study will be required. I believe that some of the specimens from Mexico and Central America are not conspecific with those of the U. S.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 134-5). It is found throughout the eastern U. S. from New York to Florida west to Texas and north to Nebraska. It has been recorded from British Honduras, Guatemala, Nicaragua, Costa Rica, and Panama by Bates (1887), and I have seen a specimen from El Salvador. The disjunction of this range, the apparent absence in Mexico where *colonicus* is abundant, and a few slight differences suggest that more than one species is included in these records.

In Florida it probably occurs throughout the state, except for the Everglades and the Keys. Blatchley (1928:9) recorded it from Suwannee Springs, Lakeland, Punta Gorda, Lake City, Gainesville, and Dunedin. I have seen specimens from 19 localities.

BIOLOGY: This is a common species in cow dung and at light. Apparently male and female cooperate in supplying the dung food for the larvae. This is normally packed in a wad at the end of a burrow which may be branched or not. Their activity is quite obvious on the surface where large mounds of soil (sometimes six inches in diameter) mark the burrow entrance.

Lindquist (1933:112-115) studied the burrowing behavior in detail in Kansas. By estimating the number of burrows per acre, averaging the amount of soil excavated, and the amount of dung buried, he concluded that 21 pounds of dung (air dried) were buried and 126 pounds of soil excavated per acre. Keeping in mind that this was only during one point in time, and that beetles are active a great part of the year, there can be no doubt about the important role being played in soil mixing and increased fertility. Australia and New Zealand are currently considering the introduction of such dung beetles in order to improve their pastures (Bornemissza, 1960).

This species is found almost exclusively in open pastures or roadways and does not occur in forested areas. It seems to be more abundant where there are sandy soils. In Florida, specimens have been found during every month except December and January. Halffter and Matthews (1966) compiled a list of five species of *Macrocheles* mites recorded from this beetle.

The larva is a large "hump-backed" white grub (Fig. 10). I examined one dung wad containing a third instar larva and the larva was exposed for photographing. During an extended delay in taking the pictures the larva repaired parts of the wall by adding regurgitated food material (Fig. 11). This behavior has been observed in several other species of dung beetles (Halffter and Matthews, 1966:182). Howden (1955a) also mentioned a unique case of the larva of *Peltotrupes* building a retreat of its own fecal matter.

The larva has been described by Ritcher (1945: 8-9) and is characterized as follows: prothoracic shield with an anteriorly projecting, angular process on each side; legs with a pair of terminal setae, claws absent; glossa with an irregular transverse row of granules anterior to the hypopharyngeal oncyli; maximum width of head capsule of third instar 5.36-6.1 mm.

SPECIMENS EXAMINED: 253, of which 93 were from 31 Florida localities, representing 51 collection records (for complete data see Appendix 12).

SELECTED REFERENCES: Bates, 1887:52-53; Blatchley, 1910:916, Fig. 362; 1928:9; Dillon and Dillon, 1961:512, Pl. 49, Fig. 8; Drury, 1770:77, Pl. 35, Fig. 2; Hardenberg, 1907:555-561, Pl. 30, Fig. 1-7, Pl. 34, Fig. 1; Horn, 1870a:42; Lindquist, 1933:112-115; Miller, 1954:381; 1961:735, 738, Fig. 5, 6, 8; Mohr, 1943:296; Olivier, 1789:134, Pl. 12, Fig. 113; Ritcher, 1945:8-9, Fig. 3, 6, 9, 10, 13, 17, 18, 21, 27, 32, 39 (larva); Schaeffer, 1906:256; Smith, 1892:83, Pl. 2, Fig. 3.

Genus COPRIS Muller
(Fig. 136-44)

Copris Geoffroy 1762:87 (rejected by Int. Com. Zool. Nom., Opinion 228).
Copris Muller 1764:xi.

TYPE SPECIES: *Scarabaeus lunaris* Linnaeus, 1758 (by subsequent designation of Curtis, 1832:414).

DIAGNOSIS: Medium sized (length 8-15 mm), elongate, convex, subparallel, shining. Clypeus broad, margined, and notched in all Florida species except *inemarginatus*. Sexual dimorphism often striking, the males with elongate horns on the head and protuberances and excavations on the pronotum. Easily distinguished by the general facies (Fig. 136). It can be separated from *Dichotomius*, its nearest relative in the Florida fauna, by the eight elytral striae and smaller size.

TAXONOMIC NOTES: The genus was recently revised for the Western Hemisphere (Matthews, 1961). Several of the species (e.g., *howdeni* Matthews and Halffter, and *halffteri* Matthews) are known from very few specimens.

The name *Copris* was first proposed by Geoffroy 1762 (not 1764 as stated by Matthews, 1961:2). However, the International Commission on Zoological Nomenclature (1954) has discarded this work for nomenclatural purposes. Muller (1764) apparently made a valid "indication" but included no species. The Florida species are very distinct and easily separated by the characters in the key.

DISTRIBUTION & ZOOGEOGRAPHY: The following summary is modified from Matthews (1961:4). The approximately 160 species are distributed as follows (with some species counted twice): Ethiopian (77), Oriental (46), Palearctic (27), Nearctic (16), Neotropical (8); it is absent in Madagascar and Australia. It is the most boreal of the genera of Coprini. In the Western Hemisphere it is represented in the U. S. east of the 100th meridian, in all of Mexico and U. S. territory bordering Mexico (except California), and all of Central America to Panama. A single Central American and Mexican species extends to the mountains of Colombia and Ecuador. The genus is absent in the remainder of South America, the Antilles, and the Galapagos Islands. There are presently recognized 23 species and five subspecies from the Western Hemisphere. Nine species and one subspecies are known from the U. S., of which four species are found in Florida.

Fig. 136. **Copris minutus** (Drury), line = 5mm.

BIOLOGY: The majority of the species are coprophagous, feeding on and provisioning the larvae with dung of higher mammals. One exception is *C. gopheri*, which uses the dung of the gopher tortoise, *Gopherus polyphemus* Daudin. There is a slight necrophagous tendency in some species; I have taken a single *C. inemarginatus* on the dry leg tendons of a dead horse, and Blatchley (1918) found it on a dead turtle.

Apparently all species bury the dung beneath the source and lay a single egg in each dung ovoid. The details of the accompanying behavior are variable among the species. However, there does seem to be parental care of the brood cell in all the species studied. The female maintains a smooth contour on the outside of the ovoid, preventing the growth of fungi and mold. At least some of the species stridulate. For additional information on nidification see the papers by Matthews (1961) and Halffter and Matthews (1966).

The larvae have been described for two North American species (Ritcher, 1945), and they can be distinguished from other Scarabaeinae by the following combination of characters: prothoracic shield with an anterior, angular projection on each side; legs with a single terminal seta set on a small blunt claw; venter of last abdominal segment with paired, median, caudal lobes, or a cleft median lobe.

SELECTED REFERENCES: Blatchley, 1910:916; 1928: 10; Gillet, 1911:71-79; Horn, 1870a:42-44; Matthews, 1961:1-139; Ritcher, 1945:10-12, Fig. 8, 14, 28, 34, 36, 41, 42 (larvae); Schaeffer, 1906:254-256.

Key to the Florida species of Copris

1. Clypeus entire, at most slightly sinuate medially (Fig. 138) .... *inemarginatus* Blatch.
1'. Clypeus distinctly emarginate, the central notch prominent (Fig. 139) 2

2. Lateral pronotal carina absent; lateral pronotal margin evenly curved; pygidial margin incomplete, the inner border effaced ventrally; head armed with a vertical horn in both sexes; coarse head punctures absent or confined to genal area; smaller species (length 7.5-11 mm) 3

2'. Lateral pronotal carina present; lateral pronotal margin sinuate or slightly angulate; pygidial margin complete; head of both sexes unarmed; head with coarse punctures throughout; larger species (length 13-15 mm); rare species known only from Oneco and Lake Marion, Fla. .... *howdeni* Matthews and Halffter

3. Coarse punctures of head confined to genal area; coarse pronotal punctures scattered throughout, including most of the disc; elytral striae crenulately punctate, the intervals finely but noticeably punctate; forespur linear, rounded at the tip; common Florida species ..... *minutus* (Drury)

3'. Coarse punctures absent on head; coarse pronotal punctures confined to the anterior angles, the disc appearing impunctate; elytral striae obsoletely punctate, never appearing crenulate, the intervals finely and noticeably punctate; forespur crescent-shaped, curving outward; confined to burrows of the gopher tortoise ..... *gopheri* Hubbard

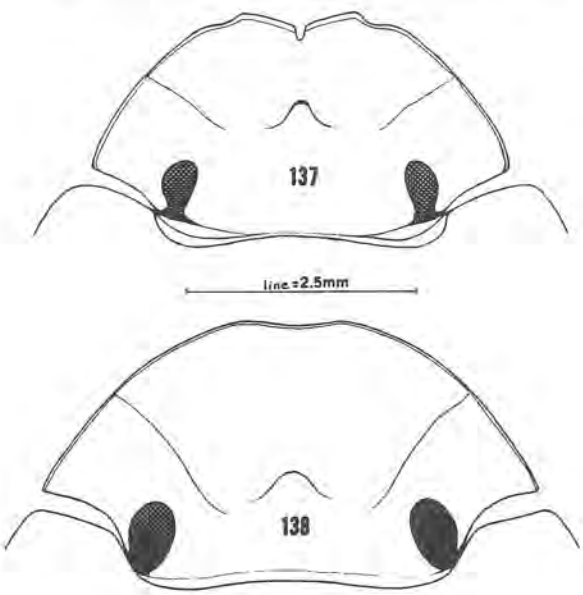


Fig. 137-138. Head of **Copris** spp.: 137) **C. minutus** (Drury), 138) **C. inemarginatus** Blatch.

Copris gopheri Hubbard

Copris gopheri Hubbard 1894:305, 307, 310-311, Fig. 20.

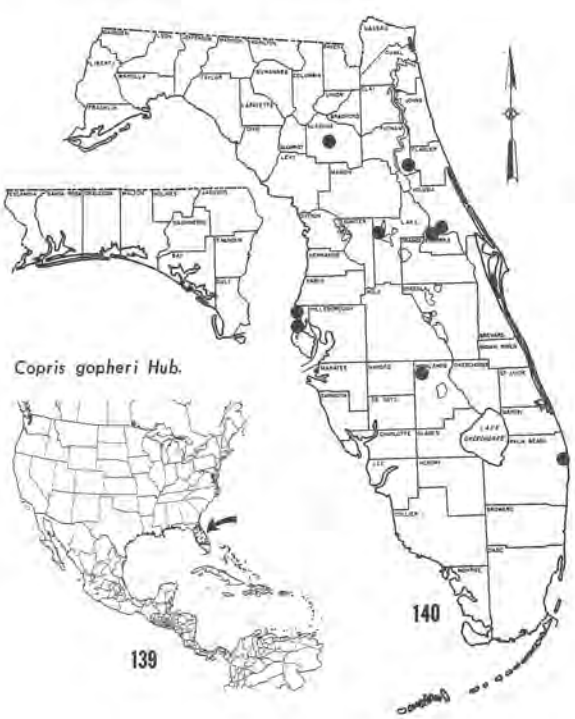
DIAGNOSIS: Small (length 7.5-10 mm), shining, black, lightly punctate. Punctures everywhere sparser than in any other species. Elytral striae sometimes with a few rounded punctures basally, but without coarse crenulate edges as in the other Florida species. Although the elytral intervals are minutely punctate, these are so small and scattered as to be almost unnoticeable. Head horn of male weakly developed, never elongate or curved as in *minutus*. Ninth elytral stria partially indicated anteriorly in *minutus;* completely absent in *gopheri*.

TAXONOMIC NOTES: A very distinct and easily recognized species, but evidently related to *minutus*. Matthews (1961:56) placed these two species in his "*minutus* complex."

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 139-40). Its range is probably coextensive with that of the gopher tortoise (Fig. 117), but it has not been reported from outside of Florida. The type locality is Crescent City, Fla. Although Hubbard (1896) implied that he collected this species at DeFuniak Springs, he was also reporting on collections from Clearwater and may not have actually had specimens from the former locality. At least no such specimens have been discovered in his collection, and all other records are from peninsular localities. Blatchley (1928:10) recorded it from Lake Worth, Enterprise, Sanford, Lake Mary, and Clearwater. I have also seen specimens from Gainesville and Lake Letta Subdivision (Highlands Co.).

BIOLOGY: This is one of the several obligates associated with burrows of the gopher tortoise. A few specimens have been taken at light, but other than this, nothing has been published on its habits except the original observations by Hubbard (1894:305):

> Specimens were found in every gopher hole examined, and were frequently abundant. Eighty-four specimens were collected in a single burrow. The female forms food-balls of gopher dung, after the manner of related species above ground. In each of these she lays a single egg, and then buries



it 4 or 5 inches deep in the sand beneath the floor of the gallery. The material in these balls is finely fibrous and dark green in color. The larva begins eating near the surface of the ball and forms a cavity considerably larger than its body by pressing outward the dung, thus disturbing the sphere and rendering it more or less pear-shaped. In this operation it is evidently assisted by the peculiar hump on the back, so remarkably characteristic of the larvae of this genus. The larva does not consume the whole of its food supply, but disintergrates the greater part of the mass, converting it into a friable, black earth which falls away at a touch. It finally constructs an oval cocoon within the ball, with rather thin and brittle walls formed from this black earth, cemented by saliva or some other secretion, and in this completes its transformations. In the burrows which contain egg-balls, specimens of the imago are less common, and there appears to be a continuous succession of broods throughout the year.

I have not taken it in the several tortoise burrows excavated at Gainesville nor in malt and proprionic acid bait traps set in the entrances to these burrows. The immature stages are unknown.

SPECIMENS EXAMINED: 17 from 4 Florida localities as follows: (3) Alachua Co., Gainesville, VII-65, E. Gourley, *Gopherus* burrow. The following Gainesville records are from blacklight traps with dates and collectors as shown: (1) 15-V-68, R. E. Woodruff; (1) 24-X-68, R. E. Woodruff; (2) 27-V-70, R. E. Woodruff; (2) 24-X-71, F. W. Mead; (2) 3-4-X-72, H. V. Weems, Jr.; (1) Highlands Co., Lake Letta Subdivision, 16-VIII-61, T. Morris, blacklight trap; (4) Pinellas Co., Clearwater, 27-VI, Hubbard (OSU); (1) Seminole Co., Lake Mary (OSU).

SELECTED REFERENCES: Blatchley, 1928:10; Castle and Laurent, 1896:303; Hamilton, 1896:286; Hubbard, 1896:301; Matthews, 1961:4, 27, 31-32, 34, 36, 40, 56-59, Fig. 11, 14, 28-31, 35; Schaeffer, 1906:255; Young and Goff, 1939:60-61.

Copris howdeni Matthews and Halffter

Copris howdeni Matthews and Halffter 1959:200-202.

DIAGNOSIS: Differs from all other U. S. species in the unarmed head of both sexes. Similar in size (length 13-15 mm) only to *inemarginatus* in Florida, but that species does not have the central notch in the clypeus. Head entirely, evenly, densely punctate as the pronotum. Pronotum unarmed, median longitudinal sulcus faint, barely visible on middle of the disc. Elytral striae crenulate, intervals completely flat, densely and coarsely umbilico-punctate. Most similar to *fricator* but separated by the coarsely and densely punctate, rugose, and flat elytral intervals.

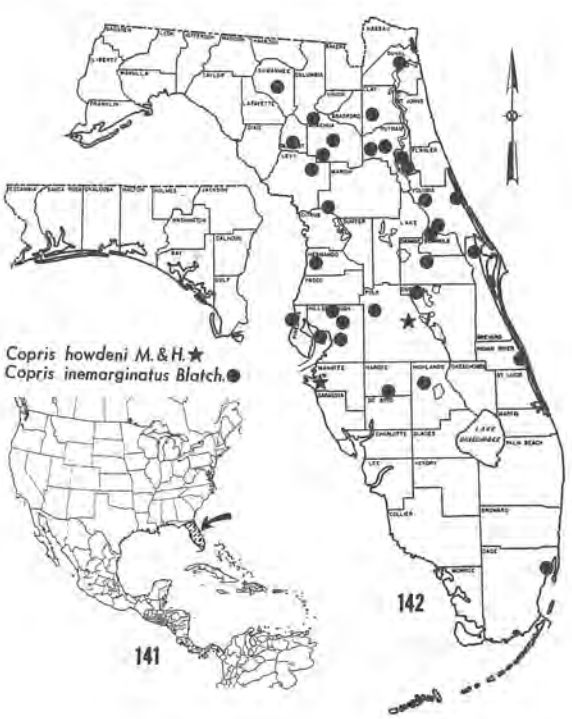
TAXONOMIC NOTES: It is closely related to *fricator* (Fab.), a common species in the northeastern U. S. According to Matthews (1961:117) this species and *fricator cartwrighti* Robinson represent isolated southern populations apparently derived from *fricator*. He stated that, "Its separation from *fricator* as a full species is based primarily on its geographical isolation and appears justified on the basis of its great ecological and climatic differences between its habitat and that of *fricator*."

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 142). Known only from Oneco and 3 mi. S. W. of Lake Marion, both in central Florida.

BIOLOGY: Nothing is known of the biology or behavior, the five known specimens being taken at light in March. The species is either very rare or occurs in a restricted niche, possibly associated with some vertebrate. I spent three nights at the type locality during the same time of year that the types were collected, operating a blacklight trap without success. The locality is about five miles inland from the coast, at the rear of an ornamental nursery operated by Miss Paula Dillman. This area contains a pond, bordered by fairly dense hammock. Other Scarabaeinae taken in the blacklight trap included *Copris minutus* and *Pseudocanthon perplexus*. Several nearby cow pastures were examined without finding this species. Its habits are still a great enigma.

SPECIMENS EXAMINED: One, the holotype, in the U. S. National Museum, with the following data: Oneco, Fla., 25-III-54, G. E. Ball, at light.

SELECTED REFERENCES: Matthews, 1961:34-35, 41, 108-109, 116-117, Fig. 11, 19, Table 2.



Copris inemarginatus Blatchley

(Fig. 138)

Copris anaglypticus Say, Schwarz 1878:449 (misidentification).
Copris inemarginatus Blatchley 1918:54-55.

DIAGNOSIS: Medium sized (length 11-15 mm), bulky, convex, shining, the clypeus without a central notch. Easily distinguished from all other U. S. species by the latter character. There is rarely a slight sinuation in the clypeal margin where this notch should be, but it is never indented and always without teeth. Upper surface of head entirely punctate, area in front of the horn almost rugosely punctate, punctures often coalescing. Head horn short, conical, and blunt, not differing between the sexes. Pronotum unarmed, densely punctate throughout. Elytral striae crenulate, punctures appearing transverse and quadrate; intervals convex, appearing smooth but very finely punctate. Pygidium completely margined.

TAXONOMIC NOTES: This species was first recorded under the name *anaglypticus* Say (Schwarz, 1878:449) which is now considered a synonym of *fricator* (Fab.). Blatchley described this species after some delay because he received the opinion from the late E. A. Schwarz and H. S. Barber that this was " . . . merely a depauperate form, due to biological conditions of which we are now ignorant, but which is not specifically distinct from *C. anaglypticus*." There can be no doubt about the distinctness of this species, and long series have proven the constancy of the inemarginate clypeus and other features. It was placed in the "*fricator* complex" of species by Matthews (1961:110), but it is isolated from the rest of the group by the lack of the clypeal notch or emargination.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 141-2). It is apparently confined to peninsular Florida with records from Jacksonville to Miami. The type locality is Dunedin, and Blatchley (1928:10) added Gainesville, LaGrange, Lakeland, Port Orange, and Enterprise. In addition to these, Matthews (1961:110) added High Springs, Miami, Lutz, Tampa, 4 mi. N. W. Dunnellon, Orlando, Kissimmee, Interlachen, 8 mi. S. Interlachen, Sanford, 13 mi. N. O'Brien, Stemper, and Weeki Wachee. Young (1959:103) reported an elytral fragment from a Pleistocene deposit at Vero Beach. I have seen it from 20 localities (for complete data see Appendix 13).

BIOLOGY: This is a common species in cow dung in the spring, but usually only in scrub habitats. Young (1959:106) indicated that, along with the walking stick (*Anisomorpha buprestoides* Stol.), this is a "highly characteristic dung beetle" of the scrub. He went on to state that " . . . perhaps *Copris inemarginatus*, a sort of living fossil, did once utilize the dung of *Equus, Mammut*, and *Mammuthus* which are also found as fossils with it at Vero." Part of the type series was taken from a dead turtle, and I have taken one specimen on the dried tendons of a horse carcass. Although Blatchley (1918:55) reported specimens taken "at porch light in June and July," I have never encountered it at light nor in over 1000 blacklight trap samples examined. I have taken a few specimens in traps baited with malt and proprionic acid, and yeast. Matthews (1961:110) stated that it is " . . . most active during the winter and spring from November to April." I suspect that the records reflect the time of year during which most collecting has been done; the hot summer months are not as appealing to the northern collectors as are the mild winters. I have seen specimens collected every month except September, October, and December.

My field notes contain the following observations: at Redwater Lake (Putnam Co.) on Jan. 6, I collected 10 specimens from burrows beneath cow dung. In nearly every case there was only a single specimen per dung cake, the only exception being one cake with three beetles. The burrows were slanting about 45 degrees away from the source and were about six inches long. No brood balls were found. They were more frequent than *C. minutus* which is also abundant during the winter. At Charlie Creek (Hardee Co.) on Jan. 21, I took 15 specimens in burrows which were 6 to 9 inches deep. This was a turkey oak scrub area, but the pasture was entirely open. On Mar. 20, near Huntington (Putnam Co.), Dr. J. E. Lloyd and I took 93 specimens under cow dung in an open pasture near a turkey oak scrub. Most of the specimens were in the dung or in the top three inches of sand. Many dung piles, seemingly in the proper condition, contained no beetles, but over 40 specimens were taken in a single pile. The immature stages are unknown.

SPECIMENS EXAMINED: 160, including the holotype, from 20 Florida localities, representing 27 collection records (for complete data see Appendix 13).

SELECTED REFERENCES: Blatchley, 1919:31; 1928: 10; Dozier, 1918:332; Matthews, 1961:35, 40, 108-110, Fig. 11, 19, 47, 56, Table 2; Young, 1959:103-106.

Copris minutus (Drury)

(Fig. 136-7)

Scarabaeus minutus Drury 1770:78-79; Pl. 35, Fig. 6.
Scarabaeus silenus Fabricius 1775:21.
Scarabaeus ammon Fabricius 1781:24.
Scarabaeus lar Fabricius 1787:13.
Copris reflexus Panzer 1794:7.
Copris minutus (Drury), Horn 1870a:42-51.

DIAGNOSIS: Small (length 8-12.5 mm), shining, black, the head horn often well developed in both sexes. The only Florida species which has a long, narrow head horn in major males. Easily distinguished from all other American *Copris* by the uniformly punctate proepimeron. In all other species the proepimeron is divided longitudinally by a feeble carina which differentiates an outside, densely punctate area, from an inside, almost impunctate one.

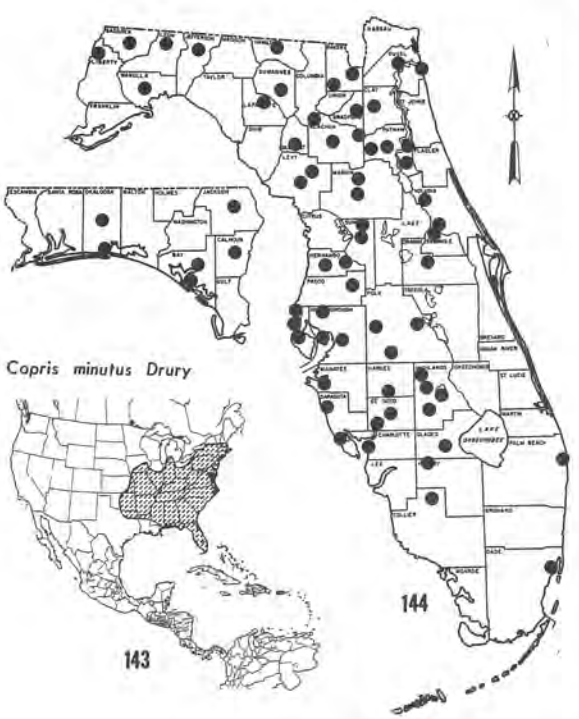
TAXONOMIC NOTES: The synonymy cited above was confirmed by Matthews (1961). There is considerable variation in size and development of the head horn. In plotting horn height against femoral length, Matthews (1961:Fig. 2) found that most specimens from Mobile and Montgomery, Alabama, and Clarksville, Florida fell near the upper extreme of the curve. However, two specimens from that area fell near the bottom of the curve. Further study of long series of specimens from throughout the range will be necessary before any interpretation can be made of this variability.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 143-4). It occurs throughout the eastern U. S. from New Hampshire south to Florida, west to Texas and north to Iowa. In Florida it was recorded by Matthews from 36 localities from Miami in the south to Calhoun County in the north. I have seen specimens from most of the state, representing 75 localities. There are very few records for the east coast and none from the Everglades or the Keys.

BIOLOGY: This is a very abundant species in cow dung throughout the year in Florida. It is also attracted to lights, especially in the winter. Despite its abundance, very little has been published on its behavior or biology. Ritcher (1945:10-11) described the larva and added the following observations:

> Adults of *C. minutus* construct a brood chamber several inches deep in the soil beneath cattle droppings. Here several balls are formed from an unshaped mass of dung. Balls with eggs have a slight pyriform shape, measuring 13 to 15 mm in length and 13 to 14 mm in width. Adults are usually found in the brood chambers with the balls even after the larvae within have pupated.

I have taken a few specimens on a dead dog and on rotting blue crabs, but it appears to be rarely necrophagous. Very few specimens have been taken in numerous bait traps using fermenting malt.



SPECIMENS EXAMINED: Over 1,300, of which 943 were from 75 Florida localities, representing 209 collection records (for complete data see Appendix 14).

SELECTED REFERENCES: Blatchley, 1910:916; 1928: 10; Brown, 1928a:25; Davis, 1966:213; Dillon and Dillon, 1961:512, Pl. 49, Fig. 9; Dozier, 1918:332; 1920:365; Horn, 1870a:42-51; Matthews, 1961:17, 31, 36, 40, 59-63, Fig. 2, 11, 14, 36, 51, 65, Table 2; Miller, 1954:Table 1, 2; Ritcher, 1945:10-11, Fig. 36, 41 (larva); Schaeffer, 1906:255.

Genus PHANAEUS MacLeay

(Fig. 1, 145-54)

Phanaeus MacLeay 1819:124.

TYPE SPECIES: *Phanaeus vindex* MacLeay 1819 (designation not known, but cited by Matthews 1966: 38).

DIAGNOSIS: Large and bulky (length 13-20 mm, width 7-12 mm), brightly colored with metallic green or blue, often with red or golden reflections. Males have the pronotum flattened somewhat and projecting at the posterior angles, and the head has a long curved horn. The front tarsi are absent in the males (Fig. 49) but usually present in females. The elytral striae feebly impressed, the intervals reticulately punctate. Easily distinguished from all other Florida Coprini by the bright color and absence of tarsi in the males (this character found only in one other genus, *Deltochilum*, of the Scarabaeini).

TAXONOMIC NOTES: The genus was revised by d'Olsoufieff (1924), but several species have been described since then. Robinson (1948e) revised the U. S. species, but his treatment is unsatisfactory in many cases. Three species have been reported from Florida, but one of these is based on an allopatric subspecies of *P. difformis* which is here synonymized. Most of the subspecies created by Robinson do not appear valid to me. The entire genus is in need of revision, as are our few U. S. species. Edmonds (1972) published an excellent morphological study of the "phanaeine" Scarabaeinae which will provide a firm basis for future taxonomic studies.

DISTRIBUTION & ZOOGEOGRAPHY: There are approximately 100 species known, of which nearly all are Neotropical, with 9 found in the Nearctic and a single species known from the West Indies (endemic to Jamaica). Matthews (1966:38) stated that the genus is of South American origin with extensive penetration of

Fig. 145. Lateral view of **Phanaeus vindex** MacL., male (4X).

Central and North America, which it must have invaded early (in the Upper Cretaceous or Eocene, according to Halffter, 1964).

BIOLOGY: Most of the North American species are coprophagous, but a high percentage of the South American ones are necrophagous. A few species are diurnal, but most are strictly nocturnal. Some species are confined to forested areas, but several are found in the grassland biome, especially those which utilize herbivore dung. The behavior has not been studied in detail for the Florida species.

Stewart (1967) studied the food preferences of dung beetles in Georgia by using baited pitfall traps. The most abundant species was *Phanaeus vindex* MacL. with *P. igneus* a distant second. In three separate locations, feces preferences by the beetles were in the following order: swine, opossum, dog, cow, raccoon, and horse. None was found in chicken or lamb feces. Cow dung was far less attractive than that of swine or opossum " . . . even in an environment dominated by cattle."

The larva is known for only one of the U. S. species (*vindex*). It can be distinguished from the other known Florida larvae of the subfamily Scarabaeinae by the following combination of characters (Ritcher, 1945:12-13): prothoracic shield with an anteriorly projecting, angular process on each side; glossa with a transverse row of closely spaced spine-like setae anterior to the hypopharyngeal oncyli; venter of last abdominal segment with a single broad, caudal, median lobe; tarsal claws absent; medium portion of last ventral abdominal segment covered with a large quadrate patch of stout, caudally directed, spine-like setae; maximum width of head capsule of third instar 4.2-4.6 mm.

SELECTED REFERENCES: Blanchard, 1885:167-169; Blatchley, 1910:917; 1928:11; d'Olsoufieff, 1924:5-172; Edmonds, 1972; Gillet, 1911:81-87; Matthews, 1966: 38-45; Ritcher, 1945:12-13 (larva); Robinson, 1948e: 299-305.

Key to the Florida species and subspecies of Phanaeus

1. Elytral intervals one and two (and the sutural one) carinate for at least one-half their length; the remaining intervals with carinate reticulations between the punctures which are elongate depressions and never round (Fig. 146); major male with head horn conical for its entire length (Fig. 145), not flattened or spatulate near the tip; posterior pronotal angles produced . . . *vindex* MacL.

1'. Elytral intervals feebly convex, but never carinate, the punctures usually rounded, the areas between simply convex but not carinate (Fig. 147, 149); major male with head horn flattened dorsoventrally for part of its length, expanded laterally and somewhat spatulate near the tip (Fig. 1); posterior pronotal angles not produced . . . . . *igneus* MacL. 2

2(1'). Elytra shining to the unaided eye, the first three intervals with very few punctures except near the suture; all elytral punctures smaller, less dense, and less alutaceous (Fig. 149-50); peninsular Florida . . . . . *igneus floridanus* d'Ols.

2'. Elytra dull to the unaided eye, the first three intervals usually with some punctures throughout; all elytral punctures larger, denser, and very noticeably alutaceous (Fig. 147-8); western panhandle of Florida . . . . . *igneus igneus* MacL.

Phanaeus igneus igneus MacLeay

(Fig. 147-8)

Phanaeus igneus MacLeay 1819:133.
Phanaeus tityus Dejean 1836:155 (nomen nudum).
Phanaeus scabripennis Sturm 1843:106 (nomen nudum).
Phanaeus igneus nigrocyaneus Gemminger and Harold 1869:1018 (nomen nudum, attributed to MacLeay in Litt.).
Phanaeus igneus igneus MacL., Robinson 1948e:304.

DIAGNOSIS: Easily distinguished from the other Florida species (*vindex*) by the characters in the key. It can usually be told at a glance from *igneus floridanus* by the dull, alutaceous elytra (Fig. 147-8). They are rarely as brightly colored with red and bronze reflections as the peninsular form.

TAXONOMIC NOTES: Both subspecies were originally described as full species, but since they appear to intergrade somewhere in north Florida, I have considered them subspecifically distinct. Actually I have seen no specimens which could not be separated, but critical material is lacking from the northern and western parts of the state. I have seen no specimens of *floridanus* from north of the Florida peninsula. Al-

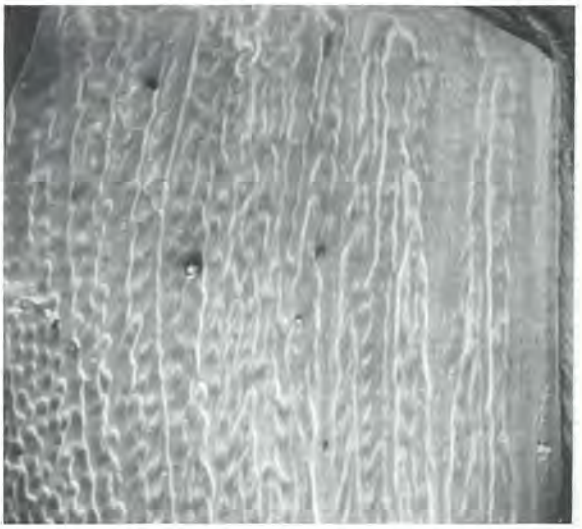


Fig. 146. Stereoscan photo of left elytron of **Phanaeus vindex** MacL.: (17X). Compare Fig. 147-150.

though not a part of a formal synonymy, Edmonds (1972:832) listed *floridanus* as a synonym of *igneus*.

There is a blue-black color form which appears to be found on the fringes of the range (e.g., coastal North Carolina and Georgia). This phenomenon has been noticed in other species of *Phanaeus*, as well as in *igneus floridanus*. This color form was responsible for the name *nigrocyaneus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 151-2). Outside of Florida it has been recorded from Alabama, Georgia, and North Carolina. It was reported from Clemson, South Carolina in the three papers by Cartwright (1934b, 1939a, 1950), although Kirk (1969:34 and 1970:31) reported it from several other areas. It apparently does not occur in the mountains. In Florida it appears to be confined to the panhandle west of the Suwannee River, the easternmost record being Madison County.

BIOLOGY: The habits of this subspecies have not been investigated. It is fairly common under cow and human dung, and large numbers have been taken in traps baited with malt and proprionic acid. I have seen Florida specimens collected in March through June, and September and October. The immature stages are unknown.

SPECIMENS EXAMINED: 172, of which 67 were from 7 Florida localities as follows: (40) Calhoun Co., Clarksville, 21-III-54, H. F. Howden, malt traps; (1) Jefferson Co., Monticello, 24-VI-33, F. W. Walker [UMMZ]; (1) same data except 7-X-34, G. B. Fairchild; (1) Leon Co., Tall Timbers Res. Sta., 14-IX-70, D. L. Harris, pitfall; (1) same data except 8-XI-71; (1) Liberty Co., Rock Bluff P. O., 6-IV-29, T. H. Hubbell [UMMZ]; (6) Liberty Co., Torreya State Park, 30-IV-46, F. N. Young [UMMZ]; (6) same data except 12-IV-60; H. V. Weems, Jr., malt traps; (5) Madison Co., 2-V-46, F. N. Young [UMMZ]; (3)

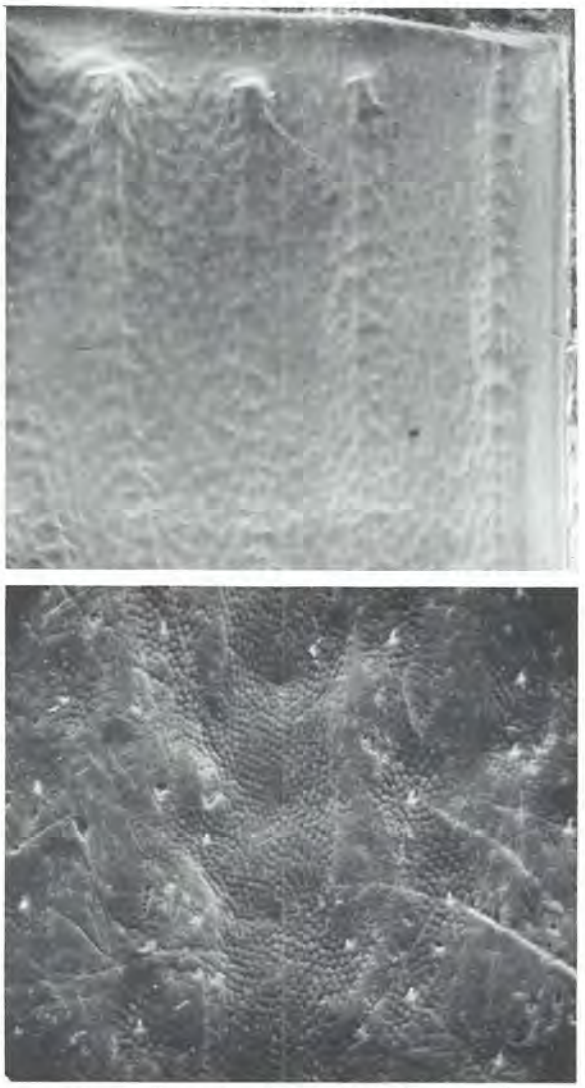


Fig. 147-148. Stereoscan photos of left elytron of **Phanaeus igneus igneus** MacL.: 147) 20X, 148) 128X. Note extent of alutaceous areas.

Madison Co., Greenville, 2-6-IX-32, L. K. Gloyd [UMMZ]; (2) Walton Co., DeFuniak Springs, 11-IX-29, T. H. Hubbell [UMMZ].

SELECTED REFERENCES: Blanchard, 1885:169 (in part); Blatchley, 1928:11 (in part); Brimley, 1938:199; Edmonds, 1972:832; Miller, 1954:378-382, Table 1-2; 1961:735, Table 1; Robinson, 1948e:304.

Phanaeus igneus floridanus d'Olsoufieff

(Fig. 1, 149-50)

Phanaeus floridanus d'Olsoufieff 1924:94.
Copris floridanus Dols., Leng and Mutchler 1927:38 (lapsus)
Phanaeus igneus floridanus d'Ols., Robinson 1948e:304.

Fig. 149-150. Stereoscan photos of left elytron of **Phanaeus igneus floridanus** d'Ols.: 149) 24X, 150) 128X. Note extent of alutaceous areas.

DIAGNOSIS: Bright, shining, metallic green, often with red and bronze reflections. Easily separated from typical *igneus* by the shining elytral intervals, the first three often nearly impunctate (Fig. 149-50). Everywhere the sculpture less pronounced and punctures of the elytral intervals usually rounded and not noticeably alutaceous. Head horn of major male shown in Fig. 1.

TAXONOMIC NOTES: (see also this section under the nominate subspecies). There is a blue-black form with no coppery reflections, of which I have seen very few specimens. All of these were from coastal areas (e.g., Marco, Miami, Pompano Beach, Vero Beach), except a doubtful specimen from a student collection labeled "Gainesville."

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 151-2). The type locality is "Est-Florida: Doubleday, Foster-St. Johns Bluff." It is apparently confined to peninsular Florida, my southernmost record being Miami and the northernmost the type locality. I have seen no specimens from west of the Suwannee River.

BIOLOGY: It is presumably similar to that of the nominate subspecies. I have taken specimens commonly in cow dung and once on a dead dog, but by far the most specimens were taken in traps baited with malt and proprionic acid. H. R. Dodge collected 109 specimens in fermenting yeast bait (made up on 9-X) traps at Gainesville, on the following dates, with numbers in parentheses: 10-13-X (9), 14-16-X (33), 17-X (21), 18-X (22), 19-X (24). The bait was much more productive after 4 days and continued to be attractive after 10 days. Specimens have been collected every month of the year in Florida. The immature stages are unknown. This species and *vindex* are a part of the regular diet of the burrowing owl in Florida.

SPECIMENS EXAMINED: over 660 from more than 40 Florida localities, representing 135 collection records (for complete data see Appendix 15).

SELECTED REFERENCES: Blatchley, 1928:11 (*igneus* in part); 1932:17, 50, 163; Dozier, 1918:332; 1920:365; Edmonds, 1972:832; Hamilton, 1894:252.

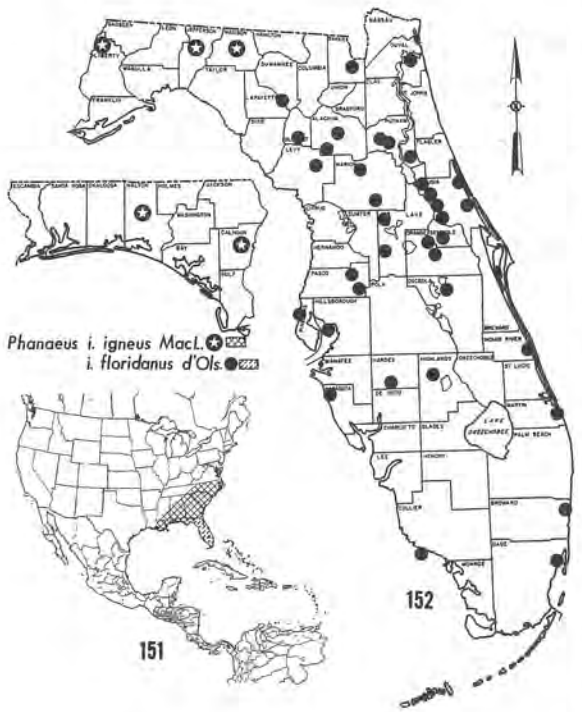
Phanaeus vindex MacLeay

(Fig. 145-6)

Phanaeus carnifex Linnaeus 1758:346 (in part, not Jamaica).
Phanaeus vindex MacLeay 1819:133.
Phanaeus vindex cyanellus Robinson 1938:107. (NEW SYNONYMY)
Phanaeus difformis magnificens Robinson 1948e:302. (NEW SYNONYMY)

DIAGNOSIS: Easily distinguished from *igneus* and subspecies by the characters in the key. Pronotum of the major male with a flattened area projecting posteriorly at the posterior angles. In a few specimens the elytra are blue and the pronotum green (*cyanellus*), a striking contrast to the normal bronze or reddish pronotum and green elytra.

TAXONOMIC NOTES: The name *carnifex*, long used in American literature for this species, is properly applied to a Jamaican species. The nomenclatural problems have been thoroughly discussed by Barber (1928) and Matthews (1966). The name *cyanellus* was proposed by Robinson (1938:107) as a variety for the blue-green form mentioned above. Color changes on the margin of the geographic range are found in several species of *Phanaeus* (e.g., *torrens, quadridens, igneus*, etc.) but I do not believe that such forms represent subspecies. In most cases there appear to be no differences except color. The synonymy of *difformis magnificens* is proposed after examination of the types.



Although I have found no other Florida specimens to match exactly, I believe they fall within the range of variation. It is likely that *difformis difformis* LeConte is only a western subspecies of *vindex*, although I am not formally proposing such at this time because of a lack of material from the western U. S. This is a wide-ranging species which has a great amount of variation, and additional study will be required to interpret this variability in light of geography and behavior. Edmonds (1972) lists a *vindex* group, containing 32 of the 44 species of *Phanaeus*, and the *vindex* complex composed of 4 species (*vindex, difformis, igneus,* and *triangularis*).

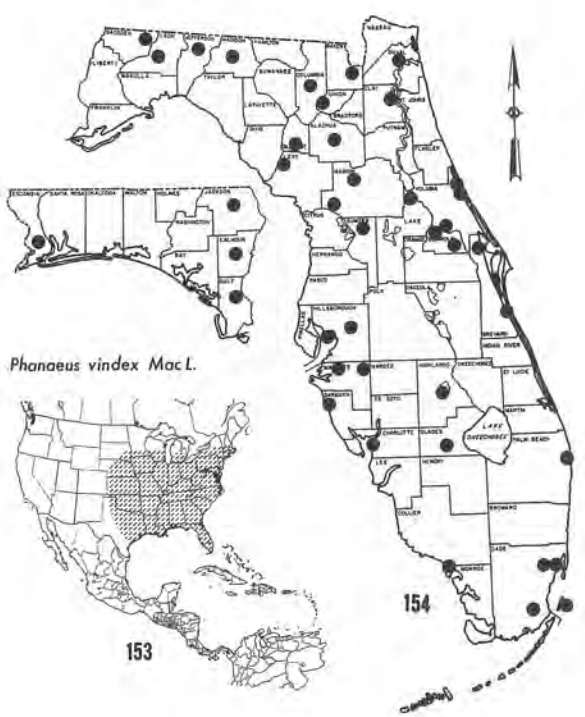
DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 153-4). It is widely distributed throughout the eastern U. S. from Massachusetts to Florida, west to Texas, and north to South Dakota. In Florida it is found throughout the state except for the Everglades and Keys.

BIOLOGY: Although this is a common, morphologically well known, widely distributed species, there have been few detailed observations on its biology and behavior. It is primarily coprophagous, with a decided preference for human dung. The dung is provisioned for the larvae in nearly vertical burrows a few inches beneath the source. The dung wads are irregularly shaped, but often pyriform, the egg being deposited in the teat-like end. The adults, according to Ritcher (1945:13), " . . . do not stay with the young as do the species of *Copris*." For a characterization of the larva see this section under the genus.

As is true with many coprophagous scarabs, a phoretic association exists with several mites. This association was studied by Stewart and Davis (1967), who stated that *Macrocheles amygdaligera* (Berl.) and " . . . probably all these phoretic macrochelids are predators on insect eggs, small insect larvae, and nematodes." They noted that in the laboratory these mites readily fed on eggs of the swine stomach worm, *Physocephalus sexalatus* (Molin), for which *Phaneus vindex* is a known intermediate host. The beetles are also known as intermediate hosts for a second stomach worm, *Ascarops strongylina* (Rudolphi) (Stewart & Kent, 1963). The close association or "consortisms" between swine, nematodes, dung beetles, and mites appears to be very complex. Future work in this regard should prove very interesting. Specimens have been taken every month of the year in Florida, but it does not appear as common here as in Georgia. It is one of the regular elements in the diet of the burrowing owl in Florida, the remains of hundreds of beetles being found in their pellets.

SPECIMENS EXAMINED: Over 215, of which 110 were from 45 Florida localities, representing 91 collection records (for complete data see Appendix 16).

SELECTED REFERENCES: Barber, 1928:383; Becton, 1930:315-321, Fig. 1-10 (alimentary tract); Blanchard, 1885:168-169; Blatchley, 1910:917, Fig. 363; 1928:11; Borror and Delong, 1964:313, Fig. 22-57c, d; Brown, 1928a:25; Comstock, 1940:517; Dillon and Dillon, 1961: 513, Pl. 50, Fig. 1-2, color Pl. D; Edmonds, 1972; Hardenberg, 1907:563, Pl. 31, Fig. 22, Pl. 34, Fig. 3 (mouthparts); Lindquist, 1933:111; Miller, 1961:738-739; Ritcher, 1945:12-13, Fig. 7, 20, 24, 31, 33, 40 (larva); Stewart and Davis, 1967:20-26; Stewart and Kent, 1963:158-159.



TRIBE ONTHOPHAGINI

(Fig. 155-176)

The tribe is represented in the Western Hemisphere only by the type genus *Onthophagus*. It can be distinguished readily from all other Florida Scarabaeinae by the characters in the key. Eight other genera are currently recognized in the tribe: *Mimonthophagus* (Ethiopian), *Macropocopris* (Australian), *Caccobius* (Palearctic, Oriental, Ethiopian), *Milichus* (Ethiopian), *Cyobius* (Oriental), *Anoctus* (Oriental), *Caccophilus* (Ethiopian), and *Phalops* (Ethiopian, Oriental).

Genus ONTHOPHAGUS Latreille

(Fig. 155-176)

Onthophagus Latreille 1802:141.

TYPE SPECIES: *Scarabaeus taurus* Schreber (by monotypy).

DIAGNOSIS: Medium sized (length 2-8.5 mm), alutaceous to shining, pubescent or glabrous, color black to metallic green or bronze, a few species maculate with red, orange, or yellow spots. General shape oval, usually somewhat flattened above. Clypeus entire or notched, the margin raised or not evident. Head and/or pronotum often furnished with horns or protuberances in the male. Scutellum not visible. All tarsi present. Middle and posterior tibiae expanded at the apex, the middle with two spurs, the posterior with one. Elytra with seven striae, not deeply impressed, often broken into lines and dashes, the intervals not strongly convex.

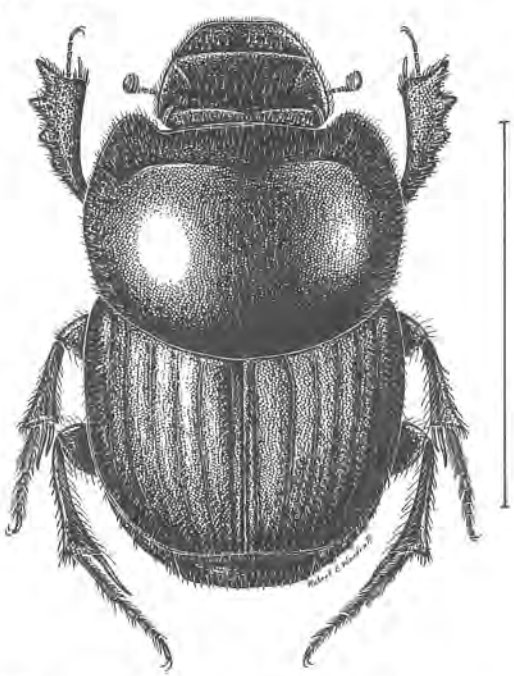


Fig. 155. **Onthophagus p. polyphemi** Hubbard, line = 5mm.

Most similar in general appearance to *Oniticellus* (Fig. 177), from which it can be distinguished by the nine-segmented antennae and the lack of a scutellum.

TAXONOMIC NOTES: This is perhaps the largest genus of beetles known, with 1,500+ described species. The species of America north of Mexico were recently revised by Howden and Cartwright (1963). Numerous subgenera have been proposed, especially for Old World species. Halffter and Matthews (1966:254) listed 18 subgenera, but these have not been applied to the North American forms. Most of the Florida species are readily recognized by the characters of the key, but a few are difficult without comparative material. Problems of subspeciation exist in three of our species: *striatulus*, *polyphemi*, and *orpheus*. These are discussed in detail under each species.

Curtis (1825) designated *nuchicornis* L. as the type species, but, as Latreille listed only one species when he described the genus (*taurus* Schreber), Curtis' designation is invalid.

DISTRIBUTION & ZOOGEOGRAPHY: Of the 1,500+ species in the world, 114 are known from the Western Hemisphere, 37 from the U. S. and Canada, and 11 species and 2 subspecies from Florida. They are not recorded south of 40° south latitude in South America or north of 55° north latitude in North America. Balthasar (1963) stated that the genus is Ethiopian in origin, and according to Halffter (1964a) it probably entered North America from Asia via the Bering land bridge early in the Cenozoic since there is moderate radiation in South America.

Five species are recorded from the Antilles (Matthews, 1966:8), two of which have been introduced there. One of these is African, and the other is widespread in Mexico and Central America. Both have been introduced only on the island of Martinique. None of these occurs in Florida, and none of the Florida species is found in the West Indies. Curiously, another African species (*depressus*) has been introduced accidentally into Florida and Georgia.

BIOLOGY: In such a large genus, as might be expected, there is a wide variety of food habits, although most species are coprophagous. The Florida species are mostly found in cow dung, although a few apparently are found only in other kinds of dung. *O. polyphemi* is confined to the burrows of the gopher tortoise, and *orpheus* appears to be primarily associated with pack rats (*Neotoma* spp.), at least in Florida. One species (*striatulus*) is found almost exclusively in fungi. The habits of *aciculatulus* are completely unknown. It probably occupies some unusual niche not yet discovered. *O. tuberculifrons* is the most abundant species in Florida, and it has been recorded from the widest range of foods, including several kinds of dung, fungi, carrion, and decaying vegetable matter. Among the species not known in Florida there are some which are myrmecophilous, saprophagous, sarcophagous, and coprophagous (sometimes exclusively on dung of one mammal). At least two species are found only on bat guano in caves.

Most of the Florida species are more abundant in sandy soils, although two (*concinnus* and *subaeneus*) usually are found in hardwood forests with deep leaf mold. The gopher tortoise occurs only in very sandy areas, and the obligate *O. polyphemi* coincides with this habitat. These burrows, as micro-caverns, offer a cooler, moister, darker habitat than the surrounding area.

Several of the Florida species are attracted to artificial baits, but only *depressus* (introduced from Africa and subgenerically different) has been taken at light. Baits include malt extract, fermenting yeast, proprionic acid, Staley's sauce bait, and amyl acetate.

In most of the species which have been studied, the rate of development is rapid and, in at least some of the species, there are several generations per year in Florida. Adults of *tuberculifrons* have been found during the entire year at Gainesville and are active during the coldest weather. Other species, such as *concinnus* and *aciculatulus*, appear to have a narrow period of adult seasonal activity.

The immature stages are known for only two (*pennsylvanicus* and *hecate*) of the 11 Florida species. The larvae that are known are typical Scarabaeinae and "hump-backed" in appearance. The "hump" is accentuated by a dorsal, conical, setate protuberance. The known larvae are very similar, with minute differences in the venter of the last abdominal segment.

The behavior of our species is almost completely unknown. Stridulation is not known in the genus. Howden and Cartwright (1963:7) recorded the following generalizations about the biology:

> Three instars are present, each stage lasting from 8 days to 2 weeks. Development from egg to teneral adult is rapid, usually taking only 5 or 6 weeks. Emergence of the adults from the pupal cells may be delayed in hot dry weather and during the winter. The burrows, made at the edge of or under cow dung, are often twisted, sometimes branched and vary in depth from 1 to 9 inches, depending on the species. The oval brood cell, approximately 1½ times as long as wide and filled with dung, is formed nearly horizontally at the end of the burrow or branch. After the egg is fastened on end to the side of a small cavity formed in the upper end of the dung, the cavity wall is sealed with the same material. The burrow may then be partly refilled with soil and the egg and subsequent larva left without further attention.

SELECTED REFERENCES: Blatchley, 1910:917-921; 1928:11-13; Boucomont, 1932:293-332; Boucomont and Gillet, 1927:103-263; Brown, 1926:99-101; 1927a:128-133; Horn, 1875:137-141; Howden and Cartwright, 1963:1-133, 84 Fig.; Howden, Cartwright, and Halffter, 1956:1-16; Ritcher, 1945:13-15 (larvae); Schaeffer, 1914:290-300.

Key to the Florida species of Onthophagus

(Modified from Howden and Cartwright, 1963)

1. Disc of pronotum tuberculate or simply punctate; setae not flattened if present; head and/or pronotum often with horns, protuberances, or carinae in the male; never attracted to light 2

1'. Disc of pronotum closely, setigerously, annularly punctate, the ring-like punctures separated by less than their diameters; each puncture anteriorly with a distinct tubercle, centrally with a short, recumbent, flattened, yellow seta; in Florida known only from Highlands Co.; head and pronotum without secondary sexual characters; attracted to light .... *depressus* Har.

2(1). Disc of pronotum smooth or distinctly punctate, tubercles lacking on disc or, if present, less than one-half the diameter of nearest puncture in basal area 3

2'. Disc of pronotum tuberculate; punctures, if present, vague with diameters approximately equal to that of the tubercles 12

3(2). Color uniform, rarely with humeral umbone or entire elytra lighter in teneral specimens 4

3'. Pronotum and elytra decidedly different in color, elytra bi-colored or spotted 13

4(3). Disc of pronotum virtually impunctate, shiny black or brownish black; males without horns or protuberances on head or pronotum, 5-7 mm in length; in gopher tortoise burrows .... (*polyphemi* and subspecies) .. 5

4'. Disc of pronotum distinctly punctate, vestiture variable; males with or without horns or protuberances on head or pronotum, size variable 6

5(4). Elytral intervals with one or two rows of setigerous punctures (Fig. 155), punctures often with a tubercle at anterior margin; peninsular Florida ..... *p. polyphemi* Hub.

5. Elytral intervals 2 and 4 with only a few scattered setae, nearly impunctate; west of Apalachicola River .... *p. sparsisetosus* Howd. & Cartwr.

6(4'). Shining black, brown, blue, green, or cupreous; more than 4 mm in length; pronotum lacking numerous smaller secondary punctures 7

6'. Dull or feebly shining, alutaceous, brown or black, or if shining only 3 to 4 mm in length; some with small secondary punctures on pronotum 10

7(6). Pronotum without basal margin; clypeal emargination, if any, not dentate on each side; male with at least small vertical head horns basally; size and color variable 8

7'. Pronotum narrowly margined basally; clypeus usually bidentate, the teeth low, triangular, and well separated; less than 5mm in length; shining blackish green or coppery; without tubercles or horns behind eyes; male with short conical pronotal protuberance .... *subaeneus* (Beauv.)

8(7). Second and third elytral intervals with three rows of setigerous tubercles; male with long, slender, vertical horn above each eye; male pronotal protuberance rounded; color blue-black to bronze, never bright green; in fungi .... (*striatulus* and subspecies) 9

8'. Second and third elytral intervals with one or two rows of setigerous punctures or tubercles; male pronotum with bifurcate protuberance projecting above head; color bright green; packrat droppings ..... *o. orpheus* (Panz.)

9(8). Elytral intervals alutaceous between tubercles ..... *s. striatulus* (Beauv.)

9'. Elytral intervals smooth and shining between tubercles ..... *s. floridanus* Blatch.

10(6'). Anterior edge of pronotal punctures with a small shining tubercle; clypeus weakly bidentate; west coast, vicinity of Dunedin .... *aciculatulus* Blatch.

10'. Anterior edge of pronotal punctures lacking tubercles; clypeus truncate to rounded, never bidentate; widely distributed 11

11(10). Dull brownish to black with pronotal punctures generally the same size, usually all with setae; larger (length 3-5 mm) .... *pennsylvanicus* Har.

11'. Shining black, pronotal punctures of two sizes, very small punctures lacking setae scattered among the large punctures; smaller (length 2-4 mm) ..... *oklahomensis* Brown

12(2'). Pronotum bright shiny green or bluish; elytra usually bicolored, green with yellow base and apex ..... *concinnus* Lap.

12'. Color uniformly dull black to grey, usually with red-brown spots at apex of elytra .... *hecate blatchleyi* Brown

13(3'). Pronotum shining between punctures, not dull brownish black; pygidium usually distinctly punctate with at least apical half shining; male with vertical horns on head .... *s. striatulus* (Beauv.)

13'. Pronotum dull brownish black, alutaceous between setigerous punctures; pygidium shallowly punctate, usually alutaceous at least to apical third; male without horns on head .... *tuberculifrons* Har.

Onthophagus aciculatulus Blatchley

Onthophagus alutaceus Blatchley 1919:31 (not Wiedemann 1823:14).

Onthophagus aciculatulus Blatchley 1928b:128.

Onthophagus aciculatus Blatch., Leng and Mutchler 1933:38 (misspelling).

DIAGNOSIS: Small (length 3.8-4.5mm), black, shining, minutely alutaceous. Clypeus bidentate, the teeth weakly developed, barely reflexed. Head with two tubercles basally and single tubercle near the middle; these tubercles conical, not highly raised. Pronotum weakly produced antero-medially into a convex projection, not actually in the form of a tubercle; punctures shallow, margined with a minute tubercle anteriorly; marginal line fine but complete. Elytra more noticeably alutaceous than head and pronotum; striae fine, the punctures shallow and inconspicuous; intervals flat, setigerously punctate-tuberculate, the setae fine, yellow, and arranged in one or two rows per interval. The female is unknown.

It is similar in size and general appearance to *oklahomensis, pennsylvanicus,* and *subaeneus.* It is easily separated from the first two by the bidentate clypeus, convex antero-median protuberance (male), the shallow pronotal punctures, and the three conical tubercles of the head. From the latter it can be distinguished by the more alutaceous surface, the less conspicuous pubescence, less prominent pronotal protuberance (male), and three, rather than two, conical head tubercles.

TAXONOMIC NOTES: Blatchley renamed his *alutaceus* which was preoccupied by *alutaceus* (Wiedemann, 1823). The second and third supplement to the Leng catalogue misspelled his new name as*aciculatus.* It is known only from three male specimens.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 158). It is endemic to Florida, where it is known from Dunedin and Pasco County, although Kirk (1970) recorded it erroneously from South Carolina.

BIOLOGY: Practically nothing is known about this rare species. The holotype was taken "on the wing," Jan. 7. Howden and Cartwright (1963: 80) recorded a second specimen collected at Dunedin by Blatchley on Jan. 22, 1921. However, Blatchley (1928:13), a reference not cited by Howden and Cartwright, recorded the second specimen as ". . . beaten from oak, Jan. 31." The third recorded specimen was collected in Pasco County without precise locality or habitat data on March 20, 1957. It is likely that it is a winter or early spring species which is found on the dung of some obscure mammal. I have searched for it in the vicinity of the type locality on three occasions without success.

SPECIMENS EXAMINED: Two (of the three known specimens), including the holotype in the Blatchley collection at Purdue University. The other specimen is labeled Pasco Co., Fla., 20-III-57, H. V. Weems, Jr. [FSCA].

SELECTED REFERENCES: Blatchley, 1928:12-13; Howden and Cartwright, 1963: 79-80, Fig. 8, 83-84; Kirk, 1970.

Onthophagus concinnus Laporte

Onthophagus concinnus Dejean 1836:157 (nomen nudum).
Ontophagus concinnus Laporte de Castelnau 1840:87 (misspelling of the genus for all 39 species, but the page headings are correct).
Onthophagus viridicollis Sturm 1843:108 (nomen nudum).
Onthophagus protensus Melsheimer 1845:134.
Onthophagus subaeneus (Beauv.), Horn 1875:130 (misidentification).

DIAGNOSIS: Large for the genus (length 5.2-8.1 mm), bicolored green and yellow, the major male with anteriorly directed pronotal protuberance. Easily distinguished from all other Florida species by the yellow and green color pattern. In sculpture it shares with *hecate blatchleyi* the elongate pronotal tubercles or granules.

TAXONOMIC NOTES: In most of the U. S. literature this species is reported under the name *subaeneus* (Beauv.). Howden and Cartwright (1963:112) pointed out that this was a result of an early misidentification by Horn (1875), and the name *subaeneus* is now applied to the species previously known in nearly all the U. S. literature as *cribricollis* Horn.

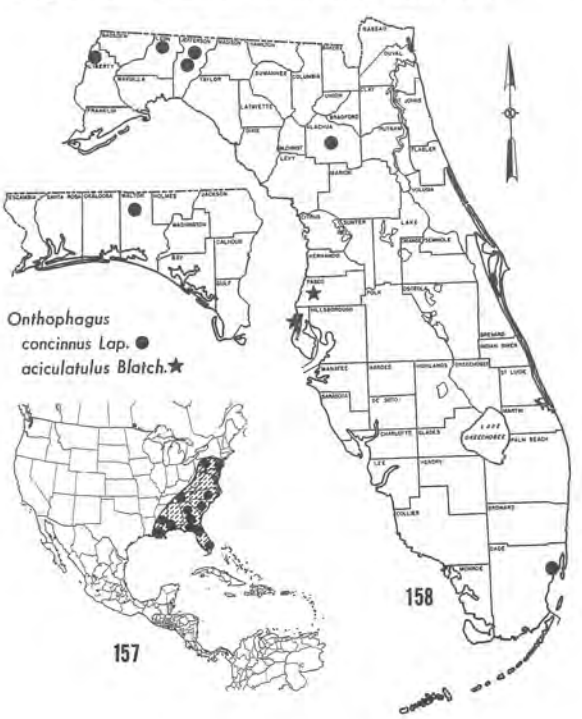
DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 157-8). Howden and Cartwright (1963:111) recorded it from the following states: Florida, Georgia, Mississippi, New Jersey, North Carolina, Pennsylvania, South Carolina, and Tennessee. They listed the following Florida records: Miami, Monticello, Mossyhead, Newmans (sic) Lake, and Wacissa. Blatchley (1928) did not record it from Florida. I have seen it from 4 additional Florida localities (see specimens examined).

BIOLOGY: Howden and Cartwright (1963:111-112) reported it as follows:

> Biologically, *O. concinnus* is still somewhat of an enigma. It is a widely distributed species, occuring in the spring and fall from New Jersey to Florida and westward to Mississippi. Nowhere does it seem common. A possible explanation of its seeming rarity may stem from the fact that the adults are usually taken on the droppings of small mammals, skunks, foxes, and possibly others, only occasionally being taken on human feces or cow dung. It has been taken under fungi, under chicken manure, and a few specimens have been collected in fermenting malt traps. Several live females were placed in flower pots and supplied with fresh cow droppings, but none of the specimens evinced any interest in the dung, dying without attempting to construct brood cells.

Several of the specimens that I have seen were taken in human dung in forested (hammock) areas. Others were taken in a Malaise-type trap in a forested area, and several were taken in unbaited pitfall traps at Tall Timbers Res. Sta. (Leon Co.). It appears to be found in the same habitats as *Glaphyrocanthon viridis*. Florida specimens have been taken from March through September. The immature stages are unknown.

Fig. 156. Stereoscan photo of male pronotal horn of **Onthophagus hecate blatchleyi** Brown (dorsal view, 56X).



SPECIMENS EXAMINED: 57 from Alabama, New Jersey, and Georgia, as well as 56 from 4 Florida localities as follows: (1) Alachua Co., Gainesville, 12-V-24, H. E. Bratley (determined as *janus* by Schwarz); (1) Gainesville, 12-V-66, R. E. Woodruff, human dung; (7) Gainesville, 10-IV-67, F. J. Moore, human dung; (6) Gainesville, 17-XI-7-XII-72, H. R. Dodge, feces bait traps; (1) Dade Co., Brickell Hammock, 7-VII-36, F. N. Young; (37) Leon Co., Tall Timbers Res. Sta., Woodyard Hammock, various dates from 27-III to 28-IX, D. L. Harris, unbaited pitfalls; (1) Liberty Co., Torreya St. Pk., 1-IV-64, H. V. Weems, Jr., Malaise trap; (1) same data except 5-VII-65; (1) same data except 18-V-66, trapped in window.

SELECTED REFERENCES: Boucomont, 1932:329; Brimley, 1938:200; Howden and Cartwright, 1963:108-112; Lacordaire, 1856:109, Fig. 7, 61-63; Schaeffer, 1914:294.

Onthophagus depressus Harold

Onthophagus depressus Harold 1871a:116.
Onthophagus carteri Blackburn 1904:147.

DIAGNOSIS: Large (length 6.0-7.7mm), oval, brownish black to gray, dull. Clypeus bidentate, narrowly emarginate between, the surface with transversely elongate rugae or tubercles. Pronotal punctures variable in size, but usually round, with an anterior tubercle, sometimes obscuring one-half of each puncture. Differs from all other Florida species by the short, flat, broad setae in each puncture of the dorsal surface (head, pronotum, elytra, and pygidium). Practically no secondary sexual dimorphism, and no horns or protuberances on head or pronotum in either sex.

TAXONOMIC NOTES: The above synonomy was suggested by Arrow (*In* Cartwright, 1938:114). However, no mention is made of the name *carteri* or reference to the synonymy in the recent revision by Howden and Cartwright (1963). It is related to *bituberculatus*, another African species, which was reported from Martinique in the West Indies (Matthews, 1966:25). Both species belong to d'Orbigny's (1913) 32nd group of African species.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 159-60). The type locality of *depressus* is Caffraria, southeast Africa; that of *carteri* is Australia. In the U. S. it has been reported from Lyons, Vidalia, and Wenona, Georgia and Lake Placid and Sebring, Florida (Howden and Cartwright, 1963:127). It was first reported from Florida by Robinson (1948c:177) based on a specimen from Archbold Biological Station. Frost (1963:34) erroneously considered his specimens the first Florida record. I have seen additional specimens from Lake Letta Subdivision, north of Avon Park, and from Archbold Biological Station (both in Highlands Co.). It is peculiar that an African species should turn up in such disjunct localities as Australia, Georgia, and Florida. This is especially true since the U. S. localities are inland, and it has not been found near the coast. It is doubtful that it occurs in the intervening areas between the Georgia and Florida localities, since it is attracted to light, and should be easily detected with blacklight traps.

Matthews (1972:305-306) indicated that *O. depressus* was accidentally introduced into Australia (probably near Sydney) before 1900. Shortly afterwards (Blackburn, 1904) it was described as *O. carteri*. It appears that it did not move from the Sydney area until after 1941 and may now be expanding its range. Matthews (loc. cit.) mentioned that several specimens were found in marine littoral conditions in Australia which is ". . . undoubtedly an essential part of its dispersal ability."

BIOLOGY: It is the only Florida species of *Onthophagus* that is attracted to light. Although it was taken in cow dung by P. W. Fattig in Georgia, I have searched for it in vain in cow dung in Florida. At the Archbold Biological Station, where it has been taken at light, I examined several hundred piles of cow dung without finding a single beetle. Specimens have been taken from March through October in Florida. The immature stages are unknown.

SPECIMENS EXAMINED: Over 1000, of which 140 were from Highlands Co., Florida as follows: (3) Lake Placid, Citrus Tower, 3-VII-60, R. E. Woodruff, at light; the remainder were from Lake Letta Subdivision, by Ted Morris in blacklight trap, with numbers and dates as follows: (1) 27-III-61; (37) 31-III-61; (9)

2-V-61; (2) 31-V-61; (13) 14-VI-61; (15) 21-VI-61; (5) 27-VI-61; (3) 19-VII-61; (5) 8-VIII-61; (40) 22-VIII-61; (2) 29-VIII-61; (1) 6-IX-61; (1) 2-X-61; (1) 19-IV-62; (2) 28-V-62.

SELECTED REFERENCES: Cartwright, 1938:114; Frost, 1963:34; 1964:142; Howden, 1966a:1186; Fig. 18; Howden and Cartwright, 1963:126-127, Fig. 4, 79-80; Matthews, 1972:305-306; Paulian and Lebis, 1960:23, Fig. 9; Robinson, 1948c:177.

Onthophagus hecate blatchleyi Brown

(Fig. 156)

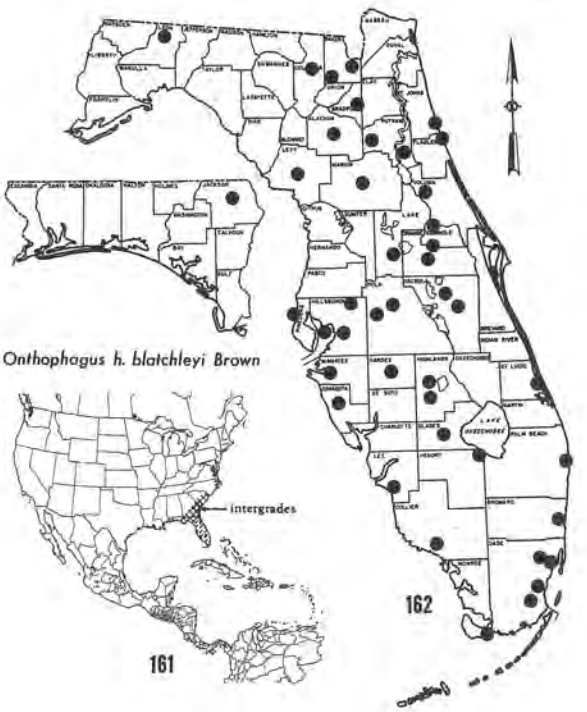
Onthophagus hecate (Panz.), Blatchley 1928:12.
Onthophagus blatchleyi Brown 1929a:86-87.
Onthophagus hecate blatchleyi Brown, Howden & Cartwright 1963:120-123, Fig. 11, 73-75.

DIAGNOSIS: Large for the genus (length 5.5-8.2 mm), dull, gray, usually with a few orange to red spots at the elytral apices. In the elongate pronotal granules or tubercles it is similar only to *concinnus* in Florida. However, that species is bicolored green and yellow.

TAXONOMIC NOTES: Howden and Cartwright (1963: 122), in relegating this form to subspecific status, remarked that it ". . . has been treated at a subspecies not because it is lacking in distinguishing characteristics, but because all the characteristics in specimens from north of peninsular Florida appear to blend with the true *hecate*." I have not seen any Florida specimens which are intermediate or similar to the nominate subspecies. However, critical material is lacking from the western panhandle and from the zone of reported intergradation. The Florida population nearly always has the orange spots at the elytral apices, the pronotal granules are less elongate and more widely spaced, and the dorsal pubescence is shorter and less conspicuous. The specimens I have seen of *hecate* from parts of the range (e.g. Missouri and Kansas) differ in some of the same relative characters (e.g. denseness of pronotal granules) from the northeastern populations. This common, widespread species would make an ideal subject for a detailed study of variation and subspeciation.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 161-2). The typical form is known only from peninsular Florida. Howden and Cartwright (1963:Fig. 119) showed intergrades from Clarksville, Florida through southeastern Georgia to the coastal plains of South Carolina. Kirk's record (1969-70) from South Carolina probably refers to these intergrades.

In Florida I have seen it from nearly all areas of the peninsula, excluding the Keys. Although this subspecies (or possibly intergrades with *hecate*) probably occurs throughout the panhandle, I have seen only a single specimen from that area (Jackson Co.).



BIOLOGY: Howden and Cartwright (1963:123) recorded the following information: ". . . at cow dung, small animal droppings, decaying fruits, and the fermenting malt-proprionic acid mixture. Specimens were taken both in the sandhill areas and in the low hammock areas of south Florida." In addition I have seen specimens from dead fish, rotting pork, rabbit pellets, rotting palm, human dung, deer droppings, dead dog, and Steiner trap. Unbaited pitfall traps at Tall Timbers Res. Sta. (Leon Co.) have produced 681 specimens. It is not attracted to light. I have seen Florida specimens collected every month of the year. The immature stages are unknown.

SPECIMENS EXAMINED: 1,160 from 54 Florida localities, representing 362 collection records (for complete data see Appendix 17).

SELECTED REFERENCES: Except for Kirk's (1969-70) questionable South Carolina record, there are no references other than those cited under the synonymy above.

Onthophagus oklahomensis Brown

Onthophagus oklahomensis Brown 1927a:128.

DIAGNOSIS: Small (length 2-4.1 mm), black, mostly shining, somewhat flattened dorsally. Clypeus rounded or truncate, never notched or dentate. Carinae of the head weakly developed or obsolete. Head and pronotum without horns or protuberances in either sex. Most

similar to *pennsylvanicus*, it is distiguished by the two sizes of pronotal punctures (interspersed), generally smaller size, shinier pronotum, and more pronounced posterior pronotal margin.

TAXONOMIC NOTES: Although very close to *pennsylvanicus*, it is distinct in detailed morphology as well as habitat preferences. It is the smallest U. S. species (length 2 mm).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 163-4). It was recorded by Howden and Cartwright (1963:81) from the following states: Arkansas, Florida, Georgia, Kansas, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. In Florida they listed it as statewide (25 localities). I have seen specimens from most of Florida except the Everglades and the Keys.

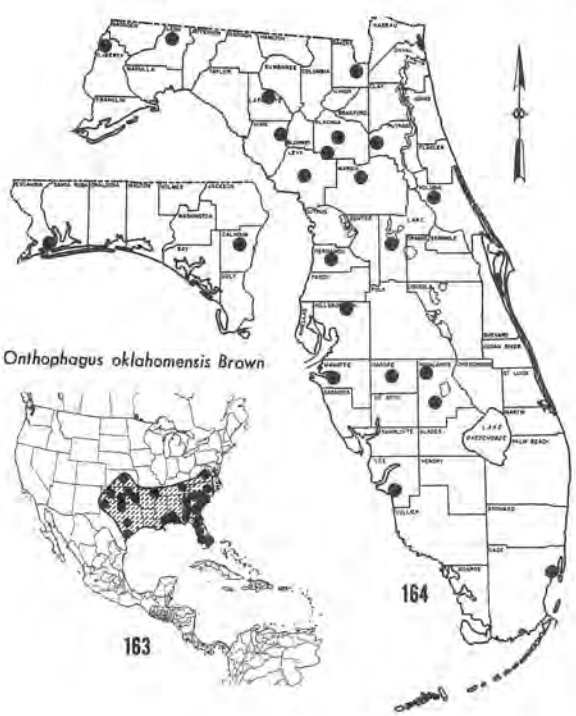
BIOLOGY: Howden and Cartwright (1963:82) reported the following:

> The habitat preference of *O. oklahomensis* differs from *pennsylvanicus*, for though both species are sometimes taken together, the former is restricted almost entirely to sandy areas. It is commonly taken in the sandhill regions of the southeastern coastal plain as well as in sandy areas in Oklahoma and Texas. The species appears to be generally a dung feeder, making shallow 1-to-3-inch burrows under or beside piles of cow dung. Besides being attracted to dung, adults come readily to rotten melon rind, bananas, and malt and proprionic acid traps. In the laboratory, cow manure was used by the beetle for construction of small oval cells buried 1-to-2 inches deep in packed sandy clay. Sand grains coating the cells made them difficult to measure, but 11 cells averaged approximately 10 mm. long by 8 mm. wide. In this species as in *pennsylvanicus*, development from egg to adult takes about 3 weeks or slightly longer. Several of the cells were formed about June 25, and on July 17 some contained pupae or teneral adults. The length of the various instars was not ascertained.

I have seen specimens with the following habitat information: human dung, cow dung, dog dung, fleshy fungus, Jap beetle trap, and bait traps with malt, proprionic acid, asafoetida, and yeast. It is not attracted to light. Specimens have been taken in Florida every month except January, February, and September. Although several hundred *hecate blatchleyi* were taken in unbaited pitfall traps at Tall Timbers Res. Sta. (Leon Co.), only 1 *oklahomensis* was taken in the same traps.

SPECIMENS EXAMINED: Over 600, of which 540 were from 23 Florida localities, representing 60 collection records (for complete data see Appendix 18).

SELECTED REFERENCES: Boucomont, 1932:319; Howden and Cartwright, 1963:80-82, Fig. 3, 58; Knaus, 1927:126.



Onthophagus orpheus orpheus (Panzer)

Scarabaeus orpheus Panzer 1794:5.
Onthophagus orpheus (Panz.), Sturm 1843:107.
Onthophagus janus var. *orpheus* (Panz.), Horn 1875: 139.
Onthophagus orpheus orpheus (Panz.), Howden and Cartwright 1963:47-50.

DIAGNOSIS: Large for the genus (length 5-9 mm), shining green or bronze. Male with a deeply forked, anteriorly projecting protuberance on the pronotum and two dorsally projecting, short horns on the base of the head. Clypeus transversely rugose and punctate. Pronotum punctate-tuberculate, the tubercles projecting posteriorly at the anterior edge of each puncture; punctures bearing fine, whitish setae, more noticeable at the sides. Distinguished from the other two subspecies of *orpheus* by the pronotal and elytral punctures with tubercles on their anterior margins. It can be separated from the other Florida species by the shape of the male pronotal protuberance and the other characters in the key.

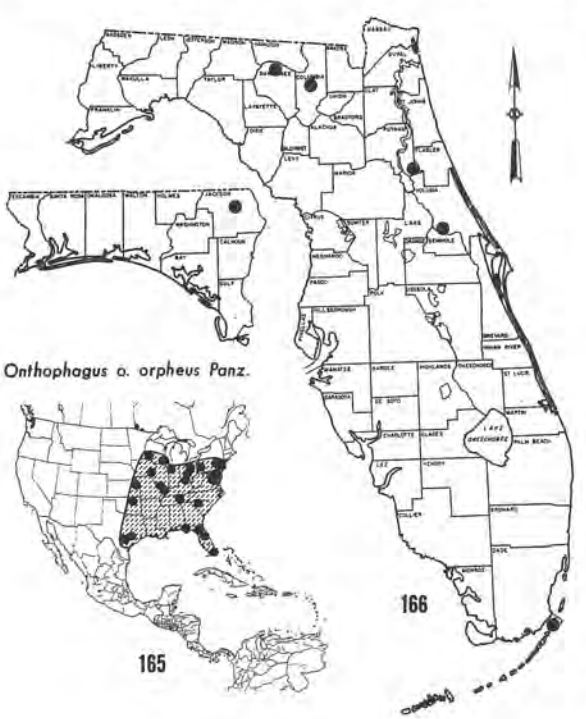
TAXONOMIC NOTES: Apparently all Florida specimens are referrable to the nominate subspecies. This polymorphic species is in need of further study. Howden and Cartwright (1963:49) stated that ". . . instead of being divisible into several subspecies as treated here, [it] may represent a series of sibling species; however, the taxonomy of the group will remain obscure

until a great deal more is known about the biology of the complex." Most of my Florida specimens were confirmed as this subspecies by Cartwright.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 165-6). It was recorded by Howden and Cartwright (1963) from the following states: Florida, Illinois, Indiana, Iowa, Kansas, Maryland, Minnesota, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and Wisconsin. They listed the following Florida localities: Enterprise, Lake City, Live Oak, Florida Caverns State Park, and Key Largo. Blatchley (1928:12) also listed Crescent City.

BIOLOGY: All of my Florida specimens have been associated with woodrats (*Neotoma floridanus* and subspecies). I have taken it also in Ohio in woodrat droppings. Howden and Cartwright (1963:50) recorded the following hosts: buzzard's nest, woodchuck burrows, in a cave, cow dung, and malt traps. It is not attracted to light. They suggested that, "Inasmuch as most of the species of *Onthophagus* that are not general dung feeders seems to have a very restricted host preference, it seems quite likely that further investigation may show that three or four morphologically similar species with quite diversified habits are placed here under the name *orpheus*."

SPECIMENS EXAMINED: 40, of which 21 were from 2 Florida localities as follows: (19) Jackson Co., Florida Caverns St. Pk., 6-X-60, R. E. Woodruff, *Neotoma* droppings; (1) same data except 18-IV-63; (2) Monroe Co., Key Largo 7-VI-60, R. E. Woodruff & L. J. Bottimer, in dung chamber in nest of *Neotoma floridana smalli*; (1) same data except 7-XII-66, R. E. Woodruff, B. K. Dozier, & J. H. Knowles.



SELECTED REFERENCES: Blatchley, 1910:910; 1928: 12; Boucomont, 1932:311; Brown, 1926:100; Dillon and Dillon, 1961:514-515, Pl. 49, Fig. 6; Howden and Cartwright, 1963:47-50, Fig. 6, 26-27; Schaeffer, 1914: 295.

Onthophagus pennsylvanicus Harold

Onthophagus ovatus (Linn.), Melsheimer 1806:4 (misidentification)
Onthophagus moeris Sturm 1826:178 (nomen nudum).
Onthophagus pennsylvanicus Dejean 1836:158 (nomen nudum).
Onthophagus pennsylvanicus Harold 1871a:115.
Onthophagus falcipes Harold 1871a:115.
Onthophagus pensylvanicus Har., Horn 1875:141 (misspelling).
Onthophilus pensylvanicus Har., Hubbard and Schwarz 1878:655 (misspelling of both genus and species).

DIAGNOSIS: Small (length 3.3-5 mm), black to dark gray, dull to feebly shining. Clypeus truncate to rounded, not dentate. Pronotum without horns or protuberances; punctures shallow, and nearly always setigerous, separated by about one diameter, mostly of same size, rarely with a few finer ones scattered near the midline; the surface between the punctures finely alutaceous. Elytral intervals dull, alutaceous, at least third, fourth, and fifth with tubercles arranged in two irregular rows. Most similar to *oklahomensis*, from which it differs by the pronotal punctures being nearly uniform with only rarely smaller ones interspersed. In addition it is generally larger, less shining, and the posterior pronotal margin is poorly developed.

TAXONOMIC NOTES: Although superficially similar to *oklahomensis*, it is distinct both in morphology and habits. The reference above to *ovatus* is presumed to be a misidentification for this European species. Howden and Cartwright (1963:84) indicated that *ovatus* is not known from North America. Several early records for *pennsylvanicus* could refer also to *oklahomensis*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 167-8). Howden and Cartwright (1963:84) recorded it from "Colorado, South Dakota, and all states east and south of these except New Mexico, Vermont, and Maine." In Florida Blatchley (1928:12) recorded it from Sanford, Sarasota, Dunedin, and Palmdale. I have seen specimens from most of the state except the southern one-fourth of the peninsula. Although records are lacking for the entire eastern coast, this is probably an artifact of collecting.

BILOGY: It has been found on dung of a variety of animals. It is also sometimes found in carrion, rotting fungi, and decaying fruits. It is not attracted to light. It is much less common in Florida than in states to

the north. Howden and Cartwright (1963:85) stated that specimens are ". . . most commonly collected in areas having a clay-type soil, but also occur in fairly sandy localities." I collected 63 specimens in cow dung on Payne's Prairie near Gainesville in pure sand along with *oklahomensis* and *hecate blatchleyi*.

Howden and Cartwright (1963) made the following observations on the life history: winding burrows, two to three inches deep, are made beneath and at the margin of a pile of cow dung, where they terminate in a cell averaging 6 mm wide by 10 mm long; a single elongate egg is laid upright in a small cavity in the upper end; development from egg to adult is approximately three weeks.

The larva has been described by Ritcher (1945 and 1966), but it is inseparable from that of *oklahomensis*. It differs from *hecate* by having the raster with less than 60 short, stout setae, usually in one patch, and the maxillary stridulatory teeth number four to seven.

SPECIMENS EXAMINED: Over 300, of which 191 were from 18 Florida localities, representing 27 collection records (for complete data see Appendix 19).

SELECTED REFERENCES: Blatchley 1910:920; 1928: 12; Brown, 1926:100; Dillon and Dillon, 1961:515, Pl. 49, Fig. 12; Howden and and Cartwright, 1963:82-85, Fig. 2, 59-60; Lindquist, 1933:111, 120; Miller, 1954: 379-380, Table 1-2; 1961:738; Mohr, 1943:296; Ritcher, 1945:15, Fig. 45 (larva); Schaeffer, 1914:297; Wilson, 1932:79, 81.

Onthophagus polyphemi polyphemi Hubbard

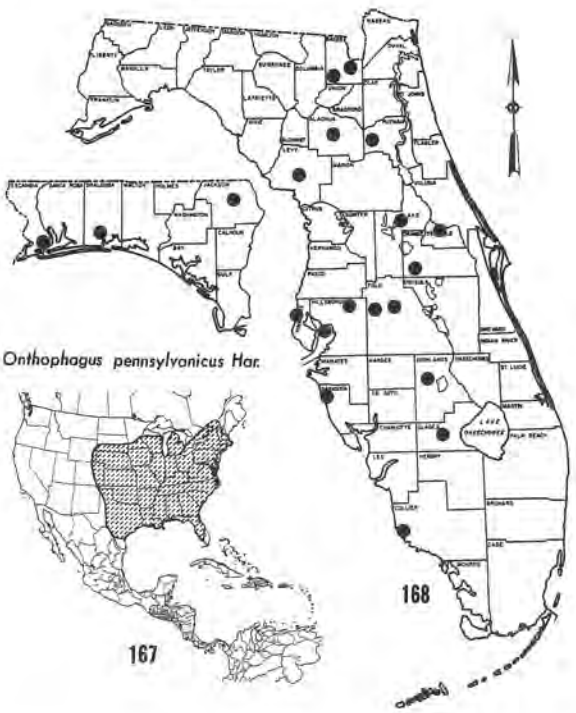
(Fig. 155)

Onthophagus polyphemi Hubbard 1894:311-312, Fig. 21.

Onthophagus polyphemi polyphemi Hubbard, Howden and Cartwright 1963:35-38.

DIAGNOSIS: Large (length 4.7-6.9 mm), dark reddish brown to black, shining. Clypeus rarely, barely emarginate, truncate anteriorly; posterior portion delimited by a transverse, evenly elevated carina. Another transverse carina at the vertex of the head, more highly elevated laterally (both carinae weakly developed in the female). Head punctures setigerous and scattered unevenly. Pronotum of major males swollen and slightly produced anteriorly, that of the female evenly convex; disc shining, without coarse punctures and setae; coarse, setigerous, tuberculate punctures confined to lateral area, and in males, to the area in front of the swelling. Elytral striae vaguely punctate, intervals smooth, shining, and, except for the sutural one, each with a double row of minute tubercles having setigerous punctures at their bases.

It can be separated easily from all other Florida species by the shining surface, and the pronotum is without coarse punctures and setae over the central one-third. It is very similar to the subspecies *sparsisetosus* but can usually be distinguished by the characters in the key. In addition, the surface throughout has more punctures, setae, and tubercles. One character which appears to consistently separate the two is the nearly impunctate second elytral interval in *sparsisetosus*.



TAXONOMIC NOTES: Howden and Cartwright (1963: 40) considered the two forms subspecifically distinct because ". . . the dorsal punctures, slightly reduced in size and number, of specimens north (Tillman, S. C.) and west (High Springs, Fla.) of Crescent City (type locality) indicate possible intergradation."

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 169-70). The nominate subspecies is recorded from southeastern South Carolina (Tillman) to south Florida (Miami), and, along with *sparsisetosus*, is probably coextensive with the range of the gopher tortoise (*Gopherus polyphemus* Daudin). The type locality is Crescent City, Florida, and it has been reported from the following additional localities: 4 mi. N. of High Springs, Gainesville, Leesburg, Lutz, Miami, Stemper (Howden and Cartwright 1963:37); Lake Worth, Enterprise, Sanford, Lake Mary, LaGrange, Funiak, Clearwater (Blatchley, 1928:12). The "Funiak" (probably DeFuniak Springs) locality probably refers to *sparsisetosus*. Although recorded from Miami by Howden and Cartwright (1963: 37), this record is not shown in their distribution map (Fig. 5) or reflected in their general statement of the southernmost Florida record as "central Florida." The distribution of the gopher tortoise is shown in Fig. 67-8, based on unpublished data supplied by W. A. Auffenberg.

BIOLOGY: Both subspecies of *polyphemi* are part of an assemblage of arthropods which are obligates in the burrows of the gopher tortoise. They feed on the dung of the tortoise and are sometimes abundant in a single burrow. Hubbard (1894:305) stated: "I did not find this beetle in the few galleries examined in winter, and it was probably in pupa at that season. In July it was not rare. One of the burrows produced twenty-one specimens. Its larva was not seen." Howden and Cartwright (1963:37) reported specimens collected in March, June, July, and August, with those from March appearing freshly emerged. I have seen specimens from these months as well as February, May, and June.

Although a few specimens have been taken in malt and proprionic acid traps set in the burrows, excavation appears to be the only way to collect numbers of specimens. The tortoise burrows vary considerably in length (up to 20 ft.) and maximum depth (8 to 12 ft.). Excavation of such a burrow, especially being careful to collect the arthropods, is a time consuming and laborious undertaking. Hubbard (1894:303) stated that one of his excavations ". . . was in loose yellow sand of our pine woods subsoil, and when my exploration was completed, so large a pit had been dug that a coach and span of horses might have been swallowed up in it." There have been no observations on the behavior of the species, and the immature stages remain unknown.

SPECIMENS EXAMINED: 30 ffrom 10 Florida localities as follows (all were taken from gopher tortoise burrows): (1) Alachua Co., 2 mi. W. Newnan's Lake, 8-VIII-62, R. E. Woodruff & B. Benesh; (1) same data except 11-V-63, J. F. Anderson; (1) Alachua Co., Gainesville Airport, VII-65, E. Gourley; (1) same data except 14-V-66; (3) same data except 27-VII-66; (1) Alachua Co., Archer, 28-III-60, R. E. Woodruff; (6) Gilchrist Co., Trenton, 28-IV-66, E. Gourley; (2) Lake Co., Leesburg, 2-VII-38, C. C. Goff; (8) Leon Co., Tallahassee, 24-II-68, R. E. Woodruff; (1) Marion Co., 1-VII-60, B. Papy; (1) Putnam Co., 12-VI-60, H. V. Weems, Jr.; (2) Putnam Co., Crescent City, VII, Hubbard (paratypes); (1) Putnam Co., 4 mi. S. of Interlachen, 29-III-60, R. E. Woodruff.

SELECTED REFERENCES: Blatchley, 1928:12; Castle and Laurent, 1896:303; Howden and Cartwright, 1963: 35-38, Fig. 5, 14-15; Howden, Cartwright, and Halffter, 1956:10; Hubbard, 1896:301; Schaeffer, 1914:293; Young and Goff, 1939:61.

Onthophagus polyphemi sparsisetosus

Howden and Cartwright

Onthophagus polyphemi sparsisetosus Howden and Cartwright 1963:38-41, Fig. 5, 16-17.

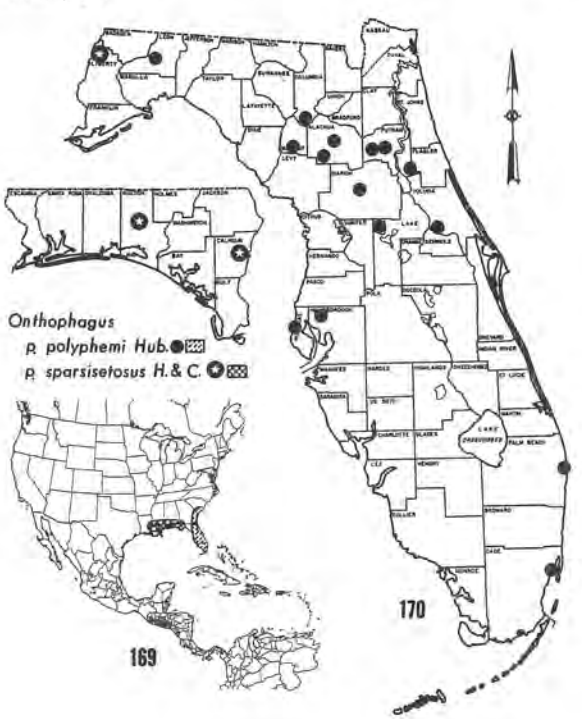
DIAGNOSIS: Very similar to *p. polyphemi* except that dorsally it has fewer punctures, setae, and tubercles. The one character which appears to consistently separate the two is the nearly impunctate second elytral interval in *sparsisetosus*. There are very few coarse pronotal punctures at the sides and in front of the protuberance in the males; this difference is less noticeable in the females.

TAXONOMIC NOTES: (see this section under the nominate subspecies).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 169-70). The type locality of this subspecies is 6 mi. S. W. of Stapleton, Alabama; paratypes are from 6.5 mi. S. of Lucedale, Mississippi, near Clarksville, Florida, and Funiak (DeFuniak Springs?), Florida. Howden and Cartwright (1963) postulated that the Apalachicola River might be the barrier between the subspecies. I have seen a single specimen from Torreya State Park, on the east side of the Apalachicola, and it agrees well with *sparsisetosus*. If there is a natural feature which marks the geographic division of the two forms, then it must be something other than the Apalachicola River. Critical material is not available from the northern parts of the gopher tortoise range.

BIOLOGY: Practically nothing is known of the habits of this subspecies, except that it is found in burrows of the gopher tortoise. Presumably its habits are similar to those of the nominate subspecies. The type series of 103 specimens from Alabama was taken in a single burrow from one to 12 feet inside the entrance.

SPECIMENS EXAMINED: 35, of which 34 were Alabama paratypes, and one was from Florida as follows: Liberty Co., Torreya St. Pk., 24-IV-61, H. V. Weems, Jr.



SELECTED REFERENCES: Nothing has been published on this recently described subspecies except the original description.

Onthophagus striatulus floridanus Blatchley

Onthophagus nigrescens Blatchley 1916:94 (not d'Orbigny 1902:21).
Onthophagus floridanus Blatchley 1928b:128.
Onthophagus striatulus floridanus Blatch., Howden and Cartwright 1963:45-47.

DIAGNOSIS: Large (length 5.5-7.2 mm), black, shining, punctures anteriorly tuberculate and setigerous. Major male with two vertical, long horns at the base of the head which fit on each side of the pronotal protuberance. No other Florida species has such head horns, except weakly developed ones beneath the elongate pronotal protuberance in *orpheus*. Distinguished from nominate *striatulus* by the fairly uniform black color, more shining dorsal surface, and elytral intervals having alutaceous sculpture between the tubercles. In most specimens seen there are four rather than three rows of tuberculate, setigerous punctures on each elytral interval. Elytra never bicolored as sometimes in typical *striatulus*.

TAXONOMIC NOTES: I have referred all Florida specimens to this subspecies and have seen no specimens that I consider intermediate with *striatulus*. Howden and Cartwright (1963:46) stated:

> *O. floridanus* Blatchley is subsequently listed and described as an allopatric subspecies. Many of the characteristics of *s. floridanus*, such as tuberculate-punctate pronotum and black color, appear separately in populations of *s. striatulus*, but of the many specimens examined none with a range outside the southeastern coastal plain exhibited all the characteristics of *s. floridanus*. This fact coupled with the restricted distribution of *s. floridanus* would seem to make valid its recognition as a subspecies.

This complex of forms is in need of further study. Florida specimens were sent to Cartwright for inclusion in the revision of *Onthophagus* (Howden and Cartwright, 1963). In a series from Gainesville, taken in a single fungus, specimens were determined both as *striatulus* and *floridanus*. I have reexamined these and can find no trace of the alutaceous elytral sculpture and therefore have no hesitation in referring them all to *floridanus*. Howden and Cartwright (1963:46) mentioned other specimens from Dunedin and High Springs with varying amounts of faint alutaceous sculpture on the elytra, and they stated: "These should perhaps be considered intermediate forms." If these forms are allopatric as these authors have stated, I find it difficult to conceive of "intermediate forms" from Dunedin, the type locality of *floridanus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 171-2). Howden and Cartwright (1963:Fig. 1) showed typical *floridanus* confined to the Florida peninsula. No specimens have been seen by these authors or by myself from the western panhandle. Although, as mentioned above, intermediate forms were mentioned from Dunedin, Gainesville, and High Springs, these are not included in the zone of intergradation shown on their map (Fig. 1).

BIOLOGY: Florida specimens have been collected every month except March, April, July, and December. This is the only Florida species which is primarily an inhabitant of fleshy "toadstool" fungi. There is one record from a dead opossum, and, probably like *s. striatulus*, it will rarely be found in dung and other carrion. Specimens have been trapped in bait cans using karo syrup, malt, yeast, and asafoetida. Several were taken in unbaited pitfalls at Tall Timbers Res. Sta. (Leon Co.). At Gainesville I placed several fresh "toad stool" fungi in a can about half full of sand, and between Aug. 9 and 16, I collected 70 specimens as follows: after 3 days (12), after 4 days (5), after 5 days (14), and after 7 days (39). It is not attracted to light. The immature stages are unknown.

SPECIMENS EXAMINED: 197 from 16 Florida localities, representing 57 collection records (for complete data see appendix 20).

SELECTED REFERENCES: Blatchley, 1928:12; Howden and Cartwright, 1963: 45-47, Fig. 1, 24-25.

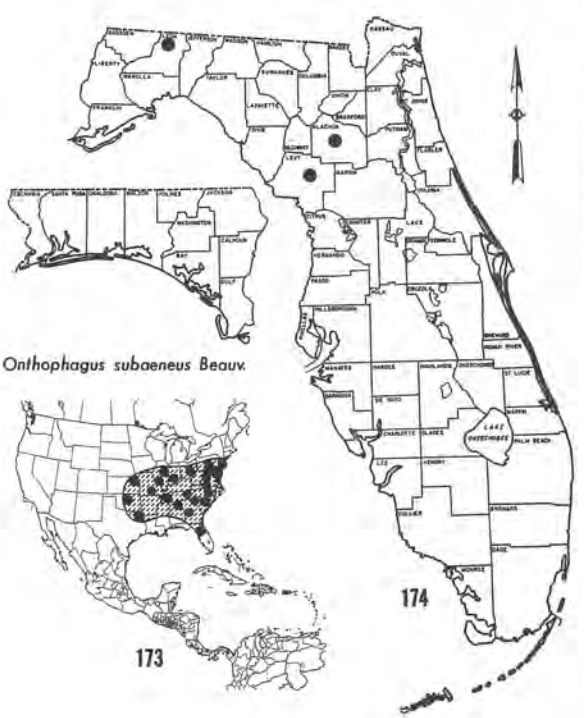
Onthophagus subaeneus (Beauvois)

Copris subaeneus Palisot de Beauvois 1811:105.
Onthophagus subaeneus (Beauv.), Haldeman and LeConte 1853:54.
Onthophagus cribricollis Horn 1881:76.

DIAGNOSIS: Small (length 3.3-5mm), head and pronotum shining, dark iridescent cupreous to green; elytra dull shining, black with cupreous or green cast. Clypeus abruptly reflexed and broadly emarginate anteriorly, angulate on each side of the emargination, often appearing bidentate. Pronotum completely margined; with a small conical protuberance medially, barely extending over the anterior pronotal margin in the major male; punctures spaced mostly less than two diameters apart, anteriorly and laterally with tubercles on their anterior margin, and all setigerous with fine, long, whitish setae. Elytral intervals minutely alutaceous, usually each with two rows of tuberculate, setigerous punctures. It can be distinguished from the other Florida species by the characters in the key. In addition, the pronotal pubescence is finer and longer than our other species. In the bidentate clypeus it is most similar to *aciculatulus,* but that species is black, has the pronotum alutaceous, and has three low conical protuberances on the head.

TAXONOMIC NOTES: The name *subaeneus* has been misapplied in most North American literature to the species treated here as *concinnus,* following Howden and Cartwright (1963). The present species had gone under the name *cribricollis* since 1881.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 173-4). Howden and Cartwright, (1963:75) recorded it from the following states: Alabama, District of Columbia, Florida, Georgia, Illinois, Indiana, Kansas, Maryland, Missouri , New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Virginia. They listed Levy Co. and Gainesville as the only Florida records. It was not recorded from the state by Blatchley, and I have seen only one Florida specimen (see Specimens Examined).



BIOLOGY: This species is rare in collections, although apparently sometimes common in certain situations. Sim (1930:141) collected 120 specimens during two seasons at Rancocas Park, New Jersey on rabbit pellets. These were nearly all taken in June and July in the sandy "pine-barren" country. He made the following behavioral observations:

> The beetles were most active on warm sunny days after showers, and practically all were found between 9 A.M. and noon. None was ever observed on the wing in the afternoon or on a cloudy morning. As in all species of *Onthophagus* whose habits are known to me, *cribricollis* buries its food where found and sinks it vertically to a depth of a few inches, where the subsequent grub lives in a double walled plaster cell of its own manufactures. The entire metamorphosis was found to require about one month. As in other species, this beetle probably overwinters as a hibernating adult buried singly at a depth of several inches.

Howden and Cartwright (1963:75) recorded specimens from fungi, carrion, under dung of various animals (including chicken manure), and malt or malt and proprionic acid traps. Brown (1926) found it in moist woodlands in Oklahoma. The immature stages are unknown.

SPECIMENS EXAMINED: Six, one of which was from Florida: (1) Leon Co., Tall Timbers Research Station, 30-V-6-VI-70, D. L. Harris, pitfall trap in Woodyard Hammock.

SELECTED REFERENCES: (all of these are under the name *cribricollis* except Howden and Cartwright). Blatchley, 1910:920; Brown, 1926:100-101; 1928a:26; Howden and Cartwright, 1963:72-76, Fig. 8, 54-55; Schaeffer, 1914:297; Sim, 1930:140-141.

Onthophagus tuberculifrons Harold

Onthophagus tuberculifrons Sturm 1843: 108 (nomen nudum).
Onthophagus tuberculatus Gemminger and Harold 1869:1038 (nomen nudum, attributed to Zimmerman in litt.).
Onthophagus tuberculifrons Harold 1871a:115.

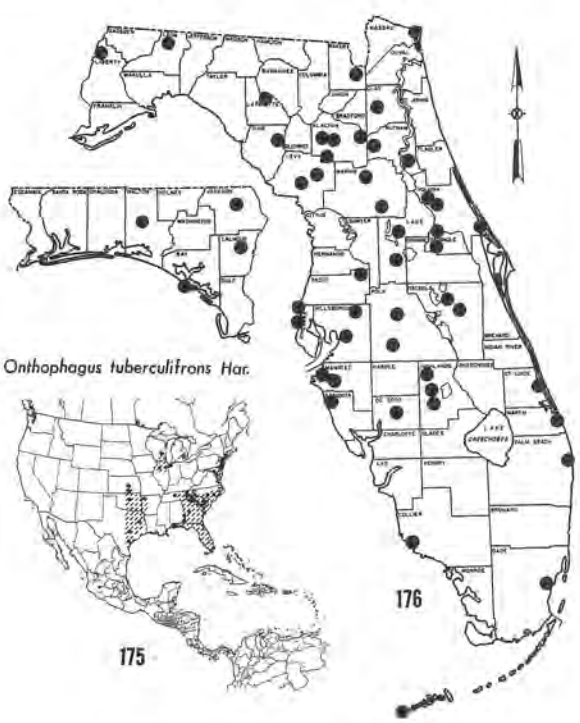
DIAGNOSIS: Small (length 3-5.5 mm), dull, alutaceous, brown to black, elytra maculate with variable

orange spots, at least some present at the humeri and apices. Clypeus broadly emarginate (males) or acutely emarginate, the angles each side dentate (females). Head with two "bumps" or tubercles at the vertex; clypeal carina short, low, and most noticeable in females. Pronotum margined anteriorly and laterally, but feebly so posteriorly; unmodified with horns or protuberances in either sex. Elytral intervals alutaceous, biseriately setigerously punctate-tuberculate. Readily distinguished from all other small Florida species by the maculate elytra. Similar to *aciculatulus*, but that species is black, and the eyes are wider (about six facets) dorsally.

TAXONOMIC NOTES: This is a distinctive species not easily confused with any other. Florida specimens, according to Howden and Cartwright (1963:86), have the pronotal punctures larger and with the tubercles often lacking, but in other respects they do not differ from the remainder of the population.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 175-6). It has been recorded from Connecticut south to Florida, west to eastern Texas, and north to Wisconsin. However, it is not uniformly found in the intervening areas. It is found throughout Florida, including at least one record from the Keys (Monroe Co.).

BIOLOGY: This is probably the most common dung beetle in Florida. It is very abundant in fresh cow dung and has been recorded from several other types of dung. It is also found in rotting fungi, other vegetable substances, and occasionally in carrion. I have taken specimens in several liquid baits, including malt, proprionic acid, asafoetida, amyl acetate, and yeast. In a single pint jar containing fermenting yeast which had been left for two nights I collected over 700 specimens of this species. It appears to be most abundant in sandy areas. The immature stages are unknown.



SPECIMENS EXAMINED: Over 4,000 from 57 Florida localities, representing 146 collection records (for complete data see Appendix 21).

SELECTED REFERENCES: Blatchley, 1910:919-920; 1928:13; Boucomont, 1932:319; Brown, 1926:101; 1928a:26; Dillon and Dillon, 1961:515, Pl. 49, Fig. 13; Horn, 1875:140-141; Howden and Cartwright, 1963:85-88; Fig. 9, 52-53; Knaus, 1926:264; Miller, 1954:376; Schaeffer, 1914:298.

TRIBE ONITICELLINI

(Fig. 177)

The Florida record of this tribe is based an a single specimen of *Oniticellus cubiensis* Lap., recorded by Schwarz (in a manuscript) and cited by Blatchley (1929:13). This old record is doubtful, and recent collecting has produced no further specimens. However, since it does occur in the Bahamas (Matthews, 1966), I have included it here on the chance that it again might be found in Florida.

The tribe is primarily Ethiopian and Oriental, with the few American representatives displaying all the characteristics of relict species (Halffter and Matthews, 1966:255). There are nine genera known from the World, representing three subtribes: Oniticellina, in which our single species is placed; Drepanocerina; and Helictopleurina.

The tribe is represented in the Western Hemisphere by only six species in three genera as follows: *Drepanocerus reconditus* Matthews, a species recently described from above 4,000 feet in the Blue Mountains of Jamaica; *Liatongus californicus* (Horn), known from high altitudes in Utah, California, and Oregon; *Oniticellus militaris* (Cast.), found in Brazil, and possibly recently introduced from the Old World (Pereira, personal communication); *Liatongus monstrosus* Bates from Mexico; *O. rhinocerulus* Bates from Mexico and possibly not congeneric with Old World *Oniticellus* (Halffter, personal communication); and *O. cubiensis* Lap. from Cuba, Jamaica, Bahamas, and the doubtful record from Key West, Florida.

The tribe was discussed in detail by Janssens (1953), who proposed the genus *Euoniticellus* in which the species *cubiensis* Lap. was placed. However, the name has been treated as a subgenus of *Oniticellus* by Balthasar (1963), Matthews (1966), and Halffter and Matthews (1966). If subgenera are to be recognized in the genus, its "taxonomic isolation" (Matthews, 1966) would probably merit a separate subgenus. Until a reevaluation is made of all the members of the tribe,

I see little advantage in maintaining existing, or describing new, subgeneric names.

The tribe is most similar superficially to the Onthophagini from which it can be distinguished easily by the eight-segmented rather than nine-segmented antennae, and the scutellum small but visible. All other Florida members of the subfamily have the antenna nine-segmented and the scutellum hidden.

Genus ONITICELLUS Serville

(Fig. 177)

Oniticellus Serville 1828:356 (often cited as 1825; fide Blackwelder, 1957:933, the citation should be 1828 for part 2:345-832).
Euoniticellus Janssens 1953:9, 41.

TYPE SPECIES: *Scarabaeus cinctus* Fabricius 1775 (designation not known, but cited by Matthews, 1966).

DIAGNOSIS: Similar in general facies to *Onthophagus*, but differs by having eight-segmented rather than nine-segmented antennae (the reverse being listed by Arnett, 1962:412), and the scutellum is visible. (see description of our single species, *O. cubiensis* Lap.)

TAXONOMIC NOTES: Janssens (1953) divided this genus into two: *Oniticellus* and *Euoniticellus*. However, Balthasar (1963) relegates the latter to subgeneric status. I agree with Matthews (1966), that if subgeneric categories are maintained, *O. cubiensis* is sufficiently distinct to occupy a position by itself. However, one of the key features of the "genus" *Euoniticellus* is the projecting genal margin, a character which is absent in *O. cubiensis*.

DISTRIBUTION & ZOOGEOGRAPHY: The Florida record of this genus is based on a single specimen of *O. cubiensis* from Key West recorded by Schwarz (in a manuscript), and cited by Blatchley (1928:13). Since this record is doubtful, and recent collecting has produced no specimens, it probably does not occur here now. However, it does occur in the Bahamas, as well as Cuba and Jamaica (Matthews, 1966), and I have treated it here so that it might be recognized if it is found in Florida again. The genus is represented in the New World by this species and one in Mexico.

The genus contains 23 species distributed as follows: Ethiopian (14), Palearctic (4), Oriental (3), West Indian (1), and Mexican (1). Matthews (1966: 27) believed the genus was Ethiopian in origin and probably entered North America from Asia via the Bering Bridge. The relict distribution in the New World parallels that in the genus *Sisyphus*, and I believe such patterns will require further zoogeographic studies for logical explanation. Certainly the Bering land bridge did permit the introduction of many organisms into the New World. However, the distribution of one species in the West Indies and one in Mexico, while the genus is lacking in the remainder of North America and absent in colder climates, would appear to substantiate the theory of continental drift.

The distributions of such relict species is of considerable academic interest, but there is little fossil evidence to assist in arriving at an understanding.

BIOLOGY: All of the species are apparently coprophagous, although a Mexican species in the related genus *Liatongus* is associated with debris in the nests of leaf-cutting ants (*Atta* sp.). None of the species has been studied in any detail, but most of them appear to deposit a single egg into a relatively small dung mass at the end of burrows below the dung source. This behavior is similar to that of many *Onthophagus*. *O. cubiensis* occurs almost exclusively in open terrain and was never found by Matthews (1966:30) in forests or at the edges of wooded areas, and he found no edaphic preferences.

SELECTED REFERENCES: Arnett, 1962; Blatchley, 1928; Halffter and Matthews, 1966; Janssens, 1953; Matthews, 1966.

Oniticellus cubiensis Laporte

(Fig. 177)

Oniticellus cubiensis Laporte de Castelnau 1840:92.
Euoniticellus cubiensis (Lap.), Janssens 1953.

DIAGNOSIS: Typical Scarabaeinae, most similar to

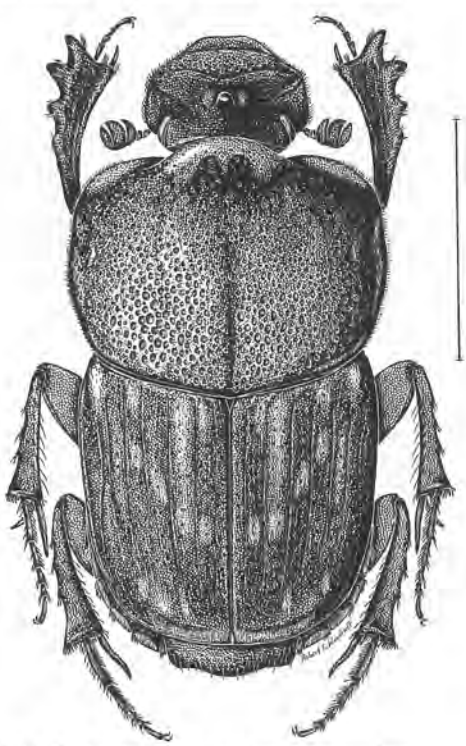


Fig. 177. **Oniticellus cubiensis** Lap., line = 3mm.

species of *Onthophagus*, from which it can be distinguished by the presence of a visible scutellum and eight-segmented antennae. Length: 6.5-7.5 mm; width: 3-4 mm. Dull, light brown with extensive dark brown markings over all surfaces, arranged in a pattern as in Fig. 177; distinct cupreous reflections on head and pronotum. Pygidium with a central dark spot. Clypeus not dentate or emarginate; head entirely strongly margined, occipital carina strong and complete. Base of pronotum not margined; surface very densely and coarsely punctate with punctures of two sizes; median longitudinal sulcus basal, rather deeply impressed. Elytra leaving edges of abdominal sternites uncovered laterally; eight shallow striae, indistinctly punctate; glabrous except for a few long setae emerging in an irregular row from first interstria very near posterior apex.

Male with a short, stout horn on middle vertex, a transverse ridge across middle of clypeus, followed by a pair of curved ridges on clypeus between clypeogenal angles and horn. Fore tarsus with first segment globular, inserted near base of fore spur. *Female* without clypeal ridges or horn, with only one wide, straight, transverse clypeo-frontal carina. Fore tarsus with first segment long, linear, inserted well away from spur.

TAXONOMIC NOTES: The species appears to occupy an isolated taxonomic position within the genus, one which led Matthews (1966) to suggest that it belongs in a subgenus of its own, if subgeneric categories are maintained. It is distinguished from other members of the genus by the shape of the head, a head horn in the male, prosternal tumescence confined to the female, and especially the absence of a distinct transverse row of long hairs on the distal edges of the elytra.

DISTRIBUTION & ZOOGEOGRAPHY: It is known from Jamaica, Cuba, Isle of Pines, and New Providence and Eleuthera in the Bahamas. Blatchley (1928:13) stated that it was ". . . recorded by Schwarz (MS.) as having been taken at Key West by Morrison." This is the only record from Florida. I have searched (without success) for specimens at the U. S. National Museum to substantiate this record. The manuscript referred to by Blatchley is an annotated copy of Schwarz's list of Florida Coleoptera (1878) which Blatchley said was in the Smithsonian library. I have been unable to locate this manuscript.

Although there is some doubt about the Florida record, I have included the species here to permit its identification should additional specimens be found. I have personally searched for it without success in various kinds of dung on the Florida Keys. The Key West area is so well developed that few natural areas remain. The supply of animal dung is very low since no cattle are kept there. There are presently only about two horses and several dogs and cats to provide a dung supply. Human dung is also in short supply since "privies" are now illegal.

The West Indian distribution is rather interesting. Matthews (1966) stated that it is the only member of the subfamily Scarabaeinae in the Greater Antilles which occurs on more than one island. He further stated that ". . . the apparent absence of any geographical variation suggests that it recently jumped from one island to the others." If this is true, its presence in the Bahamas suggests possible future immigration into Florida.

BIOLOGY: It is a common species in cow dung in Cuba and Jamaica, but is never found in forested areas (Matthews, 1966:30). I have collected a large series (50+) along a cleared clay road through pine forests in the province of Pinar del Rio, Cuba. There appear to be no edaphic preferences (a fact which would permit its establishment in the soil-poor Florida Keys). Matthews found it in Jamaica at altitudes up to 2,400 feet, but it was more abundant at sea level. I have also found it common in many areas of Jamaica.

Its behavior has not been studied, and the immature stages have not been described. In most of the species of *Oniticellus* the female lays a single egg in a small mass of dung at the end of a burrow beneath the source.

SPECIMENS EXAMINED: About 400, from Cuba and Jamaica.

SELECTED REFERENCES: Blatchley, 1928:13; Chevrolat, 1864:410; Gowdey, 1926:18; Gundlach, 1891:147; Janssens, 1953; and Matthews, 1966:27-32, Fig. 14-18, 24.

Subfamily APHODIINAE

(Fig. 178-309)

TYPE GENUS: Aphodius Illiger 1798 (by tautonomy).

The higher categories of the Aphodiinae (i.e. tribes, subtribes, groups, and genera) are poorly understood, and nearly every reference has a different arrangement. Part of the problem is due to the tremendous numbers of species, at least some of which fill the gaps between any arrangement of higher categories devised. Until the subfamily receives additional study on a world basis, the arrangement, even at the generic level, will be very unsatisfactory.

Schmidt (1910a, 1910b) divided the subfamily into five "groups": Aphodiina, Eupariina, Psammobiina, Rhyparina, and Corythoderina. Balthasar (1964) recognized seven tribes: Aphodiini, Eupariini, Psammobiini, Rhyparini, Corythoderini, Thinorycterini, and Demarziellini. Representatives of only the first three are known from the U. S., and all three are represented in Florida.

Among the three tribes in Florida, there are genera which have been placed in more than one tribe and others which cannot be properly assigned. For this reason I have not utilized the tribes in the treatment which follows, although their current usage is shown in the checklist in the introduction.

Specific examples of confusion about generic relationships are numerous, but I will list only a few here. The genus *Myrmecaphodius* (Fig. 212) was recently described for a single species found in the nests of the imported fire ant (*Solenopsis invicta* Buren). It is related to the genus *Euparia*, of which the single species *castanea* (Fig. 220) occurs in Florida in the nests of another ant (*Solenopsis geminata*). If we look only at these two species there would be little doubt about their generic distinction on the basis of numerous gross morphological characters. However, if we look at other species of *Euparia* from Central and South America, it is not difficult to bridge these gaps. A good example is *E. vandykei*, which could be placed in either genus, depending upon the weight given to certain characters. In some cases the intermediate species is described as another genus because it cannot be assigned easily. An example of the latter is *Aphotaenius* which was described for a species which has characters of both *Aphodius* and *Ataenius*, and in both of which it had been placed by previous authors. The latter two genera are placed in separate tribes by all authors. The genus *Aphotaenius* then must be arbitrarily assigned to one of these tribes. I maintain that there is little value in using tribes at this stage in our knowledge.

The latest catalogue (Schmidt, 1910b) listed 1,166 species for the world, but numerous species have been described since that time. There are currently over 300 described species known from America north of Mexico. The two largest genera, *Aphodius* and *Ataenius*, are both in need of revision. The latter is currently under study by O. L. Cartwright of the U. S. National Museum.

The subfamily is characterized as follows: clypeus dilated to cover mandibles and other mouthparts (occasionally maxillary palpi visible from above); antennae nine-segmented, the club three-segmented; middle coxae contiguous or nearly so; posterior tibiae with two apical spurs; six visible abdominal segments; tarsi with distinct claws; body shape always oblong, somewhat cylindrical.

The larvae are characterized as follows (Ritcher, 1966:26): antenna four- (or apparently five) segmented with the last segment reduced in size, third segment usually with apical process; epipharynx trilobed, pedium surrounded by phobae; tormae united, with prominent epitorma; galea and lacinia of maxilla distinctly separate, but often close together; maxillary stridulatory teeth sometimes absent; dorsum of thoracic and abdominal segments plicate; concavities of respiratory plates of thoracic spiracles facing posteriorly, those of abdominal spiracles facing ventrally or cephaloventrally; legs four-segmented, with well developed claws; and lobes whitish or yellowish, bare of setae. For keys to the known U. S. larvae and additional descriptions, see the paper by Jerath (1960b).

The biology and ecology of the subfamily is so diverse that few generalizations can be made. Many of the species feed on dung or decaying vegetable matter. Some of the dung feeding species are known only from the dung of one animal (e.g., deer, *Geomys*, *Gopherus*, etc.). Some are found only along the seacoast and others only at high altitudes. Several species are myrmecophilous or termitophilous. Many of the species are abundant at lights. The North American literature contains little information about the ecology of this group, except for a paper on the Oregon fauna by Jerath and Ritcher (1959). However, there is an excellent account of the ecology of European species, with special reference to Sweden (Landin, 1961).

SELECTED REFERENCES: Arnett, 1962:412-414; Balthasar, 1964:1-652; Blatchley, 1910:920-935; 1928: 13-14; 22-28; Cartwright, numerous papers 1934-1965; Dillon and Dillon, 1961:516-523; Horn, 1870b: 110-134; 1871a: 284-297; 1887:1-110; Jerath, 1960b:43-94 (larvae); Jerath and Ritcher, 1959:169-175; Landin, 1961:1-228; Mohr, 1930:263-284; Ritcher, 1958:311-334; 1966:26-29 (larvae); Schmidt, 1910a:1-155; 1910b:1-111; 1912:1-11; 1922:1-614.

Key to the Florida genera of Aphodiinae

1. Pronotum usually with transverse swellings and grooves; median longitudinal impression usually present; head rugulose to verrucose; clypeus often dentate; posterior tarsal segments usually short, triangular; posterior tibial spurs often twisted, flattened on one side, and spatulate-shaped 7

1'. Pronotum without transverse swellings and grooves, median longitudinal impression rarely evident; head usually without rugulae, although often with feeble vermiculate lines; clypeus dentate or not; posterior tarsal segments usually elongate, not expanded or triangular; posterior tibial spurs usually long, narrow and acute... 2

2(1'). Middle and posterior tibiae with transverse carinae; head often tuberculate; some species bicolored or maculate 3

2'. Posterior tibiae without transverse carinae, although there is often at least one on the middle tibiae; head never tuberculate; color brown to black, never bicolored or maculate..... 4

3(2). Middle and posterior tibiae with a terminal fringe of setae or spicules..... (Fig. 178) ..... *Aphodius*

3'. Middle and posterior tibiae with the terminal fringe replaced by two small, triangular teeth, each with a fine, hairlike seta basally on each side. (Fig. 292)..... ..... *Aphotaenius carolinus* (Van D.)

4(2'). Pronotum explanate or expanded at the sides; posterior tibia curved inwardly, slightly expanded at the apex; myrmecophilous..... 5

4'. Pronotum not explanate at the sides; posterior tibia straight or feebly curved, not expanded at the apex; not myrmecophilous..... 6

5(4). Elytra deeply notched at the base inside the humeri which are prolonged into a cuneiform process; lateral pronotal margin with fine, noncontiguous setae; dorsal surface covered with fine yellowish pubescence, the setae arising from tuberculate punctures; genae separated from clypeus by a deep notch; pygidium smooth, not verrucose. (Fig. 220) .... *Euparia castanea* Serville

5'. Elytra not deeply notched at the base, the humeri dentate but not prolonged; lateral pronotal margin with flattened, contiguous, blunt setae; dorsal surface glabrous; genae feebly separated from the clypeus; pygidium verrucose. (Fig. 212) .... *Myrmecaphodius excavaticollis* (Blanch.)

6(4'). Mesosternum not carinate, clypeus without teeth; terminal segment of maxillary palpi slender, elongate; middle and posterior tarsi one-third longer than their tibiae; sexual dimorphism noticeable; male with anterior tibiae bidentate, the apical spur long, twisted, and incurved at the tip; female with anterior tibiae tridentate, apical spur short, straight, and acute. (Fig. 290) ..... *Pseudataenius socialis* (Horn)

6'. Mesosternum carinate; clypeus sometimes dentate; terminal segment of maxillary palpi thicker at the middle and posterior tarsi never as much as one-third longer than their tibiae; sexual dimorphism not noticeable, the male never with anterior tibial spur twisted and incurved at the apex. (Fig. 222) ..... *Ataenius*

7(1). Long spur of posterior tibia at least as long as first two tarsal segments; tarsus distinctly shorter than tibia; middle and posterior tarsal segments, especially the first one, expanded at the apex, somewhat triangular. (Fig. 293) ... *Psammodius*

7'. Long spur of posterior tibia usually shorter, rarely longer, than the first tarsal segment; tarsus as long as tibia; middle and posterior tarsal segments not greatly expanded 8

8(7'). Pronotum without lateral fringe of setae; smallest species of Scarabaeidae (length 1.9-3 mm); pygidium with 6-10 elongate setae; elytral intervals convex, not carinate or costate. (Fig. 306) ..... *Pleurophorus*

8'. Pronotum margined laterally with a fringe of spatulate setae; larger (length 3-4 mm); pygidium without elongate setae; elytral intervals costate. (Fig. 309) .... *Rhyssemus scaber* Hald.

Genus APHODIUS Illiger

(Fig. 178)

Aphodius Illiger 1798:15.

TYPE SPECIES: *Scarabaeus fossor* Linnaeus 1758 (by subsequent designation of Curtis, 1824).

DIAGNOSIS: Mandibles concealed beneath the clypeus; pronotum without transverse swellings and impressions or rows of punctures; head never granulate or verrucose; tarsal segments cylindrical, elongate, never triangular; middle and posterior tibiae with transverse carinae (Fig. 41); elytral intervals never carinate, simply convex or flattened; several species pale yellow, and a few bicolored with red and black; length 2 to 8 mm; width 1 to 4 mm.

TAXONOMIC NOTES: The genus was established in 1798 to include 32 species, but no type species was designated. Curtis' designation cited above was accepted by Chapin (1940), and the subsequent type designations of *Scarabaeus oblongus* Scopoli by Gozis (1886) and *Scarabaeus erraticus* Linnaeus by Paulian (1935) are both invalid.

Schmidt (1922a) listed 74 subgenera of *Aphodius*. Some of these names also have been elevated to generic rank, especially by European authors. The genus is so large (with 1,000+ species described) that a worldwide revision is not imminent.

It has a nearly cosmopolitan distribution, and several species have been transported accidentally around the world by man. Until a thorough study of the world fauna is made, it is futile to divide the species into natural groupings. The U. S. species were placed in groups with letter designations by Horn (1887), but these are of little value at the present time. I have therefore used *Aphodius* in its broadest sense without reference to subgeneric names, except to point out where the species were placed by Schmidt.

The problem of subgenus in the large genus *Aphodius* was discussed by Grebenscikov (1956). He

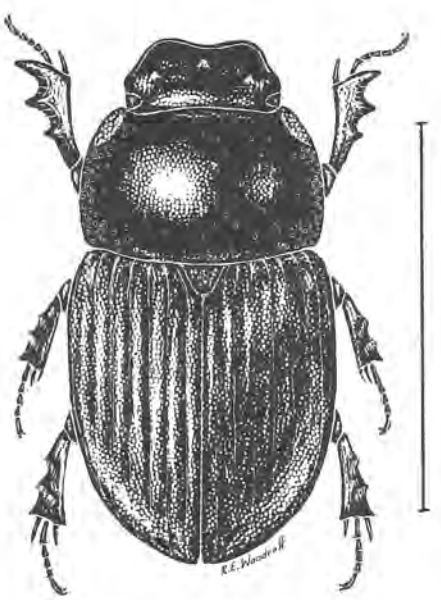


Fig. 178. **Aphodius fimetarius** (L.), line = 5mm.

believed that the evolutionary unit should be either a genus or not, and that the concept of subgenus was not tenable. My personal belief is that the use of subgenera or species groups permits organization within large genera (e.g., *Aphodius* and *Phyllophaga*) without the attendant nomenclatural problems associated with generic names (and the binomial).

The U. S. species are in need of revision, although the Florida fauna is fairly well-known. The latest revision of the U. S. species is by Horn (1887), and the number of species has been more than doubled since that time. Few subspecies of U. S. species have been described, and most of these are of doubtful validity.

The genus is the only representative of the tribe Aphodiini in Florida. Its nearest relative in our fauna is the genus *Aphotaenius* which is presently placed in the Psammodiini.

DISTRIBUTION & ZOOGEOGRAPHY: The genus is nearly world-wide in distribution with about 1,000 described species. Nearly 200 species are known from the U. S., 17 of which are here reported from Florida, with two others doubtfully recorded. Five of the Florida species have been introduced from the Old World and are now widely distributed in the New World; this is especially true for *A. lividus* which is recorded from nearly all parts of the globe. Many of these introduced species are more abundant than our native ones and are more plentiful in their new territories than in their native habitats. Most of these introductions occurred more than 50 years ago, and the beetles were most likely transported in ship ballast or in slave and cattle boats where dung was readily available.

Only two of the Florida species (*A. lividus* and *A. cuniculus*) reach the West Indies, and both are widespread in the Caribbean and Gulf area. Only one West Indian species (of the four known from there) has been reported as endemic (from Cuba).

Apparently several of the introduced species are continuing to expand their range. One such example is *A. haemorrhoidalis*, which was not found in Florida prior to 1967, although it is common in cow dung throughout the eastern U. S. Only one species (*A. floridanus*) is truly endemic in Florida, although those found in the burrows of the gopher tortoise and the pocket gopher are nearly endemic.

BIOLOGY: Nearly all members of the genus feed on dung of the higher animals. Several species are known only from the burrows of rodents (e.g., *Geomys, Thomomys*), and one is associated with the gopher tortoise (*Gopherus polyphemi* Daudin). Other species have been found in the dung of deer, pack rats, fox, etc., but are particularly abundant in cow dung. All of the Florida species (except *parcus*) are found in dung. *A. parcus* is sometimes collected in large numbers at light, especially in coastal localities, but it has not been found feeding, or even hiding, in dung.

Although this group probably contains as much diversity in habits as the other primary dung feeders (Scarabaeinae), they have not been as thoroughly studied. One exception is the recent work by Landin (1961 and 1968) in which the ecology of several European *Aphodius* is detailed. He concluded that the factors governing the distribution of the species are ". . . mainly of a climatic (and microclimatic) character."

McDaniel and Balsbaugh (1968) found two species of *Aphodius* overwintering in frozen cow dung in South Dakota. Many species of *Aphodius* have been found on snow in the winter, and some species fly in swarms (emerging from hibernation) during early spring in northern latitudes. There are also many alpine species in the Palearctic region, and I have collected them in the high paramo in South America.

A few species have been reported as pests of cultivated mushrooms, and at least one species (*A. pardalis*) is a turf pest in the Pacific northwest. The following Florida species are attracted to light: *aegrotus, campestris, cuniculus, floridanus, laevigatus, lividus, parcus, rubeolus,* and *troglodytes*. Certain species are attracted to artificial baits such as malt; among which are the following Florida species: *campestris, cuniculus,* and *stupidus*. Some species (e.g., *stupidus, bicolor,* and *crassulus*) are active primarily in the winter or early spring. Others, such as *campestris, fimetarius,* and *lividus*, are active nearly the entire year, especially in the southern half of the state. Some of the species are extremely abundant and can be found by the hundreds in a single cow dropping. Landin (1961:208) reported that the competition within a single dropping was individual rather than interspecific or intraspecific. He concluded that the fluctuations of populations depended on " . . . abiotic environmental factors rather than on the competition factor." The larvae of 16 U. S. species were described by Jerath (1960b).

SELECTED REFERENCES: Balthasar, 1964; Blatchley, 1928; Brown, 1927b; Chapin, 1940; Grebenscikov, 1956; Horn, 1870; 1887; Jerath, 1960b; Landin, 1961; 1968; Schmidt, 1910a; 1910b; 1922a.

Alphabetical listing of Florida Aphodius with the subgenera in which they were placed by Schmidt (1922a)

aegrotus Horn (not placed, but would fit *Koshantschikovius*)
bicolor Say (*Cinacanthus*)
campestris Blatchley (not placed, but would fit *Koshantschikovius*)
crassulus Horn (*Mendidius*)
cuniculus Chev. (*Nialus*); the synonym *vestiarius* Horn was placed in the subgenus *Oromus*
fimetarius (L.) (*Aphodius*)
floridanus Rob. (not placed, but would fit *Agrilinus*)
granarius (L.) (*Calamosternus*)
haemorrhoidalis (L.) (*Teuchestes*)
haldemani Horn (*Platyderides*)
laevigatus Hald. (*Koshantschikovius*)
lentus Horn (*Amidorus*)
lividus (Oliv.) (*Nialus*)
lutulentus Hald. (*Amidorus*)

parcus Horn (not placed by Schmidt, but placed in the genus *Didactylia* by Brown, 1929a).
rubeolus Beauv. (*Koshantschikovius*)
rusicola Melsh. (*Agrilinus*)
stercorosus Melsh. (*Koshantschikovius*)
stupidus Horn (*Amidorus*)
troglodytes Hubbard (*Koshantschikovius*)

Key to the Florida species of Aphodius

1. Surface of elytra dull, alutaceous, opaque; pronotum densely punctate.....2
1'. Surface of elytra shining, never alutaceous; pronotal punctation variable from dense to impunctate 4

2(1). Mesosternum carinate; color red-brown; length about 3.5 mm; Florida record (Pensacola) doubtful.....*lentus* Horn
2'. Mesosternum not carinate; color dull gray to brown-black; length 3-7 mm.....3

3(2'). Clypeus on each side rounded, barely angulate; elytral pubescence obvious, evenly distributed; length 3-5 mm; common in northern Florida, especially in winter.....*stupidus* Horn
3'. Clypeus on each side angulate; elytral pubescence short, inconspicuous, scattered; length 5.5-7 mm; only two Florida records.....*lutulentus* Hald.

4(1'). Size larger (length 6-8 mm; width 3-4 mm); elytra red or brown, never black.....5
4'. Size smaller (length 2-6.5 mm; width 1-2.5 mm); elytral color variable from black to pale yellow 6

5(4). Bicolored, elytra red, the pronotum black with anterior angles red. Head with three prominent tubercles; common species in cow dung .....*fimetarius* (L.)
5'. Color uniform red-brown; head with transverse carina, but no prominent tubercles; occurring in burrows of the Florida pocket gopher (*Geomys*) and rarely at light.....19

6(4'). Head tuberculate, at least with three convex areas on the frons, ground color mainly black (except *lividus* which is pale with smoky markings) 7
6'. Head not tuberculate, never with more than the frons noticeably convex; ground color brown to yellow (dorsally black and ventrally orange to reddish in *bicolor*).....13

7(6). Clypeus with two prominent teeth; primarily a winter species of the northern half of the state.....*crassulus* Lec.
7'. Clypeus without prominent teeth; not primarily winter species.....8

8(7'). Elytra tipped with a broad red area; scutellum nearly twice as long as broad.....*haemorrhoidalis* (L.)
8'. Elytra without red spots at the tip; scutellum only slightly longer than broad, often barely punctate to impunctate.....9

9(8'). Base color of elytra and pronotum yellow with smoky brown markings...*lividus* (Oliv.)
9'. Base color black to dark red brown, nearly unicolorous 10

10(9'). Basal marginal line of pronotum absent; smaller species (length about 3 mm); common throughout Florida at light.....*cuniculus* Chev.
10'. Basal marginal line of pronotum complete; larger species (length 4-5 mm); rarely collected at light.....11

11(10'). Scutellum depressed, surrounded by a depression; pronotal punctures widely and unevenly scattered; first segment of posterior tarsi shorter than the long spur; a single Florida record (Jackson Co.).....*granarius* (L.)
11'. Scutellum convex, not surrounded by a depression; pronotal punctures more evenly distributed and denser; first segment of posterior tarsi as long or longer than the long tibial spur 12

12(11'). Elytral intervals convex; pronotal punctures larger, denser, and of two distinct sizes; found sparingly the length of the Florida peninsula .....*floridanus* Rob.
12'. Elytral intervals more flatterned; pronotal punctures smaller, less dense, and nearly uniform in size; Florida record doubtful.....*rusicola* Melsh.

13(6'). Dorsal surface black, venter red to orange; only three Florida records; larger (length 5.5-6.5 mm) .....*bicolor* Say
13'. Nearly uniform red brown to pale yellow; smaller (length 2-5 mm).....14

14(13'). Lateral pronotal margin with setae.....15
14'. Lateral pronotal margin without setae.....18

15(14'). Setae of lateral pronotal margin elongate; small (length 2-3 mm); pale yellow, often with smoky markings on the pronotum; transverse carinae of middle and posterior tibiae obsolete.....*parcus* Horn
15'. Setae of lateral pronotal margin short; larger (length 3-4.5 mm); usually red-brown, at least the pronotum; transverse carinae of middle and posterior tibiae well developed.....16

16(15'). First segment of posterior tarsi slender, elongate, longer than the long tibial spur; none of elytral intervals pubescent; found in the burrows of the Florida gopher tortoise (*Gopherus polyphemi*) ... *troglodytes* Hubbard

16'. First segment of posterior tarsi shorter or equal to the long spur; elytra pubescent on lateral posterior one-third; found in cow dung and at light.....17

17(16'). Spurs of posterior tibia short, spatulate, with a broad concave surface; first posterior tarsal segment shorter than the long tibial spur; color nearly uniformly red-brown..... .....*rubeolus* (Beauv.)

17'. Spurs of posterior tibia elongate, narrow, with a narrow concave surface; first posterior tarsal segment about equal to the long tibial spur; color somewhat variable, the elytra often paler yellow than the pronotum, rarely red-brown throughout.....*campestris* Blatch.

18(14'). Basal marginal line of pronotum complete; short and broad (width 2 mm); pronotal punctures coarse at lateral one-third, the disc with very minute punctures; tarsal claws elongate (nearly two-thirds the length of last tarsal segment); found in burrows of the pocket gopher (*Geomys* spp.) and at light..... .....*aegrotus* Horn

18'. Basal marginal line of pronotum absent; elongate narrow (width 1.5 mm); at least some of the coarse pronotal punctures encroaching on the disc; tarsal claws normal (about half the length of the last tarsal segment); Florida record doubtful, common in cow dung in N. E. .....*stercorosus* Melsh.

19(5'). Male anterior tibial spur broad and spatulate shaped (Fig. 180); pronotum explanate at sides; a single Florida record..... .....*haldemani* Horn

19'. Anterior tibial spur normal, narrow and pointed (Fig. 179); pronotum normal, not explanate at sides; frequent locally at light ....*laevigatus* Hald.

Aphodius aegrotus Horn

Aphodius aegrotus Horn 1870b:127-128.
Aphodius geomysi Cartwright 1939b:356-357. (NEW SYNONYMY).

DIAGNOSIS: Dorsal surface glabrous, shining, deep red-brown, broad, and short, elliptical in outline. Head without tubercles, lightly punctate with fine punctures. Pronotum extremely finely punctate throughout and with a group of coarse punctures on the lateral one-third, some of which are elongate in shape; lateral margin without fringe of setae; basal marginal line complete. Elytra without any trace of pubescence, finely punctate. Tarsal claws narrow and extremely elongate for the genus.

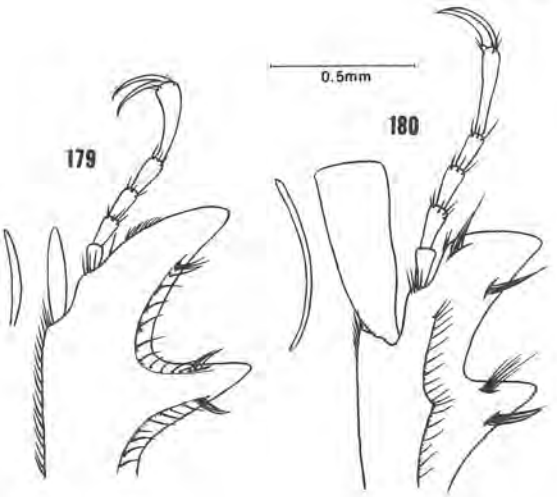
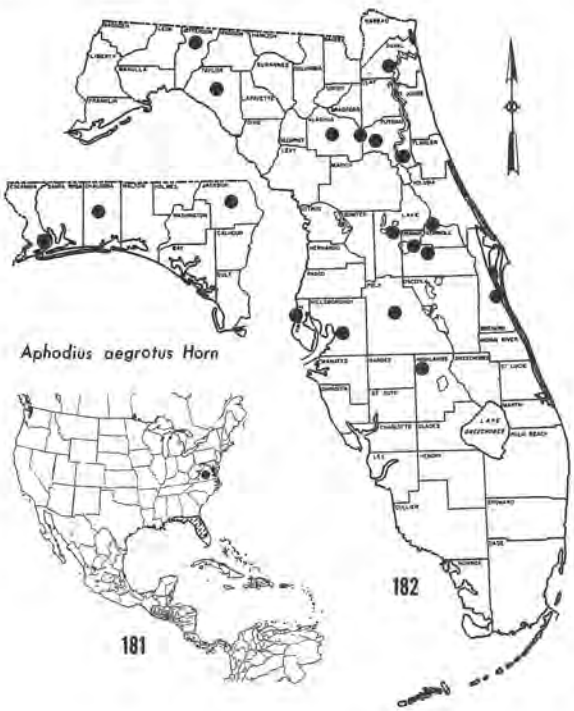


Fig. 179-180. Anterior tibiae and tarsi of **Aphodius** spp. (males): 179) **A. laevigatus** Hald., 180) **A. haldemani** Horn. Note shape of tibial spurs.

Similar in color to *rubeolus* from which it can be separated by the elongate, acute posterior tibial spurs. Of the Florida species, it appears most closely related to *troglodytes* from which it can be separated by the lack of marginal setae on the pronotal sides. Of the U. S. species, it is most closely related to *cavidomus* Brown, known from prairie dog burrows in Oklahoma, from which it can be separated by its larger size, greater convexity, and elliptical shape.

TAXONOMIC NOTES: This species was described by Horn from "North Carolina" and was subsequently reported by him (1887) from Florida. Nothing has been published on the species since Horn's works, and it has long been unrecognized. The type specimen is apparently lost, since it was not found at the Philadelphia Academy of Sciences with the remainder of Horn's collection. I have examined the three specimens labeled as *aegrotus* in the Horn collection, and all are from Florida. They all carry the accession number 5549 of the Horn collection. One of these is *A. troglodytes* Hubbard, and was probably a curatorial misplacement rather than a misidentification by Horn. The other two are presumably the basis of Horn's record for Florida. One bears the "Fla." label and the other ""Marion County" without reference to a state. These specimens are conspecific with paratypes of *A. geomysi* Cartwright (1939b), which is the basis of the above synonymy. It is unfortunate that this latter name requires suppression, since it indicates the relationship with the pocket gopher.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 181-2). It was described from "North Carolina," but no further specimens have been seen from there. It is known



otherwise only from Florida where it is recorded from Pensacola in the western panhandle to northern Highlands County in the south. Its range is probably coextensive with its host (*Geomys pinetis* and related species of the southeast (Fig. 75). Blatchley (1929) had not examined any Florida specimens and merely repeated Horn's records. However, I found two specimens in the Blatchley collection at Purdue University from Dunedin, Florida, but they were erroneously determined as *rubeolus*. The type locality of *geomysi* is Newnan's Lake, Alachua County, Florida. Other localities mentioned in the original description of that species include: Gainesville, Eau Gallie, Lake Streaty, and Marianna. Hubbell and Goff (1939:161) also reported it [as *geomysi*] from Melrose and Welaka. I have seen it from 10 additional localities.

BIOLOGY: As mentioned earlier this species is found in the burrows of the Florida pocket gopher (*Geomys pinetis* ssp.), where it feeds on dung. It is often very common in this habitat, but has never been found in any other kind of dung. It is not uncommon at light, but is never abundant. Practically nothing is known of the habits within the burrows. The tarsal claws are more elongate than in other species, a situation which might provide some freedom from dislodgment when the host creates a disturbance. Specimens have been collected every month except December and January. The immature stages are unknown.

SPECIMENS EXAMINED: 196 from 17 Florida localities, representing 87 collection records (for complete data see Appendix 22).

SELECTED REFERENCES: Blatchley, 1928:24; Cartwright, 1939b:356, 357; Horn, 1870b:127-218; 1887:43; Hubbell and Goff, 1939:161; Schmidt 1922a:333-334.

Aphodius bicolor Say

Aphodius bicolor Say 1823:212.
Aphodius comanchi Robinson 1940:146.

DIAGNOSIS: Distinguished from nearly all other species by the black upper surface and the red to orange ventral surface. Clypeal angles each side of the emargination prominent and reflexed. Head, pronotum, and elytra densely, fairly coarsely punctate. Tips of the elytra with an alutaceous patch, but otherwise glabrous. Pronotal midline often impunctate, shining; basal marginal line complete. Legs orange-red like the venter; first segment of anterior tarsi much shorter than the second; first segment of posterior tarsi longer than the long tibial spur. Rare in Florida and found primarily in the winter (September - April).

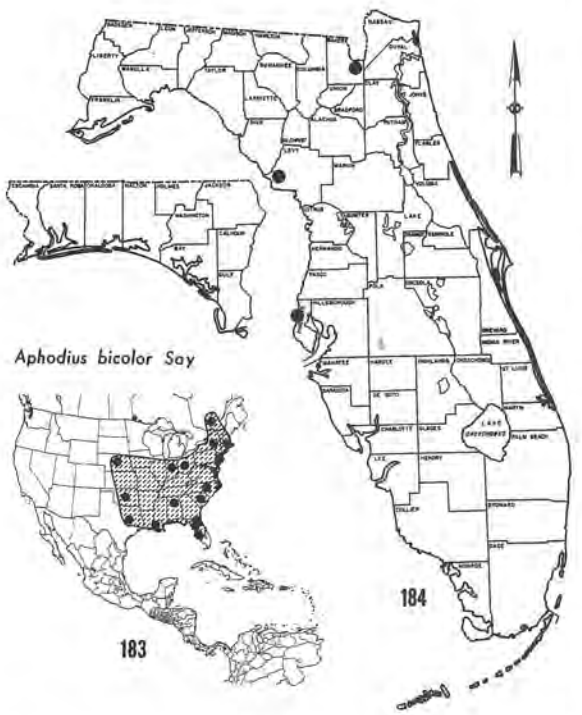
TAXONOMIC NOTES: *A. comanchi* Robinson was described from Texas, but later synonymized by its author (1947:150) as only a larger specimen of *bicolor* Say. The species is variable in length (4.5 to 6.5 mm) and color. Horn (1870b:130) mentioned specimens which had the elytra "dark ferrugineus with the alternate intervals (2-4-6) showing paler rounded spots." I have not seen this color variation, and all the Florida specimens have the elytra entirely black.

There is considerable sexual dimorphism in the anterior tibiae and the posterior femora. In the male the anterior tibial spur arises almost opposite the lower tooth, a position rare within the genus; posterior femur fimbriate on the posterior margin, as well as on the inner margin of the posterior tibia. In the female the anterior tibial spur arises almost opposite the middle tooth, a normal position in the genus; posterior femur has only a few setae on the posterior margin, but is not fimbriate, nor is the inner face of the posterior tibia.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 183-4). It is fairly widely distributed in the U. S. although rarely abundant. It has been recorded from the following states: Alabama (Loding, 1933), Florida (Blatchley, 1919), Illinois (Mohr, 1943), Indiana (Blatchley, 1910). Louisiana (Summers, 1874). Massachusetts (Horn, 1887), Missouri (Say, 1823), Nebraska (Dawson, 1922), New Jersey (Smith, 1910), New York (Leng, 1928), North Carolina (Brimley, 1938), Ohio (Dury, 1902), Oklahoma (Brown, 1928a, South Carolina (Cartwright, 1934b), Texas (Horn, 1870b), and Canada (Wickham, 1894).

In Florida it has been collected only three times, from Dunedin on the west coast to Macclenny in the northeast (see section on specimens examined for complete data).

BIOLOGY: Very little has been published on this species. It is primarily a winter species (September-



April), but is rarely abundant. It has been found on a wide variety of soil types and appears to be more common in wooded situations. Mohr (1943) reported taking 123 specimens in Illinois from a single pile of cow dung which was deposited either the night before or early that morning. I collected nearly 100 specimens in Ohio in a pastured woodlot in September.

The single Florida specimen that I have collected was taken in a malt trap set in a farm woodlot, heavily grazed by cattle and with no undergrowth. Several hours of collecting at this locality in cow dung, of various ages, failed to produce additional specimens. The other Florida specimen, on which the habitat was recorded, was in a wooded area in the dung of a wild animal, possibly a wild pig. The immature stages are unknown.

SPECIMENS EXAMINED: Approximately 115, only 3 of which are from Florida as follows: (1) Baker Co., Macclenny, 9-XII-60, R. E. Woodruff and E. W. Holder, Jr., malt bait trap; (1) Levy Co., 10 mi. N. of Cedar Key, 7-I-67, A. L. O'Berry, pig (?) dung; (1) Pinellas Co., Dunedin, 18-III-18, W. S. Blatchley [PU].

SELECTED REFERENCES: Blatchley, 1910:933; 1919:31; 1928:24; Dillon and Dillon, 1961:520, Pl. 50, Fig. 8; Horn, 1870b:130; 1887:46; Mohr, 1943: 292; Robinson, 1947a:150.

Aphodius campestris Blatchley

Aphodius campestris Blatchley 1912:330.

Aphodius compestris Blatch., Loding 1945:99 (misspelling).

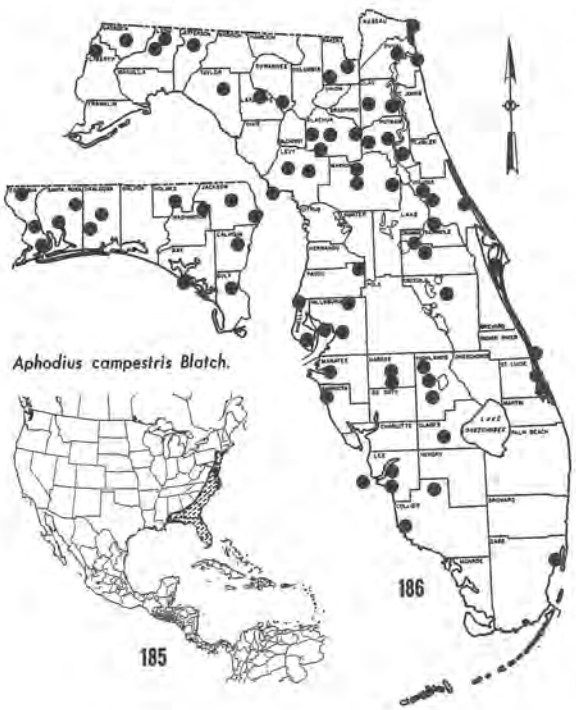
Aphodius stercorosus Melsh., Frost 1964:142 (?misidentification).

DIAGNOSIS: Small (length 2.5-4 mm), pale yellow to yellow-brown, rarely red-brown, the pronotum often darker than the elytra. Similar to *rubeolus*, from which it is easly separated by the longer more narrow posterior tibial spurs; first posterior tarsal segment as long as the next three. In *rubeolus* the posterior tibial spurs are short, broad, and spatulate; first posterior tarsal segment distinctly shorter than the next three. Also similar to *stercorosus*, which has not definitely been recorded from Florida, but in that species the basal marginal line of the pronotum is absent. There is usually a patch of pubescence on the posterior one-third of the elytra of *campestris*

TAXONOMIC NOTES: Although this species is fairly distinctive, it has been confused with *stercorosus* in collections, and it was probably the basis for the Florida record of that species by Frost (1964). Variation exists primarly in size and color. The smaller specimens (2.5-3 mm) are often much lighter colored than the larger ones (4 mm). It is only these larger ones which are reddish-brown and most similar in color to *rubeolus*. Although not placed in a subgenus by Schmidt (1922a), it would fall in his *Koshantschikovius*. Brown (1927b) placed it in Horn's group "I-B" along with *rubeolus*, *stercorosus*, *lentus*, *tenuistriatus*, *troglodytes*, *cynomysi*, and *cavidomus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 185-6). It was described originally from near Sarasota, Florida, and subsequently recorded from the following states: Alabama (Loding, 1945), Georgia (Miller, 1954), New Jersey (Sim, 1930), North Carolina (Brimley, 1938), and South Carolina (Cartwright, 1934b). It probably occurs more widely in the eastern U. S., especially in the Gulf states and in sandy areas of the east coast. In Florida it has been found in nearly all areas of the state and probably occurs throughout. It has not yet been collected in southern Dade or Monroe Counties or in the Keys. It is interesting that Blatchley (1928) recorded it only from three locations: Sarasota, Dunedin, and LaGrange. Since it is presently common throughout the year in cow dung and at light, it is difficult to explain the paucity of early records, unless it has greatly increased in abundance during the past 40 years.

BIOLOGY: Although this is one of the most common dung beetles in Florida, very little information is available on its habits. It is common in cow dung and also has been found on deer, horse, and human dung. It is one of the most comonly collected *Aphodius* in light traps in Florida. I have collected large numbers in malt bait traps, especially those to which a few drops of proprionic acid have been added. A few specimens were taken in rotting fungi, and some were collected in a Berlese funnel sample of sand pine litter. Miller



(1954) collected specimens in traps baited with human dung only between 5 P.M. and 10 A.M. None were taken in traps between 8 A.M. and 7 P.M. Although adults are not rare in cow dung during the daytime, these data, along with the abundance at light, suggest a nocturnal flight period. It appears to be more abundant in very sandy soil conditions and was found in the Pine Barrens of New Jersey under these conditions. Adults have been collected every month of the year in Florida. The immature stages are unknown.

SPECIMENS EXAMINED: Over 1,600 Florida specimens from 80 localities, representing 384 collection records (for complete data see Appendix 23), including the type (Blatchley Collection, Purdue University).

SELECTED REFERENCES: Blatchley, 1914:91; 1928:23; Brown, 1927b:163-165; Miller, 1954:380, Table 1; Sim, 1930:140, 142.

Aphodius crassulus Horn

Aphodius crassulus Horn 1870b:118.

DIAGNOSIS: The only Florida *Aphodius* with two distinct teeth on the clypeus. Black, shining, extremely convex, compact, length 3.6 to 6 mm. Scutellum small; posterior tibiae fringed with equal spinules; anterior tibial face smooth, impunctate; first segment of anterior tarsi shorter than second; head trituberculate. Clypeus with a few granules and punctate-rugose near the margin. In general appearance it is similar to *floridanus* Robinson, from which it can be distinguished by the bidentate clypeus, the more prominent and acute genal angles, dark black color, and the much more convex elytral intervals on the apical one-third.

TAXONOMIC NOTES: This species was placed by Horn (1887) in his group "B" although he admitted that this group was ". . . not very homogenous." Cartwright recently (1957) studied the group of species closely related to *crassulus*, including the following: *bottimeri* Cartwr., *odocoilis* Rob., *brimleyi* Cartwr., *spiniclypeus* Hinton, *windsori* Cartwr., *lodingi* Cartwr., *abusus* Fall, *crassuloides* Fall, and *pseudabusus* Cartwr. It was placed in the subgenus *Mendidius* by Schmidt (1922a).

A. crassulus is particularly variable in size (length 3.6 to 6 mm, although no Florida specimens have been seen over 5 mm long). Sexual dimorphism is most noticeable in the anterior tibial teeth and spur. In the male the third or basal tooth is about normal in size, but in the female it is reduced, making the middle tooth appear much more elongate. The anterior tibial spur is stouter and more curved in the male. The clypeal teeth are much more prominent and reflexed in the female.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 187-8). It was recorded by Horn (1870b) from Georgia and Florida, and in 1887 he listed it from "Florida to Texas." It is also recorded from North Carolina (Brimley, 1938), South Carolina, Virginia, and Georgia (Cartwright, 1957). Records from Ohio (Dury, 1902), New Jersey (Sim, 1930), and New Mexico (Fall and Cockerell, 1907) probably refer to other species.

Schwarz (1878) did not encounter the species, but included the Florida record of Horn. Blatchley (1928) recorded a single specimen from Lake City, although he did not collect the species. Cartwright (1957) had not seen Florida specimens. I have seen specimens from nine Florida localities, all of which are in the northern portion of the state. The southernmost record is Pasco County, and I have not seen specimens from west of Tall Timbers Res. Sta. (Leon Co). It probably has a wider range in the state, but is rarely collected due to its secretive habits in wooded areas during the winter.

BIOLOGY: Cartwright (1957) recorded it only from deer droppings in shady woods. I have not taken it in deer droppings, but it is not uncommon in cow or horse dung. However, it has been taken in these droppings only in shaded areas. My largest series (39) was collected on Jan. 17, 1959, in horse dung deposited on deep leaf mold under a large live oak tree at the margin of a hammock. The dung appeared to be several days old, and all specimens, often in pairs, were concealed inside the droppings. Ten specimens were found in a single dropping about three inches in diameter. Specimens were active even though the low temperature for the previous night was 20° F., and the high for the day was 38° F. at 3 P.M. My records indicate that it is primarily a winter species (October-March).

It has been found associated with a closely related species, *lodingi* Cartwr. in South Carolina, but I have found it only with *fimetarius* (L.) and *cuniculus* Chev. The immature stages are unknown.

SPECIMENS EXAMINED: 103, of which 101 were from 8 Florida localities (for complete data see Appendix 24).

SELECTED REFERENCES: Blatchley, 1928:14; Cartwright, 1957:58; Horn, 1887:10-11.

Aphodius cuniculus Chevrolat

Aphodius cuniculus Chevrolat 1864:411-412.

Aphodius vestiarius Horn 1870b:121-122.

Aphodius granarius guadeloupensis Fleutiaux and Salle 1889:46.

DIAGNOSIS: Small (length 3-3.5 mm), black to dark red-brown, shining, front trituberculate, the middle tubercle often raised and nearly pointed; basal marginal line of pronotum absent; first anterior tarsal segment shorter than the second; elytra parallel on outer margin, striae indistinctly punctured, intervals convex with few minute punctures.

It is one of three Florida *Aphodius* which lack the basal marginal line of the pronotum; the others being *lividus* and *stercorosus*. It is easily distinguished from both by its smaller size, and black to red-brown color, rather than pale yellow with smoky markings.

TAXONOMIC NOTES: *Aphodius vestiarius* Horn, the type of locality of which was St. Augustine, Florida, was synonymized by Cartwright (1949a:37). *A. cuniculus* Chevr. was described from Cuba. Paulian (1947:37) synonymized A. *granarius* var. *guadeloupensis* Fleutiaux and Salle under *cuniculus*. He also placed this species in the genus *Nialus* which was treated as a subgenus by Schmidt (1922a). Althugh Schmidt placed *cuniculus* in the subgenus *Nialus*, he placed *vestiarius* (which was subsequently synonymized under *cuniculus*) in his subgenus *Oromus*. I prefer to retain the species as an *Aphodius*, and I have abstained from assigning subgenera in this paper.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 189-90). It is widely distributed throughout the Gulf Coast and Caribbean, including most of the Lesser Antilles and as far south as Nicaragua in Central America. Chapin (1940) recorded it in the West Indies from the following islands: Cuba, Jamaica, Hispaniola, Puerto Rico, Bieques, St. Thomas, St. John, St. Croix, St. Kitts, Antigua, Montserrat, Guadeloupe, Dominica, Martinique, St. Lucia, Barbados, St. Vincent, Carriacou, Grenada, and Tobago. Bates (1887) reported it from Mexico, Guatemala, and Nicaragua. Cartwright (1949a) reported the follow records for the U. S.: Alabama: Escambia Co.; Florida: Capron, Centreville, Haw Creek, Indian River, Lake Harney, Lake Worth, Miami, Pensacola, Sarasota; Georgia: Lyons, Okefenokee Swamp, Savannah; South Carolina: Beaufort, Seabrook Island, Tillman, Yemassee; Texas: Brownsville, Devil's River, Galveston, Harrisburg, Macdona, and Victoria. Blatch-

ley (1928) listed the following Florida localities: Chokoloskee, Dunedin, Enterprise, Ft. Myers, Haw Creek, LaBelle, Lake Worth, Pablo Beach, Royal Palm Park, Sanford, St. Augustine, and St. Petersburg.

My Florida records are nearly all from the peninsula. I have not seen any specimens from Jay, Monticello, Pensacola, or Quincy, panhandle localities where light traps have been operated over extended periods. Although its general range would include thise area, and Cartwright (1949a) reported it from Pensacola, it is much less common there than in the peninsula.

BIOLOGY: This species is common in cow dung throughout the year and often attracted to lights in enormous numbers. Paulian (1947) also reported it from decaying vegetables and fruits. I have not found it in rotting fungi. The immature stages are unknown.

SPECIMENS EXAMINED: Over 1,000, of which 938 were from 43 Florida localities, representing 105 collection records (for complete data see Appendix 25).

SELECTED REFERENCES: Bates, 1887:85; Blatchley, 1928:22; Cartwright, 1949a:37; Chapin, 1940:7; Horn, 1870b:121-122; 1887:18-19; Paulian 1947:37-38, Fig. 35.

Aphodius fimetarius (Linnaeus)

(Fig. 178)

Scarabaeus fimetarius Linnaeus 1758:348.
Scarabaeus pedellus DeGeer 1774:266.
Scarabaeus bicolor Fourcroy 1785:9.
Aphodius nodifrons Randall 1838:20.
Aphodius fimetarius (L.), Erichson 1848:805.

The following names, applied to "varieties," are probably also synonyms:

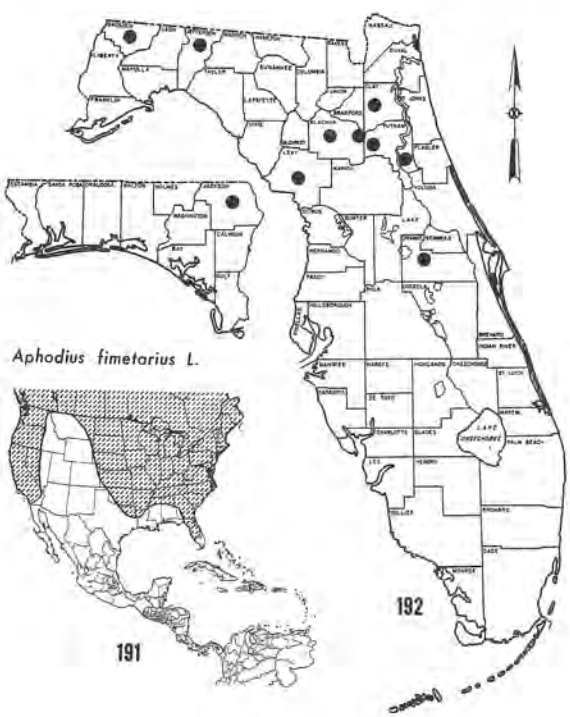
Scarabaeus foetens Fabricius 1787:8.
Scarabaeus autumnalis Naezen 1792:167.
Aphodius orophilus Charpentier 1825:210.
Aphodius fimetarius var. *monticola* Heer 1841:513.
Aphodius fimetarius var. *imperfectus* Mulsant 1842:187.
Aphodius fimetarius var. *maculipennis* Mulsant 1842: 187.
Aphodius fimetarius var. *punctulatus* Mulsant 1842:187.
Aphodius fimetarius var. *subluteus* Mulsant 1842:187. 338.
Aphodius fimetarius var. *cinnamomeus* Harold 1863: 338.
Aphodius fimetarius var. *cardinalis* Reitter 1892:186.
Aphodius fimetarius var. *bicolorellus* Schmidt 1922: 273.

DIAGNOSIS: Head trituberculate, the tubercles more prominent in the male. Pronotum very convex, the punctures irregularly spaced; in the male there is a central depression anteriorly. Transverse carinae of middle and posterior tibia extremely well developed, the area at each carina expanded, and immediately constricted below each (Fig. 180).

It is the only Florida species with red elytra and black pronotum with red anterior angles. It is one of the two large (length 6.5-8.5 mm) species in Florida; the other being *laevigatus* Hald., which is a uniform brown color, never bicolored red and black.

TAXONOMIC NOTES: As could be guessed from the above synonymy, this species is quite varible, especially in color. Nearly all of the varieties listed above are based solely on color differences, and I doubt their validity. In the U. S. we apparently have only the typical color form.

It was placed in the nominate subgenus by Schmidt (1922), near *A. aestivalis* Stephens. He recognized as valid the following nine color varieties: *fimetarius, autumnalis, foetens, monticola, punctulatus, subluteus, hypopygialis, bicolorellus,* and *cardinalis.*



DISTRIBUTION & ZOOGEOGRAPHY: (Fig 191-2). It is widespread in the Holarctic Region and recorded by Schmidt (1922a) from Europe, Kashmir, Asia, north coast of Africa, North America, and Canada. It was apparently introduced into the U. S. very early and soon became widespread and common. Randall (1838, under the name *nodifrons*) stated that it was ". . . extremely abundant throughout all Maine." Horn (1887) predicted that, "It will probably invade every portion of our territory." Brown (1940) reviewed its history in North America and concluded that it is ". . . generally distributed in southern Canada from Nova Scotia to British Columbia and occurs commonly over the major portion of the United States." Although it is abundant in California and Oregon, it appears to be

absent through most of the Rocky Mountain States and the southwest.

In Florida it has been found only as far south as Orlando and as far west as Jackson County. The lack of records from the western panhandle probably reflects the paucity of collecting there. However, Loding (1945) reported it only from Etowah Co., in the northern third of Alabama. It is interesting that Blatchley (1928) did not record it from Florida.

BIOLOGY: This is a common species in cow and horse dung, but it is not attracted to light. Thomas (1939) reported that it was occasionally found in mushroom caves in the U. S., but was not a pest here. However, he stated that it was a well known mushroom pest in France, feeding on both mycelium and mushrooms. I have not found it in wild fungi during numerous collecions in such habitats.

In the U. S., as well as in Germany, it is found throughout the year, and I have taken specimens encrusted with ice crystals during December in Ohio. Landin (1961:216) reported that in Sweden there were two generations per year in the southern and central parts of the country, and that there they always hibernated as adults. In Florida my records are from November through April. It is possible that there is only one generation per year here, and that the adults are not active during the hotter parts of the year.

The larva has been described and figured by Jerath (1960b). It is characterized as follows: raster without palidia; stridulatory teeth present on maxillary palpifer; laeotorma of the epipharynx not produced caudad; palpifer with three or fewer stridulatory teeth; raster with less than 91 tegillar setae; stridulatory area of stipes with 14-18 teeth; galea dorsally with seven setae; first and second antennal segments subequal, third short.

SPECIMENS EXAMINED: Several hundred, of which 114 were from 11 Florida localities, representing 16 collection records (for complete data see Appendix 26).

SELECTED REFERENCES: Blatchley, 1910:930; Brown, 1940:73; Dillon and Dillon, 1961:517, Pl. 50, Fig. 4; Jerath, 1959:170-172; 1960b:56-57, Fig. 5, 14, 23, 42, 43, 52, 76, 82 (larva); Landin, 1961:215-216; Mohr, 1930:263-284; 1943:294-295; Schmidt, 1922a: 272-273.

Aphodius floridanus Robinson

Aphodius floridanus Robinson 1947b:169-170.

DIAGNOSIS: Convex, shining, dark red-brown to black; head trituberculate; the middle tubercle often transversely elongate, not pointed; scutellum convex, not surrounded by a depression; pronotal punctures of two distinct sizes, especially on the disc; elytral intervals convex. Most closely related to *rusicola* Melsh., from which it can usually be separated by the convex rather than flattened elytral intervals and the disparity between puncture sizes of the pronotum. Members of the *rusicola* complex are difficult to determine, especially without comparative material. All Florida specimens have been referred to the name *floridanus*, and typical *rusicola* has not been found yet in the state.

TAXONOMIC NOTES: The difficult *rusicola* complex of species is in need of a thorough study. Although the Florida population appears to be a distinct species, it is quite variable, especially in the convexity of the elytral intervals and the punctation of the pronotum. Large series of specimens from the entire geographic range of the complex will be required to evaluate the variation. These specimens are especially lacking from the southeastern coastal plain.

I was able to compare the Florida population with a good series only from Ohio. In general Florida specimens are nearly uniform black rather than red-brown; size is much more uniform (about 5 mm); the elytral intervals are generally more convex; pronotal punctures are more unevenly spaced, with fewer coarse punctures; and most of the specimens have been collected in the winter and early spring (January - April) rather than in the fall (August - September).

Horn (1887) placed *rusicola* in his group "B," along with nine other species, of which *fimetarius* (L.) and *crassulus* Horn are found in Florida. These species are not closely related. Schmidt (1922a) placed *rusicola* in his subgenus *Agrilinus*, to which *floridanus* could be added.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 193-4). The type locality is 5 miles west of Daytona, Florida.

Blatchley (1928, under *ruricola*) reported it from Fort Capron, Lake Worth, and Jacksonville, although he had not collected it personally. It has not been reported in the literature since the original description.

It probably occurs sparingly throughout Florida; my marginal records are from Immokalee and Miami in the south to Jay (Santa Rosa Co.) in the western panhandle. Cartwright (in litt.) reported specimens in the U. S. National Museum from the type locality, Highlands Hammock State Park, and Fort Myers.

BIOLOGY: Although specimens have been collected from most areas of the state, it does not appear to be common anywhere. I have taken it in cow dung and deer droppings, but most of the records are from blacklight trap collections.

Most of the specimens have been collected between January and May. If this is not an artifact of collecting, it is a further difference from the northeastern populations of *rusicola*, which occur primarily in the fall. The immature stages are unknown.

SPECIMENS EXAMINED: 110 from 23 Florida localities, representing 37 collection records (for complete data see Appendix 27).

Aphodius granarius (Linnaeus)

Scarabaeus granarius Linnaeus 1767:547.
Scarabaeus quadrituberculatus Fabricius 1798:75.
Aphodius niger Creutzer 1799:20.
Aphodius carbonarius Sturm 1805:128.
Aphodius ater Thunberg 1818:400.
Aphodius haemorrhous Stephens 1830:196.
Aphodius lucens Stephens 1830:196.
Aphodius emarginatus Stephens 1830:196.
Aphodius melanopus Stephens 1830:198.
Aphodius elongatus Menetries 1832:182.
Aphodius retusus Waltl 1835:67.
Aphodius aterrimus Melsheimer 1845:136.
Aphodius adelaidae Hope 1846:146.
Aphodius metallicus Haldeman 1848a:105.
Aphodius spretus Haldeman 1848a:106.
Aphodius perezi Harold 1870c:113.
Aphodius inutilis Horn 1887:50.
Aphodius nama Kolbe 1908:126.
The following "varieties" were recognized as valid by Schmidt (1922a):
suturalis Falderman 1835:259.
parcepunctatus Mulsant 1842:199.
cribratus Mulsant 1842:199.
rugosulus Mulsant 1842:199.
concolor Mulsant 1842:199.
brunnescens Reitter 1892:189.
ragusanus Reitter 1892:718.
signatus Schmidt 1922:322.

One other "variety," *guadeloupensis* Fleutiaux and Salle (1889:396), has been synonymized under *cuniculus* Chevr. by Paulian (1947:37).

DIAGNOSIS: Medium sized (length 3-5 mm), black to dark brown, shining, subparellel, head trituberculate; pronotal punctures irregularly spaced and widely scattered; elytral intervals flattened, minutely punctate; first segment of anterior tarsi shorter than the second; basal marginal line of pronotum fine but entire; abdominal segments rugulose, and more closely punctate at the sides; first segment of posterior tarsi shorter than the long tibial spur; scutellum surrounded by a depression. Most similar in general appearance to *floridanus* from which it can be separated by the first posterior tarsal segment being shorter than the long tibial spur.

TAXONOMIC NOTES: Since this species has been spread around the world, apparently by commerce, it is not surprising that it has been described a great many times, and the above synonymy has resulted. It is also highly variable, especially in Europe, which has resulted in some synonymy and the recognition of several "varieties." Whether any of these actually represent subspecies will only be determined after a thorough study. Variation in U. S. specimens is most noticeable in size and extent of pronotal punctation (also different between the sexes). Horn (1887) placed it in his group "C" along with *vittatus* Say and *gutiatus* Esch. Schmidt (1922a) placed it in the subgenus *Calamosternus* with eight other species.

DISTRIBUTION & ZOOGEOGRAPHY: It is one of the most cosmopolitan species, having been taken in nearly every part of the globe. Horn (1887:16) stated that it was originally an inhabitant of Europe but had been spread by commercial intercourse throughout the world, and in the U.S. it had appeared in every locality from which he had received *Aphodius*. I have seen specimens from California, Georgia, Illinois, Indiana, Missouri, Ohio, Oregon, Pennsylvania, Texas, Utah, Washington, British Columbia, and Canada. In addition, it has been reported in the literature from Alabama, Connecticut, District of Columbia, Louisiana, Michigan, Nebraska, New Jersey, New Mexico, North Carolina, Oklahoma, and South Carolina. In Florida, it has been found only in Jackson County, although it is probably more widely distributed in the panhandle. It appears that it has not yet invaded the Florida peninsula.

BIOLOGY: This is one of the most common species in cow dung in the northeastern U. S. Landin (1961: 219) stated that in Sweden it was "Highly polyphagous, feeding on all kinds of dung, debris, decaying vegetables, compost, carrion, etc."

The larva has been described by Jerath (1960b) and is characterized as follows: raster with palidia; dexiotorma produced caudad; lacinia with a row of six setae along the mesal edge and a short seta posteriorly; second and third antennal segments subequal, first long; laetorma produced caudad; abdominal segments 6-8 dorsally with three transverse rows of setae; galea ventrally with a row of six or seven short setae. It can be distinguished from all other known Florida

Aphodius larvae by the presence of palidia on the raster.

In New Jersey, Wilson found only a single generation per year, with the adults overwintering. Alicata (1935) reported this beetle as an intermediate host for a nematode parasite of swine, *Ascarops strongylina* (Rudolphi). The beetles apparently ingest the eggs from dung, the nematode hatches rapidly and becomes encysted in the abdominal cavity of the beetle, frequently interlaced superficially by some tracheal tubes.

SPECIMENS EXAMINED: Over 1,000, of which 45 were from Jackson Co., Fla., 18-III-58, H. V. Weems, Jr., in cow dung; this being the only Florida record.

SELECTED REFERENCES: Blatchley, 1910:931, Fig. 366; Dillon and Dillon, 1961:520, Pl. 50, Fig. 6; Horn, 1870b:120; 1887:107; Jerath, 1960b:53, Fig. 12, 23 (larva); Mohr, 1943:292; Schmidt, 1922a:320-322; Wilson, 1932:81-83.

Aphodius haemorrhoidalis (Linnaeus)

Scarabaeus haemorrhoidalis Linnaeus 1758:348.
Aphodius triplagiatus Harold 1862:163.

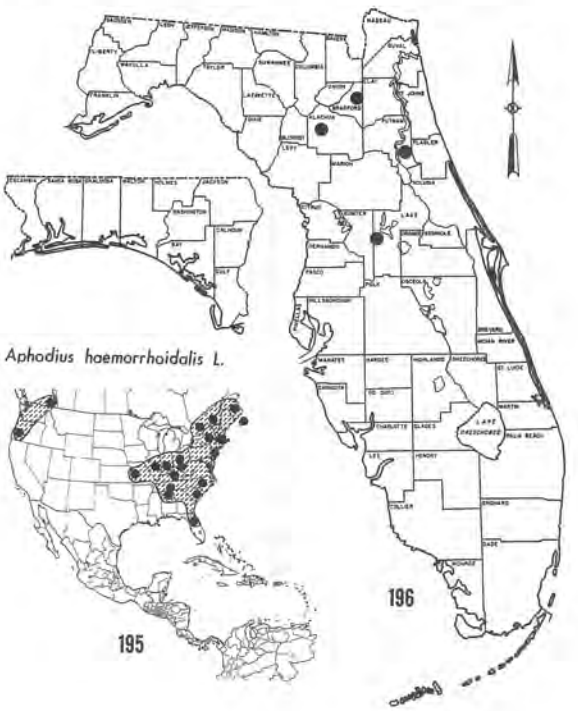
The following "varieties" were recognized by Schmidt (1922a), but probably represent only color variation and should be listed as synonyms:

Aphodius haemorrhoidalis sanguinolentus (Herbst) 1783:6.
Aphodius haemorrhoidalis humeralis (Mulsant) 1842: 174.
Aphodius haemorrhoidalis crudus Schmidt 1922a:30.

DIAGNOSIS: The only Florida species with the apical one-third of the elytra red and the remainder black (occasionally with the humeri also red). Scutellum elongate, nearly twice as long as wide, densely punctate, except for the tip. Elytra short, convex, shining, the striae broad. Pronotal punctures of two sizes, the larger ones very coarse, the basal marginal line complete. First anterior tarsal segment reduced, the second about three times longer. Clypeus rounded, barely emarginate at middle, the genal angles prominent but rounded; head trituberculate, the eyes transverse. Medium sized (length 4-5 mm).

TAXONOMIC NOTES: Variation is most noticeable in the color pattern of the elytra. The most common pattern is with only the apical one-third reddish (typical *haemorrhoidalis*), although it is not uncommon with the elytral apices and the humeri also red (var. *sanguinolentus*). A variety with only the humeri red (var. *humeralis*) is found in Europe, but has not been reported in the U. S.

Schmidt (1922a:26) placed it in the subgenus *Teuchestes* with four other species. Landin (1961:210) considered it in the genus *Colobopterus*. As indicated under the generic discussion, I prefer to retain our species in *Aphodius* until a world revision is accomplished.



DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 195-6). This is another European species which has been introduced into North America. The first U. S. record was made by Schaeffer (1915:50-51), who reported it from Secaucus and Hackensack, New Jersey. Brown (1940:73) recorded it from Nova Scotia, New Brunswick, southern Quebec, and in the Ottawa (Ontario) district. He also reported it (1967:89) from Creston, British Columbia. It is also reported in the literature from North Carolina (Brimley, 1938:200), South Carolina (Cartwright, 1934b:238), New York (Leng. 1928: 419), Kentucky and Massachusetts (Jerath, 1960b:65), and Illinois (Mohr, 1943:295). I have also seen specimens from Alabama, Indiana, Missouri, Ohio, Oregon, and Tennessee.

It has not been reported previously from Florida, and during nine years of collecting I did not encounter it until 1967. Since the four Florida collections represent only five specimens and it was not found previously, it appears that it has only recently expanded its range this far south.

BIOLOGY: This is a common species in nearly all kinds of dung. Landin (1961:210) found that in Sweden they normally hibernated as third instar larvae, but occasionally as an adult, and adults regularly occurred from June to August. In Illinois, Mohr (1943: 295) found adults only from April to June. He re-

ported 85 larvae from a single pile of cow dung in May, and the adults emerged on June 12. He also noted that adults were found in small numbers (no more than seven per dung cake) in dung more than one day old.

The Florida specimens which I collected were in cow dung at least two days old. The specimen from near Welaka, Florida, was taken in an open pasture with two large live oak trees, under the shade of which the specimen was found in company with *Coppris minutus* (Drury), *C. inemarginatus* Blatchley, and *Aphodius fimetarius* (L.). The soil was very sandy and bare of vegetation under the trees. The other Florida specimen was taken on the sandy bank of the Palatlakaha Creek in the shade of a tree.

The larva has been described and figured by Jerath (1960b) and is characterized as follows: raster without palidia; maxilla without stridulatory teeth on palpifer; lacinia dorsally with a row of five long setae along the mesal edge and a short seta posteriorly; galea ventrally with a row of 8-10 short setae; raster with teges of 51-81 short setae; abdominal segments six to eight each with three transverse rows of setae; width of head capsule 1.22-1.45 mm.

SPECIMENS EXAMINED: Over 300, of which only 5 were from Florida as follows: (2) Alachua Co., 5 mi. S. Newberry, 13-VII-68, S. K. Derr, cow dung; (1) Bradford Co., 12 mi. N. Starke, 1-X-68, R. E. Woodruff, cow dung; (1) Lake Co., 5 mi. S. of Leesburg, Palatlakaha Creek on Rt. 27, 24-IV-67, R. E. Woodruff, in cow dung; (1) Putnam Co., 3 mi. N. of Welaka, 20-III-67, R. E. Woodruff & J. E. Loyd, in cow dung.

SELECTED REFERENCES: Brown, 1940: 73; Jerath, 1960b:65-66, Fig. 55 (larva); Landin, 1961:210; Mohr, 1943:295; Schmidt, 1922a:29-30.

Aphodius haldemani Horn

(Fig. 180)

Aphodius politus Horn 1870:128, not *politus* Mulsant 1870:204.

Aphodius haldemani Horn 1877:33-34, new name for *politus* Horn 1870:128, preoccupied by *politus* Mulsant 1870:204.

Aphodius (*Platyderus*) *haldemani* Horn, Schmidt 1913:123.

Aphodius (*Platyderides*) *haldemani* Horn, Schmidt 1922a:48.

(Robinson, 1948a:116, appeared to cite his *magnificens* in synonymy, but his text clearly indicated that this was not his intention.)

DIAGNOSIS: Of the Florida species it is similar in general appearance and color only to *laevigatus* Hald. (=*goffi* Cartwr.). Males of the two species are easily distinguished on the basis of the anterior tibial spur which is broad, truncate, and spatulate shaped in *haldemani* (Fig. 180), while it is narrow and acutely pointed in *laevigatus* (Fig. 179). In addition it is larger (8mm) than any other Florida species.

Horn (1887) placed it in his group I-a and characterized it as follows: pronotal sides explanate; clypeus rounded (not denticulate); mesosternum not carinate between coxae; surface polished, sculpture very feeble; elytral striae fine and finely punctate, the intervals flat and smooth.

TAXONOMIC NOTES: Horn (1887) proposed the name *haldemani* to replace his *politus*, a name preoccupied slightly earlier in the same year (1870) by Mulsant. Robinson's (1948a:116) citation of his *magnificens* in synonymy appear to be due to the way the typesetter handled it. In the discussion he later gave characters to distinguish *haldemani* from *magnificens*. It is possible that the single Florida specimen, here referred to *haldemani*, is actually a new species. Many of the species in this group are known from few specimens and are associated with burrowing rodents.

DISTRIBUTION & ZOOGEOGRAPHY: Horn (1887) listed only Texas and Kansas. Brown (1928d:39) listed Payne Co., Oklahoma and Douglas Co., Kansas. Robinson (1948a:116) specifically listed College Station, Texas. Since the Florida record is such a distance from the known distribution, this suggests further that it may represent another, possibly undescribed, species. Since *haldemani* is known from burrows of the pocket gopher, *Geomys breviceps*, it is likely that their distributions may coincide. See Fig. 75 for distribution of the Florida species and subspecies of pocket gophers.

BIOLOGY: Many of the species in the subgenus *Platyderides* are known to be associated with burrowing rodents of the genera *Geomys* and *Thomomys*. Robinson (1948d:119) recorded *haldemani* from burrows of *Geomys breviceps* in Texas. The single Florida specimen was taken in a malt bait trap recessed in the ground in a turkey-oak, long-leaf pine hammock. The area contains many burrows of the gopher tortoise and pocket gophers. The sand hill is also inhabited by the burrowing beetle, *Peltotrupes profundus*. Blacklight traps operated nightly for five years, within 100 yards of the collection site, have produced many *Aphodius laevigatus* but not a single additional specimen of *haldemani*.

SPECIMENS EXAMINED: Three, only one of which was from Florida as follows: (1) Alachua Co., Gainesville, Doyle Conner Building, 9-I-69, R. E. Woodruff and D. L. Mays, malt bait trap.

SELECTED REFERENCES: Brown, 1928d:39; all other pertinent references are cited in the synonymy above.

Aphodius laevigatus Haldemann

(Fig. 179)

Aphodius laevigatus Haldeman 1848:103.

Aphodius concavus Say, Blatchley 1928:23-24 (misidentification).

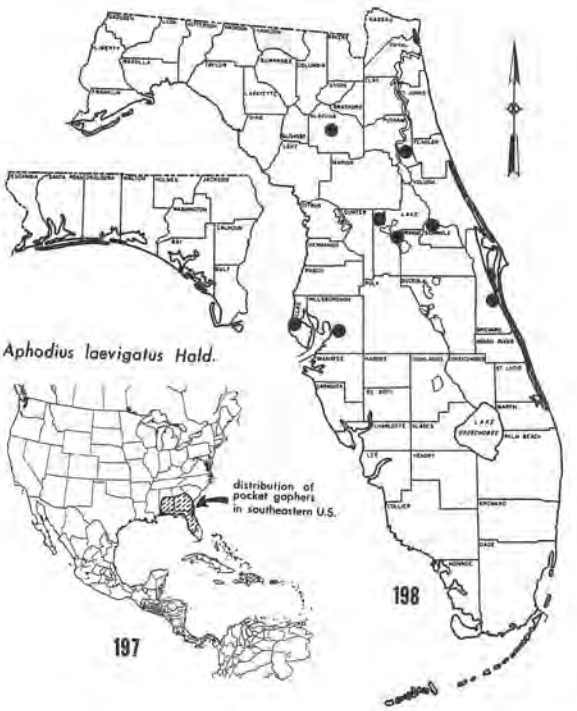
Aphodius goffi Cartwright 1939b:354.

DIAGNOSIS: One of the three largest *Aphodius* in Florida (length 6.5-8 mm). From *fimetarius* (L.) it can be distinguished easily by the uniform dark brown color rather than the bicolored red elytra and black pronotum. It differs further by having the head transversely carinate, but never tuberculate. From *haldemani* it can be distinguished by the shape of the male anterior tibial spur (Fig. 179-80). Most of the dorsal surface of head, pronotum, and elytra nearly impunctate, the few punctures very minute except for a few medium sized ones near the anterior pronotal angles. Basal marginal line of pronotum complete. Clypeus broadly emarginate in the middle, the angles prominent and sometimes toothlike, but not pointed and reflexed as in *crassulus*. First segment of posterior tarsus slightly shorter than the long tibial spur. Spurs of middle and posterior tibiae flattened and somewhat concave on the innerside, the shorter one slightly twisted.

TAXONOMIC NOTES: The name *laevigatus* Hald. had been listed as a synonym of *concavus* Say in most of the literature until 1951, when Cartwright discovered the type specimen and subsequently synonymized his *goffi*. Blatchley (1914:91; 1928:23-24) reported it from Florida as *concavus*. He also listed *hamatus* Say on the basis of a manuscript by Leng which indicated that the manuscript record by Schwarz of *concavus* from Crescent City, Florida, should be *hamatus*. The latter is a far northern species from Oregon to Michigan, and it has not been recorded south of these areas. It is readily distinguished from *concavus* or *laevigatus* and is certainly not found in Florida.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 197-8). The range of this species is probably coextensive with the pocket gopher (*Geomys pinetis* Rafinesque and subspecies, and possibly *G. colonus* Bangs, *G. fontanelus* Sherman, and *G. cumberlandis* Bangs). It has presently been found only in Florida, overlapping the distribution of three subspecies of *Geomys pinetis* (*austrinus* Bangs, *floridanus* (Audubon and Bachman), and *goffi* Sherman). The distribution map of the pocket gophers (Fig. 75) is based on unpublished data kindly furnished by C. H. Handley and E. V. Komarek.

BIOLOGY: It is apparently restricted to the burrows of pocket gophers, and it is frequently taken at light. It has never been found in any other habitat although it is sometimes common in the burrows. It is a dung feeding species, but otherwise nothing is known of its habits or behavior. The immature stages are unknown.



SPECIMENS EXAMINED: 140 from 10 Florida localities, representing 55 collection records (for complete data see Appendix 28).

SELECTED REFERENCES: Blatchley, 1914:91; 1928: 14, 23; Cartwright, 1939b:354; 1951:29; Hubbell and Goff, 1939:160.

Aphodius lentus Horn

Aphodius lentus Horn 1870b:125.

DIAGNOSIS: Small (length 3.5-4 mm), elongate, reddish brown, dorsal surface dull, alutaceous. Pronotum densely punctate, posterior marginal line complete. Mesosternum carinate between the coxae. Elytra with short pubescence, especially the first and second intervals apically; intervals flattened, the one nearest the suture with fairly large punctures basally. Head convex, without trace of frontal tubercles, clypeus scarcely emarginate at the middle, the angles broadly rounded. First segment of posterior tarsi longer than the long tibial spur and as long as the next three tarsal segments. Similar by the dull, alutaceous surface to *lutulentus* and *stupidus*, differing from both by the smaller size, red-brown color, and the finely carinate mesosternum between the coxae.

TAXONOMIC NOTES: Horn (1887) placed it in his group "H" along with four other species, all of which are opaque or alutaceous. Schmidt (1922a:227) placed it in the subgenus *Amidorus*. Brown (1927b: 162) placed it in Horn's group "I-B."

DISTRIBUTION & ZOOGEOGRAPHY: It was recorded by Horn (1887) from Georgia, Illinois, Massachusetts, and Pennsylvania. Subsequently it has been recorded from Florida (Blatchley, 1928); Indiana, (Blatchley, 1910); New Jersey (Sim, 1930); North Carolina (Brimley, 1938); Ohio (Dury, 1902); Quebec, Kansas, and Nebraska (Brown, 1927b).

The single Florida record by Blatchley (1928:23) is from Pensacola, based on a manuscript record by Schwarz of specimens from the Schaeffer collection. I have not found this species during the present study, nor was I able to locate the specimens on which the above records were based. O. L. Cartwright (personal communication) indicated that there were no Florida specimens in the U. S. National Museum. Its presence in Florida is somewhat doubtful until additional specimens are collected.

BIOLOGY: Little is known about this species, and it has always been reported as relatively uncommon. Sim (1930:142) indicated that several specimens were found in deer droppings in New Jersey, with the records being between May 25 and June 14. The immature stages are unknown.

SPECIMENS EXAMINED: Five from North Carolina and Indiana; no Florida specimens seen.

SELECTED REFERENCES: Blatchley, 1910:931-932; 1928:23; Brown, 1927b:165; Horn, 1887:27-28; Sim, 1930:142.

Aphodius lividus (Olivier)

Scarabaeus lividus Olivier 1789:86, Pl. 26, Fig. 222.
Scarabaeus suturalis Fabricius 1792:28.
Aphodius obsoletus Fabricius 1801:70.
Scarabaeus biliteratus Marsham 1802:15.
Aphodius discus Wiedemann 1823:28.
Aphodius cincticulus Hope 1846:147.
Aphodius spilopterus Germar 1848:189.
Aphodius scutellaris Roth 1851:132.
Aphodius sequens F. Walker 1858:207.
Aphodius maculicollis Montrouzier 1860:268.
Aphodius luridus Arrow 1903:511 (lapsus calami).
Aphodius lividus matusitai Nakane 1961:25-26.

The following "varieties" are listed as valid by Schmidt (1922a:317), but they are probably also synonyms:
limicola Panzer 1798:58.
anachoreta Fabricius 1801:74.
innumerabilis Schmidt 1911:31.

DIAGNOSIS: Medium sized (length 3-6 mm), glabrous, ground color pale yellow, the pronotum and elytra often with variable smoky areas. Posterior marginal line of pronotum wanting, the lateral margin fimbriate. Head trituberculate, the clypeus emarginate at the middle, the angles obtuse, rounded; color dark brown, often with lighter areas anteriorly. Pronotum irregularly punctate, the coarse punctures almost absent on the disc; color pale yellow on the sides, the center dark brown. Elytra elongate, the intervals feebly convex, the punctures very minute; color pale except for smoky pattern along the suture and in an elongate patch covering central two-thirds of each elytron. First segment of anterior tarsi shorter than the second. First segment of posterior tarsi barely shorter than the long tibial spur. The color pattern readily distinguishes it from all other Florida species.

TAXONOMIC NOTES: Horn (1887:18) placed this species with *vestiarius* Horn (currently considered a synonym of *cuniculus* Chev.) in his group "D." Schmidt (1922a) placed it in the subgenus *Nialus* along with 21 other species. It is nearly worldwide in distribution, and both the punctation and color pattern are variable. For these reasons the synonymy is fairly extensive. It is unlikely that subspecies exist in a species which has been artifically widely distributed and apparently is moved about easily by commerce. Cartwright and Gordon (1971:263-264) recently synonymized the subspecies *matusitai* Nakane.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 199-200). It is probably the most widely distributed of all the species of Scarabaeidae. Although it was undoubt-

edly introduced into the U. S., there is little information to indicate when it first arrived. In 1887, Horn reported it from the ". . . Southern States, as far west as New Mexico." Schmidt (1922a) listed it from the entire world. In 1878, Schwarz recorded it only from "Ft. Capron" and listed it as "very rare" in Florida. However, by 1928, Blatchley indicated that it was the ". . . most common *Aphodius* in the State."

Although its general range encompasses nearly all of North, Central, and South America, it is surprisingly absent from a few areas (e.g., I never collected it during several years' observations in Ohio). In Florida it has been found in nearly every part of the state from Pensacola to Key West.

BIOLOGY: With such a wide geographic range it is obvious that the species has a wide range of edaphic and climatic tolerances. It is common in various kinds of dung and is often attracted, literally by the thousands, to lights. Lindquist (1935:8) reported collecting 1,113 specimens in a single cow dropping in Texas.

Howden (1955b:65-66) discussed so-called "parasitism" by this species. He found the larvae in brood cells of *Onthophagus*, and the larva of the latter was consumed by an *Aphodius* larva. In each of five cases observed, he found the immature stages (eggs or larvae) of the *Onthophagus* were "parasitized" by single *Aphodius* larvae.

The larva has been described and figured by Jerath (1960b:64, Fig. 63) and is characterized as follows: raster with palidia; maxilla without stridulatory teeth on palpifer; lacinia with a row of five long setae along the mesal edge; spiracle-bearing area with two setae ventrally; clypeus without any protuberances; galea with a row of seven or more short setae; raster with 27-42 short tegillar setae; abdominal segments 6-8 dorsally each with 3 transverse rows of setae; width of head capsule 1.25-1.35 mm; frons on each side with two depressions.

SPECIMENS EXAMINED: Several thousand (on many of which data was not recorded early in the study), including 13,500 Florida specimens, representing 760 collection records listed in Appendix 29.

SELECTED REFERENCES: Bates,1887:85; Blatchley, 1928:22; Horn, 1870b:121; 1887:18; Howden, 1955b: 65-66; Jerath, 1960b:52, 64, Fig. 63 (larva); Schmidt, 1922a:317.

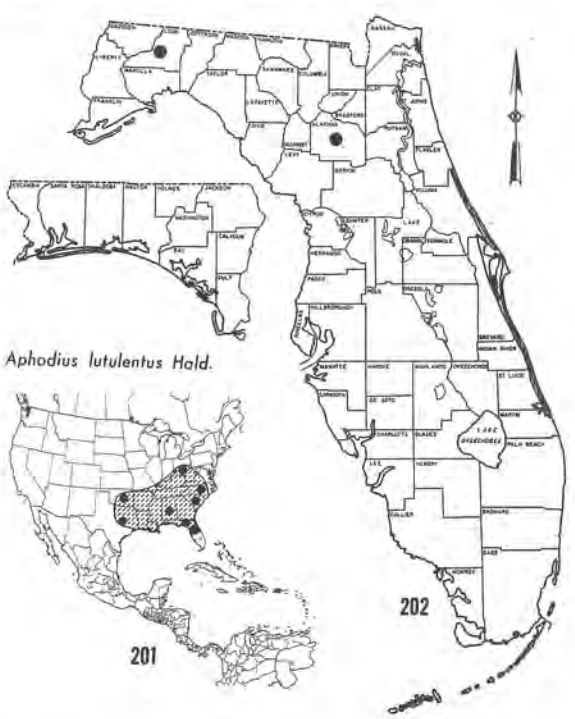
Aphodius lutulentus Haldeman

Aphodius lutulentus Haldeman 1843:304.
Aphodius corvinus Haldeman 1848:104 (not Erichson 1848:831).

DIAGNOSIS: Medium sized (length 5.5-7mm), dull, alutaceus gray to black, head and pronotum densely punctate; clypeus emarginate at middle, strongly angulate each side; elytral intervals flat, the striae only silghtly impressed with punctures light and preceded by "quote mark" crenulations, sculpture of the intervals complex, alutaceous, muricate, and semi-rugulose. Sexual dimorphism noticeable: the anterior tibial spur of the male equalling the first four tarsal segments in length, that of the female normal (less than the length of the first two tarsal segments).

Similar to two other Florida species (*lentus* Horn and *stupidus* Horn) in the opaque or dull elytra. It is larger than either, is never red-brown as in *lentus*, and the elytra are less pubescent than in *stupidus*. It differs further from the latter by the more rugosely sculptured elytra, less convex pronotum, more angulate clypeus, and more coarsely and densely punctate pronotum.

TAXONOMIC NOTES: The sexual dimorphism was responsible for the synonym *corvinus* Hald., which was based on the male sex. Three other synonymous names (*brunnipennis* Esch., *opacipennis* Melsh., and *rugulosus* Dej.) are listed by Gemminger and Harold (1869: 1053), but these are all *nomina nuda*. Horn (1887) placed it in his group "H" along with four other opaque species. Schmidt (1922a) placed it in the subgenus *Amidorus* with 22 other species.



DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 201-2). No type locality was given in the original description, and Horn (1870b:125) listed it from "Middle and upper Southern States." It was recorded in subsequent literature from Alabama (Loding, 1945), Florida (Blatchley, 1928), North Carolina (Brimley, 1938), Oklahoma (Brown, 1928a), and South Carolina (Cartwright, 1934b). I also have seen specimens from Ohio and Texas (new state records).

I have not encountered it during the present study in Florida. Blatchley (1928:23) mentioned a manuscript record of Schwarz from Tallahassee, and Cartwright (in litt.) listed a specimen in the U. S. National Museum with the following data: Gainesville, Fla., 11-2-33, F. N. Young (I have not been able to determine if this is November or February). This species is rare in collections, and practically nothing has been published concerning its habits. It is primarily a fall and winter species, occurring from October to February. Brown (1928a:26) reported it "common on the prairies" in Oklahoma. The immature stages are unknown.

SPECIMENS EXAMINED: 17, none of which was from Florida.

SELECTED REFERENCES: Blatchley, 1928:23; Brown, 1928a:26; Horn, 1870b: 124-125; 1887:26-27; Schmidt, 1922a:226-227.

Aphodius parcus Horn

Aphodius parcus Horn 1887:42-43.
Didactylia parca Horn, Brown 1929a:91.

DIAGNOSIS: Small (length 2-3 mm), pale yellow, pronutum often a little darker in the middle. Pronotum moderately convex, the punctures scattered, shallow; basal marginal line fine but distinct; lateral margin fimbriate with about 8-10 long setae. Head not tuberculate, clypeus broadly, shallowly emarginate at the middle, the angles not prominent, obtusely rounded; genal angles with a group of long setae. Scutellum slightly concave, virtually impunctate. Tarsi all narrow and elongate. The most distinctive feature of the species is the absence of transverse ridges on the middle and posterior tibiae which are replaced by scattered stiff setae with the sockets darker and somewhat tuberculate.

TAXONOMIC NOTES: Horn (1887) placed it in his heterogeneous group "I-C." It was not placed in a subgenus by Schmidt (1922a). Brown (1929a) placed two North American species, *A. parcus* Horn and *A. knausi* Fall, in the genus *Didactylia*. Fall (1932) subsequently treated *Didactylia* as a subgenus of *Aphodius*. As mentioned in my generic discussion, future revisionary work will be necessary to clarify the status of such entities. Although this is one of the more distinct groups of *Aphodius*, I prefer to treat it with the other Florida *Aphodius* until further study.

Fall (1932:184) called attention to a form from New Jersey and Georgia which was extremely similar to *parcus* and *knausi*, but which he considered a "local variant" of the latter. These two species are difficult to distinguish, and additional material will be necessary to clarify the status of the two names and the New Jersey and Florida variants.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 203-4). It was originally described from "eastern Florida." Although subsequently recorded from New Jersey (Smith, 1910), these records are referred to a variety of *knausi* by Fall (1932). The typical *parcus* is presently known only from peninsular Florida. It is interesting that Blatchley (1928) reported no Florida specimens, although I found three specimens from Dunedin and one from Sarasota in the Blatchley collection at Purdue University. These were placed in the same pinning tray with *A. cuniculus*, but they are totally unlike that species, and it is difficult to conceive of Blatchley confusing the two species.

BIOLOGY: Nothing has been published concerning the habits of this species, and the immature stages are unknown. It has never been collected in dung, and all of the specimens have been taken at light. It appears to be most common at coastal localities, although it is not rare at Gainesville. Little is known also about the related *A. knausi* except that it is known from fossil sand dunes in Kansas and from the shores of Lake Michigan.

SPECIMENS EXAMINED: Over 1,547 from 27 Florida localities, representing 138 collection records (for complete data see Appendix 30).

SELECTED REFERENCES: Blatchley, 1928:24; Brown, 1929a:91; Fall, 1932: 184-185.

Aphodius rubeolus Beauvois

Aphodius rubeolus Beauvois 1805:90, Pl. 2, Fig. 4.

Aphodius pallidus Dejean 1836:161 (nomen nudum).

Aphodius rubidus Sturm 1843:110.

Aphodius copronymus Melsheimer 1845:136 (often cited as 1844).

DIAGNOSIS: Medium sized (length 3.5-5 mm), fairly uniform red-brown, shining. Head not tuberculate, the clypeal suture deep and darker in color; clypeus shallowly emarginate at the middle, the angles each side rounded. Pronotum with basal marginal line complete, coarse punctures present only at the sides, the disc with barely noticeable fine punctures. Elytral intervals flat, the striae finely or obsoletely punctate; posterior one-third pubescent near the side margin. First posterior tarsal segment shorter than the long tibial spur; posterior tibial spurs short, blunt, with one side broad, slightly concave. First segment of anterior tarsi longer than the second.

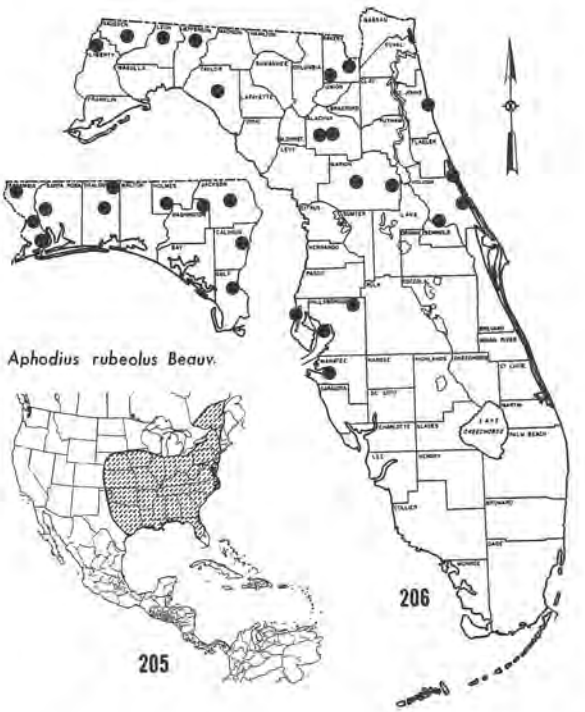
Most similar to *campestris* from which it can be distinguished by its redder color and the short blunt posterior tibial spurs. It is similar in color to *aegrotus* but is less elliptical in shape, and the elytra are pubescent along the posterior margin, whereas they are without vestiture in *aegrotus*.

TAXONOMIC NOTES: Horn (1887) placed it in his group "I-B" with *stercorosus* Melsh. This group was revised by Brown (1927b), and along with *rubeolus* and *stercorosus*, he included *lentus* Horn, *tenuistriatus* Horn, *troglodytes* Hubbard, *cynomysi* Brown, and *cavidomus* Brown. Along with *aegrotus* Horn, these reddish to yellow species form a fairly uniform grouping. Schmidt (1922a) placed it in the subgenus *Koshantschikovius* along with seven other species.

This species is variable in punctation, extent of basal marginal line of pronotum, shape of posterior tibial spurs, and other minor features. It is possible that it is a composite as it is now understood, and additional study of specimens from the entire range will be necessary to clarify the situation.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 205-6). Horn (1887:34) listed it from ". . . Middle states to Missouri and Texas, also rarely in Massachusetts." Brown (1927b:164) indicated that its range was the same as *stercorosus* which he listed ". . . from Quebec (Joliette and Chambly counties) and Florida west to Colorado and Texas." Additional state records include Alabama (Loding, 1945), District of Columbia (Ulke, 1902), Florida (Blatchley, 1928), Indiana (Blatchley, 1910), Nebraska (Dawson, 1922), New Jersey (Smith, 1910), New York (Leng, 1928), North Carolina (Brimley, 1938), Ohio (Dury, 1902), Oklahoma (Brown, 1928a), and South Carolina (Cartwright, 1934b).

It was recorded by Blatchley (1928:23) from the following Florida localities: Enterprise, LaGrange, St. Augustine, Centerville, and Oneco on the west coast of the peninsula and as far west as Pensacola in the panhandle. It appears to be replaced by *campestris* in most of the peninsula.



BIOLOGY: Brown (1927a) indicated that this species ". . . occurs beneath manure and is common only in sandy soil." Howden (1955b) recorded rearing the species from what was presumably the larval food mass of *Phanaeus* which was buried 31 inches deep. He suggested that in some cases *Aphodius* larvae may be "parasitic" on the larvae of other Scarabaeidae which provision their larvae with dung. Other than these two notes, little has been published on its habits, and the immature stages are unknown.

In Florida I have rearely found it in cow dung, even in extremely sandy areas. Nearly all of my records are from light traps. It has been taken in Florida every month except December and January.

SPECIMENS EXAMINED: About 285, of which 221 were from 36 Florida localities, representing 115 collection records (for complete data see Appendix 31).

SELECTED REFERENCES: Blatchley, 1910:932; 1928:23; Brown, 1927b:164; Dawson, 1922:79; Horn, 1870b:126-127; 1887:34-35; Howden, 1955b:65.

Aphodius rusicola Melsheimer

Aphodius corvinus Dejean 1836:162 (nomen nudum).
Aphodius rusicola Melsheimer 1845:136 (often cited as 1844).
Aphodius curtus Haldeman 1848:105.
Aphodius ruricola Melsh., LeConte 1863b:36.
Aphodius aurelianus Harold 1863:334, 375.

DIAGNOSIS: Medium sized (3.5-5.5 mm), oblong, oval, convex, brown to black, shining. Head distinctly trituberculate, the middle tubercle truncate and often transversely elongate, clypeus emarginate at the middle, the angles each side obtuse but prominent. Pronotum convex, punctures denser and larger at the sides, those of the disc uniformly moderate in size, separated regularly by at least twice their diameter, posterior marginal line entire. Elytra convex, shining, the intervals flat, finely, sparsely punctate. First segment of anterior tarsi shorter than the second. First segment of posterior tarsi shorter or equal to the tibial spur. It is often difficult to distinguish from *floridanus* Rob. and other members of this complex. Florida specimens have all been referred to *floridanus* which is usually darker (mostly black), usually coarse pronotal punctures more numerous and elytral intervals more convex.

TAXONOMIC NOTES: This species, as it is now understood, is possibly a composite of several very closely related forms. Additional study will be required to clarify this complex. Horn (1887:15) indicated that the specimens from "more Southern States" were larger, the elytra less deeply striate, the intervals flatter and more distinctly punctulate, and that this was the form referred to *aurelianus* by Harold (1863). Horn (1887) placed it in his group "B" along with a heterogeneous assemblage of nine other species. Schmidt (1922a:291) placed it in the subgenus *Agrilinus* with 17 other species.

The name in the original description is spelled "*rusicola*" in two places, although all subsequent publications have spelled it "*ruricola*." Perhaps the spelling in the original description is a printer's error since no later author has used the original spelling, but I have not found any evidence to this effect.

DISTRIBUTION & ZOOGEOGRAPHY: It has not been recorded definitely from Florida, and the entire published distribution is questionable until its taxonomic status is more thoroughly elucidated. It is recorded in the literature from Alabama, Canada, District of Columbia, Florida, Illinois, Indiana, Nebraska, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, and South Carolina. Blatchley (1928:22) reported it from the following Florida localities: Fort Capron, Lake Worth, and Jacksonville. All these records probably are referrable to *floridanus* Rob.

BIOLOGY: It is apparently common in cow dung in a variety of edaphic and climatic situations, although more abundant at the margins of woods. It is sometimes common at light. The immature stages are unknown.

SPECIMENS EXAMINED: About 250, mostly from Ohio; none from Florida.

SELECTED REFERENCES: Blatchley, 1910:930; 1928:22; Dillon and Dillon, 1961:517, 520, Pl. 50, Fig. 5; Horn, 1870b:118-119; 1887:15.

Aphodius stercorosus Melsheimer

Aphodius stercorosus Melsheimer 1845:136 (often cited as 1844).

DIAGNOSIS: Small (3.3-4.4 mm), shining, brownish yellow, the elytra often clouded with dark brown. Head not tuberculate, distinctly and uniformly punctate, frontal suture distinct; clypeus broadly emarginate at the middle, the angles on each side rounded, not prominent. Pronotum not fimbriate on sides, punctures fine and sparse at the middle, closely spaced and of unequal size at the sides; posterior marginal line absent. Elytral striae rather coarsely and closely punctate; elytra without trace of pubescence, the apex distinctly alutaceous. First segment of posterior tarsi longer than the long tibial spur. Similar to *campestris* Blatch. and *rubeolus* Beauv., but distinguished from both by the absence of the posterior marginal line of the pronotum and the lack of a fimbriate lateral pronotal margin.

TAXONOMIC NOTES: Most of the early records of this species from the southeastern U. S. probably refer to *campestris* Blatch. Horn (1887) placed it in his group "I-B" with *rubeolus* Beauv. Brown (1927b) revised the group and included seven species in it. Schmidt (1922a) included it in his subgenus *Koshantschikovius* along with seven other species.

This species is highly variable in pronotal punctation and color. The elytral color varies from a uniform pale yellowish or uniform red-brown to a red-brown center with pale margins. The darker areas of pronotum and elytra often are smoky in appearance, like those of *lividus* Oliv.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 207). It is probably found only in the panhandle in Florida, although recorded from other parts of the state in the literature. Horn (1887:35) reported that it ". . . occurs over our entire area east of the Mississippi as far north as Dacota [sic]." Brown (1927b:164) recorded it from ". . . Quebec (Joliette and Chambly Counties) and Florida west to Colorado and Texas."

Blatchley (1928:23) reported it from three Florida localities: Enterprise, Lake Worth, and Suwannee Springs. Frost (1964:142) reported it from Archbold Biological Station (Highlands County). However, all of these reports probably are referrable to *campestris* Blatch.

Fig. 207. Florida distribution of **Aphodius stercorosus** Melsh.

BIOLOGY: This species is common in cow dung in a variety of edaphic and climatic situations. I have collected nearly 100 specimens from a single pile of cow dung in Ohio. I have taken it also in human dung, from which it was reported also by Howard (1900:556). Wilson (1932:79, 81) found it in sheep droppings in New Jersey from May to September, but it was ". . . more abundant during the latter part of the summer."

The larva has been described and figured by Jerath (1960b:63-64, Fig. 54). It is characterized as follows: raster without palidia; maxilla without stridulatory teeth on palpifer; lacinia dorsally with a row of five long setae along the mesal edge and a short seta posteriorly; spiracle-bearing area with two setae ventrally; galea ventrally with a row of seven or more short setae; raster with 17-22 tegillar setae; width of head capsule 0.89-0.96 mm.

SPECIMENS EXAMINED: Over 300 from the northeastern U. S.; 10 from Florida as follows:
(2) Escambia Co., Bratt, 28-29-VI-68, F. S. Blanton, blacklight trap; (1) Escambia Co., Bratt, 25-VIII-68, F. S. Blanton, blacklight trap; (3) Jefferson Co., Big Bend Hort. Lab., near Monticello, 30-V-69, W. H. Whitcomb, blacklight trap; (1) ibid., 28-VII-69, R. E. Woodruff, blacklight trap; (2) ibid., 2-VIII-69, W. H. Whitcomb, blacklight trap; (1) Leon Co., Tall Timbers Res. Sta., 21-22-VI-69, A. Bhatkar, blacklight trap.

SELECTED REFERENCES: Blatchley, 1910:932; 1928:23; Brown, 1927b:163-164; Dillon and Dillon, 1961:520, Pl. 50, Fig. 7; Frost, 1964:142; Horn, 1870b: 127; 1887:35; Jerath, 1960b:63-64, Fig. 54 (larva); Wilson, 1932: 79, 81.

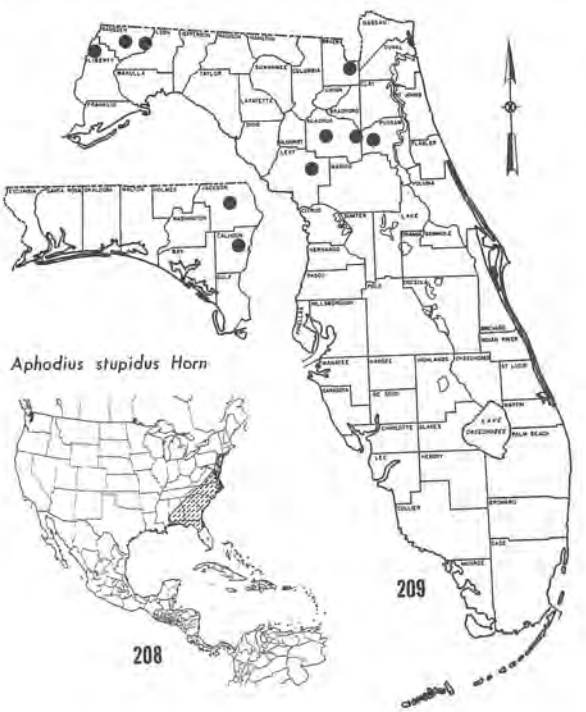
Aphodius stupidus Horn

Aphodius stupidus Horn 1870b:125.

DIAGNOSIS: Medium sized (length 3-5mm), black to gray, dull, alutaceous or subopaque. Head densely, evenly punctate, the center with a short, blunt tubercle; clypeus broadly, feebly emarginate in the middle, the angles on each side rounded, obtuse. Pronotum convex, alutaceous, the punctures dense and nearly evenly spaced about one diameter apart; posterior marginal line complete and deeply impressed. Elytra alutaceous and pubescent, the setae in two rows the length of each interval; striae coarsely, somewhat crenately punctate, the intervals flat, punctate, and with scattered granules. First segment of anterior tarsi shorter than the second. First segment of posterior tarsi slightly longer than the long tibial spur.

Similar in the opaque surface to *lentus* and *lutulentus*. From the first it can be separated by the noncarinate mesosternum, darker color, obvious pubescence, and less elongate shape; from the second it can be separated by the smaller size (3-5 mm in contrast to 5.5-7mm), the angles of the clypeus less prominent, the elytral pubescence much longer and more obvious, and the elytra less granulate or submuricate.

TAXONOMIC NOTES: A distinct species, related to the two mentioned above and placed with them and two others by Horn (1887) in his group "H." Schmidt (1922a) placed it in the subgenus *Amidorus* with 22 other species. Horn (1887:25) used the greater length of the first posterior tarsal segment to separate *lutulentus* from *stupidus*. This character does not hold up in the specimens I have seen, this segment actually being longer in *stupidus*.



DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 208-9). It has been recorded from the following states: Alabama (Loding, 1945), Georgia (type locality), New Jersey (Sim, 1930), North Carolina (Brimley, 1938), and South Carolina (Cartwright, 1934b). Blatchley (1928) did not record it in his "Scarabaeidae of Florida," and it has not been reported previously from the state.

I have seen it from eight Florida counties, the southernmost record being 8 mi. E. of Bronson (Levy Co.). It probably has a wider range in northwest Florida than my records indicate, but it is rarely collected because it occurs in the winter months.

BIOLOGY: This species is sometimes common in cow and horse dung, most often at the margins of woods. It is another of the winter species; the Florida records are from September to April, with the majority from December and January. Sim (1930) found the same seasonal distribution in New Jersey. There ap-

pears to be nothing published on its habits, and the immature stages are unknown.

SPECIMENS EXAMINED: 194 from 11 Florida localities, representing 24 collection records (for complete data see Appendix 32).

SELECTED REFERENCES: Harold, 1874c:184, 204; Horn, 1887:27; Sim, 1930:142.

Aphodius troglodytes Hubbard

Aphodius troglodytes Hubbard 1894:305, 312-313.

DIAGNOSIS: Small (length 3-4 mm), pale yellow-brown, feebly convex, shining. Head without tubercles, barely convex, the punctures minute and scattered as they are on the pronotum (no coarse punctures intermixed), clypeus barely emarginate at the middle, the angles obtuse, rounded, not prominent. Posterior marginal line of pronotum entire; pronotum often transparent, showing the musculature beneath. Elytra somewhat elliptical in outline, the apex slightly truncate, the striae lightly impressed and shallowly punctate; intervals feebly convex, minutely punctate. First segment of anterior tarsi longer than the second.

Similar to *aegrotus*, *stercorosus*, *campestris*, and *rubeolus*, but easily distinguished from all of these by the lack of any coarse punctures on the pronotum. It is most similar to *aegrotus* but is smaller, paler, and the first posterior tarsal segment is longer than the long tibial spur.

TAXONOMIC NOTES: A very distinct species, not easily mistaken for any other. Hubbard (1894) and Brown (1927b) placed it in Horn's group "I-B," and Schmidt (1922a) placed it in the subgenus *Koshantschikovius*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 210-11). It probably ranges coextensively with the gopher tortoise, *Gopherus polyphemi* Daudin, but it is recorded in the literature only from Florida and South Carolina. The distribution map of the tortoise (Fig. 117) is based on unpublished data provided by W. A. Auffenberg, Florida State Museum, to whom I express my appreciation for its use here.

The type locality is Crescent City, Florida, and subsequent literature records include Enterprise, Gainesville, Lake Mary, Lake Worth, and Miami. I have seen it from six additional localities (for complete data see Appendix 33).

BIOLOGY: It is apparently confined to the burrows of the gopher tortoise, *Gopherus polyphemi* Daudin, along with two other scarabs (*Copris gopheri* Hub. and *Onthophagus polyphemi* Hub.). It is a dung feeding

species, and all stages have been found in the tortoise dung in the burrows. It is rarely attracted to light. In many ways it is adapted similarly to cave animals (e.g., reduced eyes, pale color, and elongate tarsi). Apparently the micro-cavern of these burrows is sufficiently distinct to permit the evolution of an entire assemblage of arthropod obligates. *A. aegrotus*, which occurs in the burrows of the pocket gopher, has parallel modifications for subterranean life. In life, adults of *A. troglodytes* are much paler than pinned specimens: the integument is often sufficiently transparent to view the wings beneath the elytra and muscles of the thorax. This absence of pigment is similar to that in the blind cave carabid genus *Pseudanophthalmus*.

The larva has been described and figured by Jerath (1960b:64-65, Fig. 15) and is characterized as follows: raster without palidia; maxilla without stridulatory teeth on palpifer; lacinia dorsally with a row of five long setae along the mesal edge and a short seta posteriorly; spiracle-bearing area with two setae ventrally; galea ventrally with a row of seven or more short setae; raster with 26-32 tegillar setae; abdominal segments 6-8 dorsally each with two transverse rows of setae; width of head capsule 0.86-0.89 mm.

SPECIMENS EXAMINED: 51 from 8 Florida localities, representing 24 collection records (for complete data see Appendix 33).

SELECTED REFERENCES: Blatchley, 1928:23; Brown, 1927b: 166; Castle and Laurent, 1896:303; Hamilton, 1894:252; Hubbard, 1896:299, 301; Jerath, 1960b: 64-65, Fig. 15 (larva); Young and Goff, 1939:61.

Genus MYRMECAPHODIUS Martinez

(Fig. 212-219)

Myrmecaphodius Martinez 1952:85-87, Fig. 8-17, 50.

TYPE SPECIES: *Myrmecaphodius proseni* Martinez 1952 (by monotypy).

DIAGNOSIS: Similar to *Euparia* from which it differs in the poorly developed genae, lack of a basal notch on the elytra, humeral angle not projecting into a cuneiform process, and the verrucose pygidium. Also similar to *Ataenius* from which it differs in the explanate pronotal sides (Fig. 215), flattened setae of the lateral pronotal fringe (Fig. 215-7), the more curved posterior tibiae, and the peculiar curve and twist of the posterior tibial spurs. Length 5-6 mm.

TAXONOMIC NOTES: According to the literature, *Myrmecaphodius* contains only the type species, *proseni* Martinez. Generic assignments in the Aphodiinae, especially the myrmecophiles and termitophiles, require much more material (specimens) before they can be considered stable. It has been recognized for some time (by Martinez, Cartwright, and myself) that the beetle found in the imported fire ant nests in the United States was a member of this genus. Although it was originally thought to be the "genotype" *proseni*, subsequent study has indicated otherwise. I now believe that it is the species recorded in past literature as *Euparia excavaticollis* (Blanchard). It is likely that other species of *Euparia* are congeneric with *M. proseni* (e. g., *E. vandykei* Hinton), but further study will be required to confirm this.

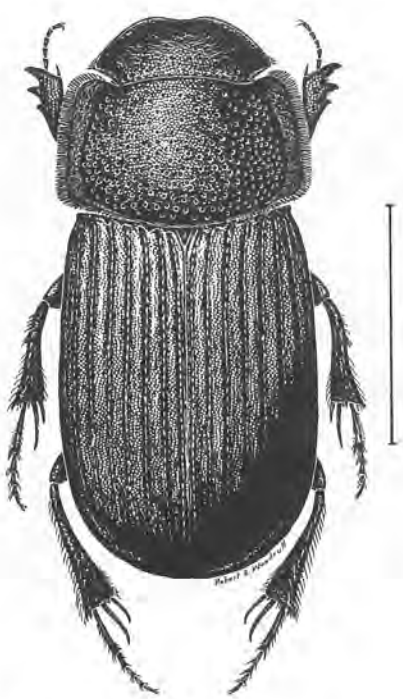


Fig. 212. **Myrmecaphodius excavaticollis** (Blanch.), line = 2.5mm.

DISTRIBUTION & ZOOGEOGRAPHY: The type species, *proseni*, was described from Argentina, Prov. Buenos Aires, Partido de Puan, Estacion Felipe Sola, and has not been reported in the literature since. *M. excavaticollis* was described originally from Argentina, Prov. Corrientes, near the village of d'Italy. It is now one of the most common Aphodiinae at light in the southeastern U. S. wherever the imported fire ant occurs (see this section under the species treatment for further details).

BIOLOGY: The exact role played by these beetles in the host ant nests is still unknown. They appear to be associated only with the ant genus *Solenopsis*, especially *saevissima* and its relatives. Their complete life cycle apparently occurs in the nest where larvae and pupae also have been found. Further biological, ecological, and behavioral studies of these inquilines should provide pertinent information to any biological control program for the imported fire ant.

SELECTED REFERENCES: See this section under the single Florida species.

Myrmecaphodius excavaticollis (Blanchard)

(Fig. 212-219)

Oxyomous excavaticollis Blanchard 1846:184 (often cited as 1837 or 1843, but see Sherborn and Woodward, 1901, for clarification of dates).

Euparia excavaticollis (Blanchard), Harold 1870a:23, 29-30.

Myrmecaphodius proseni Martinez, (misidentification of early N. A. examples by me and others).

Myrmecaphodius excavaticollis (Blanchard), NEW COMBINATION.

DIAGNOSIS: Large (5.5-6.1 mm), elongate, subparallel, black to brown, shining. Head somewhat deflexed, similar to *Ataenius* but with regulae more noticeable. Clypeus broadly emarginate at the middle, the angles on each side broadly rounded; clypeo-genal suture barely indented at the margin and raised for its length, but otherwise feebly indicated. Eyes hidden in repose; anteocular pit deep but narrow. Pronotum explanate at the sides and fringed with short, flattened setae (Fig. 215-17); the area inside the lateral margin, and extending along the posterior margin, somewhat excavate and often encrusted with dirt (Fig. 213). Pronotal punctures irregularly spaced and of two sizes; coarse ones deep and denser between the lateral excavate sides and the central one-third, becoming sparser in the antero-median area; small punctures fairly evenly distributed between the coarser ones. Elytra parallel sided, the lateral margin with a fringe of setae for about the anterior one-half its length. Striae deep, the punctures elongate, sides weakly crenate;

Fig. 213-214. Adult and larva **Myrmecaphodius excavaticollis** (Blanch.) in nest of **Solenopsis invicta** Buren (6X). Note dirt incrustations common on the adult.

In the United States it has long been found wherever the imported fire ant was found. Collins and Markin (1971), on the basis of my identifications, reported it from Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and Texas. The Florida distribution has changed radically since its discovery, because of the spread of the ant host (See map, Fig. 218-9, and Appendix 35 for Florida records).

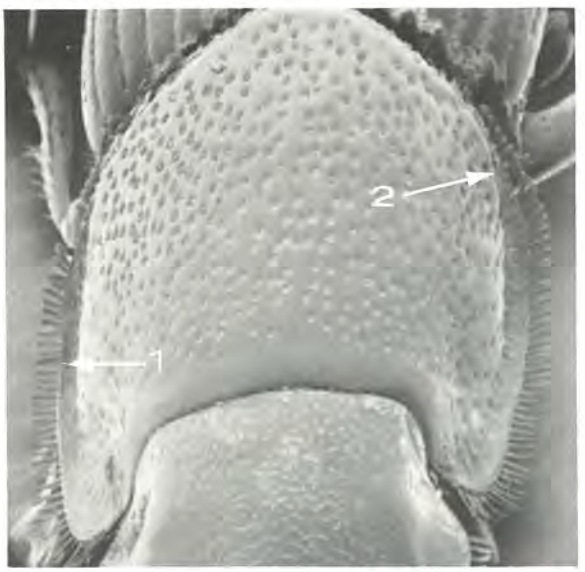


Fig. 215. Stereoscan photo of **Myrmecaphodius excavaticollis** (Blanch.). Dorsal view of pronotum (26X). Arrows refer to enlarged areas in Fig. 216-217.

intervals flattened and minutely punctate. Humeral angle dentate but not prolonged; base of the elytra without a deep notch. Pygidium dull, verrucose, the pattern irregular. Anterior tibial spur of the male inturned abruptly near the tip, that of the female nearly straight.

TAXONOMIC NOTES: This species is distinguished easily from other U. S. Aphodiinae by the characters listed above, but it is very similar to *M. proseni* Martinez from Argentina. There appear to be several undescribed species from South America, all very closely related. Thanks to a grant from the USDA, through the University of Florida, I was able to study the holotype of *M. proseni* and to collect relevant material in South America. W. H. Whitcomb and his associates have since provided much additional ant associated material. Antonio Martinez, Buenos Aires, Argentina, provided assistance in the field, access to his private collection, and the loan of paratypes and related material which will be the subject of joint papers elsewhere.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 218-9). The type locality is Argentina, Province of Corrientes, near the village of d'Italy. The exact host relationships will determine whether the beetle is found with one or more ant species. Its range probably will be found to be coextensive with its hosts.

Fig. 216. Stereoscan photo (310X) of **M. excavaticollis** (Blanch.) lateral pronotal seta (enlargement of area at arrow 1 in Fig. 215).

BIOLOGY: It was apparently introduced into the U. S. along with the imported fire ants, probably after 1950. Most of the inquilines in the Aphodiinae are host specific (at least to the host genus), and this species probably is also. The related ant, *Solenopsis geminata*, has another host specific aphodiine, *Euparia castanea*. No published observations are available to determine whether the beetles are synechthrans (unwelcomed guests), synoeketes (unnoticed or tolerated guests), or symphiles (true guests or obligates).

If the beetles are truly obligates only in the mounds of the imported fire ant, then they might offer a convenient survey tool since they are readily attracted to light. Most of my specimens were taken in black-light traps.

Ashdown (Anonymous, 1967) reported on my studies and included a photograph of the beetle. At that time the species was thought to by *Myrmecaphodius proseni* Martinez, the monotypic member of the genus. It was described from Argentina from the nests of *Solenopsis saevissima* Smith, the ant which was called the imported fire ant in the U. S. until recently. It now appears that there has been much confusion in the taxonomy of this group of ants, and our species was recently described as *S. invicta* Buren (1972).

Collins and Markin (1971) reported it from 98% of the imported fire ant nests they examined in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and Texas. They were unable to learn much about the behavior or the biological role played by the beetles. In laboratory ant colonies they found that beetles ". . . wandered off to a secluded corner and did not mingle with the ants." They reported that beetles released a strong musky odor when confined, but they found no evidence of trichomes or secretions attractive to the ants. D. P. Wojcik and I have conducted observations on beetles in laboratory ant colonies at Gainesville. The results will be published elsewhere in a more extensive paper on the exact host relationships and taxonomic status of this inquiline.

Specimens have been collected in Florida from March through November. Adults probably are present throughout the year in the shelter of the ant nest, but flights are confined to warmer periods. It would be significant to know whether their flights coincide with the nuptial flights of the ant. Whatever mechanism the beetle uses to locate an ant colony could be of considerable practical value in survey and detection programs for the imported fire ant.

The larvae (Fig. 214) and pupae have been collected, but technical descriptions of them will appear in another paper.

SPECIMENS EXAMINED: Over 10,000, of which 2,441 were from 10 Florida localities, representing 280 collection records (for complete data see Appendix 35).

SELECTED REFERENCES: Anonymous, 1967:5; Blackwelder, 1944:213; Collins and Markin, 1971; Martinez, 1952:87-91; Schmidt, 1922a:396-397, Fig. 19a-e (mouthparts).

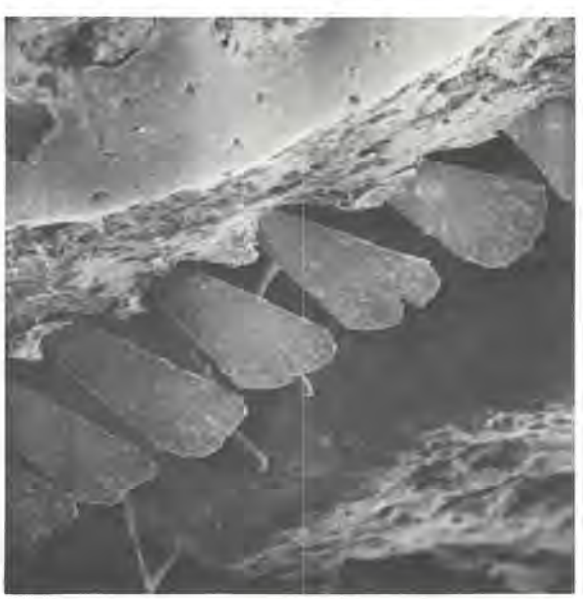
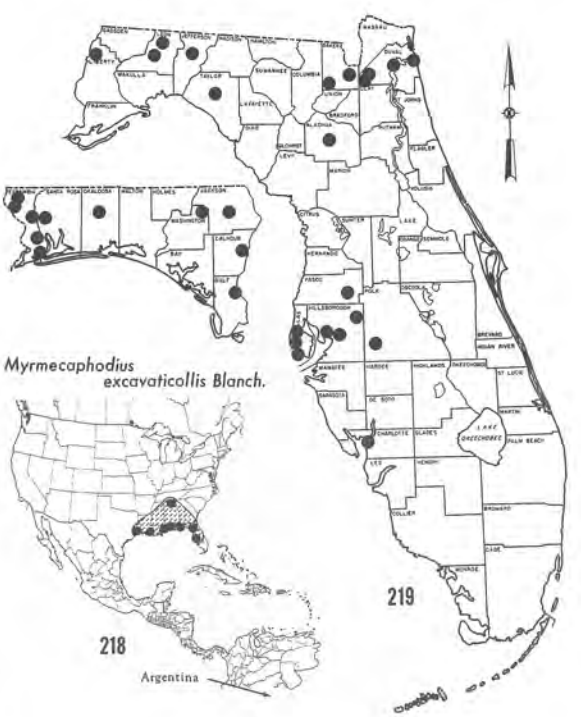


Fig. 217. Stereoscan photo (265X) of **M. excavaticollis** (Blanch.) pronotal setae near posterior angle (enlargement of area at arrow 2 in Fig. 215).



Genus EUPARIA Serville

(Fig. 220)

Euparia Serville 1828:357 (often cited as 1825).

TYPE SPECIES : *Euparia castanea* Serville (by monotypy).

DIAGNOSIS: General facies unique (Fig. 220); medium sized (length 5 mm), reddish brown, pubescent. Genae prominent; pronotum explanate laterally; humeri of elytra projecting forward with a notch at the base; middle and posterior tibiae arcuate without trace of transverse carinae, the outer angle projecting, the spurs elongate, curved.

It is most similar in general appearance to *Myrmecaphodius* (Fig. 212) and *Ataenius* (Fig. 222); easily separated from the former by the lack of a transverse carina on the middle tibia, the prolonged humeri, and dorsal pubescence and from the latter by the explanate pronotal sides, arcuate middle and posterior tibiae, prolonged humeri, and enlarged genae.

TAXONOMIC NOTES: Many of our species of *Ataenius* were placed in this genus until the two genera were separated by Harold (1867). Sixteen species were recognized by Schmidt (1922a), and nineteen were mentioned by Hinton (1936). However, many of these apparently are not congeneric and have been placed in recently described genera (e.g., *Phalangochaeta* and *Bruchaphodius* by Martinez, 1952).

Within the tribe Eupariini there are several myrmecophilous genera which seem to form a distinct group. These include *Euparia*, *Euparixia*, *Euparixoides*, *Myrmecaphodius*, *Cartwrightia*, *Rhyparus*, and *Phalangochaeta*. The higher categories within the Aphodiinae are not well defined and require further study for a satisfactory arrangement.

DISTRIBUTION & ZOOGEOGRAPHY: Hinton (1936) considered the genus "cosmopolitan," but as mentioned above, many of the species probably are not congeneric. I believe that the genus (sensu stricto) probably occurs only in the New World. Only two species, *E. castanea* Serv. and *E. vandykei* Hinton, are known from North America, with the latter being described from Temascaltepec, Mexico. For distribution of *E. castanea*, see the appropriate section under that species.

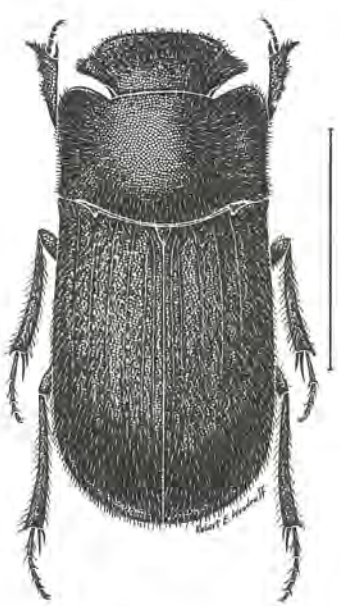


Fig. 220. **Euparia castanea** Serv., line = 2.5mm.

BIOLOGY: Apparently all of the species are myrmecophilous, but the habits of several are unknown. Nearly all of them have been collected also at light. Practically nothing is known of the behaviour of the genus in order to classify them as to type of myrmecophile. The larva of only a single species, *E. castanea*, has been described.

SELECTED REFERENCES: Harold, 1870a:20-30; Hinton, 1936:273-274; Horn, 1871a:289-290; Martinez, 1952:92-102; Schmidt, 1922a:390-398.

Euparia castanea Serville

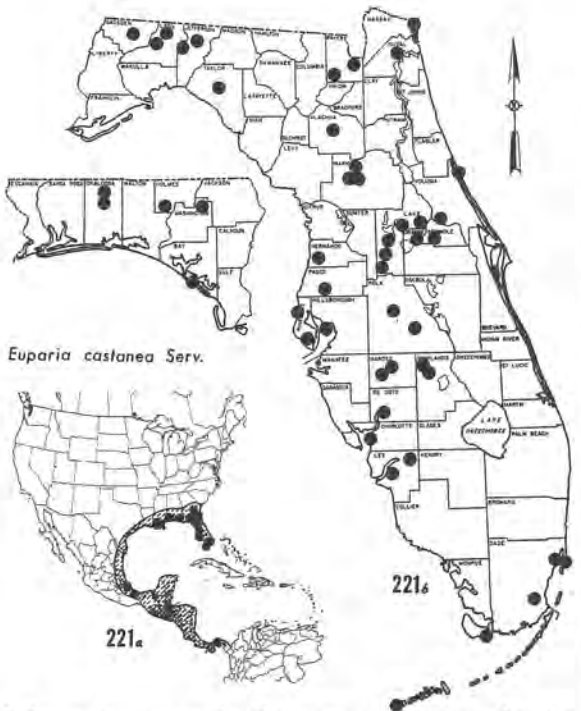
(Fig. 220)

Euparia castanea Serville 1828:357 (often erroneously cited as 1825).

DIAGNOSIS: Medium sized (length 5 mm), reddish-brown, elongate, subparallel, pubescent, the pronotal sides explanate. Genae large, divided from the clypeus by a notch at the suture, acutely angled and produced laterally in front of the eye; eyes not visible from above when head in repose. Pronotum explanate, especially in the anterior angles, with the margin reflexed, posterior angles quadrate, the basal outline arcuate; evenly punctate, punctures separated by about twice their diameter, and each bearing a fine, elongate, golden seta. Elytra nearly parallel sided, striae lightly impressed especially at the base, intervals feebly convex and setigerously punctate throughout; humeral angles produced anteriorly into an acute angle, basal line carinate to a notch at base of the fifth stria. Scutellum elongate, flattened, and impunctate. Middle and posterior tibiae arcuate to the produced outer tip; long spur very elongate, curved, and longer than first tarsal segment. It can be distinguished from the only other N. A. species, *E. vandykei* Hinton, by the pubescent dorsal surface and the prominently produced humeri.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 221). Its range probably is coextensive with the host ant, *Solenopsis geminata* (Fab.). It has been recorded from Alabama, Florida, and Louisiana (Horn, 1887:87), Georgia (Harold, 1870a:24), Teapa, Mexico (Bates, 1889:393), Panama and Puerto Barrios, Guatemala (Hinton, 1936:274). In Florida it probably occurs throughout the state, as does the host ant. Blatchley (1928:24) recorded it only from Fernandina and Sanford, Florida.

BIOLOGY: It apparently is confined to the nests of the fire ant, *Solenopsis geminata*. The behavior within the nest is completely unknown. Division of Plant



Industry inspectors, in the course of surveys for the imported fire ant (*Solenopsis invicta* Buren), often encounter it in numbers when kicking over the mounds of *S. geminata*. Frank Urso and Aubrey Crews sent over 100 live beetles to me in vials with moist paper toweling. During the two days in transit, all of the beetles died. These same men observed that the beetles feign death when exposed, although they revive within a few minutes and seek shelter in the mound. The ants apparently pay little attention to the beetles at this time and make no attempt to carry them back into the nest. This species has never been found in the nests of *Solenopsis invicta* Buren, although another myrmecophilous aphodiine (*Myrmecaphodius excavaticollis* (Blanch.)) appears to be host specific with that ant. Specimens of both beetle species often are taken at light, although *E. castanea* rarely exceeds five specimens per collection.

The larva has been described and figured by Jerath (1906b) and is characterized as follows: clypeus with three setae on each side; frons with two posterior frontal setae and one anterior frontal seta; maxillary stridulatory area with more than seven teeth; raster with 55-71 tegillar setae; galea ventrally with a row of six or seven short setae, dorsally with four stout setae; lower anal lobe divided into two adjacent sub-lobes.

SPECIMENS EXAMINED: Over 460 (including specimens from Mexico and Guatemala), of which 448 were from 57 Florida localities, representing 149 collection records; (for complete data see Appendix 34).

SELECTED REFERENCES: Bates, 1889:393; Blatchley, 1914:91; 1928:24; 1932:20; Harold, 1870a:23-24; Hinton, 1936:273-274; Horn, 1871a:289-290; 1887: 86-87; Jerath, 1960b:69-70, Fig. 4, 20, 24, 31, 44, 45, 61 (larva); Schmidt, 1922a:390-391.

Genus ATAENIUS Harold

(Fig. 222-289)

Ataenius Harold 1867b:82.

TYPE SPECIES: *Ataenius scutellaris* Harold 1867b (by monotypy).

DIAGNOSIS: Small (length 2.5-5.5 mm) elongate, often subparallel, shining, alutaceous, or pubescent, red-brown to black. Head convex, smooth or punctate (Fig. 225), rarely tuberculate or with transverse rugulae (Fig. 226), usually bent downward, the eyes often hid-hidden in repose; clypeus dentate or not (Fig. 225); mandibles concealed. Pronotum without transverse depressions and swellings (Fig. 229), the lateral margin fimbriate or not. Elytra variable, but usually with the striae deeply impressed, often sculptured and the intervals convex, or flattened and punctate or smooth (Fig. 235-7, 246-8, 261-3, 268-70, 275-7, 281-3). Pygidium partly exposed, with a groove basally for reception of the ventrally dentate elytral apices; the exposed area often concave, rough, and commonly filled with soil. Mesosternum carinate or not Metasternum with elongate groove in center. Tibial structure variable but never with a transverse carina as in *Aphodius*, and posterior tibia never as arcuate as in *Euparia* and *Myrmecaphodius*. Outer apical angle always prolonged and often spiniform (Fig. 223-4). Tarsal segments usually long; never short and triangular in outline. Tibial spurs usually narrow, elongate, and acute (Fig. 230-1); never short, blunt, and spatulate-shaped. First segment of anterior tarsi always longer than the second.

TAXONOMIC NOTES: At present 41 described and several undescribed species are recognized from the U.S., of which 30 (including 4 new species) are found in Florida. Many of the species are very similar in general appearance, and they are difficult to identify without comparative material. It is often necessary to resort to the spinule of the posterior tibiae (Fig. 223-4) for distinction between members of the *strigatus* group. These characters are sometimes difficult to see unless the tarsi are positioned properly, and then only under good light and high magnification (90X). Characters of the venter often are obscured by poor mounting techniques, and care should be taken to bend the tip of the mounting point to make at least one half the venter visible.

The original manuscript for my treatment was completed in 1967. Blacklight trapping since then has provided well over 1 million additional specimens in this genus, many of which are still to be processed. The thousands of additional specimens which have been studied since 1967 have provided a better picture of the distribution, as well as adding several species to the list.

O. L. Cartwright (emeritus entomologist, U.S. National Museum of Natural History) has been the leading authority on this group for nearly half a century. He presently has in press a revision of the U.S. species

of *Aphotaenius*, *Pseudataenius*, and *Ataenius*. Much of my material has been sent to him for confirmation, resulting in many of the unfamiliar names appearing herein. He has graciously permitted me to use these changes in advance of the appearance of his revision. The formal synonymies for some of the names, as well as the names for new species, are not included here in deference to Cartwright's paper. Where certain name changes were noted too late for complete changing of the text, they have been indicated as footnotes.

The name *Ataenius* Harold often is cited as being described on page 100 of part 2 of the "Coleopterologische Hefte." Although this is where the formal description of the genus appeared, the name was actually proposed on page 82 of part 1, for the new species *scutellaris*. It presently includes several species that formerly were placed in *Euparia*. Chapin (1940: 12) stated that an earlier name, *Auparia* Duval, is not available because it was an intended emendation of *Euparia* Serville and therefore takes the same type as that genus.

Hinton (1937b) listed 24 characters which he considered the minimum ones necessary to properly describe each species of *Ataenius*. He also found that the male genitalia were the only characters to satisfactorily distinguish many species. Unfortunately very few descriptions of U. S. species have contained these suggestions. Much synonymy has resulted from poor descriptions and from authors studying only limited faunal areas.

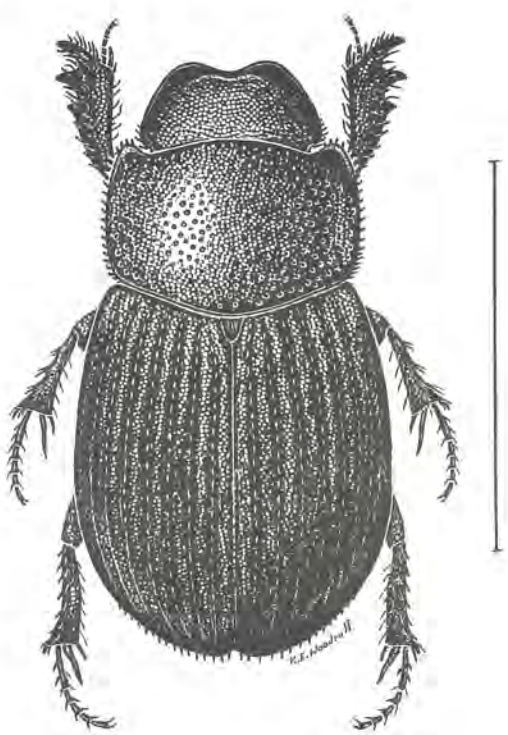


Fig. 222. **Ataenius saramari** Cartwr., line = 2.0mm.

DISTRIBUTION & ZOOGEOGRAPHY: Schmidt (1922a:415) recognized 130 species from all parts of the world. There are 41 presently recognized from the U. S., but there are also several undescribed species (Cartwright in litt.). Species appear to be more abundant in tropical and subtropical areas, with only a few entering the Palearctic region. Chapin (1940) recognized 27 species from the West Indies, of which 8 are found in Florida.

In Florida I have recorded 30 species, at least 4 of which are undescribed. Three others have been recorded from Florida, but they were not found in the present survey and probably do not occur in Florida. These are: *brevis* Fall, a species known only from mountainous areas except for the record of Florida in the second supplement to the Leng Catalogue (Leng and Mutchler, 1933:39); *stercorator* (Fab.), reported in earlier works, including Blatchley (1928:26-27), but said by Fall (1930:107-108) not to occur in North America; *cognatus* (Lec.) a name long misapplied by earlier workers (including Blatchley, 1928:27), but it is now known only from Texas and New Mexico according to Cartwright (1948b). There are single records only for the following four species: new species #1 (Big Pine Key), new species #3 (Flagler Beach), *abditus* (Macclenny, Baker Co.), and *wenzelii* (Wewahitchka, Gulf Co.).

BIOLOGY: With so many species, it is not surprising that the habits of the genus are diverse. In Florida, several species (e.g., *erratus, cylindrus, simulator, spretulus*) are found in cow dung. Others are known only from humus or leaf mold (e.g., *ovatulus, exiguus, rhyticephalus*) and probably are saprophagous. At least one (*insculptus*) appears to be confined to deer droppings, and another (*brevicollis*) has been found primarily in pack rat (*Neotoma*) dung. Another species (*brevinotus*) has been found in fox squirrel nests. Although probably saprophagous, *saramari* is found only in typical sandpine scrub. All of the Florida species except three (*insculptus, ovatulus, saramari*) have been taken at light, some of them in enormous numbers.

The larvae have been described for the following six Florida species (Jerath, 1960b): *ovatulus, rhyticephalus* (=*strigicauda, simulator* (=*schwarzi*) *erratus, imbricatus, and platensis*. Larvae of the genus are characterized by Jerath (1960b:70) as follows:

> Frons on each side with two posterior frontal setae and a microsensilla, a long seta at each anterior angle, a single long exterior frontal seta and a microsensilla, and a short anterior frontal seta and a microsensilla. Each antennal base with two long setae and one short seta exterolaterally and a long seta dorsally. Second and third antennal segments subequal, first long. Tormae asymmetrical; dexiotorma produced cephalad and caudad into an armlike structure; laeotorma shorter than dexiotorma and slightly produced cephalad and caudad with ends blunt. Scissorial area of left mandible with S1+2, S3, and S4. Galea centrally with four or five short

setae, dorsally with three stout setae. Lacinia dorsally with a row of five long setae near the mesal edge and a short seta posteriorly. Labial palp 2-segmented. Spiracular concavity facing ventrally. Lower anal lobe divided into two distinct sublobes.

SELECTED REFERENCES: Blatchley, 1928:24-27; Cartwright, 1934a:200-201; 1939b:360-361; 1941:33; 1943:108; 1944b:28-29; 1945:47, 1948b:147-153; 1965: 101-104; Chapin, 1940:12-40; Fall, 1930:93-108; Harold, 1867b:82; 1867c:100; 1874a:15-25; Hinton, 1937:177-196; Horn, 1871a:284-297; 1887:67-86; Jerath, 1960b:70-80 (larvae); Schmidt, 1922a:413-459.

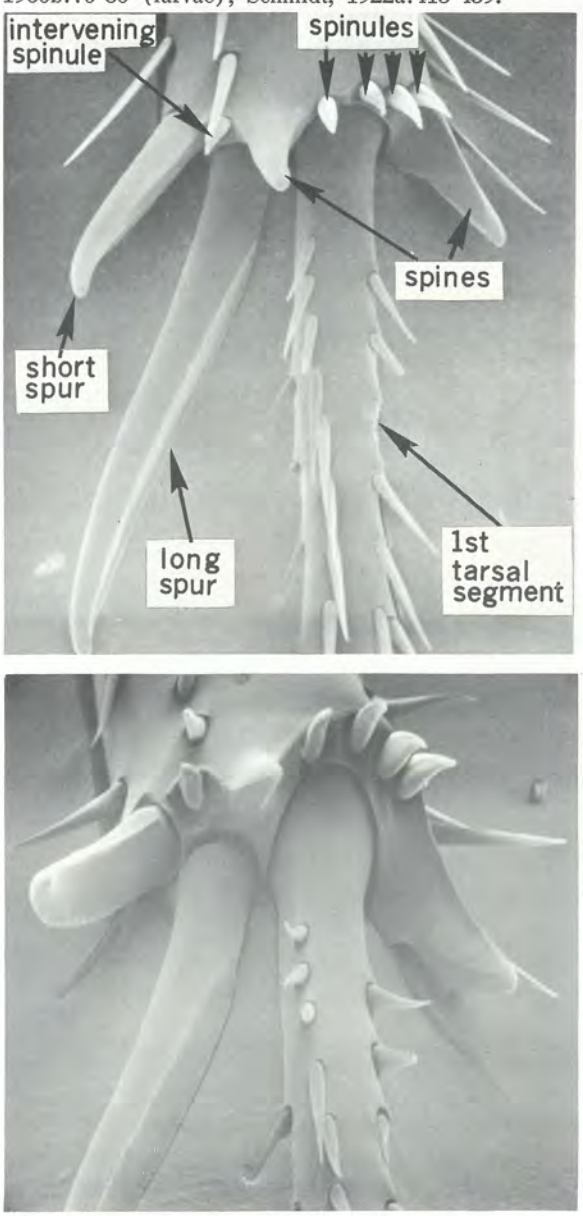


Fig. 223-224. Stereoscan photos of posterior tibial apex of **Ataenius picinus** Har., showing key taxonomic characters for the genus: 223) dorsal view, 145X, 224) oblique view, 145X.

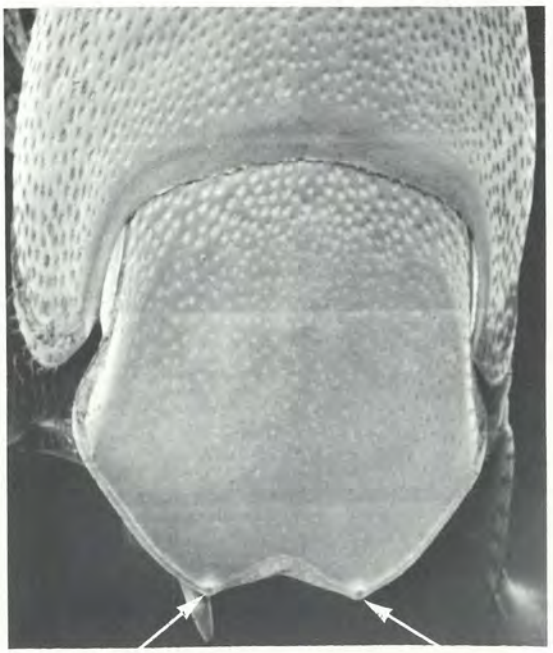


Fig. 225. Stereoscan photo of head of **Ataenius cylindrus** Horn (50X). Note teeth at arrow, described as dentate clypeus.

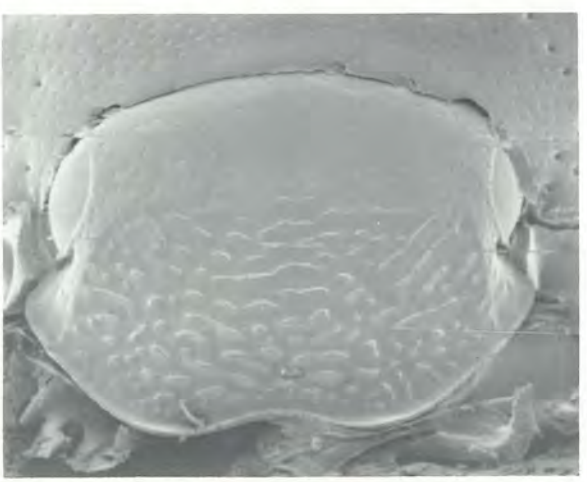


Fig. 226. Stereoscan photo of head of **Ataenius simulator** Har. (50X). Note transverse rugulae, but margin without teeth.

Key to the Florida species of Ataenius

(excluding three undescribed species discussed in the text)

1. Elytra dull, subopaque, opaque, argillaceous alutaceous, or pubescent (e.g., Fig. 235-7, 246-8 2
1'. Elytra shining, never argillaceous or pubescent (often short blunt setae present, but never long pubescence) (e.g., Fig. 268-70, 275-7, 281-3) 6

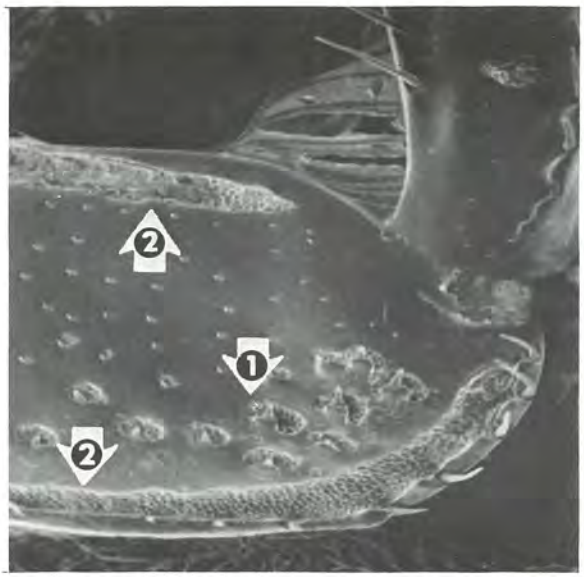


Fig. 227. Stereoscan photo of anterior femur (ventral view) of **Ataenius picinus** Har. (105X). Sensor at arrow 1 enlarged in Fig. 228. Arrow 2 indicates areas called anterior and posterior lines.

Fig. 228. Stereoscan photo of sensor shown in arrow 1 of Fig. 227 (1050X).

Fig. 229. Stereoscan photo of **Ataenius cylindrus** Horn, showing pronotal puncture pattern (oblique view, 42X).

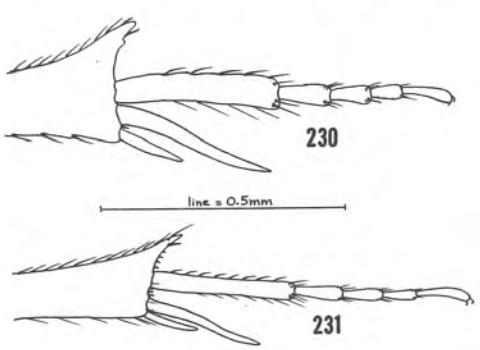


Fig. 230-231. Posterior tibiae and tarsi of **Ataenius** spp.: 230) **A. simulator** Har., 231) **A. platensis** Blanch.

2(1). Elytral intervals carinate and the alternate ones higher, at least on the apical one-fourth 3

2'. Elytral intervals flat, convex, or weakly carinate, the alternate ones not higher even on the apical one-fourth.....4

3(2). Clypeus dentate, the head punctures smaller and sparser on the anterior half; elytral striae crenate each side; elytral intervals only minutely alutaceous between, noticeably alternately higher only on the apical declivity; found only in deer droppings, not known to be attracted to light.....*insculptus* Horn

3'. Clypeus without teeth, the punctures coarse and dense over the entire head; elytral intervals alutaceous except for the bare top of the carinae, alternately higher throughout; common at light; (Fig. 235-7).....*alternatus* Melsh.

4(2'). Head, pronotum, and elytra feebly shining, minutely alutaceous but never argillaceous; elytral intervals feebly carinate, the setae fine, short, and inconspicuous (Fig. 261-3).....*miamii* Cartwr.

4'. Head, pronotum, and elytra completely argillaceous, gray; elytral intervals convex, or partly carinate, the setae coarse, short, golden, and conspicuous 5

5(4'). Pronotal punctures very coarse, many coalescing, forming reticulate ridges between; body shape more oval; elytral intervals weakly carinate (Fig. 246-8); lateral pronotal margin evenly rounded, setae straight, fine, truncate, but not enlarged or spatulate on tip; extreme south Florida (Lower Keys & Dry Tortugas) ..... *havanensis* Balth.*

5'. Pronotal punctures coarse but distinct, at least some bare areas between at posterior center; body shape more elongate, parallel-sided; elytral intervals flattened; lateral pronotal margin angulate at posterior one-fourth, the sides nearly parallel, setae flattened, sometimes enlarged or spatulate at tip; common and wide-ranging species..... ..... *imbricatus* (Melsh.)*

6(1'). Clypeus dentate or strongly angled each side of median emargination.....7

6'. Clypeus without teeth, broadly rounded each side of median emargination.....13

7(6). Pronotum fimbriate laterally with long setae; larger species (length 4 mm); known only from Ft. Lauderdale south (=*linelli* Cartwr.) ..... *languidus* Schmidt

7'. Pronotum entire laterally or with minute short setae; smaller species (length 2.5-3.5 mm); some species widely distributed.....8

8(7'). Elytra oval in outline; pronotum short and broad, the punctures irregular on disc, leaving several bare areas; rare species in Florida 9

8'. Elytra more elongate; pronotum more elongate, the punctures coarse, leaving few bare areas; some common Florida species.....10

9(8). Clypeal teeth prominent; posterior one-third of elytral intervals not gray nor noticeably eroded on sides; rare species, throughout peninsula .....*ovatulus* Horn

9'. Clypeal teeth barely visible; posterior one-third of elytral intervals gray, eroded each side; found primarily in packrat nests in South Florida; (=*frankenbergeri* Balth.).... ..... *brevicollis* Wollaston

10(8'). Elytral intervals weakly carinate throughout, punctures few and inconspicuous; marginal line of posterior femur deep and entire; more convex species; (Fig. 225, 229)..... ..... *cylindrus* Horn

10'. Elytral intervals convex, not carinate, nearly impunctate or punctures obvious and arranged primarily on the outside of each interval; marginal line of posterior femur absent; more elongate, less convex.....11

11(10'). Smaller (length 2.5-3 mm); area between pronotal punctures microreticulate, presenting a dull appearance; clypeal teeth less prominent; common in Florida.....*exiguus* Brown

11'. Larger (length 3.5-4.3 mm); area between-pronotal punctures shining; two rare Florida species, represented by single records each from northern areas (Baker & Calhoun Co.) 12

12(11). Larger (4-4.3 mm), shiny black; pronotal punctures of two sizes, scattered, not coalescing even on sides; elytral intervals very finely punctate (barely visible at 90X); pygidium smooth, shining; single Florida record (Blountstown, Calhoun Co.)...*figurator* Har.

12'. Smaller (3.5-4 mm) dull black (finely alutaceous in part); pronotal punctures nearly all of one size, coarse, and coalescing on sides; elytral intervals noticeably punctate (at 90X); pygidium coarsely punctate, eroded; single Florida record (Macclenny, Baker Co.)..... ..... *abditus* Hald.

13(6'). Pronotum and elytra margined with short blunt setae; small (length 2.75-3 mm), convex; elytra ovate in outline (found only in litter under sand pine [*Pinus clausa*], not attracted to light); or larger (length 4 mm); elytral intervals eroded each side on apical one-third (primarily in packrat nests in south Florida) 28

13'. Pronotum margined or not, but elytra without marginal setae; larger (length 3-6 mm), convex or flattened above; elytra usually subparallel; attracted to lights.....14

14(13'). Pronotum unusually short (barely more than one-third the length of elytra); larger (length 5-5-6 mm); basal and lateral pronotal margin non-fimbriate; rare species, in squirrel nests and occasionally at light..*brevinotus* Chapin*

14'. Pronotum not noticeably short (nearly one-half the length of elytra); smaller (length 3-5.5 mm); basal and/or lateral pronotal margin fimbriate; some common species at light 15

15(14'). Small (length 3 mm), elongate, somewhat flattened above; pronotum with median basal longitudinal depression; punctures of the head elongate, often coalescing...*gracilis* (Melsh.)

15'. Larger (length 4-5.5 mm), elongate, convex, not noticeably flattened above; pronotum without median basal longitudinal depression; punctures of head variable but never elongate and coalescing 16

*Both species appear dirty or incrusted, due to surface sculpture shown in Fig. 246-248.

*Now considered by Cartwright to be an undescribed species near *brevinotus*.

16(15'). Head granulate to rugose from clypeus to the eyes (Fig. 226); first segment of posterior tarsus shorter than long tibial spur (Fig. 226, 230) ..... *simulator* Har.

16'. Head not granulate or rugose, although sometimes weakly wrinkled; first segment of posterior tarsus longer than or equal to long tibial spur (Fig. 231) 17

17(16'). Accessory spine of middle and posterior tibiae adjajcent to the short spur, without an intervening spinule..... *erratus* Fall

17'. Accessory spine of middle and posterior tibiae separated from the short spur by one of the terminal spinules (Fig. 223-4) 18

18(17'). Antero-median area of pronotum without coarse punctures; smaller (length 4 mm), dark brown; base of head with large bare areas between punctures, or the punctures fine and scattered 26

18'. Antero-median area of pronotum usually with some coarse punctures; larger (length 4.5-5.5 mm), black; base of head with a band of coarse punctures 19

19(18'). Posterior tibial fringe of four spinules (Fig. 223-4); ninth elytral interval finely, closely punctate, the remaining intervals less densely punctate (Fig. 268) ..... *picinus* Har.

19'. Posterior tibial fringe of more than four spinules; ninth elytral interval not punctate different from the remainder (Fig. 275) 20

20(19'). Elytral intervals on lateral and apical one-third coarsely punctate as are the humeri; pronotum coarsely, densly punctate at the sides, but coarse punctures nearly absent on median one-third (=*strigicauda* Bates of auct. in part) ..... *rhyticephalus* (Chevr.)

20'. Elytral intervals and humeri not coarsely punctate anywhere; pronotal punctures often coarser at the sides, but the median area also with scattered coarse punctures.....21

21(20'). Coarse pronotal punctures nearly uniformly distributed, rarely any large areas without coarse punctures; elytral intervals less convex, noticeably punctate and microalutaceus (Fig. 281-3); species primarily from the coast..22

21'. Coarse pronotal punctures scattered; often large areas without coarse punctures; elytral intervals feebly convex, almost imperceptibly punctate, not microalutaceus (Fig. 275-6); some common species, not confined to the coast 23

22(21). Elytral intervals flattened; shape of elytra together more oval; single Florida record (Wewahitchka, Gulf Co.) and probably found only in western Florida panhandle..... ..... *wenzelii* Horn*

22'. Elytral intervals at least partly convex; shape of elytra together more elongate, parallel sided; common in some coastal areas, especially the Florida Keys.....*rudellus* Fall*

23(21'). Posterior tibial spinules usually 6 (5 to 8); area behind the clypeus rarely with any transverse wrinkles 25

23'. Posterior tibial spinules usually 5 (4 to 6); area behind the clypeus with at least a few transverse wrinkles 24

24(23'). Profemur shiny, with very few fine punctures on posterior face; pronotal punctures irregularly scattered, the fine punctures not prominent; rarely do coarse punctures coalesce in anterior angles; common species in the peninsula .....*spretulus* (Hald.)

24'. Profemur with numerous coarse punctures on posterior face, noticeable; coarse pronotal punctures denser, especially at sides and anterior angles where some usually coalesce; in Florida probably limited to northern counties, few records .....*strigatus* (Say)

25(23). Apical elytral declivity eroded each side; clypeus with transverse rugulae for at least half head length; north Florida, rare .... *apicalis* Hinton

25'. Apical elytral declivity normal, not eroded each side; clypeus punctate, transverse rugulae not present; common in Florida peninsula .....*fattigi* Cartwr.

26(18). Elytral intervals noticeably punctate, shining, not minutely alutaceus (Fig. 275-6); pronotum convex, the coarse punctures larger and deeper; common Florida species 27

26'. Elytral intervals nearly impunctate, minutely alutaceous; pronotum somewhat flattened, the coarse punctures smaller, shallower, and more scattered; known in Florida only from Key West and Everglade[?] (=*luteomargo* of my original ms.) ....*waltherhorni* Balth.

*The two species in couplet 22 are difficult to distinguish and their validity has been questioned. Since they appear to occupy different geographic areas they are maintained as distinct here.

27(26). Base of head with a band of coarse punctures; more coarse punctures found in antero-median area of pronotum; few scattered Florida records ..... *integer* Har.*

27'. Base of head with fine scattered punctures; antero-median area of pronotum nearly devoid of coarse punctures; common Florida species ..... *platensis* (Blanch.)*

28(13). Smaller (length 2.75-3 mm), convex, oval; clypeus smoothly rounded; elytral intervals not noticeably eroded anywhere; found only in litter under sand pine (*Pinus clausa*); (Fig. 366-7) ..... *saramari* Cartwr.

28'. Larger (length 4 mm), more elongate, parallel-sided; clypeus angulate to weakly dentate, not smoothly rounded; elytral intervals eroded on each side on apical one-third; found primarily in packrat nests in south Florida (=*frankenbergeri* Balth.) .... *brevicollis* Wollaston

Ataenius abditus (Haldeman)

Aphodius (*Oxyomus*) *abditus* Haldeman 1848:106.
Euparia abdita (Hald.), LeConte 1863b:36.
Ataenius abditus (Hald.), Gemminger & Harold 1869: 1066.
Ataenius attenuator Harold 1874a:22.
Ataenius jalapensis Bates 1887:100.

DIAGNOSIS: Small (length 3.5-4 mm), elongate, subparallel, shining, black. Clypeus dentate, head moderately coarsely and rather densely punctured, the punctures finer anteriorly, with extreme anterior margin impunctate and feebly rugose. Pronotum appearing without lateral setae, but in reality setae are present although very short, fine and appressed against the margin; puctures coarse, dense, becoming slightly sparser and finer anteriorly. Elytral striae moderately fine, the strial punctures coarse and off center, encroaching on the inner margin of each interval; intervals nearly flat, single row of fine punctures along the outer margin. In its elongate, parallel, dorsally flattened appearance it is similar to *gracilis* and *exiguus*. The former does not possess clypeal teeth, and the latter is smaller (length 2.5-3 mm) and the pronotal surface is microreticulate and dull between the punctures.

TAXONOMIC NOTES: Horn (1887:72-73) synonymized *attenuator* Har., and *jalapensis* Bates was listed as a synonym by Blackwelder (1944:213). Two subspecies (*texanus* Har. and *exiguus* Brown) have been described, but these are now considered valid species. Many of the earlier records confused the three forms and are thus unreliable. Sufficient variation exists to suggest that, over the broad geographic range reported, possibly several closely related species are presently unrecognized. A critical study of large series of specimens will be necessary to elucidate the situation.

*The two species separated in couplet 27 have long been considered synonyms. Cartwright (in litt. 1972) now believes they are distinct, although he had difficulty placing many of my specimens (see text for further discussion).

Fig. 232. Florida distribution of three **Ataenius** spp.: 1) **A. apicalis** Hinton, 2) **A. abditus** (Hald.), 3) **A.** n.sp. #3.

DISTRIBUTION & ZOOGEOGRAPHY: Most published distribution records are subject to the taxonomic confusion just mentioned. Blatchley's records (1928:25) from Ft. Capron, Haulover, and Enterprise, Florida, are probably all referable to *exiguus* Brown. The true *abditus* appears to be a more northern species, although recorded from Haiti (Chapin, 1940:21). If the synonymy of *jalapensis* is correct, it is found also in Mexico. I have seen only a single Florida specimen, from 5 miles west of Macclenny (Baker County).

BIOLOGY: Although apparently rather common in some parts of its range, it is rare in the two states (Ohio and Florida) where I have collected extensively. I have seen two specimens taken at light in Wisconsin. I collected it on dead fish on a sandy beach at Lake Erie and in human dung along a sandy creek bank in central Ohio. One specimen was labeled "from around woodchuck burrow." The single Florida specimen was taken in a Berlese funnel sample from "litter at log." The immature stages are unknown.

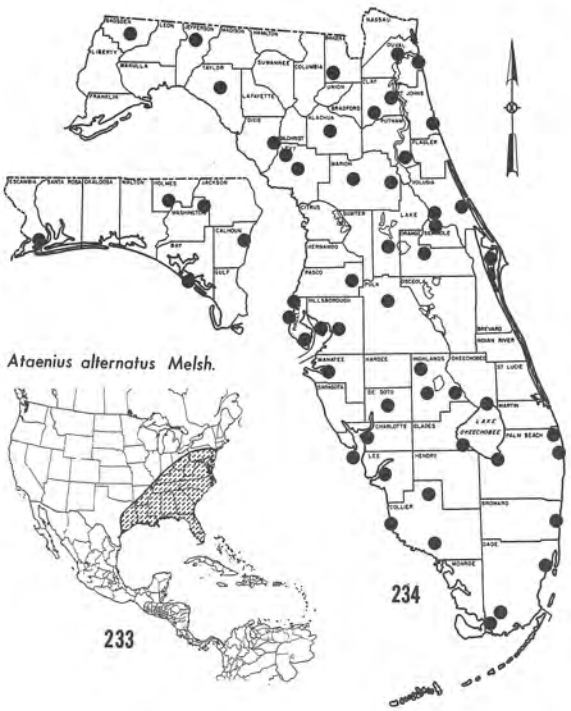
SPECIMENS EXAMINED: Eight, of which only one was from Florida as follows: Baker Co., 5 mi. W. Macclenny, 21-VIII-65, W. Suter, litter at log.

SELECTED REFERENCES: Bates, 1887:101; 1889: 394; Blatchley, 1910:926-927; 1928:25; Brown, 1932: 10; Chapin, 1940:20-21; Dillon and Dillon, 1961:522, Pl. 50, Fig. 14; Horn, 1871a:289; 1875:142; 1887:72-73; Schmidt, 1922a:449.

Ataenius alternatus (Melsheimer)

(Fig. 233-7)

Oxyomus alternans Dejean 1836:163 (nomen nudum).
Oxyomus alternatus Melsheimer 1845:137 (often cited as 1844).
Euparia alternatus (Melsh.), LeConte 1863b:37.
Ataenius alternatus (Melsh.), Gemminger and Harold 1869:1066.



DIAGNOSIS: One of the most distinctive species in the genus. The dull alutaceous appearance and the alternately raised elytral intervals (Fig. 236) that are black and bare on the carinate tips immediately distinguish it from all our other species.

TAXONOMIC NOTES: No other species are known that are very similar and thus there are no specific synonyms. Variation is minimal and only barely noticeable in size.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 233-4). It was recorded by Horn (1887:75) from Pennsylvania (type locality) to Florida west to Texas. It was previously recorded from Florida by Blatchley (1928:25-26), Dozier (1918:333), and Frost (1964:142) Blatchley's records were mainly from the northern part of the state south to Sarasota, Okeechobee, and Ft. Myers. I have found it in all areas of the state except the Keys.

BIOLOGY: This in one of the most common species in Florida, although it appears to be less so in the northern part of its range. However, practically nothing is known of its biology since nearly all specimens have been taken at light. As many as 5,000 have been taken in a single blacklight trap sample (Highlands Co., 25-VII-61). Blatchley (1928:26) recorded specimens from beneath weed debris near water, and I have seen other specimens from Berlese samples of *Pinus clausa* litter and mahogany butress debris. Florida specimens were collected every month of the year except December and January. The immature stages are unknown.

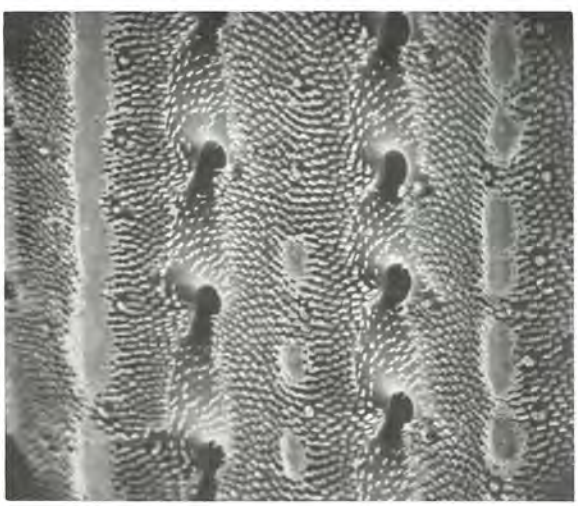


Fig. 235-237. Stereoscan photos of left elytron of **Ataenius alternatus** (Melsh.): 235) 89X, 236) 215X, 237) 956X.

SPECIMENS EXAMINED: More than 15,000 from 59 Florida localities, representing 241 collection records (for complete data see Appendix 36).

SELECTED REFERENCES: Blatchley, 1910:925; 1928: 25-26; Dozier, 1918:333; Frost, 1964:142; Horn, 1871a: 285; 1887:75; Schmidt, 1922a:442.

Ataenius apicalis Hinton

Ataenius apicalis Hinton 1937a:195-196, Fig. 40-44.

DIAGNOSIS: A large black species with the posterior one-fourth of the elytra (declivity) eroded on the sides of each elytral interval. The only other Florida species with similar posterior is *brevicollis* Wollaston, a smaller (about 4 mm) species which can easily be distinguished by the characters in the key. Except for the eroded sides of the posterior elytral intervals, *apicalis* is almost identical to *fattigi* Cartwr.

TAXONOMIC NOTES: There is apparently no confusion in the history of the species. It may have been confused in some past literature with other members of the *strigatus* complex (e. g., *spretulus, fattigi, cognatus, strigatus*).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 232) It was originally described from Minatitlan, State of Veracruz, Mexico. Cartwright (1948b:151) recorded it from Alabama, Georgia, Louisiana, Mississippi, South Carolina, Texas, and Virginia. I have also collected it in Ohio (new state record). The two Florida specimens came from Torreya State Park (Liberty Co.), a locality well known as a relictual area for northern species which inhabit the cool ravines of the Apalachicola River.

BIOLOGY: There appears to be no published biological information on this species. My Ohio specimens were collected in raccoon dung on a large oak log. In Alabama I collected a long series in cow dung on the sandy borders of a swamp forest. The two Florida specimens were collected in a blacklight trap.

SPECIMENS EXAMINED: 75, of which only 2 were from a single Florida locality: (2) Liberty Co., Torreya State Park, 15-16-VIII-68, H. V. Weems, Jr., blacklight trap.

SELECTED REFERENCES: Aside from the original description, the only reference is that of Cartwright (1948b:151).

Ataenius brevicollis (Wollaston)

Oxyomus brevicollis Wollaston 1854:229.
Ataenius brevicollis (Wollaston), Gemminger & Harold 1869:1066.
Ataenius frankenbergeri Balthasar 1938:56-57.

DIAGNOSIS: The clypeus of this species is angulate each side of the median indention and sometimes appears dentate. This is why it appears in two places in the key. It is not similar to any of the Florida species, but it shares with *apicalis* the eroded sides of the elytral intervals on the posterior declivity. It is smaller (3.8-4 mm versus 4.5-4.8 mm) than *apicalis* and is distinguished easily from it and all other Florida species by the characters in the key.

TAXONOMIC NOTES: Cartwright (in litt. 1972, and on specimen labels) has indicated the above synonymy. I have seen only Florida specimens. The type locality is in the Madeira Islands. I have some reservations in accepting the Florida and Madeira Islands specimens as conspecific, especially since nearly all my material (422 specimens) was collected in the nests of an endemic packrat.

Chapin (1940:41), in an addendum to his paper on West Indian Aphodiinae, indicated that *frankenbergeri* ". . . is the species that I have here considered to be *A. sulcatulus* (Chevrolat). While the identification is not fully established, sufficient variation in the series from Baragua [Cuba] was noticed to make such an identification highly probable." Blackwelder (1944) listed both *frankenbergeri* Balth. and *rhyticephalus* Chevr. as synonyms of *sulcatulus* Chevr.

In my original dissertation (1967) I listed this as new species #1 after specimens had been referred to Cartwright for confirmation. The following year (Cartwright, 1968:27) revived the name *frankenbergeri* from synonymy under *sulcatulus* and recorded it from the U. S. for the first time. Several of my specimens were recorded in that paper.

DISTRIBUTION & ZOOGEOGRAPHY: The type of *brevicollis* came from the Madeira Islands and was subsequently recorded also from the Canary Islands. The type of *frankenbergeri* came from Cuba. Under *frankenbergeri*, Cartwright (1968:27) recorded it from: Brazos, Texas; Gulfport, Mississippi; Dade Co., New Smyrna, and Key Largo, Florida. Except for those from Key Largo, I have seen only one from Dade Co. and one from Gainesville, Florida.

BIOLOGY: Nothing has been published on the biology of this species. It appears to inhabit islands. My specimens were nearly all collected in the nests of an endemic packrat *(Neotoma floridana smalli* Sherman*)* on Key Largo (Fig. 73). Larvae and pupae were also found in dung in the nests, but they will be formally described elsewhere. Most of the packrat nest specimens were taken by collecting debris and running it through a modified Berlese funnel. It probably occurs throughout the year, but specific records are lacking for Feb., Aug., Oct., and Nov.

Blacklight traps were operated on several occasions within a few feet of the packrat nests, but no *Ataenius* were collected. There are two other records (2 specimens) of the species at blacklight traps.

SPECIMENS EXAMINED: 422 from 3 Florida localities, representing 14 collection records as follows: (1) Alachua Co., Gainesville, 1-7-VIII-56, L. A. Hetrick, blacklight trap; (1) Dade Co., Miami, 13-IX-60, P. E. Briggs, blacklight trap; Monroe Co., North Key Largo by R. M. Baranowski, L. J. Bottimer, B. K. Dozier, J. H. Knowles, R. W. Swanson, and R. E. Woodruff with the following numbers and dates: (10) 18-III-60; (10) 7-VI-60; (1) 30-VI-60; (159) 7-XII-66; (1) 26-I-68; (82) 5-III-68; (33) 22-III-68; (8) 5-VI-68; (42) 25-VII-68; (24) 6-IX-68; (31) 8-V-69; (20) 25-VI-69.

SELECTED REFERENCES: Cartwright, 1968:27; Chapin, 1940:41; Schmidt, 1922a:437; Wollaston, 1857: 79; 1864;191; 1865:179.

Ataenius brevinotus Chapin[1]

Ataenius brevinotus Chapin 1940:39-40.

DIAGNOSIS: One of the largest species in the U. S. (length 5-6 mm). Pronotum exceptionally short and broad for the genus, and elytra broadest at the posterior one-third. Pronotum without lateral marginal setae, the anterior angles rounded and slightly produced anteriorly; punctures generally coarse and dense, extending to and including the lateral margin (not noticed in any other species). Elytral striae fine, the punctures distinct but not conspicuous; intervals nearly flat, minutely alutaceous with a few very fine punctures. Posterior femur slender, subparallel, the posterior marginal groove entire.

TAXONOMIC NOTES: Chapin (1940:39-40) suggested that this species ". . . is apparently an intermediate between the typical *Ataenius* and typical *Euparixia*." It is very unlike most *Euparixia*, and in general habitus resembles only *costaricensis* Hinton. In addition, all the species of *Euparixia*, for which the habits are known, occur in leaf-cutting ant (Attini) nests (Woodruff and Cartwright, 1967), whereas *A brevinotus* is associated with squirrel nests.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 238-9). It was described from a unique specimen from Baragua, Cuba and previously not reported from the U. S. However, specimens have been known from Florida since 1946. It probably occurs over a much wider range than indicated on the map, and may be coextensive with the southeastern forms of the fox squirrel. It is known presently from Gainesville and Welaka south to Miami.

BIOLOGY: It apparently is associated exclusively with fox squirrel nests, where it is probably coprophagous. It was taken on a few occasions at light and once in a Steiner fruit fly trap. Most of the records are for May, with one each for January and July. The immature stages are unknown.

[1] Cartwright (in litt.) has indicated that this is a new species near *brevinotus*.

*Fig. 238-239. Florida specimens are now considered by Cartwright (in litt.) to be a new species near **brevinotus** Chapin.

SPECIMENS EXAMINED: Six from four Florida localities as follows: (2) Alachua Co., Gainesville, 17-V-66, J. W. Perry, blacklight trap; (1) Dade Co., Matheson Hammock, 2-V-51, D. R. Paulson, at light; (1) Hillsborough Co., Plant City, 14-V-66, T. J. Favoroso, Steiner trap; (2) Putnam Co., Welaka, 25-VII-46, J. C. Moore, *Sciurus niger* nest. In addition, O. L. Cartwright supplied the following records from the U. S. National Museum: Alachua Co., 7 mi. N. Gainesville, 22-I-47, J. C. Moore, *Sciurus niger* nest; Manatee Co., Oneco, Paula Dillman, at light; Pinellas Co., Dunedin, 14-V-59, O. L. Cartwright, at light.

SELECTED REFERENCES: Nothing has been published on this species except the original description.

Ataenius cylindrus Horn

Oxyomus cylindrus Dejean 1836:136 (nomen nudum).
Ataenius cylindrus Horn 1871a:289.
Ataenius hornii Harold 1874a:19.
Ataenius cylindricus Horn, Slosson 1893:148 (misspelling).

DIAGNOSIS: Small (length 3.2-4 mm), elongate, oval, shining, black. Clypeal teeth well-developed and conspicuous. Elytral intervals subacutely carinate, and the

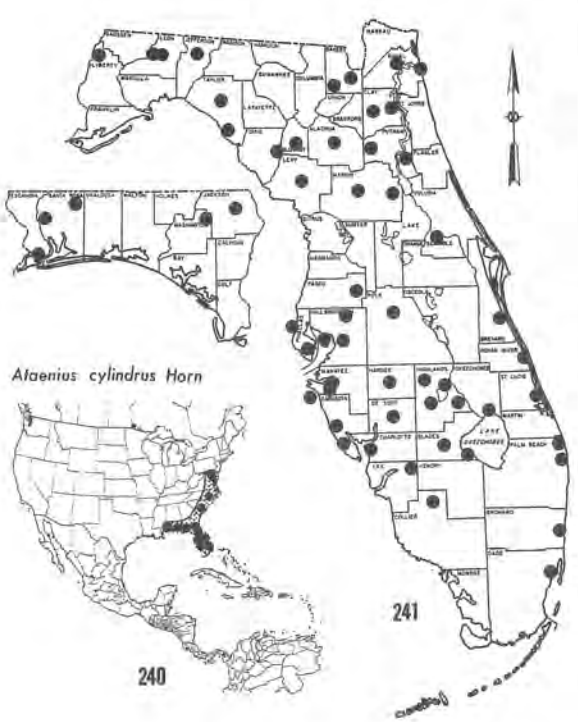
pronotal punctures are evenly distributed; two characters which separate it from the superficially similar *ovatulus*. In addition, the latter is shorter, has a more oval, convex shape, and the pronotal punctures are deep and often are separated by convex bare areas.

TAXONOMIC NOTES: The peculiar misspelling of Slosson (1893:148) was perpetuated in the "Coleopterorum Catalogus" (Schmidt, 1910b:74) and the "Genera Insectorum" (Schmidt, 1910a:106). Horn (1875: 142) synonymized *lecontei* Har. and *ovatulus* Horn under this name, but the latter is a valid species with *lecontei* as a synonym.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 240-1). It was listed by Horn (1887:71) from North Carolina to Florida and subsequently recorded from District of Columbia (Ulke, 1902:24), Alabama (Loding, 1945:100), South Carolina (Cartwright, 1950:72), and northern part of Florida south to Ft. Myers and Palmdale (Blatchley, 1928:25).

Earlier Florida records include Pensacola and Suwannee Springs (Slosson, 1893:148, 150); and Archbold Biological Station (Frost, 1964:142). My records include nearly all parts of the state from Pensacola to Miami, but it has not been found in the Everglades or the Keys.

BIOLOGY: This is a common species at light and in cow dung. Fresh dung does not appear to be attractive, and specimens were found only in half dry dung which was several days old. Specimens have been taken in Florida every month except November. The immature stages are unknown.



SPECIMENS EXAMINED: 1,025 from 62 Florida localities, representing 139 collection records (for complete data see Appendix 37).

SELECTED REFERENCES: Blatchley, 1928:25; Horn, 1887:71; Schmidt, 1922a: 454-455; Slosson, 1893: 148, 150.

Ataenius erratus Fall

Ataenius erratus Fall 1930:96-97.

DIAGNOSIS: Large (length 5-5.5 mm), elongate, shining, black. A member of the *strigatus* group with an accessory spinule on the posterior tibia. It is the only Florida species in this group which has the accessory spinule next to the spur, without one of the spinules of the terminal fringe intervening. The general shape is distinctive but difficult to describe, the pronotum is relatively short and the elytra relatively long. The inner margins of the elytral intervals are unusually finely crenate, and the ventral abdominal segments are finely and nearly uniformly punctate.

TAXONOMIC NOTES: Males have the spur of the anterior tibia strongly incurved at the tip, and the elytra are less alutaceous than in the female (actually barely visible in either sex). Fall mentioned in the original description that the specimen referred to by Horn (1887:82) as a male of *strigatus* is probably *erratus*.

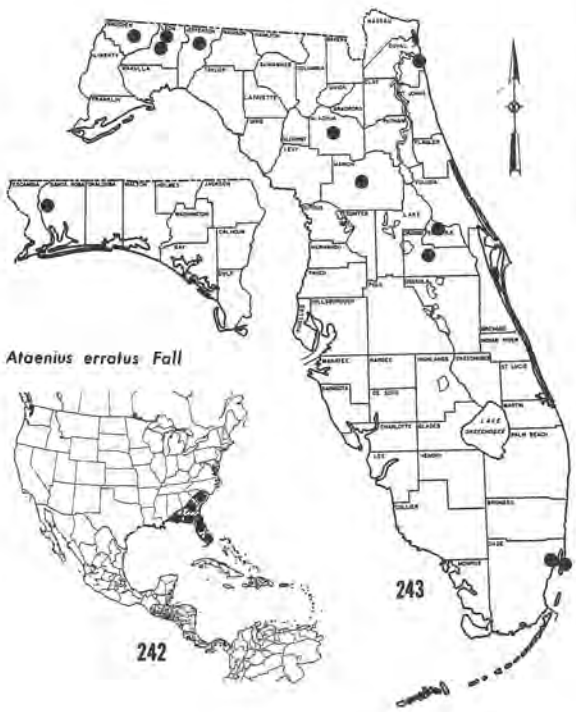
DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 242-3). Cartwright (1948b:149) recorded it from Florida, Georgia, and South Carolina. I have also seen specimens from Anniston, Alabama (new state record). In Florida I have seen specimens from Jay (Santa Rosa Co.) in the panhandle to Miami in the south, but the intervening records are spotty.

BIOLOGY: This species occurs in cow dung and is attracted to light. It is normally moderately common, but rarely is found in large numbers (e.g., 220 on 14-V-58 at Sanford and 100 on 31-XII-62 at Miami). It has been found from late May to early August except for Miami, where most specimens were taken in December. I have taken it in fresh to one-day-old cow dung, but always in bare sandy areas; once under the shade of a large live oak tree.

The larva has been described by Jerath (1960b: 77-78) and is characterized as follows: seventh and eighth abdominal segments broad, with the ninth and tenth narrow; stridulatory teeth on the stripes 20 or more; raster with teges of 44-50 hamate setae; clypeus not marked into pre-clypeus and post-clypeus; lower anal lobe divided into two distinct sublobes placed remote from each other; width of head capsule 1.32-1.35 mm.

SPECIMENS EXAMINED: 876 from 13 Florida localities representing 60 collection records (for complete data see Appendix 38).

SELECTED REFERENCES: Cartwright 1948b:149; Jerath, 1960b:77-78 (larva).



Ataenius exiguus Brown

Ataenius abditus exiguus Brown 1932:10.
Ataenius exiguus Brown, Frost 1964:142.

DIAGNOSIS: Small (length 2.5-3 mm), elongate, subparallel, brown to black, mostly shining. Closely related and similar to *abditus* (Hald.) but always smaller, the pronotum duller between the punctures, and body shape relatively different. Superficially similar to *gracilis* Melsh., but that species lacks clypeal teeth and has elongate punctures on the head.

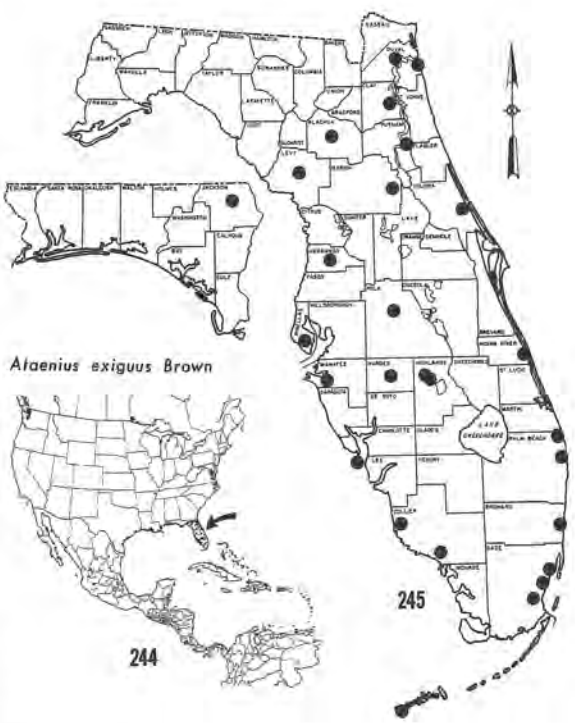
TAXONOMIC NOTES: It was originally described as a subspecies of *abditus* but is presently considered a distinct species. Although the two are closely related, no intermediate forms have been found, and specimens are normally easy to distinguish.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 244-5). The type locality is Homestead, Florida, and it has not been reported from outside of this state. Within Florida it has been found from Florida Caverns State Park (Jackson Co.) and Jacksonville (Duval Co.) south to Homestead (Dade Co.).

BIOLOGY: Very little is known about this species except that it is attracted to light. Although I took a single specimen in cow dung, it does not appear to be primarily coprophagous. Other label data includes: fruit of *Ocotea catesbyana*, at *Solanum tuberosum*, McPhail trap, and *Pinus clausa* debris. Six were floated from *Solenopsis geminata* nests at Payne's Prairie (Alachua Co.). The immature stages are unknown. It has been collected every month of the year except December and January.

SPECIMENS EXAMINED: Over 1,000 from 31 Florida localities, representing 92 collection records (for complete data see Appendix 39).

SELECTED REFERENCES: Nothing has been published on this species except the two references listed above in the synonymy.

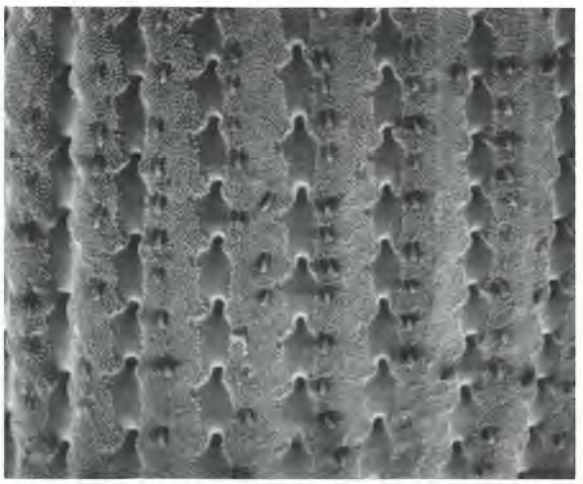


Ataenius fattigi Cartwright

Ataenius fattigi Cartwright 1948b:149, 151-153.

DIAGNOSIS: Large (length 4.5-6 mm), elongate, shining black. Another species in the *strigatus* complex; it is generally larger and shinier, the pronotum densely punctate at the sides, and the posterior tibial apex with five to eight spinules (the most common being six). Similar to *spretulus* in Florida but larger (length 4.5-6 mm as compared to 4.05-5.40 mm) and can be distinguished by the characters in the key. Also related to *apicalis* Hinton, but that species has the elytral intervals distinctly eroded over the apical one-fifth.

TAXONOMIC NOTES: As a member of the *strigatus* complex, it is related to *strigatus*, *spretulus*, and *api-*



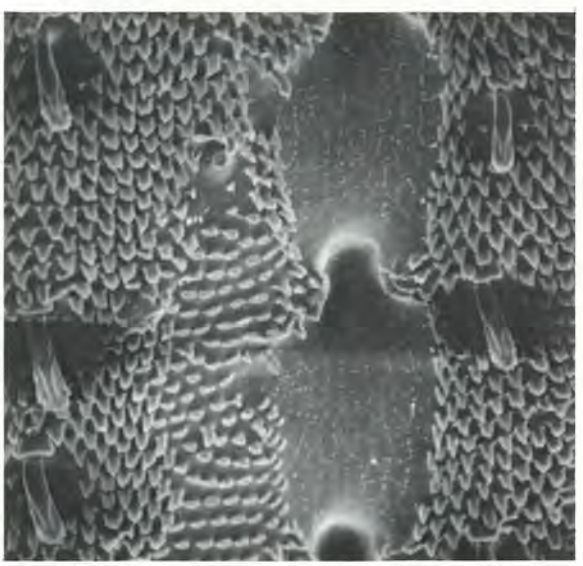


Fig. 246-248. Stereoscan photos of left elytron of **Ataenius havanensis** Balth: 246) 90X, 247) 459X, 248) 962X.

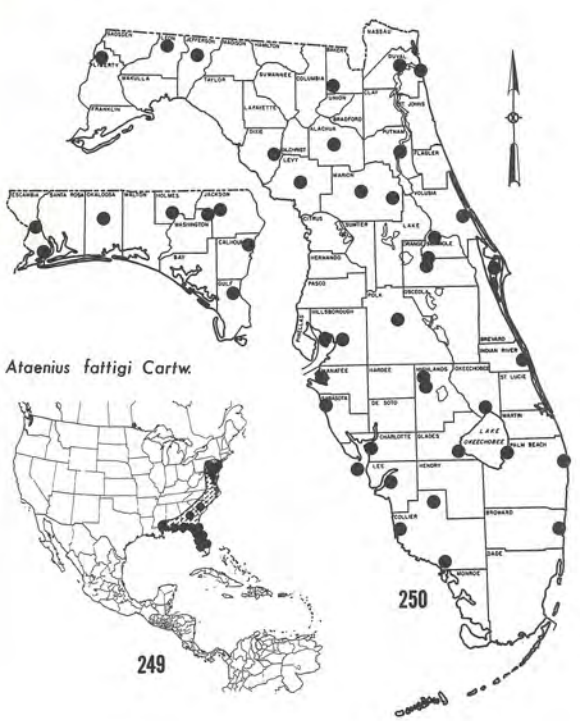
calis. The species of this group are difficult to identify without comparative specimens.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 249-50). It was originally described from Florida, Georgia, Maryland, Mississppi, New Jersey, Pennsylvania, and South Carolina (type locality: Georgetown County). Florida localities mentioned in the type series include Canal Point, Gainesville, Ft. Myers, Lake Alfred, Lake Lucy, Little Manatee River, Ocala National Forest, and Tampa. My records include most of the state from Pensacola to Ft. Lauderdale; it has not yet been found in the Everglades, Miami, or the Keys.

BIOLOGY: Cartwright (1948b:153) indicated that over eightly percent of his specimens ". . . were found under broken leaves, twigs, and surface litter along paths on hard ground in woodlands; two were found in a burned over woods, and a few were taken in trap lights." In Florida it is sometimes extremely abundant at light (e.g., over 1,000 from Lake Letta Subdivision, near Avon Park, 22-VIII-61), but I have never found it in cow dung. Two specimens were seen from "subcortical log with *Passalus*," and other were reported as possible pests of "Tidwarf Bermuda grass." In Florida it has been found every month except January. The immature stages are unknown.

SPECIMENS EXAMINED: Over 2,848 from 52 Florida localities, representing 141 collection records (for complete data see Appendix 40).

SELECTED REFERENCES: Frost, 1964:142; Jerath and Ritcher, 1959:172-173.



Ataenius figurator Harold

Ataenius figurator Harold 1874:24.

DIAGNOSIS: Easily distinguished from all other Florida species by the convex, smooth, shining pygidium. The other species have the pygidium heavily sculptured. It is dark, shiny black; legs reddish brown; form elongate, sub-parallel; clypeus dentate; posterior femur without marginal groove; posterior tibia without accessory spine; length 3-4 mm.

TAXONOMIC NOTES: The name *figurator* Harold (1874, type locality: Louisiana) often has been cited as a synonym of *haroldi* Steinheil (1872, type locality: San Luis, Argentina). Horn (1887:79-80) recognized *figurator* as valid after examining a cotype. He compared *haroldi* to specimens from "Indian Territory and Arizona," but was not willing to consider them the same. Schmidt (1922a:435) recognized both species as distinct. Chapin (1940:15-16) synonymized *figurator* under *haroldi*. Cartwright (in litt.) has indicated that there is a complex of species near *figurator* which will be clarified in his revision in press. He has seen my Florida specimens and labeled them as *figurator*.

Fig. 251. Florida distribution of **Ataenius figurator** Har.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 251) The type locality is Louisiana, without specific locality. Horn (1887) listed it from Georgia, Louisiana, and Texas. Until the taxonomy is clarified it is not possible to determine which of the literature records (especially those of Chapin from the West Indies) refer to this species. In Florida it is known only from two localties (Blountstown, Calhoun Co.; Tall Timbers Res. Sta., Leon Co.) in the extreme northern part of the state.

BIOLOGY: Nothing has been published on its biology. All the specimens I have seen were collected at light.

SPECIMENS EXAMINED: Over 200, of which only 1 was from Florida as follows: (1) Calhoun Co., Blountstown, 3-IX-68, H. Paulk, blacklight trap. Cartwright (in litt.) listed it from Leon Co., Tall Timbers Research Station.

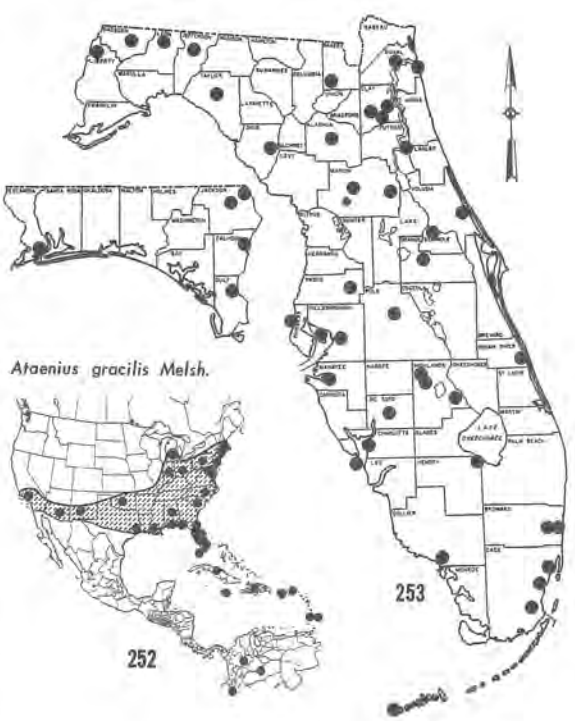
SELECTED REFERENCES: Bates, 1887:99; Chapin, 1940:15-16; Horn 1887:79-80; Schmidt, 1922a:435.

Ataenius gracilis (Melsheimer)

Oxyomus gracilis Melsheimer 1845:137 (often cited as 1844).
Psammodius gracilis (Melsh.), DuVal 1857:119.
Euparia gracilis (Melsh.) LeConte 1836b:36.
Ataenius gracilis (Melsh.), Gemminger and Harold 1869:1066.
Aphodius chilensis Solier 1851:72 (fide Schmidt 1922a: 436).

DIAGNOSIS: Small (length 3-3.5 mm), elongate, subparallel, flattened above, black, shining. A very distinctive species in general appearance but somewhat similar to *exiguus* Brown. The latter has clypeal teeth. The dense elongate punctures of the head and the median impressed line on the posterior half of the pronotum, combined with the flattened dorsum, easily distinguish it from all other Florida species.

TAXONOMIC NOTES: The snyonymy of *Aphodius chilensis* Solier is based solely on the literature as I have not seen the types nor specimens from Chile. Although it has been placed in several related genera, in all characters it is a typical *Ataenius*, although closely related to *Saprosites*.



DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 252-3). The type locality is Pennsylvania, and it has a wide distribution within the U. S. Arrow (1903:513) stated that it occurred ". . . throughout the Western Hemisphere." In the U. S. it has been definitely reported from: Alabama, Arizona, California, Connecticut, District of Columbia, Florida, Indiana, Louisiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, and Texas.

Horn (1871a:286) stated that it ". . . occurs on the entire American Continent wherever Aphodiini occur." Although it is widespread, records are lacking for most of the Rocky Mountain area.

Chapin (1940:25) reported it from nine islands in the West Indies: Cuba, Jamaica, Hispaniola, Puerto Rico, Vieques, St. Croix, St. Kitts, Barbados, and St. Vincent. Arrow (1903:513) added Grenada, and Schmidt (1922a:436) included Guadeloupe as well as Colombia, Peru, Chile, and "Kongo." As far as I know, the latter is the only record from outside the Western Hemisphere.

In Florida it probably occurs throughout the state, although records are lacking for most of the panhandle, the Everglades, and the Keys (except for Key West). Apparently it is easily moved about by commerce and is likely to be introduced into other parts of the world.

BIOLOGY: It is one of the most common species in Florida and is attracted to lights. Aside from this, practically nothing is known of its biology. Judging from its wide distribution it has a wide tolerance of climatic and edaphic conditions. It has been recorded every month of the year in Florida. The immature stages are unknown.

SPECIMENS EXAMINED: Over 3,000 from 54 Florida localities, representing 222 collection records (for complete data see Appendix 41).

SELECTED REFERENCES: Blatchley, 1910:925; 1928:26; Chapin, 1940:25; Dillon and Dillon, 1961: 522, Pl. 50, Fig. 15; Horn, 1871a:286; 1887:79; Schmidt, 1922a:436.

Ataenius havanensis Balthasar

(Fig. 246-8)

Ataenius havanensis Balthasar 1938:56.

DIAGNOSIS: Similar to *imbricatus* Melsh. and sometimes difficult to distinguish because both species often are encrusted with dirt. The characters of the key should distinguish the two species, but comparative material is helpful.

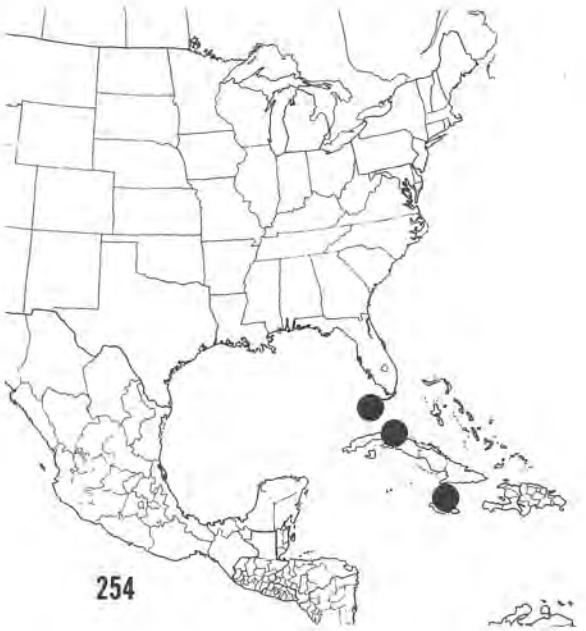


Fig. 254. Distribution of **Ataenius havanensis** Balth.

TAXONOMIC NOTES: This species was not recognized among my material in the original dissertation (1967). Chapin (1940:41), in an addendum to his revision of the West Indian Aphodiinae, indicated that *havanensis* ". . . appears to me inseparable from *A. miamii* Cartwright." Since then Cartwright has examined the Balthasar types and revived *havanensis*. It may have been confused earlier with *imbricatus* in some literature records.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 254) The type locality is Havana, Cuba, and it has subsequently been recorded by Howden (1970:2) from Duncans (Trelawny Parish) on the northern coast of Jamaica. The Florida records are from the Lower Keys (Stock Island and Garden Key, Dry Tortugas). Presumably this is a West Indian species, barely entering Florida, and probably more widely distributed than presently known.

BIOLOGY: Nothing has been published on its biology. I have seen specimens from blacklight traps, from beach debris, and from under casuarina needles.

SPECIMENS EXAMINED: 10 from 2 Florida localities as follows: (7) Monroe Co., Stock Island, 9-VIII-68, F. A. Buchanan, blacklight trap; (1) Monroe Co., Dry Tortugas, Garden Key, 9-V-61, H. V. Weems, Jr., under beach debris; (2) loc. cit., 10-VII-63, H. A. Denmark, Berlese sample of casaurina needles.

SELECTED REFERENCES: Chapin, 1940:41; Howden, 1970:2.

Ataenius imbricatus (Melsheimer)

(Fig. 255-6)

Aphodius imbricatus Melsheimer 1845:136 (often cited as 1844).
Euparia imbricata (Melsh.), LeConte 1863b:37.
Ataenius imbricatus (Melsh.), Gemminger and Harold 1869:1066.
Ataenius sordidus Harold 1869:109.

DIAGNOSIS: One of the most readily distinguished species due to the surface being completely encrusted with a gray argillaceous coating and the elytral intervals and pronotal punctures with short yellow setae. In its dull appearance it is similar to *alternatus* (Melsh.), but that species has the elytral intervals alternately raised, tips of the carinae smooth and black, and without setae.

TAXONOMIC NOTES: This species is not closely related to any other in our fauna, but is probably related to South American forms. The Florida specimens appear to fall into two size ranges (3-3.5 mm and 4-4.5 mm). These do not seem to be correlated with geographic distribution or with any other morphological characters. Additional study, especially of the genitalia, will be necessary to ellucidate the situation.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 255-6). Horn (1887:75) indicated that it was widely distributed in the Western Hemisphere and recorded it from Mexico, Cuba, Honduras, Brazil, and from Massachusetts to Texas in the U. S. Chapin (1940:22) reported it from the following West Indian islands: Cuba, Dominican Republic, Bahamas (Nassau and Arthurs Town), and Andros Island. Blackwelder (1944:214) added Mexico, Guatemala, Nicaragua, Argentina, Puerto Rico, and St. Croix.

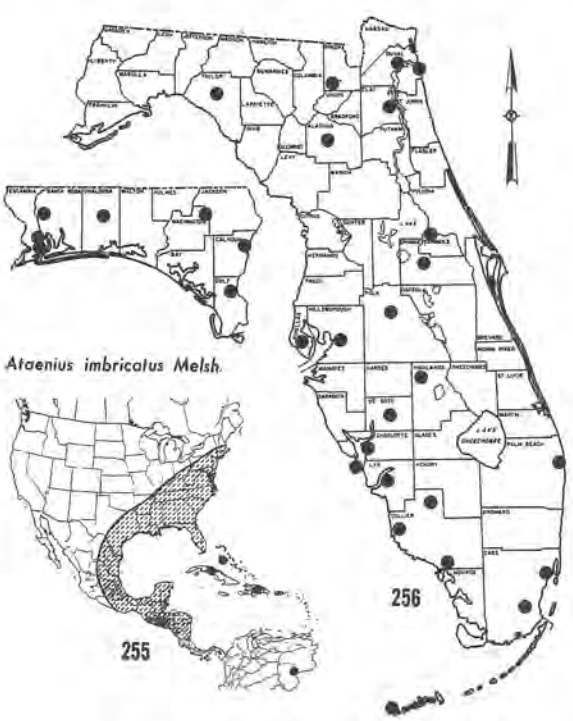
In Florida it has been reported by Blatchley (1928: 25) from three localities: Dunedin, Gainesville, and St. Petersburg. My records indicate a fairly general distribution within the state from Pensacola to Key West.

BIOLOGY: This species often is abundant at lights, but very little is known about its biology. It has been found in Florida from March through November, but is more abundant in the fall (August - October). It seems to be more abundant near coastal localities.

The larva has been described by Jerath (1960b: 78-79) and is characterized as follows: seventh and eighth abdominal segments broad, the ninth and tenth narrow; stridulatory teeth of stipes 21-24; clypeus not marked into preclypeus and post-clypeus; lower anal lobe divided into two distinct sublobes placed remotely from each other; raster with teges of 34-43 hamate setae; width of head capsule 1.02-1.12 mm.

SPECIMENS EXAMINED: Over 1,035 from 32 Florida localities, representing 101 collection records (for complete data see Appendix 42).

SELECTED REFERENCES: Bates, 1887:99; Blatchley, 1910:925; 1928:25; Chapin, 1940:21-22; Horn, 1871a: 285; 1887:74; Jerath, 1960b:78-79 (larva); Schmidt, 1922a:443.



Ataenius insculptus Horn

Ataenius sculptilis Harold, LeConte 1878:402 (misidentification).
Ataenius insculptus Horn 1887:70.

DIAGNOSIS: Medium sized (length 4-4.5 mm), heavily sculptured, glabrous, dull, opaque. Elytral intervals distinctly carinate in the middle, a flattened shelf on each side before catenuately punctate striae. Pronotum without marginal setae, the punctures encroaching on the margin. The clypeal teeth distinguish it from the other dull, alutaceous, or argillaceous species.

TAXONOMIC NOTES: Horn (1887:70) indicated that this species agreed well with the description of *sculptilis* Har., but he stated that *insculptus* had no accessory spinule at the inner angle of the posterior tibial apex. Robinson (1947a:150) examined Horn's type and after removal of some dirt, discovered a short accessory spinule. It is possible that these two are not the same, and that LeConte's determination (1878:402) was correct, but this cannot be determined without examination of both type specimens. I perfer to retain the name *insculptus* until this can be done.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 257-8). It was originally described from "Florida" and subsequently recorded from Tampa (Blatchley, 1928:25), based on a manuscript record by Schwarz. LeConte (1878:402) recorded it from Enterprise. The only other literature record is that of Robinson (1947a:150), who recorded it from Martha, New Jersey. In addition to the list of specimens examined, I have seen a specimen from South Carolina (new state record), and the U. S. National Museum contains specimens from "Tampa, Fla., 7.4, Hubbard and Schwarz; and Highlands Hammock St. Pk., Fla., 21-V-59, O. L. Cartwright, in deer droppings."

BIOLOGY: This as a rare species in collections, and nearly every specimen has been taken in deer droppings. One specimen was taken in a Berlese sample of pine butress debris, but no specimens have been found at light. The larvae are undescribed, although I collected one larva in deer droppings which will be the subjejct of a future paper. Adults have been found from May to October.

SPECIMENS EXAMINED: 11 from 3 Florida localities as follows: (1) Highlands Co., Highlands Hammock St. Pk., 5-VI-60, R. E. Woodruff, in deer droppings; (6) same data except 3-VII-60; (2) same data except 8-VII-67, B. K. Dozier, deer droppings; (1) Orange Co., Orlando, 31-VII-65, W. Suter, pine butress; (2) Walton Co., Eglin Air Force Base, Beaver Pond, 5-X-66, R. E. Woodruff, in deer droppings.

SELECTED REFERENCES: Blatchley, 1928:25; Robinson, 1947a:150.

Ataenius integer Harold

Ataenius integer Harold 1868a:86.
Ataenius integer Har., Schmidt 1922a:434 (cited in synonymy under *platensis*).
Ataenius intiger Har., Cartwright 1964:103 (*lapsus calami*).

DIAGNOSIS: This species is difficult to distinguish from *platensis* (Blanch.), but it usually has a band of coarse punctures across the base of the head, and there are more of the coarse punctures scattered in the antero-median area of the pronotum.

TAXONOMIC NOTES: This species has long been synonymized under *platensis*, following Schmidt (1922a: 434). Cartwright (in litt. and on determination labels) has resurrected the species. However, he could not place more than 50% of my specimens as either *integer* or *platensis*. He stated that he believes they are distinct species but ". . . may form hybrids." I have not been able to distinguish them to my satisfaction.

DISTRIBUTION & ZOOGEOGRAPHY: The type locality is merely Brazil with no precise location. Curiously Chapin (1940) did not record *integer* or *platensis* from the West Indies. Most of my specimens positively determined by Cartwright are from the Florida panhandle, but a few are from as far south as Avon Park (Highlands Co.) and Parrish (Manatee Co.).

BIOLOGY: Nothing has been published on its biology, and the immature stages are unknown. Most of the specimens were taken at light in July and August. Several were taken in leaf litter samples run through a "modified Tulgren apparatus" [Berlese sample].

SPECIMENS EXAMINED: All of the following 15 specimens from 7 Florida localities have been checked by Cartwright: (1) Bay Co., Panama City Beach, 5-VII-67, A. H. Boike, mosquito light trap; (1) ibid., 8-VII-67; (1) ibid., 11-VII-67; (1) ibid., 11-VII-67; (1) Gulf Co., Wewahitchka, 10-VIII-67, A. H. Boike; mosquito light trap; (2) ibid., 14-VIII-67; (1) ibid., 31-VIII-67; (1) Highlands Co., Avon Park, 18-VII-60, M. H. Muma, Berlese sample; (2) Hillsborough Co., Knights, M. H. Muma, Berlese sample; (1) Manatee Co., Parrish, 20-VII-60, M. H. Muma, Berlese sample; (2) Orange Co., Apopka, 3-X-68, R. E. Woodruff, blacklight trap; (1) Polk Co., Winter Haven, 3-VIII-60, J. Hayward, blacklight trap; (1) loc. cit., 18-V-67, H. L. Green, can trap.

As mentioned above, several specimens were labeled by Cartwright as "*platensis* or *integer*." The following localities are represented: Alachua Co.: Gainesville; Baker Co.: Macclenny; Bay Co.: Panama City Beach; Calhoun Co.: Blountstown; Collier Co.: Ochopee; Dade Co.: Goulds; Escambia Co.: Walnut Hill, Bratt; Gulf Co.: Wewahitchka; Holmes Co.: Westville; Jackson Co.: Marianna; Jefferson Co.: Monticello; Marion Co.: Ocala; Monroe Co.: S. Key Largo.

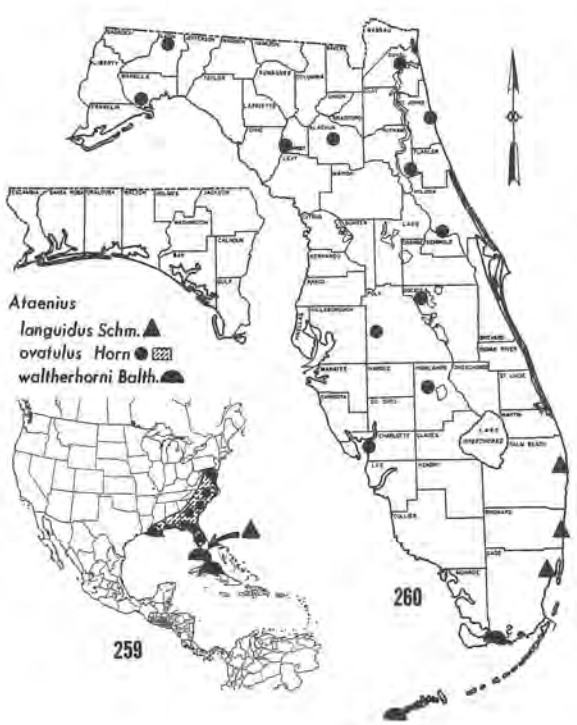
SELECTED REFERENCES: Nothing has been published on this species except the references cited in the synonymy above.

Ataenius languidus Schmidt

Ataenius languidus Schmidt 1911:31.
Ataenius linelli Cartwright 1944b:28-29.

DIAGNOSIS: Medium sized (3.9-4.6 mm), convex, glabrous, shining, dark brown. Similar in general appearance to *simulator* Har. and *platensis* Blanch., but differs from both in having a few fine setae on the ventral abdominal segments. It differs further from *simulator* by having the long spur of the posterior tibia not as long as the first two tarsal segments, and the spurs are narrower and less concave ventrally; the clypeal rugosity extends only half the length of the head and is always less strongly developed; the coarse pronotal punctures are more generally distributed to include the median anterior area. From *platensis* it differs further by having clypeal denticles, or at least a sharp angle on each side of the median emargination, and the long posterior tibial spur is longer than the first tarsal segment.

TAXONOMIC NOTES: Although closely related to the two species mentioned above, it is quite distinct. Cartwright (in litt.) indicated the synonymy above, and I have since confirmed it by comparison with material in the Hinton collection.



DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 259-60) The type locality for *languidus* is Mexico, "S-Madre de Durango." The type locality for *linelli* is Miami, Florida. I have seen Florida specimens only from Dade and Broward Co. Cartwright (in litt.) listed Miami, Coconut Grove, West Palm Beach, Lake Worth, Lake Wales, and Knight's Key.

BIOLOGY: Nothing has been published on its biology. My specimens were all taken at light, but it appears to be rare in Florida. Seasonal records include April through August.

SPECIMENS EXAMINED: 20 from 2 locations as follows (all collected by H. F. Strohecker unless otherwise indicated): Dade Co.: (1) V-1919, paratype of *linelli;* (1) VI-47; (1) 17-IV-48; (2) 17-V-48; (6) 18-V-48; (1) VI-48; (1) 2-VIII-48; (1) Miami, 25-IV-60, P. E. Briggs, blacklight trap; (1) Broward Co., Ft. Lauderdale, 15-VII-39, D. Bergh.

SELECTED REFERENCES: Nothing has been published on this rare species except the original description and a repeat of it by Schmidt (1922a:452-453).

Ataenius miamii Cartwright

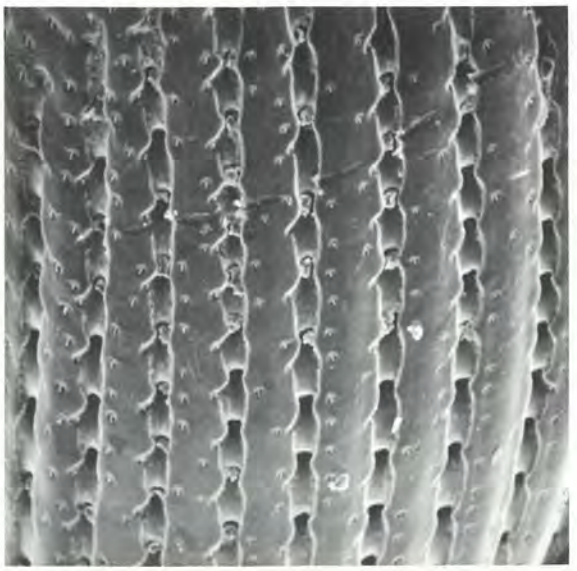
(Fig. 261-3)

Ataenius miamii Cartwright 1934a:200-201.
Ataenius havaniensis Balthasar 1938:56. (synonymy cited in error by Chapin 1940:41).

DIAGNOSIS: One if the five dull, opaque Florida species. Small (length 3-3.7 mm), oval, convex, without clypeal teeth. Elytral intervals cariniform and with a single longitudinal row of short, inconspicuous setae. Most similar to *imbricatus* Melsh., but easily separated by the lack of the gray argillaceous coating of that species plus the other characters in the key. Chapin (1940:23) mentioned that, of the West Indian species, it was most similar to *tenebrosus* Arrow, but could be distinguished by the oval elytra and the setigerous punctures of the elytra.

TAXONOMIC NOTES: The above synonymy was established by Chapin (1940:22) based on the original description only.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 264-5). It was originally described from Miami, Florida, and subsequently reported from Spring Hill, Alabama; Lakehurst, New Jersey; Clemson, South Carolina; and Fredericksburg, Virginia (Cartwright, 1941:33). Chapin (1940:23) recorded it from Barbados, St. Croix, and St. Kitts in the West Indies, and if the above synonymy is correct it is known from Cuba. Chapin believed that the Miami specimens "... are almost certainly recent arrivals from some West Indian island." However, Cartwright's subsequent records indicated that it was found in Virginia in 1904, Alabama in 1911, and New Jersey in 1923.



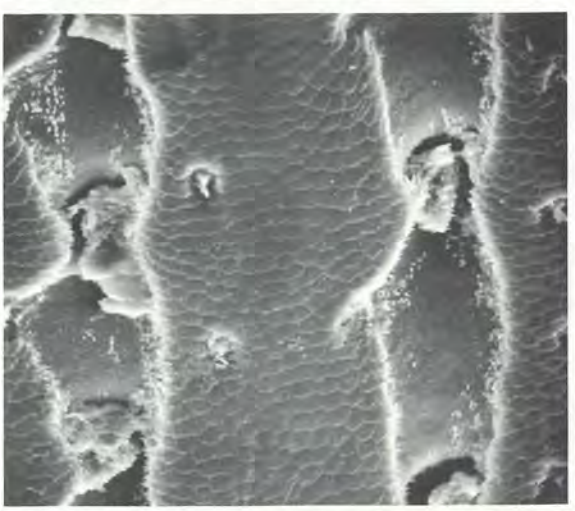
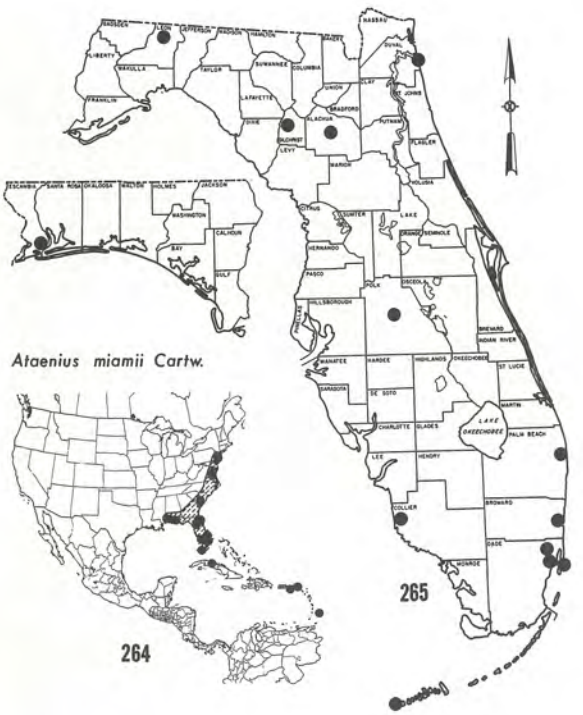


Fig. 261-263. Stereoscan photos of right elytron of **Ataenius miamii** Cartwr.: 261) 94X, 262) 497X, 263) 795X.



In Florida it has been reported previously only from Miami. I have seen specimens from Pensacola to Key West, but the records between are spotty.

BIOLOGY: Nearly all known specimens have been taken at light. A single specimen is labeled "at *Citrullus vulgaris*." Most of the specimens that I have collected were taken from a swimming pool during the daytime at Gainesville. Apparently it is more common at coastal and other sandy localities. Specimens have been collected from February through October, but most specimens were taken in August. The immature stages are unknown.

SPECIMENS EXAMINED: 176 from 17 Florida localities, representing 52 collection records (for complete data see Appendix 43).

SELECTED REFERENCES: Cartwright, 1941:33; Chapin, 1940:22-23, 41.

Ataenius ovatulus Horn

Ataenius ovatulus Harold (manuscript name).
Ataenius ovatulus Horn 1871a:286.
Ataenius lecontei Harold 1874a:20.
Ataenius ovatus Horn, Summers 1874:88 (misspelling).

DIAGNOSIS: Small (length 2.5-3.5 mm), oval, convex, shining, gray to black. Similar to *cylindrus* and difficult to separate from it without comparative material. It is usually smaller, more convex, and more ovate than that species and has the pronotal punctures

more widely scattered to show several, somewhat swollen, bare areas.

TAXONOMIC NOTES: Horn (1875:142) recognized that his *ovatulus* was based on a specimen with worn clypeus that did not show the teeth. However, he considered both *ovatulus* and *lecontei* synonyms of his *cylindrus*. There is no doubt that *ovatulus* and *cylindrus* are distinct, although similar, species. Their habits also are different, *ovatulus* never coming to light.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 259-60). It was reported by Horn (1887:79) from "Pennsylvania to Louisiana" and, under the name *lecontei*, from "District of Columbia to Louisiana." Specific state records include the following: District of Columbia (Ulke, 1902), Florida (Blatchley, 1928), Louisiana (Summers, 1874), North Carolina (Brimley, 1938), and South Carolina (Cartwright, 1939a). Dury's (1906: 257) record for Cincinnati, Ohio, was based on a misidentification, and the specimens are actually *Aphotaenius carolinus* (Van Dyke) according to Cartwright (1958:134). I have also seen a specimen from Atlanta, Georgia (new state record).

In Florida, Blatchley recorded it from Enterprise, Lakeland, Punta Gorda, and St. Augustine. Cartwright (in litt.) listed specimens in the U. S. National Museum from Crescent City and Jacksonville. I have seen specimens from 6 additional localities (see section on specimens examined).

BIOLOGY: Since this species is not attracted to light and is not found in dung, it is one of the most rarely collected species of *Ataenius*. It is sometimes abundant (Cartwright, personal communication) at the bases of large trees, especially in open fields. Three of the specimens I have seen were taken from litter beneath plaster bags on the ground. I collected two specimens from beneath the wool stuffing from an old car seat in a layer of longleaf pine needles. Specimens have been collected in Florida in April, June, July and August.

The larva has been described and figured by Jerath (1960b:74, Fig. 49) and is characterized as follows: seventh and eighth abdominal segments broad, the ninth and tenth narrow; clypeus distincly divided into preclypeus and postclypeus; raster with teges of 27-31 and 34-37 hamate setae scattered irregularly; conical stridulatory teeth of the stipes 13-19; maximum width of head capsule of third instar 0.89-0.99 mm.

SPECIMENS EXAMINED: 24, of which only 10 were from Florida as follows: (2) Alachua Co., Gainesville, 10-IV-70, R. E. Woodruff, wool stuffing of old car seat; (3) Gilchrist Co., Wilcox, 27-VI-65, W. Suter, litter under plaster bags; (1) Highlands Co., 6-VI-60, H. V. Weems, Jr.; (1) Leon Co., 5 mi. E. of Tallahassee, 6-VII-65, W. Suter, pine buttress; (1) Leon Co., Tall Timbers Res. Sta., 19-VII-71, D. Harris, pitfall trap; (1) Osceola Co., Kissimmee, 1-VIII-62, M. H. Muma, Berlese sample; (1) Wakulla Co., Sopchoppy, 21-VII-65, W. Suter, tree fork-oak.

SELECTED REFERENCES: Blatchley, 1928:26; Cartwright, 1950:72; 1958:134; Horn, 1871a:286; 1875: 142; 1887:78-79; Jerath, 1960b:74, Fig. 49 (larva); Robinson, 1948c:177.

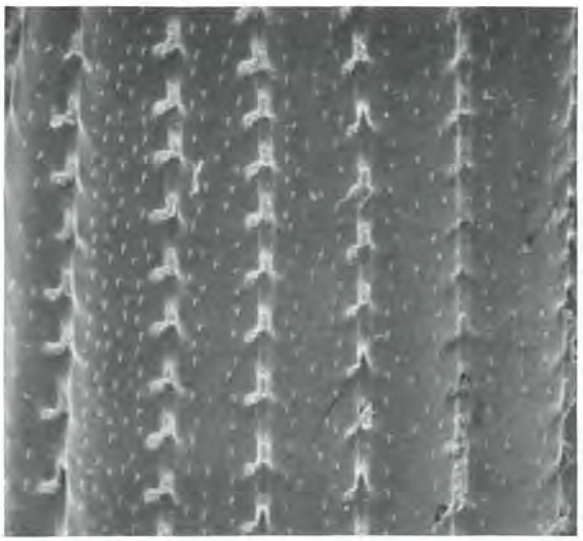
Ataenius picinus Harold

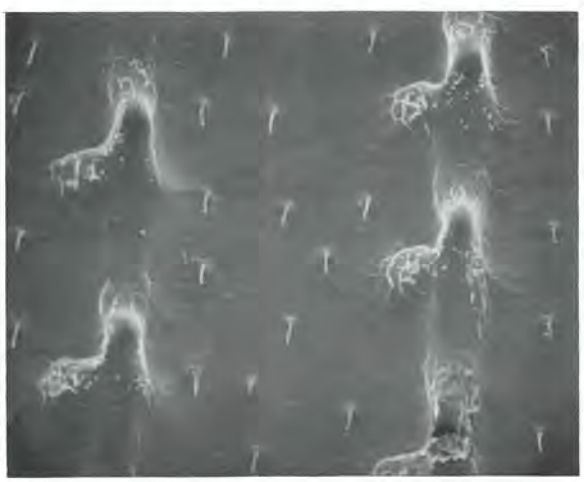
(Fig. 223-4, 227-8, 268-72)

Ataenius picinus Harold 1867a:281.
Ataenius duplopunctatus Lea 1923:6.
Ataenius salutator Fall 1930:99.
Ataenius queirosii Paulian 1934:219.
Ataenius darlingtoni Hinton 1937:179-181, Fig. 6-9.
Ataenius boucomontii Paulian 1937:41.
Ataenius waltherhorni Balthasar 1938:55 (synonymy suggested by Chapin 1940 but in error, according to Cartwright 1968:27).
Ataenius alegrus Balthasar 1947:50.
Saprosites rugosus Richards 1959:41.

DIAGNOSIS: Large (length 4.5-5.6 mm), black, shining, elongate. It is a member of the *strigatus* group, similar in appearance to *spretulus*, *fattigi*, and *erratus* of the Florida species. It is easily distinguished by the crenate lateral pronotal margin, the finely, densely punctate ninth elytral interval, and the posterior tibial fringe always of four fimbriae (Fig. 223-4). The punctation of the ninth elytral intervals and humeri is noticeably denser than that of any of the other elytral intervals.

TAXONOMIC NOTES: The above synonymy (with the





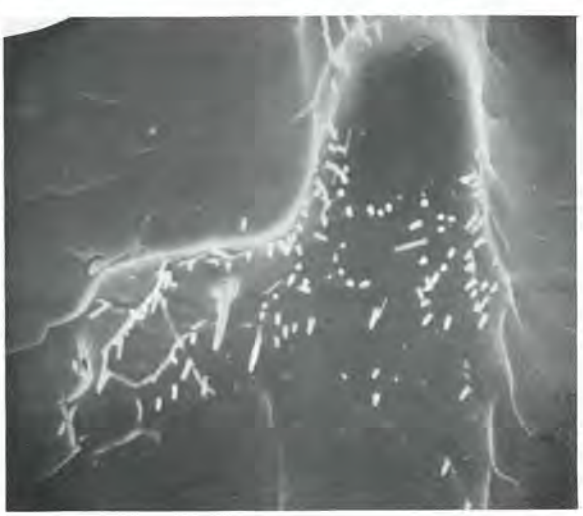


Fig. 268-270. Stereoscan photos of right elytron of **Ataenius picinus** Har.: 268) 90X, 269) 278X, 270) 1200X.

exception of *waltherhorni*) was established by Cartwright (1964:103 and 1970:226) after an examination of the respective types. The synonymy of *waltherhorni*, under *darlingtoni*, was suggested by Chapin (1940:41) but was based only on the literature. Cartwright (1968: 27) has indicated that *waltherhorni* is a valid species. The number of synonyms is due primarily to the wide disjunct range of this species.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 266-7). This probably is the most widely distributed species of *Ataenius*. Cartwright (1964:104) recorded the distribution as follows: "... South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. It occurs in the West Indies, in Cuba, Jamaica, Hispaniola, Puerto Rico, Virgin Islands, Antigue, Guadeloupe, and Grenada. South American specimens from Brazil, Bolivia, Paraguay, Uruguay, Argentina, and Chile have been examined. I have seen it also from Australia, New Zealand, Fiji, New Caledonia, and New Hebrides."

In Florida it has a peculiar disjunct distribution, occurring throughout the panhandle east to Mayport on the coast and south to Gainesville, then skipping the entire peninsula and reappearing at Key West. The single Key West record possibly represents an introduction.

BIOLOGY: Most specimens have been taken at light, but it appears to be common at times in cow dung. I have taken it in fresh cow dung, in company with *Ataenius erratus* Fall, in an open pasture on bare sandy soil. Cartwright (1964:104) stated that he "... collected it in large numbers in suitable areas in fresh to day-old cow dung." Judging from its wide geographic range, it is found in a variety of climatic and edaphic situations. In Florida it has been collected between March and October. The immature stages are unknown.

SPECIMENS EXAMINED: 375 from 22 Florida localities, representing 56 collection records (for complete data see Appendix 44).

SELECTED REFERENCES: Cartwright, 1954:47; 1964: 103-104; Chapin, 1940: 30-31, 41.

Ataenius platensis (Blanchard)

(Fig. 231, 275-7)

Oxyomus platensis Blanchard 1846:185 (often cited as 1838).
Ataenius anticus Fall 1930:105-106.
Ataenius platensis (Blanch.), Gemminger and Harold 1869:1067.
Ataenius plantensis (Blanch.), Jerath 1960b:71 (misspelling).

DIAGNOSIS: Medium sized (length 3.5-4.5 mm), elongate, shining black or dark brown. This is another species in the *strigatus* group and is most similar to *spretulus*. However, *platensis* is usually smaller, the

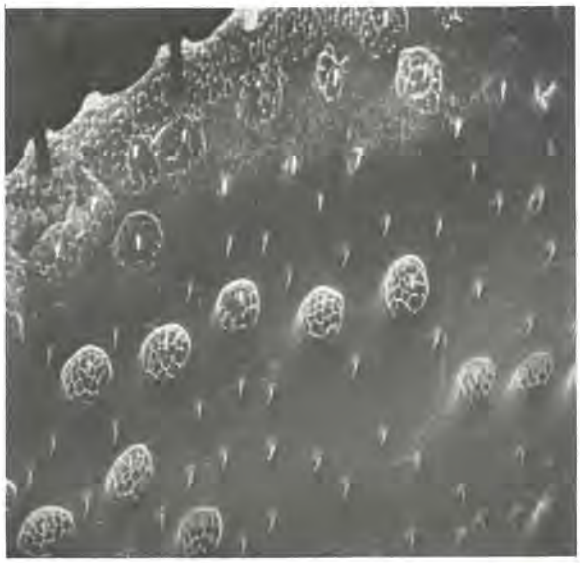


Fig. 271. Stereoscan photo of ventral surface of trochanter of anterior leg of **Ataenius picinus** Har. (180X). Sensors, not previously noted and the function of which is unknown, enlarged in Fig. 272.

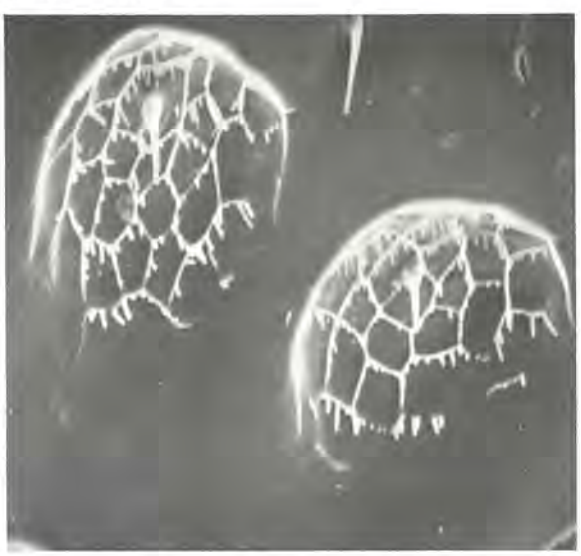


Fig. 272. Stereoscan photo of trochanter sensors in **Ataenius picinus** Har. (898X). Enlargement of Fig. 271.

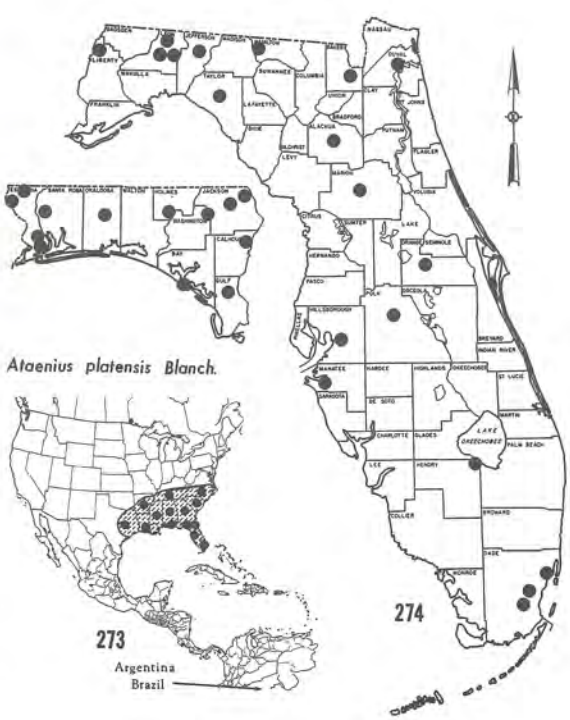
basal line of punctures of the head is fine and scattered, the clypeal rugulae are more strongly developed, and the fine punctures of the elytral intervals are more noticeable. The coarse pronotal punctures are nearly always absent in the antero-median area, a character shared by *simulator* which has first posterior tarsal segment noticeably shorter than the long tibial spur. It is closest to *integer* Harold which has been listed as a synonym (Schmidt, 1922a:434). Cartwright (in litt.) now recognizes it as valid. *A. integer* has coarse punctures basally on the head whereas they are scattered and fine on *platensis*.

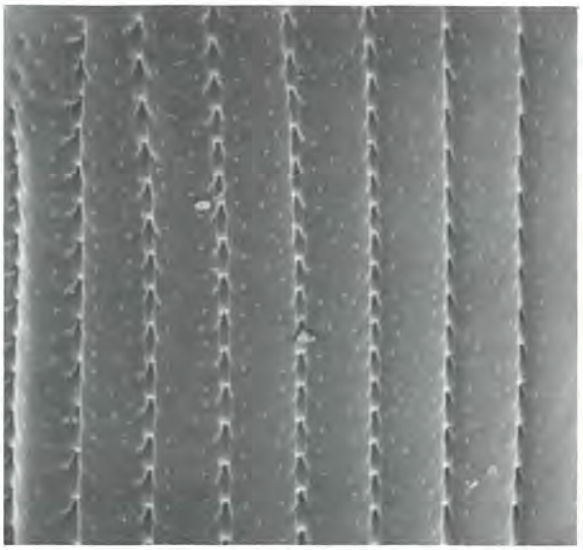
TAXONOMIC NOTES: This is another species with a fairly wide geographic range, contributing to the synonymy cited above. Specimens are somewhat variable, especially in size and extent of the coarse pronotal punctures. Usually the antero-median area is without coarse punctures, but in a few cases such punctures are scattered irregularly in this area. The several hundred specimens sent to O. L. Cartwright were determined questionable, as were some of *integer*. When questioned about these he replied (in litt.) that "... they may form hybrids."

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 273-4). The type localities are as follows: *platensis* (Argentina), *anticus* (Hope, Arkansas). It has been recorded subsequently from Florida, Georgia, and Louisiana (Fall, 1930:105), North Carolina and Texas (Hinton, 1937:177), Alabama, Mississippi, South Carolina, and Tennessee (Cartwright, 1948b:149).

In Florida it probably occurs throughout the peninsula, but is especially abundant in the panhandle. My records include Pensacola to Homestead, but, except for Miami, it has not been found on the coast of the peninsula. It is possible that some of my earlier records refer to *integer* since the two species were considered synonyms until recently.

BIOLOGY: It is often very abundant at light in the panhandle of Florida. I have never found it in cow dung, but I took 65 specimens from beneath human dung in a sandy area along the edge of Lake Okeechobee at Clewiston. Davis (1966:214) found it common in cow dung in North Carolina from July through November, and he collected a single specimen at carrion





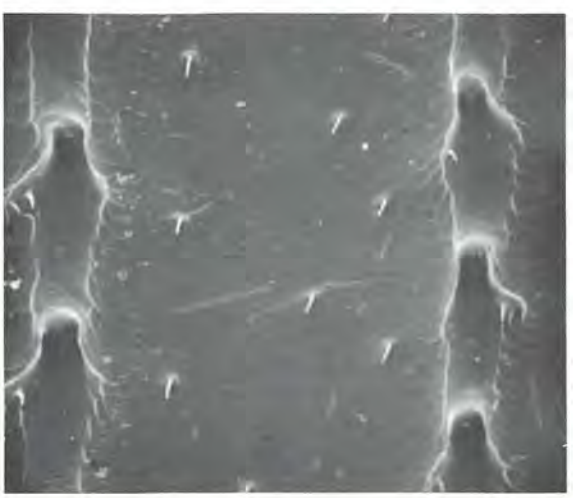


Fig. 275-277. Stereoscan photos of left elytron of **Ataenius platensis** Blanch.: 275) 80X, 276) 398X, 277) 1600X.

in March. Specimens were sent to me from the roots of garden peas and from sweet potato roots, and the beetles were thought to be responsible for the damage. I was unable to obtain confirming evidence about their feeding. Specimens have been collected in Florida every month except November and December.

In Tennessee, Walker (1957) collected specimens in traps baited with rotting cantaloupe and dead fish. These traps were placed in four habitats: mesic forest, bottom forest, ridge forest, and old field. *A. platensis* was found only in traps set in the latter habitat. Successionally the beetles were found abundant on dead fish from the first to the sixth day, but scarce from the sixth to eighth day, after which none were found.

The larva has been described by Jerath (1960b:79-80) and is characterized as follows: seventh and eighth abdominal segments broad, the ninth and tenth narrow; stridulatory teeth on the stipes 20-25; raster with teges of 42-44 hamate setae scattered irregularly; clypeus marked into preclypeus and postclypeus; lower anal lobe divided into two adjacently placed sublobes; width of head capsule 1.06-1.12 mm.

SPECIMENS EXAMINED: Over 2,064 from 48 Florida localities, representing 165 collection records (for complete data see Appendix 45).

SELECTED REFERENCES: Cartwright, 1948b:148-149; Hinton, 1937:177-178, Fig. 1-5; Jerath, 1960b: 79-80 (larva).

Ataenius rhyticephalus (Chevrolat)

Auperia rhyticephala Chevrolat 1864:413.
Ataenius rhyticephalus (Chevr.), Gemminger & Harold 1869:1067.
Ataenius stercorator Fab., Horn 1887:83 (misidentification).
Ataenius strigicauda (of authors in part, but not Bates 1887:96, Pl. 6, Fig. 24).
Ataenius solitarius Blatchley 1928a:69.
Ataenius sosolitarius Blatchley 1928:26 (printer's error).
Ataenius floridanus Brown 1930:3-4.

DIAGNOSIS: Large (length 4.5-6 mm), elongate, subparallel, broader than usual, feebly shining, black to dark brown. This is another species of the *strigatus* group, but it is one of the most distinctive. The coarse pronotal punctures are almost always coalescing at the anterior angles, and they are noticeably more abundant on the lateral one-third, leaving the median area with only a few scattered coarse punctures. Even the slightly raised pronotal margin is heavily punctate at the sides. The elytral intervals are more coarsely punctate than most species, the ninth and tenth, as well as the humeri, becoming almost rugose. The venter is more coarsely punctate than most species, and the metasternum usually has a group of about four coarse punctures near coxae. The posterior tibial fringe is composed of four spinules.

TAXONOMIC NOTES: This species was treated as *strigicauda* in my original manuscript, following the concept of the species current at that time (e.g., Cartwright, 1948b, et al.). Fall (1930:98) reported that the specimen recorded by Horn (1887:83) as the only specimen of *stercorator* Fab. known to him from North America was actually this species (under the name *floridanus*). Both *floridanus* and *solitarius* were synonymized by Cartwright (1948b:149) under *strigicauda*. Chapin (1940:32) mentioned that variation in *strigicauda* occurred in the ". . . degree of alutaceousness of the elytral intervals and the strength of the punctures on the head . . . ," but both were independent of geography and each other. Curiously, Schmidt (1922a) omitted *strigicauda* in his monograph of the Aphodiinae, but he treated *rhyticephalus*.

Cartwright (in litt. and on determination labels) has indicated that *strigicauda* is a valid Mexican species, but that most U. S. records apply to *rhyticephalus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 278). The type locality for *rhyticephalus* is Cuba. The type locality of *strigicauda* is Cordoba, Mexico (restricted by Chapin, 1940:32). The type of *solitarius* is from Royal Palm Park, Florida, and that of *floridanus* is "Florida."

Ataenius rhyticephalus Chevr.

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Chapin (1940:32) also recorded *strigicauda* from Mexico, Hondurus, Panama, Bolivia, Argentina, and the following islands of the West Indies: Bahamas, Barbados, Cuba, Dominica, Guadeloupe, Hispaniola, Jamaica, Puerto Rico, St. Croix, St. Lucia, St. Vincent, and Trinidad. Arrow (1903:511) added Grenada and Becquia Island. I do not know which of the above records apply to *rhyticephalus* and which to *strigicauda*. Cartwright (1948b:150) recorded it from Florida and South Carolina.

In Florida it has been recorded previously from Biscayne, Levy Co., Royal Palm Park, and Sand Point. My records have added 11 localities, and it is now known from Monticello (Jefferson Co.) in the north to Everglades National Park (Dade Co.) and Key West (Monroe Co.) in the south.

Cartwright (in litt.) reported the following Florida records in the U. S. National Museum: Dade Co., Paradise Key, 21-III-19, E. A. Schwarz; Dade Co., Timms Hammock, 24-II-19; Highlands Co., Highlands Hammock St. Pk., 21-V-59, O. L. Cartwright; Monroe Co., Key West; Volusia Co., Enterprise, 26-V; Volusia Co., Enterprise, 23-V, M. L. Linell Collection.

BIOLOGY: It is apparenty fairly common in Central America and the West Indies, but it is rare in Florida. It is attracted to light in small numbers, and I have taken it in human and deer dung and under a log in a cave. Blatchley (1928:26) sifted a specimen from "...weed debris on margin of ditch." It probably occurs throughout the year, although records are lacking for January, October, and December.

The larva has been described and figured by Jerath (1960b:75-76, Fig. 81) [under the name *strigicauda*] and is characterized as follows: seventh and eighth abdominal segments broad, the ninth and tenth narrow; conical stridulatory teeth on stipes 13-16; raster with teges of 50-56 setae; maximum width of head capsule of third instar 1.32-1.38 mm.

SPECIMENS EXAMINED: 21 from 11 Florida localities, plus a few from Mexico and the West Indies (for complete data see Appendix 50).

SELECTED REFERENCES: (Mostly under the name *strigicauda*) Arrow, 1903:511; Cartwright, 1948b: 149-150; Chapin, 1940:31-32; Fall, 1930: 97-98; Hinton, 1937:195, Fig. 35-39; Horn, 1887:83; Jerath, 1960b:75-76, Fig. 81 (larva); Schmidt 1922a:440.

Ataenius rudellus Fall

(Fig. 281-3)

Ataenius rudellus Fall 1930:103-104.

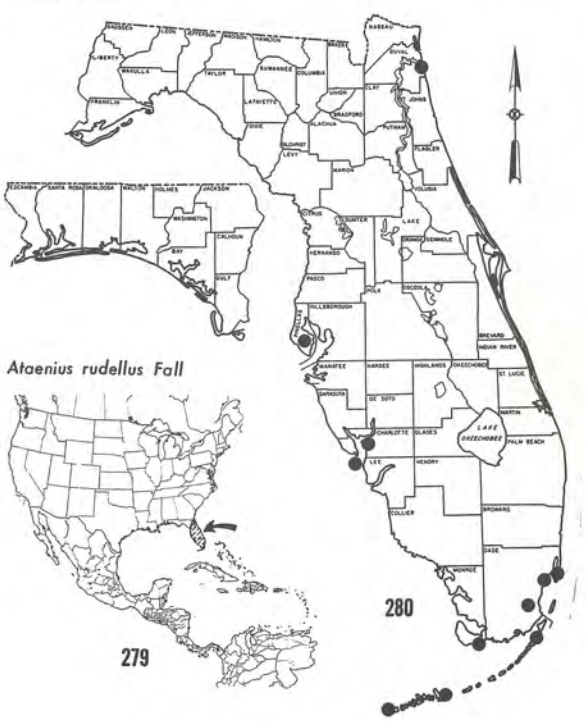
DIAGNOSIS: Medium sized (length 3.5-4.5 mm), elongate, feebly shining, black. This is another in the *strigatus* group, but it is fairly easy to recognize once the species is learned. The coarse pronotal punctures

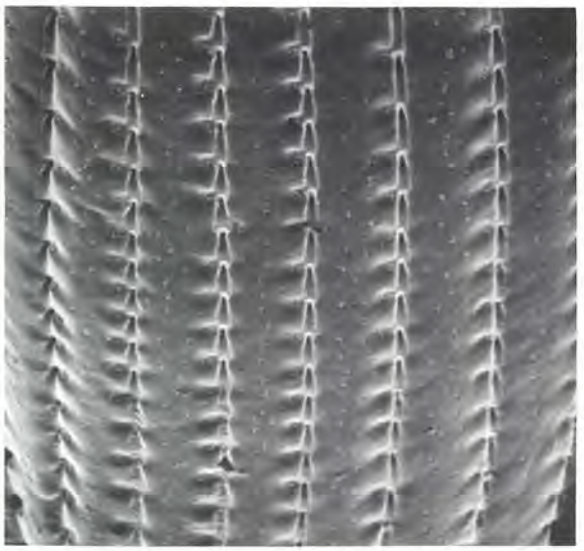
are almost uniformly placed, with never any extensive bare areas in between. The elytral intervals are feebly convex, noticeably punctate, minutely alutaceous, the striae carinately punctate (Fig. 281-3). It is most similar to *wenzelii* Horn.

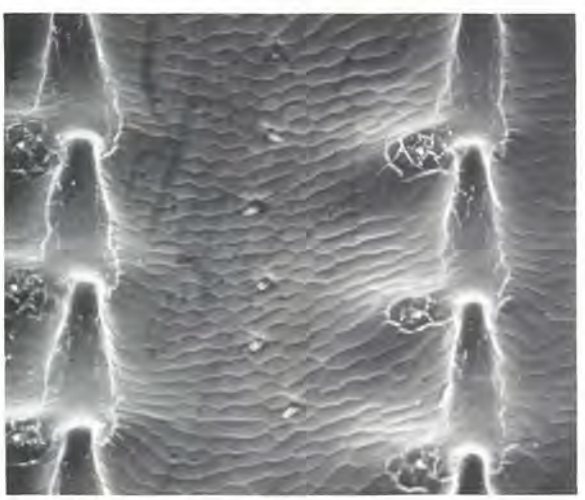
TAXONOMIC NOTES: All but one of the Florida specimens examined appear to be referable to *rudellus* rather than *wenzelii*, although the two are closely related. Both Robinson (1947a:150-151) and Cartwright (1948b:150) mentioned that the two might be synonymous, but neither had sufficient material for a final judgment. Although I now have a good series from Florida, I have seen very few specimens from the northeastern U.S. Additional specimens, from throughout the range, will be required to settle this question. The Florida specimens are less alutaceous, the elytral intervals are more convex, and at least the first two intervals are noticeably punctate. In New Jersey specimens the elytral intervals are flat, distinctly alutaceous, the punctures not noticeable. Cartwright (in litt.) listed one of my specimens from Wewahitchka, Gulf Co., Fla. as *wenzelii*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 279-80). It was originally discribed from St. Petersburg, Florida, and it has not been found yet outside the state. All records are from coastal areas: on the east coast from Mayport to Key West and on the west coast from St. Petersburg to Punta Gorda.

BIOLOGY: It apparently is confined to coastal regions, but nothing is known of its habits except that it is attracted to light. Specimens have been taken in Florida every month of the year. The immature stages are unknown.







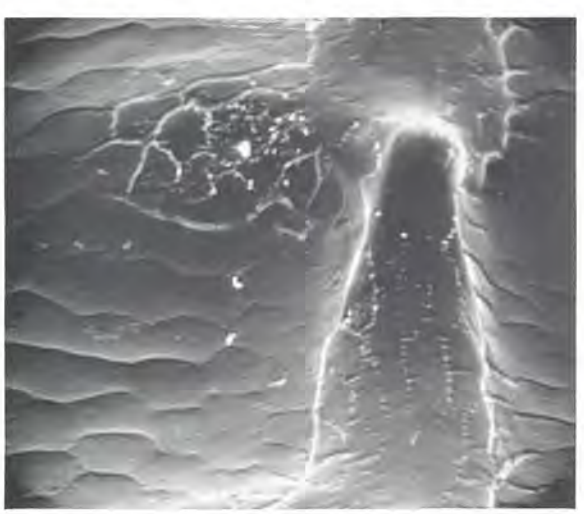


Fig. 281-283. Stereoscan photos of left elytron of **Ataenius rudellus** Fall. 281) 91X, 282) 400X, 283) 1125X.

SPECIMENS EXAMINED: 194 from 11 Florida localities, representing 38 collection records (for complete data see Appendix 46).

SELECTED REFERENCES: Cartwright, 1948b:150; Robinson, 1947a:150-151.

Ataenius saramari Cartwright

(Fig. 222)

Ataenius saramari Cartwright 1939b:360-361.

DIAGNOSIS: Small (length 2.8-3.2 mm), convex, oval, shining, black. Similar to a small *ovatulus* but possessing a fringe of short, nearly clavate setae around the elytral border. It differs further by lacking clypeal teeth, the angles each side of the median emargination are rounded, and the first posterior tarsal segment is shorter than the long tibial spur. The posterior femur has an entire posterior marginal line, and the posterior tibia lacks the accessory spinule.

TAXONOMIC NOTES: Although abundantly distinct in minor features it is closely related to *ovatulus* and *cylindrus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 284-5). The type locality is St. Cloud, Florida, and it is not known outside the state. Its distribution appears to be limited to fossil dunes or shorelines occupied by sand pine (*Pinus clausa* Engelm.). The present records are for Marion, Martin, Osceola, and St. Lucie counties, but it probably has a wider range.

BIOLOGY: It was previously known only from the type specimen that was taken in a pocket gopher burrow. As suspected by Cartwright in the original description, it is not one of the peculiar obligates associated with these animals, but is found in the leaf (needle) mold under sand pine. It is not attracted to light, and nearly all specimens have been taken in debris placed in a modified Berlese funnel. I collected two specimens in the soil surface beneath about three inches of pine needles. The habitat is located in deep sand hills with numerous lichens, similar in appearance to the habitat of *Peltotrupes youngi* Howden. It is probably another in the growing list of relict animals and plants associated with prehistoric shorelines. It probably occurs throughout the year, with records for all months except February, March, and November.

SPECIMENS EXAMINED: 87 from 7 Florida localities (for complete data see Appendix 47).

SELECTED REFERENCES: Nothing has been published on this species except the original description and the paper by Hubbell and Goff (1939:161), recording the collection of the type specimen.

Ataenius simulator Harold

(Fig. 226, 230)

Ataenius simulator Harold 1868a:85.
Psammodius schwarzi Linell 1896:721.
Psammobius schwarzi Linell, Schmidt 1910a:121.
Ataenius schwarzi Linell, Brown 1928c:307.

DIAGNOSIS: Medium sized (length 3.5-4.8 mm), convex, elongate, shining, dark brown to black. Front of head verrucose or rugulose to the eyes where there is a band of medium-coarse punctures (Fig. 226). Clypeus without teeth, but the margin is reflexed at the angles. Larger pronotal punctures coarse, deep, and scattered over the sides and posterior one-third, leaving the antero-median area with only the smaller punctures. In this character it is similar to *platensis*, but the first posterior tarsal segment is longer than the long tibial spur in that species (Fig. 231). In *simulator* this segment is much shorter than the long tibial spur and broader than in most other *Ataenius* (Fig. 230).

TAXONOMIC NOTES: This species appears to occupy an intermediate position between *Ataenius* and *Psammodius*. It is similar to *Psammodius* in the strongly verrucose clypeus (Fig. 226), deep pronotal punctures, swollen posterior femora, short middle and posterior tibiae, short and broad first posterior tarsal segment, and broader, more spatulate-shaped tibial spurs. However, in all other characters it is a typical *Ataenius*. The above synonymy was established by Cartwright (1964:103).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 286-7). The type of *simulator* is from Mendoza, Argentina, and that of *schwarzi* is from Jacksonville, Florida. Cart-

wright (1964:103) summarized the distribution as folows: Argentina, Brazil, Bolivia, Chile, Uruguay, Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. He also saw a small series from Windsor, New South Wales, Australia.

In Florida I have seen it from Pensacola to Miami, but there are no records for the Keys. Blatchley (1928: 27) recorded it only from Jacksonville (the type of *schwarzi*) and Orlando.

BIOLOGY: This is one of the most common species in the southeastern U. S., but nearly all specimens have been taken at light. Cartwright (1964:103) estimated that over 275,000 were taken in a light trap at Blackville, South Carolina on 4 June 1938. I have taken a few specimens in cow and human dung, but dung does not appear to be a common food. Specimens have been found on two occasions in burrows of the gopher tortoise (*Gopherus polyphemus* (Daudin). Although it is probably of no economic importance most of the time, one report indicated that a 10 acre field of peanuts was being damaged by the beetles feeding in the pith about an inch underground. Specimens were seen with the following ecological notes: in tobacco field, in diseased tung nuts on the ground, string beans, malt trap, Japanese beetle trap, and Steiner fruit fly trap.

The larva has been described (under the name *schwarzi*) by Jerath (1960b:77) and is characterized as follows: seventh and eighth abdominal segments broad, the ninth and tenth narrow; blunt stridulatory teeth on the stipes 21-23; raster with teges of 54 setae; each mandible with two setae both dorsally and ventrally; width of head capsule of third instar 1.09 mm.

SPECIMENS EXAMINED: Over 16,554 from 77 Florida localities, representing 403 collection records (for complete data see Appendix 48).

SELECTED REFERENCES: Brown, 1928c:307; Cartwright, 1964:103; Jerath, 1960b:77 (larva).

Ataenius spretulus (Haldeman)

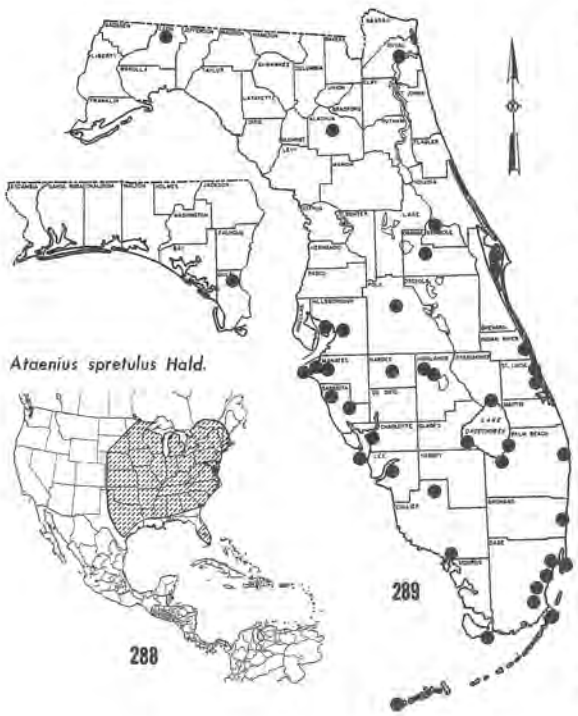
Aphodius spretulus Haldeman 1848:106.
Euparia spretulus (Hald.), LeConte 1863b:36.
Ataenius spretulus (Hald.), Gemminger and Harold 1869:1067.
Ataenius cognatus (Lec.), Blatchley 1928:27 (misidentification).
Ataenius consors Fall 1930:104-105 (not Blackburn, 1904).
Ataenius falli Hinton 1934:119 (new name for *consors* Fall).

DIAGNOSIS: Large (length 4.05-5.4 mm), elongate, subparallel, shining, black. This is another of the *strigatus* group, and it is similar to *fattigi*, *erratus*, and *picinus* of the Florida species. The coarse pronotal punctures are scattered widely and everywhere sparse. It can be separated by the characters listed in the key, but comparative specimens are helpful. It is closest to *fattigi*, but that species averages larger, the coarse pronotal punctures are more numerous and denser (especially at the sides and anterior angles), and the number of spinules of the posterior tibia is usually six (with a range of five to eight), whereas there are normally five in *spretulus* (with a range of four to six).

TAXONOMIC NOTES: Many of the early literature records confused several species in the *strigatus* group, and they are mostly unreliable. This species was synonymized under *strigatus* for some time, and was not recognized until 1943 when Cartwright examined the type and resurrected the name. Many of the early workers (e.g., Blatchley, 1910 and 1928) called the common *Ataenius* of the eastern U. S. by the name *cognatus* (Lec.). However, Cartwright (1948b:150) recognized that species only from Texas and New Mexico.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 288-9). Cartwright (1948b:150) listed the following states: Alabama, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, and West Virginia, and Ontario, Canada.

In Florida it has a peculiar distribution: no specimens being found from north of Sanford or in the panhandle. It is unlikely that this is an artifact of



collecting since the species is common at light, and numerous traps have been operated throughout the state. Further study will be necessary to clarify this distribution.

BIOLOGY: This species is sometimes abundant at light in south Florida (e.g., 500+ from the USDA Plant Introduction Station, Dade Co., 10-IV-61). I have collected very few specimens in cow dung in Florida, although it is abundant in this habitat in Ohio. I have taken a single specimen in deer droppings. Blatchley (1928:27, under the name *cognatus*) reported it ". . . by the hundreds at the Park [Royal Palm Park] beneath piles of decaying Chara and weed debris along ditches." Several specimens were taken in McPhail fruit fly traps baited with a fermenting mixture containing pineapple juice. Adults have been collected every month in Florida.

The larva is probably described but has not been positively identified. Jerath (1960b) described larvae of three species of *Ataenius*, at least one of which is probably this species. However, none of these was reared to adult, or the associated adults were of two species, or were not necessarily the same as the larvae. Hoffman (1935) described a larva, and presented biological information in Minnesota, under the name *cognatus*. Since that species is now known only from Texas and New Mexico, and *A. spretulus* is a common species in Minnesota, it is possible that his larvae represented the latter species.

SPECIMENS EXAMINED: Over 1,580 from 30 Florida localities (for complete data see Appendix 49).

SELECTED REFERENCES: Blatchley, 1928:27; Cartwright, 1943:108, 1948b:150, 153; Hoffman, 1935: 666-667 (larva?); Jerath, 1960b:71-75 (larva).

Ataenius strigatus (Say)

Scarabaeus strigatus Knoch, cited in Melsheimer Catalogue 1806 (nomen nudum).
Aphodius strigatus Say 1823:212.
Ataenius strigatus (Say), Gemminger & Harold 1869:1067.
(Due to much taxonomic confusion many of the early records of this species are found under the names *stercorator* and *cognatus*).

DIAGNOSIS: This species is the earliest described in a group of species which are very similar in appearance, until one becomes familiar with the slight but consistent differences. The characters in the key should permit indentification of most specimens. The clypeus usually has noticeable transverse rugulae; posterior tibia with fringe of four or five spinules; usually at least a few coarse pronotal punctures coalesce in the anterior angles; and the posterior face of the profemur coarsely, often roughly, punctate.

TAXONOMIC NOTES: Fall (1930) discussed in detail the early taxonomic confusion of this species. In my original manuscript (1967) I did not recognize this species in any of my Florida material. I still have some reservations about its occurrence here. The only two Florida specimens, labeled as such by Cartwright and returned to me, are from the same light trap sample (Wewahitchka, Gulf Co.) as the single Florida record of *wenzelii*. On close comparison, I can find only minor differences between these specimens, and they all have the posterior face of the profemur heavily punctate. Further study will be required to determine the exact status of *strigatus* in Florida.

DISTRIBUTION & ZOOGEOGRAPHY: Cartwright 1948b:151) recorded it from Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Mississippi, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Virginia, West Virginia, and Wisconsin. Since I knew it was widespread, I was surprised not to find it in Florida material I examined. When I inquired of Cartwright in 1967 for the basis of his listing Florida, he replied that he could find no Florida specimens in the U. S. National Museum and had no specific records. Fall (1930) also did not record it from Florida. Recently, Cartwright (in litt., 1972) listed Daytona Beach and Wewahitchka, the latter questioned above.

BIOLOGY: Although the biology of this species probably is known, the early taxonomic confusion makes it difficult to know which references really apply to this species. It is an extremely common species in the

northeastern U. S. where it is found often with *spretulus* in cow dung. I have collected it also under dead fish on the shores of Lake Erie. It is one of the most abundant species at light in the northeast.

SPECIMENS EXAMINED: Several thousand, of which only two questionable specimens were from Florida: (2) Gulf Co., Wewahitchka, 27-VII-67, A. H. Boike, mosquito light trap.

SELECTED REFERENCES: Blatchley, 1910:925; 1928:26; Brown, 1928:28; Cartwright, 1934:239; 1948b: 151; Davis, 1966:214; Dillon & Dillon, 1961: 522-523, Pl. 49, Fig. 14; Fall, 1930:101-103; Horn, 1887:69, 82; Mohr, 1943:292; Schmidt, 1922a:428.

Ataenius waltherhorni Balthasar

Ataenius waltherhorni Balthasar 1938:55.
Ataenius luteomargo Chapin (misidentification in my original ms.).

DIAGNOSIS: Most of the body surface, especially the pronotum, elytra, and femora, minutely alutaceous although partly shining. Pronotum less convex and more flattened than in most other Florida species. Margins of pronotum and elytra often much paler, rarely appearing bicolored. Somewhat similar in pronotal punctation to *platensis*, but that species is never alutaceous, possesses a posterior marginal line on the middle and posterior femora, and has an accessory spine on the posterior tibial apex. In *waltherhorni* the posterior marginal line of the middle and posterior tibiae is wanting along with the accessory spine of the posterior tibia, although the spinule is uneven in length.

TAXONOMIC NOTES: This species was listed in my original dissertation (1967) as *luteomargo* Chapin, a species previously unrecorded from the U.S. Specimens were sent to Cartwright and were confirmed. Later, specimens were returned to me with the name *waltherhorni*, after the respective types were examined. Cartwright (1968:27) revived it from synonymy under *darlingtoni* Hinton (now considered as a synonym of *picinus* Harold) where Chapin (1940:41) had placed it. Chapin (1940:36) listed erroneous determinations of *marginellus* Fab. (Chevrolat, 1864), *terminalis* Chevrolat (Arrow, 1903), and *versicolor* Schmidt (Hinton, 1937) under the synonymy of his new species *luteomargo*. I have had no opportunity to check this material against Florida specimens. Curiously, Schmidt did not include *versicolor*, a species he described in 1916, in his monograph (1922a) of the Aphodiinae.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 259-60) Cartwright (1968:27) published the only U.S. record based on a single specimen ". . . labeled Everglade, Florida, May 1912 in Wm. T. Davis collection, Purdue University." The localities Everglade and Chokoloskee were used by some early dealers in Florida insect specimens. Many of the records of Lepidoptera are almost certainly erroneous and represent West Indian or Central American species (see Kimball, 1965). "Everglade" could refer to Everglades (Collier Co.), but large blacklight trap samples from Ochopee nearby (see Fig. 20) have not produced this species.

The only Florida specimens, that I have seen, were from the Naval Base at Key West in a mosquito light trap. Additional blacklight trap samples from both Key West and Stock Island have proven negative for *waltherhorni*. It is likely that this is a West Indian species that periodically gets transported to Florida, but it has never become established, at least in any numbers.

The type locality for *waltherhorni* is Havana, Cuba, 7-VII-22, W. H. Hoffman. It was named in honor of Dr. Walther Horn, cicindelid specialist and (at that time) Director of the Deutschen Instituts der Kaiser Wilhelm-Gesellschaft in Berlin-Dahlem.

BIOLOGY: Nothing has been published on its biology. The immature stages are unknown. The "Everglade" specimen was collected in May, and those from Key West came from a composite mosquito light trap sample for July and August.

SPECIMENS EXAMINED: Nine from Key West, Florida, VII-VIII-1960, B. Niren, mosquito light trap.

SELECTED REFERENCES: Blackwelder, 1944:214; Cartwright, 1968:27; Chapin, 1940:41.

Ataenius wenzelii Horn

Ataenius wenzelii Horn 1887:77-78.
Ataenius ludovicianus Fall 1930:100.

DIAGNOSIS: Very similar to *rudellus* Fall and difficult to separate even with comparative material. Generally it is larger (4.3-4.8 mm), the elytral intervals flatter on the disc, and the distribution is more western. The male anterior tibial spur is incurved at the tip.

TAXONOMIC NOTES: The synonymy of *ludovicianus* Fall was established by Cartwright (1948b:150). In the same paper he also suggested that *rudellus* ". . . may eventually be considered a synonym." Judging from recent determination labels, he still maintains the two as distinct. However, the only Florida specimen of *wenzelii* determined by Cartwright was taken in the same light trap sample with the two specimens of *strigatus* mentioned earlier. On close comparison I can find only minor differences. The posterior face of the anterior femur is heavily punctate in all three specimens. Additional specimens and study will be required to clarify the status of *strigatus* and *wenzelii* in Florida.

DISTRIBUTION & ZOOGEOGRAPHY: The type locality of *wenzelii* is Atlantic City, New Jersey, and Horn also recorded it from "Florida (cab. LeC.) [and] one in my cabinet marked Colorado, which may be open to doubt." Schmidt (1922a:436) copied this distribution without the query for Colorado. The type locality for *ludovicianus* is Winnfield, Louisiana. Blatchley (1928:27) did not find it in Florida but mentioned a record from Haulover in a manuscript list by Schwarz. This record probably refers to *rudellus*. Cartwright (1948b:150) recorded *wenzelii* from Florida, Louisiana, New Jersey, Pennsylvania, South Carolina, and Texas. My single questionable Florida specimen is from Wewahitchka, Gulf Co.

BIOLOGY: Nothing has been published on its biology, and the immature stages are unknown. Most of the specimens have been taken at light, and many were from coastal situations.

SPECIMENS EXAMINED: 15, of which only 1 questionable Florida specimen was from Gulf Co., Wewahitchka, 27-VII-67, A. H. Boike, mosquito light trap.

SELECTED REFERENCES: Blatchley, 1928:26; Cartwright, 1948b:150; Robinson, 1947:150-151; Schmidt, 1922a:436.

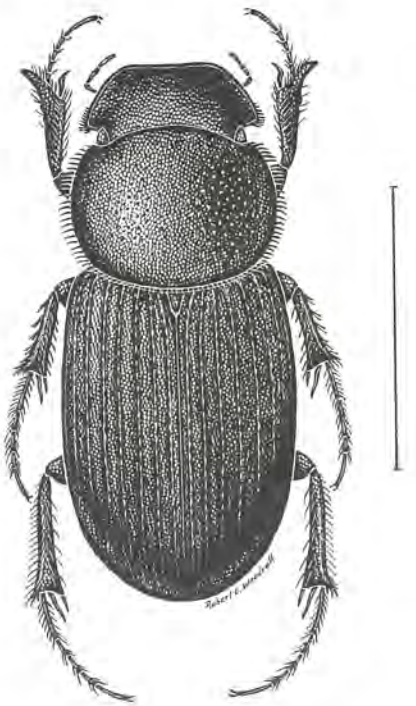


Fig. 290. **Pseudataenius** n.sp. near **socialis** (Horn), line = 2.5mm.

Ataenius new species

The following new species are known from Florida and are to be formally described by O. L. Cartwright (in press). They are briefly mentioned here primarily so the reader will be aware of them when trying to identify specimens with my manual.

#1 is known from Big Pine Key (Monroe Co.) and is related to *imbricatus* or *havanensis*.

#2 is known from Miami (Dade Co.) and Oneco (Manatee Co.).

#3 is known from a single specimen taken in a mosquito light trap at Flagler Beach (Flagler Co.), 18-V-54. It is a large species (length 6.5 mm) in the *scutellaris* group and similar only to *insculptus* in the Florida fauna. The pronotum is slightly explanate at the sides, and the pronotal punctures are coarse and closely spaced at the anterior angles. The elytra are deeply sculptured, the intervals crenulate and eroded over the apical one-third.

#4 is the species treated here as *brevinotus* Chapin.

Genus PSEUDATAENIUS Brown

(Fig. 290)

Pseudataenius Brown 1927c:290.

TYPE SPECIES: *Ataenius socialis* Horn (by original designation of Brown, 1927c:290).

DIAGNOSIS: Medium sized (length 4-5 mm), elongate, subparallel, reddish-brown, superficially resembling *Ataenius*. Differs from that genus by the feeble transverse carinae of the middle tibiae (female only), by the elongate middle and posterior tarsi, which are one-third longer than their respective tibiae, and by the elongate maxillary palpi. It resembles *Euparia* in the short, transverse head and the prominent genae, but it lacks the explanate pronotal sides and the basal notch of the elytra of that genus. Sexual dimorphism striking (see description of our single species).

TAXONOMIC NOTES: The uniqueness of the single species, *P. socialis*, was pointed out by several early writers (e.g., Horn, 1887:76-77), but they preferred to treat it as an aberrant *Ataenius*. It is a very distinctive genus and easily separated from its nearest allies in the tribe Eupariini.

For sections on distribution and zoogeography, biology, and selected references, see the discussion under *P. socialis*, the only species in the genus.

Pseudataenius socialis (Horn)*

(Fig. 290)

Ataenius socialis Chevrolat (manuscript name).
Ataenius socialis Harold (manuscript name).
Ataenius socialis Horn 1871a:287-288.
Pseudataenius socialis (Horn), Brown 1927c:290.

DIAGNOSIS: Medium sized (length 4-5mm), elongate, subparallel, reddish-brown, feebly convex, shining. Head evenly, sparsely punctate; clypeus broadly emarginate at the middle, the angles each side broadly rounded, not prominent; eyes larger than usual, the genae prominent and projecting laterally in front of the eyes. Pronotum feebly convex, rounded, the basal marginal line complete; margin fimbriate laterally and posteriorly with elongate setae. Scutellum feebly convex, virtually impunctate. Elytra subparallel, the striae crenately punctate, the intervals moderately convex, minutely punctate. Sexual dimorphism pronounced; *Male*: anterior tibia with only the terminal tooth well developed, the spur exceptionally elongate, twisted, and bent (Fig. 18); middle tibiae with practically no trace of transverse carinae; head broader and shorter, the surface finer and less densely punctate; pronotum more transverse, the punctures finer and less numerous. *Female*: anterior tibia normal, tridentate, the spur straight and short; middle tibia with two feeble transverse carinae; head narrower and longer, the surface more coarsely and densely punctate; pronotum less transverse, the punctures coarser and more numerous.

TAXONOMIC NOTES: It was originally described as an *Ataenius*, but is easily distinguished from that genus. It appears to be intermediate in some respects between *Euparia* and *Ataenius*. Cartwright (1939a:285-286) mentioned variation in the male anterior tibial spur which showed a clinal arrangement from South Carolina to Kansas.

DISTRIBUTION AND ZOOGEOGRAPHY: (Fig. 291). It has been recorded from the following states: Georgia, Louisiana, and Texas (Horn, 1887:77); District of Columbia (Ulke, 1902:24); New Jersey (Smith, 1910: 314); South Carolina and Kansas (Cartwright, 1939a: 285). I have collected it also in Alabama (new state record). It has not been recorded previously from Florida. I have seen specimens from Tallahassee and Monticello near the northern border of the state (new state record).

BIOLOGY: This was a rarely collected species until blacklight traps were operated regularly at Tall Timbers Research Station (Leon Co.) and Big Bend Hort. Lab. (Jefferson Co.). I have also taken two specimens in cow dung in Alabama. All of the specimens I have seen were taken from June 2 to July 7, although Cartwright (1939a:285) recorded *P. socialis* from July 7 to 15 in South Carolina. It appears to have the shortest seasonal activity of any Florida aphodiine. The immature stages are unknown.

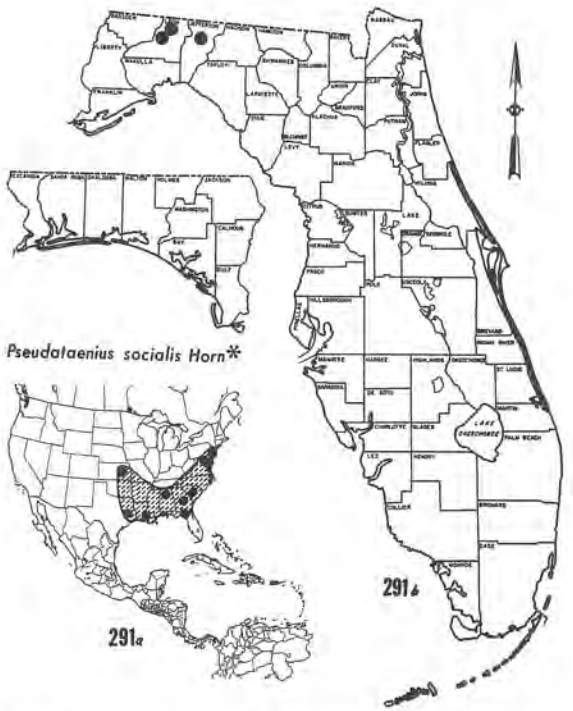


*Fig. 291. Florida specimens are now considered by Cartwright (in litt.) to be a new species near **socialis** (Horn).

SPECIMENS EXAMINED: Over 10,000 from 2 Florida counties with specific records as follows: (20) Jefferson Co., Monticello, 17-VI-58, A. M. Phillips, blacklight trap; (157) Jefferson Co., Big Bend Hort. Lab., 12-VI-69, W. H. Whitcomb, blacklight trap; (2,000+) ibid., 22-VI-69; (6) Leon Co., Tallahassee, 21-VI-65, W. Suter, at light; (37) ibid., 23-VI-65; (5) ibid., 29-VI-65. Several others were taken in Berlese funnel samples of leaf mold from Woodyard Hammock, Tall Timbers Res. Sta., all in June.

SELECTED REFERENCES: Brown, 1927c:290; Cartwright, 1939a:285-286; Horn, 1887:69, 76, 109; Schmidt, 1922a:433.

*Since this was written Cartwright has indicated (in litt.) that all the specimens from Florida represent an undescribed species which is in his manuscript presently in press.

Genus APHOTAENIUS Cartwright

(Fig. 292)

Aphotaenius Cartwright 1952:181-182.

TYPE SPECIES: *Ataenius carolinus* Van Dyke, 1928 (by original designation of Cartwright, 1952:182).

DIAGNOSIS: Similar to *Aphodius* and *Ataenius*, but more like the latter. Small (length 2.75 mm), elongate, oval, very convex, shining black. Head smooth except for a band of coarse punctures across the occiput; clypeus shallowly emarginate, the angles each side denticulate, the teeth prominent and turned up; the area between the teeth with a chevron-shaped area pointing dorsally, this probably being the reflexed clypeal margin. Genae bent downward as in *Ataenius*. Pronotum not crenate nor fimbriate; densely, coarsely punctate with the vestige of a mid-line indicated by a broken line of punctures. Pygidium as in *Ataenius*, the anterior basal portion with a longitudinal groove receiving the ventrally dentate elytral tips, the exposed apical portion with a depressed central area. Middle and posterior tibiae with distinct oblique carinae similar to *Aphodius*, but the apex with two well-separated triangular teeth, replacing the usual fringe of spinules; each tooth of the apex with a very fine hairlike seta basally on each side, the outer apical angle spine-like as in *Ataenius*.

TAXONOMIC NOTES: This genus was proposed because two species were found which did not fit well into existing genera. For example, our species was placed in *Ataenius* by Van Dyke (1928) and in *Aphodius* by Hinton (1937). *Aphotaenius* presently contains four species, only one of which (*carolinus*) occurs in Florida.

Although the characters mentioned above are sufficient for generic distinction, this species superficially resembles a diminutive *Ataenius ovatulus* Horn. It was placed in the tribe Eupariini by Cartwright, a position substantiated by the larva (Jerath, 1960b). Arnett (1962:414) erroneously listed it in the tribe Psammodiini.

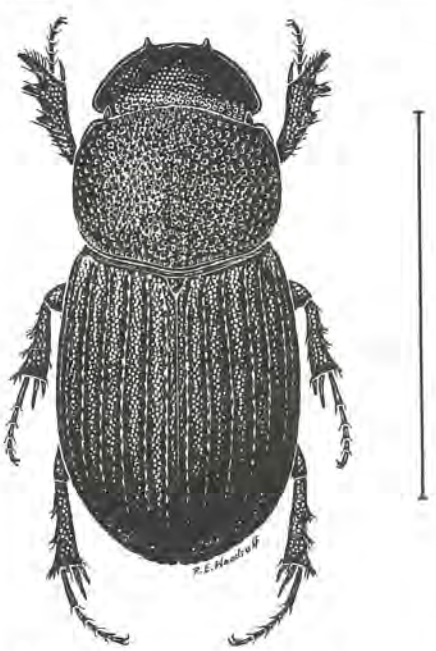


Fig. 292. **Aphotaenius carolinus** (Van Dyke), line = 2.0mm.

DISTRIBUTION & ZOOGEOGRAPHY: It is known only from the Western Hemisphere, a single species each from Mexico, Brazil, Colombia, and the U. S.

BIOLOGY: Practically nothing is known of the habits of the genus, except that all the species appear to be dung feeders. The larvae are known only for *A. carolinus*.

SELECTED REFERENCES: (see this section under our single species).

Aphotaenius carolinus (Van Dyke)

(Fig. 292)

Ataenius carolinus Van Dyke, 1928: 157-158.
Aphodius carolinus (Van Dyke), Hinton 1937:196.
Aphotaenius carolinus (Van Dyke), Cartwright 1952: 182-183.

DIAGNOSIS: (see this section under the genus).

TAXONOMIC NOTES: This species appears to be most closely related to *howdeni* Cartwright from Mexico. Both species have the prominent clypeal teeth, impunctate anterior part of the head, and are the same general small size (length 2.5-3.1 mm). The strial punctures of *carolinus* crenate, the intervals weakly, and the intervals are only slightly convex, whereas in *howdeni* the strial punctures are coarse and strong and the intervals convex.

DISTRIBUTION & ZOOGEOGRAPHY: It is known from Indiana to Maryland south to Florida. Cartwright (1958) mentioned that, except for recent collections in North Carolina, South Carolina, and Georgia, most specimens were collected more than 50 years ago and ". . . it now seems confined to the Carolinas and Georgia."

Cartwright (1952:183) also listed a record from Key West, Florida, with an old and very doubtful label, this being the only published record for the state. I have collected it only at Florida Caverns State Park in Jackson County.

BIOLOGY: Although Cartwright (1958:134) indicated that it is usually found in and under deer droppings in shady woods, my specimens were taken in pack rat dung at the entrance to a small cave (see habitat photo Fig. 127-128). Only two of these were alive, but there were numerous fragments, indicating that it was probably more abundant earlier in the season. In North Carolina, Cartwright (1952:183) found it from April 29 to September 10.

The larva has been described and figured by Jerath (1960b:68-69) and is characterized as follows: clypeus with one seta on each side; frons without posterior and anterior frontal setae; maxillary stridulatory area with four or five conical teeth; second and third antennal segments subequal, the first short; lacinia with terminal uncus; galea ventrally with six or seven short setae; raster with 19-23 tegillar setae.

SPECIMENS EXAMINED: 18, of which 4 were from Jackson Co., Fla., Florida Caverns State Park, 6-X-60, R. E. Woodruff, in pack rat dung; fragments of several additional specimens were collected at the same locality.

SELECTED REFERENCES: Cartwright, 1952:182-183; 1958:134; 1963:49, 51; Hinton, 1937:196; Jerath, 1960b:68-69, Fig. 11, 18, 34, 35, 47, 57, 74 (larva).

Genus PSAMMODIUS Fallén

(Fig. 293-305)

Psammodius Fallén 1807:37.
Psammobius Heer 1841:531.

TYPE SPECIES: *Aphodius sulcicollis* Illiger (by subsequent designation of Curtis, 1829).

DIAGNOSIS: Small (length 2.5-4.6 mm), convex, shining, reddish-brown to dark brown. Head granulate (Fig. 294), the granules rarely elongate transversely; clypeus emarginate at the middle, the angle each side dentate in three of the Florida species. Eyes usually hidden in repose, a deep depression (anteocular pit) in front of the eye along the lateral margin of the genae (Fig. 294). Pronotum convex, the punctures scattered, often large and deeply impressed and sometimes forming transverse furrows or depressions accompanied by swollen impunctate areas; at least part of lateral and posterior margin fimbriate, the setae not clavate. Elytra often swollen posteriorly, the striae moderately impressed and the intervals convex. Middle and posterior tibiae noticeably widened at the apex, the spurs often flattened, spatulate and longer than the first tarsal segment (Fig. 295-7); the tibiae with transverse ridges or at least setigerous tubercles. Tarsi usually short, the segments often triangular in outline (Fig. 295-7).

TAXONOMIC NOTES: The American species were revised recently by Cartwright (1955), but specimens often are difficult to identify without comparative material, since that paper contains no illustrations. Two species formerly in the genus were placed in *Xeropsammobeus*, and another was transferred to *Ataenius*. Several species of *Pleurophorus* were formerly placed in *Psammodius*.

Ataenius simulator (=*schwarzi*) appears to occupy an intermediate position between *Ataenius* and *Psammodius*, and several other species contain characters of both genera. Cartwright (1955) suggested that these two genera ". . . probably should be placed in the same tribe of the Aphodiinae." However, *Ataenius* is closely related also to *Euparia* and *Myrmecaphodius* of the Eupariini, so that a considerable reshuffling would be required by such a move. Until a more extensive study can be made of the higher categories within the Aphodiinae, I prefer to maintain *Psammodius* and *Ataenius* in separate tribes.

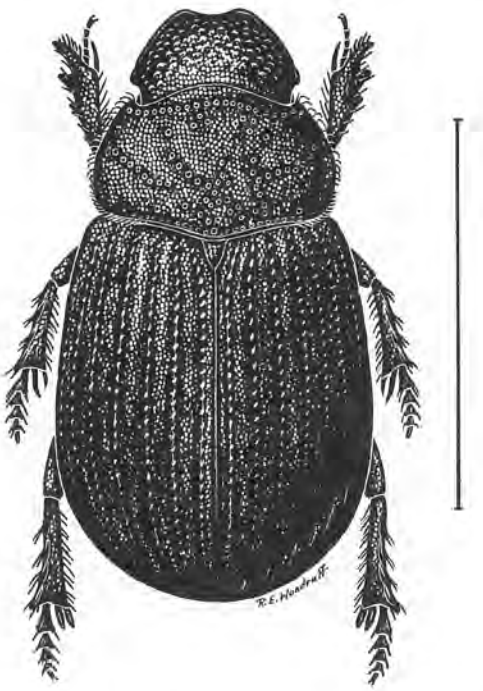


Fig. 293. **Psammodius malkini** Cartwr., line = 2.0mm.

Cartwright (1955) recognized two general groups of *Psammodius*, but because several species are intermediate, he did not elect to create subgenera. One group is more elongate, the maxillary galea is covered with close parallel rows of mixed, fine, hairlike and hooked setae (giving a brushlike tip), and the pronotum usually does not have deep transverse grooves or furrows. The other group is more globular, the maxillary galea is provided with heavy chitinous teeth, and the pronotum usually has transverse grooves or furrows.

DISTRIBUTION & ZOOGEOGRAPHY: The genus is widely distributed in all major zoogeographic regions, and several species have been distributed by commerce. Schmidt (1922a) recognized 37 species, 15 of which were from the Western Hemisphere (this number raised to 35 by Cartwright, 1955) with half the remainder from Europe and Africa and an equal number from Australia and Asia. Of those from the Western Hemisphere, 16 are recorded from the U. S. (4 of which are also known from Mexico and one from Argentina), 6 additional species occur in Mexico and Central America, and 13 are known only from South America.

Four species have been found in Florida. Of these, one is endemic, one is found in Georgia and Florida, one is found on the Atlantic and Gulf Coast from New Jersey to Mississippi, and the last is reported from South Carolina and Georgia but is probably introduced from South America (where it is known from Argentina, Paraguay, and Bolivia).

BIOLOGY: Nearly all members of the genus are found in sandy areas, especially dunes along the coast and sand bars along major rivers. They probably feed on roots of halophytic plants, although this has not been firmly established. Several species are flightless, and the eyes are vestigial. Many of the species are rare except locally, but a few are taken in large numbers at lights. The larvae have been described for two of the U. S. species (neither of which occurs in Florida), and they were characterized by Jerath (1960b) as follows: clypeus divided into smaller preclypeus and large postclypeus; first and third antennal segments subequal, second shorter than the first and third; epipharynx with dexiophoba and laephoba monostichous; galea ventrally with a long seta and a row of three short setae; lacinia dorsally with a row of five long setae near the mesal edge and a short seta posteriorly; each abdominal spiracle-bearing area with 6-8 setae ventrally and two setae dorsally; lower anal lobe divided into two sublobes remote from each other.

SELECTED REFERENCES: Blatchley, 1928:27; Cartwright, 1955:413-462; Horn, 1887:92-98; Jerath, 1960b:80-82, Fig. 9, 37, 38, 50, 66, 72, 87 (larvae); Schmidt, 1922a:469-485.

Key to Florida species of Psammodius

1. Clypeus dentate; larger (length 2.5-4.6 mm) 2

1'. Clypeus without teeth; smaller (length 2-2.5 mm); Fig. 293-4 ..... *malkini* Cartwr.

2. Posterior tibia with a transverse ridge in front of the apex; pronotal punctures shallow and widely scattered, the intervening areas smooth, flat and not swollen ..... *bidens* Horn

2'. Posterior tibia without a transverse ridge in front of the apex; pronotal punctures deep, the intervening areas irregularly swollen 3

3. Pronotal punctures irregularly spaced, but distributed throughout; long spur of middle tibia shorter than or equal to first two tarsal segments ..... *armaticeps* Fall

3'. Pronotal punctures confined to a band on posterior one-half, the anterior one-half impunctate, especially in the middle; long spur of middle tibia usually longer than the first two tarsal segments ..... *cruentus* Har.

Fig. 294. Stereoscan photo of head of **Psammodius malkini** Cartwr. (caudal view, 75X). Note verrucose head and anteocular pit.

Psammodius armaticeps (Fall)

Psammobius armaticeps Fall 1932:190.
Psammodius armaticeps Fall, Cartwright 1955:460.

DIAGNOSIS: Similar to *P. cruentus*, but the punctation of the pronotum, although widely scattered, never leaves a broad impunctate area on the anterior one-half.

TAXONOMIC NOTES: The pronotal punctation varies in extent but never approaches the situation found in *cruentus*.

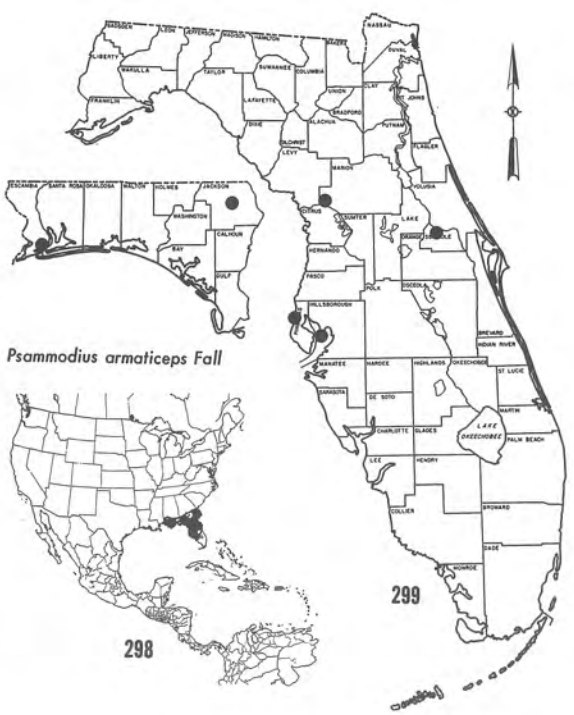
DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 298-9). It is known only from Georgia and Florida. Cartwright (1946:90) indicated that he had examined the specimen from Tybee Island, Georgia, mentioned by Fall in the original description of *armaticeps*, and found that it represented *cruentus*. The only definite station record for Georgia is St. Simon Island. The type locality is Pensacola, Florida, and Cartwright (1955:461) reported Tampa as the only other Florida record. I have now seen specimens from four additional Florida localities.

BIOLOGY: Nothing has been published on the habits of this species. Cartwright (1955:461) had seen 56 specimens, but he recorded no habitat or behavioral information. In company with O. L. Cartwright, I collected 72 specimens at Dunedin, Florida, on May 14, 1959. Almost all of these were taken at night by scratching in oyster shell and sand used for fill dirt around the base of a lighted sign. It is interesting that a blacklight trap sample, collected exactly one year later at Tampa, produced 73 additional specimens. My Florida records are for May, June, and August. Cartwright (1955:461) reported the season as March 12 to May 22, August, and September. The immature stages are unknown.

Fig. 295-297. Stereoscan photos of posterior tibia of **Psammodius malkini** Cartwr.: 295) ventral view, 85X, 296) oblique view, 190X, 297) caudal view, 135X. Note shape of spurs as compared with those of **Ataenius** (Fig. 223-224).

SPECIMENS EXAMINED: 153 from 6 Florida localities as follows: (1) Escambia Co., Pensacola, 25-VIII-42. R. C. Barnes, mosquito light trap; (1) Hillsborough Co., Tampa, 22-VI-42, R. C. Barnes, mosquito light trap; (3) Hillsborough Co., Tampa, McDill Field, 20-V-43, B. Malkin, at light; (73) Hillsborough Co., Tampa, 14-V-60, E. E. Crooks, blacklight trap; (1) Jackson Co., 28-V-54, mosquito light trap; (1) Marion Co., Dunnellon, 2-VIII-56, W. Suter; (72) Pinellas Co., Dunedin, 14-V-59, R. E. Woodruff, at light; (1) Seminole Co., Sanford, 2-V-62, G. W. Desin, blacklight trap.

SELECTED REFERENCES: Nothing has been published on this species except the papers cited in the synonymy above.



Psammodius bidens Horn

Psamodius bidens Horn 1871a:293.
Psammobius cruentus Horn, Blatchley 1928:27 (misidentification).

DIAGNOSIS: Differs from the other two Florida species with dentate clypeus by the possession of well defined, carinate, transverse ridges on the middle and posterior tibiae. In addition, the pronotal punctures are scattered, few and coarse, but not so deeply impressed to make the surrounding areas appear swollen. The long spurs of the middle and posterior tibiae are more twisted and the first tarsal segments shorter and more expanded apically.

TAXONOMIC NOTES: This species was listed as a synonym of *cruentus* Har. by Schmidt (1910a, 1910b, 1922a) and Blatchley (1928). However, it is quite distinct, and the name was revived by Chapin (1940:9) and Cartwright (1955:451).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 300-1). Cartwright recorded it from Florida, Georgia, Maryland, Mississippi, New Jersey, North Carolina, South Carolina, Virginia, and Puerto Rico. Blatchley (1928: 27) reported it (under the name *cruentus*) from the following Florida localities: Capron, Cedar Keys, Dunedin, Lake Okeechobee, New Smyrna, Pensacola, and Tampa. Cartwright (1955) added Miami, and I have seen it from three additional localities: Crescent Beach, Punta Gorda, and St. Augustine (for complete data see section on specimens examined). The Puerto Rican record is based on a single specimen from the beach at Humacao.

BIOLOGY: Cartwright (1955:452) indicated that it is found among grass roots growing in sand along the coast, and the season is April 12 to October 12. I have seen a few specimens collected at light, and I took two specimens about two inches deep in bare sand at the edge of a concrete building at Crescent Beach. The immature stages are unknown.

SPECIMENS EXAMINED: Eight from four Florida localities as follows: (1) Charlotte Co., Punta Gorda, 15-V-59, R. E. Woodruff, at light; (2) Dade Co., Port of Miami, Dodge Island, 24-X-66, J. E. Porter, mosquito light trap; (2) Dade Co., Port of Miami, Dodge Island, 2-XI-66, J. E. Porter, mosquito light trap; (2) St. Johns Co., Crescent Beach, 25-VI-60, R. E. Woodruff; (1) St. Johns Co., St. Augustine, 8-VII-34, at light.

SELECTED REFERENCES: Blatchley, 1928:27; Cartwright, 1955:451-452; Chapin, 1940:9; Schmidt, 1922a: 478.

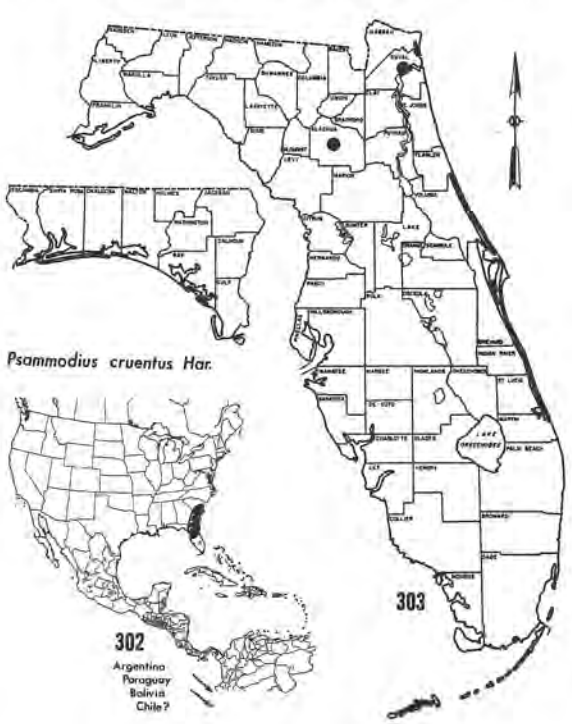
Psammodius cruentus Harold

Psammodius cruentus Harold 1867a:282.
Psammodius shermani Cartwright 1946:89.

DIAGNOSIS: Differs from the other Florida species by the pattern of pronotal punctation. The punctures are deeply impressed and unevenly placed, but they are confined to the basal one-half except for a few on the sides; thus the anterior one-half has a broad impunctate area, which is often uneven and slightly wrinkled. This pattern is similar to that of *Ataenius simulator* Har., but the punctures are not as depressed and are less numerous in that species.

TAXONOMIC NOTES: Cartwright (1955) synonymized his *P. shermani* after recognizing that the U. S. and South American specimens represented the same species. *P. bidens* was listed as a synonym by Schmidt (1922a:478), but it is a very distinct species. Blatchley's (1928) records of *cruentus* are probably all referable to *bidens* which he listed as a synonym.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 302-3). It was recorded by Cartwright (1955) from the fol-



lowing: Georgia, South Carolina, Argentina, Bolivia, and Paraguay. The type locality is not known, but is probably Chile (Harold's paper being on "Die Chilensischen Aphodiden"). All of the South Carolina records (Folly Beach, Isle of Palms, Sullivans Island, Mount Pleasant) are from around Charleston Bay, and the single Georgia record is from Tybee Island. The latter is the earliest record (June, 1927) for North America.

Previously it has not been reported definitely from Florida, but I have seen specimens from Gainesville and Jacksonville. The records of Blatchley (1928:27) probably all refer to *bidens*, which he listed as a synonym of *cruentus*.

BIOLOGY: It is primarily a coastal species that appears to have only relatively recently been introduced into North America. The type series of *shermani* Cartwright was taken ". . . under a thin line of debris around a depression back of the beach after a storm." (Cartwright, 1946:90). The four Florida specimens were taken at light.

Cartwright (1955:462) reported the season as October to April in South America and June 3 to September 10 in North America. My records for Florida extend the latter slightly from May 28 to September 15. The immature stages are unknown.

SPECIMENS EXAMINED: Five, of which four were from two Florida localities as follows: (3) Alachua Co., Gainesville, 28-V-58, R. E. Woodruff, blacklight trap; (1) Duval Co., Jacksonville, 15-IX-42, R. C. Barnes, mosquito light trap.

SELECTED REFERENCES: Blatchley, 1928:27; Cartwright, 1955:461-462; Schmidt, 1922a:478.

Psammodius malkini Cartwright

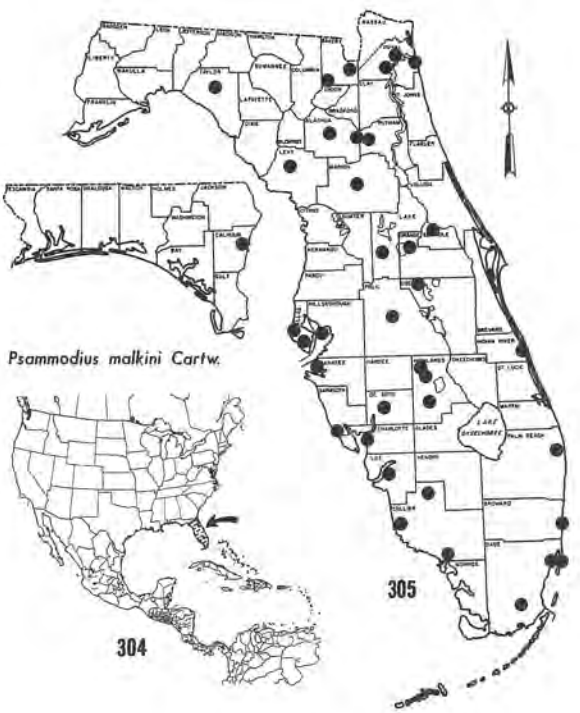
(Fig. 293-7)

Psammodius malkini Cartwright 1946:90.

DIAGNOSIS: In Florida it is the smallest species of the genus (length 2-2.5 mm) and the only one without clypeal teeth. It is usually light brown and more inflated than the others. The pronotal punctures are scattered, but they are often partially in line to form moderate transverse furrows with corresponding convex ridges bordering them. This condition is variable and is never as pronounced as in some of the western species (e.g., *mimeticus* Fall). The lateral pronotal margin is usually fimbriate only near the anterior and posterior angles, but never completely fimbriate as in the other Florida species.

TAXONOMIC NOTES: It is apparently related to *P. hydropicus* Horn, a wingless species with vestigial eyes, but is less inflated, and the eyes are well developed.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 304-5). It is known only from Florida, where the type locality



is MacDill Field at Tampa. It was recorded by Cartwright (1955:443) from three other localities: LaBelle, Miami, and Sanford. I have seen specimens from 23 locations, from Blountstown (Calhoun Co.) and Macclenny (Baker Co.) in the north to Homestead (Dade Co.) in the south.

BIOLOGY: Nothing has been published on the habits of this species except that it was found from May 5 to August 7 (Cartwright, 1955). My records extend the season from April 29 to November 2, although most specimens were taken from June through September. I have practically no information about this species except that often it is attracted to lights in large numbers. Cartwright (1955) had seen only 21 specimens, but I have seen 1,216 during this study. The immature stages remain unknown.

SPECIMENS EXAMINED: 3,083 from 44 Florida localities, representing 232 collection records (for complete data see Appendix 51).

SELECTED REFERENCES: Cartwright, 1955:443.

Genus PLEUROPHORUS Mulsant

(Fig. 306)

Pleurophorus Mulsant 1842:312.

TYPE SPECIES: *Scarabaeus caesus* Creutzer 1796 (by monotypy).

DIAGNOSIS: Distinguished from other members of the tribe Psammodiini by the lack of ciliae or fimbriae on the pronotal sides and base. The Florida species are very small (length 1.9-3 mm; width 0.9-1.2 mm), elongate, shining, reddish-brown, with the legs and anterior pronotal angles often lighter. Head granulate, clypeus emarginate at the middle, the angles each side obtusely rounded, never dentate. Pronotum coarsely, irregularly punctate, the median longitudinal furrow evident, at least on the basal one-half. Elytra deeply striate punctate, the intervals convex. Pygidium with from six to ten elongate setae. Contains the smallest species of Scarabaeidae known.

TAXONOMIC NOTES: The American species of this genus have been rather recently revised by Cartwright (1948a). However, the species are so small that they are sometimes difficult to identify without comparative material, and especially since no illustrations accompany the above paper. The two Florida species are readily separated by the characters in the key. At present, nine American species are recognized. Several of the species have been placed previously in *Psammodius* and *Diastictus*. The generic limits have not been established firmly, and it is likely that the Old World species placed in *Pleurophorus* are not congeneric with the New World species.

Before Cartwright's study, nearly all U. S. specimens were referred to *P. parvulus* (Chev.) or *P. batesi* Arrow. The former is known now only from the West Indies, and the latter is a synonym of *P. micros* Bates. The genus is placed with *Psammodius*, *Rhyssemus*, and *Trichiorhyssemus* in the tribe Psammodiini.

DISTRIBUTION & ZOOGEOGRAPHY: Schmidt (1922a) listed species from Africa, Celebes, Ceylon, Europe, Java, New Caledonia, Tashkent, and the U. S. As mentioned earlier, it is possible that these are not all congeneric. In the New World, Cartwright (1948a) reported specimens from Canada to Argentina, including most of the U. S., the West Indies, Mexico, and Central America. In Florida the two species have been found from Pensacola to Homestead, but not on the Keys.

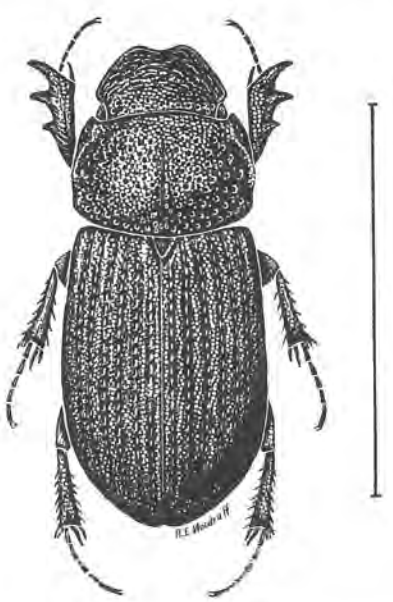


Fig. 306. **Pleurophorus longulus** Cartwr., line = 2.0mm.

BIOLOGY: Very little is known about the habits of the genus, although specimens are sometimes abundant at light. Some species have been taken in flood debris along larger rivers and flying over such areas at dusk. Cartwright (1948a) mentioned that specimens were poorly represented in American collections of Coleoptera. During the course of his revision he saw only 1,033 specimens from 32 museum, university, and private collections. I have examined over 100,000 Florida specimens of *P. longulus* during my study, over 1,000 having been found in a single light trap sample.

The larvae of two species, *P. caesus* (Creutz.) and *P. longulus* Cartwright, have been described and figured by Jerath (1960b). The former were taken from potato hills in Washington, and the latter were found in soil samples and in the roots of dog fennel in Alabama. They are characterized as follows: each antennal base with two long setae and a short seta exterolaterally and one long seta dorsally; clypeus not distinctly divided into preclypeus and postclypeus; lacinia dorsally with a row of four or five long setae near the mesal edge and one short seta posteriorly; galea ventrally with a long seta and two short setae; spiracular concavity facing ventrally; each abdominal spiracle-bearing area with two setae ventrally and one seta dorsally; lower anal lobe divided into two sublobes placed adjacent to each other.

SELECTED REFERENCES: Cartwright, 1948a:131-145; Horn, 1887:90-92; Jerath, 1960b:82-84, Fig. 6, 21, 22, 36, 51, 64, 65, 73, 89 (larvae); Schmidt, 1922a:488-492.

Key to the Florida species of Pleurophorus

1. Base of head with mixed fine and moderate punctures; first posterior tarsal segment gradually tapering, but not noticeably widened apically; eroded area of pygidium divided in the middle by a smooth longitudinal carina; pygidial setae 6-8; common Florida species..... *longulus* Cartwright

1'. Base of the head finely punctate; first posterior tarsal segment noticeably widened apically; eroded area of pygidium without a longitudinal smooth carina at the middle; pygidial setae 8-10; rare in Florida ..... *micros* Bates

Pleurophorus longulus Cartwright

(Fig. 306)

Pleurophorus longulus Cartwright 1948a;143-144.
Pleurophorus parvulus Chevrolat, Blatchley 1928:28 misidentification).

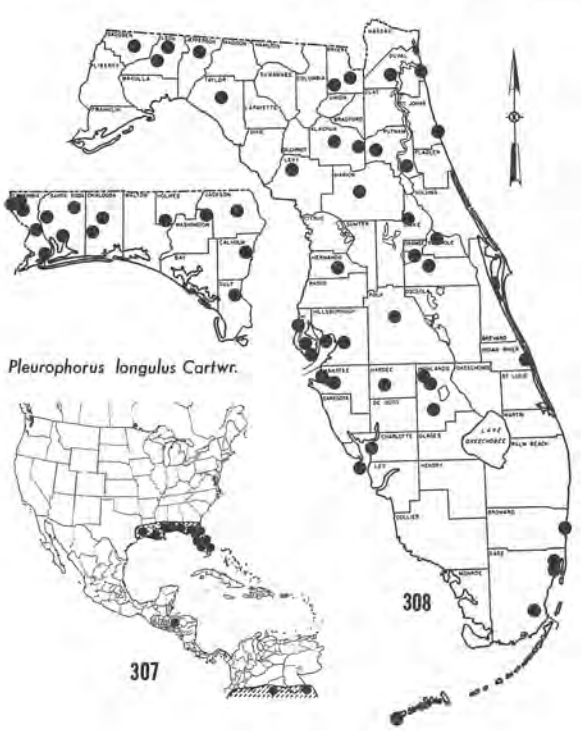
DIAGNOSIS: One of the smallest scarabs in the world (length 1.9-2.4 mm, width 0.9-1.0 mm). Easily distinguished from the only other Florida species, *P. micros*, by the characters in the key. In addiiton it is generally smaller, and the most common number of pygidial setae is six.

TAXONOMIC NOTES: It is variable in size as mentioned above and in the extent of pronotal punctation. The number of pygidial setae varies from six to eight, but these are sometimes partly or completely broken off. Sexual dimorphism usually is evident: the males smaller, more slender, middle and posterior tarsi longer, the elytra often lighter in color, and the terminal abdominal segment not flattened or depressed at the middle.

Blatchley (1928:28; 1928a:69) reported *P. parvulus* from Dunedin, Florida. However, this species is not known now from the U. S., but occurs in the West Indies. Many of the early records of *parvulus* refer to other species, and Blatchley's record undoubtedly applies to *P. longulus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 307-8). Cartwright (1948a:144) reported the distribution ". . . to be from Southern United States to Argentina in South America, by far the widest of any known species of this genus." Actually *P. caesus*, an European species, has been introduced into various parts of the New and Old World and was recorded by Schmidt (1922a:490) from Europe, North Africa, lower Asia, Madagascar, Chile, and the United States. Although Cartwright's statement implied that *P. longulus* was known from the entire area metnioned, he saw no specimens from areas between Louisiana and South America (except for a single interception at Mobile on plants from Honduras).

In Florida it probably occurs throughout the state, with the possible exception of the Keys. It has been found from Pensacola to Homestead (for complete data see Appendix 52).



BIOLOGY: Nothing has been published on the habits of this species except that it has been taken at light. Although I have seen several thousand specimens, I can add very little information, since nearly all of these were from blacklight traps. My notes indicate the following: on October 3, 1962, at a service station in Gainesville, 60 specimens were taken around the gasoline pump lights at 8 PM just before a light rain; specimens continued to fly in the rain, and they crawled much faster than most other Aphodiinae; two pairs were found in copula; the only other Aphodiinae collected at this time were *Ataenius gracilis* Melsh. and *A. fattigi* Cartwr. Specimens have been collected every month of the year in Florida. The larva was described and figured by Jerath (1960b).

SPECIMENS EXAMINED: Over 100,000 of which data were recorded for 84,841 from 63 Florida localities, representing 705 collection records (for complete data see Appendix 52).

SELECTED REFERENCES: Blatchley, 1928:28; Frost, 1964:142; Jerath, 1960b:83-84, Fig. 21, 51, 65 (larva).

Pleurophorus micros (Bates)

Psammodius micros Bates 1887:103.
Psammodius nanus (DeGeer), Horn 1887:96 (misidentification).
Pleurophorus batesi Arrow 1903:514.
Pleurophorus micros (Bates), Cartwright 1948a:140.

DIAGNOSIS: Small (length 2-3 mm), elongate, shining, pronotum coarsely punctate, head granulate. Superficially similar to the only other Florida species, *P. longulus*, but easily separated by the characters in the key. In addition it is usually larger, and the most common number of pygidial setae is eight.

TAXONOMIC NOTES: Although originally described in the genus *Psammodius*, it is distinguished easily from it by the lack of ciliae or fimbriae on the lateral and posterior pronotal margin. Horn's (1887) identification of *P. nanus* apparently was incorrect, and that species does not occur in the U. S. Schmidt (1922a: 457) listed it as an *Ataenius* from Surinam. The

synonymy of *P. batesi* was established by Cartwright (1948a:141), who indicated that it was only a light colored form of *micros*.

Variation is noticeable in size (length 2-3 mm); the three Florida specimens which I have seen are smaller than those from Arizona. The color varies from light to dark brown, and the pronotal punctation varies in extent.

DISTRIBUTION & ZOOGEOGRAPHY: It was recorded by Cartwright (1948a) from the following: Arizona, California, Florida, Nevada, Texas, Utah, Mexico (including Baja, California), and Guatemala (type locality). The single Florida record mentioned by Cartwright is Citrus County, Gum Cave, 25-VII-95, Hubbard and Schwarz (U. S. National Museum). I have seen only three Florida specimens, all of which are from Miami.

BIOLOGY: Nothing has been published on the habits of this species except that it has been taken at light. The immature stages are unknown.

SPECIMENS EXAMINED: About 40, of which only 3 were from Florida as follows: (1) Miami International Airport, 14-VI-66; (1) Port of Miami, Dodge Island, 13-VI-66; (1) Port of Miami, Dodge Island, 2-XI-66; all of which were collected by J. E. Porter in mosquito light traps.

SELECTED REFERENCES: Cartwright, 1948a:140-142; Horn, 1887:96; Schmidt, 1922a:481.

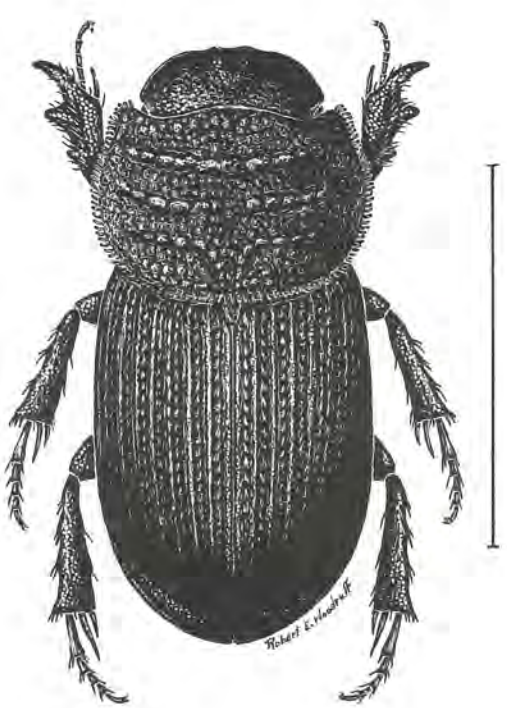


Fig. 309. **Rhyssemus scaber** Hald., line = 2.0mm.

Genus RHYSSEMUS Mulsant

(Fig. 309)

Rhyssemus Mulsant 1842:314.

TYPE SPECIES: *Ptinus germanus* Linnaeus 1767 (designation not known, but cited by Balthasar (1964: 556).

DIAGNOSIS: Small (length 3-4 mm), dull, granulate, black to gray. Head deflexed, almost entirely granulate or verrucose, the vertex with a "v"-shaped marking, eyes invisible in repose. Pronotum wider than long, transverse swellings and the depressions granulate, lateral and basal margin fringed with clavate setae. Elytra as wide as pronotum, striae fine, intervals with a row of elongate tubercles placed closely and slightly oblique (on the inner side) and a more elevated cariniform line on the outer side which is entire anteriorly, interrupted posteriorly. Middle and posterior tibiae with transverse carinae. Easily distinguished from all other Florida genera by the granulate head, the transverse ridges of the pronotum, and the clavate marginal pronotal setae.

TAXONOMIC NOTES: There are about 90 species in the world (Balthasar, 1964), of which five are known from the U. S. Subgenera have not been established, although several closely related genera have been erected. Balthasar (1964) treated the Ethiopian and Palearctic species, but the world fauna is in need of revision, especially since several species have been moved about by commerce. In our fauna the genus is most closely related to *Psammodius* and is placed in the tribe Psammodiini.

DISTRIBUTION & ZOOGEOGRAPHY: It is represented in all the major zoogeographic regions of the world, although the species are much more numerous in the Old World. The five U. S. species are distributed from Ontario, Canada to Florida (?), west to Colorado, California, and Arizona. None is recorded from the West Indies. The Florida record is based on a single specimen of *R. scaber* which might have been mislabeled.

BIOLOGY: Practically nothing has been published on the habits of the genus, except that specimens are found in sandy places, often near water. There are a few records of specimens taken at light. As far as I can determine, the immature stages have not been described.

SELECTED REFERENCES: Balthasar, 1964:556-582; Clouet, 1901:36-117; Horn, 1871a:290; 1887:87-90; Schmidt, 1910a:123-124; 1922a:497-498.

Rhyssemus scaber Haldeman

(Fig. 309)

Rhyssemus scaber Haldeman 1848:107 (often cited as 1846).

DIAGNOSIS: Differs from all other Florida Aphodiinae by the generic characters. Small (length 3-4 mm), dark brown to black, the legs reddish-brown. Surface of head granulate, the anterior granules larger and more widely spaced; clypeus broadly emarginate at the middle, the angles each side obtusely rounded, genae small, rounded, poorly defined. Pronotum convex, not punctate, but granulate throughout; four transverse ridges (excluding apical and basal partial ridges) of larger polished granules, the grooves between with small granules surrounded by light colored alutaceous areas; pronotal margin laterally and basally with flat, clavate setae. Elytral sculpture complicated: striae relatively broad and straight, the outer edge with a row of oblique tubercles; the intervals carinate, the carinae nearly regularly interrupted. Scutellum small, pale, translucent. Middle and posterior tibiae with three transverse setate ridges. Tarsal segments subtriangular, but never as short and broad as in *Psammodius*.

TAXONOMIC NOTES: Clouet (1901) divided the genus into two sections without subgeneric names and placed this species in group "B," although he had not seen specimens.

DISTRIBUTION & ZOOGEOGRAPHY: Horn (1871a: 290) reported it from "the Atlantic region" and later (1887:89) from "the Middle States to Texas." The only specific records I have found are: District of Columbia (Ulke, 1902:24, 49), Florida (Blatchley, 1928:27-28), and New Jersey (Smith, 1910:314). Cartwright (in litt.) indicated that there are no specimens in the U. S. National Museum from south of Ft. Monroe, Virginia.

The only Florida record is that of Blatchley (1928: 27) who mentioned a specimen in the H. C. Fall collection from "Lake Mary." This collection is now in the Museum of Comparative Zoology, and through the courtesy of P. J. Darlington, I was able to examine this specimen. There is no doubt about the determination of the species, but there is some doubt in my mind about the validity of the locality record. The label contains no information except "Lake Mary, Fla." and is without date or collector. It has a pin hole where the label was previously pinned, suggesting the possibility of a curatorial error in labeling. Since there are no other records south of Virginia, and extensive collecting has not revealed its presence, I do not believe it occurs in Florida. It is included here to permit its identification in case it should be found.

BIOLOGY: Practically nothing is known about the habits of this species, and the immature stages are unknown. It was reported by Horn (1887:89) from the ". . . margins of streams" and by Ulke (1902:49) from ". . . under stones in wet places."

SPECIMENS EXAMINED: Four, including the single specimen from Lake Mary, Florida; the other three are from New Jersey.

SELECTED REFERENCES: Blatchley, 1928:27-28; Horn, 1871a:290; 1887:88-89; Schmidt, 1922a:503; Ulke, 1902:24, 49.

Subfamily HYBOSORINAE

(Fig. 310)

TYPE GENUS: Hybosorus MacLeay, 1819: 120.

A small subfamily, mostly of Old World distribution, with about 107 species in 20 genera (Arrow, 1912). Only two of the genera, *Hybosorus* and *Pachyplectrus*, occur in the U. S. *Pachyplectrus* appears to be our only native representative of the group, and it is represented by a single rare species from Arizona and California. *Hybosorus* contains 12 species, which are African or Madagascaran, with two exceptions: one species from Syria and *H. illigeri* Reiche which is known from southern Europe (Spain and southern France), Algeria, Persia, India, most of Africa and the southeastern U. S. It was apparently introduced into the U. S. before 1847 and probably arrived on slave ships (Paulian, 1944:5).

The subfamily is characterized by the corneous and prominent labrum and mandibles, 10-segmented antennae, the club 3-segmented with the first segment hollowed to receive the second (Fig. 317-18), anterior coxae oblique, contiguous, epimera of the metathorax visible, 6 visible abdominal segments, and eyes emarginate in front.

The group has gone under a variety of similar names, such as Hybosorides, Hybosorites, Hybosorini and has even been elevated to family rank by Gardner (1935) and followed by Paulian (1944).

The larvae are also distinct and were the primary reason for elevating the group to family status by Gardner. The most distinctive features are the presence of stridulatory structures on the prothoracic and mesothoracic legs, and the presence of three truncate lobes on the anterior margin of the labrum. The larva of our single species is unknown, but if it possesses these characters, it should be easily distinguished from other scarab larvae. Ritcher (1966) indicated that the larvae show relationships with the Acanthocerinae, based on the similarity of the epipharynges, spatulate setae of the raster, and the fact that both have stridulatory organs on the legs.

Genus HYBOSORUS MacLeay

(Fig. 310-20)

Hybosorus MacLeay 1819:120.

TYPE SPECIES: Hybosorus illigeri Reiche (designation unknown, but cited by Paulian, 1944).

DIAGNOSIS: Distinguished from *Pachyplectrus*, the only other U. S. member of the subfamily, by the narrow rather than broad mandibles, with the outer edge evenly rounded rather than angulate. The middle and posterior tibiae are much thicker in *Pachyplectrus*.

TAXONOMIC NOTES: Twelve species are recognized in the genus (Arrow, 1912:36-37) with the single species in the New World. The genus is in need of revision, since no paper treats the entire genus.

DISTRIBUTION & ZOOGEOGRAPHY: Our species is presumably introduced and is native to southern Europe. The remaining 11 species are distributed as follows: Madagascar (2), India (1), Syria (1), and Africa (7).

BIOLOGY: Very little is known about the genus except that most species are attracted to lights. No records have been found on the food habits or behavior, and no species is known to stridulate (Arrow, 1904).

SELECTED REFERENCES: Arrow, 1904; 1909; 1912; Paulian, 1944; Ritcher, 1966 (larvae).

Hybosorus illigeri Reiche

(Fig. 310-20)

Hybosorus illigeri Reiche 1853:88.
Scarabaeus arator Illiger 1803:210-212 (not Fabricius 1775).
Hybosorus laportei Westwood 1845:159.
Hybosorus roei Westwood 1845:159.
Hybosorus carolinus LeConte 1848:84.
Hybosorus oblongus Gemminger & Harold 1869 (attributed to Dahl in litt.) (nomen nudum).

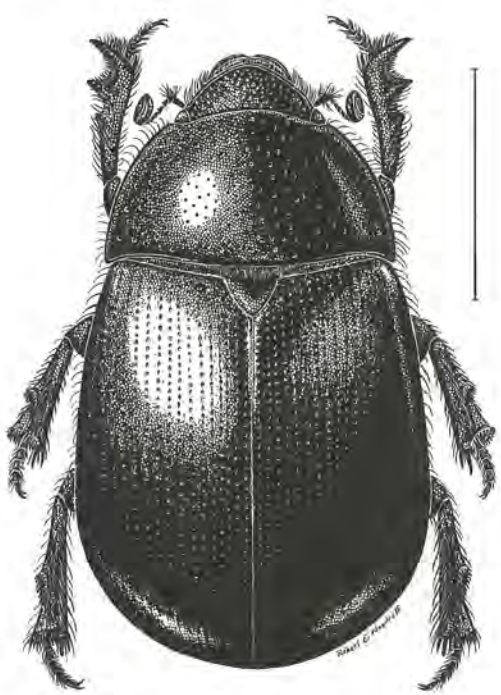


Fig. 310. **Hybosorus illigeri** Reiche, line = 5mm.

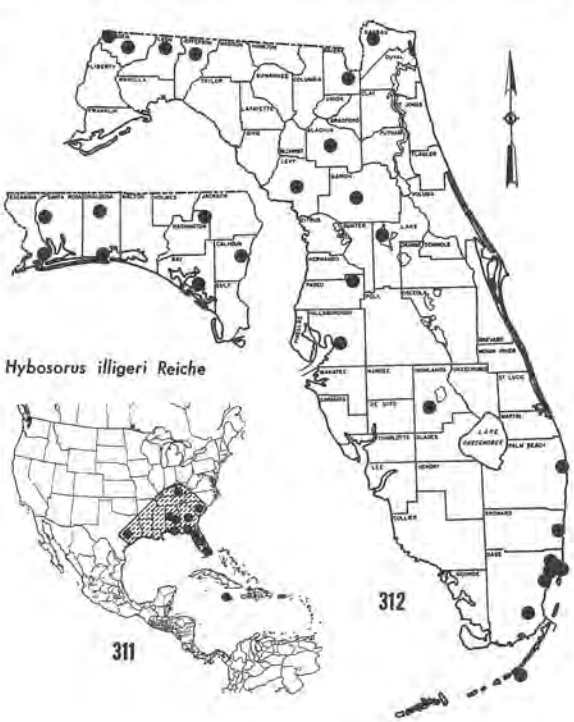
DIAGNOSIS: Easily distinguished by the characters of the subfamily, for which it is the only Florida representative. The general shape (Fig. 310) and the great number of elytral striae (18) will immediately separate it from all other Florida Scarabaeidae. Length 5-7 mm; width 3-4 mm.

TAXONOMIC NOTES: Two "varieties" (*thoracicus* Westwood 1845:159 and *nossibianus* Fairmaire 1895: 17) are listed by Arrow (1912:36), but their status has not been evaluated by recent work. It is therefore impossible to state whether they represent subspecies or merely individual variation.

H. illigeri Reiche (1853) was proposed to replace *Scarabaeus arator* Illiger (1803), a name preoccupied by *S. arator* Fabricius (1775) (currently recognized as a member of the genus *Heteronychus* of the subfamily Dynastinae). *H. carolinus* LeConte (1848) is now known to be a synonym, and, according to the International Rules (Article 60b), it must compete with the replacement name of the homonym for priority.

The two names described by Westwood *(laportei* and *roei)* (1845) are the earliest synonyms and would have priority. None of these synonyms has been used in the primary zoological literature for more than 100 years and can be considered *nomina oblita* according to the International Rules (Article 23b). However, this can be formalized only by a Direction of the International Commission of Zoological Nomenclature. Such a request will be made, and the name *H. illigeri* Reiche is used here for the sake of conservation.

DISTRIBUTION & ZOOGEOGRAPHY: (map, Fig. 102). Arrow (1912:36) listed it from "Sudeuropa, Kleinasien, Algerian, Persien, Punjab, Centralindien,



Afrika (tota), and Madagascar." Since the synonym *carolinus* was described in 1848, the species was apparently introduced into the U. S. before this date. Paulian (1944:5) suggested that it probably arrived via slave ships. Howden (1970:2) recorded it from Jamaica, stating that it ". . . is a rather recent European import to the United States, where it is widespread in sandy localities in the southeastern states." In the United States it has been reported from South Carolina (Cartwright, 1934b:238), "So. States" (Leng, 1920), Alabama (Loding, 1945:100), and North Carolina (Ritcher, 1966:37). I have also seen specimens from southern Kentucky, Georgia, and Texas (new state records). Blatchley (1928) did not record it in his "Scarabaeidae of Florida." In Florida it is widely distributed from Homestead in the south to Pensacola in the north.

BIOLOGY: This species is sometimes very abundant, especially in the Florida panhandle and at Miami. Nearly all of the specimens seen, or personally collected, were taken at light. In Florida, specimens have been taken from April through October, with the greatest number being found in June and July. This would indicate probably a single generation per year. The larva of our species is unknown, despite the abudance of the adult. The larva of an Indian species (*H. orientalis* Westwood) was described and figured by Ritcher (1966:37-39). These larvae are distinguished from other scarabs by the presence of stridulatory structures on both the prothoracic and mesothoracic legs and the presence of three truncate lobes on the anterior margin of the labrum. If the larva of *H. illigeri* possesses these characters it should be readily distinguished from all other Florida Scarabaeidae.

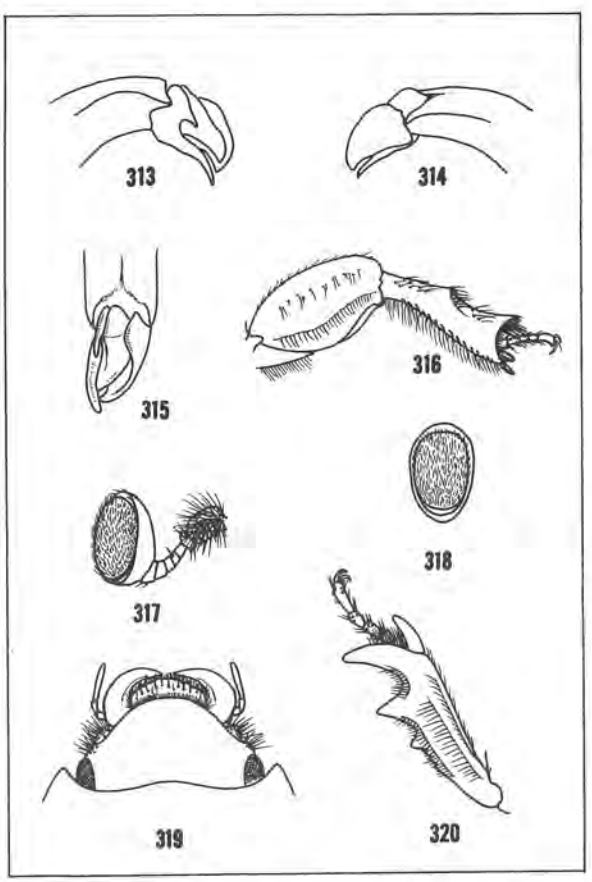


Fig. 313-320. Morphological structures of **Hybosorus illigeri** Reiche. 313) Left lateral view of male genitalia. 314) Right lateral view of male genitalia. 315) Dorsal view of male genitalia. 316) Ventral view of left posterior leg. 317) Dorsal view of left antenna. 318) Caudal view of antennal club. 319) Dorsal view of head. Note prominent mandibles and labrum. 320) Dorsal view of left anterior tibia and tarsus.

Although most specimens have been collected at light, a few have been taken in other situations. Several specimens were taken at Miami in Japanese beetle traps in which geraniol and eugenol were used as baits. Since numerous such traps have been used throughout the state, and no others have produced this species, these baits are probably of limited attractiveness. I have collected two specimens under dry cow dung in Alabama, but this was probably only a convenient shelter. No adult feeding has been observed.

SPECIMENS EXAMINED: 1,475+ from 33 localities in Florida and over 100 from other states (for complete data see Appendix 53).

Subfamily OCHODAEINAE

(Fig. 321-32)

TYPE GENUS: Ochodaeus Serville 1828:360.

This subfamily contains 3 genera and about 65 species (Arrow, 1912:23). The largest genus is *Ochodaeus* which contains approximately 61 described species distributed in North America, Central America, South America, Africa, Europe, and Asia. It is likely that not all of these species are congeneric, and the group requires further study. Of the other described genera, *Synochodaeus* (from South West Africa), contains a single species, and *Chaetocanthus* (from South and West Africa) contains three described species.

Eighteen species of *Ochodaeus* are known from America north of Mexico, and 16 species are listed from Mexico, Central America, and South America (Blackwelder, 1944). Only two of the U. S. species occur in the eastern half of the country, and they are separated in the key. Most of the species are found in sandy country and especially in the semi-arid regions of the southwestern U. S.

The general facies of the group (Fig. 321) is distinct from that of any other scarab, and they appear to occupy an isolated taxonomic position within the family. Judging from the small number of species, with no

close relatives and the peculiar relictual distribution pattern, they probably represent the vestiges of an ancient group.

The following combination of characters, as well as the distinct general facies, should permit easy recognition of the group: antennae 10-segmented, labrum and mandibles prominent and visible from above, color uniformly pale yellow to dark brown, dorsally and ventrally pubescent, epimera of metathorax covered, ventral abdominal segments six in number and not connate, longer middle tibial spur pectinate (Fig. 324-6, 330). The latter character alone will separate the genus *Ochodaeus* from all known Scarabaeidae.

The subfamily has not been treated as a whole and is in need of revision. The latest treatise on the only U. S. genus, *Ochodaeus*, is that of Fall (1909).

The biology and behavior of the group are almost completely unknown. The subfamily is omitted from Ritcher's recent book (1966) on scarab larvae, and as far as I can determine, none of the larvae has been described. Nearly all of the specimens have been captured at light, although I have personally taken three specimens in bait traps containing amyl acetate. The only clue to their habits is a label note for *O. frontalis* Lec., indicating they were dug from shallow burrows in an open sandy area, marked by "push-ups" similar to those of *Eucanthus* (Geotrupinae). They are apparently nocturnal, and all known species stridulate. They are evidently secretive and never abundant. Even at lights, rarely are more than three or four specimens collected on a given night.

The exact taxonomic position of the subfamily will not be firmly established until the immature stages are discovered. They have been accorded family status by some (Arrow, 1911) and listed as a part of the subfamily Orphninae and the tribe Orphnini by others (LeConte and Horn, 1883; Blatchley, 1910). However, I believe they are suffficiently distinct to be accorded subfamily rank with no close relatives. They are placed here near the Geotrupinae because of their superficial resemblance to that group and the suggestion that they might be burrowers. They can immediately be distinguished from that group by the 10-segmented rather than 11-segmented antennae and by the unique pectinate middle tibial spur.

Genus OCHODAEUS Serville

(Fig. 321-32)

Ochodaeus Serville 1828:360 (often cited as 1825; fide Blackwelder, 1957:933, the citation should be 1828 for Part 2:345-832).
Ochodaeus Megerle (manuscript name).
Cadocera Eschscholtz 1818:451.
Ochodaeus Dejean 1821:56 (nomen nudum).
Stomphax Fischer 1823:158.
Psephus Kirby 1826:678 (cited as 1828 in Arrow, 1912:23).

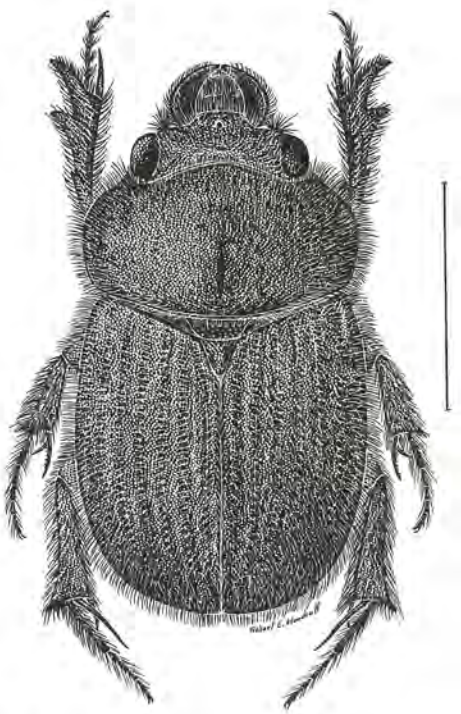


Fig. 321. **Ochodaeus frontalis** Lec., line = 2.5mm.

TYPE SPECIES: Not cited in the available literature, but probably *Scarabaeus chrysomeloides* Schrank 1781: 16 (=*chrysomelinus* Fabricius 1792:175).

DIAGNOSIS: The most distinctive feature of the genus is the pectinate inner middle tibial spur, a character not known in any other beetles. Other salient features include 10-segmented antennae, 6 visible abdominal segments, posterior and middle tibiae with 2 apical spurs, pronotum unarmed with horns, protuberances, or excavations; mandibles and labrum prominent and visible from above; body clothed with erect pubescence dorsally and ventrally; epimera of metathorax covered; pygidium exposed; scutellum visible; color pale yellow to dark brown, never black nor metallic.

TAXONOMIC NOTES: The name *Ochodaeus* is cited in all of the catalogues as the valid name, with *Cadocera* Eschscholtz, *Stomphax* Fischer, and *Psephus* Kirby listed as synonyms. The original descriptions of all these names are not available to me, and I am therefore following current usage. However, since all three of these synonyms apparently antedate the name *Ochodaeus* there is a nomenclatural problem which will probably need to be submitted to the International Commission on Zoological Nomenclature for a decision.

An efffort was made to clarify this situation, and the results illustrate some of the problems encountered in solving nomenclatural questions. An outline of the availabe information follows:

The first person to use the name *Ochodaeus* was Megerle in a manuscript, and this has no standing in nomenclature according to the International Rules. De-

jean (1821:56), in a catalogue of the beetles in his collection, used the name *Ochodaeus* attributing it to Megerle and including a single species, *chrysomelinus* Fabr. The same citation was included in the third edition (1836-37) of Dejean's catalogue. Serville used the name in volume 10 of the Encyclopedie Methodique on page 360. This work is not available to me, but it is cited as the original description of the genus by Gemminger and Harold (1869:1073), Arrow (1912:21), and Blackwelder (1944:216). All of these authors gave the date as 1825, as did the Leng Catalogue of the beetles of North America (1920). Neave (1940) in the Nomenclator Zoologicus listed the name with the following information: "*Ochodaeus* (Megerle MS) Dejean 1821, Catal. Coleopt., 56 *(n.n.)*; Serville 1825, Ency. Meth., Ins., 10, 360.—Col." However, Blackwelder (1957:933) indicated that volume 10 of the Encyclopedie Methodique was issued in two parts; the first (covering pages 1 to 344) was published in 1825, and the second (covering pages 345 to 832) was published in 1828. Since the description of *Ochodaeus* is cited as occurring on page 360, the date should be 1828.

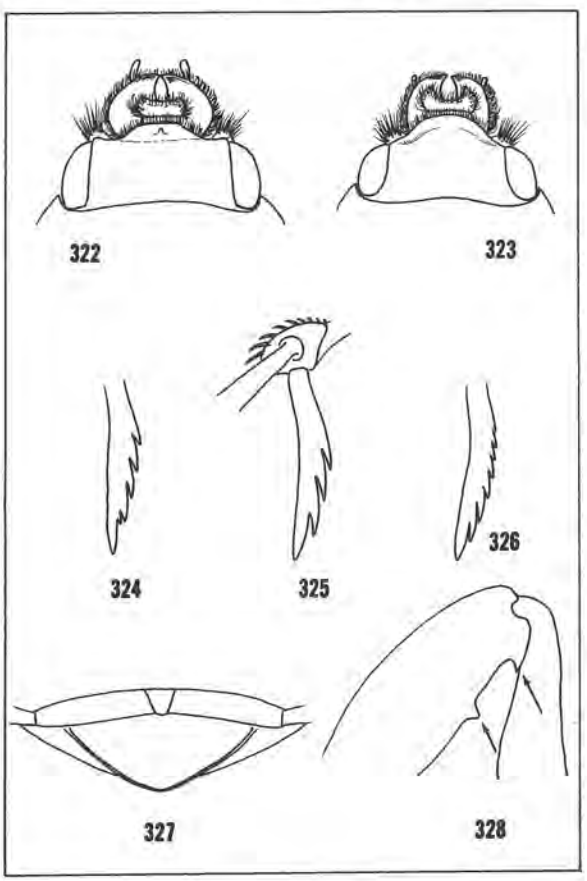


Fig. 322-328. Morphological structures of **Ochodaeus** spp.: 322) Dorsal view of head of **Ochodaeus frontalis** Lec. from Sanford, Florida. Note the shape of the mandibles, labrum, and presence of a clypeal tubercle. 323) Dorsal view of head of **Ochodaeus musculus** Say from Livingston Co., Michigan. Note the shape of the mandibles, labrum, and absence of a clypeal tubercle. 324) Pectinate inner spur on left middle tibia of male **Ochodaeus frontalis** Lec. from Gainesville, Florida. 325) Pectinate inner spur on left middle tibia of male **Ochodaeus frontalis** Lec. from Torreya State Park, Florida. 326) Pectinate inner spur on left middle tibia of female **Ochodaeus frontalis** Lec. from Gainesville, Florida. 327) Caudal view of pygidium and propygidium of **Ochodaeus frontalis** Lec. Note the V-shaped notch in the propygidium for reception of the elytral apices. 328) Ventral view of the right posterior femur of a male **Ochodaeus frontalis** Lec. Arrows point to the two femoral teeth.

Gemminger and Harold (1869:1073), in a catalogue of the beetles of the world, listed the following synonyms for *Ochodaeus* (on what authority I have yet to determine): *Cadocera* Eschscholtz, *Psephus* Kirby, and *Stomphax* Fischer. These were listed without bibliographic citations or dates. Arrow (1912:21), in the most recent world catalogue of the group, cited the same names in synonymy with the following citations:

Cadocera Esch. Mem. Acad. Petersbg. VI, 1818, p. 451.—Reitt. Verh. Nat. Ver. Brunn XXX, 1892, p. 254.

Psephus Kirby and Spence, Introd. Entom. III, 1828, p. 678.

Stomphax Fisch. Entomogr. Imp. Ross. II, 1823, p. 158.

This same synonymy, with identical dates, was listed by Blackwelder (1944:216) in his catalogue of the beetles of Latin America. These three names were all checked in Neave's "Nomenclator Zoologicus" with the following results: *Stomphax* is attributed to "Fischer de Waldheim 1824, Ent. Imp. Russ. 2, 159 (Col.)" (this date is one year later than the 1823 previously cited); "*Psephus* Kirby 1926 Introd. Ent. 3. 678.—Col. (Ochodaeid.)." and "*Psephus* Candeze 1859, Mem. Soc. Sci. Liege, 14, (Monog. Elater.) 19.—Col. (Elaterid.) (See *Propsephus* Hyslop 1921.)"; *Cadocera* was not found in Neave, but there was an entry for "*Cadoceras* Fischer 1882, Man. Conch., 394.—Moll."

The book by Kirby and Spence was cited by Blackwelder (1957:1147) as published in 1826, with a note that the date 1828 should be 1826. Horn and Schenkling (1928:357-358) indicated that the article by Fischer (under the name Fischer von Waldheim) was published in volume 2 of a 5 volume work, with this volume dated 1823-24. They listed this work as rare, and I have not been able to obtain a copy to verify the date.

Excluding the nomen nudum of Dejean and the manuscript name of Megerle, the names are listed below in what appears to be their chronological order:

Cadocera Eschscholtz 1818
Stomphax Fischer von Waldheim 1823-24
Psephus Kirby and Spence 1826
Ochodaeus Serville 1828

If the above facts are correct, the name *Ochodaeus* is antedated by three other names, but none of these has been cited as valid for over 100 years. The International Rules of Zoological Nomenclature, Article 23b (1961 edition), state that: "A name that has remained unused as a senior synonym in the primary zoological literature for more than fifty years is to be considered

a forgotten name (nomen oblitum)." Such names are to be referred to the International Commission for appropriate action. To follow strictly the rules of priority in this case would necessitate changing the name of a world-wide genus, one which has been firmly established in the literature for the past 100 years, as well as changing the name of the subfamily. Howden (1968) described one new species from Canada, but he shed no light on the problem of the proper generic name.

The latest treatise on the U. S. species is that by Fall (1909), and the genus is in need of revision. The U. S. species are currently under study by Dr. H. F. Howden (Carleton University, Ottawa, Canada). The taxonomic position of *Ochodaeus* is somewhat controversial, but there seems to be little value in speculating about this point until the immature stages have been discovered.

No subspecies have been described for any of our species. Characters used for separation of the U. S. species include the following: shape of the mentum and mandibles, presence or absence of a clypeal tubercle, sutural angle of elytral apices dentiform or not, presence or absence of a tooth on the inner face of the posterior tibia in the males, vertex of head carinate or not, and posterior femur with or without a tooth at the apex.

DISTRIBUTION & ZOOGEOGRAPHY: There are approximately 61 species known from the World, of which 18 are recorded from the U. S., with only two of these occurring east of the Mississippi River. There is a single species reported in the literature from "West Indies."

BIOLOGY: Practically nothing is known about the habits of the genus, and the immature stages are completely unknown. All of the species are apparently attracted to light, but usually in small numbers (rarely more than three or four). I have taken three specimens of *O. frontalis* Lec. in bait traps containing amyl acetate, and additional studies with baits may prove rewarding. Most of the species occur in sandy areas, especially in arid regions of the southwestern U. S. I suspect that they spend the daylight hours underground, in burrows similar to those of some of the secretive Geotrupinae. The enlarged mandibles, with sharp cutting surfaces, are similar to those of some Geotrupinae which feed on fungi (sometimes subterranean species). This morphological parallel is possibly a reflection of similar feeding habits.

It appears that all of the species stridulate, using a unique structure on the antepenultimate abdominal tergite which is rubbed against a minute file-like area on the venter of the elytra (Arrow, 1904:726). No observations have been published on live specimens, and these structures have only been studied morphologically. Arrow (1904:726) postulated that the unique pectinate middle tibial spur is in the proper position to be used as a "comb" for cleaning the abdominal stridulatory projections. Although this seems logical enough, it is dangerous to draw conclusions about function, based solely on morphological grounds. Much interesting information remains to be gained from a study of the biology and behavior of this peculiar group.

SELECTED REFERENCES: Arrow, 1904:725-726; 1911:390-394; 1912:21-24; Blackwelder, 1944:216-217; Fall, 1909:30-38; Gemminger and Harold, 1869:1073-1074; Horn, 1876:177-183.

Key to the species of Ochodaeus east of the Mississippi River

1. Clypeus with a central tubercle near the suture, anterior margin punctate, not convex, truncate at the middle; mandibles with outer margin evenly rounded; mentum broader than long, shallowly emarginate anteriorly (Fig. 322); posterior tibiae of both sexes without teeth on inner face; posterior femur of well developed males with two teeth on posterior margin (Fig. 328); widely distributed in Florida.... ..... *Ochodaeus frontalis* LeConte

1'. Clypeus without a central tubercle, anterior margin impunctate, convex, broadly rounded at the middle; mandibles with outer margin subparallel; mentum about as long as broad, deeply emarginate anteriorly (Fig. 323); posterior tibia of male with an acute median tooth on inner face; posterior femur with a single tooth at the tibial junction; northern U. S. south to North Carolina and Alabama, no Florida record.. *Ochodaeus musculus* (Say)

Fig. 329. Stereoscan photo of head of **Ochodaeus frontalis** Lec. (caudal view, 41X).

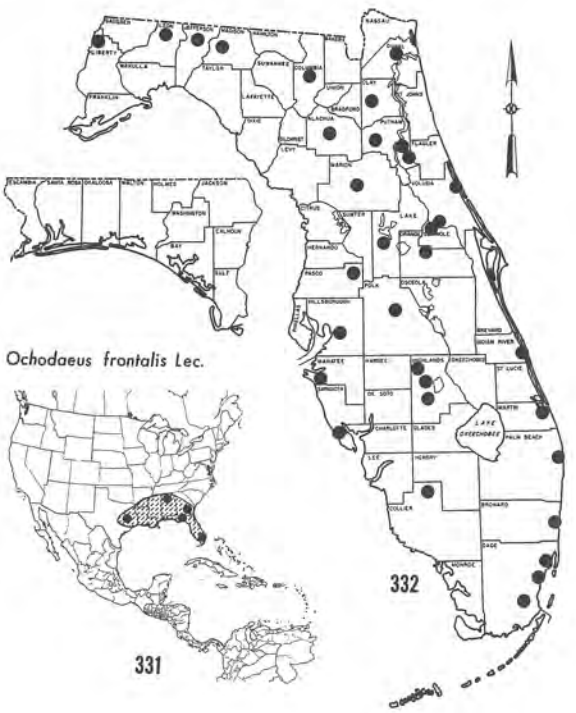
Ochodaeus frontalis LeConte

(Fig. 321-22, 324-32)

Ochodaeus frontalis LeConte 1863a:76.
Ochodaeus complex LeConte 1868:51

DIAGNOSIS: Easily distinguished from the only other eastern species by the presence of a tubercle on the clypeus. It is the only species definitely recorded from Florida.

Fig. 330. Stereoscan photo of middle tibial spur of **Ochodaeus frontalis** Lec. (dorsal view, 125X).



TAXONOMIC NOTES: Ochodaeus complex LeConte was described from New Mexico, the essential characters being a trituberculate clypeus. Horn (1876:183) synonymized this name under *frontalis* because two of these tubercles are represented by darker spots such as occur in most of the species at the ends of the frontal suture. The type of *frontalis* is from Texas, and it is possible that the Florida form is not conspecific with it. This problem can be solved only after a revision of the North American species.

Variation is most noticeable in size and color. Males may be well-developed and possess two teeth on the anterior and posterior femora, or may possess only the single tooth at the tibial junction. The pectinate middle tibial spur may have from three to eight teeth, some of which may be double (Fig. 324-26).

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 331-32). The type of *frontalis* is from "Texas" with no precise locality mentioned. The type of *complex* is from "New Mexico." *O. frontalis* is reported in the literature from Alabama (Lawrence Co.), Florida, and Texas. In addition, I have seen specimens from southern Georgia (new state record).

In Florida it probably occurs throughout the mainland, but it has not been recorded from offshore islands, the Keys, nor from west of the Apalachicola River. The latter void is probably due to lack of collecting rather than an hiatus in the range, although numerous light trap samples from Pensacola, Jay, Okaloosa Co., St. Andrews St. Pk., Chipley, and Florida Caverns St. Pk. have all been negative. I have examined specimens from over 30 Florida localities. Blatchley (1928:28) in his "Scarabaeidae of Florida" listed only Enterprise and Miami (based on other collections), and he had not collected the species.

BIOLOGY: As is true for the genus, practically nothing is known of the habits of this species. Nearly all specimens have been taken at light, although I took three specimens at Gainesville in a bait trap containing amyl acetate.

My earliest record is for May 25 (Salerno, Martin Co.), and the latest is December 16 (Miami). The majority of the records are from July through October.

The species stridulates, but this has not been recorded or studied in any way. It would be interesting to know if the pectinate middle tibial spur is used for cleaning the stridulatory structures as Arrow (1904: 726) suggested. The immature stages are unknown.

SPECIMENS EXAMINED: 328 from 32 localities in Florida (for complete data see Appendix 54).

SELECTED REFERENCES: Blatchley, 1928:28; Fall, 1909:37-38; Horn, 1876:183; LeConte, 1863a:76; Loding, 1945:100.

Ochodaeus musculus (Say)

(Fig. 323)

Odontaeus musculus Say 1835:178-179.
Ochodaeus americanus Westwood 1852:66, Pl. 9, Fig. 3.
Ochodaeus opacus LeConte 1868:51.

DIAGNOSIS: Easily distinguished from the only other eastern species, *frontalis* Lec., by the absence of a tubercle on the clypeus, the mentum as long as wide and deeply emarginate, and the mandibles subparallel at the sides instead of evenly rounded (Fig. 323).

TAXONOMIC NOTES: Ochodaeus americanus Westwood was synonymized by LeConte (1854), and *opacus* LeConte was synonymized by Horn (1876). The latter was based on a female of *musculus*.

DISTRIBUTION & ZOOGEOGRAPHY: This species has not yet been recorded from Florida. The basis for including it here is the record of Loding (1945:100) for Calvert, Mobile Co., Alabama. If this record is correct, it is likely to occur in the western panhandle of Florida, especially around Pensacola. It has been recorded from the following states: Illinois (Fall, 1909: 33), Indiana (Say, 1835:178; Fall, 1909:33; Blatchley, 1910:935), Kansas (Fall, 1909:33), Michigan (Horn, 1876:182), Nebraska (Horn, 1876:182; Dawson, 1922: 86), Washington, D. C. (Ulke, 1902:24), and Manitoba, Canada (Fall, 1909:33). I have also seen specimens from Athens Co., Ohio and Harnett Co., North Carolina (new state records).

BIOLOGY: As is true with the other species, very little is known about the behavior of *O. musculus* except that it is attracted to light, and it presumably stridulates.

SPECIMENS EXAMINED: 25, but none from Florida.

Subfamily GEOTRUPINAE

(Fig. 333-370)

TYPE GENUS: Geotrupes Latreille 1796.

DIAGNOSIS: Easily distinguished from the other subfamilies of Scarabaeidae by the 11-segmented antennae. Other diagnostic features include: mandibles not hidden by clypeus; clypeus sharply delimited from the vertex, often with a tubercle or horn; anterior femora with a silky spot on the anterior surface; pygidium largely hidden by the elytra; scutellum visible; abdominal spiracles on the membrane between sclerites; and male genitalia enclosed in a definite sclerotized genital capsule.

TAXONOMIC NOTES: This is a relatively small subfamily, the latest world catalogue (Boucomont, 1912) listing 442 species in 63 genera. Many new species have been discovered since that time, but no accurate count is presently available. The subfamily in North and Central America is probably better known taxonomically than any other subfamily of Scarabaeidae, due especially to recent revisions by Howden (1955a; 1964).

The subfamily contains four tribes: Lethrini, Athyreini, Bolboceratini, and Geotrupini. The latter three occur in the New World, but only the last two are found in the U. S., both being represented in Florida.

DISTRIBUTION & ZOOGEOGRAPHY: Howden (1955a) listed 59 species and subspecies in 10 genera for America north of Mexico and later (1964) added two new species. In Florida the subfamily is represented by 13 species in 7 genera, of which 5 species and 1 genus are endemic. Three others are nearly endemic, each being found only in a small southern portion of neighboring states. This is by far the greatest percentage of endemism of any scarab subfamily in Florida.

BIOLOGY: As the name implies these beetles are burrowers in the soil. The biology and behavior of many species, especially Bolboceratini, are practically unknown. Many forms are semi-colonial in restricted habitats. In some cases these are fossil dunes or fossil shore line deposits, indicating the antiquity of the group. Some dig burrows to tremendous depths (8-10 ft.) in the loose sands of the Florida peninsula. Although a few are found in dung, most species feed on fungi or decaying vegetable matter. Apparently all species stridulate, although there are few published observations on this aspect of their behavior (Arrow, 1904; Alexander, Moore, and Woodruff, 1963). Most of the species are attracted to light, and a few are strictly nocturnal. Many species are attracted to chemical baits, especially fermenting malt and molasses.

Practically no species in the family is of any economic importance. The genus *Lethrus* in Europe is sometimes a pest of grape vines because of its habits of cutting leaves and twigs used in nidification. A European species of *Geotrupes* is listed by Thomas (1939) as a pest of edible mushrooms in Germany. A few species are incidental pests of lawns and golf courses because of the piles of soil excavated during their burrowing activity. A recently described species, *Ceratophyus gopheri* Cartwright, caused concern on golf greens in California. In Florida, *Bradycinetulus ferrugineus* (Beauv.) has been found rarely under similar conditions. In another instance, *Peltotrupes profundus* Howden was considered a pest in lawns in a new housing development at Beacon Square Subdivision in Pasco County.

It is likely that the dung feeding species are intermediate hosts for some vertebrate parasites such as nematodes and tapeworms, as are members of the Scarabaeinae. Nearly every specimen of this subfamily that I have collected has harbored mites. Apparently this association is phoretic, but very little information has been published on the subject. G. W. Krantz, Oregon State University, studied many of these mites, especially of the family Macrochelidae. Of several hundred specimens sent for his studies, the most common one was *Macrocheles dimidiatus* Berl., although several new species were also abundant (Krantz & Mellott, 1968). The parasites and commensals of numerous Old World species have been studied by Theodorides (1949, 1950, 1952).

The larvae can be distinguished from other North American Scarabaeidae by the following combination of characters (Howden, 1955a:162): antennae 3-segmented, the penultimate segment bearing one or more conical sense organs, third segment greatly reduced in diameter; inner and outer lobes of maxillae entirely free; teeth present on maxillary stridulatory area; hypopharynx with oncyli; terga of abdominal segments three to seven with two dorsal annulets; mesothoracic and metathoracic legs often with stridulatory organs.

SELECTED REFERENCES: Blanchard, 1888:103-110; Blatchley, 1910:936-939; 1928:28-30, 44-45; Boucomont, 1902:1-20; 1911:333-350; 1912:1-47; Cartwright, 1953:95-120; Horn, 1868:313-322; Howden, 1955a:151-319; 1964:1-91; Jekel, 1865:513-618; Mohr, 1930:263-284; Paulian, 1939:351-360; Ritcher, 1947:1-27.

Key to the Florida tribes and genera of Geotrupinae

(modified from Howden, 1955a)

1. Antennal club large, about as long as the basal 8 segments, rounded (Fig. 54); body brown or orange and black (Fig. 333, 336, 339, 342) .....BOLBOCERATINI....2

1'. Antennal club small, about half as long as the basal 8 segments, elongate (Fig. 53); body black to dull gray, often with metallic reflections (Fig. 353, 360, 368)..GEOTRUPINI..5

2(1). Eyes entirely divided by canthus; color sometimes variegated 3

2'. Eyes only partly divided by canthus; color uniform brown to black 4

3(2). Bicolored, orange and black; middle coxae narrowly separated by slender projection of mesosternal plate. (Fig. 339) ....*Bolbocerosoma hamatum* Brown

3'. Color uniform brown; middle coxae contiguous, not separated by projection of mesosternal plate. (Fig. 333) ....*Bolboceras floridensis* (Wallis)

4(2'). Elytron with 5 striae between suture and humeral umbone; humeral angle of elytron not broadly rounded, the margin almost always produced into a tubercle at the angle. (Fig. 342) ..... *Eucanthus*

4'. Elytron with 7 striae between suture and humeral umbone; humeral angle of elytron broadly rounded, the margin never produced into a tubercle at the angle. (Fig. 336) ....*Bradycinetulus ferrugineus* (Beauv.)

5(1'). Elytra fused, connate, surface roughly granulate; flightless, wings vestigial; dull gray. (Fig. 368) .....*Mycotrupes*

5'. Elytra free, not roughly granulate; wings fully developed; often with metallic sheen.....6

6(5'). Middle and hind tibiae each with a pronounced transverse apical carina; margin of elytra not widely flared, striae obvious. (Fig. 353) .....*Geotrupes*

6'. Middle and hind tibiae with only a trace of an external transverse apical carina; margin of elytra widely flared, striae obscure. (Fig. 360) ..... *Peltotrupes*

Tribe BOLBOCERATINI

(Fig. 333-52)

The tribe can be distinguished from the Geotrupini by the smaller antennal club, which is about half as long as the basal eight segments, elongate, and not convex on both sides. In addition, most of the species are brown and without metallic lustre, although *Bolbocerosoma* is bicolored orange and black. Many of the species have protuberances and excavations on the pronotum, especially of the males, and in *Bolboceras*, well-developed males have an elongate head horn.

The following resumé of the distribution is derived primarily from Howden (1955a and 1964). In the world there are approximately 320 species in 15 genera, of which 124 species and 11 genera occur in the New World. Four genera with six species represent the tribe in Florida, and although none of the genera and only one of the species is endemic, two other species are known only from Florida and contiguous areas of Alabama and/or Georgia.

Specimens of this tribe are rare in collections, although a few species are locally abundant. Many of them are found only in xeric situations. Their habits are poorly known, except that most species are attracted to lights and dig deep burrows, but none of them is known to feed on dung.

Genus BOLBOCERAS Kirby

(Fig. 333)

Bolboceras Kirby 1818b:459.
Odontaeus Megerle *In* Dejean 1821:56 (nomen nudum).
Odontaeus Klug 1845:37.
Odantaeus Klug, Howden 1955a:213 (misspelling).

TYPE SPECIES: *Bolboceras mobilicornis* Fabricius 1775 (by subsequent designation of Curtis 1829: opposite Pl. 259).

DIAGNOSIS: Medium sized (length 6-10 mm), convex, red-brown to tan, shining. Eyes entirely divided by a canthus; clypeus emarginate weakly at the middle; clypeo-genal suture marked by a carina. Head of major male with an elongate, narrow horn curved back over the pronotum. Minor male often similar to the female and without a horn. Pronotum of major male excavate deeply on each side of a short median protuberance which has a line of punctures in a depressed median area; the excavations bordered by sharp carinae laterally. Elytra each with 14 rows of punctures, the eleventh usually indicated only for the center part of its length and the second stria only about two-thirds the elytral length; intervals convex, shining.

TAXONOMIC NOTES: The species are highly variable and difficult to distinguish without reference to the male genitalia. Although Wallis (1928) did an adequate job of revising the genus, the status of some species is open to question, and further study is necessary, especially in the *filicornis* group of species (including *alabamensis* and *floridensis*). It is possible that more than one species is present in Florida, but all specimens have been assigned tentatively to *floridensis*.

DISTRIBUTION & ZOOGEOGRAPHY: According to Howden (1955a:295) there are 11 species in the genus, 10 of which occur in the U. S., with the remaining one (the type species) from Europe. Most of the species are found in the northeastern U. S., with only a single species occurring in the west from British Columbia to California. Two of the species (*alabamensis* and *floridensis*) have very restricted ranges.

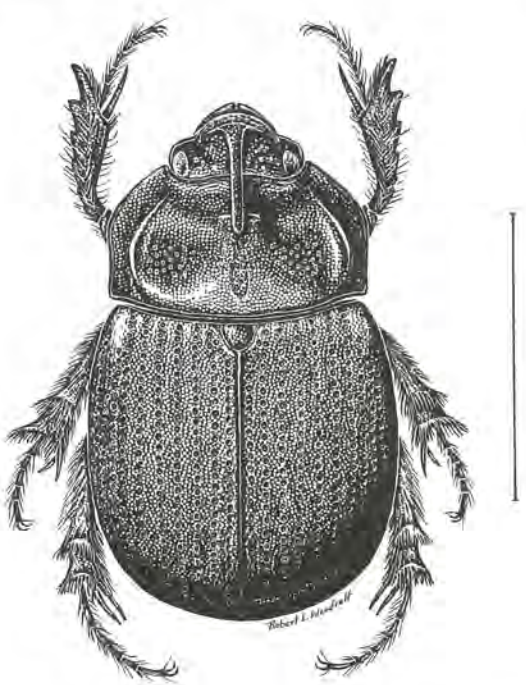


Fig. 333. **Bolboceras floridensis** (Wallis), line = 5mm.

BIOLOGY: There is very little information concerning these seemingly rare beetles. All of them apparently make burrows, commonly in old road beds or wheel ruts. Most of them have been taken at light but usually in small numbers. For additional discussions of the individual species the reader is referred to the papers by Wallis (1928), Sim (1930), and Howden (1964).

SELECTED REFERENCES: Blatchley, 1910:938; 1928:29; Cartwright, 1953:101; Horn, 1870a:42; Howden, 1955a:213-227; 1964:76-77; Wallis, 1928:119-128, 151-156, 168-176, 22 Fig.; 1929:239-241, 4 Fig.

Bolboceras floridensis (Wallis)

(Fig. 333)

Odontaeus floridensis Wallis 1928:155.
Odontaeus filicornis Say, Schwarz 1878:450; Blatchley 1928:29 (misidentification).
Bolboceras floridensis (Wallis), Howden 1955a:222-223.

DIAGNOSIS: Medium sized (length 6-10mm). Distinguished from the closely allied species by the shape of the median lobe of the male genitalia. The head horn of the male is of the movable type. It is easily distinguished from other Florida species of Geotrupinae by the general habitus (Fig. 333).

TAXONOMIC NOTES: As mentioned under the genus, the *filicornis* group of species (including *alabamensis* and *floridensis*) requires further study. Additional series of specimens will be necessary to evaluate the variation. I have tentatively assigned all Florida specimens to *floridensis*. There appear to be minute but consistent differences between specimens from the southern tip of the peninsula and those from the north. There appears to be a gap in the distribution in central Florida, but this may be an artifact of collecting.

The misidentifications mentioned above are almost certainly referable to this species. The specimen of *corniger* from the Slosson collection cited by Blatchley (1928) probably is the holotype of *floridensis*, and the specimen of *filicornis* from Tampa, recorded by Schwarz (1878) and mentioned by Blatchley, probably is the allotype of *floridensis*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 334-5). The type was from Lake Worth, and it presently is known only from Florida. I have seen specimens from Homestead to Pensacola, but the records between these localities are spotty. There is a noticeable lack of records in the central portion of the peninsula and in the panhandle between Pensacola and the Apalachicola River. However, this is probably due to its rarity and the paucity of collecting in these areas.

BIOLOGY: Wallis (1928) saw three specimens when he described the species, and Howden (1955a) saw

only six specimens when he revised the subfamily. I have seen 643 specimens during this study, but most were from one locality and I can add very little to the knowledge of the species. Nearly all specimens were taken in light traps, malt bait traps, or unbaited pitfall traps. In several instances they have been taken with *Mycotrupes gaigei, M. cartwrighti,* and *Peltotrupes profundus* in deep sand ridges that are probably Pleistocene marine terraces. It appears to be a winter species, having been taken from November through June but most abundant from January through March. The immature stages are unknown.

SPECIMENS EXAMINED: 643 from 19 Florida localities, representing 103 collection records (for complete data see Appendix 55).

SELECTED REFERENCES: Nothing has been published on this species except the papers cited under the synonymy above.

Genus BRADYCINETULUS Cockerell

(Fig. 336)

Bolboceras Kirby 1818:459 (in part).
Amechanus Horn 1870a:48 (not Thomson 1864).
Bradycinetus Horn 1871b:334 (not Sars 1865).
Bradycellus Schaeffer 1906:249 (not Erichson 1837).
Bradycinetulus Cockerell 1906:242.
Amechamus Horn, Boucomont 1911:341 (misspelling).

TYPE SPECIES: *Scarabaeus ferrugineus* Beauvois 1809 (by subsequent designation of Cartwright, 1953:101).

DIAGNOSIS: Large (length 17-21 mm, width 10-12 mm), globular, brown, feebly shining, minutely alutaceous. Eyes only partially divided by a canthus. Head with a short truncate horn in the female, the clypeus more elongate, rugose, hornless, and concave in the male. Pronotal protuberance developed into a pair of horns in the male. Scutellum wider than long, not depressed. Posterior vertical face of the prosternal intercoxal piece wide and flat, the ventral edge evenly arcuate or slightly angulate at the middle. Easily distinguished from the other three genera of Florida Bolboceratini by the large size; maximum size of the others being about 12 mm.

TAXONOMIC NOTES: Three of the names cited above were preoccupied and the new name *Bradycinetulus* was proposed by Cockerell (1906:242). This synonymy is taken from Cartwright (1953:101). The three known species are easily separated by the structures of the head, especially the male.

DISTRIBUTION & ZOOGEOGRAPHY: All of the three known species are found in the U. S. east of the Rocky Mountains. One species is known only from Texas, another is known from Arkansas, Kansas, Nebraska, Oklahoma, and Texas. Our Florida species is found from North Carolina to Florida and west to Mississippi.

BIOLOGY: All of the species are attracted to light and dig vertical burrows. Other than this, practically nothing is known of their habits. The immature stages are unknown for all of the species.

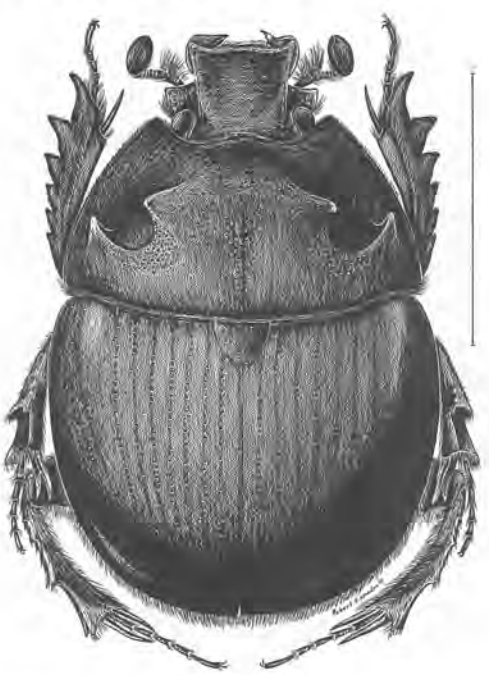


Fig. 336. **Bradycinetulus ferrugineus** (Beauv.), line = 8mm.

SELECTED REFERENCES: Cartwright, 1953:101-105; Howden, 1955a:191-195; 1964:62-63.

Bradycinetulus ferrugineus (Beauvois)

(Fig. 336)

Scarabaeus ferrugineus Palisot de Beauvois 1805:90.
Bolboceras lecontei Dejean 1836:149 (nomen nudum).
Athyreus ferrugineus (Beauv.), Klug 1845:22.
Bolboceras ferrugineus (Beauv.), Lacordaire 1856:143.
Amechanus ferrugineus (Beauv.), Horn 1870a:48.
Bradycinetus ferrugineus (Beauv.), Horn 1885:89.
Athyreus (Bradicinetus) ferrugineus (Beauv.), Boucomont 1902:8.
Bradycinetus ferrugineus (Beauv.), Schaeffer 1906:250.
Bradycinetulus ferrugineus (Beauv.), Cockerell 1906:242.
Bolboceras (Amechamus) ferrugineus (Beauv.), Boucomont 1911:341.

DIAGNOSIS: Easily recognized by the characters given in the key and those listed under the genus. It is closely related to *fossatus* (Hald.), from which it can be separated by the nearly straight lateral edge of the eye canthus.

TAXONOMIC NOTES: Although this species has been transferred from one genus to the next, it is very distinct and has no specific synonyms.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 337-8). It was recorded by Cartwright (1953:102) from Alabama, Florida, Georgia, North Carolina, Mississippi, and South Carolina (type). He recorded the following localities in Florida: Cedar Key, Crescent City, Dunedin, Enterprise, Gainesville, Indian River, Kissimmee, LaGrange, Lutz, Miami, Orlando, Port St. Joe, Sanford, St. Augustine, and Wacissa. I have added only Glen St. Mary, Hialeah, Pensacola, Tall Timbers Res. Sta. and Winter Park.

BIOLOGY: Manee (1908:459-460) published the first accounts of the biology of this species. Howden (1955a: 192-194) discussed a large colony in North Carolina, and the following summary is derived primarily from this reference. No food has been observed, and the immature stages have not been discovered. Burrows are found more often in open spots, especially sandy roads through turkey oak scrub. The burrows are usually vertical and marked by a "push up" of sand similar to that of most Bolboceratini. Two beetles were never found in the same burrow, although Manee reported finding pairs in burrows which were plugged. The burrows are sometimes extremely deep (11 feet), but they average about 28 inches. Specimens have been found in Florida from March through October.

SPECIMENS EXAMINED: 50, of which 44 were from 9 Florida localities, representing 35 collection records (for complete data see Appendix 56).

SELECTED REFERENCES: Cartwright, 1953:102-103, Fig. 14h, Pl. 3; Howden, 1955a:192-194, Pl. 10, Fig. 2; Manee, 1908:459-460, Pl. 20.

Genus BOLBOCEROSOMA Schaeffer

(Fig. 339)

Bolbocerosoma Schaeffer 1906:254.

TYPE SPECIES: *Scarabaeus farctus* Fabricius 1775 (by original designation).

DIAGNOSIS: Easily distinguished from all other Florida Geotrupinae by the bicolored (orange and black) elytra and pronotum. In addition, the eyes are completely divided by a canthus; intercoxal process between the middle coxae with a tooth-like elevation; middle coxae very narrowly separated, nearly contiguous; lateral pronotal carinae no wider than the head; elytral base not margined.

TAXONOMIC NOTES: The species were recently revised by Howden (1955a). The male genitalia are useful in distinguishing some of the closely related species. Intraspecific variation is especially noticeable in the external sexual characters of the male: the tubercles on the head, the horn of the vertex, and the pronotal modification.

DISTRIBUTION & ZOOGEOGRAPHY: Most of the 12 species and one subspecies occur east of the Rocky

Mountains, although at least one extends to Arizona, and two are found as far south as the states of Nuevo Leon and Coahuila in Mexico. A single species (*hamatum*) is known from Florida.

BIOLOGY: Most of the species are rarely collected, although at least some are locally abundant. Several of the species are known from less than half a dozen specimens. Nearly all of the species have been taken at light, and several have been dug from shallow burrows. There have been no observations on the adult food. Larvae of possibly two species (*tumefactum?* and *farctum*) have been described. According to Howden (1955a:164) they differ from related larvae by the following combination of characters: antennae three-segmented, the penultimate segment with two conical sense organs; galea emarginate; legs four-segmented with pronounced claws; metathoracic legs not reduced; abdomen not enlarged.

SELECTED REFERENCES: Blatchley, 1910:937; 1928:29; Boucomont, 1911:332-350; Brown, 1928b: 192-196, 9 Fig.; 1929b:213; Dawson, 1922:194; Dawson and McColloch, 1924:9-15; Howden, 1955a:163-190; 1964:31-32; Ritcher, 1947:11-12; Robinson, 1941: 132.

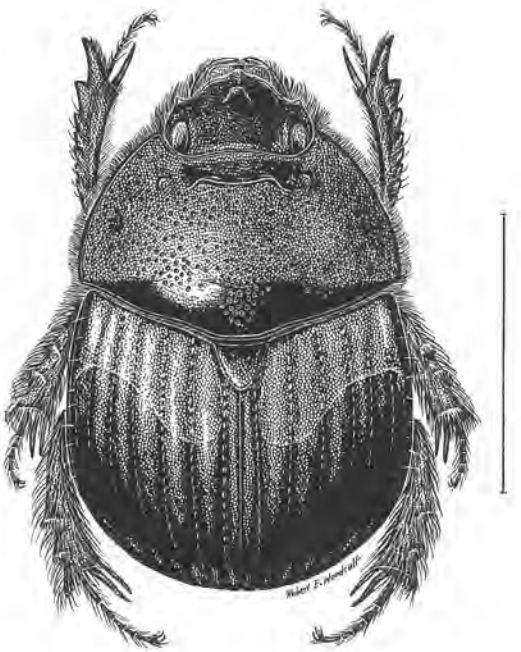


Fig. 339. **Bolbocerosoma hamatum** Brown, line = 5mm.

Bolbocerosoma hamatum Brown

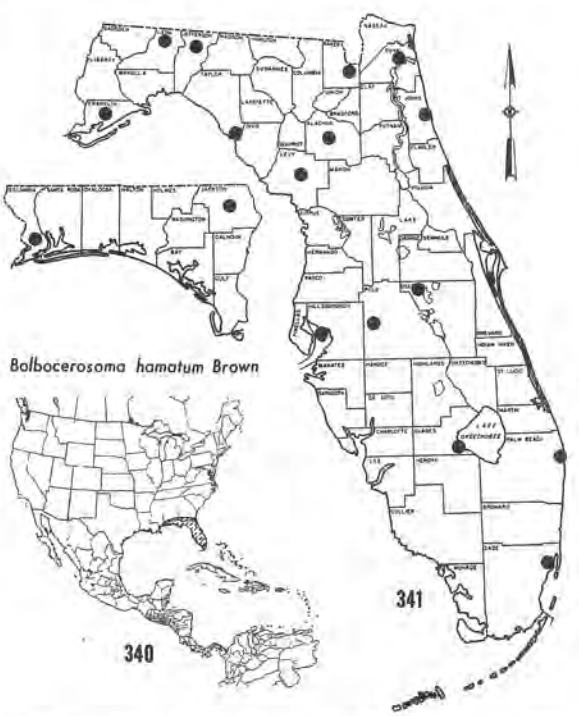
(Fig. 339)

Bolbocerosoma hamatum Brown 1929b:213.
Bolbocerosoma farctum (Fab.), Blatchley 1928:29-30 (misidentification).
Bolbocerosoma farctum var. *tumefactum* (Beauv.), Dozier 1920:365 (misidentification).

DIAGNOSIS: Easily distinguished from other Florida Geotrupinae by the characters listed under the genus. It is similar to *B. farctum* but has the lateral lobes of the male genital capsule deflexed at the apices to form hooks.

TAXONOMIC NOTES: Dozier (1920:365) listed *B. farctum* var. *tumefactum* (Beauv.) from Gainesville. However, this is a valid species not recorded from any locality near Florida. Blatchley (1928:29) reported *farctum* as the only species from Florida. There is little doubt that these records refer to *hamatum*, since the latter was unrecognized at the time, and the species are superficially similar.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 340-1). It is known only from Florida, southern Georgia, and southern Alabama. Howden (1955a:1964) listed the following localities: Alabama: Coden and Spring Hill; Florida: Gainesville, Kissimmee, Lakeland, and Steinhatchee River; Georgia: Billy's Island in the Okefenokee Swamp (holotype), and Chickamauga. I have seen Florida specimens from Escambia Co. in the north to Miami in the south.



BIOLOGY: Very little information is available on this rare species as most of the specimens have been taken at light. Howden (1955a) saw only 11 specimens when he revised the genus, and I have seen 74 during this study. Dozier (1920:365) recorded specimens (under the name *tumefactum*) ". . . from beneath bark of

fallen pine, Aug. 3." and ". . . flying over grass-wet prairie July 30." I have seen a single specimen taken in a McPhail fruit fly trap (using fermenting pineapple juice, etc.), and two specimens were taken in the burrows of the trap door spider, *Cyclocosmia truncata*. Specimens have been collected every month of the year except December and January. The immature stages are unknown.

SPECIMENS EXAMINED: 74 from 16 Florida localities, representing 43 collection records (for complete data see Appendix 57).

SELECTED REFERENCES: Howden, 1955a:164, 166, 177-178; 1964:62.

Genus EUCANTHUS Westwood

(Fig. 342)

Eucanthus Westwood 1848:387.

TYPE SPECIES: *Scarabaeus lazarus* (=*meliboeus*) Fabricius 1775 (by monotypy).

DIAGNOSIS: Medium sized (length 5-14 mm), light tan to dark red-brown, usually shining. Eyes only partially divided by a canthus. Clypeus and vertex each with a transverse carina or horn, the clypeal one reduced in the female and the one on the vertex reduced in the male. Middle coxae nearly contiguous; metasternum narrowly acute and linear between the coxae. Pronotum with transverse punctate depressions and a median transverse carina; protuberances in the form of conical swellings or tubercles; median longitudinal line depressed and punctate. Elytra with five deeply punctate striae between the suture and the humeral umbone. Easily distinguished by the characters in the key.

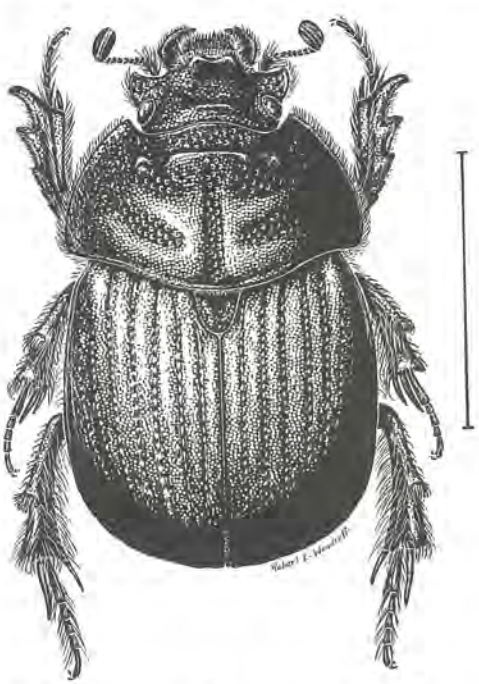


Fig. 342. **Eucanthus subtropicus** Howden, line = 5mm.

TAXONOMIC NOTES: Although the genus has been revised twice in the past few years (Howden, 1955a; 1964), it will require further study to adequately define the species. The distribution patterns of several forms, as well as the extent of variability, suggest that there may be other closely related species that are presently unrecognized. Howden (1964:64) stated that because of the complex variation, including genitalia, ". . . and still inadequate series from many localities, the present review attempts to delimit the readily definable species and indicate the major population differences in the highly variable ones." Until further study can be made, I have adopted the names here as proposed by Howden (1964).

DISTRIBUTION & ZOOGEOGRAPHY: The genus contains eight known species, of which one is Australian, one is South American, and six are North American. Only one North American species (*mexicanus* Howden) is completely allopatric with respect to the others. One of the Florida species (*alutaceus*) has a very restricted range in southern Georgia, Alabama, and Mississippi, and northern Florida. The others have fairly broad ranges, and *lazarus* (Fab.) occupies most of the U. S. east of the Rocky Mountains (excluding Florida). The distribution patterns of the three Florida species are shown in Fig. 347-352.

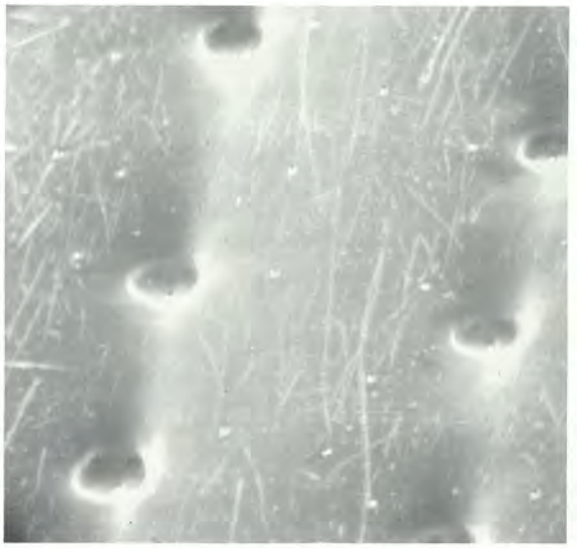
BIOLOGY: All of the species are attracted to light and dig burrows, but little else is known of their biology. Nothing is known of the adult or larval food. The larvae of two species are known and can be characterized as follows (Howden, 1955a:200): body slightly bent without enlarged abdomen; legs three-segmented with claws; metathoracic legs not reduced; paired ventral anal lobes; galea not emarginate; penultimate segment of antenna with more than two (usually four) conical sense organs.

SELECTED REFERENCES: Blatchley, 1910:937; 1928:30; Boucomont, 1911:336; Brown and Wilson, 1956:58-59; Howden, 1955a:199-213; 1964:63-76, Fig. 59-73; Manee, 1908:459; Ritcher, 1947:10; Schaeffer, 1906:253.

Key to the Florida species of Eucanthus

1. Entire dorsal surface alutaceous, appearing dull, greasy (Fig. 345-6); larger (length 10-14 mm); rare species ..... *alutaceus* Cartwr.

1'. Entire dorsal surface between punctures shining, without alutaceous sculpture (Fig. 343-4); smaller (length 6.5-12.2 mm); fairly common species 2



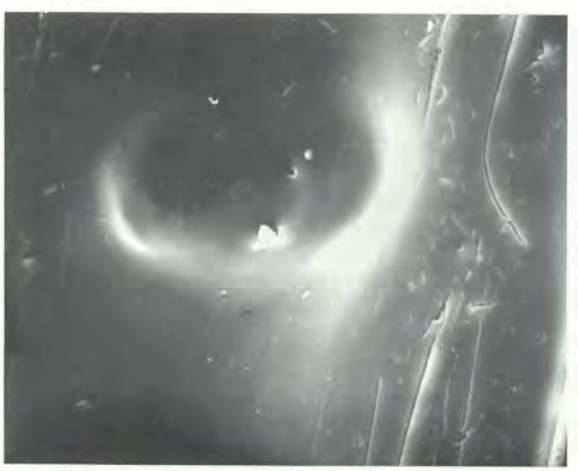
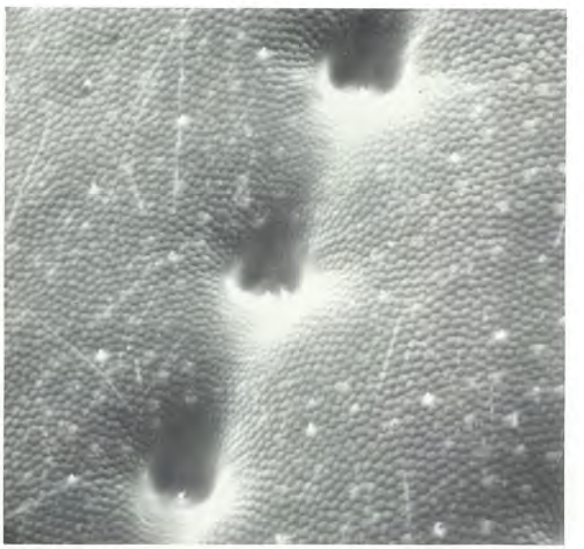


Fig. 343-344. Stereoscan photos of elytron of **Eucanthus subtropicus** Howd.: 343) 145X, 344) single puncture, 564X. Note lack of alutaceus sculpture.



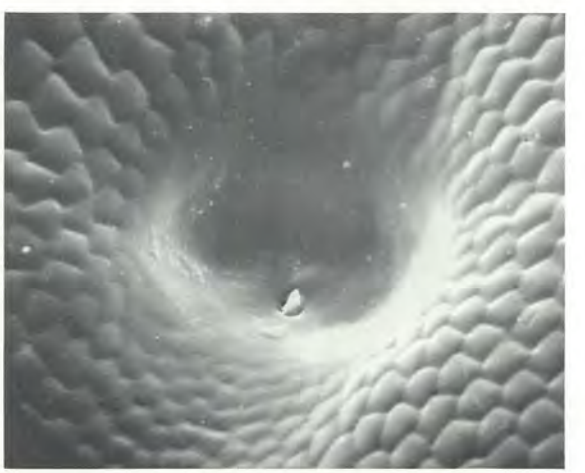


Fig. 345-346. Stereoscan photos of elytron of **Eucanthus alutaceus** Cartwr.: 345) 145X, 346) single puncture, 564X. Note alutaceus sculpture.

2(1'). Anterior edge of eye canthus almost straight across, the outer angle not produced anteriorly; antennal club large, longer than ventral portion of the eye ..... *impressus* Howden

2'. Anterior edge of eye canthus sinuate and produced at the outer angle; antennal club small, usually shorter than ventral portion of the eye ..... *subtropicus* Howden

Eucanthus alutaceus Cartwright

(Fig. 345-6)

Eucanthus lazarus var. *alutaceus* Cartwright 1944b:30.
Eucanthus alutaceus Cartwright, Howden 1955a:210-211.

DIAGNOSIS: Easily distinguished by the alutaceous dorsal surface, presenting a dull, greasy appearance (unique in the genus) (Fig. 345-46). There are very few other minor differences between this species and *lazarus*. The elytral intervals are more noticeably flattened, and the pronotal horns of the male are large and conical. The size is generally larger (length 10-14 mm) than the other two Florida species (length 6.5-12 mm).

TAXONOMIC NOTES: Although originally described as a "var." of *lazarus*, it is one of the most distinctive species in the genus.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 347-8). It is known only from a few localities in Alabama (type: Lucedale), Florida, Georgia, and Mississippi. In Florida, Howden (1964:69) recorded it from Gainesville and Oneco (although the latter is not shown on his map, Fig. 12). I have also seen Florida specimens from Baker and Leon Co. This species has the most restricted range of any North American *Eucanthus*.

BIOLOGY: Practically nothing is known about this rare species since nearly all specimens have been collected at light. Only 24 specimens were seen by Howden (1964:69), and I have seen 50 others. It has been collected in Florida from August through March. It appears to have a wide range of soil tolerances from the Tallahassee "Red Hills" sandy clay to the pure sand around Gainesville. The immature stages are unknown.

SPECIMENS EXAMINED: 50, of which 48 were from Florida as follows: (1) Baker Co., S23, R3, T21, 3-III-61, E. W. Holder, Jr.; (1) Leon Co., Tallahassee, 1-XI-59, G. W. Dekle; Leon Co., Tall Timbers Res. Sta., L. Collins, blacklight trap with following numbers and dates: (10) 29-VIII-5-IX-67, (6) 6-11-IX-67, (4) 12-16-IX-67, (7) 31-X-29-XI-67, (5) 30-XI-18-XII-67, (4) 20-XII-67-8-I-68, (1) 24-I-20-II-68, (5) 2-XI-68-9-I-69, (2) 10-I-5-II-69, (2) 6-II-4-III-69.

SELECTION REFERENCES: Howden, 1964:68-70, Fig. 69, Map 12.

Eucanthus impressus Howden

Eucanthus lazarus (Fab.), Blatchley 1928:30 (misidentification).
Eucanthus subtropicus Howden 1955a:204 (in part).
Eucanthus impressus Howden 1964:72-74, Fig. 63-65, 71, Map 14.

DIAGNOSIS: Medium sized (length 7-12.2 mm), light brown to dark red-brown, shining. Distinguished from the other Florida species by the characters in the key. In addition, the number of pronotal punctures is usually reduced from that found in its nearest relative (*subtropicus*).

TAXONOMIC NOTES: Although most specimens can be separated from *subtropicus* by the characters in the key, some individuals are difficult to place. There is considerable intraspecific variation, but according to Howden (1964:74) ". . . the characters show discordant intergradation over a wide area and it does not seem advisable, at present, to subdvide the various populations." He also stated that "The punctures [pronotal] attain maximum size in Florida specimens, decreasing in size northward as well as westward."

The early Florida records of *lazarus* by Blatchley (1928:30), and other earlier authors, probably refer partly to *impressus* and partly to *subtropicus*. Typical *lazarus* is not recorded for Florida by Howden (1964). All of the Florida specimens of *impressus* were referred earlier to *subtropicus* by Howden (1955a), and some were included in the paratype series of *subtropicus*. All of my Florida material was studied by Howden and included in his revision (1964). Both species require further study before a clear picture will emerge.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 349-50). It was recorded by Howden (1964) from Alabama, Arkansas, Colorado, Florida, Georgia, Iowa, Kansas, Louisiana, Maryland, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, North Carolina, Oklahoma, South Carolina, and Texas. The holotype is from Claremore, Oklahoma, and the allotype is from Douglas Co., Kansas. Howden (1964:72) recorded the following Florida localities: Alachua Co., Broward Co., Buena

Vista, Captiva Island, Charlotte Harbor, Coral Gables, Crescent City, Dade Co., Enterprise, Gunntown, Haulover, Homestead, Indian River, Jacksonville, Kissimmee, Manatee Co., Marineland, Miami, Monticello, Paradise Key, Punta Gorda, Royal Palm Park, Sarasota, Stanford (Sanford?), Tampa, Venice, Weeki Wachee, and Winter Park. Most of my specimens were recorded by Howden, but they are listed in their entirety here in Appendix 58.

BIOLOGY: Practically nothing is known about this species except that it is attracted to light. Specimens have been collected in Florida from January through October. Judging from its wide distribution, it appears to have a broad tolerance of various soil types, although it is most abundant in sandy localities. The immature stages are unknown.

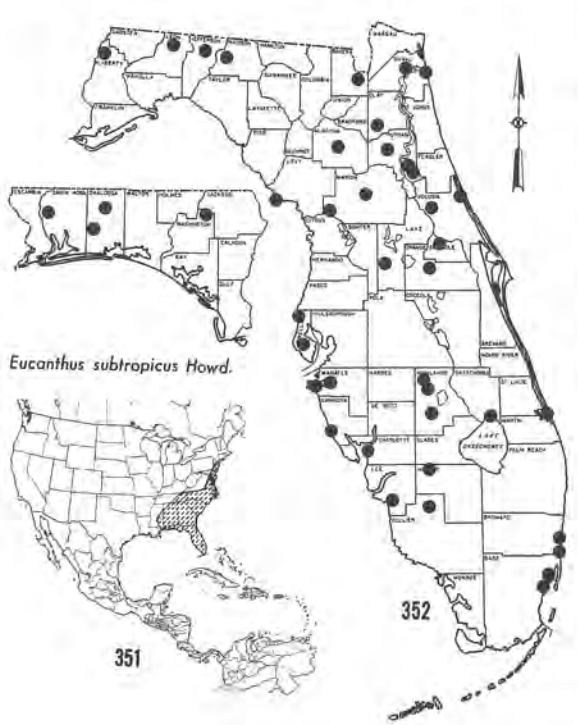
SPECIMENS EXAMINED: 41, of which 38 were from 16 Florida localities, representing 28 collection records (for complete data see Appendix 58).

SELECTED REFERENCES: Nothing has been published on this recently described species except the original description.

Eucanthus subtropicus Howden

(Fig. 343-4)

Eucanthus lazarus (Fab.), Blatchley, 1928:30 (misidentification).
Eucanthus lazarus subtropicus Howden 1955a:204-210.
Eucanthus subtropicus Howden, Howden 1964:70-72.



DIAGNOIS: Medium sized (length 6.5-12 mm), usually dark red brown, shining. It is most similar to *impressus* from which it can be separated by the characters in the key. In addition *subtropicus* has less sexual dimorphism in the pronotal characters, the transverse pronotal depressions are more heavily punctate, and the transverse pronotal carina is more sharply raised.

TAXONOMIC NOTES: Blatchley's (1928:30) Florida records of *lazarus*, and those of earlier workers, probably all refer to either this species or *impressus*. Frost (1964:142) recorded both *subtropicus* and *lazarus* from Archbold Biological Station, but the latter probably refers to *impressus*. This form was described originally as a subspecies of *lazarus*, and *impressus* was not distinguished from it at that time. The two are sometimes difficult to distinguish.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig 351-2). It was recorded by Howden (1964:70-71) from Alabama, District of Columbia, Florida, Georgia, Maryland, Mississippi, New Jersey, North Carolina, South Carolina, and Tennessee. In Florida he recorded the following localities: Archbold Biological Station, Cedar Key, Crescent City, Daytona Beach, Dunnellon, Ft. Lauderdale, Gainesville, Greenville, Immokalee, Interlachen, Jacksonville, LaBelle, Largo, Miami, Monticello, Okeechobee, Oneco, Orlando, Port Sewall, Punta Gorda, Sanford, Stuart, Tarpon Springs, Venice, Welaka, and Winter Park. I have seen specimens from Miami to Jay (Santa Rosa Co.), and apparently it occurs throughout the state.

BIOLOGY: Although this is a fairly common species at light, nothing is known about the adult or larval food. Specimens were not attracted to any of the fermenting baits used during this study, as were many of the Geotrupini. Howden (1955a:208) found a large colony at Southern Pines, N. C., in an old sandy road, where they dug vertical burrows averaging 20 inches deep. Specimens have been collected every month of the year in Florida. The larva has been described by Howden (1955a:210) and was characterized as follows; maximum width of head capsule 2.0 mm; frons on each side with two or three posterior frontal setae; glossa with small setae extending entirely across anterior portion. These characters appear to separate it from larvae of *lazarus* from Arkansas, described by Ritcher (1947:25). However, few larval specimens are known of either species, and the limits of variation have not been determined.

SPECIMENS EXAMINED: 171 from 31 Florida localities, representing 110 collection records (for complete data see Appendix 59).

SELECTED REFERENCES: Nothing has been published on this species except the references listed in the synonymy cited above.

Tribe GEOTRUPINI

(Fig. 353-370)

The tribe can be distinguished from the Bolboceratini by the enlarged antennal club, which is about as long as the basal eight segments, rounded, and convex on both sides. In addition, most of the species are black with some metallic sheen and, except for *Mycotrupes*, have the pronotum without horns or protuberances in either sex.

The following resume of the distribution was derived primarily from Howden (1955a; 1964). In the world there are approximately 135 species in 8 genera, of which 34 species and subspecies in 4 genera occur in the New World between Canada and El Salvador. Three genera and seven species represent the tribe in Florida, where one genus (*Peltotrupes*) and four species are endemic.

Many of the species occur in mesic, temperate, forested areas, although *Mycotrupes* and *Peltotrupes* are found in deep sand ridges, usually indicative of Pleistocene shorelines, marine terraces, or dunes.

Genus GEOTRUPES Latreille

(Fig. 353-5)

Geotrupes Latreille 1796:6.

Geotrupes Fabricius 1798:1-7 (junior homonym).

TYPE SPECIES: *Scarabaeus stercorarius* Linnaeus 1758 (designated under the plenary powers of the International Commission on Zoological Nomenclature, Opinion 346).

DIAGNOSIS: Large (length 10-18 mm), oval, black, often with vague metallic blue or green sheen, shining. Antennal club small, not convex on both sides. Eyes completely divided by a canthus. Head sometimes with a short horn, but pronotum without horns, protuberances, or excavations. Anterior femur with a conspicuous hairy spot on anterior surface. Elytra striate, with seven striae between the suture and the humeral umbone.

TAXONOMIC NOTES: Numerous subgenera have been proposed (Jekel, 1865) within the genus, but these do not appear to reflect natural groupings in the North American species. Both of the Florida species were placed in the subgenus *Cnemotrupes*, but they are not closely related.

The authorship of the name *Geotrupes*, the designation of a type species, and establishment of the proper gender have been the subject of several papers (Potts, 1948, 1951; Townes and Howden, 1952; and International Commission on Zoological Nomenclature, 1955, 1956). During the establishment of the type species, the International Commission (1955, Opinion 346) established the gender as feminine, and it was so used by Howden (1966:48). However, the International Commission varied this ruling and established the gender as masculine in Declaration 46 (1956), and it was so designated in the Official List of Generic Names in Zoology (1958).

DISTRIBUTION & ZOOGEOGRAPHY: Howden (1955a) listed 71 species in the world, distributed as follows: (11) Europe; (6) Russia; (29) Eastern Asia, Japan; (3) India, Burma, Malaysia; (6) North Africa, Near East; (9) North America east of Rocky Mountains; (7) Central America. He later (1966) added four new species from Mexico and Central America. In the U. S. the genus is confined to the area east of the Rocky Mountains where most of the species have a fairly broad range. However, *G. ulkei*, a wingless species, is known only from a few disjunct populations in Alabama, North Carolina, Tennessee, and Virginia. Only two species are known from Florida.

BIOLOGY: The habits of the species are highly variable and not easily summarized. The adults usually feed on dung or fungi, but at least one species (*semiopacus*) is common on carrion. The larval food varies from cow dung to dead leaves or grass. Larval development requires from one to two years, and adult emergence appears to be primarily in the fall or late summer. The burrows extend from 2 to 30 inches deep, and may contain from one to several brood cells per burrow. A few species are attracted to light (including both Florida species), and most of them are attracted to fermenting baits such as malt and molasses. For additional biological notes on each species the reader is referred to the revision by Howden (1955a).

The larvae have been described for all the U. S. species except *balyi* (Howden, 1955a, 1964). They were characterized as follows: anal opening surrounded by a

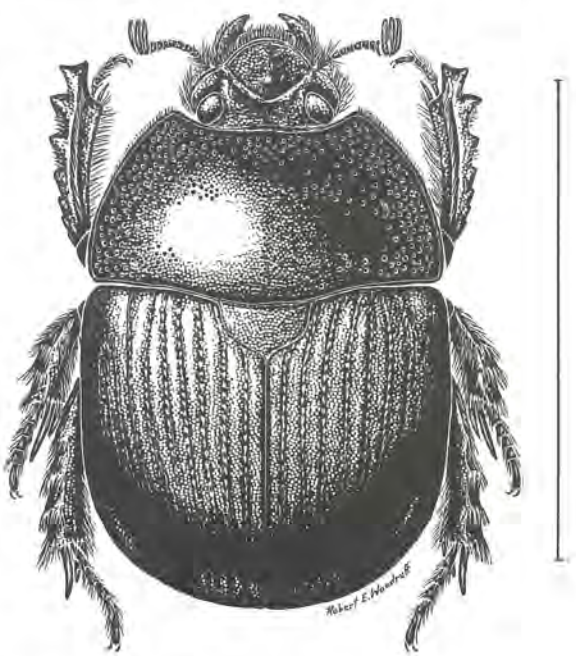


Fig. 353. **Geotrupes egeriei** Germar, line = 16mm.

flap-like dorsal anal lobe and a pair of Ventral anal lobes; mesothoracic legs greatly reduced in size; mesothoracic and metathoracic legs with stridulatory organs; terminal antennal segment at least one-fourth as long as the second segment; abdomen moderately swollen; endoskeletal figure of ventral anal lobe below anal opening laterally expanded with sharp, fairly truncate angles.

SELECTED REFERENCES: Blanchard, 1888:103-110; Blatchley, 1910:938-939; 1928:44-45; Boucomont, 1902:11-14; 1911:344-345; 1912:22-33; Bradley, 1944: 112-113; Horn, 868:313-322; Howden, 1955a:228-277; 1966:48-62, 77-79; Jekel, 1865:513-618; Paulian, 1939: 351-360; Ritcher, 1947:6-8; 1966:41-43 (larvae).

Key to the Florida species of Geotrupes

1. Row of setigerous punctures on anterior surface of front tibiae close throughout to the inferior margin of the groove in which it is situated, the surface of the tibia below this groove broad and smooth; elytral striae noticeably crenulate throughout; lateral pronotal margin noticeably angulate to the anterior angle; metallic sheen usually more pronounced, green or blue; Fig. 353-4 ..... *egeriei* Germ.

1'. Row of setigerous punctures on anterior surface of front tibiae distant apically from the carina forming the lower edge of the broad groove in which it is situated, this carina forming a narrow inferior margin for the anterior surface of the tibia (Fig. 355); elytral striae weakly crenulate, especially apically; lateral pronotal margin more evenly rounded; not noticeably angulate to the anterior angle; metallic sheen not pronounced, usually brassy or purple .... *b. blackburnii* (Fab.)

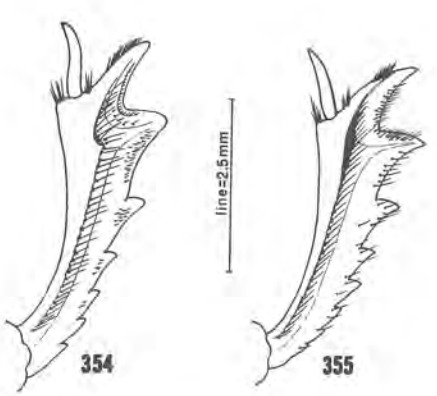


Fig. 354-355. Anterior tibia (dorsal view) of **Geotrupes** spp.: 354) **G. egeriei** Germ., and 335) **G. blackburnii** (Fab.).

Geotrupes blackburnii blackburnii (Fabricius)

(Fig. 355)

Scarabaeus blackburnii Fabricius 1781:20.
Geotrupes blackburnii (Fab.), Laporte 1840:100.
Geotrupes conicollis Jekel 1865:591.
Geotrupes jekellii Horn 1868:317.
Geotrupes blackburnii blackburnii (Fab.), Howden 1955a:237-244.

DIAGNOSIS: Medium sized (length 8-10 mm), black to coppery, shining. Easily separated from *egeriei*, the only other Florida species, by the characters in the key. In addition, it is narrower, the elytra more parallel sided, less convex, the pronotum less punctate, and the elytral intervals are flatter. The male genitalia are also diagnostic.

TAXONOMIC NOTES: Howden (1955a) recognized two subspecies, the nominate one and *excrementi* Say. The latter is primarily a western form which can be distinguished only on the basis of the male genitalia. All Florida specimens were referred by Howden to the nominate subspecies, and I have placed all of my specimens under that name. In comparing a long series from Ohio I find that Florida specimens differ in the pronotum being usually more densely punctate, and the elytral intervals are more convex. I have not seen sufficient material to evaluate the variation of genitalic characters of the Florida populations.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 356-7). The nominate subspecies is recorded from Vermont to Florida and intergrades with subspecies *excrementi* in the Mississippi Valley. Howden (1955a:246) stated ". . . additional data will probably show intergradation occurring in a general line from Central Ohio southward, west of the Appalachian Mountains to Rockmart, Ga." The neotype locality of *excrementi* is Columbia, Missouri.

In Florida, Blatchley (1928:44) recorded it from Tallahassee and Lake City, and Howden (1955a) added Jacksonville, Ocala, and Levy County. I have added six localities, including Panama City in the panhandle. It has not been recorded south of Ocala.

BIOLOGY: In the northeastern U. S. this is a common species in cow dung and occasionally at light. However, it appears to be very uncommon in Florida. Howden (1955a:239-243) discussed the biology of this species in North Carolina, and the following summary is largely derived from that paper. The burrows are three to eight inches in depth, varying somewhat with soil type. The brood cells are about two and one-half to three and one-half inches long by three-fourths to one inch in diameter. In no case has more than one cell been found per burrow. The cell, composed of dung and/or grass and leaves, is placed in a short lateral shaft at the end of the vertical burrow. The egg is elongate, oval, and deposited singly about one-half inch from

the end of the cell. When the food is consumed the larva plasters the side of the cell with its feces, making a hard compact cell about two inches long. Oviposition occurs from January to May with incubation lasting at least ten days. Duration of the first instar is 20 to 30 days; second instar 20 days; third instar 90 to 120 days; prepupa 4 to 9 days; pupa 15 to 20 days. Early growth of the third instar is rapid, their food supply being consumed in 15 to 20 days, after which they become quiecsent until pupation. Adults feed and overwinter in a feeding burrow, and in the spring the female alone digs and provisions the brood cells.

Where the species is abundant, specimens are commonly collected in bait traps, but I have never taken it in any of the traps I have operated in Florida, although I have taken thousands of *G. egeriei*, *Peltotrupes*, and *Mycotrupes*. Howden (1955a:241) tested several chemicals and found that proprionic acid and n-butyric acid were the most attractive substances used. Specimens are found sometimes at light, but this does not appear to be a good attractant.

The larva was described by Howden (1955a:243) and can be distinguished from *egeriei*, our only other species, as follows: tip of the tibiotarsus of each leg with a tubercle bearing a minute brownish claw; last antennal segment less than half the length of the second segment.

SPECIMENS EXAMINED: Over 200, of which 19 were from 6 Florida localities as follows: (1) Alachua Co., Gainesville, 1957, L. A. Hetrick, blacklight trap; (1) loc. cit. V-50; (1) loc. cit. XII-51; (1) Gainesville, 10-II-46, H. V. Weems, Jr.; (1) Gainesville, 23-XII-58, J. W. Perry, blacklight trap; (1) Baker Co., Glen St. Mary, 5-V-60, E. W. Holder, Jr., malt traps; (1) Bay Co., Panama City, 4-I-60, T. Johnson; (13) Jackson Co., 18-III-58, H. V. Weems, Jr., cow dung and dead pig; (1) Jefferson Co., Monticello, 2-II-60, A. M. Phillips, blacklight trap; (1) Leon Co., Tallahassee, 1-XI-59, G. W. Dekle.

SELECTED REFERENCES: Blanchard, 1888:106, 110; Blatchley, 1910:939; 1928:44; Dillon and Dillon, 1961: 524; Horn, 1880:145; Howden, 1955a: 237-244; Miller, 1961:739, Table 1.

Geotrupes egeriei Germar

(Fig. 353-4)

Geotrupes egeriei Germar 1824:114.
Geotrupes lecontei Jekel 1865:592.

DIAGNOSIS: Large (length 11.5-20 mm), oval, convex, shining, black with green or blue reflections. Distinguished from *blackburnii*, the only other Florida species, by the characters in the key. In addition, it is more convex, the elytra not parallel sided, the striae are more uniformly punctate and crenulate, the intervals more convex, and the pronotal punctures are denser. The male genitalia are diagnostic.

TAXONOMIC NOTES: Variation is most noticeable in size, the specimens from the northeastern U. S. being smaller. The smallest Florida specimen I have seen was 14 mm in length. The extent of pronotal punctation varies, but it is nearly always coarser and denser than in *blackburnii*. The punctation of the clypeus is also variable but is nearly always dense. The metallic reflections vary from yellow green to blue, but both forms are found together. *G. lecontei* Jekel was based on the female of *egeriei*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 358-9). Howden (1955a:252-253) recorded it from the following states: Alabama, District of Columbia, Florida, Georgia, Illinois, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Tennessee, and Virginia. In Florida he recorded it from the following localities: Gainesville, Interlachen, Jacksonville, Lakeland, Lutz, Miami, Monticello, New Smyrna, Ocala, Putnam Co., Sanford, Steinhatchee, and Valparaiso. It has not been recorded south of the center of the peninsula except for the single record from Miami.

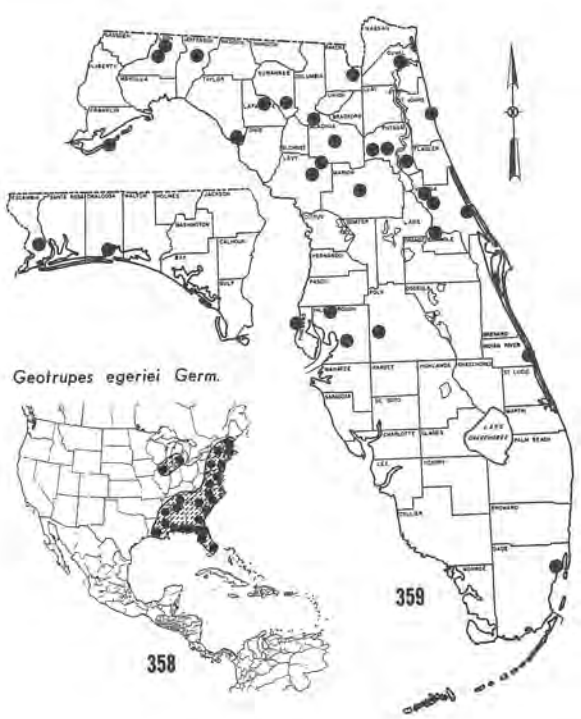
BIOLOGY: Although this species appears to be common, especially in Florida, it is not often collected except in malt bait traps or in unbaited pitfall traps. It is taken occasionally in light traps, especially in the spring in north Florida. It has been found on fungi, cow dung, and rotting watermelon. Howden (1955a: 250) reported finding a pair of beetles at Interlachen,

Florida, in a burrow 40 inches deep. At the same locality he found a single female and a brood wad of old cow dung at a depth of 20 inches. The cell was about two and one-half inches long by one inch wide. The egg was found in a cavity about one-half inch from the end of the cell and measured 4.2 by 2.3 mm. Before it hatched it increased to 4.7 by 3.2 mm. Howden (1955a:250-251) stated that it appears to have a two-year life cycle in the mountains of North Carolina, but in Florida it ". . . could possibly have a 1-year or 2-year cycle, as activity certainly was not greatly impaired by any cold weather." I have seen Florida specimens collected every month of the year. It appears to be a winter species, as indicated by pitfall trap collections. Nearly all of the light trap records are for November through February.

The larva has been described by Howden (1955a: 251-252) and can be distinguished from *blackburnii* as follows: tip of the tibiotarsus of each leg with a small tubercle but without a claw; last antennal segment about three-fifths the length of the second segment.

SPECIMENS EXAMINED: Over 550, of which 530 were from 23 Florida localities, representing 330 collection records (for complete data see Appendix 60).

SELECTED REFERENCES: Blanchard, 1888:106, 110; Blatchley, 1928:44-45; Horn, 1869:318; 1880:145; Howden, 1955a:247-253; Miller, 1954:376.



Genus PELTOTRUPES Blanchard

(Fig. 360-7)

Peltotrupes Blanchard 1888:105, 109.

TYPE SPECIES: *Geotrupes chalybeus* LeConte 1878 (not Mulsant 1842; n. n. *profundus* Howden) (by monotypy).

DIAGNOSIS: Large (length 15-23 mm), oval, somewhat flattened above, black with purple to green sheen, shining. The genus is close to *Geotrupes* but differs by the following combination of characters: middle and posterior tibia without transverse apical carina; outer carina of the upper face of the anterior tibia missing; middle and posterior femur with a single carinate margin posteriorly; elytral striae obsolete, indicated by rows of fine, shallow punctures, the intervals flat and not raised; lateral elytral margin expanded especially anteriorly; anterior tibia of male with outer apex elongate and turned inward nearly at right angle.

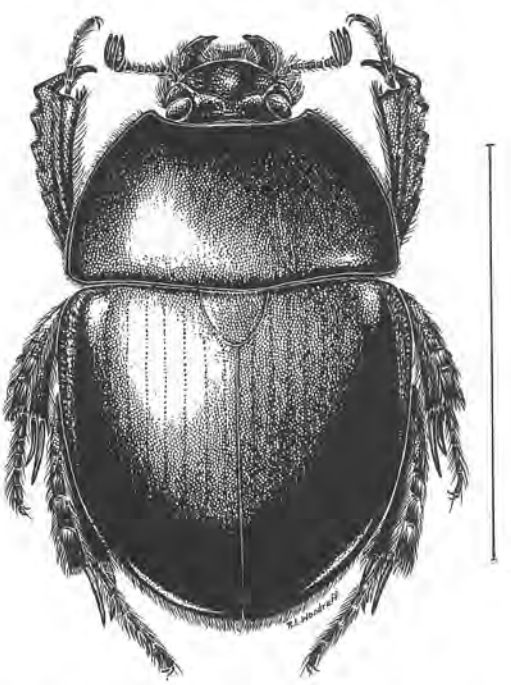


Fig. 360. **Peltotrupes profundus** Howden, line = 16mm.

TAXONOMIC NOTES: The genus was revised by Howden (1955a:277-288) to include two species and one subspecies. His conclusions were based in part on the assumption that they were flightless, as in *Mycotrupes*, and that relict populations were involved. Since this revision, it has been determined (Matthews, personal communication and several observations by D. L. Mays and me) that at least some of the populations fly (e. g., Archbold Biological Station and

Fig. 361. **Peltotrupes profundus** Howd. in couplatory position, male above (approx. natural size).

Gainesville). They all appear to have functional wings, the elytra are not fused (as they are in *Mycotrupes*), and it is likely that all are capable of flight.

It is probable that most populations are isolated from each other in isolated deep sand deposits (usually fossil dunes, shore lines, or marine terraces) similar to the situation found in *Mycotrupes*.

It is possible that each isolated population represents a distinct species or subspecies, but the morphological characters are sufficiently variable within a population that they are presently inseparable. I have examined about 1,800 specimens from throughout the range, and (with one exception) I can find no characters, including the genitalia, that appear satisfactory for distinguishing the populations. The exception is the population occupying the Ocala National Forest area or "Orange Island," and which has been described as *youngi* Howden. It seems to me that if we are to recognize some of the populations as distinct, such as *dubius* Howden, then we are faced with naming most other isolated colonies. Since the latter would require at least a dozen new names, I have elected to treat them here only as two species, *profundus* and *youngi*.

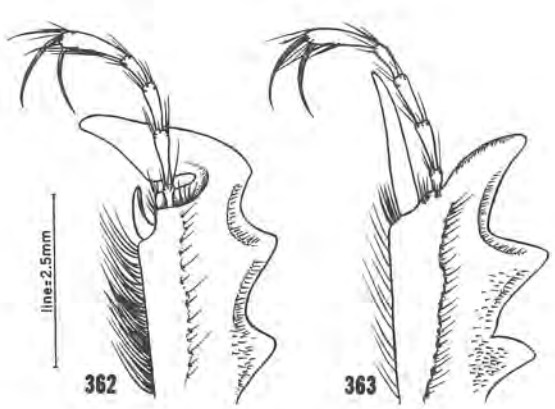
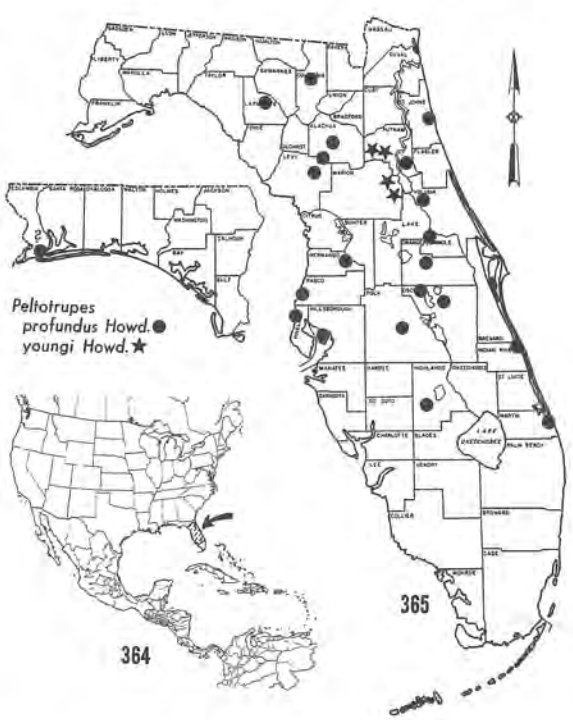


Fig. 362-363. Anterior tibiae and tarsi of **Peltotrupes profundus** Howd.: 362) male, 363) female.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 364-5). The genus is confined to peninsular Florida. Marginal records include Martin Co. in the south on the east coast, Tampa in the south on the west coast, St. Augustine in the north on the east coast, and Lafayette Co. in the northwest. Howden (1955a:282) reported Pensacola in his list of localities, but did not comment further. In subsequent papers (1963, 1966a) on zoogeography and effects of the Pleistocene, he made no mention of this record. In fact, he stated (1963:183) that "... *Peltotrupes* does not occur north of the Suwanee River." I have not seen specimens from Pensacola, but I have collected a series 12.8 mi. N. W. of Branford, a locality on the west side of the Suwanee River.

Considerable bait trapping in the "Trail Ridge" area in Baker County has failed to yield any *Peltotrupes*. These beetles usually occur in colonies isolated from each other, but by what factors we are far from answering. Suitable appearing habitat between colonies often seems to be uninhabited. On nearly every occasion that I have had to operate bait traps on a trip through any section of the state, I have obtained new and interesting distribution records. I believe that the present distribution pattern will be altered greatly by additional collecting, and that it is too premature to attach any great significance to present patterns.

BIOLOGY: These beetles were long considered one of the great Florida rarities, and practically nothing was known about their habits until Young's (1950) paper. In fact the only species known up to that time was described by LeConte in 1878 on the basis of



fragments. The earliest published note on their habits was by Leng (1887) who quoted a correspondent as finding them on Dec. 24, ". . . late in the afternoon about a quantity of horse and mule manure on a sandy road running through high pine lands." There are no subsequent records of manure acting as an attractant or being used as food. Schaeffer (1913) mentioned that they were attracted to stale urine. I baited several traps with urine without success, although they were taken a few feet away in malt traps.

Young (1950) and Howden (1952, 1955a) were able to collect several hundred specimens in traps baited with fermenting syrups (e. g., malt, molasses, and honey), and I have collected over 1,800 specimens by the same technique. These same papers, as well as one by Young, Hubbell, and Hayne (1955) contain copius notes on the biology and behavior of these beetles. By combining this information with my own observations, the following outline of the biology is constructed. This outline appears to hold for all populations studied. However, it should be pointed out that very few burrows have been excavated completely and very few brood cells found.

Fig. 366-367. Habitat of **Peltotrupes youngi** Howd. at Juniper Springs, Ocala National Forest (Marion Co., Florida). The trees are sand pine **(Pinus clausa)**, the understory is mainly scrub palmetta **(Sabal etonia)**, and the ground is often covered with lichens **(Cladonia** spp.).

Adult burrowing activity is most noticeable in early spring (January - April). The burrows, which are marked by large piles of sand or "push-ups" (Fig. 6), are usually vertical and often extend to great depths (averaging about six feet, with a maximum record of 10 feet). The burrow may be plugged for the top few inches with subsurface sand, but several burrows were completely open except for the plug at the entrance immediately below the push-up. The entrance is usually at the side and slightly sloping away from the push-up. The diameter of the burrow, which is probably proportional to the width of the beetle making it, is usually one-half to seven-eighths inch in diameter. At the bottow of the burrow there is a lateral passage, often six inches long by two inches wide in which the larva is found. The cell is usually loosely packed with surface litter, most often including needles and male cones of sand pine (*Pinus clausa* (Englemann) Vassey) and leaves of live-oak (*Quercus virginiana* Miller). Howden (1955a:287) reported only two instances in which more than one cell was found per burrow. I have never found more than one cell. It is likely that the female digs a number of these burrows in order to lay her complement of eggs. The eggs hatch within about one week, and early larval development is fairly rapid. However, no detailed information is available on the length of larval instars except that the third instar apparently lasts from April until the following winter. Exact time of pupation or adult emergence is not known, but most adult activity is in the spring. Howden (1955a:287) mentioned that the larva constructed a tube of its own fecal matter around itself, ". . . thus keeping the loose litter and sand from caving in." Adults stridulate loudly when disturbed.

The habitats of the species (Fig. 366-7) have at least one thing in common — deep sand. This is usually occupied by "scrub" or "sandhill" vegetation. For a thorough discussion of these two habitats and the indicator plants, the reader is referred to the excellent paper by Laessle (1958). The soil types are of the St. Lucie or Norfolk series and consist of more or less strongly washed and sorted sands. *Peltotrupes* has never been collected in areas without either sand pine (*Pinus clausa*) or turkey oak (*Quercus laevis* Walt.).

The larva of *P. youngi* (under the name *profundus*) was described by Howden (1952). It can be distinguished from larvae of the other Geotrupinae by the following combination of characters: head capsule asymmetrical; third antennal segment reduced to a mere cap on the second segment; glossa not emarginate; epipharynx with 25 or more chaetae on each chaetoparia; legs without claws, terminating in several long, stiff setae with tuberculate bases; body shape distinctive, the abdomen greatly swollen, almost five times as thick as the head capsule.

SELECTED REFERENCES: Blanchard, 1888:104-105, 109; Blatchley, 1928:44; Howden, 1952:41-48; 1955a: 277-288; 1963:180-183; Schaeffer, 1913:169; Young, 1950:88-92; Young, Hubbell, and Hayne, 1955:53-54.

Key to the species of Peltotrupes

1. Iridescent color usually purple or blue; sutural stria evident at the scutellum; lateral elytral margin more sharply expanded; widely distributed in the peninsula from Lake City to Hobe Sound ..... *profundus* Howden
1'. Iridescent color usually green; sutural stria obsolete at the scutellum; lateral elytral margin more obtusely expanded; narrowly distributed in the Ocala National Forest scrub .... *youngi* Howden

Peltotrupes profundus Howden

(Fig. 360-3)

Geotrupes chalybeus LeConte 1878:402-403 (not Mulsant 1842).
Geotrupes (*Peltotrupes*) *chalybeus* LeConte, Blanchard 1888:105.
Geotrupes (*Peltotrupes*) *profundus* Howden 1952:41.
Peltotrupes profundus profundus Howden, Howden 1955a:279.
Peltotrupes profundus dubius Howden 1955a:282-284. (NEW SYNONYMY).

DIAGNOSIS: Usually separated from *youngi* only by the following combination of characters, none of which alone will consistently suffice: iridescent color, especially of the males, bright purple to blue; sutural stria near the scutellum definitely impressed, the other striae more pronounced; punctures immediately behind the anterior pronotal margin usually in two rows completely across; lateral margin of elytra expanded at a sharper angle to the downward curve of the disc.

TAXONOMIC NOTES: *Geotrupes chalybeus* LeConte (1878:402) was preoccupied by *Geotrupes stercorarius* var. *chalybeus* Mulsant (1842:358). The new name *profundus* was proposed by Howden (1952:41) to replace *chalybeus* Lec. It is unfortunate that such a change is required by the International Rules because the two forms are not in the same genus, and the Mulsant name was proposed for a "variety" which probably has no taxonomic standing. I have synonymized the subspecies *dubius* for several reasons. First, and as mentioned under the genus, the species appear capable of flight, and a river should not be an important barrier. Secondly, I have been able to examine a fair series of specimens (46) from the type locality (Welaka), and some of them cannot be separated from some specimens of *profundus* from other isolated areas. And lastly, there seems little advantage in recognizing such a population unless all other equally isolated populations are named. It is possible that this genus is still undergoing speciation, but that the forms have not yet reached the stage where they can be easily distinguished morphologically.

I have retained the name *youngi* because that population usually is separable on morphological grounds (although very weak), and because it occupies the largest and somewhat unique scrub, the Ocala National Forest. For further comments see this section under *youngi*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 364-5). Howden (1955a:282) recorded it from the following localities: Croom (Hernando Co.), Enterprise, Gainesville, Gilchrist Co., Hernando Co., Kissimmee, Lake City, Orlando, Pensacola, Putnam Co., Tampa, Tarpon Springs, and Winter Park. He did not comment further on the Pensacola record even though it is isolated from the main range, and I have not seen specimens from there. The northernmost record (except for Pensacola) is Lake City and the southernmost near Hobe Sound.

BIOLOGY: Apparently it does not differ from the general account reported under the genus. The larva of this species has not been described; the report by Howden (1952) under this name refers to *youngi*. Frost (1964:142) reported a specimen taken in a blacklight trap at Archbold Biological Station, and numerous specimens have been taken in a blacklight trap at Gainesville.

The following field notes on behavior were made by D. L. Mays and me at Gainesville: on 9 January 1968, temperature 59° F. at 8 P.M., 3 malt bait traps were set in turkey oak, long-leaf pine sand hill near the Doyle Conner Building (S.W. 34th St.). One bait trap (located near a 15 watt blacklight trap) produced seven *P. profundus* between dusk and 8 P.M. and one beetle from 8 P.M. to 8 A.M. The blacklight trap yielded two females by morning. The two other bait traps yielded 36 specimens from dusk until 8 A.M. Apparently the flight period lasts for a very short time near dusk, and they fly very near the ground. This is probably why their flight has not been seen previously. Both Mays and I have seen several such flights as well as heard the very loud buzzing. Fragments of this species are frequently found in burrowing owl pellets.

Copulation took place in jars in the laboratory (Fig. 361). The elytra on these beetles is flanged at the sides near the humerus. The male hooks the peculiar anterior tibial spur (Fig. 362-3) under this flange of the female during copulation; he palpates the area near the scutellum with antennae and palpi; the posterior tibial apex and the long tibial spur appear to guide the genitalia; during the above behavior the middle legs moved fore and back along the lateral elytral margin, at the same time pushing down. The

female was nearly immobile during the entire sequence.

SPECIMENS EXAMINED: 1,018 from 17 Florida localities (for complete data see Appendix 61).

SELECTED REFERENCES: (Also see this section under the genus) Blatchley, 1928:44; Boucomont, 1910: 354; 1912:27; Bradley, 1944:112; Frost, 1964:142; Horn, 1880:144-145; Howden, 1955a:279-284; Leng, 1887:212; Moore, 1953:70-71; Young, 1950:82-92 (in part); Young, Hubbell, and Hayne, 1955:53-54.

Peltotrupes youngi Howden

Geotrupes chalybeus LeConte, Young 1950:88-92 (misidentification).
Geotrupes (*Peltotrupes*) *profundus* Howden 1952:41-48 (in part).
Peltotrupes youngi Howden 1955a:284-288.

DIAGNOSIS: Usually separated from *profundus* only by the following combination of characters, none of which alone will consistently suffice: iridescent color, especially of the males, bright green; sutural stria near the scutellum vaguely indicated, the other striae weekly impressed; punctures immediately behind the anterior pronotal margin often missing or in a single row, rarely in two rows; lateral margin of elytra expanded at a more obtuse angle to the downward curve of the disc.

TAXONOMIC NOTES: The biology and larva were described under the name *profundus* (=*chalybeus*) before *youngi* was recognized as dictinct. I have some reservations about recognizing this form as a distinct species, but I have retained it as such for two reasons: 1) the color and other morphological characters seem to be fairly constant, and 2) the area occupied by this population (the Ocala National Forest scrub) appears to be a distinct, easily circumscribed entity.

Kurz (1942) and Laessle (1958) have reported on the unusual nature of this scrub, especially in regard to the presence of turkey oak there. Laessle (1958: 378) stated:

> The dunes of the Ocala National Forest differ from any Recent dunes, and from most Pleistocene dunes of Florida, in a number of respects other than the unusually long distance that they have moved back of the Pamlico shore. The topography of the land on which the dunes formed was unusual in that it contained elevations at least 125 ft. above the shore line.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 364-5). The type locality is 4 miles west of Rodman, Putnam Co., Florida. It probably occupies the entire area of the Ocala National Forest scrub but has presently been recorded only from the type locality and Lake Suzan in the north to Lake Kerr and Juniper Springs in the south.

BIOLOGY: The biology apparently does not differ from the general account reported under the genus. The larva of this species is the only one known, and it was fully described and illustrated by Howden (1952) under the name *profundus*. Two adults were taken in January about six inches deep under toadstool type fungus which had been fed upon (presumably by these beetles), under a mat of sand pine needles.

SPECIMENS EXAMINED: In addition to many of the 126 paratypes listed by Howden, I have seen 733 specimens from 4 localities as follows: (4) Marion Co., Juniper Springs, 31-I-61, H. V. Weems, Jr.; (2) ibid., 13-I-72, R. E. Woodruff, under fungi; (1) Marion Co., Lake Kerr, 23-III-61, R. E. Woodruff; (1) Marion Co., Ocala Nat. For., 20-IV-56, R. A. Morse, malt trap; (1) ibid., 6-III-70, S. P. Christman, pitfall; (137) Putnam Co., near Lake Suzan, 9-II-59, R. E. Woodruff, malt traps; (240) ibid., 11-II-59; (350) ibid., 13-II-59.

SELECTED REFERENCES: Only the references listed above in the synonymy apply to this species.

Genus MYCOTRUPES LeConte

(Fig. 368-70)

Geotrupes (*Mycotrupes*) LeConte 1866:381.
Thorectes (*Mycotrupes*) Boucomont 1902:15.
Geotrypes (*Mycotrypes*) Boucomont 1911:349 (unwarranted emendations).
Mycotrupes LeConte, Olson and Hubbell 1954:7.

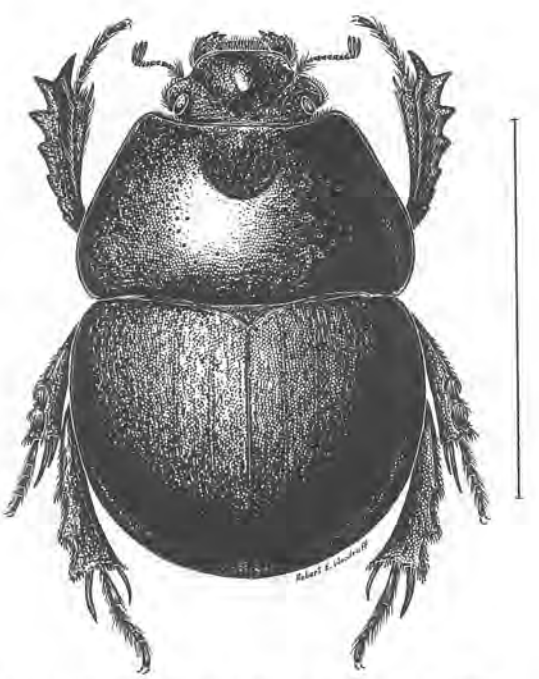


Fig. 368. **Mycotrupes gaigei** Ols. & Hub., line = 10mm.

TYPE SPECIES: *Geotrupes* (*Mycotrupes*) *retusus* LeConte 1866 (by monotypy).

DIAGNOSIS: Easily distinguished from all other Florida Geotrupinae by the fused elytra and the absence of metathoracic wings. Small to medium sized (length 9-17 mm), oval, very convex, dull, granular, black to gray, nearly impunctate. Sexual dimorphism usually pronounced; anterior tibia of male with an extra tooth at apex, pointing forward and downward; anterior tibial spur of the male straight and normal, that of the female broader and inturned near the tip; clypeus of male with a horn, that of the female at most tuberculate or callose; pronotum of male excavate near the middle, the margins of the concavity polished and convex, at least partially interrupted postero-medially. For additional generic characters the reader is referred to the excellent revision by Olson, Hubbell, and Howden (1954).

TAXONOMIC NOTES: Before 1954, when Olson, Hubbell, and Howden revised the genus, all specimens were referred to *lethroides* Westwood or *retusus* LeConte. The latter was considered a synonym of *lethroides* by Boucomont (1911) and by subsequent authors until the recent revision. Both of these species are distinct, but neither occurs in Florida. The three known Florida species were described as new in the paper by Olson, Hubbell, and Howden (1954).

Although recently revised, *Mycotrupes* still contains many interesting problems in speciation. Since they have lost the powers of flight and occupy only deep sand ridges, it is natural that numerous isolated populations exist. The three named Florida species are completely allopatric and are separated by broad barriers of low land and/or major river courses. It is likely that additional study and specimens will show that there are still other closely related, but distinct, noninterbreeding populations in Florida. For additional information, see the discussions under each species.

Since there has been a recent revision of the group, the remarks here will be confined primarily to new information, and the reader is referred to the paper by Olson, Hubbell, and Howden (1954) for a more detailed treatment.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 369-70). The five known species are confined to deep, well-drained sand deposits of the southeastern Coastal Plain, but they are not evenly distributed within this area. One species (*lethroides*) is known only from the vicinity of Augusta, Georgia; *retusus* is known from two areas in South Carolina; *cartwrighti* is found in southern Georgia and northern Florida; and the last two, *gaigei* and *pedester*, are endemic to Florida (for further discussion on the last three species, see the individual species account).

Hubbell (1954) and Howden (1963) have discussed in detail the relationship of these distributional patterns to the events of the Pleistocene. Recent geological studies (Alt and Brooks, 1965) and numerous others in progress have greatly modified previous ideas about the age and extent of various prehistoric shore lines. Some interesting correlations between *Mycotrupes* distributions and geological events eventually might be possible, but as the distributional patterns are not well known, and the geological findings are rapidly changing the older concepts, it is futile to draw elaborate conclusions at this time.

BIOLOGY: All members of the genus presumably have similar habits. The greatest period of adult activity is during the winter (November - April), although a few specimens have been taken at other times of the year. The habitats are deep sand ridges probably indicative of Pliocene or Pleistocene shore lines. The vegetation is variable but usually involves turkey oak, sand pine, or long-leaf pine. The understory is always open with sparse ground cover except for leaves or pine needles.

The burrows are marked by "push-ups" of soil similar to but larger than those of most Geotrupinae. It appears that the species are active during the day, but this aspect of their behavior has not been investigated carefully. The burrows vary in depth, but most are more than three feet deep with a maximum record of eight feet. The only published account of the biology of the species is by Howden (1954:52-56), from which the following summary is derived. Only three larval specimens (all of *gaigei*) are known, and they were found at depths of 66, 72, and 78 inches. The larval food is not definitely known, but on one occasion appeared to be cow dung. Whether more than one cell is provisioned per burrow has not been definitely established, but from their position in a large excavation it appeared that several branched off at different depths.

Adults stridulate, but this has not been studied in any detail. They apparently live for extended periods (Howden reported a caged female which lived for 13 months). Larvae (known only for *gaigei*) can be separated from other known Geotrupini by the broadly truncate (lacking sharp angles) configuration of the endoskeletal figure below the anal opening. In addition, the characteristics of the tormae, epipharynx, and glossa are diagnostic.

The adults were extremely rare in collections until T. H. Hubbell discovered that they were attracted to fermenting molasses, during his studies on the camel-cricket genus *Ceuthophilus*. Howden (1954) found them attracted to fermenting malt and perhaps more strongly to malt with a few drops of proprionic acid added. I have collected over 1,000 specimens in bait traps, but have found that the addition of proprionic acid made little difference. The meager available data suggests that a pheromone might increase the effectiveness of the trap into which a specimen has fallen. Over 10,000 specimens of *cartwrighti* were taken in unbaited pitfalls at Tall Timbers Res. Sta. (Leon Co.).

SELECTED REFERENCES: Blatchley, 1928:45; Boucomont, 1911:349-350; Horn, 1868:314; Howden, 1955a:288-293; Olson, Hubbell, and Howden, 1954:1-59.

Key to the Florida species of Mycotrupes

1. Pronotum usually without a tubercle behind the anterior margin medially; if present, it is low, transverse and indented postero-medially, not conical or elongate; granules of elytral disc usually distinct, the area between noticeably alutaceous, appearing velvety; southwestern peninsular Florida (Arcadia to Estero) ..... *pedester* Howden

1'. Pronotum usually with a conical or elongate tubercle behind the anterior margin medially; granules of elytra distinct or confluent, appearing velvety or shining; northern half of the peninsula (Enterprise to Tallahassee) .. 2

2(1'). Each elytron with two double striae faintly indicated at least for half their length; granules of elytral disc mostly confluent, very few distinct; pronotum with a few distinct punctures near the lateral and posterior borders of the median convexity; averaging smaller (length 11 mm); northcentral Florida (Enterprise to Lafayette Co.) .... *gaigei* Ols. and Hubb.

2'. Elytra with practically no vestige of striae; granules of elytral disc nearly all distinct, rarely confluent; pronotum without punctures; averaging larger (length 15 mm); northern Florida (Tallahassee to Atlantic Beach[?] and southern Georgia ....*cartwrighti* Ols. and Hubb.

Mycotrupes cartwrighti Olson and Hubbell

Geotrupes retusus Lec., Hebard 1903:261 (misidentification).

Geotrupes lethroides Westwood, Blatchley 1928:45 (in part).

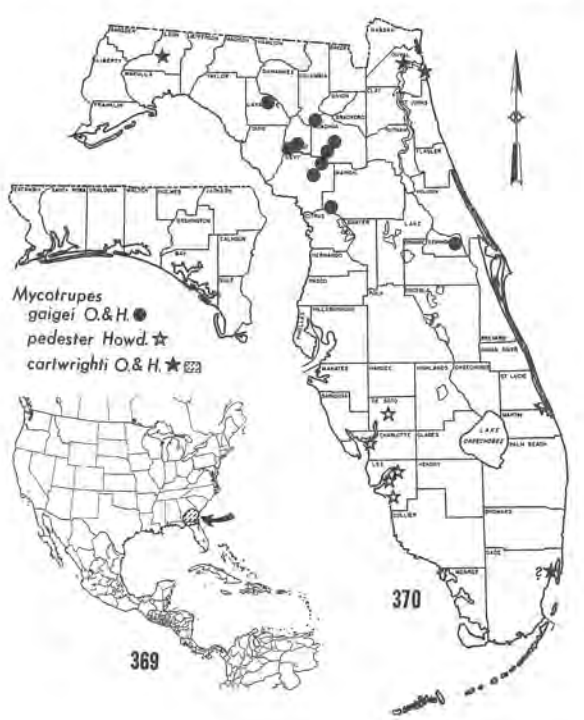
Mycotrupes cartwrighti Olson and Hubbell 1954:20-24.

DIAGNOSIS: Generally larger (average length about 15 mm) than the other two Florida species, but not as large as *lethroides*. The elytral striae are practically never indicated. It is most similar to *pedester* but, in addition to being larger, the clypeal horn is longer, less inclined; the male pronotal excavation (maximum) is larger, often exceeding the head in size; and the mesal margin of the ventrodextral process of the male genitalia is feebly concave. It is allopatric with all other species.

TAXONOMIC NOTES: Olson and Hubbell (1954:20) stated that "*Mycotrupes cartwrighti* is very close to *M. pedester*, which may possibly be only subspecifically distinct; . . ." However, they saw only 37 specimens of *cartwrighti* and 16 of *pedester*. I have examined over 10,000 additional specimens of *cartwrighti* and 31 of *pedester*, and I believe that they are distinct species.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 369-70). Blatchley's records of *lethroides* (1928:45) from St. Augustine and Enterprise are probably both referrable to other species, as *lethroides* is now known only from the vicinty of Augusta, Georgia. Olson and Hubbell (1954:23) stated that these records ". . . are almost surely attributable to *cartwrighti*.", although they did not see the specimens. Blatchley indicated that the St. Augustine record was from "(Ham.)," which is a manuscript list of Coleoptera taken in the vicinity of St. Augustine, Florida, by Rev. Charles Johnson (Schwarz, 1889:169). Since this list is from the "vicinity" of St. Augustine, there is no way of telling the exact location, and I have been unable to locate the specimens. It is quite possible that they do not represent *cartwrighti*. The record from Enterprise was attributed to "(Dietz)" by Blatchley on the basis of records supplied by Charles Schaeffer from the Brooklyn Museum collection. I also have not located this specimen(s), but I am reasonably sure that it applies to the same population take by me at Geneva (a few miles south of Enterprise), and here referred to *gaigei*, although possibly representing a new species.

There are two other records of *cartwrighti* which require further explanation. These are Miami, Florida, and Comfort, Texas, based on specimens from the H. M. Klages collection in the Carnegie Museum and reported by Olson and Hubbell (1954:23). This collection is notorious for the number of specimens with erroneous labels, and Olson and Hubbell stated that the "Comfort, Texas" label was ". . . almost certainly



an error." However, they did not question the "Miami, Florida" record, even though no additional specimens of any *Mycotrupes* are known within 250 miles north and 150 miles west of Miami. There is little doubt in my mind that this specimen is mislabeled as is the one from Texas.

By excluding Miami (erroneous label) and Enterprise (probably referable to *gaigei* or a new species), the distribution pattern of *cartwrighti* (Olson and Hubbell, 1954:Text Fig. 1; and followed by Howden, 1963: Map 1) appears much more logical (see Fig. 112).

Aside from the questionable records mentioned above, it has been reported (Olson and Hubbell, 1954: 23) from the following locations: Georgia: Grady Co.; Thomas Co., Thomasville; Dooley Co., U. S. Highway 41 at Pennahatchee Creek, 2 mi. N. of Vienna; Liberty Co., Hinesville; Florida: Leon Co., 6.5 mi. E. of Tallahassee (type); Duval Co., Jacksonville and Atlantic Beach.

The single specimen from Hinesville, Georgia, varies slightly from typical specimens and is from an area separated from the main range of *cartwrighti* by the Altamaha River. Olson and Hubbell (1954:23) suggested that it ". . . may prove representative of an atypical population or perhaps a distinct subspecies."

Hebard's record (1903:261) of *retusus* from Thomasville, Georgia (not cited by Olson and Hubbell), is almost certainly referable to *cartwrighti*.

BIOLOGY: The type of locality (6.5 mi. E. of Tallahassee) was described by Olson and Hubbell as follows:

> . . . margins of a mesophytic hardwood forest ("hammock") on a slope in the Tallahassee Red Hills district. The soil was a sandy loam of the Orangeburg series, with about 16 inches of loamy sand over bright red friable sandy clay. The forest was composed of black and white oak, hickory, sassafras, sweet gum, and scattered loblolly pines, with scanty undergrowth, and the ground surface was covered with a thin leaf litter, somewhat rooted about by hogs.

I have collected 31 specimens very near the type locality in a similar situation that adjoined a cow pasture. The general habitat is shown in Fig. 121. If the records from Jacksonville, Atlantic Beach, and St. Augustine are valid, the species has a broader range of habitats than the other species. The latter localities are in deep, well-drained sands, in many cases occupied by turkey oak.

This species does not appear to differ in its general habits from that described for the genus. However, it is not well-known, and the immature stages have not been discovered. Nearly all known specimens were taken in malt or molasses bait traps, or in unbaited pitfall traps.

Although some specimens have been collected every month of the year, the greatest numbers were found from late October through March. The largest single collection was of 118 specimens in a pitfall operated from Dec. 20 to Dec. 27. Until the pitfall traps were operated at Tall Timbers Research Station, the species was known from 37 specimens in the type series and 31 additional specimens which I collected. As a result of these pitfalls, well over 10,000 *M. cartwrighti* were collected over a two and one-half year period. Except for a few species of Aphodiinae which are taken by the tousands in light traps, this is the greatest number of specimens for any Florida scarab.

This sampling program continues presently, and the data is too extensive and recent to analyze here. These samples are collected as a part of studies on the effects of fire and that of cultivation on insect populations. An analysis of this data will be published elsewhere.

SPECIMENS EXAMINED: Over 10,000 including a large part of the type series. (10) Jefferson Co., near Monticello, Big Bend Hort. Lab., Mar., June, July, Aug., S. Fluker, pitfalls; (8) Leon Co., 6 mi. E. of Tallahassee, Old St. Augustine Road, 5-7-X-60, R. E. Woodruff, malt traps; (23) ibid., 15-24-IV-63; (10,000+) Leon Co., 18 mi. N. Tallahassee, Tall Timbers Research Station, weekly records for 2½ years, D. L. Harris, W. H. Whitcomb, W. W. Baker, pitfall traps (detailed records will be the subject of a paper elsewhere).

SELECTED REFERENCES: Howden, 1955a:292, Pl. 1, Pl. 5, Fig. 4; 1963: 181, Table 1, 3, Map 1.

Mycotrupes gaigei Olson and Hubbell

(Fig. 368)

Geotrupes lethroides Westwood, Blatchley 1928:45 (misidentification in part).
Mycotrupes gaigei Olson and Hubbell 1954:15-19.

DIAGNOSIS: Differs from all the other species by the faint but definite vestiges of two striae on each elytron. Granules of the elytral disc nearly all partially confluent, forming minute irregular rugulae, while in the other species the granules usually are distinct. The only species with noticeable punctures on the disc of the pronotum, although they sometimes are scattered widely and camouflaged by the coarse surface. Fossorial bristles of the middle and posterior tibiae are more numerous than in the other species. In males the horn usually is more inclined, and the metallic bronze color usually is noticeable.

TAXONOMIC NOTES: Olson and Hubbell (1954) postulated that this species was one of the first to split off from the ancestral stock, and that it is ". . . in some respects the most primitive as well as the most aberrant members of the genus."

Blatchley's record (1928:45) of *lethroides* from Enterprise probably refers to this species, not to *cartwrighti* as indicated by Olson and Hubbell (1954: 23). Although I have not seen specimens from this locality, I have seen several from Geneva which is only a few miles south. I have tentatively assigned them

to *gaigei*, but they show several minor differences (especially lack of a median tubercle behind the anterior pronotal margin). Further study of longer series will be required to determine if this population is distinct.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 369-70). The type locality is 3.9 mi. N. of the Santa Fe River bridge on U. S. Highway 41, north of High Springs, Florida. In addition to the type locality, Olson and Hubbell (1954:18) listed the following localities: Dixie Co., Oldtown; Gilchrist Co., 0.6 mi. S. Wilcox; Alachua Co., High Springs, Warren's Cave, 4 mi. and 2.1 mi. W. Archer; Levy Co., 5 mi. S. W. Archer; Marion Co., Dunnellon; Citrus Co. It occurs on the central portion of a belt of rolling sandy uplands which extends from the Georgia line in eastern Madison and western Hamilton counties southward into Pasco and Pinellas counties. However, it is not everywhere present therein. I have also seen specimens from near Geneva and from 5 mi. E. of Mayo, which are not parts of this same sand ridge. However, further study may prove these populations to be distinct from *gaigei*.

BIOLOGY: There probably is more information available on this species than any other in the genus, but it is still poorly known. The general region which it inhabits is called the "Peninsular Limesink Region" by Harper (1914). Most of this area is occupied by "sandhills" or "scrub" vegetation (for further discussion of these two habitats see Laessle, 1958). The beetles appear to be colonial and occupy only certain portions of the area mentioned and are not always present in similar appearing habitats. They are sometimes abundant locally; I have taken more than 50 specimens in a pint bait jar left for two days and nights near Archer, Florida.

The general biology is discussed under the genus. This is the only species of the genus for which the larva is known. For additional discussion of the habits and description of the larva see Howden (1954: 52-56).

SPECIMENS EXAMINED: 1,488 from 10 Florida localities, representing 23 collection records (for complete data see Appendix 62).

SELECTED REFERENCES: Howden, 1954:53-56; 1955a:291-292, Pl. 5, Fig. 6; 1963:181, Table 1, 3, Map. 1.

Mycotrupes pedester Howden

Mycotrupes pedester Howden, (*In* Olson, Hubbell, and Howden) 1954:24-28.

DIAGNOSIS: Similar to *cartwrighti* but averaging smaller (length about 13 mm). In addition to the characters in the key, the male clypeal horn is shorter, more compressed, and slightly more inclined; area of male pronotal excavation (maximum) smaller than the head; mesal margin of ventrodextral process of male genitalia nearly straight.

TAXONOMIC NOTES: Olson and Hubbell (1954:20) suggested that *pedester* and *cartwrighti* ". . . may possibly be only subspecifically distinct;". Although they are similar, the many consistent differences and the disjunct range, with another distinct species inserted between them, would appear to be ample justification for the recognition as full species.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 369-70). It was recorded by Howden (1954:28) from Arcadia, Fort Myers, and Punta Gorda (type locality), Florida. I have added Estero to extend the distribution about 15 miles further south. The localities mentioned are at the end of a chain of small and large patches of scrub and are known as "scrub islands" (Olson and Hubbell, 1954:28). These habitats are discontinuous from DeSoto County to Marco Island in the Ten Thousand Islands group. Several of these "scrub islands" south of Fort Myers are shown by Laessle (1958: Fig. 6) to be associated with the Silver Bluff Sea and are termed "Naples bar scrubs." This appears to encompass scrubs at Estero, Bonita Springs, and Naples. It is interesting that 13 bait traps set in sand pine/rosemary scrub at Bonita Springs failed to produce any *Mycotrupes*, at the same time traps set in a Caribbean pine area at Estero yielded four specimens. Additional trapping will be necessary to determine the exact limits of distribution of this species.

BIOLOGY: This species is apparently much less common than the other Florida species (especially *gaigei*). It was described from 16 specimens, and I have seen only 31 additional ones. None of the specimens seen at the time of the original description was accompanied by field notes, and nothing has been published on the habits or biology of the species. I have recorded the following field notes.

On March 28, 1962, a single malt trap was set at Tice, Florida (Lee Co.) about 1.3 mi. S. of the Caloosahatchee River, along Ortiz Road. The area was mostly cleared nearby, and the trap was placed near a drainage canal at the edge of a cow pasture of about 10 acres. The area did not appear to be scrub, and I did not anticipate any *Mycotrupes*, but set the trap for Scarabaeinae. However, when the trap was checked on March 30, a single *M. pedester* was found.

On March 27, 1962, I set nine malt traps 1.2 mi. west of Bonita Springs on County Road 865 in a typical scrub containing sand pine, rosemary, and scattered dwarf live oaks. The oaks were heavily covered with epiphytes, including bromelaids and one orchid (*Epidendrum tampense* Lindl.). The ground was bare in many spots, and there were large areas covered with terrestrial lichens (*Cladonia*). These traps were checked on March 29 and 30, and April 6, but they contained no *Mycotrupes*. Among other things, the traps contained six specimens of a rare cerambycid (*Aethecerinus horni* Lec.) and a large elaterid (*Lanelater sallei* (Lec.)).

On March 27, 1962, I set four other traps within the city limits of Bonita Springs on the east side of

U. S. Highway 41 near the Rosemary Park subdivision. The area was similar to the previous locality except that there were numerous gopher tortoise burrows. No *Mycotrupes* or other items of interest were found on subsequent checking of these traps.

On March 27, 1962, I set 13 traps at Estero, about 0.5 miles east of U. S. Highway 41 at the north edge of the city. The area had been burned recently, and most of the ground cover was gone. The main vegetation was Caribbean pine with some scattered large live oaks and a dense mat of saw palmetto in places. Small "push ups" of white sand could be seen easily against the charred black soil surface; about 150 were counted in a one-half acre square. The "push ups" were fresh, since a hard rain two days earlier would have knocked most of them down. When the traps were checked on March 29, two *Mycotrupes pedester* were found, and one additional one on March 30. The traps were not checked again until April 6, when four more *Mycotrupes* were found. Also of interest were six specimens of a rare weevil (*Paragraphus setosus* Blatchley). Considering that 13 traps were operated for 10 nights with a total catch of 7 *Mycotrupes*, this species was not abundant. It is possible that some of the numerous "push ups" were made by other burrowing scarabs, but none was collected. Several of the traps were dug out by animals, probably racoons or armadillos.

SPECIMENS EXAMINED: 31 from 3 Florida localities as folows: (1) Charlotte Co., Punta Gorda, 19-IV, R. C. Casselberry; (2) Lee Co., Estero, 29-III-62, R. E. Woodruff, malt traps; (1) ibid., 30-III-62; (4) ibid., 6-IV-62; (3) ibid., 4-IV-64, B. K. Dozier; (7) ibid., 13-1-65; (12) ibid., 10-III-65; (1) Lee Co., Tice, 30-111-62, R. E. Woodruff, malt traps.

SELECTED REFERENCES: Howden, 1955a:292-293; 1963:181, Table 1, 3, Map 1.

Subfamily ACANTHOCERINAE [1]

(Fig. 371-407)

TYPE GENUS: Acanthocerus MacLeay 1819: 136.

A small subfamily of approximately 10 genera and 120 species, with 3 genera and about 75 species in the New World. Only two genera (*Cloeotus* and *Acanthocerus*), represented by three species, occur in the U. S., with the others being primarily tropical.

The group is characterized by the unique globular body shape (Fig. 43, 371, 382, 396), the flattened and broad tibiae (Fig. 392-95), antennae 9- or 10-segmented, pygidium concealed by the elytra, scutellum large and triangular, five visible abdominal segments (Fig. 39), and by the numerous incised lines on most of the legs (Fig. 392-95, 400-01). The most distinctive feature is the body shape (Fig. 43), which is unlike any other Scarabaeidae, but similar to the genus *Agathidium* of the Silphidae. They are capable of tucking in the head, pronotum, and legs to form a compact ball, when feigning death. This capacity reaches the maximum in the genus *Acanthocerus*, the members of which resemble globular, shining seeds. The carinate elytral intervals on the posterior one-third, and the wavy lines intervening, present a unique pattern in all of the Scarabaeidae.

This subfamily has been treated as a distinct family by Boving and Craighead (1931:52), and this was followed by Edwards (1949a). It was considered a part of the Trogidae by Lacordaire (1856) and de-Borre (1886). It was treated as a subfamily by Ritcher (1966), and this is the position taken by most modern taxonomists of the Scarabaeidae. The group's relationships are rather obscure, because they possess many unique features.

Ritcher (1966) indicated that, on larval characters, they were related to the Hybosorinae, based on similarity of the epipharynges, the spatulate setae of the raster, and the presence of stridulatory organs on the legs.

The habits are not well known, and most specimens have been collected under bark or by beating dead limbs. At least some species are termitophilous (Boucomont, 1936). *Philarmostes* is associated with termites in Madagascar and Costa Rica, and two species of *Acanthocerus* are associated with termites in Brazil (Ritcher, 1958:325). Ohaus (1909) stated that both

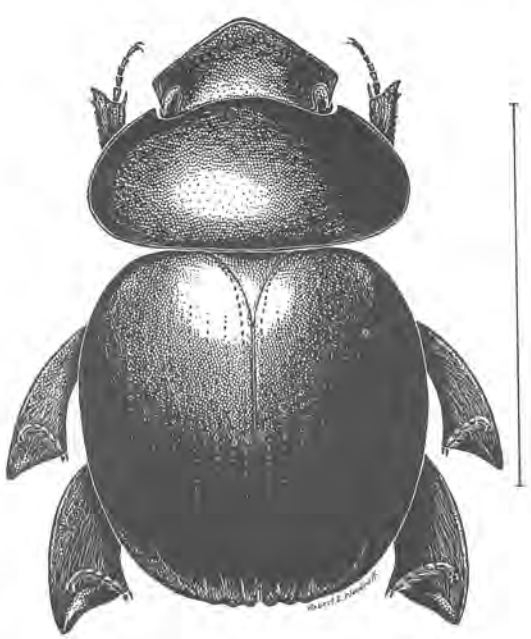


Fig. 371. **Acanthocerus aeneus** MacL., line = 5mm.

[1] Since this was set in type, Cartwright and Gordon (1971, Scarabaeidae of Micronesia) pointed out some neglected literature involving an old homonym of *Acanthocerus*. They state that the correct name for the type genus should be *Ceratocanthus*, and therefore the subfamily should be Ceratocanthinae.

adults and larvae appear to feed on rotten wood. Although Ritcher (1966) mentioned, under Acanthocerinae, that the Asiatic *Haroldius* is myrmecophilous, this genus is a member of the subfamily Scarabaeinae. I have reared two specimens of *Cloeotus globosus* from the frass in burrows of *Popilius disjunctus* (Ill.) (Passalidae). Although Edwards (1949a:52) indicated that: "*Acanthocerus aeneus* MacL. is said to occur on flowers of several species . . .", I have not been able to verify this reference, and I doubt its validity. *Cloeotus aphodioides* stridulates loudly (Alexander, Moore, and Woodruff, 1963:113), but the significance of these sounds has not been determined. The morphology of the stridulatory organs is also unknown. It is possible that the numerous incised lines of the venter and legs play some role in sound production. Some species of *Cloeotus* are found in early spring congregated under loose bark (in hibernation?), and others have been collected at lights.

Key to the Florida genera and species of Acanthocerinae

(includes all species known from the U. S.)

1. Posterior angles of pronotum obliterated, sides rounded; anterior marginal line of pronotum barely indicated (Fig. 388); genae poorly defined; clypeus punctate, but no transverse lines present (Fig. 383); elytral striae (rows of punctures) no extending to elytral base; middle and posterior tibiae completely flattened (Fig. 392-93); body completely contractile (Fig. 371) ..... *Acanthocerus aeneus* MacL.

1'. Posterior angles of pronotum obvious, nearly right-angled; anterior marginal line of pronotum deeply incised, forming a deep groove at the anterior pronotal angles (Fig. 389); clypeus punctate and with transverse lines present (Fig. 385, 387); elytral striae (rows of punctures) extending to the elytral base (except at humeral angles); middle and posterior tibiae not completely flattened, although expanded (Fig. 394-95); body partly contractile (Fig. 396) 2

2. Clypeus with numerous transverse incised lines, forming a fingerprint pattern; eyes emarginate anteriorly with an elongate narrow canthus (Fig. 385); body form more rounded and globular; lateral elytral margin anteriorly serrate (Fig. 386, 396) ..... *Cloeotus globosus* (Say)

2'. Clypeus with few transverse lines, but not arranged in fingerprint pattern; eyes emarginate anteriorly with a short canthus (Fig. 387); body form more elongate, less convex; lateral elytral margin entire (Fig. 384) ..... *Cloeotus aphodioides* (Ill).

Genus ACANTHOCERUS MacLeay

(Fig. 371, 383, 388, 392-93)

Acanthocerus MacLeay 1819:136.
Sphaeromorphus Germar 1843:111.

TYPE SPECIES: A. aeneus MacLeay 1819:137 (by monotypy).

DIAGNOSIS: This genus can be distinguished readily by the characters given in the key. In addition, specimens are usually larger, shinier, and more metallic than *Cloeotus*.

TAXONOMIC NOTES: The genus is in need of revision. The last general treatise was that of Harold (1874b). Several of the genera of Acanthocerinae were confused by Germar (1843), and the name *Sphaeromorphus* is a synonym which resulted. The species are difficult to study because the contractile form does not permit ready access to ventral structures.

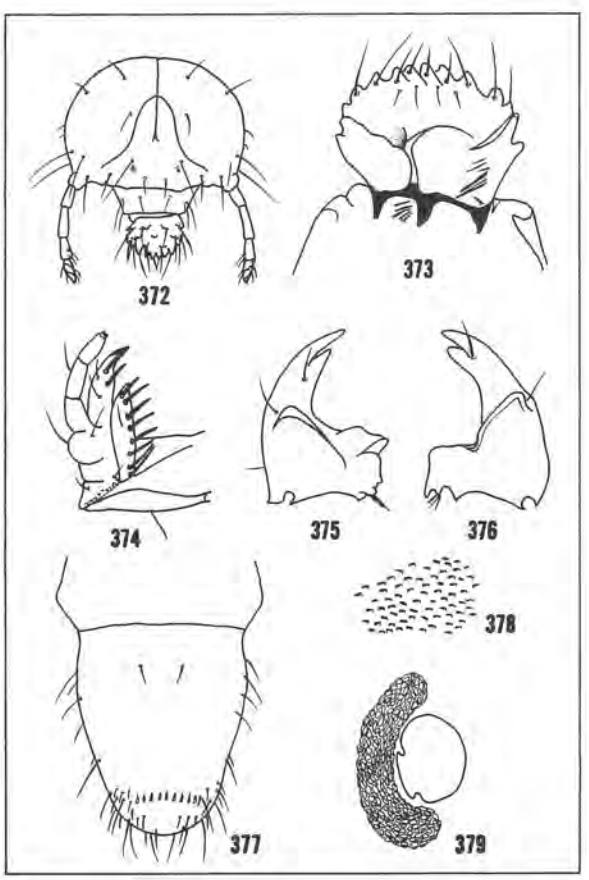
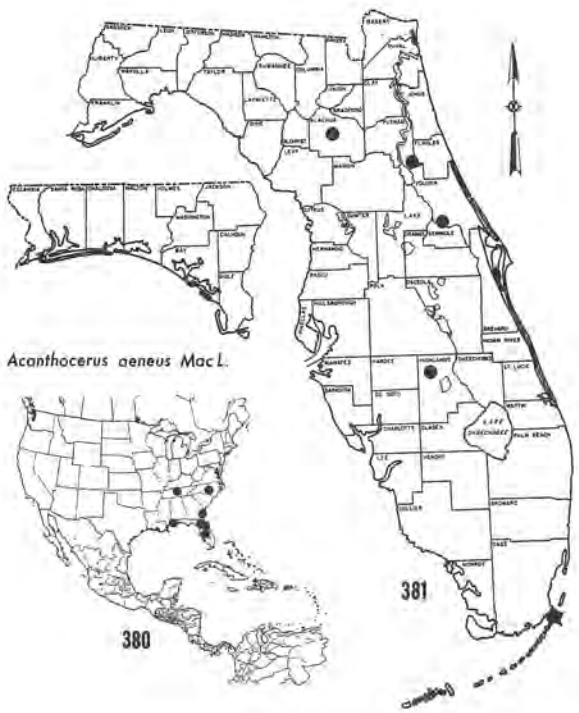


Fig. 372-379. Larva of **Cloeotus aphodioides** (Ill.) (figures redrawn from Ritcher, 1966): 372) Frontal view of head. 373) Ventral view of epipharynx. 374) Dorsal view of left maxilla. 375) Dorsal view of left mandible. 376) Dorsal view of right mandible. 377) Venter of last abdominal segment. Note the row of broad setae in the palidium. 378) Portion of the stridulatory area on the metathoracic leg. 379) Thoracic spiracle.

DISTRIBUTION & ZOOGEOGRAPHY: The genus is exclusively American with about 33 described species. Sixteen species are recorded from Brazil, five from the West Indies, and a single species (*A. aeneus* MacL.) from the U. S. However, Blackwelder (1944: 218) also listed *A. volvox* Er. from "U.S.A." without specific locality.

BIOLOGY: Nothing is known of the food habits of the adults, and the immature stages are unknown. Adults are usually rare, and their behavior has not been studied. There is no published report of stridulation in the genus, but since it is known in most other members of the subfamily, it is also likely in *Acanthocerus*. Specimens have been collected by beating dead vegetation, and at light.

SELECTED REFERENCES: Arnett, 1962:417; Arrow 1912:48-49; Blackwelder, 1944:218; de Borre, 1886:64; Gemminger and Harold, 1869:1091-1092; Harold, 1874b:28-41; Lacordaire, 1856:155-159.



Acanthocerus aeneus MacLeay

(Fig. 371, 383, 388, 392-93)

Acanthocerus aeneus MacLeay 1819:137.
Sphaeromorphus aeneus (MacLeay), Henshaw 1885a: 89.
Acanthocerus volvox Erichson 1843:123 (synonymy?).

DIAGNOSIS: Easily distinguished from the other Florida members of the subfamily by the characters in the key. Their form is more globular than the species of *Cloeotus*, and they are capable of forming a more compact ball during the death feint. Posterior pronotal angles obliterated; anterior pronotal line incomplete and without deep depression in anterior angles; less punctate throughout; elytral punctures not reaching the base and much less impressed; clypeus flat, not raised at anterior margin. Length 7 mm (distended); width 4 mm.

TAXONOMIC NOTES: The species is so rare in collections that little information is available on variability. The single specimen from Key Largo, Florida, probably represents a distinct species, but I am inclined to postpone its description until additional material is available. The *A. volvox* Erichson has been listed numerous times (Gemminger and Harold, 1869; Arrow, 1912; Leng, 1920) as a synonym of *A. aeneus* MacL. However, it is listed as a valid species by Blackwelder (1944:253) and recorded from "U.S.A." Further study will be necessary to clarify the position of the name *volvox*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 380-81). This species has been recorded from Alabama (Loding, 1933; 1945), Florida (Blatchley, 1928), Georgia (Kissinger, 1955), North Carolina (Brimley, 1938), and South Carolina (Kirk, 1969). I have also seen a specimen from Nashville, Tennessee (new state record). (For Florida records, see section on specimens examined.)

BIOLOGY: Very little is known about this rare species, there probably being less than 15 specimens in all the museums of the world. It has been collected by beating dead vines (Schwarz, 1878), and the only specimen I have collected was under similar circumstances. Kissinger (1955:14 and in litt.) collected two specimens under these conditions. Loding (1945:101) recorded two specimens from under bark. The only other reference to its habits is by Edwards (1949a:52), who stated that it ". . . is said to occur on flowers of several species or in rotten logs or stumps." I have been unable to determine the source of this information, and I question its validity.

SPECIMENS EXAMINED: 7 specimens from 5 Florida localities as follows: (1) Haw Creek, 10-VII, Hubbard and Schwarz (USNM); (1) Enterprise, 13-VI, Hubbard and Schwarz (USNM); (1) Enterprise, V-87, W. Beutenmuller (USNM); (1) Gainesville, Hatchet Creek, III-35, J. Kilby, stomach of *Rana sphenocephala* (UMMZ); (1) Gainesville, 1-IX-61, W. J. Platt, III (REW); (1) Highlands Hammock State Park, 8-VII-63, D. G. Kissinger, beating trees (REW); Monroe Co., Key Largo Key, 7-XII-66, R. E. Woodruff and J. H. Knowles, beating grapevine at night (REW) [possible new species].

Genus CLOEOTUS Germar

(Fig. 382, 384-87, 389-91, 394-96)

Cloeotus Germar 1843:129.
Acanthocerus of Germar 1843, not MacLeay, 1819.
Sphaerelytrus Blanchard 1846:186.

TYPE SPECIES: Unknown, but probably *C. latebrosus* Germar 1843.

DIAGNOSIS: Easily recognized by the characters listed in the key. In addition, specimens are less contractile, smaller, more extensively punctate, less shining, and with a purple rather than a green sheen as in *Acanthocerus.*

TAXONOMIC NOTES: The genus as a whole is in need of revision, because there is no general paper on the group since that by Harold (1874b). The two U. S. species are easily distinguished, but the considerable variation suggests that perhaps more than two species are going under these names. Adequate series of specimens are not available to evaluate this variation. Germar (1843) incorrectly interpreted the genus *Acanthocerus* and included several species of *Cloeotus* in it.

DISTRIBUTION & ZOOGEOGRAPHY: The genus is strictly American, and Blackwelder (1944:217-218) listed 39 species distributed from Argentina to the U. S. Only two species are recorded from the U. S., both of which are found in Florida. Both of them are found in Central and South America also (although further study is necessary to decide if these specimens are conspecific with our forms).

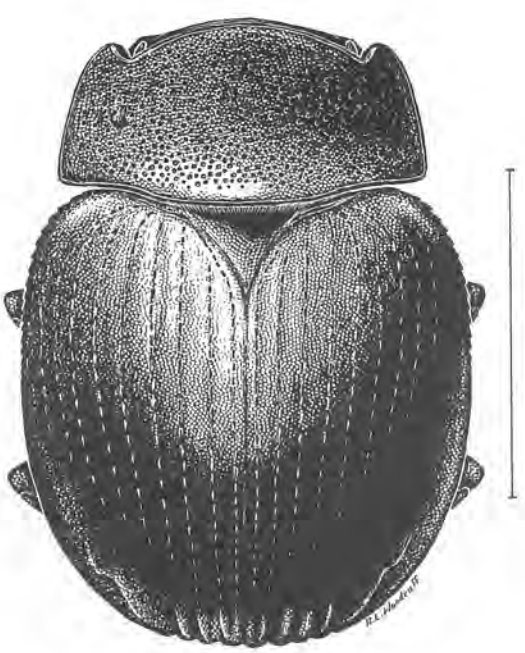


Fig. 382. **Cloeotus globosus** (Say), line = 3mm.

BIOLOGY: The habits of the species are poorly known, although specimens are sometimes found in considerable numbers. Most specimens have been taken by beating dead limbs and vines. Bates (1887:118) stated that, "They feed on dead fungoid matter and galls. I have seen *Cloeotus plicatus* and other species feeding on old woody boleti, and a species of the same genus on gall-like excrescences on the midrib of a *Paullinia* leaf." Our species have been recorded from under bark, at dead animal carcasses (Blatchley, 1910:940-941), and I have reared two specimens of *C. globosus* from the frass in Passalid burrows. Either the species have a wide range of foods, or we have yet to learn the specific food item associated with the above situations.

As far as I know, all of the species stridulate, but the significance of these sounds has not been investigated, and the nature of the sound producing organs has not been described.

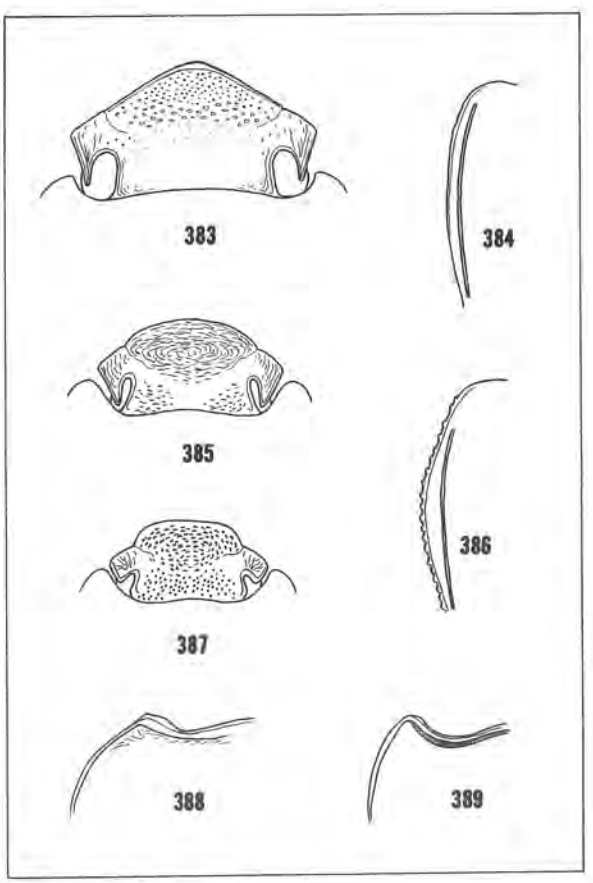


Fig. 383-389. Acanthocerinae: 383) Dorsal view of head of **Acanthocerus aeneus** MacL. 384) Dorsal view of left elytral margin of **Cloeotus aphodioides** (Ill.). 385) Dorsal view of head of **Cloetus globosus** (Say). 386) Dorsal view of head of **Cloeotus aphodioides** (Ill.) 387) Dorsal view of left elytral margin of **Cloeotus globosus** (Say). 388) Dorsal view of left anterior pronotal angle of **Acanthocerus aeneus** MacL. 389) Dorsal view of left anterior pronotal angle of **Cloeotus globosus** (Say).

The larva (Fig. 372-79) is known for only one of our species *(C. aphodioides)*, but the food and habits are unknown. The known larvae possess stridulatory organs on both the mesothoracic and metathoracic legs. The significance of stridulation in both adults and larvae would be of interest in relation to that of the Passalidae with which they have been found.

SELECTED REFERENCES: Arrow, 1912; Bates, 1887; Blackwelder, 1944; Blatchley, 1910; de Borre, 1886; Germar, 1843; Harold, 1874b; Lacordaire, 1856.

Cloeotus aphodioides (Illiger)

(Fig. 384, 387, 390-91, 394-95)

Melolontha aphodioides Illiger 1800:109.
Scarabaeus latipes Germar 1824:114.
Trox splendidus Say 1835:180.
Acanthocerus laevistriatus Laporte 1840:109.
Cloeotus aphodioides (Illiger), Germar 1843:137.

DIAGNOSIS: Easily distinguished from the only other U. S. species by the entire rather than serrate lateral elytral margin (Fig. 384). It is more elongate than our other species, although still capable of considerable contraction to form a hemispherical mass. Length 3.75 mm (contracted); width 2.5 mm.

TAXONOMIC NOTES: Bates (1887) described the "variety" *prionomus* from Guatemala, which he separated from typical *aphodioides* by the ". . . subrectangular shoulders, and a very narrow dilated margin, which for a short space near the shoulder is conspicuously, though finely, serrated." These characters appear to me to be of specific value, and this "variety" probably should be elevated to specific rank. I have not examined Guatemalan specimens, nor have I seen the type.

Variation is most noticeable in the extent of the opalescent color, the punctation of the clypeus and pronotum, and in some specimens there is a trace of minute serrations on the elytral margin. However, the latter are never as noticeable, deeply incised, or extensive as in *C. globosus*.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 397-98). It was recorded by Leng (1920:253) from Florida, Georgia, Indiana, Texas, and Mexico. It has been reported also from Alabama (Loding, 1945:101), Ohio (Dury, 1902:155), South Carolina (Cartwright, 1934b: 240), and Washington, D. C. (Ulke, 1902:24). I have also seen specimens from Kentucky, Illinois, and Mississippi (new state records). In Florida it has been reported previously from Biscayne Bay, Citra, Crescent City, and Enterprise (Blatchley, 1928:45). It probably occurs throughout the state, although I have no records from north of Gainesville (for complete data on Florida specimens, see appendix 63). It is also reported by Blackwelder (1944:217) from Brazil, Chaco, Colombia, and Mexico.

BIOLOGY: Although there have been several brief notes concerning the food habits of this species, some of these are conflicting. Hamilton (1887:64) stated that it was found in early spring (until May) under the bark of dead standing trees not yet separated from the wood—notably oak. He also stated, "They enter the tree through a hole in the bark that has served the previous summer for the exit of some wood-bred beetle—in the present instance *Urographis fasciatus;* they scoop out when necessary some of the borings of the original inhabitant between the wood and the bark, and in this excavation pack themselves closely, leaving the hole by which they entered open." Lugger (1888: 84) indicated that Hamilton was probably wrong in supposing them to enter these burrows for hibernation, since he had reared the beetles from eggs in the same situation.

The adults stridulate loudly, and they have been tape recorded. An audiospectrograph of the sound is

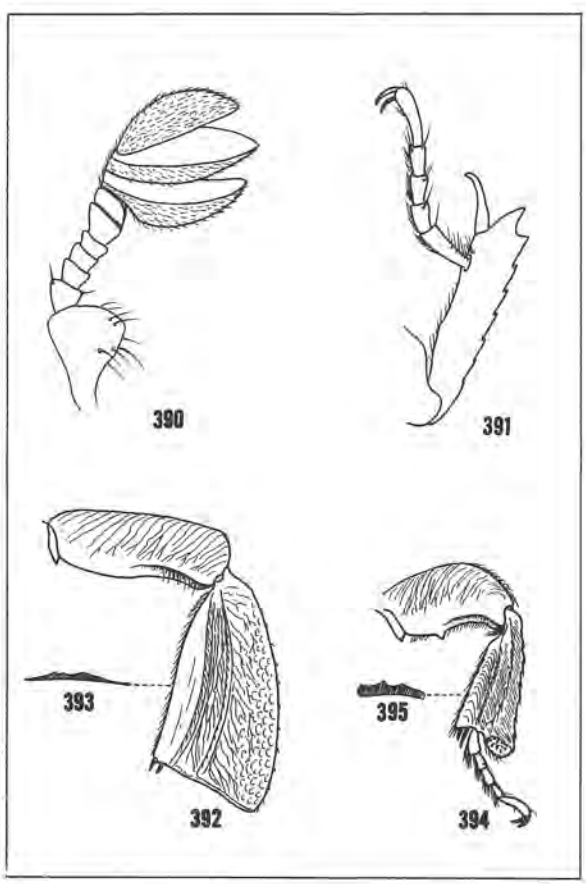


Fig. 390-395. Acanthocerinae: 390) Ventral view of right antenna of **Cloeotus aphodioides** (Ill.) (from a slide mount). 391) Ventral view of left anterior tibia and tarsus of **C. aphodioides** (Ill.). 392) Ventral view of left posterior femur and tibia of **Acanthocerus aeneus** MacL. Note the pattern of incised lines. 393) Cross section of posterior tibia of **A. aeneus** MacL. 394) Ventral view of left posterior femur, tibia, and tarsus of **Cloeotus aphodioides** (Ill.). 395) Cross section of posterior tibia of **C. aphodioides** (Ill.).

Fig. 396. Stereoscan photo (montage, 22X) of lateral view of **Cloeotus globosus** (Say).

presented by Alexander, Moore, and Woodruff (1963: Fig. 14). When a large number were caged together, they congregated into a compact ball in the darkest corner of the cage, where they continued to move about and stridulate so that the squirming mass emitted a steady, shrill sound. The stridulatory organs have not been located nor described.

A few specimens have been collected at light, but this does not appear to be a good attractant. I have personally collected over 100 individuals under the bark of an oak stump in an arbor-vitae bog in Ohio, but I have not met with similar numbers in Florida.

The larvae of this species (the only known larva of a U. S. member of the subfamily) has been described and figured by Ritcher (1966:67-69; Fig. 156-161, 163-164). These figures have been redrawn for use here and appear as Fig. 372-79. I thank Dr. P. O. Ritcher and Oregon State University for permission to use them. The larva is characterized primarily by the serrate margin of the labrum and the presence of stridulatory organs on the meso- and metathoracic legs. It is further described as follows: epipharynx with a dextral beak-like process; maxilla with separate galea and lacinia; maxillary stridulatory area with a row of conical teeth; antennae four-segmented, with the last segment not reduced in diameter and with a dorsal sensory spot; thoracic spiracle with concavity of respiratory plate facing posteriorly; abdominal spiracles with these plates facing anteriorly; abdominal segments (two to five) dorsally plicate; raster with a transverse palidia of spatulate setae; legs four-segmented, with well-developed claws.

SPECIMENS EXAMINED: 125 specimens, only 18 of which were from Florida (for complete data see appendix 63).

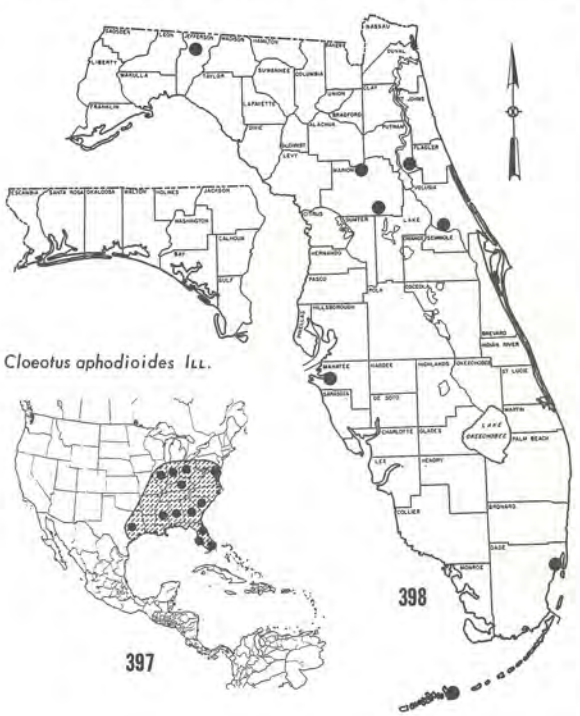
SELECTED REFERENCES: Alexander, Moore, and Woodruff, 1963:113; Bates, 1887:119-120; Blatchley, 1910:940; 1928:45; Hamilton, 1887:64-65; Hardenberg, 1907:570, Pl. 32, 34 (mouthparts); Lugger, 1888:84; Ritcher, 1966:67-69, Fig. 156-161, 163-164 (larva).

Cloeotus globosus (Say)

(382, 385-86, 389, 396, 399-405)

Trox globosus Say 1835:140.
Acanthocerus puncticollis Erichson 1843:140.
Acanthocerus antiquus Erichson 1843:141.
Acanthocerus globosus var. *macleayi* Perty 1830:43. (?synonymy by Bates 1887)
Acanthocerus globosus var. *sticticus* Erichson 1843: 140. (?synonymy by Bates 1887)

DIAGNOSIS: The species is easily distinguished from the only other U. S. species by the serrate (or cre-



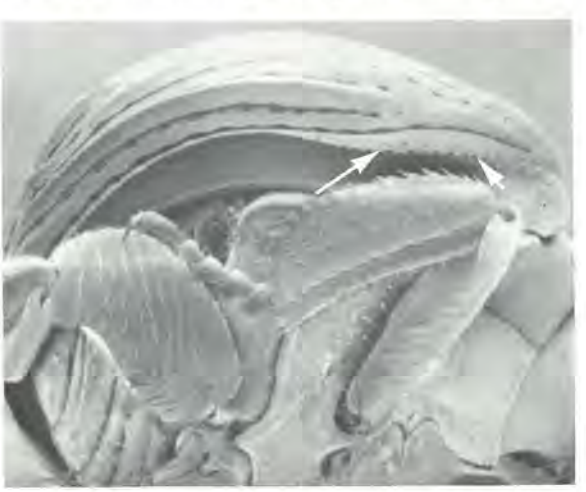


Fig. 399. Stereoscan photo of **Cloeotus globosus** (Say) (oblique ventral view, 22X). Note crenulate elytral margin at arrow.

nate) basal one-half of the lateral elytral margin (Fig. 386). In addition, it is more globular, the clypeus is covered with incised lines (Fig. 385), and the elongate elytral punctures are further separated. Length 4 mm (contracted); width 3 mm.

TAXONOMIC NOTES: The two "varieties" listed above *(macleayi* and *sticticus)* were described from South America, and Bates (1887:119) doubted their validity. He indicated that further material from South American localities would be necessary to decide the question. Nothing further has been published on this problem. When a revision of the genus is undertaken, I suspect that there will be several species discovered that are now going under the name *globosus.*

Fig. 400-401. Stereoscan photos of right posterior tibia of **Cloeotus globosus** (Say) (oblique ventral view): 400) 90X, 401) 214X. Note pattern of incised lines, the function of which is unknown.

Variation is most noticeable in the color, extent of the pronotal punctation, and especially in the pattern formed by the carinae and intervening striae of the posterior one-third of the elytra.

Fig. 402. Stereoscan photo of left anterior tarsal socket of **Cloeotus globosus** (Say) (ventral view, 210X).

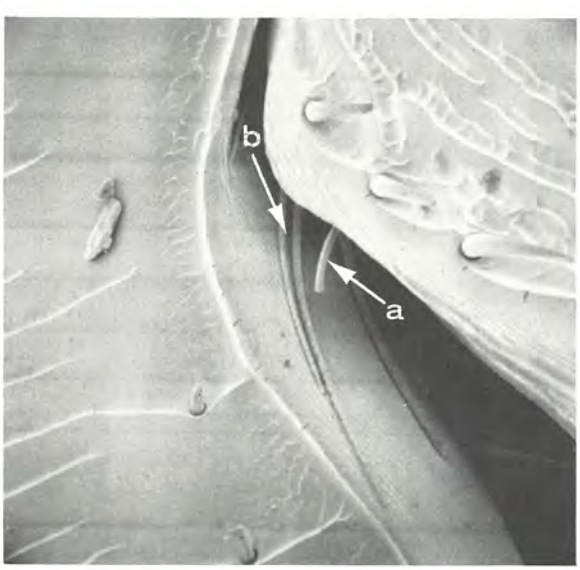
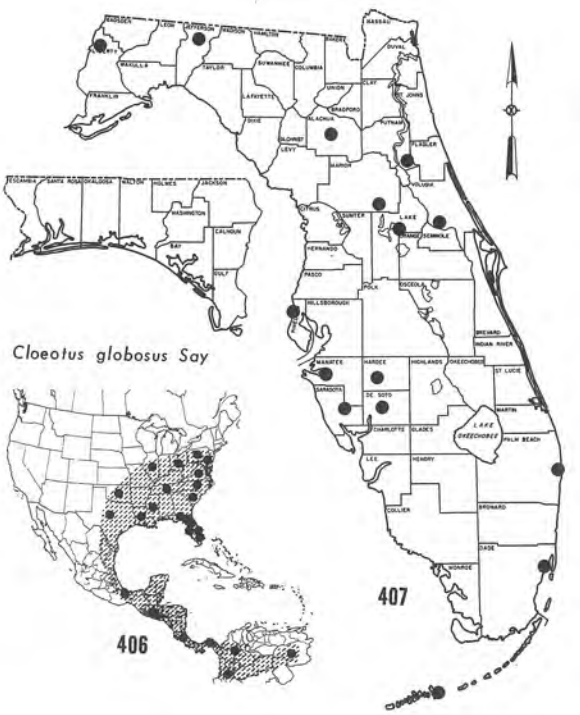


Fig. 403. Stereoscan photo of anterior tibia-femur junction of **Cloeotus globosus** (Say) (ventral view, 214X). Note the seta at arrow "a" which fits in the groove at arrow "b" and locks the femur and tibia together.

DISTRIBUTION & ZOOGEOGRAPHY: (Fig. 406-07). Leng (1920:253) listed it from Alabama, Florida, Indiana, New York, and Mexico. It has been reported also from Louisiana (Summers, 1874:88), North Carolina (Brimley, 1938:202), Ohio (Dury, 1902:155), and South Carolina (Cartwright, 1934b:240). It was originally described from Pennsylvania. I have also seen specimens from Illinois, Mississippi, Oklahoma, Tennessee, Texas, and Virginia. Outside the U. S. it has been reported from Argentina, Brazil, Colombia, Guatemala, Mexico, and Panama (Blackwelder, 1944:218). In Florida it has been reported from Crescent City, Dunedin, Enterprise, Gainesville, and Lake Worth (Blatchley, 1928:46). I have seen specimens from 14 additional Florida localities (for complete data see appendix 64).

Fig. 404. Stereoscan photo (425X) of pronotal punctures of **Cloeotus globosus** (Say). Material inside the punctures is soil.

Fig. 405. Stereoscan photo (45X) of posterior one-fourth of the left elytron of **Cloeotus globosus** (Say). Note the peculiar pattern of incised lines.



BIOLOGY: In general, the habits of this species appear to be similar to those of *C. aphodioides*. However, specimens have not been reported in large numbers from under a single piece of bark, as has that species. A few specimens have been taken at light. Blatchley (1910:941) reported collecting specimens in Indiana on November 30 ". . . from the half-dried carcass of a dog." This is the only record I can find (although this has been quoted by others) of this habit. If this is a general feeding habit, this would strengthen the relationship to the Trogidae (a family with which it has been linked by earlier workers). I have reared two specimens from larvae found in the frass of the Betsy beetle, *Popilius disjunctus* (Ill.) (Passalidae), at Gainesville. Unfortunately no larvae were preserved, and this stage remains undescribed.

SPECIMENS EXAMINED: 61, of which 55 were from 14 Florida localities (for complete data see Appendix 64).

SELECTED REFERENCES: Bates, 1887:119; Blatchley, 1910:940-941; 1928:45; Hamilton, 1887:65.

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During the course of my general studies on the Scarabaeidae, I have attempted to build a card file representing a world bibliography of this family. This bibliography is far from being exhaustive, but it presently contains over 6,000 citations. This card file was the basic source from which the present bibliography on Florida Laparosticti was prepared. My personal library was the chief source of papers, but I had access to the excellent taxonomic library of the Division of Plant Industry and the library of the University of Florida. Other references were obtained on inter-library loan, on microfilm, xerox, or by other copying processes.

During the summer of 1971, I had the good fortune to attend the Summer Institute of Systematics at the U. S. National Museum (jointly sponsored by the Smithsonian Institution and the National Science Foundation). At this time I was able to check, verify, and copy many rare or obscure publications located in the Library of Congress, the Smithsonian Institution, the National Agricultural Library, and in the reprint files of specialists at the National Museum. I wish to express my thanks to the respective librarians who facilitated these searches and to R. D. Gordon and O. L. Cartwright.

The references are cited basically as recommended in the "Style manual for biological journals" (AIBS, 1964). However, they differ in two specific points: 1) the abbreviation "Ent." rather than "Entomol." is used (this abbreviation has been used consistently within the field of entomology for over 100 years); and 2) all geographical names are spelled out in order to avoid any confusion resulting from abbreviations in various languages.

Special effort was made to check the original publication for titles, dates, and other pertinent bibliographic data. Those entries preceded by an asterisk were not personally seen, but the citations were checked against other bibliographies. Chief among the sources of careful and accurate citations is the bibliography accompanying the "Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America" (Blackwelder, 1957). Other sources of bibliographic information include Blackwelder (1949), Brown (1964), Hagen (1862-1863), Horn and Schenkling (1928-1929), etc.

Since the International Rules of Zoological Nomenclature are based on the system of priority, the exact dates for all publications are critical. Therefore, I have devoted much time and effort to assure accuracy of these citations. Where dates were found to vary from the usual citations, this information is noted under the specific entry in the bibliography. For example, most of the previous citations for Serville, including the Leng Catalogue (1920), listed the date as 1825. The portion containing descriptions of Scarabaeidae actually appeared in Part II, pages 345-832, which was published in 1828 (Blackwelder, 1957:933). Surnames are cross-indexed when the name was listed more than one way in previous literature (e.g., Laporte, Comte de Castelnau).

As nearly as possible, all citations are exact copies of the title page, with spelling and punctuation as in the original, although no effort has been made to include diacritical marks or accents. If no formal title appeared, as often occurred in notes in minutes of meetings, a title was derived from the information on scarabs only, and it is included in parentheses (e.g., Angell, 1913). The presence and number of figures, plates, tables, and maps are noted, except for articles not personally seen. I am convinced that listing such data in the bibliography may save the reader a great amount of time and checking. Many times during the course of this study, I wished that previous papers had included such details.

Although a few references probably have been overlooked, special effort has been made to list all known articles dealing with Florida species of the subfamilies Scarabaeinae, Aphodiinae, Geotrupinae, Hybosorinae, Ochodaeinae, and Acanthocerinae. References on Florida species in other subfamilies will appear in Part II.

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APPENDICES 1-7

APPENDIX 1: DELTOCHILUM GIBBOSUM GIBBOSUM (FABRICIUS)

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Alachua				
1	Alachua		13-IV-25		
2	Alachua		1-III-36		
1	Alachua		24-IV-36		
2	Alachua		28-III-49	B.W.Cooper	
1	Alachua		18-IV-49		
2	Alachua		V-58	T.J. Walker,Jr.	
1	Alachua	Gainesville	XII-53	L.A. Hetrick	
1	Alachua	Gainesville	8-V-58	F.W. Mead	
1	Alachua	Gainesville	12-VII-67	C.I. Ayres	
4	Alachua	Gainesville	14-VII-69	H.W. Campbell	can trap
2	Alachua	Gainesville	18-IX-69	H.W. Campbell	can trap
1	Alachua	Gainesville	27-VIII-72	C.I. Ayres	
1	Alachua	Micanopy	4-VII-56	G. Rogers	
2	Alachua	Newnan's Lake	17-X-61	R.E. Woodruff	dead crabs
2	Dade		IV-48	H.F. Strohecker	
2	Dade		11-V-48	H.F. Strohecker	
1	Dade	Coral Gables	8-III-27		
3	Dade	Homestead	26-IX-61	R.M. Baranowski	
1	Franklin	St. George's Island	27-VI-5-VIII	W.W. Baker	pitfall trap
3	Highlands	Sebring	10-VI-60	Woodruff,Bottimer	chicken feathers
3	Indian River	Vero Beach	7-XI-31	E.M. Becton	
1	Indian River	Vero Beach	10-VII-32	E.M. Becton	
2	Jefferson	Big Bend Hort. Lab.	15-VI-70	Fluker	pecan pitfall
1	Leon	Meridian	4-VIII-65	W. Suter	dead dog
13	Leon	Tall Timbers Res.Sta.	various	D. Harris	pitfalls
	(one each in 13 weekly pitfalls from Mar.-Oct., of these 8 were in Sept. & Oct.)				
1	Levy	Manatee Springs St. Pk.			
1	Monroe	Long Pine Key	IX-50		
3	Monroe	Long Pine Key	IX-50	H.F. Strohecker	molasses trap
1	Okaloosa	Eglin Homes,Eglin AFB	5-VIII-66	P.A. Thomas	
1	Orange	Orlando	23-V-60	J.R. Woodley	
1	Orange	Taft	23-V-60	J.R. Woodley	Jap beetle trap
1	Pinellas	Dunedin	21-III-17	W.S. Blatchley	
1	Putnam	Redwater Lake	1-VII-60	H.V. Weems,Jr.	
1	Seminole		19-I-60	J.R. Hunt	rotting log
1	Seminole	Goldenrod	12-V-64	G.W. Desin	
1	Volusia	DeLeon Springs	6-IX-60	C.R. Roberts	malt trap
1	Volusia	New Smyrna Beach		R.W. Rings	
1	?	"Fla."		H.W. Wenzel	

APPENDIX 2: CANTHON PILULARIUS (LINNAEUS)

1	Alachua		20-II-49	B.W. Cooper	
2	Alachua		20-III-49	O.S. Russell	
1	Alachua		12-V-59	H.V. Weems,Jr.	cow dung
1	Alachua	Archer	7-VIII-59	R.E. Woodruff	cow dung
2	Alachua	Chitty Ranch	5-VI-65	R.E. Woodruff	cow dung
4	Alachua	Chitty Ranch	8-IV-69	R.E. Woodruff	cow dung
1	Alachua	Gainesville	22-III-25	O.M. Bates	
1	Alachua	Gainesville	5-IV-48	W.J. Downes	
1	Alachua	Gainesville	23-III-53	H.F. Howden	cow dung
2	Alachua	Gainesville	28-IX-55	F.L. Wilson	
36	Alachua	Gainesville	24-VI-58	R.E. Woodruff	cow dung
1	Alachua	Gainesville	28-IV-62	R.E. Woodruff	cow dung
1	Alachua	Gainesville	20-IX-63	W.J. Platt	
1	Alachua	Gainesville, SW	11-IV-67	D.L. Mays	
3	Alachua	Hawthorne	21-IV-61	R.E. Woodruff	cow dung
4	Alachua	Newnan's Lake	12-V-59	R.E. Woodruff	cow dung
75	Alachua	Waccasassa Flats	13-VII-68	S.K. Derr	cow dung
6	Alachua	Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
18	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
6	Baker	Glen St. Mary	5-IV-60	E.W. Holder,Jr.	cow dung
1	Baker	Glen St. Mary	21-IV-60	E.W. Holder,Jr.	malt trap
2	Baker	Glen St. Mary	10-V-60	E.W. Holder,Jr.	cow dung
1	Brevard		23-III-54	H.V. Weems,Jr.	
1	Citrus	Inverness	13-III-63	J.C. Sellers	
1	Columbia	Lake City		W.S. Blatchley	
1	Dade	Opa Locka	17-X-65	J.E. Porter	mosq.light trap
26	Dixie	Oldtown, 10mi. N.	29-VII-65	R.E. Woodruff	cow dung
2	Hardee	Zolfo Springs	25-IV-54	H.V. Weems,Jr.	
10	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
1	Hendry		25-VII-56	H.V. Weems,Jr.	
1	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
2	Indian River	Vero Beach	26-VI-32	E.M. Becton	
3	Jackson		18-III-58	H.V. Weems,Jr.	
2	Lake		27-IV-62	G.W. Desin	
1	Levy		2-VI-54	H.V. Weems,Jr.	
1	Levy	Lebanon	8-IV-66	L.D. Ober	
1	Liberty	Torreya State Park	12-IV-60	H.V. Weems,Jr.	cow dung
1	Manatee	Tallevast	4-V-54	C.J. Bickner	
1	Marion	Rainbow Springs	30-VII-56	W. Suter	
1	Nassau	Hilliard	26-V-64	C.F. Zeiger	
1	Pinellas	Dunedin	11-II-13	W.S. Blatchley	
1	Putnam		11-VI-59	H.V. Weems,Jr.	
50	Putnam	near Hawthorne	24-VI-59	R.E. Woodruff	cow dung
2	Putnam	Redwater Lake	17-VI-60	H.V. Weems,Jr.	cow dung
22	Putnam	Redwater Lake	16-VII-60	H.V. Weems,Jr.	cow dung
2	Sarasota	Sarasota	6-III-11	W.S. Blatchley	
1	Seminole	Sanford	28-VIII-63	G.W. Desin	
2	Suwanee	Suwanee	9-VI-65	C.F. Zeiger	
5	Taylor	Perry	18-VII-36	W.C. Stehr	
2	Taylor	Tennile	8-V-67	W.J. Coleman	
1	Volusia	DeLeon Springs	20-IV-60	C.R. Roberts	malt trap
8	Volusia	DeLeon Springs	5-V-60	C.R. Roberts	malt trap
1	Volusia	DeLeon Springs	14-VII-60	C.R. Roberts	malt trap
1	Volusia	Seville	25-VII-60	G.W. Desin	

APPENDIX 3: CANTHON VIGILANS LECONTE

64	Alachua	Gainesville	various	various	blacklight trap
	(43 separate collections from Mar.-Sept.,with months & collections as follows:III(1) IV(11),V(14),VI(3),VII(12),VIII(1),IX(1);the most specimens (8) on 12-IV-70.)				
1	Bradford		3-V-59	H.V. Weems,Jr.	
1	Escambia		9-VIII-58	M. Tidwell	
1	Gadsden	Quincy	12-VI-56	W.B. Tappan	blacklight trap
1	Gadsden	Quincy	15-V-58	W.B. Tappan	blacklight trap
3	Hernando	Brooksville	22-VIII-38	C.C. Goff	
2	Jefferson	Monticello	9-VII-58	A.M. Phillips	blacklight trap
2	Marion	Dunellon, 2mi. W.	22-IV-64	C.F. Zeiger	at light
1	Marion	Ocala	21-VI-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	5-VI-64	T.R. Adkins	blacklight trap
3	Marion	Ocala	2-VII-64	T.R. Adkins	blacklight trap
1	Okaloosa	Ocean City	21-VI-63	H.O. Hilton	at light
1	Pasco	Dade City	17-VII-38	W.C. Stehr	
1	Santa Rosa	Jay	2-V-62	T.W. Boyd	blacklight trap

APPENDIX 4: BOREOCANTHON DEPRESSIPENNIS (LECONTE)

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Alachua	Alachua-Levy Co.line	25-II-59	R.E. Woodruff	malt trap
4	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
1	Alachua	Gainesville	26-III-19	G.B. Merrill	
1	Alachua	Gainesville	28-IV-62	R.E. Woodruff	cow dung
1	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	malt trap
1	Alachua	High Springs	25-III-53	Howden & Dozier	
2	Alachua	near Newnan's Lake	7-10-IV-60	R.E. Woodruff	malt trap
1	Alachua	near Newnan's Lake	13-VIII-62	R.E. Woodruff	malt trap
2	Alachua	Waccasassa Flats	13-VII-68	S.K. Derr	cow dung
1	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	
8	Calhoun	near Clarksville	20-III-54	H.F. Howden	malt trap
2	Clay	Goldhead Branch St.Pk.	1-V-65	R.E. Woodruff	cow dung
57	Dixie	Oldtown, 10mi. N	29-VII-65	R.E. Woodruff	cow dung
3	Duval	Jacksonville	IV-10	P. Laurent	
2	Duval	Jacksonville	4-IV-14	L.H. Weld	(USNM)
1	Duval	Jacksonville	8-IV-14	L.H. Weld	(USNM)
1	Gadsden	Quincy	15-III-05	W.A. Hooker	
4	Hernando	Brooksville	22-VIII-38	C.C. Goff	
1	Hillsborough	Tampa		Hubbard & Schwarz	(USNM)
1	Levy		27-V-56	R.A. Morse	human feces
1	Levy	Alachua Co.line,1mi.W	23-25-II-59	R.E. Woodruff	
4	Liberty	Torreya State Park	19-VII-38	W.C. Stehr	
1	Liberty	Torreya State Park	20-VIII-38	W.C. Stehr	
1	Liberty	Torreya State Park	12-IV-60	H.V. Weems,Jr.	at light
3	Marion	Anthony	31-III-59	E.W. Holder,Jr.	cow dung
1	Marion	Dunnellon	2-VIII-56	W. Suter	
1	Marion	Ocala	25-V-60	W.J. Platt,III	
4	Marion	Romeo	17-VII-38	W.C. Stehr	
1	Pinellas	St. Petersburg			
9	Putnam	Crescent City		Hubbard & Schwarz	(USNM)
1	Putnam	Redwater Lake	18-VII-59	H.V. Weems,Jr.	
14	Putnam	Redwater Lake	17-VI-60	H.V. Weems,Jr.	cow dung
34	Putnam	Redwater Lake	18-VI-60	Pam Weems	cow dung
43	Putnam	Redwater Lake	16-VII-60	H.V. Weems,III	cow dung
1	Putnam	near Redwater Lake	8-VII-63	H.V. Weems,Jr.	
7	Taylor	Perry	18-VII-38	W.C. Stehr	
1	Volusia	DeLeon Springs	24-VII-60	C.R. Roberts	malt trap
1	Walton	DeFuniak Springs?		Hubbard & Schwarz	(USNM)
1	?	"Fla."		J.B. Smith	(USNM)

APPENDIX 5: BOREOCANTHON PROBUS GERMAR

4	Alachua		1-VI-54	H.V. Weems,Jr.	
1	Alachua		26-III-59	H.V. Weems,Jr.	
1	Alachua	Gainesville	3-VII-26	G.B. Merrill	
1	Alachua	Gainesville	21-VII-28	H.E. Bratley	
1	Alachua	Gainesville	10-VII-38	G.B. Merrill	
1	Alachua	Gainesville	29-III-58	R.E. Woodruff	
1	Alachua	Gainesville	28-IV-58	L.C. Kuitert	
2	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	malt trap
3	Alachua	Gainesville	16-III-63	J.D. Spooner	rabbit pellets
6	Alachua	Gainesville	7-IV-63	J.D. Spooner	rabbit pellets
1	Broward	Ft. Lauderdale	31-VIII-22	D.M. Bates	
1	Dade	Coral Gables	20-V-27		
1	Lee	Estero	10-III-65	B.K. Dozier	in flight
1	Highlands	Avon Park	22-II-49	C.J. Bickner	
1	Highlands	Lake Jackson	8-VII-28	E.B. Cram	
2	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	
1	Indian River	Vero Beach	21-XI-31	E.M. Becton	
1	Jefferson	Monticello	8-V-58	R.E. Woodruff	
1	Lake		8-III-30	J.E. Sadler	Fla.Fruitfly trap
1	Lake		25-VII-63	W.P. Henderson	rabbit pellets
1	Leon	Tall Timbers Res.Sta.	27-III-3-IV	D. Harris	pitfall trap
1	Levy		3-IV-54	H.V. Weems,Jr.	at light
1	Orange	Doctor Phillips	28-VI-48	D.D. Link	
1	Orange	Orlando	28-V-63	W.A. Avazian	Jap beetle trap
1	Orange	Rock Springs	20-VI-35		
1	Pinellas	Dunedin	10-II-16	W.S. Blatchley	
1	Pinellas	Dunedin	5-III-22	W.S. Blatchley	
1	Polk	Devenport	2-X-48	P. Pettigrew	
1	Putnam	Crescent City		Hubbard & Schwarz	
1	Putnam	Interlachen, 4mi. S.	16-V-58	R.E. Woodruff	malt trap
1	Putnam	Redwater Lake	9-VI-63	H.V. Weems,Jr.	
1	St. Lucie	Ft. Pierce, 5mi. S.	27-I-59	R.E. Woodruff	human dung
1	Volusia	Enterprise	16-6	Hubbard & Schwarz	
1	Volusia	Sanford	9-VII-63	G.W. Desin	

APPENDIX 6: MELANOCANTHON BISPINATUS (ROBINSON)

4	Alachua		6-V-56	R.A. Morse	can trap
3	Alachua	Gainesville	13-IV-24	G.B. Merrill	
1	Alachua	Gainesville	24-III-53	H.F. Howden	
1	Baker	Glen St. Mary	1-IV-60	E.W. Holder,Jr.	malt trap
2	Baker	Glen St. Mary	14-IV-60	E.W. Holder,Jr.	malt trap
3	Baker	Glen St. Mary	21-IV-60	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	25-IV-60	E.W. Holder,Jr.	malt trap
1	Calhoun	near Clarksville	21-III-54	H.F. Howden	
5	Columbia		15-VI-58	T.J. Walker,Jr.	
10	Columbia	High Springs, 4mi. N.	25-III-53	Howden & Dozier	malt trap
3	Franklin	St. Vincent's Island	25-VII-72	W.W. Baker	under logs,etc.
2	Franklin	St. Vincent's Island	26-VII-72	W.W. Baker	dead roach
1	Gadsden		11-IV-60	H.A. Denmark	
62	Leon	Tall Timbers Res.Sta.	various	D. Harris	pitfall traps
	(mostly single specimens in weekly pitfalls from Feb.-Sep.,with months & collections as follows:II(1),III(2),IV(22),V(15),VI(5),VII(10),VIII(1),IX(1).,the most specimens (3) on 4-11-V-70.)				
3	Levy		31-V-56	R.A. Morse	can trap
1	Liberty	Torreya State Park	19-VII-38	W.C. Stehr	
1	Volusia	Enterprise (paratype)		ex C. Schaeffer	(USNM)
1	Volusia	Enterprise (paratype)	23-V	Hubbard & Schwarz	(USNM)

APPENDIX 7: MELANOCANTHON GRANULIFER (SCHMIDT)

2	Alachua		17-V-56	R.A. Morse	
1	Alachua		3-VI-60	R.E. Woodruff	dead bird
30	Alachua	Archer	3-6-IV-60	R.E. Woodruff	malt trap
3	Alachua	Gainesville	6-X-34	F.N. Young	
3	Alachua	Gainesville	8-IV-38	W.A. Murrill	
1	Alachua	Gainesville	17-VI-41		
1	Alachua	Gainesville	2-VIII-55	C.N. Patton	
6	Alachua	Gainesville,KincaidRd.	13-15-II-59	R.E. Woodruff	malt trap
21	Alachua	Gainesville,KincaidRd.	17-21-II-59	R.E. Woodruff	malt trap
6	Alachua	Gainesville,KincaidRd.	22-26-II-59	R.E. Woodruff	malt trap
1	Alachua	Gainesville	28-IV-62	R.E. Woodruff	cow dung
1	Alachua	Gainesville	11-VIII-62	R.E. Woodruff	
2	Alachua	Gainesville	12-VIII-62	R.E. Woodruff	in fungi
10	Baker		8-V-59	E.W. Holder,Jr.	malt trap
6	Baker	Trail Ridge	12-V-59	E.W. Holder,Jr.	malt trap
1	Citrus	Inverness	25-IV-43	B. Malkin	

(continued)

APPENDICES 7-11

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
4	Clay	Goldhead Branch St.Pk.	1-V-65	R.E. Woodruff	cow dung
1	Columbia		17-IX-58	R.E. Woodruff	dead cottonmouth
1	Columbia	High Springs, 4mi. N.	22-III-53	Howden & Dozier	malt trap
2	Columbia	High Springs, 4mi. N.	25-III-53	Howden & Dozier	malt trap
10	Dixie	Oldtown, 10mi. N.	29-VII-65	R.E. Woodruff	cow dung
1	Franklin	St. Vincent's Island	26-VII-72	W.W. Baker	
1	Hamilton		29-VII-54	H.B. Wesson	
3	Lake	Tavares	21-I-25	E.W. Berger	rotten citron
1	Jefferson	Lamont	18-VII-38	W.C. Stehr	
1	Manatee	Mayakka City	16-V-62	C.J. Bickner	
1	Marion	Ocala	5-VII-61	T.R. Adkins	Jap beetle trap
1	Marion	Ocala	29-VIII-63	T.R. Adkins	Jap beetle trap
1	Pasco		2-V-60	H.C. Sellers	
1	Putnam	Crescent City		Hubbard & Schwarz	
1	Putnam	near Redwater Lake	16-VII-60	H.V. Weems,III	cow dung
1	Sumpter	Coleman	17-IV-61	W.P. Henderson	
1	Sumpter			Hubbard & Schwarz	
2	Suwannee	Suwannee	9-VI-65	C.F. Zeiger	

APPENDIX 8: MELANOCANTHON PUNCTATICOLLIS (SCHAEFFER)

1	Alachua		7-VII-55	H.V. Weems,Jr.	
2	Alachua	Archer, 2mi. W.	24-III-53	Howden & Dozier	malt trap
2	Alachua	Archer, 2mi. W.	25-II-59	R.E. Woodruff	malt trap
5	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
55	Alachua	Alachua-Levy Co.line	23-25-II-59	R.E. Woodruff	malt trap
2	Alachua	Alachua-Levy Co.line	28-II-59	R.E. Woodruff	malt trap
1	Columbia	High Springs, 4mi. N.	25-III-53	Howden & Dozier	malt trap
1	DeSoto	Arcadia	5-V-48	C.J. Bickner	
1	Hillsborough	Tampa	25-III	Hubbard & Schwarz	
101	Levy		31-V-56	R.A. Morse	can trap
3	Levy		25-II-59	R.E. Woodruff	malt trap
8	Levy	Alachua Co.line,W.	25-28-II-59	R.E. Woodruff	malt trap
1	Levy	near Bronson	21-23-II-59	R.E. Woodruff	malt trap
14	Levy	near Bronson	23-25-II-59	R.E. Woodruff	malt trap
43	Levy	Bronson, 8mi. E.	23-25-II-59	R.E. Woodruff	malt trap
1	Levy	near Bronson	25-28-II-59	R.E. Woodruff	malt trap
4	Marion	Ocala National Forest	20-IV-56	R.A. Morse	
1	Pinellas	Dunedin	15-III-13	W.S. Blatchley	
1	Putnam	Crescent City		Hubbard & Schwarz	
1	Putnam	near Interlachen	16-V-58	R.E. Woodruff	
12	Putnam	near Lake Suzan	9-11-II-59	R.E. Woodruff	malt trap
13	Putnam	near Lake Suzan	13-II-59	R.E. Woodruff	malt trap
2	Putnam	near Redwater Lake	18-VI-60	H.V. Weems,Jr.	cow dung
1	Putnam	near Redwater Lake	16-VII-60	H.V. Weems,Jr.	cow dung

APPENDIX 9: GLAPHYROCANTHON VIRIDIS (BEAUVOIS)

1	Alachua		27-IV-55	H.V. Weems,Jr.	
1	Alachua	Gainesville	7-VI-53		
2	Alachua	Gainesville	4-V-58	H.V. Weems,Jr.	
1	Alachua	Gainesville	23-VI-59	H.V. Weems,Jr.	leaf litter
1	Alachua	Gainesville	5-VII-60	H.V. Weems,Jr.	
1	Alachua	Gainesville	10-VII-60	H.V. Weems,Jr.	hardwood hammock
1	Alachua	Gainesville	29-III-64	H.V. Weems,Jr.	
3	Alachua	Gainesville	19-VII-64	R.E. White	
1	Lake		11-VI-58	T.J. Walker,Jr.	
205	Leon	Tall Timbers Res.Sta.	various	D. Harris	pitfall traps
	(83 separate collections from Apr.-Dec.,with months & collections as follows:IV(2),V(6),VI(19),VII(12),VIII(22),IX(16),X(4),XII(1);the most specimens (12) on 30-VIII-7-IX-71.)				
1	Marion	Moss Bluff, 1 1/2mi.S	22-V-58	M.H. Muma	Berlese sample
3	Volusia	Holly Hill	18-VI-60	E.D. Smith	malt trap
1	Volusia	Ormond	6-IV-11	W.S. Blatchley	
1	?	UF Agr. Exp. Sta.#139			

APPENDIX 10: PSEUDOCANTHON PERPLEXUS (LECONTE)

1	Alachua		15-X-33	F.W. Mead	
1	Alachua	Gainesville	10-IV-63	E.M. Collins,Jr.	blacklight trap
1	Bay	St. Andrews St. Pk.	23-IV-63	R.E. Woodruff	blacklight trap
2	Charlotte	Englewood	30-VIII-60	H.M. Faircloth	blacklight trap
1	Collier	Immokalee	29-III-60	A.T. Wilson	blacklight trap
1	Dade		VI-48	H.F. Strohecker	
1	Dade		IV-49	H.F. Strohecker	
1	Dade	Homestead	18-II-42	O.W. Calkins	
1	Dade	Miami	24-I-41	O.D. Link	
1	Dade	Miami	III-59	C.F. Dowling	blacklight trap
1	Dade	Miami	6-V-60	P.E. Briggs	blacklight trap
1	Dade	Miami	13-IX-60	P.E. Briggs	blacklight trap
1	Dade	Miami Bch.Fisher'sIsl.	27-V-66	J.E. Porter	mosq.light trap
1	Dade	Royal Palm Park	13-XII-24	W.S. Blatchley	
3	Dade	Royal Palm Park	1-IV-27	W.S. Blatchley	
1	Dade	USDA Plant Intro.Sta.	10-IV-61	P.E. Briggs	blacklight trap
1	Duval	Jacksonville	23-VI-42	R.C. Barnes	
1	Duval	Jacksonville Beach	29-V-54		mosq.light trap
3	Highlands	near Cornwell	7-IV-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
1	Jackson		28-V-54		mosq.light trap
4	Jackson	Fla. Caverns St. Pk.	18-IV-63	R.E. Woodruff	blacklight trap
1	Lee	Sanibel	30-III-54		mosq.light trap
1	Leon	Tall Timbers Res.Sta.	11-X-68	W. Baker	pitfall trap
1	Leon	Tall Timbers Res.Sta.	29-IV-70	F.W. Mead	blacklight trap
1	Leon	Tall Timbers Res.Sta.	13-20-VII-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	6-12-VII-71	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	7-13-IX-71	D. Harris	pitfall trap
2	Leon	Tall Timbers Res.Sta.	23-30-VIII	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	30-VIII-7-IX	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	17-24-VII-72	D. Harris	pitfall trap
1	Levy	Otter Creek	2-IV-59	R.E. Woodruff	on dead cow
1	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight trap
3	Manatee		8-IV-64		mosq.light trap
3	Manatee	Oneco		Paula Dillman	
2	Manatee	Oneco	12-13-IV-66	R.E. Woodruff	blacklight trap
1	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
1	Monroe		1-V-53	E.L. Sleeper	
1	Monroe	Big Pine Key	1-VII-34	F.N. Young	
1	Monroe	Everglades Nat. Pk.	5-IV-58	R.E. Woodruff	at light
1	Monroe	Everglades Nat. Pk.	14-III-62	G.F. Spencer	blacklight trap
1	Monroe	Everglades Nat. Pk.	28-III-70	R.M. Baranowski	blacklight trap
1	Monroe	Grassy Key	24-VI-61	W.W. Warner	light trap
5	Monroe	Key Largo	7-VI-60	R.E. Woodruff	Neotoma dung
4	Monroe	Long Pine Key	IX-50		
1	Okaloosa	Eglin AFB, 3mi.S.Holt	4-X-66	R.E. Woodruff	blacklight trap
1	Pinellas	Dunedin	10-VII-17	W.S. Blatchley	
3	Sarasota	Sarasota	9-IV-54		mosq.light trap

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST

APPENDIX 11: ATEUCHUS LECONTEI (HAROLD)

1	Alachua		11-VII-51	Witherington	
5	Alachua		24-VI-58	H.A. Denmark	armadillo carcass
2	Alachua	Archer	21-VII-60	A.E. Graham	
31	Alachua	Arredondo	22-VII-69	D.P. Wojcik	blacklight trap
6	Alachua	Arredondo	12-IV-70	D.P. Wojcik	blacklight trap
5	Alachua	Chitty Ranch	8-IV-69	R.E. Woodruff	cow dung
6	Alachua	Gainesville	26-III-19	J.C. Goodwin	in dung
4	Alachua	Gainesville	5-VII-19	G.B. Merrill	
5	Alachua	Gainesville	1-X-34	F.N. Young	
2	Alachua	Gainesville	16-VII-39	G.B. Merrill	
1	Alachua	Gainesville	1-IV-47	H.V. Weems,Jr.	
1	Alachua	Gainesville	24-VIII-48	H.V. Weems,Jr.	
1	Alachua	Gainesville	VI-53	L.A. Hetrick	
1	Alachua	Gainesville	15-VII-53	H.V. Weems,Jr.	
17	Alachua	Gainesville	7-VIII-56	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville	7-IV-57	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville	2-V-57	L.A. Hetrick	blacklight trap
35	Alachua	Gainesville	7-VII-57	L.A. Hetrick	blacklight trap
5	Alachua	Gainesville	5-VIII-57	J.W. Perry	blacklight trap
2	Alachua	Gainesville	28-VIII-57	L.A. Hetrick	blacklight trap
242	Alachua	Gainesville	various	Woodruff & Perry	blacklight trap
	(from 36 collections from Mar.-Nov.(1958-65),with months & collections as follows: III(1),IV(2),V(4),VI(7),VII(6),VIII(5),IX(6),X(4),XI(1);the most specimens(68) on 24-VIII-59.)				
1	Alachua	Gainesville	2-XI-65	Woodruff & Samol	yeast bait
1	Alachua	Gainesville	2-XI-65	Woodruff & Samol	Staley's bait #7
3	Alachua	Gainesville	9-XI-65	Woodruff & Samol	yeast bait
10	Alachua	Gainesville	16-XI-65	Woodruff & Samol	yeast bait
3	Alachua	Gainesville	16-XI-65	Woodruff & Samol	propionic acid
2	Alachua	Gainesville	16-XI-65	Woodruff & Samol	Staley's bait #7
17	Alachua	Gainesville	26-VII-66	A.L. D'Berry	dog dung
11	Alachua	Gainesville	10-IV-67	F.J. Moore	human dung
12	Alachua	Gainesville	24-VI-67	E. Mercer	blacklight trap
1	Alachua	Gainesville	24-X-68	R.E. Woodruff	blacklight trap
7	Alachua	Gainesville	2-XI-68	F.W. Mead	blacklight trap
1	Alachua	Gainesville	2-XI-68	F.W. Mead	blacklight trap
1	Alachua	Gainesville	29-XI-68	F.W. Mead	blacklight trap
6	Alachua	Gainesville	2-VI-69	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	24-VI-69	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	2-VII-69	F.W. Mead	blacklight trap
3	Alachua	Gainesville,NW 34 St.	4-VII-69	Duke Campbell	
5	Alachua	Gainesville	5-6-VII-69	F.W. Mead	blacklight trap
2	Alachua	Gainesville	9-VII-69	F.W. Mead	blacklight trap
8	Alachua	Gainesville	14-VII-69	W.H. Campbell	pitfall trap
8	Alachua	Gainesville,NW 34 St.	14-VII-69	Duke Campbell	can 9
2	Alachua	Gainesville	22-VII-69	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	10-IV-70	R.E. Woodruff	pine needles
1	Alachua	Gainesville	22-VIII-71	R.E. Woodruff	in toadstools
1	Alachua	Gainesville	2-VII-72	F.W. Mead	blacklight trap
1	Alachua	Gainesville	31-VII-72	F.W. Mead	blacklight trap
9	Alachua	Newman's Lake	12-V-59	R.E. Woodruff	
13	Alachua	Newman's Lake	1-VII-59	R.E. Woodruff	dead crabs
1	Alachua	Newman's Lake	4-IV-60	R.E. Woodruff	malt trap
3	Alachua	Newman's Lake	17-IV-60	R.E. Woodruff	malt trap
3	Alachua	Newman's Lake	17-X-61	R.E. Woodruff	dead crabs
3	Alachua	Newman's Lake	27-VII-69	R.E. Woodruff	human dung
13	Alachua	Newman's Lake, 2mi. W	9-VIII-62	R.E. Woodruff	fleshy fungus
9	Alachua	Newman's Lake, 2mi. W	9-VIII-62	R.E. Woodruff	malt traps
41	Alachua	Newman's Lake, 2mi. W	10-VIII-62	R.E. Woodruff	fleshy fungus
10	Alachua	Newman's Lake, 2mi. W	10-VIII-62	R.E. Woodruff	malt trap
10	Alachua	Newman's Lake, 2mi. W	13-VIII-62	R.E. Woodruff	malt trap
35	Alachua	Newman's Lake, 2mi. W	13-VIII-62	R.E. Woodruff	fleshy fungus
4	Alachua	Payne's Prairie	5-VI-65	R.E. Woodruff	cow dung
1	Alachua	Pine Hills Estates	28-VI-69	H.V. Weems,Jr.	at blacklight
8	Alachua	Waccasassa Flats	13-VII-68	S.K. Derr	cow dung
10	Alachua	near Warren's Cave	8-XII-	R.E. Woodruff	cow dung
19	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
1	Bay	Sunnyside	18-VI-52	C.A.&W.E.Triplehorn	
1	Broward	Pompano	8-VI-57	O.R. Paulson	
1	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
1	Charlotte	Punta Gorda	4-51	M. Robinson	
85	Clay		11-VII-60	H.A. Denmark	under oak leaves
13	Clay		5-VII-61	H.A. Denmark	decaying fungi
1	Dixie	Oldtown	16-VI-65	W. Suter	palmetto stump
1	Duval	Jacksonville	2-IX-42	R.C. Barnes	mosq.light trap
5	Franklin	St. George's Island	27-VI-5-VIII	W.W. Baker	pitfall trap
1	Gadsden	Quincy	6-VII-59	W.D. Tappan	mosq.light trap
3	Gilchrist	Trenton	2-IX-59	R.E. Woodruff	horse dung
17	Gilchrist	Trenton, 7mi. NW	29-VI-65	R.E. Woodruff	cow dung
1	Hernando	Hog Pond	8-VI-63	J.F. Turk	cow dung
2	Highlands	Archbold Bio. Sta.	3-VII-60	R.E. Woodruff	cow dung
1	Highlands	Highlands Hammock SP	10-VII-63	D.E. Dozier	at light
2	Highlands	Lake Letta Subdiv.	2-VIII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	8-VIII-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	21-III-62	T. Morris	blacklight trap
23	Highlands	Sebring	10-VI-60	Woodruff,Battimer	chicken feathers
3	Hillsborough	Brandon	22-X-65	J.W. Patton	blacklight trap
1	Jackson		III-58	H.V. Weems,Jr.	cow dung
1	Jackson	Greenwood	10-VIII-55	H.B. Wesson	
1	Jefferson	Big Bend Hort. Lab.	9-IX-69	R.H. Miller	blacklight trap
1	Jefferson	Big Bend Hort. Lab.	1-VI-70	FTuker	pitfall,rainy
2	Jefferson	Big Bend Hort. Lab.	29-VI-70	FTuker	pitfall,hickory
3	Jefferson	Big Bend Hort. Lab.	10-VIII-70	FTuker	pitfall,hickory
4	Jefferson	Monticello	11-VI-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	9-VII-58	A.M. Phillips	blacklight trap
2	Jefferson	Monticello	5-VIII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	8-IX-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	19-IX-58	A.M. Phillips	blacklight trap
3	Lake		10-VII-58	T.J. Walker	
1	Lake	Howey	30-VI-60	C.L. Felshaw	Steiner trap
2	Lake	Ocala National Forest	14-V-56	R.A. Morse	human feces
2	Leon	Iamonia, 5mi. W.	4-VIII-65	W. Suter	buttress debris
2	Leon	Tallahassee	24-IV-63	R.E. Woodruff	
1	Leon	Tallahassee	24-VI-65	W. Suter	buttress debris
1	Leon	Tallahassee	1-VII-65	W. Suter	buttress debris
1	Leon	Tall Timbers Res.Sta.	8-14-VI-68	W.H. Whitcomb	Berlese funnel
327	Leon	Tall Timbers Res.Sta.	various	D. Harris	pitfall traps
	(from 94 collections from Sept.-Nov.(1968-72),with months & collections as follows: IV(1),V(11),VI(12),VII(10),VIII(21),IX(23),X(5),XI(3);the most specimens (34) on 31-VIII-8-IX-70.)				
6	Liberty	Torreya State Park	16-VIII-60	H.V. Weems,Jr.	blacklight trap
22	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
2	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight trap
2	Liberty	Torreya State Park	18-IX-68	H.V. Weems,Jr.	blacklight trap
1	Marion	Dunnellon	12-III-60	T.R. Adkins	Jap beetle trap
1	Marion	Juniper Springs	27-VII-59	H.A. Denmark	at light
1	Marion	McIntosh	1-VIII-60	T.R. Adkins	McPhail trap
1	Marion	Ocala	6-VII-38	W.C. Stehr	
1	Marion	Ocala	2-VI-63	T.R. Adkins	blacklight trap
2	Okaloosa	Crestview, 12mi. N.	31-VIII-60	W.C. Rhoades	blacklight trap
1	Orange	Orlando	31-VII-61	J.R. Woodley	
1	Orange	Pine Castle	27-VII-62	W.A. Avazian	Jap beetle trap

(continued)

APPENDICES 11-15

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Osceola	Narcoosee, 7.4mi. S.	1-II-59	R.E. Woodruff	malt trap
1	Pasco	Dade City	15-VII-25	C.F. Gardner	Persea americana
1	Pasco	Dade City	1-XII-59	J.C. Sellers	
1	Pinellas	Dunedin	29-III-12	W.S. Blatchley	
1	Pinellas	Dunedin	15-VI-14	W.S. Blatchley	
1	Pinellas	Dunedin	20-IX-17	W.S. Blatchley	
1	Pinellas	Dunedin	15-VII-20	W.S. Blatchley	
50	Polk	Winter Haven	16-VIII-68	Mumm & Greene	cantrap,sandpines
13	Putnam	Hawthorne, 5mi. W.	24-IV-58	R.E. Woodruff	cow dung
12	Putnam	Redwater Lake	28-VIII-59	H.V. Weems,Jr.	at light
28	Putnam	Redwater Lake	21-VII-60	Debra Weems	at light
5	Putnam	Redwater Lake	22-III-62	R.E. Woodruff	cow dung
6	Putnam	Welaka,UF Cons.Res.	19-24-III-67	R.E. Woodruff	malt trap
4	St. Johns	Ft. Mantanzas Nat.Mon.	26-IX-66	R.E. Woodruff	in rotting fungi
2	Santa Rosa	Lake Carr,Blackwater R	19-VIII-71	Debra Weems	at blacklight
9	Sarasota	Venice	20-VI-36	A. Nicolay	
7	Sarasota	Venice	4-VII-36	A. Nicolay	
1	Seminole	Lake Mary	5-XI-63	G.W. Desin	blacklight trap
1	Seminole	Sanford	3-VI-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	28-VII-60	G.W. Desin	blacklight trap
6	Seminole	Sanford	2-IX-60	G.W. Desin	blacklight trap
2	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
1	Taylor	Perry	18-VII-38	W.C. Stehr	
2	Taylor	Perry	5-VIII-68	E.P. Merkel	blacklight trap
12	Volusia	Deland	23-XI-60	C.R. Roberts	malt trap
14	Volusia	DeLeon Springs	21-VI-60	C.R. Roberts	malt trap
3	Volusia	DeLeon Springs	8-VII-60	C.R. Roberts	malt trap
2	Volusia	New Smyrna	20-IV	M. Wright	
17	Volusia	New Smyrna	10-VI	M. Wright	
1	Volusia	New Smyrna	11-VII	M. Wright	
1	Volusia	New Smyrna	23-VII	M. Wright	

APPENDIX 12: DICHOTOMIUS CAROLINUS (LINNAEUS)

15	Alachua	Gainesville	various	Woodruff & Perry	blacklight trap
	(from 13 collections from May-Nov.(1955-69),with months & collections as follows: V(3),VI(1),VII(2),VIII(3),IX(3),XI(1).				
2	Alachua	near Hawthorne	24-VI-59	R.E. Woodruff	cow dung
1	Alachua	Pine Hills Estates	29-VIII-69	Camilla Weems	at light
1	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
1	Dade		20-III-52		
1	Dade		20-III-52	H.F. Strohecker	
1	Gadsden	Quincy	12-VI-56	W.B. Tappan	blacklight trap
2	Gadsden	Quincy	26-II-62	W.B. Tappan	blacklight trap
2	Gadsden	Quincy	4-VII-62	W.B. Tappan	blacklight trap
4	Hillsborough		23-IV-49	S.B. Mansell	
4	Jackson		7-VII-54	F.W. Mead	
1	Jackson	Marianna	22-IV-69	F.W. Mead	at light
3	Jefferson	Monticello	16-VII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	5-VIII-58	A.M. Phillips	blacklight trap
2	Jefferson	Monticello	13-VIII-58	A.M. Phillips	blacklight trap
3	Jefferson	Monticello	26-VI-59	A.M. Phillips	blacklight trap
2	Jefferson	Monticello	6-X-59	A.M. Phillips	blacklight trap
1	Leon	Tall Timbers Res.Sta.	14-21-IX-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	14-21-IX-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	28-IX-4-7IV	W.H. Whitcomb	pitfall trap
1	Liberty	Bristol	30-VIII-66	W. Suter	
1	Liberty	Torreya State Park	14-VIII-68	H.V. Weems,III	
1	Marion	Ocala	18-VIII-61	A.E. Graham	at light
1	Marion	Ocala	10-VIII-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	3-VII-63	T.R. Adkins	blacklight trap
2	Marion	Ocala	2-VIII-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	13-IX-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	27-IX-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	28-V-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	2-VII-64	T.R. Adkins	blacklight trap
2	Marion	Ocala	24-VII-64	T.R. Adkins	blacklight trap
22	Okaloosa	Crestview, 12mi. N.	21-VIII-60	W.C. Rhoades	blacklight trap
1	Orange		16-IX-55	H.A. Denmark	
1	Orange	Winter Garden	15-IX-57	H.A. Denmark	
1	Santa Rosa	Jay	1-VIII-62	T.N. Boyd	blacklight trap
1	Santa Rosa	Blackwater St. For.	19-VIII-71	Debra Weems	at blacklight
1	Seminole	Sanford	23-XI-60	G.W. Desin	blacklight trap
1	Washington	Chipley, Swf. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 13: COPRIS INEMARGINATUS BLATCHLEY

1	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
1	Alachua	Gainesville	16-XI-65	Woodruff & Samol	Staley's bait #7
1	Alachua	Gainesville	19-XI-65	Woodruff & Samol	yeast bait
2	Clay	Goldhead Branch St.Pk.	1-V-65	R.E. Woodruff	cow dung
1	Gilchrist	near Trenton	2-IV-59	R.E. Woodruff	cow dung
15	Hardee	Charlie Creek,Rt. 17	21-I-60	R.E. Woodruff	cow dung
1	Highlands	Sebring		H.V. Weems,Jr.	
1	Hillsborough		23-IV-49	S.B. Mansell	
1	Hillsborough	Brandon	8-I-62	J.W. Patton	cow dung
1	Levy	Bronson, 8mi. E.	21-IV-59	R.E. Woodruff	under dead horse
1	Marion	Dunnellon, 4mi. NW	3-VIII-38	Hubbell-Friauf	at light
1	Pinellas	Dunedin	12-II-13	W.S. Blatchley	
1	Pinellas	Dunedin	5-VI-17	W.S. Blatchley	
1	Pinellas	Dunedin	10-VII-17	W.S. Blatchley	
1	Pinellas	Dunedin	4-III-18	W.S. Blatchley	
2	Putnam	Hawthorne	5-I-60	R.E. Woodruff	cow dung
93	Putnam	Huntington	20-III-67	Woodruff & Lloyd	
5	Putnam	Interlachen	17-XI-51	B.K. Dozier	cow dung
7	Putnam	Interlachen	22-III-53	B.K. Dozier	malt trap
1	Putnam	Interlachen	29-III-60	R.E. Woodruff	cow dung
10	Putnam	Redwater Lake	6-I-60	R.E. Woodruff	cow dung
1	Putnam	Redwater Lake	22-III-62	R.E. Woodruff	cow dung
1	Putnam	Redwater Lake	20-VIII-67	Debra Weems	at light
5	Putnam	Rodman	6-IV-49	F.N. Young	traps
2	Putnam	Welaka	20-III-67	Woodruff & Lloyd	cow dung
1	Seminole	Winter Park	20-II-29		
2	Volusia	DeLeon Springs	1-VII-29		

APPENDIX 14: COPRIS MINUTUS (DRURY)

2	Alachua		7-II-54	H.A. Denmark	blacklight trap
1	Alachua		6-IV-54	H.V. Weems,Jr.	at light
1	Alachua		17-III-55	H.A. Denmark	blacklight trap
1	Alachua		XI-68	S. Cabler	
1	Alachua	Alachua	15-III-53	Lagrove	
2	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
4	Alachua	Archer, 3/4 mi. W.	28-31-III-67	D.L. May	malt,cat dung trap
1	Alachua	Arredondo Estates	22-VII-69	D.P. Wojcik	blacklight trap
4	Alachua	Chitty Ranch	5-VI-65	R.E. Woodruff	cow dung
1	Alachua	Gainesville	1-XII-37	G.B. Merrill	
299	Alachua	Gainesville	various	various	blacklight trap
	(from 69 collections from Jan.-Dec.(1947-72),with months & collections as follows: I(19),II(9),III(2),IV(2),V(3),VI(1),VII(1),IX(1),X(2),XI(11),XII(20);the most specimens (28) on 8-10-I-71.)				
3	Alachua	Hawthorne	24-VI-58	R.E. Woodruff	cow dung
5	Alachua	Newnan's Lake	17-X-61	R.E. Woodruff	dead crabs
50	Alachua	Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
1	Baker	Glen St. Mary	10-V-60	E.W. Holder,Jr.	cow dung
1	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
112	Baker	Glen St. Mary	24-I-61	E.W. Holder,Jr.	cow dung
12	Baker	Glen St. Mary	6-II-61	E.W. Holder,Jr.	decaying pork
5	Baker	Glen St. Mary	16-II-61	E.W. Holder,Jr.	cow dung
1	Baker	Olustee	5-III-59	R.E. Woodruff	cow dung
2	Bay	Southport	28-I-60	W. Miller	
1	Charlotte	Punta Gorda	20-X-60	H.M. Faircloth	blacklight trap
2	Clay	Goldhead Branch St.Pk.	1-V-65	R.E. Woodruff	blacklight trap
6	Collier	Immokalee	21-XII-57	H.M. Faircloth	blacklight trap
13	Collier	Immokalee	30-XII-59	H.M. Faircloth	blacklight trap
9	Collier	Immokalee	26-I-4-II-60	A.F. Wilson	blacklight trap
9	Collier	Immokalee	4-II-60	A.F. Wilson	blacklight trap
27	Collier	Immokalee	9-II-60	A.F. Wilson	blacklight trap
2	DeSoto	Arcadia	21-I-60	R.E. Woodruff	cow dung
1	Duval	Jacksonville	15-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	22-VI-50	G.G. Norman	Jap beetle trap
1	Duval	Mayport	21-III-62	L.W. Taylor	blacklight trap
1	Gadsden	Quincy	19-V-58	W.B. Tappan	blacklight trap
2	Gadsden	Quincy	30-XII-58	W.B. Tappan	blacklight trap
1	Gadsden	Quincy	9-II-59	W.B. Tappan	blacklight trap
4	Gilchrist	Trenton	2-IV-59	R.E. Woodruff	horse dung
1	Glades	Palmdale, 11mi. S.	19-II-65	R.E. Woodruff	cow dung
3	Hamilton	Jasper, 8mi. N.	8-XI-57	R.E. Woodruff	at light
1	Hardee	Charlie Creek,Rt. 17	21-I-60	R.E. Woodruff	cow dung
1	Hendry	LaBelle	29-III-62	W.W. Smith	Steiner trap
1	Hernando	Croom's Lake	5-XI-61	J.W. Patton	at light
1	Highlands	Highlands Hammock SP	11-VI-66	B.K. Dozier	
1	Highlands	Lake Istokpoga	29-III-22	W.S. Blatchley	
1	Highlands	Lake Letta Subdiv.	16-VIII-61	T. Morris	blacklight trap
1	Highlands	Sebring	27-II-61	J.C. Manlon	blacklight trap
1	Hillsborough	Brandon	18-V-62	J.W. Patton	blacklight trap
1	Hillsborough	Brandon	23-VII-66	J.W. Patton	cat dung
1	Hillsborough	Tampa	25-V-61	R.G. Racine	
9	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
6	Jefferson	Monticello	7-I-60	A.M. Phillips	blacklight trap
4	Jefferson	Monticello	3-III-60	A.M. Phillips	blacklight trap
8	Lafayette	Branford, 5mi. W.	13-II-60	R.E. Woodruff	dead dog
52	Leon	Tall Timbers Res.Sta.	various	D. Harris	pitfall traps
	(from 40 collections from Jan.-Dec.(1970-72),with months & collections as follows: I(4),II(1),VI(3),VII(8),VIII(2),IX(5),X(6),XI(5),XII(6).				
1	Levy	Bronson	1-VII-60	T.R. Adkins	Jap beetle trap
1	Levy	Otter Creek	14-III-58	H.V. Weems,Jr.	cow dung
2	Levy	Otter Creek	14-III-58	R.E. Woodruff	cow dung
5	Liberty	Torreya State Park	26-I-65	H.V. Weems,Jr.	blacklight trap
1	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight trap
1	Marion	Anthony	31-III-59	E.W. Holder,Jr.	cow dung
1	Marion	Anthony	24-I-64	T.R. Adkins	Steiner trap
4	Marion	Ocala	13-IV-62	T.R. Adkins	blacklight trap
2	Marion	Ocala	14-XI-62	T.R. Adkins	blacklight trap
2	Marion	Ocala	21-XI-62	T.R. Adkins	blacklight trap
3	Marion	Ocala	21-VI-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	27-IX-63	T.R. Adkins	blacklight trap
5	Marion	Ocala	8-XI-63	T.R. Adkins	blacklight trap
8	Marion	Ocala	13-XI-63	T.R. Adkins	blacklight trap
7	Marion	Ocala	26-XI-63	T.R. Adkins	blacklight trap
7	Marion	Ocala	27-XI-63	T.R. Adkins	blacklight trap
4	Marion	Ocala	5-VI-64	T.R. Adkins	blacklight trap
2	Marion	Ocala	26-VI-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	2-VII-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	17-VII-64	T.R. Adkins	blacklight trap
1	Okaloosa	Crestview, 12mi. N.	31-VIII-68	W.C. Rhoades	blacklight trap
1	Okaloosa	Ocean City	19-I-63	H.O. Hilton	
1	Orange	Orlando	1-VI-60	J.R. Woodley	
1	Osceola		15-III-56	H.A. Denmark	at light
1	Pinellas	Dunedin	27-III-13	W.S. Blatchley	
1	Pinellas	Dunedin	VII-15	W.S. Blatchley	
1	Pinellas	Dunedin	16-III-22	W.S. Blatchley	
4	Putnam	Hawthorne, 5mi. E.	5-I-60	R.E. Woodruff	cow dung
8	Putnam	Huntington	20-II-67	R.E. Woodruff	cow dung
2	Putnam	Interlachen	29-III-60	R.E. Woodruff	cow dung
1	Putnam	Melrose, 2mi. S.	21-XII-64	R.E. Woodruff	horse dung
1	Putnam	Palatka, East	26-VI-62	T.R. Adkins	Jap beetle trap
31	Putnam	Redwater Lake	17-I-59	R.E. Woodruff	horse dung
21	Putnam	Redwater Lake	18-VIII-59	H.V. Weems,Jr.	cow dung
5	Putnam	Redwater Lake	6-I-60	R.E. Woodruff	cow dung
35	Putnam	Redwater Lake, 2mi. E.	6-I-60	R.E. Woodruff	cow dung
3	Putnam	near Lake Suzan	23-II-58	R.E. Woodruff	cow dung
21	Putnam	near Lake Suzan	17-I-59	R.E. Woodruff	cow dung
3	Putnam	near Lake Suzan	6-II-59	R.E. Woodruff	cow dung
6	Putnam	Welaka, 2mi. N.	20-III-67	Woodruff & Lloyd	
1	Sarasota	Englewood	26-II-60	A.F. Wilson	blacklight trap
3	Sarasota	Sarasota	16-II-11	W.S. Blatchley	
1	Sarasota	Sarasota	1-VII-11	W.S. Blatchley	
1	Sarasota	Sarasota	7-I-63	C.L. Yax	Steiner trap
10	Seminole	Sanford	8-XI-61	G.W. Desin	blacklight trap
2	Seminole	Sanford	20-XII-61	G.W. Desin	blacklight trap
33	Sumter	Sumterville, 1mi. W.	5-XII-66	R.E. Woodruff	cow dung
1	Sumter	Wildwood	25-I-67	E.W. Holder,Jr.	
1	Volusia	DeLeon Springs	21-VI-60	C.R. Roberts	malt trap

APPENDIX 15: PHANAEUS IGNEUS FLORIDANUS D'OLSOUFIEFF

1	Alachua	11-VIII-40		
1	Alachua	8-X-40		
1	Alachua	5-XI-41		
1	Alachua	XII-42		
1	Alachua	21-I-48	B.W. Cooper	
1	Alachua	4-III-49	E.H. McConkey	
1	Alachua	21-V-49		
2	Alachua	21-V-49	S.B. Mansell	
1	Alachua	17-III-53	Lagrove	
1	Alachua	16-X-53	F.W. Mead	
1	Alachua	9-V-56	B.G. Watson	
1	Alachua	26-IX-57	J. Mulrennan	
2	Alachua	26-III-59	H.V. Weems,Jr.	flying in daytime
2	Alachua	2-VI-60	R.E. Woodruff	malt trap
70	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
2	Alachua	Archer, 3/4mi. W.	28-31-III-67	D.L. Mays	malt yeast dung
1	Alachua	Gainesville	9-V-11		
1	Alachua	Gainesville	III-13		
1	Alachua	Gainesville	4-IV-15		
1	Alachua	Gainesville	1-IV-16		
1	Alachua	Gainesville	20-V-16		
1	Alachua	Gainesville	10-II-22		
1	Alachua	Gainesville	II-29	T.H. Hubbell	
2	Alachua	Gainesville	17-IV-29	T.H. Hubbell	
1	Alachua	Gainesville	10-V-29	T.H. Hubbell	
2	Alachua	Gainesville	23-IX-34		

(continued)

APPENDICES 15-17

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
5	Alachua	Gainesville	28-IX-34	F.N. Young	
27	Alachua	Gainesville	29-IX-34	F.N. Young	
1	Alachua	Gainesville	29-III-38	T.H. Hubbell	
1	Alachua	Gainesville	24-IV-44	H.C. Bucha	
1	Alachua	Gainesville	4-IX-44	T.H. Hubbell	
1	Alachua	Gainesville	10-XI-54	A.L. Alberty	
1	Alachua	Gainesville	1-IV-58	W.E. Woodruff	
1	Alachua	Gainesville	7-X-59	R.E. Woodruff	
1	Alachua	Gainesville	25-III-61	H.V. Weems,Jr.	human dung
1	Alachua	Gainesville	13-XI-61	E. Lang	flew in car
4	Alachua	Gainesville	11-VIII-62	R.E. Woodruff	malt trap
1	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	fleshy fungus
21	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	malt trap
1	Alachua	Gainesville, 10mi. N.	IX-66	D.L. Mays	
1	Alachua	Gainesville	2-VI-69	R.E. Woodruff	dead skunk
1	Alachua	near Hawthorne	24-VI-69	R.E. Woodruff	cow dung
1	Alachua	Lake Lowery	24-II-67	H.A. Denmark	
17	Alachua	Newnan's Lake	IV-27	N.A. Wood	
2	Alachua	Newnan's Lake	4-6-XII-29	T.H. Hubbell	
19	Alachua	Newnan's Lake	4-IV-60	R.E. Woodruff	malt trap
13	Alachua	Newnan's Lake	10-IV-60	R.E. Woodruff	malt trap
2	Alachua	Newnan's Lake, 2mi. W.	3-VIII-62	R.E. Woodruff	malt trap
7	Alachua	Newnan's Lake, 2mi. W.	9-VIII-62	R.E. Woodruff	malt trap
7	Alachua	Newnan's Lake, 2mi. W.	10-VIII-62	R.E. Woodruff	malt trap
6	Baker	Glen St. Mary	15-IV-60	E.W. Holder,Jr.	malt trap
6	Baker	Glen St. Mary	21-IV-60	E.W. Holder,Jr.	malt trap
10	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
30	Baker	Glen St. Mary	5-XII-60	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	16-XII-60	E.W. Holder,Jr.	malt trap
5	Baker	Glen St. Mary	26-XII-60	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	10-I-61	E.W. Holder,Jr.	
1	Baker	Glen St. Mary	2-II-61	E.W. Holder,Jr.	malt trap
1	Baker	Macclenny	9-XII-60	E.W. Holder,Jr.	malt trap
1	Broward	Pompano Beach	8-VI-57	D.R. Paulson	
1	Collier	Marco Island	18-IV-58	D.R. Paulson	
2	Columbia	High Springs	26-30-X-29	T.H. Hubbell	
1	Dade	Miami	16-VI-33	F.N. Young	
3	Dade	Miami	18-VI-33	F.N. Young	
2	Dade	Miami	30-VI-33	F.N. Young	
2	Dade	Miami	25-I-34	F.N. Young	
6	Dade	Miami	18-III-34	F.N. Young	
11	Dade	Miami	23-VI-34	F.N. Young	
1	Dade	Miami	6-VII-35	Conlan	
1	Dade	Miami	16-I-39	F.N. Young	at dung
1	Dade	Miami	5-I-65	B.K. Dozier	
1	DeSoto	Arcadia	21-I-60	R.E. Woodruff	cow dung
2	Gilchrist	near Trenton	21-IV-59	R.E. Woodruff	cow dung
1	Hardee	Charlie Creek,Rt. 17	21-I-60	R.E. Woodruff	
1	Highlands	Sebring	15-III-61	A.L. Collier	
1	Hillsborough	Tampa	IV-18	W.S. Blatchley	
1	Hillsborough	Tampa	III-30	W.S. Blatchley	
1	Indian River	Indian River	IV-1880	F.A. Eddy	
1	Indian River	Vero Beach	8-XI-31	E.M. Becton	
3	Lake		13-III-22	T.P. Winter	
7	Lake		17-III-22	T.P. Winter	
1	Lake		18-III-22	T.P. Winter	
1	Lake	Groveland	14-VIII-68	W.P. Henderson	
1	Lake	Leesburg	11-VI-59	A.L. Bentley	
1	Lake	Leesburg	17-VI-59	A.L. Bentley	
1	Lake	Mascotte	17-V-61	W.P. Henderson	hog pen
1	Lake	Tavares, 2mi. W.	4-VIII-38	Hubbell-Friauf	
1	Levy		24-III-49	W.L. Jennings	
5	Marion	Anthony	31-III-59	E.W. Holder,Jr.	dung
5	Marion	Candler	20-II-26	A.C. Cole	
1	Marion	Dunnellon, 4mi.NW	3-VII-38	Hubbell-Friauf	
9	Marion	Juniper Springs	6-X-40	F.N. Young	
1	Marion	Ocala, 10mi.SW	3-IX-38	Hubbell-Friauf	
1	Martin	Hobe Sound	1-II-59	R.E. Woodruff	malt trap
1	Martin	Hobe Sound, 9mi. N.	1-II-59	R.E. Woodruff	in gopher burro
1	Orange		1-III-22	T.P. Winter	
1	Orange	Orlando	2-X-61	J.R. Woodley	
2	Osceola	Narcoossee, 7.4mi. S.	1-II-57	R.E. Woodruff	malt trap
1	Pasco	Dade City	16-II-59	B.E. Tyner	
2	Pasco	Dade City	20-X-59	J.C. Sellers	
1	Pasco	St. Joseph	27-IX-60	J.C. Sellers	
1	Pasco	Zephyrhills	11-XI-71	L.B. Hill	
1	Pinellas	Dunedin	24-XII-16	W.S. Blatchley	
2	Pinellas	Gulfport	III-12		
4	Pinellas	Gulfport	V-12		
1	Putnam	Interlachen, 6mi.SW	21-III-53	Howden & Dozier	malt trap
2	Putnam	Redwater Lake	6-I-60	R.E. Woodruff	cow dung
1	Sarasota	Sarasota	4-II-11	W.S. Blatchley	
1	Seminole	Forest City	11-IX-61	C.O. Youtsey	
1	Seminole	Longwood	14-III-60	G.W. Desin	
1	Seminole	Wagner	14-VIII-61	G.W. Desin	
1	Suwannee	Branford			dead dog
4	Volusia	DeLand	3-VIII-60	C.R. Roberts	malt trap
2	Volusia	DeLand	23-XI-60	C.R. Roberts	malt trap
3	Volusia	DeLeon Springs	28-IV-60	C.R. Roberts	malt trap
17	Volusia	DeLeon Springs	13-V-60	C.R. Roberts	malt trap
5	Volusia	DeLeon Springs	21-VI-60	C.R. Roberts	malt trap
8	Volusia	DeLeon Springs	8-VII-60	C.R. Roberts	malt trap
2	Volusia	DeLeon Springs	29-VII-60	C.R. Roberts	malt trap
18	Volusia	DeLeon Springs	10-VIII-60	C.R. Roberts	malt trap
16	Volusia	DeLeon Springs	4-XI-60	C.R. Roberts	malt trap
7	Volusia	Enterprise		H.W. Wenzel	
1	Volusia	Enterprise	16-IV-21	J.H. Williamson	
1	Volusia	Enterprise	20-IV-21	J.H. Williamson	
4	Volusia	Enterprise	III-23		
1	Volusia	New Smyrna		R.W. Rings	
1	Volusia	Orange City	20-XI-61	G.W. Desin	
2	Volusia	Ormond	1-IV-11	W.S. Blatchley	
1	Volusia	Ormond	III-19	W.S. Blatchley	

APPENDIX 16: PHANAEUS VINDEX MACLEAY

5	Alachua		3-X-59	D.G. Young	
1	Alachua	Austin Cary Forest	12-VI-59	H.V. Weems,Jr.	human dung
1	Alachua	Gainesville			
1	Alachua	Gainesville	9-V-34		
1	Alachua	Gainesville	9-III-35		
1	Alachua	Gainesville	16-IV-35		
1	Alachua	Gainesville	8-VI-40		
1	Alachua	Gainesville	1-X-46	H.V. Weems,Jr.	
1	Alachua	Gainesville	13-II-49	E.H. McConkey	
1	Alachua	Gainesville	3-V-51		
1	Alachua	Gainesville	8-X-51	J. Haynie	
1	Alachua	Gainesville	20-IV-54	F.W. Mead	dog dung
1	Alachua	Gainesville	20-VIII-55	R.A. Morse	human dung
1	Alachua	Gainesville	5-IV-58	F.W. Mead	
1	Alachua	Gainesville	21-V-58	T.J. Walker	
1	Alachua	Gainesville	24-VI-58	R.E. Woodruff	cow dung
1	Alachua	Gainesville	14-II-59	H.V. Weems,Jr.	

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Alachua	Gainesville	IV-59		
1	Alachua	Gainesville	X-59	Jeter	
2	Alachua	Gainesville	IX-60	S. Cabler	
2	Alachua	Gainesville	8-IV-62	E. Nutter	
1	Alachua	Gainesville	28-III-64	R.E. Woodruff	dog dung
1	Alachua	Gainesville	5-VI-65	R.E. Woodruff	cow dung
1	Alachua	Gainesville	25-IX-65	L.D. Ober	
1	Alachua	Gainesville	17-IX-66	A.L. O'Berry	dog dung
2	Alachua	Gainesville	29-X-66	A.L. O'Berry	dog dung
1	Alachua	Gainesville	10-VIII-67	E. Mercer	
1	Alachua	Gainesville	18-VII-68	B. Townesend	
1	Alachua	Gainesville	19-VIII-68	C.E. Woodruff	
1	Alachua	Gainesville	20-IX-70	R.E. Woodruff	in swimming pool
1	Alachua	Gainesville	4-IV-71	R.E. Woodruff	
1	Alachua	Gainesville	27-X-71	R.E. Waites	
1	Alachua	Pine Hills Estates	12-V-68	A.L. O'Berry	
1	Alachua	Pine Hills Estates	25-VI-69	Debra Weems	at blacklight
2	Alachua	Pine Hills Estates	25-VII-69	Debra Weems	
1	Alachua	Pine Hills Estates	18-VIII-69	A.L. O'Berry	
5	Alachua	near Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
1	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	
1	Baker	Glen St. Mary	16-II-61	E.W. Holder,Jr.	
1	Baker	Glen St. Mary, 2mi.SSE	9-X-61	E.W. Holder,Jr.	
1	Baker	Osceola National For.	15-VIII-69	C.F. Zeiger	
1	Brevard	Eau Gallie	14-XI-70	H.C. Levan	
4	Calhoun	Clarksville	21-III-54	N.F. Howden	malt traps
1	Clay	Hibernia	26-IX-58	E.W. Holder	in spider web
1	Dade		26-VIII-65	C.T. Grahowski	
1	Dade	Hialeah	30-VI-71	M. Yunot	
1	Dade	Homestead	13-VIII-60	C. Strohm	
1	Dade	Miami	2-VIII-60	J.R. McFarlin	
1	Dade	Miami	18-I-61	D.H. Alexander	
1	Dade	Miami	5-X-61	D.H. Alexander	
1	Dade	Miami	16-III-63	G.R. Searls	Steiner trap
1	Dade	Miami Internat.Airport	IX-53		
1	Dade	Miami Springs	12-IV-69	B.K. Dozier	
1	Duval	Jacksonville	8-X-36		
1	Escambia		10-IV-58	M.A. Tidwell	
1	Escambia		17-IV-59	M.A. Tidwell	
1	Gadsden	Hinson	7-V-20	C.A. Reese	
2	Gilchrist	near Trenton	2-IV-58	R.E. Woodruff	cow dung
1	Glades	Palmdale, 11mi. S.	19-II-68	R.E. Woodruff	cow dung
1	Gulf	Dalkeith	21-V-21	C.A. Reese	
1	Highlands	Highlands Hammock SP	12-VII-59	R.E. Woodruff	deer droppings
1	Highlands	Lake Istokpoga	VIII-45		human dung
1	Hillsborough	Dover	21-XI-70	E.R. Simmons	
1	Hillsborough	Tampa	IX-61	T. Mascarino	
1	Jackson		18-III-58	H.V. Weems,Jr.	under dead pig
1	Jefferson	Monticello	7-XI-34	G. Fairchild	
1	Jefferson	Monticello, 6mi. W.	24-VII-65	W. Suter	
1	Jefferson	Monticello	24-IV-66	H.W. Collins,Jr.	
1	Lake	Astor Park	6-IX-53	W. Auffenberg	
1	Leon	Tallahassee	1-XI-59	G.W. Dehle	
1	Leon	Tallahassee	1-X-70	R.E. Woodruff	
1	Levy	Manatee Springs SP	5-VI-63	C.F. Zeiger	
1	Madison		2-V-46	F.N. Young	
1	Manatee	Duette	14-VIII-62	D.C. Chancey	
1	Marion		20-VIII-61	G.O. Platt	
4	Marion	Anthony	31-III-59	E.W. Holder,Jr.	cow dung
1	Marion	Martin	24-III-59	E.W. Holder,Jr.	
1	Marion	Rainbow Springs	30-VII-56	W. Suter	
1	Monroe	Elliot Key	VIII-34	E. Moore	
1	Palm Beach	Lake Worth	29-III-22	W.S. Blatchley	
1	Polk	Lake Alfred	9-XI-56	R.A. Newkirk	
1	Sarasota	Sarasota	9-II-11	W.S. Blatchley	
1	Sarasota	Sarasota	3-III-11	W.S. Blatchley	
1	Seminole	Geneva	29-IX-59	G.W. Desin	
1	Seminole	Sanford	8-III-60	B. Talmadge	
1	Sumter			B. McKeown	
1	Sumter	Wildwood	31-III-61	W.P. Henderson	
1	Taylor		22-IV-61	H.V. Weems,Jr.	human dung
1	Union	Santa Fe River, Rt.24	19-X-60	F.W. Mead	
1	Volusia	Daytona Beach	9-VIII-61	G.W. Desin	
1	Volusia	Ormond	4-IV-99	W.S. Blatchley	

APPENDIX 17: ONTHOPHAGUS HECATE BLATCHLEY! BROWN

3	Alachua		12-V-59	H.V. Weems,Jr.	cow dung
139	Alachua	Chitty Ranch	5-VI-65	R.E. Woodruff	cow dung
2	Alachua	Gainesville	15-XI-46	H.V. Weems,Jr.	
1	Alachua	Gainesville	29-III-47	H.V. Weems,Jr.	
2	Alachua	Gainesville	9-XI-57	R.E. Woodruff	cow dung
4	Alachua	Gainesville	29-III-58	R.E. Woodruff	cow dung
1	Alachua	Gainesville	27-IV-58	R.E. Woodruff	cow dung
4	Alachua	Gainesville	27-VI-58	R.E. Woodruff	cow dung
16	Alachua	Gainesville	27-VII-58	R.E. Woodruff	cow dung
1	Alachua	Gainesville	11-VI-63	J.D. Spooner	dead fish
10	Alachua	Gainesville	4-IV-71	R.E. Woodruff	cow dung
14	Alachua	Waccasassa Flats	13-VI-68	S.K. Derr	cow dung
1	Alachua	Warren's Cave	16-V-65	R.E. Woodruff	cow dung
4	Baker	Glen St. Mary	18-IV-60	E.W. Holder,Jr.	malt trap
2	Baker	Glen St. Mary	21-IV-60	E.W. Holder,Jr.	malt trap
4	Baker	Glen St. Mary	2-V-60	E.W. Holder,Jr.	malt trap
5	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
4	Baker	Glen St. Mary	16-XII-60	E.W. Holder,Jr.	malt trap
4	Baker	Glen St. Mary	26-XII-60	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	2-I-61	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	14-I-61	Woodruff & Holder	malt trap
3	Baker	Glen St. Mary	6-II-61	E.W. Holder,Jr.	rotting pork
2	Baker	Glen St. Mary	6-II-61	E.W. Holder,Jr.	malt trap
26	Baker	Glen St. Mary	14-II-61	E.W. Holder,Jr.	cow dung
19	Baker	Glen St. Mary	23-II-61	E.W. Holder,Jr.	malt trap
6	Baker	Glen St. Mary	28-II-61	E.W. Holder,Jr.	malt trap
4	Baker	Glen St. Mary	1-III-61	E.W. Holder,Jr.	rabbit pellets
5	Baker	Macclenny	9-XII-60	Woodruff & Holder	malt trap
4	Baker	Macclenny	13-XII-60	E.W. Holder,Jr.	malt trap
1	Baker	Macclenny	26-XII-60	E.W. Holder,Jr.	malt trap
1	Baker	Macclenny	2-I-61	E.W. Holder,Jr.	
2	Baker	Olustee	5-III-59	R.E. Woodruff	cow dung
2	Broward	Davie	8-I-62	D.P.B. McLean	
1	Collier		24-XI-55	H.V. Weems,Jr.	rotting palm
3	Collier	Collier-Seminole SP	20-III-58	R.E. Woodruff	human dung
1	Columbia	Osceola National For.	19-IV-54	F.W. Mead	
1	Dade		7-IV-48	Orr	
1	Dade	Everglades Nat. Pk.	31-X-62	H.V. Weems,Jr.	
1	Dade	Goulds	26-I-44	O.D. Link	cabbage
1	Dade	Homestead	19-IV-44	O.D. Link	lima beans
13	Dade	Homestead	20-IV-70	J.H. Knowles	Sechium edule
1	Dade	Miami	4-III-33	F.N. Young	
1	Dade	Miami	30-VI-33	F.N. Young	
1	Dade	Miami	7-IV-62	C.F. Dowling	dog dung
1	Dade	Miami	8-VI-67	J. Dillon	
1	Dade	Opa Locka	15-IV-68	C.F. Dowling,Jr.	

(continued)

APPENDICES 17-21

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Dade	Princeton	20-I-37	O.D. Link	
1	Dade	Royal Palm Park	4-V-37	H.F. Strohecker	
2	Glades	Palmdale, 11mi. S.	19-II-65	R.E. Woodruff	cow dung
5	Hardee	Zolfo Springs	26-II-62	R.E. Woodruff	cow dung
7	Hendry	Clewiston	13-IX-59	R.E. Woodruff	human dung
1	Highlands	Highlands Hammock SP	22-IX-56	H.A. Denmark	
2	Highlands	Highlands Hammock SP	12-VII-59	R.E. Woodruff	deer droppings
3	Highlands	Sebring	12-VIII-64	B.K. Dozier	
1	Hillsborough	Brandon	15-I-62	J.W. Patton	dog dung
1	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
1	Hillsborough	Port Tampa	25-IV-61	J.W. Patton	black medick
1	Hillsborough	Tampa	2-VI-63	J.W. Patton	
5	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
1	Jackson	Fla. Caverns St. Pk.	23-IV-61	H.V. Weems,Jr.	
1	Lake	Clermont	28-XI-61	W.P. Henderson	rotting citron
4	Lee	Estero	10-III-65	B.K. Dozier	human dung
684	Leon	Tall Timbers Res.Sta.	various	D. Harris	pitfall traps
	(from 267 collections from Mar.-Dec.(1969-72),with months & collections as follows: III(3),IV(47),V(17),VI(27),VII(51),VIII(38),IX(42),X(28),XI(11),XII(2);the most specimens (28) on 8-14-IX-70.)				
1	Levy		13-III-54	H.V. Weems,Jr.	
4	Levy		14-III-58	H.V. Weems,Jr.	cow dung
5	Levy	Otter Creek	14-V-59	R.E. Woodruff	rabbit pellets
2	Manatee	Oneco	12-IV-66	R.E. Woodruff	cow dung
1	Marion		23-III-57	H.V. Weems,Jr.	
5	Orange	Orlando, 4mi. S.	26-I-59	R.E. Woodruff	cow dung
14	Orange	Orlando, 4mi. S.	1-II-59	R.E. Woodruff	malt trap
10	Orange	Orlando, 10mi. S.	1-II-59	R.E. Woodruff	malt trap
1	Orange	Orlando	3-VIII-61	J.R. Woodley	
1	Osceola	Holopaw, 2mi. S.	1-II-59	R.E. Woodruff	dead dog
5	Osceola	Narcoossee, 2mi. N.	1-II-59	R.E. Woodruff	malt trap
1	Osceola	Narcoossee, 7.4mi. S.	1-II-59	R.E. Woodruff	cow dung
1	Palm Beach	Lake Worth	5-III-64	R.A. Long	dung
5	Palm Beach	Lake Worth	5-III-64	C.F. Dowling	animal dung
1	Palm Beach	Lake Worth	26-XII-71	W.E. Wyles	papaya fruit
32	Pinellas	Dunedin	14-V-59	R.E. Woodruff	human dung
1	Polk	Auburndale	15-VIII-61	W.P. Henderson	
1	Polk	Berea	1-III-62	R.E. Vild	
1	Polk	Lakeland	3-IV-62	R.E. Vild	Steiner trap
1	Polk	Lakeland	23-VII-62	C.D. Risk	
1	Polk	Winter Haven	3-V-59	R.E. Woodruff	cow dung
4	Putnam	near Lake Suzan	6-I-60	R.E. Woodruff	cow dung
1	Sarasota	Sarasota	4-VI-54	H.V. Weems,Jr.	on ocean beach
3	Seminole	Casselberry	15-VII-59	C.O. Youtsey	in fernery
1	Seminole	Geneva	31-VII-61	G.W. Desin	
1	Seminole	Goldenrod	24-VIII-60	C.O. Youtsey	
1	Seminole	Lake Monroe	23-VIII-61	C.O. Youtsey	
3	Seminole	Sanford	4-V-60	G.W. Desin	malt trap
1	Seminole	Sanford	10-IV-62	G.W. Desin	
2	St. Lucie	Ft. Pierce, 10mi. S.	22-I-69	R.E. Woodruff	human dung
1	St. Lucie	White City	2-X-61	E.W. Campbell	
1	Volusia	DeLeon Springs	29-IV-59	R.E. Woodruff	cow dung

APPENDIX 18: ONTHOPHAGUS OKLAHOMENSIS BROWN

1	Alachua		15-IV-56	R.A. Morse	human dung
49	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
34	Alachua	Archer	8-IV-60	R.E. Woodruff	malt trap
1	Alachua	Gainesville	6-V-56	R.A. Morse	human dung
4	Alachua	Gainesville	9-XI-57	R.E. Woodruff	cow dung
16	Alachua	Gainesville	29-III-58	R.E. Woodruff	human dung
30	Alachua	Gainesville	27-IV-58	R.E. Woodruff	malt trap
4	Alachua	Gainesville	28-IV-62	R.E. Woodruff	cow dung
1	Alachua	Gainesville	11-VIII-62	R.E. Woodruff	malt trap
1	Alachua	Gainesville	11-VII-62	R.E. Woodruff	fleshy fungus
1	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	fleshy fungus
63	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	malt trap
16	Alachua	Gainesville	4-IV-63	R.E. Woodruff	dog dung
1	Alachua	Gainesville	2-XI-65	Woodruff & Samol	propionic acid
1	Alachua	Gainesville	2-XI-65	Woodruff & Samol	asafoetida bait
1	Alachua	Gainesville	5-XI-65	Woodruff & Samol	asafoetida bait
3	Alachua	Gainesville	12-XI-65	Woodruff & Samol	yeast bait trap
1	Alachua	Gainesville	16-XI-65	Woodruff & Samol	propionic acid
34	Alachua	Gainesville	16-XI-65	Woodruff & Samol	yeast bait trap
2	Alachua	Gainesville	19-XI-65	Woodruff & Samol	yeast bait trap
3	Alachua	Gainesville	26-VII-66	A.L. O'Berry	dog dung
1	Alachua	Gainesville	15-VIII-66	R.E. Woodruff	in swimming pool
12	Alachua	Newman's Lake	5-IV-60	R.E. Woodruff	malt trap
3	Alachua	Payne's Prairie	5-VI-65	R.E. Woodruff	cow dung
1	Alachua	Warren's Cave	8-XI-61	R.E. Woodruff	cow dung
6	Baker	Glen St. Mary	19-XI-58	R.E. Woodruff	cow dung
18	Baker	Glen St. Mary	5-IV-60	E.W. Holder,Jr.	cow dung
12	Baker	Glen St. Mary	15-IV-60	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	18-IV-60	E.W. Holder,Jr.	malt trap
33	Baker	Glen St. Mary	21-IV-60	E.W. Holder,Jr.	malt trap
12	Baker	Glen St. Mary	25-IV-60	E.W. Holder,Jr.	malt trap
3	Baker	Glen St. Mary	28-IV-60	E.W. Holder,Jr.	malt trap
13	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
2	Baker	Glen St. Mary	16-XII-60	E.W. Holder,Jr.	malt trap
2	Baker	Macclenny	9-XII-60	Woodruff & Holder	
8	Calhoun	Clarksville	21-III-54	H.F. Howden	malt trap
1	Clay	Camp Crystal	6-V-67	H.V. Weems,Jr.	human feces
4	Dixie	Oldtown, 10mi. N.	29-VII-65	R.E. Woodruff	cow dung
1	Escambia	Pensacola	4-V-61	T.W. Boyd	Jap beetle trap
1	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
2	Hernando	Hog Pond	8-VIII-63	J.F. Turk	cow dung
5	Highlands	Archbold Bio. Sta.	3-VII-60	R.E. Woodruff	cow dung
2	Highlands	Avon Park	10-IV-61	R.E. Woodruff	cow dung
20	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
3	Lafayette	Mayo, 5mi. E.	20-V-60	R.E. Woodruff	malt trap
1	Lake		11-VII-58	T.J. Walker	malt trap
3	Lee	Estero	6-IV-62	R.E. Woodruff	malt trap
1	Leon	Tall Timbers Res.Sta.	12-18-X-71	D. Harris	pitfall trap
3	Levy		27-V-56	R.E. Woodruff	malt trap
1	Liberty	Torreya State Park	12-IV-60	H.V. Weems,Jr.	malt trap
1	Manatee	Oneco	12-IV-66	R.E. Woodruff	cow dung
5	Marion	Anthony	31-III-59	E.W. Holder,Jr.	dung
1	Marion	Anthony	1-IV-59	E.W. Holder,Jr.	cow dung
1	Marion	Zuber	8-IV-59	E.W. Holder,Jr.	cow dung
4	Putnam		6-I-60	R.E. Woodruff	cow dung
5	Putnam	Hawthorne, 5mi. W.	24-IV-58	R.E. Woodruff	cow dung
24	Putnam	Redwater Lake	6-I-60	R.E. Woodruff	cow dung
26	Putnam	Redwater Lake	17-VI-60	H.V. Weems,Jr.	cow dung
10	Volusia	DeLeon Springs	22-IV-60	R.E. Woodruff	malt trap
1	Volusia	DeLeon Springs	21-VI-60	C.R. Roberts	malt trap

APPENDIX 19: ONTHOPHAGUS PENNSYLVANICUS HAROLD

1	Alachua		12-V-59	R.E. Woodruff	Steiner trap
1	Alachua		12-V-59	H.V. Weems,Jr.	cow dung
7	Alachua	Austin Carey Forest	12-VI-59	H.V. Weems,Jr.	human dung
63	Alachua	Chitty Ranch	5-VI-65	R.E. Woodruff	cow dung
6	Alachua	Gainesville	29-III-58	R.E. Woodruff	human dung
4	Alachua	Gainesville	27-VII-58	R.E. Woodruff	cow dung
1	Alachua	Gainesville	28-IV-62	R.E. Woodruff	
1	Alachua	Gainesville	4-IV-63	R.E. Woodruff	dog dung
1	Alachua	Gainesville	26-VII-66	A.L. O'Berry	dog dung
2	Alachua	Gainesville	22-VIII-66	R.E. Woodruff	in swimming pool
29	Baker	Glen St. Mary	5-IV-60	E.W. Holder,Jr.	cow dung
20	Baker	Glen St. Mary	21-XII-60	E.W. Holder,Jr.	malt trap
6	Baker	Olustee	5-III-59	R.E. Woodruff	cow dung
1	Collier	Naples	8-III-60	H.W. Collins,Jr.	McPhail trap
1	Escambia	Pensacola	4-V-61	T.W. Boyd	Jap beetle trap
1	Highlands	Highlands Hammock SP	12-VII-59	R.E. Woodruff	deer droppings
3	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
30	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
1	Lake	Eustis	30-IV-62	C.L. Felshaw	Steiner trap
1	Levy		13-III-54	H.V. Weems,Jr.	
4	Levy		14-III-58	H.V. Weems,Jr.	cow dung
1	Okaloosa		15-III-55	F.W. Mead	
1	Orange	Vineland	25-II-62	H.V. Weems,Jr.	
1	Polk	Lakeland	3-IV-62	R.E. Vild	Steiner trap
1	Polk	Winter Haven	3-V-59	R.E. Woodruff	cow dung
2	Putnam	Hawthorne, 5mi. W.	24-IV-58	R.E. Woodruff	cow dung
1	Putnam	Redwater Lake	17-VI-60	H.V. Weems,Jr.	cow dung

APPENDIX 20: ONTHOPHAGUS STRIATULUS FLORIDANUS BLATCHLEY

2	Alachua		17-V-56	R.A. Morse	can traps
1	Alachua	Gainesville	7-VI-58	H.A. Denmark	
1	Alachua	Gainesville	19-IX-58	H.A. Denmark	
3	Alachua	Gainesville	4-XI-58	R.E. Woodruff	fleshy fungus
1	Alachua	Gainesville	26-XI-60	Pamela Weems	dead opossum
74	Alachua	Gainesville	9-13-VIII-62	R.E. Woodruff	fleshy fungus
1	Alachua	Gainesville	27-VIII-63	R.E. Woodruff	fleshy fungus
1	Alachua	Gainesville	5-XI-65	Woodruff & Samol	karo syrup bait
2	Alachua	Gainesville	5-XI-65	Woodruff & Samol	yeast bait trap
1	Alachua	Gainesville	12-XI-65	Woodruff & Samol	karo syrup bait
2	Alachua	Gainesville	16-XI-65	Woodruff & Samol	Staley's bait #7
1	Alachua	Gainesville	19-XI-65	Woodruff & Samol	Staley's bait #7
1	Alachua	Gainesville	19-XI-65	Woodruff & Samol	asafoetida bait
1	Alachua	Gainesville	19-XI-65	Woodruff & Samol	malt trap
1	Alachua	Gainesville	26-VIII-66	R.E. Woodruff	in swimming pool
3	Alachua	Gainesville	9-I-69	R.E. Woodruff	malt trap
1	Alachua	Gainesville	18-IX-69	D.L. Mays	malt trap
2	Alachua	Gainesville	22-VIII-71	R.E. Woodruff	fleshy fungus
12	Alachua	Newman's Lake, 2mi.W.	9-VIII-62	R.E. Woodruff	fleshy fungus
5	Alachua	Newman's Lake, 2mi.W.	10-VIII-62	R.E. Woodruff	fleshy fungus
1	Baker	Macclenny	24-VIII-66	H.W. Collins,Jr.	Steiner trap
2	Clay		5-VI-61	H.A. Denmark	decaying fungus
1	Dade	Richmond	V-48	H.F. Strohecker	
1	Franklin	St. George's Island	27-VI-5-VIII	W. Baker	pitfall trap
2	Franklin	St. George's Island	5-20-VIII-72	W. Baker	pitfall trap
3	Lafayette	Branford, 12.8mi. NW	18-II-60	Woodruff & Weems	malt trap
2	Lee	Ft. Myers	3-II-60	H.W. Collins,Jr.	malt trap
1	Lee	Ft. Myers	8-II-60	H.W. Collins,Jr.	malt trap
2	Lee	Olga	11-II-60	H.W. Collins,Jr.	malt trap
55	Leon	Tall Timbers Res.Sta.	various	Baker & Harris	pitfall traps
	(from 41 collections from May-Jan.(1968-72), with months & collections as follows: V(1), VI(2), VIII(1), IX(13), X(18), XI(4), XII(1), I(1); the most specimens (3) on 11-X-68.)				
1	Levy	Bronson, 8mi. E.	28-II-59	R.E. Woodruff	malt trap
1	Manatee		25-I-62	D.C. Chancey	McPhail trap
1	Pinellas	Dunedin	1-XI-14	W.S. Blatchley	
6	Polk	Winter Haven	16-VIII-69	Muma & Greene	can,sand pine dune
1	Seminole	Sanford	13-V-60	G.W. Desin	malt trap
1	Volusia	Deland	23-XI-60	C.R. Roberts	malt trap

APPENDIX 21: ONTHOPHAGUS TUBERCULIFRONS HAROLD

14	Alachua	Airport	11-VI-63	J.D. Spooner	decaying fish
70	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
30	Alachua	Archer	8-IV-60	R.E. Woodruff	malt trap
1	Alachua	Chitty Ranch	8-IV-69	R.E. Woodruff	cow dung
3	Alachua	Gainesville	10-X-46	H.V. Weems,Jr.	human dung
3	Alachua	Gainesville	15-I-47	H.V. Weems,Jr.	human dung
1	Alachua	Gainesville	17-VII-55	R.A. Morse	human dung
35	Alachua	Gainesville	9-XI-57	R.E. Woodruff	cow dung
13	Alachua	Gainesville	29-III-58	R.E. Woodruff	cow dung
39	Alachua	Gainesville	29-III-58	R.E. Woodruff	human dung
21	Alachua	Gainesville	1-IV-58	R.E. Woodruff	malt trap
1	Alachua	Gainesville	27-VI-58	R.E. Woodruff	cow dung
4	Alachua	Gainesville	27-VII-58	R.E. Woodruff	cow dung
1	Alachua	Gainesville	12-V-59	R.E. Woodruff	cow dung
7	Alachua	Gainesville	11-VIII-62	R.E. Woodruff	cow dung
7	Alachua	Gainesville	11-VIII-62	R.E. Woodruff	fleshy fungus
8	Alachua	Gainesville	12-VIII-62	R.E. Woodruff	cow dung
6	Alachua	Gainesville	13-VII-62	R.E. Woodruff	malt trap
8	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	fleshy fungus
11	Alachua	Gainesville	13-VIII-62	R.E. Woodruff	malt trap
6	Alachua	Gainesville	4-IV-63	R.E. Woodruff	dog dung
48	Alachua	Gainesville	2-XI-65	Woodruff & Samol	propionic acid
14	Alachua	Gainesville	2-XI-65	Woodruff & Samol	amyl acetate bait
2	Alachua	Gainesville	5-XI-65	Woodruff & Samol	propionic acid
3	Alachua	Gainesville	5-XI-65	Woodruff & Samol	asafoetida bait
51	Alachua	Gainesville	9-XI-65	Woodruff & Samol	yeast bait
13	Alachua	Gainesville	9-XI-65	Woodruff & Samol	asafoetida bait
19	Alachua	Gainesville	12-XI-65	Woodruff & Samol	asafoetida bait
2	Alachua	Gainesville	12-XI-65	Woodruff & Samol	propionic acid
13	Alachua	Gainesville	12-XI-65	Woodruff & Samol	amyl acetate bait
1	Alachua	Gainesville	12-XI-65	Woodruff & Samol	Staley's bait #7
108	Alachua	Gainesville	12-XI-65	Woodruff & Samol	yeast bait
748	Alachua	Gainesville	16-XI-65	Woodruff & Samol	yeast bait
6	Alachua	Gainesville	16-XI-65	Woodruff & Samol	asafoetida bait
1	Alachua	Gainesville	16-XI-65	Woodruff & Samol	amyl acetate bait
9	Alachua	Gainesville	16-XI-65	Woodruff & Samol	propionic acid
6	Alachua	Gainesville	16-XI-65	Woodruff & Samol	asafoetida bait
61	Alachua	Gainesville	19-XI-65	Woodruff & Samol	
1	Alachua	Gainesville	19-XI-65	Woodruff & Samol	propionic acid
7	Alachua	Gainesville	19-XI-65	Woodruff & Samol	asafoetida bait
6	Alachua	Gainesville	2-VI-69	R.E. Woodruff	dead skunk
1	Alachua	Melrose	16-I-63	T.R. Adkins	Steiner trap
11	Alachua	Melrose, 2mi. S.	21-XII-64	R.E. Woodruff	horse dung
9	Alachua	near Newnan's Lake	4-IV-60	R.E. Woodruff	malt trap
8	Alachua	Newnan's Lake, 2mi. W.	9-VIII-62	R.E. Woodruff	fleshy fungus
6	Alachua	Newnan's Lake	27-VII-69	R.E. Woodruff	human dung
12	Alachua	Payne's Prairie	5-VI-65	R.E. Woodruff	cow dung
8	Alachua	Waccasassa Flats	13-VII-58	S.K. Derr	cow dung
223	Alachua	near Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
24	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
13	Baker	Glen St. Mary	5-IV-60	E.W. Holder,Jr.	cow dung
40	Baker	Glen St. Mary	15-IV-60	E.W. Holder,Jr.	malt trap
60	Baker	Glen St. Mary	16-IV-60	E.W. Holder,Jr.	malt trap
52	Baker	Glen St. Mary	18-IV-60	E.W. Holder,Jr.	malt trap

(continued)

APPENDICES 21-23

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
75	Baker	Glen St. Mary	21-IV-60	E.W. Holder,Jr.	malt trap
80	Baker	Glen St. Mary	25-IV-60	E.W. Holder,Jr.	malt trap
83	Baker	Glen St. Mary	28-IV-60	E.W. Holder,Jr.	malt trap
700+	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
3	Baker	Glen St. Mary	5-XII-60	E.W. Holder,Jr.	malt trap
85	Baker	Glen St. Mary	16-XII-60	E.W. Holder,Jr.	malt trap
13	Baker	Glen St. Mary	21-XII-60	E.W. Holder,Jr.	malt trap
140	Baker	Glen St. Mary	26-XII-60	E.W. Holder,Jr.	malt trap
40	Baker	Glen St. Mary	14-I-61	R.E. Woodruff	malt trap
3	Baker	Glen St. Mary	14-II-61	E.W. Holder,Jr.	cow dung
4	Baker	Glen St. Mary	20-II-61	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	23-II-61	E.W. Holder,Jr.	malt trap
1	Baker	Macclenny	2-XII-60	E.W. Holder,Jr.	malt trap
100	Baker	Macclenny	9-XII-60	Woodruff & Holder	malt trap
5	Baker	Macclenny	13-XII-60	E.W. Holder,Jr.	malt trap
95	Baker	Macclenny	26-XII-60	E.W. Holder,Jr.	malt trap
20	Baker	Macclenny	2-I-61	E.W. Holder,Jr.	malt trap
50	Baker	Macclenny	12-I-61	E.W. Holder,Jr.	malt trap
8	Baker	Macclenny	31-I-61	E.W. Holder,Jr.	malt trap
6	Bay	St. Andrews St. Pk.	19-V-60	R.E. Woodruff	malt trap
4	Calhoun	Clarksville	21-III-54	H.F. Howden	malt trap
10	Clay	Camp Crystal	6-V-67	H.V. Weems,Jr.	in human feces
11	Clay	Goldhead Branch SP	1-V-65	R.E. Woodruff	cow dung
1	Collier	Naples	8-III-60	H.W. Collins,Jr.	medfly trap
1	Dade	Miami Beach	25-V-66	J.E. Porter	
1	Dade	Perrine	21-I-66	D.M. Habeck	Butyl acetate bait
4	Dade	Richmond	21-I-66	D.M. Habeck	Butyl acetate bait
4	DeSoto	Arcadia	21-I-60	R.E. Woodruff	cow dung
9	Dixie	Oldtown, 10mi. N.	27-VII-65	R.E. Woodruff	cow dung
3	Hardee	Hog Pond	8-VI-63	J.F. Turk	cow dung
1	Highlands		1-II-59	H.V. Weems,Jr.	malt trap
30	Highlands	Archbold Bio. Sta.	3-VII-60	R.E. Woodruff	cow dung
2	Highlands	Avon Park	27-IV-48	C.J. Bickner	on Citrus sp.
16	Highlands	Avon Park	10-IV-61	R.E. Woodruff	cow dung
6	Highlands	Sebring	11-IV-61	J.C. Hanlon	cow dung
1	Hillsborough	Brandon	15-I-62	J.W. Patton	dog dung
22	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
2	Jackson		18-III-58	H.V. Weems,Jr.	dung
1	Lake	Clermont	28-XI-61	W.P. Henderson	rotting Citrus sp.
1	Lake	Lake Jem	22-V-63	E.R. Fatic	
1	Lake	Tavares	27-V-66	C.L. Felshaw	Steiner trap
10	Lafayette	Mayo, 5mi. E.	16-20-V-60	R.E. Woodruff	malt trap
1	Leon	Tall Timbers Res.Sta.	6-13-XII-71	D. Harris	pitfall
1	Levy		31-IV-48	W. Thames	
24	Levy		14-III-58	H.V. Weems,Jr.	dung
1	Levy	Bronson, 8mi. E.	25-II-59	R.E. Woodruff	malt trap
4	Levy	Otter Creek	14-III-58	R.E. Woodruff	cow dung
18	Liberty	Torrey State Park	12-IV-60	H.V. Weems,Jr.	malt trap
1	Manatee	Bradenton	20-IV-56	C.J. Bickner	rotten citrus
1	Manatee	Oneco	12-IV-66	R.E. Woodruff	cow dung
3	Marion	Anthony	31-III-59	E.W. Holder,Jr.	dung
1	Marion	Oklawaha	21-X-59	M.H. Mumm	Berlese sample
1	Marion	Wiersdale	16-XII-63	T.R. Adkins	Steiner trap
3	Martin		1-II-59	R.E. Woodruff	malt trap
6	Osceola	Holopaw	1-II-59	R.E. Woodruff	dog carrion
24	Osceola	Narcoosee, 7.4mi. S.	1-II-59	R.E. Woodruff	malt trap
1	Palm Beach	West Palm Beach	25-X-56	R.A. Long	poinsettia
9	Pasco	Lacoochee, 6mi. NE	12-XII-65	A.L. O'Berry	cow dung
1	Pinellas	Dunedin	24-III-13	W.S. Blatchley	
1	Pinellas	Dunedin	9-III-18	W.S. Blatchley	
1	Pinellas	Dunedin	18-III-18	W.S. Blatchley	
1	Pinellas	Dunedin	16-22	W.S. Blatchley	
1	Pinellas	Dunedin	14-V-59	R.E. Woodruff	human dung
1	Pinellas	Tarpon Springs	29-IV-59	R.E. Woodruff	cow dung
1	Polk	Ft. Meade	30-XI-61	R.E. Vild	Steiner trap
1	Polk	Winter Haven	3-V-59	R.E. Woodruff	cow dung
3	Polk	Winter Haven	16-VIII-66	Muma & Greene	can,sand pine dune
78	Putnam		6-I-60	R.E. Woodruff	cow dung
35	Putnam	near Hawthorne	17-I-59	R.E. Woodruff	cow dung
95	Putnam	Hawthorne, 5mi. E.	5-I-60	R.E. Woodruff	cow dung
8	Putnam	near Lake Suzan	23-II-58	R.E. Woodruff	cow dung
41	Putnam	near Lake Suzan	17-I-59	R.E. Woodruff	cow dung
10	Putnam	near Lake Suzan	6-II-59	R.E. Woodruff	cow dung
2	Putnam	near Redwater Lake	17-I-59	R.E. Woodruff	horse dung
45	Putnam	Redwater Lake	17-VI-60	H.V. Weems,Jr.	cow dung
4	St. Lucie	Ft. Pierce, 5mi. S.	27-I-59	R.E. Woodruff	human dung
7	St. Lucie	Ft. Pierce, 10mi. S.	27-I-59	R.E. Woodruff	human dung
1	Sarasota	Sarasota	9-II-11	W.S. Blatchley	
1	Sarasota	Sarasota	21-II-11	W.S. Blatchley	
1	Sarasota	Sarasota	6-VIII-63	J.T. Holden	Steiner trap
1	Seminole	Casselberry	15-VII-59	C.O. Youtsey	
1	Seminole	Fern Park	18-VII-60	G.W. Desin	
4	Seminole	Sanford	2-V-60	G.W. Desin	malt trap
1	Seminole	Sanford	27-V-63	G.W. Desin	
4	Volusia	Deland	23-XI-60	C.R. Roberts	malt trap
7	Volusia	DeLeon Springs	22-IV-60	R.E. Woodruff	malt trap
22	Volusia	DeLeon Springs	21-VI-60	C.R. Roberts	malt trap
5	Volusia	DeLeon Springs	8-VII-60	C.R. Roberts	malt trap
4	Volusia	DeLeon Springs	10-VIII-60	C.R. Roberts	malt trap
1	?	Bloomfield	24-IV-63	R. Fatic	

APPENDIX 22: APHODIUS AEGROTUS HORN

1	Alachua	(Paratype)	28-VI-38	H.K. Wallace	Geomys burrow
1	Alachua	Gainesville(Paratype)	21-VIII-22	G.B. Merrill	
1	Alachua	Gainesville	10-VII-27	J.S. Rogers	
98	Alachua	Gainesville	various	various	blacklight trap
	(from 43 collections from Feb.-Nov.(1956-72),with months & collections as follows: II(1),III(4),IV(3),V(3),VI(6),VII(7),VIII(2),IX(5),X(11),XI(1);the most specimens (13) on 3-10-VIII-72.)				
27	Alachua	Gainesville, SE	4-19-VII-63	J.F. Anderson	Geomys burrows
1	Brevard	Eau Gallie (Paratype)	1-V-38	C.C. Goff	Geomys burrows
1	Brevard	Eau Gallie (Paratype)	9-VIII-38	C.C. Goff	Geomys burrows
1	Duval	Jacksonville	16-VII-69	R. King	blacklight trap
1	Duval	St. Nicholas		Ashmead	(USNM)
29	Escambia	Pensacola	various	T.W. Boyd	blacklight trap
	(from 11 collections from May-Aug.(1960-62),the most specimens (6) on 25-V-60.)				
1	Highlands	Lake Letta Subdiv.	27-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	19-VII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	19-VII-62	T. Morris	blacklight trap
6	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
1	Jefferson	Monticello	29-VII-59	A.M. Phillips	blacklight trap
1	Lake	Tavares, 2mi. S.	25-IV-67	R.E. Woodruff	blacklight trap
1	Okaloosa	Crestview	5-IX-68	J. Carter	blacklight trap
7	Okaloosa	Crestview	6-IX-68	J. Carter	blacklight trap
1	Orange	Apopka	9-X-68	H. Van Pelt	blacklight trap
1	Orange	Winter Park	15-VIII-39	H.T. Fernald	
1	Orange	Winter Park	15-V-44	H.T. Fernald	
1	Pinellas	Dunedin	10-VI-15	W.S. Blatchley	
1	Pinellas	Dunedin	7-III-19	W.S. Blatchley	
1	Putnam	Interlachen 2mi. SW	6-X-71	Woodruff & Graham	blacklight trap
1	Seminole	Sanford	2-IX-60	G.W. Desin	blacklight trap
2	Taylor	Perry	18-IV-69	W.L. Beers	blacklight trap

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST

APPENDIX 23: APHODIUS CAMPESTRIS BLATCHLEY

1	Alachua		30-III-54	H.A. Denmark	at light
1	Alachua		8-V-54	H.V. Weems, Jr.	at light
1	Alachua		17-III-55	R.A. Morse	at light
1	Alachua		12-IV-55	R.A. Morse	at light
13	Alachua	Archer	20-II-48	M.W. Nirenberg	
9	Alachua	Archer	6-IV-60	R.E. Woodruff	malt trap
4	Alachua	Archer	8-IV-60	R.E. Woodruff	malt trap
1	Alachua	Chantilly Acres	23-VI-67	F.S. Blanton	mosq.light trap
1	Alachua	Chantilly Acres	18-VII-67	F.S. Blanton	mosq.light trap
1	Alachua	Chantilly Acres	17-X-67	F.S. Blanton	mosq.light trap
1	Alachua	Chantilly Acres	19-21-IX-69	F.S. Blanton	mosq.light trap
1	Alachua	Chitty Ranch	8-IV-69	R.E. Woodruff	cow dung
1	Alachua	Gainesville	2-III-25	T.H. Hubbell	
1	Alachua	Gainesville	15-IV-25	T.H. Hubbell	
1	Alachua	Gainesville	17-IV-25	T.H. Hubbell	
1	Alachua	Gainesville	26-V-25	T.H. Hubbell	
2	Alachua	Gainesville	5-IV-37	G.B. Merrill	
2	Alachua	Gainesville	14-III-39	G.B. Merrill	
1	Alachua	Gainesville	29-III-39	G.B. Merrill	
4	Alachua	Gainesville	15-IV-39	G.B. Merrill	
1	Alachua	Gainesville	15-II-46	H.V. Weems,Jr.	
785	Alachua	Gainesville	various	various	blacklight trap
	(from 129 collections from Jan.-Dec.(1948-72),with months and collections as follows: I(3),II(6),III(8),IV(7),V(17),VI(20),VII(19),VIII(9), IX(18),X(12),XI(6),XII(4); the most specimens (177) on 3-10-VIII-72.)				
2	Alachua	Newberry	23- V-48	M.W. Nirenberg	
1	Alachua	Newberry,2.3mi.N.	23-IV-48	M.W. Nirenberg	
2	Alachua	Newnan's Lake	27-II-48	M.W. Nirenberg	
10	Alachua	Newnan's Lake	4-IV-60	R.E. Woodruff	malt trap
2	Alachua	Newnan's Lake, 2mi.W.	9-VIII-62	R.E. Woodruff	fleshy fungus
8	Alachua	San Felasco Hammock	16-III-48	M.W. Nirenberg	
3	Alachua	Warren's Cave, near	8-XII-61	R.E. Woodruff	cow dung
3	Baker	Glen St. Mary	19-IX-58	E.W. Holder,Jr.	cow dung
6	Baker	Glen St. Mary	15-IV-60	E.W. Holder,Jr.	malt trap
12	Baker	Glen St. Mary	19-IV-60	E.W. Holder,Jr.	malt trap
3	Baker	Glen St. Mary	10-V-60	E.W. Holder,Jr.	malt trap
8	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
17	Baker	Glen St. Mary	16-XII-60	E.W. Holder,Jr.	malt trap
7	Baker	Glen St. Mary	26-XII-60	E.W. Holder,Jr.	malt trap
1	Baker	Glen St. Mary	8-X-69	H.W. Collins,Jr.	blacklight trap
4	Baker	Macclenny	9-XII-60	Holder & Woodruff	malt trap
2	Baker	Macclenny	13-XII-60	Holder & Woodruff	malt trap
6	Baker	Macclenny	26-XII-60	E.W. Holder,Jr.	malt trap
3	Baker	Olustee	16-V-63	E.P. Merkel	blacklight trap
10	Baker	Olustee	22-V-63	E.P. Merkel	blacklight trap
6	Baker	Olustee	7-V-66	E.P. Merkel	blacklight trap
2	Baker	Olustee	11-VI-66	E.P. Merkel	blacklight trap
7	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
9	Baker	Olustee	13-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	20-VII-66	E.P. Merkel	blacklight trap
18	Baker	Olustee	23-VIII-66	E.P. Merkel	blacklight trap
8	Baker	Olustee	16-21-IX-66	E.P. Merkel	blacklight trap
1	Bay	St. Andrews SP	19-V-60	R.E. Woodruff	malt trap
1	Brevard	Merritt Island	11-III-56	H.V. Weems,Jr.	at light
13	Calhoun	Clarksville	21-III-54	H.F. Howden	malt trap
1	Clay		4-VIII-61	H.A. Denmark	at light
1	Clay		11-VIII-61	H.A. Denmark	at light
2	Clay	Green Cove Springs	1-VIII-42	R.C. Barnes	mosq.light trap
1	Collier	Immokalee	23-29-III-60	A.F. Wilson	blacklight trap
1	Collier	Immokalee	29-II-60	A.F. Wilson	blacklight trap
1	Collier	Immokalee	8-IV-60	H.M. Faircloth	blacklight trap
2	Collier	Naples, 9mi. W.	13-IX-63	B. K. Dozier	
1	Dade	Miami	18-VII-60	P.E. Briggs	blacklight trap
1	Dade	Miami	22-VII-60	P.E. Briggs	blacklight trap
1	Duval	Jacksonville	27-VII-42	R.C. Barnes	mosq.light trap
3	Duval	Jacksonville	10-X-42	R.C. Barnes	mosq.light trap
1	Duval	Mayport	19-VII-61	L.W. Taylor	blacklight trap
4	Escambia	Bratt	25-VII-68	F.S. Blanton	blacklight trap
1	Escambia	Molino	26-IX-68	T.C. Bishop	blacklight trap
1	Escambia	Molino	10-IV-69	E.N. Bishop	blacklight trap
4	Escambia	Molino	24-IV-69	T.C. Bishop	blacklight trap
1	Escambia	Molino	15-IV-69	E.N. Bishop	blacklight trap
5	Escambia	Pensacola	5-VIII-42	R.C. Barnes	mosq.light trap
1	Escambia	Pensacola	30-VIII-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	13-III-61	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	25-VI-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	1-VIII-61	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	22-VIII-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	23-V-62	T.W. Boyd	blacklight trap
1	Gadsden	Quincy	27-VII-59	W.B. Tappan	blacklight trap
14	Glades	Palmdale, 11mi. S.	19-II-65	R.E. Woodruff	cow dung
1	Gulf	Wewahitchka	23-IX-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	20-VIII-69	C. Laird	blacklight trap
1	Gulf	Wewahitchka	24-VIII-69	C. Laird	blacklight trap
1	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
5	Highlands	Archbold Bio. Sta.	3-VII-60	R.E. Woodruff	cow dung
6	Highlands	Archbold Bio. Sta.	19-III-68	R.E. Woodruff	malt trap
1	Highlands	Highlands Hammock SP	5-VI-60	L.J. Bottimer	deer droppings
1	Highlands	Lake Letta Subdiv.	19-VI-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
5	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	7-XI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	15-XI-61	T. Morris	blacklight trap
6	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	19-VII-62	T. Morris	blacklight trap
3	Highlands	Lake Placid	20-I-60	R.E. Woodruff	cow dung
2	Highlands	Sebring	30-VII-62	T. Morris	blacklight trap
2	Hillsborough	Brandon	12-V-66	J.W. Patton	blacklight trap
16	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
1	Hillsborough	Tampa	28-I-43	R.C. Barnes	mosq.light trap
8	Hillsborough	Tampa	14-V-60	E.E. Crooks	blacklight trap
1	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
1	Indian River	Vero Beach	17-18-V-64	W.L. Bidlingmayer	truck trap #8
1	Indian River	Vero Beach	17-18-V-64	W.L. Bidlingmayer	suction trap #3
3	Jackson		27-VIII-69	E.L. Tipton	blacklight trap
1	Jackson	Florida Caverns SP	18-IV-63	R.E. Woodruff	blacklight trap
5	Jackson	Jim Woodruff Dam	25-V-54	C.L. Ramsey	mosq.light trap
1	Jackson	Sneads	21-V-54	J.P. McDaniel	mosq.light trap
6	Jackson	Sneads	25-V-54	J.P. McDaniel	mosq.light trap
110	Jefferson	Big Bend Hort.Lab.	various	various	blacklight trap
	(from 33 collections from Mar.-Nov.(1956-69),with months & collections as follows: II(2),IV(5),V(6),VI(1),VII(4),VIII(8),IX(7),X(2),XI(1); the most specimens (26) on 18-IV-69.)				
7	Lafayette	Mayo, 5mi. E.	20-V-60	R.E. Woodruff	malt trap
5	Lee	Estero	6-IV-62	R.E. Woodruff	malt trap
1	Lee	Ft. Myers	28-I-44	C.S. Tuthill	on tomato
1	Lee	Sanibel Island	30-XII-66	F.S. Blanton	mosq.light trap
1	Leon	Tallahassee	20-III-54	H.F. Howden	
29	Leon	Tall Timbers Res.Sta.	various	various	blacklight trap
	(From 16 collections from May-Oct.(1969).)				
1	Levy	Bronson, 8mi. E.	28-II-59	R.E.Woodruff	malt trap

(continued)

APPENDICES 23-28

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
4	Levy	Manatee Springs	27-VII-68	S.K. Derr	blacklight trap
1	Levy	Sea Horse Key	7-IX-57	H.A. Denmark	at light
6	Liberty	Torreya State Park	12-IV-60	H.V. Weems,Jr.	malt trap
8	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
5	Manatee		23-VIII-65	B.K. Dozier	
7	Manatee	Oneco		P. Dillman	
4	Manatee	Oneco	13-IV-66	R.E. Woodruff	blacklight trap
2	Marion	Anthony	31-III-59	E.W. Molder,Jr.	dung
2	Marion	Juniper Springs	22-I-60	H.A. Denmark	Berlese sample
1	Marion	Juniper Springs	23-III-60	H.A. Denmark	Berlese sample
1	Marion	Juniper Springs	28-IV-60	H.A. Denmark	Berlese sample
1	Marion	Ocala	6-IV-59	R.E. Woodruff	at light
2	Marion	Ocala	16-VI-62	T.R. Adkins	blacklight trap
6	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
1	Nassau	Ft. Clinch SP	4-IV-64	H.V. Weems,Jr.	at light
1	Okaloosa	Crestview	6-IX-68	J.H. Carter	blacklight trap
1	Okaloosa	Crestview	19-IX-68	J.H. Carter	blacklight trap
1	Okaloosa	Crestview	29-IX-68	J.H. Carter	blacklight trap
1	Okaloosa	Eglin AFB,3mi.S.Holt	4-X-66	R.E. Woodruff	blacklight trap
1	Orange	Apopka	3-X-68	R.E. Woodruff	blacklight trap
4	Orange	Apopka	9-X-68	H. Van Pelt	blacklight trap
1	Orange	Winter Park	9-V-40	H.T. Fernald	
1	Orange	Winter Park	14-III-42	H.T. Fernald	
1	Orange	Winter Park	3-X-42	H.T. Fernald	
16	Osceola	Narcoosee,7.4mi. S.	1-II-59	R.E. Woodruff	malt trap
12	Pasco	Lacoochee, 6mi. NE	12-XII-65	A.L. O'Berry	cow dung
1	Pinellas	Dunedin	11-II-13	W.S. Blatchley	
1	Pinellas	Dunedin	8-IV-21	W.S. Blatchley	
1	Pinellas	Dunedin	14-XII-23	W.S. Blatchley	
1	Pinellas	Dunedin	16-XII-24	W.S. Blatchley	
1	Pinellas	Dunedin	15-IV-25	W.S. Blatchley	
1	Pinellas	St. Petersburg	1-VI-59	C.E. Bingaman	blacklight trap
1	Pinellas	Tarpon Springs	20-III-50	H.F. Howden	at light
1	Putnam		24-IV-58	R.E. Woodruff	cow dung
1	Putnam		6-I-59	R.E. Woodruff	cow dung
1	Putnam	Interlachen, 8mi.SE	21-III-53	Howden & Dozier	malt trap
2	Putnam	Interlachen	29-III-60	R.E. Woodruff	cow dung
1	Putnam	Lake Suzan, near	11-II-59	R.E. Woodruff	cow dung
1	Putnam	Melrose, 2 mi. S.	21-XII-64	R.E. Woodruff	horse dung
1	Putnam	Red Water Lake	6-I-60	R.E. Woodruff	cow dung
1	Putnam	Red Water Lake	27-28-V-67	H.V. Weems,Jr.	blacklight trap
32	Putnam	Welaka	19-24-III-67	R.E. Woodruff	malt trap
1	Putnam	Welaka,U.of F.Reserve	9-IV-64	H.A. Denmark	blacklight trap
1	Santa Rosa	Blackwater River SP	16-VIII-71	H.V. Weems,Jr.	at light
1	Santa Rosa	Milton	30-VIII-68	Bill Zain	blacklight trap
1	Sarasota	Sarasota	17-II-11	W.S. Blatchley	
1	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
2	St. Lucie	Jensen Beach, 6mi. N.	1-II-59	R.E. Woodruff	cow dung
1	St. Lucie	Ft. Pierce, 10mi. S.	27-I-59	R.E. Woodruff	human dung
2	Suwannee	Branford	10-XI-65	G.K. Hicks	mosq.light trap
107	Taylor	Perry	various	Beers & Merkel	blacklight trap
	(from 28 collections from Apr.-Aug.(1960-69),with months & collections as follows: IV(4),V(8),VI(4),VII(4),VIII(8); the most specimens (14) on 23-VII-68.)				
55	Volusia	DeLand	23-XI-60	C.R. Roberts	malt trap
2	Volusia	DeLeon Springs	22-IV-60	R.E. Woodruff	malt trap
10	Volusia	DeLeon Springs	21-VI-60	C.R. Roberts	malt trap
5	Volusia	DeLeon Springs	8-VII-60	C.R. Roberts	malt trap
2	Volusia	New Smyrna Beach	10-VI	M. Wright	
1	Washington	Chipley, 5 mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 24: APHODIUS CRASSULUS HORN

6	Alachua	Newnan's Lake	27-II-48	M.W. Nirenberg	
3	Alachua	San Felasco Hammock	16-III-48	M.W. Nirenberg	
2	Baker	Olustee	5-III-59	R.E. Woodruff	cow dung
1	Bradford	Starke	3-XI-34	F.N. Young	
12	Leon	Tall Timbers Res.Sta.	various	Baker & Harris	pitfall traps
	(from 11 collections from Sept.-Jan.(1969-71).				
3	Levy	Otter Creek	14-III-58	H.V. Weems,Jr.	cow dung
2	Levy	Otter Creek	14-III-58	R.E. Woodruff	cow dung
8	Pasco	Lacoochee, 6mi. NE	12-XII-65	A.L. O'Berry	cow dung
3	Putnam		23-II-58	R.E. Woodruff	cow dung
12	Putnam	Hawthorne, 5mi. E.	5-I-60	R.E. Woodruff	cow dung
39	Putnam	Redwater Lake,3/4mi.NE	17-I-59	R.E. Woodruff	horse dung
5	Putnam	Redwater Lake	6-I-60	R.E. Woodruff	cow dung in open
3	Putnam	Redwater Lake, 2mi.E.	6-I-60	R.E. Woodruff	cow dung in shade
2	Putnam	Redwater Lake	22-III-62	R.E. Woodruff	cow dung

APPENDIX 25: APHODIUS CUNICULUS CHEVROLAT

2	Alachua	Archer	20-II-48	M.W. Nirenberg	
66	Alachua	Gainesville	various	Woodruff & Perry	blacklight trap
	(from 22 collections from May-Feb.(1959-69);the most specimens (9) on 8-X-59).				
7	Alachua	Newnan's Lake	27-II-48	M.W. Nirenberg	
6	Alachua	near Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
1	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
3	Charlotte	Punta Gorda	15-VI-59	R.E. Woodruff	at light
4	Charlotte	Punta Gorda	20-X-60	H.M. Faircloth	blacklight trap
2	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
1	Charlotte	Punta Gorda	9-XI-60	H.M. Faircloth	blacklight trap
1	Collier	Immokalee	4-II-60	A.F. Wilson	blacklight trap
4	Collier	Immokalee	18-V-60	H.M. Faircloth	blacklight trap
7	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
1	Dade	Hialeah	VIII-62	L.B. Hill	
1	Dade	Miami	18-III-34	F.N. Young	
5	Dade	Miami	V-49	Strohecker colln.	
1	Dade	Miami	IX-49	Strohecker colln.	
4	Dade	Miami	III-59	C.F. Dowling	blacklight trap
3	Dade	Miami	18-VI-60	P.E. Briggs	blacklight trap
2	Dade	Miami	9-V-61	P.E. Briggs	blacklight trap
1	Dade	Miami Internat.Airport	2-IX-65	J.E. Porter	mosq.light trap
1	Dade	Miami Internat.Airport	18-IX-65	J.E. Porter	mosq.light trap
2	Dade	Miami Internat.Airport	31-III-66	J.E. Porter	mosq.light trap
1	Dade	Miami Beach	12-X-64	J.E. Porter	mosq.light trap
1	Dade	Miami Beach	21-X-64	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	11-VII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	15-VII-66	J.E. Porter	mosq.light trap
1	Dade	Royal Palm Park	5-IV-27	W.S. Blatchley	
1	Dade	South Miami	2-V-59	C.F. Dowling	blacklight trap
1	Dade	USDA Plant Intro.Sta.	10-IV-61	P.E. Briggs	blacklight trap
6	Glades	Lakeport	18-V-54	Kornegay	mosq.light trap
7	Glades	Palmdale, 11mi. S.	19-II-65	R.E. Woodruff	cow dung
37	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
10	Highlands	Archbold Bio. Sta.	3-VII-60	R.E. Woodruff	cow dung
13	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	8-VIII-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	16-VIII-61	T. Morris	blacklight trap
23	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
17	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	10-X-61	T. Morris	blacklight trap
4	Highlands	Lake Letta Subdiv.	18-X-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
5	Highlands	Lake Placid	20-I-60	R.E. Woodruff	cow dung
1	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
5	Indian River	Vero Beach	18-V-54	Hearne	mosq.light trap
3	Indian River	Vero Beach	2-XI-61	R.E. Woodruff	at light
2	Indian River	Vero Beach	12-V-64	W.L. Bidlingmayer	suction trap
75	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
50	Indian River	Vero Beach	11-VI-64	W.L. Bidlingmayer	truck trap
3	Indian River	Vero Beach	2-XI-64	W.L. Bidlingmayer	truck trap
3	Lee	Boca Grande Island	6-VI-61	H.M. Faircloth	blacklight trap
1	Lee	Boca Grande Island	9-VI-61	H.M. Faircloth	blacklight trap
5	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
9	Lee	Ft. Myers	7-IX-61	H.M. Faircloth	blacklight trap
1	Lee	Ft. Myers	14-III-63	H.M. Faircloth	blacklight trap
1	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	mosq.light trap
1	Martin	Salerno	18-V-54	Martin	mosq.light trap
2	Monroe	Stock Island	14-II-67	F.A. Buchanan	blacklight trap
1	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
2	Orange	Apopka	3-X-68	R.E. Woodruff	blacklight trap
13	Pasco	Lacoochee, 6mi. NE	12-XII-65	A.L. O'Berry	cow dung
1	Pinellas	Dunedin	8-II-21	W.S. Blatchley	
1	Pinellas	Dunedin	15-IV-25	W.S. Blatchley	
13	Putnam	Hawthorne, 5mi. E.	6-I6-0	R.E. Woodruff	cow dung
4	Putnam	Interlachen, 2mi. SW	6-I-71	Woodruff & Graham	blacklight trap
1	Putnam	near Lake Suzan	17-I-59	R.E. Woodruff	cow dung
3	Putnam	near Redwater Lake	17-I-59	R.E. Woodruff	horse dung
25	Putnam	near Redwater Lake	6-I-60	R.E. Woodruff	cow dung
1	Putnam	Welaka, 3mi. N.	20-III-67	Woodruff & Lloyd	cow dung
1	Putnam	Welaka, 2air mi. NE	20-III-67	R.E. Woodruff	cow dung
1	St. Johns	St. Augustine	20-I-11	W.S. Blatchley	
2	Sarasota	Sarasota	30-I-11	W.S. Blatchley	
2	Sarasota	Sarasota	4-II-11	W.S. Blatchley	
2	Sarasota	Sarasota	9-II-11	W.S. Blatchley	
2	Sarasota	Sarasota	25-II-11	W.S. Blatchley	
1	Seminole	Sanford	25-II-11	W.S. Blatchley	
1	Seminole	Sanford	17-XI-60	G.W. Desin	blacklight trap
39	Seminole	Sanford	23-XI-60	G.W. Desin	blacklight trap
68	Seminole	Sanford	1-XI-61	G.W. Desin	blacklight trap
250+	Seminole	Sanford	8-XI-61	G.W. Desin	blacklight trap
50+	Seminole	Sanford	20-XII-61	G.W. Desin	blacklight trap
5	Seminole	Sanford	3-VII-62	G.W. Desin	blacklight trap
1	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
2	Sumter	Sumterville, 1mi. W.	5-XII-66	R.E. Woodruff	cow dung
2	Taylor	Steinhatchee	18-V-54	Wood	mosq.light trap
20	Volusia		23-VII-54	H.A. Denmark	at light

APPENDIX 26: APHODIUS FIMETARIUS (LINNAEUS)

7	Alachua		24-II-48	M.W. Nirenberg	
2	Alachua	Chitty Ranch	8-IV-69	R.E. Woodruff	cow dung
1	Alachua	Gainesville	15-XI-46	H.V. Weems,Jr.	
1	Alachua	Gainesville	12-IV-47	H.V. Weems,Jr.	
1	Alachua	Melrose, 2mi. S.	21-XII-64	R.E. Woodruff	horse dung
30	Alachua	near Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
1	Clay	Goldhead Branch St.Pk.	1-V-55	F.W. Mead	
1	Gadsden	Quincy	30-IV-56	F.W. Mead	
21	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
1	Jefferson	Monticello		R.E. Woodruff	cow dung
1	Levy		14-III-58	H.V. Weems,Jr.	cow dung
1	Orange		22-I-60	J.R. Hunt	cow dung
8	Putnam		6-I-60	R.E. Woodruff	cow dung
15	Putnam	near Lake Suzan	17-I-59	R.E. Woodruff	cow dung
5	Putnam	near Redwater Lake	17-I-59	R.E. Woodruff	horse dung
18	Putnam	Welaka, 2mi. N.	21-III-67	Woodruff & Lloyd	cow dung

APPENDIX 27: APHODIUS FLORIDANUS ROBINSON

1	Alachua	Gainesville	7-IV-57	L.A. Hetrick	blacklight trap
13	Alachua	Newnan's Lake	27-II-48	M.W. Nirenberg	
6	Alachua	San Felasco Hammock	16-III-48	M.W. Nirenberg	
2	Baker	Olustee	5-III-59	R.E. Woodruff	cow dung
2	Collier		10-IV-58	R.E. Woodruff	rabbit dung
1	Collier		10-IV-58	H.V. Weems,Jr.	
3	Collier	Immokalee	4-IV-60	H.M. Faircloth	blacklight trap
1	Collier	Immokalee	13-IV-60	H.M. Faircloth	blacklight trap
2	Collier	Immokalee	18-V-60	H.M. Faircloth	blacklight trap
1	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
1	Dade		IV-49	H.F. Strohecker	
1	Dade	Miami	2-I-59	C.F. Dowling	at light
4	Dade	Miami	9-V-61	P.E. Briggs	blacklight trap
2	Gadsden	Quincy	9-II-59	W.B. Tappan	blacklight trap
2	Gadsden	Quincy	26-II-62	W.B. Tappan	blacklight trap
2	Glades	Palmdale, 11mi. S.	19-II-65	R.E. Woodruff	cow dung
4	Hendry	Clewiston	20-V-58	R.E. Woodruff	human dung
1	Highlands	Lake Placid	20-I-60	R.E. Woodruff	cow dung
7	Highlands	Highlands Hammock SP	5-VI-60	R.E. Woodruff	deer droppings
1	Highlands	Highlands Hammock SP	3-VII-60	R.E. Woodruff	deer droppings
1	Indian River	Vero Beach	9-IV-64	W.L. Bidlingmayer	truck trap #1
1	Jackson	Florida Caverns SP	18-IV-63	R.E. Woodruff	blacklight trap
17	Jefferson	Monticello	28-IV-58	A.M. Phillips	blacklight trap
2	Jefferson	Monticello	25-III-59	A.M. Phillips	blacklight trap
4	Jefferson	Monticello	27-IV-59	A.M. Phillips	blacklight trap
1	Leon	Tall Timbers Res.Sta.	18-26-X-71	D. Harris	pitfall trap
1	Levy		23-II-57	H.V. Weems,Jr.	in dung
2	Levy	Otter Creek	14-III-58	R.E. Woodruff	cow dung
1	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
11	Putnam	Redwater Lake	22-III-62	R.E. Woodruff	cow dung
2	Santa Rosa	Chumukla (Exp. Sta.)	4-IV-58	M. Lutrick	blacklight trap
2	Santa Rosa	Chumukla (Exp. Sta.)	18-IV-58	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	24-IV-58	M. Lutrick	blacklight trap
1	Santa Rosa	Jay	23-V-62	T.W. Boyd	blacklight trap
1	Sarasota	Sarasota	10-IV-54		at light
3	Seminole	Sanford	20-I-62	G.W. Desin	blacklight trap
21	Seminole	Sanford	27-II-62	G.W. Desin	blacklight trap

APPENDIX 28: APHODIUS LAEVIGATUS HALDEMAN

3	Alachua		28-VI-38	H.K. Wallace	Geomys burrows
1	Alachua	Gainesville	25-IV-57	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville	1-IV-61	G.O. Platt	
27	Alachua	Gainesville	11-V-63	J.F. Anderson	Geomys burrows
1	Alachua	Gainesville	24-V-63	J.F. Anderson	Geomys burrows
1	Alachua	Gainesville	26-V-63	R.E. Woodruff	Geomys burrows
1	Alachua	Gainesville	9-VI-63	J.F. Anderson	Geomys burrows
1	Alachua	Gainesville	16-VI-63	J.F. Anderson	Geomys burrows
1	Alachua	Gainesville	22-VI-63	J.F. Anderson	Geomys burrows
6	Alachua	Gainesville	23-VI-63	J.F. Anderson	Geomys burrows
1	Alachua	Gainesville	26-VI-63	J.F. Anderson	Geomys burrows

(continued)

APPENDICES 28-29

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
9	Alachua	Gainesville	4-VII-63	J.F. Anderson	Geomys burrows
2	Alachua	Gainesville	7-VII-63	J.F. Anderson	Geomys burrows
60	Alachua	Gainesville	various	Woodruff & Mead	blacklight trap
	(from 29 collections from every month (1968-72), except Mar. & May;the most specimens (12) on 3-XII-68).				
1	Brevard	Eau Gallie	1-V-38	C.C. Goff	Geomys burrows
1	Hillsborough	Brandon	22-X-65	J.W. Patton	blacklight trap
1	Lake	Leesburg	31-III-38	C.C. Goff	Geomys burrows
1	Lake	Leesburg	15-IV-38	C.C. Goff	Geomys burrows
1	Orange	Apopka	15-VI-63	C.J. Musgrove	St.Augustine grass
1	Pinellas	Largo	28-IX-59	R.E. Woodruff	at light
1	Putnam	Welaka	21-III-67	R.E. Woodruff	blacklight trap
1	Seminole	Sanford	13-I-11	W.S. Blatchley	

APPENDIX 29: APHODIUS LIVIDUS (OLIVIER)

2	Alachua		12-XI-69	F.W. Mead	blacklight trap
6	Alachua		31-III-70	F.W. Mead	blacklight trap
10	Alachua	Austin Cary Forest	28-30-VII-66	L.A. Hetrick	blacklight trap
2	Alachua	Austin Cary Forest	10-IX-66	L.A. Hetrick	blacklight trap
1	Alachua	Chantilly Acres	26-IV-68	F.S. Blanton	blacklight trap
5	Alachua	Chitty Ranch	5-VI-65	R.E. Woodruff	cow dung
1	Alachua	Gainesville	15-IV	G.B. Merrill	
1	Alachua	Gainesville	5-III-24	T.H. Hubbell	
1	Alachua	Gainesville	6-III-24	T.H. Hubbell	
1	Alachua	Gainesville	7-II-25	T.H. Hubbell	
1	Alachua	Gainesville	14-V-25	T.H. Hubbell	
1	Alachua	Gainesville	15-IV-39	G.B. Merrill	
1	Alachua	Gainesville	24-III-48	H.V. Weems,Jr.	
2	Alachua	Gainesville	11-VI-48	H.V. Weems,Jr.	
1271	Alachua	Gainesville	various	various	blacklight trap
	(from 147 collections from Jan.-Dec.(1957-72),with months & collections as follows: I(9),II(5),III(14),IV(8),V(15),VI(23),VII(27),VIII(10),IX(17),X(11),XI(5),XII(2); the most specimens (64) on 14-VII-59).				
1	Alachua	Island Grove	28-V-54	B. Jones	mosq.light trap
12	Alachua	Newnan's Lake	27-II-48	W.M. Nirenberg	
1	Baker	Glen St. Mary	1-VIII-69	H.W. Collins	blacklight trap
1	Baker	Glen St. Mary	17-IX-69	H.W. Collins	blacklight trap
1	Baker	Glen St. Mary	8-X-69	H.W. Collins	blacklight trap
4	Baker	Glen St. Mary	19-V-70	H.W. Collins	blacklight trap
2	Baker	Glen St. Mary	23-VI-70	H.W. Collins	blacklight trap
7	Baker	Glen St. Mary	30-VI-70	H.W. Collins	blacklight trap
1	Baker	Macclenny	4-XI-68	H.W. Collins	blacklight trap
52	Baker	Macclenny	V-69-VI-70	H.W. Collins	blacklight trap
	(from 9 collections,with months & collections as follows:V(4),VI(3),VII(2);the most specimens (13) on 28-V-70).				
12	Baker	Olustee	2-4-VII-66	E.P. Merkel	blacklight trap
7	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
7	Baker	Olustee	13-VII-66	E.P. Merkel	blacklight trap
4	Baker	Olustee	20-22-VIII-	E.P. Merkel	blacklight trap
9	Baker	Olustee	23-VIII-66	E.P. Merkel	blacklight trap
2	Baker	Olustee	29-IX-5-X-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	11-VI-69	E.P. Merkel	blacklight trap
5	Broward		19-IV-43	R.L. Rolland	
1	Broward	Ft. Lauderdale	27-X-61	G.F. Spencer	blacklight trap
3	Calhoun	Blountstown	3-IX-68	H. Paulk	blacklight trap
1	Calhoun	Blountstown	10-IX-68	H. Paulk	blacklight trap
1	Calhoun	Blountstown	18-IX-68	H. Paulk	blacklight trap
2	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
1	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
1	Clay	Goldhead Branch St.Pk.	1-V-65	R.E. Woodruff	cow dung
3	Collier	Ochopee	17-IX-68	S.H. Brown	blacklight trap
1	Dade		24-IV-48		
1	Dade	Coral Gables	19-X-35		light trap
1	Dade	Homestead	14-VII-38	W.C. Stehr	
2	Dade	Homestead	26-VII-62	R.E. Woodruff	cow dung
2	Dade	Homestead	26-IV-69	R.M. Baranowski	blacklight trap
3	Dade	Homestead	18-V-69	R.M. Baranowski	blacklight trap
1	Dade	Homestead, AFB	19-VI-66	J.E. Porter	mosq.light trap
1	Dade	Homestead, AFB	22-VI-66	J.E. Porter	mosq.light trap
1	Dade	Miami	25-VIII-46	L.B. Isham	
1	Dade	Miami	18-V-48		
4	Dade	Miami	19-IV-59	C.F. Dowling	blacklight trap
3	Dade	Miami	28-IV-60	P.E. Briggs	blacklight trap
1	Dade	Miami	1-VI-60	P.E. Briggs	blacklight trap
1	Dade	Miami	27-IV-61	B.K. Dozier	
1	Dade	Miami	18-IX-61	B.K. Dozier	
1	Dade	Miami	10-V-61	J.L. Weaver	Jap beetle trap
495	Dade	Miami	various	various	blacklight trap
	(from 64 collections,with months & collections as follows:I(3),II(8),III(1),IV(1), V(7),VI(7),VII(2),VIII(14),IX(9),X(10),XI(1),XII(1);the most specimens (58) on 2-VI-66).				
1	Dade	Opa Locka,Coast Guard	6-VII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	15-VII-66	J.E. Porter	mosq.light trap
1	Dade	Orchid Jungle Hammock	29-V-69	R.M. Baranowski	blacklight trap
1	Dade	Royal Palm Park	15-IV-27	W.S. Blatchley	
1	Dade	Royal Palm Park	25-III-29	W.S. Blatchley	
4	Dade	Sub-Tropical Exp.Sta.	12-IV-69	R.M. Baranowski	blacklight trap
1	Dade	Sub-Tropical Exp.Sta.	30-IX-69	R.M. Baranowski	blacklight trap
10	Dade	Sub-Tropical Exp.Sta.	12-III-70	R.M. Baranowski	blacklight trap
3	Duval	Jacksonville	21-V-69	R. King	blacklight trap
10	Duval	Jacksonville	4-VI-69	R. King	blacklight trap
1	Duval	Jacksonville	16-VI-69	R. King	blacklight trap
6	Duval	Jacksonville	11-IX-69	R. King	blacklight trap
2	Duval	Jacksonville	15-IX-69	R. King	blacklight trap
2	Duval	Mayport	1-XI-61	L.W. Taylor	blacklight trap
4	Escambia	Bratt, 3 1/2mi. SE	VI-68	A.J. Blanton	blacklight trap
4	Escambia	Bratt	7-VI-68	D.C. Blanton	blacklight trap
3	Escambia	Bratt	14-VI-68	D.C. Blanton	blacklight trap
3	Escambia	Bratt	16-VI-68	D.C. Blanton	blacklight trap
4	Escambia	Bratt	16-VII-68	D.C. Blanton	blacklight trap
1	Escambia	Bratt	17-VII-68	D.C. Blanton	blacklight trap
1	Escambia	Bratt	19-VII-68	D.C. Blanton	blacklight trap
1	Escambia	Bratt	23-VI-68	D.C. Blanton	blacklight trap
1	Escambia	Bratt	30-VI-68	D.C. Blanton	blacklight trap
4	Escambia	Bratt	25-VIII-68	F.S. Blanton	blacklight trap
2	Escambia	Molino	5-IV-68	E.N. Bishop	blacklight trap
1	Escambia	Molino	31-X-68	T. Bishop	blacklight trap
7	Escambia	Molino	3-IV-69	Bishop	blacklight trap
1	Escambia	Molino	15-V-69	E.N. Bishop	blacklight trap
6	Escambia	Molino	19-VI-69	E.N. Bishop	blacklight trap
1	Escambia	Pensacola	6-IX-61	T.W. Boyd	blacklight trap
2	Escambia	Walnut Hill	5-IX-68	E.N. Bishop	blacklight trap
12	Escambia	Walnut Hill	19-IX-68	T.C. Bishop	blacklight trap
1	Escambia	Walnut Hill	26-IX-68	T.C. Bishop	blacklight trap
10	Escambia	Walnut Hill	10-X-68	T.C. Bishop	blacklight trap
3	Escambia	Walnut Hill	17-X-68	T.C. Bishop	blacklight trap
1	Escambia	Walnut Hill	4-IV-69	D. Thomley	blacklight trap
39	Escambia	Walnut Hill	9-IV-69	D. Thomley	blacklight trap
16	Escambia	Walnut Hill	16-IV-69	D. Thomley	blacklight trap
1	Gadsden	Chattahoochee	10-VI-54	F.N. Young	at light
1	Gadsden	Quincy	9-II-59	W.B. Tappan	blacklight trap
40	Glades	Lakeport	18-V-54	Kornegay	mosq.light trap
1	Gulf	Wewahitchka	14-VIII-69	C. Laird	blacklight trap
3	Gulf	Wewahitchka	20-VIII-69	C. Laird	blacklight trap
3	Gulf	Wewahitchka	15-IX-69	C. Laird	blacklight trap
1	Gulf	Wewahitchka	31-X-69	C. Laird	blacklight trap
2	Gulf	Wewahitchka	8-XI-69	C. Laird	blacklight trap
1	Hardee	Charlie Creek,Rt. 17	21-I-60	R.E. Woodruff	cow dung
40	Hardee	Zda	3-V-67	Brad Fagan	blacklight trap
2	Highlands	Archbold Bio. Sta.	3-VII-61	Brad Fagan	cow dung
1	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	light trap
126	Highlands	Lake Letta Subdiv.	3-VI-60	T. Morris	blacklight trap
100+	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
20	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	10-X-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	27-III-62	T. Morris	blacklight trap
20	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
10	Highlands	Lake Letta Subdiv.	19-VII-62	T. Morris	blacklight trap
6	Highlands	Lake Placid	20-I-60	R.E. Woodruff	cow dung
30	Highlands	Sebring	24-VII-62	T. Morris	blacklight trap
7	Hillsborough	Brandon	18-V-62	J.W. Patton	blacklight trap
4	Hillsborough	Brandon	22-X-65	J.W. Patton	blacklight trap
65	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
5	Hillsborough	Brandon	12-V-66	J.W. Patton	blacklight trap
1	Hillsborough	Parrish, 12mi. N.	11-IV-66	R.E. Woodruff	blacklight trap
8	Hillsborough	Tampa	8-VII-60	C.H. Lynch	blacklight trap
2	Indian River	Oslo Area	11-12-V-64	W.L. Bidlingmayer	truck trap #3
1	Indian River	Oslo Area	13-13-V-64	W.L. Bidlingmayer	truck trap #6
1	Indian River	Oslo Area	25-26-V-64	W.L. Bidlingmayer	truck trap #8
1	Indian River	Oslo Area	26-27-V-64	W.L. Bidlingmayer	truck trap #8
2	Indian River	Vero Beach	25-V-64	W.L. Bidlingmayer	
200+	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
3	Indian River	Vero Beach	10-VI-64	W.L. Bidlingmayer	suction trap
2	Jackson		28-V-54		mosq.light trap
3	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
200	Jackson		27-VIII-69	E.L. Tipton	blacklight trap
1	Jackson		22-IV-70	E.L. Tipton	blacklight trap
2	Jackson	Fla.Caverns State Pk.	18-IV-63	R.E. Woodruff	blacklight trap
16	Jackson	Marianna	5-IX-68	E.L. Tipton	blacklight trap
1	Jackson	Marianna	11-IX-68	E.L. Tipton	blacklight trap
17	Jackson	Marianna	11-V-68	E.L. Tipton	blacklight trap
1	Jackson	Marianna	22-IV-69	F.W. Mead	motel lights
45	Jackson	Marianna	1-VII-69	E.L. Tipton	blacklight trap
4	Jackson	Marianna	1-V-70	E.L. Tipton	blacklight trap
75	Jackson	Marianna	7-V-70	E.L. Tipton	blacklight trap
150	Jackson	Marianna	5-VI-70	E.L. Tipton	blacklight trap
80	Jackson	Marianna	11-VI-70	E.L. Tipton	blacklight trap
1	Jackson	Sneads	18-V-54	J.P. McDaniel	mosq.light trap
3	Jackson	Sneads	21-V-54	J.P. McDaniel	mosq.light trap
5	Jackson	Sneads	25-V-54	J.P. McDaniel	mosq.light trap
5394	Jefferson	Big Bend Hort. Lab.	various	various	blacklight trap
	(from 58 collections from Mar.-Nov.(1968-69),with months & collections as follows: (II(3),IV(6),V(18),VI(20),VII(18),VIII(26),IX(40),X(26),XI(1);the most specimens (450+) on 15-VI-69).				
1	Lake	Groveland	2-III-65	W.P. Henderson	at light
1	Lee	Ft. Myers	25-V-61	H.M. Fairchoth	blacklight trap
2	Leon	Tallahassee	15-X-68	T.E. Gilland	blacklight trap
3700	Leon	Tall Timbers Res.Sta.	various	various	blacklight trap
	(from 132 collections from Mar.-Dec.(1968-70),with months & collections as follows: I(1),IV(14),V(15),VI(16),VII(20),VIII(16),IX(25),X(18),XI(3),XII(2);the most specimens (300+) on 13-VI-69).				
1	Levy		14-III-58	H.V. Weems,Jr.	cow dung
4	Levy	Otter Creek	14-III-58	R.E. Woodruff	cow dung
1	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
1	Manatee	Bradenton	12-VIII-53	H.V. Weems,Jr. Paula Dillman	at light
3	Manatee	Oneco			
1	Manatee	Oneco	12-IV-66	R.E. Woodruff	cow dung
1	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
1	Marion	Juniper Springs	28-IV-60	H.A. Denmark	Berlese sample
1	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
41	Monroe	Big Pine Key	28-V-62	R.E. Woodruff	cow dung
1	Monroe	Everglades Nat. For.	28-III-70	R.M. Baranowski	blacklight trap
2	Monroe	Key West	27-X-62	B.K. Dozier	
1	Monroe	Key West	23-VIII-68	F.A. Buchanan	blacklight trap
1	Monroe	Key West	27-VIII-68	F.A. Buchanan	blacklight trap
1	Monroe	Key West	6-XII-68	F.A. Buchanan	blacklight trap
3	Monroe	Key West	25-IV-69	F.A. Buchanan	blacklight trap
2	Monroe	Key West	21-V-69	F.A. Buchanan	blacklight trap
1	Monroe	Key West	27-V-69	F.A. Buchanan	blacklight trap
1	Monroe	Stock Island	11-XII-62	F.A. Buchanan	blacklight trap
2	Monroe	Stock Island	9-VIII-68	F.A. Buchanan	blacklight trap
5	Monroe	Stock Island	7-III-69	F.A Buchanan	blacklight trap
1	Nassau	Fernadina Beach	18-V-54	B.D. Douglas	mosq.light trap
1	Okaloosa	Crestview,Hwy. 90W	28-VIII-69	J. Carter	blacklight trap
3	Okaloosa	Laurel Hill	18-V-54		mosq.light trap
1	Okeechobee	Okeechobee	10-VII-38	W.C. Stehr	
6	Okeechobee	Okeechobee	21-V-54	V.E. Lightsey	mosq.light trap
6	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
15	Orange	Apopka	9-X-68	H. Van Pelt	blacklight trap
1	Orange	Orlando	20-IV-62	J.L. Beck	blacklight trap
1	Orange	Orlando	5-VI-62	J.L. Beck	blacklight trap
1	Orange	Plymouth	10-V-61	C.E. Mosteller	
1	Palm Beach		4-III-18	W.S. Blatchley	
1	Palm Beach	Belle Glade	30-IV-57	E.D. Harris	bait trap
1	Palm Beach	Belle Glade	10-V-57	E.D. Harris	bait trap
1	Palm Beach	International Airport	12-V-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	13-V-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	16-V-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	18-V-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	19-22-V-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	20-VI-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	3-VII-66	J.E. Porter	mosq.light trap
1	Palm Beach	West Palm Beach	19-V-43	M. LeRoy	
1	Palm Beach	West Palm Beach	20-V-43	M. LeRoy	bale of cotton
19	Palm Beach	West Palm Beach	22-VII-59	M.L. Messec	blacklight trap
1	Palm Beach	West Palm Beach	18-XI-59	M.L. Messec	blacklight trap
11	Pasco	Lacoochee	12-VII-69	A.L. O'Berry	blacklight trap
2	Pinellas	Dunedin	5-VI-15	W.S. Blatchley	
2	Pinellas	Dunedin	10-VI-15	W.S. Blatchley	
1	Pinellas	Dunedin	10-VII-17	W.S. Blatchley	
400	Pinellas	Largo	17-VI-69	K. Mickman	blacklight trap
1	Pinellas	St. Petersburg	1-VI-59	C.E. Bingaman	
1	Polk	Frostproof	7-VI-63	M.H. Muma	
2	Polk	Winter Haven	29-V-62	R.W. Robnett	blacklight trap
1	Putnam	Interlachen, 2mi. SW	5-X-71	M. Graham	blacklight trap
16	Santa Rosa	Jay	16-V-62	T.W. Boyd	blacklight trap
5	Santa Rosa	Jay	23-V-62	T.W. Boyd	blacklight trap
12	Sarasota	Englewood	7-8-VII-70	J.H. Brown	blacklight trap
1	Sarasota	Nokomis	18-V-54	W.E. Taylor	mosq.light trap
1	Sarasota	Sarasota	30-I-11	W.S. Blatchley	
1	Sarasota	Sarasota	14-II-11	W.S. Blatchley	
1	Sarasota	Sarasota	25-II-11	W.S. Blatchley	
126	Seminole	Sanford	3-VI-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	10-V-61	G.W. Desin	Jap beetle trap
20	Seminole	Sanford	8-XI-61	G.W. Desin	blacklight trap
196	Taylor	Perry	various	Merkel & Beers	blacklight trap
	(from 32 collections from Apr.-Sept.(1968-69),with months & collections as follows:				

(continued)

APPENDICES 29-34

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
	IV(5),V(5),VI(7),VII(5),VIII(9),IX(1);the most specimens (100+) on 23-VI-69).				
1	Taylor	Steinhatchee	18-V-54		mosq.light trap
1	Volusia	DeLeon Springs	5-VIII-58	C.R. Roberts	in fernery
7	Volusia	Islesboro	18-V-54	W.E. Bender	mosq.light trap
2	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap
	APPENDIX 30: APHODIUS PARCUS HORN				
3	Alachua	Gainesville, 6mi. NE	9-VII-66	L.A. Hetrick	blacklight trap
225	Alachua	Gainesville	various	various	blacklight trap
	(from 29 collections from May-Sept., with months and collections as follows: V(4), VI(16),VII(6),VIII(1),IX(1); the most specimens (65) on 6-8-VI-69.)				
11	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	13-VII-66	E.P. Merkel	blacklight trap
1	Broward	Davie	26-IX-63	C.E. Stegmaier	at light
49	Broward	Ft. Lauderdale	8-VI-60	G.F. Spencer	blacklight trap
135	Broward	Ft. Lauderdale	11-VI-61	G.F. Spencer	blacklight trap
39	Broward	International Airport	various	J.E. Porter	mosq.light trap
	(from 11 collections from June-Sept., with months & collections as follows: VI(4), VII(3),VIII(1),IX(3); the most specimens (15) on 13-VI-66.)				
12	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
1	Collier	Naples, 9mi. N.	13-IX-63	B.K. Dozier	
1	Dade	Miami	18-V-48	H.F. Strohecker	
683	Dade	Miami & Miami Beach	various	various	blacklight trap
	(from 44 collections from May-Oct., with months & collections as follows: V(9); VI(16),VII(7),VIII(4),IX(6),X(2); the most specimens (200+) on 5-VII-65.)				
1	Dade	Opa Locka,Coast Guard	28-VI-66	J.E. Porter	mosq.light trap
2	Dade	Opa Locka,Coast Guard	6-VII-66	J.E. Porter	mosq.light trap
5	Dade	Opa Locka,Coast Guard	11-VII-66	J.E. Porter	mosq.light trap
20	Dade	Opa Locka,Coast Guard	15-VII-66	J.E. Porter	mosq.light trap
2	Dade	Opa Locka,Coast Guard	26-VII-66	J.E. Porter	mosq.light trap
2	Dade	Opa Locka,Coast Guard	8-VIII-66	J.E. Porter	mosq.light trap
1	Dade	West Miami	16-VII-59	R.W. Swanson	blacklight trap
4	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
3	Duval	Mayport	6-VI-62	L.W. Taylor	blacklight trap
22	Indian River	Vero Beach	15-16-V-64	W.L. Bidlingmayer	truck trap #1
51	Indian River	Vero Beach	16-17-V-64	W.L. Bidlingmayer	truck trap #3
2	Indian River	Vero Beach	17-18-V-64	W.L. Bidlingmayer	truck trap #3
23	Indian River	Vero Beach	17-18-V-64	W.L. Bidlingmayer	truck trap #1
3	Indian River	Vero Beach	1-2-VI-64	W.L. Bidlingmayer	truck trap #1
1	Indian River	Vero Beach	2-3-VI-64	W.L. Bidlingmayer	truck trap #6
37	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
5	Lee	Boca Grande Island	9-VI-61	H.M. Faircloth	blacklight trap
10	Manatee	Bradenton Beach	16-V-54	W.B. Emmer	mosq.light trap
4	Manatee	Bradenton Beach	20-V-54	D. McLaughlin	mosq.light trap
4	Manatee	Oneco		Paula Dillman	
24	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
3	Marion	Ocala	16-VI-62	T.R. Adkins	blacklight trap
19	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
3	Martin	Salerno	25-V-54	Martin	mosq.light trap
2	Palm Beach	International Airport	17-VI-65	J.E. Porter	mosq.light trap
2	Palm Beach	International Airport	18-VI-65	J.E. Porter	mosq.light trap
4	Palm Beach	International Airport	26-VI-65	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	26-VI-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	3-VII-66	J.E. Porter	mosq.light trap
12	Palm Beach	International Airport	5-VII-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	13-VII-66	J.E. Porter	mosq.light trap
3	Pinellas	Dunedin	25-XI-25	W.S. Blatchley	
1	Pinellas	St. Petersburg	1-VI-59	C.E. Bingaman	blacklight trap
2	Pinellas	St. Petersburg	31-V-62	R.H. Forsyth	blacklight trap
50+	Pinellas	St. Petersburg	3-VI-62	R.H. Forsyth	blacklight trap
1	Putnam	Red Water Lake	27-28-V-67	H.V. Weems,Jr.	blacklight trap
1	Sarasota	Sarasota	16-II-11	W.S. Blatchley	
1	Seminole	Sanford	5-VIII-60	G.W. Desin	blacklight trap
30	Seminole	Sanford	6-VI-62	G.W. Desin	blacklight trap
2	Seminole	Sanford	17-VI-62	G.W. Desin	blacklight trap
2	Taylor	Perry	9-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	11-VI-69	W.L. Beers	blacklight trap
16	Volusia	DeLeon Springs	27-V-70	W.B. Compton	in soil
1	Volusia	New Smyrna	28-V	M. Wright	
1	Volusia	New Smyrna	10-VI	M. Wright	
	APPENDIX 31: APHODIUS RUBEOLUS BEAUVOIS				
1	Alachua		3-III-24	T.H. Hubbell	
1	Alachua		6-IV-48	M.W. Nirenberg	
1	Alachua		23-IV-48	M.W. Nirenberg	
75	Alachua	Gainesville	various	various	blacklight trap
	(from 32 collections from Mar.-Oct., with months & collections as follows: III(5), IV(7),V(3),VI(8),VII(3),VIII(1),IX(3),X(3); the most specimens (7) on 29-III-60.)				
1	Alachua	Waccasassa Flats	13-VII-68	S.K. Derr	cow dung
1	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
4	Baker	Glen St. Mary	10-V-60	E.W. Holder,Jr.	cow dung
1	Baker	Macclenny	24-VII-69	H.W. Collins	blacklight trap
2	Baker	Olustee	20-VII-66	E.P. Merkel	blacklight trap
10	Baker	Olustee	29-IX-5-X-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	11-VI-69	E.P. Merkel	blacklight trap
1	Calhoun	Blountstown	3-IX-68	H. Paulk	blacklight trap
1	Escambia	Bratt	VI-68	A.J. Blanton	mosq.light trap
1	Escambia	Molino	12-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Molino	24-IV-69	T.C. Bishop	blacklight trap
1	Escambia	Pensacola	1-VIII-61	T.W. Boyd	blacklight trap
4	Escambia	Pensacola	30-VIII-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	3-X-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	25-IV-62	T.W. Boyd	blacklight trap
1	Gadsden	Quincy	21-IV-59	W.B. Tappan	blacklight trap
1	Gulf	Wewahitchka	13-VII-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	17-VIII-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	31-VIII-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	6-IX-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	22-IX-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	2-X-68	C.R. Laird	blacklight trap
1	Gulf	Wewahitchka	14-VIII-69	C.R. Laird	blacklight trap
2	Hillsborough	Hillsborough River SP	25-III-59	R.E. Woodruff	cow dung
1	Hillsborough	Tampa	18-XI-42	R.C. Barnes	mosq.light trap
1	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
1	Jackson		27-VIII-69	E.L. Tipton	blacklight trap
1	Jackson	Florida Caverns SP	18-IV-63	R.E. Woodruff	blacklight trap
1	Jackson	Marianna	11-X-68	E.L. Tipton	blacklight trap
7	Jackson	Marianna	6-V-69	E.L. Tipton	blacklight trap
4	Jackson	Marianna	1-VIII-69	E.L. Tipton	blacklight trap
28	Jefferson	Big Bend Hort. Lab.	various	various	blacklight trap
	(from 17 collections from Mar.-Oct., with months & collections as follows: III(1), IV(5),V(6),VI(1),VIII(2),IX(1),X(1); the most specimens (5) on 16-IV-69.)				
1	Leon	Tall Timbers Res.Sta.	5-6-IV-69	A. Bhatkar	blacklight trap
1	Leon	Tall Timbers Res.Sta.	10-IV-69	A. Bhatkar	blacklight trap
3	Leon	Tall Timbers Res.Sta.	14-V-69	A. Bhatkar	blacklight trap
2	Leon	Tall Timbers Res.Sta.	16-V-69	A. Bhatkar	blacklight trap
1	Leon	Tall Timbers Res.Sta.	21-V-69	A. Bhatkar	blacklight trap
1	Leon	Tall Timbers Res.Sta.	14-VI-69	A. Bhatkar	blacklight trap
2	Leon	Tall Timbers Res.Sta.	15-16-VI-69	A. Bhatkar	blacklight trap
1	Liberty	Camp Torreya	26-IV-24	T.H. Hubbell	

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Liberty	Torreya State Park	16-VIII-60	H.V. Weems,Jr.	blacklight trap
1	Liberty	Torreya State Park	15-V-64	R.E. White	
1	Manatee	Oneco	13-IV-66	R.E. Woodruff	blacklight trap
1	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
1	Marion	Ocala	18-III-50	H. & A. Howden	cow dung
4	Marion	Ocala	16-VI-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	8-XI-63	T.R. Adkins	blacklight trap
3	Okaloosa	Crestview, 12mi. N.	31-VIII-60	W.C. Rhoades	blacklight trap
1	Okaloosa	Crestview	12-IX-68	J. Carter	blacklight trap
1	Okaloosa	Laurel Hill	18-V-54	Thomas	mosq.light trap
1	Santa Rosa	Jay	29-V-62	T.W. Boyd	blacklight trap
6	Santa Rosa	Chumukla Exp. Sta.	18-IV-58	R.E. Woodruff	blacklight trap
20	Taylor	Perry	various	Merkel & Beers	blacklight trap
	(from 11 collections from Apr.-Aug., with months & collections as follows: IV(3), V(1),VI(3),VII(1),VIII(3);the most specimens (5) on 12-VI-69.)				
5	Taylor	Perry	12-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	25-VI-69	W.L. Beers	blacklight trap
2	Taylor	Perry	22-VIII-69	W.L. Beers	blacklight trap
1	Volusia	New Smyrna	28-V	M. Wright	
4	Washington	Chipley, 5mi. E.			
	APPENDIX 32: APHODIUS STUPIDUS HORN				
3	Alachua	Gainesville	8-XII-61	R.E. Woodruff	cow dung
3	Alachua	Melrose, 2mi. S.	21-XII-64	R.E. Woodruff	horse dung
4	Alachua	Warren's Cave, near	8-XII-61	R.E. Woodruff	cow dung
10	Baker	Glen St. Mary	30-XI-60	E.W. Holder,Jr.	malt trap
43	Baker	Glen St. Mary	5-XII-60	E.W. Holder,Jr.	malt trap
22	Baker	Glen St. Mary	16-XII-60	E.W. Holder,Jr.	malt trap
25	Baker	Glen St. Mary	21-XII-60	E.W. Holder,Jr.	malt trap
8	Baker	Glen St. Mary	26-XII-60	E.W. Holder,Jr.	malt trap
7	Baker	Glen St. Mary	14-I-61	R.E. Woodruff	cow dung
9	Baker	Glen St. Mary	24-I-61	E.W. Holder,Jr.	malt trap
2	Baker	Macclenny	28-IX-60	E.W. Holder,Jr.	malt trap
1	Baker	Macclenny	2-XII-60	E.W. Holder,Jr.	malt trap
29	Baker	Macclenny	9-XII-60	R.E. Woodruff	malt trap
8	Baker	Macclenny	26-XII-60	E.W. Holder,Jr.	malt trap
4	Baker	Macclenny	2-I-61	E.W. Holder,Jr.	malt trap
2	Baker	Macclenny	12-I-61	E.W. Holder,Jr.	malt trap
4	Baker	Macclenny	31-I-61	E.W. Holder,Jr.	malt trap
2	Calhoun	Clarksville	21-III-54	H.F. Howden	
1	Gadsden	Quincy	19-I-59	W.B. Tappan	blacklight trap
1	Gadsden	Silver Lake Rec.Area	3-II-60	R.E. Woodruff	malt trap
1	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
1	Levy	Bronson, 8mi. E.	28-II-59	R.E. Woodruff	malt trap
1	Liberty	Torreya State Park	12-IV-60	H.V. Weems,Jr.	malt trap
3	Putnam		23-II-58	R.E. Woodruff	cow dung
	APPENDIX 33: APHODIUS TROGLODYTES HUBBELL				
2	Alachua	Gainesville	19-IV-68	R.E. Woodruff	blacklight trap
3	Alachua	Gainesville	30-V-2-VI-68	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	2-VI-68	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	26-27-VI-68	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	28-30-VI-68	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	1-2-VII-68	R.E. Woodruff	blacklight trap
2	Alachua	Gainesville	31-V-69	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	6-8-VI-69	R.E. Woodruff	blacklight trap
3	Alachua	Gainesville	18-21-VII-69	R.E. Woodruff	blacklight trap
2	Alachua	Gainesville	3-10-VIII-72	F.W. Mead	blacklight trap
1	Alachua	Gainesville	27-VII-66	E. Gourley	Gopherus burrow
1	Dade	Miami	29-XII-33	F.N. Young	Gopherus burrow
1	Dade	Miami	31-XII-33	F.N. Young	Gopherus burrow
4	Gilchrist	Trenton	28-IX-66	E. Gourley	Gopherus burrow
10	Highlands	Lake Letta Subdiv.	2-V-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	19-VI-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	27-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	8-VIII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
1	Highlands	Sebring	30-XII-62	T. Morris	blacklight trap
4	Putnam	Crescent City		H.W. Wenzel	(OSU)
3	Putnam	Interlachen, 4mi. S.	29-III-60	R.E. Woodruff	Gopherus burrows
1	Taylor	Perry	23-VII-68	E.P. Merkel	blacklight trap
	APPENDIX 34: EUPARIA CASTANEA SERVILLE				
1			12-VI-66	B.K. Dozier	light
1	Alachua	Arredondo Estates	1-IX-65	A.L. O'Berry	blacklight trap
1	Alachua	Austin Cary Forest	7-VI-66	L.A. Hetrick	blacklight trap
2	Alachua	Austin Cary Forest	23-VI-66	L.A. Hetrick	blacklight trap
3	Alachua	Austin Cary Forest	16-17-IX-66	L.A. Hetrick	blacklight trap
25	Alachua	Gainesville	various	various	blacklight trap
	(from 2) collections from Mar.-Sept., with months & collections as follows: III(1), IV(1),V(4),VI(5),VII(6),VIII(1),IX(2); the most specimens (5) on 15-VI-61.)				
13	Alachua	Gainesville	17-IV-70	D.P. Wojcik	Solenopsis nest
7	Alachua	Gainesville	17-IV-70	D.P. Wojcik	Solenopsis nest
14	Alachua	Gainesville	17-IV-70	D.P. Wojcik	Solenopsis nest
4	Baker	Macclenny	16-VIII-66	H.W. Collins	Solenopsis nest
1	Baker	Macclenny	26-IX-68	H.W. Collins	blacklight trap
1	Baker	Olustee	27-VI-66	E.P. Merkel	blacklight trap
2	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	19-VIII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	20-22-VIII	E.P. Merkel	blacklight trap
1	Baker	Olustee	24-28-VIII	E.P. Merkel	blacklight trap
1	Baker	Olustee	29-IX-5-X-66	E.P. Merkel	blacklight trap
1	Bay	Panama City	13-V-67	F.W. Mead	blacklight trap
2	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
3	Charlotte	Punta Gorda, 6mi. S.	19-IX-68	R.O. Akins	blacklight trap
1	Dade	Homestead AFB	13-IX-66	J.E. Porter	mosq.light trap
45	Dade	Miami & Miami Beach	various	various	light traps
	(from 32 collections from Mar.-Oct., with months & collections as follows: III(1), IV(2),V(8),VI(4),VII(3),VIII(8),IX(5),X(2); the most specimens (8) on 4-VIII-65.)				
1	Dade	Miami Bch.,Fisher's Is.	27-V-66	J.E. Porter	mosq.light trap
1	Dade	West Miami	16-VII-59	R.W. Swanson	blacklight trap
2	DeSoto	Ft. Ogden	17-II-60	G.P. Lamb	ant mound
1	Duval	Jacksonville	VIII	R.L. Hickle	
5	Duval	Jacksonville	24-II-60	F.J. Vaughn	Solenopsis nest
1	Gadsden	Quincy	9-II-59	W.B. Tappan	blacklight trap
1	Gadsden	Quincy	12-X-59	W.B. Tappan	blacklight trap
4	Hardee	Ona	10-III-60	R.H. Rhoades	Solenopsis nest
2	Hardee	Wauchula	28-XII-59	G.P. Lamb	Solenopsis nest
3	Hernando	Weeki Wachee Springs	24-I-69	R.E. Brown	Solenopsis nest
1	Highlands	Highlands Hammock SP	11-VI-66	B.K. Dozier	light
2	Highlands	Lake Letta Subdiv.	27-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	8-VIII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	16-VIII-61	T. Morris	blacklight trap
4	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
5	Highlands	Lake Letta Subdiv.	28-V-62	T. Morris	blacklight trap
12	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap

(continued)

APPENDICES 34-36

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Hillsborough	Tampa	23-V-60	R.G. Racine	ant mound
3	Holmes	Ponce de Leon, 4mi.W.	10-XI-59	L. Conn	Solenopsis nest
1	Jefferson	Big Bend Hort. Lab.	10-VI-69	R.E. Woodruff	blacklight trap
2	Jefferson	Lloyd	12-III-58	R.H. Miller	Solenopsis nest
3	Jefferson	Monticello	12-IV-57	R.H. Miller	Solenopsis nest
2	Jefferson	Monticello	22-IV-58	C.L. Alligood	Solenopsis nest
1	Jefferson	Monticello	11-VI-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	26-VI-59	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	16-XI-65	R.H. Miller	Solenopsis nest
1	Jefferson	Monticello	17-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	20-VIII-68		blacklight trap
1	Jefferson	Monticello	5-VII-69		blacklight trap
3	Lake	Bay Lake	10-VI-66	J. Bledsoe	Solenopsis nest
7	Lake	Bay Lake	18-III-69	W.P. Henderson	Solenopsis nest
1	Lake	Cassia	25-I-60	G.W. Desin	Solenopsis nest
1	Lake	Cassia	29-I-60	C.O. Youtsey	Solenopsis nest
8	Lake	Cassia	29-II-60	J.R. Hunt	Solenopsis nest
1	Lake	Groveland	14-IV-69	W.P. Henderson	Solenopsis nest
2	Lake	Cassia	22-X-64	G.W. Desin	Solenopsis nest
3	Lake	Cassia	17-II-66	G.W. Desin	Solenopsis nest
8	Lake	Howey-in-the-Hills	9-I-67	Crews & Urso	Solenopsis nest
100	Lake	Howey-in-the-Hills	1-II-67	Crews & Urso	Solenopsis nest
11	Lake	Markham	18-II-60	J.R. Hunt	Solenopsis nest
2	Lake	Mt. Dora	9-V-68	H.M. Van Pelt	Solenopsis nest
2	Lee	Alva	26-XI-69	R.O. Akins	
2	Lee	Ft. Myers	22-X-68	R.O. Akins	Solenopsis nest
12	Leon	Tallahassee	3-IV-57	G.W. Dekle	Solenopsis nest
1	Leon	Tall Timbers Res.Sta.	8-14-VI-68	W.H. Whitcomb	Berlese funnel
1	Leon	Tall Timbers Res.Sta.	11-VI-69	R.E. Woodruff	blacklight trap
1	Marion	Kendrick	28-XII-64	E.W. Holder,Jr.	Solenopsis nest
2	Marion	Lowell	18-XI-69	E.W. Holder,Jr.	Solenopsis nest
4	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
2	Marion	Ocala	5-X-67	E.W. Holder,Jr.	Solenopsis nest
2	Marion	Reddick	13-XI-69	E.W. Holder,Jr.	Solenopsis nest
1	Monroe	Flamingo,Everg1.N.P.	5-IV-58	R.E. Woodruff	at light
6	Monroe	Flamingo,Everg1.N.P.	28-III-70	R.M. Baranowski	blacklight trap
1	Monroe	Key West	IV-60	B. Niren	mosq.light trap
1	Monroe	Key West	28-IV-60	J.B. Barnwell	mosq.light trap
6	Okaloosa	Crestview	19-I-60	W.J. Stagner	Solenopsis nest
3	Okaloosa	Crestview, 12mi. NW	29-IX-60	W.C. Rhoades	blacklight trap
13	Orange	Wekiva River	12-II-60	J.R. Hunt	Solenopsis nest
1	Palm Beach	West Palm Beach	23-VII-59	M.L. Messec	blacklight trap
2	Pasco	Land-O-Lakes	13-X-60	G.W. Smith	Solenopsis nest
5	Pinellas	Dunedin	14-V-59	R.E. Woodruff	at light
1	Pinellas	St. Petersburg	3-VI-62	R.H. Forsyth	blacklight trap
2	Polk	Lake Wales	26-I-60	R.E. Woodruff	Solenopsis nest
1	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
1	Seminole		19-I-60	J.R. Hunt	
2	Seminole	Longwood	14-I-60	G.W. Desin	Solenopsis nest
1	Taylor	Perry	25-VI-68	E.P. Merkel	blacklight trap
1	Taylor	Perry	19-VIII-68	E.P. Merkel	blacklight trap
6	Volusia	Deltona	27-III-64	G.W. Desin	Solenopsis nest
3	Volusia	Holly Hill	30-I-69	G.W. Desin	Solenopsis nest
2	Washington		9-II-59	A.L. Baker	Solenopsis nest
7	Washington	Chipley	5-IX-58	A.L. Baker	Solenopsis nest
8	Washington	Chipley, 7mi. S.	5-XI-59	A.L. Baker	Solenopsis nest

APPENDIX 35: MYRMECAPHODIUS EXCAVATICOLLIS BLANCHARD

1	Alachua	Austin Cary Forest	29-VII-67	L.A. Hetrick	blacklight trap
3	Alachua	Austin Cary Forest	2-VII-67	L.A. Hetrick	blacklight trap
1	Alachua	Austin Cary Forest	9-VIII-67	L.A. Hetrick	blacklight trap
44	Alachua	Gainesville	1967-70	various	blacklight trap
	(from 26 collections from Mar.-Sept.,with months & collections as follows:III(4),IV (2),V(1),VI(5),VII(10),VIII(2),IX(2);the most specimens (4) on 13-15-VI-69).				
1	Alachua	Payne's Prairie	27-X-68	T.H. Dickens	floated ex NFAnest
1	Alachua	Payne's Prairie	25-III-70	D.P. Wojcik	floated ex NFAnest
2	Alachua	Payne's Prairie	25-III-70	D.P. Wojcik	floated ex NFAnest
1	Alachua	Payne's Prairie	25-III-70	D.P. Wojcik	floated ex NFAnest
1	Alachua	Payne's Prairie	20-IV-70	D.P. Wojcik	floated ex NFAnest
4	Baker	Macclenny	11-VI-69	H.W. Collins	blacklight trap
1	Baker	Macclenny	28-V-70	H.W. Collins	blacklight trap
1	Baker	Olustee	19-VIII-66	E.P. Merkel	blacklight trap
2	Baker	Olustee	23-VI-66	E.P. Merkel	blacklight trap
1	Calhoun	Blountstown	3-IX-66	H. Paulk	blacklight trap
14	Calhoun	Blountstown	18-IX-66	H. Paulk	blacklight trap
3	Calhoun	Blountstown	25-IX-68	H. Paulk	blacklight trap
7	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
2	Charlotte	Punta Gorda	19-IX-68	R.O. Akins	blacklight trap
10	Clay	US 301 N, SR 218	23-VI-70	D.P. Wojcik	floated ex IFAnest
3	Duval	Baldwin, US 301 S	15-VIII-68	A. Banks	floated ex IFAnest
2	Duval	Baldwin	26-III-70	A. Banks	floated ex IFAnest
1	Duval	Baldwin	26-III-70	D.P. Wojcik	floated ex IFAnest
2	Duval	Baldwin	26-III-70	D.P. Wojcik	floated ex IFAnest
1	Duval	Jacksonville	20-VIII-68	L.W. Taylor	blacklight trap
1	Duval	Jacksonville	5-V-69	R. King	blacklight trap
10	Duval	Jacksonville	20-IV-70	D.P. Wojcik	floated ex IFAnest
13	Duval	Maxville, 1/2mi. W.	10-II-70	D.P. Wojcik	floated ex IFAnest
4	Duval	Maxville	18-III-70	D.P. Wojcik	floated ex IFAnest
1	Escambia	Bratt	27-VIII-64	Blanton & Broce	blacklight trap
2	Escambia	Bratt, 3mi. SE	VI-68	A.J. Blanton	blacklight trap
2	Escambia	Bratt	9-VI-68	O.C. Blanton	blacklight trap
5	Escambia	Bratt	29-VI-68	F.S. Blanton	blacklight trap
52	Escambia	Ensley, 3mi. NE	12-VII-66	R.E. Woodruff	at light
1	Escambia	Molino	17-X-68	T.C. Bishop	blacklight trap
3	Escambia	Molino	15-V-69	E.N. Bishop	blacklight trap
28	Escambia	Molino	26-VI-69	E.N. Bishop	blacklight trap
5	Escambia	Molino	10-VII-69	E.N. Bishop	blacklight trap
4	Escambia	Molino	24-VII-69	E.N. Bishop	blacklight trap
28	Escambia	Molino	31-VII-69	E.N. Bishop	blacklight trap
2	Escambia	Molino	14-VIII-69	E.N. Bishop	blacklight trap
5	Escambia	Molino	22-VIII-69	E.N. Bishop	blacklight trap
2	Escambia	Molino	18-IX-69	E.N. Bishop	blacklight trap
2	Escambia	Molino	25-IX-69	E.N. Bishop	blacklight trap
116	Escambia	Pensacola	1960-62	Boyd & Woodruff	blacklight trap
	(from 17 collections from Apr.-Aug.,with months & collections as follows:IV(1),V(4), VI(2),VII(4),VIII(6);the most specimens (18) on 17-V-60.)				
81	Escambia	Walnut Hill	5-IX-68	E.N. Bishop	blacklight trap
92	Escambia	Walnut Hill	12-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Walnut Hill	26-IX-68	T.C. Bishop	blacklight trap
15	Escambia	Walnut Hill	3-X-68	T.C. Bishop	blacklight trap
5	Escambia	Walnut Hill	10-X-68	E.N. Bishop	blacklight trap
154	Gulf	Wewahitchka	1967-69	Laird & Goike	blacklight trap
	(from 12 collections from Aug.-Nov.,with months & collections as follows:VIII(3),IX (4),X(4),XI(1);the most specimens (58) on 21-X-69.)				
1	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
40	Hillsborough	Plant City	18-VI-69	A. Banks	under stone
15	Hillsborough	Seffner	15-X-62	R.G. Racine	IFA mound
5	Hillsborough	Tampa	21-V-69	K.H. Schroeder	IFA nest
1	Jackson	Marianna	5-IX-68	E.L. Tipton	blacklight trap
1	Jackson	Marianna	27-IX-68	E.L. Tipton	blacklight trap
6	Jackson	Marianna	26-V-70	E.L. Tipton	blacklight trap
536	Jefferson	Big Bend Hort. Lab.	1968-69	various	blacklight trap
	(from 56 collections from Apr.-Oct.,with months & collections as follows:IV(5),V(6), VI(3),VII(14),VIII(16),IX(7),X(5);the most specimens (110) on 10-VII-69.)				
37	Leon	Tallahassee	11-VIII-69	T.E. Gilland	blacklight trap
26	Leon	Tallahassee	22-VIII-69	T.E. Gilland	blacklight trap
723	Leon	Tall Timbers Res.Sta.	1968-69	various	blacklight trap
	(from 62 collections from Apr.-Oct.,with months & collections as follows:IV(3),V(11), VI(12),VII(15),VIII(10),IX(10),X(1);the most specimens (85) on 23-VI-69.)				
1	Leon	Tall Timbers Res.Sta.	8-15-VI-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	15-22-VI-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	30-VI-2-VII-D.	Harris	pitfall trap
2	Leon	Tall Timbers Res.Sta.	28-I-72	E. Nickerson	Solenopsis nest
1	Leon	Tall Timbers Res.Sta.	17-24-VII-72D.	Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	31-VII-7-VIII	"	pitfall trap
26	Liberty	Torreya State Park	15-16-VIII-68H.V.	Weems,Jr.	blacklight trap
147	Okaloosa	Crestview, 12mi. NW	various	Rhoades & Carter	blacklight trap
	(from 11 collections from Aug.& Sept.,the most specimens (69) on 30-VIII-60.)				
1	Pinellas	Bay Pines	9-I-69	W.A. Bank	Solenopsis nest
2	Pinellas	Gulfport	9-I-69	W.A. Bank	Solenopsis nest
7	Pinellas	Largo	1-X-68	R.E. Brown	fire ant nest
1	Pinellas	Largo	3-XII-68	Hill,HickmanCarroll	blacklight trap
2	Pinellas	Largo	17-VI-69	K. Hickman	blacklight trap
2	Polk	Bartow, 10mi. S.	13-VII-67	C.S. Lofgren	fire ant nest
7	Santa Rosa		18-VIII-59	M. Lutrick	blacklight trap
3	Santa Rosa	Chumukla (Exp. Sta.)	9-IX-59	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	1-VIII-58	M. Lutrick	blacklight trap
2	Santa Rosa	Chumukla (Exp. Sta.)	11-IX-58	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	29-IX-58	M. Lutrick	blacklight trap
11	Santa Rosa	Chumukla (Exp. Sta.)	26-VIII-59	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	16-IX-59	M. Lutrick	blacklight trap
16	Santa Rosa	Chumukla (Exp. Sta.)	29-IX-59	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	2-X-59	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	12-X-59	M. Lutrick	blacklight trap
28	Taylor	Perry	various	Merkel & Beers	blacklight trap
	(from 16 collections from Apr.-Aug.,with months & collections as follows:IV(1),V(2), VII(3),VIII(10);the most specimens (4) on 13-VIII-68.)				
2	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 36: ATAENIUS ALTERNATUS (MELSHEIMER)

1			12-IX-61	B.K. Dozier	
2	Alachua	R20E, T9S, S24	11-III-58		
1	Alachua		16-III-55	R.A. Morse	
5	Alachua		17-III-55	R.A. Morse	
1	Alachua		21-III-55	R.A. Morse	
1	Alachua		12-IV-55	R.A. Morse	
4	Alachua		19-IV-55	R.A. Morse	
1	Alachua	Austin Cary Forest	3-X-67	L.A. Hetrick	blacklight trap
2805	Alachua	Gainesville	various	various	blacklight trap
	(from 98 collections from Feb.-Nov., with months and collections as follows: II(3), III(7),IV(7),V(19),VI(15),VII(14),VIII(14),IX(6),X(7),XI(2); the most specimens (227) on 29-IX-59.)				
78	Baker	Olustee	16-V-63	E.P. Merkel	blacklight trap
4	Baker	Olustee	23-V-63	E.P. Merkel	blacklight trap
11	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
2	Bay	St. Andrews SP	23-IV-63	R.E. Woodruff	blacklight trap
3	Broward	Ft. Lauderdale	1-XI-60	G.F. Spencer	blacklight trap
5	Calhoun	Blountstown	3-IX-68	H. Paulk	blacklight trap
4	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
196	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
10	Charlotte	Punta Gorda	20-X-60	H.M. Faircloth	blacklight trap
3	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
3	Charlotte	Punta Gorda	9-XI-60	H.M. Faircloth	blacklight trap
3	Clay		4-VII-64	H.A. Denmark	at light
2	Clay	Goldhead Branch SP	13-VI-63	B.K. Dozier	
2	Clay	Green Cove Springs	27-VII-42	R.C. Barnes	mosq.light trap
1	Collier	Immokalee	30-XII-59	H.M. Faircloth	blacklight trap
5	Collier	Immokalee	9-16-II-60	A.F. Wilson	blacklight trap
14	Collier	Immokalee	4-IV-60	H.M. Faircloth	blacklight trap
1	Collier	Naples	13-IX-63	B.K. Dozier	blacklight trap
15	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
1	Dade	Everglades NP	21-VIII-65	W. Suter	buttress debris
		Mahogany Hammock			mahogany
2	Dade	Miami	12-IV-61	B.K. Dozier	at light
2	Dade	Miami	25-VI-61	P.E. Briggs	blacklight trap
5	Dade	Miami	28-VIII-61	B.K. Dozier	at light
1	Dade	Miami	18-IX-61	B.K. Dozier	
2	Dade	Miami	21-IX-61	B.K. Dozier	at light
1	Dade	Miami Internat.Airport	5-X-65	J.E. Porter	mosq.light trap
5	DeSoto	Arcadia	1-VI-55	H.A. Denmark	
1	DeSoto	Arcadia	11-IV-62	M.H. Muma	Berlese sample
1	DeSoto	Ft. Ogden	19-IV-66	R.H. Rhoades	Steiner trap
2	Dixie	Old town,1Smi.S.,Rt.349	8-VI-68	R.E. Woodruff	blacklight trap
5	Duval	Jacksonville	23-VI-42	R.C. Barnes	mosq.light trap
9	Duval	Jacksonville	28-VII-42	R.C. Barnes	mosq.light trap
3	Duval	Jacksonville	5-VIII-42	R.C. Barnes	mosq.light trap
4	Duval	Jacksonville	15-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	20-VII-60	L.W. Taylor	blacklight trap
1	Duval	Jacksonville	VIII	R.L. Blickle	
1	Duval	Jacksonville	1-VI	R.L. Blickle	
27	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
3	Duval	Mayport	17-VIII-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	12-X-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	8-III-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	22-III-61	L.W. Taylor	blacklight trap
1	Escambia	Pensacola	2-VIII-60	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	16-VIII-60	T.W. Boyd	blacklight trap
100+	Escambia	Pensacola	8-VIII-61	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	22-VIII-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	30-VIII-61	T.W. Boyd	blacklight trap
11	Escambia	Pensacola	18-VI-62	T.W. Boyd	blacklight trap
1	Gadsden		18-V-39	J.N. Knull	
10	Glades	Moore Haven	3-VII-60	R.E. Woodruff	at light
6	Highlands	Archbold Bio. Sta.	18-20-III-68	R.E. Woodruff	blacklight trap
1	Highlands	Avon Park	10-VI-61	M.H. Muma	Berlese sample
1	Highlands	Avon Park	30-VI-62	M.H. Muma	Berlese sample
1	Highlands	Childs	9-IV-66	W. Suter	swamp floor
2	Highlands	Cornwell, near	7-IV-61	T. Morris	blacklight trap
200+	Highlands	Highlands Hammock SP	4-VIII-61	T. Morris	blacklight trap
58	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
1	Highlands	Highlands Hammock SP	27-VII-64	C.E. Stegmaier	
9638+	Highlands	Lake Letta Subdiv.	1961-62	T. Morris	blacklight trap
	(from 18 collections from May-Nov., with months & collections as follows: V(1), VI(4),VII(4), VIII(5),IX(1),X(2),XI(1); the most specimens (5000+) on 25-VII-61.)				
1	Highlands	Lake Placid	2-IV-62	M.H. Muma	Berlese sample
30	Highlands	Sebring	27-II-61	J.C. Hanlon	blacklight trap
22	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
9	Hillsborough	Tampa	8-VII-60	C.H. Lynch	blacklight trap
5	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
1	Jefferson	Monticello	17-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	6-IX-68	W.H. Whitcomb	blacklight trap
19	Lake	Groveland	2-VIII-65	W.P. Henderson	blacklight trap
42	Lee	Boca Grande Island	9-VI-61	H.M. Faircloth	blacklight trap

(continued)

APPENDICES 36-39

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
7	Lee	Boca Grande Island	16-VI-61	H.M. Faircloth	blacklight trap
21	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
58	Lee	Ft. Myers	25-V-61	H.M. Faircloth	blacklight trap
9	Lee	Ft. Myers	7-IX-61	H.M. Faircloth	blacklight trap
1	Levy		6-V-55	F.W. Mead	
6	Levy		10-X-55	R.A. Morse	
3	Levy	Chiefland	17-VIII-38	W.C. Stehr	
1	Manatee	Oneco	13-IV-66	R.E. Woodruff	blacklight trap
2	Marion	Juniper Springs	29-VII-59	H.A. Denmark	Berlese sample
28	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
1	Marion	Juniper Springs	28-IV-60	H.A. Denmark	Berlese sample
1	Marion	Juniper Springs	25-VII-60	H.A. Denmark	Berlese sample
1	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
1	Okeechobee	Okeechobee	3-VII-38	W.C. Stehr	
7	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
1	Orange	Orlando	20-IX-61	J.R. Woodley	
1	Orange	Orlando	5-VI-62	J.L. Beck	blacklight trap
1	Orange	Winter Park	15-VIII-42	H.T. Fernald	
1	Palm Beach	Belle Glade	15-IV-57	E.D. Harris	bait trap
1	Palm Beach	International Airport	12-VI-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	21-VI-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	16-VII-66	J.E. Porter	mosq.light trap
2	Palm Beach	Jupiter	16-VI-66	B.K. Dozier	
1	Palm Beach	West Palm Beach	22-VII-59	M.L. Messec	blacklight trap
2	Palm Beach	West Palm Beach	23-VII-59	M.L. Messec	blacklight trap
5	Pasco	Dade City	17-VII-38	W.C. Stehr	
74	Pinellas	Dunedin	14-V-59	R.E. Woodruff	at light
1	Pinellas	Largo	28-IX-57	R.E. Woodruff	at light
200+	Pinellas	St. Petersburg	3-VI-62	R.H. Forsyth	blacklight trap
1	Pinellas	Tarpon Springs	19-III-50	H. & A. Howden	at light
15	Polk	Lake Alfred	7-III-61	R.E. Woodruff	at light
7	Polk	Winter Haven	3-VIII-60	J.T. Hayward	blacklight trap
1	Polk	Winter Haven	9-VIII-60	J.T. Hayward	blacklight trap
21	Putnam	Welaka, Univ. Fla.Res.	9-IV-64	H.A. Denmark	blacklight trap
1	Sarasota	Sarasota	16-V-61	J.W. Patton	at light
1	Seminole	Oviedo	23-VII-62	M.H. Muma	Berlese sample
2	Seminole	Sanford	3-VI-60	G.W. Desin	blacklight trap
6	Seminole	Sanford	28-VII-60	G.W. Desin	blacklight trap
3	Seminole	Sanford	6-VIII-60	G.W. Desin	blacklight trap
5	Seminole	Sanford	1-XI-61	G.W. Desin	blacklight trap
10	Seminole	Sanford	8-XI-61	G.W. Desin	blacklight trap
50+	Seminole	Sanford	20-II-62	G.W. Desin	blacklight trap
17	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
6	St. Johns	Crescent Beach	25-VI-60	R.E. Woodruff	at light
5	Taylor	Perry	14-VIII-61	E.P. Merkel	blacklight trap
5	Volusia		27-VII-54	H.A. Denmark	at light
2	Volusia	Enterprise	29-V	H.W. Wenzel	
6	Volusia	Merritt Island	11-III-56	H.V. Weems,Jr.	at light
1	Volusia	New Smyrna	23-VII	M. Wright	
1	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 37: ATAENIUS CYLINDRUS HORN

1	Alachua	Arredondo	12-IV-70	D.P. Wojcik	blacklight trap
1	Alachua	Chantilly Acres	21-VI-67	F.S. Blanton	blacklight trap
1	Alachua	Chitty Ranch	3-IV-69	R.E. Woodruff	cow dung
172	Alachua	Gainesville	various	various	blacklight trap
	(from 44 collections from Feb.-Sept., with months & collections as follows: II(1), III (7), IV(6), V(8), VI(9), VII(7), VIII(3), IX(2); the most specimens (28) on 7-IV-57.)				
7	Alachua	Newnan's Lake, 2mi. W.	12-V-59	R.E. Woodruff	cow dung
1	Alachua	Paradise	18-III-48	M.W. Nirenberg	
1	Alachua	San Felasco Hammock	16-III-48	M.W. Nirenberg	
3	Alachua	near Warren's Cave	8-XII-61	R.E. Woodruff	cow dung
5	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
5	Baker	Glen St. Mary	1-III-61	E.W. Holder,Jr.	on carrion
6	Baker	Olustee	5-III-59	R.E. Woodruff	cow dung
2	Baker	Olustee	16-V-63	E.P. Merkel	blacklight trap
6	Baker	Olustee	22-V-63	E.P. Merkel	blacklight trap
2	Baker	Olustee	11-VI-66	E.P. Merkel	blacklight trap
1	Brevard	Malabar	12-IV-61	M.H. Muma	Berlese sample
1	Broward	Ft. Lauderdale	11-VI-62	G.F. Spencer	blacklight trap
2	Charlotte	Englewood	30-VIII-60	H.M. Faircloth	blacklight trap
104	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
1	Clay	Goldhead Branch St.Pk.	1-V-65	R.E. Woodruff	cow dung
2	Clay	Green Cove Springs	1-VIII-42	R.C. Barnes	mosq.light trap
1	Collier	Immokalee	18-V-60	H.M. Faircloth	blacklight trap
4	Dade	Miami	19-IV-57	C.F. Dowling	blacklight trap
1	DeSoto	Arcadia	15-IX-42	R.C. Barnes	mosq.light trap
4	Dixie	Oldtown, 15mi. S.	8-VI-68	R.E. Woodruff	blacklight trap
15	Duval	Jacksonville	27-VII-42	R.C. Barnes	mosq.light trap
14	Duval	Jacksonville	18-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	8-III-61	L.W. Taylor	blacklight trap
2	Escambia	Pensacola	25-V-60	T.W. Boyd	blacklight trap
2	Gilchrist	near Trenton	2-IV-59	R.E. Woodruff	at light
1	Glades	Moore Haven	3-VII-61	R.E. Woodruff	at light
1	Glades	Palmdale	28-I-59	H.V. Weems,Jr.	under rock
1	Glades	Palmdale, 11mi. S.	19-II-65	R.E. Woodruff	cow dung
49	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
3	Highlands	Archbold Bio. Sta.	3-VII-60I	R.E. Woodruff	cow dung
1	Highlands	Avon Park	18-VII-60	M.H. Muma	Berlese sample
13	Highlands	Avon Park	10-IV-61	R.E. Woodruff	cow dung
11	Highlands	near Cornwell	7-IV-61	T. Morris	blacklight trap
1	Highlands	Highlands Hammock SP	12-VII-59	R.E. Woodruff	deer droppings
1	Highlands	Highlands Hammock SP	5-VI-60	R.E. Woodruff	deer droppings
5	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
4	Highlands	Lake Letta Subdiv.	2-V-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	19-VI-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
1	Highlands	Lorida	8-IV-59	R.E. Woodruff	carrion
1	Hillsborough	Brandon	22-X-65	J.W. Patton	blacklight trap
42	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
16	Hillsborough	Hillsborough River SP	24-III-59	R.E. Woodruff	at light
1	Hillsborough	Tampa	22-VI-42	R.C. Barnes	mosq.light trap
19	Hillsborough	Tampa	14-V-60	E.E. Crooks	blacklight trap
1	Hillsborough	Tampa	8-VI-60	C.H. Lynch	blacklight trap
2	Indian River	Vero Beach	9-VI-64	W.L. Didlingmayer	truck trap #1
1	Jackson		28-V-54		mosq.light trap
1	Jackson	Fla. Caverns St. Pk.	5-X-60	R.E. Woodruff	at light
1	Jefferson	Monticello	29-VII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	27-IV-59	A.M. Phillips	blacklight trap
1	Lee	Alva	30-VII-59	O.M. Bull,Jr.	at light
1	Leon	Silver Lake	29-VII-56	W. Suter	
1	Leon	Tallahassee	22-VIII-69	T.E. Gilland	blacklight trap
1	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight tapp
13	Levy	Otter Creek	14-III-58	R.E. Woodruff	cow dung
2	Levy	Otter Creek	14-III-58	H.V. Weems,Jr.	cow dung
3	Levy	Otter Creek	25-VII-59	H.V. Weems,Jr.	at light
1	Manatee	Longboat Key	3-VII-61	J.W. Patton	at light

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
38	Manatee	Oneco		Paula Dillman	
1	Manatee	Oneco	13-IV-66	R.E. Woodruff	blacklight trap
3	Marion	Juniper Springs	27-VII-59	H.A. Denmark	at light
1	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
1	Marion	Juniper Springs	28-IV-60	H.A. Denmark	Berlese sample
21	Marion	Ocala	6-IV-59	R.E. Woodruff	at light
1	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight tap
74	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
2	Palm Beach		12-V-58	H.A. Denmark	at light
1	Palm Beach	International Airport	5-III-66	J.E. Porter	mosq.light trap
1	Palm Beach	Jupiter	16-VI-66	B.K. Dozier	at light
1	Pasco	Dade City	17-VII-38	W.C. Stehr	
200+	Pinellas	Dunedin	14-V-59	R.E. Woodruff	at light
2	Pinellas	St. Petersburg	1-VI-59	C.E. Bingaman	blacklight trap
2	Polk	Lake Alfred	7-III-61	R.E. Woodruff	at light
1	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
24	Putnam	Hawthorne, 5mi. E.	24-IV-58	R.E. Woodruff	cow dung
20	Putnam	Welaka,UF Reserve	9-IV-64	H.A. Denmark	blacklight trap
1	Santa Rosa	Blackwater River SP	16-VIII-71	H.V. Weem,,Jr.	at light
2	Santa Rosa	Chumukla (Exp. Sta.)	30-V-58	M. Lutrick	blacklight trap
1	Sarasota	Englewood	14-IX-60	H.M. Faircloth	blacklight trap
7	Sarasota	Nokomis	9-V-60	R.E. Woodruff	in spider web
3	Seminole	Markham	24-II-60	J.R. Hunt	cow dung
2	Seminole	Sanford	3-VI-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
21	St. Lucie	Ft. Pierce, 10mi. S.	27-I-59	R.E. Woodruff	human dung
1	Taylor	Jug Island Road	3-VII-65	W. Suter	straw pile
1	Taylor	Perry	29-V-67	W.L. Beers	blacklight trap
7	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 38: ATAENIUS ERRATUS FALL

34	Alachua	Chitty Ranch	5-VI-65	R.E. Woodruff	cow dung
310	Alachua	Gainesville	various	various	blacklight trap
	(from 35 collections from May-Aug., with months & collections as follows: V(2), VI(16), VII(14), VIII(1); the most specimens (37) on 8-VI-59.)				
81	Dade	Miami	7-VI-62	R.W. Swanson	blacklight trap
13	Dade	Miami	3-XII-62	R.W. Swanson	blacklight trap
100	Dade	Miami	31-XII-62	R.W. Swanson	blacklight trap
1	Dade	Miami Beach	12-VII-63	J.E. Porter	mosq.light trap
2	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
4	Gadsden	Quincy	16-VI-58	W.B. Tappan	blacklight trap
5	Jefferson	Big Bend Hort. Lab.	10-VI-69	R.H. Miller	blacklight trap
1	Jefferson	Big Bend Hort. Lab.	27-VI-69	W.H. Whitcomb	blacklight trap
1	Jefferson	Big Bend Hort. Lab.	8-VIII-69	R.E. Woodruff	blacklight trap
1	Leon	Tallahassee	21-VI-65	W. Suter	
2	Leon	Tall Timbers Res.Sta.	8-14-VI-68	W.H. Whitcomb	wood.ham.B-funnel
2	Leon	Tall Timbers Res.Sta.	8-14-VI-68	W.H. Whitcomb	wood.ham.B-funnel
3	Leon	Tall Timbers Res.Sta.	8-14-VI-68	W.H. Whitcomb	wood.ham.B-funnel
2	Leon	Tall Timbers Res.Sta.	14-18-VI-68	W.H. Whitcomb	wood.ham.B-funnel
6	Marion	Ocala	8-VI-62	T.R Adkins	blacklight trap
42	Marion	Ocala	26-VI-62	T.R. Adkins	blacklight trap
4	Orange	Orlando	5-VI-62	J.L. Beck	blacklight trap
3	Santa Rosa	Chumukla (Exp.Sta.)	30-V-58	M. Lutrick	blacklight trap
220	Seminole	Sanford	14-V-58	J.W. Wilson	blacklight trap
16	Seminole	Sanford	8-VI-60	G.W. Desin	blacklight trap
2	Seminole	Sanford	9-VI-60	G.W. Desin	blacklight trap
12	Seminole	Sanford	14-VI-61	G.W. Desin	blacklight trap
7	Seminole	Sanford	3-VII-62	G.W. Desin	blacklight trap
2	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap

APPENDIX 39: ATAENIUS EXIGUUS BROWN

1	Alachua	Chitty Ranch	8-IV-69	R.E. Woodruff	cow dung
179	Alachua	Gainesville	various	various	blacklight trap
	(from 18 collections from Mar.-Oct., with months and collections as follows: III(2), IV(1), V(1), VI(1), VII(5), VIII(2), IX(4), X(2); the most specimens (33) on 15-III-61.)				
6	Alachua	Paynes Prairie	17-IV-70	D.P. Wojcik	Solenopsis nest
1	Broward	Ft. Lauderdale	9-XI-53	O.D. Link	Ocotea fruit
1	Broward	Ft. Lauderdale	8-VI-60	G.F. Spencer	blacklight trap
1	Broward	Internatl. Airport	25-IX-65	J.E. Porter	mosq.light trap
1	Broward	Internatl. Airport	6-I-66	J.E. Porter	mosq.light trap
1	Broward	Internatl. Airport	21-IX-66	J.E. Porter	mosq.light trap
1	Broward	Internatl. Airport	18-X-66	J.E. Porter	mosq.light trap
2	Broward	Internatl. Airport	25-X-66	J.E. Porter	mosq.light trap
1	Clay	Green Cover Springs	11-IX-42	R.C. Barnes	mosq.light trap
16	Collier	Naples, 9mi. W.	13-IX-63	B.K. Dozier	at light
1	Collier	Ochopee	24-VIII-68	S.H. Brown	blacklight trap
1	Dade	Dodge Island	2-XI-66	J.E. Porter	mosq.light trap
1	Dade	Goulds	16-II-37	O.D. Link	Solanum tuberosum
1	Dade	Homestead AFB	19-X-66	J.E. Porter	mosq.light trap
1	Dade	Kendall	2-III-65	Neil Chernoff	at light
1	Dade	Miami	20-XI-53	O.D. Link	McPhail trap
75	Dade	Miami	1960-66	various	blacklight trap
	(from 16 collections from Apr.-Nov., with months and collections as follows: IV(3), V(2), VI(2), VIII(1), IX(3), X(2), XI(3); the most specimens (54) on 13-IX-60.)				
1	Duval	Jacksonville	5-VIII-42	R.C. Barnes	mosq.light trap
5	Duval	Mayport	21-IX-60	L.W. Taylor	blacklight trap
4	Duval	Mayport	12-X-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	8-III-61	L.W. Taylor	blacklight trap
1	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
1	Hernando		13-III-56	R.A. Morse	at light
8	Highlands	Highlands Hammock SP	4-VIII-61	T. Morris	blacklight trap
8	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
2	Highlands	Highlands Hammock SP	12-VI-66	B.K. Dozier	at light
1	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	16-VIII-61	T. Morris	blacklight trap
135	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
36	Highlands	Lake Letta Subdiv.	3-X-61	T. Morris	blacklight trap
3	Highlands	Lake Letta Subdiv.	7-XI-61	T. Morris	blacklight trap
4	Highlands	Lake Letta Subdiv.	21-VI-62	T. Morris	blacklight trap
7	Highlands	Sebring	13-VIII-64	B.K. Dozier	at light
200+	Hillsborough	Brandon	IX-72		
22	Hillsborough	Tampa	8-VII-60	C.H. Lynch	blacklight trap
3	Indian River	Vero Beach	2-XI-61	R.E. Woodruff	at light
3	Indian River	Vero Beach, Oslo area	9-VI-64	W.L. Didlingmayer	truck trap
1	Jackson	Florida Caverns SP	13-IV-60	H.A. Denmark	blacklight trap
4	Lee	Boca Grande	9-VI-61	H.M. Faircloth	blacklight trap
1	Lee	Boca Grande	16-VI-61	H.M. Faircloth	blacklight trap
4	Lee	Boca Grande	26-VI-61	H.M. Faircloth	blacklight trap
12	Lee	Ft. Myers	7-IX-61	H.M. Faircloth	blacklight trap
1	Levy	Ft. Myers	10-X-59	R.A. Morse	at light
3	Manatee	Oneco		Paula Dillman	
13	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
1	Marion	Juniper Springs	23-III-60	H.A. Denmark	Berlese sample
175	Martin	Juniper Springs	14-XI-65	J.C. Dickinson	at light
1	Monroe	Stock Island	3-IV-68	J.I. Feeder	blacklight trap
1	Palm Beach	Internatl. Airport	13-VI-66	J.E. Porter	mosq.light trap
1	Palm Beach	Internatl. Airport	5-VII-66	J.E. Porter	mosq.light trap
1	Palm Beach	Jupiter	16-VI-66	B.K. Dozier	at light
6	Palm Beach	Lake Park		B.K. Dozier	at light

(continued)

APPENDICES 39-42

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Palm Beach	West Palm Beach	12-VII-59	M.L. Messec	blacklight trap
14	Pinellas	St. Petersburg	3-VI-62	R.H. Forsyth	blacklight trap
4	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
2	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
1	Putnam	Welaka,U.of F. Res.	9-IV-64	H.A. Denmark	blacklight trap
2	Volusia	New Smyrna	10-VI	M. Wright	

APPENDIX 40: ATAENIUS FATTIGI CARTWRIGHT

10	Alachua	Austin Cary Forest	2-V-57	L.A. Hetrick	blacklight trap
343	Alachua	Gainesville	various	various	blacklight trap
	(from 51 collections from Feb.-Dec.,with months & collections as follows:II(2),III (5),IV(6),V(2),VI(8),VII(11),VIII(8),IX(3),X(6),XII(1);the most specimens (48) on 14-III-63.)				
1	Alachua	Paradise, 5.3mi. NW	20-IV-48	M.W. Nirenberg	
5	Baker	Olustee	16-V-63	E.P. Merkel	blacklight trap
1	Baker	Olustee	22-V-63	E.P. Merkel	blacklight trap
2	Broward	Ft. Lauderdale	1-XI-60	G.F. Spencer	blacklight trap
10	Calhoun	Blountstown	3-IX-68	N. Paulk	blacklight trap
1	Calhoun	Blountstown	13-VIII-68	E. Curlee	blacklight trap
19	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
4	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
1	Clay		5-VII-61	H.A. Denmark	
5	Collier	Immokalee	4-11-V-60	H.M. Faircloth	blacklight trap
1	Collier	Immokalee	18-V-60	H.M. Faircloth	blacklight trap
1	Collier	Naples, 9mi. N.	13-IX-63	B.K. Dozier	blacklight trap
1	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
10	Dixie	Oldtown, 1Smi. S.	8-VI-68	R.E. Woodruff	blacklight trap
1	Duval	Jacksonville	28-VII-42	R.C. Barnes	mosq.light trap
2	Duval	Jacksonville	15-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	22-IX-42	R.C. Barnes	mosq.light trap
4	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	8-III-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	12-VII-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	13-XII-61	L.W. Taylor	blacklight trap
3	Escambia	Molino	5-IX-68	E.N. Bishop	blacklight trap
2	Escambia	Pensacola	18-VI-62	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	10-VII-62	T.W. Boyd	blacklight trap
1	Glades	Moore Haven	3-VII-61	R.E. Woodruff	at light
4	Gulf	St.Joseph,T.H.StonePk.	14-VI-69	H.V. Weems,Jr.	
1	Gulf	Wewahitchka	13-VII-67	A.H. Boike,Jr.	mosq.light trap
2	Gulf	Wewahitchka	17-VIII-67	A.H. Boike,Jr.	mosq.light trap
26	Highlands	Highlands Hammock SP	4-VIII-61	T. Morris	blacklight trap
32	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
2	Highlands	Highlands Hammock SP	24-VIII-65	W. Suter	subcortical log
2075	Highlands	Lake Letta Subdiv.	1961-62	T. Morris	blacklight trap
	(from 16 collections from May-Nov.,with months & collections as follows:V(1),VI(4), VII(4),VIII(3),IX(1),X(1),XI(2);the most specimens (1000+) on 22-VIII-61.)				
5	Highlands	Sebring	17-XI-60	J.C. Hanlon	blacklight trap
1	Highlands	Sebring	27-I-61	J.C. Hanlon	blacklight trap
1	Highlands	Sebring	31-V-61	T. Morris	blacklight trap
18	Highlands	Sebring	20-XII-61	T. Morris	blacklight trap
6	Hillsborough	Brandon	3-III-60	J.W. Patton	blacklight trap
1	Hillsborough	Tampa	26-III-60	J.W. Patton	blacklight trap
1	Holmes	Westville	23-VIII-68	W.C. Thomas	blacklight trap
1	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
5	Indian River	Vero Beach	2-XI-61	R.E. Woodruff	at light
2	Jackson	Marianna	5-IX-68	E.L. Tipton	blacklight trap
1	Jefferson	Monticello	28-IV-58	A.M. Phillips	blacklight trap
2	Jefferson	Monticello	17-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	23-VIII-68	W.H. Whitcomb	blacklight trap
2	Jefferson	Monticello	29-VIII-68	R.H. Miller	blacklight trap
17	Lee	Boca Grande Island	9-VI-61	H.M. Faircloth	blacklight trap
13	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
1	Lee	Ft. Myers	25-V-61	H.M. Faircloth	blacklight trap
17	Lee	Ft. Myers	7-IX-61	H.M. Faircloth	blacklight trap
1	Leon	Tall Timbers Res.Sta.	19-VIII-69	W. Baker	blacklight trap
5	Levy		10-X-55	H.V. Weems,Jr.	at light
3	Liberty	Torreya State Park	15-16-VIII	H.V. Weems,Jr.	blacklight trap
13	Manatee	Palmetto	16-IX-66	C.J. Bickner	Tidwarf grass
1	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
2	Okaloosa	Crestview	6-IX-68	J.H. Carter	blacklight trap
1	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
1	Orange	Orlando	10-V-62	J.L. Beck	blacklight trap
1	Orange	Winter Park	15-VII-38	H.T. Fernald	at light
1	Palm Beach	International Airport	15-IX-66	J.E. Porter	mosq.light trap
1	Palm Beach	West Palm Beach	22-VII-59	M.L. Messec	blacklight trap
1	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
2	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
1	Putnam	Welaka,UF Conserv.Res.	9-IV-64	H.A. Denmark	blacklight trap
1	Sarasota	Sarasota	16-V-61	J. Hayward	blacklight trap
1	Seminole	Oviedo, 4.5mi. N.	15-X-62	M.H. Muma	Berlese sample
68	Seminole	Sanford	1-XI-61	G.W. Desin	blacklight trap
18	Seminole	Sanford	8-XI-61	G.W. Desin	blacklight trap
1	Seminole	Sanford	21-XII-61	G.W. Desin	blacklight trap
1	Seminole	Sanford	3-VII-62	G.W. Desin	blacklight trap
50	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
1	Volusia	Merritt Island	11-III-56	H.V. Weems,Jr.	at light
1	Volusia	New Smyrna	10-VI	M. Wright	
1	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 41: ATAENIUS GRACILIS (MELSHEIMER)

Thousands of this common species have not yet been tabulated, but the following records are representative.

1040	Alachua	Gainesville	various	various	blacklight trap
	(from 86 collections from all months as follows: I(2),II(6),III(9),IV(7),V(12), VI(17),VII(14), VIII(4),IX(6),X(3),XI(4),XII(1); the most specimens 300+ on 10-IV-63.)				
8	Baker	Olustee	16-V-63	E.P. Merkel	blacklight trap
25	Baker	Olustee	22-V-63	E.P. Merkel	blacklight trap
1	Broward	Davie	4-XII-53	O.O. Link	at light
7	Broward	Ft. Lauderdale	8-VI-60	G.F. Spencer	blacklight trap
11	Broward	Internatl. Airport	1965-66	J.E. Porter	mosq.light trap
	(from 10 collections from V(2),VI(2),IX(5),X(1).)				
1	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
1	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
1	Clay		5-VII-61	H.A. Denmark	at light
1	Clay	Goldhead Branch SP	13-VII-63	B.K. Dozier	
2	Clay	Green Cove Springs	1-VII-42	R.C. Barnes	mosq.light trap
5	Collier	Ochopee	24-VIII-68	S.H. Brown	blacklight trap
9	Collier	Ochopee	27-VIII-68	S.H. Brown	blacklight trap
1	Dade	Goulds	21-23-III-68	R.E. Woodruff	blacklight trap
4	Dade	Goulds	24-IX-68	R.E. Woodruff	blacklight trap
8	Dade	Homestead	26-VII-62	J.H. Knowles	blacklight trap
1	Dade	Homestead AFB	17-VII-66	J.E. Porter	mosq.light trap
326	Dade	Miami	1960-65	various	light traps
	(from 29 collections from Jan.-Nov., with months and collections as follows: I(1), II(1),III(4),IV(7),V(1),VI(3),VII(2),VIII(2),IX(4),X(3),XI(1); the most specimens (96) on 27-VII-60.)				
1	Dade	Port Everglades	13-IX-66	J.E. Porter	mosq.light trap
2	Dade	South Miami	2-V-59	C.F. Dowling	blacklight trap
14	Dade	USDA Pl.Introd.Sta.	10-IV-61	P.E. Griggs	blacklight trap
3	DeSoto	Arcadia	10-VIII-42	R.E. Barnes	mosq.light trap
2	DeSoto	Arcadia	16-IX-42	R.C. Barnes	mosq.light trap
3	Duval	Jacksonville	23-VI-42	R.C. Barnes	mosq.light trap
5	Duval	Jacksonville	5-VIII-42	R.C. Barnes	mosq.light trap
10	Duval	Jacksonville	14-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	18-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	10-X-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	VIII	R.L. Blickle	
1	Duval	Mayport	23-XI-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	22-III-61	L.W. Taylor	blacklight trap
1	Escambia	Pensacola	31-X-61	T.W. Boyd	blacklight trap
1	Gadsden	Quincy	21-IV-59	W.B. Tappan	blacklight trap
1	Gulf	Wewahitchka	24-VIII-69	C. Laird	blacklight trap
1	Henry	Clewiston	2-II-41	M. Wright	
7	Highlands	Archbold Bio. Sta.	18-20-III-68	R.E. Woodruff	blacklight trap
2	Highlands	Cornwell, near	7-IV-61	T. Morris	blacklight trap
497	Highlands	Lake Letta Subdiv.	1961-62	T. Morris	blacklight trap
	(from 12 collections from III(1),V(1),VI(1),VIII(3),X(2),XI(2),XII(1); the most specimens (160+) on 10-XII-61.)				
27	Highlands	Sebring	20-XII-61	T. Morris	blacklight trap
48	Highlands	Sebring	15-I-62	T. Morris	blacklight trap
110	Hillsborough	Brandon	3-III-60	J.W. Patton	blacklight trap
2	Hillsborough	Brandon	12-V-60	J.W. Patton	blacklight trap
1	Hillsborough	Tampa	18-XI-42	R.C. Barnes	mosq.light trap
1	Hillsborough	Tampa	14-V-60	E.E. Crooks	blacklight trap
4	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
32	Jackson	Florida Caverns SP	18-IV-63	R.E. Woodruff	blacklight trap
2	Jackson	Sneads	18-V-54	J.P. McDaniel	mosq.light trap
3	Jackson	Sneads	25-V-54	J.P. McDaniel	mosq.light trap
1	Jefferson	Monticello	29-VII-58	A.M. Phillips	blacklight trap
2	Jefferson	Monticello	25-III-59	A.M. Phillips	blacklight trap
12	Jefferson	Monticello	6-X-59	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	9-X-69	W.H. Whitcomb	blacklight trap
2	Lee	Boca Grande Island	16-VI-61	N.M. Faircloth	blacklight trap
118	Leon	Tall Timbers Res.Sta.	1-13-VIII-68	L. Collins	blacklight trap
3	Leon	Tall Timbers Res.Sta.	5-6-X-68	W. Baker	blacklight trap
1	Leon	Tall Timbers Res.Sta.	28-31-I-69	W. Baker	blacklight trap
23	Leon	Tall Timbers Res.Sta.	6-VIII-69	W. Baker	blacklight trap
1	Leon	Tall Timbers Res.Sta.	1-6-VI-70	O. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	22-29-VI-70	O. Harris	pitfall trap
1	Liberty	Torreya SP	15-VI-64	T.E. White	
6	Liberty	Torreya SP	20-V-64	H.V. Weems,Jr.	blacklight trap
1	Manatee	Manatee Springs	2-VIII-65	B.K. Dozier	
12	Manatee	Oneco		Paula Dillman	
1	Manatee	Oneco	13-IV-66	R.E. Woodruff	blacklight trap
1	Marion	Juniper Springs	23-III-60	H.A. Denmark	Berlese sample
18	Marion	Juniper Springs	26-II-60	H.A. Denmark	Berlese sample
10	Marion	Juniper Springs	20-IV-60	H.A. Denmark	Berlese sample
1	Marion	Ocala	6-IV-59	R.E. Woodruff	at light
4	Marion	Ocala	20-IV-62	T.R. Adkins	blacklight trap
5	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
1	Monroe	Key West	V-59	J.B. Barnwell	mosq.light trap
1	Monroe	Stock Island	26-XII-62	F.A. Buchanan	blacklight trap
5	Orange	Apopka	3-X-65	R.E. Woodruff	blacklight trap
1	Orange	Winter Park	2-V-45	H.T. Fernald	
3	Pasco	Dade City	17-VII-38	W.C. Stehr	
5	Pinellas	Dunedin	14-V-59	R.E. Woodruff	at light
1	Polk	Lake Alfred	1-III-61	R.E. Woodruff	at light
4	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
4	Polk	Winter Haven	5-VIII-60	J. Hayward	blacklight trap
5	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
15	Putnam	Welaka,U.of Fla.Res.	9-IV-64	H.A. Denmark	blacklight trap
1	Sarasota	Mayakka River SP	10-IV-54	D.J. Borror	at light
1	Seminole	Fern Park	30-I-62	G.W. Desin	Steiner trap
1	Seminole	Sanford	21-XI-60	G.W. Desin	blacklight trap
7	Seminole	Sanford	2-IX-61	G.W. Desin	blacklight trap
50+	Seminole	Sanford	20-II-62	G.W. Desin	blacklight trap
6	Seminole	Sanford	17-VII-62	G.W. Desin	blacklight trap
12	Taylor	Perry	15-VIII-68	E.P. Merkel	blacklight trap
5	Volusia	New Smyrna	20-IV	M. Wright	

APPENDIX 42: ATAENIUS IMBRICATUS (MELSHEIMER)

(The data were recorded before this species was distinguished from havanensis, and some records probably represent that species.)

29	Alachua	Gainesville	1956-68	various	blacklight traps
	(from 12 collections from July-Oct., with months and collections as follows: VII(3), VIII(4),IX(2),X(3); the most specimens (13) on 1-7-VIII-56.)				
1	Baker	Olustee	16-V-63	E.P. Merkel	blacklight trap
3	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
2	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
3	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
25	Charlotte	Punta Gorda	20-X-60	H.M. Faircloth	blacklight trap
6	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
35	Charlotte	Punta Gorda	9-XI-60	H.M. Faircloth	blacklight trap
1	Clay		4-VIII-61	H.A. Denmark	at light
1	Clay	Green Cove Springs	27-VII-42	R.C. Barnes	mosq.light trap
3	Collier	Immokalee	4-IV-60	H.M. Faircloth	blacklight trap
10	Collier	Naples, 9mi. N.	13-IX-63	B.K. Dozier	at light
2	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
68	Dade	Homestead AFB	1965-66	J.E. Porter	mosq.light trap
	(from 18 collections from June-Oct., with months and collections as follows: VI(2), VII(2),VIII(4),IX(6),X(4); the most specimens (10) on 22-VI-66 and 6-X-65.)				
1	Dade	Miami	III-59	C.F. Dowling	blacklight trap
1	DeSoto	Arcadia	15-IX-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	27-VII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	5-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	15-VIII-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	20-VII-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
1	Escambia	Ensley, 3mi. NE	12-VII-66	R.E. Woodruff	at light
1	Escambia	Pensacola	17-V-60	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	25-V-60	T.W. Boyd	blacklight trap
9	Escambia	Pensacola	12-VII-61	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	8-VIII-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	22-VIII-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	6-IX-61	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	18-VI-62	T.W. Boyd	blacklight trap
1	Gulf	Wewahitchka	24-VII-67	A.H. Boike,Jr.	mosq.light trap
2	Highlands	Archbold Bio.Sta.	18-20-III-68	R.E. Woodruff	blacklight trap
9	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
100+	Highlands	Lake Letta Subdiv.	16-VIII-61	T. Morris	blacklight trap
100+	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
30	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
7	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
21	Highlands	Sebring	17-XI-60	J.C. Hanlon	blacklight trap
7	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
21	Lee	Boca Grande Island	16-VI-61	H.M. Faircloth	blacklight trap
54	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
49	Lee	Ft. Myers	7-IX-61	H.M. Faircloth	blacklight trap
3	Lee	Ft. Myers	14-III-63	J.B. Barnwell	mosq.light trap
120	Monroe	Key West	IV-V-VI-60	B. Niren	mosq.light trap
115	Monroe	Key West	VII-VIII-60	B. Niren	mosq.light trap

(continued)

APPENDICES 42-47

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Monroe	Key West	24-X-63	B.K. Dozier	at light
2	Monroe	Key West	27-X-63	B.K. Dozier	at light
159	Monroe	Stock Island	various	various	light traps
	(From 18 collections from May-Oct., with months & collections as follows: V(1), VI(4),VII(2),VIII(1),IX(4),X(6); the most specimens (76) on 9-IX-58.)				
4	Okaloosa	Crestview	6-IX-68	J.H. Carter	blacklight trap
1	Orange	Orlando	31-VII-65	W. Suter	grass pile
1	Palm Beach	West Palm Beach	23-VII-59	M.L. Messec	blacklight trap
1	Pinellas	Largo	28-IX-59	R.E. Woodruff	at light
2	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
1	Santa Rosa	Chumuckla (Exp. Sta.)	30-V-58	M. Lutrick	blacklight trap
3	Seminole	Sanford	1-XI-61	G.W. Desin	blacklight trap
1	Taylor	Perry	15-VIII-68	E.P. Merkel	blacklight trap
5	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 43: ATAENIUS MIAMII CARTWRIGHT

1	Alachua	Gainesville	5-III-58	R.E. Woodruff	under board
1	Alachua	Gainesville	25-VIII-58	J.W. Perry	blacklight trap
1	Alachua	Gainesville	26-II-59	R.E. Woodruff	malt trap
1	Alachua	Gainesville	10-VIII-661	R.E. Woodruff	swimming pool
6	Alachua	Gainesville	15-VIII-66	R.E. Woodruff	swimming pool
13	Alachua	Gainesville	22-VIII-66	R.E. Woodruff	swimming pool
1	Alachua	Gainesville	24-VII-67	R.E. Woodruff	swimming pool
15	Alachua	Gainesville	10-24-VIII	R.E. Woodruff	swimming pool
3	Alachua	Gainesville	17-IV-70	D.P. Wojcik	Solenopsis nest
1	Alachua	Paynes Prairie	17-IV-70	D.P. Wojcik	Solenopsis nest
4	Broward	Ft. Lauderdale	19-IX-66	J.E. Porter	mosq.light trap
1	Broward	Internat. Airport	5-X-65	J.E. Porter	mosq.light trap
1	Broward	Internat. Airport	30-IX-65	J.E. Porter	mosq.light trap
1	Broward	Internat. Airport	13-VIII-66	J.E. Porter	mosq.light trap
4	Broward	Internat. Airport	19-IX-66	J.E. Porter	mosq.light trap
1	Broward	Internat. Airport	25-X-66	J.E. Porter	mosq.light trap
1	Broward	Port Everglades	19-IX-66	J.E. Porter	mosq.light trap
1	Collier	Naples, 9mi. N.	13-IX-63	B.K. Dozier	at light
2	Dade	Miami	21-VII-23	F.N. Young	(Paratypes)
32	Dade	Miami	25-VIII-63	B.K. Dozier	at light
1	Dade	Miami	14-VIII-64	C.E. Stegmaier	at light
2	Dade	Miami	8-VIII-66	B.K. Dozier	
2	Dade	Miami	15-VIII-66	B.K. Dozier	
22	Dade	Miami	24-VIII-66	B.K. Dozier	
1	Dade	Miami Beach	3-VII-64	J.E. Porter	mosq.light trap
1	Dade	Miami Beach	24-VII-64	J.E. Porter	mosq.light trap
1	Dade	Miami Beach	14-IX-64	J.E. Porter	mosq.light trap
3	Dade	Miami Beach	24-IX-64	J.E. Porter	mosq.light trap
1	Dade	Opa Locka	5-VII-66	J.E. Porter	mosq.light trap
2	Dade	Opa Locka,Coast Guard	11-VII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	15-VII-66	J.E. Porter	mosq.light trap
9	Dade	Opa Locka,Coast Guard	8-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	10-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Port Everglades	19-IX-66	J.E. Porter	mosq.light trap
2	Duval	Mayport	12-X-60	L.W. Taylor	blacklight trap
1	Escambia	Pensacola	5-VII-42	R.E. Barnes	mosq.light trap
1	Escambia	Pensacola	2-VII-60	T.W. Goyd	blacklight trap
1	Escambia	Pensacola	16-VIII-60	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	18-VI-62	T.W. Boyd	blacklight trap
1	Gilchrist	Bell	28-IV-34	L. Cobb	at Citrullus sp.
1	Leon	Tall Timbers Res.Sta.	3-IX-68	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	15-27-VI-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	29-VI-6-VII	D. Harris	pitfall trap
2	Leon	Tall Timbers Res.Sta.	17-24-VIII	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	6-12-VII-71	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	1-8-XI-71	D. Harris	pitfall trap
1	Monroe	Plantation Key	4-IV-66	Zeiger & Weems	blacklight trap
2	Monroe	Stock Island	13-X-65	F.A. Buchanan	blacklight trap
1	Monroe	Stock Island	19-X-66	F.A. Buchanan	blacklight trap
15	Monroe	Stock Island	9-VIII-68	F.A. Buchanan	blacklight trap
1	Palm Beach	Internat. Airport	21-IX-66	J.E. Porter	mosq.light trap
1	Polk	Winter Haven	30-V-67	M.H. Muma	in cantrap

APPENDIX 44: ATAENIUS PICINUS HAROLD

2	Alachua	Gainesville, 3mi. N.	3-VII-65	R.E. Woodruff	cow dung
1	Alachua	Gainesville	30-V-2-VI-68	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	14-16-VI-68	R.E. Woodruff	blacklight trap
2	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
1	Duval	Mayport	12-X-60	L.W. Taylor	blacklight trap
6	Duval	Mayport	22-III-61	L.W. Taylor	blacklight trap
24	Escambia	Bratt, 3.5mi. SE	VI-68	A.J. Blanton	blacklight trap
129	Escambia	Bratt	VI-68	F.S. Blanton	blacklight trap
1	Escambia	Bratt	28-VI-68	F.S. Blanton	blacklight trap
1	Escambia	Bratt	29-VI-68	F.S. Blanton	blacklight trap
1	Escambia	Bratt	25-VIII-68	F.S. Blanton	blacklight trap
3	Escambia	Molino	5-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Molino	18-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Molino	25-IX-69	E.N. Bishop	blacklight trap
2	Escambia	Ensley, 3mi. NE	12-VII-66	R.E. Woodruff	at light
34	Escambia	Pensacola	1960-62	T.W. Boyd	blacklight trap
	(From 11 collections from IV(2),V(3),VI(2),VII(2),X(1);the most specimens (11) on 23-V-62.)				
1	Escambia	Walnut Hill	12-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Walnut Hill	26-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Walnut Hill	3-X-68	E.N. Bishop	blacklight trap
1	Escambia	Walnut Hill	10-X-68	E.N. Bishop	blacklight trap
5	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
3	Jackson		28-V-54		mosq.light trap
1	Jackson	near Butler's Landing	6-VI-54	F.N. Young	
1	Jackson	Marianna	5-IX-68	E.L. Tipton	blacklight trap
2	Jefferson	Big Bend Hort. Lab.	8-VII-69	R.E. Woodruff	blacklight trap
2	Jefferson	Monticello	19-V-59	A.M. Phillips	blacklight trap
1	Leon	Tall Timbers Res.Sta.	11-VII-69	W. Baker	blacklight trap #4
1	Leon	Tall Timbers Res.Sta.	11-VII-69	W. Baker	blacklight trap
5	Leon	Tall Timbers Res.Sta.	27-VII-69	A. Bhatkar	blacklight trap
2	Monroe	Key West	28-IV-60	J.B. Barnwell	mosq.light trap
2	Okaloosa	Crestview, 12mi. N.	31-VIII-60	W.C. Rhoades	blacklight trap
1	Okaloosa	Crestview	J-IX-68	J.H. Carter	blacklight trap
1	Santa Rosa	Chumuckla, (Exp. Sta.)	1958-59	M. Lutrick	blacklight trap
	(From 12 collections from Apr.-Oct.,with months & collections as follows:IV(3),V(3), VI(1),VII(2),IX(2),X(1);the most specimens (84) on 30-V-58.)				
1	Santa Rosa	Jay	23-V-62	T.W. Boyd	blacklight trap
13	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	

APPENDIX 45: ATAENIUS PLATENSIS BLANCHARD

204	Alachua	Gainesville	various	various	light traps
	(From 21 collections from Mar.-Oct.,with months & collections as follows:III(3),IV(3), V(2),VI(2),VII(6),VIII(4),X(1);the most specimens (64) on 7-VII-57.)				
4	Baker	Glen St. Mary	23-II-61	E.W. Holder,Jr.	malt trap
1	Baker	Macclenny	28-VIII-67	H.W. Collins	blacklight trap
1	Bay	Panama City Beach	5-VII-67	A.H. Boike,Jr.	mosq.light trap
2	Bay	Panama City Beach	11-VII-67	A.H. Boike,Jr.	mosq.light trap
1	Bay	St. Andrews St. Pk.	19-IV-63	R.E. Woodruff	blacklight trap
3	Calhoun	Blountstown	3-IX-68	H. Paulk	blacklight trap
14	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
1	Dade		IV-49		
1	Dade	Goulds	28-X-68	Mead & Habeck	blacklight trap
1	Dade	Goulds,Monkey Jungle	24-IV-68	R.E. Woodruff	blacklight trap
1	Dade	Homestead	18-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Homestead, AFB	18-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Homestead, AFB	11-IX-66	J.E. Porter	mosq.light trap
10	Dade	Miami	28-IX-60	P.E. Briggs	blacklight trap
1	Dade	Miami	11-V-62	R.T. McMillan	blacklight trap
1	Dade	Miami	25-V-62	R.T. McMillan	blacklight trap
1	Dade	Miami	31-V-62	R.T. McMillan	blacklight trap
2	Dade	Miami	26-IX-62	R.T. McMillan	blacklight trap
1	Dade	Miami	18-I-63	R.E. Brown	blacklight trap
1	Dade	Miami Internat.Airport	15-VII-66	J.E. Porter	mosq.light trap
1	Dade	Miami Internat.Airport	25-VII-66	J.E. Porter	mosq.light trap
1	Dade	Miami Internat.Airport	19-X-66	J.E. Porter	mosq.light trap
1	Dade	Modello	5-II-37	O.D. Link	
1	Dade	Orchid Jungle	2-VIII-68	R.M. Baranowski	blacklight trap
1	Dade	Ross-Costello Hammock	12-IX-68	R.M. Baranowski	blacklight trap
2	Dade	South Miami	19-IV-59	C.F. Dowling	blacklight trap
7	Dade	USDA Plant Intro.Sta.	10-IV-61	P.E. Briggs	blacklight trap
2	Dade	West Miami	16-VII-59	R.W. Swanson	blacklight trap
1	Duval	Jacksonville	14-VIII-42	R.C. Barnes	mosq.light trap
2	Escambia	Bratt	27-VIII-64	Blanton & Broce	blacklight trap
18	Escambia	Bratt, 3 1/2mi. SE	VI-68	A.J. Blanton	blacklight trap
7	Escambia	Bratt	25-VIII-68	F.S. Blanton	blacklight trap
20	Escambia	Ensley, 3mi. NE	12-VII-66	R.E. Woodruff	at light
431	Escambia	Pensacola	1960-62	T.W. Boyd	blacklight trap
	(From 18 collections from Mar.-Oct.,with months & collections as follows:III(1),IV(1), V(4),VI(2),VII(1),VIII(5),IX(2),X(2);the most specimens (110) on 20-VI-62.)				
1	Escambia	Walnut Hill	10-X-68	E.N. Bishop	blacklight trap
17	Gulf	Wewahitchka	1967-69	Boike & Laird	light traps
	(From 10 collections from VII(4),VIII(5),X(1).				
1	Hamilton	Jennings, 6mi. SW	22-III-62	T.R. Adkins	sweet potato
65	Hendry	Clewiston	13-IX-59	R.E. Woodruff	human dung
1	Highlands	Avon Park	10-VII-61	M.H. Muma	Berlese sample
5	Highlands	Avon Park	30-VII-62	M.H. Muma	Berlese sample
1	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
2	Hillsborough	Knights	5-VII-61	M.H. Muma	Berlese sample
2	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
1	Jackson	Fla. Caverns St. Pk.	9-VII-54	F.W. Mead	sweeping
40	Jackson	Fla. Caverns St. Pk.	18-IV-63	R.E. Woodruff	blacklight trap
10	Jackson	Marianna	5-IX-68	E.L. Tipton	blacklight trap
1	Jackson	Sneads	18-V-54	J.P. McDaniel	mosq.light trap
1	Jefferson	Big Bend Hort. Lab.	18-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Big Bend Hort. Lab.	31-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	6-IX-68	W.H. Whitcomb	blacklight trap
3	Leon	Chaires	17-VII-65	W. Suter	sawdust pile
1	Leon	Tallahassee	21-VI-65	W. Suter	
7	Leon	Tallahassee	22-VIII-69	T.E. Gilland	blacklight trap
62	Leon	Tall Timbers Res.Sta.	1968-72	D. Harris	pitfall traps
	(From 34 collections from every month except Feb.,Oct.,Nov.,with months & collections I(1),III(2),IV(3),V(4),VI(6),VII(9),VIII(3),IX(2),XII(2);the most specimens (13) on 12-21-VI-72.)				
3	Liberty	Torreya State Park	16-VIII-60	H.V. Weems,Jr.	blacklight trap
600	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
3	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight trap
7	Manatee	Oneco		Paula Dillman	
2	Manatee	Parrish	20-VII-60	M.H. Muma	Berlese sample
1	Manatee	Parrish	19-IV-61	M.H. Muma	Berlese sample
1	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
10	Okaloosa	Crestview	3-IX-68	J.H. Carter	blacklight trap
1	Okaloosa	Crestview	5-IX-68	J.H. Carter	blacklight trap
3	Okaloosa	Crestview	6-IX-68	J.H. Carter	blacklight trap
1	Orange	Orlando	22-VIII-65	W. Suter	
2	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
186	Santa Rosa	Chumuckla, (Exp. Sta.)	1958-62	M. Lutrick	blacklight trap
	(From 13 collections from Apr.-Oct.,with months & collections as follows:IV(1),V(3), VI(1),VII(2),VIII(1),IX(3),X(2);the most specimens (44) on 29-IX-59.)				
9	Santa Rosa	Jay	29-V-62	T.W. Boyd	blacklight trap
2	Taylor	Perry	29-V-67	W.L. Beers	blacklight trap
1	Taylor	Perry	14-VIII-68	E.P. Merkel	blacklight trap
8	Taylor	Perry	15-VIII-68	E.P. Merkel	blacklight trap
12	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 46: ATAENIUS RUDELLUS FALL

55	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
15	Charlotte	Punta Gorda	20-X-60	H.M. Faircloth	blacklight trap
5	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
10	Charlotte	Punta Gorda	9-XI-60	H.M. Faircloth	blacklight trap
1	Dade	Dodge Island	19-IX-66	J.E. Porter	mosq.light trap
1	Dade	Dodge Island	11-X-66	J.E. Porter	mosq.light trap
1	Dade	Homestead AFB	18-VIII-60	J.E. Porter	mosq.light trap
1	Dade	USDA Plant Intro.Sta.	10-IV-61	P.E. Briggs	blacklight trap
3	Duval	Mayport	8-III-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	22-III-61	L.W. Taylor	blacklight trap
6	Lee	Boca Grande Island	9-VI-61	H.M. Faircloth	blacklight trap
5	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
1	Monroe	Bahia Honda SP, 101	26-28-VI-70	R.E. Woodruff	blacklight trap
1	Monroe	Flamingo, Everg1.NP	5-IV-58	R.E. Woodruff	at light
1	Monroe	Flamingo, Everg1.NP	10-V-66	F.E. Craighead	at light
1	Monroe	Key Largo	24-VI-70	K.E.& R.E.Woodruff	blacklight trap
5	Monroe	Key West	VII-VIII	Ben Niren	mosq.light trap
1	Monroe	Key West	28-IV-60	J.B. Barnwell	mosq.light trap
1	Monroe	Key West	15-V-60	J.B. Barnwell	mosq.light trap
2	Monroe	Key West	26-XI-60	C.A. Bennett	blacklight trap
2	Monroe	Key West	27-I-61	C.A. Bennett	blacklight trap
59	Monroe	Stock Island	1958-68	various	blacklight trap
	(From 17 collections from Feb.-Dec., with months and collections as follows: II(1), III(1),V(2),VI(1),VII(2), VIII(2),IX(3),X(2),XI(1),XII(2); the most specimens (18) on 21-V-68.)				

APPENDIX 47: ATAENIUS SARAMARI CARTWRIGHT

41	Marion	Juniper Springs	1959-61	H.A. Denmark	Pinus clausa debris
	(From 12 collections from I(2),IV(1),V(2),VII(1),VIII(1),IX(2),X(1),XI(1),XII(1); the most specimens (10) on 21-IX-59.)				
1	Marion	Wefrsdale	22-V-55	M.H. Muma	Berlese sample
1	Martin	Jonathan Dickinson SP	17-VII-59	H.A. Denmark	Berlese sample
2	Osceola	Alligator Lake, near	17-VII-59	H.A. Denmark	Berlese sample
2	Osceola	Alligator Lake, near	30-X-59	R.E. Woodruff	under Pinus clausa
6	Osceola	St. Cloud, SE of	29-I-62	M.H. Muma	Berlese sample
1	Osceola	St. Cloud, SE of	18-VII-62	M.H. Muma	Berlese sample
17	Osceola	St. Cloud, 5mi. E.	22-X-62	M.H. Muma	Berlese sample
12	St. Lucie		17-VII-59	H.A. Denmark	Berlese sample

APPENDICES 48-49

APPENDIX 48: ATAENIUS SIMULATOR HAROLD

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
2	Alachua	Arredunda Estates	22-VII-69	D.P. Wojcik	blacklight trap
1	Alachua	Austin Cary Forest	7-VII-66	L.A. Hetrick	blacklight trap
2563	Alachua	Gainesville	various	various	light traps
	(from 136 collections from every month, with months & collections as follows: I(8), II(5),III(8),IV(10),V(15),VI(32),VII(19),VIII(9),IX(10),X(10),XI(5),XII(4); the most specimens (250+) on 6-VII-61.)				
6	Alachua	High Springs	29-V-54	M. Nelson	mosq.light trap
1	Alachua	R20E, T10S, S5	10-III-50		
1	Baker	Glen St. Mary	19-IX-58	R.E. Woodruff	cow dung
1	Baker	Glen St. Mary	16-XII-61	E.W. Holder,Jr.	malt trap
25	Baker	Olustee	11-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	23-VIII-66	E.P. Merkel	blacklight trap
1	Bay	Panama City Beach	11-VII-67	A.H. Boike,Jr.	mosq.light trap
1	Bay	St. Andrews SP	19-IV-63	R.E. Woodruff	blacklight trap
4	Calhoun	Blountstown	3-IX-66	H. Paulk	blacklight trap
5	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
1	Clay	Gold Head Branch SP	13-VII-63	B.K. Dozier	blacklight trap
2	Clay	Green Cove Springs	27-VII-42	R.C. Barnes	mosq.light trap
1	Clay	Green Cove Springs	1-VIII-42	R.C. Barnes	mosq.light trap
1	Collier	Everglades	18-V-54	J.M. Davison	mosq.light trap
1	Dade	Miami Internatl.Airport			
2	DeSoto	Arcadia	10-VIII-42	R.C. Barnes	mosq.light trap
3	DeSoto	Arcadia	14-VIII-61	M.H. Muma	Berlese sample
1	DeSoto	Arcadia	17-X-62	M.H. Muma	Berlese sample
1	DeSoto	Brownville	21-IV-66	R.H. Rhoades	Steiner trap
2	Dixie	Oldtown,Rt.349,15mi.S.	8-VI-68	R.E. Woodruff	blacklight trap
4	Duval	Jacksonville	23-VI-42	R.C. Barnes	mosq.light trap
4	Duval	Jacksonville	28-VII-42	R.C. Barnes	mosq.light trap
3	Duval	Jacksonville	15-VIII-42	R.C. Barnes	mosq.light trap
2	Duval	Jacksonville	5-V-69	R. King	blacklight trap
16	Duval	Mayport	7-VII-60	L.W. Taylor	blacklight trap
5	Duval	Mayport	12-X-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	2-XI-60	L.W. Taylor	blacklight trap
1	Duval	Mayport	23-XI-60	L.W. Taylor	blacklight trap
7	Duval	Mayport	22-III-61	L.W. Taylor	blacklight trap
6	Duval	Mayport	21-XII-61	L.W. Taylor	blacklight trap
300	Escambia	Bratt	27-VIII-64	Blanton & Broce	blacklight trap
80	Escambia	Bratt, 3kmi.SE	VI-68	A.J. Blanton	blacklight trap
45	Escambia	Bratt	VI-68	F.S. Blanton	blacklight trap
18	Escambia	Bratt	28-VI-68	F.S. Blanton	blacklight trap
1	Escambia	Bratt	29-VI-68	F.S. Blanton	blacklight trap
95	Escambia	Bratt	25-VIII-68	F.S. Blanton	blacklight trap
10	Escambia	Ensley, 3mi. NE	12-VII-66	R.E. Woodruff	at light
1	Escambia	Molino	17-X-68	E.N. Bishop	blacklight trap
1	Escambia	Molino	24-IV-69	T.C. Bishop	blacklight trap
2	Escambia	Molino	1-V-69	T.C. Bishop	blacklight trap
204	Escambia	Pensacola	various	Boyd & Barnes	light traps
	(from 16 collections from Apr.-Aug., with months and collections as follows: IV(2), V(3),VI(2),VII(3),VIII(6); the most specimens (100+) on 25-VII-61.)				
17	Escambia	Walnut Hill	10-X-68	E.N. Bishop	blacklight trap
1	Gadsden	Glen Julia Springs	6-VI-54	F.N. Young	
261	Gadsden	Quincy	1958-61	W.B. Tappan	blacklight trap
	(from 9 collections from II(1),IV(1),V(2),VI(1),VII(1),VIII(1),IX(1),X(1); the most specimens (200+) on 8-VI-59.)				
1	Gilchrist	Trenton	28-IV-66	E. Gourley	Gopherus burrow,6'
1	Gulf	Wewahitchka	31-VII-67	A.H. Boike,Jr.	mosq.light trap
1	Gulf	Wewahitchka	6-IX-67	A.H. Boike,Jr.	
2	Gulf	Wewahitchka	3-IX-69	C. Laird	blacklight trap
2	Gulf	Wewahitchka	3-X-69	C. Laird	blacklight trap
32	Hamilton	Jasper, 8mi. N.	8-XI-57	R.E. Woodruff	at light
1	Hardee	College Mill	24-VII-63	R.H. Rhoades	Steiner trap
2	Hendry	Clewiston	13-IX-59	R.E. Woodruff	human dung
6	Highlands	Archbold Bio. Sta.	18-20-III-68	R.E. Woodruff	blacklight trap
1	Highlands	Avon Park	23-I-61	M.H. Muma	Berlese sample
2	Highlands	Avon Park	30-VII-62	M.H. Muma	Berlese sample
2	Highlands	Cornwell, near	7-IV-61	T. Morris	blacklight trap
17	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	light
20	Highlands	Highlands Hammock SP	13-VIII-65	B.K. Dozier	light
40	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
75	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
150	Highlands	Lake Letta Subdiv.	27-VI-61	T. Morris	blacklight trap
30	Highlands	Lake Letta Subdiv.	19-VII-61	T. Morris	blacklight trap
14	Highlands	Lake Letta Subdiv.	16-VIII-61	T. Morris	blacklight trap
35	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
8	Highlands	Lake Letta Subdiv.	11-VII-62	T. Morris	blacklight trap
3	Highlands	Sebring	15-I-62	T. Morris	blacklight trap
77	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
1	Hillsborough	Dover	1-IV-71	E.R. Simmons	blackeye peas
15	Hillsborough	Tampa	22-VI-42	R.C. Barnes	mosq.light trap
2	Hillsborough	Tampa	14-V-60	E.E. Crooks	blacklight trap
58	Holmes	Westville	3-IX-68	W.C. Thomas	blacklight trap
1	Indian River	Vero Beach	18-V-54	Fultz	mosq.light trap
1	Indian River	Vero Beach	8-VI-64	W.L. Bidlingmayer	suction trap
50	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
20	Jackson		28-V-54		mosq.light trap
4	Jackson		18-III-58	H.V. Weems,Jr.	cow dung
4	Jackson	Florida Caverns SP	13-IV-60	H.A. Denmark	blacklight trap
100+	Jackson	Florida Caverns SP	18-IV-63	R.E. Woodruff	blacklight trap
4	Jackson	Marianna	5-IX-68	E.L. Tipton	blacklight trap
1	Jackson	Marianna	11-IX-68	E.L. Tipton	blacklight trap
50+	Jackson	Sneads	25-V-54	J.P. McDaniel	mosq.light trap
284	Jefferson	Big Bend Hort. Lab.	various	various	blacklight trap
	(from 20 collections from Mar.-Nov., with months & collections as follows: III(1), IV(2),V(1),VI(4),VII(2),VIII(4),IX(4),X(2); the most specimens (100+)on 11-VI-58 and 9-VII-58.)				
1	Lake		1-IX-54	F.W. Mead	
8	Lake	Groveland	5-V-61	W.P. Henderson	at light
6	Lake	Groveland	2-III-65	W.P. Henderson	blacklight trap
65	Lake	Groveland	2-VIII-65	W.P. Henderson	blacklight trap
2	Leon	Tallahassee	21-VI-65	W. Suter	
121	Leon	Tall Timbers Res.Sta.	1968-72	various	pitfall traps
	(from 66 collections from every month except Feb.,Sept.,Oct., with months and collections as follows: I(5),II(9),IV(21),V(6),VI(8),VII(7),VIII(1),XI(5),XII(5); the most specimens (13) on 8-18-VI-68.)				
1	Levy	Inglis	26-VII-60	T.R. Adkins	Jap beetle trap
2	Levy	Manatee Springs	23-VIII-68	B.K. Dozier	
1	Liberty	Torreya State Park	16-IV-62	R.E. Woodruff	blacklight trap
10	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
2	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight trap
1	Liberty	Torreya State Park	15-16-VIII	H.V. Weems, Jr.	blacklight trap
1	Liberty	White Oak Landing	18-VIII-53	F.N. Young	
3	Madison		11-V-54	V.W. Henry	mosq.light trap
1	Madison		14-V-54	V.W. Henry	mosq.light trap
2	Madison	Madison	20-IV-66	R. Hamrick	tobacco field
1	Manatee	Bradenton	31-VIII-60	E.H. Frederic	blacklight trap
1	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
1	Manatee	Parrish	17-X-62	M.H. Muma	Berlese sample
1	Marion	Anthony	31-III-59	E.W. Holder,Jr.	cow dung
4	Marion	Juniper Springs	28-VII-59	H.A. Denmark	at light
1	Marion	McIntosh	18-V-54	Schorfhaar	mosq.light trap
250	Marion	Ocala	6-IV-59	R.E. Woodruff	at light
20	Marion	Ocala	8-VI-62	R.T. Adkins	blacklight trap
23	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
10000	Okaloosa	Crestview, 12mi. N.	31-VIII-60	W.C. Rhoades	blacklight trap
6	Okaloosa	Laurel Hill	18-V-54	Thomas	mosq.light trap
2	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
23	Orange	Apopka	3-X-68	R.E. Woodruff	blacklight trap
40	Orange	Orlando	20-IV-62	J.L. Beck	blacklight trap
12	Orange	Orlando	10-V-62	J.L. Beck	blacklight trap
75	Orange	Orlando	23-V-62	J.L. Beck	blacklight trap
68	Orange	Orlando	5-VI-62	J.L. Beck	blacklight trap
2	Osceola	Kissimmee	29-VI-61	M.H. Muma	Berlese sample
1	Palm Beach	Jupiter	16-VI-69	B.K. Dozier	blacklight trap
3	Palm Beach	West Palm Beach	23-VII-59	M.L. Messec	blacklight trap
105	Pinellas	Dunedin	14-V-59	R.E. Woodruff	at light
1	Pinellas	Largo	28-IX-59	R.E. Woodruff	at light
2	Polk	Lake Alfred	7-III-61	R.E. Woodruff	at light
3	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
1	Polk	Winter Haven	25-IV-62	J. Hayward	blacklight trap
4	Polk	Winter Haven	29-V-62	R.W. Robnett	blacklight trap
2	Putnam	Welaka,U.of Fla.Res.	9-IV-64	H.A. Denmark	blacklight trap
7	Santa Rosa		22-VII-55	E.D. McCall	on peanuts
675	Santa Rosa	Chumukla (Exp.Sta.)	1958-62	M. Lutrick	blacklight trap
	(from 17 collections from Apr.-Oct., with months and collections as follows: IV(1), V(5),VI(1),VII(3),VIII(2),IX(3),X(2); the most specimens (175) on 24-X-58.)				
72	Seminole	Sanford	1960-62	G.W. Desin	blacklight trap
	(from 9 collections from II(2),VI(1),VII(3),VIII(1),XI(2); the most specimens (43) on 17-VII-62.)				
1	St. Johns	St. Augustine	5-VII-38	W.C. Stehr	
1	St. Lucie	Ft. Pierce	24-XII-43	O.D. Link	string beans
1	St. Lucie	Ft. Pierce	11-I-44	G.F. Carter	string beans
1	Suwannee	Suwannee	28-IV-54	H.V. Weems,Jr.	
80	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap
1	?	Loch Arbor	17-V-60	C.O. Youtsey	at light

APPENDIX 49: ATAENIUS SPRETULUS (HALDEMAN)

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
15	Alachua	Gainesville	1968	various	blacklight trap
	(from 13 collections from Mar.-Aug.,with months & collections as follows:III(1),V(2), VI(2),VII(7),VIII(1).)				
4	Brevard	Merritt Island	11-III-56	H.V. Weems,Jr.	at light
1	Broward	Ft. Lauderdale	16-V-60	G.F. Spencer	blacklight trap
2	Broward	Ft. Lauderdale	1-XI-60	G.F. Spencer	blacklight trap
1	Broward	International Airport	11-V-66	J.E. Porter	mosq.light trap
1	Broward	International Airport	18-IX-66	J.E. Porter	mosq.light trap
10	Charlotte	Punta Gorda	15-V-57	R.E. Woodruff	at light
2	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
25	Charlotte	Punta Gorda	20-X-60	H.M. Faircloth	blacklight trap
2	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
39	Charlotte	Punta Gorda	9-XI-60	H.M. Faircloth	blacklight trap
1	Charlotte	Punta Gorda	1-XII-60	H.M. Faircloth	blacklight trap
1	Charlotte	Punta Gorda	9-XII-60	H.M. Faircloth	blacklight trap
4	Charlotte	Punta Gorda, 6mi. S.	19-XI-68	R.G. Akins	blacklight trap
25	Collier		17-IX-68	S.H. Brown	blacklight trap
13	Collier	Immokalee	8-VI-58	R.E. Woodruff	at light
8	Collier	Immokalee	9-16-II-60	A.F. Wilson	blacklight trap
5	Collier	Immokalee	23-29-III-60	A.F. Wilson	blacklight trap
15	Collier	Immokalee	4-IV-60	H.M. Faircloth	blacklight trap
2	Collier	Immokalee	13-IV-60	H.M. Faircloth	blacklight trap
16	Collier	Immokalee	11-V-60	H.M. Faircloth	blacklight trap
39	Collier	Immokalee	18-V-60	H.M. Faircloth	blacklight trap
21	Collier	Ochopee	24-VIII-68	S.H. Brown	blacklight trap
8	Collier	Ochopee	27-VIII-68	S.H. Brown	blacklight trap
15	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
2	Dade		5-III-49		
16	Dade		12-III-49		
33	Dade		IV-49		
6	Dade		20-IV-49		
35	Dade		V-49		
4	Dade		12-V-49		
17	Dade		28-V-49		
1	Dade		10-IV-61	B.K. Dozier	
1	Dade		1-V-61	B.K. Dozier	
1	Dade	Coral Gables	8-VII-59	R.W. Swanson	
2	Dade	Coral Gables	9-VII-59	R.W. Swanson	blacklight trap
4	Dade	Coral Gables	10-VII-59	R.W. Swanson	blacklight trap
1	Dade	Dodge Island, E.	14-VI-66	J.E. Porter	mosq.light trap
3	Dade	Everglades NP,JunkHam.	21-V-59	R.M. Baranowski	Berlese sample
2	Dade	Everglades NP,JunkHam.	3-VII-59	R.M. Baranowski	Berlese sample
3	Dade	Everglades NP,JunkHam.	10-VII-59	R.M. Baranowski	Berlese sample
3	Dade	Fairchild Trop.Gardens	20-VI-59	R.W. Swanson	blacklight trap
1	Dade	Goulds,Monkey Jungle	21-23-III-60	R.E. Woodruff	blacklight trap
3	Dade	Goulds,Monkey Jungle	24-IV-68	R.E. Woodruff	blacklight trap
197	Dade	Homestead	various	various	light traps
	(from 32 collections from every month except Nov.,with months & collections as follows:I(2),II(4),III(1),IV(1),V(1),VI(4),VII(3),VIII(4),IX(6),X(4),XII(2);the most specimens (22) on 19-VII-66.)				
1	Dade	Kendall	26-III-65	Neil Chernoff	at light
178	Dade	Miami	various	various	light traps
	(from 36 collections from every month except Dec.,with months & collections as follows:I(2),II(1),III(5),IV(1),V(2),VI(11),VII(5),VIII(1),IX(3),X(1),XI(2);the most specimens (24) on 8-VIII-60.)				
2	Dade	Miami Springs	21-VIII-65	B.K. Dozier	
1	Dade	Opa Locka,Coast Guard	6-VII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	11-VII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	8-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Orchid Jungle	2-VIII-68	R.M. Baranowski	blacklight trap
5	Dade	Orchid Jungle	29-VIII-68	R.M. Baranowski	blacklight trap
3	Dade	Perrine	29-VI-60	P.E. Briggs	blacklight trap
1	Dade	Perrine	2-VII-60	P.E. Briggs	blacklight trap
3	Dade	Perrine	3-VII-60	P.E. Briggs	blacklight trap
7	Dade	Perrine	5-VII-60	P.E. Briggs	blacklight trap
500+	Dade	Plant Intro. Sta.	10-IV-61	P.E. Briggs	blacklight trap
1	Dade	Sub-Tropical Exp.Sta.	12-IV-69	R.M. Baranowski	blacklight trap
1	Duval	Jacksonville	5-V-69	R. King	blacklight trap
2	Duval	Mayport	2-XI-60	L.W. Taylor	blacklight trap
13	Duval	Mayport	1-II-61	L.W. Taylor	blacklight trap
11	Duval	Mayport	8-III-61	L.W. Taylor	blacklight trap
2	Duval	Mayport	15-III-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	22-III-61	L.W. Taylor	blacklight trap
2	Glades	Moore Haven	3-VII-61	R.E. Woodruff	at light
1	Gulf	Wewahitchka	21-VIII-67	A.H. Boike,Jr.	mosq.light trap
4	Hardee	Zolfo Springs	26-III-62	R.E. Woodruff	cow dung
15	Highlands	Archbold Bio. Sta.	18-20-III-68	R.E. Woodruff	blacklight trap
2	Highlands	Avon Park	15-I-62	M.H. Muma	Berlese sample
1	Highlands	Highlands Hammock SP	5-VI-60	R.E. Woodruff	deer droppings
1	Highlands	Lake Letta Subdiv.	2-V-61	T. Morris	blacklight trap
31	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	8-VII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	8-VIII-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
9	Highlands	Sebring	20-XII-61	T. Morris	blacklight trap
3	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
1	Hillsborough	Tampa	14-V-60	E.E. Crooks	blacklight trap

(continued)

APPENDICES 49-52

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
14	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
1	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
10	Lee	Ft. Myers	14-III-63	H.M. Faircloth	blacklight trap
1	Leon	Tall Timbers Res.Sta.	18-VI-70	D. Harris	pitfall trap
3	Manatee	Bradenton	16-V-54	W.G. Emmer	mosq.light trap
1	Manatee	Bradenton	19-III-58	R.E. Woodruff	at light
3	Manatee	Bradenton Beach	16-V-54	W.G. Emmer	mosq.light trap
2	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
40	Monroe	Everglades NP,Flamingo	14-III-62	G.F. Spencer	blacklight trap
3	Monroe	Key Largo	28-VII-60	W.W. Warner	mosq.light trap
6	Monroe	Key West	28-IV-60	J.B. Barnwell	mosq.light trap
14	Monroe	Key West	VII-VIII-60	B. Niren	
2	Monroe	Key West	27-I-61	C.A. Bennett	blacklight trap
2	Monroe	Key West	14-III-69	F.A. Buchanan	blacklight trap
29	Monroe	Stock Island	various	Warner & Buchanan	light traps
	(from 10 collections from IV(2),V(2),VI(1),IX(1),X(2),XII(2);the most specimens (12) on 9-IX-58.)				
1	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
1	Orange	Orlando	5-III-38	H.T. Fernald	
1	Palm Beach	Belle Glade	6-V-57	E.J. Harris	
1	Palm Beach	International Airport	12-VI-66	J.E. Porter	mosq.light trap
2	Palm Beach	Pahokee	20-I-41	O.W. Calkins	in McPhail trap
1	Palm Beach	South Bay	6-I-42	G.H. Baker	
3	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
1	Sarasota	Mayakka River St. Pk.	3-VI-54	H.V. Weems,Jr.	at light
5	Sarasota	Sarasota	16-V-61	J.W. Patton	at light
1	Seminole	Sanford	5-VIII-60	G.W. Desin	blacklight trap
6	Seminole	Sanford	19-X-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	27-X-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	17-XI-60	G.W. Desin	blacklight trap
2	Seminole	Sanford	2-II-61	G.W. Desin	blacklight trap
2	Seminole	Sanford	2-III-61	G.W. Desin	blacklight trap
1	Seminole	Sanford	1-XI-61	G.W. Desin	blacklight trap
1	St. Lucie	Ft. Pierce	14-IX-59	M.H. Muma	Berlese sample

APPENDIX 50: ATAENIUS RHYTICEPHALUS (CHEVROLAT)

1	Alachua	Gainesville	7-VIII-56	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville	12-VI-68	A.T. Fletcher	mosq.light trap
1	Alachua	Gainesville	9-IX-68	R.E. Woodruff	blacklight trap
1	Alachua	Grant's Cave	10-XI-57	R.E. Woodruff	under wood in cave
1	Collier	Collier-Seminole SP	20-III-58	R.E. Woodruff	Human dung
1	Dade	Everglades NP,JunkHam.	20-IV-60	R.M. Baranowski	Berlese sample
1	Duval	Jacksonville	18-VIII-42	R.C. Barnes	mosq.light trap
1	Highlands	Highlands Hammock SP	27-VII-59	R.E. Woodruff	deer droppings
5	Highlands	Highlands Hammock SP	9-IX-59	R.E. Woodruff	deer droppings
1	Jefferson	Big Bend Hort. Lab.	18-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	23-VIII-68	W.H. Whitcomb	blacklight trap
2	Marion	Juniper Springs	27-VII-59	H.A. Denmark	at light
2	Marion	Juniper Springs	28-VII-59	H.A. Denmark	at light
1	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
1	Sarasota	Mayakka River St. Pk.	16-VI-65	W. Suter	buttress debris

APPENDIX 51: PSAMMODIUS MALKINI CARTWRIGHT

22	Alachua	Arredondo Estates	16-IX-66	A.L. O'Berry	blacklight trap
1	Alachua	Austin Cary Forest	25-VI-66	L.A. Hetrick	blacklight trap
120	Alachua	Austin Cary Forest	9-VI-66	L.A. Hetrick	blacklight trap
2	Alachua	Austin Cary Forest	16-17-IX-66	L.A. Hetrick	blacklight trap
1574+	Alachua	Gainesville	various	various	light traps
	(from 105 collections from Mar.-Oct.,with months & collections as follows:III(1),IV (5),V(8),VI(27),VII(32),VIII(12),IX(13),X(4);the most specimens (200+) on 11-13-VII-69.)				
2	Alachua	Melrose	1-VII-70	R.E. Brown	blacklight trap
1	Baker	Macclenny	26-IX-68	H.W. Collins	blacklight trap
1	Baker	Macclenny	28-VI-69	H.W. Collins	blacklight trap
2	Baker	Macclenny	24-VII-69	H.W. Collins	blacklight trap
2	Baker	Olustee	23-VI-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	20-22-VIII	E.P. Merkel	blacklight trap
63	Broward	Ft. Lauderdale	8-VI-60	G.F. Spencer	blacklight trap
30	Broward	Ft. Lauderdale	9-VI-60	G.F. Spencer	blacklight trap
1	Broward	Ft. Lauderdale	7-VII-60	G.F. Spencer	blacklight trap
1	Broward	Ft. Lauderdale	2-IX-60	G.F. Spencer	blacklight trap
13	Broward	Ft. Lauderdale	11-VI-62	G.F. Spencer	blacklight trap
2	Broward	International Airport	11-VIII-65	J.E. Porter	mosq.light trap
1	Broward	International Airport	9-XI-65	J.E. Porter	mosq.light trap
1	Broward	International Airport	24-VI-66	J.E. Porter	mosq.light trap
5	Broward	International Airport	19-IX-66	J.E. Porter	mosq.light trap
1	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
28	Charlotte	Punta Gorda	15-V-57	R.E. Woodruff	at light
8	Charlotte	Punta Gorda, 6mi. S.	19-IX-68	R.O. Akins	blacklight trap
1	Collier	Immokalee	20-27-IV-60	H.M. Faircloth	blacklight trap
2	Collier	Naples, 9mi. N.	13-IX-63	B.K. Dozier	at light
4	Collier	Ochopee	15-X-68	S.H. Brown	blacklight trap
1	Dade	Homestead	5-X-68	R.M. Baranowski	blacklight trap
14	Dade	Homestead	21-IX-69	R.M. Baranowski	blacklight trap
72	Dade	Miami	various	various	light traps
	(from 23 collections from May-Nov.,with months & collections as follows:V(1),VI(4), VII(5),VIII(2),IX(8),X(4),XI(1);the most specimens (20) on 3-IX-60.)				
4	Dade	Opa Locka	15-VI-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka	8-VIII-66	J.E. Porter	mosq.light trap
4	Dade	Ross-Costello Hammock	2-X-68	R.M. Baranowski	blacklight trap
1	Dade	Ross-Costello Hammock	22-X-68	R.M. Baranowski	blacklight trap
4	Dade	Ross-Costello Hammock	1-VIII-69	R.M. Baranowski	blacklight trap
5	Dade	Ross-Costello Hammock	22-VIII-69	R.M. Baranowski	blacklight trap
1	Dade	Ross-Costello Hammock	11-IX-69	R.M. Baranowski	blacklight trap
6	Dade	Ross-Costello Hammock	10-X-69	R.M. Baranowski	blacklight trap
3	Dade	Ross-Costello Hammock	20-X-69	R.M. Baranowski	blacklight trap
6	Dade	Ross-Costello Hammock	21-X-69	R.M. Baranowski	blacklight trap
2	Dade	Sub-Tropical Exp.Sta.	12-IX-69	R.M. Baranowski	blacklight trap
6	Dade	Sub-Tropical Exp.Sta.	30-IX-69	R.M. Baranowski	blacklight trap
3	Dade	Sub-Tropical Exp.Sta.	24-X-69	R.M. Baranowski	blacklight trap
5	DeSoto	Arcadia	15-IX-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	15-IX-42	R.C. Barnes	mosq.light trap
1	Duval	Jacksonville	22-IX-42	R.C. Barnes	mosq.light trap
47	Duval	Jacksonville	9-VIII-61	L.W. Taylor	blacklight trap
1	Duval	Jacksonville	11-VI-69	R. King	blacklight trap
1	Duval	Jacksonville	23-VII-69	R. King	blacklight trap
2	Duval	Jacksonville	12-VIII-69	R. King	blacklight trap
4	Duval	Jacksonville	11-X-69	R. King	blacklight trap
5	Duval	Jacksonville	15-IX-69	R. King	blacklight trap
643+	Duval	Mayport	1960-61	L.W. Taylor	blacklight trap
	(from 11 collections from July-Nov.,with months & collections as follows:VII(4),VIII (3),IX(2),X(1),XI(1);the most specimens (200+) on 12-VII-61 & 2-VIII-61.)				
1	Highlands	Avon Park	7-XII-59	M.H. Muma	Berlese sample
5	Highlands	Highlands Hammock SP	4-VIII-61	T. Morris	blacklight trap
8	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
5	Highlands	Lake Letta Subdiv.	14-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	4-VI-62	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	19-VII-62	T. Morris	blacklight trap
1	Highlands	Lake Placid	25-VIII-65	W. Suter	buttress debris

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Indian River	Vero Beach	12-V-64	W.L. Bidlingmayer	truck trap
128	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
67	Indian River	Vero Beach	11-VI-64	W.L. Bidlingmayer	truck trap
1	Lake	Minneola	16-VII-62	M.H. Muma	Berlese sample
1	Lee	Ft. Myers	7-IX-61	H.M. Faircloth	blacklight trap
1	Levy	Manatee Springs	27-VII-68	S.K. Derr	blacklight trap
2	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
1	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
5	Marion	Ocala	16-VI-62	T.R. Adkins	blacklight trap
14	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
3	Orange	Apopka	9-X-68	H. Van Pelt	blacklight trap
1	Osceola	Kissimmee	16-X-61	M.H. Muma	Berlese sample
1	Palm Beach	International Airport	12-VIII-65	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	12-X-65	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	31-V-66	J.E. Porter	mosq.light trap
1	Palm Beach	International Airport	4-VII-66	J.E. Porter	mosq.light trap
1	Palm Beach	West Palm Beach	10-V-62	R.A. Long	blacklight trap
2	Palm Beach	West Palm Beach	23-VIII-59	M.L. Messec	blacklight trap
2	Pinellas	Largo	13-VI-69	Hickman & Hill	blacklight trap
33	Pinellas	Largo	17-VI-69	K. Hickman	blacklight trap
4	Pinellas	St. Petersburg	3-VI-62	R.M. Forsyth	blacklight trap
4	Pinellas	St. Petersburg	23-VIII-66	W.A. Allen	Bahia grass lawn
16	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
1	Polk	Winter Haven	5-VIII-60	J. Hayward	blacklight trap
2	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
1	Polk	Winter Haven	13-VI-62	W. Breidenbach	blacklight trap
1	Polk	Winter Haven	3-VII-62	C.O. Rick	blacklight trap
4	Putnam	Interlachen, 2mi. SW	5-X-71	Graham & Woodruff	blacklight trap
7	Putnam	Interlachen, 2mi. SW	5-6-X-71	Graham & Woodruff	blacklight trap
10	Putnam	Interlachen, 2mi. SW	6-X-71	Graham & Woodruff	blacklight trap
2	Sarasota	Englewood	7-8-VII-70	J.H. Brown	blacklight trap
1	Seminole	Sanford	19-X-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	3-VII-62	G.W. Desin	blacklight trap
4	Seminole	Sanford	17-VI-62	G.W. Desin	blacklight trap
1	Taylor	Perry	8-VIII-68	E.P. Merkel	blacklight trap
1	Taylor	Perry	19-VIII-68	E.P. Merkel	blacklight trap

APPENDIX 52: PLEUROPHORUS LONGULUS CARTWRIGHT

150	Alachua	Austin Cary Forest	25-VI-66	L.A. Hetrick	Ellisco trap 15w
150	Alachua	Austin Cary Forest	9-VII-66	L.A. Hetrick	blacklight trap
500	Alachua	Austin Cary Forest	28-30-VII-66	L.A. Hetrick	blacklight trap
1000	Alachua	Austin Cary Forest	10-IX-66	L.A. Hetrick	blacklight trap
500	Alachua	Austin Cary Forest	16-17-IX-66	L.A. Hetrick	blacklight trap
6000+	Alachua	Gainesville	various	various	light traps
	(From 154 collections from every month except Jan. & Mar., with months & collections as follows: II(2),IV(4),V(9),VI(22),VII(31),VIII(31),IX(32),X(19),X(2),XII(1); the most specimens (434) on 3-IX(70.)				
5	Alachua	Melrose	1-VII-70	R.E. Brown	blacklight trap
3221	Baker	Glen St. Mary	various	H.C. Collins	blacklight trap
	(from 11 collections from Apr.-Oct., with months & collections as follows: IV(1), V(1),VIII(4),IX(2),X(3); the most specimens (1000+) on 26-VIII-69.)				
424	Baker	Macclenny	various	H.C. Collins	blacklight trap
	(from 13 collections from May-Oct., with months and collections as follows: V(2), VI(5),VII(3),IX(1),X(2); the most specimens (100) on 15-VII-69.)				
4800+	Baker	Olustee	various	E.P. Merkel	blacklight trap
	(from 19 collections from May-Oct., with months & collections as follows: V(2), VI(5),VII(3),VIII(5),IX(3),X(1); the most specimens (1250+) from 22-28-IX-66.)				
1	Broward	Ft. Lauderdale	8-VI-60	G.F. Spencer	blacklight trap
225	Calhoun	Blountstown	various	H. Paulk	blacklight trap
	(From 7 collections from VIII(1),IX(4),X(2);the most specimens (100+ on 3-IX-68.)				
1	Charlotte	Punta Gorda	3-XI-60	H.M. Faircloth	blacklight trap
1	Charlotte	Punta Gorda, 6mi. S.	19-IX-68	R.O. Akins	blacklight trap
20	Dade	Homestead	21-IX-69	R.M. Baranowski	blacklight trap
1	Dade	Miami	19-VII-60	P.E. Briggs	blacklight trap
4	Dade	Miami	13-IX-60	P.E. Brigs	blacklight trap
1	Dade	Miami	11-V-62	R.T. McMillan	blacklight trap
3	Dade	Miami	9-X-62	J.R. McFarlin	blacklight trap
2	Dade	Opa Locka,Coast Guard	6-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Ross-Costello Hammock	2-X-68	R.M. Baranowski	blacklight trap
1	Dade	Ross-Costello Hammock	11-IX-68	R.M. Baranowski	blacklight trap
1	Dade	Ross-Costello Hammock	10-X-69	R.M. Baranowski	blacklight trap
7	Dade	Sub-Tropical Exp.Sta.	12-IX-69	R.M. Baranowski	blacklight trap
2	Dade	Sub-Tropical Exp.Sta.	30-IX-69	R.M. Baranowski	blacklight trap
350	Duval	Jacksonville	various	R. King	blacklight trap
	(from 11 collections from May-Sept., with months & collections as follows: V(2), VI(3),VII(2),VIII(1),IX(3); the most specimens (100+) on 11-IX-69.)				
1	Duval	Mayport	1-VIII-60	L.W. Taylor	blacklight trap
6	Duval	Mayport	12-X-60	L.W. Taylor	blacklight trap
41	Escambia	Bratt	various	various	blacklight trap
	(from 11 collections from VI(6),VII(4),IX(1); the most specimens (18) on 27-VII-64.)				
596	Escambia	Molino	various	E.N. & T. Bishop	blacklight trap
	(from 12 collections from June-Oct., with months & collections as follows: VI(2), VII(1),VIII(3),IX(4),X(2); the most specimens (200+) on 5-IX-68.)				
1281	Escambia	Pensacola	various	Barnes & Boyd	blacklight trap
	(from 18 collections from June-Oct. & Feb., with months & collections as follows: VI(1),VII(3),VIII(8),IX(2),X(3),XI(1); the most specimens (260+) on 22-VIII-61.)				
430	Escambia	Walnut Hill	various	various	blacklight trap
	(from 11 collections from IV(1),IX(7),X(3); the most specimens (250+) on 28-IX-69.)				
200+	Gadsden	Quincy	26-VIII-58	W.B. Tappan	blacklight trap
10	Gadsden	Quincy	15-IX-58	W.B. Tappan	blacklight trap
10	Gadsden	Quincy	23-IX-58	W.B. Tappan	blacklight trap
4	Gadsden	Quincy	12-X-59	W.B. Tappan	blacklight trap
423	Gulf	Wewahitchka	various	C. Laird	blacklight trap
	(from 10 collections from Aug.-Nov., with months & collections as follows: VIII(3), IX(3),X(3),XI(1); the most specimens (100+) on 14-VIII-55 & 14-X-69.)				
75	Hardee	Ona	3-V-67	B. Fagan	blacklight trap
36	Hardee	Ona	17-VIII-67	B. Fagan	blacklight trap
120	Hardee	Ona,Range Cattle Exp.S.	18-IX-68	B. Fagan	blacklight trap
20	Hernando	Brooksville,3¼mi. S.	31-VII-69	C.B. Williams	blacklight trap
40	Highlands	Highlands Hammock SP	4-VIII-61	T. Morris	blacklight trap
13	Highlands	Highlands Hammock SP	13-VIII-64	B.K. Dozier	at light
632	Highlands	Lake Letta Subdiv.	various	T. Morris	blacklight trap
	(from 11 collections from June-Dec., with months & collections as follows: VI(2), VII(3),VIII(2),IX(1),X(2),XII(1); the most specimens (500+) on 22-VIII-61.)				
1	Highlands	Lake Placid,Parker Is.	25-VIII-65	W. Suter	buttress debris
13	Highlands	Sebring	20-XII-61	T. Morris	blacklight trap
11	Highlands	Sebring	15-I-62	T. Morris	blacklight trap
50	Hillsborough	Brandon	17-19-V-62	J.W. Patton	blacklight trap
8	Hillsborough	Brandon	3-III-66	J.W. Patton	blacklight trap
10	Hillsborough	Brandon	12-V-66	J.W. Patton	blacklight trap
1	Hillsborough	Tampa	6-V-60	E.E. Crooks	blacklight trap
5	Hillsborough	Tampa	14-V-60	E.E. Crooks	blacklight trap
20	Holmes	Ponce de Leon	1968	W.C. Thomas	blacklight trap
600	Holmes	Ponce de Leon	3-IX-68	W.C. Thomas	blacklight trap
11	Indian River	Vero Beach	9-VI-64	W.L. Bidlingmayer	truck trap
400	Jackson		27-VIII-69	E.L. Tipton	blacklight trap
144	Jackson	Marianna	various	Barnes & Tipton	blacklight trap
	(from 9 collections from May,Aug.-Oct., with months & collections as follows: V(1), VIII(1),IX(3),X(4); the most specimens (75) on 27-IX-68.)				
36781+	Jefferson	Big Bend Hort.Lab.	various	various	light traps
	(from 153 collections from Mar.-Oct., with months & collections as follows: III(2),				

(continued)

APPENDICES 52-57

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
	IV(1),V(10),VI(19),VII(16),VIII(27),IX(42),X(35); the most specimens (2050+) on 17-VIII-68.)				
80	Lake	Pittman	5-VIII-69	K. Lorenzen	blacklight trap
2	Lee	Boca Grande Island	16-VI-61	H.M. Faircloth	blacklight trap
1	Lee	Boca Grande Island	26-VI-61	H.M. Faircloth	blacklight trap
2	Leon	Tallahassee	15-X-68	T.E. Gilland	blacklight trap
18	Leon	Tallahassee	11-VIII-69	T.E. Gilland	blacklight trap
27	Leon	Tallahassee	22-VIII-69	T.E. Gilland	blacklight trap
21551	Leon	Tall Timbers Res.Sta.	various	various	blackl.& pitfall
	(from 116 collections from Mar.-Dec., with months & collections as follows: III(1), IV(1),V(11),VI(14),VII(12),VIII(12),IX(34),X(24),XI(2),XII(4); the most specimens (1500+) on 5-IX-69.)				
8	Levy	Manatee Springs	27-VIII-68	S.K. Derr	blacklight trap
10	Manatee	Palmetto	22-VI-62	E.H. Frederic	blacklight trap
17	Manatee	Parrish, 12mi. N.	11-IV-66	R.E. Woodruff	blacklight trap
3	Manatee	Oneco	13-IV-66	R.E. Woodruff	blacklight trap
1	Marion	Ocala	6-IV-59	R.E. Woodruff	at light
8	Marion	Ocala	16-VI-62	T.R. Adkins	blacklight trap
8	Marion	Ocala	22-VI-62	T.R. Adkins	blacklight trap
1	Monroe	Key West	17-VIII-68	F.A. Buchanan	blacklight trap
2	Monroe	Key West	13-IX-68	F.A. Buchanan	blacklight trap
1	Monroe	Key West	17-IX-68	F.A. Buchanan	blacklight trap
1	Monroe	Stock Island	6-VIII-68	F.A. Buchanan	blacklight trap
1300	Okaloosa	Crestview	various	J. Carter	blacklight trap
	(from 18 collections from VIII(6),& IX(12); the most specimens (225+) on 17-VIII-69.)				
150	Okaloosa	Eglin AFB, 3mi.S.Holt	4-X-66	R.E. Woodruff	blacklight trap
2	Orange	Apopka	3-X-60	R.E. Woodruff	blacklight trap
35	Orange	Apopka	4-X-68	R.E. Woodruff	blacklight trap
75	Orange	Apopka	7-X-68	H. Van Pelt	blacklight trap
175	Orange	Apopka	8-X-68	H. Van Pelt	blacklight trap
100	Orange	Apopka	9-X-68	H. Van Pelt	blacklight trap
1	Orange	Orlando	1-IX-69		mosq.light trap
2	Pinellas	Dunedin	14-V-59	R.E. Woodruff	at light
1	Pinellas	Largo	28-IX-59	R.E. Woodruff	blacklight trap
3	Pinellas	Largo	16-X-66	L.B. Hill	blacklight trap
11	Pinellas	Largo	19-20-VI-69	Hill & Hickman	blacklight trap
50+	Pinellas	St. Petersburg	3-VI-62	R.H. Forsyth	blacklight trap
7	Polk	Winter Haven	3-VIII-60	J. Hayward	blacklight trap
1	Polk	Winter Haven	5-VIII-60	J. Hayward	blacklight trap
2	Polk	Winter Haven	9-VIII-60	J. Hayward	blacklight trap
16	Putnam	Interlachen, 2mi.S.	5-X-71	Graham & Woodruff	blacklight trap
100	Putnam	Interlachen, 2mi.S.	6-X-71	Graham & Woodruff	blacklight trap
2	Putnam	Red Water Lake, Weems	9-IX-67	H.V. & D. Weems	blacklight
13	Putnam	Welaka, U.of F. Res.	9-IV-64	H.A. Denmark	blacklight trap
1	St. Johns	Crescent Beach	7-VIII-71	R.E. Woodruff	blacklight trap
100	Santa Rosa		18-VIII-59	M. Lutrick	blacklight trap
11	Santa Rosa	Blackwater River S.For.	16-VIII-71	H.V. Weems,Jr.	at light
100	Santa Rosa	Milton	30-VIII-68	Bill Zain	blacklight trap
100	Santa Rosa	Milton	9-IX-68	J.J. Spears	blacklight trap
100	Santa Rosa	Milton	29-IX-68	Bill Zain	blacklight trap
1	Santa Rosa	Chumukla (Exp.Sta.)	1-VIII-58	M. Lutrick	blacklight trap
44	Santa Rosa	Chumukla (Exp.Sta.)	11-IX-58	M. Lutrick	blacklight trap
9	Santa Rosa	Chumukla (Exp.Sta.)	29-IX-58	M. Lutrick	blacklight trap
10	Santa Rosa	Chumukla (Exp.Sta.)	24-X-58	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp.Sta.)	21-VII-59	M. Lutrick	blacklight trap
10	Santa Rosa	Chumukla (Exp.Sta.)	12-X-59	M. Lutrick	blacklight trap
2	Seminole	Sanford	8-XI-61	G.W. Desin	blacklight trap
492	Taylor	Perry	various	Merkel & Beers	blacklight trap
	(from 26 collections from VI(2),VII(5),VIII(16),IX(3); the most specimens (300+) on 26-VIII-69.)				
503	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap
30	Washington	Chipley	4-X-68	J.E. Davis	blacklight trap
50	Washington	Chipley	18-X-68	J.E. Davis	blacklight trap

APPENDIX 53: HYBOSORUS ILLIGERI REICHE

266	Alachua	Gainesville	various	various	light traps
	(from 51 collections from Apr.-Oct., with months and collections as follows: IV(2), V(14),VI(8),VII(8),VIII(9),IX(7),X(2); the most specimens (50+) on 6-VII and 12-VII-61.)				
2	Baker	Glen St. Mary	10-VI-60	E.W. Holder,Jr.	at light
1	Bay	Panama City	13-V-57	F.W. Mead	at light
40	Broward	Ft. Lauderdale	8-VI-60	G.F. Spencer	blacklight trap
1	Broward	Internatl. Airport	17-XI-61	J.E. Porter	mosq.light trap
1	Broward	Internatl. Airport	11-IX-63	J.E. Porter	mosq.light trap
47	Broward	Internatl. Airport	1965-66	J.E. Porter	mosq.light trap
	(from 33 collections from May-Nov., with months & collections as follows: V(10), VI(6),VII(1),VIII(9),IX(4),XI(3); the most specimens (7) on 15-VIII-65.)				
1	Calhoun	Blountstown	27-V-54	H.M. Van Pelt	at light
2	Dade	Florida City	27-VIII-65	W. Suter	at light
1	Dade	Hialeah	15-V-62	C.E. Stegmaier	at light
63	Dade	Homestead	various	various	light traps
	(from 8 collections from V(3),VIII(2),IX(1),X(2); the most specimens (50+) on 21-V-59.)				
614	Dade	Miami	various	various	light traps
	(from 136 collections from Apr.-Oct., with months and collections as follows: IV(2),V(20),VI(26),VII(15),VIII(27),IX(28),X(14); the most specimens (85) on 9-VI-62.)				
1	Escambia	Pensacola	30-VIII-61	T.W. Boyd	blacklight trap
7	Escambia	Pensacola	14-VI-62	T.W. Boyd	blacklight trap
1	Gadsden	Chattahoochee	10-VI-54	F.N. Young	at light
50+	Gadsden	Quincy	8-VI-59	W.B. Tappan	blacklight trap
1	Highlands	Archbold Biol. Sta.	22-VIII-65	W. Suter	at light
8	Hillsborough	Brandon	11-V-62	J.W. Patton	blacklight trap
6	Hillsborough	Brandon	16-V-62	J.W. Patton	blacklight trap
4	Hillsborough	Brandon	22-VIII-63	J.W. Patton	blacklight trap
11	Jefferson	Big Bend Hort. Lab.	24-V-69	W.H. Whitcomb	blacklight trap
49	Jefferson	Big Bend Hort. Lab.	28-V-69	W.H. Whitcomb	blacklight trap
5	Jefferson	Big Bend Hort. Lab.	30-V-69	W.H. Whitcomb	blacklight trap
4	Jefferson	Big Bend Hort. Lab.	27-VI-69	W.H. Whitcomb	blacklight trap
9	Jefferson	Big Bend Hort. Lab.	27-VI-69	R.E. Woodruff	blacklight trap
1	Jefferson	Monticello	10-IX-68	R.H. Miller	blacklight trap
53	Jefferson	Monticello	22-V-69	R.H. Miller	blacklight trap
1	Lake	Leesburg	10-VI-60	G.W. Dekle	at light
1	Leon	Tall Timbers Res.Sta.	1-13-VIII-68	L. Collins	blacklight trap
1	Leon	Tall Timbers Res.Sta.	27-VII-69	A. Bhathar	blacklight trap
1	Levy		9-IX-56	H.V. Weems,Jr.	
1	Levy		10-X-55	R.A. Morse	
2	Marion	Ocala	13-IV-62	T.R. Adkins	blacklight trap
6	Marion	Ocala	5-VI-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	26-VI-64	T.R. Adkins	blacklight trap
2	Marion	Ocala	17-VII-64	T.R. Adkins	blacklight trap
2	Marion	Ocala	24-VII-64	T.R. Adkins	blacklight trap
1	Monroe	Plantation Key	27-V-68	H.V. Weems,Jr.	at blacklight
1	Nassau	Hilliard	12-VII-59	H.V. Weems,Jr.	at light
35	Okaloosa	Crestview, 12mi. W.	31-VIII-69	W.C. Rhoades	blacklight trap
3	Okaloosa	Ocean City	5-VI-63	H.O. Hilton	at light
1	Palm Beach	Internatl. Airport	18-VI-65	J.E. Porter	mosq.light trap
1	Pasco	Lacoochee	12-VI-69	A.L. O'Berry	blacklight trap
62	Santa Rosa	Jay	6-VI-62	T.W. Boyd	blacklight trap
12	Santa Rosa	Chumukla (Exp. Sta.)	30-V-58	M. Lutrick	blacklight trap
7	Santa Rosa	Chumukla (Exp. Sta.)	24-VI-59	M. Lutrick	blacklight trap
1	Santa Rosa	Chumukla (Exp. Sta.)	16-IX-59	M. Lutrick	blacklight trap
3	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST

APPENDIX 54: OCHODAEUS FRONTALIS LECONTE

154	Alachua	Gainesville	various	various	light traps
	(from 58 collections from June-Nov., with months & collections as follows: VI(7), VII(25),VIII(8),IX(9),X(7),XI(2); the most specimens (44) on 3-10-VIII-72.)				
1	Broward	Ft. Lauderdale	19-IX-66	J.E. Porter	blacklight trap
1	Broward	Internatl. Airport	19-IX-66	J.E. Porter	mosq.light trap
1	Broward	W. Hollywood	3-X-56	D.R. Paulson	at light
2	Charlotte	Englewood	30-VIII-60	H.M. Faircloth	blacklight trap
6	Clay	Goldhead Branch SP	13-VII-63	B.K. Dozier	at light
1	Collier	Immokalee	30-VII-59	H.M. Faircloth	blacklight trap
1	Dade	Homestead	29-VI-62	J.H. Knowles	blacklight trap
66	Dade	Miami	1961-66	Porter & Swanson	light traps
	(from 23 collections from June-Dec., with months & collections as follows: VI(2), VII(1),VIII(3),IX(6),X(6),XI(1),XII(3); the most specimens (19) on 3-X-65.)				
1	Dade	Perrine	1-VI-63	R.W. Swanson	mosq.light trap
2	Duval	Jacksonville	23-VII-42	R.C. Barnes	mosq.light trap
2	Duval	Jacksonville	14-VIII-42	R.C. Barnes	mosq.light trap
3	Duval	Jacksonville	10-X-42	R.C. Barnes	mosq.light trap
30	Highlands	Lake Letta Subdiv.	1961-62	T. Morris	blacklight trap
	(from 18 collections from June-Nov., with months & collections as follows: VI(7), VII(4),VIII(3),IX(1),X(2),XI(1); the most specimens (4) on 19-VII-61.)				
2	Highlands	Sebring	17-XI-60	J.C. Hanlon	blacklight trap
1	Highlands	Sebring	30-VII-62	T. Morris	blacklight trap
1	Highlands	Brandon	22-X-65	J.W. Patton	blacklight trap
1	Indian River	Vero Beach	8-VI-64	W.L. Bidlingmayer	suction trap
3	Indian River	Vero Beach	10-VI-64	W.L. Bidlingmayer	suction trap
1	Jefferson	Monticello	9-VII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	29-VII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	5-VIII-59	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	19-VIII-59	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	17-VII-69	W.H. Whitcomb	blacklight trap
1	Leon	Tall Timbers Res.Sta.	16-VII-3-VIII	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	3-10-IV-72	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	17-24-VII-72	D. Harris	pitfall trap
1	Liberty	Torreya State Park	16-VIII-60	H.V. Weems,Jr.	blacklight trap
1	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
1	Manatee	Oneco		Paula Dillman	
2	Marion	Ocala	1-XI-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	3-VII-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	24-VII-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	31-VII-64	T.R. Adkins	blacklight trap
4	Martin	Salerno	25-V-54	Martin	mosq.light trap
1	Orange	Winter Park	8-VIII-40	H.T. Fernald	at light
1	Orange	Winter Park	14-VII-44	H.T. Fernald	at light
1	Palm Beach	Internatl. Airport	13-VII-66	J.E. Porter	mosq.light trap
1	Palm Beach	West Palm Beach	25-VIII-65	J.E. Porter	mosq.light trap
1	Palm Beach	West Palm Beach	10-IX-65	J.E. Porter	mosq.light trap
1	Pasco	Dade City	17-VII-38	W.C. Stehr	
1	Pasco	Lacoochee	12-VI-69	A.L. O'Berry	blacklight trap
1	Polk	Winter Haven	11-VII-62	R.W. Babbett	blacklight trap
1	Putnam	Crescent City	VI-38	C.T. Brues	
1	Putnam	Interlachen, 2mi. W.	5-X-71	M. Graham	blacklight trap
1	Putnam	Satsuma, 1.7mi. NE	30-VII-38	Hubbell-Friauf	
3	Seminole	Sanford	8-VII-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	5-VIII-60	G.W. Desin	blacklight trap
5	Seminole	Sanford	25-VIII-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	13-X-60	G.W. Desin	blacklight trap
3	Seminole	Sanford, Naval AS	3-VII-62	G.W. Desin	blacklight trap

APPENDIX 55: BOLBOCERAS FLORIDENSIS (WALLIS)

1	Alachua		10-II-54	F.W. Mead	at light
1	Alachua		27-III-54	F.W. Mead	at light
1	Alachua		31-III-54	H.A. Denmark	at light
1	Alachua	Archer	8-IV-60	R.E. Woodruff	malt trap
1	Alachua	Gainesville	27-XI-67	J.W. Perry	blacklight trap
1	Alachua	Gainesville	11-I-72	F.W. Mead	blacklight trap
2	Alachua	Newnan's Lake, 2mi.W.	1-IV-60	R.E. Woodruff	malt trap
1	Alachua	Newnan's Lake, 2mi.W.	10-IV-60	R.E. Woodruff	malt trap
57	Baker	Glen St. Mary	1960-61	E.W. Holder, Jr.	malt traps
	(from collections from II(5),IV(4),XI(1); the most specimens (13) on 15-II-61.)				
2	Collier	Immokalee	30-XII-59	H.M. Faircloth	blacklight trap
2	Collier	Immokalee	4-II-60	A.F. Wilson	blacklight trap
1	Collier	Immokalee	29-III-60	A.F. Wilson	blacklight trap
1	Dade	Homestead	20-I-42	O.W. Calkins	
1	DeSoto	Arcadia	20-XI-42	R.C. Barnes	mosq.light trap
1	Escambia	Pensacola	24-I-61	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	16-I-62	T.W. Boyd	blacklight trap
2	Highlands	Archbold Biol.Sta.	18-20-III-68	R.E.Woodruff	blacklight trap
1	Jefferson	Monticello	9-IV-61	A.M. Phillips	blacklight trap
4	Lafayette	Mayo, 5mi. E.	20-V-60	R.E. Woodruff	malt trap
2	Lee		11-VI-41	J. Haynie	
2	Lee	Ft. Myers	21-I-41	J.H. Sealy	
548	Leon	Tall Timbers Res.Sta.	1969-72	Baker & Harris	pitfall traps
	(from 64 collections from Oct.-May, with months & collections as follows: X(1), XI(2),XII(5),I(11),II(26),III(15),IV(2),V(1); the most specimens (6) on (26-III-69.)				
1	Levy	Bronson	25-II-59	R.E. Woodruff	malt trap
1	Liberty	Torreya State Park	12-IV-60	H.V. Weems,Jr.	at light
1	Palm Beach	Pahokee	20-I-41	J. Haynie	
1	Palm Beach	West Palm Beach	18-XII-59	M.L. Messec	blacklight trap
1	Palm Beach	West Palm Beach	22-XII-59	M.L. Messec	blacklight trap
1	Palm Beach	West Palm Beach	6-I-60	M.L. Messec	blacklight trap
1	Palm Beach	West Palm Beach	11-I-60	M.L. Messec	blacklight trap
1	Sarasota	Englewood	26-II-60	A.F. Wilson	blacklight trap
1	St. Lucie	Ft. Pierce	31-I-41	G.H. Baker	

APPENDIX 56: BRADYCINETULUS FERRUGINEUS (BEAUVOIS)

21	Alachua	Gainesville	1934-71	various	various
	(single specimens each collections from Mar.-Oct., with months & collections as follows: III(1),IV(2),V(2),VI(2), VII(3),VIII(3),IX(4),X(3),)				
2	Alachua	Arredondo Estates	10-11-VI-69	D.P. Wojcik	
5	Alachua	Arredondo Estates	23-VI-69	D.P. Wojcik	at blacklight
1	Alachua	Arredondo Estates	27-VI-69	D.P. Wojcik	at blacklight
2	Alachua	Pine Hills Est.	31-XII-69	H.A. Denmark	
1	Baker		VIII-35	Student colln.	
1	Baker	Glen St. Mary (2mi.E.)	9-X-61	E.W. Holder	
1	Dade	Hialeah	14-VII-27	G.B. Merrill	
1	Escambia	Pensacola	9-VII-58	R.E. Woodruff	found dead
3	Leon	Tall Timbers Res.Sta.	30-VI-6-VII-70	D.Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	13-20-VII-70	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	26-VII-3-VIII	D. Harris	pitfall trap B
1	Leon	Tall Timbers Res.Sta.	26-VII-3-VIII	D. Harris	pitfall trap A
1	Leon	Tall Timbers Res.Sta.	21-28-VI-71	D. Harris	
1	Leon	Tall Timbers Res.Sta.	24-31-VI-72	D. Harris	pitfall trap
1	Orange	Winter Park	23-VIII-41	H.T. Fernald	

APPENDIX 57: BOLBOCEROSOMA HAMATUM BROWN

55	Alachua	Gainesville	1939-71	various	light traps
	(from 25 collections from all months except Jan.,June,Dec., with months and collections as follows: II(1),III(3),IV(12),V(1),VII(1),VIII(2),IX(1),X(1), XI(2); the most specimens (16) on 4-20-IV-67.)				

APPENDICES 57-63

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
1	Baker	Glen St. Mary	15-IX-59	E.W. Holder,Jr.	
1	Dade	Miami Springs	30-XI-61	B.K. Dozier	at light
1	Dade	Miami Springs	31-VIII-65	M.E. Huck	at light
1	Dade	North Miami	7-II-62	W.S. Brewton	McPhail trap
1	Duval	Jacksonville	27-VII-51	R. Baker	
1	Escambia		14-VI-60	M. Tidwell	
1	Franklin		14-V-57	F.W. Mead	
1	Glades	Moore Haven	21-X-56	D. Thornton	
1	Hillsborough	Tampa	4-XI-64	Jean Beem	
1	Jackson		4-VII-63	F.J. Moore	Cyclocosmia burrow
1	Jackson		31-V-65	F.J. Moore	Cyclocosmia burrow
1	Jefferson	Monticello	28-III-61	A.M. Phillips	blacklight trap
1	Leon	Tall Timbers Res.Sta.	17-24-XI-69	D. Harris	pitfall trap
1	Leon	Tall Timbers Res.Sta.	27-VII-3-VIII	D. Harris	woodyard hammock
1	Leon	Tall Timbers Res.Sta.	2-9-XI-70	D. Harris	pitfall trap
1	Levy	Otter Creek	1-X-58	R.E. Woodruff	dead in window
1	Palm Beach	West Palm Beach	12-VII-70	W.T. Rowan	
2	?	"Florida"		student colln.	

APPENDIX 58: EUCANTHUS IMPRESSUS HOWDEN

1	Alachua	Gainesville	28-V-58	J.W. Perry	blacklight trap
2	Alachua	Gainesville	14-III-63	R.E. Woodruff	blacklight trap
1	Alachua	Gainesville	30-VII-63	J.W. Perry	blacklight trap
1	Alachua	Gainesville	20-IV-66	J.W. Perry	blacklight trap
1	Alachua	Gainesville	14-20-IV-67	D.L. Mays	blacklight trap
1	Alachua	Gainesville	6-VII-67	J.W. Perry	blacklight trap
1	Collier	Immokalee	4-II-60	A.F. Wilson	blacklight trap
2	Collier	Immokalee	4-IV-60	H.M. Faircloth	blacklight trap
1	Dade		IV-49		
1	Dade	Coral Gables	XII-36		
1	Dade	Fisher's Island	1-VII-66	J.E. Porter	mosq.light trap
1	Dade	Homestead	11-II-44	O.W. Calkins	blacklight trap
1	Dade	Homestead	23-II-44	O.W. Calkins	blacklight trap
1	Dade	Homestead AFB	18-VIII-66	J.E. Porter	mosq.light trap
1	Dade	Miami	VII-47		
1	Dade	Miami	2-VIII-48		
2	Dade	Miami	12-I-61	D.R. Paulson	at light
1	Dade	Miami	3-VI-62	C.F. Dowling	blacklight trap
1	Dade	Miami Beach	20-I-64	J.E. Porter	mosq.light trap
1	Dade	Redlands	19-V-57	D.R. Paulson	at light
1	Highlands	Highlands Hammock SP	10-VIII-63	B.K. Dozier	
1	Highlands	Sebring	12-IV-61	J.C. Hanlon	blacklight trap
1	Hillsborough	Tampa	22-IV-50	R.W. Lindner	in trap
1	Indian River	Vero Beach	8-VI-64	W.L. Bidlingmayer	suction trap
8	Indian River	Vero Beach	10-VI-64	W.L. Bidlingmayer	suction trap
1	Jefferson	Monticello	13-IX-60	A.M. Phillips	blacklight trap
1	Manatee		27-II-54	F.W. Mead	blacklight trap
1	Sarasota	Englewood	30-VII-60	H.M. Faircloth	blacklight trap

APPENDIX 59: EUCANTHUS SUBTROPICUS HOWDEN

56	Alachua	Gainesville	1919-72	various	light traps
	(from 45 collections from Mar.-Nov.,with months & collections as follows:III(1),IV(7) V(3),VI(3),VII(14),VIII(6),IX(6),X(3),XI(2);the most specimens (3) on 22-VII-58,12-VII-61, & 14-III-63.)				
1	Baker		10-XI-59	E.W. Holder,Jr.	
1	Broward	Ft. Lauderdale	23-XI-27	G.B. Merrill	
3	Broward	Hallandale	10-XII-61	B.K. Dozier	in burrows
1	Clay	Goldhead Branch St.Pk.	13-VII-63	B.K. Dozier	at light
3	Collier		6-VIII-63	F.J. Moore	
1	Collier	Immokalee	21-XII-59	H.M. Faircloth	blacklight trap
1	Collier	Immokalee	30-XII-59	H.M. Faircloth	blacklight trap
1	Collier	Immokalee	26-1-4-II-60	A.F. Wilson	blacklight trap
2	Collier	Immokalee	4-IV-60	H.M. Faircloth	blacklight trap
2	Collier	Immokalee	18-V-60	H.M. Faircloth	blacklight trap
1	Dade		7-VIII-63	F.J. Moore	
1	Dade	Coral Gables	15-X-19	M. Miller	blacklight trap
1	Dade	Fairchild Trop.Gardens	13-X-64	R.E. Brown	blacklight trap
1	Dade	Miami	28-VIII-61	B.K. Dozier	at light
1	Dade	Opa Locka,Coast Guard	11-VII-66	J.E. Porter	mosq.light trap
1	Dade	Opa Locka,Coast Guard	15-VII-66	J.E. Porter	mosq.light trap
1	Duval	Mayport	13-XII-61	L.W. Taylor	blacklight trap
1	Highlands	Archbold Bio. Sta.	20-III-68	R.E. Woodruff	blacklight trap
1	Highlands	Highlands Hammock SP	10-VII-63	B.K. Dozier	
1	Highlands	Lake Letta Subdiv.	21-VI-61	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	29-VIII-61	T. Morris	blacklight trap
1	Highlands	Sebring	27-II-61	J.C. Hanlon	blacklight trap
1	Highlands	Sebring	13-VIII-64	B.K. Dozier	
1	Jefferson	Monticello	29-IX-59	A.M. Phillips	blacklight trap
1	Lake	Groveland	2-VIII-65	W.P. Henderson	at light
2	Lake	Ocala National Forest	18-VII-53	H.V. Weems,Jr.	
1	Lee	Estero	30-II-62	R.E. Woodruff	malt trap
29	Leon	Tall Timbers Res.Sta.	1970-71	D. Harris	pitfall traps
	(from 14 collections from VI(1),VII(5),VIII(4),IX(2),XII(2);the most specimens (8) on 24-31-VIII-70.)				
3	Liberty	Torreya State Park	4-VII-65	H.V. Weems,Jr.	blacklight trap
3	Liberty	Torreya State Park	20-V-66	H.V. Weems,Jr.	blacklight trap
1	Manatee	Bradenton	9-IX-64	E.H. Frederic	
1	Manatee	Oneco		Paula Dillman	
2	Marion	Ocala	31-V-63	T.R. Adkins	blacklight trap
2	Marion	Ocala	14-VI-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	13-XI-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	26-VI-64	T.R. Adkins	blacklight trap
1	Marion	Ocala	31-VI-64	T.R. Adkins	blacklight trap
2	Okaloosa	Crestview, 12mi. NW	31-VIII-60	W.C. Rhoades	blacklight trap
2	Okaloosa	Eglin AFB,3mi.S.Holt	4-X-66	R.E. Woodruff	blacklight trap
1	Orange	Orlando	23-XII-31		
1	Orange	Orlando	6-VI-32		
1	Santa Rosa	Chumukla (Exp. Sta.)	18-IV-58	M. Lutrick	blacklight trap
1	Seminole	Sanford	8-VII-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	6-VIII-60	G.W. Desin	blacklight trap
2	Seminole	Sanford	13-X-60	G.W. Desin	blacklight trap
1	Seminole	Sanford	23-VIII-64	G.W. Desin	blacklight trap
3	Seminole	Sanford,Naval Air Sta.	3-VII-62	G.W. Desin	blacklight trap
1	Volusia	Daytona Beach	15-VII-45	J.H. Robinson	
4	Volusia	Daytona Beach	3-XI-60	R.E. Woodruff	dug from burrow
1	Volusia	Daytona Beach	6-VI-62	G.W. Desin	Jap beetle trap
1	Volusia	DeLand	31-VIII-64	G.W. Desin	Jap beetle trap
13	Washington	Chipley, 5mi. E.	31-VIII-60	W.C. Rhoades	blacklight trap

APPENDIX 60: GEOTRUPES EGERIEI GERMAR

1	Alachua		28-IX-39		
4	Alachua-Levy	County line, SR24	21-II-59	R.E. Woodruff	malt trap
12	Alachua-Levy	County line, SR24	25-II-59	R.E. Woodruff	malt trap
7	Alachua-Levy	County line, SR24	28-II-59	R.E. Woodruff	malt trap
3	Alachua	Archer, 2mi. W.	28-31-III-70	D.L. Mays	malt-yeast-catdung
1	Alachua	Archer, 2mi. W.	21-II-59	R.E. Woodruff	malt trap
14	Alachua	Archer, 2mi. W.	25-II-59	R.E. Woodruff	malt trap
9	Alachua	Archer, 2mi. W.	28-II-59	R.E. Woodruff	malt trap
61	Alachua	Gainesville	various	various	light & malt traps

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
	(from 31 collections from Aug.-Apr., with months & collections as follows: VIII(2), X(5),XI(8),XII(2),I(4),II(5),III(3),IV(2); the most specimens (15) in a malt trap on 15-II-59.)				
1	Alachua	High Springs	26-X-59	T.H. Hubbell	
3	Alachua	Newnan's Lake, 2mi.W.	4-IV-60	R.E. Woodruff	malt trap
2	Alachua	Newnan's Lake, 2mi.W.	10-IV-60	R.E. Woodruff	malt trap
64	Baker	Glen St. Mary	1960	E.W. Holder,Jr.	malt traps
	(from 9 collections from IV(7),XI(1),XII(1); the most specimens (40) on 30-XI-60.)				
21	Baker	Macclenny	26-12-60	E.W. Holder,Jr.	malt trap
4	Baker	Macclenny	2-I-61	E.W. Holder,Jr.	malt trap
20	Baker	Macclenny	31-I-61	E.W. Holder,Jr.	malt trap
3	Escambia		20-VIII-59	M. Tidwell	
1	Franklin	St. George's Island	27-VI-5-VIII	W. Baker	pitfall trap
1	Hillsborough	Brandon	6-XI-65	J.W. Patton	
1	Indian River	Vero Beach	30-VII-32	E.M. Becton	blacklight trap
1	Jefferson	Big Bend Hort.Lab.	10-VIII-70	Fluker	pitfall trap
19	Lafayette	Branford, 12.0mi.NW	18-II-60	Woodruff & Weems	malt trap
1	Leon	Tallahassee	24-IV-63	R.E. Woodruff	malt trap
132	Leon	Tall Timbers Res.Sta.	1968-71	various	pitfall traps
	(from 61 collections from Aug.-Dec. & Mar., with months and collections as follows: VIII(7),IX(44),X(17),XI(10),XII(1),III(2); the most specimens (8) on 30-IX-68.)				
2	Levy		25-28-II-59	R.E. Woodruff	malt trap
1	Levy	Bronson	23-II-59	R.E. Woodruff	malt trap
16	Levy	Bronson	25-II-59	R.E. Woodruff	malt trap
2	Levy	Bronson	28-II-59	R.E. Woodruff	malt trap
2	Levy	Bronson, 8mi. E.	21-II-59	R.E. Woodruff	malt trap
10	Levy	Bronson, 8mi. E.	23-II-59	R.E. Woodruff	malt trap
23	Levy	Bronson, 8mi. E.	25-II-59	R.E. Woodruff	malt trap
16	Levy	Bronson, 8mi. E.	28-II-59	R.E. Woodruff	malt trap
2	Marion	Ocala	8-XI-63	T.R. Adkins	blacklight trap
50	Putnam	Lake Suzan, near	9-II-59	R.E. Woodruff	malt trap
22	Putnam	Lake Suzan	11-II-59	R.E. Woodruff	malt trap
2	Putnam	Welaka	20-III-67	J. Mellott	cat dung
1	Suwannee	O'Brien, 3.6mi. N.	17-III-56	H. Howden	malt
6	Volusia	DeLand	23-XI-60	C.R. Roberts	malt trap
2	Volusia	DeLand	6-V-62	J.H. Van Zant,Jr.	malt trap
1	Volusia	DeLeon Springs	4-XI-60	C.R. Roberts	malt trap

APPENDIX 61: PELTOTRUPES PROFUNDUS HOWDEN

2	Alachua		6-V-56	R.A. Morse	can trap
1	Alachua		17-V-56	R.A. Morse	can trap
1	Alachua-Levy	County Line,SR 24	21-II-59	R.E. Woodruff	malt trap
69	Alachua-Levy	County Line,SR 24	25-II-59	R.E. Woodruff	malt trap
15	Alachua-Levy	County Line,SR 24	28-II-59	R.E. Woodruff	malt trap
1	Alachua	Archer, 2mi. W.	29-31-III-67	D.L. Mays	malt,yeast,dung
57	Alachua	Archer, 2mi. W.	21-II-59	R.E. Woodruff	malt trap
65	Alachua	Archer, 2mi. W.	25-II-59	R.E. Woodruff	malt trap
24	Alachua	Archer, 2mi. W.	28-II-59	R.E. Woodruff	malt trap
240	Alachua	Gainesville	1929-59	various	malt traps
	(from 8 collections from Jan.-Mar.,the most specimens (101) on 15-II-59.)				
45	Alachua	Gainesville	1960-72	various	blacklight trap
	(from 19 collections from Nov.-Apr.,with months & collections as follows:II(3),XII(4) I(10),II(1),IV(1);the most specimens (7) on 21-I-68.)				
2	Alachua	Gainesville, 2mi. E.	13-I-53	C.H. Wharton	high pine-red oak
8	Highlands	Archbold Bio. Sta.	4-6-III-67	J.E. Lloyd	malt trap
5	Highlands	Archbold Bio. Sta.	19-22-I-68	R.E. Woodruff	malt trap
1	Indian River	Sebastian	24-I-62	R.E. Woodruff	crawling on lichen
20	Lafayette	Branford, 12.8mi. NW	18-II-60	R.E. Woodruff	malt trap
21	Levy	Bronson	23-II-59	R.E. Woodruff	malt trap
199	Levy	Bronson	25-II-59	R.E. Woodruff	malt trap
58	Levy	Bronson	28-II-59	R.E. Woodruff	malt trap
2	Levy	Bronson, 8mi. E.	21-II-59	R.E. Woodruff	malt trap
6	Levy	Bronson, 8mi. E.	23-II-59	R.E. Woodruff	malt trap
49	Levy	Bronson, 8mi. E.	25-II-59	R.E. Woodruff	malt trap
7	Levy	Bronson, 8mi. E.	28-II-59	R.E. Woodruff	malt trap
2	Martin	Hobe Sound, .5mi.N.	1-II-59	R.E. Woodruff	malt trap
1	Osceola	Narcoossee, 7.4mi. S.	1-II-59	R.E. Woodruff	malt trap
3	Pasco	Beacon Square Subdiv.	20-I-67	W.A. Allen	in lawn
6	Pasco	Beacon Square Subdiv.	14-III-67	W.A. Allen	in lawn
5	Polk	Winter Haven	26-I-68	Muma & Greene	can trap,sand dune
2	Polk	Winter Haven	12-II-68	Muma & Greene	can trap,sand dune
2	Polk	Winter Haven	26-II-68	Muma & Greene	can trap,sand dune
2	Polk	Winter Haven	12-III-68	Muma & Greene	can trap,sand dune
2	Seminole	Paola	28-IV-60	G.W. Desin	malt trap
1	Seminole	Paola	5-V-60	G.W. Desin	malt trap
3	Volusia	Barberville, 10mi. S.	16-III-56	Howden & Denmark	
4	Volusia	DeLeon Springs	19-22-IV-60	R.E.Woodruff	malt trap
5	Volusia	DeLeon Springs	5-V-60	C.R. Roberts	malt trap

APPENDIX 62: MYCOTRUPES GAIGEI OLSON & HUBBELL

63	Alachua-Levy	County line, SR24	21-II-59	R.E. Woodruff	malt trap
173	Alachua-Levy	County line, SR24	25-II-59	R.E. Woodruff	malt trap
71	Alachua-Levy	County line, SR24	28-II-59	R.E. Woodruff	malt trap
2	Alachua	Archer, 2mi. W.	28-31-III-67	D.L. Mays	malt-yeast-catdung
19	Alachua	Archer, 2mi. W.	21-II-59	R.E. Woodruff	malt trap
96	Alachua	Archer, 2mi. W.	23-II-59	R.E. Woodruff	malt trap
185	Alachua	Archer, 2mi. W.	25-II-59	R.E. Woodruff	malt trap
26	Alachua	Archer, 2mi. W.	28-II-59	R.E. Woodruff	malt trap
1	Alachua	Archer	8-IV-60	R.E. Woodruff	malt trap
11	Columbia	High Springs	1-4-II-60	R.E. Woodruff	malt trap
18	Lafayette	Branford, 12.8mi. NW	18-II-60	R.E. Woodruff	malt trap
48	Lafayette	Branford, 12.8mi. NW	20-V-60	R.E. Woodruff	malt trap
2	Levy		31-V-56	R.A. Morse	can trap
279	Levy	Bronson	23-II-59	R.E. Woodruff	malt trap
125	Levy	Bronson	25-II-59	R.E. Woodruff	malt trap
92	Levy	Bronson	28-II-59	R.E. Woodruff	malt trap
18	Levy	Bronson, 8mi. E.	21-II-59	R.E. Woodruff	malt trap
104	Levy	Bronson, 8mi. E.	23-II-59	R.E. Woodruff	malt trap
64	Levy	Bronson, 8mi. E.	25-II-59	R.E. Woodruff	malt trap
20	Levy	Bronson, 8mi. E.	28-II-59	R.E. Woodruff	malt trap
10	Levy	Meredith, near	23-II-59	R.E. Woodruff	malt trap
51	Seminole	Geneva	20-IV-60	R.E. Woodruff	malt trap
1	Suwannee	O'Brien, 3.6mi. N.	17-III-56	H.F. Howden	malt trap

APPENDIX 63: CLOEOTUS APHODIOIDES (ILLIGER)

1	Alachua	Gainesville	7-IV-57	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville	25-IV-57	L.A. Hetrick	blacklight trap
3	Dade		2-VI-66	Neil Chernoff	
1	Dade		VI-49	H.F. Strohecker	
3	Dade		25-V-50	H.F. Strohecker	
1	Dade		V-54	H.F. Strohecker	
1	Dade	Matheson Hammock	8-IV-59	M.V. Weems,Jr.	under bark
1	Dade	Orchid Jungle	17-VI-69	R.M. Baranowski	blacklight trap
2	Dade	Ross-Costello Hammock	VI-48	H.F. Strohecker	
1	Jefferson	Monticello	22-V-69	R.H. Miller	blacklight trap
2	Manatee	Oneco		Paula Dillman	at light
1	Marion	Weirsdale	17-VIII-60	T.R. Adkins	Steiner trap

APPENDIX 64

NO.	COUNTY	LOCALITY	DATE	COLLECTOR	HOST
		APPENDIX 64: CLOEOTUS GLOBOSUS (SAY)			
34	Alachua	Gainesville	various	various	various
	(from 21 collections from Apr.-Sept., with months and collections as follows: IV(2),V(5),VI(3),VII(6),VIII(3),IX(1); the most specimens (7) from 30-V-2-VI-68.)				
1	Alachua	Chantilly Acres	29-V-68	F.S. Blanton	mosq.light trap
1	Alachua	Pine Hills Estates	3-VII-69	H.V. Weems,Jr.	at blacklight
1	Dade		VI-49	H.F. Strohecker	
1	Dade		25-V-50	H.F. Strohecker	
2	Dade		V-54	H.F. Strohecker	
1	Dade		15-V-66	N. Chernoff	
2	Dade	Matheson Hammock	2-V-57	D.R. Paulson	
1	DeSoto	Arcadia	21-XI-63	R.H. Rhoades	Steiner trap
1	Gadsden	Glen Julia Springs	6-VI-54	F.N. Young	
1	Hardee	Ona	14-VII-67	R.H. Rhoades	Steiner trap
1	Jefferson	Monticello	8-V-58	R.E. Woodruff	beating limbs
1	Lake	Mount Dora	1-VIII-62	C.L. Felshaw	Steiner trap
1	Liberty	Torreya State Park	7-V-69	H.V. Weems,Jr.	at blacklight
2	Liberty	Torreya State Park	16-V-71	Weems & Fairchild	blacklight trap
1	Manatee	Oneco		Paula Dillman	at light
1	Marion	Welrsdale	17-VIII-60	T.R. Adkins	Medfly trap
1	Monroe	Big Pine Key	16-VII-63	H.V. Weems,Jr.	under board
1	Sarasota	Mayakka River SP	5-VI-54	H.V. Weems,Jr.	at light

INDEX

This index contains only the scientific names of those species treated in the "Systematic Account" in this volume (Part I). The species treated in Part II are listed in the checklist on pages 26-29, but they are not included in this index. The illustrations are also listed here as well as in the list of Figures on pages v-vii. No attempt was made to list all synonyms in the index, but those which have recently been established (or might contribute to confusion) are listed in italics. The "Table of Contents" should be consulted to locate the general discussions that are not a part of the "Systematic Account" indexed here.