ARTHROPODS OF FLORIDA
and Neighboring Land Areas

VOLUME 13

THE SCARAB BEETLES OF FLORIDA

(Coleoptera: Scarabaeidae) Part II. The May or June Beetles (genus *Phyllophaga*)

by
Robert E. Woodruff
and
Brenda M. Beck

Florida Department of Agriculture and Consumer Services
Doyle Conner, Commissioner

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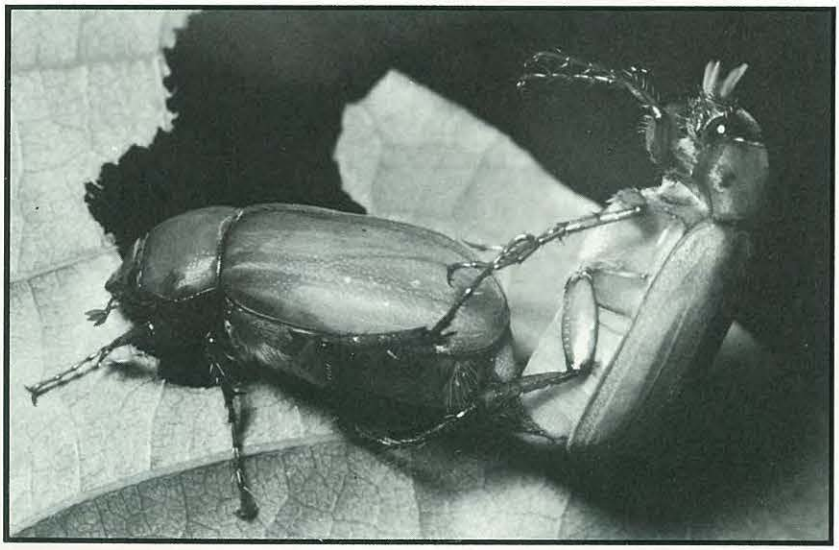

Typical position of May beetles, feeding and mating at night; female on the left [*Phyllophaga quercus* (Knoch)]. Photo by Jeff Lotz.

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Contribution No. 716, Bureau of Entomology
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DEDICATION

It is with great pleasure that we dedicate this volume to Dr. Milton W. Sanderson, the dean of North American *Phyllophaga* specialists for over 50 years. He was the moving force which enabled this study to be completed, and he has always been willing to share his phenomenal knowledge with younger workers. His monumental collection, accumulated during his tenure at the Illinois Natural History Survey, will be the mecca to which all future specialists must go. His personal friendship to the senior author resulted in the donation of his library, manuscripts, many new species, and other pertinent materials. Without his stimulation and continued support, this volume would not have been completed.

This public document was promulgated at a cost of $38,214.00 or $26.00 per copy. It makes available to all interested persons the results of arthropod faunal studies, emphasizing Florida and the Circum-Caribbean Region. PI89T-37

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FOREWORD

This is the Part II of **The Scarab Beetles of Florida**, initiated in 1973 by Dr. Robert E. Woodruff with Volume 8 of **Arthropods of Florida and Neighboring Land Areas, (Coleoptera: Scarabaeidae) Part I. The Laparostici (Subfamilies: Scarabaeinae, Aphodiinae, Hybosorinae, Ochodaeinae, Geotrupinae, Acanthocerinae)**. The high standards of accuracy and attention to detail are continued in this volume. The difficult task of preparing a treatment of the subject that is understandable to the novice and at the same time a scholarly and comprehensive presentation for other systematics authorities is accomplished.

This volume is based on more than 30 years of extensive collecting in many parts of Florida in all seasons of the year by the senior author, using a variety of collecting techniques. As in the first volume, virtually all known collection records for the group studied are given, and questionable and potential Florida records are considered. Over 100,000 specimens were examined.

In their treatment of the large and difficult to understand genus *Phyllophaga*, the authors have made extensive use of genitalia as the most reliable means of species identification. Genitalia of all known Florida species and those of some closely related species are exceptionally well illustrated through the use of scanning electron microscope photographs of the highest quality. An extensive bibliography documents information presented in this volume and presents references for anyone who wants to study the subject further, although the present volume gives a comprehensive treatment of what is known about Florida *Phyllophaga*.

The present faunal study, like that treated in Part I, is provided primarily as a manual to assist in the identification of the Florida species. Specific identification of an organism is essential to understanding the role it plays in the environment and in determining the course of action for controlling those species that become a problem to humans. The name is the "key" to the published literature and is essential before controls are attempted. Illustrated keys for the identification of the Florida species are provided along with an adequate description of each species.

Dr. Robert Eugene Woodruff or "Bob" as he is called by his friends and associates, was born in Kennard, Ohio, on 20 July 1933, son of Marvin C. and Thelma B. Woodruff. On 27 June 1954 he and Nina Evelyn Gunsaulies were married in Urbana, Ohio, where Bob's parents still reside. They have 2 children, Kris Eugene Woodruff, 29, now living in San Juan, Puerto Rico, and Cheri Ellen Taylor, 33, now residing in Silver Spring Shores, Florida. Bob and Evelyn have 2 grandchildren. Bob was educated in the public schools of Ohio. From early childhood he expressed an interest in the natural sciences. In 1950 and 1951 he entered the Junior Science Fairs of the Ohio Academy of Science, receiving superior awards both years and a scholarship to any of the 10 state universities. Following graduation from Urbana High School in 1951, he enrolled at Wabash College in Crawfordsville, Indiana. During 1951-1952 he served as Curator of the insect collection at Wabash College. The following year he transferred to Ohio State University where he received the Bachelor of Science degree with a major in entomology in 1956.

From 1952 to 1955 he was an assistant in the Department of Natural History of the Ohio State Archaeological and Historical Society 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 Department of Zoology and Entomology at Ohio State University, under Professor Josef N. Knull, Curator of the Entomological Museum. This experience led him to specialize 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, including 32 habitus drawings in Part I of **The Scarab Beetles of Florida**, published in 1973.

From 1957 to 1958 he was employed as a medical entomologist with the Kentucky State Health Department, in Louisville, working on St. Louis Encephalitis and related mosquito projects. He attended special courses of instruction on insects of medical importance at the U. S. Public Health Service, Communicable Disease Center, in Atlanta, and at 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, Florida Department of Agriculture and Consumer Services). He was initially employed as the "Survey Entomologist" to coordinate the federal-state Cooperative Economic Insect Survey, in Florida, which he fulfilled until 1963. The responsibilities included field surveys, identifications, and reports for pests of turf, field crops, vegetables, fruit, pastures, and ornamental plants.

From 1963 more emphasis was on detection of foreign pests and primary identification for beetles (Coleoptera) and grasshoppers (Orthoptera). Biological control and pest management have been investigated with pests introduced from Latin America. Responsibilities included curating the Coleoptera and Orthoptera for the Florida State Collection of Arthropods, now the fifth largest arthropod collection in the United States, and the development of the entomological portion of the DPI library. Consultancies were interspersed with this position from 1978. Retirement

after 30 years of service for the State of Florida was effective 31 July 1988. He continues to serve the program as an Emeritus Entomologist.

In September 1963 Bob entered the Graduate School of the University of Florida, from which he received the Doctor of Philosophy degree with a major in entomology 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 has taken him to much of the U. S. and the following countries where he has collected and studied specimens: Antigua, Argentina, Australia, Barbados, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, El Salvador, Fiji, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Mexico, Montserrat, Nevis Island, Nicaragua, Paraguary, Peru, Puerto Rico, St. Kitts, St. Lucia, St. Vincent, Trinidad, Uruguay, and Venezuela. He has received grants and contracts from the Ohio Academy of Sciences, United States Public Health Service, National Science Foundation, Smithsonian Institution, U. S. Department of Agriculture, Australian Academy of Sciences, Florida State Museum (since July 1988 the Florida Museum of Natural History), Illinois Natural History Survey. In 1988 he held a consultancy with FAO (United Nations) in Barbados, St. Lucia, and Grenada; and Agro Delta in the Dominican Republic. In 1989 he held a consultancy with Texas A. & M. University in College Station, Texas and Dallas, Texas. He is currently consulting with United Nations, FAO and has a 6-month Fulbright Fellowship for research in Paraguay.

Societies in which Dr. Woodruff holds membership include: Association for Tropical Biology, Coleopterists Society (President, 1978; Editor, 1972-1977), Entomological Society of America, Florida Entomological Society (Associate Editor, 1971-1977), Gamma Sigma Delta, Phi Kappa Psi, Sigma Xi, Sociedad Mexicana de Entomologia, Society of Systematic Zoologists, and Gainesville (Florida) Gem & Mineral Society. He is an Adjunct Professor, Department of Latin American Studies, University of Florida, Adjunct Professor, Department of Entomology & Nematology, University of Florida; Courtesy Associate Professor, Department of Entomology & Structural Pest Control, Florida A. & M. University, in Tallahassee; Adjunct Curator, Department of Natural Science, Florida Museum of Natural History (since 1972); Research Associate, Museo Nacional de Historia Natural, Santo Domingo, Dominican Republic; and Collaborator, USDA, APHIS (1960 to present). In 1986 he received an award (with H. A. Denmark, F. W. Mead, and H. V. Weems, Jr.) from the Insect Behavioral Ecology unit for taxonomic service, Florida Entomological Society. Since 1983 he has served on the Board of Directors, (Chairman) Caribbean Center for Scientific Research (non-profit). Since 1986 he has served on the Board of Directors of PhytoTechnica Floridana, consulting corporation. He is a member of the Board of Directors of the "North American Beetle Fauna Project". In 1986-1987 he served as the first President of the Center for Systematic Entomology, Inc. He received an Honorary Award from the Eastern Federation of Mineral & Lapidary Societies, to select scholarships by the American Federation of Mineral Societies Scholarship Foundation for 1989.

Dr. Woodruff has served as Editor of **The Journal of the Newell Entomological Society** (President, 1965-1966); Editor, **Coleopterist's Newsletter**, 1970; Associate Editor, **Florida Entomologist**, 1969-1975; Editor, **Coleopterist's Bulletin**, 1971-1975; Associate Editor, 1975-1982; Managing Editor, **Insect World Digest**, 1971-1974; on Council of Biological Editors, 1972-78; member, Editorial Board, **Colemania, Indian Journal of Taxonomic Entomology**, 1981-present; member Editorial Board, **Insect Mundi**, 1985-present. He has attended more than 30 national and international scientific meetings, including the 14th International Congress of Entomology, in Washington, D. C. (for which he designed the logo). In 1964 he attended two months of training at the Organization for Tropical Studies, San Jose, Costa Rica. In 1971 he attended the Summer Institute for Systematics, Smithsonian Institution. He has presented papers at meetings of the Entomological Society of America, National Pest Control Association, Ohio Academy of Sciences, Sociedad Mexicana de Entomologia, International Congress of Entomology, Florida Entomological Society, and other scientific organizations. He has published over 150 papers, primarily in the field of taxonomic and economic entomology.

Dr. Woodruff is listed in **American Men of Science, Directory of Zoological Taxonomists, The Naturalists Directory, International Scholars Directory, Personalities of the South, Who's Who in the South and Southeast**, and **Directory of North American Entomologists**. He is a Methodist. His hobbies include archaeology, paleontology, scientific illustration, tropical biology, lapidary, jewelry, and music (trumpet, guitar, voice). He has served as merit badge counsellor for the Boy Scouts in all natural history subjects.

Brenda Miller Beck was born in Key West, Florida on 23 October 1948, daughter of George P. and Bonnie S. Miller. Brenda and Dennis A. Beck were married 1 July 1970 in Gainesville, Florida. They have one daughter, Jessica Denise, age 5. Brenda received her elementary and high school education in the public schools of Florida, Oklahoma, and Texas, graduating from Gainesville High School in 1967. Brenda worked at the University of Florida during the summer prior to her last year of high school. In March 1974 she received the Associate of Arts degree from Santa Fe Community College, in Gainesville, Florida. She began work with the Division of Plant Industry in 1968 and has worked continuously in the Bureau of Entomology for 21 years. Currently a Laboratory Technologist IV, Brenda has worked extensively with Coleoptera, particularly in the preparation of genitalia of scarabaeid beetles for study, involving scanning electron photomicroscopy, and identification of Scarabaeidae and

tera. For many years, under the tutelage of Dr. Woodruff, and also for the past year under Dr. Michael Thomas, Brenda has served as the principal, active curator of the Coleoptera and Orthoptera collections of the Florida State Collection of Arthropods. She also has worked extensively in the curating of the large alcohol-preserved, compactor-stored collections of the FSCA, and the computerization of collection data. In recent years she has worked also with Dr. Howard Weems on the annual summary of all donations to the FSCA, the computing of estimated values of these donations, and preparation of several thousand formal letters of acknowledgment which have been sent to donors. Working with Dr. Woodruff, Brenda has acquired a considerable knowledge of the identification of Scarabaeidae and other Coleoptera. Her current research interest is centered on the *Phyllophaga* of the United States and the West Indies. In February 1989, at the request of Dr. Robert L. Crocker of Texas A. & M. University, Brenda spent a week at Texas A. & M. training personnel on the extraction of Scarabaeidae genitalia and their preparation for study. Brenda was raised as a Baptist. Her hobbies are raising horses and dogs and working with plants. She also enjoys writing poetry and some fiction.

Bureau of Entomology
Division of Plant Industry
Florida Department of Agriculture
and Consumer Services

1 August 1989

Howard V. Weems, Jr.
Editor

List of Tables

PREFACE

When Part I of this series on the "Scarab Beetles of Florida" was published (Woodruff, 1973), it was anticipated that succeeding parts would be completed soon thereafter. The press of routine duties, considerable travel and field work, and the volume of specimens have each contributed to this 16-year delay.

The senior author's retirement in August, 1988, provided the impetus and opportunity to complete the manuscript. The delay allowed the inclusion of many more specimens and permitted the illustration of the genitalia and other taxonomic characters by use of the scanning electron microscope. We believe it was worth the wait, and the resulting publication should be more useful for identifying the Florida fauna of these interesting insects.

This part is co-authored, the work and responsibilities being equally shared, except for the final writing. The authors have jointly worked for over 50 years with the Florida Department of Agriculture, during which varying amounts of time were spent preparing specimens and data for this eventual publication. We have also prepared many of the specimens and recorded much of the data for the final part (III), which will include the remainder of the Melolonthinae and the subfamilies Rutelinae, Dynastinae, and Cetoniinae. We anticipate completion of Part III without the attendent delays previously encountered.

As with Part I, emphasis was placed on preparing a faunal study to enable the user to identify specimens and then to learn what is known about that species. It is therefore a compilation of original data, integrated with the existing literature on the Florida species. Such faunal surveys are useful to a wide audience, including homeowners, biologists, biogeographers, ecologists, entomologists, pest control operators, and environmentalists.

Permanent preservation of vouchered specimens is an important part of any such study. The Florida State Collection of Arthropods* is the primary repository for our specimens, and it is now the second best collection of this genus in the World (behind the Illinois Natural History Survey; see Woodruff, 1987). Many times during this study we were stymied and unable to solve problems, because previously reported specimens were not documented and properly vouchered in a permanent public collection.

Our emphasis on providing an identification manual required that some traditional elements were shortened by time and space restrictions. Although the species of *Phyllophaga* are externally similar, their distinctive genitalia provide exceptional characters for identification. As a result of this, long verbal descriptions are both superfluous and misleading. We thus chose to expend our time and energies in preparing the genitalia illustrations from scanning electron microscope photographs (Plates 1-32, fig. 1-378).

We believe that these illustrations should permit easy comparison and positive identification, far better than words could convey. Ironically, just 100 years ago, Smith (1889b:485) first used these structures with the following comments: "No words could accurately describe their peculiar turning and twistings. I shall not undertake verbal descriptions of these parts, but prefer to let my figures answer most questions."

We hope that this volume will stimulate collectors and students to pursue the many gaps in our knowledge of a dominant element of our diverse Florida insect fauna. If it accomplishes these goals, we will be repaid adequately for the efforts expended in its preparation.

ACKNOWLEDGMENTS

As employees of the Division of Plant Industry, Florida Department of Agriculture and Consumer Services, we have been able to pursue various aspects of this study during the past 30 years. For this opportunity, and for their encouragement and understanding, we thank the following former and present administrators of this organization: The Honorable Doyle E. Conner, Commissioner of Agriculture; Dr. W. G. Cowperthwaite (deceased), H. L. Jones, Dr. S. A. Alfieri, and R. Gaskalla, Directors, Division of Plant Industry; and H. A. Denmark, Chief of the Bureau of Entomology.

We also have had close cooperation from our past and present colleagues in the Bureau of Entomology: G. W. Dekle, Dr. G. B. Edwards, Dr. E. E. Grissell, Dr. A. B. Hamon, Dr. J. B. Heppner, Dr. F. W. Mead, Dr. L. A. Stange, Dr. M. C. Thomas, and Dr. H. V. Weems, Jr. They provided specimens, advice, and companion-

*The Florida State Collection of Arthropods is composed of several collections which were previously maintained as separate: Univ. Florida, Agr. Exp. Sta.; Univ. Florida, Dept. Entomology and Nematology; 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, Florida 32602.

ship on many field trips.

In addition to the support from the Florida Department of Agriculture, organizational support and grants were received by the senior author from: 1) The National Science Foundation (for a summer traineeship at the Organization for Tropical Studies in Costa Rica; for participation in the Summer Institute for Systematics at the Smithsonian Institution; for 2 months of study at the Illinois Natural History Survey; and for a week of study at Texas A. & M. University). 2) The Florida Game and Freshwater Fish Commission and 3) the U. S. Army Corps of Engineers for participation in surveys of the Cross Florida Barge Canal area and the Osceola National Forest. 4) The University of Florida, Department of Entomology & Nematology, and the Institute of Food & Agricultural Sciences, for the opportunity to use the scanning electron microscope and for graduate student assistance over the past several years. 5) The Illinois Natural History Survey for the opportunity to spend 2 months studying there, and continued support. 6) The Texas A. & M. University at College Station (Dr. H. R. Burke and E. G. Riley) and at Dallas (Dr. R. L. Crocker and Dr. J. E. Reinert) for the opportunity to study for a week at each collection.

We are indebted to most of the major museums in the United States for loans of specimens or use of their facilities during personal visits. We apologize for any inadvertent omission in the following list (abbreviations are those used in the text and proposed by Arnett, et al., 1986); names of curator(s) who provided assistance are listed after the abbreviations: American Museum of Natural History (AMNH), M. A. Cazier, M. Statham, P. Vaurie, L. H. Herman; Archbold Biological Station (ABSC), M. A. Deyrup, J. N. Layne; Canadian National Collection (CNCC), E. G. Monroe, H. A. Howden, E. C. Becker; Chicago Field Museum Natural History (FMNH), R. L. Wenzel, H. S. Dybas; Florida State Collection of Arthropods (FSCA), H. V. Weems, Jr.; Illinois Natural History Survey (INHS), W. E. LaBerge, J. K. Bouseman; Museum of Comparative Zoology, Harvard University (MCZC), P. J. Darlington, S. Shaw, J. F. Lawrence; Ohio State University (OSUC), J. N. Knull, F. J. Moore, C. A. Triplehorn; Purdue University (PUIC), Leland Chandler, R. H. Arnett, Jr.; Texas A. & M. University (TAMU), H. R. Burke, E. G. Riley, R. L. Crocker; United States National Museum (USNM), O. L. Cartwright, R. D. Gordon; University of Florida (in FSCA), T. J. Walker, J. E. Lloyd; University of Michigan Museum of Zoology (UMMZ), Barry O'Conner, M. F. O'Brien, T. H. Hubbell, R. D. Alexander.

We are also indebted to the following individuals for various assistance, including the loan or donation of specimens from their private collections: R. H. Arnett, Jr., R. M. Baranowski, Bernard Benesh, L. J. Bottimer, O. L. Cartwright, Neil Chernoff, P. M. Choate, Jr., L. R. Davis., Jr., M. A. Deyrup, N. M. Downie, B. K. Dozier, H. L. Dozier, Jr., M. Druckenbrod, T. Fincher, J. H. Frank, C. A. Frost, S. W. Frost, E. J. Gerberg, R. D. Gordon, D. H. Habeck, G. Halffter, A. R. Hardy, E. I. Hazard, C. Hilfiker, H. E. Hinton, H. F. Howden, O. E. Hunt, R. L. Jacques, P. E. Landolt, J. W. McReynolds, A. Martinez, C. W. Mills, III, F. J. Moore, C. W. O'Brien, D. R. Paulson, S. B. Peck, P. Reyes C., E. G. Riley, P. O. Ritcher, H. H. Samol, M. W. Sanderson, Joe Schuh, P. E. Skelley, B. J. Smittle, W. R. Suter, M. C. Thomas, P. A. Thomas, D. W. Thornton, R. H. Turnbow, K. W. Vick, W. W. Warner, F. N. Young, Jr.

Light traps were a primary source of specimens and many individuals cooperated by operating traps and preserving samples during the past 30 years and, we sincerely thank them: T. R. Adkins, W. W. Baker, R. M. Baranowski, W. L. Beers, E. N. Bishop, D. C. Blanton, F. S. Blanton, A. H. Boike, T. W. Boyd, P. E. Briggs, R. E. Brown, S. H. Brown, F. A. Buchanan, E. M. Collins, Jr., H. W. Collins, L. Collins, E. E. Crooks, G. W. Desin, C. F. Dowling, Jr., P. C. Drummond, G. B. Fairchild, H. M. Faircloth, E. H. Frederic, Jr., A. E. Graham, V. K. Gupta, J. C. Hanlon, D. L. Harris, J. Hayward, E. I. Hazard, L. A. Hetrick, E. W. Holder, Jr., N. Holler, E. G. Kelsheimer, R. L. King, J. H. Knowles, M. Lutrick, R. T. McMillan, D. L. Mays, E. S. Mercer, E. P. Merkel, M. L. Messec, T. Morris, A. L. O'Berry (Fields), J. W. Patton, J. W. Perry, A. M. Phillips, W. H. Pierce, J. E. Porter, W. C. Rhoades, B. J. Smittle, R. W. Swanson, W. B. Tappan, L. W. Taylor, W. H. Whitcomb, J. R. Wiley, J. W. Wilson, D. P. Wojcik, D. O. Wolfenbarger.

The two localities which produced the most records are Gainesville and Tall Timbers Research Station (Leon Co.), and we especially thank the present and past staff there for many favors: E. V. and Roy Komarek, W. W. Baker, D. L. Harris, L. Collins, W. H. Whitcomb, Awinash Bhatkar, and Mary Arnett.

We thank the many Division of Plant Industry (DPI) and U. S. Department of Agriculture inspectors in Florida who provided assistance and specimens. Although space does not permit listing all of them here, most are listed as collectors in the Appendices. We thank many other DPI employees for their contributions: for photographic assistance, Jeffrey Lotz; for art work, John Corkery; for editorial assistance, K. R. Langdon, F. W. Mead, M. C. Thomas, H. V. Weems,

Jr., N. El-Gholl, J. O'Bannon; for library assistance, Irene Ayres, M. Batey, C. Edwards, Louise Henley, June Jacobson, A. Kolesar, Alice Sanders; for secretarial work, I. Ayers, E. Manning, D. Proveaux, J. Temple, F. Williams, S. Yocom; for microscope slide preparation, A. L. Fields and E. Ostanik.

For assistance with the scanning electron microscope (SEM), we especially thank: Thelma C. Carlysle (USDA, retired) for many volunteer hours and technical aid; the SEM supervisors: Dr. G. Erdos and Donna Williams, Botany Department, University of Florida; and especially to entomology graduate student P. E. Skelley for his mastery of both the critical point drier preparation technique and his adept use of the SEM itself.

During 2 months of study at the Illinois Natural History Survey, the following individuals contributed in many ways: J. K. Bouseman, A. R. Brigham, A. Eckhoff, B. Gillies, G. Godfrey, C. Heister, S. Heydon, A. Kirts, K. McGiffen, S. L. Passoa, R. L. Selander, J. Sherrod, D. & S. Voegtlin, and M. L. Williamson.

Although mentioned in other capacities, we must separately express special thanks to 4 individuals: Dr. Milton W. Sanderson to whom we dedicate this volume, for his undaunted support in every possible way, and for his many years of devotion to the study of this genus; Paul E. Skelley to whom we dedicate one of the new species, for his assistance in every aspect of the study; Dr. Michael C. Thomas for his computer expertise and personal sacrifices to facilitate the camera-ready copy; and to Frances Williams for her meticulous conversion of a handwritten manuscript to an accurate computer version; and to them all for their valued personal friendship.

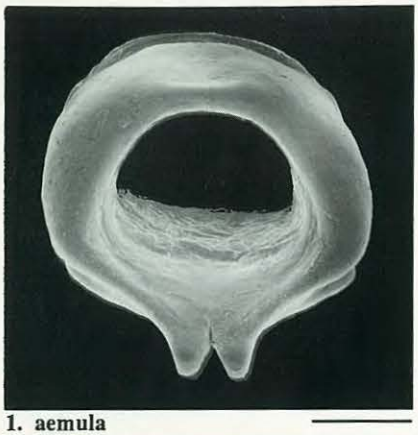
ABSTRACT

In this faunal study, data are presented for 54 species of *Phyllophaga* recorded from Florida. Two new species, *pseudofloridana* and *skelleyi*, are described, and 9 other species are recorded from the State for the first time: *anxia* LeConte, *apicata* Reinhard, *forbesi* Glasgow, *foxii* Davis, *implicita* Horn, *perlonga* Davis, *profunda* Blanchard, *puberula* DuVal, and *yemasseei* Cartwright. In addition, illustrations are provided for the first time of the female genitalia for 4 species: *clemens* Horn, *elizoria* Saylor, *georgiana* Horn, and *okeechobea* Robinson. Two species [*P. murrea* Sanderson, previously known from a unique female, under *P. elongata* Linell, and *P. vanalleri* Schaeffer, originally described as a subspecies of *obsoleta*, under *obsoleta* (Blanchard)] are synonymized.

Scanning electron microscope photographs are provided for the male (4 or 5 views) and female (2 views) genitalia, as well as other relevant taxonomic characters. Data are presented for each species under the following headings: synonymy, type locality, diagnosis, description, taxonomic notes, distribution (Florida and United States), biology and ecology, adult host plants, immatures, specimens examined, and selected references. Maps showing both Florida and United States distribution are provided for each species.

Keys are provided for the adults of 54 species, and for the known larvae of 23 species. Eight tables provide: 1) an alphabetical checklist of figures and maps; 2) a chronological list of Florida *Phyllophaga* descriptions; 3) the arrangement by "groups" of various authors; 4) a summary chart of life cycle data; 5) an alphabetical list and references to known larvae of Florida species; 6) a list of 17 misspelled names of Florida species, and their citations; 7) an annotated alphabetical checklist of the 96 names used for Florida species; and 8) a summary of 22 basic taxonomic character states. Specimen label data are listed in the Appendices (1-39) as is a list of the figures (40), and the Bibliography contains 376 references.

PLATE 1: FIG. 1-12. **PHYLLOPHAGA** MALE GENITALIA (CAUDAL), Line=0.5 mm



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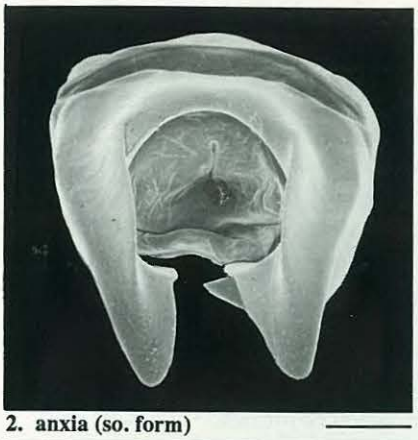

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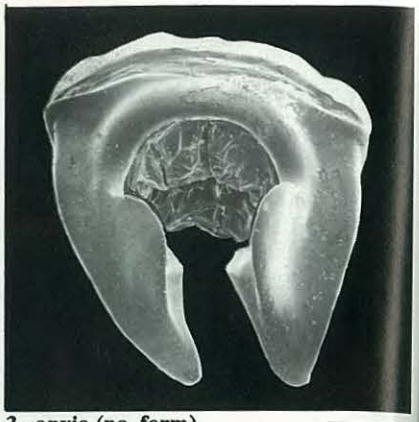


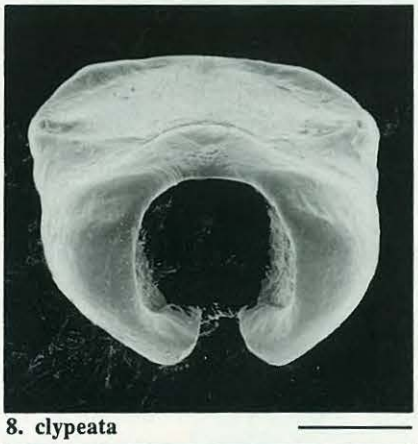
3. anxia (no. form)

4. apicata (sac)

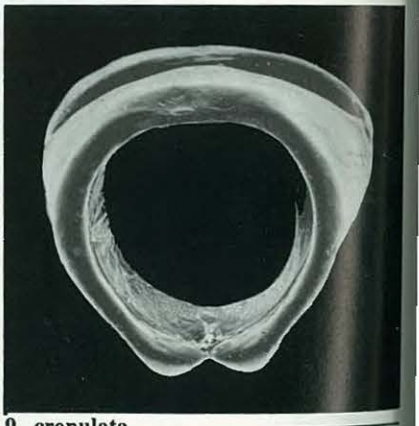
5. apicata (no sac)

6. bruneri

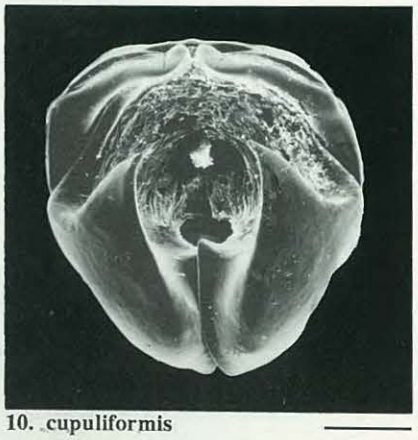
7. clemens



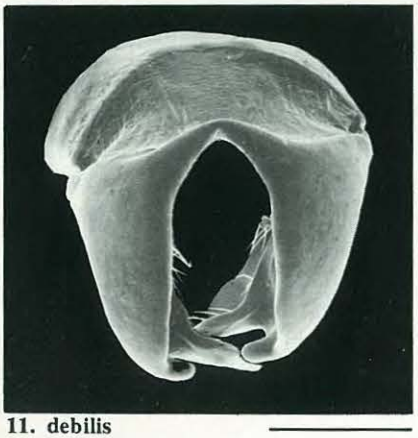
8. clypeata



9. crenulata



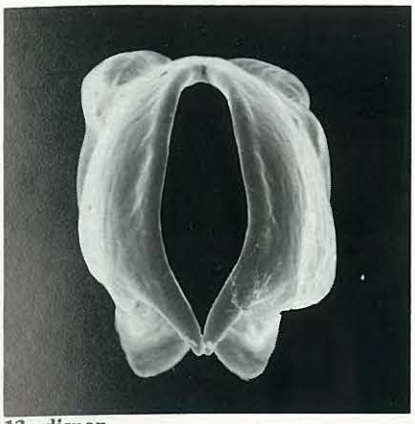
10. cupuliformis



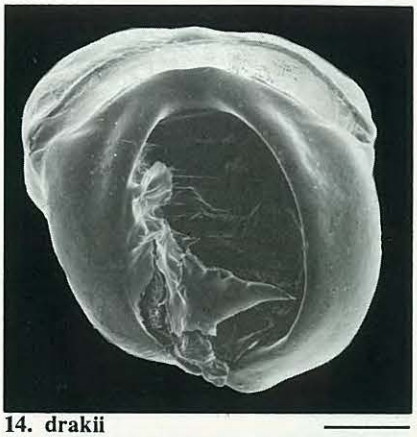
11. debilis

12. diffinis

PLATE 2: FIG. 13-24. **PHYLLOPHAGA** MALE GENITALIA (CAUDAL), Line=0.5 mm

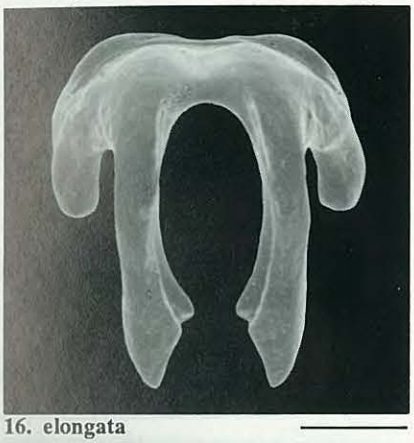


13. dispar

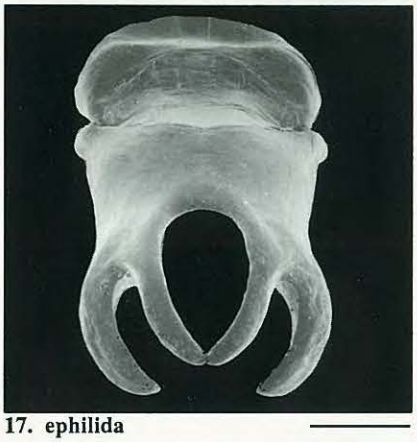


14. drakii

15. elizoria

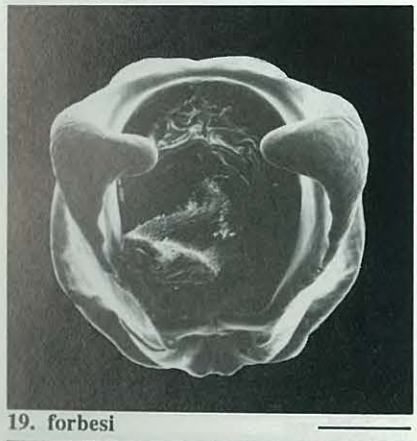


16. elongata



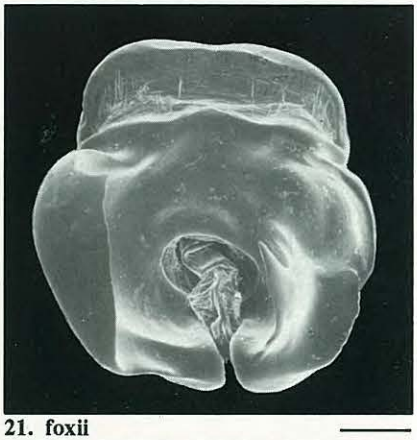
17. ephilida

18. floridana



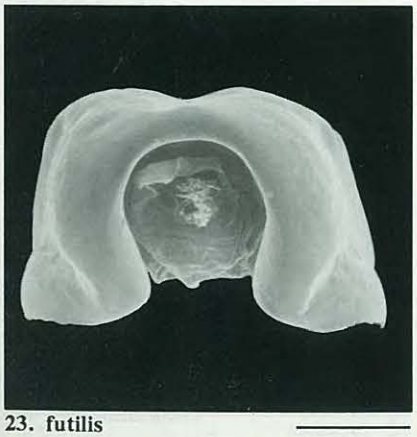
19. forbesi

20. forsteri

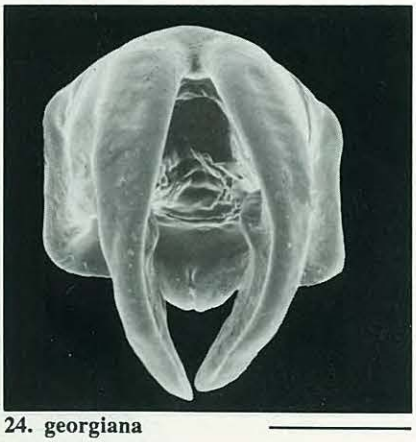


21. foxii

22. fraterna



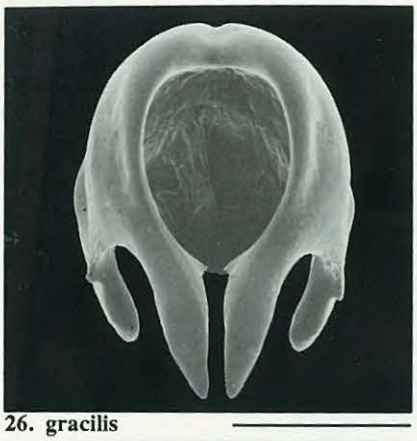
23. futilis



24. georgiana

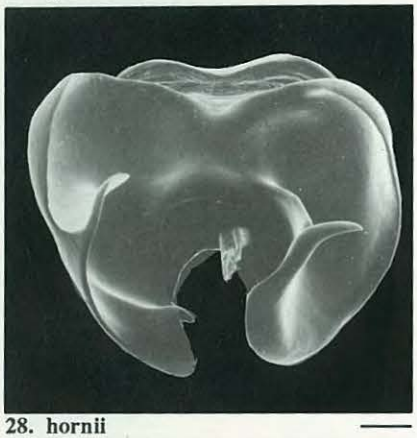
PLATE 3: FIG. 25-36. **PHYLLOPHAGA** MALE GENITALIA (CAUDAL), Line=0.5 mm

25. glaberrima



26. gracilis

27. hirticula

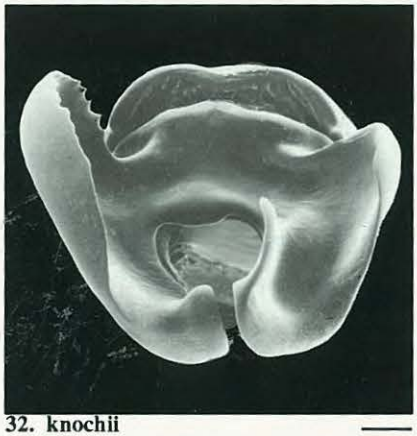


28. hornii

29. ilicis

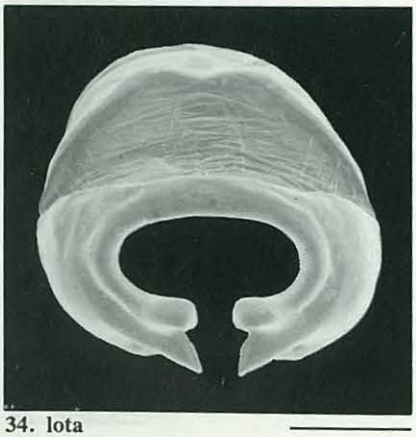
30. implicita

31. infidelis

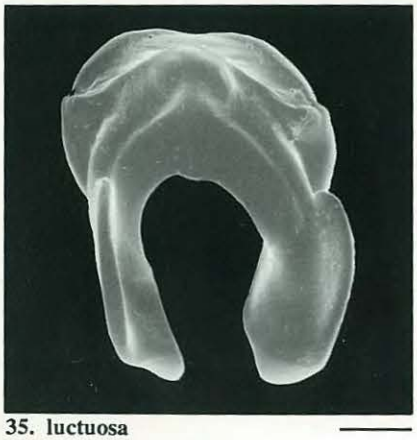


32. knochii

33. latifrons



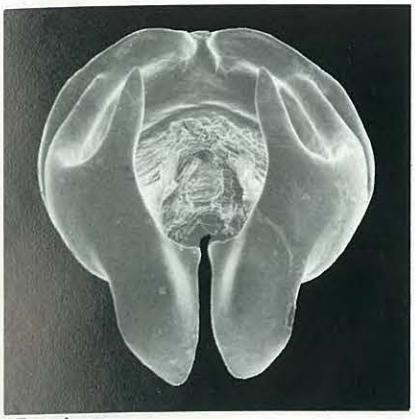
34. lota



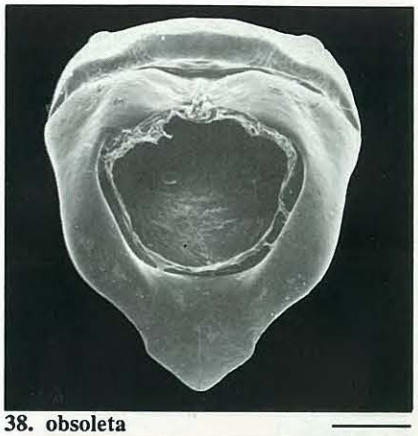
35. luctuosa

36. mariana

PLATE 4: FIG. 37-48. **PHYLLOPHAGA** MALE GENITALIA (CAUDAL), Line=0.5 mm



37. micans



38. obsoleta

39. okeechobea

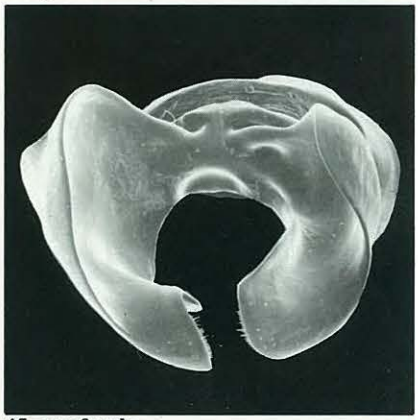
40. ovalis

41. panorpa

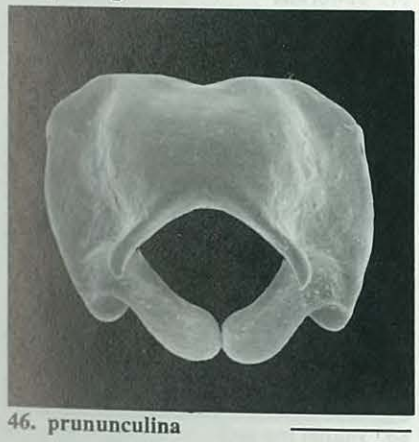
42. parvidens

43. perlonga

44. postrema



45. profunda



46. prununculina

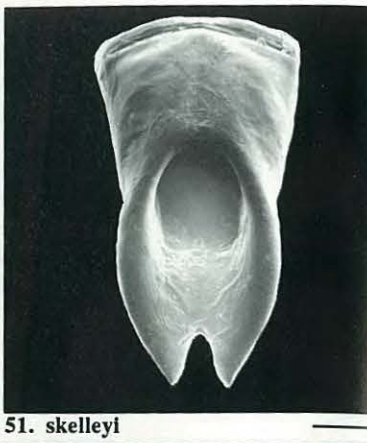
47. pseudofloridana

48. puberula

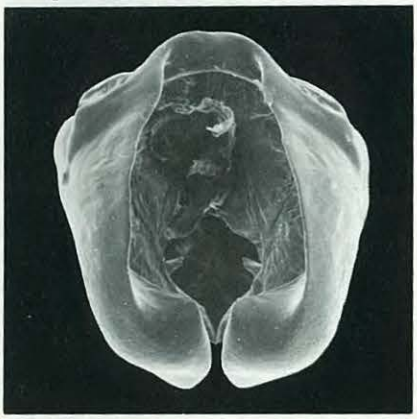
PLATE 5: FIG. 49-60. **PHYLLOPHAGA** MALE GENITALIA (CAUDAL), Line=0.5 mm

49. quercus

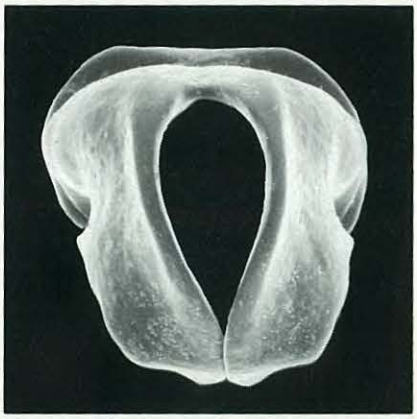
50. schaefferi



51. skelleyi



52. subpruinosa

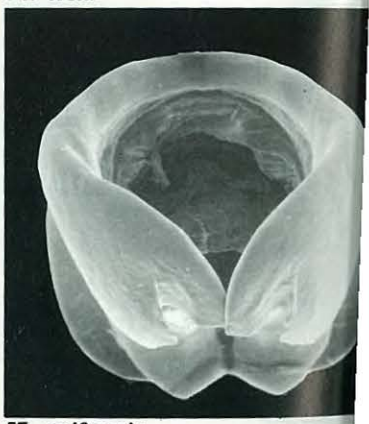


53. taxodii

54. tecta

55. tristis

56. ulkei



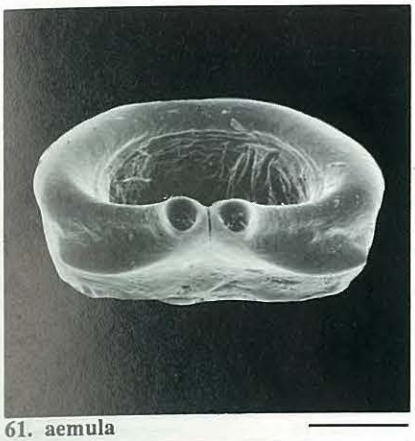
57. uniformis

58. yemasseei

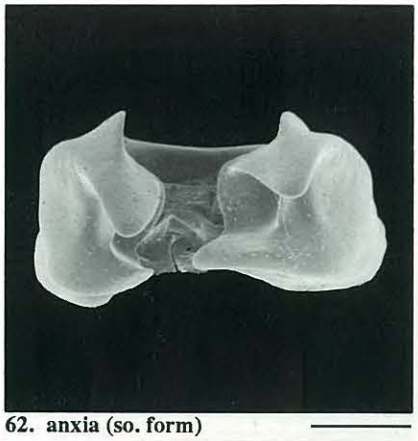
59. youngi (sac)

60. youngi (no sac)

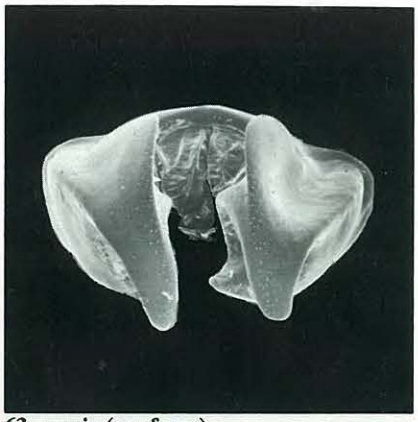
PLATE 6: FIG. 61-72. **PHYLLOPHAGA** MALE GENITALIA (VENTRAL), Line=0.5 mm



61. aemula



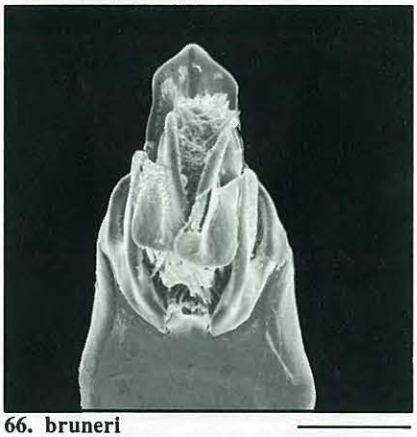
62. anxia (so. form)



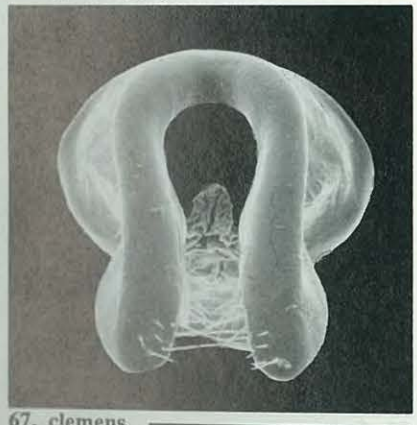
63. anxia (no. form)

64. apicata (sac)

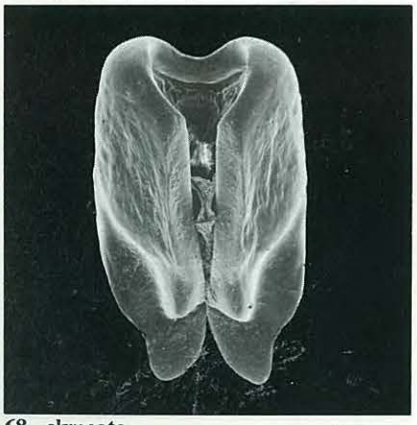
65. apicata (no sac)



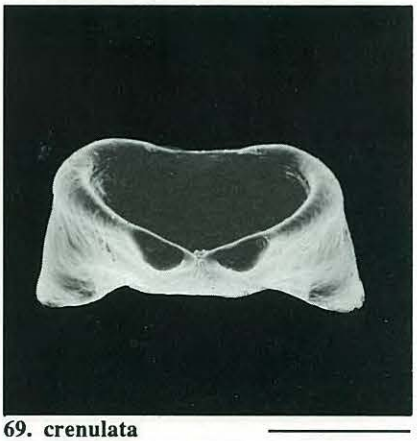
66. bruneri



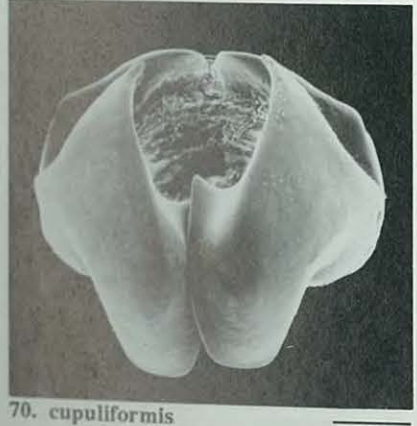
67. clemens



68. clypeata

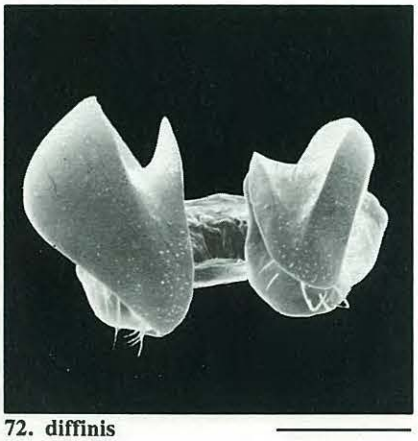


69. crenulata



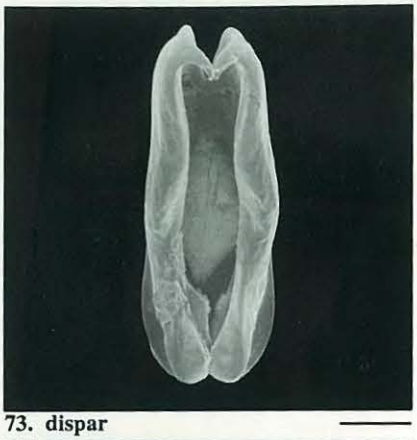
70. cupuliformis

71. debilis

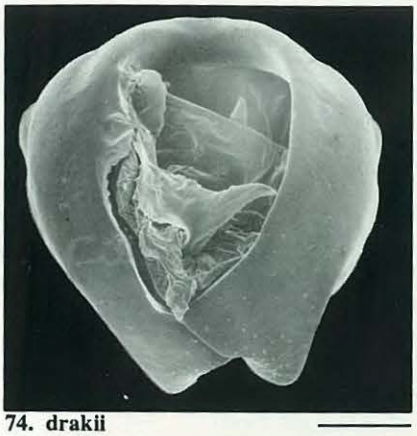


72. diffinis

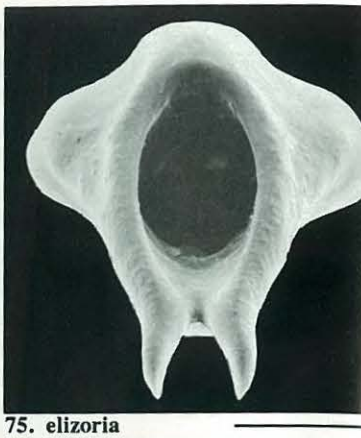
PLATE 7: FIG. 73-84. **PHYLLOPHAGA** MALE GENITALIA (VENTRAL), Line=0.5 mm



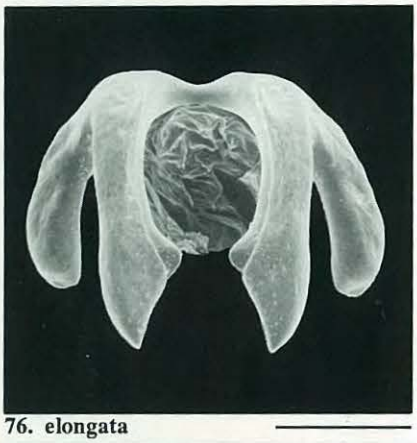
73. dispar



74. drakii



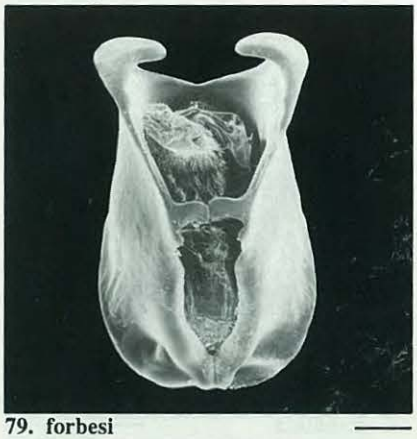
75. elizoria



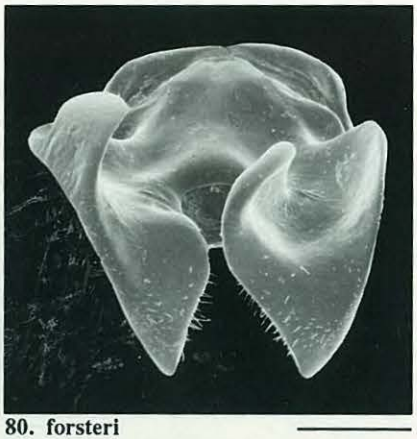
76. elongata

77. ephilida

78. floridana

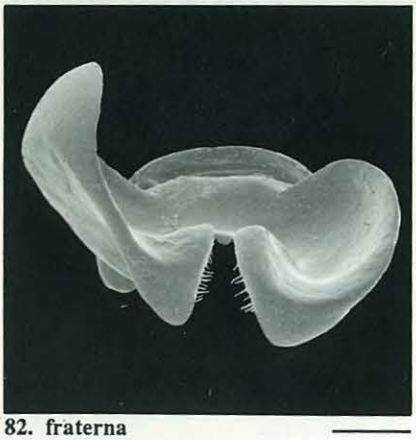


79. forbesi



80. forsteri

81. foxii



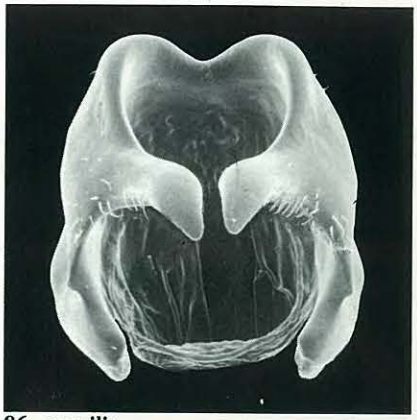
82. fraterna

83. futilis

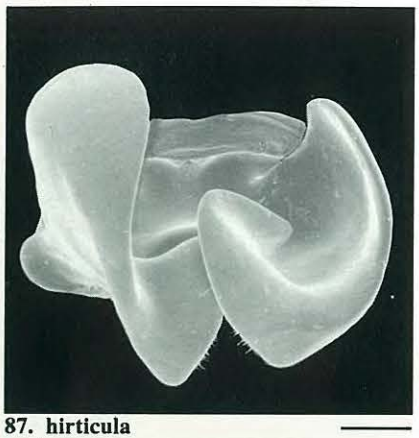
84. georgiana

PLATE 8: FIG. 85-96. **PHYLLOPHAGA** MALE GENITALIA (VENTRAL), Line=0.5 mm

85. glaberrima



86. gracilis

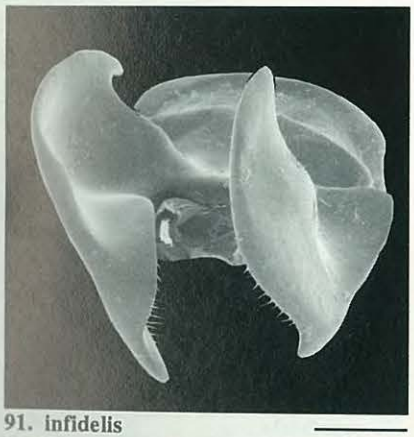


87. hirticula

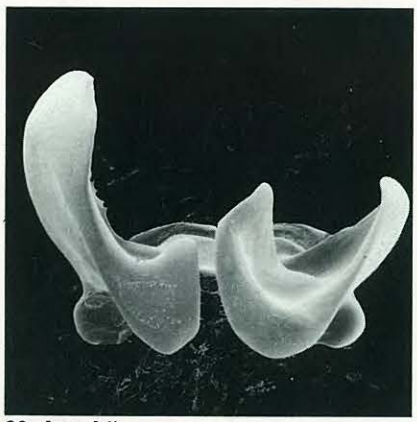
88. hornii

89. ilicis

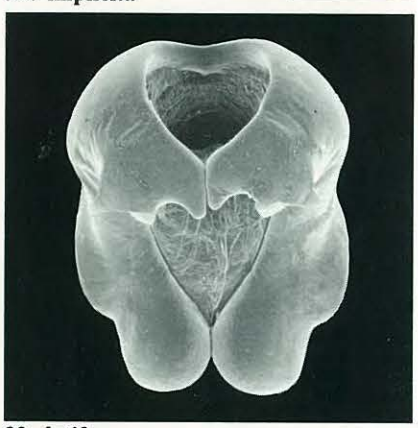
90. implicita



91. infidelis

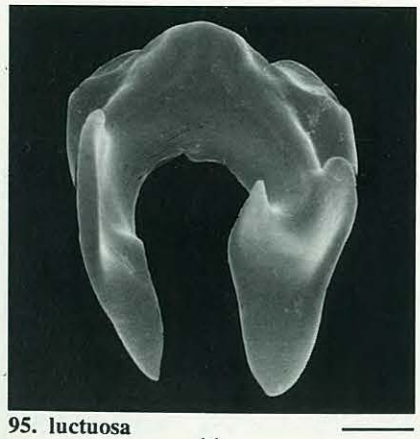


92. knochii

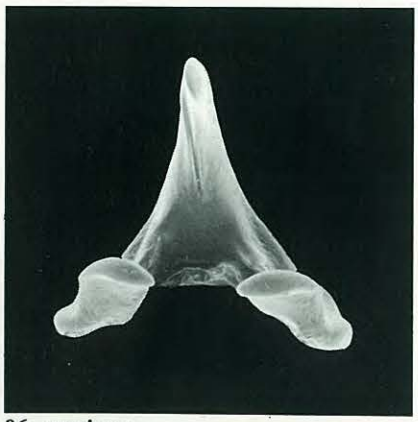


93. latifrons

94. lota

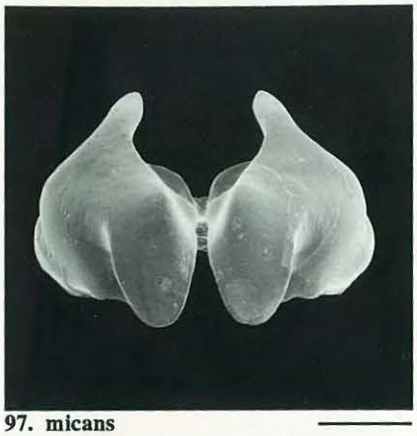


95. luctuosa

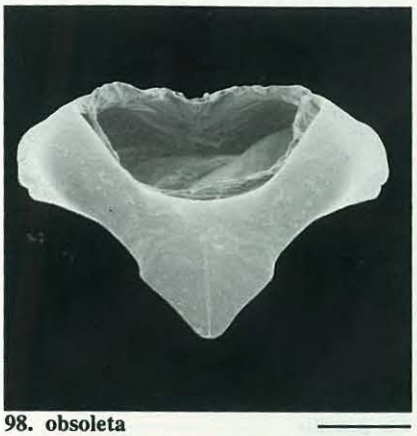


96. mariana

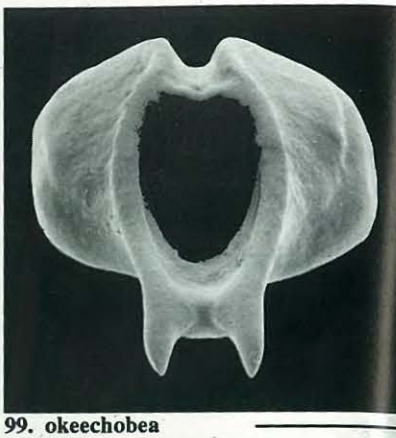
PLATE 9: FIG. 97-108. **PHYLLOPHAGA** MALE GENITALIA (VENTRAL), Line=0.5 mm



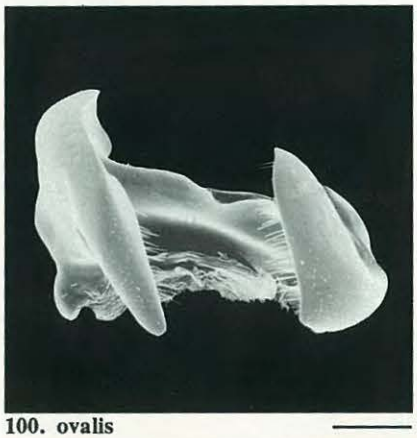
97. micans



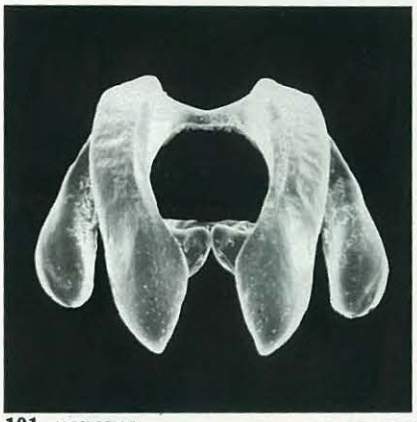
98. obsoleta



99. okeechobea



100. ovalis



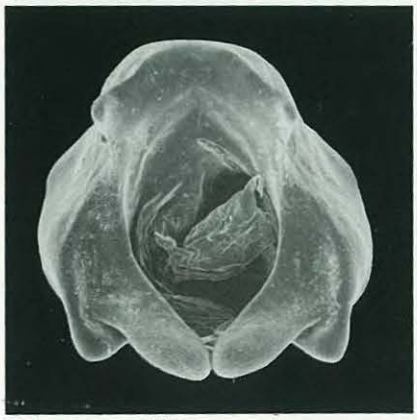
101. panorpa

102. parvidens

103. perlonga

104. postrema

105. profunda

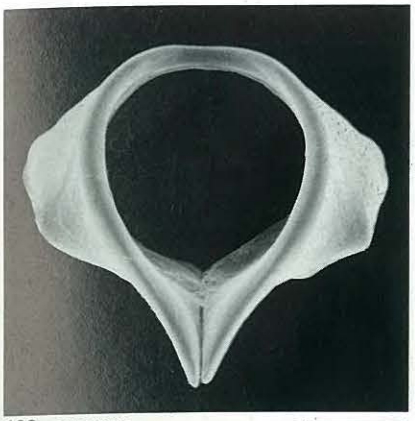


106. prununculina

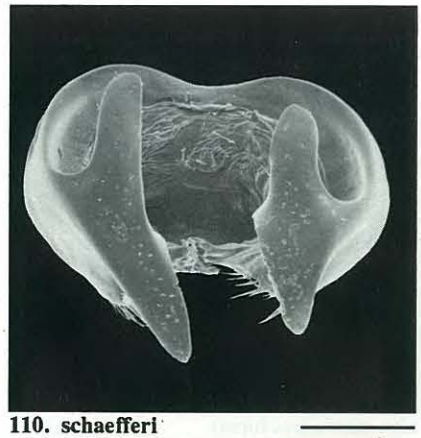
107. pseudofloridana

108. puberula

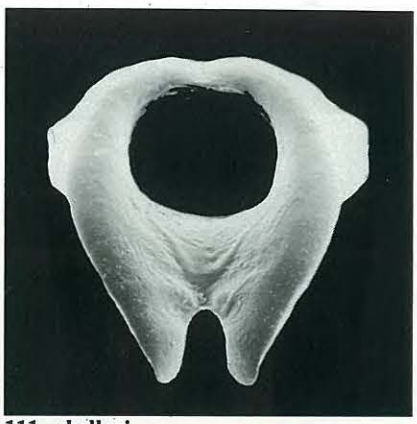
PLATE 10: FIG. 109-120. **PHYLLOPHAGA** MALE GENITALIA (VENTRAL), Line=0.5 mm



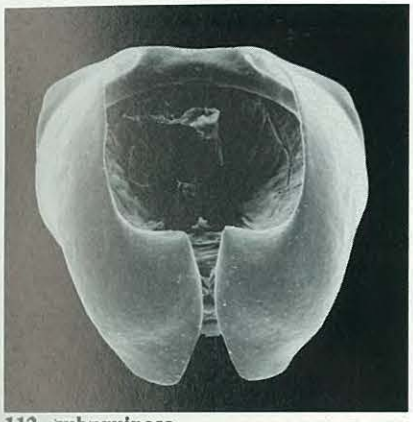
109. quercus



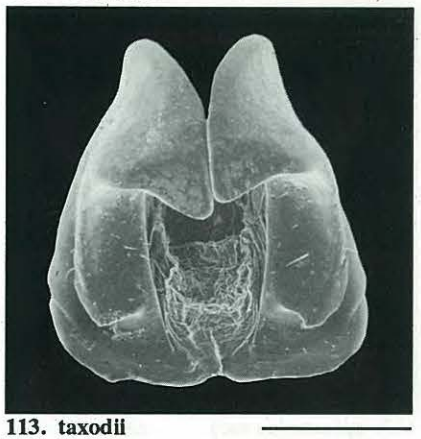
110. schaefferi



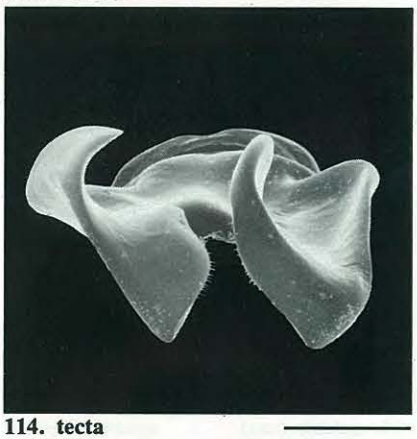
111. skelleyi



112. subpruinosa

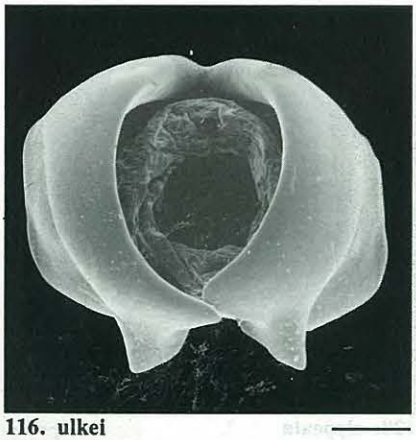


113. taxodii



114. tecta

115. tristis

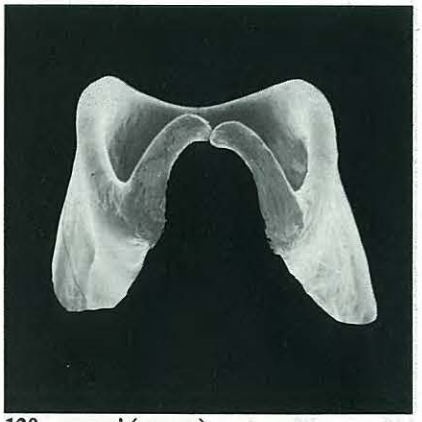


116. ulkei

117. uniformis

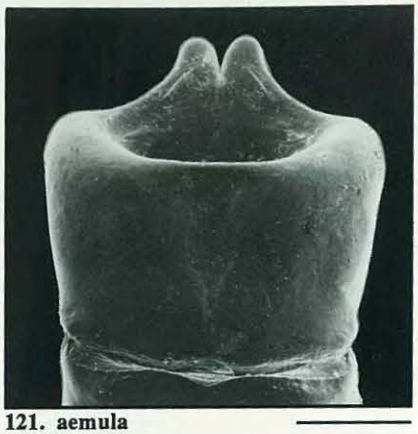
118. yemasseei

119. youngi (sac)



120. youngi (no sac)

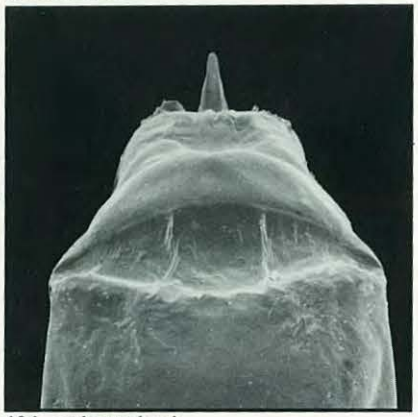
PLATE 11: FIG. 121-132. **PHYLLOPHAGA** MALE GENITALIA (DORSAL), Line=0.5 mm



121. aemula

122. anxia (so. form)

123. anxia (no. form)



124. apicata (sac)

125. apicata (no sac)

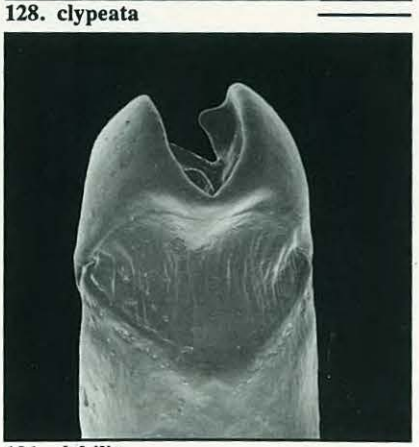
126. bruneri

127. clemens

128. clypeata

129. crenulata

130. cupuliformis



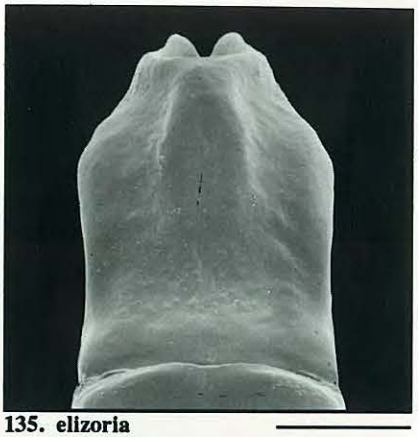
131. debilis

132. diffinis

PLATE 12: FIG. 133-144. **PHYLLOPHAGA** MALE GENITALIA (DORSAL), Line=0.5 mm

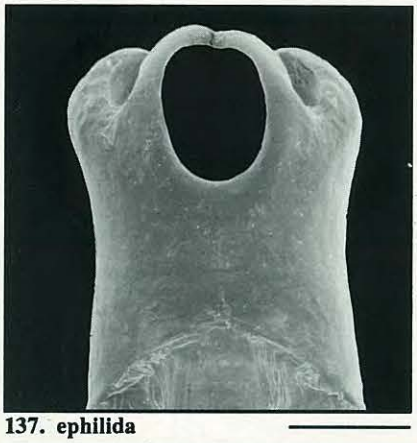
133. dispar

134. drakii



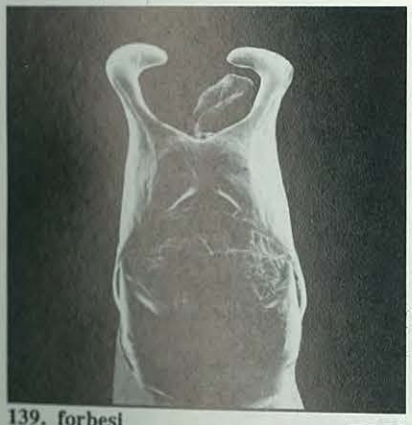
135. elizoria

136. elongata



137. ephilida

138. floridana

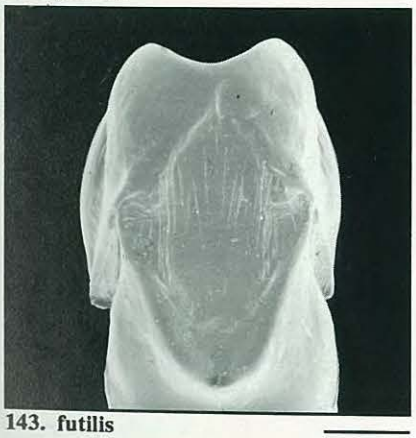


139. forbesi

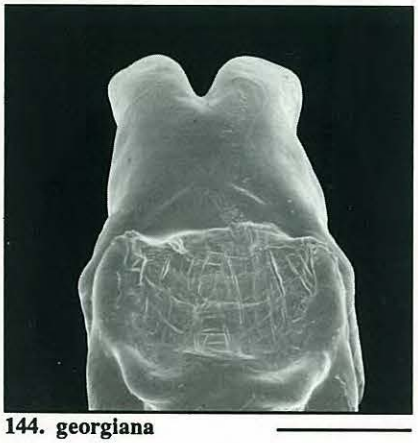
140. forsteri

141. foxii

142. fraterna



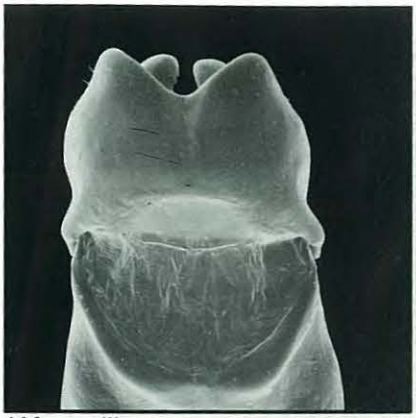
143. futilis



144. georgiana

PLATE 13: FIG. 145-156. **PHYLLOPHAGA** MALE GENITALIA (DORSAL), Line=0.5 mm

145. glaberrima



146. gracilis

147. hirticula

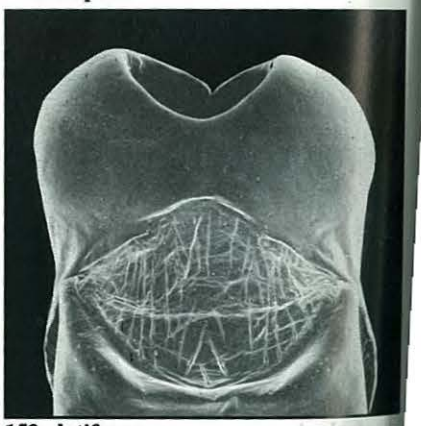
148. hornii

149. ilicis

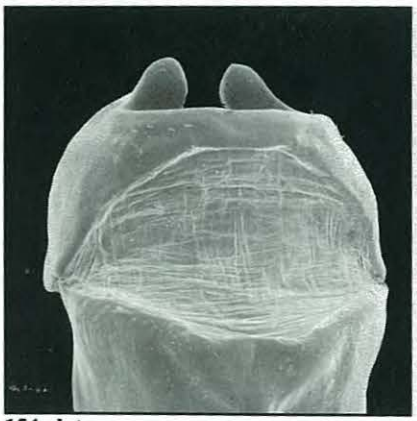
150. implicita

151. infidelis

152. knochii



153. latifrons

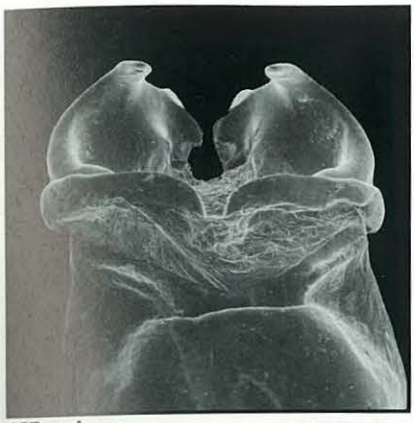


154. lota

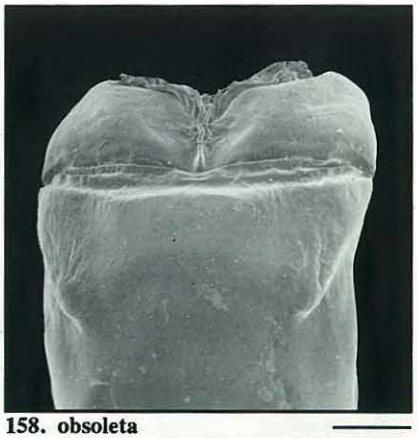
155. luctuosa

156. mariana

PLATE 14: FIG. 157-168. **PHYLLOPHAGA** MALE GENITALIA (DORSAL), Line=0.5 mm



157. micans

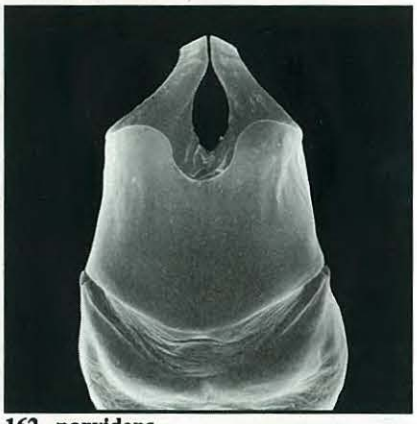


158. obsoleta

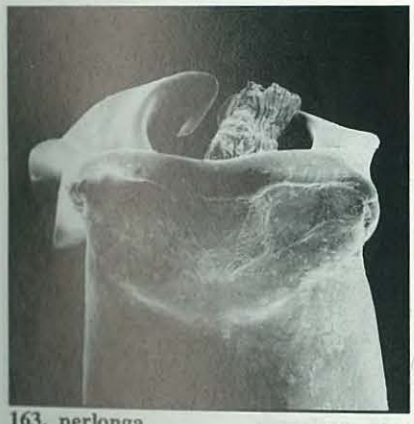
159. okeechobea

160. ovalis

161. panorpa



162. parvidens



163. perlonga

164. postrema

165. profunda

166. prununculina

167. pseudofloridana

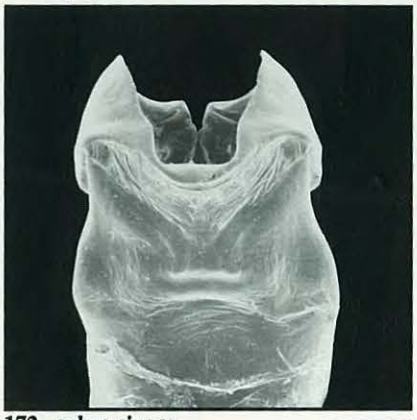
168. puberula

PLATE 15: FIG. 169-180. **PHYLLOPHAGA** MALE GENITALIA (DORSAL), Line=0.5 mm

169. quercus

170. schaefferi

171. skelleyi



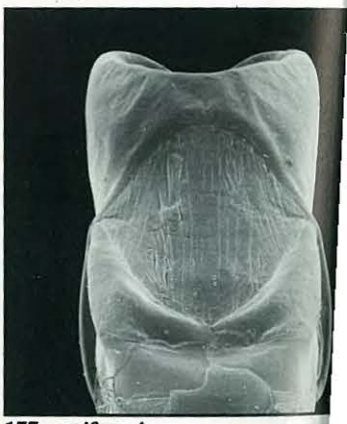
172. subpruinosa

173. taxodii

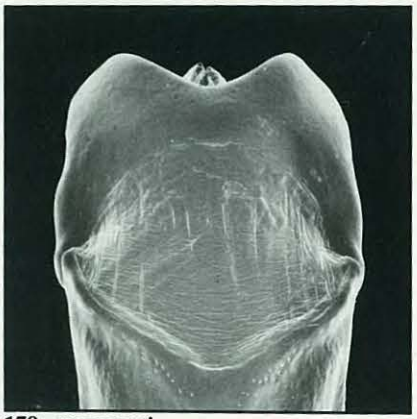
174. tecta

175. tristis

176. ulkei



177. uniformis



178. yemasseei

179. youngi (sac)

180. youngi (no sac)

PLATE 16: FIG. 181-192. **PHYLLOPHAGA** MALE GENITALIA (RIGHT LATERAL), Line=0.5 mm

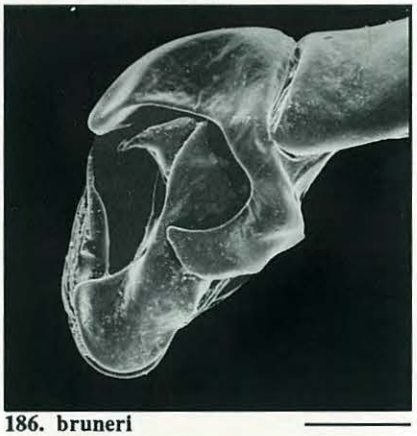
181. aemula

182. anxia (so. form)

183. anxia (no. form)

184. apicata (sac)

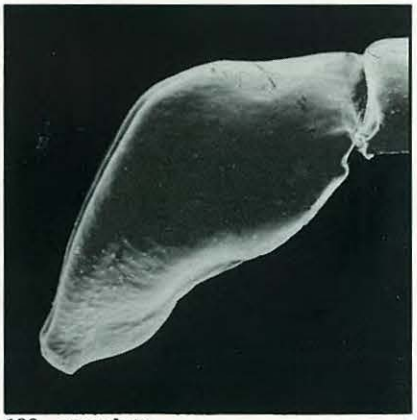
185. apicata (no sac)



186. bruneri

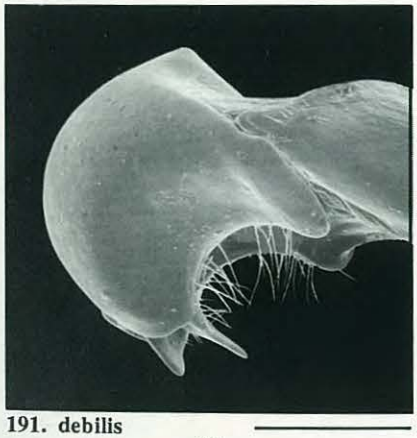
187. clemens

188. clypeata



189. crenulata

190. cupuliformis



191. debilis

192. diffinis

PLATE 17: FIG. 193-204. **PHYLLOPHAGA** MALE GENITALIA (RIGHT LATERAL), Line=0.5 mm

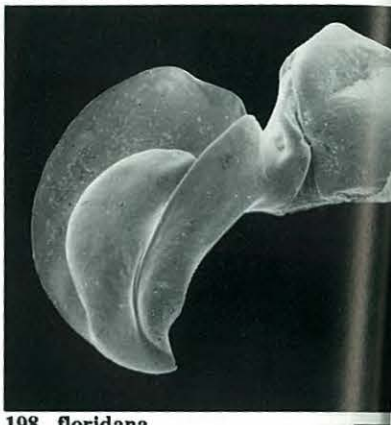
193. dispar

194. drakii

195. elizoria

196. elongata

197. ephilida

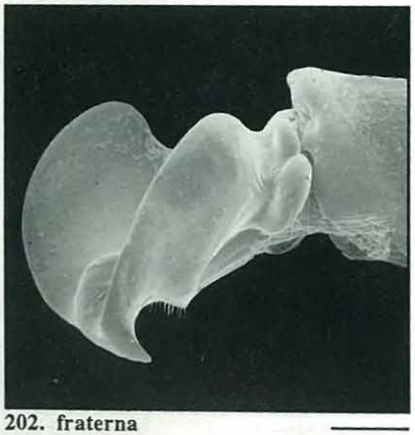


198. floridana

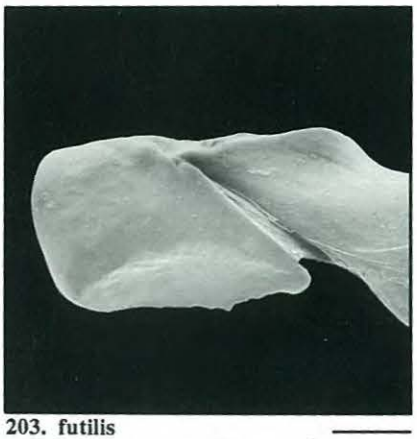
199. forbesi

200. forsteri

201. foxii



202. fraterna

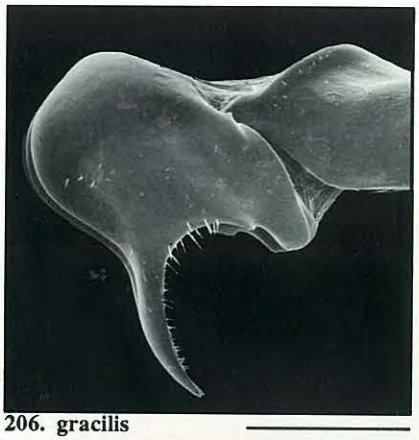


203. futilis

204. georgiana

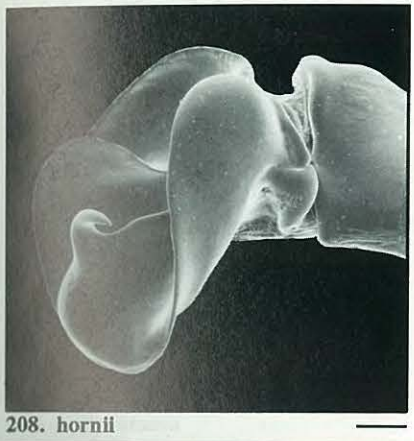
PLATE 18: FIG. 205-216. **PHYLLOPHAGA** MALE GENITALIA (RIGHT LATERAL), Line=0.5 mm

205. glaberrima



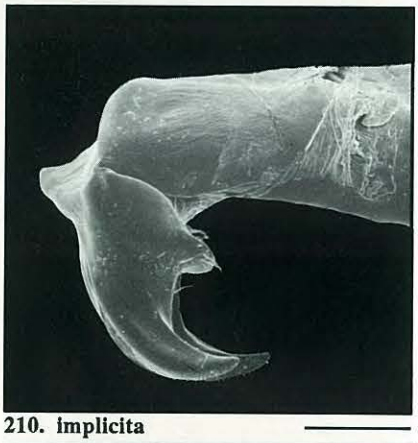
206. gracilis

207. hirticula



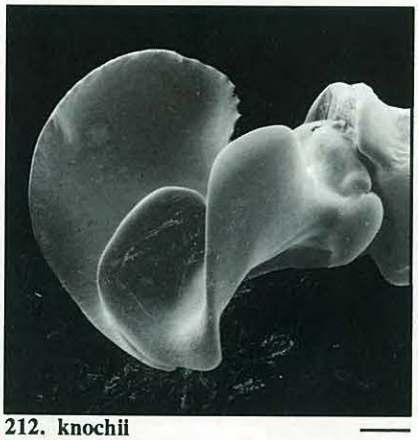
208. hornii

209. ilicis



210. implicita

211. infidelis



212. knochii

213. latifrons

214. lota

215. luctuosa

216. mariana

PLATE 19: FIG. 217-228. **PHYLLOPHAGA** MALE GENITALIA (RIGHT LATERAL), Line=0.5 mm

217. micans ———

218. obsoleta ———

219. okeechobea —

220. ovalis ———

221. panorpa ———

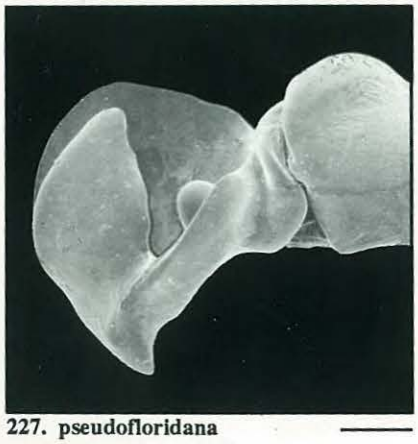
222. parvidens —

223. perlonga ———

224. postrema ———

225. profunda

226. prununculina ———

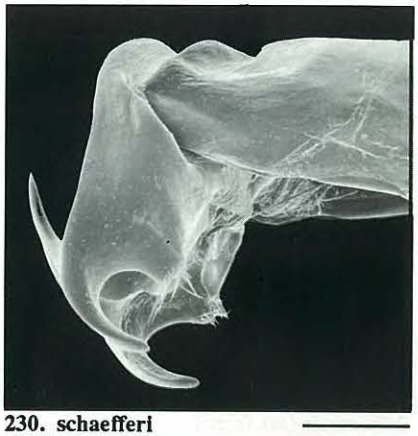


227. pseudofloridana ———

228. puberula

PLATE 20: FIG. 229-240. **PHYLLOPHAGA** MALE GENITALIA (RIGHT LATERAL), Line=0.5 mm

229. quercus



230. schaefferi

231. skelleyi

232. subpruinosa

233. taxodii

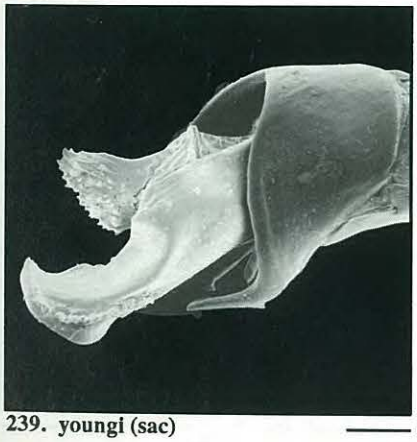
234. tecta

235. tristis

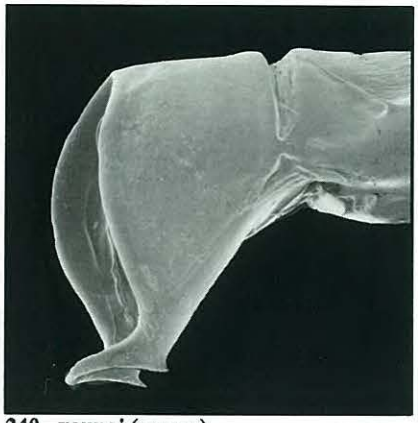
236. ulkei

237. uniformis

238. yemasseei



239. youngi (sac)



240. youngi (no sac)

PLATE 21: FIG. 241-252. **PHYLLOPHAGA** MALE GENITALIA (LEFT LATERAL), Line=0.5 mm

241. anxia (so. form)

242. anxia (no. form)

243. drakii

244. floridana

245. forsteri

246. foxii

247. fraterna

248. hirticula

249. hornii

250. ilicis

251. implicita

252. infidelis

PLATE 22: FIG. 253-262. **PHYLLOPHAGA** MALE GENITALIA (LEFT LATERAL), Line=0.5 mm

253. knochii

254. luctuosa

255. ovalis

256. perlonga

257. postrema

258. profunda

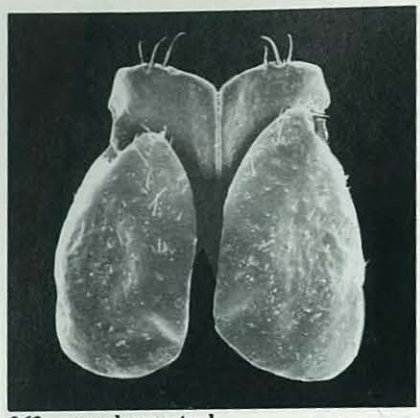
259. pseudofloridana

260. schaefferi

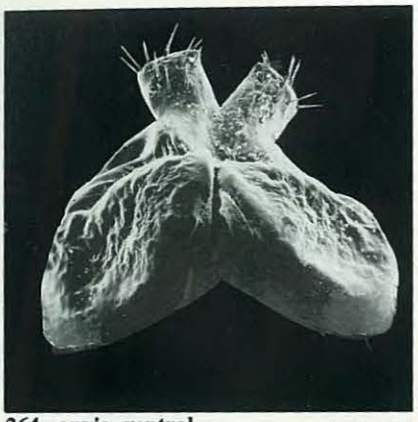
261. tecta

262. ulkei

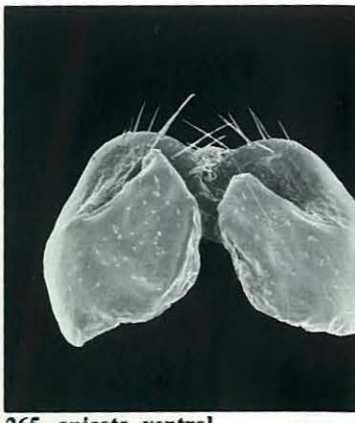
PLATE 23: FIG. 263-274. PHYLLOPHAGA FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



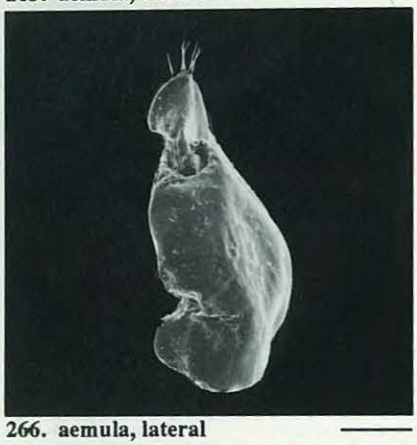
263. aemula, ventral



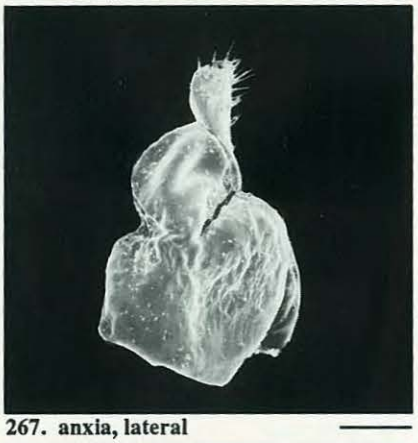
264. anxia, ventral



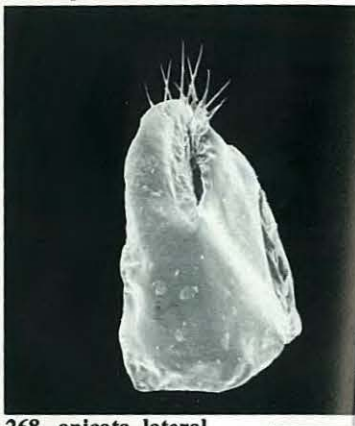
265. apicata, ventral



266. aemula, lateral

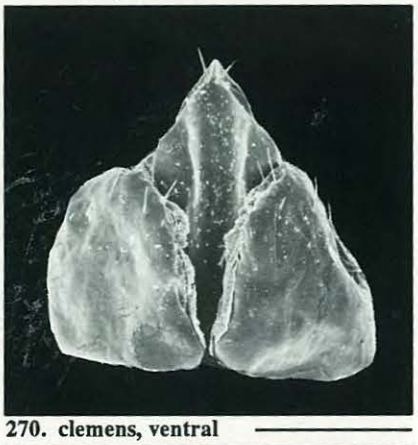


267. anxia, lateral



268. apicata, lateral

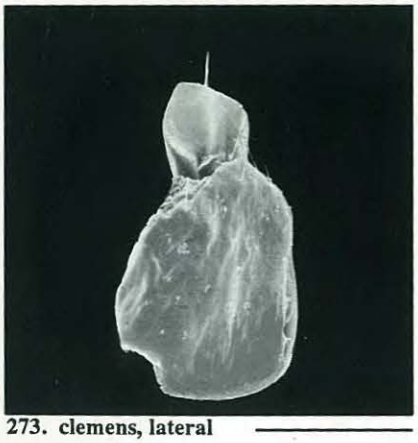
269. bruneri, ventral



270. clemens, ventral

271. clypeata, ventral

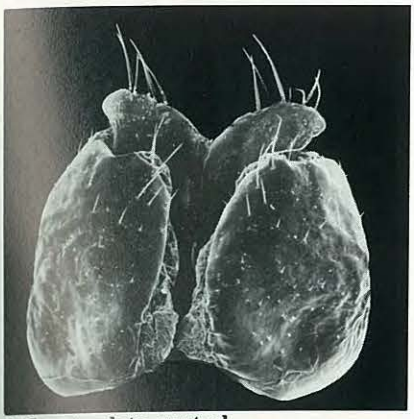
272. bruneri, lateral



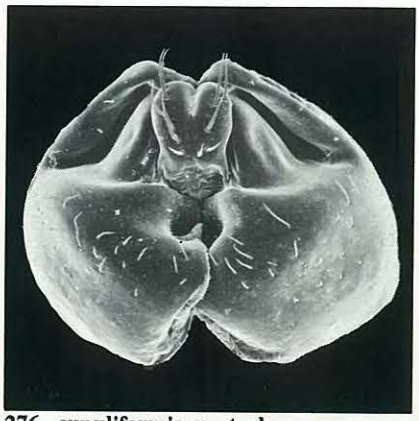
273. clemens, lateral

274. clypeata, lateral

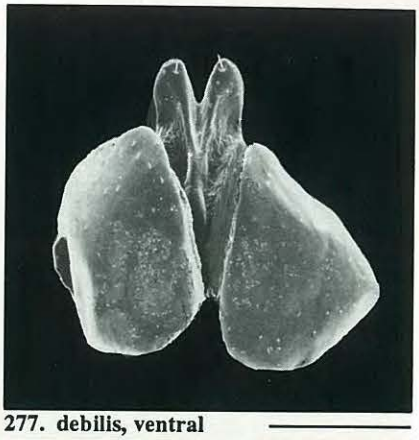
PLATE 24: FIG. 275-286. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



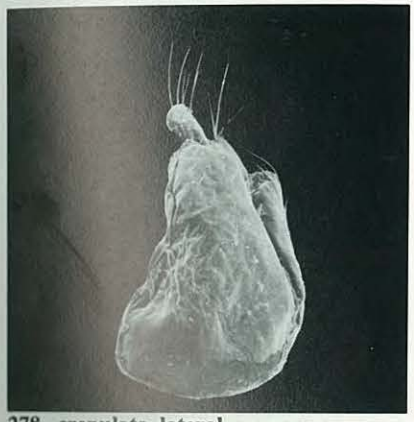
275. crenulata, ventral



276. cupuliformis, ventral



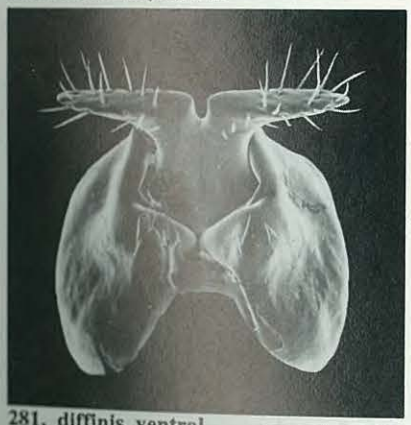
277. debilis, ventral



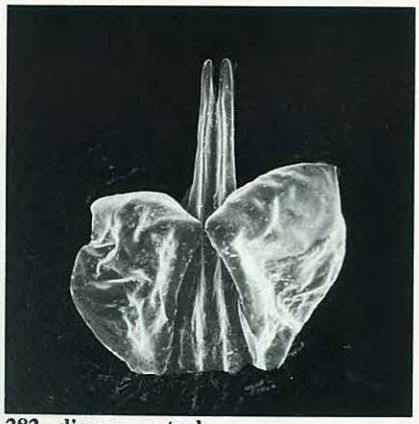
278. crenulata, lateral

279. cupuliformis, lateral

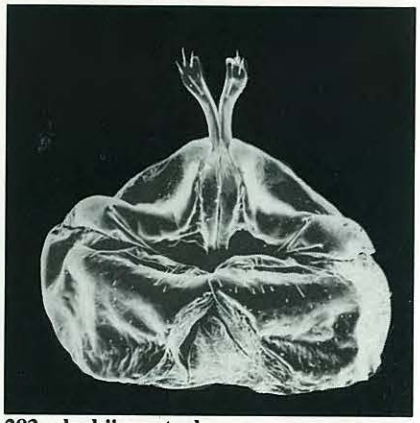
280. debilis, lateral



281. diffinis, ventral



282. dispar, ventral



283. drakii, ventral

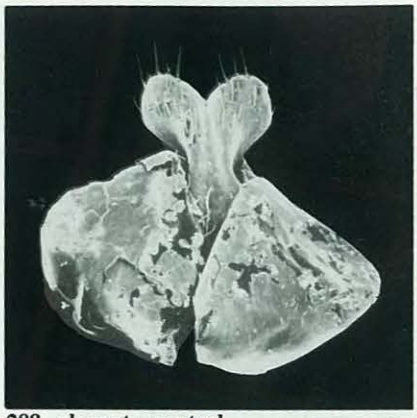
284. diffinis, lateral

285. dispar, lateral

286. drakii, lateral

PLATE 25: FIG. 287-298. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm

287. elizoria, ventral



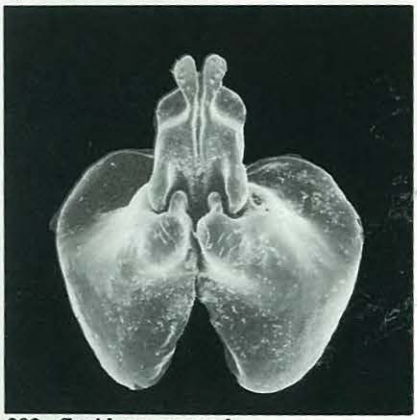
288. elongata, ventral

289. ephilida, ventral

290. elizoria, lateral

291. elongata, lateral

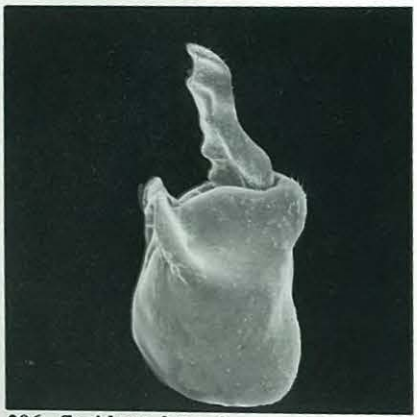
292. ephilida, lateral



293. floridana, ventral

294. forbesi, ventral

295. forsteri, ventral

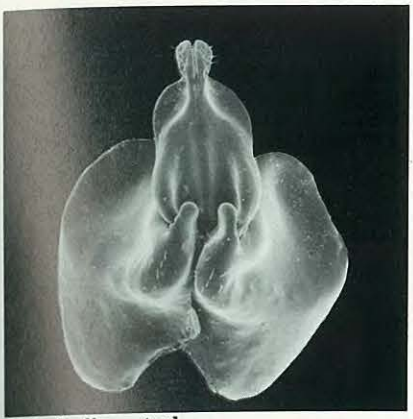


296. floridana, lateral

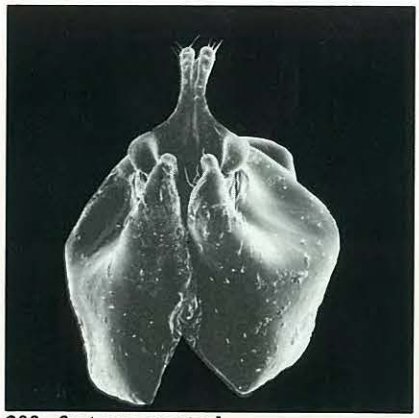
297. forbesi, lateral

298. forsteri, lateral

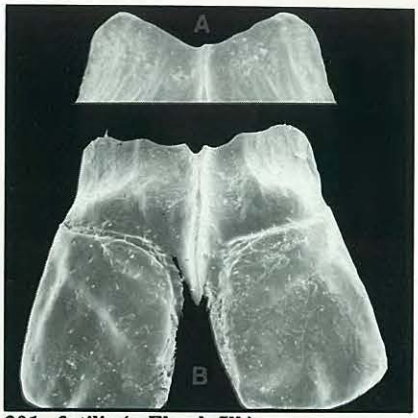
PLATE 26: FIG. 299-310. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



299. foxii, ventral



300. fraterna, ventral



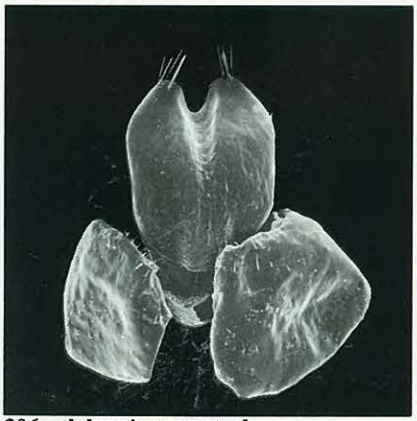
301. futilis (a-Fla., b-Ill.)

302. foxii, lateral

303. fraterna, lateral

304. futilis, lateral

305. georgiana, ventral



306. glaberrima, ventral

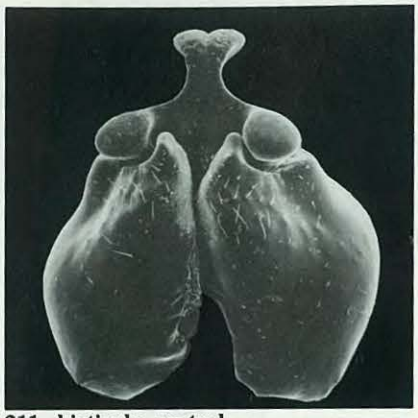
307. gracilis, ventral

308. georgiana, lateral

309. glaberrima, lateral

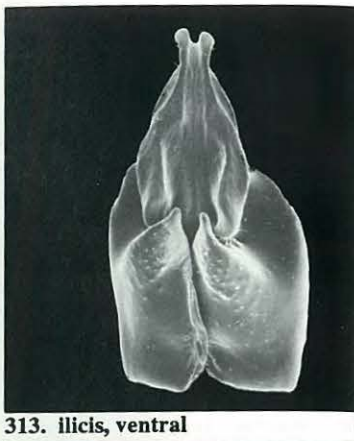
310. gracilis, lateral

PLATE 27: FIG. 311-322. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



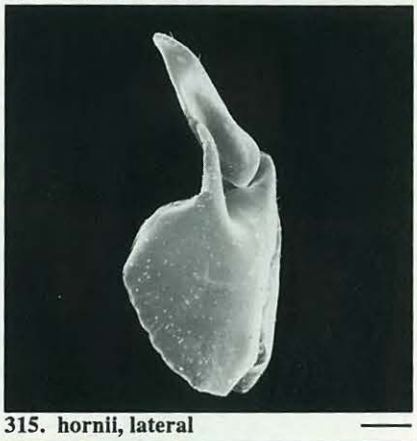
311. hirticula, ventral ——

312. hornii, ventral ——



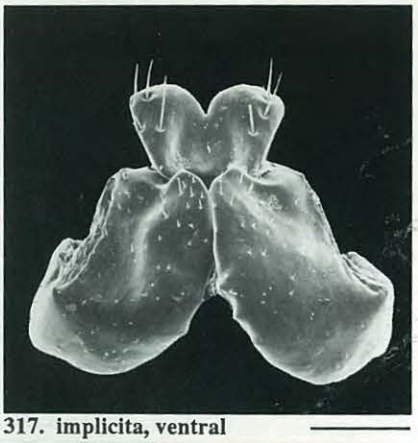
313. ilicis, ventral

314. hirticula, lateral ——

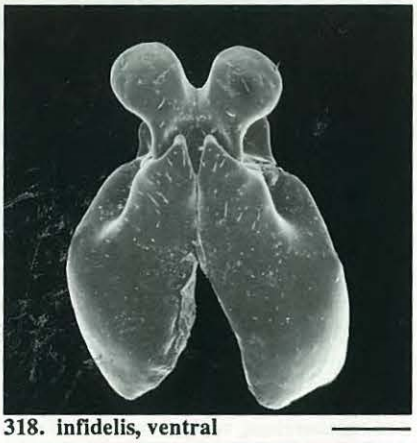


315. hornii, lateral ——

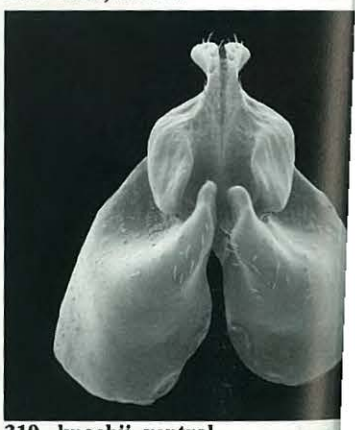
316. ilicis, lateral



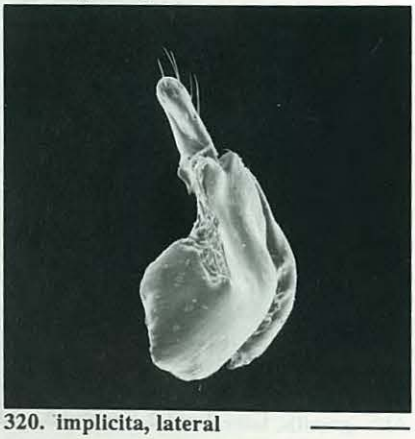
317. implicita, ventral ——



318. infidelis, ventral ——



319. knochii, ventral

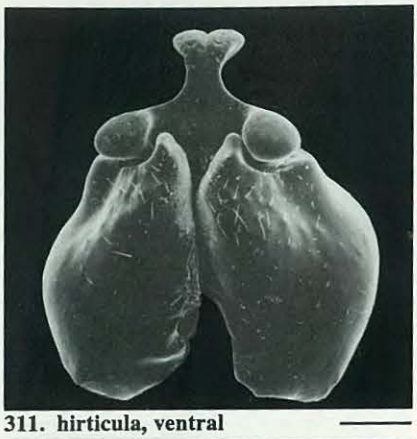


320. implicita, lateral ——

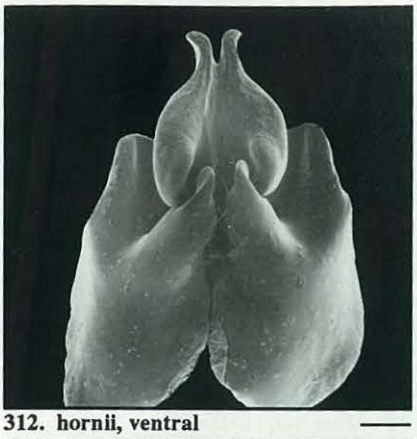
321. infidelis, lateral ——

322. knochii, lateral

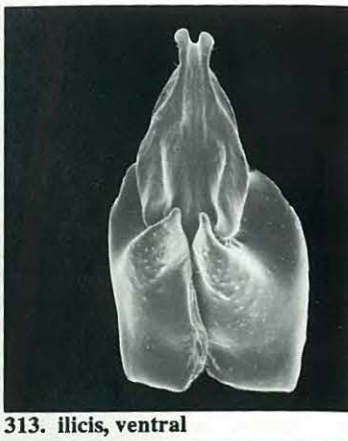
PLATE 27: FIG. 311-322. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



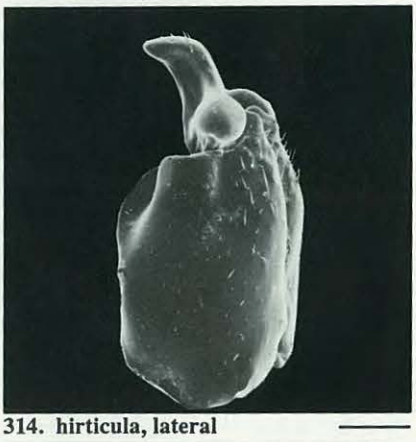
311. hirticula, ventral



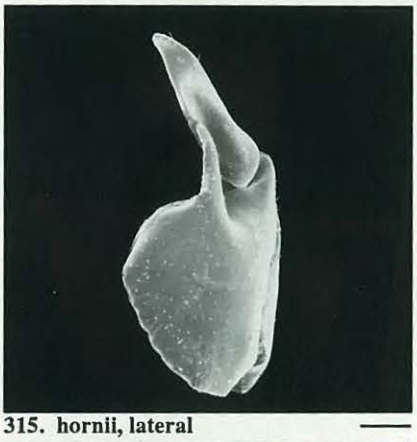
312. hornii, ventral



313. ilicis, ventral

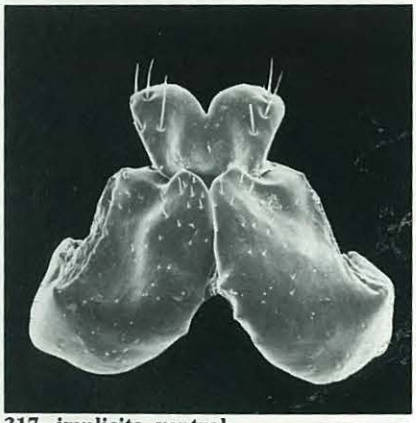


314. hirticula, lateral

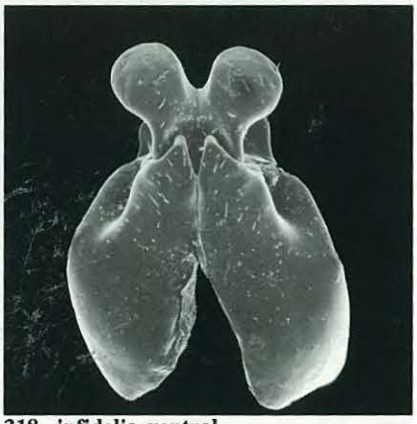


315. hornii, lateral

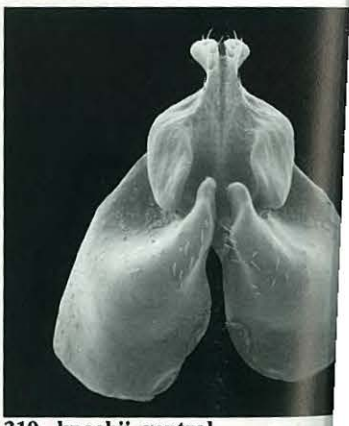
316. ilicis, lateral



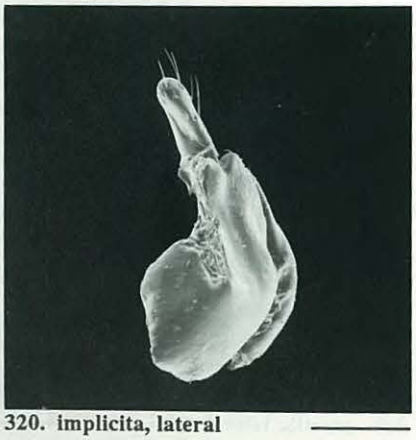
317. implicita, ventral



318. infidelis, ventral



319. knochii, ventral

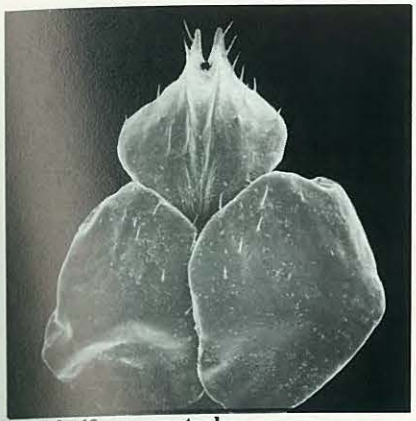


320. implicita, lateral

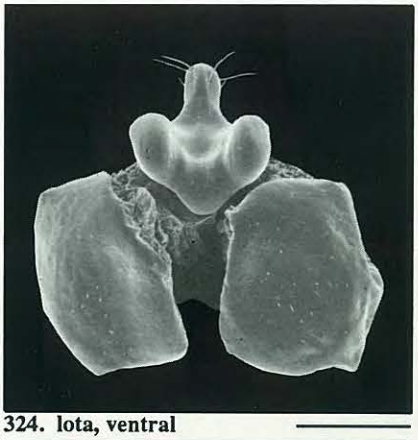
321. infidelis, lateral

322. knochii, lateral

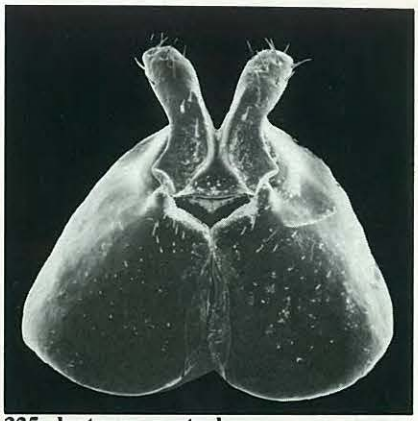
PLATE 28: FIG. 323-334. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



323. latifrons, ventral



324. lota, ventral

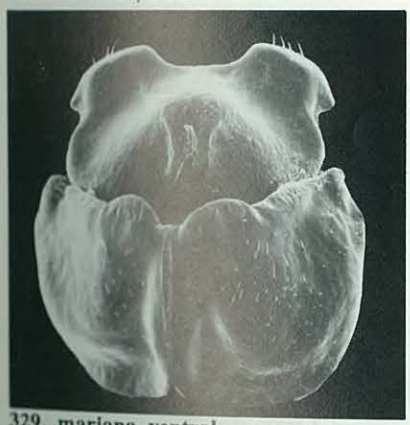


325. luctuosa, ventral

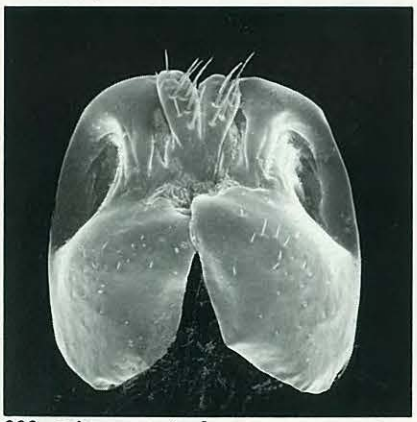
326. latifrons, lateral

327. lota, lateral

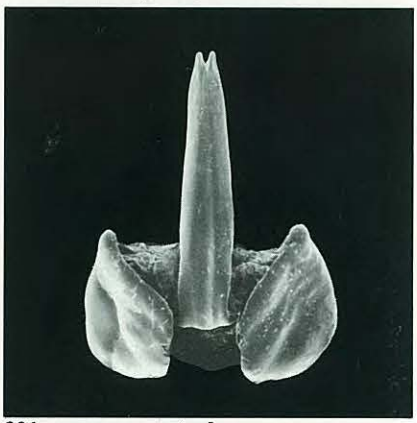
328. luctuosa, lateral



329. mariana, ventral

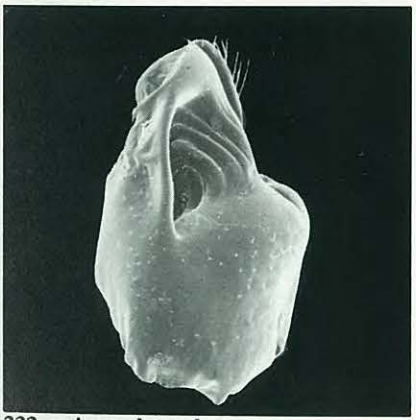


330. micans, ventral

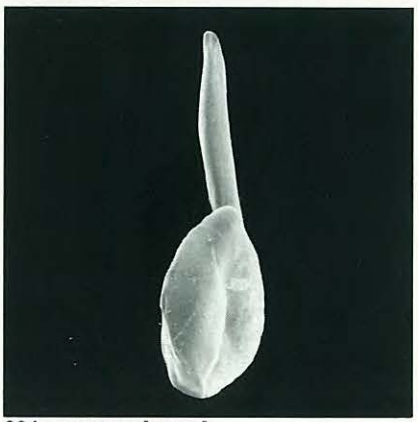


331. murrea, ventral

332. mariana, lateral

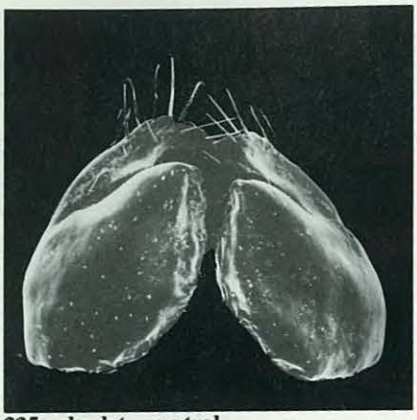


333. micans, lateral

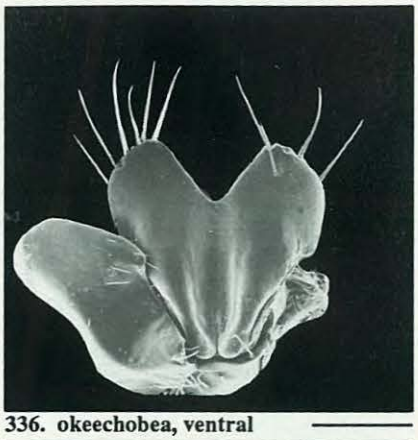


334. murrea, lateral

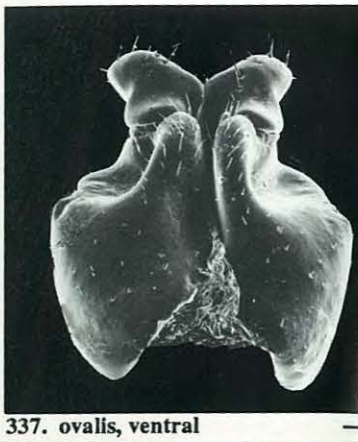
PLATE 29: FIG. 335-346. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



335. obsoleta, ventral



336. okeechobea, ventral

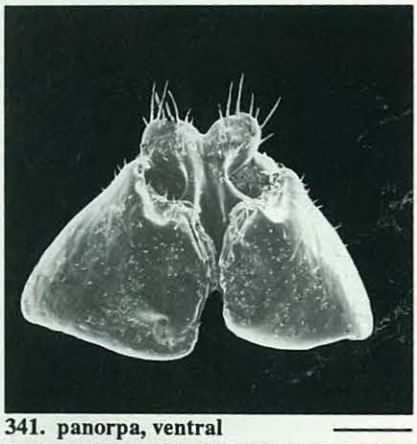


337. ovalis, ventral

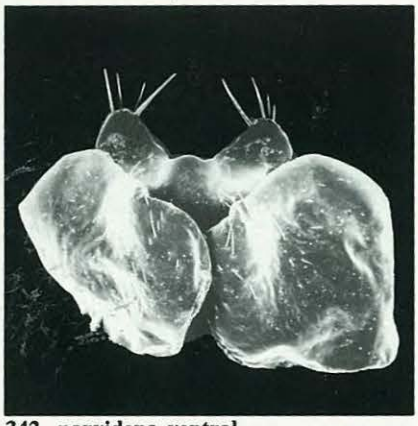
338. obsoleta, lateral

339. okeechobea, lateral

340. ovalis, lateral



341. panorpa, ventral



342. parvidens, ventral

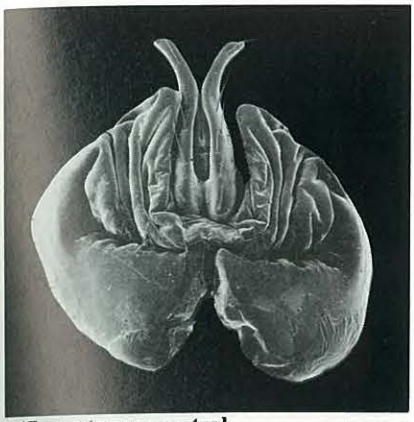
343. perlonga, ventral

344. panorpa, lateral

345. parvidens, lateral

346. perlonga, lateral

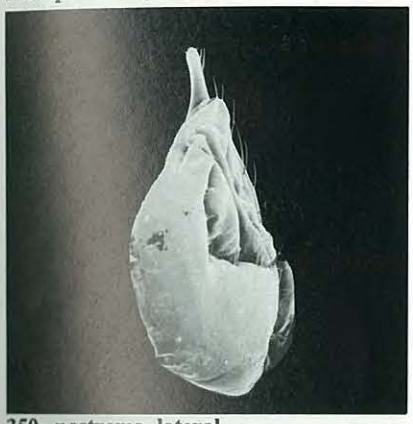
PLATE 30: FIG. 347-358. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



347. postrema, ventral

348. profunda, ventral

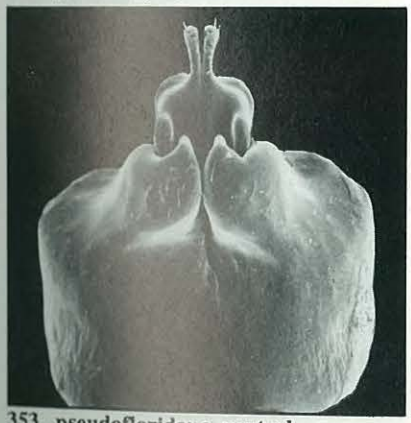
349. prununculina, ventral



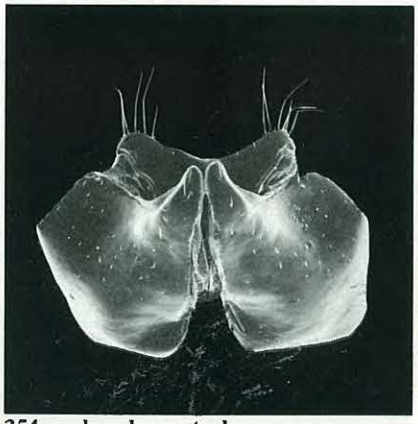
350. postrema, lateral

351. profunda, lateral

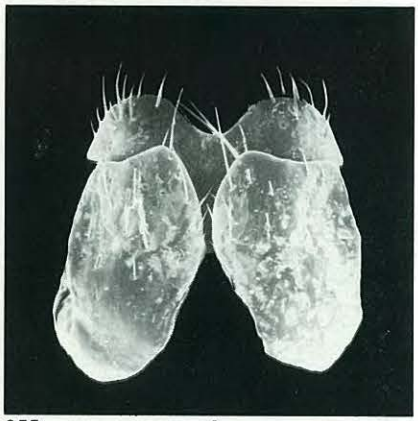
352. prununculina, lateral



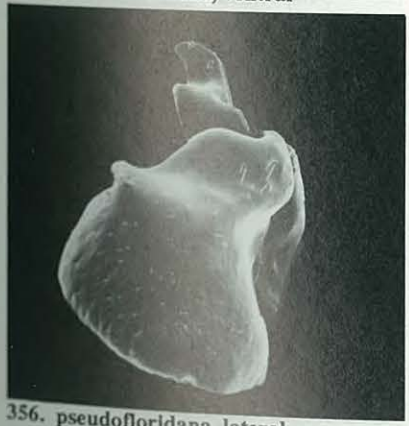
353. pseudofloridana, ventral



354. puberula, ventral.



355. quercus, ventral

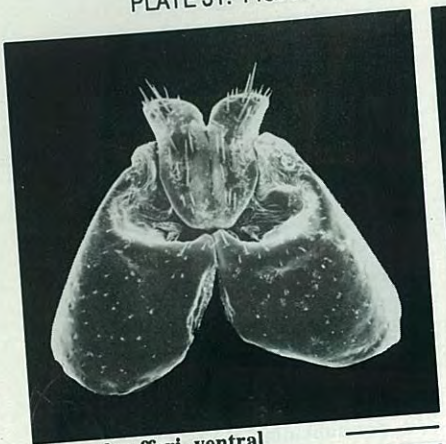


356. pseudofloridana, lateral

357. puberula, lateral

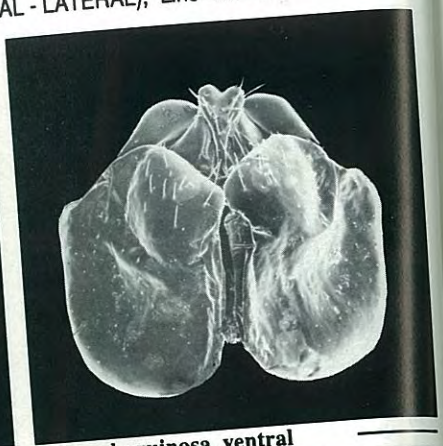
358. quercus, lateral

PLATE 31: FIG. 359-370. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



359. schaefferi, ventral

360. skelleyi, ventral



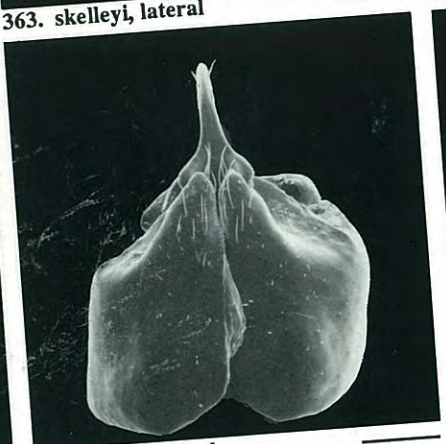
361. subpruinosa, ventral

362. schaefferi, lateral

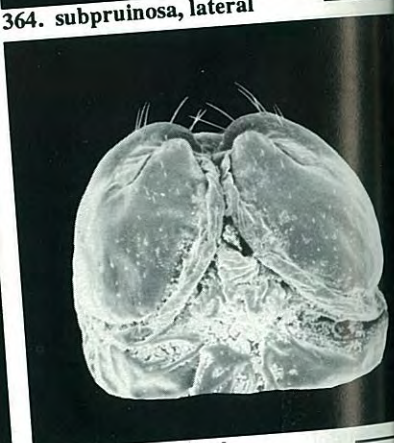
363. skelleyi, lateral

364. subpruinosa, lateral

365. taxodii, ventral



366. tecta, ventral



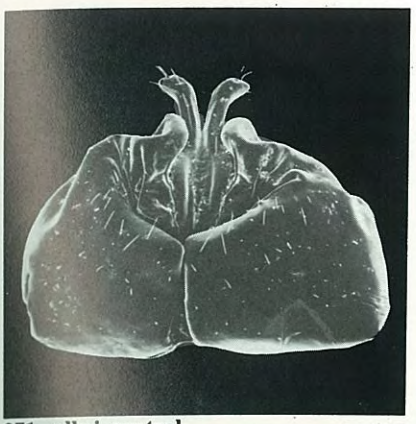
367. tristis, ventral

368. taxodii, lateral

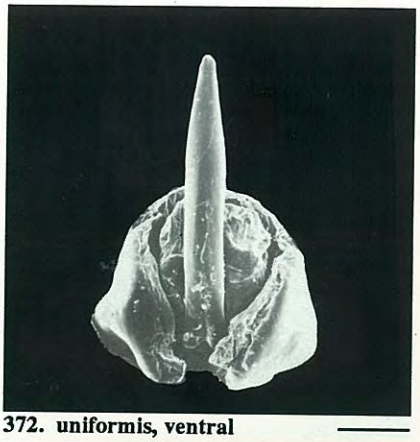
369. tecta, lateral

370. tristis, lateral

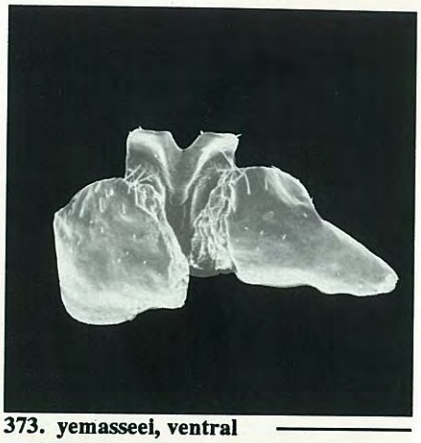
PLATE 32: FIG. 371-378. **PHYLLOPHAGA** FEMALE GENITALIA (VENTRAL - LATERAL), Line=0.5 mm



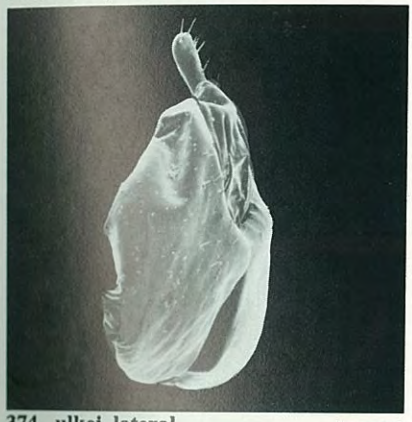
371. ulkei, ventral



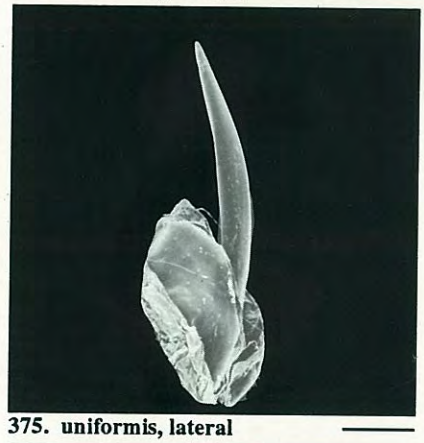
372. uniformis, ventral



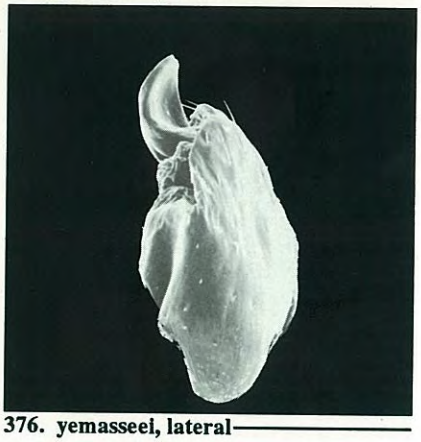
373. yemasseei, ventral



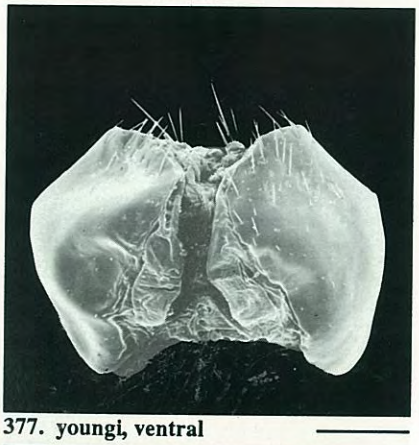
374. ulkei, lateral



375. uniformis, lateral



376. yemasseei, lateral



377. youngi, ventral

378. youngi, lateral

PLATE 33: FIG. 379-390. **PHYLLOPHAGA** ANTERIOR TARSAL CLAWS & ELYTRAL SCULPTURE

379. dispar, tarsus (56X)

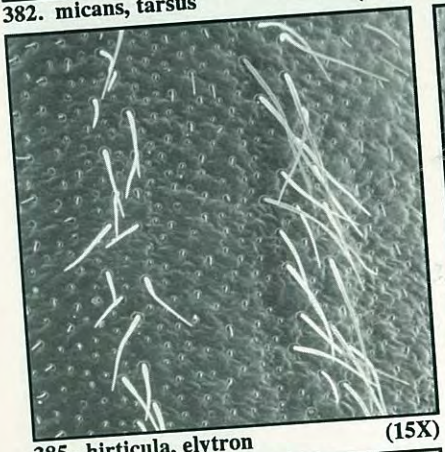
380. georgiana, tarsus (52X)

381. lota, tarsus

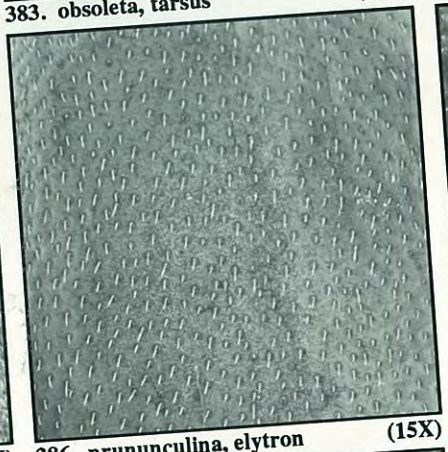
382. micans, tarsus (38X)

383. obsoleta, tarsus (38X)

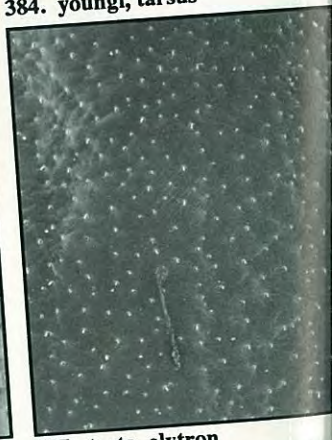
384. youngi, tarsus



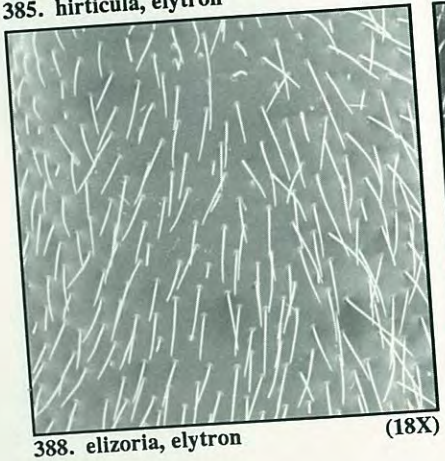
385. hirticula, elytron (15X)



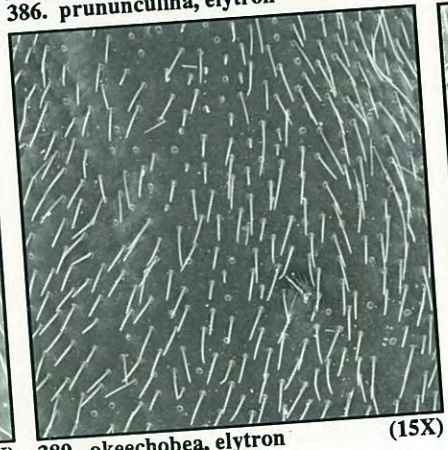
386. prununculina, elytron (15X)



387. tecta, elytron



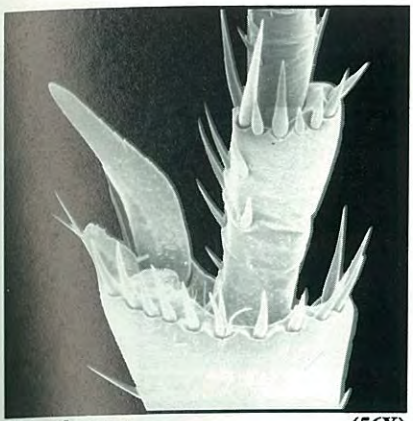
388. elizoria, elytron (18X)



389. okeechobea, elytron (15X)

390. skelleyi, elytron

PLATE 34: FIG. 391-402. **PHYLLOPHAGA** MALE POSTERIOR TIBIAL APICES & SPURS



391. clemens (56X)

392. debilis (33X)

393. dispar (33X)

394. ephilida (33X)

395. futilis (24X)

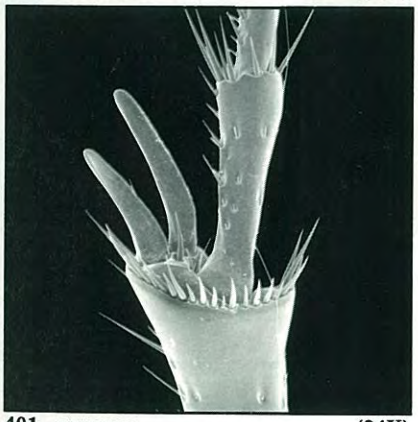
396. glaberrima (24X)

397. infidelis (17X)

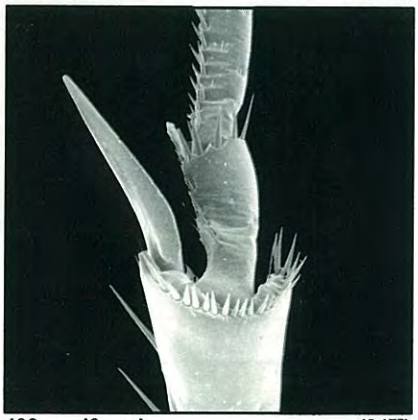
398. luctuosa (17X)

399. micans (24X)

400. prununculina (19X)

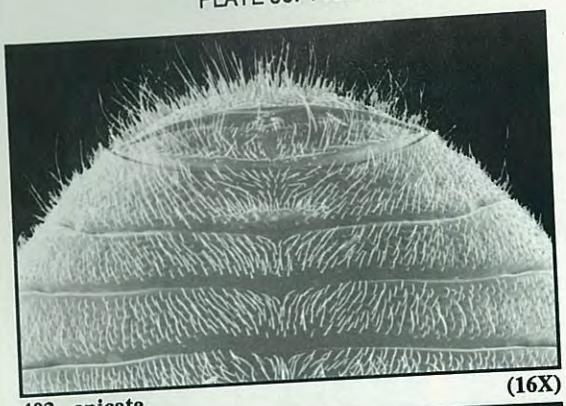


401. quercus (24X)

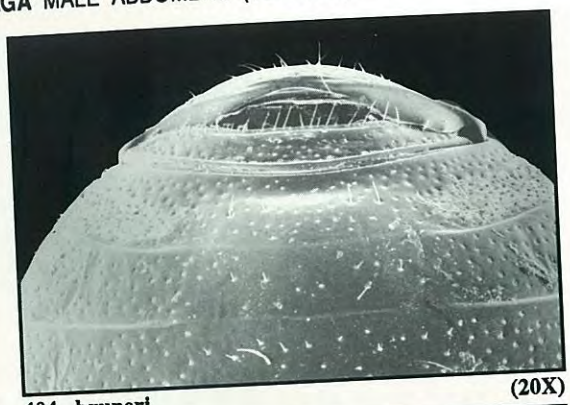


402. uniformis (24X)

PLATE 35: FIG. 403-410. **PHYLLOPHAGA** MALE ABDOMENS (VENTRAL)



403. apicata (16X)



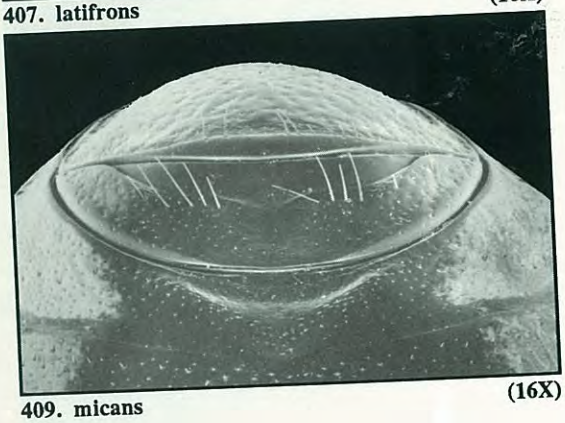
404. bruneri (20X)

405. futilis (16X)

406. georgiana (16X)

407. latifrons (16X)

408. luctuosa (16X)



409. micans (16X)

410. obsoleta (16X)

Table 1. Alphabetical checklist of figures and maps.

	Male Genitalia				Female Genitalia		Text	Map	
	caudal	ventral	dorsal	lateral	ventral	lateral	Figures	FL	US
aemula	1	61	121	181	263	266		464	465
anxia (so.)	2	62	122	182	264	267		466	467
anxia (no.)	3	63	123	183					467
apicata	4, 5	64, 65	124, 125	184, 185	265	268	403, 468, 470-1	474	475
bruneri	6	66	126	186	269	272	404, 426-7, 457-61, 476-7	478	479
clemens	7	67	127	187	270	273	391	480	481
clypeata	8	68	128	188	271	274		482	483
crenulata	9	69	129	189	275	278		484	485
cupuliformis	10	70	130	190	276	279		486	487
debilis	11	71	131	191	277	280	392, 418	488	489
diffinis	12	72	132	192	281	284	453	490	491
dispar	13	73	133	193	282	285	379, 393	492	493
drakii	14	74	134	194, 243	283	286			
elizoria	15	75	135	195	287	290	388, 419-20, 462-3, 495, 584, 586, 588	496	497
elongata	16	76	136	196	288	291	498	500	501
ephilida	17	77	137	197	289	292	394,455	502	503
floridana	18	78	138	198, 244	293	296		504	505
forbesi	19	79	139	199	294	297		506	507
forsteri	20	80	140	200, 245	295	298	452	508	509
foxii	21	81	141	201, 246	299	302	432, 510-516	517	518
fraterna	22	82	142	202, 247	300	303			
futilis	23	83	143	203	301	304	395, 405	519	520
georgiana	24	84	144	204	305	308	380, 406	521	522
glaberrima	25	85	145	205	306	309	396, 422	523	524
gracilis	26	86	146	206	307	310		525	526
hirticula	27	87	147	207, 248	311	314	385	527	528
hornii	28	88	148	208, 249	312	315	419, 529	530	531
ilicis	29	89	149	209, 250	313	316		532	533
implicita	30	90	150	210, 251	317	320		534	535
infidelis	31	91	151	211, 252	318	321	397	536	537
knochii	32	92	152	212, 253	319	322	538	539	540
latifrons	33	93	153	213	323	326	407,423,430,433-8,541-2	543	544
lota	34	94	154	214	324	327	381	545	546
luctuosa	35	95	155	215, 254	325	328	398, 408	547	548
mariana	36	96	156	216	329	332		549	550
micans	37	97	157	217	330	333	382, 399, 409		

Table 1. Alphabetical checklist of figures and maps (cont.).

	Male Genitalia				Female Genitalia		Text Figures	Map	
	caudal	ventral	dorsal	lateral	ventral	lateral		FL	US
murrea					331	334	551		
obsoleta	38	98	158	218	335	338	383, 410	552	553
okeechobea	39	99	159	219	336	339	389, 494, 588	554	555
ovalis	40	100	160	220, 255	337	340	416	556	557
panorpa	41	101	161	221	341	344	413, 414, 499	558	559
parvidens	42	102	162	222	342	345	439-441	560	561
perlonga	43	103	163	223, 256	343	346		562	563
postrema	44	104	164	224, 257	347	350	451	564	565
profunda	45	105	165	225, 258	348	351	411, 566	567	568
prununculina	46	106	166	226	349	352	386, 400, 446-450	569	570
pseudofloridana	47	107	167	227, 259	353	356	571, 572, 573	574	575
puberula	48	108	168	228	354	357		576	577
quercus	49	109	169	229	355	358	401, 428-429, 431, 578	579	580
schaefferi	50	110	170	230, 260	359	362		581	582
skelleyi	51	111	171	231	360	363	390,424-5,583,585,587-8	589	590
subpruinosa	52	112	172	232	361	364		591	592
taxodii	53	113	173	233	365	368		593	594
tecta	54	114	174	234, 261	366	369	387	595	596
tristis	55	115	175	235	367	370	421, 454, 469, 472-3	597	598
ulkei	56	116	176	236, 262	371	374	417, 442-445	599	600
uniformis	57	117	177	237	372	375	402, 415, 601, 602	603	604
yemasseei	58	118	178	238	373	376		605	606
youngi	59, 60	119, 120	179, 180	239, 240	377	378	384, 456, 607	608	609

The figures for the plates were produced with a camera attachment on the scanning electron microscope. The male genitalia are all shown in 4 views, and the asymmetrical ones in 5 views (right and left lateral). The female genitalia are all symmetrical and are shown in 2 views (ventral and right lateral). Genitalia of *drakii*, *fraterna*, and *micans* are illustrated for comparison, although not recorded from Florida. Label data for the illustrated specimens are provided in Appendix 39.

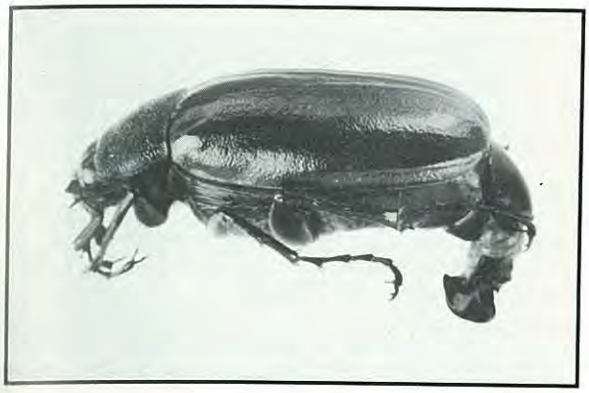


Figure 411. *Phyllophaga profunda*: lateral view of male with genitalia extracted. Specimens are often pinned in this fashion, or with the genitalia mounted on card points.

INTRODUCTION

Probably no other genus of North American insects is so universally recognized as are the "May or June Bugs". Folk songs and nursery rhymes have used them as a theme, and children play with them. It is not surprising, since adult beetles often swarm by the hundreds to almost any artificial light during the warm humid evenings of May and June, throughout most of the United States. The C-shaped "grub worms" (fig. 457) dug from the soil, and used for fish bait, are the destructive larval form. Few laymen realize that the larvae often spend 2 to 4 years beneath the soil, feeding on roots of various plants, especially the sod used for our lawns and golf courses.

They also do not realize that there is not one "June Bug", but there are more than 200 species in the United States, and 54 species are recorded here from Florida. Basically, *Phyllophaga* are all quite similar in general appearance (fig. 411), although they are variable in size (7.8mm to 25.2mm long) and color (yellowish to blackish).

In Europe the "Maikafer" (May beetle) belongs to the related genus *Melolontha* which has similar habits and much folklore associated with it; partly because it appears as huge broods, in different years. The name *Phyllophaga* comes from the Greek *Phyll* = leaf, and *phaga* = to eat, in reference to their serious defoliation of various hardwood trees in the east and midwest.

Because of their general similarity and great abundance, they are neglected by many collectors and are thought to be difficult to identify by many professional entomologists. However, large, well-developed male and female genitalia offer exceptionally reliable characters for separation of the species (see plates 1-32). The genus provides an excellent opportunity to study the diversity of forms inhabiting even a small area, to learn principles of zoogeography, speciation, mating behavior, etc.

fig. 412. *Phyllophaga hornii*: male genitalia gold plated and mounted on aluminum stub for study and photography with the scanning electron microscope (stub is 0.5 inches across).

Format of Presentation

The general format is that used for Part I of the "Scarab Beetles of Florida" (Woodruff, 1973). Some modifications were made, since this volume deals with a single genus. Greater reliability has been placed on genitalia illustrations rather than traditional keys, although keys are provided for both adults and larvae. The genitalia figures are placed at the beginning because of their importance and to enable their numbering before completion of the text.

This volume was produced on computer and submitted as "camera-ready" copy to the printer, permitting closer editorial control and the ability to make last minute corrections and additions. It also eliminated the possibilities of type-setting errors at the printer and extensive galley proofing.

Because of the shared responsibilities of the co-authors, and to avoid confusion and passive voice, the pronoun we is used in most of the text. There are a few situations (e.g., examination of type specimens in other museums) when only the senior author was

fig. 413. *Phyllophaga panorpa*: male genitalia, caudal view; original polaroid print before background painting. (13mm = 0.5mm).

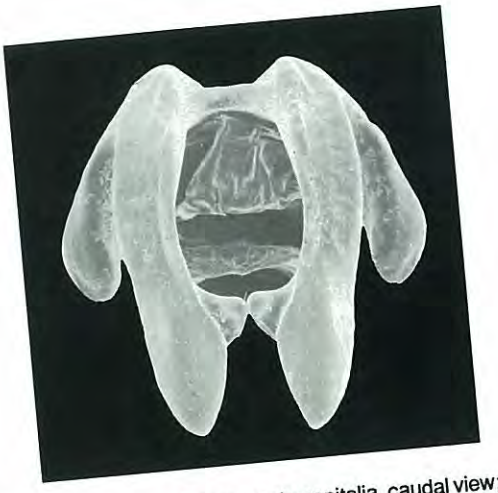


fig. 414. *Phyllophaga panorpa*: male genitalia, caudal view; after retouching, background painting, and cropping for plates (13mm = 0.5mm).

involved; in these cases the pronoun **I** was used. The specimen data were produced first and formatted into the Appendices, as background for the text discussions. The Bibliography was completed next, and the pertinent references were cited by species in the Selected References. The individual species treatments were written by section (i.e., synonymy, type locality, diagnosis, etc.). These sections were later merged by computer under each species. The Distribution Maps were then completed and text figures added. The Introduction and Index were written last.

Keys: The keys to both larvae and adults are artificial in the sense that they involve morphological structures easily seen or differentiated, without regard to phylogenetic or functional significance. They are adaptations of existing keys, modified for the Florida fauna, with additions and deletions as required.

Although the adult beetles have some excellent external characters, many species cannot be identified with ease or certainty without reference to the genitalia. The key to adults should be used with this in mind. The key to known larvae also must be used with caution for several reasons: 1) more than half the larvae of Florida species are unknown; 2) most characters are based on few rearings, and variation has not been studied; and 3) some species (e.g., *aemula*) are known from only the first instar, although most are based on third instars; characters may differ beween the instars.

Illustrations: Most of the half-tone figures were made on the scanning electron microscope (details under Methods & Materials). Line drawings are both original and copies from existing literature (particularly larval characters). The sources for the latter are always indicated. Photographs of mating behavior were taken at night in the field by Jeff Lotz and R. E. Woodruff.

Species Accounts: Each Florida species (except those treated in Questionable and Potential Records) was treated in the following format:

1) **Synonymy**: All previous name combinations are listed in chronological order, each entry followed by the author, date, and page (complete citations are found in the Bibliography). A comma between the name and the author indicates that he was responsible for the name combination, but was not the author of the species.

2) **Type locality**: When it was possible to determine exact localities, they are listed in quotes as in the original description. In some cases, no specific locality was given (e.g., *anxia*), and the presumed locality is listed.

3) **Diagnosis**: Efforts were made to make this section a concise aid for identification. Because of the reliance on genitalic characters, the best method to compare species is reference to the genitalia figures. We have attempted to indicate species that are superficially (externally) similar or which appear to be closely related by genitalic characters. These similar species are listed, and reference is made to the pertinent figures. Occasionally supplemental morphological characters are added.

4) **Description**: The 2 new species (*pseudoflor*[illegible] *dana* and *skelleyi*) are extensively described in the tr[illegible] ditional way. However, long, wordy descriptions

over 50 similar species would rarely be helpful and would occupy an inordinate amount of space. We believe this is a special group in which the saying, "a picture [of the genitalia] is worth a thousand words", aptly applies. We have discussed the following characters for each species: **Length** was measured from the tip of clypeus to the tip of elytra (not abdomen, which may move, especially after dissection). These numbers represent the minimum and maximum length in our series of specimens to the tenth of a millimeter. **Width** was measured at the maximum point (variable because some specimens have elytra slightly separated at the suture and therefore appear wider). These numbers represent the minimum and maximum in our series of specimens. Numbers in parentheses, followed by an author's name, are extensions (either direction) of our measurements and the reference for them. **Shape**: The general form is described as oblong, oval, parallel, widest behind, convex, or subdepressed. **Color**: The species of *Phyllophaga* vary from pale yellow through various shades of brown to nearly black. Unfortunately no standards have been established for these colors, and they are difficult to express precisely. The older, latinized terminology, used by LeConte, Horn, et al., has been followed by most workers. Even though we don't believe the terms convey the shades of color effectively, we have no better system at present. However, many species are distinctively colored and often can be rough sorted from mixed collections by color alone. **Vestiture**: The surface coating is either pubescent (hairy), pruinose (velvety), or glabrous (smooth). Occasionally a species (e.g., *aemula*) has the surface pruinose and pubescent. The hairs (setae) of pubescent species may be recumbent or erect, short or long, dense or scattered, and may differ on head, pronotum, elytra, and abdomen. Glabrous species are shiny or dull. **Antenna**: The most obvious character is the number of segments (from 9 to 10), and the sexual dimorphism in length of the club (larger in males). The length of the male club is given in relation to the previous segments of the scape (stem). **Clypeus**: The front margin is either entire (not indented at middle) to emarginate (with median indentation deep, shallow, or moderate). The margin is reflexed or not, the edge raised prominently, moderately, or slightly. **Tarsal claws**: The claws are curved slightly or strongly. They are cleft in the subgenus *Phytalus* (*georgiana* & *obsoleta*), but toothed in nearly all others. The tooth position is most frequently median, but may be basal, nearer the base (subbasal), or nearer the tip (antemedian). The tooth shape may be acute, blunt, and prominent or reduced. It appears to be absent in males of *panorpa*. **Male posterior tibial spurs**: Normally there are 2 enlarged terminal spurs, the lower (outer) one may be fixed (unarticulated) (fig. 391, 392, 394, 400, 402) or movable (fig. 393, 401) (articulated), but the upper (inner) spur always is movable, normally longer. The lower spur occasionally is modified into a twisted shape (fig. 395) or reduced to aborted (fig. 396, 500, 402). The shape of each spur is described as are their relative lengths to each other and to the first tarsal segment. **Genitalia**: Because there is no standard terminology and there are several basic genitalia types, no lengthy descriptions are attempted. However, figure references for the various views are cited, and these should provide positive means for identification of both males and females.

5) **Taxonomic Notes**: Any information was included here on synonymy, type specimens, questions about validity, variability, etc.

6) **Distribution**: We provide maps, and reference to them, for both Florida and the U.S. We have divided them so that discussions on records are clearer. Florida records are based on specimens examined only, unless a specific questionable literature record is discussed. All specimen data are either listed under SPECIMENS EXAMINED (10 or less records) or in the Appendices (10 or more records). The U. S. distribution was basically plotted from the literature, but trying to locate specific records in order to place dots accurately. Questionable or unusual records are shown on the map by a question mark.

7) **Biology & Ecology**: General remarks are given first on such things as seasonal activity, abundance, and other notes. These are followed by 2 subdivisions: a) **Adult Host Plants**: These are primarily literature records, normally with Luginbill & Painter's (1953) list by family first. It is then followed by other host records, usually by state, with author and date citation. Few adult hosts were recorded in our study, partly because of the apparent non-specificity of most species and the ease by which they may be collected at light; b) **Immatures**: The known larvae are described from the literature. Little time or effort was spent on rearing, so there is little original data here. However, the pertinent literature is cited to aid the reader in obtaining information.

8) **Specimens Examined**: For those species with less than 10 records, the data are listed here; the others are only summarized, with the total number and reference to the full data in the appropriate Appendix.

9) **Selected References**: Except for catalogues or checklists, we have attempted to cite all references to

Table 2.
Chronological List of Florida *Phyllophaga* Descriptions
(only valid species are listed)

1781. **tristis** Fabricius
1792. **crenulata** Froelich
1801. **quercus** Knoch
1801. **ilicis** Knoch
1801. **hirticula** Knoch
1817. **knochii** Shoenherr & Gyllenhal
1825. **ephilida** Say
1850. **anxia** LeConte
1850. **futilis** LeConte
1850. **profunda** Blanchard
1850. **uniformis** Blanchard
1850. **glaberrima** Blanchard
1850. **diffinis** Blanchard
1850. **obsoleta** Blanchard
1855. **forsteri** Burmeister
1855. **prununculina** Burmeister
1855. **gracilis** Burmeister
1855. **dispar** Burmeister
1856. **latifrons** LeConte
1856. **puberula** DuVal
1856. **parvidens** LeConte
1856. **debilis** LeConte
1884. **subpruinosa** Casey
1885. **georgiana** Horn
1887. **clypeata** Horn
1887. **clemens** Horn
1887. **postrema** Horn
1887. **infidelis** Horn
1887. **luctuosa** Horn
1887. **implicita** Horn
1887. **aemula** Horn
1889. **ulkei** Smith
1889. **hornii** Smith
1896. **elongata** Linell
1916. **forbesi** Glasgow
1920. **perlonga** Davis
1920. **foxii** Davis
1924. **taxodii** Langston
1924. **cupuliformis** Langston
1928. **lota** Luginbill
1929. **mariana** Fall
1932. **bruneri** Chapin
1935. **youngi** Cartwright
1937. **elizoria** Saylor
1937. **schaefferi** Saylor
1938. **floridana** Robinson
1939. **apicata** Reinhard
1939. **ovalis** Cartwright
1944. **tecta** Cartwright
1944. **yemasseei** Cartwright
1948. **okeechobea** Robinson
1950. **panorpa** Sanderson
1989. **pseudofloridana** Woodruff & Beck
1989. **skelleyi** Woodruff & Beck

each species by author and pages (with figures, tables, plates, and maps). Full citations appear in the terminal bibliography. We undoubtedly have missed some references, but we believe the section is relatively complete.

Historical Resumé

The first list of Florida *Phyllophaga* was that included in the "Coleoptera of Florida" (Schwarz, **1878**). Six described species (*latifrons, cerasina, glaberrima, micans, fraterna*, and *tristis*), and 4 undescribed species were recorded under the generic name *Lachnosterna*. Dozier (**1918**) listed 5 described species (*prununculina, glaberrima, parvidens, latifrons* and *micans*) and 1 undescribed species "near *nova*" from Gainesville.

The first extensive list (29 species) was produced by Blatchley (**1929**) in his "Scarabaeidae of Florida". Young and Thames (**1949**) reported 41 species in their "Preliminary list of the *Phyllophaga* of Florida". The monograph on the "May Beetles of the United States and Canada" (Luginbill & Painter, **1953**) contained records of 40 Florida species. In Part I of the "Scarab Beetles of Florida", Woodruff (**1973**) listed 40 described and 2 undescribed species of *Phyllophaga*.

In the present study we recorded 54 species

including 2 new species, 9 new State records, and 2 species placed in synonymy; 16 additional species are listed as questionable or potential.

Methods and Materials

Over 100,000 specimens of the genus *Phyllophaga* were examined for this study. Because the genitalia are the most reliable taxonomic characters, these were normally dissected. Since many species are extremely common, voucher specimens of these often were preserved in alcohol (70% isopropyl) rather than conventional pinning.

Genitalia: Dissection of genitalia from these large beetles is an easy operation. The last ventral segment and the pygidium are pried apart so that the genital opening is accessible. Generally forceps are an adequate tool to extract the genitalia on fresh specimens. However, an insect pin or dissecting needle is handier for females and alcohol preserved specimens. Dried specimens must be relaxed in a humidity chamber, in an ultrasonic machine, or in boiling water, prior to dissection.

On specimens to be retained in alcohol, the genitalia were exposed sufficiently for identification, but were left attached to the internal membranes. For pinned specimens, the genitalia may be handled the same way, but they often are mounted on traditional triangular card points or preserved in microvials with glycerine. Some minor cleaning of the male claspers and the female pubic process may be required to see all the features, but clearing with potassium hydroxide is not required.

The male internal sac or aedeagus usually is hidden within the basal piece and often requires everting in order to study it. In some species (e.g., *apicata, bruneri, tristis, youngi*), the sac is always somewhat everted and normally visible without further dissection (fig. 4, 59, 64, 119, 124, 179, 184, 239). Presently most taxonomic characters are found on the parameres, but limited study suggests that excellent characters may be found on the aedeagus. These may be useful in clarifying some of the similar species, such as the *fraterna* complex.

During our early studies we made microscope slide preparations of these, but their 3-dimensional shape was lost, and relative positions of characters was obscured. In order to study them "in the round" techniques were developed (by P. E. Skelley) to keep the soft parts rigid. The sacs were everted either by dissection with jeweler's forceps and hook-tipped minutens (for previously dry specimens that had been relaxed in detergent water), or by squeezing the surrounding muscles to inflate the aedeagus by osmotic pressure (for freshly killed specimens). The inflation, especially on the relaxed specimens, could be increased by injection of 70% isopropyl alcohol through a hypodermic syringe.

Once inflated, they were dehydrated through several changes of ethanol (80-90-100-100%). Dehydration required at least 10 changes for fresh specimens (from 10-100%). They then were dried in a critical point drier (Tousimis, Samdri 780A*), so that all parts remained rigid and in place. They were mounted finally on card points which were glued to a stub for eventual study and photography under the scanning electron microscope. Our studies are very preliminary for the aedeagus, and we only illustrate a few to show how significant they may be and to encourage their future study (fig. 433-450, 583, 601, 602).

Illustrations: The genitalia are at a size range and complexity that conventional photography is difficult (particularly depth of field). No single view of the male genitalia is adequate to clarify characters in most species, and line drawings of several views each (about 380 required) were planned. However, the use of a scanning electron microscope enabled us to prepare much better and more detailed illustrations.

Specimens (genitalia) were cleaned in an ultrasonic cleaner, glued to an aluminum stub, and coated with 24 karat gold (fig. 412) (approximately 150 angstroms thick) in an Eiko Engineering IB-2 Sputter Coater*. They were placed then in the chamber of the scanning electron [SEM] microscope (Hitachi S-450*) with a camera attachment. Most study was done at 20 kilovolts, permitting a minimum magnification of 16 times. After specimens were oriented, they were photographed on Polaroid (55 Professional, positive/negative*) 4x5in. instant sheet film. Negatives were developed and stored with the positive print for later darkroom work. Scale lines (in microns) were produced automatically by the microscope and appeared on the photographs. Over 1000 photographs were taken, in order to obtain the final 548.

All final prints for the plates (1-35) were made from the polaroid negatives, enlarged or reduced for uniform size, and improved for reproduction, with standard techniques in the darkroom (for which we are

*Mention of a proprietary name does not necessarily imply endorsement of the product or company by the State of Florida.

greatly indebted to Jeff Lotz). They then were cropped to a uniform 2 1/4in. square for composition into the plates.

Because the backgrounds of the SEM photographs were not uniform, obscuring certain features, we developed a technique for painting them black (see before and after, fig.413,414). The finished product is therefore a combination of photography and artwork. Painting was done on the photograph surface with fine camel's hair brushes (0000 to 2), using the opaque black water soluble paint (No. GY9) of a Gamma Retouch Set (25/8, M. Grumbacher, Inc*.). Dirt and damaged areas also were retouched with the other 7 shades of white and gray in this set. Over 200 hours of painting time were required.

The finished illustrations were mounted on heavy stock in the format of the plates, using strips of double-faced carpet tape (Super Stick, Superior, Union, Mo*.). Legends for the plates, scale lines, and the squares for the illustrations were generated on a computer with Aldus Pagemaker*. The scale lines were measured to the nearest millimeter on the polaroid print and then drawn to that length on the computer. The sheets with figure legend, scale lines, and outlines of the squares were used as an overlay negative by the printer to crop the photographs uniformly, when combined with the half-tone negatives. Windows, the size of the finished half-tone areas, were made of ruby lith to match the computer generated squares. Plates 1 to 34 were finally reduced by 6%, but Plate 35 was reproduced at original size.

Halftone negatives of 150 line screen, using the Duo-tone process, were prepared by Storter Printing Co., Gainesville; printing was done by Paramount-Miller Graphics, Jacksonville, Florida.

fig. 415. *Phyllophaga uniformis*: adult beetles feeding on elm foliage at night.

Collecting Techniques

Perhaps this section might appear superfluous, since even children can easily collect "June Bugs" around the lights at night. Probably all the Florida species are attracted to lights, if they are within a reasonable distance of their habitat. More than 95% of our specimens were collected with blacklight (ultra-violet) light traps of various design (see U. S. Department of Agriculture, 1961).

However, many of the rare species either have restricted habitats, or we know too little about them. Some (e.g., *taxodii* on cypress) are so host specific that special effort must be made to operate traps near the host. In other cases (e.g., *skelleyi* in turkey oak scrub) the general habitat must be located to collect specimens.

Because they feed and mate at night (with the possible exception of *okeechobea*), they are collected easily from their hosts, with the aid of a headlight (flashlights require a hand, and both are needed to hold the container and to collect specimens). Beetles usually are so intent on feeding or mating that they are not disturbed easily, and they may be picked like grapes. Often more diversity and specimens may be collected from foliage (in a comparable time period) than a light trap in the same area. Usually we try to use both techniques.

Specimens may be collected in killing jars with cyanide, ethyl acetate, or lighter fluid, or they may be preserved in alcohol (70% isopropyl preferred). Because they are large and exude body fluids on dead the latter technique is better, providing adequate protection until genitalia can be dissected and specimens can be mounted.

GENERAL ACCOUNT OF THE GENUS *PHYLLOPHAGA*

This is one of the largest genera of animals in United States, where over 200 species occur. An

number may be found in Mexico and Central America. Because there are so many species, generalities are difficult to make. They occupy many ecological niches, and every major habitat (except aquatic) seems to have been invaded. Since they are often economic pests in both adult and larval stages, it is imperative to know which of the many species is involved, so that control strategies can be planned effectively.

Taxonomy: The United States fauna is fairly well-known, partly due to the work of M. W. Sanderson (1937-1958, and unpublished) and the faunal study by P. Luginbill and R. H. Painter (1953). This is not the case in other areas (e.g., Mexico and the West Indies) where up to 50% of the species may be undescribed. The Florida fauna was well-known previously, and the 2 new species described herein are the first in nearly 40 years.

However, the U. S. fauna was not always on such a firm foundation. Historically, our species were placed in numerous genera from 1781 until 1916 and named by 25 authors. They are shown in chronological order in Table 2. The name of the genus is firmly established now, but past confusion about its validity contributed to some homonomy and disagreement among various workers. Glasgow (1916) provided a detailed review of the confusion and was instrumental in stablizing the name.

Briefly, the problems revolved around Harris' (1827) original description of *Phyllophaga* in a footnote, which contained several valid species, but was not accompanied by a description. The International Rules of Nomenclature clearly recognize this as an "indication", and the name should be recognized for these insects. The type species, *hirticula* Knoch, was chosen by Glasgow (1916).

The date of Harris' description has been listed often as 1826 (e.g., Glasgow, 1916; Saylor, 1942). In a later edition of the same book (Harris, 1863:30) he again used a footnote to cite the original description as follows: "A genus proposed by me in 1826. It signifies leaf-eater. Dejean subsequently called this genus *Ancylonycha*." However, in 1869 Scudder published the "Entomological correspondence of Thaddeus William Harris, M. D." and included a complete list of his publications, giving the date of the relevant paper as 1827. The reference was published in the Massachusetts Agricultural Journal (Repository), Volume 10, No. 1, on which the date July, 1827 appears. Harris may have referred to his 1826 date, on the basis of letters (see Scudder, 1869:17) in that year or when he submitted the manuscript, but the actual date of publication should be 1827. However, that date is of no apparent consequence in the synonymy.

Several prominent early workers (e.g., LeConte, 1856; Horn, 1887; Smith, 1889) believed that *Phyllophaga* was not valid, because it was not accompanied by a description. They used the generic name *Lachnosterna* Hope (1837), rejecting both *Ancylonycha* Dejean (1833) and *Phyllophaga* on the same grounds. In addition to *Lachnosterna*, LeConte (1856) also recognized 3 new genera (*Eugastra, Endrosa*, and *Gynnis*) and the *Listrochelus* of Blanchard (1850) within what we now call *Phyllophaga*.

When Horn (1887b) published his monograph of *Lachnosterna*, he suppressed LeConte's genera, as well as *Trichestes* and *Tostegoptera* Blanchard (1850). Saylor (1942) treated the genera related to *Phyllophaga*, establishing the following as subgenera: *Phytalus* Erichson (1847), *Listrochelus* Blanchard (1850), *Chlaenobia* Blanchard (1850), *Tostegoptera* Blanchard (1850), *Eugastra* LeConte (1856), *Chirodines* Bates (1888). He also created 3 new genera: *Triodonyx, Clemora*, and *Cnemarachis*. Saylor later (1937) raised *Chlaenobia* to generic status, at the same time uniting the Old World *Brahmina* Blanchard (1850) and *Holotrichia* Hope (1837) with *Phyllophaga*.

Sanderson (in several papers and pers. com.) preferred to treat most of the "genera" as subgenera, breaking them down into "species groups". This avoids creation of homonomy and keeps the near relatives together. There appear to be no sets of exclusive characters which will suffice to segregate the *Phyllophaga* relatives into clear cut genera (even from different continents). Luginbill and Painter (1953) avoided the problem in their treatment of the U. S. species by not mentioning subgenera, eliminating the species of the subgenera *Listrochelus* and *Phytalus*, but including those in the subgenera *Tostegoptera* and *Eugastra* (without reference to these names).

Moron (1986), treating the Mexican species, recognized the subgenera *Phyllophaga, Phytalus, Listrochelus, Chlaenobia, Tostegoptera, Eugastra*, and *Triodonyx*, as well as species groups and "complejos" within the groups. The arrangements of Horn (1887b), Boving (1942), Sanderson (mss.), and Moron (1968) are summarized for the Florida species in Table 3.

The most important breakthrough in the taxonomy of this genus came with the discovery that the genitalia of both sexes offered excellent characters to distinguish otherwise very similar species. These were first used by Smith (1889b), when he illustrated the genitalia as a supplement to Horn's (1887b) monograph. Prior to that, some of the leading workers had such difficulties in distinguishing species that they

Table 3.
Arrangement of Florida *Phyllophaga* according to groupings by various authors.

	Horn (1887)	Boving (1942)	Sanderson (ms.)	Moron (1986)
aemula (Horn)	XII	1	crenulata	
anxia LeConte	IX	16	rugosa	anodentata
apicata Reinhard	(XVI)	(4)	setidorsis	
bruneri Chapin			Cnemarachis (subgenus)	
clemens (Horn)	V		crassissima	
clypeata (Horn)	XV		quercus	
crenulata (Froelich)	XII	1	crenulata	
cupuliformis Langston	(IX)	14	crassissima	
debilis (LeConte)	VI	9	crassissima	
diffinis (Blanchard)	IX		rugosa	
dispar (Burmeister)	XV	12	quercus	
elizoria Saylor	(XII)		crenulata	
elongata (Linell)			elongata	
ephilida (Say)	IV	11	crassissima	ephilida
floridana Robinson	(IX)		rugosa	
forbesi Glasgow		11	crassissima	
forsteri (Burmeister)	IX	21a	rugosa	
foxii Davis	(IX)	(21b)	rugosa	
futilis (LeConte)	VII	10	crassissima	
georgiana Horn	Phytalus		georgiana	
glaberrima (Blanchard)	IV	11	crassissima	ephilida
gracilis (Burmeister)	VII	13	crassissima	
hirticula (Knoch)	XI	21	rugosa	
hornii (Smith)	IX	21	rugosa	
ilicis (Knoch)	XI	21	rugosa	
implicita (Horn)	X	17	implicita	
infidelis (Horn)	IX		rugosa	
knochii (Schoenherr & Gyllenhal)	IX	21	rugosa	
latifrons (LeConte)	IV	12	crassissima	
lota Luginbill	V		crassissima	
luctuosa (Horn)	IX	19	rugosa	
mariana Fall	(XII)		crenulata	
obsoleta (Blanchard)			obsoleta	Phytalus (subg.)
okeechobea Robinson	(XII)		crenulata	
ovalis Cartwright			rugosa	
panorpa Sanderson			elongata	
parvidens (LeConte)	XII	1	crenulata	
perlonga Davis	IX		rugosa	
postrema (Horn)	VII		rugosa	
profunda (Blanchard)	IX	21	rugosa	
prununculina (Burmeister)	IV	11	crassissima	
pseudofloridanas n. sp.	(IX)		crenulata	
puberula (DuVal)			Cnemarachis (subgenus)	
quercus (Knoch)	XV	2	quercus	
schaefferi Saylor			rugosa	
skelleyi n. sp.	(XII)		crenulata	
subpruinosa (Casey)	IX	(14)	crassissima	
taxodii Langston	VI		crassissima	
tecta Cartwright	(IX)		rugosa	
tristis (Fabricius)	XVI	4	setitdorsis	anodentata
ulkei (Smith)	IX		rugosa	
uniformis (Blanchard)			crassissima	
yemasseei Cartwright			(Phytalus)	
youngi Cartwright			Cnemarachis (subgenus)	

( ) = placed in Horn's group by subsequent authors.

described the opposite sexes as different species, placed the same species in 2 genera under different specific names, and generally added to the problem of correctly identifying the many species. Horn (1887b) stated that "*Lachnosterna* is certainly one of the most difficult genera in our fauna ...," and Riley (1891) published a paper entitled "On the difficulty of dealing with *Lachnosterna*."

When Glasgow revived the name *Phyllophaga* in 1916, he also was able to establish the synonymy of many species by reference to genitalia of most type specimens available at that time. This provided the nomenclatural stability which has greatly aided later workers, but unfortunately Glasgow never published his proposed monograph, nor illustrations of the genitalia as he planned.

Generic Synonymy

Phyllophaga Harris

Phyllophaga Harris, **1827**:7 (footnote); type: *Melolontha hirticula* Knoch, designated by Glasgow (1916).

Ancylonycha Dejean, **1833**:160 (in part); type: *Melolontha serrata* Fabricius, designated by Duponchel (1849).

Lachnosterna Hope, **1837**:99; type: *Melolontha fervida* Fabricius, by original designation.

Trichesthes Erichson, **1847**:658; type: *Melolontha pilosicollis* Knoch, by monotypy (=*tristis*).

Trichestes Blanchard, **1850**:141; type: *Melolontha pilosicollis* Knoch (=*tristis*). Saylor (1942:162) cited this as an "unnecessary emendation of *Trichesthes* Erichson", but Riley (1988:26) called it a "a justified emendation."

Endrosa LeConte, **1856**:234; type: *Melolontha quercus* Knoch, by subsequent designation of Saylor (1942).

Gynnis LeConte, **1856**:262; type: *Gynnis debilis* LeConte, by monotypy.

Subgenera

Phytalus Erichson, **1847**:658; type: *Melolontha pubereus* Mannerheim, designated by Saylor (1942).

Chlaenobia Blanchard, **1850**:116; type: *Chlaenobia ciliatipes* Blanchard, by monotypy.

Listrochelus Blanchard, **1850**:141; type: *Listrochelus laportei* Blanchard, by monotypy.

Tostegoptera Blanchard, **1850**:149; type: *Melolontha lanceolata* Say, by monotypy.

Eugastra LeConte, **1856**:233; type: *Tostegoptera cribrosa* LeConte, designated by Saylor (1942).

Chirodines Bates, **1888**:169; type: *Chirodines zunilensis* Bates, by monotypy.

Triodonyx Saylor, **1942**:158; type: *Phyllophaga gigantissima* Saylor, by original designation.

Cnemarachis Saylor, **1942**:159; type: *Lachnosterna vandinei* Smyth, by original designation. Synonyms: *Abcrana* Saylor, 1942:159, and ***Clemora*** Saylor, 1942:159-160.

Discussion: Because of the nature of the present publication (faunal rather than monographic), it is not appropriate to devote more space to the synonymy than the basics listed above. More complete and detailed accounts may be found in Saylor (1942), Sanderson (1951), and Moron (1986). The genus name *Stenothorax* Harris, 1827 (not 1826), has been listed by some authors (e.g., Moron, 1986; Riley, 1988) as a synonym of *Phyllophaga*, but I have found no justification for such treatment. The name was proposed in the same footnote as was *Phyllophaga*, both being coined for parts of the old genus *Melolontha*. However, Harris (1827:8) clearly stated that "*Stenothorax* would be a good name for the subgenus having the *subspinosa* for its type." (Riley, 1988:26 stated: "Type species not designated"). The *subspinosa*, referred to by Harris, is currently placed in the genus *Macrodactylus* and has nothing to do with *Phyllophaga*.

Morphology

The dictionary definition of morphology involves the form and structure of plants and animals. As such it encompasses just about anything we can see on an organism. Someone once said (and rightfully so) that no species has been thoroughly or completely described. The job of the taxonomist is to determine which characters are important, of the thousands possessed by a group of organisms, and then apply them to the scheme of classification and to comparative studies.

Phyllophaga species are so similar in general appearance that the normal comment of a casual observer is: "they all look alike". That is only superficial, and the taxonomist is fortunate that excellent distinguishing morphological features are found in nearly all the species. The most distinctive structures (the genitalia) happen to be hidden inside the abdomen, but they are extracted easily. Most of these have been mentioned already in the Format of Presentation and Taxonomy sections, and they are shown graphically in Table 8.

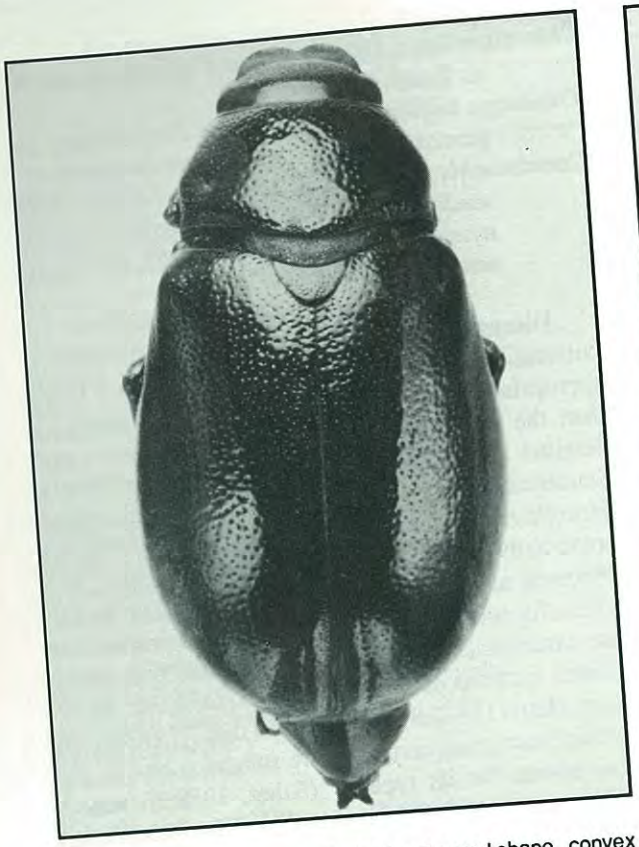


fig. 416. *Phyllophaga ovalis*: illustrating the oval shape, convex body and glabrous , shiny appearance (length = 21mm).

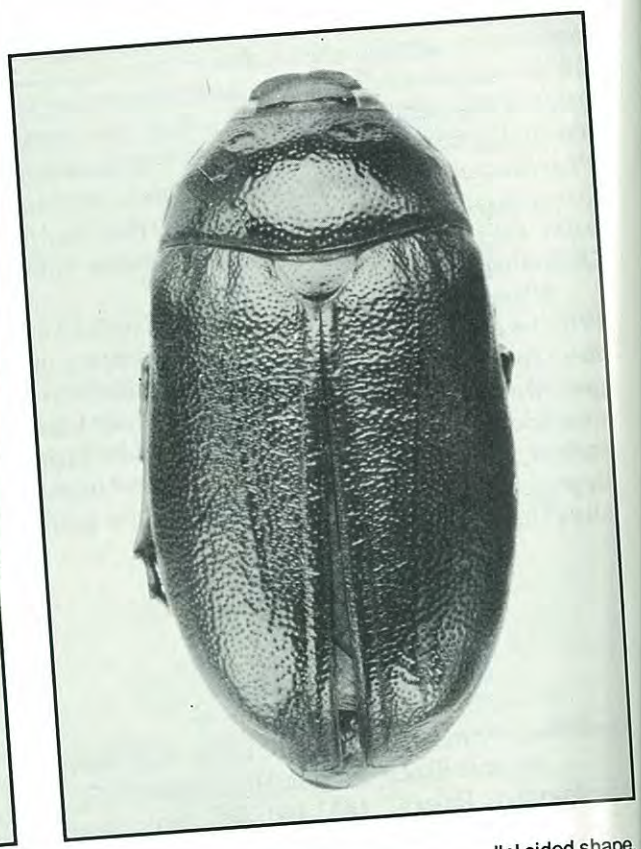


fig. 417. *Phyllophaga ulkei*: illustrating the parallel sided shape, slightly wider behind. Body less convex, glabrous, moderately shiny, surface somewhat rugose, and elytral striae more noticeable (length = 23mm).

It is virtually impossible to describe the subtle differences in external morphology and the complex genitalia. Therefore we will devote only a small amount of space to the subject, briefly clarifying some of the characters used.

The genus *Phyllophaga* belongs to the tribe Melolonthini, which contains 5 genera in Florida (see key), characterized as follows: Abdominal sternites (6) at least partially fused (generally 4 or 5); sutural lines present between sternites, even when fused. Meso- and metathoracic tibiae with 2 spurs. Tarsal claws usually equal (not in *Hypotrichia*). Antennae 9- or 10-segmented (rarely 8) (fig. 418-419), the club of 3 to 7 segments (Hardy, 1974).

The genus *Phyllophaga* is delineated by the following characteristics: Mandibles concealed from dorsal view. Last abdominal spiracles on upper, sclerotized portion of sterna. Anterior coxae transverse, flattened. Side piece of metathorax narrow. Antennal club 3-segmented in both sexes. Pygidium large, dorsal margin usually concealed by elytra when abdomen in repose. Tarsal claws cleft (fig. 380, 383) (subgenus *Phytalus*) or toothed (fig. 379, 381-2, 384) (*Phyllophaga* sens. str.). Male posterior tibial spurs both movable in some species, one fixed (lower) and one movable in others; both movable in females.

Some of the characters used in the key and descriptions require additional clarification:

Antenna: (fig. 418-419) The number of segments is occasionally difficult to count, because the segments, between the basal scape and the club, sometimes are fused and not movable. However, any suture or vestige thereof should be considered as a division when counting segments. Past descriptions have relied heavily on the length of the club in relation to the stem (=funicle), but without precise measurements. Although we have included this in the descriptions, we have trouble deciding whether the club is equal in length to the stem (often called subequal in the literature, when almost is meant).

Clypeus: (fig. 421-424) The margin may be raised (reflexed) in varying degrees, and the center may have an indentation at the middle (emargination) or without (referred to as entire). The clypeus may be variously punctate, setate, rugose, or glabrous; the suture may

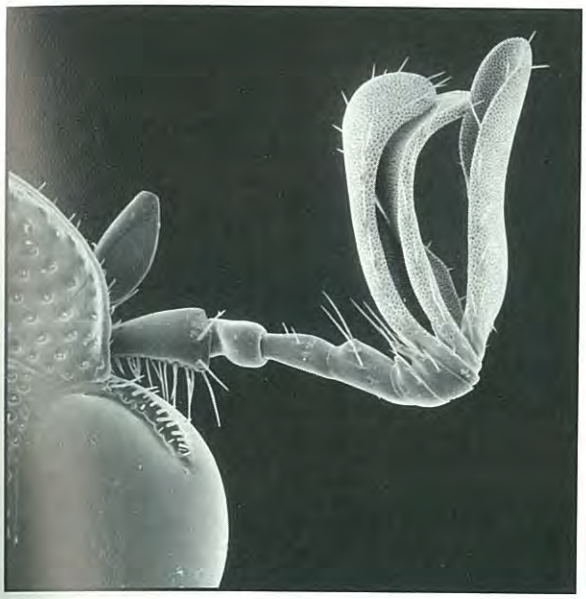


fig. 418. *Phyllophaga debilis*: right antenna, 9-segmented (magnified 35x).

fig. 419. *Phyllophaga elizoria*: right antenna, 10-segmented, club longer than the stem (magnified 25x).

segments of the female usually are convex, with no special modification of the ultimate (8th) or penultimate (7th) sternites. Males often have both of these sternites modified with depressions, carinae, and sculpture that are species specific. These were used by the early workers (before 1889) as the primary distinguishing characters. The sternites (indicating abdominal segments) are variously numbered by different authors. Luginbill and Painter (1953) used "Sternum 8" for the last, and Riley (1988) numbered the visible segments from 1 to 6 (last). This terminology is the result of the first 2 segments being hidden under the metathorax and coxal plates. Although there are some excellent specific characters on the last 2 sternites, they are difficult to describe, and genitalic characters are more reliable and easier to see.

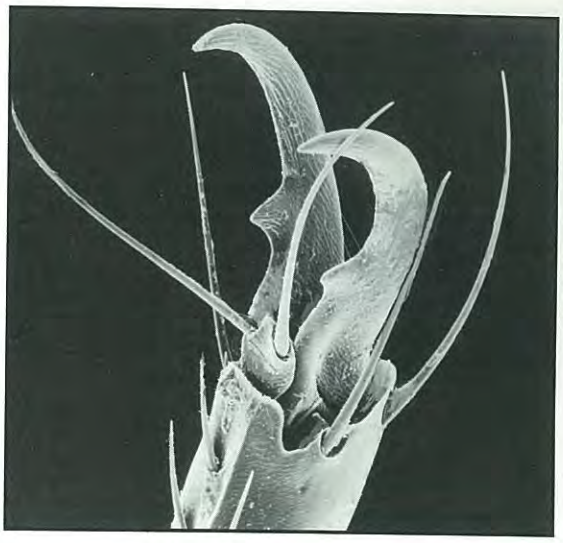


fig. 420. *Phyllophaga elizoria*: anterior tarsal claws, diagonal view (35mm = .05mm).

Elytra: (fig. 385-390) The elytra may be pubescent, glabrous, or pruinose. The pruinosity is created by microtrichia (fig. 429-431) causing a diffraction g rating. It often appears velvety and sometimes iridescent and can be abraded. The striae (or costae) are normally reduced or barely indicated, except for the sutural one (see fig. 416-417 for comparison).

Male Posterior Tibial Spurs: (fig. 391-402) Although the genus normally has 2 tibial spurs, males of several species have the posterior tibia with one spur reduced, sometimes aborted and appearing absent. That spur is the lower (=inner) one, and the other is the upper (=outer), which always is movable and usually the longer of the 2. The lower spur rarely is modified drastically (e.g., *futilis*, fig. 395) and is the longer one. Other terms which may be confusing are "movable" (=articulated) and "fixed" (=unarticulated). When the spur is fixed (only in the lower) it has no socket showing, and it is immovable. In learning this character, the reader should compare the base of the upper spur which always has an obvious socket and is movable. Another character, which may be more useful

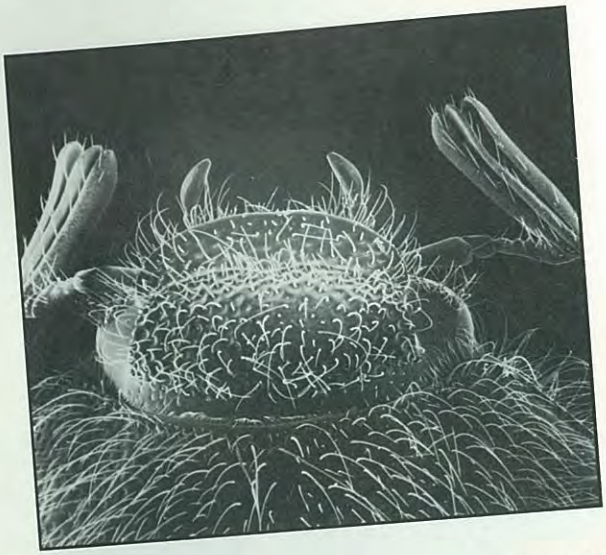


fig. 421. *Phyllophaga tristis*: head pubescent, clypeus entire (10mm = 0.5mm).

fig. 423. *Phyllophaga latifrons*: head glabrous, clypeus entire, margin reflexed at middle (7mm = 0.5mm).

fig. 422. *Phyllophaga glaberrima*: head glabrous, clypeus emarginate (7mm = 0.5mm).

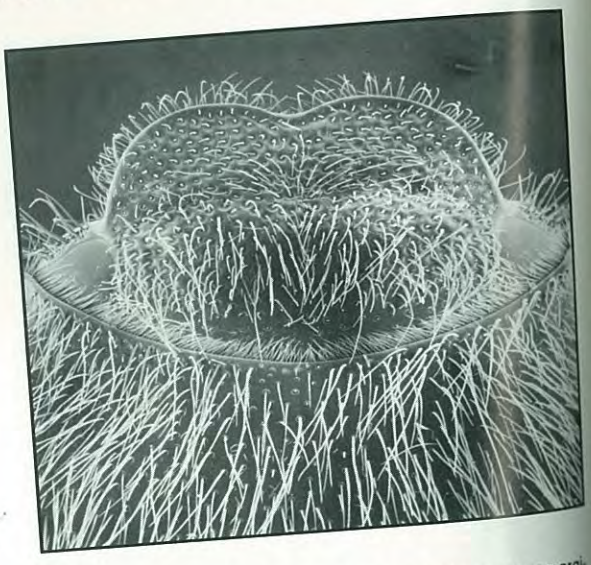


fig. 424. *Phyllophaga skelleyi*: head pubescent, clypeus emarginate, margin barely reflexed (7mm = 0.5mm).

spur which always has an obvious socket and is movable. Another character, which may be more useful than thought previously, is the fringe of setae on the apex of the posterior tibiae, normally referred to as the "fringe of spinules" (fig. 425). Differences in the number of these setae were tabulated for *elizoria*, *okeechobea*, and *skelleyi* (fig. 588).

Genitalia: (pl. 1-32) The male genitalia are so distinctive that most species can be recognized at a glance, when good illustrations are available. The female genitalia are nearly as distinctive, but their simplicity makes for less obvious characters. Only a few (e.g., the *tristis* complex) females cannot be distinguished except by association with the males. Unfortunately, a good terminology has not been developed for the various genitalia forms, and this complicates any verbal description. The terms used here are those proposed by Boving (1942), recognizing that terminology and homology need attention.

The large male organ is composed of 3 primary elements (fig. 432): 1) Basal piece: cylindrical, elongate (especially so in *perlonga*), curved downward

fig. 425. *Phyllophaga skelleyi*: right posterior tibial apex, showing 2 large movable (articulated) spurs and the fringe of spinules (see chart, fig. 588) (10mm = 0.5mm).

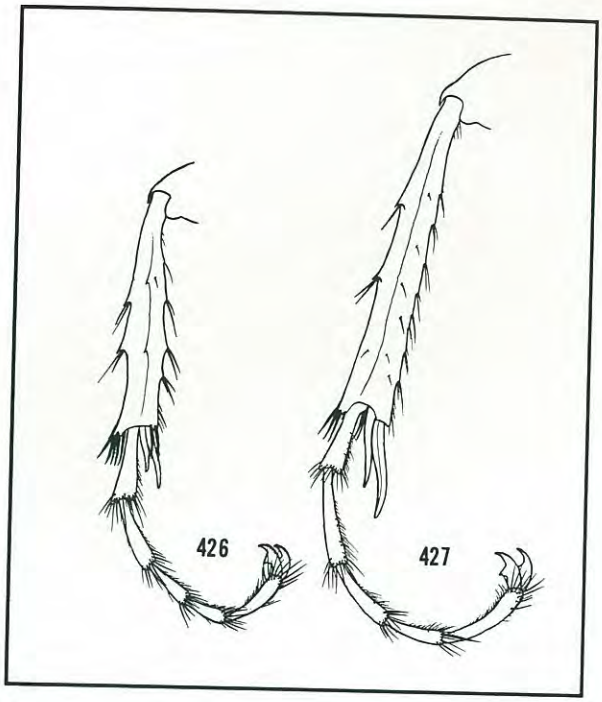


fig. 426-427. *Phyllophaga bruneri*: middle (426) and hind (427) tibia and tarsus (12mm = 0.5mm).

posterior end. The anterior part closed by a membrane at the opening for the aedeagus (''trema''). Dorsally it is called ''tectum'' and the lower part called ''ventral membrane'' (behind which reposes the invaginated aedeagus). 2) Claspers: Most taxonomic characters are found here. They are composed of the ''phallobase'' which surrounds the base and the ''trema'' and the ''parameres'' which are the paired prolongations often extensively modified and either symmetrical or asymmetrical. 3) Aedeagus: The intromittent organ (=penis valves, Wood, 1952) or invaginated internal sac. The structure rarely has been used taxonomically, except in species groups where it normally protrudes and is heavily sclerotized (e.g., *tristis* complex; subgenera *Listrochelus* and *Cnemarachis*). However, we believe that the aedeagus may be much more useful to distinguish closely related species. We have illustrated several here (fig. 433-450, 583, 601, 602) to show the form and numerous characters thereon. These were possible only because of advances in techniques, to critically point dry them in 3-dimensional form and the use of the SEM to study and illustrate them (see Methods & Materials). No terminology or homology has been developed for these structures, making them difficult to describe. They deserve greater attention in the future.

The female genitalia always are symmetrical and much simplified in comparison with the male (fig. 451-456). The original terminology of Smith (1889b) divided the typical structure into 3 elements: 1) inferior plates (basal), 2) superior plates (upper), and 3) a pubic process. The 2 plates often are fused, with or without folds or sutures to indicate the division, and their shape can be modified by dissection and distention or contraction of the softer connecting membranes. An ''internal process'', found on the inferior plate at the middle, projects toward the pubic process and may provide useful characters. The most useful element is the pubic process, which is usually rigid and distinctively shaped. The basic type involves a bifurcate tip and a suture or vestige thereof medially (fig. 343). A second type has the process linear (fig. 372) and difficult to homologize to the basic type. A few species (*youngi*, fig. 377; *tristis*, fig. 367; *obsoleta*, fig. 335) appear to have the pubic process absent.

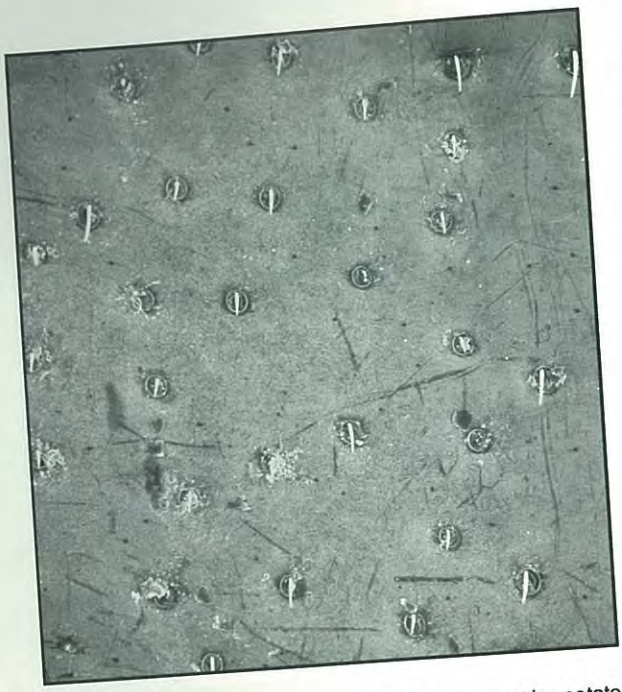


fig. 428. *Phyllophaga quercus*: elytral sculpture, showing setate punctures (whiteness due to SEM charging) (magnified 80x).

fig. 430. *Phyllophaga latifrons*: elytral sculpture, microtrichia larger than on *quercus*, at lower magnification (450x).

fig. 429. *Phyllophaga quercus*: elytral sculpture, showing microtrichia which give the elytra a pruinose appearance (magnified 800x).

fig. 431. *Phyllophaga quercus*: elytral sculpture with micropore and microtrichia (magnified 4000x).

Key to Florida Genera of the tribe Melolonthini (Adults)

(modified from Howden, 1968, and Hardy, 1974)

1. Pygidium large, narrowed to a rounded apex; fore coxae transverse; larger (7.8 to 25mm long, usually 10mm or more) 2

1'. Pygidium small, oval; fore coxae distinctly conical; smaller (5.9 to 12.5mm long, usually less than 12mm) ..... *Diplotaxis*

2(1). Antennal club of 3 segments in both sexes; elytra never clothed with scales, often glabrous 4

2'. Antennal club of 5 (female) to 7 (male) segments; elytra often clothed with scales, the pattern in stripes or blotches 3

3(2'). Elytra with scales; segments of male antennal club flattened, curved outward; male posterior femur not or barely enlarged..... ..... *Polyphylla*

3'. Elytra without scales, pubescent; first and last segments of male antennal club contoured, slightly curved outward; male posterior femur noticeably enlarged; a single endemic Florida species (*pubescens* (Cartwright)) .. .. *Polylamina*

4(2). Side piece of metathorax wide; tarsal claws unequal, front and middle claws with unique large, oval, basal lobe on the outer claw and normal on the other; anterior tibiae bidentate (male), tridentate (female); mentum narrow, apex rounded; labial palpi closely set; a single endemic Florida species (*spissipes* LeConte) .....*Hypotrichia*

4'. Side piece of metathorax narrow; tarsal claws similar, toothed or cleft, but never with a basal lobe on one; anterior tibiae usually tridentate in both sexes; mentum large, quadrate, largely setose; labial palpi widely separated, placed near outer apical angles; 54 Florida species ..... *Phyllophaga*

Biology and Behavior

We have combined the subjects here because they are so interrelated, and we have devoted minimal time to these areas. Every aspect of an animal's existence involves behavior (e.g., eclosure, feeding, mating, attraction to light, etc.). The time necessary to observe such behavior in detail is beyond the scope of this paper, but we have included some brief observations, as well as citations for further reference.

Life History: The known life cycles for Florida species are summarized in Table 4. We have not personally spent time rearing the various species (except for *bruneri*), and their cycles may be different under Florida conditions (as they are in other parts of the country). Therefore, the data in Table 4 should be used with caution.

The following outline is typical for the genus (exceptions and details are discussed later and under each species treatment). Beetles mate on foliage at night, returning to their hiding places (in the soil and

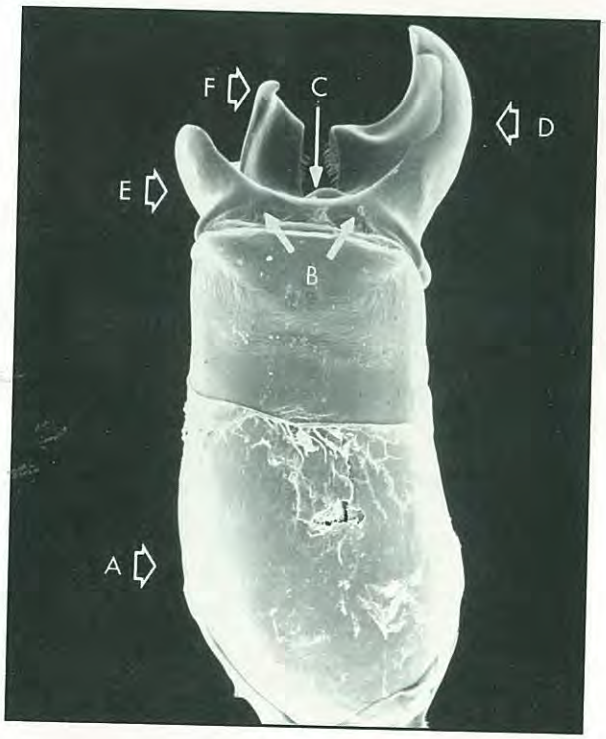


fig. 432. *Phyllophaga foxii*: male genitalia, dorsal view (magnified 16x). A = basal piece, B = phallobase, C = trema, D = left paramere (clasper), E = right paramere (clasper), F = right interior process.

Table 4. Life cycle summary of Florida *Phyllophaga*.

Species	State	Cycle in Years[1]	Pupation Time	Citation
anxia	Nebraska	3±	July	Jarvis, 1966
apicata	Texas	1	September	Reinhard, 1941
bruneri	Florida	-1?	winter?	present work
crenulata	Indiana	3, 4	July	Davis, 1916a
	Kansas	2	August	Hayes, 1925
	Kentucky	3, 2	summer	Ritcher, 1940
	Michigan	2, 3	fall	Yeager, 1950
	Indiana	3, 2	spring	Davis, 1916a
ephilida	Kentucky	2	June	Ritcher, 1940
	?	2, 3?	late summer & fall	Yeager, 1950
forsteri	Indiana	3	July	Davis, 1916a
futilis	Kansas	2		Hayes, 1920
	Kentucky	2, 3	summer	Ritcher, 1940
	Michigan	2, 3	fall	Yeager, 1950
	Indiana		spring	Davis, 1916a
gracilis	Michigan	2, 3	spring	Yeager, 1950
	Indiana	3	July	Davis, 1916a
hirticula	Kentucky	3, 2		Ritcher, 1940
	Kansas	3	summer	Hayes, 1920
(var. comosa)	Indiana	3	July	Davis, 1916a
ilicis	Michigan?		fall	Yeager, 1940
	Kansas	2, 3		Hayes,1920
implicita	Indiana	3, 2	July	Davis, 1916a
	?	2, 3	late summer & fall	Yeager, 1950
luctuosa	Costa Rica, El Salvador	1	January-February	King, 1984
obsoleta	South Carolina	2-3?		Yeager, 1950
prununculina	Indiana		spring	Davis, 1916a
quercus	Indiana	2	before September	Davis, 1913b
tristis	Kansas	2, 1	August	Hayes, 1925
	Kentucky	2	summer	Ritcher, 194
	Michigan	2-3	fall	Yeager, 195
	Texas[2]	1	August	Reinhard, 19
youngi	Florida		winter	present wo

[1]Most frequent time given first.
[2]Eggs from Hope, Arkansas.

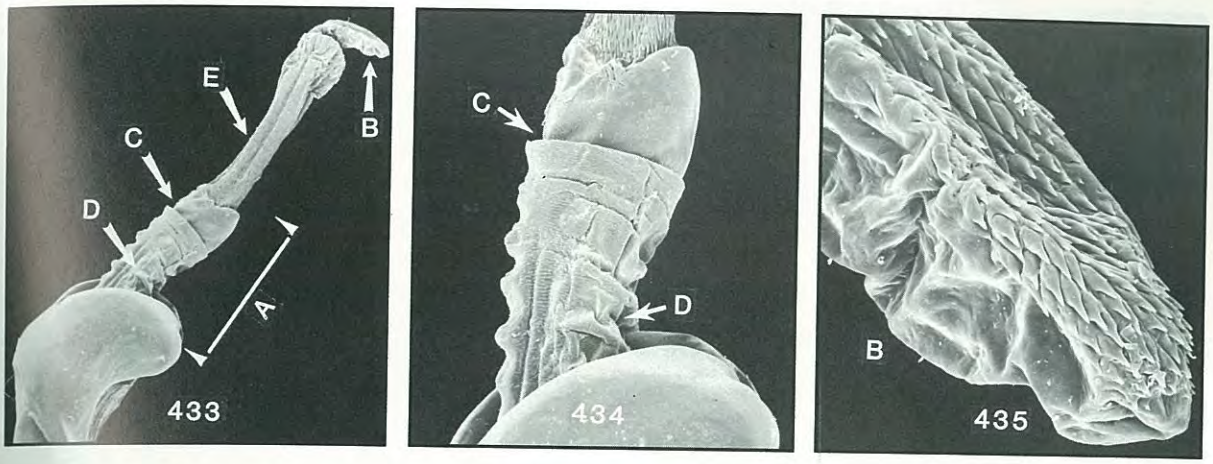


fig. 433-435. *Phyllophaga latifrons*: aedeagus (internal sac) extruded. A = enlarged area in fig. 434; B = enlarged tip in fig. 435; C = enlarged area in fig. 436; D = enlarged area in fig. 437; E = enlarged area in fig. 438. 433) line = 0.5 mm; 434) line = 0.25mm; 435) line = 0.05mm.

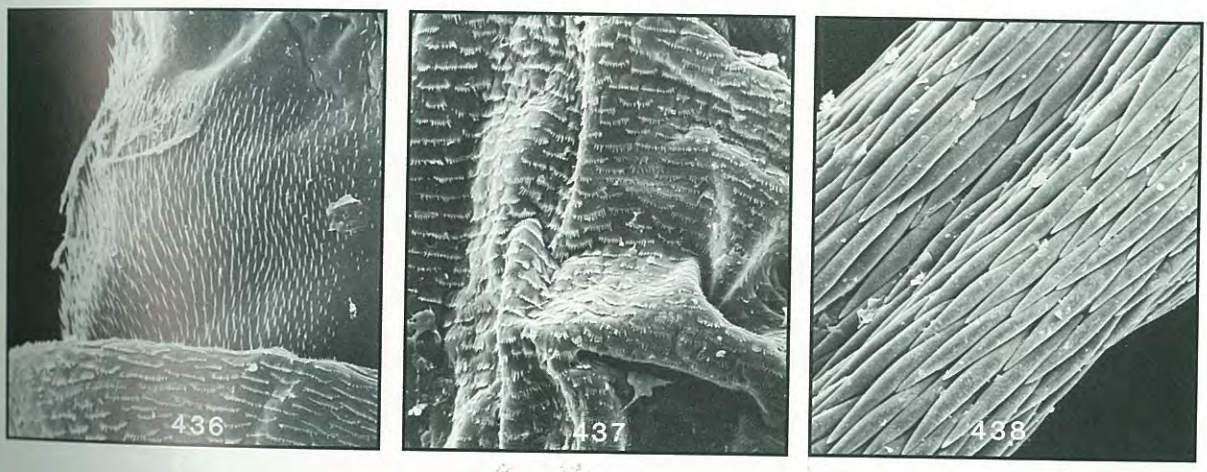


fig. 436-438. *Phyllophaga latifrons*: aedeagus, enlargements of areas in fig. 433: (line = 0.05mm): 436) fig. 433 C; 437) fig. 433 D; 438) fig. 433 E.

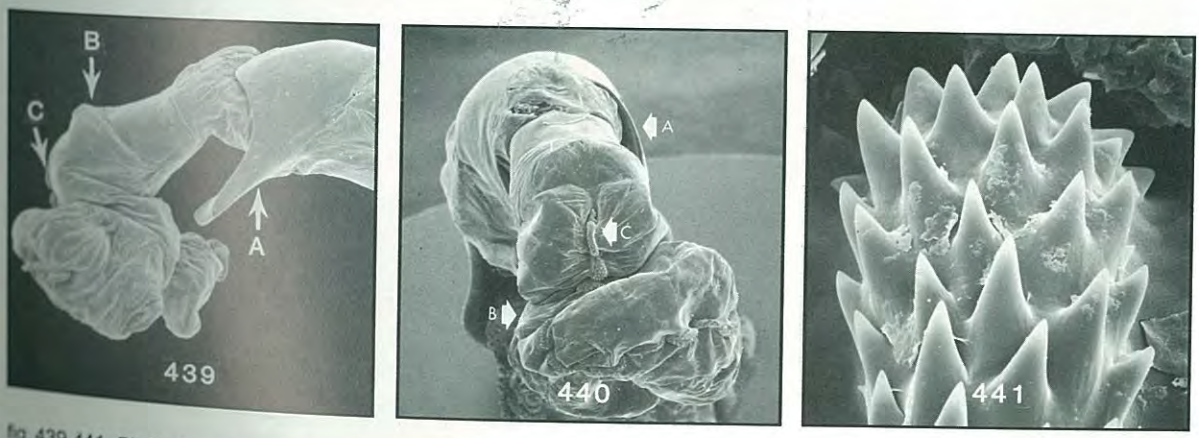


fig. 439-441. *Phyllophaga parvidens*: male genitalia. 439) aedeagus (A) extruded from parameres (B), with spinose area (C) enlarged in fig. 441 (line = 0.5mm). 440) same, caudal view (line = 0.5 mm). 441) spinose area (C) of aedeagus (line = 0.05mm).

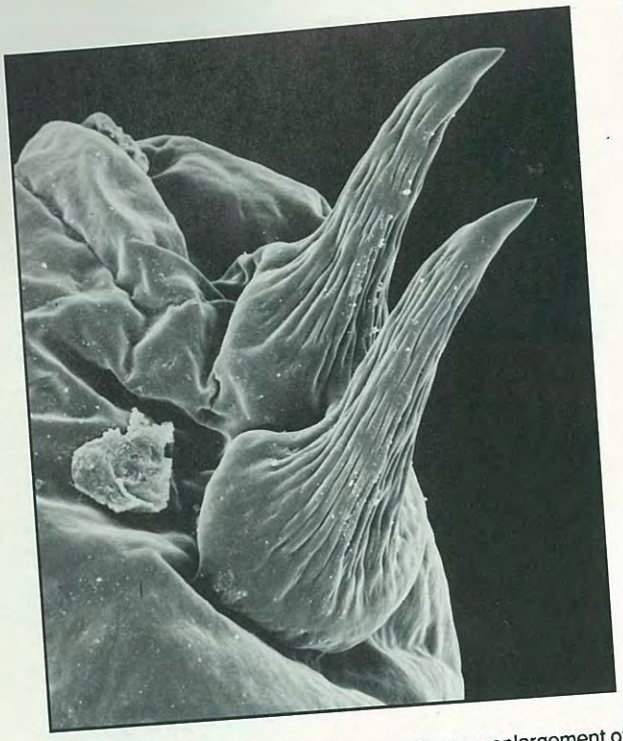


fig. 442. *Phyllophaga ulkei:* horns on aedeagus; enlargement of fig. 444D (magnified 130x).

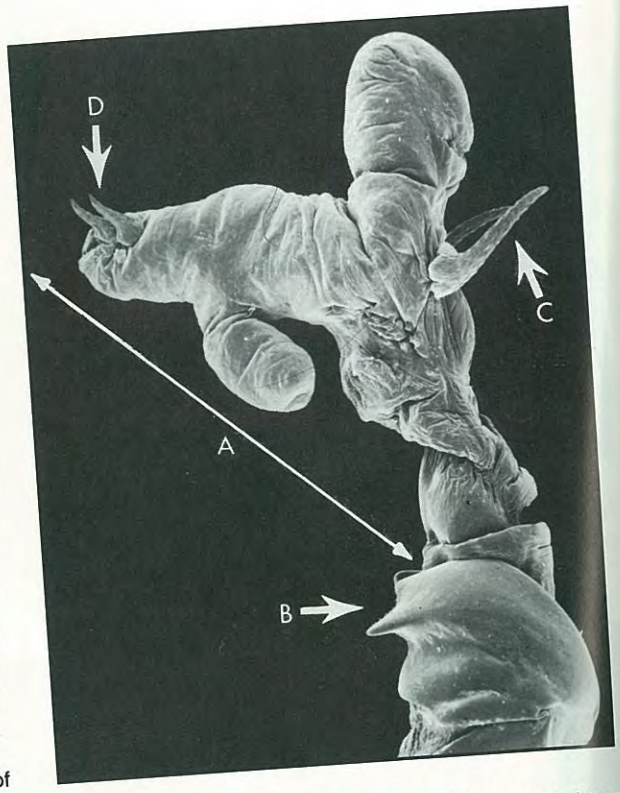
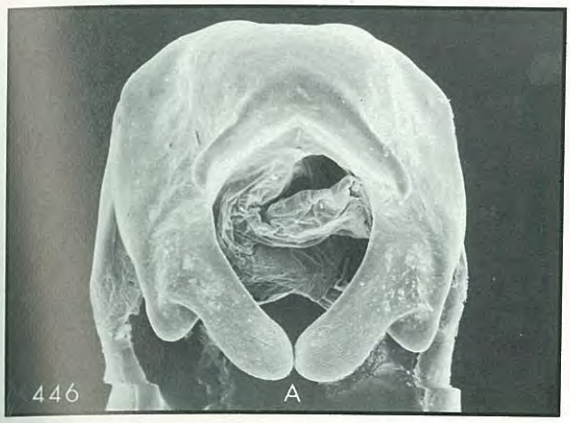


fig. 444. *Phyllophaga ulkei:* male genitalia, right lateral, aedeagus (A) extruded from parameres (B), critical point dried. "Horns": (C) enlarged, fig. 445, (D) enlarged, fig. 442 (8mm = 0.5mm).

fig. 443. *Phyllophaga ulkei:* male genitalia, dorsal view, aedeagus (A) extruded from parameres (B), prepared by critical point drying. (C) enlarged in fig. 445. (11mm = 0.5mm).

fig. 445. *Phyllophaga ulkei:* male aedeagus; spinose horn, enlargement of fig. 444C (12mm = 0.05mm).



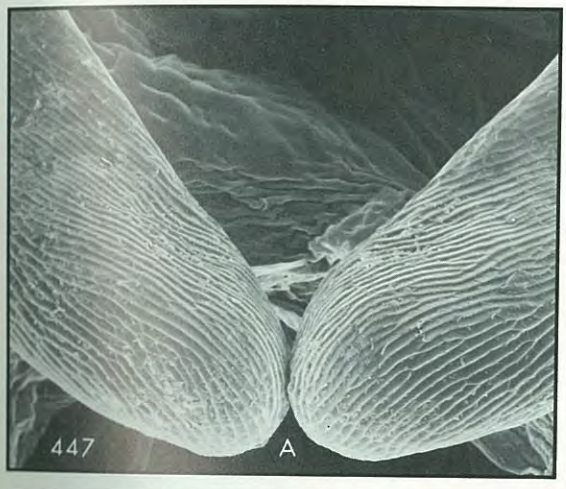


fig. 446-448. *Phyllophaga prununculina*: male genitalia, caudal-ventral view. 446) area A enlarged in fig. 447-448 (17mm = 0.5mm). 447) enlarged paramere tips of fig. 446 A (7mm = 0.05mm). 448) further enlargement of paramere tip of fig. 446 A and 447 A (5mm = 0.005mm).

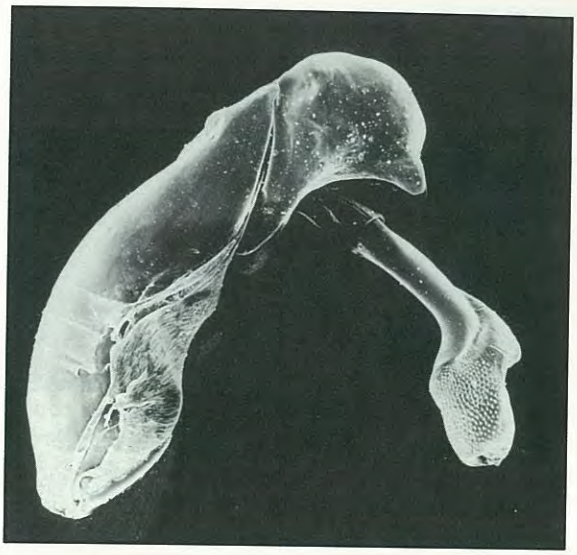


fig. 449. *Phyllophaga prununculina*: male genitalia, left lateral view, with sclerotized aedeagus extruded (tip enlarged in fig. 450) (magnified 25x).

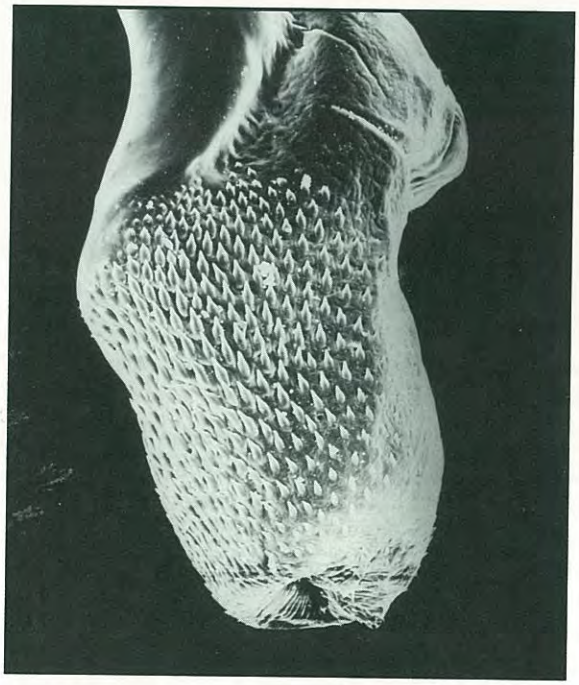


fig. 450. *Phyllophaga prununculina*: tip of aedeagus, enlarged from fig. 449 (magnified 100x).

under debris) just before dawn. Females burrow into the soil a few inches deep to deposit eggs singly in a cell. The eggs are white to cream colored, elongate, but swell to spherical later, when they become turgid, tough, and leathery. The larval head capsule may be seen a few days before hatching (usually within 30

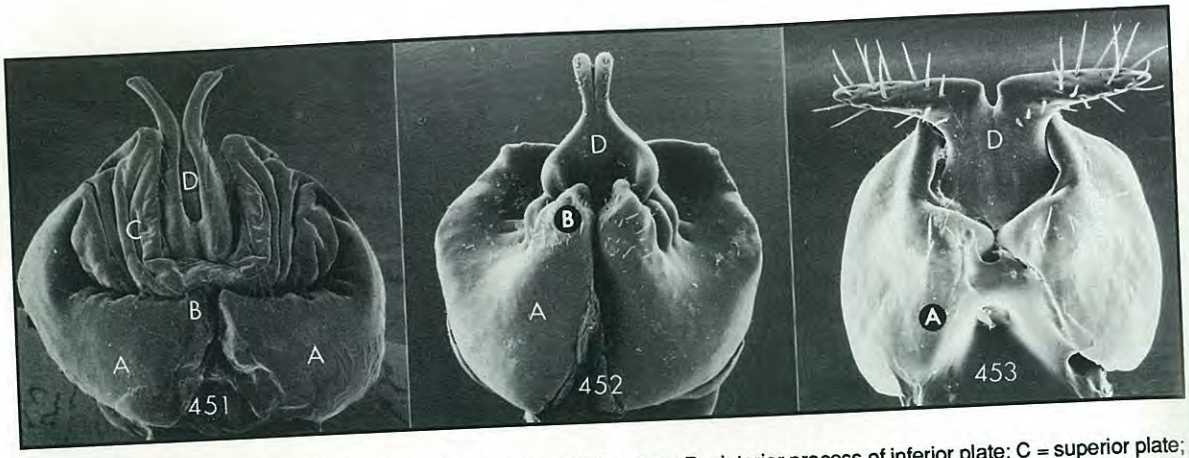


fig. 451-453. *Phyllophaga* spp., female genitalia types: A = inferior plate; B = interior process of inferior plate; C = superior plate; D = pubic process. 451) *P. postrema* (7mm = 0.5mm), with all 3 elements. 452) *P. forsteri* (11mm = 0.5mm), with only a vestige of the superior plate. 453) *P. diffinis*, with highly modified pubic process, and no superior plate (18mm = 0.5mm).

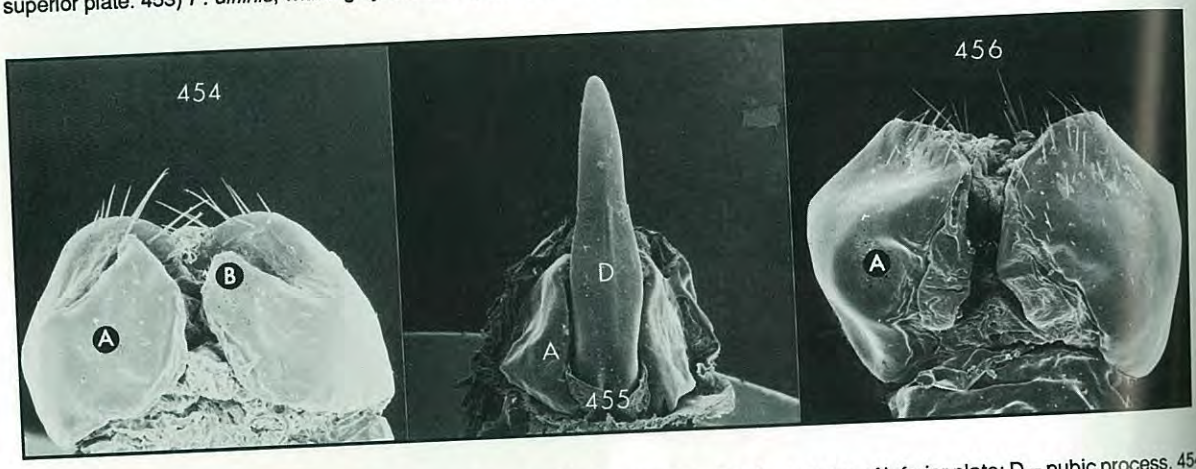


fig. 454-456. *Phyllophaga* spp., female genitalia types: A = inferior plate; B = interior process of inferior plate; D = pubic process. 454) *P. tristis*, with no pubic process, but interior process on inferior plate (16mm = 0.5mm). 455) *P. ephilida*, with inferior plate and fused, linear pubic process (8mm = 0.5 mm). 456) *P. youngi*, with single inferior plate, and no superior plate or pubic process (12mm = 0.5mm).

days). Larvae have 3 molts of variable duration, the third instar possessing good taxonomic characters (the first and second have not been adequately studied). Larvae are white (thus "white grubs") except for the head (reddish to dark brown) and the posterior one-third (gray to black), due to fecal material visible through the transparent integument. They feed on live roots (and apparently dead organic material), often causing damage to sod. The time of pupation is generally uniform for each species, mostly in the fall, but sometimes (e.g., *quercus*) in the spring. The entire cycle ranges from 1 to 4 years, with some species requiring 2 or 3 years from the same egg masses.

Subtropical conditions may speed up the process, and species which require several years in northern climates may need only a year in Florida.

We have not noticed any indication of alternate year abundance in our data, although these data were not obtained or recorded with this in mind. In northern states, workers often have referred to "broods" for these heavy, alternate year emergences (e.g., Davis, 1918; Forbes, 1916). The use of the term "brood" was questioned by Shenefelt and Simkover (1951); they suggested "flight" would be a better term. Neiswander (1963) defined "brood" as all the May beetles that occur in any one year, regardless of the number of species involved. He based his "brood A, B, C" on the basic assumption that a 3-year cycle was normal, and thus the "broods" appeared every 3 years. This is not the normally accepted use of the term.

Adult Diel Activity: Species of *Phyllophaga* are essentially nocturnal, flying from dusk and after sun down to their host trees, and normally returning to hide just before dawn. During our studies we puzzled over

the taxonomic status of the sympatric, closely related *elizoria* and *okeechobea*. After we finally sorted the specimens to our satisfaction, we noticed that the label data suggested a daytime activity for *okeechobea* (none at light) and a nocturnal one for *elizoria* (nearly all at light). Although further observations are needed, we believe that *okeechobea* is diurnal, and that this is the species isolating mechanism that maintains the 2 in the same locality (e.g., Archbold Biological Station). Although there are probably some species of *Phyllophaga* occasionally found in the daytime, we know of only one other (*Triodonyx* n. sp., from Arizona; W. E. Warner, pers. com.) which flies regularly during the day. However, many of the relictual Melolonthinae appear to be diurnal (e.g., *Gronocarus, Hypothyce, Phobetus, Polylamina, Thyce*).

Attraction: May beetles obviously are attracted to their host plants and to their mates. The nature of these attractions (possible sex or aggregating pheromones) has received little attention, and we have not studied them. However, the most notable attraction is that to light (especially ultraviolet). This behavior has produced nearly all of our specimens for study. Their attraction to light was known to early workers as well, and led to the control recommendation of suspending a light over a tub of water with a layer of kerosene on top. The nature of the attraction is still poorly understood, although types of lights and height of light trap location were studied by Chandler, et al. (1956). The nature of the light attraction was the subject of a 10-paper symposium (USDA, 1961), and various trap designs were discussed by Hollingsworth, et al. (1963). I have found that even the flightless *cribrosa* group are attracted to lights in Texas.

Season: In northern states, most species appear in May or June, giving rise to the common name. Even though this generality holds for most species in many areas, some species emerge in the fall, especially in the desert areas of the southwestern United States. The season often appears to be extended (both early and late) in Florida, as can be seen in the records under each species. We have collected *bruneri* every month of the year in Miami, but it appears to have 2 population peaks (one in May-June, one in Aug-Sept.) and possibly 2 generations per year.

Plant Hosts: Adult beetles feed on a great variety of plant species in diverse plant families (see species treatments under the heading "Adult Host Plants"). Most are found on broad leaved trees and shrubs, but a few are primarily conifer feeders (e.g., *prununculina, debilis, taxodii*, and *clypeata*). The latter 2 species appear to be host specific to cypress. Of those feeding on the non conifers, they have such diverse hosts (sometimes with different preferences in different localities) that few generalities can be made. I studied the negative and positive hosts for the introduced *bruneri* in Miami (Woodruff, 1961) without finding any pattern of plant families. Sometimes a close relative (in the same genus) of a good host would have no beetles or feeding signs. The positive hosts and their families are shown under *bruneri* in the species treatments.

General Behavior: Other aspects not treated above, but which had some discussion in the literature, include: proportion of the sexes (Chamberlin & Seaton, 1941); larval spatial pattern (Guppy & Harcourt, 1970); oviposition (Sweetman, 1927); height of flight (Shenefelt & Simkover, 1951); mite symbiosis (Jarvis, 1964); soil temperature influence on grubs (McColloch & Hayes, 1923; species of a single host (hawthorn) (McCulloch & Hayes, 1922); and especially in the following general references: Chamberlin, et al., 1943-1941; Forbes, 1891b-1916; Hayes, 1925, 1929; Hayes & McColloch, 1928; Ritcher, 1939-1958.

Immature Stages: Unfortunately we know less than half the larvae for our Florida species, and only the pupa of *bruneri* has been described (Woodruff, 1961). The known larvae are summarized in Table 4, and they are treated in the following key. Taxonomic characters are found primarily on the last ventral abdominal segment (fig. 460) and the epipharynx (fig. 459). Space does not permit a more detailed treatment here, but the known larvae are described in detail under each species. The primary references to larvae are as follows: Boving (1937, 1942); Boving & Craighead (1931); Davis (1913-1920); Hayes (1925-1929); Hayes & McColloch (1920, 1928); Moron (1958); Peterson (1951); Ritcher (1938-1967); Uhler (1941); Wade (1935).

Phyllophaga pupae have rarely been treated, and never in a taxonomic sense. Ritcher (1939) reviewed the literature on the depth at which pupation takes place. He found that some species (e.g., *hirticula*) pupated deep in the soil, others (e.g., *inversa*) were shallow, and most were intermediate (e.g., *futilis*). Factors influencing depth included the structure, drainage, and moisture of the soil, but they "did not change the relative positions of the various species." Differences in latitude also had no effect on the depth for a given species.

Moron (1986:163-168, fig. 281-287) described and illustrated a typical pupa, the spiracles, and sexual characters for a Mexican species (*brevidens* Bates).

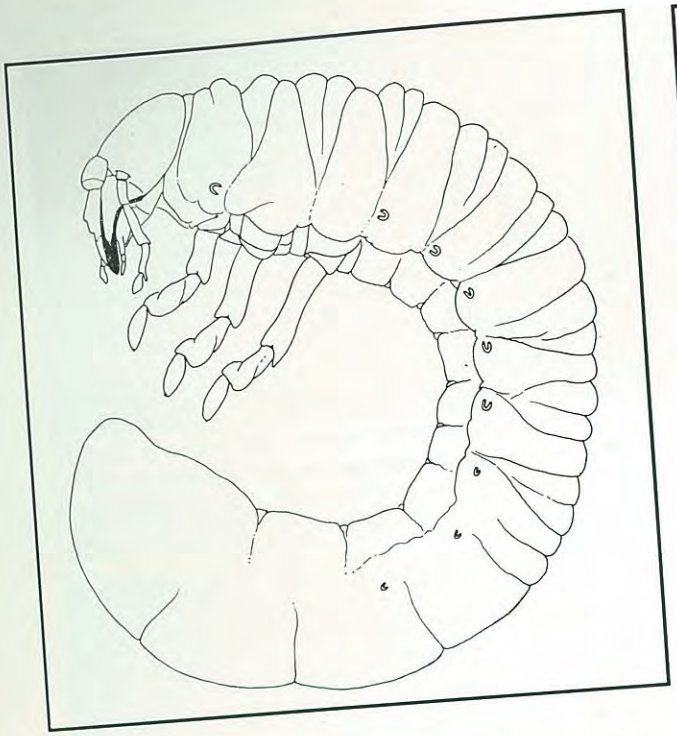


fig. 457. *Phyllophaga bruneri*: third instar larva (13mm = 1.5mm).

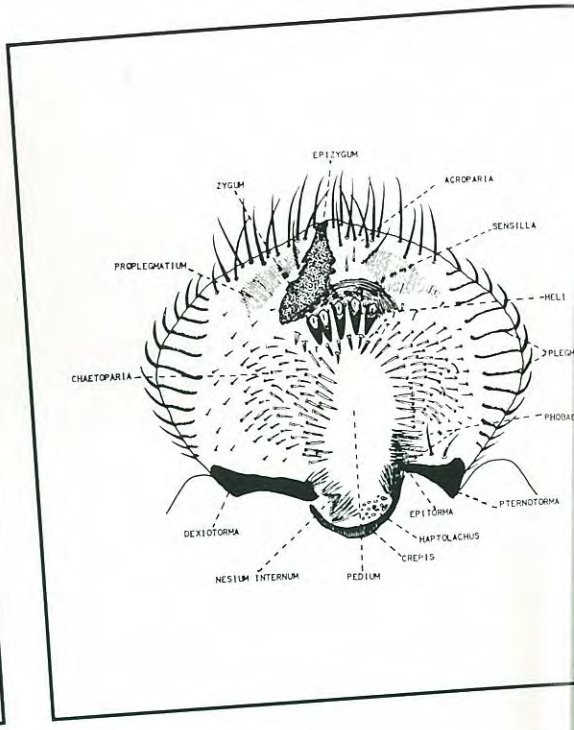


fig. 459. *Phyllophaga bruneri*: epipharynx of third inst

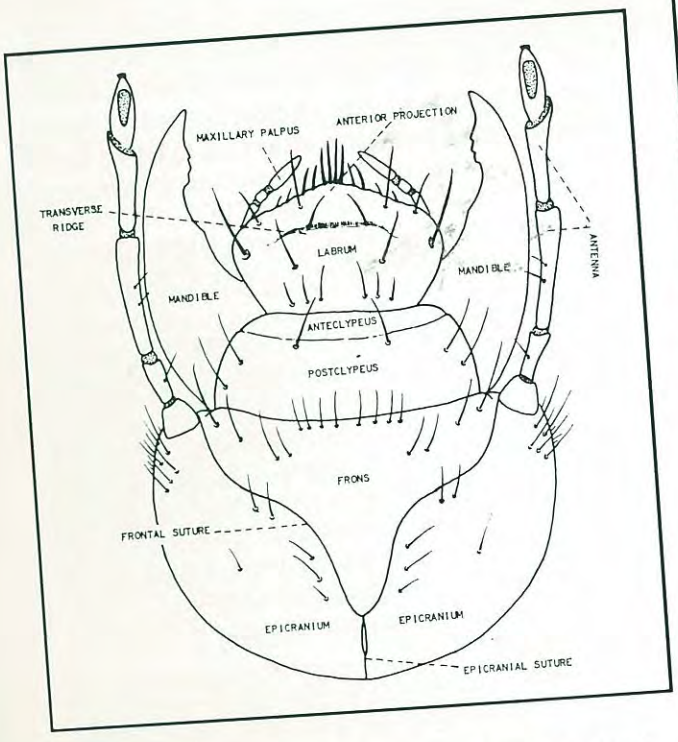


fig. 458. *Phyllophaga bruneri*: head of third instar larva, dorsal.

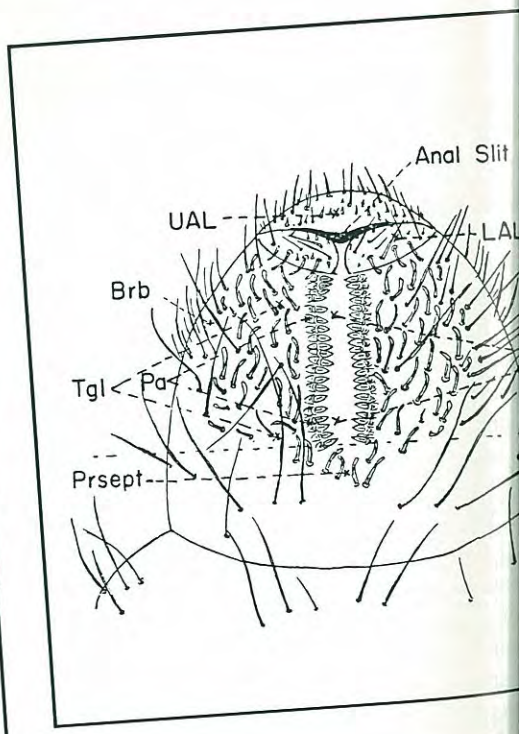


fig. 460. *Phyllophaga* sp.: ventral view of 10th a
ment with raster, diagrammatic (After Boving
barbula; LAL = lower anal lip; Pa = palidium; Prse
setae; Sept = septula; Tgl = tegillum; UVA = up

KEY TO KNOWN LARVAE OF FLORIDA *PHYLLOPHAGA*

(modified from Boving 1942 and Ritcher 1966)

1. Palidia absent (Fig. 477) (subgenus *Cnemarachis*) ..... *bruneri* Chapin

1'. Palidia present (Fig. 460) (subgenera *Phytalus* & *Phyllophaga*) 2

2(1'). Maxillary articulating skin ventrally with short, conical, or rounded dark granules; pali usually straight, pointed tips (hooked in *quercus*) 3

2'. Maxillary articulating skin ventrally with long and short setae, and sometimes with small, ring-shaped pale punctures among the setae, but never with thick, dark granules; pali various shapes 6

3(2). Proplegmata distinct, 7 to 14, or a few more; pali sometimes curved, with straight lateral edges and sharp points; numbering 8-27; preseptular setae numerous; and lobes with many pointed short and strong setae 4

3'. Proplegmata absent or vestigial, appearing faintly as several fine lines on each side; pali 10-20 or a few more; maxillary articulating skin ventrally with 9-35 or more granules .. .. *quercus* (Knoch)

4(3). Maxillary articulating skin with 5 short, thick, pointed granules; palidium with 1 irregular row of 25-27 pali; proplegmata 7-10 ....*aemula* (Horn)

4'. Maxillary articulating skin with many more than 5 granules; palidium with 18-24 pali; proplegmata 12-15 5

5(4'). Maxillary articulating skin with 14-21, sometimes more, cone-shaped granules; heli 8-10; proplegmata 12-15; palidium with 20-24 or more straight pali ..... *crenulata* (Froelich)

5'. Maxillary articulating skin with 25-35 cone-shaped granules; heli 14; proplegmata approximately 15; palidium with about 18 somewhat curved pali .... *parvidens* (LeConte)

6(2'). Proplegmata absent; pali 10-13; dorso-exterior region of mandible with no punctures; pali depressed, short, bent toward septula; septula broadly oval; crepidal punctures 6 or less (probably includes *apicata* also) .... *tristis* (Fabricius

6'. Proplegmata present, at least on 1 side of epipharynx 7

7(6') Proplegmata either indistinct and often different in number on both sides, or not more than 4; dorso-exterior punctures of mandible (normally) present; pali hooked, 12 or more, or long sharply pointed and 20 or more 8

7'. Proplegmata distinct, usually same number on both sides, more than 4; dorso-exterior punctures of mandible absent 12

8(7). Proplegmata 25 or more .... *prununculina* (Burmeister)

8'. Proplegmata 20 or less 9

9(8'). Proplegmata about 20 .... *debilis* (LeConte)

9'. Proplegmata 10 or less 10

10(9'). Pali 17-20; proplegmata 6 or 7 .... *glaberrima* (Blanchard)

10'. Pali 20-25 or more; proplegmata 8-10 11

11(10'). Dorso-molar region with about 12 setae and fewer than 10 punctures in front of them at inner margin of scissorial part ....*ephilida* (Say)

11'. Dorso-molar region with 10-15 punctures .. ..*futilis* (LeConte)

12(7'). Pali 9-10; dorso-exterior region of mandible with no punctures 16

12'. Pali 12-30; dorso-exterior region of mandible with 0-30 punctures 13

13(12'). Pali 20-30 14

13'. Pali 12-18 16

14(13). Proplegmata 11-15; preseptular setae 6 or more; pali 20-30; dorso-exterior region of mandible with either 3-10 or 20-25 punctures; pali in irregular row (some parts double) .... *anxia* (LeConte)

14'. Proplegmata 6 or less; preseptular setae absent (*latifrons*) or 7-10 (*micans*); pali 22 or more; dorso-exterior region of mandible with either few (1, 2, or absent) to 15 (*micans*) or 3-10 (*latifrons*) 15

15(14'). Proplegmata 4 or less; pali 22 or a few more in 1 quite regular row and closely set in whole palidium; dorso-exterior region of mandible with few (1-2 or absent) to about 15; scrobis with 8 or fewer punctures; preseptular setae absent .(probably includes *cupuliformis* also) ..... *micans* (Knoch)

15'. Proplegmata 4-6; pali about 26, palidium extending forward with several (usually 3-5) pali in front of tegillum; dorso-exterior region of mandible with 3-10 punctures; scrobis with 8-18 punctures; often 1-2 preseptular setae .. .. *latifrons* (LeConte)

16(13'). Dorso-exterior punctures of mandible 1-4; pali 13-16; proplegmata 3 or less, short, weak, not always same on each side; preseptular setae absent ..... *dispar* (Burmeister)

16'. Dorso-exterior punctures of mandible 15-30; pali 12-18; proplegmata 5-8 on one side, less than 5 on other; preseptular setae normally absent, but many specimens with 1-5 .... *gracilis* (Burmeister)

17(12). Both right and left chaetoparia with numerous punctures among the setae, even spreading into pedium ..... *luctuosa* (Horn)

17'. Only right chaetoparia with numerous punctures among the setae 18

18(17'). Dorso-exterior region of mandible with 10 or less punctures 19

18'. Dorso-exterior region of mandible with 18 or more punctures 20

19(18). Pali about twice as long as wide at base, varying in size in different parts of palidium, very closely set and irregularly arranged; dorso-exterior region of mandible with 5 or less punctures ..... *ilicis* (Knoch)

19'. Pali at least 3 times as long as wide at base, about same size throughout palidium, less close than in *ilicis* and in an almost regular row; dorso-exterior region of mandible with 10 or fewer punctures .... *profunda* (Blanchard)

20(18'). Dorso-exterior region of mandible with 20 or less punctures 21

20'. Dorso-exterior region of mandible with 30 or more punctures 22

21(20). Proplegmata generally long and curved, usually 9-11; septula elongate, subelliptical, slightly constricted in middle; preseptular setae 4 or less; pali 25-35 ..... *hornii* (Smith)

21'. Proplegmata fairly short and almost straight, usually 7-8; septula subrectangular; preseptular setae about 7; pali 27-32 .... *forsteri* (Burmeister)

22(20'). Pali 20; proplegmata 10; preseptular setae 5; crepidal punctures about 50; scrobis with a longitudial series of about 10 punctures and about 6 setae .... *knochii* (Schoen. & Gyll.)

22'. Pali about 30; proplegmata 8-10; preseptular setae 6-8; crepidal punctures about 35; scrobis with a longitudinal row of about 6 punctures and 1 to 5 setae ..... *hirticula* (Knoch)

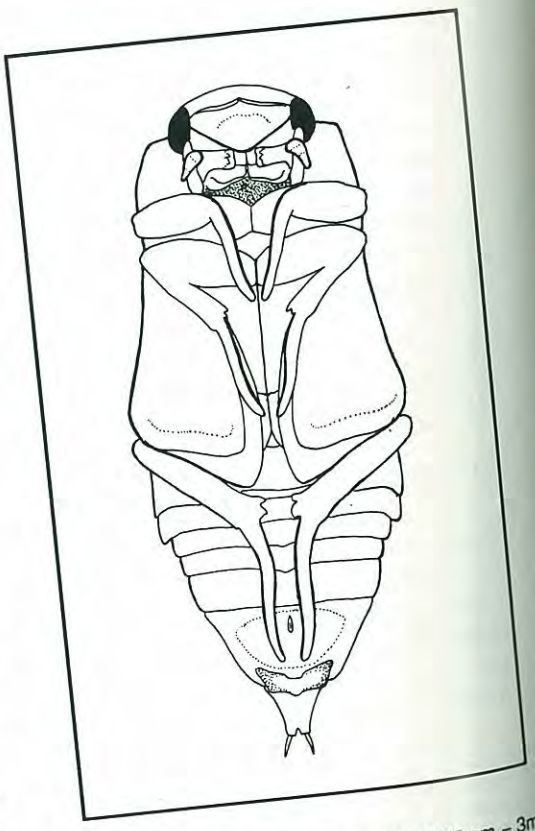


fig. 461. *Phyllophaga bruneri* : pupa, ventral (25mm = 3mm)

Distribution and Zoogeography

Although different names have been used for *Phyllophaga* in various parts of the World, we feel that nothing is accomplished (and much is lost) by splitting the group into genera purely on the basis of geography. We therefore believe that *Phyllophaga* (sensu lato) occurs in both Eastern and Western Hemispheres, even though the European and Asiatic literature often uses the names *Lachnosterna, Holotrichia*, and *Brahmina*.

With the above as a premise, we believe there are probably more than 1000 species of *Phyllophaga*. We have not studied Old World species, and little further will be said about them here. In the New World, about 200 species are found in the United States, 254 in Mexico (Moron, 1986), 80 in South American (Frey, 1975), and probably more than 150 in the West Indies (Sanderson, pers. com. and Woodruff, unpublished).

Several checklists for the United States were consulted for various reasons, but their short (and often vague) distribution records were of limited use. However, they are listed here for the benefit of the reader: Austin (1880); Blackwelder (1939, 1957); Blackwelder & Blackwelder (1948); Crotch (1874); Dalla Torre (1912); Haldeman & LeConte (1853); Henshaw (1885, 1887, 1889, 1895); LeConte (1863); Leng (1920); Leng & Mutchler (1927, 1933).

Table 5. Alphabetical list and references to known larvae of Florida *Phyllophaga*.

	Hayes, 1925	Hayes, 1929	Boving, 1942	Ritcher, 1966
aemula			p. 29-30; fig. 2-8	
anxia			p. 45; fig. 114-116	p. 86-87
apicata*	p. 70-72	fig. 27, 188	p. 33; fig. 33-36	p. 86, 87, 97; fig. 225
bruneri	[Woodruff, 1961: 1-31; fig. 1-26]			
crenulata	p. 61-63	fig. 185	p. 30; fig. 9-13	p. 86,88,91,93; fig. 180, 198
cupuliformis*		fig. 170	p. 42; fig. 106-109	
debilis			p. 36; fig. 63-65	
dispar			p. 40-41; fig. 92-94	
ephilida		fig. 161	p. 40-41; fig. 83-85	p. 86-87, 89; fig. 220
forsteri	[Hayes, 1920: 307]		p. 53; fig. 199-203	
futilis		fig. 37, 69, 164	p. 38; fig. 72-73	p. 86-87, 89; fig. 219
glaberrima			p. 39; fig. 86-87	
gracilis		fig. 163	p. 40-41; fig. 99-101	
hirticula	p. 56-58	fig. 182	p. 51; fig. 179-182	p. 86-87, 91, 95, 97; fig. 184, 205, 207, 217, 224
hornii		fig. 173	p. 52; fig. 191-194	p. 86, 88, 91, 93, 95; fig. 176, 188, 189, 204, 213
ilicis		fig. 184	p. 50; fig. 168-172	
implicita		fig. 180	p. 45-46; fig. 133-137	p. 86-87
knochii			p. 51; fig. 183-186	
latifrons		fig. 160	p. 40; fig. 88-91	
luctuosa			p. 47; fig. 148-151	
micans*		fig. 170	p. 42; fig. 106-109	p. 86-87, 93; fig. 201
obsoleta	[King, 1984: key p. 45-48; fig. 7]			
parvidens			p. 31; fig. 14-17	
profunda		fig. 179	p. 50-51; fig. 173-176	p. 88, 95; fig. 208
prununcula			p. 38-39; fig. 79-81	
quercus			p. 31; fig. 18-22	p. 87
tristis*	p. 70-72	fig. 27, 188	p. 33; fig. 33-36	p. 86, 87, 97; fig. 225

*P. cupuliformis/micans and apicata/tristis adults are so similar that larvae are indistinguishable at present.

Within the United States, there have been many state lists or faunal studies which give a general idea of *Phyllophaga* species found therein. These are variable in quality of both the collecting and the knowledge at the time they were prepared. They are listed alphabetically by state, with the number of species in brackets, and with the author and date in parentheses: **Alabama** [66] (Loding, 1945); **Arkansas** [44] (Sanderson, 1944); **Arizona** [44] (Butler & Werner, 1961); **Connecticut** [13] (Britton, 1920); **Florida** [42] (Young & Thames, 1949), [54] (present study); **Georgia** [66] (Fattig, 1944); **Illinois** [34] (Forbes, 1916); **Indiana** [26] (Blatchley, 1910); **Iowa** [33] (Travis, 1934); **Kansas** [44] (Knaus, 1897); **Kentucky** [36] (Ritcher, 1940); **Louisiana** [62] (Riley, 1988); **Mississippi** [45] (Langston, 1927b), [53] (Lago, 1980); **Missouri** [27] (Owens, 1950); **Nebraska** [25] (Dawson, 1922), [+8] (Ratcliffe, 1974); **New Jersey** [32] (Smith, 1910); **New York** [30] (Leonard, 1926); **North Carolina** [39] (Brimley, 1938); **North Dakota** [10] (Lago, et al. 1979); **Ohio** [36] (Neiswander, 1963); **South Carolina** [31] (Luginbill, 1928) [55] (Kirk, 1969, 1970); **South Dakota** [17] (Kirk & Balsbaugh, 1975); **Texas** [96] (Reinhard, 1950); **Wisconsin** [18] (Chamberlin, et al., 1943)

We have attempted to provide detailed distribution records for Florida and also the United States distribution for those recorded here. These are discussed under the DISTRIBUTION heading, and maps are provided for Florida (the dots as near the localities as possible) and the U. S. (general distribution area outlined and indicated by shading; questionable records are so indicated). We used Luginbill and Painter (1953) as our basic source, but their maps and written records were not documented by citations. Their dots usually appeared in the center of a state, although this is misleading in several coastal species in the southeast. We have tried to verify any unusual distribution records, but we have not always succeeded. Although most of the major state lists are noted in the previous paragraph, there are many smaller references, dealing with only a few species. The several papers by Hatch (1928, 1929, 1941) are extremely useful as a starting point for such a literature search.

In the Florida fauna, 3 species (*bruneri, puberula*, and *youngi*) are introduced from the West Indies. *P. obsoleta* has basically a Mexico-Central America-South America distribution, just barely extending into the United States, in Florida occurring only in the panhandle. The following 8 species are recorded only from Florida and may be precinctive (endemic): *elizoria* Saylor, *elongata* Linell, *floridana* Robinson, *okeechobea* Robinson, *ovalis* Cartwright, *skelleyi* n. sp., and *tecta* Cartwright.

Other New World references, by geographic area, which may be useful in interpreting zoogeography of *Phyllophaga* are: **Central America** (King, 1984; King & Saunders, 1979, 1984); **Cuba** (Garcia-Vidal, 1975-1987); **Hispaniola** (Sanderson, 1951); **Lesser Antilles** (Chalumeau, 1983, 1985; Chalumeau & Gruner, 1976); **Mexico** (Moron, 1986); **Puerto Rico** (Wolcott, 1948); **South America** (Frey, 1975); and **West Indies** (Saylor, 1940).

Economic Importance

Few other groups of insects are as abundant and as economic in both the larval and adult stages as are the "white grubs" and "June bugs". Although we have seen severe damage to sod and tree foliage in Florida, it has not been as extensive as reported elsewhere. Most references discuss economic damage, but few have quantified it. In addition to isolated economic reports and those of a general nature, we have tried to summarize, in the following paragraphs, some references with meaningful figures.

Surprisingly, Luginbill and Painter (1953) devoted little space to economics in their treatment of the U. S. species. They mentioned that thousands of acres of pasture in a single locality had the feed value reduced by larvae, and the damage of white grubs to corn, timothy, and potatoes (during peak years in the north-central states) amounted to "... several million dollars in a single year." They suggested that one reason, that damage by adults in the south is seldom serious, is the "... steady rise in temperature in the spring ... causes the adult May beetles to emerge gradually."

Davis (1916a:270) gave more graphic data on numbers. In May and June of 1914, he surveyed the area of northern Illinois, Iowa, Wisconsin, and Michigan, where he found "... the timber, which consisted chiefly of oak and hickory, was completely stripped of its foliage ... the beetles were so abundant that the dead ones accumulating beneath the lights had to be swept away each morning to prevent or at least modify the terrible stench which they produced." The volume was so great that "At one small town in Wisconsin the beetles accumulating beneath the ten arc lights of the town were hauled away each morning for a period of ten days or two weeks, by the wagon load."

In 1918, Davis provided more specific damage figures for the heavy larval infestations of 1912 in Iowa, Illinois, and Wisconsin. He estimated the damage to corn, timothy, and potatoes in that area at $7,000,000, and in other areas at $5,000,000. He also gave estimates of larval populations in heavily infested areas at 106,680 per acre. In the fall (when they are well-fed), he estimated that each grub weighed 1 gram (454 per pound), and thus there were 235 pounds of grubs per acre. He even recommended feeding them to hogs because they had nearly the same percentage of fat and protein per pound as corn (although deficient in carbohydrates). His figure of food value being good at $3.00 per acre (presumably 235 pounds) is related to the economics of the time, and can hardly be compared with modern costs.

Forbes (1908:166) had earlier given statistics on the quantities of grubs found in a 10-acre destroyed cornfield in Illinois. By sifting the soil of each hill (3.5 ft. square) to a depth of 20 inches, he collected 3460 grubs per 100 hills, or "... about three hundred pounds of grubs to the acre." Swine (100 pigs about 75 pounds each and 8 large sows) were introduced into the field on September 23, and by October 13 (20 days) the entire 10 acres were rooted to a depth of 10 to 12 inches, and the grubs were reduced by 86% to 4.8 per hill. He did point out that the thorny-headed worm of swine (*Echinorhynchus gigas*) uses white grubs as an intermediate host, so that swine should not be used for control where they have been pastured previously. Forbes also mentioned hand collecting of adults as a means of control. He quoted statistics from Sweden (presumably for the related genus *Melolontha*) in a ten-year period (1885-1895), when residents collected 29,736 bushels of beetles at a labor cost of $15,554 (52 cents per bushel). They believed that this system reduced the population from 14,801 (1887) to 5,611 bushels (1895), even though more collectors were involved in 1895.

Since conifers are one of the most significant elements of Florida forests, the species feeding on them have an economic impact, however difficult to assess. Grubs are known to damage pine nursery stock (Baker, 1972, 1985; Nairn & Wong, 1965; Shenefelt & Simkover, 1951; Yeager, 1950), and adults of several species damaged pine flowers in Louisiana (McLemore, 1953).

Rolston and Barlow (1980) reported larvae damaging sweet potato tubers in Louisiana sufficiently to require preplanting insecticide treatment.

In Mexico, Moron (1986:7-8) reported a reduction of 1,314 kilograms per hectare of corn, due to *Phyllophaga* larvae. He listed another case in the state of Jalisco where grubs destroyed 13,784 hectares of corn, beans, rice, and sorghum. Damage resulted in the use of many insecticides over the years: Carbofuran, Chlorfenvinfos, Chlorpirifos, DDT, Diazinon, Foxim, heptachlor, Isofenfos, Protiofos, and Terbufos. The use of such a chemical arsenal has had not only an economic impact, but a profound effect on the environment as well.

In Florida, sugarcane is the one specific economic field crop which may be affected by white grubs. Although grubs of other scarab genera are pests, apparently the only species of *Phyllophaga* involved is *latifrons* (Gordon & Anderson, 1981; Cherry, 1984-1985; Sosa, 1984). The introduced species, *bruneri*, is a known sugarcane pest in Cuba (Stahl & Scaramuzza, 1929), but it has not yet reached the Lake Okeechobee sugarcane region. Because many species of *Phyllophaga* are sugarcane pests elsewhere, the following additional citations may be useful: Box (1953); VanDine (1926); VanDine & Christenson (1932); Wade (1951); Williams, et al. (1969); Wilson (1969).

Wolcott (1914-1948) devoted considerable attention to the white grubs as pests of sugarcane in Puerto Rico, where they were once an economic threat. He stated (1948:250) that they "... reached such a peak of abundance as to become the decisive factor in determining whether the growth of sugarcane or any other crop was possible." He further indicated that they "... were the major insect pest of every crop grown ... in bulk, ... overbalanced all the other insects of the Island, not only individually, but all other insects combined." All this was before the introduction of the giant Surinam toad (*Bufo marinus* L.) which brings us to the next section on natural enemies.

Natural Enemies

As pointed out in the previous section, these insects can occur in tremendous numbers (wagon loads!). When such populations explode, they are often followed by some measure of control by natural enemies, such as predators and parasites. We all know the story of seagulls and grasshoppers in the history of the Mormons in Utah.

From the economic viewpoint, we are fortunate that there is an entire complex of such natural enemies of the genus *Phyllophaga*. J. J. Davis (1919), the author of the "wagon loads" quote, published an extensive monograph on these natural enemies. We have mentioned most of these under the species of beetle parasitized or preyed upon. Because chemicals

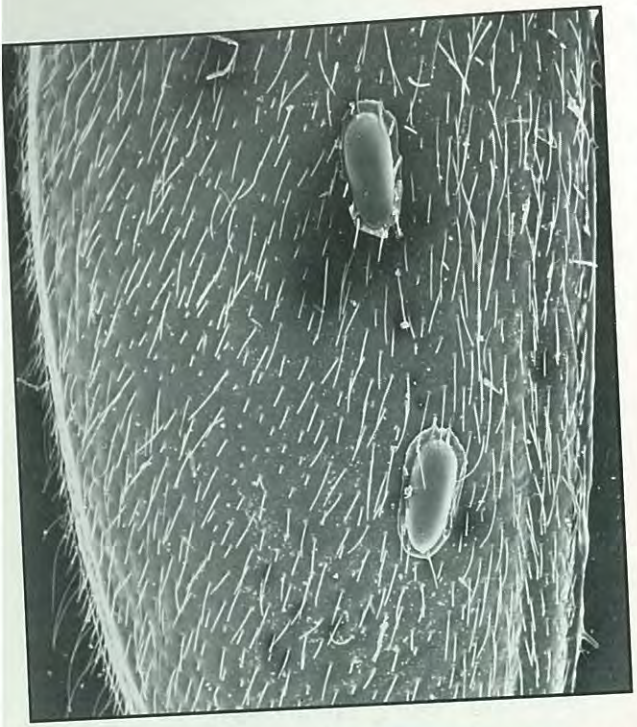


fig. 462. *Phyllophaga elizoria*: left elytron with two eggs of a parasitic fly (8mm = 0.5mm).

fig. 463. *Phyllophaga elizoria*: enlargement of lower egg on fig. 462 (21mm = 0.5mm).

have not provided satisfactory control and often cause environmental problems, current emphasis is being placed in biological control. Space does not permit an extensive treatment of the subject here, but we provide the following notes and references.

Parasites: Both larvae and adults of *Phyllophaga* are parasitized by several families of Diptera and Hymenoptera. From adults, the following insect parasites have been reared (references in parentheses):

DIPTERA:

Pyrgotidae: *Pyrgota undata* Wiedeman, *Pyrgota valida* Harris (Forbes, 1907; Davis, 1919).

Tachinidae: *Cryptomeigenia theutis* Walker, *Cryptomeigenia aurifacies* Walton, *Eutrixoides jonesii* Walton, *Eutrixa exile* Coquilett, *Biomyia lachnosternae* Townsend (Davis, 1919). *Cryptomeigenia aurifacies* Walton, *Eutrixoides jonesii* Walton (Puerto Rico, Wolcott, 1948).

Sarcophagidae: *Sarcophaga prohibida* Aldrich, *S. tuberosa sarracenioides* Aldrich, *S. cimbicis* Townsend, *S. helicis* Townsend, *S. utilis* Aldrich, *S. falculata* Pand., *S. n. sp.* (Davis, 1919); *S. basalis* Walker, *S. bullata* Paykull, *S. johnsoni* Aldrich (Fattig, 1944).

From the larvae, the following insect parasites have been reared:

HYMENOPTERA:

Tiphiidae: *Tiphia inornata* Say, *T. punctata* Robertson, *T. transversa* Say, *T. vulgaris* Robertson; *Elis 5-cincta* Fabricius, *E. atriventris* Gahan, *E. illinoisensis* Dalla Torre, *E. interrupta* Say, *E. obscura* Fabricius (Davis, 1919); *Tiphia confusa* Allen, *T. inornata* Say, *T. transversa* Say, *T. vulgaris* Rob.; *Myzine caroliniana* Panzer, *M. dubiosa* Cresson, *M. maculata* Fabricius, *M. obscura* Fabricius (Fattig, 1944); *Tiphia inornata* Say (Riley, 1874; Petch & Hammond, 1925; Forbes, 1907; Wolcott, 1914); *Tiphia berbereti* Allen (Berberet & Helms, 1970; Rivers, Mayo, & Helms, 1979; Jarvis, 1966).

Scoliidae: *Campsomeris plumipes* Drury, *C. quadrimaculata* Fabricius; *Scolia dubia* Say (Fattig, 1944); *Campsomeris dorsata* Fabricius (Davis, 1919); *Dielis* (*Campsomeris*) *trifasciata* Fabricius, *D. dorsata* Fabricius, *D. pyrura* Rohwer; *Elis xanthonotus* Rohwer, *E. haemorrhoidalis* Fabricius, (Puerto Rico, Wolcott, 1948).

Pelecinidae: *Pelecinus polyturator* Drury (Davis, 1919; Fattig, 1944; Lim, Yule, & Stewart, 1980; Petch & Hammond, 1925).

Ichneumonidae: *Ophion bifoveolatum* Brulle (Forbes, 1907; Davis, 1919); *O. ancyloneura* Cameron, *O. purgatus* Say (Fattig, 1944).

DIPTERA:

Tachinidae: *Microphthalma disjuncta* Wiedeman, *M. pruinosa* Coquillett (Davis, 1919); *M. disjuncta* Wied., *M. divisa* Wied. (Fattig, 1944); *M. disjuncta* Wied. (Forbes, 1907). *M. phyllophagae* Curran (Petch & Hammond, 1925).

Dexiidae: *Ptilodexia harpasa* Walker (=*tibialis* Desvoidy), *P. abdominalis* Desvoidy, *Myocera cremides* Walker?, *Prosena (Mochlosoma) lacertosa* ven der Wulp (Davis, 1919); *Ptilodexia cerata* Walker (Fattig, 1944).

Bombyliidae: *Sparnopolius fulvus* Wiedeman (Forbes, 1907; Davis, 1919; Fattig, 1944). Hyperparasite: *Exoprosopa fascipennis* (Forbes, 1907); *E. fasciata* (Ritcher & Fluke, 1935).

Predators: The number of vertebrate animals, known to feed on *Phyllophaga*, is too extensive to list here, but involves many birds, mammals, and toads. Although the number of insect predators is probably much larger than recorded, the following species are known as predators on larvae:

DIPTERA:

Asilidae: (larvae of the robber flies feed externally on white grubs): *Promachus vertebratus* Say, *P. fitchii* Osten-Sacken, *P. bastardii* Macquart, *Erax maculatus* Macquart (=*interruptus* Macq., *E. lateralis* Macq.), *E. aestuans* Linnaeus, *E. cinerascens* Bellardi (=*albibarbis* Macq.), *Deromyia winthemi* Wiedeman, *D. discolor* Loew, *D. umbrina* Loew, *Asilus paropus* Walker, *A. lecythus* Walker, *Ceraturgus cruciatus* Say (Davis, 1919); *Asilus notatus* Wied., *A. virginicus* Banks, *Deromyia discolor* Loew, *D. termata* Loew, *D. winthemi* Wied., *Erax interruptus* Linn., *E. rufibarbis* Macquart, *Proctacanthus brevipennis* Wiedeman, *P. longus* Wiedeman, *P. rufus* Willison, *Promachus bastardii* Macq., *P. rufipes* Fabricius (Fattig, 1944).

Tabanidae (larvae of horse flies feed externally on white grubs): *Tabanus sulcifrons* Macquart, *T. atratus* Fabricius (Davis, 1919); *T. americanus* Forster, *T. fulvulus* Wiedeman, *T. molestus* Say, *T. nigrescens* P.deBeauvois (Fattig, 1944).

COLEOPTERA:

Carabidae (larval and adult ground beetles prey on white grubs): *Harpalus pennsylvanicus* Dejean, *H. caliginosus* Fabricius, *Calosoma calidum* Fabricius (Davis, 1919); *C. sayi* Dejean, *C. scrutator* Fabricius, *Dicaelus dilatatus* Say, *D. purpuratus* Bon., *Harpalus caliginosus* Fab., *H. erythropus* Dejean, *H. pennsylvanicus* Dej., *Pasimachus punctatus* Haldeman, *Scaphinotus unicolor* Fabricius (Fattig, 1944).

Elateridae: *Pyrophorus luminosus* Illiger (Davis, 1919; Wolcott, 1948); *P. havaniensis* Castelnau (present work).

Miscellaneous. The following groups of parasites or predators are either minor or non-insect and are only briefly and generally cited here.

Mites: Davis (1919:102) recorded *Rhizoglyphus phylloxerae* Riley, *Tyroglyphus armipes* Banks, and *Parasitus* sp. on larvae, and *Uropoda* sp. on adults. Jarvis (1964) discussed the association between a species of *Caloglyphus* (Acaridae) and *Phyllophaga anxia*. It was described as a new species by Oseto and Mayo (1975). Petch and Hammond (1925) listed hypopial nymphs of *Tyroglyphus* sp. infesting 100% of white grubs in one area in Quebec, but they found *Rhizoglyphus phylloxerae* infrequently.

Parasitic worms: The helminth known as the thorny-headed worm of swine (*Echinorhynchus gigas*) was reported by Stiles (1892) to be secondary in white grubs. It was discussed in detail by Glasgow (1926). Hall (1929) discussed helminths and their intermediary hosts. Davis (1919) reported only a few larvae infested with hairworms (Merminthidae) of the genus *Mermis* (one of which was obtained at Pensacola, Florida). Davis (1919) reported 2 species of nematodes in white grubs: *Diplogaster aerivora* Cobb and *Cephalobus*(?) sp. Berberet and Helms (1969) studied 2 species of Eugregarina *(Gregarina* sp. and *Actinocephalus* sp.) in *Phyllophaga anxia*.

Spiders: Davis (1919) listed the following spiders preying on adult *Phyllophaga*: *Lycosa helluo* Wakeman, *Xysticus gulosus* Keys, and *Plectana stellata* Hentz. Jennings (1974) discussed crab spiders preying on scarab beetles. In our study, we found *Phyllophaga youngi* being consumed by *Nephila clavipes* (Linnaeus), and *P. skelleyi* was trapped by *Acanthepeira marion* Levi.

Toads: We cannot treat natural enemies without considering the giant Surinam toad (*Bufo marinus* L.) which has been introduced around the world to control white grubs in sugarcane. *Phyllophaga guanicana* Smyth, from Puerto Rico, is possibly extinct from this toad's predation. Wolcott (1948) treated the success in control of white grubs in Puerto Rico. Although the toad was introduced into south Florida many years ago, it does not seem to be extremely abundant and has had no apparent effect on the *Phyllophaga* fauna here.

Protozoa: Little information is available on the protozoan parasites which seem to be common and play a commensal role in *Phyllophaga* white grubs. Travis and Becker (1931) described and illustrated the following from white grubs: Class Mastigophora (*Polymastix phyllophagae* n. sp., *Monocercomonas melolonthae* Grassi, *Eutrichomastix passale* Tanabe,

Eutrichomastix phyllophagae n. sp., *Embadomonas phyllophagae* n. sp.). Class Rhizopoda (*Arcella* sp., *Allantion* sp.).

Diseases: Many types of diseases have been found in scarab larvae, and some are available in commercial formulations to use in control. Milky disease is one of the important ones (Dutky, 1941). *Micrococcus nigrofaciens* Northrup, a bacterial disease, was considered of minor importance in control (Davis, 1919). Several fungus diseases of white grubs have been reported. *Metarrhizum anisopliae* Metsch. (the green muscardine fungus), *Isaria densa* Link (=*Botrytis tenella*) (the white muscardine fungus), and *Cordyceps melolonthae* Tulasne all were reported by Davis (1919). *Isaria vexans* Pettit and *Cordyceps melolonthae* (Tulasne)? were recorded by Pettit (1895). In Nova Scotia, Piers (1889) reported a fungus from May beetle larvae (probably *Cordyceps melolonthae*).

General references dealing in part with parasites and predators: Davis, 1918, 1919; Fattig, 1944; Forbes, 1907, 1908; Lin, 1979; Lin, Stewart, & Yule, 1981; Lin, Yule, & Stewart, 1980; Miner, 1952; Petch & Hammond, 1925, 1926; Wolcott, 1914, 1937, 1948.

QUESTIONABLE AND POTENTIAL RECORDS

In any study of this nature, dealing with thousands of museum specimens and voluminous literature records, errors are likely to be encountered. We have included here those records for which we have some doubts, specimens which have been intercepted at ports and are potential introductions, and those which we believe are most likely to be added to the Florida faunal list. These are treated below, alphabetically under each species. In addition, we must point out what we believe to be a number of mislabelled specimens (perhaps in other groups of insects as well), all of which bear the collector label F. W. Walker, mostly 1920 to 1922, and from Gainesville, Florida (mostly in the University of Michigan Museum of Zoology). A similar case, involving the same basic label data, was encountered for another scarab of western origin (*Canthon imitator* Brown), which resulted in the erroneous description of a new subspecies (*floridanus* Brown) based on this disjunct distribution (Woodruff, 1973:38-39). During the present study, we saw several specimens with this data, some of which were well out of the normal geographic range, including the only Florida records for *ilicis* and *ephilida*, as well as the only Gainesville records for *georgiana* and *hirticula*.

We are convinced that the above Walker specimens, and potentially any with similar data, were mislabelled. According to Dr. T. H. Hubbell (pers. comm.), F. W. Walker was normally meticulous about keeping field notes, for which a number was usually attached to the pinned specimen. In reference to the *Canthon* mentioned above, Hubbell stated "I think your surmize that they were mislabelled is probably correct, ... the chances are that Walker had nothing to do with this material."

In general, we have had other specimens for which we had good evidence or good reason to doubt their validity. We have eliminated most of these from our data bank without comment. Our basic philosophy is that it is much more difficult to eliminate an error in print than it is to add or clarify questionable records by future collection or study. Some distribution records perpetuated by Luginbill and Painter (1953) are impossible to refute or check because they gave no data source for their maps or statements.

Two other incidents point out the possibility of disassociating genitalia from the specimens, causing confusion and, in one case, synonymy. Luginbill & Painter (1953) used a special "smoking" technique on the genitalia to eliminate glare during photography. These specimens are easily recognized. Unfortunately they did not reassociate the genitalia with the specimens. Their figures and genitalia (which we have in the USNM) for *floridana* are actually the species, *pseudofloridana*, but we could not locate beetles from which the genitalia were dissected.

The other incident was even more confusing. Sanderson (1950) described *murrea* from a unique female from Florida. He mentioned that it resembled *elongata*, but that the female genitalia were of a different type, comparing it to *congrua*. No further specimens have ever been found that match this combination. We borrowed the holotype from the U[illegible] and mounted it for the scanning electron microscope photographs. Although we treated it as a [illegible] during preparation of this manuscript, we are convinced that the body is that of *elongata* and genitalia are those of *clypeata*, creating the new synonymy.

Individual Species Discussions

Phyllophaga analis (Burmeister)
(=*bifoveolata* DuVal, *subsericans* DuVal)

Two specimens in the FSCA represent [illegible] tions of this Cuban species at Miami, Florida

III-47, R. Baker, on *Solanum melongena* Linnaeus var. *esculentum* Nees, from Cuba, SPB Acc. #95342; (1) 1-VI-56, F. A. Buchanan, from Cuba.

Chapin (1932:197-199, fig. 31) redescribed and illustrated this species, recording it from the following Cuban Provinces: Havana, Santa Clara, Camaguey, and the Isle of Pines. He also mentioned that a pair was taken at Ancon, Panama, May 10, 1909, feeding on "mariones", the only Cuban species known to him with a continental record. Box (1953) and Stahl (1929) both listed it as a pest of sugarcane. There is no evidence that it is established in Florida.

***Phyllophaga cribrosa* (LeConte)**

Young and Thames (1949:126) recorded a specimen of this species from "?Orange County, H. T. Townsend". Although they indicated that it was "... very doubtful", they state "It may, however, occur in the xeric sand areas of the Central Highlands of Florida".

Aside from the western distribution (Texas, Oklahoma, New Mexico; *fide* Luginbill & Painter, 1953:51), it is wingless and has limited dispersal powers. We believe the specimen was mislabelled.

***Phyllophaga dissimilis* (Chevrolat)**

This Cuban species has been intercepted several times at Miami, Florida: 6-VI-50, 11-VI-50, 24-VI-50, all by J. E. Porter, on aircraft from Havana, Cuba [INHS]; 5-VI-56, B. B. Sugarman, from Cuba [FSCA]; 2-V-57, D. A. Miller, at *Hibiscus esculentus* Linnaeus, interception No. M-10281, from Cuba [FSCA].

Chapin (1932:201-202, fig. 35) redescribed and figured the species, recording it from the following Provinces in Cuba: Santa Clara, Camaguey, and Oriente. Other Provinces represented in the INHS include: Havana, Pinar del Rio, and Matanzas. Box (1953:9) listed it as a pest of sugarcane in Cuba. There is no evidence that it is established in Florida.

***Phyllophaga drakii* (Kirby)**

Early in this study, we believed this species was found in Florida. However, on further study, all specimens proved to be either *postrema* (fig. 44, 104, 164, 224, 257, 347, 350) or *ulkei* (fig. 56, 116, 176, 236, 262, 371, 374); two species with similar genitalia. It is illustrated here (fig. 14, 74, 134, 194, 243, 283, 286) to aid in this distinction.

Luginbill and Painter (1953:92-93) recorded it from nearly all eastern states, except Florida. It is a very large (av. 22mm long), dark species, often easy to pick out from large collections of mixed species.

***Phyllophaga fraterna* Harris**

Several older lists (Blatchley, 1929; Young & Thames, 1949) recorded this species for Florida. Because of the similarity of several species in this group (e.g., *curialis, floridana, foxii, incuria, mississippiensis, paternoi, pseudofloridana*), some of which were separated only recently, these probably were misidentified. There appear to be no valid Florida records for this species.

It is illustrated here (fig. 22, 82, 142, 202, 247, 300, 303) and distinguished from *floridana* (fig. 18, 78, 138, 198, 244, 293, 296) and *pseudofloridana* (fig. 47, 107, 167, 227, 259, 353, 356). Since *fraterna* is recorded from nearly the entire eastern half of the United States (Luginbill & Painter, 1953), additional study is needed to clarify the species in this complex.

***Phyllophaga glabricula* (LeConte)**

Although no specimens were seen from Florida in the present survey, Luginbill and Painter (1953:60) recorded it from "the prairie States of the United States and also in Florida (fig. 54)." The other states shown on their map are Colorado, Kansas, Nebraska, Oklahoma, and Texas. Since we were unable to find confirmation of this record 1) in the USNM (where many of Luginbill & Painter's specimens reside) or 2) in the extensive collection and records of M. W. Sanderson at the INHS, and 3) this is a very unlikely distribution to include Florida, we doubt this record.

It is possible that the "*glabricula*" was somehow mistaken for "*glaberrima*", a ubiquitous and common species in Florida. The genitalia of *glabricula* are quite distinct and were illustrated by Luginbill & Painter (1953: pl. 53, fig. 6-11).

***Phyllophaga hirtiventris* (Horn)**

One specimen of this species was intercepted at Lake Buena Vista (Orange Co. Florida), 25-III-87, by C. Phelps in a nursery, on *Yucca recurvifolia* Salisbury, from Houston, Texas.

It is treated and illustrated by Luginbill and Painter (1953:57-58, pl. 53, fig. 1-5) and was considered common in some areas. However, no specimens were recorded from Florida, and no others were found during our survey. Fattig (1944:17) recorded a single

Table 6.

List of misspelled use of Florida *Phyllophaga* names.

Misspelling	Correct name	Author, date: page
austricolia	austricola	Fall, 1929a:110 (printer's error)
cupulifornis	cupuliformis	Young & Thames, 1949:127
debelis	debilis	Young & Thames, 1949:127
duvalis	duvalus	Young & Thames, 1949:127
ephilids	ephilida	Hayes, 1925:118
ephilidia	ephilida	Dalla Torre, 1912:188
fosteri	forsteri	Fattig, 1944: 22; Jaques, 1926: 338, 1927: 315, 1928: 304; Owens, 1950:62-63, 83, 88; Travis, 1933: 397, 1934:317
futilus	futilis	Ritcher, 1966:86, 87, 97
futulis	futilis	Jaques, 1926:338, 1927:315, 1928:304
herticula	hirticula	Jaques, 1926:338
illicis	ilicis	Hayes, 1925:15, 81, table 57, 59
implicata	implicita	Hayes, 1925:13, 56, 65; Jaques, 1927:315
anchophora	onchophora	Fattig, 1944:31
prununcillina	prununculina	Cartwright, 1939:285
subpruninosa	subpruinosa	Ray, 1967:45
taxidi	taxodii	Loding, 1945:105
tristic	tristis	Fattig, 1944:29

Georgia specimen from Tate, 27-VI-1932. Except for that record, it appears to be distributed primarily in the central part of the United States (i.e., Arkansas, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, Oklahoma, and Texas). The male and female genitalia are similar in general shape to *latifrons*, but distinct in specific characters.

***Phyllophaga hondura* Saylor**

Three specimens of this Central American species were found at a nursery in Apopka (Orange Co., Florida), 13-V-85, P. Gibson, in unrooted cuttings of devil's ivy or golden pothos (*Epipremnum aureum* (Linden & Andre) Bunt.), shipped from Honduras. One of these was still alive when it was received in Gainesville for identification.

The species is known from Honduras, Belize (British Honduras), and Costa Rica (Saylor, 1943). In Honduras, King (1984) found it common in areas with between 1000 and 2000mm annual rainfall (normally with a 2 year life cycle); he illustrated the genitalia (fig. 5, p.44). Although there is no evidence that it is established in Florida, the increased flow of plants from Central America in the nursery industry, and the interception mentioned above, indicate the probability of introduction.

***Phyllophaga hubbelli* Cartwright**

This species may occur in northern Florida. It was described from 3 specimens (1 male, 2 females) taken in: Alabama, Calhoun Co., Oxford, 1.5mi. S., 18-VII-38, Hubbell and Friauf (misspelled Freauf in original description) [USNM, 1 male]; Georgia, Summerville, 4-VIII-37, P. W. Fattig, on hickory and red oak [INHS, 2 females]. No additional specimens have been reported for this rare species. The distribution suggests that it may be found in the panhandle of Florida.

***Phyllophaga lobata* (Fall)**

There is a single specimen in the FSCA with a very old handwritten label, indicating "Jackson Co., Fla." probably from the University of Florida Agricultural Experiment Station collection; undoubtedly misbelled. A rare species found only in Arizona. It was treated and illustrated by Luginbill & Painter (1953:18

pl. 21, fig. 1-5).

***Phyllophaga lodingi* Sanderson**

A single specimen in the FSCA is from Alachua Co., 17-III-36, with no collector or specific locality. The label is similar to that used for student collections at the University of Florida; undoubtedly mislabelled. A rare mountain species from Madison Co., Alabama. It is treated and illustrated by Luginbill & Painter (1953:82-83, pl. 62, fig. 8-14).

***Phyllophaga omani* Sanderson**

This rare species is a member of the subgenus *Phytalus* and is similar in appearance to *georgiana* and *gracilis*. It is known from 7 specimens: Alabama, Burnsville, 20-VII-30, P. W. Oman (holotype, female); Georgia, Prattsburg, 24-VII-30, R. H. Beamer, at light (allotype, male); Georgia, Thomasville, 28-V-38, W. H. Thames, Jr., on crab apple (1 male) [INHS]; "North America" (Saylor, 1939:162-163; pl. 9, fig. 2a-e; 1 male); Mississippi, Biloxi (Lago, 1980; 1 male); Aiken Co., South Carolina (Riley, 1988; 1 male); and Louisiana, Washington Parish, Lee Memorial Forest, near Sheridan, 7-VIII-85, C. B. Barr, mercury vapor and blacklight sheet (Riley, 1988; 1 male).

Nothing else appears to be known about the species. The record from Thomasville, Georgia, suggests that it may occur in Florida. It was treated and the genitalia illustrated by Saylor (1939:162-163, fig. 2a-d).

***Phyllophaga onchophora* Chapin**

A single specimen of this Cuban species was found at Savannah, Georgia, by P. W. Fattig, at light. The date was recorded by Sanderson (1942:42) as "May 2, 1929", but Fattig (1944:31) listed it as "May 21, 1929" and misspelled the name as "*anchophora*".

The species was described from 5 specimens from the following localities in Cuba: Paso Estancia; Trinidad, Santa Clara; Santiago de las Vegas, Havana; Perico, Matanzas. Since 2 other West Indian species (*youngi* Cartwright and *bruneri* Chapin) are established in Miami, another (*puberula*) was collected once in Miami, and *onchophora* was found in a Georgia port, it eventually may be found in Florida. It was treated and the genitalia illustrated by Chapin (1932:184, fig. 18).

***Phyllophaga portoricensis* Smyth**

A single specimen of this Puerto Rican species was taken at Palm Beach Co., Florida, Delray Beach, 17-V-79, K. Stolley, on *Dracaena deremensis* Engl., from Puerto Rico. It was intercepted live in a shipment of plants, but is not likely to be established in Florida. Along with the similar *Phyllophaga vandinei* Smyth, this is the most economic species of *Phyllophaga* on sugarcane in Puerto Rico (Wolcott, 1948:255-262; Box, 1953:9). It is another member of the subgenus *Cnemarachis*.

***Phyllophaga rugosa* (Melsheimer)**

A single, badly damaged, male specimen has the label data: Florida, Alachua Co., Gainesville, Chantilly Acres, 11-VI-68, F. S. Blanton, mosquito light trap. Although this is a common species in the northeast and midwest, it is not recorded from the tier of states north of Florida (Luginbill & Painter, 1953: fig. 76). Additionally, hundreds of light trap samples over 30 years in Gainesville, and many from Chantilly Acres, have produced no further specimens.

Because of the above, and knowing that the collector operated traps in New York also, this appears to be a label error. It probably is not found in Florida, but for aid in identification, refer to the genitalia illustrations in Luginbill & Painter (1953: pl. 71, fig. 6-12).

***Phyllophaga submucida* (LeConte)**

The only published Florida record for this species is Luginbill and Painter (1953:29, fig. 17). Their distribution map is similar to that for *glabricula* (another questionable Florida record); including Arkansas, Kansas, Missouri, Oklahoma, and Texas, with no records for the tier of states north of Florida. We were unable to verify the source for any Florida specimens (including pers. comm. with M. W. Sanderson), and we do not believe it occurs here. The genitalia were illustrated by Luginbill & Painter (1953: pl. 33, fig. 1-6).

Table 7.
Annotated Alphabetical Checklist of names used for Florida *Phyllophaga*
(synonyms are italicized, valid names are bold face)

aemula (Horn) 1887b:271 — valid species
alpina (Linell) 1896:726 — synonym of **anxia** (LeConte)
anxia (LeConte) 1850:226 — valid species
apicata Reinhard 1939:58 — valid species [described as subspecies of **tristis**]
austricola Fall 1929b:216 — synonym of **debilis** (LeConte)
austricolia Fall 1929a:110 — misspelling of **austricola** Fall in original description; synonym of **debilis** (LeConte)

biimpressa (Smith) 1889a:97 — synonym of **profunda** (Blanchard)
boops (Horn) 1887b:284 — synonym of **dispar** (Burmeister)
brevicollis (Blanchard) 1850:132 — synonym of **anxia** (LeConte)
bruneri Chapin 1932:203 — valid species (subgenus **Cnemarachis**)
burmeisteri (LeConte) 1856:242 — synonym of **ephilida** (Say)
carolina (Fall) 1912:43 — synonym of **uniformis** (Blanchard)
cephalica (LeConte) 1856:245 — synonym of **anxia** (LeConte)
cerasina (LeConte) 1856:241 — synonym of **prununculina** (Burmeister)
ciliata (LeConte) 1856:253 — synonym of **ilicis** (Knoch)
clemens (Horn) 1887b:227 — valid species
clypeata (Horn) 1887b:283 — valid species
comans (Burmeister) 1855:358 — synonym of **diffinis** (Blanchard)
comosa Davis 1920:337 — synonym of **hirticula** (Knoch)
crenulata (Froelich) 1792:94 — valid species
cupuliformis Langston 1924:450 — valid species [described as subspecies of **micans** (Knoch)]
deanii Luginbill 1928:78 — synonym of **subpruinosa** (Casey)
debilis (LeConte) 1856:262 — valid species
decidua (LeConte) 1856:246 — synonym of **futilis** (LeConte)
diffinis (Blanchard) 1850:138 — valid species
dispar (Burmeister) 1855:361 — valid species
dubia (Smith) 1888:183 — synonym of **anxia** (LeConte)
duvalus Robinson 1938:110 — synonym of **schaefferi** Saylor
elizoria Saylor 1937:321 — valid species; new name for **pygidialis**Schaeffer 1906, not Brenske 1892:190.

elongata (Linell) 1896:725 — valid species
ephilida (Say) 1825:196 — valid species
fimbriata (Burmeister) 1855:326 — synonym of **ilicis** (Knoch)
floridana Robinson 1938:110 — valid species
forbesi Glasgow 1916:378 — valid species
forsteri (Burmeister) 1855:325 — valid species
futilis (LeConte) 1850:226 — valid species
foxii Davis 1920:334 — valid species
georgicana (Gyllenhal) 1817:77 — synonym of **crenulata** (Froelich)
georgiana Schaeffer 1909:382 — preoccupied; new name: **schaefferi** Saylor 1937 (not Horn 1885:122)

georgiana (Horn) 1885:122 — valid species (not Schaeffer 1909) (subgenus **Phytalus**)
gibbosa (Burmeister) 1855:324 — synonym of **futilis** (LeConte)
glaberrima (Blanchard) 1850:136 — valid species
gracilis (Burmeister) 1855:361 — valid species
grandior (Linell) 1896:727 — synonym of **profunda** (Blanchard)
hirticula (Knoch) 1801:79 — valid species
hornii (Smith) 1889a:95 — valid species
howei Sanderson 1937a:17 — synonym of **clemens** (Horn)
ilicis (Knoch) 1801:75 — valid species
implicita (Horn) 1887b:262 — valid species
inana (LeConte) 1856:242 — synonym of **gracilis** (Burmeister)

Table 7 (cont.).

infidelis (Horn) 1887b:253	valid species
insperata (Smith) 1889a:93	synonym of **anxia** (LeConte)
integra (LeConte) 1856:258;	synonym of **clypeata** (Horn) (not Say 1835:180-181)
jonesi Sanderson 1939:5	synonym (?) of **ilicis** (Knoch)
knochii (Schoenherr & Gyllenhal) 1817:75	valid species
latifrons(LeConte) 1856:241	valid species
linelli Saylor 137:321	synonym of **implicita** (Horn)
lota Luginbill 1928:87	valid species
luctuosa (Horn) 1887b:254	valid species
lugubris (LeConte) 1856:248	synonym of **forsteri** (Burmeister)
lutescens (LeConte) 1856:249	synonym of **forsteri** (Burmeister)
mariana Fall 1929a:111	valid species
micans (Knoch) 1801:77	valid species
minor Linell 1896:728	synonym of **implicita** (Horn)
murrea Sanderson 1950:90	synonym of **elongata** (Linell)
nova (Smith) 1889a:95	synonym of **forsteri** (Burmeister)
obsoleta (Blanchard) 1850:131	valid species (includes **vanalleri** Schaeffer)(subgenus **Phytalus**)
okeechobea Robinson 1948:33	valid species
ovalis Cartwright 1939:353	valid species
pagilis Saylor 1937:321	synonym of **glaberrima** (Blanchard); new name for **parva** Linell 1896, not Brenske 1892:180
panorpa Sanderson 1950:91	valid species
parva (Linell) 1896:726	synonym of **glaberrima** (Blanchard) (not Brenske 1892:180)
parvidens (LeConte) 1856:259	valid species
perlonga Davis 1920:329	valid species
pilosicollis (Knoch) 1801:85	synonym of **tristis** (Fabricius)
politula (Horn) 1887b:248	synonym of **forsteri** (Burmeister)
porcina (Hentz) 1830:253	synonym of **ilicis** (Knoch)
postrema (Horn) 1887b:233	valid species
profunda (Blanchard) 1850:132	valid species
prununculina (Burmeister) 1855:360	valid species
pseudofloridana Woodruff & Beck	**new species**
puberula (DuVal) 1856:56	valid species
puncticollis Blanchard 1850:133	synonym of **anxia** Blanchard
pygidialis Schaeffer 1906:257	synonym of **elizoria** Saylor (not Brenske 1892:190)
quadrata (Smith) 1889a:94	synonym of **postrema** (Horn)
quercus (Knoch) 1801:72	valid species
rufiola LeConte 1856:256	synonym of **diffinis** (Blanchard)
rugosioides (Linell) 1896:728	synonym of **luctuosa** (Horn)
schaefferi Saylor 1937:321	valid species; replacement name for **georgiana** Schaeffer 1909:382, not Horn 1885:122.
semicribrata (LeConte) 1856:247	synonym of **forsteri** (Burmeister)
serricornis (LeConte) 1856:247	synonym of **futilis** (LeConte)
skelleyi Woodruff & Beck	**new species**
sororia (LeConte) 1856:246	synonym of **diffinis** (Blanchard)
subpruinosa (Casey) 1884:38	valid species
taxodii Langston 1924:449	valid species
tecta Cartwright 1944:32	valid species
tristis (Fabricius) 1781:39	valid species
ulkei (Smith) 1889a:94	valid species
uniformis (Blanchard) 1850:133	valid species
uninotata (Walker) 1866:323	synonym of **anxia** (LeConte)
vanalleri (Schaeffer) 1927:215	synonym of **obsoleta** (Blanchard): **new synonym**
volvula LeConte) 1856:235	synonym of **gracilis** (Burmeister)
yemasseei Cartwright 1944:30	valid species
youngi Cartwright 1935:102	valid species (subgenus **Cnemarachis**)

Table 8. Summary of Taxonomic Character States

	Antenna 9-segmented	Antenna 10-segmented	Male antennal club = stem	Male antennal club shorter than stem	Male antennal club longer than stem	Clypeus entire	Clypeus emarginate	Tooth of male anterior tarsal claw median	Tooth of male anterior tarsal claw postmedian	Tarsal claws cleft	Body pubescent	Body glabrous	Body pruinose	Male lower posterior tibial spur fixed, long [1]	Male lower posterior tibial spur fixed, reduced [2]	Male lower posterior tibial spur moveable	Male genitalia asymmetrical	Male genitalia symmetrical	Length minimum (mm)	Length maximum (mm)
aemula		X		X			X	X			X				X			X	17.4	24.8
anxia		X	X				X	X				X		X			X		17.2	23.6
apicata		X		X		X			X		X					X		X	10	13
bruneri	X			X			X	X				X			X		X		7.8	10.3
clemens	X		X			X			X			X				X		X	9.5	11
clypeata	X		X			X			X			X				X		X	15.9	18
crenulata		X		X				X	X		X			X	X			X	14.8	22.2
cupuliformis		X	X				X	X					X		X		X		13.8	17.8
debilis	X		X			X			X				X					X	9.7	12.5
diffinis	X						X	X					X		X				14	16.8
dispar	X		X			X			X				X				X		11	12.9
elizoria		X					X	X					X				X		14.4	17.3
elongata		X	X					X					X			X			12.4	15.5
ephilida		X	X					X	X				X			X			13	17.8
floridana		X	X					X					X		X			X	16.6	20.6
forbesi		X						X	X				X			X			13.6	17.9
forsteri		X	X					X	X				X			X			14.4	18.5
foxii		X	X					X	X				X			X			16.5	19
futilis		X		X				X	X			X				X			14.2	17.9
georgiana					X			X		X									11.6	14.5
glaberrima		X	X					X		X									13.1	16.5
gracilis		X	X					X	X				X						10	13.2
hirticula		X	X					X	X										16.2	20
hornii		X	X					X	X				X						19	23.1
ilicis		X	X					X	X										18.3	23.9
implicita	X		X					X	X				X						14.6	18.5
infidelis		X		X				X	X										18.3	20.7

[1] Long = 1/2 or more length of upper spur.
[2] Reduced = less than 1/2 length of upper spur.

Table 8. Summary of Taxonomic Character States

	Antenna 9-segmented	Antenna 10-segmented	Male antennal club = stem	Male antennal club shorter than stem	Male antennal club longer than stem	Clypeus entire	Clypeus emarginate	Tooth of male anterior tarsal claw median	Tooth of male anterior tarsal claw postmedian	Tarsal claws cleft	Body pubescent	Body glabrous	Body pruinose	Male lower posterior tibial spur fixed, long [1]	Male lower posterior tibial spur fixed, reduced [2]	Male lower posterior tibial spur moveable	Male genitalia asymmetrical	Male genitalia symmetrical	Length minimum (mm)	Length maximum (mm)
knochii		X	X				X	X				X		X			X		19.7	23.3
latifrons		X			X	X		X					X	X				X	12.8	19.3
lota	X		X			X		X				X		X				X	9.6	13.7
luctuosa		X		X			X	X				X		X			X		17.8	23.6
mariana		X		X			X	X			X					X		X	19.8	24
obsoleta		X			X		X			X		X				X		X	13	17.5
okeechobea		X	X				X		X		X					X		X	13	16.2
ovalis		X	X				X	X				X		X			X		18.4	21.6
panorpa		X			X		X		X		X				X			X	16.1	19.1
parvidens		X	X				X		X		X		X			X		X	13.9	22.3
perlonga		X	X				X	X				X		X			X		20.8	24..7
postrema		X	X				X	X				X		X			X		18.6	23.7
profunda		X	X				X	X				X		X			X		18.7	25.2
prununculina		X			X		X		X				X		X			X	14	18.5
pseudofloridana		X	X				X	X				X		X			X		14	18.3
puberula	X		X				X	X			X					X		X	14.5	16.7
quercus	X		X				X	X					X			X		X	12.3	16.9
schaefferi		X	X				X	X				X			X		X		15.1	18
skelleyi		X			X				X		X					X		X	15	19.4
subpruinosa		X	X				X	X					X	X				X	14.1	16.6
taxodii	X		X			X			X			X		X				X	10.6	15.9
tecta		X	X				X	X				X		X			X		16.1	21.8
tristis		X	X			X			X		X					X		X	10	14
ulkei		X	X				X	X				X		X			X		12.7	24
uniformis		X		X			X	X				X			X			X	13.7	17.7
yemasseei	X		X			X			X			X		X				X	10	10.9
youngi	X			X			X	X				X				X		X	15.4	17.5

[1]Long = 1/2 or more length of upper spur.
[2]Reduced = less than 1/2 length of upper spur.

Key to Adults of Florida *Phyllophaga*

1. Tarsal claws toothed (fig. 379, 381, 382, 383, 384) 2
1'. Tarsal claws cleft (fig. 380, 383); subgenus *Phytalus* 3

2(1). Hind and middle tibiae with incomplete carina; lateral tibial margin with separate edges or well marked spines (fig. 426-427); 3 introduced Cuban species, known only in Miami area; see male genitalia 186, 228, 239, 240 subgenus *Cnemarachis* 4
2'. Hind and middle tibiae with complete transverse or oblique carina at middle; lateral tibial margin without edges or spines; subgenus *Phyllophaga* 6

3(1'). Tarsal cleft with terminal (outer) tooth longest (fig. 380); male genitalia: symmetrical, with 2 long projections, not united at tip (fig. 24, 84, 144, 204); female genitalia: pubic process bifurcate, deeply divided (fig. 305, 308) ..... *georgiana* Horn
3'. Tarsal cleft with lower (inner) tooth longest (fig. 383); male genitalia: symmetrical, the tip united, without projections (fig. 38, 98, 158, 218); female genitalia: pubic process missing, tip of plates not prolonged or deeply divided (fig. 335, 338) ..... *obsoleta* (Blanchard)

4(2). Body with dark pattern (often metallic) on elytral suture, disc of pronotum (fig. 476); aedeagus with group of spines pointing dorsally toward large paired hooks, covered by a dorsal shield (fig. 186); distribution: Cuba, Miami to Ft. Lauderdale and Naples; length 7.8-10.3mm ..... *bruneri* Chap
4'. Body uniformly pale-colored, never dark on elytral suture or disc of pronotum; genitalia as in fig. 22 239, 240; length 14.5-17.5mm .....

5(4'). Body glabrous, shiny, without dorsal pubescence; male genitalia with parameres projecting into bo shaped tip (fig. 239), aedeagus asymmetrical, flared at tip (fig. 59); female genitalia: fig. 377-3 distribution: Bahamas, Miami (Brickell Hammock); length 15.4-17.5mm ..... *youngi* Cartwri
5'. Body pubescent with short hairs; parameres of male genitalia without boot-shaped tip, smoothly roun to tip (fig. 228), aedeagus symmetrical to near the produced, nearly pointed tip (fig. 48); female g talia: fig. 354, 357; distribution: Cuba, Miami (1 record); length 14.5-16.7mm ..... *puberula* (Du

6(2'). Body above pubescent, hairs long or short .....
6'. Body above glabrous, if setae present, widely scattered .....

7(6). Setae of elytra arranged in rows; male genitalia asymmetrical (fig. 27), female genitalia: fig. 31 ..... *hirticula* (K
7'. Setae of elytra variable but never in rows; male genitalia mostly symmetrical (except *ilicis*) .....

8(7'). Male genitalia asymmetrical (fig. 29, 89, 149, 209, 250); female genitalia with elongate, bifurcat process (fig. 313, 316) .....
8'. Male genitalia symmetrical (fig. 1, 4, 9, 15, 16, 36, 39, 41, 42, 55); female genitalia variable, exactly as above .....

9(8'). Hairs of dorsum exceptionally long, especially on pronotum; small (10-14mm); clypeus entire (aedeagus protruding between parameres (fig. 4, 55); [*tristis* complex] .....
9'. Hairs of dorsum variable, from short-recumbent to long-erect; larger (12.4-24mm); clypeus en aedeagus not protruding between parameres. .....

10(9). Aedeagus with short terminal spinose process (fig. 184, 468, 471), area behind it shaped as wish-bone (fig. 4, 64, 124, 470); females indistinguisable from *tristis*; in Florida, recorded only from Alachua & Union Co. ..... *apicata* Reinhard

10'. Aedeagus with long curved terminal spinose process (fig. 235, 469, 473), area behind not wish-bone shaped (fig. 55, 115, 175, 472); females indistinguishable from *apicata*; in Florida, recorded only from panhandle ..... *tristis* Fabricius

11(9'). Larger species (19.8-24mm); dorsal hairs uniform, not longer on pronotum; male genitalia with trilobed appearance (unique) (fig. 36, 96, 156, 216); female genitalia: 329, 332 ..... *mariana* Fall

11'. Size variable (12.4-24.8mm), but mostly smaller species (12.4-20mm); dorsal hairs variable, from short to extremely long and recumbent on pronotum; male genitalia not trilobed; female genitalia variable 12

12(11'). Pubescence variable, sometimes long on pronotum; lower male posterior tibial spurs both movable; body shape widest behind, not parallel sided; male genitalia variable (fig. 1, 9, 15, 39, 42, 51) 14

12'. Pubescence short, not obvious; lower male posterior tibial spur fixed and reduced; body shape nearly parallel sided; male genitalia with parameres produced, not united at tip (fig. 16, 41) 13

13(12'). Smaller (12.4-15.5mm); tips of male parameres concave on inside (fig. 16, 498); tooth of male tarsal claws basal, but noticeable; female genitalia: fig. 288, 291 ..... *elongata* Linell

13'. Larger (16.1-19.1mm); tips of male parameres convex on inside (fig. 41, 499); tooth of male tarsal claws missing; female genitalia: fig. 341, 344 ..... *panorpa* Sanderson.

14(12). Male genitalia in caudal view with almost circular opening, the parameres united at tip (fig. 1, 9) 15

14'. Male genitalia in caudal view with opening elongate, oval, the parameres elongate and somewhat carinate (fig. 15, 39, 42, 51) 16

15(14). Male genitalia with parameres prolonged at tip, the notch between acute (fig. 1, 61, 121, 181); female genitalia (fig. 263, 266) with outer angle of pubic process truncate, not pointed ..... *aemula* (Horn)

15'. Male genitalia with parameres not prolonged at tip, the notch between wide, obtuse (fig. 9, 69, 129, 189); female genitalia (fig. 275, 278) with outer angle of pubic process produced, pointed .... *crenulata* (Froelich)

16(14'). Pronotal pubescence similar to that of elytra, short, recumbent; male genitalia deeply, broadly notched above aedeagal opening, parameres divided for most of their length, the tips touching (fig. 42) .... *parvidens* (LeConte)

16'. Pronotal pubescence longer than that of elytra, long and some erect (fig. 586, 587); male genitalia not notched at top of aedeagal opening, parameres divided for short distance, the tips diverging, pointed (fig. 15, 39, 51) 17

17(16'). Male genitalia with double carina above aedeagal opening; outer margin of parameres indented opposite where they unite below (fig. 15, 39) 18

17'. Male genitalia not carinate above aedeagal opening; outer margin of parameres evenly arcuate (not indented) from top to tip (fig. 51, 111, 171, 231; female 360, 363) ..... *skelleyi* n.sp

18(17). Male genitalia in ventral/caudal view with the carinae above aedeagal opening on each side of a deep groove, sides more swollen (fig. 39, 99, 159, 219, 494); possibly diurnal ..... *okeechobea* Robinson

18'. Male genitalia in ventral/caudal view with the carinae on each side of raised area, not deeply grooved, sides less swollen (fig. 15, 75, 135, 195, 495); nocturnal ..... *elizoria* Saylor

19(6'). Body above pruinose (velvety), sometimes slightly iridescent 20
19'. Body above mostly shining, never pruinose, not iridescent 24

20(19). Clypeus entire (fig. 423); 8th sternite of male with bifurcate process (fig. 542) (male genitalia: fig. 33, 93, 153, 213; female genitalia: fig. 323, 326) ..... *latifrons* (LeConte)
20'. Clypeus emarginate; 8th sternite of male without process; genitalia not as above 21

21(20'). Lower spur of posterior tibia (male) missing (fig. 400); tooth of anterior tarsal claw postmedian; male genitalia: fig. 46, 106, 166, 226; female genitalia: fig. 349, 352 ..... *prununculina* (Burmeister)
21'. Lower spur of posterior tibia (male) variable, but always present; tooth of anterior tarsal claw median; male & female genitalia not as above 22

22(21'). Lower spur of posterior tibia (male) movable (fig. 401); body color reddish to chestnut brown, never dark purplish; body parallel sided; male genital parameres united: fig. 49, 109, 169, 229; female genitalia: fig. 355, 358 ..... *quercus* (Knoch)
22'. Lower spur of posterior tibia (male) fixed (fig. 399); body color purplish (at least the pruinose sheen); body wider behind; male genitalia with parameres separated (fig. 10, 52) 23

23(22'). Tooth of anterior tarsal claw strong, acute; male genitalia: fig. 52, 112, 172, 232; female genitalia: fig. 361, 364 ..... *subpruinosa* (Casey)
23'. Tooth of anterior tarsal claw weak, obtuse (fig. 382); male genitalia: 10, 70, 130, 190; female genitalia: 276, 279 ..... *cupuliformis* Langston

24(19'). Male genitalia asymmetrical 25
24'. Male genitalia symmetrical 43

25(24). Antenna 9-segmented. 26
25'. Antenna 10-segmented 28

26(25). Small (9.7-12.5mm), pale yellow; tooth of anterior tarsal claw post median; male genitalia wit parameres overlapping at tip (fig. 11, 71, 131, 191); female genitalia with pubic process pointed, a dee V-shape division at tip (fig. 277, 280) ..... *debilis* (Hor
26'. Larger (14-18.5mm), dark brown; tooth of anterior tarsal claw median; male genitalia with paramer not overlapping at tip (fig. 12, 30); female genitalia with pubic process truncate at tip (fig. 281, 317 .....

27(26'). Male genitalia (fig. 12, 72, 132, 192) with large cusps on each paramere, tips broad; female genitalia (281, 284) with pubic process projecting laterally with about 13 long setae ..... *diffinis* (Blancha
27'. Male genitalia (fig. 30, 90, 150, 210, 251) with parameres projecting to pointed tip, without large cu on each side; female genitalia (fig. 317, 320) with pubic process projecting forward, truncate, with a 4 long setae ..... *implicita* (H

28(25'). Lower posterior tibial spur (male) movable; male genitalia (fig. 31, 50); female genitalia: 318, 3 .....
28'. Lower posterior tibial spur (male) fixed; genitalia variable, not as above .....

29(28). Male antennal club shorter than stem; body oval, shiny, convex, larger (18.3-20.7mm); male ger fig. 31, 91, 151, 211, 252; female genitalia: fig. 318, 321 ..... *infidelis*
29'. Male antennal club equal to stem; body more parallel, more rugose, elytra more flattened, smaller 18mm); male genitalia: fig. 50, 110, 170, 230, 260; female genitalia: fig. 359, 362 .. *schaefferi*

30(28'). Male genitalia with nearly round opening to aedeagus, paramere tips overlapping below, pointing toward each other (fig. 43, 44, 56) 31

30'. Male genitalia with parameres elongate or with large cusps, the opening to aedeagus recessed more deeply, variable in shape at the parameres which never overlap at tip (fig. 2, 18, 20, 21, 28, 32, 35, 40, 45, 47, 54) 33

31(30). Male with right paramere produced outward, the bottom border truncate, broad, basal piece exceptionally long (fig. 43, 103, 163, 223, 256); female genitalia: fig. 343, 346; rare species in Florida panhandle ..... *perlonga* Davis

31'. Male genitalia nearly symmetrical except for overlapping paramere tips, right paramere similar to left, not produced outward, basal piece normal length (fig. 44, 56); female genitalia: fig. 347, 371; more common species, extending to peninsula 32

32(31'). Male genitalia with right paramere having 2 posteriorly projecting processes (fig. 224); female genitalia: fig. 347, 350 ..... *postrema* (Horn)

32'. Male genitalia with right paramere having 1 posteriorly projecting process (fig. 236); female genitalia: fig. 371, 374; beetle: fig. 417 ..... *ulkei* (Smith)

33(30'). Left paramere of male genitalia with diagonal carina on outside (fig. 258, 566); large species (18.7-25.2mm); female genitalia: fig. 348, 351; Florida records only from Florida Caverns St. Pk. ..... *profunda* (Blanchard)

33'. Left paramere of male genitalia with no carina on outside; size variable (14mm-23.6mm); female genitalia not as above 34

34(33'). Parameres of male genitalia pointing downward, nearly pointed at tip, barely asymmetrical, no large cusps formed inside parameres (fig. 2, 62, 122, 182); female genitalia with truncate, bifurcate pubic process (fig. 264, 267); Florida records only from Torreya St. Pk. ..... *anxia* (LeConte)

34'. Parameres of male genitalia usually not projecting downward, but rounded parameres forming large cusps (fig. 18, 20, 21, 28, 32, 35, 40, 47, 54); female genitalia not as above; some widespread common species 35

35(34'). Parameres of male genitalia in ventral view (fig. 100) pointing in opposite directions, posteriorly (left) and anteriorly (right), many long setae on inside edge of parameres; female genitalia with long internal process and broadly divided pubic process (fig. 337); rare, large (18.4-21.6mm), oval, shiny species, known only in western Florida panhandle; beetle: fig. 416 ..... *ovalis* Cartwright

35'. Parameres of male genitalia in ventral view not pointing in opposite directions, with only a few setae on inside; female genitalia not as above; size and shape variable 36

36(35'). Male antennal club shorter than stem; large (17.8-23.6mm), oval, piceous species with coarsely punctate pronotum; male genitalia: fig. 35, 95, 155, 215, 254; female genitalia: fig. 325, 328 *luctuosa* (Horn)

36'. Male antennal club equal in length to stem; size, shape, and color variable; male and female genitalia not as above 37

37(36'). Right internal process of male paramere modified into a hook or S-shape, the left paramere with a double cusp, formed by a carina medially (fig. 28, 88, 148, 208, 249, 529); female genitalia: fig. 312, 315; Florida panhandle ..... *hornii* (Smith)

37'. Right internal process of male paramere not modified into a hook, the left paramere with only 1 cusp, no median carina; female genitalia not as above 38

38(37'). Left paramere with posteriorly projecting tooth at top (fig. 200), top of phallobase with medial knob (fig. 20); female genitalia: fig. 295, 298; small (14.4-18.5mm), oval, castaneous, shiny ..... *forsteri* (Burmeister)

38'. Left paramere not projecting posteriorly into a tooth; top of phallobase without noticeable knob; genitalia not as above; size variable (14-23.6mm), shape and color variable 39

39(38'). Pronotum coarsely punctate, the median line noticeable; elytra castaneous with head and pronotum darker; large (19.7-23.3mm); male genitalia: fig. 32, 92, 152, 212, 253; female genitalia: 319, 322 ..... *knochii* Schoen. & Gyll.

39'. Pronotum not coarsely punctate, the median line not obvious; color nearly uniform; size variable (14-21.8mm); male genitalia: fig. 18, 21, 47, 54; female genitalia: fig. 293, 299, 353, 366 40

40(39'). Color reddish brown to castaneous; large (16.1-21.8mm), oval, shiny, striae obliterated; male genitalia: fig. 54, 114, 174, 234, 261; female genitalia: fig. 366, 369; common at Gainesville ..... *tecta* Cartwright

40'. Color dark brown to black; size variable (14-20.6mm), shape variable, elytra less shiny because of strial indications and punctures; genitalia not as above (male: fig. 18, 21, 47; female: 293, 299, 353); *fraterna* complex 41

41(40'). Internal process of right paramere sharply pointed, male genitalia: fig. 21, 81, 141, 201, 246; female genitalia: 299, 302 [Sanford, Florida]; male: fig. 510-514; female: 515, 516 [South Carolina], Florida record questionable ..... *foxii* Davis

41'. Internal process of right paramere not sharply pointed, flat and broad, male genitalia: fig. 18, 47; female genitalia: fig. 293, 353 42

42(41'). Size larger (16.6-20.6mm); internal process of right paramere directed posteriorly (tip often hidden by carina or cusp of right paramere), the area above aedeagal opening not swollen into distinct knob from right lateral view; male genitalia: fig. 18, 78, 138, 198, 244; female genitalia: fig. 293, 296; peninsular Florida (see map fig. 504) ..... *floridana* Robinson

42'. Size smaller (14-18.3mm); internal process of right paramere directed upward (tip usually visible from right lateral view), the area above aedeagal opening swollen into a distinct knob (fig. 571, 572); male genitalia: fig. 47, 107, 167, 227, 259; female genitalia: fig. 353, 367, 573; north Florida, south Georgia ..... *pseudofloridana* n. sp.

43(24'). Antennae 9-segmented; clypeus entire; mostly small species (9.5-15.9mm), except *clypeata* (15.7-18mm); male genitalia: fig. 7, 8, 13, 34, 53, 58; female genitalia: fig. 270, 271, 282, 324, 365, 373 4

43'. Antennae 10-segmented; clypeus emarginate; some larger species (13-17.9mm), except *gracilis* (10-13.2mm); male genitalia: fig. 17, 19, 23, 25, 26, 57; female genitalia: fig. 289, 294, 301, 306, 307, 37 4

44(43). Lower male posterior tibial spur movable; male genitalia with parameres long, cylindrical (fig. 18 193); female genitalia with pubic process long, cylindrical (fig. 271, 282) .....

44'. Lower male posterior tibial spur fixed; male genitalia variable, but not long, cylindrical (fig. 187, 21 233, 238); female genitalia variable (fig. 270, 324, 365, 373) .....

45(44). Larger (15.7-18mm); color castaneous to brown; male genitalia: fig. 8, 68, 128, 188; female genital fig. 271, 274 ..... *clypeata* (Ho

45'. Smaller (11-12.9mm); color dark brown to piceous; male genitalia: fig. 13, 73, 133, 193; fem genitalia: fig. 282, 285 ..... *dispar* (Burmeis

46(44'). Anterior tarsal claw of male with tooth median; male genital parameres sharply pointed at tip, with a knob above directed inward (fig. 34, 94, 154, 214); female genitalia unique with 3 lobes on pubic process, the median directed upward and setate (fig. 323, 327) ..... *lota* Luginbill

46'. Anterior tarsal claw of male with tooth postmedian (nearer base than tip); male genitalia variable (fig. 7, 53, 58), but parameres not pointed; female genitalia not trilobed (fig. 270, 365, 373) 47

47(46'). Larger (10.6-15.9mm); male genital parameres flattened in caudal view, indented laterally at above half their length (fig. 53, 113, 173, 233); pubic process of female genitalia bifurcate, the tips pointed (fig. 365, 368); specific to cypress ..... *taxodii* Langston

47'. Smaller (9.5-11mm); male genital parameres not flattened in caudal view, not indented laterally (fig. 7, 58); pubic process of female genitalia either not bifurcate, or tips truncate (fig. 270, 373) 48

48(47'). Male genital parameres more than twice as long as wide, with cluster of long setae internally and on tips, and no secondary process on caudal face of parameres (fig. 7, 67, 127, 187); pubic process of female genitalia not bifurcate, tip triangular (fig. 270, 272) ..... *clemens* (Horn)

48'. Male genital parameres about as wide as long, without setae between or at tips, and an extra process on caudal face of parameres (fig. 58, 118, 178, 238); pubic process of female genitalia bilobed, the tips truncate (fig. 373, 376) ..... *yemasseei* Cartwright

49(43'). Smaller (10-13.2mm); male genital parameres prolonged downward, pointed, sickle-shaped from side view, setae projecting posteriorly along inside of curve (fig. 26, 86, 146, 206); female genitalia: fig. 307, 310 ..... *gracilis* (Burmeister)

49'. Larger (13.1-17.9mm); male genital parameres not as above (fig. 17, 19, 23, 25, 57); female genitalia: fig. 289, 294, 301, 306, 372 50

50(49'). Lower male posterior tibial spur reduced (less than half length of upper movable spur); male genitalia: fig. 17, 25, 57; female genitalia: fig. 289, 306, 372 51

50'. Lower male posterior tibial spur long (more than half length of upper movable spur); male genitalia: fig. 19, 23; female genitalia: fig. 294, 301 53

51(50). Male genitalia elongate, cylindrical, parameres divided, resembling 4 long fingers, the outer (lower) ones longer and strongest; male genitalia: fig. 17, 77, 137, 197; female genitalia: fig. 289, 292; Florida records doubtful ..... *ephilida* (Say)

51'. Male genitalia elongate or not, parameres not produced into 4 finger-like projections; male genitalia: fig. 25, 57; female genitalia: fig. 306, 372; common Florida species 52

52(51'). Male anterior tarsal claws with tooth median; male genitalia 3 times longer than high (fig. 57, 117, 177, 237); pubic process of female genitalia long, cylindrical, not bifurcate at tip, no setae on tip (fig. 372, 375) ..... *uniformis* (Blanchard)

52'. Male anterior tarsal claws with tooth post median (nearer base than tip); male genitalia about 2 times longer than high (fig. 25, 85, 145, 205); pubic process of female genitalia flattened ventrally, bifurcate, the tips with setae (fig. 306, 309) ..... *glaberrima* (Blanchard)

53(50'). Male genital parameres forming a cup-shape below, without inward projecting fingers at caudal apex or internally (fig. 28, 83, 143, 203); pubic process of female genitalia broad, resembling superior plates, not cylindrical (fig. 301, 304); male anterior tarsal claws with median tooth; male lower posterior tibial spur fixed, modified into unique, long, boot-shaped process (fig. 395) ..... *futilis* (LeConte)

53'. Male genital parameres forming a cylinder, not cup-shaped below, but with caudal and ventral (median) finger-like projections (fig. 19, 79, 139, 199); pubic process of female genitalia prolonged into a cylindrical shape (fig. 294, 297); male anterior tarsal claws with tooth postmedian; male lower posterior tibial spur fixed, half length of upper ..... *forbesi* Glasgow

Phyllophaga aemula (Horn)
(fig. 1, 61, 121, 181, 263, 266, 464, 465)

Lachnosterna aemula Horn 1887b:271.
Phyllophaga aemula, Glasgow 1916:373.

TYPE LOCALITY: "northern Georgia".

DIAGNOSIS: Superficially it is similar to the following hirsute Florida species (see genitalia figures in parentheses for comparison): *crenulata* (male: 9, 69, 129, 189; female: 275, 278); *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *ilicis* (male: 29, 89, 149, 209, 250; female: 313, 316); *mariana* (male: 36, 96, 156, 216; female: 329, 332); *parvidens* (male: 42, 102, 162, 222; female: 342, 345); and *skelleyi* (male: 51, 111, 171, 131; female: 360, 363).

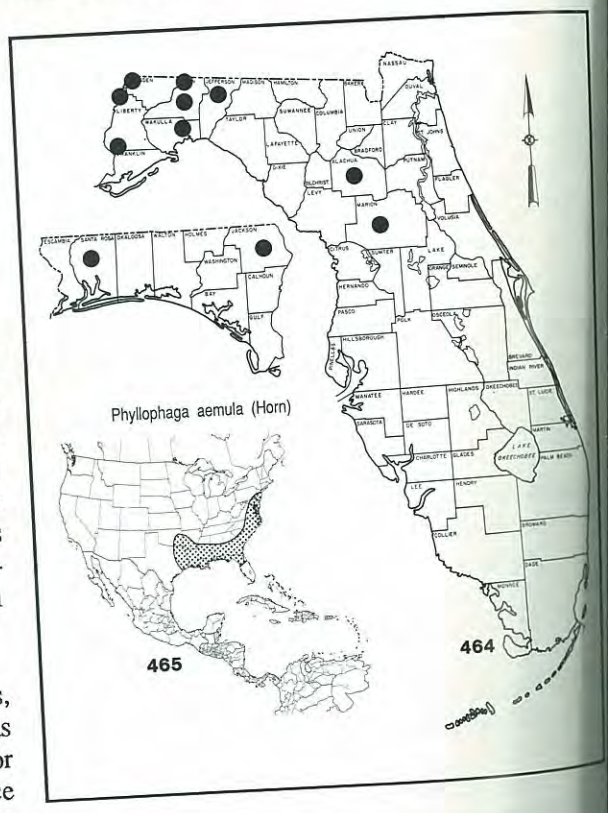
In addition, *aemula* and *parvidens* have pruinescent elytra under the pubescence, whereas *crenulata* does not. In male *ilicis* the body is narrower, the antennal club is longer, and the lower tibial spur is fixed. The male genitalia of *aemula* have the bottom of the claspers projecting, but in *crenulata* they are gently rounded.

DESCRIPTION: **Length**: 17.4-24.8mm; **Width**: 9.6-13.2mm. **Shape**: oblong, oval, robust. **Color**: brown. **Vestiture**: pubescent, clothed with fine, short, recumbent hairs; surface pruinose. **Antenna**: 10-segmented; male club two-thirds length of stem. **Clypeus**: emarginate; border narrowly reflexed. **Tarsal Claws**: tooth large, acute, median. **Male Posterior Tibial Spurs**: lower movable, two-thirds length of upper; both spurs broad and attenuate. **Female Genitalia**: fig. 263 (ventral), 266 (lateral). **Male Genitalia**: fig. 1 (caudal), 61 (ventral), 121 (dorsal), 181 (right lateral).

TAXONOMIC NOTES: A fairly uniform species, with no synonyms having been created. Variation was noted primarily in body color (from light to dark or reddish brown). As with *crenulata*, the pubescence sometimes appears more noticeable, due to the thickness of individual setae and partial removal from wear. The holotype male (Type No. 3683) and paratype female (No. 3683), labelled "Ga.", from the Horn collection, were examined at the MCZC; both have the genitalia dissected. Also in the Horn collection are: (2) "Haulover, Fla., March, 364", and (1) "Horn Coll. H 10259."

U.S. DISTRIBUTION (fig. 465): Luginbill & Painter (1953: fig. 11) recorded it from **Alabama, Arkansas, Florida, Georgia, Mississippi, New Jersey, North Carolina, Oklahoma, South Carolina**, and **Virginia**. In addition, Reinhard (1950:37) recorded it from **Texas** (Brazos Co.), and Riley (1988: map 2) recorded it from **Louisiana** (8 localities in 7 parishes).

The **Arkansas** record was based on 1 specimen from Crawford Co. (Sanderson, 1944:21). Smith (1910:319) saw only 1 from **New Jersey** (DaCosta). Loding (1945:105) listed 8 counties in **Alabama**, and Langston (1927:63) listed 9 records from **Mississippi**. Cartwright (1934:268) saw a single specimen from Clemson, **South Carolina**. Although the type locality is "northern **Georgia**," Fattig (1944:27) saw only 5 specimens in his extensive **Georgia** survey (Albany, Head River, Thomasville).



FLORIDA DISTRIBUTION (fig. 464): Our southernmost record is Ocala (Marion Co.), and it probably occurs from there north and west to include the entire panhandle. Smith (1889b:518) reported specimens from Haulover, Florida collected by Schwarz, and these are the basis for Blatchley's (1929:69) record from "Haulover (Sz. Ms. and Fall)". He apparently saw no Florida specimens. We believe these specimens may be a misidentification and represent one of the *elizoria* complex. Young and Thames (1949:12

repeated Blatchley's record and added: "locally common in northern part of state."

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:20) listed the adult season as May to July. Our earliest Florida record was April 18 (Florida Caverns State Park) and the latest was October (Gainesville). At Gainesville it was most abundant in July and August.

There is a curious note on behavior by Schwarz (1891:241) which follows: "In 1875 while in camp at Haulover Canal, in Florida, I had occasion to observe *Lachnosterna aemula*, which in the earlier part of March was flying about after dark, but also in the early morning, when it was still so dark that the flying beetles could only be heard but not seen."

Smith (1889b:518) erroneously cited this reference to read "... Haulover, Fla., March 11-13 ... they fly shortly before sunrise, *instead of at dusk and early evening*, as do most of the other species." [italics ours]. The identity of Schwarz's specimens is in doubt, since we have not found *aemula* that far south, and in 1891 the 2 species that we suspect he had (*elizoria* or *okeechobea*) were not yet described. However, the reference to a species having early morning flight gave us another clue to the habits of the rare *okeechobea* (see discussion under that species).

Adult Host Plants: Beech, ebony, pine, rose, willow [families] (Luginbill & Painter, 1953:20); cypress, pine (Langston, 1927b:63); willow oak (Sanderson, 1944:21); red oak, persimmon (Fattig, 1944:27); pecan, grape (Reinhard, 1950:47); dogwood (Riley, 1988:72).

Immatures: Only the first instar larva has been described, and care should be used when comparing it with the third instar of other species (e.g., in our Key). On larval characters, Boving (1942:29-30, fig. 2, 8) placed it in his group 1, along with *crenulata, rubiginosa*, and *parvidens*. His description follows: "Posterior part of labrum with no setae. Anterior marginal region of frons with 2 setae on each side. Epicranium on each side opposite concave posterior part of frontal suture and epicranial suture with 2 setae. Dorso-molar region of right mandible (Fig. 4) with an oblique series of about 5 setae at the anterior part of mola and 15 to 20 setae in a patch behind; dorso-exterior region with a few punctures or usually bare; scrobis with a longitudinal row of 6 punctures; ventro-lateral carina without setae. Maxillary articulating area ventrally with about 5 short, thick, dark granules (Figs. 2, 6). Epipharynx with 5 large heli in a distal row and 2 short ones in a proximal row. Proplegmatium (Fig. 5) distinct, subelliptical, moderately wide with 7 to 10 preplegmata; chaetoparia with few, usually setula-bearing punctures; crepidal punctures about 4. Raster (Fig. 8) with inversely spatulate septula; each palidium with one irregular row of from 25 to 27 straight, sharply pointed, moderately long, densely set pali; preseptular setae about 12, long, and arranged in three very irregular transverse rows. Hatching spine (Fig. 3) represented by a weakly sclerotized, thin, yellowish plate."

SPECIMENS EXAMINED: 450 from the following 9 Florida counties: Alachua, Gadsden, Jackson, Jefferson, Leon, Liberty, Marion, Santa Rosa, and Wakulla. Over 255 specimens, representing 111 records, were from Gainesville. For complete data, see Appendix 1.

SELECTED REFERENCES: Blatchley, 1929:69; Boving, 1937:5; 1942:12-13, 15, 21, 23, 29-30, 58, 61, 62, figure 2-8, 204-205; Cartwright, 1934:268; Dalla Torre, 1912:183; Fattig, 1944:7-8, 27; Glasgow, 1916:373-374; Horn, 1887b:265, 270-271, 295; Langston, 1927b:62-63, 87, plate 10, figure 39; Leng, 1920:256; Loding, 1945:105; Luginbill & Painter, 1953:5, 20, figure 11, plate 22(1-4); Reinhard, 1946:479; 1950:47; Riley, 1988:49, 51, 54, 70-73, 112, 172, 208, figure 57-60, map 2, table 3-4; Sanderson, 1944:16, 21, table 1; Schwarz, 1891:241; Smith, 1889a:518, figure 66, plate 58; 1910:319; Travis, 1933:397; Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga anxia (LeConte)

(fig. 2, 3, 62, 63, 122, 123, 182, 183, 241, 242, 264, 267, 466, 467)

Lachnosterna anxia LeConte 1850:226.
Ancylonycha brevicollis Blanchard 1850:132.
Ancylonycha puncticollis Blanchard 1850:133.
Lachnosterna cephalica LeConte 1856:245.
Ancylonycha uninotata Walker 1866:323.
Lachnosterna dubia Smith 1888:183.
Lachnosterna insperata Smith 1889a:93.
Lachnosterna alpina Linell 1896:726.
Phyllophaga anxia, Glasgow 1916:371.

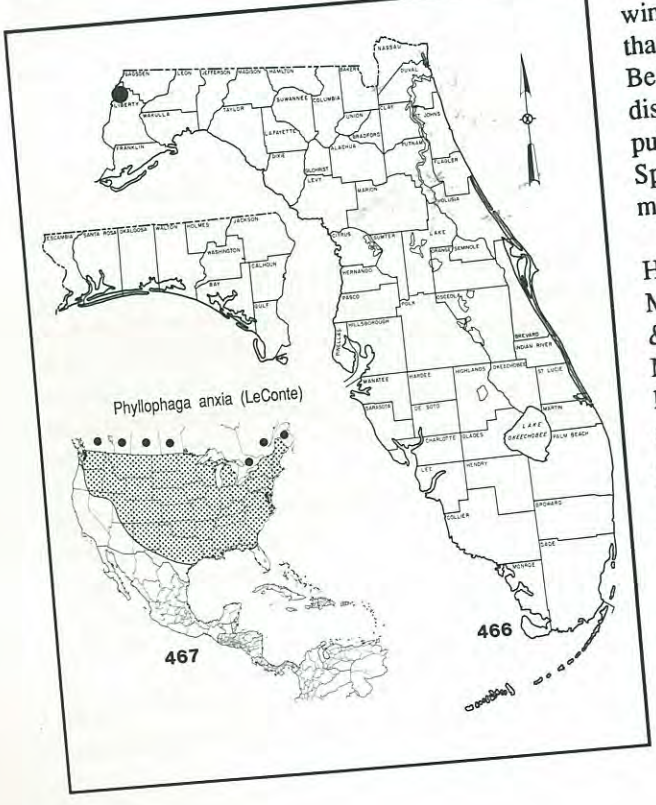
TYPE LOCALITY: no specific locality, but presumed to be "Lake Superior".

DIAGNOSIS: Superficially it is similar to several dark glabrous Florida species, but is easily distinguished by the genitalia. As a member of the *fusca* group, the male genitalia are asymmetrical (but only mildly) (fig. 2, 62, 122, 182, 241), and the female genitalia (fig. 264, 267) have a distinct transverse fold on the basal plates. Of Florida species, genitalia are similar only to *implicita* (male: 30, 90, 150, 210, 251; female: 317, 320). However,

that species has 9-segmented rather than 10-segmented antennae.

DESCRIPTION: **Length**: 17.2-22.5mm (23.6mm, Riley); **Width**: 9.3-11.6mm (12.6mm, Riley). **Shape**: oblong, ovate, subdepressed. **Color**: dark brown to black. **Vestiture**: glabrous, moderately polished. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: emarginate; border moderately reflexed. **Tarsal Claws**: tooth strong, median. **Male Posterior Tibial Spurs**: lower fixed, half length of upper. **Female Genitalia**: fig. 264 (ventral), 267 (lateral). **Male Genitalia**: southern form: fig. 2 (caudal), 62 (ventral), 122 (dorsal), 182 (right lateral), 241 (left lateral); northern form: fig. 3 (caudal), 63 (ventral), 123 (dorsal), 183 (right lateral), 242 (left lateral).

TAXONOMIC NOTES: With the 7 synonyms listed above, it is obvious that there has been much confusion about *anxia*. Variation in body size and in genitalia are noticeable. Two distinct types of male genitalia (northern and southern forms) are recognized (fig. 2, 3, 62, 63, 122, 123, 182, 183, 241, 242). Our few Florida specimens are clearly the southern form. It has the widest distribution of any U.S. species. Luginbill & Painter (1953:80) mentioned that Utah specimens are half the size of those from other parts of the country.



Space does not permit a thorough accounting of the above synonymy, which was established by Glasgow (1916:371). This is one of the species which needs more detailed study, especially the internal sac, to clarify the extensive variation.

U.S. DISTRIBUTION (fig. 467): Luginbill & Painter (1953: fig. 73-74) recorded it from every state **except Arizona, California, Florida, Nevada, West Virginia** and **Wyoming**. They also list 11 provinces in Canada, making this the widest distributed of all U.S. *Phyllophaga*.

FLORIDA DISTRIBUTION (fig. 466): The 4 Florida specimens were all taken at Torreya State Park (Liberty Co.), the source for several records of northern species in this relictual area along the Apalachicola River. These are the first Florida records.

BIOLOGY & ECOLOGY: Because there is a northern and southern form, based on genitalic differences, some of the references to biology may refer to one or the other. Our 3 Florida records are for April, May, and July.

Forbes (1916:227-228) called it a distinctly northern species in Illinois where it apparently has a 3-year cycle, collected as early as April 15 and as late as July 8. In North Carolina, Brimley (1938:203) reported collecting it in the ground or under stones or logs in winter and early spring. Hayes (1929:66) cited a report that it had a 4-year life cycle in Manitoba, Canada. Because of its economic importance and its widespread distribution, there have been more studies (and results publications) on this species than any other in the U. Space permits only citing the references by subject matter as follows:

Tiphiidae (Hymenoptera) parasites (Berberet Helms, 1970; Lim, Stewart, & Yule, 1981; Riv Mayo, & Helms, 1979); gregarine parasites (Berb & Helms, 1969); mites (Jarvis, 1964, 1966; Osc Mayo, 1975); anatomy and histology of adults larvae (Berberet & Helms, 1972); life history control in Canada (Hammond, 1948); general na enemies (Lim, 1979; Lim, Stewart, & Yule, 1981; Yule, Stewart, 1980; Petch & Hammond, 1925, 1 oviposition (Sweetman, 1927).

Adult Host Plants: Basswood, birch, maple, beech, bignonia, buckeye, dogwood, ebony, elm, honeysuckle, magnolia, mallow, pulse, rose, sweet gale, tupelo, walnut, willow, laurel, maple ter, polemonium, witchhazel, goosefoot [fa

(Luginbill & Painter, 1953:80-81); nectarine, persimmon (Reinhard, 1950:45); ash, willow, persimmon, oak, sumac, blackberry (Ritcher, 1940:109); elm, willow, poplar, apple, cherry, boxelder, hackberry, linden, mountain ash (Forbes, 1916:228, "preference for elm and willow"); poplar, pecan, willow (Langston, 1927b:44); farkleberry, Chickasaw plum, grape, sweet gum, smooth alder, wax myrtle, water oak, black jack oak, sand blackberry (Luginbill, 1928:72); preferred: willow, ash, elm, lilac; others: plum (blossoms and leaves), apple (blossoms and leaves), currant, chokecherry, hazelnut, spirea, raspberry, gooseberry, dock, nettle, artichoke, giant ragweed, strawberry, goldenrod, peony (Sweetman, 1931: table 19); quaking aspen, large-toothed aspen, privet (Travis, 1934:329).

Immatures: The third instar larva was described by Boving (1942:44, fig. 114-116), who places it in his group 16, along with *fusca, vehemens, fervida, marginalis*, and *drakii* (based on larval characters). His description follows: "Posterior part of labrum with a tranverse series of 5 to 7 long setae on each side. Anterior marginal region of frons with a transverse, somewhat irregular series of 5 to 7 setae on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 3 or 4 setae. Dorso-molar region of right mandible (Fig. 116) with a patch of about 30 setae; dorso-exterior region with either from 3 to about 10, or from about 20 to 25 punctures; scrobis with about 7 punctures in an irregular, longitudinal row and occasionally with a single or 2 to 3 setae; ventro-lateral carina with 6 to 8 setae; baso-lateral region with a patch of about 8 setae and some punctures. Epipharynx with about 12 heli; proplegmatium rather broad, long and spatulate with 11 to 15 curved proplegmata; right chaetoparia with numerous punctures among the setae; crepidal punctures about 25. Raster (Fig. 115) with anterior third of septula oval, tapering posteriorly into a subrectangular part; palidium with one very irregular, in places double row of pali numbering from 20 to 30 or more; palus (Fig. 114) compressed, with concave sides and hooked at the tip; majority of pali separated by a distance half as long as a palus or shorter; preseptular setae 6 or more. (Length of body about 40 mm.; width of head about 5.5 mm.)."

Ritcher (1966:87-88) included it in his key, but included no illustrations.

SPECIMENS EXAMINED: several thousand, of which only 4 were from Florida with the following data: (1) Liberty Co., Torreya St. Pk., 14-IV-79, L. R. Davis, Jr., at blacklight; (2) loc. cit., 11-VII-81, P. M. Choate, Jr., on trees at night; (1) loc. cit., 21-22-V-83, K. W. Vick, blacklight trap.

SELECTED REFERENCES: Berberet & Helms, 1969:395-396; 1970:471-472, figure 1-3; 1972:1026-1027, 1031-1032, 1036, 1038, 1040-1042, 1044, 1047, 1050, 1052, figure 1-64, plate 1-7; Blatchley, 1910:970, figure 390; Boving, 1937:3; 1942:6-7, 12, 23, 37, 45, 59, 61, figure 114-116, 237; Brimley, 1938:203; Cartwright, 1934:240; Chamberlin & Seaton, 1941:467, table 1; 1941:467, table 1; Chamberlin, Fluke, & Callenbach, 1943:677-678, table 1-2; Chamberlin, et al., 1938:228, 230, 233, 236, 238, table 1-2, 4-8; 1939:105, table 1; Chandler, Taylor, & Deay, 1956:187; Criddle, 1918:3-4; Crotch, 1874:60; Dalla Torre, 1912:190; Davis, 1918:4, 7, figure 2; 1919:81, 84, 106, 112; Dawson, 1922:215-216, 221; Fattig, 1944:7-8, 20-21; Forbes, 1916:217-218, 223-224, 227-228, 230, 235, 238-239, 241-248 252, 255; Glasgow, 1916:371, 374; Hammond, 1948:403-416; Hayes, 1925:41, 81; 1929:66; Henry & Heit, 1940:280-282; p, 1-4; Horn, 1887b:294; Hudson, 1919:81-82 (as *dubia*); Jaques, 1926:338; 1927:315; Jarvis, 1964:207-210; 1966:401-409; Knaus, 1897:216; Langston, 1927b:34, 43, 83, plate 6, figure 24; LeConte, 1850:226; 1856:245; Leonard, 1926:424; Lim, 1979:i-xxi, 1-230, illustr.; Lim, Yule, & Stewart, 1980:219-220;Loding, 1945:104; Luginbill, 1928:56, 71-72, figure 19, male A-E, female F-G; Luginbill & Painter, 1953:10, 79, figure 73, plate 69(1-12); McColloch & Hayes, 1923:30; McLeod & Schultz, 1988:95; Melsheimer, 1853:59; Nairn & Wong, 1965:33-34; Owens, 1950:33; Petch & Hammond, 1925:24-28; 1926:85-91; Reinhard, 1950:45; Riley, 1988:70-74, fig. 3, map 3, table 1, 3-4; Ritcher, 1939:64; 1940:75, 82-84, 86, 109, 128, figure 12, plate 3; 1949a:19, 25; 1966:86-87; Rivers, 1977:2-6, 14-15, 18, 21, 23, 27-31; Rivers, Mayo, & Helms, 1979:362-363, 372; Sanderson, 1944:16, 21, table 1; Schwardt, 1943:117; Shenefelt & Simkover, 1951:223; Sim, 1928:29-30, 55, plate 7; Smith, 1889b:503; 1910:319 (as *dubia*); 1960:77; Sweetman, 1927:783, 785-788, 790; 1931:401, 407-408, 411, 413-414, 416, 418-421, figure 4, table 10, 14, 17-19; Travis, 1933: table 4; 1934:317, 328, 354, figure 16, plate 4, table 1; Uhler, 1941:1-2, 8, 10, 12, 14, 16-17, 19, 21, figure 1, 9, 18, 27, 36-37, plate 1, 3, 5, 7, 9; Wickham, 1894:223 (as *dubia*); Yeager, 1950:172, 176.

Phyllophaga apicata Reinhard

(fig. 4, 5, 64, 65, 124, 125, 184, 185, 265, 268, 403, 468, 470, 471, 474, 475)

Phyllophaga tristis apicata Reinhard 1939:58-59.
Phyllophaga apicata, Sanderson 1944:20.

TYPE LOCALITY: "College Station, Texas".

DIAGNOSIS: This and *tristis* are the only small (10-13mm long), yellowish brown, hairy species in Florida. These two are difficult to distinguish except by the aedeagus (internal sac) of the males (females can be identified only by association). In *apicata* (fig. 4, 64, 124, 184) there are 2 apical aedeagal processes; the dorsal toothed near the apex, the distal process single bladed, looped downward, then curved upward and with apex entire.

fig. 468-469. *Phyllophaga tristis* complex: aedeagus extruded and critical point dried (10mm = 0.5mm). 468) *apicata* from Gainesville. 469) *tristis* from Okaloosa Co.

fig. 471. *Phyllophaga apicata*: aedeagus (right lateral view) (5mm = 0.05mm).

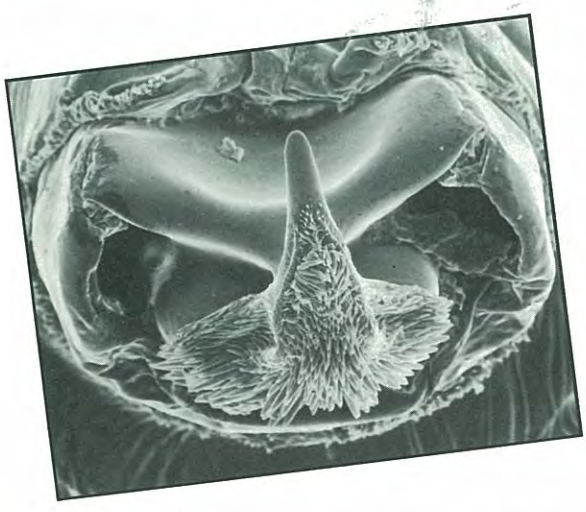


fig. 470. *Phyllophaga apicata*: aedeagus (caudal view) (5mm = 0.05mm).

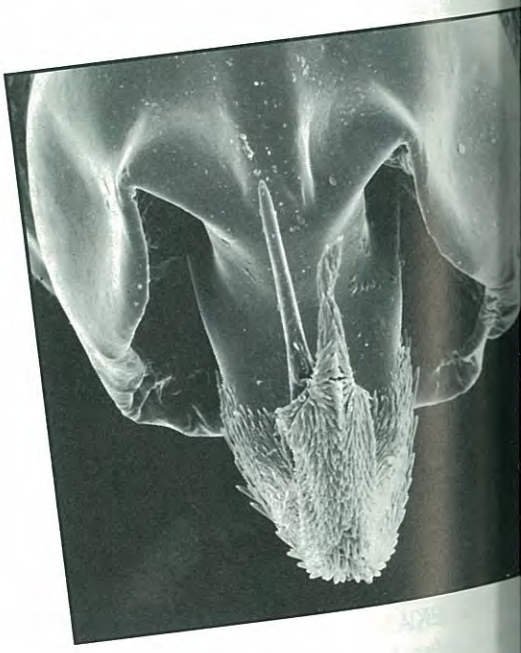


fig. 472. *Phyllophaga tristis*: aedeagus (caudal v = 0.05mm.).

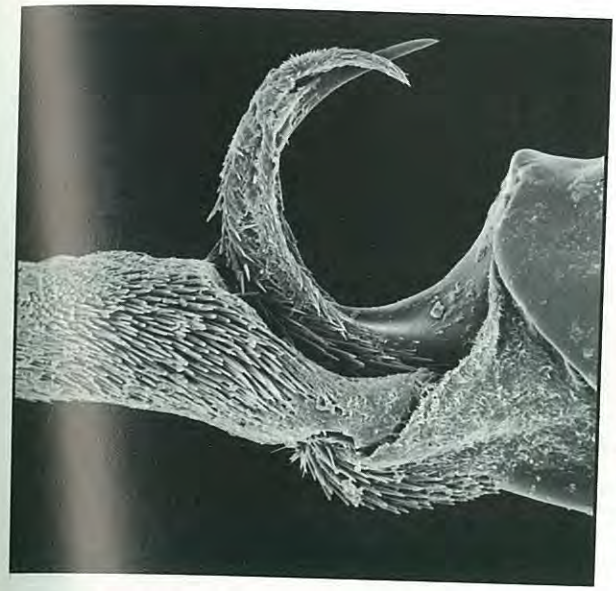
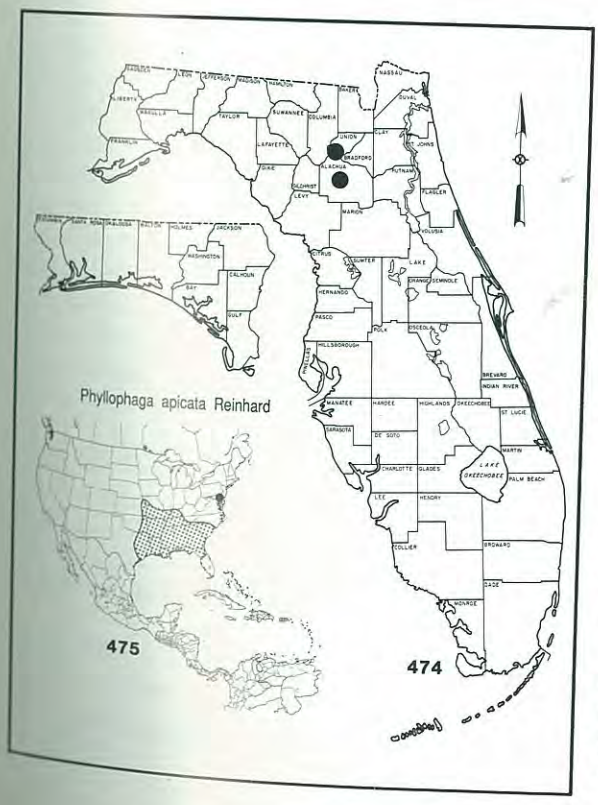


fig. 473. *Phyllophaga tristis*: aedeagus (right lateral view) (5mm = 0.05mm).

DESCRIPTION: **Length**: 10.0-13.0mm; **Width**: 5.2-6.5mm (7.3mm, Riley). **Shape**: oblong, slightly wider behind. **Color**: rufotestaceous. **Vestiture**: pubescence, long, erect on head and pronotum, shorter, suberect on elytra; surface more shining than in *tristis*. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: entire, rounded to nearly straight medially; margin broad, strongly reflexed. **Tarsal Claws**: tooth small, antemedian, acute. **Male Posterior Tibial Spurs**: lower movable, slender, obtuse, longer than first tarsal segment. **Abdomen**: fig. 403 (venter). **Female Genitalia**: fig. 265 (ventral), 268 (lateral). **Male Genitalia**: fig. 4, 5 (caudal), 64, 65 (ventral), 124, 125 (dorsal), 184, 185 (lateral).



TAXONOMIC NOTES: This form was originally described as a subspecies of *tristis*, along with *amplicornis* and *suttonana*. These are now considered species, although they are similar and confused in all literature before 1939. The *tristis* complex has an extremely broad geographic range and extensive external variation in vestiture. The only secure characters for distinguishing the forms are in the aedeagus (internal sac) of the male genitalia (fig. 468, 470, 471, vs. 469, 472, 473). Females of all forms are presently inseparable. The complex needs a thorough evaluation from its entire range and an examination of the Fabrician type of *tristis*.

U.S. DISTRIBUTION (fig. 475): Reinhard (1939:59) listed paratypes from: **Alabama** (Mobile, Auburn); **Arkansas** (Cody's Gap); **Georgia** (Zebulon, Perry, Rome); **Kansas** (Tonganoxie State Lake); **Kentucky** (Paducah); **Maryland** (Takoma Park); **South Carolina** (Walhalla, Chappells, Florence); **Texas** (College Station, Atlanta, Smith Co.); **Washington, D.C.** Riley (1988:86) listed it from 6 parishes in **Louisiana**.

This is a wide and spotty distribution which needs clarification by further collections. Many of the older literature records for *tristis* possibly refer to this species. Luginbill and Painter (1953: fig. 19) show *tristis* from the eastern two thirds of the U.S.

FLORIDA DISTRIBUTION (fig. 474): The only definite records are from Alachua Co. and Union Co. Older Florida records of *tristis* by Blatchley (1929:70) from Haulover and Ft. Barrancas need to be reexamined in the light of the several species now in the *tristis* complex. Young & Thames (1949:128-129) recorded *tristis* as "not uncommon around Gainesville" (probably all *apicata*) and "in western parts of the state" (probably true *tristis*).

BIOLOGY & ECOLOGY: Reinhard (1941:526-532) published the only biology data on this species (at College Station, Texas) and compared it with other members of the *tristis* complex: egg production aver-

aged 57 (20 to 87) from the first week of April to the first week of June. Average duration of egg incubation was 26.62 days. Average time for larval development was 128 days (about 1 week longer than the other members of the *tristis* complex). Duration of the pupal stage averaged 22 days (19 to 25). The adults transform in October, but spend the winter in the pupal cell, emerging in March the following year. The life cycle for *tristis* and *apicata*, at least in the south, is the shortest of any U.S. species. No differences of consequence were found between these species. Because of this, and the confusion surrounding their identity, many of the literature references to *tristis* possibly apply to *apicata* (see *tristis* treatment).

Adult Host Plants: There were no host data reported on the type series by Reinhard (1939:60). Later (1950:49), he reported the following hosts in Texas: oak, pecan, elm, and jujube. Woodruff obtained several hundred on *Cedrus deodara*, an introduced ornamental conifer, at Gainesville. Many of the host records for *tristis* (see this section for that species) could be for *apicata*, because of past confusion of the 2 species.

Immatures: Although the eggs, larvae, and pupae were studied by Reinhard (1941:530-532), he did not describe or illustrate any of the immatures. Because of the similarity of the adults in the *tristis* group, the larvae would not be expected to show noticeable differences. Both the first and third instar larvae, identified as *tristis*, were described by Boving (1942:33, fig. 33-36). No locality data were presented for these larvae, and it is doubtful that Boving knew the form with which he was dealing. Therefore the description here under *tristis* could also refer to *apicata* (as indicated earlier in our Key). The venter of the 10th abdominal segment of "*tristis*" was also illustrated by Ritcher (1966: fig. 225) and Hayes (1929: fig. 188).

SPECIMENS EXAMINED: over 800, of which 741 were from Florida, of which 739 were from Alachua Co., representing 31 collection records. An old specimen from Miami (Dade Co., 1934) is questionable, since there are no other records from south of Gainesville. For complete data see Appendix 2. Confusion between members of the *tristis* complex may be responsible for some previous misidentifications, but all the above records have been verified recently.

SELECTED REFERENCES: Reinhard, 1939:58-59; 1941:530-532; 1950:49; Riley, 1988:84-88, fig. 6, 75-78, map 5; Sanderson, 1944:20.

Phyllophaga bruneri Chapin

(fig. 6, 66, 126, 186, 269, 272, 404, 426, 427, 457-459, 461, 476-479)

Phyllophaga bruneri Chapin 1932:203.
Cnemarachis bruneri, Saylor 1942:159.
Phyllophaga (Cnemarachis) bruneri, Sanderson 1951:250.

TYPE LOCALITY: "Santiago de las Vegas, Havana", Cuba.

DIAGNOSIS: This species is related and similar to several Cuban species in the subgenus *Cnemarachis*. However, in Florida it is unique in its small size and yellowish base color, with a dark aeneous stripe on each side of the elytral suture. The male genitalia are of a unique type (fig. 6, 66, 126, 186) not found in any other Florida species. The female genitalia (fig. 269, 272) have the pubic process wanting, the superior plates fused basally,but widely divided and prolonged each side into a linear process (longer than any other Florida species).

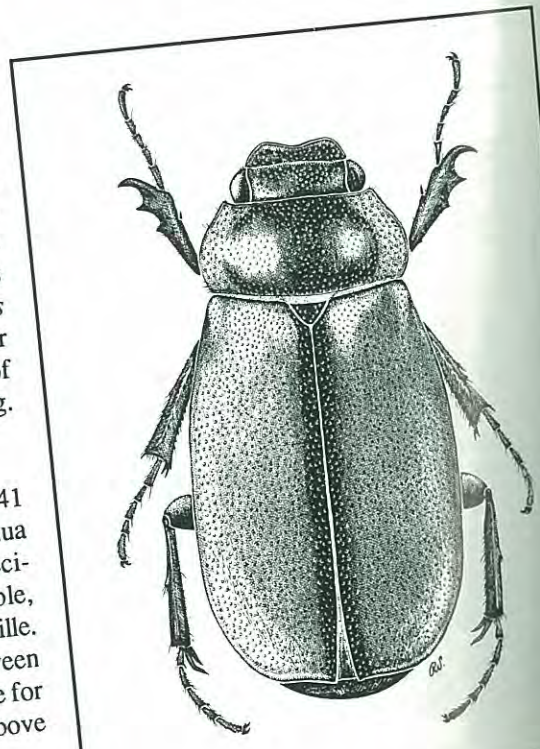
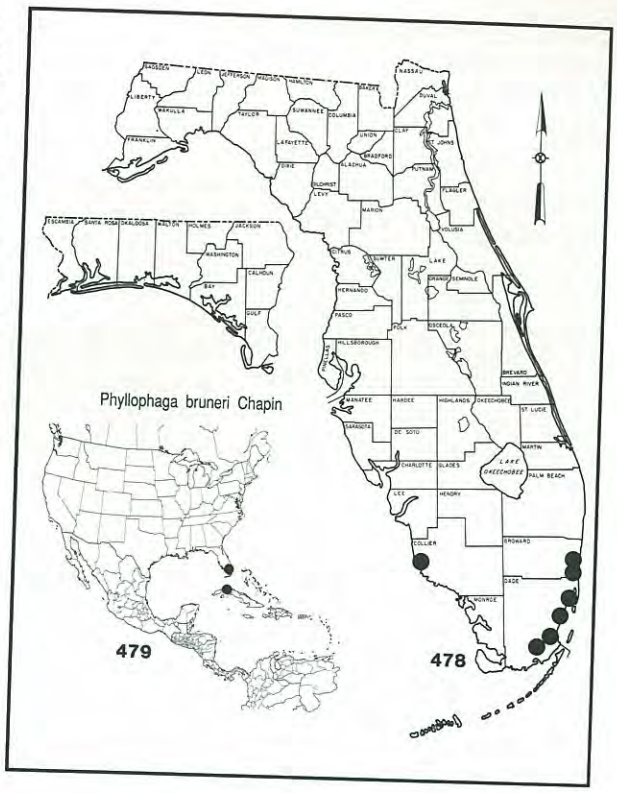


fig. 476. *Phyllophaga bruneri*: habitus of adult male, 12mm = 1mm (after Woodruff, 1961).

DESCRIPTION (fig. 476): **Length**: 7.8-10.3mm; **Width**: 4.7-5.3mm. **Shape**: cylindrical, parallel. **Color**: brownish testaceous, piceous to aeneous on pronotal disk, elytral margin, and margin of elytral suture. **Vestiture**: glabrous, shining. **Antenna**: 9-segmented; male club shorter than stem. **Clypeus**: emarginate; almost flat, median indentation deep and angulate; margin abruptly reflexed. **Tarsal Claws**: slender, slightly curved; tooth triangular, median, stouter than apical portion. **Male Posterior Tibial Spurs**: lower movable, two-thirds length of upper; longer spur twice length of first tarsal segment. **Abdomen**: fig. 404 (venter). **Female Genitalia**: fig. 269 (ventral), 272 (lateral). **Male Genitalia**: fig. 6 (caudal), 66 (ventral), 126 (dorsal), 186 (right lateral).



TAXONOMIC NOTES: This introduced Cuban species has no synonyms. Saylor (1942:159) created the genus *Cnemarachis* for most of the West Indian species of *Phyllophaga*. Sanderson (1951) treated it as a subgenus. Variation in the claspers was described and illustrated by Woodruff (1961:15, fig. 25). It is related to *suturalis* (Chevrolat), *aeruginosa* (Burmeister), *microsoma* Chapin, *aeneotincta* Chapin, and *alquizara* Chapin (all Cuban species).

I examined the holotype male labelled: USNM Type 43800, Cuba, Santiago de las Vegas, Havana, 14-VI-1921, B. T. Barreto, and compared it with Florida specimens. They are conspecific in all respects, including the genitalia. The allotype female was described by Woodruff (1961:16, fig. 11) with the following label data: Miami, Florida, 28-IV-60, P. E. Briggs, blacklight trap (FSCA). Because the female was not known to Chapin when he originally described the species, and because of the importance of the genitalia in establishing the identity of both males and females, it was deemed important to create the allotype as a point of reference. Even though this was more than 30 years after the original description, it complies with the original definition of the term allotype (see Fernald, 1939).

U.S. DISTRIBUTION (fig. 479): This introduced Cuban species is known in the U.S. only in **Florida**. Agricultural inspectors (pers. com.) at the Arizona border have intercepted it several times in vehicles originating in Miami, Florida.

FLORIDA DISTRIBUTION (fig. 478): Originally found only in Miami (Woodruff, 1959, 1960, 1961), it has spread to 3 counties; Broward, Collier, and Dade (see Appendix 3 for complete data).

BIOLOGY & ECOLOGY: Considerable work was done on this Cuban species shortly after it was introduced into Florida about 1959. It is now well established, and in the 30 succeeding years it has spread to both coasts. This species is a known pest of sugarcane in Cuba, but it has not yet been found in the sugarcane growing regions around Lake Okeechobee. It has been the subject of a Master's thesis (Samol, 1968) and a 2 year USDA, ARS grant (Habeck & Wolfenbarger, 1968). The following resume' is taken from personal observations, along with data from the above references.

Egg production varies greatly, but averages about 12 per female. No specimens have been reared from egg to adult, and no definite larval food has been established. Presumably they feed on grass roots. Adults are found during the day, within the top 3 inches of soil; larvae in the upper 6 inches. Average head capsule width for the 3 larval instars is as follows: 0.95, 1.56, 2.47mm. Two peaks of adult activity occur (86% April, May, June; 12% August, September, October), although adults emerge every month of the year. The greatest number taken on one night in a blacklight trap was 58,400 on May 12, 1965. Adult evening flight takes place primarily at about 25 minutes after sunset, with less than 1 foot candle of light. Their return from

Adult Host Plants: Woodruff (1961: table 1) provided a list of host plants in Miami:

Family	Common Name	Genus and Species
Bombacaceae	shaving-brush tree	*Pachira aquatica* Aubl.
Juglandaceae	pecan	*Carya illinoinensis* (Wangenh.) K. Koch
Leguminosae	bauhinia	*Bauhinia* sp.
Leguminosae	golden shower tree	*Cassia fistula* L.
Leguminosae	senna	*Cassia marginata* Roxb.
Leguminosae	moreton-bay chestnut	*Castanospermum australe* A. Cunn.
Leguminosae	Royal poinciana	*Delonix regia* (Bojer) Raf.
Leguminosae	coral-bean	*Erythrina* sp.
Leguminosae	madre de Cacao	*Gliricidia sepium* Stend.
Leguminosae	madre	*Gliricidia* sp.
Leguminosae	tamarind	*Tamarindus indica* L.
Malvaceae	Chinese hibiscus	*Hibiscus rosa-sinensis* L.
Meliaceae	mahogany	*Swietenia mahagoni* Jacq.*
Moraceae		*Ficus roxburghii* Wall.
Phytolaccaceae	poke berry	*Phytolacca rigida* Small
Polygonaceae		*Ruprechtia* sp.
Sapindaceae	longan	*Euphoria longana* Lam.
Sapindaceae	Spanish lime	*Melicoccus bijugatus* Jacq.
Sapotaceae	sapote	*Pouteria sapota* (Jacq.) Moore & Stearn
Sapotaceae	green sapote	*Pouteria viridis* (Pittier) Cronquist
Sapotaceae	satinleaf	*Chrysophyllum oliviforme* L.*
Ulmaceae	Florida trema	*Trema micrantha* (L.) Blume*
		(*Native Florida Plants)

the foliage to their hiding places occurs early in the morning during a brief 15 minute period (6 to 6:15a.m. on May 17-19). Duration of copulation averaged 21.6 minutes (17 to 26).

The giant Surinam toad, *Bufo marinus* Linnaeus, fed on adults. The larvae of a luminescent click beetle, *Pyrophorus havaniensis* Castelnau, were found feeding on larvae. Adult click beetles of this species were collected by the hundreds (it was previously rare) in the same light traps with the *Phyllophaga*.

Within 2 years of its discovery (June, 1959) in Miami, it had occupied an area of about 10 square miles. It was not seen at the Subtropical Experiment Station (near Homestead) until 1968. It was first found at Ft. Lauderdale in 1977 and on the west coast at Naples in 1986.

In addition to the list of positive hosts above, a list of 36 negative hosts was provided (Woodruff, 1961: table 2). The native *Trema micrantha* (L.) Blume (=*floridana*) appears to be a preferred host for both the

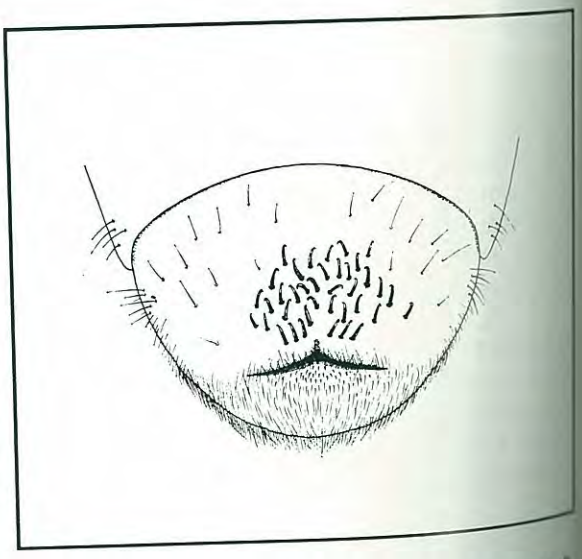


fig. 477. *Phyllophaga bruneri*: 10th abdominal segment (ventral), third instar larva, note scattered setae not arranged in rows on pallidium (see fig. 460) (13mm = 1mm).

introduced *bruneri* and *youngi* in Miami. Additional hosts since recorded are *Acacia auriculaeformis, Diospyros virginiana*, and *Eriobotrya japonica.*

Immatures: The third instar larva and the pupa were described in detail by Woodruff (1961:17-22, fig. 12, 15-24). It is the only known Florida species that has no palidia (this may be characteristic of the West Indian subgenus *Cnemarachis*, and it could be a character of the undescribed larva of *youngi*). The 5 heli and about 30 proplegmata of the epipharynx are characteristic. The only other Florida species (known) with more than 25 proplegmata is *prununculina*, and it has a palidium with more than 12 pali.

SPECIMENS EXAMINED: several thousand, including the types from Cuba, nearly all from Dade Co., Florida. Over 5000 were from 61 specific collections from Miami. For complete data see Appendix 3.

SELECTED REFERENCES: Chapin, 1932:203, plate III, figure 38; Habeck & Wolfenbarger, 1968:1-73, 28 fig. 27 tables; Ritcher, 1966:83; Samol, 1968:1-52; Woodruff, 1959:1-2, figure 1-3, map 4; 1960:47-48, figure 1-3; 1961:5, 7-13, 17, 20, 22-24, 27, figure 1-26, table 1-2; 1973:17, 28, figure 59-63.

Phyllophaga clemens (Horn)

(fig. 7, 67, 127, 187, 270, 273, 391, 480, 481)

Lachnosterna clemens Horn 1887a:144.
Phyllophaga clemens, Glasgow 1916:373.
Phyllophaga howei Sanderson 1937a:17.

TYPE LOCALITY: "occurs in Florida and Texas".

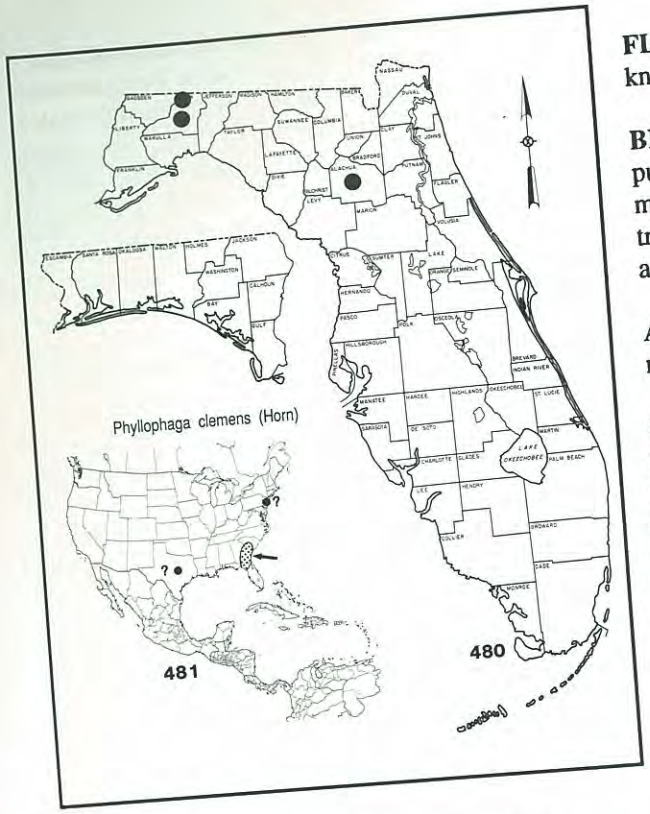
DIAGNOSIS: This small, pale yellow, glabrous species is externally similar to the following Florida species (see genitalia figures in parentheses for comparison): *clemens* (male: 7, 67, 127, 187; female: 270, 273); *debilis* (male: 11, 71, 131, 191; female: 277, 280); *gracilis* (male: 26, 86, 146, 206; female: 307, 310); *lota* (male: 34, 94, 154, 214; female: 324, 327); *taxodii* (male: 53, 113, 173, 233; female: 365, 368); and *yemasseei* (male: 58, 118, 178, 238; female: 373, 376). The fixed posterior tibial spur of the male (fig. 391) is aborted, stubby, and shorter than any of the above.

DESCRIPTION: Length: 9.5-11.0mm; **Width:** 4.2-5.2mm. **Shape:** oblong, slightly broader behind. **Color:** pale yellow to rufotestaceous; head piceous. **Vestiture:** glabrous, shining. **Antenna:** 9-segmented; male club length nearly equal to stem. **Clypeus:** entire, concave; margin widely reflexed. **Tarsal Claws:** feebly arcuate; tooth small, antemedian (male), or stronger (female). **Male Posterior Tibial Spurs** (fig. 391): lower fixed, aborted, stubby, less than half length of slender, obtuse, upper. **Female Genitalia:** fig. 270 (ventral), 273 (lateral). **Male Genitalia:** fig. 7, (caudal), 67 (ventral), 127 (dorsal), 187 (right lateral).

TAXONOMIC NOTES: The rarity of this species resulted in some early misidentifications and the synonyny of *howei* Sanderson. The specimens of both Horn and LeConte were examined at the MCZC during this study to clarify some of the confusion. Horn (1887a:144; 1887b:227) pointed out that LeConte's identification of *dispar* Burmeister was incorrect, and that it "... is *clemens* Horn". This specimen has an orange disc, the dissected female genitalia, "*L. dispar* (Burm.)" [in LeConte's handwriting], "type 8069", "*L. clemens* Horn". The second specimen in the LeConte collection bears an orange disc, the dissected male genitalia, "*clemens* 2", "specimen of a male of *lota* Lug. Sanderson 12-13-34". The third specimen is labelled "Ga.", "645", "*clemens*", with the dissected female genitalia. The Horn collection has 2 specimens, both males with genitalia extracted. The first is labelled "Fla.", "Type No. 3669"; the second is labelled "Tex.", "paratype 3669".

Smith (1889b: pl. 49, fig. 14), as pointed out by Sanderson (1939:9), apparently misidentified it also, and his figure appears to be that of *debilis* Lec. However, Smith stated that his single specimen "... was named by Dr. Horn". Ironically, the female appeared to be unknown to Smith and others until Sanderson (1939:9, fig. 4) described and figured it. Luginbill and Painter (1953:40) apparently missed Sanderson's description, stating "Female unknown", although earlier quoting Horn's statement that the female tarsal claws were stronger. This is also one of the few species for which the female genitalia were not illustrated in their plates.

Sanderson (1937a:17-18, fig. E, G) described *howei* from Fairfax, South Carolina, and Tallahassee, Florida. Two years later, Sanderson (1939:8-9, fig. 4) synonymized *howei* under *clemens* and illustrated the last ventral abdominal segment of the female. As luck would have it, the unknown female genitalia [although LeConte's misidentified *dispar* female was *clemens*] were missing. Sanderson stated "Careful dissection of the female failed to disclose any sclerotized structures which we know exist in our species." Apparently our illustrations (fig. 270, 273) are the first for the female genitalia.



FLORIDA DISTRIBUTION (fig. 480): Presently known from only Leon and Alachua Co.

BIOLOGY & ECOLOGY: No information has been published on this tiny rare species. All known specimens were taken at light or once in a Japanese beetle trap. The life history is unknown, and the immatures are undescribed.

Adult Host Plants: No host plants have been recorded; nearly all specimens were collected at light.

SPECIMENS EXAMINED: 361 from 5 localities and 2 Florida counties as follows: (1) Alachua Co., Gainesville, 11-VI-1986, P. E. Skelley; (2) Fla., 1959, M. Robinson Coll.; (2) Leon Co., 6-VI-35, H. S. Peters; (8) Leon Co., 15 mi. NE Tallahassee, 25-VI-35, H. S. Peters [Paratypes of *howei* Sanderson]; (2) Leon Co., Tallahassee, 14-VI-70, G. H. Nelson, at light; (1) Leon Co., nr. I-90 & Rt. 319, 22-VI-87, P. E. Skelley, blacklight; and (345) Leon Co., Tall Timbers Research Station, representing 40 collection records, by months as follows: V(67), VI(28), VII(3), Komarek, Harris, and Collins.

U.S. DISTRIBUTION (fig. 481): Luginbill & Painter (1953: fig. 30) reported it from **Florida, Georgia,** and **South Carolina.** Horn (1887b:227) recorded it from "**Florida** and **Texas**". I have examined Horn's 2 specimens at the MCZC (type and paratype No. 3669). Both the "Fla." and "Tex." specimens are males with the genitalia extracted; there is no doubt about their identity. However there is some doubt about the origin of the Texas specimen. Smith (1889b:496) first questioned the Texas record in Horn, stating that "It is barely possible that the specimen from the Belfrage material was really collected in Texas, but I doubt it." There have been no subsequent records for Texas, and Reinhard (1950:43) did not find it in his extensive study of Texas *Phyllophaga*.

Smith (1889b:496, pl. 49, fig. 14; 1910:319) recorded it from **New Jersey** (without specific locality). The genitalia he illustrated are not *clemens* but appear to be *debilis* (a species which was confused by several early authors). We believe the **New Jersey** record is a misidentification. Fattig (1944:16) reported a single specimen from Thomasville, **Georgia** (examined in USNM). *P. howei* was described from Fairfax, **South Carolina** and Tallahassee, **Florida** (all examined in INHS). Three additional specimens from Allendale, South Carolina, were examined in the USNM.

SELECTED REFERENCES: Blackwelder, 1939:52; Blatchley, 1929:53; Fattig, 1944:7, 16; Glasgow, 1916:373-374; Horn, 1887a:144-145; 1887b:226-228, 293; LeConte, 1856:240 (erroneous det. of *dispar*; see Horn 1887b:227); Luginbill & Painter, 1953:7, 40, figure 30, plate 40(7-9); Reinhard, 1950:43; Sanderson, 1937a:17-18, figure D, E, G (as *howei*); 1939:8-9, 13, figure 4; Sim, 1928:3, 14; Smith, 1889b:496, figure 14, plate 49; 1910:319; Dalla Torre, 1912:186; Young & Thames, 1949:127.

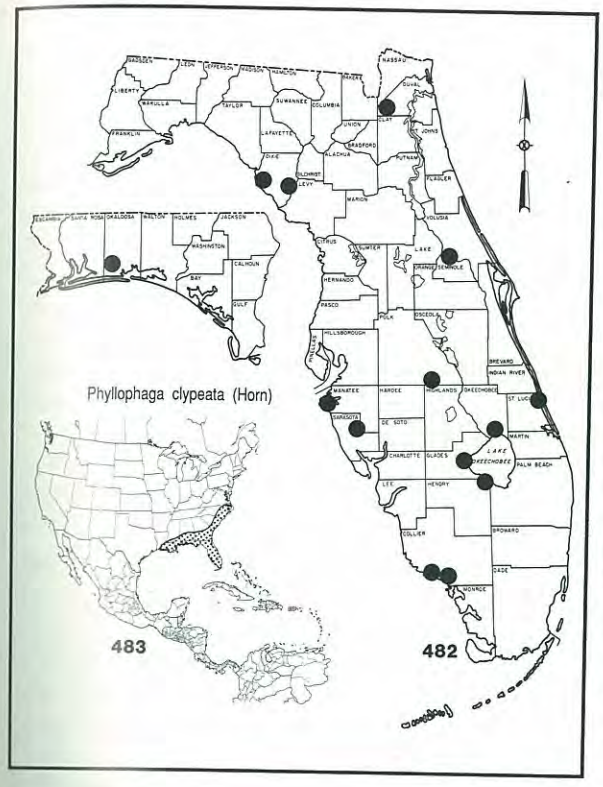
Phyllophaga clypeata (Horn)

(fig. 8, 68, 128, 188, 271, 274, 482, 483)

Lachnosterna clypeata Horn 1887a:145.
Lachnosterna integra LeConte 1856:258.
(not ***Melolontha integra*** Say 1835:180-181).
Phyllophaga clypeata, Glasgow 1916:373.

TYPE LOCALITY: "occurs in Georgia and Florida."

DIAGNOSIS: As the name implies, this species has unique entire clypeus with a wide reflexed margin. The only Florida species which might be confused on this character is *latifrons*, although it has the clypeal edge more upturned. The antennae of *clypeata* are 9-segmented, whereas those of *latifrons* are 10-segmented.



and sternum 8 has a unique bidentate caudal border (fig. 541-542). Although the male genitalia are of the same basic cylindrical form, they are easily distinguished: *clypeata* (fig. 8, 68, 128, 188) versus *latifrons* (fig. 33, 93, 153, 213).

DESCRIPTION: Length: 15.7-18.2mm; **Width**: 8.4-9.3mm. **Shape**: oblong, slightly broader behind. **Color**: rufotestaceous. **Vestiture**: glabrous, moderately shining. **Antenna**: 9-segmented; male club length nearly equal to stem. **Clypeus**: entire, concave; border widely reflexed. **Tarsal Claws**: feebly curved; tooth small, median to antemedian. **Male Posterior Tibial Spurs**: lower movable, stouter, two-thirds length of upper. **Female Genitalia**: fig. 271 (ventral), 274 (lateral). **Male Genitalia**: fig. 8, (caudal), 68 (ventral), 128 (dorsal), 188 (right lateral).

TAXONOMIC NOTES: Horn (1887a:145) listed *integra* LeConte as preoccupied, therefore proposing the new name *clypeata*. It was preoccupied because the *Melolontha integra* of Say (1835:180-181) from Mexico should have been in *Phyllophaga*, proposed by Harris in 1827. This was fortunate because LeConte's single specimen was "... rather old and inferior" (Horn, 1887b:284) leading him to mistakenly state that the inner spur of the male hind tibia is fixed. I have examined the holotype (No. 3298) with an orange disc and the labels "*integra* Lec." and "*L. clypeata* Horn" in the MCZC.

U.S. DISTRIBUTION (fig. 483): Luginbill & Painter (1953: fig. 28) reported it from **Alabama, Florida, Georgia, Mississippi**, and **South Carolina**. The type description (Horn, 1887b:284) listed "Georgia and Florida". In **Alabama**, Loding (1945:105) reported it from Mobile Co., Saraland. In **Georgia**, Fattig (1944:29) reported a single specimen from Douglas. In **Mississippi**, Langston (1927b:69) listed 8 specimens from Gulfport and Ocean Springs. In **South Carolina**, Luginbill (1928:86) recorded it only from Stokes. I have seen additional South Carolina specimens [USNM] from Georgetown, Summerton, and Cherry Grove Beach. Riley (1988:102) reported it from Livingston and St. Tammany parishes, **Louisiana**.

FLORIDA DISTRIBUTION (fig. 482): It appears to be found throughout most of the state, the southernmost record being Collier Co. The scattered records probably reflect its rarity and not any distribution pattern.

BIOLOGY & ECOLOGY: Except for the host list below, nothing has been published on the biology of this uncommon species. Our earliest Florida record is Feb. 22 (Glades Co.), and the latest is July 6 (Sanford). Riley (1988:102) found it as late as Oct. 23 in Louisiana. Most of our specimens were taken at light, with one specimen taken in a Japanese beetle trap. The life history is unknown, and the immature stages are undescribed.

Adult Host Plants: Pine [family] (Luginbill & Painter, 1953:39); cypress only (Langston, 1927b:69).

SPECIMENS EXAMINED: over 100, of which 50 were from the following 13 Florida counties: Collier, Dixie, Duval, Glades, Hendry, Manatee, Okaloosa, Okeechobee, Polk, Sarasota, Seminole, St. Lucie, Volusia. For complete data see Appendix 4.

SELECTED REFERENCES: Blatchley, 1929:70; Box, 1953:10; Brimley, 1938:203; Dalla Torre, 1912:186; Davis, 1920:333; Fattig, 1944:29; Glasgow, 1916:373-374; Horn, 1887a:145; 1887b:281, 283, 295; Ingram, 1938:89-98; Langston, 1927b:66-67, 69, 88, plate 11, figure 43; Loding, 1945:105; Luginbill, 1928:56, 86, figure 32, male A-C, female D; Luginbill & Painter, 1953:7, 38, figure 28, plate 39(1-6); Riley, 1988:49, 51, 57, 100-102, 136, 268, 282, 310, 406, figure 9, 36, 103-107, map 10, table 3-4; Sim, 1928:16-17, 51, plate 3; Smith, 1889b:521, figure 81, plate 60; Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga crenulata (Froelich)
(fig. 9, 69, 129, 189, 275, 278, 484, 485)

Melolontha crenulata Froelich 1792:94.
Melolontha georgicana Gyllenhal 1817:77.
Lachnosterna crenulata, LeConte 1856:258.
Phyllophaga crenulata, Glasgow 1916:370.

TYPE LOCALITY: "America".

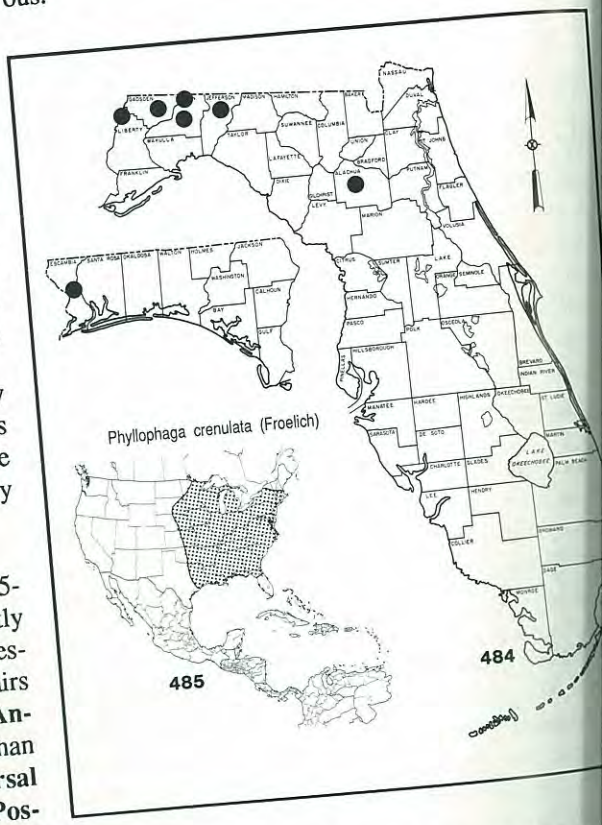
DIAGNOSIS: It is superficially similar to the following hirsute Florida species (see genitalia figures in parentheses for comparison): *aemula* (male: 1, 61, 121, 181; female: 263, 266); *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *ilicis* (male: 29, 89, 149, 209, 250; female: 313, 316); *mariana* (male: 36, 96, 156, 216; female: 329, 332); *parvidens* (male: 42, 102, 162, 222; female: 342, 345); and *skelleyi* (male: 51, 111, 171, 131; female: 360, 363).

It differs further from *aemula* and *parvidens* by lacking the pruinescence under the pubescence. Males have a short antennal club, movable lower spur on the posterior tibia, and the abdominal sterna are nearly unmodified.

DESCRIPTION: **Length**: 14.8-22.2mm; **Width**: 6.5-10.6mm (11.4mm, Riley). **Shape**: oblong oval, slightly broader behind. **Color**: tan to brown. **Vestiture**: pubescent, hairs short, recumbent, often with erect hairs intermixed; surface feebly shining, not pruinose. **Antenna**: 10-segmented; male club length shorter than stem. **Clypeus**: emarginate; border reflexed. **Tarsal Claws**: tooth strong, median in both sexes. **Male Posterior Tibial Spurs**: lower movable, about as long as upper. **Female Genitalia**: fig. 275 (ventral), 278 (lateral). **Male Genitalia**: fig. 9 (caudal), 69 (ventral), 129 (dorsal), 189 (right lateral).

TAXONOMIC NOTES: Although this common, widespread, and variable species was the third described U.S. species (almost 200 years ago), it is remarkably free from synonyms. The synonymy of *georgicana* Gyllenhal (1817) (not to be confused with *georgiana* Horn or *georgiana* Schaeffer) was established by LeConte (1856:258) and repeated by Glasgow (1916:370), although he did not see the type specimens of either species. Adding to the confusion, Blanchard (1850:133) described *Ancylonycha crenulata* which is listed as a synonym of *hirticula* Knoch (1801), the type of the genus (Dalla Torre, 1912:193).

Variation in the vestiture is noticeable, but it has not been correlated with the geographic range. The variation is primarily in the density, whiteness, and position of the pubescence. In fact, *P. albina* Burmeister differs little except the hairs are noticeably white. Horn (1887b:273) mentioned that in the "... mountainous regions of North Carolina and eastern Kentucky the erect hairs are observed to form distinct series as in *hirticula*, with the hairs even longer and more conspicuous."



U.S. DISTRIBUTION (fig. 485): Luginbill & Pa
(1953: fig. 14) recorded it from **nearly the e**
eastern U.S. as far west as **Nebraska, Kansas,**
homa, and **Texas**.

FLORIDA DISTRIBUTION (fig. 484): It pro
occurs in the northern one third of the state, the
ernmost record being Gainesville.

BIOLOGY & ECOLOGY: Luginbill &
(1953:25) indicated that it is active from the mi
March until August. Our earliest Florida re
March 3 (Gainesville), and the latest is Au
(Torreya St. Pk.), with most specimens in Ma
April. Along with *apicata* it is one of our

species. The larvae are considered pests of sod and field crops. Yeager (1950:178) listed it destroying flowers on pecan trees in Mississippi, with a 2 or 3 year life cycle. Baker (1985:269) stated that larvae were often serious pests in coniferous nurseries in the Great Lake States.

In Kansas, Hayes (1925:61-63) listed the average time in the egg stage as 18.2 days; egg to adult (1 case) was 424 days; hatching to first molt averaged 44 days; first to second molt averaged 284 days; second molt to prepupa averaged 59 days; prepupal stage averaged 7.5 days. Davis (1916a:273-274) listed the life cycle as 3 and sometimes 4 years.

Forbes (1907:475) mentioned rearing a new species of *Viviana* (Diptera: Tachinidae) from an adult beetle. Davis (1919:114) later mentioned that this was described as *V. lachnosternae* Townsend, but it was currently in the genus *Biomyia*. Davis (1919:106) also recorded rearing *Pyrgota valida* Harris (Diptera: Pyrgotidae) from *crenulata* adults (along with 12 other species of *Phyllophaga*).

Adult Host Plants: Birch, beech, bignonia, buckeye, cyrilla, dogwood, ebony, elm, honeysuckle, laurel, lily, loosestrife, mallow, maple, mulberry, pine, planetree, pulse, rose, saxifrage, tupelo, walnut, willow, barberry, basswood, sumac, witchhazel [families] (Luginbill & Painter, 1953:25); winged elm, sycamore, persimmon, water oak, willow oak, white oak, red oak, black oak, black jack oak, laurel oak, redbud, grape, black locust, crataegus, whiteheart hickory, titi, wild cherry, black gum, blackberry, black willow, pecan, peach, buckeye, cat brier, loblolly pine, hawthorn, elderberry, shagbark hickory, Alsike clover, brome-grass, cow pea, pignut, Lombardy poplar, boxelder, sassafras, mock orange, sand-bean, muscadine grape (Fattig, 1944:27-28); "... a persimmon species, with willow and hickory as second choices," and poison ivy (4 colln's.) (Forbes, 1916:232); Ritcher (1940:110) added "... strong preference for persimmon and elm, and pin oak, Spanish oak, hibiscus, blackberry;" Sanderson (1944:20) added broadleafed plantain and curly dock; Baker (1985:269) added basswood; Yeager (1950:178) stated a preference for Juneberry in Michigan, and that in Mississippi it destroys flowers on pecan trees; Shenefelt & Simkover (1951:219) added larch and white spruce; Riley (1988:114) added *Sambucus*.

On a warm spring night (26-III-89) Woodruff checked hosts in a residential area of Gainesville as follows: positive: azalea 'Formosa', grape, redbud, water oak, wisteria; negative: dogwood, ligustrum, viburnum, wild cherry. Preference was noticeable on wisteria (60).

Immatures: The third instar larva was described and illustrated by Boving (1942:30, fig. 9-13) as follows: "Posterior part of labrum with a transverse series of 7 moderately long setae on each side. Anterior marginal region of frons with a transverse series of 5 to 8 moderately long to long setae on each side. Epicranium opposite concave posterior part of frontal suture and epicranial suture with 3 to 4 long setae. Dorso-molar region of right mandible (Fig. 11) with an oblique series of 3 to 5 setae anteriorly, and a patch of about 15 setae posteriorly; dorso-exterior region without punctures; scrobis with a longitudinal row of about 7 punctures; ventro-lateral carina with a longitudinal row of 8 long setae. Maxillary articulating area (Fig. 12) ventrally with from 14 to 21 (or sometimes more) short, cone-shaped, curved, dark granules. Epipharynx with 8 to 10 heli in three curved rows; proplegmatium elliptical, moderately wide, with 12 to 15 proplegmata; chaetopariae with few, setula-bearing punctures, crepidal punctures 15 to 24. Raster (Figs. 10, 13) with broadly subelliptical septula; palidium with one irregular row of from 20 to 24 straight, sharply pointed, quite long, densely set pali; preseptular setae about 14, long or moderately long, and arranged in three or more irregular tranverse rows. (Length of body about 36 mm.; width of head 5mm.)."

Ritcher (1966:87-88) included it in his Key and illustrated the right maxilla (fig. 180) and the proplegmatia (fig. 198).

SPECIMENS EXAMINED: over 1000, of which more than 300 were from the following 6 Florida counties: Alachua, Escambia, Gadsden, Jefferson, Leon, Liberty. For complete data, see Appendix 5.

SELECTED REFERENCES: Baker, 1972:148; 1985:269; Blatchley, 1910:960, 978-979, figure 388, plate II; 1929:69; Boving, 1937:5; 1942:9, 21, 24, 30, 58, 61, figure 9-13, 206; Brimley, 1938:203; Britton, 1912:289; Cartwright, 1934:268; Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Fluke, & Callenbach, 1943:677-678, table 1-2; Chamberlin, et al., 1938:228, 233, 236, 238, table 1-8; 1939:105, table 1; Chandler, Taylor, & Deay, 1956:150-153, 155-156; Crotch, 1874:61; Dalla Torre, 1912:186, 193; Davis, 1913a:4, 6, figure 2; 1916a:268, 273-274, table 1; 1919:106; 1920:336; Dawson, 1922:21, 223(=117); Dury, 1879:8; 1902:156; Fattig, 1944:7-8, 27-28; Forbes, 1907:466, 475; 1916:217, 231-232, 236-239, 242-248, 256; Glasgow, 1916:370, 374; Harris, 1842:29 (under *georgicana* Gyll.); 1863:32, figure 12; Hayes, 1925:5, 8, 15, 58-62, 80-81, table 45-48, 57-67, plate 6-7, 9; 1929:49, 53, 56, 58-59, 65-66, 80, table 1-5, 7, 9-10, 13, figure 185, plate 14; Hayes & McColloch, 1920:75, 77, 79, figure 8, plate 8; 1928:251-252, 257; table 2-3, 7; Henry & Heit, 1940:280-281, table 1-4; Horn, 1887a:141-143, 145; 1887b:212, 215, 269-270, 272, 295; Jaques, 1926:338; 1927:315; 1928:304; Knaus, 1897:217; Langston, 1927b:7, 62-63, 87, plate 10, figure 40; LeConte, 1856:258; Leonard, 1926:425; Loding, 1945:105; Luginbill, 1928:55, 60-61, figure 9 A, male B-D,

female E; Luginbill & Painter, 1953:6, 18, 22, 24, figure 14, plate 27(1-5); McColloch & Hayes, 1922:132-135, table 2, 4-5; Neiswander, 1963: fig. 22, table 1, 3, 5-7; Owens, 1950:13, 68, 74-75, 83, 88, figure 25, plate 5; Popenoe, 1876:30; Reinhard, 1946:479; 1950:47; Riley, 1891:133; 1988:33, 54, 110-114, 165, 208, figure 122-125, map 14, table 3-4; Ritcher, 1938:24, 26; 1940:75-76, 82-86, 96, 102, 110, 114, 123, 130, figure 9, 15, 30, plate 6, table 3-4, 9-10, 14-19; 1949a:19, 26, 30-32, figure 6, 24, plate 1-2; 1966:180, 198; Sanders & Fracker, 1916:256; Sanderson, 1944:16-17, 19-20, table 1-2; Schaeffer, 1906:258; Shenefelt & Simkover, 1951:219, 222, table 1; Smith, 1889b:489, 491, 493, 518, figure 68, plate 57; 1910:319; Travis, 1933:397, 399, 405, table 4-7; 1934:316, 337, 339, 364, figure 31, plate 9, table 1; Uhler, 1940:2, 7-8, 11, 13, 16, 19, figure 5, 14, 23, 32, 42, plate 2, 4, 6, 8, 10; Wade, 1935:85; Woodruff, 1973:28; Yeager, 1950:178; Young & Thames, 1949:128.

Phyllophaga cupuliformis (Langston)

(fig. 10, 70, 130, 190, 276, 279, 486, 487)

Phyllophaga micans var. ***cupuliformis*** Langston 1924:450.

Phyllophaga cupuliformis, Woodruff 1973:28.

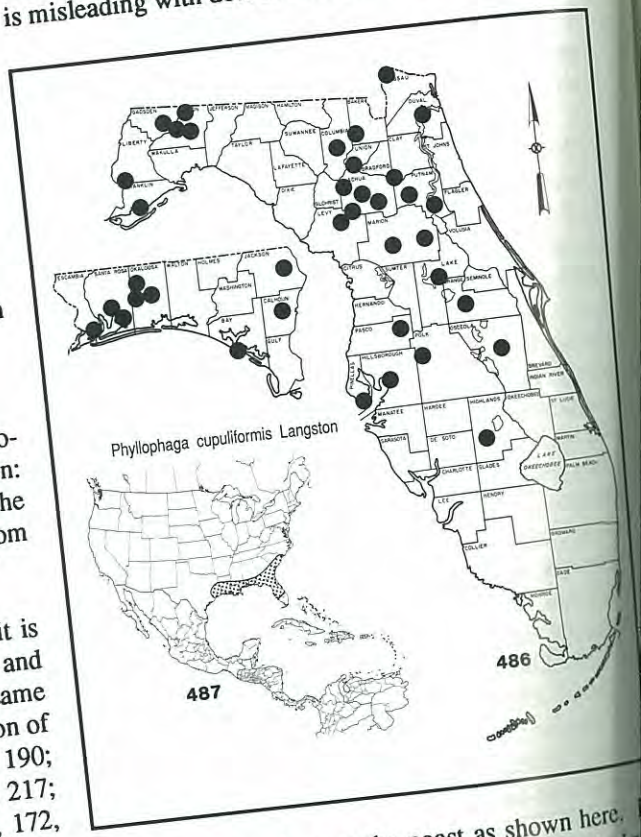
TYPE LOCALITY: No specific locality for the holotype, but the following listed in the original description: "Gulfport, Ocean Springs, and Pass Christian, in the coastal plains section of South Mississippi; and from McHenry, and Saucier, in the longleaf pine area."

DIAGNOSIS: In body shape and pruinescence it is similar to *micans* (not recorded from Florida) and *subpruinosa*. Genitalia for the 3 species are of the same basic type, but can be distinguished by comparison of the figures: *cupuliformis* (male: 10, 70, 130, 190; female: 276, 279); *micans* (male: 37, 97, 157, 217; female 330, 333); *subpruinosa* (male: 52, 112, 172, 233; female: 361, 364). The name *cupuliformis* refers to the exceptionally deep, broad, cup-shaped depression on male sternites 8 and 9.

DESCRIPTION: **Length**: 12.8-17.8mm; **Width**: 6.4-9.5mm. **Shape**: oblong, broader behind. **Color**: brownish to purplish black. **Vestiture**: glabrous, pruinose, opaque. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: feebly emarginate, concave; border moderately reflexed. **Tarsal Claws**: arcuate; tooth median, moderate (male), large (female). **Male Posterior Tibial Spurs**: lower fixed, decurved or arcuate, half length of upper; both spurs slender. **Female Genitalia**: fig. 276 (ventral), 279 (lateral). **Male Genitalia**: fig. 10, (caudal), 70 (ventral), 130 (dorsal), 190 (right lateral).

TAXONOMIC NOTES: Although originally described as a variety of *micans*, it is a distinct species. Along with 3 other species (*micans*, *sacoma*, and *subpruinosa*), it makes a distinct group of pruinose species with the same basic genitalia type.

U.S. DISTRIBUTION (fig. 487): Luginbill & Painter (1953: fig. 25) recorded it from **Alabama, Florida, Georgia, Mississippi**, and **South Carolina**. Their map is misleading with dots in the center of each state; the



records are mostly near the coast as shown here. **Mississippi**, Langston (1927b:38) stated that it had been taken more than 30 miles north of the Gulf Coa In **South Carolina**, Cartwright (1939:286) listed Meredith and Conway. In **Alabama**, Loding (1945:1 found it only at Mobile. In **Georgia**, Fattig (1944 recorded it from Butler, Cairo, Coolidge, Moul Thomasville, and Valdosta. Reinhard (1950:45 corded it from Walker and Angelina Co., **Texas**. (1988: map 14) recorded it from 2 localities Tammany parish, **Louisiana**.

FLORIDA DISTRIBUTION (fig. 486): Yo Thames (1949:127) reported it from "... northern of state". Our records include the northern two of the state as far south as Highlands Co.

BIOLOGY & ECOLOGY: (Some of the early literature on *micans* undoubtedly applies to this species, since they weren't separated until 1924). Our earliest record was February, and the latest was November (both Gainesville), with most specimens in March and April. *P. micans* was listed as a pest of loblolly pine flowers in Louisiana (McLemore, 1973:542).

Adult Host Plants: Beech, ebony, rose, tupelo, walnut, willow, witchhazel [families] (Luginbill & Painter, 1953:35); black gum, persimmon, water oak, black jack oak, willow oak, cinnamon oak, black oak, red oak, hog haw, rose (Fattig, 1944:19); hickory, pecan, sweetgum, willow, blackgum, persimmon, rose (Langston, 1927b:38).

Immatures: Although the larvae have not been described for this species, they probably are similar to those of the closely related *micans* (as noted in our key). The description of the third instar of *micans* by Boving (1942:42, fig. 106-109) follows: "Posterior part of labrum with a transverse series of 5 long setae on each side. Anterior marginal region of frons with one transverse series of about 6 long setae on each side. Epicranium opposite posterior concave part of frontal suture and epicranial suture with 3 or 4 setae on each side. Dorso-molar region of right mandible (Fig. 109) with a patch of about 15 setae and posteriorly a few granuliform setulae; dorso-exterior region with about two or no punctures, exceptionally in some specimens with one or a few setae; scrobis with a longitudinal series of about 8 larger punctures and 8 smaller, the latter mostly placed at the ventro-lateral carina; ventro-lateral carina with about 6 long setae; baso-lateral region with about 9 setae and some punctures. Epipharynx (Fig. 106) with about 12 heli; proplegmatium often indistinct, with 3 or 4 short proplegmata, not always present in the same number on both sides, sometimes absent on one side; distance between proplegmata as long or longer than a proplegma of average length; right chaetoparia with some punctures among the setae; crepidal punctures about 20. Raster (Fig. 108) with subrectangular septula; each palidium with one quite regular, anteriorly inward curved row of about 23 or more pali; pali somewhat different in number on right and left sides; palus (Fig. 107) fairly long and moderately wide, depressed, straight and pointed but with some variation in length and width in both palidia; bases of pali anteriorly close but in rest of palidium contiguous; preseptular setae about 7 in one irregular, transverse series. (Length of body about 27 mm; width of head about 4 mm.)."

Hayes (1929: fig. 170) illustrated the raster for *micans*, but he did not describe the larva. Ritcher (1966:87-88, fig. 201) included *micans* in his Key and illustrated the proplegmatia.

SPECIMENS EXAMINED: over 600, of which 586 were from 29 Florida counties. Over 360 specimens, representing 173 collection records, were from Gainesville. For complete data see Appendix 6.

SELECTED REFERENCES: Cartwright, 1939:286; Fattig, 1944:19; Langston, 1924:450, plate 44; 1927b:33, 36-37, plate 5, figure 19; Leng & Mutchler, 1927:38; Loding, 1945:104; Luginbill & Painter, 1953:11, 35, figure 25, plate 36(6-11); Philip, 1952: 151-155; Reinhard, 1939:53; Riley, 1988:31, 56, 117-119, 201-202, 435, figure 122-125, map 14, table 3-4; Woodruff, 1973:28; Young & Thames, 1949:127.

Note: Because *cupuliformis* and *micans* are confused in much of the early literature, and there is no secure way to determine which species is involved in all cases, the following references under the name *micans* are listed also.

Austin, 1880:26; Blackwelder, 1939:52; Blatchley, 1910:966, 970, figure 386, plate II; 1929:55; Boving, 1937:5; 1942:7, 9, 12-13, 23-24, 27, 42, 59-61, 63-65, figure 106-109, 233; Brimley, 1938:204; Dalla Torre, 1912:195; Davis, 1913a:10; 1919:107; Fattig, 1944:3, 7-8, 18-19; Forbes, 1916:217- 218, 220, 227, 229, 231, 238-239, 242, 244-245, 247-248, 252, 255-256; Glasgow, 1916:371, 375; Hayes, 1929:81, figure 170, plate 13; Horn, 1887a:141-144; 1887b:238, 242-243, 246, 261, 274, 277, 294; Jaques, 1926:338; 1927:315; 1928:304; King, 1914:334; Knaus, 1897:216; Langston, 1924:450, plate 44; 1927b:7, 33, 35-37, 82, plate 5, figure 18; LeConte, 1856:247, 251-252; 1883:144; Leonard, 1926:424; Loding, 1945:104; Luginbill, 1928:56, 76-77, figure 23, male A-C, female D-E; Luginbill & Painter, 1953:6, 11, 34, figure 24, plate 36(1-5); McLemore, 1973:541-542, figure 1; Neiswander, 1963: fig. 43, table 1, 6, 8; Owens, 1950:32, 37-38, 83, 86-87, figure 9, plate 2; Popenoe, 1876:30; Reinhard, 1939:53; 1944:582, 585-587, table 4-6; 1950:45; Riley, 1891:133; 1896:64-65; 1988:2, 31, 55, 117-118, 200-204, 435, figure 277-280, map 29, table 1, 3-4; Ritcher, 1938:26; 1940:76, 83-85, 93, 112, 123, 129, 136, figure 8, 12, 15, plate 5, table 3, 9-10, 14, 19-20; 1949a:19, 25, 32, figure 27, plate 2; 1966:86-87, 92, figure 93, plate 17; Sanderson, 1944:16-17, 19, table 1-2; Say, 1824:246; Schwarz, 1878:450; Smith, 1889b:488-493, 500, figure 29, plate 51; 1910:319; Travis, 1933:397, 400, table 5-7; 1934:316, 325, 352, figure 11, plate 3, table 1; 1939:693; Woodruff, 1973:28; Young & Thames, 1949:127.

Phyllophaga debilis (LeConte)

(fig. 11, 71, 131, 191, 277, 280, 392, 418, 488, 489)

Gynnis debilis LeConte 1856:262.
Lachnosterna debilis, Horn 1887a:145.
Phyllophaga debilis, Glasgow 1916:373.
Phyllophaga austricolia Fall 1929a:110.
Phyllophaga austricola Fall 1929b:216.

TYPE LOCALITY: "Philadelphia", Pennsylvania.

DIAGNOSIS: This is one of the small (9.7-12.5mm long), pale yellow, glabrous species that is externally similar to the following Florida species (see genitalia figures in parentheses for comparison): *clemens* (male: 7, 67, 127, 187: female: 270, 273); *debilis* (male: 11, 71, 131, 191; female: 277, 280); *gracilis* (male: 26, 86, 146, 206; female: 307, 310); *lota* (male: 34, 94, 154, 214; female: 324, 327); *taxodii* (male: 53, 113, 173, 233; female: 365, 368); and *yemasseei* (male: 58, 118, 178, 238; female: 373, 376). The antennae are 10-segmented in *gracilis*; both *gracilis* (10.5-13mm) and *taxodii* (12-14mm) are longer. In *debilis* there is a small median tooth on the anterior margin of the terminal abdominal sternite.

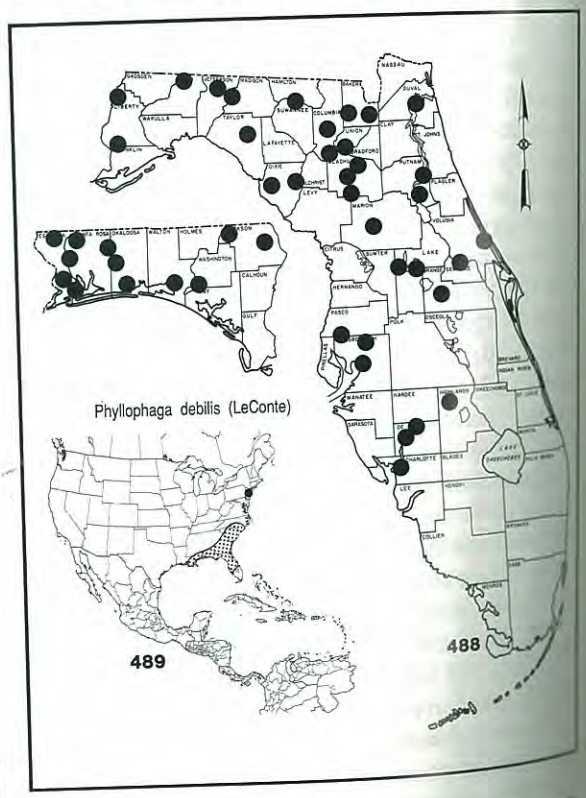
DESCRIPTION: **Length**: 9.7-12.5mm; **Width**: 4.0-5.5mm. **Shape**: elongate, cylindrical. **Color**: pale yellow to rufotestaceous, head fuscous. **Vestiture**: glabrous, moderately shining. **Antenna**: 9-segmented; male club length nearly equal to stem (fig. 418). **Clypeus**: entire, concave, margins widely reflexed. **Tarsal Claws**: feebly arcuate; tooth small, slightly antemedian. **Male Posterior Tibial Spurs** (fig. 392): lower fixed, two-thirds length of upper. **Female Genitalia**: fig. 277 (ventral), 280 (lateral). **Male Genitalia**: fig. 11 (caudal), 71 (ventral), 131 (dorsal), 191 (right lateral).

TAXONOMIC NOTES: Considerable confusion existed during the early days as to which species was *debilis*. Even though LeConte (1856:262) made it the type of his genus *Gynnis*, Horn (1887b:228) synonymized it under *dispar* (Burm.) He was followed in this by Dalla Torre (1912:188). Part of this problem was created by Horn incorrectly identifying *dispar* and describing it under the name *boops* (1887b:284).

Fortunately the LeConte and Horn collections are both at the MCZC, and I was able to examine the 4 specimens from each. Horn collection: (1) Enterprise, Fla., Horn Coll. 5745, *P. debilis* det. A. A. Granovsky 1939, female genitalia dissected; (1) Enterprise, Fla., May 22, Horn Coll. 5745, male genitalia dissected; (1) Fla., Horn Coll. 5745, male genitalia dissected; (1) Fla., 32, Horn Coll. 5745, male genitalia dissected. LeConte Collection: (1) Pa., Schaft., type 3330, male genitalia dissected, *Gynnis debilis* Lec., Schafthup, *L. dispar* Burm. [in Horn's handwriting?]; (1) Fla., Fuchs, *dispar* 2 [not *debilis* or *dispar*, but not dissected]; (1) Enterprise Fla., May 21, 375, *dispar* 3, male genitalia dissected; (1) Enterprise Fla., May 23, 376, *dispar* 4, female genitalia dissected.

The synonymy of *austricola* Fall cited above appears to have been established by Luginbill & Painter (1953:42), although no reasons were given for it. The only other reference we found for this was Boving (1942:36), in describing the larva under the name *austricola*, stated "(possibly = *debilis* (Lec.))". Most of Fall's work was very careful, and his distinction between *debilis* and *austricola* may be valid. The disjunct distribution (New Jersey vs. Gulf States) and the genitalic differences may validate Fall's species, but it was not possible to do so during this study.

U.S. DISTRIBUTION (fig. 489): Luginbill & Painter (1953: fig. 33) recorded it from **Alabama, Florida, Georgia, Mississippi, New Jersey**, and **South Carolina**. In **Mississippi** Langston (1927b:20) reported it from coastal localities: Gulfport, Perkinston (holotype of *austricola*), Pecayune, and Ocean Springs. In **Alabama**, Loding (1945:103) reported it only from Mobile Co. In **New Jersey**, Fall (1929a:110) reported specimens from Atlantic City, Camden Co., and Gloucester



Co. The holotype was from "Philadelphia", *Pennsylvania*. Riley (1988: map 15) reported it from 4 localities in St. Tammany Parish, **Louisiana**.

FLORIDA DISTRIBUTION (fig. 488): Blatchley

(1929:54) reported no specific localities. Young & Thames (1949:127), under the name *austricola*, reported it from the Aucilla and St. Johns Rivers and Enterprise near Lake Monroe. Our records include the northern two thirds of the state to Punta Gorda (Charlotte Co.) in the south.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:43) stated that it was not common, and the adult season was May to June. In Florida it is occasionally common and is found from March to August, with most specimens collected in May and June. It was most often taken in blacklight traps, but there are several records from Japanese beetle traps. The life cycle is unknown, and the immature stages probably have been described, under the name *austricola* (Boving, 1942:36).

Adult Host Plants: Under the name *austricola*, Young & Thames (1949:127) recorded it from river cypress (*Taxodium distichum*) and stated that it "... did not seem to occur on the Pond cypress (*Taxodium ascendens*)." Langston (1927b:20) recorded it from cypress and pine in Mississippi. The type specimen of *austricola* was taken on cypress (Fall, 1929a:111). Luginbill & Painter (1953:42) listed no hosts, and our many records add none.

Immatures: The third instar larva [under *austricola* Fall ("possibly = *debilis*")] was described and illustrated by Boving (1942:36, fig. 63-65) as follows: "Posterior part of labrum with a transverse, somewhat irregular series of about 4 long setae on each side. Anterior marginal region of frons with a transverse series of 3 to 4 long setae on each side. Dorso-molar region of mandible (Fig. 65) with a patch of 8 large and some minute setae; dorso-exterior region with 10 to 12 punctures; scrobis with longitudinal row of about 6 punctures; ventro-lateral carina with about 7 long setae; baso-lateral region with patch of about 7 long and many minute setae. Epipharynx (Fig. 64) with about 10 heli; proplegmatium elliptical with about 10 proplegmata; right chaetoparia with many punctures; crepidal punctures about 25. Raster (Fig. 63) with subelliptical septula; palidium with 16 to 18 pali arranged in a single row which is somewhat irregular in places; palus long, slender, straight and sharply pointed; pali close; preseptular setae about 5."

SPECIMENS EXAMINED: over 1000, of which 991 were from 28 Florida counties. More than one-third of these, representing 31 collection records, were from Gainesville. For complete data, see Appendix 7.

SELECTED REFERENCES: Blatchley, 1929:54-55; Boving, 1942:4, 6, 9, 12-13, 15, 22, 24, 36, 58, 61, 63, figure 63-65, 222 (as *austricola*); Brimley, 1942:14; Cartwright, 1944:32, figure 11; Dalla Torre, 1912:188; Fall, 1929a:110-111 (as *austricolia*); 1929b:216 (as *austricola*); Fattig, 1944:16; Glasgow, 1916:373-374; Horn, 1887a:145; 1887b:228, 293; Langston, 1924:449-450; 1927b:19-21, 70, 79, plate 2, figure 8; LeConte, 1856:262; Loding, 1945:103, 105 (as *austricola*); Luginbill & Painter, 1953:7, 42, 96, figure 33, plate 38(5-9); Riley, 1988:31, 56, 124-126, 193, 240-241, figure 132-135, map 15, table 3-4 (as *austricola* p. 124); Sanderson, 1939:9; Saylor, 1942:162; Sim, 1928:13, 50, plate 2; Woodruff, 1973:28; Wray, 1967:45; Young & Thames, 1949:127.

Phyllophaga diffinis (Blanchard)

(fig. 12, 72, 132, 192, 281, 284, 453, 490, 491)

Ancylonycha diffinis Blanchard 1850:138.
Trichestes comans Burmeister 1855:358.
Lachnosterna sororia LeConte 1856:246.
Lachnosterna rufiola LeConte 1856:256.
Lachnosterna diffinis, Horn 1887b:243.
Lachnosterna comans, Horn 1887b:261.
Phyllophaga diffinis, Glasgow 1916:372.

TYPE LOCALITY: "Texas".

DIAGNOSIS: In its medium size (14-16.8mm long), dark color, and 9-segmented antenna, it is only similar to *dispar* in Florida, although that species is usually smaller (11-12.9mm long); otherwise they are not related, and the genitalia are of completely different types. Compare *diffinis* (male: 12, 72, 132, 192; female: 281, 284) with *dispar* (male: 13, 73, 133, 193; female: 282, 285). In *diffinis* the male lower posterior tibial spur is fixed and two-thirds the length of the upper, whereas in *dispar* it is movable and almost as long as the upper (fig. 393).

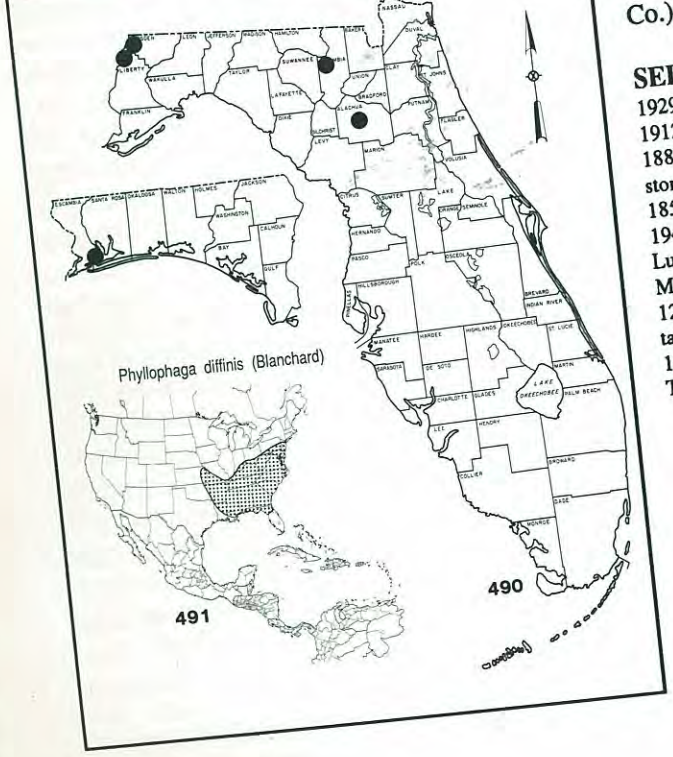
DESCRIPTION: Length: 15.2-16.8mm (14.0mm, Riley); **Width:** 7.8-8.3mm (7.3mm, Riley). **Shape:** oblong, nearly parallel, rather depressed. **Color:** red-brown to nearly black. **Vestiture:** glabrous, shining. **Antenna:** 9-segmented; male club longer than stem. **Clypeus:** emarginate, faintly sinuate medially; margin moderately reflexed. **Tarsal Claws:** feebly curved; tooth, small, median. **Male Posterior Tibial Spurs:** lower fixed, two-thirds length of upper. **Female Genitalia:** fig. 281 (ventral), 284 (lateral). **Male Genitalia:** fig. 12 (caudal), 72 (ventral), 132 (dorsal), 192 (right lateral).

TAXONOMIC NOTES: Smith (1889b:501) stated: "Dr. Horn says that after examination of Blanchard's

type, he finds that he had mistaken the species. Blanchard's *diffinis* is the *comans* of Burmeister, and has priority, while *diffinis* Horn thus becomes nameless.'' For it he proposed the name *definita*, which Glasgow (1916:373) listed as a synonym of *praetermissa* Horn.

Horn (1887b:260-261) stated (under *comans*) that he was able to examine a specimen seen by Burmeister and established that *rufiola* LeConte was ''...absolutely identical, while *sororia* is found to be a composite species the male being *comans*, the female a *micans* with the pruinosity lost. The type of *decidua* (unique) is also the same species.'' Glasgow (1916:371-372) agreed with the above synonymy, except he placed *decidua* under *futilis*.

U.S. DISTRIBUTION (fig. 491): Luginbill & Painter (1953: fig. 32) reported it from **Alabama, Arkansas, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, Ohio, South Carolina**, and **Tennessee**. Riley (1988: map 15) reported it from 3 localities in **Louisiana**. Sim (1930:146) reported it from Rancocas Park, **New Jersey**. Knaus (1897:216) reported it from Douglas Co., **Kansas** [the last 2 records were missed by Luginbill & Painter].



FLORIDA DISTRIBUTION (fig. 490): Blatchley (1929:55) reported it from Duval Co. and Tallahassee, the only records by Young & Thames (1949:127). Our records suggest that it occurs in the northern third of the state, the southernmost record being Gainesville.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:42) stated that it was not common, and the adult season was from the latter part of March to the first of June. In Florida it is not common, the earliest collections being March 14 (Gainesville) and the latest May 22 (Torreya St. Pk.). Riley (1988:132) noted that it was an early flier, arriving at lights just after dusk. The life cycle is unknown, and the immatures have not been described.

Adult Host Plants: Beech, ebony, elm, dogwood, maple, pulse, rose, rue, walnut [families] (Luginbill & Painter, 1953:42); black jack oak, water oak, red oak, white oak, chestnut oak, post oak, black oak, scrub oak, cinnamon oak, willow oak, hickory, apple, dogwood, prickly ash, soft maple, persimmon, orchard-grass, peanut, red elm (Fattig, 1944:19); red oak, white oak, black jack oak, maple, persimmon (Luginbill, 1928:84

SPECIMENS EXAMINED: several hundred, of which 44 were from the following 5 Florida counties: Alachua, Columbia, Escambia, Gadsden, and Liberty. All but specimens were taken at Torreya State Park (Liberty Co.). For complete data, see Appendix 8.

SELECTED REFERENCES: Blatchley, 1910:966, 1929:55; Cartwright, 1934:240; Crotch, 1874:61; Dalla Torre, 1912:187; Fattig, 1944:7-8, 19; Glasgow, 1916:372, 374; 1887a:142, 144-145; 1887b:238, 243, 294; Knaus, 1897:216; ston, 1927b:5, 55-56, 86, plate 9, figure 34; LeConte, 18 1856:246-247, (as *sororia*), 256-257 (as *rufiola*), 262; L 1945:104; Luginbill, 1928:56, 83-84, figure 29, male A-E, fe Luginbill & Painter, 1953:7, 41, figure 32, plate 3 Melsheimer, 1853:59; Neiswander, 1963:4, fig. 24; Riley, 1 129-132, figure 146-150, map 15, table 3-4; Sanderson, 194 table 1; Sim, 1928:40, 59, plate 11; 1930:140, 146-147 1889b:501, 514, figure 56, plate 55; Woodruff, 1973:28; Y Thames, 1949:127.

Phyllophaga dispar (Burmeister

(fig. 13, 73, 133, 193, 282, 285, 379, 393, 49

Trichestes dispar Burmeister 1855:361.
Lachnosterna dispar, Horn 1887b:228.
Lachnosterna boops Horn 1887b:284.
Phyllophaga dispar, Glasgow 1916:372.

TYPE LOCALITY: "In Nord-Amerika".

DIAGNOSIS: This is the smallest of the dark brown species (11-12.9mm long), and of the Florida species, it is externally similar only to *diffinis*. Compare *dispar* (male: 13, 73, 133, 193; female: 282, 285) with *diffinis* (male: 12, 72, 132, 192; female: 281, 284). In *dispar* the male lower posterior tibial spur is movable and almost as long as the upper, (fig. 393), whereas in *diffinis* it is fixed and two-thirds the length of the upper.

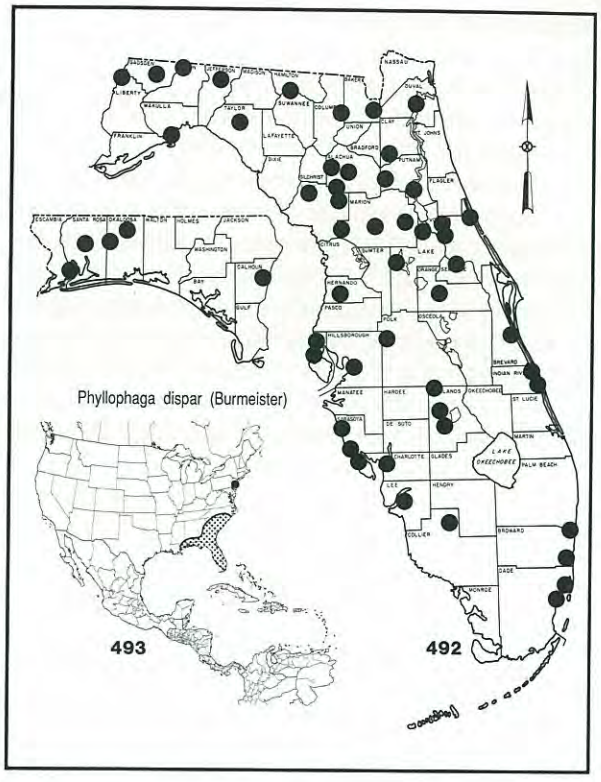
DESCRIPTION: **Length**: 11.0-12.9mm; **Width**: 5.4-6.3mm. **Shape**: oblong, cylindrical. **Color**: castaneous to piceous. **Vestiture**: glabrous, shining, rarely slightly pruinose. **Antenna**: 9-segmented; male club length nearly equal to stem. **Clypeus**: entire; margin moderately reflexed. **Tarsal Claws** (fig. 379): feebly curved, tooth small, median (female), antemedian (male). **Male Posterior Tibial Spurs** (fig. 393): lower movable, nearly as long as upper. **Female Genitalia**: fig. 282 (ventral), 285 (lateral). **Male Genitalia**: fig. 13 (caudal), 73 (ventral), 133 (dorsal), 193 (right lateral).

TAXONOMIC NOTES: Glasgow (1916:372) established the synonymy of *boops* Horn under *dispar* Burmeister. I examined the Horn and LeConte specimens at the MCZC and agree with this synonymy. The genitalia of the type (No. 3691) is that of *dispar*, and the LeConte specimen labelled by Horn as *dispar* is *debilis* LeConte (type No. 3330). Except for this early confusion, this is an easily recognized, fairly uniform species.

U.S. DISTRIBUTION (fig. 493): Luginbill & Painter (1953: fig. 29) recorded it from **Alabama, Florida, Georgia, Mississippi,** and **South Carolina**. Brimley (1938:203) reported it from Southern Pines, **North Carolina**. Smith (1910:319) listed Camden, Gloucester Co., New **Jersey**.

FLORIDA DISTRIBUTION (fig. 492): Blatchley (1929:54) reported it "... from numerous stations as far south as Tampa and Gulfport. Common at Dunedin." Our records include nearly the entire state, as far south as Coral Gables (Dade Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:40) stated that it was not abundant, and the adult season was June to August. Our earliest record is February 2 (Ft. Myers), and the latest is November 3 (Dade Co.), with most specimens taken in June, July, and August. It is sometimes abundant at Gainesville



(958 total specimens). Nearly all specimens were taken in blacklight traps, with several records from Japanese beetle traps. The third instar larva was described by Boving (1942:40), but the life history has not been studied.

Adult Host Plants: Pine [family] (Luginbill & Painter, 1953:40); long-leaf pine (Fattig, 1944:16); "... only known host plant ... is pine." (Langston, 1927b:71); loblolly pine (*Pinus taeda* L.) (Luginbill, 1928:89). The only host which we obtained, other than at light, was a specimen on *Solanum* sp.

Immatures: The third instar larva was described and illustrated by Boving (1942:40-41, fig. 92-94) as follows: "Posterior part of labrum with transverse series of 3 setae on each side. Anterior marginal region of frons with one irregular series of about 7 setae on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 3 setae. Dorso-molar region (Fig. 93) with patch of 6 to 8 setae, and 5 or fewer punctures in front; dorso-exterior region with 1 to 4 punctures; scrobis with a longitudinal series of 8 punctures; ventro-lateral carina with 7 long setae; baso-lateral region with about 8 setae. Epipharynx (Fig. 92) with about 12 heli; proplegmatium indistinct with 3 or fewer short and weak

proplegmata, not always present in the same number on both sides; distance between proplegmata as long as or longer than the length of a proplegma; right chaetoparia with some punctures among the setae; crepidal punctures about 20. Raster (Fig. 94) with subrectangular septula; palidium with one rather regular series of 13 to 16 pali extending with one or a few more pali in front of tegillum; palus short compressed, with hooked tip; distance between bases of pali generally about as long as a single palus but anteriorly somewhat longer; tegilla not meeting in front of palidia; preseptular setae absent."

fig. 494-495. Male genitalia, caudal view of: 494) *Phyllophaga okeechobea*, 495) *Phyllophaga elizoria* (14mm = 0.5mm).

SPECIMENS EXAMINED: over 1500, of which 1434 were from 36 Florida counties. Nearly 1000 of these, representing 347 collection records, were from Gainesville. For complete data, see Appendix 9.

SELECTED REFERENCES: Blatchley, 1929:54; Boving, 1942:3, 6, 9, 22, 27, 40, 59, 61, figure 92-94, 230; Brimley, 1938:203; Crotch, 1874:60; Dalla Torre, 1912:185, 188; Fall, 1929a:110; Fattig, 1944:7, 16; Frost, 1964:142; 1966:191; Glasgow, 1916:372, 374; Horn, 1887a:143-144; 1887b:215, 226-229, 285, 293, figure 20 (as *boops*); Langston, 1924:449; 1927b:5, 55-56, 86, plate 9, figure 34; LeConte, 1856:240; Loding, 1945:103; Luginbill, 1928:56, 88-89, figure 34, male A-C, female D-E; Luginbill & Painter, 1953:7, 39, figure 29, plate 40(1-6); Sim, 1928:45, 60, plate 12; Smith, 1889b:497, 521 (as *boops*), figure 15, plate 49; 1910:319; Woodruff, 1973:28; Young & Thames, 1949:127.

Phyllophaga elizoria Saylor

(fig. 15, 75, 135, 195, 287, 290, 388, 419, 420, 462, 463, 495, 496, 497, 584, 586, 588)

Lachnosterna pygidialis Schaeffer 1906:257.
(not ***H. pygidialis*** Brenske 1892:190).
Phyllophaga elizoria Saylor 1937:321.

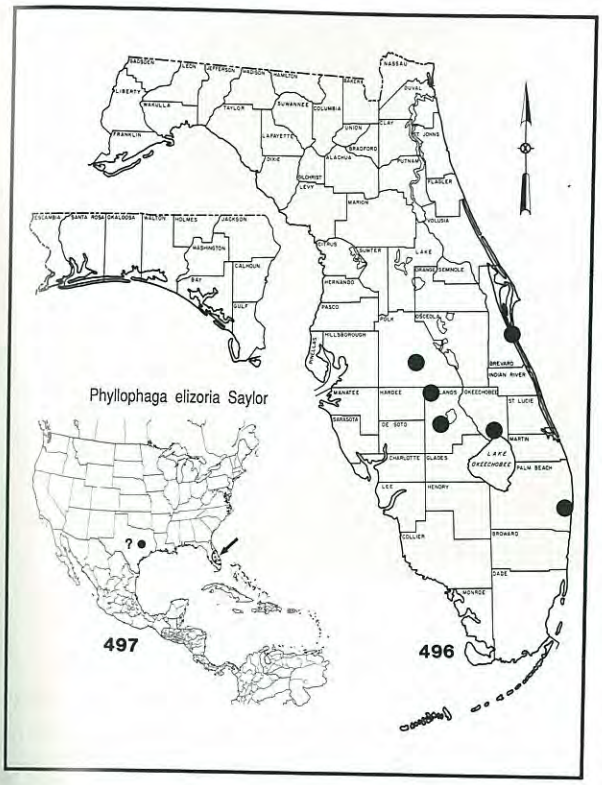
TYPE LOCALITY: of *pygidialis* Schaeffer: "Indian River, Florida".

DIAGNOSIS: The 3 following, closely related, hirsute species are externally similar and can best be distinguished by the genitalia (see figures in parentheses for comparison): *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *okeechobea* (male: 39, 99, 159, 219; female: 336, 339); and *skelleyi* (male: 51, 111, 171, 231; female: 360, 363).

DESCRIPTION: Length: 14.4-17.3mm; **Width:** 7.1-8.6mm. **Shape:** oblong, broader behind. **Color:** brown. **Vestiture** (fig. 388): pubescent, hairs long, fine; surface shiny. **Antenna:** 10-segmented; male club 1.5 times length of stem (fig. 419). **Clypeus:** distinctly emarginate, flat; margin feebly reflexed. **Tarsal Claws:** feebly curved; tooth small, nearer base than middle (fig. 420). **Male Posterior Tibial Spurs:** lower movable, nearly equal in length and width to upper; both spurs acute and hyaline margined. **Female Genitalia** fig. 287 (ventral), 290 (lateral). **Male Genitalia:** fig 15, 495 (caudal), 75 (ventral), 135 (dorsal), 195 (right lateral).

TAXONOMIC NOTES: The name *pygidialis* w first used in the genus *Holotrichia* by Brenske (1892:19 for a species from Sumatra. Saylor (1937:321) p posed the new name *elizoria* to replace the preoccup *pygidialis* Schaeffer. I examined the type at the USN with labels as follows: Ind. River, Fla.; O. Dietz; c Schaeffer; holotype *Phy. pygidialis* Sch.; M. Robin Collection 1959. I relaxed the specimen, but could find the genitalia. The genitalia was examine Glasgow (1916:374), so it apparently has been since. Ironically, Schaeffer described *arkansana* i same paper, and stated that "The genitalia are different from any of those described and figur Prof. Smith, but are unfortunately lost."

U.S. DISTRIBUTION (fig. 497): Luginbill & H (1953:52) recorded it from **Florida** and **Texas** Texas record is presumably based on the rec Reinhard (1950:47) of one male taken in a J beetle trap at Menard, Texas, 10-VII-39, R. We have not seen this specimen, but we doubt central Florida endemic occurs in Texas. E. (per. com.) could find no specimens of this s the TAMU collection, where Reinhard's speci located.



FLORIDA DISTRIBUTION (fig. 496): The type of *pygidialis* was from "Indian River, Florida". Blatchley (1929:69) could provide no other record. Young & Thames (1949:128) added De Soto City "... attacking young orange trees". These latter specimens have been reexamined and prove to be *okeechobea*. Our records indicate a restricted range in the central part of Florida from Melbourne on the north, to Boynton Beach on the south. It is most common in the Lake Wales ridge.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:52) indicated that the female was unknown, and it was described from a unique male. It has since been found in great abundance at Archbold Biological Station (Highlands Co.). Woodruff (Anonymous, 1960:148) reported that it had been reported as a pest on citrus nursery stock in Polk and Highlands Co. These latter records apply to *okeechobea*. These two species are extremely close and are relictual Florida endemics occupying the Lake Wales Ridge scrub habitats. It appears that *elizoria* is nocturnal, and *okeechobea* is diurnal.

Frost (1966:191-192, fig. 2) plotted the light trap catches at Archbold Biological Station, stating that it was not common in 1964 (56 males, 49 females). In 1965, females often outnumbered males, with their peak (30) about March 20. The first appearance was on March 5, and the latest was April 10.

Our figures of the female genitalia (fig. 287, 290) represent the first time the female has been illustrated. The life cycle is not known, and the immatures are undescribed.

Adult Host Plants: Young & Thames (1949:128) reported this species attacking young orange trees in a recently planted grove. During our study, these and other citrus records proved to be *okeechobea*, which we believe may be diurnal. There is a possibility that *elizoria* feeds on citrus, but we have not documented it. Luginbill & Painter (1953:52) did not record any hosts.

SPECIMENS EXAMINED: over 200, including the types of *pygidialis* and *elizoria*, of which 122 were from the following 6 Florida counties: Brevard, Highlands, Lake, Okeechobee, Palm Beach, and Polk. A very old specimen in the F. C. Bowditch collection is labelled "Monroe Co."; it is questionable and is thus eliminated from the data. Over 108, representing 26 collection records, were from Archbold Biological Station (Highlands Co.). For complete data, see Appendix 10.

SELECTED REFERENCES: Anonymous [Woodruff], 1960:148; Blackwelder, 1939:52; Blatchley, 1929:69 (as *pygidialis*); Dalla Torre, 1912:197; Frost, 1964:142; 1966:189, 191, figure 2; Glasgow, 1916:374 (as *pygidialis*); Luginbill & Painter, 1953:8, 52, plate 22(5-6); Reinhard, 1950:47; Robinson, 1948:32-34; Sanderson, 1939:11; Schaeffer, 1906:257-258; Woodruff, 1973:28; 1982:95-96, map 97; Young & Thames, 1949:128.

Phyllophaga elongata (Linell)

(fig. 16, 76, 136, 196, 288, 291, 498, 500, 501)

Lachnosterna elongata Linell 1896:725.
Phyllophaga elongata, Glasgow 1916:374.
Phyllophaga murrea Sanderson 1950:90. **n. syn.**

TYPE LOCALITY: "Florida".

DIAGNOSIS: The pale color, elongate body form, fine pubescence, medium size (av. 14mm long), short aborted lower male posterior tibial spur, 10-segmented antennae, and the feeble sub-basal tooth of the tarsal claw distinguish it from most Florida species except *panorpa*. The female genitalia (fig. 288, 291 versus 341, 344) are very similar, but the male genitalia are distinct (fig. 16, 76, 136, 196 versus 41, 101, 161, 221). The claspers of *elongata* are concave on the inside near the tip, whereas those of *panorpa* are convex. In addition, the posterior tarsal claw of *panorpa* is not

fig. 498. *Phyllophaga elongata*: male genitalia, enlarged tips; note concave inside of tip (35mm = 0.5mm).

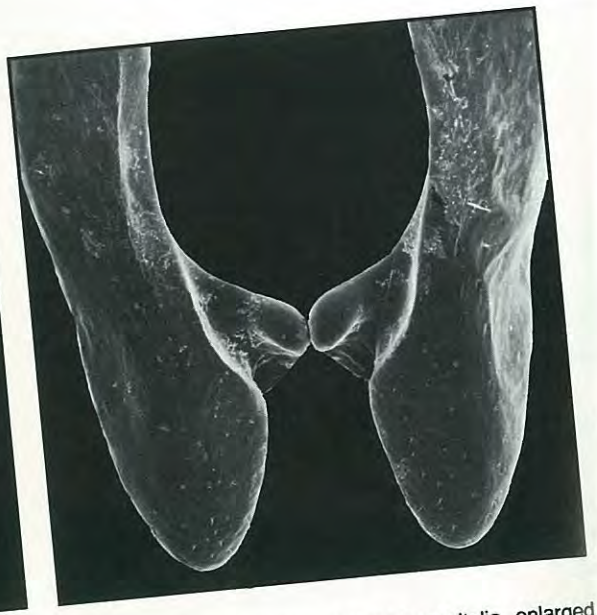


fig. 499. *Phyllophaga panorpa*: male genitalia, enlarged tips; note convex inside of tip (26mm = 0.5mm).

toothed, and the beetle is generally larger (av. 18mm long).

DESCRIPTION: **Length**: 12.4-15.5mm; **Width**: 5.7-6.8mm. **Shape**: very elongate, cylindrical. **Color**: pale rufotestaceous. **Vestiture**: pubescent, setae fine, sparse; surface slightly pruinose. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: distinctly emarginate; margin moderately reflexed. **Tarsal Claws**: tooth feeble, nearly basal. **Male Posterior Tibial Spurs**: lower fixed, aborted, one-fifth length of upper. **Female Genitalia**: fig. 288 (ventral), 291 (lateral). **Male Genitalia**: fig. 16, 498 (caudal), 76 (ventral), 136 (dorsal), 196 (right lateral).

TAXONOMIC NOTES: This rare species has no synonyms. The types were examined at the USNM (Type No. 567); they consist of 2 male specimens labelled "Fla.", one of which bears a note saying "original label to Horn 35 EAC" [E. A. Chapin]. The original description also noted them as "accession 23153 (from Charles Palm of New York)." Glasgow (1916:374) examined the type, but no lectotype appears to have been selected. [see note under *murrea* for the basis of synonymizing it under *elongata*]

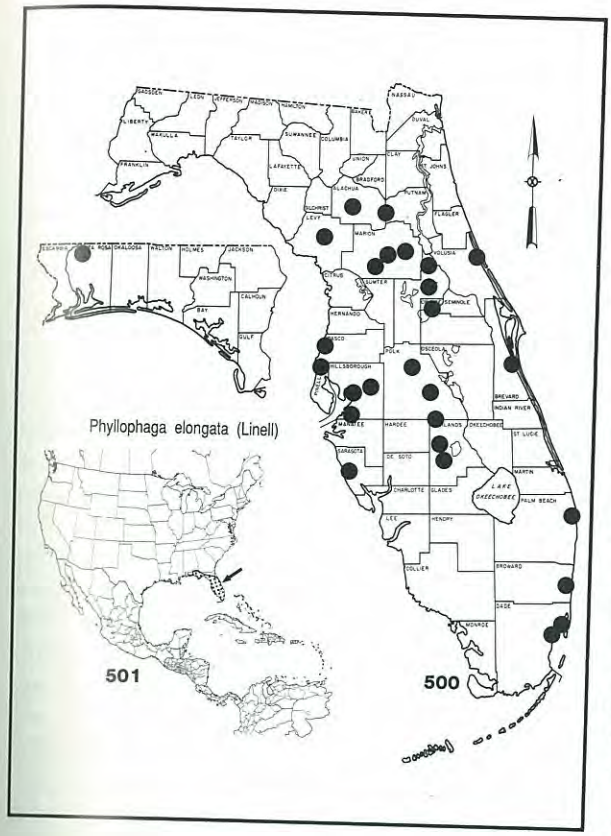
U.S. DISTRIBUTION (fig. 501): It is known only from **Florida** (Luginbill & Painter, 1953:26).

FLORIDA DISTRIBUTION (fig. 500): The types (2) were merely labelled "Florida". Blatchley (1929:53) added Enterprise, and Young & Thames (1949:126) only repeated these records. Woodruff (1982:96) recorded it from the following counties: Highlands Hillsborough, Lake, Levy, Marion, and Polk. Th records on our map (see Appendix 11) include those the USNM, INHS, UMMZ, and FSCA; they probab represent nearly every known specimen.

The basic pattern seems to be from Alachua C south to Miami. The only record out of line is for (Santa Rosa Co.); it was carefully checked and definitely *elongata*.

BIOLOGY & ECOLOGY: Luginbill & Pai (1953:26) listed it as "very rare" and appearing in and August. This is another Florida endemic for w we have little information. It appears to be f primarily in scrub habitat from April (Orange C Dade Co.) to September 23 (Archbold Biologica tion). The only series (178) was taken at the locality between June 29 and July 7 in a blacklig It also has been taken in Malaise trap, Japanese trap, Steiner trap, pitfall trap, and window tra interesting study would be the limiting factors affect *elongata* and *panorpa*, its sympatric sister *panorpa*. The life history is unknown, and the tures are undescribed.

Adult Host Plants: No hosts were found du study, and none are reported in the literature.



SPECIMENS EXAMINED: 306 from 18 Florida counties, representing 65 collection records. This rare species averages less than 2 per catch, with a single night maximum of 11 on 19-VIII-39, Hillsborough Co., 2.1 mi. W. Plant City. For complete data, see Appendix 11.

SELECTED REFERENCES: Blatchley, 1929:53; Dalla Torre, 1912:188; Glasgow, 1916:374; Harris, 1827:8; Luginbill & Painter, 1953:6, 26, plate 29(1-4); Sanderson, 1950:92; Woodruff, 1973:28; 1982: 96, map 96; Young & Thames, 1949:126.

Phyllophaga ephilida (Say)

(fig. 17, 77, 137, 197, 289, 292, 394, 455, 502, 503)

Melolontha ephilida Say 1825:196.
Lachnosterna burmeisteri LeConte 1856:242.
Lachnosterna ephilida, Horn 1887b:225.
Phyllophaga ephilida, Glasgow 1916:371.

TYPE LOCALITY: No locality listed in original description.

DIAGNOSIS: Although generally the size and color of *clypeata*, *ephilida* has a faintly sinuate clypeus and 10-segmented antennae, whereas *clypeata* has the clypeus entire and 9-segmented antennae. It is practically identical externally to *forbesi*, which contributed to early confusion between them. The genitalia are the only sure means of separation; compare *ephilida* (male: 17, 77, 137, 197; female: 289, 292) with *forbesi* (male: 19, 79, 139, 199; female: 294, 297).

DESCRIPTION: **Length:** 13.0-17.8mm (19mm, Luginbill & Painter); **Width:** 6.5-7.2mm (9.1mm, Riley). **Shape:** moderately elongate, cylindrical. **Color:** rufotestaceous, head and pronotum usually darker. **Vestiture:** glabrous, moderately shining. **Antenna:** 10-segmented; male club length nearly equal to stem. **Clypeus:** broadly emarginate; border reflexed. **Tarsal Claws:** tooth medium sized, antemedian (male), larger and nearly median (female). **Male Posterior Tibial Spurs** (fig. 394): lower fixed, short, stubby, one-sixth length of slender upper. **Female Genitalia:** fig. 290, 455 (ventral), 292 (lateral). **Male Genitalia:** fig. 17 (caudal), 77 (ventral), 137 (dorsal), 197 (right lateral).

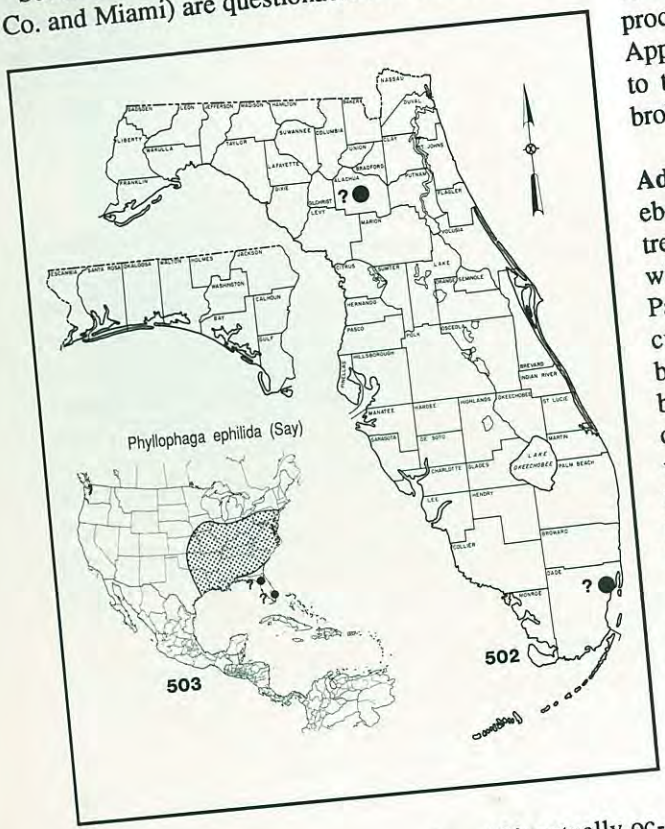
TAXONOMIC NOTES: Horn (1887b:226) established the synonymy of *burmeisteri* LeConte, stating that "The name was given under the supposition that Burmeister had incorrectly identified *longitarsis* Say ..." Dalla Torre (1912:188) mistakenly synonymized *uniformis* Blanchard under *ephilidia* [sic] as well as "var. *longitarsis* Burm. (not Say)." Both of the latter are valid species.

Because of the similarity (except in genitalia) *ephilida* and *forbesi* were confused in the literature prior to Glasgow's description in 1916.

The variety *virilis* Reinhard (1939:51-52) is recorded from Arkansas, Louisiana, and Texas (Luginbill & Painter, 1953:54-55). The exact status of this form, which was based on male genitalia differences, is in question. The 2 Florida specimens of *ephilida* match the nominate genitalia. Riley (1988:141) suggested that they may be distinct species, since he found the 2 forms together in 3 locations in Louisiana. Further study will be required to clarify this complex.

U.S. DISTRIBUTION (fig. 503): Luginbill & Painter (1953: fig. 46) recorded it from most of the eastern U.S., **west to Texas, Oklahoma, Kansas**, and **Iowa.** The **Texas** records (Reinhard, 1950:43) include the following counties: Galveston, Jefferson, Jasper, and Liberty.

FLORIDA DISTRIBUTION (fig. 502): Horn (1887b:226) recorded it from "Canada to Florida and Texas". Blatchley (1929:53) quoted Horn and added "Sevenoaks (Wick.)". Our 2 Florida records (Alachua Co. and Miami) are questionable and discussed in the



SPECIMENS EXAMINED section. If it actually occurs here, it is probably only in the northernmost tier of counties. It was not taken in extensive collections at Torreya State Park, where many other northern species were recorded.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:54) recorded it as "quite common in some sections," but they gave no seasonal data. In Louisiana, Riley (1988:137) listed the season as May to September. He also stated that it was "... the most economically important species of Phyllophaga in the state of Louisiana", because of severe larval damage to sweet potatoes. A preplanting soil insecticide application was required to minimize loss (Rolston & Barlow, 1980).

The life cycle seems to be variable in different areas. In Kentucky, Ritcher (1940:96, fig. 17) found that it "invariably" had a 2-year cycle, the grubs wintering at "extremely shallow depths," pupating in June, and adults emerging the same season. In Indiana, Davis (1920:273, under *burmeisteri*) indicated that it sometimes has a 2-and 3-year life cycle in the same cage. However, Rolston & Barlow (1980) found a 1-year cycle in Louisiana.

Riley (1988:139) mentioned that about 50% of the females that he examined were missing the pubic process, a situation not encountered in other species. Apparently the selerotized process is loosely attached to the membranous area, permitting it to be easily broken off.

Adult Host Plants: Beech, bignonia, birch, dogwood, ebony, elm, honeysuckle, mallow, olive, pine, plane-tree, pulse, rose, saxifrage, sumac, tupelo, walnut, willow, basswood, mulberry [families] (Luginbill & Painter, 1953:54); persimmon, winged elm, black locust, pecan, water oak, sumac, apple, scrub pine, river birch, black willow, dogwood, black walnut, hackberry, red bud, pear, wild cherry, strawberry, willow oak, plum (Fattig, 1944:15; "... general feeder," and willow oak, pin oak, red oak, persimmon, elm, willow, locust, cultivated apple, cultivated plum, Spanish oak, hackberry, walnut, pecan, wild cherry, dogwood, red bud, cultivated cherry, cultivated pear (Ritcher, 1940:110). The records for birch and loblolly pine by Luginbill (1928:83) are probably in error, because his illustration for *ephilida* is actually *uniformis*.

Immatures: The third instar larva was described and illustrated by Boving (1942:39-40, fig. 83-85) as follows: "Posterior part of labrum with a transverse seri of about 5 long setae on each side and a median pat of about 3 setae. Anterior marginal region of frons w one series of 6 long setae on each side. Epicranium each side opposite posterior concave part of fron suture and epicranial suture with 2 long and 4 sh setae. Dorso-molar region of right mandible (Fig. with a patch of about 12 setae and a few granules an or fewer punctures anterior to the patch; dorso-exte region with 8 to 14 punctures; scrobis with longitud row of about 8 punctures and in some specime moderately long setae; ventro-lateral carina with 7 setae; baso-lateral region with about 9 setae. Epi ynx with about 11 heli; proplegmatium elliptical w to 10 moderately long proplegmata; right chaet with many punctures among the setae; crepidal tures about 25. Raster (Fig. 85) with subrecta septula; palidia extending somewhat in front o lum, with a generally regular row of 18 to sometimes a few more pali; palus (Fig. 83) compressed, somewhat hooked; distance betwe anteriorly about the length of a palus, posterior

shorter; preseptular setae normally absent; tegillar setae comparatively few. (Length of body 28 to 30 mm.; width of head 3.5 to 4 mm.)."

Hayes (1929: fig. 161) illustrated the raster, but he did not formally describe the larva. Ritcher (1966:87-88, fig. 220) included it in his Key and illustrated the central portion of the raster.

SPECIMENS EXAMINED: several hundred from northern states, but only 2 from Florida: (1) Alachua Co., Gainesville, 10-V-22, F. W. Walker; and (1) Dade Co., Miami, 19-VII-60, J. L. Weaver, in airplane. The first record is likely mislabeled (see discussion of Walker's specimens in the QUESTIONABLE RECORDS section), and the Miami record is essentially a domestic interception.

SELECTED REFERENCES: Blackwelder, 1939:52; 1948:32; Blatchley, 1910:961, figure 377, plate I; 1929:53; Boving, 1937:6; 1942:6, 12-14, 22, 26, 39, 59, 61, 63-64, figure 83-85, 228; Brimley, 1938:203; Chandler, Taylor, & Deay, 1956:157; Crotch, 1874:60; Dalla Torre, 1912:188; Davis, 1916a:264, 268; 1918:7; 1919:114; Dury, 1902:156; Fattig, 1944:3, 14-15; Forbes, 1907:465; 1916: 226; Glasgow, 1916:371, 374, 378-379; Hayes, 1925:15, table 57-60; 1929:49, 65, 79, figure 161, plate 12, table 1; Horn, 1887a:142-144; 1887b:215, 220-222, 225, 227, 254, 278, 282-283, 293, figure 21, plate 3; Jaques, 1926:338; Knaus, 1897:215; Langston, 1927b:9, 13-14, 78, plate 1, figure 4; LeConte, 1856:241; 1859:298; Leonard, 1926:424; Loding, 1945:103; Luginbill, 1928:56, 82-83, figure 28, male A-D, female E-F; Luginbill & Painter, 1953:8, 53, 68, figure 46, plate 51(1-3, 6-7); Melsheimer, 1853:59; Neiswander, 1963: figure 26, table 1, 8; Owens, 1950:13-16, 18-19, 83, 87, figure 1, plate 1; Reinhard, 1939:52, 62, plate 1; 1950:43; Riley, 1891:133; 1988:2, 45, 59, 74-75, 101, 134-141, 144-145, 157, 234, 243, figure 22-24, 157-166, map 17, 19, table 1, 3-4; Ritcher, 1938:24-25; 1940:75-76, 81-82, 84-86, 96-97, 100, 102, 110, 117, 120, 122-123, 128, 132, 134, 149, figure 6, 17, 22, plate 6, table 3-4, 8-10, 18-20, 23; 1949a:19, 24, 34, 36, figure 46, plate 4; 1949b:3; 1958:320-321; 1966:86-87, 96, figure 97, plate 19; Rolston & Barlow, 1980:445-449; Say, 1825:196; Schaeffer, 1927:215-216; Sim, 1928:16, 18, 45, 47, 51, plate 3; 1934:7-8, fig. 4; Smith, 1889b:492, 496, figure 12, plate 49; 1910:318; Travis, 1934:314, 316, 318, 348, 364, figure 41(plate 9), figure 3(plate I); Wickham, 1894:232; Woodruff, 1973:28; Young & Thames, 1949:126.

Phyllophaga floridana Robinson
(fig. 18, 78, 138, 198, 244, 293, 296, 504, 505)

Phyllophaga floridana Robinson 1938:110.

TYPE LOCALITY: "St. Petersburg, Florida".

DIAGNOSIS: It is similar to other members of the *fraterna* complex (see genitalia figures in parentheses for comparison): *floridana* (male: 18, 78, 138, 198, 244; female: 293, 296); *foxii* (male: 21, 81, 141, 201, 246; female: 299, 302); *fraterna* (male: 22, 82, 142, 202, 247; female: 300, 303); and *pseudofloridana* (male: 47, 107, 167, 227, 259; female: 353, 356). It is larger (16.6-20.6mm) than *pseudofloridana* (14-18.3mm). In *floridana* the right male genital clasper has a larger cusp at the top, and the interior right lobe is shorter, arising further inside. Above the orifice for the aedeagus, *pseudofloridana* has a knob-like projection (see especially fig. 227, 571, 572).

DESCRIPTION: **Length**: 16.6-20.6mm; **Width**: 8.7-9.7mm. **Shape**: oblong, nearly parallel, convex. **Color**: dark brown to piceous. **Vestiture**: glabrous, shining, costae noticeable. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: emarginate, moderately and deeply notched, narrowly reflexed. **Tarsal Claws**: tooth long, triangular, median. **Male Posterior Tibial Spurs**: lower fixed, two-thirds length of upper. **Female Genitalia**: fig. 293 (ventral), 296 (lateral). **Male Genitalia**: fig. 18 (caudal), 78 (ventral), 138 (dorsal), 198 (right lateral), 244 (left lateral).

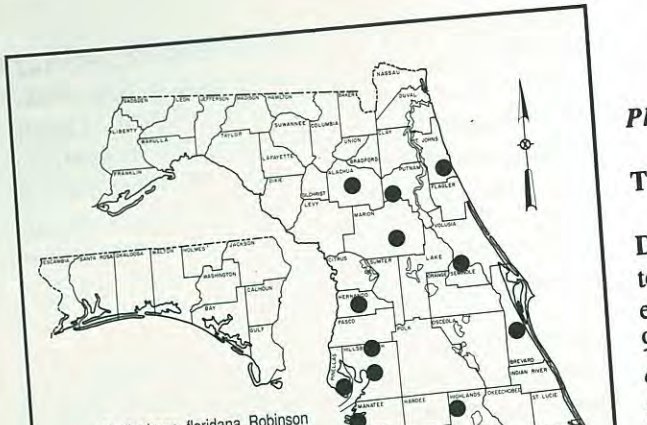
TAXONOMIC NOTES: No synonyms have been created, but, because of the recent distinction of the new species *pseudofloridana*, some early records were confused. The genitalia illustrated by Luginbill & Painter (1953: pl. 76, fig. 1-6) have been examined and belong to the new species. The genitalia are in the USNM and have the smoked coating used for photography, but they were not reassociated with the specimens from which they were dissected, so no locality information is available.

The records of Schwarz (1878:45), Blatchley (1929:56), and Young & Thames (1949:127) for *fraterna* from Enterprise (Volusia Co.) are undoubtedly *floridana*. The records for *floridana* by Fattig (1944:30), Loding (1945:105), Cartwright (1939:286), and Sanderson (1939:10) probably represent *pseudofloridana*.

U.S. DISTRIBUTION (fig. 505): Luginbill & Painter (1953:91) recorded it from **Florida** and **Georgia**. In Georgia, Fattig (1944:30) recorded it from Albany, Moultrie, Roberta, Thomasville, and Valdosta. In **Alabama**, Loding (1945:105) recorded it from Gallant, Etowah Co. In **South Carolina**, Cartwright (1939:286) recorded it from Monck's Corner.

As mentioned under TAXONOMIC NOTES, the above records are probably all *pseudofloridana* n. sp.

FLORIDA DISTRIBUTION (fig. 504): Our records for 10 counties are from Manatee and Highlands Co. in the south to Alachua and St. Johns Co. in the north. The



type locality is St. Petersburg. It is apparently endemic (precinctive) to Florida.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:91) listed it as rare and appearing in June. Young & Thames (1949:127) stated that it was "... not uncommon over the central part of the state". Our earliest record is March 24 (Univ. So. Fla. campus), and the latest is August 5 (Hillsborough River St. Pk.). No other biological information is available for this central Florida endemic. [see *pseudofloridana* also].

Adult Host Plants: Beech, ebony, tupelo [families] (Luginbill & Painter, 1953:92); water oak, willow oak, red oak, black gum, persimmon (Fattig, 1944:30); oak (Sanderson, 1939:10) [Most, if not all, of the above hosts are for the new species *pseudofloridana*; no definite hosts are known for the true *floridana*].

SPECIMENS EXAMINED: 40 from 10 Florida counties. For complete data see Appendix 12.

SELECTED REFERENCES: Blackwelder, 1939:52; Blatchley, 1929:56 (as *fraterna*); Cartwright, 1939:286; Fattig, 1944:7, 30; Luginbill & Painter, 1953:10, 91, plate 76(1-6); Sanderson, 1939:10; Schwarz, 1878:450 (as *fraterna*); Woodruff, 1973:28; Young & Thames, 1949:127. [see also *pseudofloridana* n. sp.].

Phyllophaga forbesi Glasgow
(fig. 19, 79, 139, 199, 294, 297, 506, 507)

Phyllophaga forbesi Glasgow 1916:378.

TYPE LOCALITY: "southern Illinois".

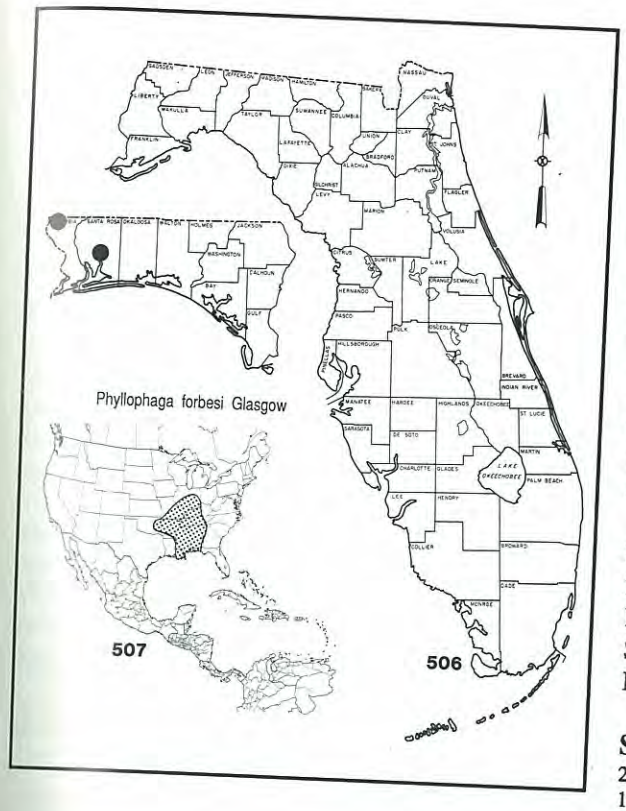
DIAGNOSIS: It is generally similar in size and color to *clypeata*, but *forbesi* has a sinuate emarginate clypeus (versus entire) and 10-segmented antennae (versus 9-segmented). It is practically identical externally to *ephilida* with which it was confused until 1916. The genitalia are the only sure means of separation; compare *ephilida* (male: 17, 77, 137, 197; female: 289, 292) with *forbesi* (male: 19, 79, 139, 199; female: 294, 297).

DESCRIPTION: Length: 14.3-17.9mm (13.6mm Riley); **Width:** 6.5-7.5mm (8.0mm, Riley). **Shape:** moderately elongate, subcylindrical. **Color:** pale rufotestaceous. **Vestiture:** glabrous, moderately shining. **Antenna:** 10-segmented; male club shorter than stem. **Clypeus:** broadly emarginate; margin moderately reflexed. **Tarsal Claws:** tooth strong, slightly anterior dian (male), or median (female). **Male Posterior Tibial Spurs:** lower fixed, half length of upper; both spurs slender. **Female Genitalia:** fig. 294 (ventral), (lateral). **Male Genitalia:** fig. 19 (caudal), 79 (ventral) 139 (dorsal), 199 (right lateral).

TAXONOMIC NOTES: No specific type locality was provided in the original description, but "Abundant in southern Illinois". Davis (1920) indicated that it was referred by him in early determinations as "new species e".

U.S. DISTRIBUTION (fig. 507): Luginbill & Painter (1953: fig. 62) recorded it from **Alabama, Arkansas, Georgia, Illinois, Indiana, Louisiana, Missouri, Oklahoma.** In **Alabama**, Loding (1945:103) recorded it from the following counties: Mobile, Monroe, Tuscaloosa. In **Georgia**, Fattig (1944:15) recorded a single specimen from Ringgold. In **Illinois**, Forbes (1916:226) listed it as "... abundant in southern Illinois", with the northernmost record from Urbana. In **Louisiana**, Riley (1988:145) recorded it from eastern parishes.

FLORIDA DISTRIBUTION (fig. 506): Our from Escambia and Santa Rosa counties constitute first records for Florida.



BIOLOGY & ECOLOGY: Luginbill & Painter (1953:69) listed it as common in some sections from the first of April to the latter part of July. Our only 2 records were taken in June and September in light traps.

Adult Host Plants: Beech, ebony, elm, logania, planetree, pulse, rose, saxifrage, walnut, willow [families] (Luginbill & Painter, 1953:69); elm, hickory, locust, oak, pecan, persimmon, *Philadelphus*, plum, poplar, rose (Langston, 1927b:15); In Illinois, Forbes (1916:226) reported 852 on cherry, 463 on peach, 422 on apple, 29 on persimmon, 15 on plum (85% of the total were on fruit trees); other hosts included rose, sycamore, walnut, oak, hickory, and willow. Riley (1988:145) added *Salix nigra* in Louisiana.

Immatures: The third instar larva was described and illustrated by Boving (1942:40, fig. 82) as follows: "Posterior part of labrum with transverse series of about 7 setae on each side. Anterior marginal region of frons with one series of 7 setae of varying lengths on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 3 long setae. Dorso-molar region of right mandible with a patch of 8 long and 8 short setae and about 10 punctures in front of the patch at inner margin of scissorial part of mandible; dorso-exterior region with about 15 punctures; scrobis with longitudinal row of about 8 punctures and 2 setae; ventro-lateral carina with 6 or 7 setae; baso-lateral region with about 9 setae. Epipharynx (Fig. 82) with about 11 heli; proplegmatium elliptical with about 8 proplegmata; right chaetoparia with numerous punctures among the setae; crepidal punctures about 25. Raster with subrectangular septula; palidium extending somewhat in front of tegillum, with a generally regular row of about 20 pali; palus short, compressed, somewhat hooked; distance between pali from half as long as a palus to as long; preseptular setae absent; tegillar setae comparatively few. (Length of body about 30mm.; width of head about 4mm.)."

SPECIMENS EXAMINED: hundreds, of which only 2 were from 2 Florida counties: (1) Escambia Co., Bratt, VI-68, F. S. Blanton, mosquito light trap; (11) Santa Rosa Co., Milton, Avalon Beach, 15-IX-83, R. Hill, blacklight trap.

SELECTED REFERENCES: Boving, 1937:6; 1942:7, 22, 26, 40, 59, 61, figure 82; Brimley, 1938:203; Davis, 1918:7; 1919:114; 1920:333; Fattig, 1944:15; Forbes, 1916:217-218, 220, 226, 236, 238, 239, 242, 246-248, 252, 255-256; Glasgow, 1916:378; Langston, 1927b:7, 9, 14, 79, plate 2, figure 5; Loding, 1945:103; Luginbill & Painter, 1953:9, 69, figure 62, plate 60(1-6); Owens, 1950:14, 16-17, 83, 87, figure 2, plate 1; Riley, 1988:58, 101, 136, 139, 144-146, 157, 234, 243, figure 171-176, map 18, table 3-4; Sanderson, 1944:16, 19, table 1; Sim, 1928:15-16, 51, plate III.

Phyllophaga forsteri (Burmeister)

(fig. 20, 80, 140, 200, 245, 295, 298, 452, 508, 509)

Ancylonycha forsteri Burmeister 1855:325.
Lachnosterna semicribrata LeConte 1856:247.
Lachnosterna lugubris LeConte 1856:248.
Lachnosterna lutescens LeConte 1856:249.
Lachnosterna forsteri, Horn 1887b:252.
Lachnosterna politula Horn 1887b:248.
Lachnosterna nova Smith 1889a:95.
Phyllophaga forsteri, Glasgow 1916:372.

TYPE LOCALITY: "In Nord-Amerika".

DIAGNOSIS: This shiny, red-brown species is superficially similar to the following Florida species (see genitalia figures in parentheses for comparison): *forsteri* (male: 20, 80, 140, 200, 245; female: 295, 298); *infidelis* (male: 31, 91, 151, 211, 252; female: 318, 321); *ovalis* (male: 40, 100, 160, 220, 255; female: 377,

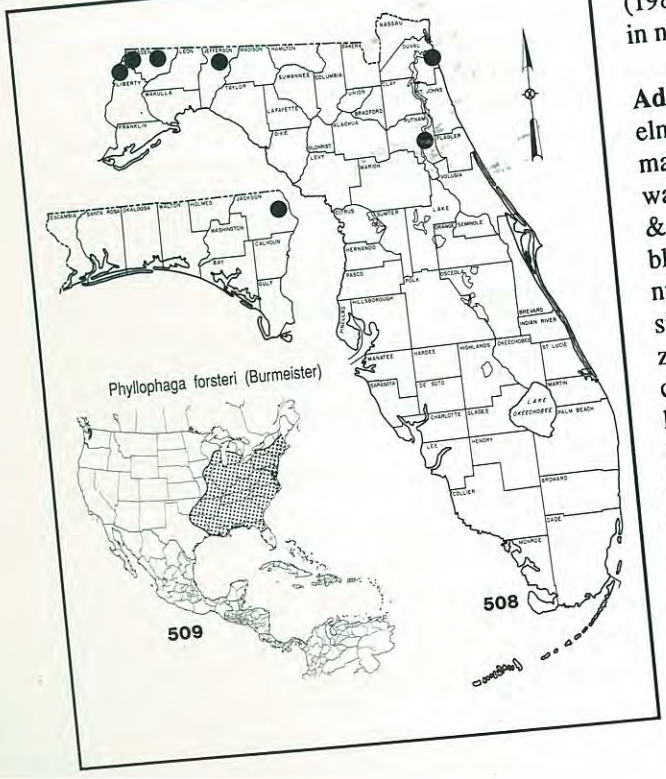
340), and *tecta* (male: 54, 114, 174, 234, 261; female: 366, 369). It is smaller (15.2-18.5mm long) than any of the other 3 and most similar to *tecta* (16.1-21.8mm long). In *forsteri* the left male genital clasper is incised deeply and (in lateral view) projects backwards toward the phallobase, whereas in *tecta* it is barely incised and has no such projection.

DESCRIPTION: **Length**: 15.2-18.5mm (14.4mm, Riley); **Width**: 7.1-8.3mm (9.6mm, Riley). **Shape**: oblong, oval. **Color**: castaneous. **Vestiture**: glabrous, slightly polished. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: emarginate; border moderately reflexed. **Tarsal Claws**: broadly arcuate; tooth median, well-developed. **Male Posterior Tibial Spurs**: lower fixed, two-thirds length of upper. **Female Genitalia**: fig. 295 (ventral), 298 (lateral). **Male Genitalia**: fig. 20 (caudal), 80 (ventral), 140 (dorsal), 200 (right lateral), 245 (left lateral).

TAXONOMIC NOTES: The long list of synonyms above indicates much early confusion about *forsteri*. Some early records (especially Gainesville) by Blatchley (1929:56) and others are referable to *tecta* Cartwright.

Part of the synonymy resulted from LeConte (1856:262) listing it as "unknown or unrecognized" by him. Horn (1887b:252) recorded it as a variety of *fraterna* Harris, with the synonym *lugubris* LeConte. In the same paper (1887b:248) he described *politula* from a single female. Dalla Torre (1912:189) listed all the above synonymy, except he recognized *politula* as valid. Glasgow (1916:372) established the entire synonymy.

Davis (1920:333) indicated that specimens he determined as "new species d" were *forsteri*.



U.S. DISTRIBUTION (fig. 509): Luginbill & Painter (1953: fig. 83) recorded it from the entire eastern half of the U.S. **as far west as Oklahoma, Arkansas, Missouri, and Iowa.** Reinhard (1950:46) added **Texas** (Smith and Cook Co.). Riley (1988: map 19) recorded it from 9 **Louisiana** parishes.

FLORIDA DISTRIBUTION (fig. 508): Most of the early records of this species in Florida (Blatchley, 1929:56), and specimens in collections, are probably *tecta*. Young & Thames (1949:127-128) pointed this out and stated that *forsteri* was found at Marianna and Torreya ravines.

Our records are few, but add eastern extensions to Mayport (Duval Co.) and Welaka (Putnam Co.).

BIOLOGY & ECOLOGY: Luginbill & Painte (1953:89) listed it as common in some southeaster states from the first of April to the first part of July. O earliest records are March 26 (Torreya State Park), a the latest is June 30 (Florida Caverns State Park). Bak (1985:269) stated that "... larvae are often destructi in nurseries [pine] in the South."

Adult Host Plants: Beech, bignonia, birch, ebo elm, grass, heath, honeysuckle, laurel, lily, magno maple, pine, pulse, rose, rue, saxifrage, sumac, tup walnut, willow, witchhazel, olive [families] (Lugi & Painter, 1953:89); white oak, black oak, red black jack oak, willow oak, water oak, post oak, c nut oak, sourwood, pine, sassafras, trumpet vine simmon, willow, black walnut, chinquapin, wit zel, loblolly pine, wild cherry, tulip poplar, sweet cat brier, black gum, alder, chestnut, blackberr huckleberry, beech, soft maple, winged elm, p ash, honey locust, ironwood, pecan, long-lea yellow sweet clover, timothy, pear, rose, sha hickory, pignut, mock orange, *Pinus virginiana* 1944:23). In Kentucky, it was "... most fre from persimmon and oak", and on hickory, willow, crataegus, sumac, blackberry (Ritcher, 19 In Illinois, Forbes (1916:233) reported (of 70 on oak, 12 on hickory, 7 on persimmon, a willow.

Immatures: The third instar larva was described and illustrated by Boving (1942:53, fig. 199-203) as follows: "Posterior part of labrum on each side with an irregular, transverse series of 7 to 10 setae. Anterior marginal region of frons with an irregular, transverse series of 7 to 10 setae of varying lengths on each side. Epicranium on each side opposite the posterior concave part of frontal suture and epicranial suture with an oblique, longitudinal series of 3 long setae. Dorso-molar setae of right mandible (Fig. 203) with a patch of about 25 setae and a few punctures; several minute punctures at inner edge of scissorial part; dorso-exterior region with 18 to 25 punctures and 1 to 3, sometimes no, setae; scrobis with longitudinal row of many irregularly placed punctures and about 3 setae; ventro-lateral carina with about 8 long setae; baso-lateral region with about 10 setae. Epipharynx (Figs. 200, 201) with about 11 heli; proplegmatium subelliptical to inversely spatulate, only moderately wide with about 7 proplegmata; chaetopariae with numerous punctures among the setae on right side only (Fig. 201); crepidal punctures about 35. Septula (Fig. 199) subrectangular with sides converging somewhat anteriorly and posteriorly; palidium with slightly irregular row of 27 to 32 pali, generally of same size; palus (Fig. 202) moderately short, depressed with lateral edges distally convex, tip pointed; bases of pali close or contiguous; preseptular setae approximately 7. (Length of body 30 to 35 mm; width of head about 4.5 mm.)."

SPECIMENS EXAMINED: over 200, of which 109 were from 6 northern Florida counties: Duval, Gadsden, Jackson, Jefferson, Liberty, and Putnam. For complete data, see Appendix 13.

SELECTED REFERENCES: Baker, 1972:148; 1985:269; Blackwelder, 1939:52; Blatchley, 1910:972, figure 387; 1929:56; Boving, 1937:5; 1942:6, 23, 29, 53, 60-61, 65, figure 199-203, 250; Brimley, 1938:203; Cartwright, 1934:268; 1944:30, 33, figure 10, plate 1; Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Fluke, & Callenbach, 1943:677-678, table 1; Chamberlin, et al., 1939:105, table 1; Crotch, 1874:61; Dalla Torre, 1912:189, 195 (as *nova*), 196 (as *politula*); Davis, 1919:114; 1920:333; Fattig, 1944:7-8 (as *fosteri* p.22), 23; Forbes, 1916:217, 233, 236-239, 242, 244, 247-248, 256; Glasgow, 1916:372, 374; Henry & Heit, 1940:279-280, table 1-2; Horn, 1887a:143; 1887b:252, 294; Jaques, 1926:338 (as *fosteri*); 1927:315 (as *fosteri*); 1928:304 (as *fosteri*); Langston, 1927b:34, 50, 85, plate 8, figure 30; LeConte, 1856:262; Leonard, 1926:424; Loding, 1945:104; Luginbill, 1928:56, 74-75, figure 21, male A-D, female E; Luginbill & Painter, 1953:10, 85-86, 88-89, figure 83, plate 74(7-12); McLemore, 1973:542; Neiswander, 1963: fig. 28, table 1-6, 8; Owens, 1950:34, 62-63, 83, 88, figure 21, plate 4 (as *fosteri*); Reinhard, 1950:46; Riley, 1988:62, 146-149, figure 177-181, map 19, table 3-4; Ritcher, 1940:75, 83-85, 87, 110, figure 12, plate 5, table 18-19; 1949a:19; Sanderson, 1939:5; 1944:16-17, 19, table 1-2; Sim, 1928:39, 58, plate 10; 1928:15-16, 51, plate III; 1930:147; Smith, 1889a:95; 1889b:490, 508-509 (as *nova*), plate 55, figure 44; 1910:319 (as *nova*); Travis, 1933:397 (as *fosteri*); 1934:317 (as *fosteri*); Yeager, 1950:177; Young & Thames, 1949:127.

Phyllophaga foxii Davis

(fig. 21, 81, 141, 201, 246, 299, 302, 432, 510, 516, 517, 518)

Phyllophaga foxii Davis 1920:334-335, pl. 63, fig. 18-23.

TYPE LOCALITY: "Tappahannock, Va."

DIAGNOSIS: It is similar to other members of the *fraterna* complex (see genitalia figures in parentheses for comparison): *floridana* (male: 18, 78, 138, 198, 244; female: 293, 296); *foxii* (male 21, 81, 141, 201, 246; female: 299, 302); *fraterna* (Male: 22, 82, 142, 202, 247; female: 300, 303); and *pseudofloridana* (male: 47, 107, 167, 227, 259; female: 353, 356). Davis (1920) also compared it to *infidelis* (male: 31, 91, 151, 211, 252; female: 318, 321), although they do not appear to be closely related.

DESCRIPTION: Length: 16.5-18mm (Davis) (19.0mm, Sim); **Width:** 8.9-10.3mm (Riley). **Shape:** oblong, nearly parallel sided, slightly wider behind. **Color:** dark brown to piceous, sometimes head and pronotum darker. **Vestiture:** glabrous, moderately shining. **Antenna:** 10-segmented, club nearly as long as stem in male, club about length of funiculus in female. **Clypeus:** moderately deeply emarginate; margin moderately reflexed. **Tarsal Claws:** arcuate, tooth strong, median in both sexes. **Male Posterior Tibial Spurs:** lower spur fixed, short, stout (half length of upper); upper spur weakly curved, slender, acute. **Female Genitalia:** fig. 299 (ventral), 302 (lateral). **Male Genitalia:** 21 (caudal), 81 (ventral), 141, 432 (dorsal), 201 (right lateral), 246 (left lateral).

TAXONOMIC NOTES: This species is a part of the complicated *fraterna* complex. We have some doubts as to its exact status, but must reserve judgement until the entire complex is revised. Early in our study, we identified 2 specimens (male & female) from Sanford (Seminole Co.) as this species, based on the male genitalia. These specimens are the ones illustrated in our plates. We never saw any additional Florida specimens with the right paramere of this form. However, we did obtain a series of the closely related *floridana* from the same locality (see SPECIMENS

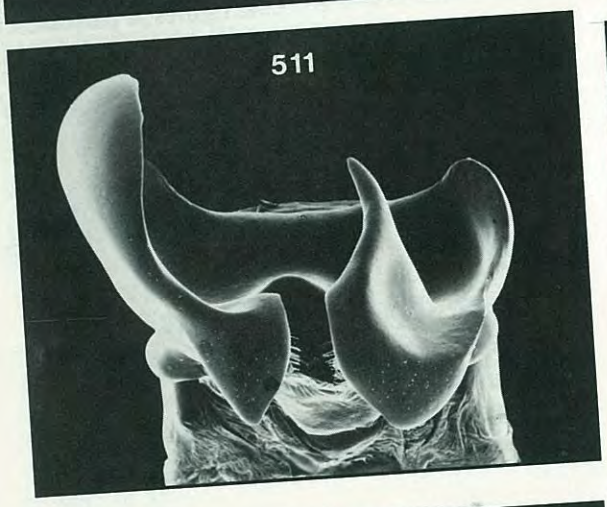


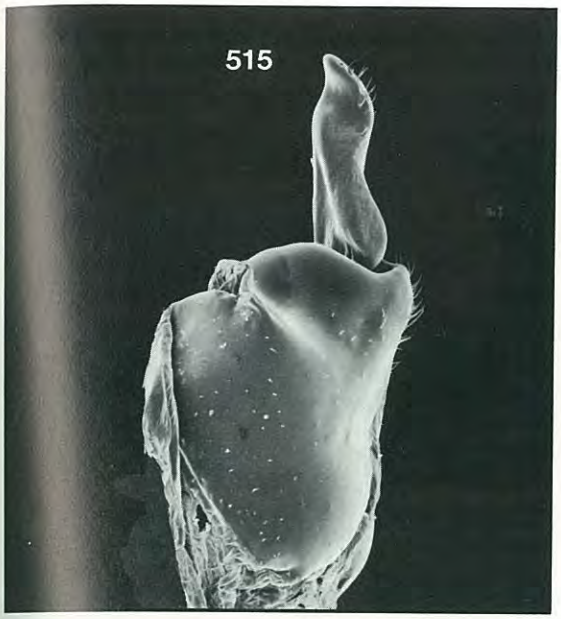
fig. 513-514. *Phyllophaga foxii*, male genitalia: 513) left lateral, 514) caudal (South Carolina, 12mm = 0.5mm).

fig. 510-512. *Phyllophaga foxii*, male genitalia: 510) right lateral, 511) ventral, 512) dorsal (South Carolina, 12mm = 0.5mm).

EXAMINED under *floridana*). We suspected that our single male *foxii* may have been just an unusual morph of *floridana*, and we eliminated it from the list of Florida species.

Because the relationships among the species of the *fraterna* complex are unclear, we have temporarily included *foxii* in our fauna. We have also illustrated the genitalia (fig. 510-516) of each sex from South Carolina for comparison. The most notable differences are in the female, where the pubic process has no obvious shield behind (above) in the South Carolina specimen (fig. 517) (more similar to *fraterna*), but the shield is well-developed and more like *floridana* in the Sanford specimen (fig. 299).

While I was at the Illinois Natural History Survey I was able to examine the holotype, allotype, 2 paratypes and 6 other specimens of *foxii*. The shape of the intern



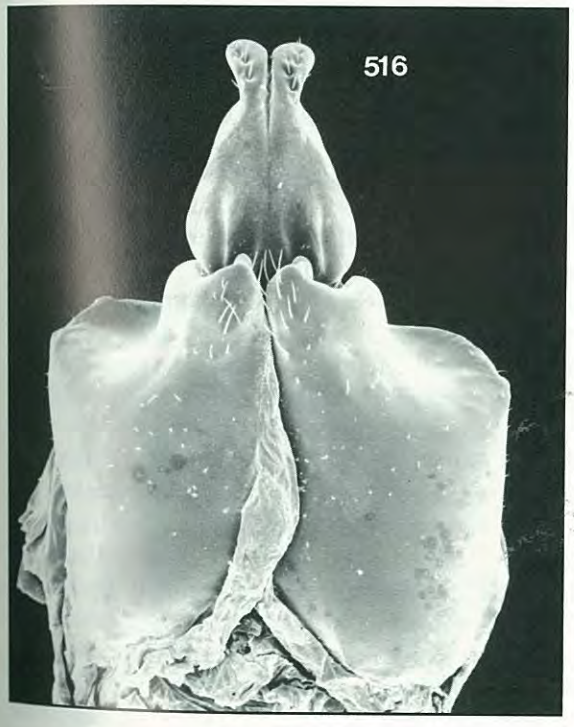
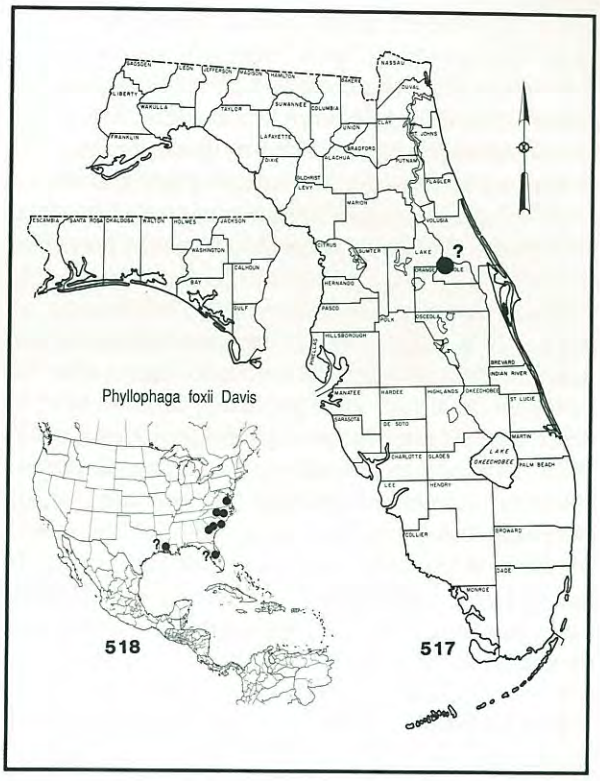


fig. 515-516. *Phyllophaga foxii*, female genitalia: 515) right lateral, 516) ventral (South Carolina, 12mm = 0.5mm).

process of the right clasper fig. 510, 514, of the male genitalia, varies considerably in shape, creating some doubt as to its reliability as a diagnostic character in this case. Because so few specimens were available from any single locality, it is presently not possible to evaluate this character. The female genitalia seem to offer better



characters in this case (fig. 515, 516).

The bottom line is that we are still in doubt about its presence in Florida, or even if it is a valid species. Only more specimens from its entire range, and a study of the entire *fraterna* complex, can shed more light on this subject.

U. S. DISTRIBUTION (fig. 518): Luginbill & Painter (1953: fig. 72) recorded it from **Georgia, Louisiana, South Carolina**, and **Virginia**. The type series (Davis, 1920:335) was from Tappahannock, **Virginia** and Columbia, **South Carolina**. Luginbill (1928:74) listed it from Georgetown, White Hall, Columbia, and Clemson, **South Carolina**. Riley (1988:151) did not find it in his **Louisiana** survey, and he suspected the report of it there (Luginbill & Painter, 1953) was in error. Fattig (1944:30) saw only 4 specimens from Augusta and Covington, **Georgia**. Brimley (1938:203) reported it from Raleigh, Farmville, Winston, Spring Hope and Wilson, **North Carolina**; apparently this reference was missed by Luginbill & Painter (1953). If our records are valid, this is the first report of it from **Florida**.

FLORIDA DISTRIBUTION (fig. 517): Our single questionable record is from Sanford, Seminole Co.

BIOLOGY & ECOLOGY: Luginbill & Painter

(1953:79) listed the season as mid-April to the first of June. The type series (Davis, 1920:335) was taken from April 17 to May 29. Brimley (1938:203) reported it from May to July, in North Carolina. Our 2 doubtful Florida specimens were taken on February 28. Although we have been able to see very few specimens, Luginbill & Painter (1953:79) stated: "Apparently a lowland species, fairly common in the plains area." In South Carolina, Luginbill (1928:74) found it common on the coast and sparingly along streams in the interior portion of the state. The life cycle is unknown, and the immatures are undescribed.

Adult Host Plants: In the original description (Davis, 1920:335) it was recorded from: blackberry, blueberry, wild rose, persimmon, red oak, Spanish oak, locust, elder bush, black gum, hackberry, birch, and sour gum. Luginbill & Painter (1953:79) listed host families: beech, birch, ebony, elm, honeysuckle, pulse, rose, sweet gale, tupelo, willow, and witchhazel. Our specimens were taken at light.

SPECIMENS EXAMINED: 12, of which 2 (male and female) questionable specimens were from Florida, Seminole Co., Sanford, 28-II-62, G. W. Desin, black-light trap.

SELECTED REFERENCES: Brimley, 1938:203; Cartwright, 1934:268; Davis, 1920:329, 334-335, fig. 18-23; Fattig, 1944:30; Frison, 1927:160; Glasgow, 1925:294; Luginbill, 1928:56, 73-74, fig. 20 (male A-C, female D); Luginbill & Painter, 1953:10, 78, 83, fig. 72, pl. 68(1-6); Riley, 1988:62, 122, 149-151, 177-178, 205, fig. 182-186; Sim, 1928:31, pl. IX; Webb, 1980:80.

Phyllophaga futilis (LeConte)

(fig. 23, 83, 143, 203, 301, 304, 395, 405, 519, 520)

Lachnosterna futilis LeConte 1850:226.
Ancylonycha gibbosa Burmeister 1855:324.
Lachnosterna decidua LeConte 1856:246.
Lachnosterna serricornis LeConte 1856:247.
Phyllophaga futilis, Glasgow 1916:371.

TYPE LOCALITY: "Lake Superior, New York, Kansas".

DIAGNOSIS: The unique male lower posterior tibial spur is fixed, longer than the upper spur, and modified into a twisted, boot-shaped process (fig. 395). The genitalia of both sexes are of a unique type, (fig. 23, 83, 143, 203, 301, 304), permitting easy recognition.

DESCRIPTION: Length: 14.2-17.9mm; **Width:** 6.9-8.6mm (8.9mm, Riley). **Shape:** oblong, convex, slightly broader behind. **Color:** reddish-brown to rufotestaceous. **Vestiture:** glabrous, moderately shining. **Antenna:** 10-segmented; male club slightly shorter than stem. **Clypeus:** feebly emarginate. **Tarsal Claws:** arcuate; tooth strong, acute, median in both sexes. **Male Posterior Tibial Spurs** (fig. 395): lower fixed, twisted, boot-shaped. **Abdomen:** fig. 405 (venter). **Female Genitalia:** fig. 301 (ventral), 304 (lateral). **Male Genitalia:** fig. 23 (caudal), 83 (ventral), 143 (dorsal), 203 (right lateral).

TAXONOMIC NOTES: Horn (1887b:230) listed *futilis* under *gibbosa* Burmeister, stating that it "... has long been known in our collections as *futilis* Lec., to which must be added *serricornis* Lec., described from a female." Dalla Torre (1912:190) listed *gibbosa* and *serricornis* as synonyms of *futilis* and added *pruinosa* Blanchard (not Wiedemann or Melsheimer). The latter is apparently a synonym of *prunina* (a valid species), according to Glasgow (1916:371) who established the total synonymy above.

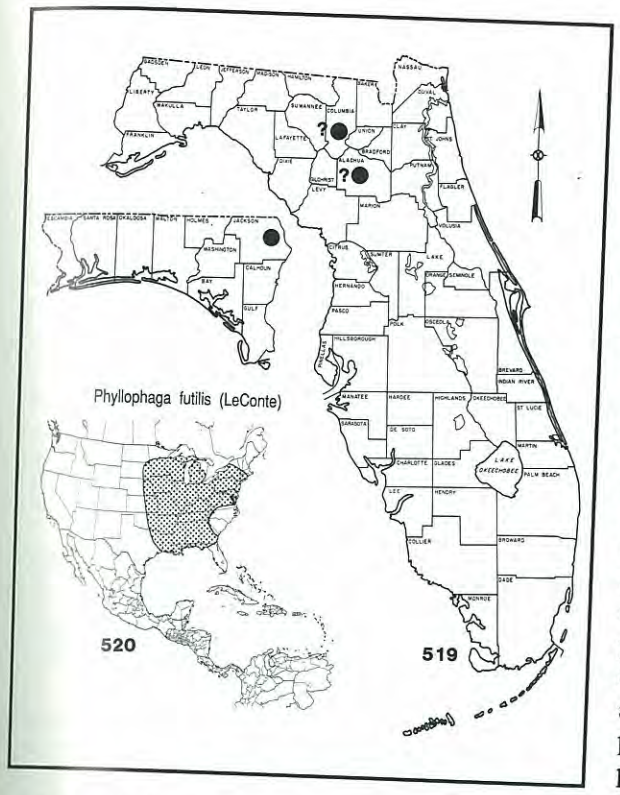
U.S. DISTRIBUTION (fig. 520): Luginbill & Painter (1953: fig. 57) recorded it from **most of the eastern half of the U.S.**, including **Florida.** Western limits include **Kansas, Nebraska, Oklahoma, South Dakota,** and **Texas.**

FLORIDA DISTRIBUTION (fig. 519): Blatchley (1929:54) recorded it from Gainesville and Lake City (det. J. J. Davis). Young & Thames (1949:127) added no other records. All our records are from Florida Caverns State Park (Jackson Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:65-66) listed it as very common in some sections from mid-March to mid-July. It is rare in Florida, being recorded only 4 times, and 2 of those from Florida Caverns State Park in April (the 2 records 16 years apart).

In Kansas (Hayes, 1925:79), eggs hatched in 11 to 38 days (av. 21.1); length of active larval stage was 389 to 773 days (av. 427.5); length of prepupal stage was 5 to 11 days (av. 7.4); length of pupal stage was 23 to 35 days (av. 27.7); the total life cycle was 428 to 853 days (av. 464.3). This suggests a 2-year cycle.

Davis (1919:106, 107, 112, 118) listed the following natural enemies of *futilis*: *Pyrgota valida* Harris (Diptera:



Pyrgotidae); *Cryptomeigenia theutis* Walker (Diptera: Tachinidae); *Eutrixa exile* Coquillett (Diptera: Tachinidae); and a spider predator, *Xysticus gulosus* Keys.

Adult Host Plants: Beech, birch, elm, honeysuckle, mallow, maple, mulberry, olive, pulse, rose, saxifrage, walnut, willow, basswood, buckeye, buttercup, dogwood, ebony, laurel, logania, nettle, oleaster, planetree, St. John's wort, witchhazel [families] (Luginbill & Painter 1953:66). In Mississippi, Langston (1927b:26) recorded only pecan, oak, and willow. Forbes (1916:225) recorded 45 hosts in Illinois, but quantities only on blackberry, apple, hackberry, elm, poplar, and corn. In Nebraska, Dawson (1922:112) found (of 361) 276 on elm, 65 on dogwood, 5 on boxelder, 4 on prickly ash, 3 on rose, 2 on gooseberry, 2 on oak, 2 on willow, 1 on blackberry, and 1 on poplar. In Kentucky, Ritcher (1940:111) recorded 23 hosts and a preference for pin oak, elm, and hackberry. In Iowa, Travis (1934:321) recorded it from bur oak, elm, butternut, hawthorn, gooseberry, hazel, cherry, plum, privet, *Cornus*, *Caragana*, apple, linden, birch, and buckeye. In Florida our only host was *Quercus nigra*.

It is obvious from the above that host preferences appear to be different in various geographic regions (e.g., in Illinois, blackberry; in Nebraska, elm; in Kentucky, pin oak).

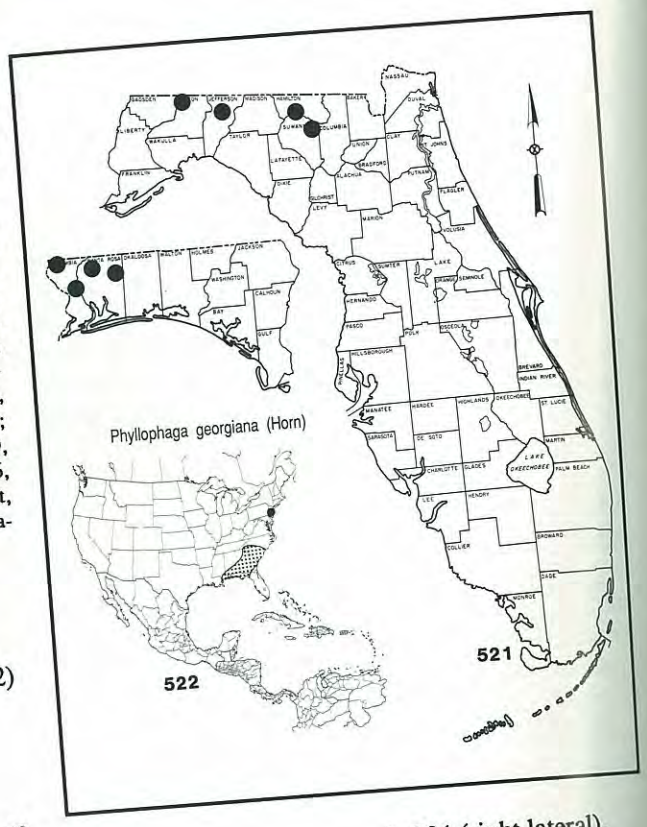
Immatures: Both the first and third instar larvae were described and illustrated by Boving (1942:38, fig. 72-73), the third as follows: "Posterior part of labrum with a transverse irregular series of about 8 either long or moderately long setae on each side. Anterior marginal region of frons with 5 long and 2 small setae on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 4 or 5 setae. Dorso-molar region of right mandible (Fig. 72) with a patch of about 15 setae and 5 to 6 punctures in front of molar part along inner margin of mandible; dorso-exterior region with about 15 punctures; scrobis with a longitudinal series of about 7 punctures and often 1 setae; ventro-lateral carina with about 7 setae; baso-lateral region with a patch of 12 to 15 setae. Epipharynx (Fig. 73) with 8 to 10 heli; proplegmatium with 8 to 10 narrow proplegmata; right chaetoparia with numerous punctures; crepidal punctures about 35. Raster with elongate-obovate septula; palidium with about 25 pali arranged in a single row which is irregular, especially posteriorly; palus long, slender, straight and sharply pointed; pali close or contiguous basally; preseptular setae about 15 in three or four irregular transverse series. Alar area of mesothorax with about 40 long, moderately long, and short setae. (Length of body about 30 mm.; width of head about 4.5 mm.)."

Hayes (1929) illustrated the raster (fig. 164), epipharynx (fig. 37), and sense cones (fig. 69), but he did not describe the larva. Ritcher (1966:87-88, fig. 219) included it in his Key and illustrated the central portion of the raster.

SPECIMENS EXAMINED: several thousand, of which only 12 were from Florida: (11) Florida Caverns State Park, Jackson Co., 18-IV-63, R. E. Woodruff, blacklight trap; (1) loc. cit., 13-IV-89, R. E. Woodruff, B. M. Beck, & P. E. Skelley, on *Quercus nigra* at night.

SELECTED REFERENCES: Blatchley, 1910:964 (as *gibbosa*); 1929:54; Boving, 1937:6; 1942:10, 22, 26, 38, 59, 61, 63, figure 72-73, 224; Chamberlin & Fluke, 1947:12; Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Fluke, & Callenbach, 1943:677-680, table 1-2, 4; Chamberlin, et al., 1938:228, 232-234, 236, 238, 240, table 1-2, 4-8; 1939:105, table 1; Chandler, Taylor, & Deay, 1956:150-152, 154-155, 157; Crotch, 1874:60; Dalla Torre, 1912:190; Davis, 1919:104-107, 112, 118; Dawson, 1922:112; Dury, 1879:7; 1902:156 (as *gibbosa*); Fattig, 1944:16-17; Forbes, 1916:217-218, 223-225, 230, 238-239, 241-248, 252-255; Glasgow, 1916:371, 375; Hayes, 1925:8, 11, 15, 80-81, table 57-67; 1928:282, 285, 289, 303-304, 306, plate 17, figure 5, 45; 1929:11, 13, 24, 26, 49, 56, 58-59, 65-66, 80, table 1, 7, 9-10, 13, figure 37, 69, 164, plate 4, 6, 12; Hayes & McColloch, 1928:251-252, 257, table 2-3, 7; Horn, 1887a:142, 144; 1887b:231, 293, figure 14, plate 3; Hudson, 1919:81-82 (as *gibbosa*);

Jaques, 1926:338 (as *futulis*); 1927:315 (as *futulis*); 1928:304 (as *futulis*); Knaus, 1897:215 (as *gibbosa*); Langston, 1927b:22, 25, 80, plate 3, figure 2; LeConte, 1850:226; 1856:243; Leonard, 1926:424; Loding, 1945:103; Luginbill & Painter, 1953:9, 65, figure 57, plate 57(7-11); McColloch & Hayes, 1922:132-135, table 2, 4-5; Melsheimer, 1853:59; Neiswander, 1963: table 1-7; Owens, 1950:3, 5-6, 20-22, 83, 87, figure 4, plate 1; Popenoe, 1876:30; Reinhard, 1950:44; Riley, 1988:58, 157-159, figure 41, 199-200, map 20, table 1, 3-4; Ritcher, 1938:24, 26; 1939:67-69, table 1, 3; 1940:76, 79, 82, 84-85, 88, 96-97, 100-102, 106, 111, 117, 120, 122-123, 130-131, 134, figure 6, 10, 26, plate 6, table 1-2, 4-6, 12-13, 17-20, 22; 1949a:19, 25, 34-35, figure 45, plate 4; 1949b:3-4, 8, table 1; 1966:86-87, 96, figure 97, plate 19; Sanders & Fracker, 1916:256 (as *gibbosa*); Sanderson, 1944:16, 21, table 1; Shenefelt & Simkover, 1951:222; Sim, 1928:43, 45, 60, plate 12; Smith, 1889b:497, figure 17, plate 49; 1910:319 (as *gibbosa*); Sweetman, 1927:785, 788; 1931:401, 409, 411, 413, 415, 421, table 6, 11; Travis, 1933:397, table 4-7; 1934:316, 320, 348, 364, figure 4, 39, plate 1, 9; Wade, 1935:85; Westcott, 1888:154-158 (as *gibbosa*); Wickham, 1894:233 (as *gibbosa*); Yeager, 1950:178; Young & Thames, 1949:127.



Phyllophaga georgiana Horn

(fig. 24, 84, 144, 204, 305, 308, 380, 406, 521, 522)

Phytalus georgiana Horn 1885:122-123.
(not Schaeffer 1909:382)
Phyllophaga georgiana, Glasgow 1916:374.
Phyllophaga (Phytalus) georgiana, Saylor 1939b:163.
Phyllophaga (Phytalus) georgianus, Young & Thames 1949:129. [not to be confused with ***georgicana*** Gyllenhal 1817:77, a synonym of ***crenulata*** Froelich].

TYPE LOCALITY: "Georgia".

DIAGNOSIS: As a member of the subgenus *Phytalus*, it is distinguished from all Florida species, except *obsoleta*, by the cleft tarsal claws (fig. 380). The inner tooth of the cleft is shorter than the outer in *georgiana*, but it is longer and larger than the outer in *obsoleta* (fig. 383). The genitalia are of completely different types; compare *georgiana* (male: 24, 84, 144, 204; female: 305, 308) with *obsoleta* (male: 38, 98, 158, 218; female: 335, 338).

DESCRIPTION: **Length**: 11.6-14.5mm; **Width**: 5.8-6.9mm. **Shape**: slender, moderately elongate. **Color**: testaceous, head piceous. **Vestiture**: glabrous, mildly shining. **Antenna**: Saylor (1939:163) listed the antenna as 8-segmented (female) but suggested that 9-segmented may be normal; club longer than stem. **Clypeus**: feebly emarginate, short. **Tarsal Claws** (fig. 380): cleft, slender; upper tooth longer. **Male Posterior Tibial Spurs**: lower fixed, half length of upper. **Abdomen**: fig. 406 (venter). **Female Genitalia**: fig. 305, (ventral), 308 (lateral). **Male Genitalia**: fig. 24, (caudal), 84 (ventral), 144 (dorsal), 204 (right lateral).

TAXONOMIC NOTES: The name *georgiana* Horn was used originally in the genus *Phytalus* (a synonym of *Phyllophaga*) and later by Schaeffer (1909:382) for an entirely different species (now known as *schaefferi* Saylor). To compound the confusion, Gyllenhal (1817:77) described *georgicana*, which is now regarded as a synonym of *crenulata* Froelich.

U.S. DISTRIBUTION (fig. 522): The unique type was from **Georgia** (Horn, 1885:123). In **Georgia**, Fattig (1944:31) recorded it only from Americus and Thomasville. Loding (1945:106) added Mobile Co., **Alabama**. Saylor (1939:163) listed Whitesbog and Lakehurst, **New Jersey**, and "Barcoure", **Alabama**. I examined specimens in the USNM from: **South Carolina** (Myrtle Beach, Yemassee, Clemson, Osborn, Hilton Head), **Mississippi** (Ocean Springs, Gulfport), **New Jersey** (White's Bog, Lakehurst, Hammonton), **Alabama** (Barboure). The latter is apparently the one cited above under "Barcoure" by Saylor.

FLORIDA DISTRIBUTION (fig. 521): Blatchley (1929) did not record it from Florida, and Young & Thames (1949:129) listed a single record for Leon Co. Our records include 6 counties in the panhandle west of

the Suwannee River. The USNM contains 1 specimen from Alachua Co., 3-IV-22, F. W. Walker. This is likely a labelling error (see section on QUESTIONABLE RECORDS).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953) did not treat this species. Our Florida records (27 collections) suggest it is a summer species; the earliest date was June 6 (Jay, Santa Rosa Co.), and the latest was September 28 (Suwannee Co.), with the most specimens (21) taken on July 4 (Suwannee River at Rt. 6). All specimens were taken in light traps. The life cycle is unknown, and the immature stages are undescribed.

Adult Host Plants: No hosts have been recorded, except collected at light.

SPECIMENS EXAMINED: about 70, of which 58 were from 6 Florida counties: Escambia, Hamilton, Jefferson, Leon, Santa Rosa, and Suwannee. For complete data see Appendix 14.

SELECTED REFERENCES: Blackwelder and Blackwelder, 1948:32; Dalla Torre, 1912:191; Fattig, 1944:7, 31; Glasgow, 1916:374-375; Horn, 1887a:142; 1887b:295; Langston, 1927b:64; Sanderson, 1937b:67-68; 1939:12; 1958:166; Saylor, 1939b:160-163, figure 3d (plate 9), figure 3a-3c (plate 10); Sim, 1928:3; Smith, 1910:319; Young & Thames, 1949:128.

Phyllophaga glaberrima (Blanchard)

(fig. 25, 85, 145, 205, 306, 309, 396, 422, 523, 524)

Ancylonycha glaberrima Blanchard 1850:136.
Lachnosterna glaberrima, LeConte 1856:242.
Lachnosterna parva Linell 1896:726.
(not ***Holotrichia parva*** Brenske 1892:180).
Phyllophaga glaberrima, Glasgow 1916:372.
Phyllophaga pagilis Saylor 1937:321.
(new name for ***parva*** Linell, not Brenske)

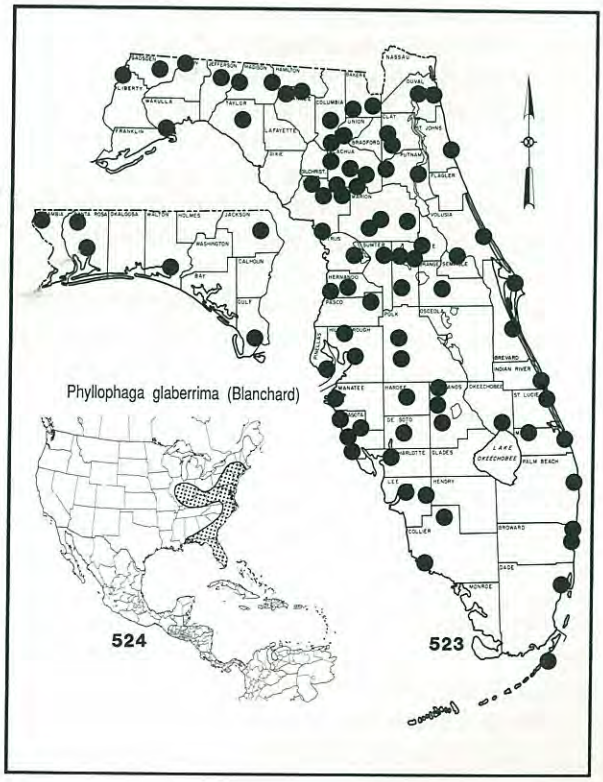
TYPE LOCALITY: "Pennsylvania".

DIAGNOSIS: It seems to be related to *prununculina* in the genitalia type and in the nearly complete reduction of the male lower posterior tibial spur. However, the genitalia are distinct; compare *glaberrima* (male: 25, 85, 145, 205; female: 306, 309) with *prununculina* (male: 46, 106, 166, 226; female: 349, 352). The pruinose coating on *prununculina* will easily separate the 2 species.

DESCRIPTION: **Length**: 13.1-16.5mm ("*parva*", 10.3mm); **Width**: 6.1-8.0mm ("*parva*", 4.7mm). **Shape**: oblong, cylindrical. **Color**: rufotestaceous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: emarginate, moderately deeply, broadly; margin moderately reflexed. **Tarsal Claws**: moderately curved; tooth antemedian (male), longer, median (female). **Male Posterior Tibial Spurs** (fig. 396): lower fixed, reduced to small dentate process; upper spur long, slender. **Female Genitalia**: fig. 306 (ventral), 309 (lateral). **Male Genitalia**: fig. 25 (caudal), 85 (ventral), 145 (dorsal), 205 (right lateral).

TAXONOMIC NOTES: The name *parva* Linell (1896:726) was given to a small form of *glaberrima*. I have examined the type of *parva* in the USNM (type No. 726) from "Fla.". Saylor (1937a:321) proposed the new name *pagilis* because of the homonymy of *Holotrichia parva* Brenske (1892:180) from Ceylon and Siam. Luginbill & Painter (1953:76) apparently were the first to synonymize *parva* under *glaberrima*. Except for size, there appear to be no differences, including genitalia.

U.S. DISTRIBUTION (fig. 524): The type locality is **Pennsylvania**. Luginbill & Painter (1953: fig. 71) recorded it from **Alabama, Florida, Georgia, New**



Jersey, Rhode Island, and **South Carolina**. Loding (1945:103) recorded it only from Mobile Co., **Alabama**. Brimley (1938:204) added Wilmington, **North Carolina**. The **Rhode Island** record is presumably based on that by Leonard (1926) from Coney Island. In **New Jersey**, Smith (1910:318) recorded it from DaCosta, Brigantine, and Anglesea. Blatchley (1910:962) stated that it was "... known from **Illinois, New York**, and southward", but he did not record it in his survey for **Indiana**.

FLORIDA DISTRIBUTION (fig. 523): It is one of the most common species throughout the state, and one of the few recorded from the Florida Keys.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:77) listed it as uncommon, appearing from the latter part of May to the middle of July. Our Florida records indicate it is the most common (7679 specimens), species and it has been taken every month of the year. The more than 6000 specimens from Gainesville represent 337 separate collections, with months and records as follows: V(36), VI(90), VII(95), VIII(84), IX(30), X(1), XI(1). Schwarz (1878:450) listed it as "rare in April"!

Adult Host Plants: Beech, rose, walnut, witchhazel [families] (Luginbill & Painter, 1953:77); water oak, laurel oak, live oak, wild cherry, pecan, sweet gum (Fattig 1944:14). In Florida, we have recorded calamondin, *Malus* sp., white mangrove, *Rhapis excelsa*, citrus roots, and cypress.

Immatures: The third instar larva was described and illustrated by Boving (1942:39, fig. 86-87) as follows: "Posterior part of labrum with a transverse series of about 8 setae on each side. Dorso-molar region of right mandible (Fig. 86) with a patch of about 10 setae and many punctures around and in front of the patch, also with a few granules; dorso-exterior region with about 5 or exceptionally no punctures; scrobis with irregular longitudinal row of about 6 punctures and sometimes a minute seta; ventro-lateral carina with about 8 long setae; baso-lateral region with about 6 setae and some punctures. Epipharynx with about 11 heli; proplegmatium elliptical with 6 to 7 proplegmata; chaetopariae without punctures; crepidal punctures about 35. Raster (Fig. 87) with subrectangular septula; palidium with a regular series of 17 to 20 pali; palus short, rather narrow, sides concave, hooked; distance between bases of pali from about half as long as a palus to as long; tegilla usually not meeting in front of palidium; presetular setae normally absent (occasionally 1 or 2 present); tegillar setae comparatively few. (The available material inadequate for full description of the larva of this species.)."

SPECIMENS EXAMINED: over 10,000, of which 7679 were from 50 Florida counties. Over 6000, representing 337 collection records, were from Gainesville. For complete data, see Appendix 15.

SELECTED REFERENCES: Austin, 1880:26; Blatchley, 1910:961-962; 1929:53; Boving, 1942:9-10, 22, 26, 39, 59, 61, 63, figure 86-87, 227; Brimley, 1938:204; Crotch, 1874:60; Dalla Torre, 1912:191; Fattig, 1944:7, 14; Frost, 1964:142; 1966:189, 191; Glasgow, 1916:372, 375; Hayes, 1925:23; Horn, 1887a:144; 1887b:221, 224, 227, 262, 293; LeConte, 1856:242; Leonard, 1926:424; Loding, 1945:103; Luginbill, 1928:56, 81-82, figure 27, male A-C, female D (as *glabberima* p. 8); Luginbill & Painter, 1953:9, 76, figure 71, plate 66(5-9); Melsheimer, 1853:59; Ritcher, 1940:76, 89, 111, plate 5; 1949a:19; Sanderson, 1937b:68; Schwarz, 1878:450; Sim, 1928:12, 50, plate 2; Smith, 1889b:495, 497, figure 11, plate 49; 1910:318; Woodruff, 1973:28; Young & Thames, 1949:126.

Phyllophaga gracilis (Burmeister)

(fig. 26, 86, 146, 206, 307, 310, 525, 526)

Trichestes gracilis Burmeister 1855:361.
Endrosa volvula LeConte 1856:235.
Lachnosterna inana LeConte 1856:242.
Lachnosterna gracilis, Horn 1887b:230.
Phyllophaga gracilis, Glasgow 1916:372.

TYPE LOCALITY: "In Nord-Amerika".

DIAGNOSIS: This small (10.0-13.2mm long), pale yellow, glabrous species is externally similar to the following Florida species (see genitalia figures in parentheses for comparison): *clemens* (male: 7, 67, 127, 187; female: 270, 273); *debilis* (male: 11, 71, 131, 191; female: 277, 280); *gracilis* (male: 26, 86, 146, 206; female: 307, 310); *lota* (male: 34, 94, 154, 214; female: 324, 327); *taxodii* (male: 53, 113, 173, 233; female: 365, 368); and *yemasseei* (male: 58, 118, 178, 238; female: 373, 376).

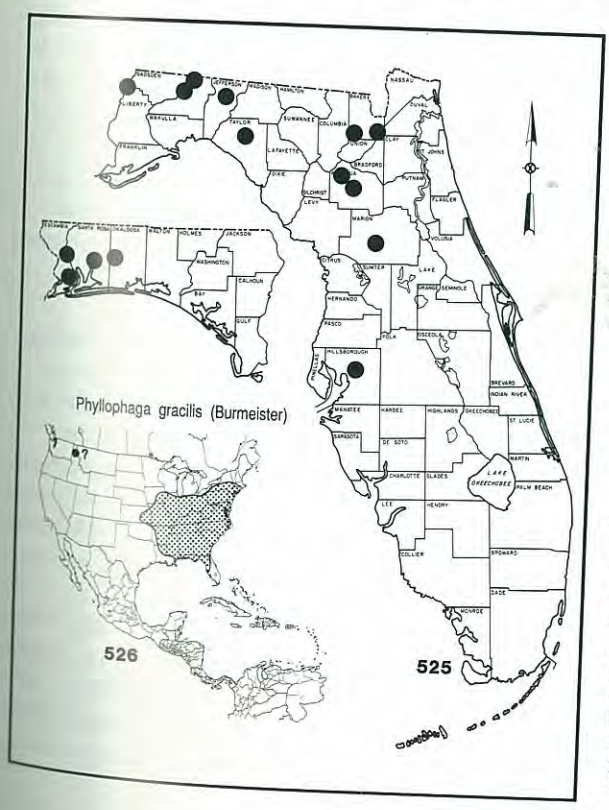
DESCRIPTION: **Length**: 10-0-13.2mm; **Width**: 4.4-6.6mm. **Shape**: elongate, cylindrical. **Color**: yellowish to pale rufotestaceous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: short, deeply emarginate; margin not widely reflexed. **Tarsal Claws**: feebly curved; tooth small, nearly median. **Male Posterior Tibial Spurs**: lower fixed, nearly equal in length to upper, obtuse,

twisted, curved. **Female Genitalia**: fig. 307 (ventral), 310 (lateral). **Male Genitalia**: fig. 26 (caudal), 86 (ventral), 146 (dorsal), 206 (right lateral).

TAXONOMIC NOTES: LeConte (1856:262) indicated that *gracilis* Burmeister was one of the species "unknown or unrecognized" by him. Horn (1887b:230) synonymized *volvula* LeConte and *inana* LeConte, "... both founded on unique females, the one with 9-jointed the other 10-jointed antennae." He also stated that there seems to be a tendency for this kind of variation in the pale species. Glasgow (1925:294) described the variety *angulata*, based on genitalic differences. The exact status of this form awaits further study. Because the 2 forms are sometimes found together, they cannot be considered subspecies. All Florida specimens appear referrable to the nominate form.

U.S. DISTRIBUTION (fig. 526): Luginbill & Painter (1953: fig. 89) recorded it from nearly the entire eastern half of the U.S., **as far west as Kansas, Arkansas, Missouri**, and **Louisiana**, with a disjunct record from **Idaho**. We have not been able to verify the latter, by literature or specimen. Travis (1934:32) recorded a single specimen labelled "**Iowa**".

FLORIDA DISTRIBUTION (fig. 525): Blatchley (1929:54) recorded it from Tallahassee; Young & Thames (1949:127) added no records. Our records include the northern half of the state, as far south as Hillsborough Co.



BIOLOGY & ECOLOGY: Luginbill & Painter (1953:94) listed it as fairly common in some localities from the latter part of June to the middle of August. Our Florida records (1557 specimens) show the earliest as April 27 (Springhead, Hillsborough Co.), and the latest was September 15 (Avalon Beach, Santa Rosa Co.), with most specimens taken in June and July. The largest single catch was 47 (Gainesville) on June 23.

Yeager (1950:178) gave the life cycle as 2 or 3 years, and stated that it pupates in the spring (unusual in *Phyllophaga*), at least in Michigan. He also indicated that larvae damage coniferous seedlings under experimental conditions. In New York, Henry & Heit (1940: table 4) collected 13,285 males (88%) and 1,698 females (12%) in light traps.

Adult Host Plants: Beech, bignonia, ebony, elm, honeysuckle, planetree, pulse, rose, tupelo, walnut, willow, witchhazel [families] (Luginbill & Painter, 1953:94). In Arkansas, Sanderson (1944:20) found a few on oak. Fattig (1944:16) recorded water oak, post oak, red oak, black gum, winged elm, hickory, persimmon, and peach. Langston (1927b:25), under the variety *angulata*, recorded only pecan and sassafras. Yeager (1950:178) stated that oaks were the "favorite food", and included Juneberry, rose, and New Jersey tea. One Florida specimen was taken on tomato, *Lycopersicon esculentum*.

Immatures: The third instar larva was described and illustrated by Boving (1942:41, fig. 99-101) as follows: "Posterior part of labrum with transverse series of about 4 setae on each side. Anterior marginal region of frons with a series of 4 long setae on each side. Epicranium on each side opposite posterior concave part of frontal suture with 2 long and 2 short setae. Dorsomolar region of right mandible (Fig. 101) with a patch of from 5 to 15 setae and often a few punctures around and in front of the patch; dorso-exterior region with about 15 to many more (about 30) punctures; scrobis with a longitudinal row of about 8 punctures and sometimes 1 or 2 setae; ventro-lateral carina with about 6 setae; baso-lateral region with about 8 setae. Epipharynx (Fig. 99) with about 10 heli; proplegmatium indistinct with 6 or much fewer, moderately long or short proplegmata, usually not present in the same number of both sides, and sometimes absent on right side; distance

between proplegmata about half as long or as long as a proplegma; right chaetoparia with a few punctures among the setae; crepidal punctures 25 or fewer. Raster (Fig. 100) with subrectangular septula; palidium with one irregular row of from 12 to 18 pali; palus short, compressed, hooked at tipl pali somewhat variable in length; distance between bases of pali about half the length of a palus, in some places longer, in other places shorter; tegilla meeting in front of palidia in some specimens but not meeting in others; preseptular setae 1 to 5 or absent; tegillar setae comparatively few. (Length of body 22 to 25mm.; width of head about 3.5mm.)'' Hayes (1929: fig. 163) illustrated the raster, but he did not describe the larva.

SPECIMENS EXAMINED: over 2000, of which 1557 were from 11 Florida counties. Almost half of these, representing 45 collection records, were taken at Tall Timbers Research Station (Leon Co.). For complete data, see Appendix 16.

SELECTED REFERENCES: Blatchley, 1910:962, 964, figure 380, plate I; 1929:54; Boving, 1937:5; 1942:3-4, 7, 9, 12-13, 22, 27, 41, 59, 61, 64, figure 99-101, 232; Brimley, 1938:204; Cartwright, 1934:240; Crotch, 1874:61; Dalla Torre, 1912:191; Davis, 1916a:264, 268; Dawson, 1922:213, 218; Easton, 1909:52; Fall, 1929a:110; Fattig, 1944:7, 16; Glasgow, 1916:372, 375; 1925:295; Hayes, 1925:72, table 57, 59; 1929:78, figure 163, plate 12; Henry & Heit, 1940:279-281, table 1-4; Horn, 1887a:143; 1887b:228-230, 293; Langston, 1927b:22-24, 80, plate 3, figure 10; LeConte, 1856:262; Leonard, 1926:424; Loding, 1945:103; Luginbill, 1928:56, 84-85, figure 30, male A-C, female D; Luginbill & Painter, 1953:10, 93-94, figure 89, plate 65(1-7); Neiswander, 1963: fig. 32; Owens, 1950:20, 30, 83; Reinhard, 1950:43; Riley, 1891:133; 1988:43, 58, 159-163, figure 34, 204-210, map 21, table 1, 3-4; Sanderson, 1937b:67; 1944:16, 19, table 1; Shaffer, 1920:83, 94, 98, figure 4, 10, plate 1; Sim, 1928:13, 50, plate 2; Smith, 1889b:492, 497, figure 16, plate 49; 1910:319; Travis, 1934:313-314, 316, 319-320, 348, 364, figure 5, plate 1, 9, figure 37, table 1; Wickham, 1894:232; Woodruff, 1961:17; Yeager, 1950:178; Young & Thames, 1949:127.

Phyllophaga hirticula (Knoch)

(fig. 27, 87, 147, 207, 248, 311, 314, 385, 527, 528)

Melolontha hirticula Knoch 1801:79.
Lachnosterna hirticula, LeConte 1856:254.
Phyllophaga hirticula, Glasgow 1916:371.

TYPE LOCALITY: ''Nordamerika''.

DIAGNOSIS: This is one of the easiest United States species of *Phyllophaga* to identify because of the unique elytral pubescence arranged in distinct rows (fig. 385). There is a variety in Kansas (*comosa* Davis) without these rows of hairs. The male and female genitalia are also diagnostic (fig. 27, 87, 147, 207, 248, 311, 314).

DESCRIPTION: Length: 16.2-20mm; **Width:** 7.3-10.6mm. **Shape:** oblong, slightly broader behind. **Color:** dark brown. **Vestiture:** pubescent, erect hairs evenly spaced on head and pronotum, arranged in rows on elytra (fig. 385); moderately shining. **Antenna:** 10-segmented; male club length nearly equal to stem. **Clypeus:** emarginate, moderately deeply; margin narrowly reflexed. **Tarsal Claws:** curved; tooth strong, median, equal in both sexes. **Male Posterior Tibial Spurs:** lower fixed, two-thirds length of upper; both spurs acute. **Female Genitalia:** fig. 311 (ventral), 314 (lateral). **Male Genitalia:** fig. 27 (caudal), 87 (ventral), 147 (dorsal), 207 (right lateral), 248 (left lateral).

TAXONOMIC NOTES: Normally such a common, widespread species would have several synonyms. However, the pattern of elytral setae in rows (fig. 385) permitted the early workers to recognize it. It was designated as the type species of the genus *Phyllophaga* by Glasgow (1916:370).

Davis (1920:337) described a variety (*comosa*) from Kansas which has no rows of hair on the elytra and the pronotal hairs are shorter and sparser. I examined the holotype at the INHS, comparing it with typical *hirticula*. Although the differences in pilosity are obvious, the other characters are difficult to distinguish. Because this form is associated with only a portion of the geographic range (Kansas and Nebraska), it may represent a subspecies. Further studies, including those of the aedeagus (internal sac), will be necessary to clarify its status. No such specimens have been found in Florida. Curiously, Fattig (1944:26) mentioned a male *hirticula* mating with a female *anxia* (a glabrous species).

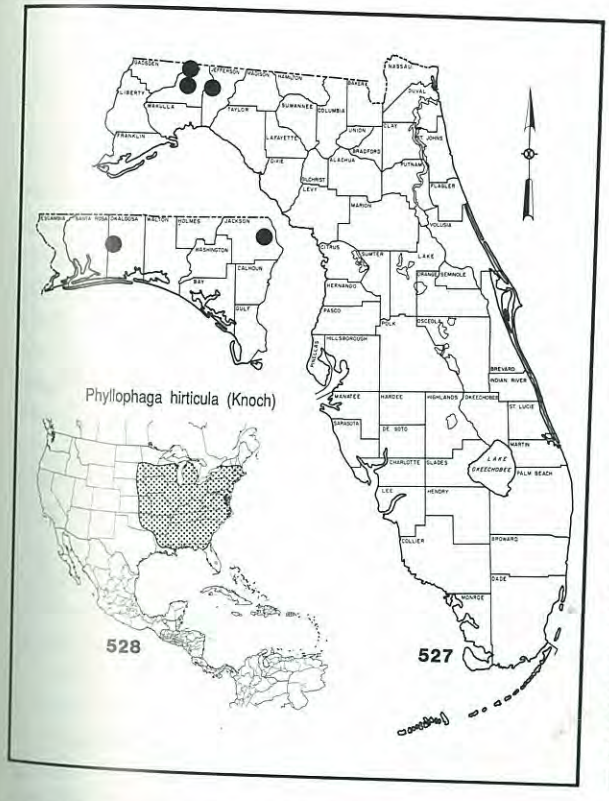
U.S. DISTRIBUTION (fig. 528): Luginbill & Painter (1953:14) recorded it from the eastern half of the U.S. as far west as **Nebraska, Kansas,** and **Oklahoma**. Although Horn (1887b:226-267) listed the range as extending to **Nebraska** and **Texas**'', it was not seen by Reinhard (1950:46) in his extensive survey of the *Phyllophaga*. Kirk & Balsbaugh (1975:59) recorded from **South Dakota** (Vermillion, Wilmot).

FLORIDA DISTRIBUTION (fig. 527): Blatchley (1929:56) and Young & Thames (1949:128) both recorded it only from Tallahassee. Our records include Leon, Jefferson, Jackson, and Okaloosa counties in the panhandle west of the Suwannee River.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:14) listed it as "Common in some sections where the grub destroys sod lands and farm crops". They listed the season as early March to the latter part of July. Our Florida records, representing a few localities in the panhandle, are from March to June. At Tall Timbers Research Station (Leon Co.) 1,435 specimens (of our total of 1,504) were collected in months and numbers of records as follows: III(5), IV(36), V(37), VI(1).

In Kansas, Hayes (1925:79), in dealing with *hirticula comosa* Davis, found the life cycle as follows: egg stage 11 to 30 days (av. 17.9); larval stage 753 to 765 days (av. 457.7); pupal stage 22 to 36 days (av. 27.7); total life cycle 786 to 831 days (av. 803.3). This represents a 3-year cycle. In Georgia, Smith & Lewis (1906:80) discovered that *hirticula* and *inversa* were eating the new buds on pecan trees, preventing the foliage from developing. In Illinois, Forbes (1916:221) considered it "... one of the most dangerous species in the state." In Iowa, Travis (1933:399) recorded 3 copulation times as follows: 8:42p.m. to 2:33a.m.; 8:46p.m. to 2:30a.m.; 8:51p.m. to 11:45p.m. In Kentucky, Ritcher (1939:67) considered it the dominant May beetle in the Inner Bluegrass Region, constituting 88% of collections. He found that the larvae, regardless of soil type, always pupated several inches below the plowline (6 in.). Forbes (1907:465) gave measurements for eggs freshly laid as follows: 1.5 by 2mm to 2.0 by 2.5mm; after 5 days they had swollen to 2.0 by 2.5 and 2.75mm. In Indiana, Chandler, et al. (1956:155) collected it in light traps at 4 ft. (141 females, 93 males) and 12 ft. (39 females, 17 males); of their 2,190 total specimens, 29.2% were females.

Davis (1919:105-107, 112) reared the following parasitic flies from *hirticula*: *Pyrgota undata* Wiedemann and *Pyrgota valida* Harris (Diptera: Pyrgotidae); *Cryptomeigenia theutis* Walker and *Eutrixa exile* Coquillett (Diptera: Tachinidae).



Adult Host Plants: Beech, birch, ebony, elm, honeysuckle, laurel, logania, magnolia, maple, mulberry, nightshade, pokeweed, pulse, rose, sumac, tupelo, walnut, willow, witchhazel, basswood, olive [families] (Luginbill & Painter, 1953:14); hickory, persimmon, water oak, red oak, black oak, white oak, post oak, pecan, apple, alder, black gum, wild cherry, tulip poplar, willow, black locust, rose, winged elm, river birch, inkberry, jimson weed, mulberry, osage orange, red clover, timothy, strawberry, blackberry, elderberry, hard maple, common fig, black walnut, Lombardy poplar, hackberry, plum (Fattig, 1944:26). Smith & Lewis (1906:80) reported it feeding on buds and leaves of pecan. In Kentucky, Ritcher (1940:111) recorded it from Spanish oak, post oak, walnut, hackberry, camperdown elm, Lombardy poplar, mulberry, pear, osage orange, plum, maple, blackberry, and elderberry. In Nebraska, Dawson (1922:116) recorded 28 on oak, 15 on blackberry, 12 on *Amorpha canescens*, and 5 on elm. In Iowa, Travis (1934:338) recorded it from elm, bur oak, hickory, willow, ash, butternut, shingle oak, hawthorn, red oak, white oak, gooseberry, hazel, and quaking aspen. In Illinois, Forbes (1916:221) called it a "... rather general feeder", finding it in numbers on oak, blackberry, mountain ash, cherry, hickory, black walnut, persimmon, and birch. Riley (1891:59-60) reported it defoliating a swamp oak and a chestnut tree in a residential area of Washington, D.C.

Immatures: The third instar larva was described and illustrated by Boving (1942:51, fig. 179-182) as follows: "Posterior part of labrum with a very irregular, at some places double, at the sagittal line forward curved series of about 11 setae on each side. Anterior marginal region of frons with a transverse double series of 6 long setae on each side in front and 4 short setae on each side behind. Epicranium on each side opposite the posterior concave part of frontal suture and epicranial

suture with an oblique longitudinal series of 3 long and 2 small setae. Dorso-molar region of right mandible (Fig. 181) with a patch of about 25 setae; several punctures at inner edge of scissorial part; dorso-exterior region with about 35 punctures and no to 4 setae; scrobis with longitudinal row of about 6 punctures and 1 to 5 setae; ventro-lateral carina with 7 to 10 setae; baso-lateral region with 12 or more setae and punctures. Epipharynx (Fig. 180) with about 12 heli; proplegmatium elliptical; rather narrow with 8 to 10 fairly short proplegmata; right chaetoparia with numerous punctures among the setae; crepidal punctures about 35. Septula (Fig. 182) subelliptical, medianly constricted, somewhat broader posteriorly, sides converging anteriorly and posteriorly; palidium with a regular row of 30 or few pali of same size; palus (Fig. 179) rather short, depressed, with lateral edges proximally concave, distally convex, tip pointed; bases of pali close or contiguous; preseptular setae 6 to 8. (Length of body 30 to 35 mm.; width of head 4.8 to 5 mm.).''

Ritcher (1966:87-88) included it in his Key and illustrated the maxillary stridulatory teeth (fig. 184), the epipharynx (fig. 205), dorsoexterior region of the mandible (fig. 207), 10th abdominal segment (fig. 217), and depressed pali (fig. 224).

SPECIMENS EXAMINED: over 10,000, of which 1504 were from 4 northern Florida counties: Jackson, Jefferson, Leon, and Okaloosa. Of these, 1435, representing 65 collection records, were from Tall Timbers Research Station (Leon Co.). For complete data, see Appendix 17..

SELECTED REFERENCES: Blackwelder, 1939:52; Blatchley, 1910:976, figure 403, plate V; 1929:56; Boving, 1937:4; 1942:6-7, 23, 29, 51, 60-61, figure 179-182; Brimley, 1938:204; Britton, 1912:289; Butler, 1888:85; Cartwright, 1934:268; Chamberlin & Callenbach, 1943:683, 685-687, table 1, 3, 5; Chamberlin & Fluke, 1947:12; Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Fluke & Callenbach, 1943:675-680, figure 1-2, table 1-2, 4; Chamberlin, et al., 1938:226-228, 230, 232-238, 240, table 1-8; 1939:104-109, figure 2-3, table 1; Chandler, Taylor, & Deay, 1956:150-155; Crotch, 1874:60; Dalla Torre, 1912:192; Davis, 1916a:262, 268-269, 275-276, table 1; 1919:106-107, 112; 1920:337; Dawson, 1922:116 (var. *comosa*); Dury, 1902:156; Easton, 1909:52; Fattig, 1944:3, 7, 25-26; Felt, 1912:398; 1916:55; Forbes, 1907:449-453, 456, 461, 463, 465, table 455-456, 463-464; Glasgow, 1916:369-370, 375; Harris, 1827:7; 1842:29; 1863:32, figure 11; Hayes, 1925:8, 15, 17, 20, 51-55, 80-81, table 38, 57; 1928:282; 1929:11, 65, 80, figure 182, plate 14; Henry & Heit, 1940:280, table 1-2; Horn, 1887a:142-144; 1887b:265-266, 273, 295; Jaques, 1925:338 (as *herticula*); 1927:315; 1928:304; Knaus, 1897:217; Langston, 1927b:58, 86, plate 9, figure 36; Le Conte, 1856:235, 254; 1883:143, 297-298; Leonard, 1926:425; Loding, 1945:105; Luginbill, 1928:55, 57-58, figure 6, male A-E, female F; Luginbill & Painter, 1953:5, 13-14, figure 5, plate 14(1-7); McColloch & Hayes, 1922:132-135, table 2, 4-5; Melsheimer, 1853:59; Neiswander, 1963: fig. 33, table 1-8; Owens, 1950:8, 10, 68-70, 83, 88, figure 23, plate 4; Peterson, 1951:83, 102, 108, figure I; Popenoe, 1876:30; Reinhard, 1939:56; 1950:46; Riley, 1891:59-60, 133; 1896:64-65; 1988:53, 70, 114, 163-166, figure 211-215, map 20, table 1, 3-4; Ritcher, 1938:24, 26; 1939:64, 67-69, table 1, 3; 1940:75-76, 79, 82-85, 89, 96, 98-105, 108, 111, 114-115, 117-118, 120-123, 130-131, 133-134, 145, 149, figure 5-6, 10, 16, 27, 29, plate 2, table 6, 8-9, 12-14, 17-21; 1949a:19, 26, 30-31, 34-36, figure 1, 10, 30-31, 33, 43, 50, plate 1-4; 1949b:3-4, 6-10, 12, figure 3, table 1, 3; 1958:321, 324; 1966:184, 205, 207, 217, 224; Roberts, 1889:100; Sanders & Fracker, 1916:256; Sanderson, 1944:20, table 1; Say, 1825:195; Saylor, 1942:161, 165, figure 11, plate 17; Slingerland, 1893:85; Smith, 1889a:97; 1889b:485, 488-493, 514, 516, figure 63, plate 58; 1910:319; Smith & Lewis, 1906:80; Stiles, 1892:53; Travis, 1933:397-399, 405, figure 1, table 2-7; 1934:313-314, 316, 337, 362, figure 29, plate 8, table 1; 1939:693; Uhler, 1941:2, 8-9, 14, 16, 20, figure 6, 15, 24, 33, 43, plate 2, 4, 6, 8, 10; Wade, 1935:85; Wickham, 1894:232; 1897:155; Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga hornii (Smith)

(fig. 28, 88, 148, 208, 249, 312, 315, 419, 529-531)

Lachnosterna hornii Smith 1889a:95-97.
Phyllophaga hornii, Glasgow 1916:373.

TYPE LOCALITY: ''Washington, D.C., Tennessee, Virginia, Ohio''.

DIAGNOSIS: This is one of the larger (19-23.1mm long), dark, glabrous Florida species that are superficially similar (see genitalia figures in parentheses for comparison): *hornii* (male: 28, 88, 148, 208, 249; female: 312, 315); *perlonga* (male: 43, 103, 163, 223, 256; female: 343, 346); and *profunda* (male: 45, 105, 165, 225, 258; female: 348, 351). It is the only species in which the inner lobe of the right clasper of the male genitalia is hooked in the shape of an S-curve in caudal view (fig. 28).

DESCRIPTION: **Length**: 19.0-23.1mm; **Width**: 9.8-12.2mm. **Shape**: oblong, oval, not broader behind, convex. **Color**: deep brown to piceous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: emarginate, moderately, deeply (more acute in female); margin narrowly reflexed. **Tarsal Claws**: arcuate; tooth median; male tooth shorter than in female. **Male Posterior Tibial Spurs**: lower fixed, less than half length of upper; both spurs acute. **Female Genitalia**: fig. 312 (ventral), 315 (lateral). **Male Genitalia**: fig. 28 (caudal), 88 (ventral), 148 (dorsal), 208, 529 (right lateral), 249 (left lateral).

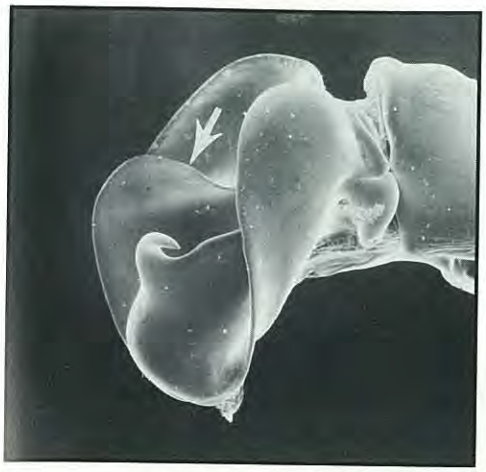
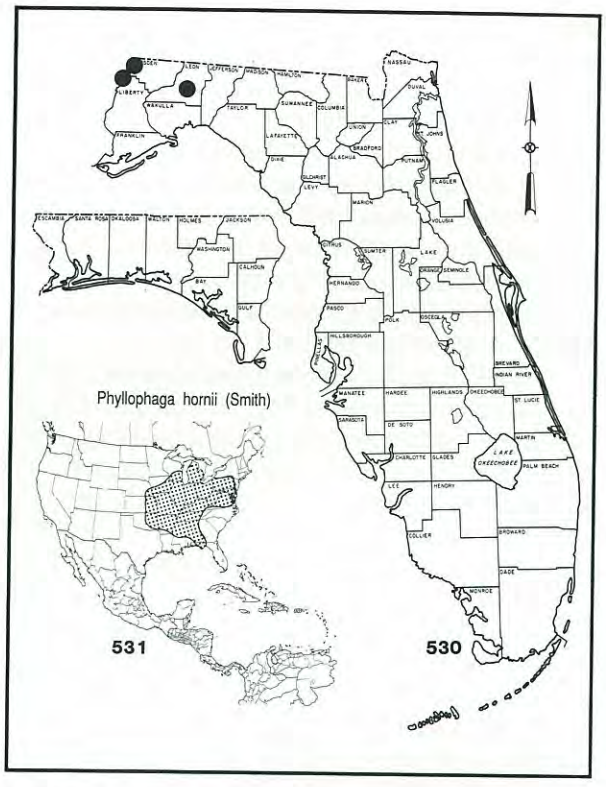


fig. 529. *Phyllophaga hornii*: male genitalia, right lateral. Extra carina at arrow, forming second cusp on left paramere, see text (7mm = 0.5mm).



TAXONOMIC NOTES: No synonyms are known, and Luginbill and Painter (1953:81) stated that the species was "... constant in all respects." The Florida specimens have the left clasper modified from the typical with an extra carina in the center, forming an extra cusp (fig. 529). However, after examination of specimens in the INHS from the entire geographic range, we concluded that this was within the range of variation for the species. Other specimens with this carina were seen from Chillicothe, Ohio. It may be an example of "major" male development in the clasper comparable to horn development in some Scarabaeinae.

U.S. DISTRIBUTION (fig. 531): Luginbill & Painter (1953: fig. 75) recorded it from **most of the eastern U.S.** except North carolina, South Carolina, Georgia, Louisiana, and Florida, as far west as **Kansas, Nebraska**, and **Oklahoma**.

FLORIDA DISTRIBUTION (fig. 530): Our specimens from Gadsden, Leon, and Liberty counties constitute the first Florida records.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:81) listed it as not abundant, appearing from the middle of March to the latter part of June. Our few Florida records (59 specimens) were from March 19 to April 23, in the Apalachicola ravines. Sim (1928:21) stated that it "... seems to be rather rare in collections."

Adult Host Plants: Birch, beech, ebony, elm, olive, planetree, pulse, rose, walnut, willow [families] (Luginbill & Painter, 1953:81). In Kentucky, Ritcher (1940:111) recorded pin oak, red oak, birch, white oak, hickory, persimmon, willow, walnut, elm, blackberry, sycamore, and ash. In Mississippi, Langston (1927b:42) found it only on elm and willow. In Illinois, Forbes (1916:234) recorded 46 from hosts: blackberry (36), oak (4), poplar (2), cherry (2), willow (1), and elm (1). In Iowa, Travis (1934:327) reported only hickory and shingle oak.

Immatures: The third instar larva was described and illustrated by Boving (1942:52, fig. 191-194) as follows: "Posterior part of labrum with a very irregular, in some places double, sagittally forward curved series of about 8 setae on each side. Anterior marginal region of frons with a transverse, irregular series of 9 setae on each side. Epicranium on each side opposite concave posterior part of frontal suture and epicranial suture with an oblique, longitudinal series of 3 long and 4 smaller setae. Dorso-molar region of right mandible (Fig. 194) with a patch of about 15 setae; dorso-exterior region with 20 or less punctures and usually with a few small setae; scrobis with longitudinal row of about 6 punctures and 1 or 2 long setae; ventro-lateral carina with 7 long setae; baso-lateral region with a patch of about 11 setae. Epipharynx (Fig. 193) with 11 heli; proplegmatium elliptical, with 9 to 11 rather long, curved proplegmata; chaetoparia with numerous punc-

tures among the setae on the right side only; crepidal punctures about 45. Septula (Fig. 191) elongate-elliptical, slightly constricted medianly, sides converging anteriorly and posteriorly; palidium with one regular row of 25 to 35 pali, one or a few more in left than in right palidium, pali of almost same size; each palus (Fig. 192) short, depressed, with lateral edges proximally concave, distally convex, tip pointed; bases of pali close or contiguous; preseptular setae about 4. (Length of body about 30 mm.; width of head about 4.5 mm.)."

Hayes (1929: fig. 173) illustrated the raster, but he did not describe the larva. Ritcher (1966:87-88) included it in his Key and illustrated the head (fig. 176), mandibles (figs. 188-189), proplegmatia (fig. 204), and the dorsoexterior region of the mandible (fig. 213).

SPECIMENS EXAMINED: over 200, of which 58 were from 3 Florida counties: Gadsden, Liberty, and Leon. Of these, 53 were from Torreya State Park (Liberty Co.).

SELECTED REFERENCES: Blatchley, 1910:967, 974, figure 395, plate IV; Boving, 1937:4; 1942:23, 29, 52, 60-61, 65, figure 191-194; Chandler, Taylor, & Deay, 1956:158; Dalla Torre, 1912:192; Dawson, 1922:214, 216, 220; Dury, 1902:156-157; Forbes, 1916:217, 234, 238-239, 242, 246; Glasgow, 1916:373, 375; Hayes, 1929:79, figure 173, plate 13; Jaques, 1927:315; 1928:304; Knaus, 1897:216; Langston, 1927b:34, 40, 81, plate 6, figure 22; Loding, 1945:104; Luginbill & Painter, 1953:10, 81, figure 75, plate 70(1-7); Neiswander, 1963: fig. 34, table 1, 3, 5; Owens, 1950:33, 41-42, 83, 87, figure 11, plate 2; Ritcher, 1938:24; 1940:76, 79, 82, 84, 90, 96, 102, 106, 111, 114, 117, 120, 123, 130, 143, figure 6, 11, 30, plate 1, table 1-2, 5, 13, 17-20; 1949a:19, 26, 30-32, 34-35, figure 2, 14-15, 39, plate 1, 3; 1949b:3-4, 6, 8, 12, table 1; 1966:86, 88, figure 176, 188, 189, 204, 213; Sanders & Fracker, 1916:256; Sanderson, 1944:16-17, 19, table 1-2; Sim, 1928:21, 52, plate 4; Smith, 1889a:95; 1889b:490-493, 510-511, figure 46, plate 50; Travis, 1933:397-399, figure 1, table 2, 5-7; 1934:316, 327, 354, figure 14, plate 4, table 1.

Phyllophaga ilicis (Knoch)

(fig. 29, 89, 149, 209, 250, 313, 316, 532, 533)

Melolontha ilicis Knoch 1801:75.
Melolontha porcina Hentz 1830:256.
Ancylonycha fimbriata Burmeister 1855:326.
Lachnosterna ilicis, LeConte 1856:253.
Lachnosterna ciliata LeConte 1856:253.
Phyllophaga ilicis, Glasgow 1916:371.
Phyllophaga jonesi Sanderson 1939:5.

TYPE LOCALITY: "Nordamerika".

DIAGNOSIS: Except for *mariana* and *aemula*, this is the largest (18.3-22.8mm long) of the pubescent Florida species. It is superficially similar to (see genitalia figures in parentheses for comparison): *aemula* (male: 1, 61, 121, 181; female: 263, 266); *crenulata* (male: 9, 69, 129, 189; female: 275, 278); *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *mariana* (male: 36, 96, 156, 216; female: 329, 332); *parvidens* (male: 42, 102, 162, 222; female: 342, 345); and *skelleyi* (male: 51, 111, 171, 231; female: 360, 363). From all the above it can be distinguished easily by the asymmetrical male genitalia and the densely, evenly punctate pronotum. With *parvidens* and *aemula* it shares the pruinescent elytra, but differs from both in having the male lower posterior tibial spur fixed and the distinctly modified abdominal sterna.

DESCRIPTION: **Length**: 18.3mm-22.8mm (23.9mm, Riley); **Width**: 10.0-12.4mm. **Shape**: oblong, slightly broader behind. **Color**: brown, opaque. **Vestiture**: pubescent, sparsely clothed with short recumbent hair; surface pruinose. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: deeply emarginate; border not widely reflexed. **Tarsal Claws**: curved, tooth strong, median. **Male Posterior Tibial Spurs**: lower fixed, obtuse, half length of slender, acute, upper. **Female Genitalia**: fig. 313 (ventral), 316 (lateral). **Male Genitalia**: fig. 29 (caudal), 89 (ventral), 149 (dorsal), 209 (right lateral), 250 (left lateral).

TAXONOMIC NOTES: Horn (1887b:268) incorrectly synonymized *subtonsa* LeConte under *ilicis*, and later (p.269) he suggested that *ciliata* might be a synonym. Smith (1889b:517-518) synonymized *ciliata* stating "... I cannot believe distinct from *ilicis*." Horn (1887b:268-269) stated that Burmeister (1855:326) apparently described his *ilicis* "from an immature specimen", and "The *fimbriata* of Burmeister is the fully mature *ilicis*." Luginbill and Painter (1953:2) synonymized *jonesi* Sanderson, but gave no reason. Sanderson compared his species with *ilicis* and illustrated the genitalic differences. It is possibly a valid species, or it may represent the same type of "major" male development as mentioned under *hornii*.

U.S. DISTRIBUTION (fig. 533): Luginbill & Painter (1953: fig. 13) recorded it from most of the eastern U.S. (including **Florida**), west to **Texas, Oklahoma, Kansas,** and **North Dakota**. Lago, Post, & Ostlie (1979:60) did not find it in their **North Dakota** survey, stating that the above record "... needs confirmation."

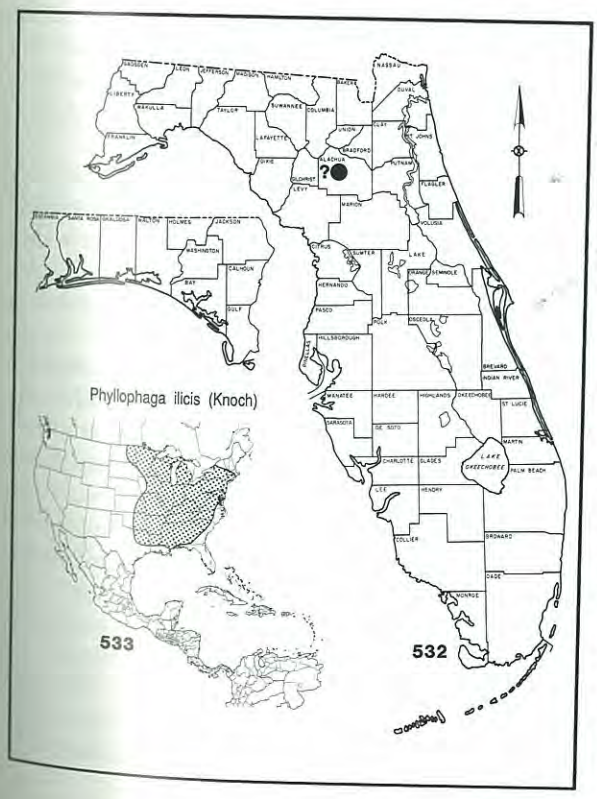
FLORIDA DISTRIBUTION (fig. 532): Although

Luginbill & Painter (1953) show Florida on their distribution map, it was not recorded by Blatchley (1929) or Young & Thames (1949). Our only record is Alachua Co., Gainesville, 5-6-V-62, F. W. Walker; it is probably a mislabelled specimen (see section on QUESTIONABLE RECORDS).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:22) listed it as not common in open pasture but more common in forest areas from the first part of April to the middle of July. Yeager (1950:179) stated that it was "...seemingly never a very abundant species, though known to be common in an area along the eastern shore of Lake Michigan." He gave the life cycle as 2 to 3 years, with pupation probably in the fall.

In Kansas, Horsfall (1929:71-72) found the species to be the dominant one near Mt. Prospect, where soils were neutral or alkaline and where the trees were largely *Quercus muehlenbergii*. He found pupation at depths of 12 to 14 inches, adults hibernating in the pupal cell, becoming active "...as soon as the ice starts to melt in the spring." In Iowa, Travis (1933:398) found it copulating at 8:47 p.m. In Indiana, Chandler et al.(1956:156) found 53 specimens at light, of which 11.3 % were females.

Davis (1919:105-107,112) reared 3 species of parasitic flies: *Pyrgota undata* Wiedeman (Diptera: Pyrgotidae); *Cryptomeigenia thuetis* Walker and *Eutrixa exile* Coquillett (Diptera: Tachinidae), from *ilicis*.



Adult Host Plants: Basswood, beech, calycanthus, dogwood, ebony, elm, heath, laurel, magnolia, maple, mulberry, olive, planetree, pulse, rose, walnut, willow, logania, witchhazel [families] (Luginbill & Painter, 1953:22); hickory, white oak, chestnut oak, black oak, red oak, black jack oak, white ash, beech, tulip poplar, soft maple, sycamore, wisteria, grape, blackberry, pecan, persimmon, sourwood, sassafras, dogwood, linden, azalea, common fig, sweet shrub (Fattig 1944:27). In Kentucky, Ritcher (1940:111) reported willow oak, Spanish oak, red oak, white oak, hickory, sycamore, persimmon, and sassafras. Horsfall (1929:72) added *Quercus muehlenbergii*. In Mississippi, Langston (1927b:62) listed only hickory, pecan, and persimmon. In Illinois, Forbes (1916:230) found it primarily on oak and elm.

Immatures: The first and third instar larvae were described and illustrated by Boving (1942:50, fig. 168-172), the third as follows: "Posterior part of labrum with about 9 long setae on each side in an anterior, medianly forward curved series and about 6 moderately long setae on each side in a posterior series. Anterior marginal region of frons with an irregular series of about 7 setae on each side in front, and another irregular series of about 5 shorter setae on each side behind. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with an oblique longitudinal series of 4 long and 4 short setae. Dorso-molar region of right mandible (Fig. 168) with a patch of about 15 setae; dorso-exterior region with about 5 or fewer small punctures and 20 or more setae of varying lengths; scrobis with a longitudinal irregular series of about 8 punctures, often with a few setae and posteriorly, at least in some specimens, with a small patch of about 6 setae; ventro-lateral carina with 8 or more long setae; baso-lateral region with a patch of about 9 setae. Epipharynx (Fig. 170) with about 12 heli; proplegmatium broad, with elliptical to somewhat spatulate outline and 8 to 11 proplegmata; right chaetoparia with numerous punctures among the setae; crepidal punctures about 50. Septula (Fig. 171) subrectangular, medianly slightly constricted, anteriorly and posteriorly with somewhat converging sides; palidium with one irregular row of 27 to 33 pali or no uniform size; usually with one or a few more pali in the one row than in the other; palus (Fig. 172) depressed, short and broad, with lateral edges distally convex, tip pointed; bases of pali close or contiguous; preseptular setae 5 to

7. (Length of body about 44mm.; width of head about 6mm.).''

SPECIMENS EXAMINED: several hundred, of which only 1 was recorded from Florida: (1) Alachua Co., Gainesville, 5-6-V-22, F. W. Walker (UMMZ). Along with several other Walker specimens, this is probably mislabelled (see QUESTIONABLE RECORDS section for discussion).

SELECTED REFERENCES: Blackwelder, 1939:52; Blatchley, 1910:976, 978-979, figure 401, plate V; Boving, 1937:4; 1942:3, 7, 12, 14, 23, 29, 50, 60-61, figure 168-172, 248; Brimley, 1938:204; Cartwright, 1934:268; Chamberlin & Fluke, 1947:12-13; Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Fluke, and Callenbach, 1943:676-680, figure 3, table 1-2, 4; Chamberlin, et al., 1938:228, 232-233, 235-238, 240, table 1-8; 1939:105-108, figure 4, table 1; Chandler, Taylor, & Deay, 1956:151-152, 156; Crotch, 1874:60; Dalla Torre, 1912:192-193; Davis, 1916a:262, 268, 276, table 1; 1918:4, figure 2; 1919:106-107, 112; Dawson, 1922:213, 222; Dury, 1879:8; 1902:156; Fattig, 1944:7-8, 26-27; Forbes, 1907:449, 451-453, 455, 461, 463, 465, table 455-456, 463-464; 1916:217, 224, 230, 238-239, 241-243, 245-248, 252-253, 255; Glasgow, 1916:371, 375; Hayes, 1925:15, 81, table 57, 59 (as *illicis*); 1929:65, 80, figure 184, plate 14; Henry & Heit, 1940:280, table 1-2; Hentz, 1830:253-258 (as *porcina*); Horn, 1887a:142-144; 1887b:215, 265, 268-269, 271, 295, figure 35, plate 3; Horsfall, 1929:71-72; Hudson, 1919:81; Jaques, 1926:338; 1927:315; 1928:304; Knaus, 1897:217; Langston, 1927b:58, 61, 87, plate 10, figure 38; LeConte, 1849:30; 1856:253-254, 262; Leonard, 1926:425; Loding, 1945:105; Luginbill, 1928:55, 62-63, figure 11, male A-D, female E; Luginbill & Painter, 1953:55 21-22, 28, 83, figure 13, plate 23(7-12); Melsheimer, 1853:59; Neiswander, 1963: fig. 35, table 1-3, 5-6, 8; Owens, 1950:13, 71-72, 83, 88, figure 24, plate 4; Popenoe, 1876:30; Riley, 1988:53, 114, 163-166, figure 211-215, map 20, table 1, 3-4; Ritcher, 1940:76, 83, 85-86, 91, 111, figure 9, plate 1, table 3, 9-10, 14; 1949a:19; Sanders & Fracker, 1916:256; Sanderson, 1939:5-6, 12-13; 1944:16, 19, table 1; Slingerland, 1893:83-86, table 3; Smith, 1889b:489, 491, 493, 517, 523, figure 65, plate 59; 1910:319; Travis, 1933:397, table 4-7; 1934:316, 338-339, 362, figure 28, plate 8, table 1; Uhler, 1940:1, 8, 10, 14, 16-18, 21, figure 11, 20, 29, 37, plate 3, 5, 7, 9; Westcott, 1888:156, 158; Wickham, 1894:232, 234; Woodruff, 1973:28; Yeager, 1950:179.

Phyllophaga implicita (Horn)

(fig. 30, 90, 150, 210, 251, 317, 320, 534, 535)

Lachnosterna implicita Horn 1887b:262.
Lachnosterna minor Linell 1896:728.
Phyllophaga implicita, Glasgow 1916:373.
Phyllophaga linelli Saylor 1937:321.

TYPE LOCALITY: ''Canada, Iowa, Missouri, Nebraska, and Louisiana''.

DIAGNOSIS: The male and female genitalia (male: 30, 90, 150, 210, 251; female: 317, 320) are characteristic, but most similar to *anxia* (male: 2, 3, 62, 63, 122, 123, 182, 183, 241, 242; female: 264, 267). The female pubic process of *implicita* is much less incised between the tips which are more rounded, with less setae, than in *anxia*. It is relatively small (14-18.5mm long), dark, antennae 9-segmented, lower posterior tibial spur of the male fixed, and the clypeus is deeply emarginate.

DESCRIPTION: Length: 14.6-18.5mm; **Width:** 8.3-9.8mm (7.4mm, Riley). **Shape:** oblong, oval, convex. **Color:** rufotestaceous to brown. **Vestiture:** glabrous, moderately shiny, head always darker. **Antenna:** 9-segmented; male club length equal to stem. **Clypeus:** emarginate, deeply, acutely; border moderately reflexed. **Tarsal Claws:** arcuate; tooth median, small, acute (male), larger (female). **Male Posterior Tibial Spurs:** lower fixed, obtuse, slightly curved, half length of straight, acute upper. **Female Genitalia:** fig. 317 (ventral), 320 (lateral). **Male Genitalia:** fig. 30 (caudal), 90 (ventral), 150 (dorsal), 210 (right lateral), 251 (left lateral).

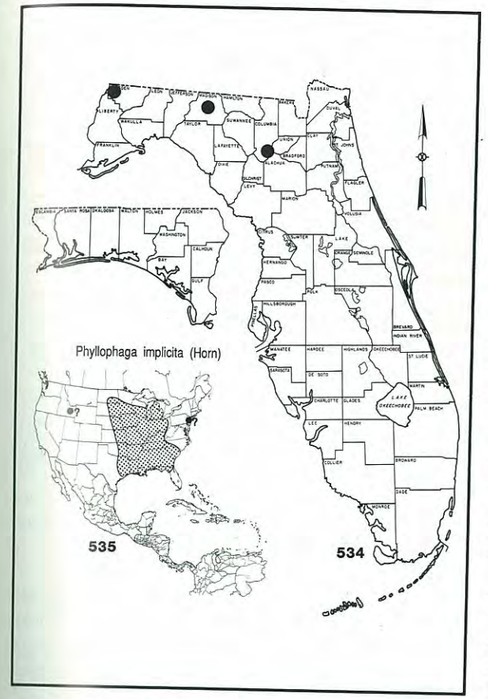
TAXONOMIC NOTES: The synonym, *minor* Linell, was preoccupied by *minor* Brenske (1894), and Saylor (1937:321) proposed the new name *linelli* for it. Glasgow (1916:378) had already established this synonymy, so Saylor's new name was superfluous. In his original description, Horn (1887b:262) stated that it is ''... mixed in most cabinets with *balia* and *comans*, and I think they partly constitute the series standing as *decidua* in the LeConte cabinet.'' The latter was established by Glasgow (1916:371) as a synonym of *futilis* Burmeister.

U.S. DISTRIBUTION (fig. 535): Luginbill & Painter (1953: fig. 36) recorded it from the **central part of the U.S.**, and a disjunct record for southern **Idaho**. Lago, Post, and Oseto (1979:57-59) added **North Dakota**.

FLORIDA DISTRIBUTION (fig. 534): Neither Blatchley (1929) nor Young & Thames (1949) recorded it from Florida. Our records, based on 3 females, from Columbia, Gadsden, and Madison counties represent the first records for the State.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:46) listed it as very common in some sections from March to mid-July. Our Florida records are based on only 3 females taken from March 18 to May 2.

In Kansas, Hayes (1925:79) reported the following life history data: egg stage 10 to 31 days (av. 18.2); larval stage 400 to 751 days (av. 425.5); pupal stage 16



to 37 days (av. 24.1); total life cycle 426 to 819 days (av. 467.8). Of his total rearings, 21 were a 2-year cycle, and 1 was a 3-year cycle.

In Illinois, Forbes (1916:221) found that it made up 15% (16,980 specimens) of their 6 year total catch of *Phyllophaga*. It was the second most abundant species (only to *hirticula*).

Adult Host Plants: Basswood, beech, birch, dogwood, ebony, elm, honeysuckle, maple, planetree, pulse, rose, tupelo, walnut, willow [families] (Luginbill & Painter, 1953:46); locust, oak, pecan, poplar, willow (Langston, 1927b:58). In Kentucky, Ritcher (1940:111) stated that its favorite food plant was willow, fairly common on elm, hackberry, and persimmon, and in small numbers on willow oak, pin oak, Spanish oak, dogwood, redbud, Chinese poplar, Lombardy poplar, plum, and cultivated cherry.

Immatures: The third instar larva was described and illustrated by Boving (1942:45-46, fig. 133-137) as follows: "Posterior part of labrum with transverse, very irregular, in some places double series of about 7 to 10 setae on each side. Anterior marginal region of frons with a transverse, at some places very irregular series of about 7 to 9 setae on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 5 long setae. Dorsomolar region of right mandible (Fig. 134) with a patch of about 18 setae; dorso-exterior region with no punctures; scrobis with a longitudinal, irregular row of 10 or more punctures (usually placed at the walls of the carinae) and occasionally with 1 or 2 setae; ventrolateral carina with 7 setae; baso-lateral region with about 8 setae. Epipharynx (Figs. 133, 135) with about 9 heli; proplegmatium indistinct; proplegmata 2 to 6 or none, short, not present in the same number on both sides; distance between them about as long as a proplegma; right chaetoparia with no or very few punctures among the setae; crepidal punctures about 25. Raster (Fig. 137) with subrectangular, slightly convex septula; palidium with one regular row of from 9 to 13 pali; palus (Fig. 136) short, compressed, with hooked tip; distance between pali as long or longer than a palus; preseptular setae 3 or more. (Length of body about 30 mm.; width of head about 4.5 mm.)."

Ritcher (1966:87-88) included it in his Key, but did not illustrate any characters.

SPECIMENS EXAMINED: about 50, of which only 3 females were from Florida: (1) Madison Co., 2-V-46, F. N. Young, at light; (1) Columbia Co., I-75, 4.2mi on S349, 18-III-77, R. Turnbow, at light; (1) Gadsden Co., Co. Rd. 269 at Flat Creek, 14-IV-79, L. R. Davis, Jr.

SELECTED REFERENCES: Baker, 1972:148; Blatchley, 1910:975, figure 396, plate IV; Boving, 1937:2; 1942:7, 9, 12-13, 23, 28, 45, 59, 61, 64, figure 133-137, 242; Chamberlin & Callenbach, 1943:683, 687; Chamberlin & Fluke, 1947:12; Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Fluke, & Callenbach, 1943:675, 677-680, figure 2, table 1-2, 4; Chamberlin, et al., 1938:227-228, 230, 232-238, 240, table 1-6, 8; 1939:105, figure 2, table 1; Dalla Torre, 1912:193; Davis, 1916a:262, 268, 276, table 1; 1919:106-107, 112, 117-118; Dawson, 1922:213, 222; Fattig, 1944:25; Forbes, 1907:449-453, 455, 461, 463, 465-466, table 455-456, 463-464; 1916:217-218, 220-224, 238-239, 241-242, 244-248, 252-253, 255; Glasgow, 1916:373, 375; Hayes, 1920:79; 1925:8, 11, 15, 20, 76, 81, table 57-67; 1928:251-252, 257, table 2-3, 7; 1929:13, 49, 56, 58-59, 65-66, 78, figure 180, plate 14, table 1, 7, 9-10, 13; Horn, 1887b:260, 262, 294, figure 25, plate 3; Jaques, 1926:338; 1927:315 (as *implicata*); 1928:304; Knaus, 1897:216; Langston, 1927b:7, 55, 57, 86, plate 9, figure 35; Luginbill & Painter, 1953:7, 45, figure 36, plate 46(1-6); McColloch & Hayes, 1922:132-135, table 2, 4-5; 1923:32; Owens, 1950:5-6, 65-66, 83, 88, figure 22, plate 4; Ritcher, 1938:24-25; 1940:76, 82, 84-86, 91, 111, 114, 128, figure 8, plate 5, table 3-4, 9-10, 14, 19; 1949a:19, 24; 1966:86-87; Sanders & Fracker, 1916:256; Sanderson, 1944:16, 19, table 1; Sim, 1928:42, 59, plate 11; Smith, 1889a:98; 1889b:515, figure 57, plate 55; Sweetman, 1927:785, 788, 790, 792, table 8-10; 1931:401, 404, 406-411, 413-416, 418-421, table 1, 5-6, 9-10, 13-15, 17-19; Travis, 1933:397, 405, table 4-7; 1934:317, 335, 360, figure 25, plate 7, table 1; Wickham, 1894:233.

Phyllophaga infidelis (Horn)

(fig. 31, 91, 151, 211, 252, 318, 321, 397, 536, 537)

Lachnosterna infidelis Horn 1887b:253.
Phyllophaga infidelis, Glasgow 1916:373.

TYPE LOCALITY: "Georgia and Florida".

DIAGNOSIS: In its shiny surface, red brown body color, and more convex shape it is similar to the following Florida species (see genitalia figures in parentheses for comparison): *forsteri* (male: 20, 80, 140, 200, 245; female: 295, 298); *infidelis* (male: 31, 91, 151, 211, 252; female: 318, 321); *ovalis* (male: 40, 100, 160, 220, 255; female: 337-340); and *tecta* (male: 54, 114, 174, 234, 261; female: 366, 369). It is generally larger (18.3-20.7mm long) than *forsteri* and *tecta*, and the elytral costae are poorly developed.

DESCRIPTION: **Length**: 18.3-20.7mm; **Width**: 9.9-11.1mm. **Shape**: oblong, oval, convex, broader behind. **Color**: chestnut brown. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: emarginate, moderately deeply (male), or more acute (female); margin narrowly reflexed. **Tarsal Claws**: arcuate; tooth strong, median in both sexes. **Male Posterior Tibial Spurs** (fig. 397): lower fixed, stubby, broad, less than half length of upper. **Female Genitalia**: fig. 318 (ventral), 321 (lateral). **Male Genitalia**: fig. 31 (caudal), 91 (ventral), 151 (dorsal), 211 (right lateral), 252 (left lateral).

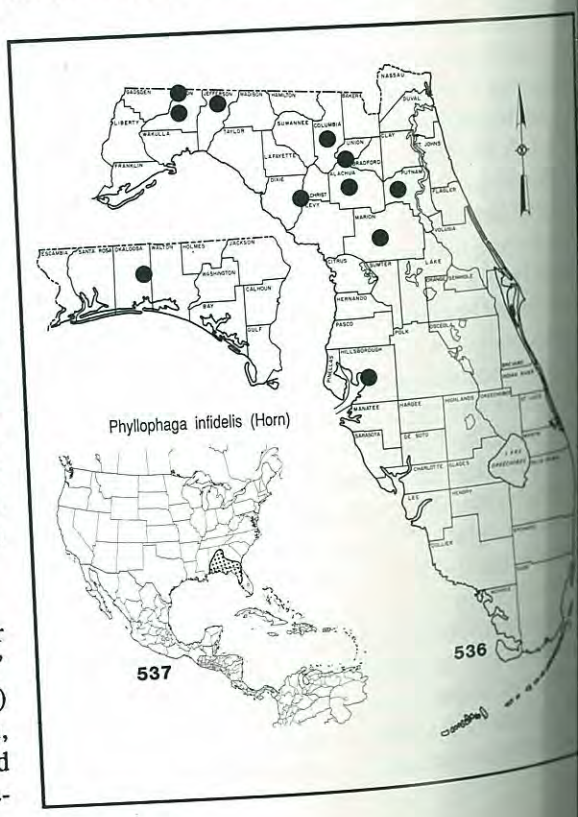
TAXONOMIC NOTES: No synonyms are known for this species. Young & Thames (1949:128) mistakenly referred to Horn's Florida specimen as "... probably represents *ovalis*." Although the 2 species are externally similar, there is no evidence for this suggestion, and *infidelis* is much more common and widely distributed in Florida. I examined the holotype (Type No. 3677) and the 6 other specimens in the Horn collection at the MCZC. The type is a male with the genitalia dissected and labelled "Marion County". Although Horn stated that it occurs in "Georgia and Florida", the type has no state label, and there is a Marion County in each.

U.S. DISTRIBUTION (fig. 537): Luginbill & Painter (1953:78) reported it from "... two southeastern States," without stating what they were. Horn (1887b:254) recorded it from **Georgia** and **Florida**. In **Georgia**, Fattig (1944:23) recorded it from Perry, Prattsburg, and Thomasville. In **Alabama**, Loding (1945:104) recorded it from Mobile, Lee, Etowah, and St. Clair counties.

FLORIDA DISTRIBUTION (fig. 536): Blatchley (1929:56) merely repeated Horn's record for the state. Young & Thames (1949:128) stated that Horn's record "... probably represents *ovalis* Cart." Although the 2 species are externally similar, *infidelis* is much more common than *ovalis*. Our records include the northern half of the state, as far south as Tampa (Hillsborough Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:78) listed it as rare from mid-March to early July. Our Florida records agree with the season, most specimens being taken in April, May, and June. The only locality where we found it frequent was Gainesville, with months and records as follows: III(4), IV(35), V(39), VI(39), VII(6). In Georgia, Fattig (1944:23) recorded 928 specimens from March to June. No information is available on the life history, and the immature stages are unknown.

Adult Host Plants: Beech, chicory, ebony, laurel, mulberry, pulse, rose, tupelo, walnut, willow, witchhazel [families] (Luginbill & Painter, 1953:78); persimmon, crab apple, water oak, willow oak, scrub post oak,



laurel oak, cinnamon oak, post oak, black oak, red oak, turkey oak, scarlet oak, live oak, pecan, black gum, hickory, sassafras, wild cherry, willow, coffee weed, hog haw, blackberry, pear, tupelo gum, witchhazel, redbud, beggarweed, mulberry, sweet gum, apple, chinquapin, shag-bark hickory, swamp cottonwood (Fattig, 1944:23). Our Florida records include pecan, pear, and *Quercus falcata*.

SPECIMENS EXAMINED: over 200, of which 186 were from 10 Florida counties. Over 123 specimens, representing 18 collection records, were from Gainesville. For complete data, see Appendix 18.

SELECTED REFERENCES: Blatchley, 1929:56; Dalla Torre, 1912:193; Davis, 1920:334; Fattig, 1944:7, 23; Glasgow, 1916:373, 375; Horn, 1887b:253, 257-258, 294; Loding, 1945:104; Luginbill & Painter, 1953:10, 78, 87, plate 67(7-11); Sim, 1928:22, 53, plate 5; Smith, 1889a:97; 1889b:509-511, 513, 515, figure 45, plate 56; Woodruff, 1973:28; Young & Thames, 1949:128.

fig. 538. *Phyllophaga knochii*: male genitalia, dorsal. Enlargement of central area between parameres, showing curves and setae which are nearly impossible to describe (21mm = 0.05mm).

Phyllophaga knochii (Schoenherr & Gyllenhal)

(fig. 32, 92, 152, 212, 253, 319, 322, 538-540)

Melolontha knochii Schoenherr & Gyllenhal 1817:75.
Ancylonycha knochii, Blanchard 1850:325.
Lachnosterna knochii, LeConte 1856:252.
Phyllophaga knochii, Glasgow 1916:371.

TYPE LOCALITY: "America septentrionali, Georgia".

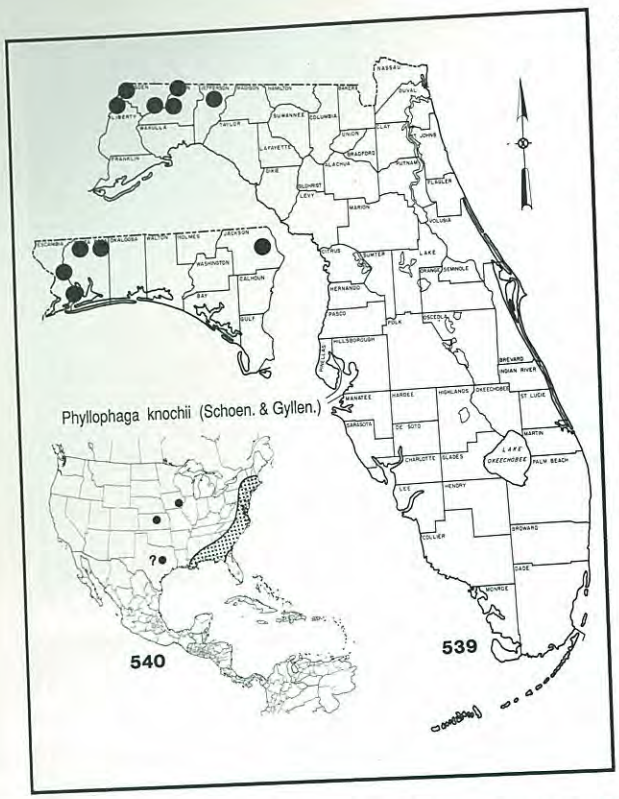
DIAGNOSIS: This is one of the largest glabrous Florida species (19.7-23.3mm long), and the color of the pronotum and elytra are often noticeably different. The densely, coarsely punctate pronotum, usually with a central, raised, impunctate line are also features which it shares with *profunda*, but the genitalia are diagnostic; compare *knochii* (male: 32, 92, 152, 212, 253; female: 319, 322) with *profunda* (male: 45, 105, 165, 225, 258; female: 348, 351).

DESCRIPTION: Length: 19.7-23.3mm; **Width:** 9.6-12.0mm. **Shape:** elongate, oval, slightly broader behind. **Color:** red-brown to piceous. **Vestiture:** glabrous, feebly shining. **Antenna:** 10-segmented; male club length equal to stem. **Clypeus:** emarginate, moderately broadly and deeply; border barely reflexed. **Tarsal Claws:** curved; tooth strong, median, slightly longer in female. **Male Posterior Tibial Spurs:** lower fixed, obtuse, half length of acute upper. **Female Genitalia:** fig. 319 (ventral), 322 (lateral). **Male Genitalia:** fig. 32, 538 (caudal), 92 (ventral), 152 (dorsal), 212 (right lateral), 253 (left lateral).

TAXONOMIC NOTES: No synonyms are known for this species. It sometimes is attributed to Gyllenhal alone, but the original description (although in Schoenherr's book, 1817), clearly stated that it was jointly authored (see Bibliography for details). For some reason, Dalla Torre (1912:193) erroneously listed *micans* LeConte (1856:247) "[non Knoch]" as a synonym of *knochii*.

U.S. DISTRIBUTION (fig. 540): Luginbill & Painter (1953: fig. 81) recorded it from **Alabama, Florida, Georgia, Massachusetts, Mississippi, New Jersey, Pennsylvania, South Carolina**, and an isolated record in **Iowa**. Smith (1889b:512) recorded it from **Kansas** and **Texas** (1 female), without specific locality. Brimley (1938:204) added **North Carolina**. Leonard (1926:425) added **New York** (6 localities).

FLORIDA DISTRIBUTION (fig. 539): Blatchley (1929) did not record it from Florida. Young & Thames (1949:128) recorded it from Torreya ravines (Liberty Co.) and stated "apparently a characteristic species of the Altamaha Grit country of Georgia and occasionally found in Florida where similar environment occurs."



Our records include 7 counties of the panhandle, all west of the Aucilla River.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:87) stated that it had never been found in any great numbers, thus of little economic importance. They stated that beetles appear from late March to July. Our Florida records are from March to mid-June, with greatest number in April. The largest single catch at a blacklight trap was 43 specimens on April 18 (Florida Caverns State Park). Sim (1928:19) suggested that it was "...limited to the sandy, pine-oak coastal plains region of the Atlantic States."

Adult Host Plants: Hickory, black jack oak, post oak, black oak, water oak, white oak, red oak, pecan, soft maple, boxelder, sycamore, Juneberry, pignut (Fattig, 1944:24); hickory, oak, pecan (Langston, 1927b:54); black jack oak, white-heart hickory, maple, hackberry (Luginbill, 1928:69). No Florida hosts were recorded, and Luginbill & Painter (1953:87) reported no hosts.

Immatures: The third instar larva was described and illustrated by Boving (1942:51, fig. 183-186) as follows: "Posterior part of labrum with an irregular, in some places double, at the sagittal line forward curved series of about 10 setae on each side. Anterior marginal region of frons with a transverse double series of 6 long setae on each side in front and some very irregularly placed and small ones on each side behind. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with an oblique, longitudinal series of 4 long setae. Dorso-molar region of right mandible (Fig. 184) with a patch of about 30 setae; several fine punctures at inner edge of scissorial part; dorso-exterior region with about 35 punctures and 5 small setae; scrobis with longitudinal series of about 10 punctures and about 6 setae; ventro-lateral carina with about 8 long setae; baso-lateral region with about 20 setae. Epipharynx (Fig. 186) with about 11 heli; proplegmatium subelliptical, number of proplegmata about 10; chaetopariae with numerous punctures among the setae on right side only; crepidal punctures about 50. Septula (Fig. 183) elongate-subrectangular, anteriorly slightly broader and with converging sides; palidium with an almost regular row of about 29 pali, generally of same size; each palus (Fig. 185) moderately long, depressed, with lateral edges distally convex, tip pointed; bases of pali close; preseptular setae about 5. (Length of body 30 to 35 mm.; width of head 4.8 to 5mm.)."

SPECIMENS EXAMINED: over 500, of which 219 were from the following 7 Florida counties: Escambia, Gadsden, Jackson, Jefferson, Leon, Liberty, and Santa Rosa. Of these, 107 specimens, representing 24 collection records, were from Torreya State Park (Liberty Co.). For complete data, see Appendix 19.

SELECTED REFERENCES: Blatchley, 1910:966, 972; Boving, 1937:4; 1942:23, 29, 51, 60-61, figure 183-186; Brimley, 1938:204; Cartwright, 1939:285; Crotch, 1874:60; Dalla Torre, 1912:193; Fattig, 1944:7, 24; Glasgow, 1916:371, 375; Horn, 1887a:143-144; 1887b:257; Knaus, 1897:216; Langston, 1927b:34, 53, 85, plate 8, figure 32; LeConte, 1856:245, 252; Leonard, 1926:425; Loding, 1945:104; Luginbill, 1928:68-69, figure 16, male A-D, female E; Luginbill & Painter, 1953:10, 83, 95, figure 81, plate 72(1-7); Melsheimer, 1853:59; Riley, 1988:62, 184-186, 217, 236, figure 249-253, map 25, table 3-4; Sanderson, 1937a:17; Sim, 1928:19, 52, plate 4; Smith, 1889b:512-513, figure 51, plate 57; 1910:319; Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga latifrons (LeConte)

(fig. 33, 93, 153, 213, 323, 326, 407, 423, 430, 433-438, 541-544)

Lachnosterna latifrons LeConte 1856:241.
Phyllophaga latifrons, Glasgow 1916:372.

TYPE LOCALITY: "New York".

DIAGNOSIS: This species is easy to identify in the male by the unique bidentate middle of the caudal border on sternum 8 (fig. 407). Although sharing the non-emarginate clypeus with *clypeata*, the form of the margin is distinct and upturned at the middle (fig. 423). It is most similar in general appearance and in pruinosity to *prununculina*. However, the genitalia are distinct; compare *latifrons* (male: 33, 93, 153, 213; female: 323, 326) with *prununculina* (male: 46, 106, 166, 226; female: 349, 352).

DESCRIPTION: Length: 12.8-19.3mm; **Width:** 6.2-9.4mm. **Shape:** oblong, cylindrical. **Color:** purplish-brown to rufotestaceous. **Vestiture:** glabrous, often pruinose. **Antenna:** 10-segmented; male club slightly longer than stem. **Clypeus:** entire, concave; margin widely reflexed (fig. 423). **Tarsal Claws:** feebly arcuate; tooth median, small (male), or larger (female). **Male Posterior Tibial Spurs:** lower fixed, stout, obtuse, about half length of attenuate, slender upper. **Abdomen:** fig. 407 (venter); always pale; bidentate process on caudal border of sternum 8 (fig. 541-542). **Female Genitalia:** fig. 323 (ventral), 326 (lateral). **Male Genitalia:** fig. 33 (caudal), 93 (ventral), 153 (dorsal), 213 (right lateral), 433-438 (aedeagus).

TAXONOMIC NOTES: This species is so distinctive that no synonyms have been created. There is sexual dimorphism in color; females being dark purplish and often more pruinose, males being light red brown with little or no pruinosity.

U.S. DISTRIBUTION (fig. 544): Luginbill & Painter (1953: fig. 20) recorded it from **Alabama, Florida, Georgia, Louisiana, Mississippi, New Jersey, North Carolina**, and **South Carolina**. The type locality is "New York", but Horn (1887b:222) stated that "... this is undoubtedly an error."

FLORIDA DISTRIBUTION (fig. 543): Schwarz (1878:450) recorded it from Florida, and Blatchley (1929:52) said "Known only from Florida". Young & Thames (1949:126) recorded it as locally abundant throughout the state. Our records include the entire state, as far south as Everglades National Park (Dade Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:32) listed it as not a common species, occuring from early March to late July. In our Florida records it is extremely common and widespread, ranking fourth in total specimens recorded (3353). About one-third

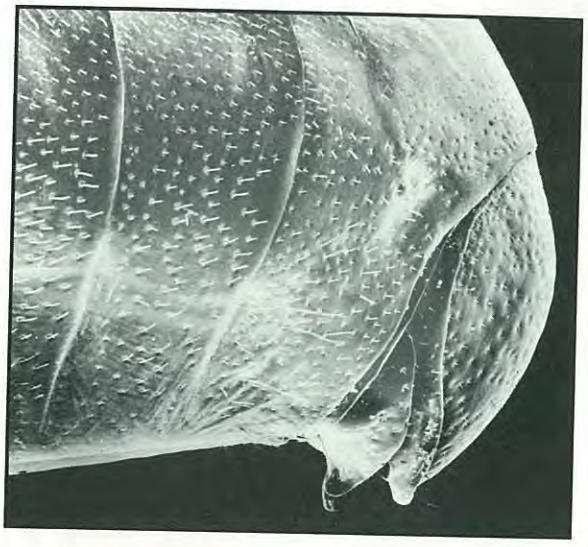


fig. 541. *Phyllophaga latifrons*: male abdomen, lateral view, showing pygidium produced and sternite 8 elongate (enlarged in fig. 452) (8mm = 0.5mm).

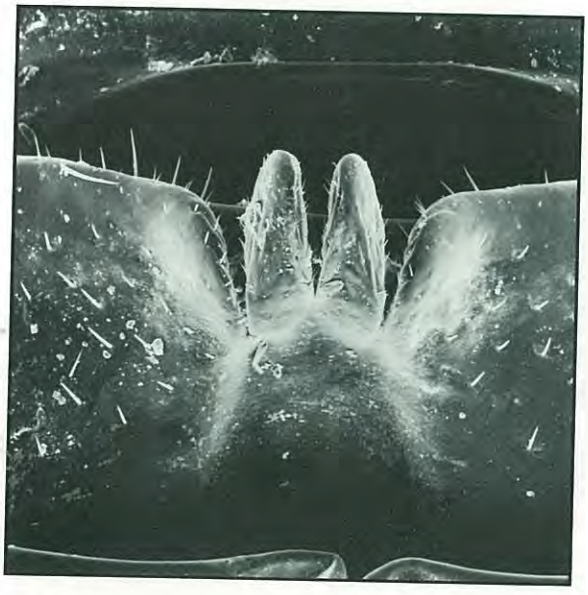
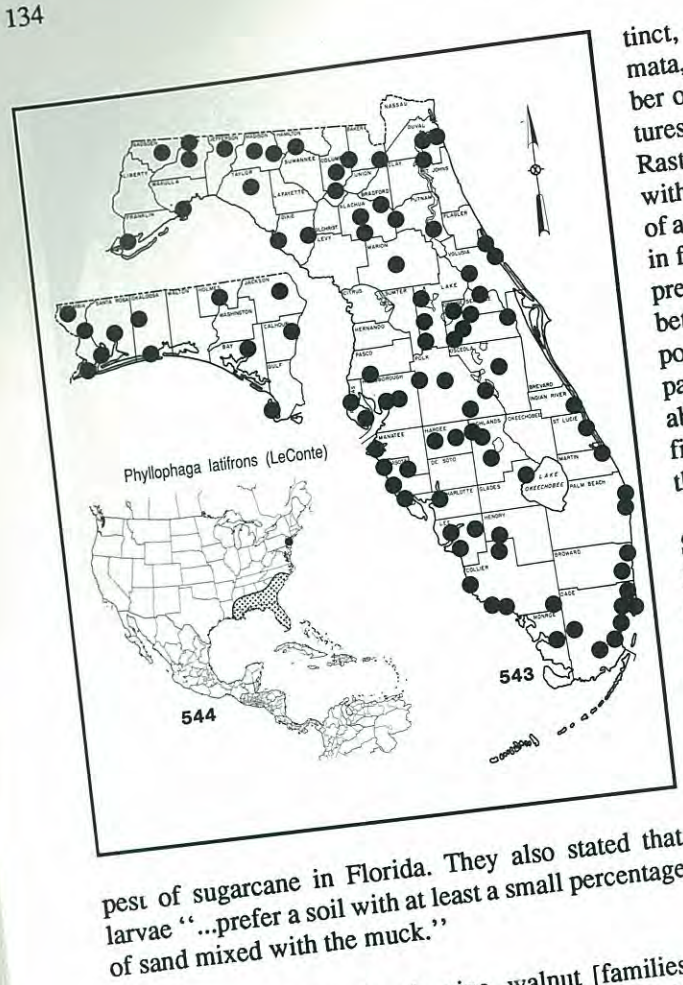


fig. 542. *Phyllophaga latifrons*: male abdomen, ventral view, showing enlarged bifurcate margin ("teeth") on sternite 8 (5mm = 0.05mm).

(1253) of these were taken at Gainesville with dates and records as follows: III(1), IV(2), V(31), VI(70), VII(29), VIII(1), IX(1), XI(2). It is often the dominant form in a single blacklight trap collection (e.g., 140 on 22-IV-59 at Homestead, Dade Co.).

Gordon and Anderson (1981:122-124) considered this the only species of *Phyllophaga* whose larva is a



pest of sugarcane in Florida. They also stated that larvae "...prefer a soil with at least a small percentage of sand mixed with the muck."

Adult Host Plants: Beech, pine, walnut [families] (Luginbill & Painter, 1953:32); oak, pecan, loblolly pine (Fattig, 1944:13). Langston (1927b:10) listed pine and cypress as chief food plants, with 1 record from pecan. In South Carolina, Luginbill (1928:81) listed only loblolly pine. Our Florida records include citrus, longleaf pine, *Trema*, sphagnum moss, *Phaseolus*, *Juniperus*, *Rosa*, and pecan.

Immatures: The third instar larva was described and illustrated by Boving (1942:40, fig. 88-91) as follows: "Posterior part of labrum with a transverse series of 5 setae on each side. Anterior marginal region of frons with one series of 5 long and moderately long setae on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 2 long and 2 short setae. Dorso-molar region of right mandible (Fig. 91) with a patch of about 6 setae and a small number of punctures; dorso-exterior region with 3 to 10 punctures; scrobis with a longitudinal row of 8 or fewer punctures; ventro-lateral carina with about 5 setae; baso-lateral region with about 7 setae. Epipharynx (Fig. 89) with about 12 heli; proplegmatium indistinct, with 4 to 6 moderately long and weak proplegmata, usually but not always present in the same number on both sides; right chaetoparia with a few punctures among the setae; crepidal punctures 25 or more. Raster (Fig. 88) with subrectangular septula; palidium with one generally regular but anteriorly irregular row of about 26 pali, and extending with usually 3 to 5 pali in front of tegillum; palus (Fig. 90) short, rather compressed, laterally concave, with hooked tip; distance between pali generally about as long as a palus but posteriorly shorter; tegilla not meeting in front of palidia; preseptular setae absent. (Length of body about 30 mm.; width of head 4.2 mm.)." Hayes (1929: fig. 160) illustrated the raster, but he did not describe the larva.

SPECIMENS EXAMINED: over 10,000, of which 3353 were from 45 Florida counties. The largest single catch was 140 at Dade Co., Homestead, 22-IV-59, D. O. Wolfenbarger, blacklight trap. For complete data, see Appendix 20.

SELECTED REFERENCES: Blatchley, 1929:52; Boving 1937:6; 1942:4, 6, 9, 12-13, 15, 22, 27, 40, 58-59, 61, 63-64, figure 88 91, 229; Box, 1953:10; Brimley, 1938:204; Crotch, 1874:60; Dall Torre, 1912:194; Fattig, 1944:7, 13; Frost, 1964:142; 1966:19 Glasgow, 1916:372, 375; Gordon & Anderson, 1981:119, 121-12 fig. 1, 7, 16, 39, 47, 51; Hayes, 1929:79, figure 160, plate 12; Ho 1887a:144; 1887b:221-222, 233, 293, figure 3, plate 3; Ingra 1938:89-98; Langston, 1927b:9-10, 78, plate 1, figure 1; LeCo 1856:241; Loding, 1945:103; Luginbill, 1928:56, 80-81, figure male A-D, female E; Luginbill & Painter, 1953:6, 31, figure 20, p 34(1-5); Riley, 1988:31-33, 48, 55, 187-189, 224, figure 10, 33, 258, map 27, table 3-4; Saylor, 1942:165, figure 6, plate 17; Schw 1878:450; Smith, 1889b:494, figure 7, plate 48; Woodruff, 196 1973:28; Young & Thames, 1949:126.

Phyllophaga lota Luginbill

(fig. 34, 94, 154, 214, 324, 327, 381, 545-54

Phyllophaga lota Luginbill 1928:87.

TYPE LOCALITY: "only at Stokes", South lina.

DIAGNOSIS: Along with *debilis*, *clemens*, *masseei*, it is one of the smallest Florida spec 13.7mm long). It is superficially similar to (se lia figures in parentheses for comparison): (male: 7, 67, 127, 187; female: 270, 273); *debi* 11, 71, 131, 191; female: 277, 280); *gracilis* 86, 146, 206; female: 307, 310); *lota* (male: 3 214; female: 324, 327); *taxodii* (male: 53,

233; female: 365, 368); and *yemasseei* (male: 58, 118, 178, 238; female: 373, 376).

DESCRIPTION: **Length**: 9.6-13.7mm; **Width**: 4.5-7.0mm. **Shape**: oblong, elongate, parallel cylindrical. **Color**: yellowish to rufotestaceous. **Vestiture**: glabrous, moderately shining. **Antenna**: 9-segmented; male club length equal to stem. **Clypeus**: entire; margin broadly reflexed. **Tarsal Claws** (fig. 381): arcuate; tooth median, nearly obsolete. **Male Posterior Tibial Spurs**: lower fixed, obtuse, half length of slender, acute upper. **Female Genitalia**: fig. 324 (ventral), 327 (lateral). **Male Genitalia**: fig. 33 (caudal), 93 (ventral), 153 (dorsal), 213 (right lateral).

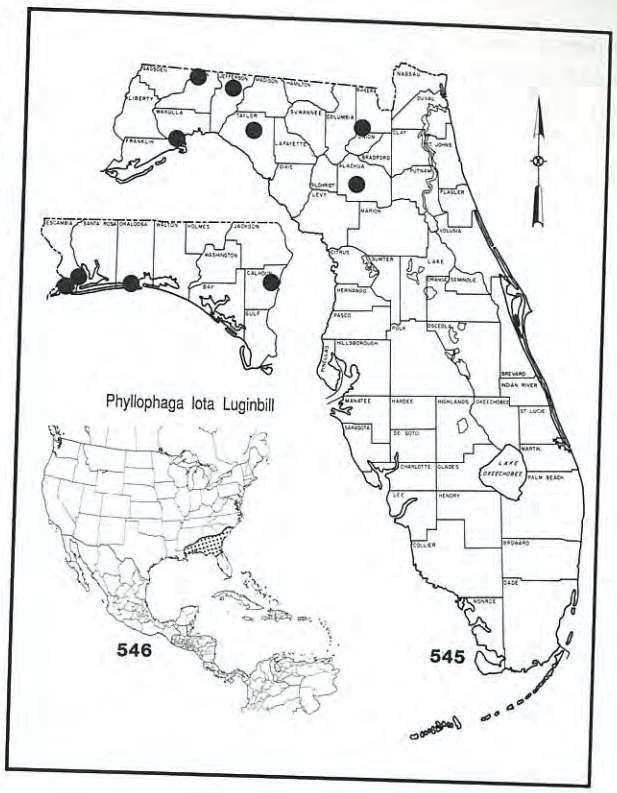
TAXONOMIC NOTES: No synonyms are known. Luginbill & Painter (1953:42) stated that it is "Constant in all respects, including genital characters."

U.S. DISTRIBUTION (fig. 546): Luginbill & Painter (1953: fig. 31) recorded it from **Alabama, Florida, Georgia, Mississippi**, and **South Carolina**. The types were from Stokes, **South Carolina** (Luginbill, 1928:87-88). In **Mississippi**, Langston (1927b:19) recorded it near the Gulf from Lucedale, Ocean Springs, and Perkinston. In **Alabama**, Loding (1945:105) recorded it from Mobile and Baldwin counties. In **Georgia**, Fattig (1944:30) recorded it from Head River, Savannah, Thomasville, and Waycross.

FLORIDA DISTRIBUTION (fig. 545): Young & Thames (1949:127) recorded it only from near Sopchoppy (Wakulla Co.) where 2 specimens were trapped in pitcher plants (*Sarracenia* sp.). Our records are for 9 counties, mostly in the panhandle, the southernmost being Gainesville (Alachua Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:41) listed it as rare and the season as late May to early July. Our Florida records are from May 19 (Perry, Taylor Co.) to September 3 (Blountstown, Calhoun Co.). We considered it quite rare until 99 specimens were taken in the surf at Panacea (Wakulla Co.) during June, July, and August by C. Hilfiker. The life history is unknown, and the immature stages are undescribed.

Adult Host Plants: Pine, planetree, willow [families] (Luginbill & Painter, 1953:41); pine, cypress (Langston 1927b:19). Although probably not a host, Young & Thames (1949:127) reported 2 specimens trapped in pitcher plants (*Sarracenia* sp.). No Florida specimens were host associated.



SPECIMENS EXAMINED: 120 from the following 9 Florida counties: Alachua, Baker, Calhoun, Escambia, Jefferson, Leon, Okaloosa, Taylor, and Wakulla. For complete data, see Appendix 21.

SELECTED REFERENCES: Fattig, 1944:7-8, 30; Langston, 1927b:17-18, 79, plate 2, figure 7; Leng & Mutchler, 1933:39; Loding, 1945:105; Luginbill, 1928:56, 87-88, figure 33, male A-C, female D; Luginbill & Painter, 1953:7, 40, figure 31, plate 41(1-6); Riley, 1988:56, 126, 192-194, 240-241, figure 263-266, table 3-4; Woodruff, 1973:28; Young & Thames, 1949:127.

Phyllophaga luctuosa (Horn)

(fig. 35, 95, 155, 215, 254, 325, 328, 398, 408, 547, 548)

Lachnosterna luctuosa Horn 1887b:254.
Lachnosterna rugosioides Linell 1896:114.
Phyllophaga luctuosa, Glasgow 1916:373.

TYPE LOCALITY: "South Carolina, Georgia, Florida, Alabama and Louisiana".

DIAGNOSIS: A large, dark, glabrous, convex species with a densely, coarsely punctate pronotum. The male

lower posterior tibial spur is fixed, narrow, acute, and nearly as long as the inner spur (fig. 398). The genitalia are diagnostic (male: 35, 95, 155, 215, 254; female: 325, 328). In the body shape it is similar to *infidelis*, but the latter is reddish brown, more shining, and the lower spur is short and stubby.

DESCRIPTION: **Length**: 17.8-23.6mm; **Width**: 10.1-12.3mm. **Shape**: oblong, oval, convex, broader behind. **Color**: dark brown to piceous. **Vestiture**: glabrous, moderately shining. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: slightly emarginate; border narrowly reflexed. **Tarsal Claws**: tooth strong, median in both sexes. **Male Posterior Tibial Spurs**: lower fixed, length equal to upper; both spurs slender and acute. **Abdomen**: fig. 408 (venter). **Female Genitalia**: fig. 325 (ventral), 328 (lateral). **Male Genitalia**: fig. 35 (caudal), 95 (ventral), 155 (dorsal), 215 (right lateral), 254 (left lateral).

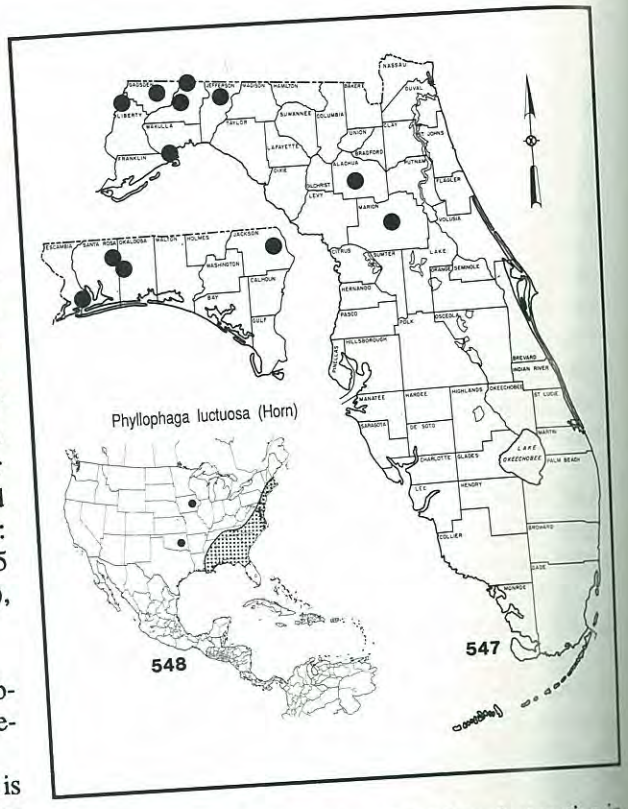
TAXONOMIC NOTES: Robinson (1938:114) established the synonymy of *rugosioides*, and this was repeated by Luginbill & Painter (1953:63).

The holotype was examined at the MCZC, and it is a male with the genitalia extracted, labelled "Ga., Type No. 3678". There are also 6 paratypes in Horn's collection; 3 are labelled "Ga.", 2 are labelled "La.", and 1 is labelled "S.C."

U.S. DISTRIBUTION (fig. 548): Luginbill & Painter (1953: fig. 55) reported it from **Alabama, Connecticut, Florida, Georgia, Maryland, Massachusetts, Mississippi, New Jersey, North Carolina, Rhode Island, South Carolina, Tennessee**, and **Virginia**, with isolated records for **Iowa** and **Oklahoma**. Riley (1988: map 28) recorded it from the "Florida parishes" of **Louisiana**.

FLORIDA DISTRIBUTION (fig. 547): Blatchley (1929:56) recorded it from Tallahassee (Leon Co.). Young & Thames (1949:128) recorded it also from Monticello (Jefferson Co.). Our records include 11 counties, mostly from the panhandle, the southernmost being Ocala (Marion Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:64) listed it as "...one of the commonest species in central South Carolina, apparently a sand hill species." Our Florida records are from February 16 (Tallahassee) to June 22 (Tall Timbers Research Station, Leon Co.). The largest number of specimens (24) was taken on March 27 (Ocala, Marion Co.). Baker (1972:148; 1985:268) stated that larvae were often destructive in nurseries [pine] and, probably, plantations.



Yeager (1950:177) gave the life cycle as 2 or 3 years, eggs being laid in spring and summer; the first winter is spent in the second and third instars; in late summer of the second year 75% of larvae pupate and reach adult in 2 to 3 weeks; they pass the second winter as adults; the remaining 25% pass the second winter as third instars, pupate the following late summer and fall, passing the third winter as adults. Females were prolific in cages, averaging 90 eggs each.

Davis (1919:114) recorded a parasitic fly, *Biomyia lachnosternae* Townsend (Diptera: Tachinidae), from adult beetles.

Adult Host Plants: Beech, birch, buckwheat, custard apple, ebony, elm, honeysuckle, mulberry, pine, pulse, rue, tupelo, vervain, walnut, willow, witchhazel [families] (Luginbill & Painter, 1953:64); water oak, willow oak, red oak, black jack oak, white oak, Chapman's oak, laurel oak, scrub oak, black oak, hickory, black gum, pine, apple, flag pawpaw, pale dock, French mulberry, prickly ash, wild cherry, longleaf pine, loblolly pine, slash pine, crab apple, sweet gum, hawthorn, river birch, wild grape, winged elm, pecan, rose, paper mulberry, orchard grass, peanut, osage orange, swamp cottonwood, Lombardy poplar (Fattig, 1944:24;

lower posterior tibial spur is fixed, narrow, acute, and nearly as long as the inner spur (fig. 398). The genitalia are diagnostic (male: 35, 95, 155, 215, 254; female: 325, 328). In the body shape it is similar to *infidelis*, but the latter is reddish brown, more shining, and the lower spur is short and stubby.

DESCRIPTION: **Length**: 17.8-23.6mm; **Width**: 10.1-12.3mm. **Shape**: oblong, oval, convex, broader behind. **Color**: dark brown to piceous. **Vestiture**: glabrous, moderately shining. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: slightly emarginate; border narrowly reflexed. **Tarsal Claws**: tooth strong, median in both sexes. **Male Posterior Tibial Spurs**: lower fixed, length equal to upper; both spurs slender and acute. **Abdomen**: fig. 408 (venter). **Female Genitalia**: fig. 325 (ventral), 328 (lateral). **Male Genitalia**: fig. 35 (caudal), 95 (ventral), 155 (dorsal), 215 (right lateral), 254 (left lateral).

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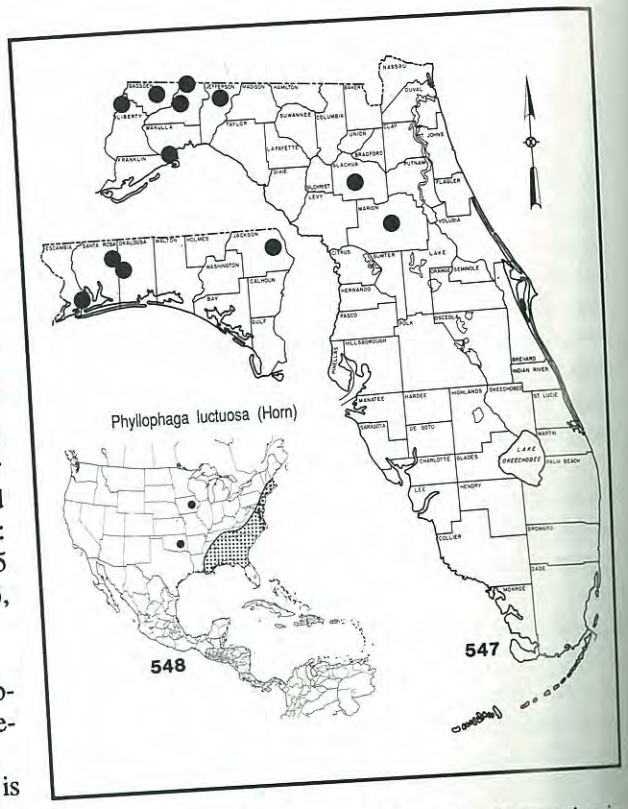
BIOLOGY & ECOLOGY: Luginbill & Painter (1953:64) listed it as "...one of the commonest species in central South Carolina, apparently a sand hill species." Our Florida records are from February 16 (Tallahassee) to June 22 (Tall Timbers Research Station, Leon Co.). The largest number of specimens (24) was taken on March 27 (Ocala, Marion Co.). Baker (1972:148; 1985:268) stated that larvae were often destructive in nurseries [pine] and, probably, plantations.



Yeager (1950:177) gave the life cycle as 2 or 3 years, eggs being laid in spring and summer; the first winter is spent in the second and third instars; in late summer of the second year 75% of larvae pupate and reach adult in 2 to 3 weeks; they pass the second winter as adults; the remaining 25% pass the second winter as third instars, pupate the following late summer and fall, passing the third winter as adults. Females were prolific in cages, averaging 90 eggs each.

Davis (1919:114) recorded a parasitic fly, *Biomyia lachnosternae* Townsend (Diptera: Tachinidae), from adult beetles.

Adult Host Plants: Beech, birch, buckwheat, custard apple, ebony, elm, honeysuckle, mulberry, pine, pulse, rue, tupelo, vervain, walnut, willow, witchhazel [families] (Luginbill & Painter, 1953:64); water oak, willow oak, red oak, black jack oak, white oak, Chapman's oak, laurel oak, scrub oak, black oak, hickory, black gum, pine, apple, flag pawpaw, pale dock, French mulberry, prickly ash, wild cherry, longleaf pine, loblolly pine, slash pine, crab apple, sweet gum, hawthorn, river birch, wild grape, winged elm, pecan, rose, paper mulberry, orchard grass, peanut, osage orange, swamp cottonwood, Lombardy poplar (Fattig, 1944:24).

black gum, oak, pecan, pine, rose (Langston, 1927b:53); loblolly pine, Georgia pine, water oak, black jack oak, white-heart hickory, elm, Chickasaw plum, wild grape, river birch, haw, sweetgum (Luginbill, 1928:70). Baker (1972:147-148) listed persimmon, mulberry, tupelo, walnut, willow, beech, birch, loblolly and longleaf pine. Our Florida records include sumac and pecan.

Immatures: The third instar larva was described and illustrated by Boving (1942:47, fig. 148-151) as follows: "Posterior part of labrum with a transverse, irregular, at the sagittal line forward curved series of about 8 setae on each side. Anterior marginal region of frons with a transverse double series of 6 to 7 long setae on each side in front and about 5 short setae on each side behind them. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 3 long and 4 short setae. Dorso-molar region of right mandible (Fig. 150) with a patch of about 18 setae; dorso-exterior region with about 25 punctures and a single or no setae; scrobis with about 12 punctures and 1 to 3 setae in an irregular longitudinal row; ventro-lateral carina with about 10 long setae; baso-lateral region with a patch of about 10 setae. Epipharynx (Fig. 148) with 12 to 14 heli; proplegmatium moderately broad and elliptical, with 7 to 11 proplegmata; chaetopariae with numerous punctures among the setae on both sides; crepidal punctures 40 or more. Septula (Fig. 149) with approximately parallel, slightly convex sides; palidium with one regular row of 25 or a few more pali, all of same length and width; palus (Fig. 151) moderately long, depressed, pointed; bases of pali close or continuous; preseptular setae about 12. (Length of body about 45mm.; width of head 6mm.)."

SPECIMENS EXAMINED: over 200, of which 164 were from 11 Florida counties. The largest single catch was 24 from Marion Co., Ocala, 27-III-77, M. C. Thomas, blacklight trap. For complete data, see Appendix 22.

SELECTED REFERENCES: Baker, 1972:147; 1985:268; Blackwelder, 1939:52; Blatchley, 1929:56; Boving, 1937:4; 1942:4, 6-7, 9-10, 12-15, 23, 28, 47, 60-61, 65, figure 148-151, 245; Brimley, 1938:204; Cartwright, 1934:268; Dalla Torre, 1912:195; Davis, 1918:9; 1919:114; Fattig, 1944:3, 7, 23; Glasgow, 1916:373, 375; Horn, 1887b:253-254, 294, figure 22, 39, plate 3; Langston, 1927b:34, 51, 85, plate 8, figure 31; Loding, 1945:104; Luginbill, 1928:55, 69-70, figure 17 A, male B-E, female F; Luginbill & Painter, 1953:9, 63, 73, figure 55, plate 56(1-5); McLemore, 1973:542; Riley, 1988:60, 194-197, 221, figure 37, 267-271, map 28, table 3-4; Sanderson, 1942:49; Sim, 1928:23, 53, plate 5; Smith, 1889b:493, 512, figure 45, plate 56; 1910:319; Woodruff, 1973:28; Yeager, 1950:177; Young & Thames, 1949:128.

Phyllophaga mariana Fall

(fig. 36, 96, 156, 216, 329, 332, 549, 550)

Phyllophaga mariana Fall 1929:111.

TYPE LOCALITY: "Florida (Lake Mary)".

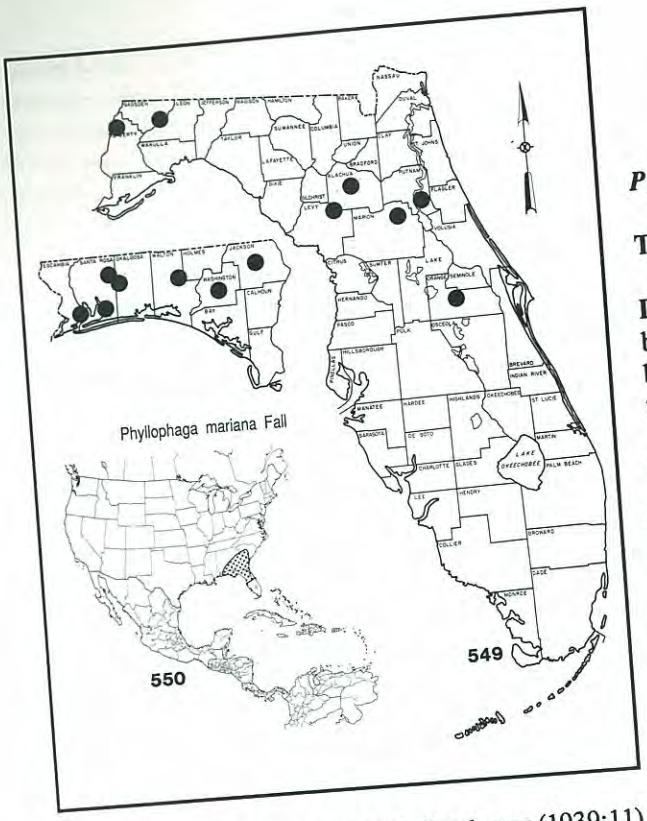
DIAGNOSIS: Except for *ilicis* (pubescence longer and denser), this is one of the largest (19.8-24.0mm long) pubescent Florida species. It is superficially similar to (see genitalia figures in parentheses for comparison): *aemula* (male:1, 61, 121, 181; female: 263, 266); *crenulata* (male: 9, 69, 129, 189; female: 275, 278); *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *mariana* (male: 36, 96, 156, 216; female: 329, 332); *parvidens* (male: 42, 102, 162, 222; female: 342, 345); and *skelleyi* (male: 51, 111, 171, 231; female: 360, 363).

DESCRIPTION: **Length**: 19.8-24.0mm; **Width**: 10.6-12.8mm. **Shape**: stout, oblong, oval, convex. **Color**: ferrugineous brown. **Vestiture**: pubescent, thinly clothed with short, grey, decumbent hairs, mixed with slightly longer, erect hairs on head, pronotum, and base of elytra. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: emarginate, moderately, obtusely cuspiform. **Tarsal Claws**: arcuate; tooth strong, median. **Male Posterior Tibial Spurs**: lower movable, nearly equal in length and structure to upper. **Female Genitalia**: fig. 329 (ventral), 332 (lateral). **Male Genitalia**: fig. 36 (caudal), 96 (ventral), 156 (dorsal), 216 (right lateral).

TAXONOMIC NOTES: No synonyms have been created for this rare species, and it is "Constant in all respects" according to Luginbill & Painter (1953:24). Variation is mainly in the extent of the pilosity in the same way as in *crenulata, aemula*, and *parvidens*.

U.S. DISTRIBUTION (fig. 550): Luginbill & Painter (1953:24) recorded it from **Florida** and **Georgia**. Cartwright (1939:286) added Blackville, **South Carolina**. In **Georgia**, Fattig (1944:31) recorded only one specimen from Fort Gaines. The USNM contains specimens from the following **South Carolina** localities: (1) Aiken, (1) W. Trapler S.R.P. (Aiken Co.), (3) Blackville (Edisto Exp. Sta.).

FLORIDA DISTRIBUTION (fig. 549): The type



locality is "Lake Mary, Florida". Sanderson (1939:11) recorded a single specimen from Orlando. Young & Thames (1949:128) recorded it as "... not uncommon in the central and northern parts of the state ... Gainesville, Jackson and Liberty counties." Our records include 13 counties, the southernmost being Orlando (Orange Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:24) listed it as "very rare" and active in April. Our Florida records of 98 specimens are from March 18 (Levy Co.) to June 17 (Okaloosa Co.), with most specimens found in April. It seems to be a characteristic species of the turkey oak scrub in the northern half of the state. There is no information on the life history, and the immature stages are undescribed.

Adult Host Plants: No hosts are reported in the literature. Our Florida records include turkey oak and sumac. Although not a host, a single specimen was taken trapped in a pitcher plant (*Sarracenia* sp.).

SPECIMENS EXAMINED: 98 from 13 Florida counties. For complete data, see Appendix 23.

SELECTED REFERENCES: Cartwright, 1939:286; Fall, 1929a:111, figure 1; Fattig, 1944:31; Leng & Mutchler, 1933:39; Luginbill & Painter, 1953:5, 23, plate 21(6-10); Sanderson, 1939:11; Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga murrea Sanderson[1]

(fig. 331, 334, 551)

Phyllophaga murrea Sanderson 1950:90.

TYPE LOCALITY: "Polk Co., Florida, Lake Streaty".

DIAGNOSIS: This species is poorly characterized, because it is known only from a single female. The body resembles *elongata*, but the genitalia are similar to *clypeata*; compare fig. 331, 334 with 271, 274.

DESCRIPTION: **Length**: 16mm; **Width**: 7mm. **Shape**: elongate, parallel, as in *elongata*. **Color**: reddish-brown. **Vestiture**: pubescent, hairs fine, short, semierect; surface shining. **Antenna**: 10-segmented; female club less than length of preceding 6-segments. **Clypeus**: slightly emarginate; margin reflexed. **Tarsal Claws**: tooth short, narrow, antemedian. **Female Posterior Tibial Spurs**: lower fixed, aborted, one-fifth length of upper; apical fringe with 20 and 24 marginal spinules. **Female Genitalia**: fig. 331 (ventral), 334 (lateral), 551 (enlargement of pubic process).

TAXONOMIC NOTES: The unique holotype female was loaned by the UMMZ, and the genitalia are illustrated in fig. 331, 334, and 551. The beetle itself appears to be *elongata*, but the genitalia are similar to *clypeata*.

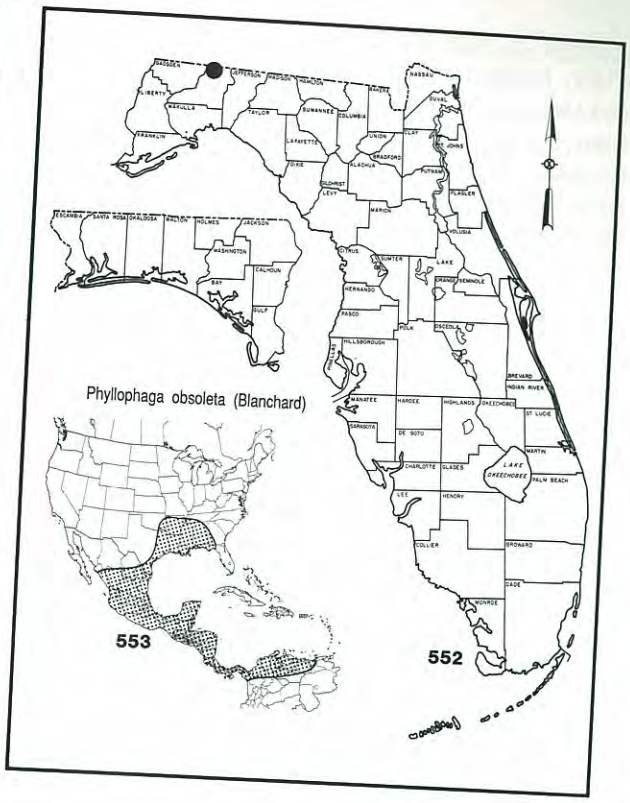
U.S. DISTRIBUTION: Recorded only from a single female from **Florida**.

FLORIDA DISTRIBUTION: Known only from "Lake Streaty, Polk Co., Florida". [Possibly Lake Streety near the border of Polk and Highlands Co.].

BIOLOGY & ECOLOGY: It is known only from the single holotype female which was collected "...with automobile headlights, beating scrub oaks and other vegetation, between 10 p.m. and 1 a.m." The life history and immature stages are unknown.

[1][After this was completed, and too late to make necessary changes throughout the manuscript, we concluded that *murrea* is a synonym. It is presumably the result of an error associating the genitalia (of *clypeata*) with the correct beetle (of *elongata*)].

fig. 551. *Phyllophaga murrea*: female genitalia (holotype); enlargement of pubic process tip (11mm = 0.05mm).



Phyllophaga obsoleta (Blanchard)

(fig. 38, 98, 158, 218, 335, 338, 383, 410, 552, 553)

Phytalus obsoletus Blanchard 1850:131.
Phytalus vanalleri Schaeffer 1927:215.
Phyllophaga (Phytalus) obsoleta vanalleri, Saylor 1939b:164. **(new synonymy)**

TYPE LOCALITY: "Mexique"; of *vanalleri* "Mobile, Alabama".

DIAGNOSIS: As a member of the subgenus *Phytalus*, it shares the cleft tarsal claws (fig. 383) with *georgiana* (fig. 380). The inner claw is longer and sturdier than the outer one in *obsoleta*. The genitalia are of completely different types; compare *georgiana* (male: 24, 84, 144, 204; female: 305, 308) with *obsoleta* (male: 38, 98, 158, 218; female: 335, 338).

DESCRIPTION: **Length**: 14.5-17.5mm (13mm, Riley); **Width**: 7.3-8mm (7.1mm, Riley). **Shape**: oblong-elongate, subparallel. **Color**: testaceous to rufotestaceous. **Vestiture**: glabrous, shining, head with long, erect, testaceous hair. **Antenna**: 10-segmented; male club usually two-fifths longer than stem. **Clypeus**: emarginate, broadly, faintly; apex nearly truncate, strongly reflexed; suture not impressed. **Tarsal Claws** (fig. 383): cleft; upper tooth narrower and shorter than lower. **Male Posterior Tibial Spurs**: lower movable, narrow, slightly curved; upper slightly shorter than lower. **Abdomen**: fig. 410 (venter). **Female Genitalia**: fig. 335 (ventral), 338 (lateral). **Male Genitalia**: fig. 38 (caudal), 98 (ventral), 158 (dorsal), 218 (right lateral).

TAXONOMIC NOTES: Saylor (1939:164-165) listed *vanalleri* as a "northern subspecies" of *obsoleta*. In the same paper he later suggested that "... when more specimens have been seen from northern Mexico and southeastern United States the name *P. vanalleri* Schaeffer may have to be withdrawn altogether."

I examined the holotype of *vanalleri* in the USNM, labelled "Mobile Co., Ala., 18-VI-24; *Phytalus vanalleri* Schffr.; Type; Brooklyn Museum Coll. 1929; Type No. 50145 U.S.N.M." The genitalia had not been dissected previously. After I examined the genitalia, and compared them with those of specimens from various parts of the range, I concluded that there is no reason to retain the name *vanalleri*.

U.S. DISTRIBUTION (fig. 553): Luginbill & Painter (1953) did not treat the species. Saylor (1939:164), under the subspecies *vanalleri*, listed it from **Alabama, Louisiana**, and **Texas**. In **Arkansas**, Sanderson (1944:21) recorded it from Crawford, Lee, and Ouachita counties. In **Georgia**, Fattig (1944:31) recorded a single specimen from Cairo. In **Alabama**, Loding (1945:106)

recorded it from the following counties: Baldwin, Clark, Madison, Colbert, Tuscaloosa, Hale, Mobile, and Monroe. In **Texas**, Reinhard (1950:51) recorded it from Limestone, Nacogdoches, Smith, and Morris counties. In **Mississippi**, Lago (1980:62) reported it from Adams, Harrison, Holmes, Lafayette, Lincoln, Oktibbeha, Pearl River, Pontotoc, Scott, Tishomingo, and Warren counties. In **Louisiana**, Riley (1988: map 1) recorded it from 21 parishes throughout the state. Sanderson (pers. com.) listed the distribution as follows: **(United States) Alabama, Arkansas, Arizona, Louisiana, Mississippi, Tennessee, Texas; (Mexico) Chiapas, Hidalgo, Jalisco, Michoacan, Mexico, Morelos, Nayarit, Nuevo Leon, Oaxaca, Puebla, Queretaro, Sinaloa, Tabasco, Veracruz; and Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Venezuela.**

FLORIDA DISTRIBUTION (fig. 552): Our records, the first from Florida, are from a single collection at Tall Timbers Research Station, Leon Co.

BIOLOGY & ECOLOGY: This species was not treated in Luginbill & Painter (1953). Our 2 Florida specimens were taken in June. In Louisiana, Riley (1988:67) found it from May 2 to August 1. King & Saunders (1984:81-82) gave the life history as similar to *menetriesi* (Blanchard), except "...adults rarely feed." For *menetriesi* they outlined the life cycle as follows: eggs (10 to 12 [days]) are 2.5mm long, laid singly or in small groups from 2 to 10cm deep in soil; first 2 larval instars took 4 to 6 weeks; third instars fed voraciously for 5 to 8 weeks on plant roots; pupal cells were formed 10 to 20cm deep; pupation took place in January or February. A single female may lay up to 200 eggs.

They considered *obsoleta* one of the Central American pest species, the larvae destroying roots of crops, including eating holes in potato tubers. They found it primarily in well-drained soils above 1000 meters, and the larval damage was more frequent near extensive pastureland. It has a one year cycle in both Costa Rica and El Salvador (King, 1984:43).

Adult Host Plants: King & Saunders (1984:82) reported hosts (presumably larvae) as "maize, potato, (pasture coffee and a wide range of other crops)", but stated that "... adults rarely feed." No other literature host records were found, and our Florida specimens were taken at light.

Immatures: The third instar larva was included in a Key to Central American white grubs by King (1984:46-48, fig. 7). He illustrated the raster (his fig. 7) but did not describe the larva in detail. The following characters are extracted from his Key: Raster with palidia regularly set; pali not hooked at tip; tegillar hamate setae extending beyond anterior end of palidia. Palidia long, parallel, with 15 to 20 pali per palidium; the pali sharp, separated at their bases by a distance equal or just less than the basal width of a palus. Tegillum each with 30 or less hamate setae.

SPECIMENS EXAMINED: several hundred, of which only 2 were from Florida with the following data: Leon Co., Tall Timbers Res. Sta., 28-VI-69, A. Bhatkar, blacklight trap.

SELECTED REFERENCES: Butler & Werner, 1961:2, 17; Fattig, 1944:31; King, 1984:37, 39, 43, 45, 48, fig. 1 (map), 5 (genitalia), 7 (larva); King & Saunders, 1984:82, fig. 39.3, 40.2b; Loding, 1945:106; Riley, 1988:33, 45, 53, 64-67, 69, 234, figure 8, 31-32, 53-56, map 1; Sanderson, 1944:20-21, table I; 1958:160, 166-167; Saylor, 1939:164-165.

Phyllophaga okeechobea Robinson

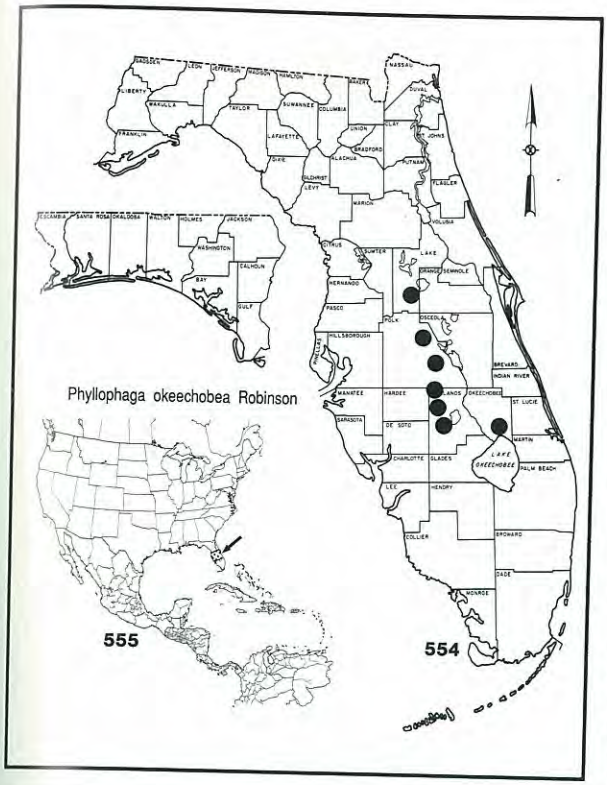
(fig. 39, 99, 159, 219, 336, 339, 389, 494, 588, 554, 555)

Phyllophaga okeechobea Robinson 1948:33-34.

TYPE LOCALITY: "Okeechobee, Okeechobee County, Florida".

DIAGNOSIS: This is the smallest (13.0-16.2mm long) of the 3 related Florida endemics that are pubescent, clypeus deeply emarginate and densely punctate, and genitalia of the same general type. For comparison, see *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *okeechobea* (Male: 39, 99, 159, 219; female: 336, 339); and *skelleyi* (male: 51, 111, 171, 231; female: 360, 363).

DESCRIPTION: **Length**: 13.0-16.2mm; **Width**: 7.5-8.8mm. **Shape**: ovate, broader behind. **Color**: dark reddish-brown. **Vestiture** (fig. 389): pubescent, hairs short, scale-like, whitish; surface shining. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: distinctly emarginate; margin reflexed. **Tarsal Claws**: strongly curved; male tooth small, nearer base than middle. **Male Posterior Tibial Spurs**: lower movable, slender, slightly curved, seven-eights length of upper. **Female Genitalia**: fig. 336 (ventral), 339 (lateral). **Male Genitalia**: fig. 39 (caudal), 99 (ventral), 159 (dorsal), 219 (right lateral).



TAXONOMIC NOTES: This species is closely related to *elizoria*, another sympatric species from central Florida. Variation is noticeable in the pilosity, but this can be abraded and worn off.

U.S. DISTRIBUTION (fig. 555): It is known only from **Florida**.

FLORIDA DISTRIBUTION (fig. 554): The type locality was Okeechobee (Okeechobee Co.) (Robinson, 1948:33-34). Some early records (e.g., Young & Thames, 1949:128) for *elizoria* are *okeechobea* [we have examined those from De Soto City]. Our records include 4 counties in the Lake Wales Ridge area.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953) did not treat this species, and it was not listed by Young & Thames (1949). After careful examination of the records and specimens, it appears that *okeechobea* is diurnal, and *elizoria* is primarily nocturnal. A mating pair of *okeechobea* was found in the dry sand at Archbold Biological Station during the day by John Sivinski. Most of the other 42 specimens examined were taken from citrus or were taken in fossil sand dunes (all in the daytime). Not a single specimen was collected with the hundreds of *elizoria* at blacklight at Archbold Biological Station. The life cycle is unknown, and the immature stages are undescribed.

Adult Host Plants: No hosts are reported in the literature. Our Florida records (most specimens) were from citrus (both orange and grapefruit), with one record each from avocado and *Crotalaria mucronata*.

SPECIMENS EXAMINED: 42, including the holotype, from the following 4 Florida counties: Highlands, Lake, Okeechobee, and Polk. For complete data, see Appendix 24.

SELECTED REFERENCES: Robinson, 1948:33-34; Woodruff, 1973:28; 1982:96-97.

Phyllophaga ovalis Cartwright

(fig. 40, 100, 160, 220, 255, 337, 340, 416, 556, 557)

Phyllophaga ovalis Cartwright 1939:353.

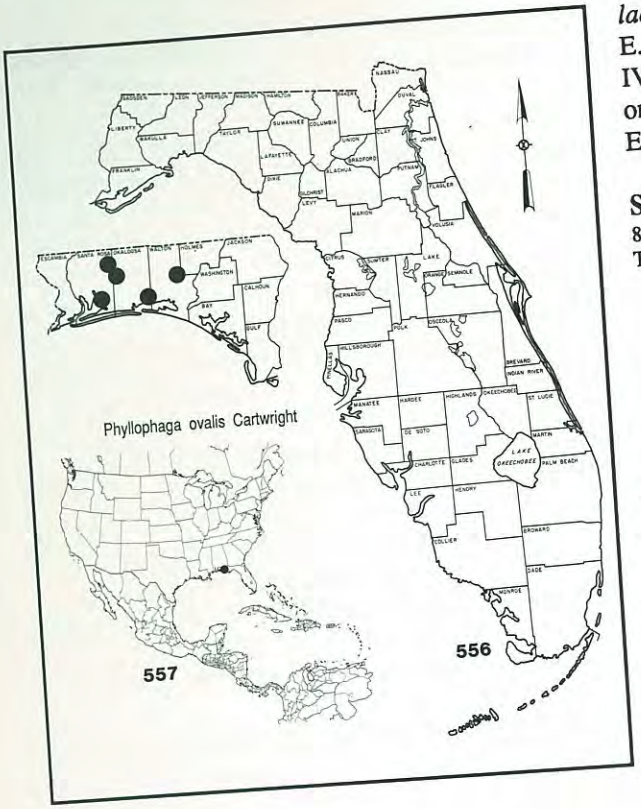
TYPE LOCALITY: "4.7 miles west of Niceville, Florida".

DIAGNOSIS: As the name implies this is a convex oval species (fig. 416). In body shape, red brown color, and its shiny surface it is similar to the following Florida species (see genitalia figures in parentheses for comparison): *forsteri* (male: 20, 80, 140, 200, 245; female: 295, 298); *infidelis* (male: 31, 91, 151, 211, 252; female: 318, 321); *ovalis* (male: 40, 100, 160, 220, 255; female: 337-340); and *tecta* (male: 54, 114, 174, 234, 261; female: 366, 369).

DESCRIPTION: **Length**: 18.4-21.6mm; **Width**: 10.1-12.1mm. **Shape**: oblong, oval, very convex. **Color**: dark castaneous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: emarginate; margin moderately reflexed. **Tarsal Claws**: median, strong, right angled. **Male Posterior Tibial Spurs**: fixed, narrow, half length of upper. **Female Genitalia**: fig. 337 (ventral), 340 (lateral). **Male Genitalia**: fig. 40 (caudal), 100 (ventral), 160 (dorsal), 220 (right lateral), 255 (left lateral).

TAXONOMIC NOTES: Although externally similar to *infidelis*, there is no basis for Young & Thames' statement (1949:128) that Horn's (1887b:253) Florida specimen "... probably represents *ovalis*."

U.S. DISTRIBUTION (fig. 557): **Florida** only.



FLORIDA DISTRIBUTION (fig. 556): It was originally described (Cartwright, 1939:354) from De Funiak Springs (Walton Co.) and 4.7 mi W. Niceville (Okaloosa Co.). Our records add Santa Rosa Co.; all 3 counties are in the western panhandle.

BIOLOGY & ECOLOGY: Until now, the species was known only from the 2 specimens available when it was described. There are still very few specimens known, all of which were collected in April. It seems to be one of the early spring species, like *skelleyi*, which is active when the new growth appears on turkey oak in the scrub areas of the Florida panhandle. The life cycle is unknown, and the immature stages are undescribed.

Adult Host Plants: Young & Thames (1949:128) mentioned that the 2 known specimens (types) were from "... turkey oak uplands." The first definite hosts were collected by E. G. Riley: upland willow oak (*Quercus incana*) and red oak (*Quercus falcata*) [det. K. Langdon]. We collected it also on turkey oak (*Quercus laevis*).

SPECIMENS EXAMINED: 9 from 2 Florida counties only: (2) Okaloosa Co., 1.5 mi. W. Holt, 14-IV-89, R. E. Woodruff, B. M. Beck, & P. E. Skelley, *Quercus laevis*; (5) Santa Rosa Co., 4 mi. N. Munson, 8-IV-82, E. G. Riley; (1) Santa Rosa Co., 3 mi. N. Munson 12-IV-87, E. G. Riley; (1) Santa Rosa Co., 1 mi. N. Holley on SR 87, 15-IV-89, R. E. Woodruff, B. M. Beck, & P. E. Skelley, *Quercus laevis*.

SELECTED REFERENCES: Luginbill & Painter, 1953:10, 86, plate 68(8-12); Woodruff, 1973:28; 1982:96, map 97; Young & Thames, 1949:128.

Phyllophaga panorpa Sanderson

(fig. 41, 101, 161, 221, 341, 344, 413-4, 499, 558, 559)

Phyllophaga panorpa Sanderson 1950:91-92.

TYPE LOCALITY: "Lake Placid, Florida".

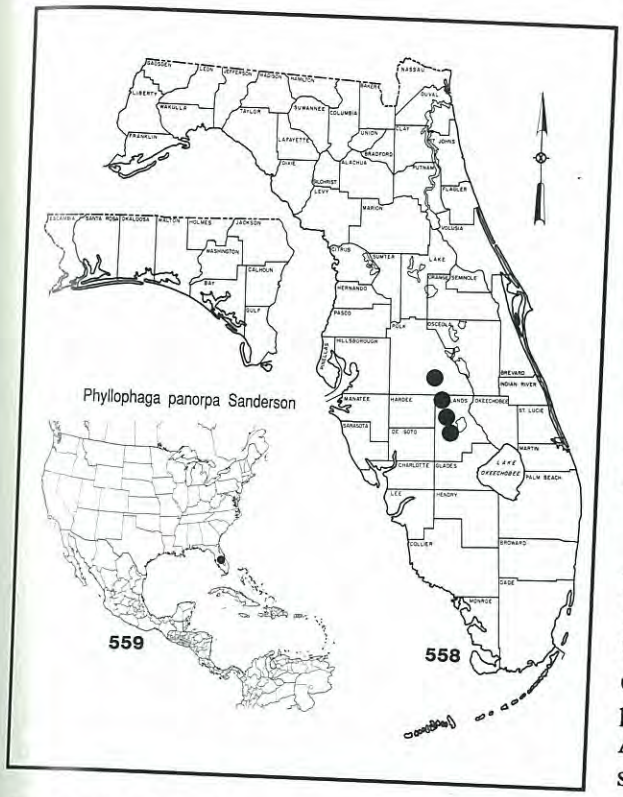
DIAGNOSIS: This is the larger (16.1-19.1mm, a 18mm long) sister species to *elongata* (12.4-15.5m av. 14mm long). Externally they are nearly identic except *panorpa* males have no teeth on the tarsal clav The male genitalia are distinctive, but the female ge talia are very similar; compare *elongata* (male: 16, 136, 196; female: 288, 291) with *panorpa* (male: 101, 161, 221; female: 341, 344).

DESCRIPTION: **Length**: 16.1-19.1mm; **Width**: 8.5mm. **Shape**: elongate, cylindrical. **Color**: light dish-brown. **Vestiture**: pubescent, hairs short, clo spaced, semi-erect, yellowish; surface slightly pruin **Antenna**: 10-segmented; male club yellowish, longer than stem. **Clypeus**: distinctly emarginate; ma conspicuously reflexed. **Tarsal Claws**: slender; without tooth, female with tooth nearer base than **Male Posterior Tibial Spurs**: lower fixed, short; apex with 36-40 spinules (male), 39-40 (female). **Fe Genitalia**: fig. 341 (ventral), 344 (lateral). **Male talia**: fig. 41 (caudal), 101 (ventral), 161 (dorsal (right lateral).

TAXONOMIC NOTES: This is a closely re larger sister species to *elongata*, but the genitalic ences are constant (fig. 498, 499).

U.S. DISTRIBUTION (fig. 559): Luginbill & (1953) did not treat this species. It is known on **Florida**.

FLORIDA DISTRIBUTION (fig. 558): Sa (1950:91-92) described it from Lake Placid (Hi



Co.) and Polk Co. Our records, except for a paratype from Polk Co., are all Highlands Co. It seems to have one of the most restricted ranges of the Florida species.

BIOLOGY & ECOLOGY: This is another species overlooked by Luginbill & Painter (1953). It appears to be a rare, localized, sister species to *elongata* that is found in the Lake Wales Ridge. Our seasonal records are from May 4 to October 2, all of which were taken at blacklight. It would be interesting to investigate the factors which enable *panorpa* and *elongata* to maintain their identity in the same area. The life cycle is unknown, and the immature stages are undescribed.

Adult Host Plants: No hosts are reported in the literature, and all our specimens were taken at light.

SPECIMENS EXAMINED: 94 from Highlands and Polk Co. For complete data, see Appendix 25.

SELECTED REFERENCES: Sanderson, 1950:91-92; Woodruff, 1982:96, map 96.

Phyllophaga parvidens (LeConte)

(fig. 42, 102, 162, 222, 342, 345, 439-441, 560, 561)

Lachnosterna parvidens LeConte 1856:259.

Phyllophaga parvidens, Glasgow 1916:373.

TYPE LOCALITY: "Georgia".

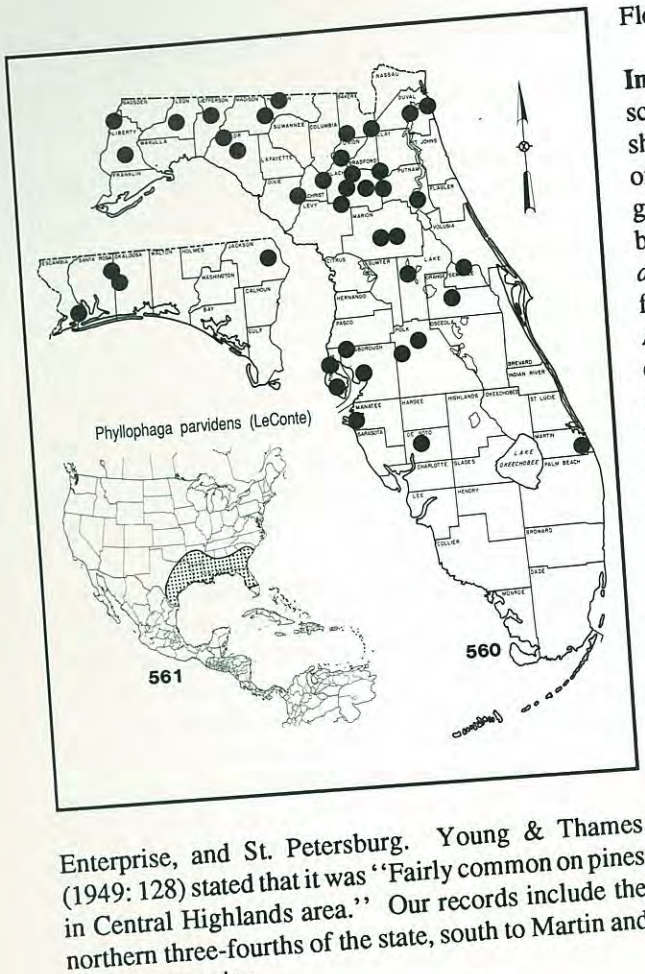
DIAGNOSIS: Of the pubescent Florida species it is most similar to *aemula*, but both posterior tibial spurs of that species are broad and attenuate, while those of *parvidens* are slender and acute. It can be separated from all the similar pubescent species by comparing genitalia (figures in parentheses): *aemula* (male: 1, 61, 121, 181; female: 263, 266); *crenulata* (male: 9, 69, 129, 189; female: 275, 278); *elizoria* (male: 15, 75, 135, 195; female: 287, 290); *mariana* (male: 36, 96, 156, 216; female: 329, 332); *parvidens* (male: 42, 102, 162, 222; female: 342, 345); and *skelleyi* (male: 51, 111, 171, 231; female: 360, 363).

DESCRIPTION: **Length**: 13.9-22.3mm; **Width**: 7.4-12.0mm. **Shape**: oblong, oval, slightly broader behind. **Color**: brown. **Vestiture**: pubescent, hairs short, decumbent, intermixed with larger erect hairs on head, pronotum, base of elytra; surface slightly pruinose. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: feebly emarginate; border narrowly reflexed. **Tarsal Claws**: moderately curved; tooth medium sized, antemedian. **Male Posterior Tibial Spurs**: lower movable, two-thirds length of upper; both spurs slender, acute. **Female Genitalia**: fig. 342 (ventral), 345 (lateral). **Male Genitalia**: fig. 42 (caudal), 102 (ventral), 162 (dorsal), 222 (right lateral), 439, 441 (aedeagus).

TAXONOMIC NOTES: No synonyms have been created, but a variety (*hysteropyga*) was described by Davis (1920:336). It is based primarily on its smaller size and was described from Texas and Florida. We have found no Florida specimens that don't fit the normal size variation found in *parvidens*. However, a large series of Texas specimens in the FSCA looks superficially different. Even though I've examined the holotype of *hysteropyga* in the INHS, I hesitate to synonymize it until further study can clarify its status.

U.S. DISTRIBUTION (fig. 561): Luginbill & Painter (1953: fig. 12) recorded it from **Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi**, and **South Carolina**. Reinhard (1950:47) recorded it from "East and Northeast **Texas** and less frequent southwestward to Atascosa and LaSalle counties."

FLORIDA DISTRIBUTION (fig. 560): Blatchley (1929:69) listed it from Tampa, St. Augustine, Gainesville,



Enterprise, and St. Petersburg. Young & Thames (1949: 128) stated that it was "Fairly common on pines in Central Highlands area." Our records include the northern three-fourths of the state, south to Martin and De Soto counties.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:21) listed it as not common, from early March to mid-June. Our Florida records (810 specimens) were from February to November, with most specimens being taken in May and June. Only the first instar larva is described, and the life history is unknown. Langston (1927b:66) listed it as "rare" in Mississippi, and Luginbill (1928:60) called it "very rare" in South Carolina. It is often abundant, at least in the Gainesville area.

Adult Host Plants: Beech, pine, rose, walnut [families] (Luginbill & Painter, 1953:21); pecan, swamp dewberry (Fattig, 1944:28); pecan and pine (Langston, 1927b:66); water oak (*Quercus nigra*) (Luginbill, 1928:60). Young & Thames (1949:128) listed it as "... fairly common on pines". Our Florida records include roots of *Eupatorium* sp., *Eremochloa ophiuroides*, plum, citrus, and hibiscus. Although presumably not hosts, Fattig (1944:28) reported a specimen trapped in a pitcher plant (*Sarracenia* sp.), and 3 specimens from Florida were labelled "vicinity of pitcher plants."

Immatures: Only the first instar larva has been described by Boving (1942:31, fig. 14-17), and care should be used when comparing it with the third instar of other species (e.g., in our Key). He placed it in his group 1, along with *aemula*, *crenulata*, and *rubiginosa*, based on larval characters. Only the first instar of *aemula* is known and can be compared. His description follows: "Posterior part of labrum with no setae. Anterior marginal region of frons with transverse series of 2 or 3 moderately long setae on each side. Epicranium on each side opposite concave posterior part of frontal suture and epicranial suture with 2 or 3 setae. Dorso-molar region of right mandible with a patch of about 18 fine setae; dorso-exterior region with no punctures; scrobis with a longitudinal row of 7 punctures; ventro-lateral carina without setae. Maxillary articulating area, (Figs. 14, 15) ventrally with 25 to 3 short, cone-shaped, dark granules. Epipharynx with about 14 heli in three curved rows; proplegmatium distinct, elliptical and wide with about 15 proplegmata chaetopariae with few or no punctures among the setae crepidal punctures about 6. Raster (Figs. 16, 17) with subrectangular septula; each palidium with one irregular row of 18 (or a few more) moderately long, slender sharply pointed, somewhat curved, densely set pa preseptular setae about 14, some long, some short, three irregular rows."

SPECIMENS EXAMINED: over 900, of which were from 29 Florida counties. More than half (4 representing 164 collection records, were f Gainesville. For complete data, see Appendix 26

SELECTED REFERENCES: Blatchley, 1929:69; B 1942:23-24, 31, 58, 61, figure 14-17, 207; Crotch, 1874:61; Torre, 1912:196; Davis, 1920:336; Fall, 1929a:111; Fattig, 1 28; Glasgow, 1916:373, 375; Horn, 1887a:145; 1887b:270-27 295; Knaus, 1897:217; Langston, 1927b:62, 65, 88, plate 11, 41; LeConte, 1856:259; Loding, 1945:105; Luginbill, 1928:55, figure 8, male A-C, female D; Luginbill & Painter, 1953:5, 18, figure 12, plate 12(1-4); Reinhard, 1946:479; 1950:47; 1988:42-43, 54, 112, 172, 207-210, figure 13, 287-290, map 3 3-4; Sanderson, 1944:16, 19, table 1; Schaeffer, 1906:258; 1889b:493, 519, figure 72, plate 59; 1910:319; Webb, 1 Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga perlonga Davis

(fig. 43, 103, 163, 223, 256, 343, 346, 562,

Phyllophaga perlonga Davis 1920:329.

TYPE LOCALITY: "Agricultural College, Mississippi".

DIAGNOSIS: This is one of the largest (20.8-24.7mm long) Florida species, characterized by an elongate parallel body, not swollen behind, dark brown to piceous, the pronotum more shining than the elytra, and the exceptionally convex pygidium. The unique male genitalia are of the general *fusca* type, except that the right paramere is produced outward (fig. 43, 103, 163, 223, 256), appearing so contorted that it seems unnatural, and the basal piece is unusually long. The female genitalia (fig. 340, 343) have the pubic process bifurcate and the superior plates cupuliform.

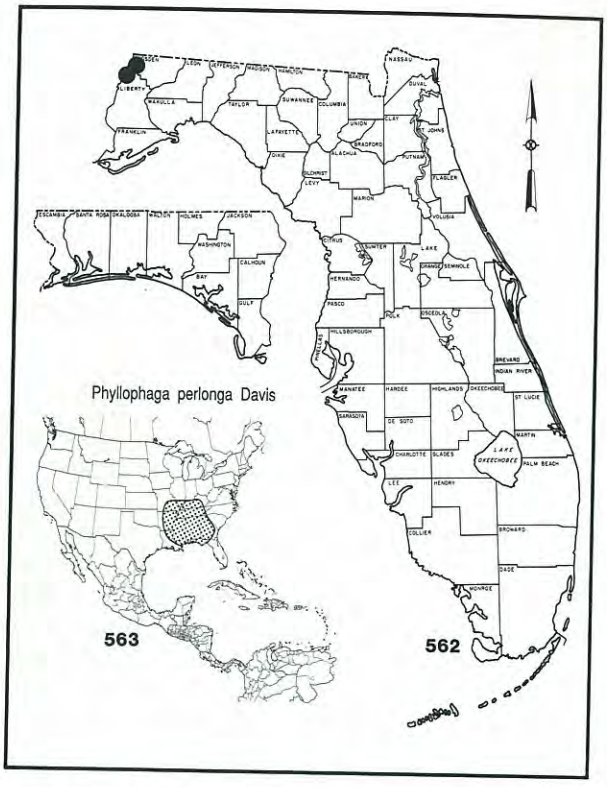
DESCRIPTION: Length: 20.8-24.7mm; **Width**: 10.5-11.6mm (12.3mm, Riley). **Shape**: elongate, nearly parallel, dorsum not noticeably convex. **Color**: rufotestaceous to piceous. **Vestiture**: glabrous, pronotum shining, elytra dull. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: slightly emarginate; border moderately reflexed. **Tarsal Claws**: tooth median, much stronger in female. **Male Posterior Tibial Spurs**: lower fixed, truncate, two-thirds length of obtuse upper. **Female Genitalia**: fig. 343 (ventral), 346 (lateral). **Male Genitalia**: fig. 43 (caudal), 103 (ventral), 163 (dorsal), 223 (right lateral), 256 (left lateral).

TAXONOMIC NOTES: No synonyms are known for this rare, distinctive species.

U.S. DISTRIBUTION (fig. 563): Luginbill & Painter (1953: fig. 52) recorded it from **Alabama, Arkansas, Georgia, Kentucky, Mississippi, Missouri, and Tennessee**. Riley (1988: map 28) added **Louisiana** (5 parishes).

FLORIDA DISTRIBUTION (fig. 562): Our records from Gadsden and Liberty counties constitute the first records from Florida.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:58) listed it as not common and active in April and May. Our few Florida specimens were taken from March 13 to April 24. In Louisiana, Riley (1988:212) found it "...fairly common in moist, hardwood bottomlands." Davis (1920) illustrated the larval raster, but the epipharynx and other diagnostic characters were not described. The life cycle in unknown.



Adult Host Plants: Beech, elm, olive, pulse, walnut, willow [families] (Luginbill & Painter, 1953:59); pecan, elm, hickory, honey locust (Davis, 1920:330); ash, hickory (Ritcher, 1940:112); elm, oak, pecan, willow (Langston, 1927b:47). We have no Florida host records.

SPECIMENS EXAMINED: 20, of which 7 were from 2 Florida counties: (1) Gadsden Co., Aspalaga Landing Rd., 21-IV-84, L. R. Davis, Jr., leaf litter at edge of flood plain; (5) Gadsden Co., Aspalaga Bluff, 5 mi. W. Sycamore, 13-III-83, P. M. Choate, Jr., leaf litter; (1) Liberty Co., Torreya State Park, 27-III-88, P. E. Skelley, at light.

SELECTED REFERENCES: Davis, 1920:329-330, figure 1; Fattig, 1944:29; Frison, 1927:160; Langston, 1927b:6, 33, 46, 85, plate 7, figure 26; Leng & Mutchler, 1927:38; Loding, 1945:105; Luginbill & Painter, 1953:8, 58, figure 52, plate 54(7-12); Ritcher, 1940:76, 82, 86, 93, 112, plate 3; 1949a:19; Sanderson, 1944:16, 21, table 1; Sim, 1928:27, 55, plate 7.

Phyllophaga postrema (Horn)

(fig. 44, 104, 164, 224, 257, 347, 350, 451, 564, 565)

Lachnosterna postrema Horn 1887b:233.
Lachnosterna quadrata Smith 1889a:94.
Phyllophaga postrema, Glasgow 1916:373.

TYPE LOCALITY: "Florida".

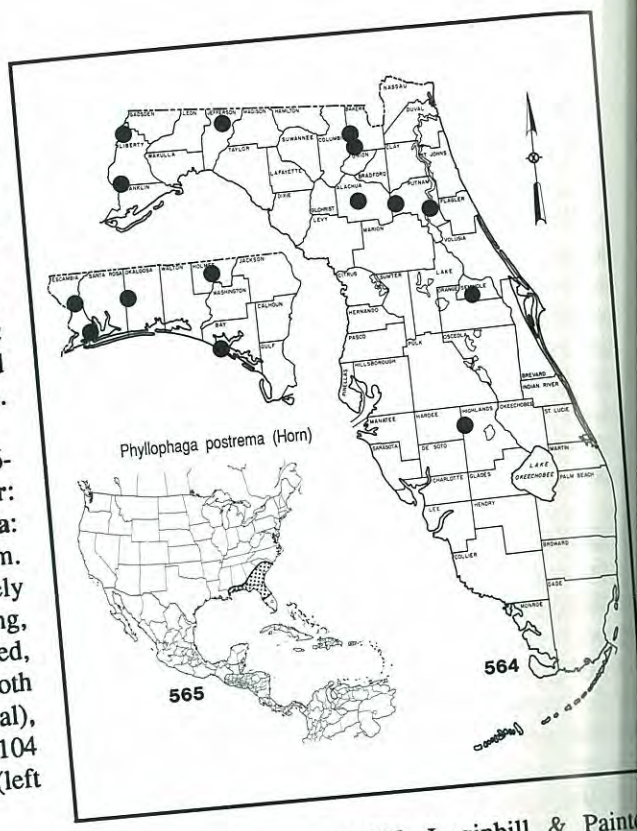
DIAGNOSIS: In body shape and color it is most similar to *ulkei*. Early in the study we confused it with *drakii* also. The 3 species have the general genitalia type of the *fusca* complex. They have the claspers overlapping at the tip and more or less asymmetrical; compare (genitalia figures in parentheses): *drakii* (male: 14, 74, 134, 194, 243; female: 283, 286); *postrema* (male: 44, 104, 164, 224, 257; female: 347, 350); and *ulkei* (male: 56, 116, 176, 236, 262; female: 371, 374).

DESCRIPTION: **Length**: 18.6-23.7mm; **Width**: 9.6-12.5mm. **Shape**: oblong, moderately robust. **Color**: castaneous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length nearly equal to stem. **Clypeus**: distinctly emarginate; margin moderately reflexed. **Tarsal Claws**: feebly curved; tooth strong, median. **Male Posterior Tibial Spurs**: lower fixed, somewhat bowed, three-fourths length of upper; both spurs acute. **Female Genitalia**: fig. 347, 451 (ventral), 350 (lateral). **Male Genitalia**: fig. 44 (caudal), 104 (ventral), 164 (dorsal), 224 (right lateral), 257 (left lateral).

TAXONOMIC NOTES: The synonymy of *quadrata* Smith was established by Davis (1920:338) who stated that he "... had no opportunity to examine the types ... but a study of our collections indicates that they are identical. The former [*postrema*] is known only by the male and the latter [*quadrata*] by the female."

U.S. DISTRIBUTION (fig. 565): Luginbill & Painter (1953: fig. 53) recorded it from **Alabama, Florida, Georgia, Mississippi**, and **South Carolina**. In **Georgia**, Fattig (1944:17) recorded it only from Roberta and Thomasville. In **South Carolina**, Cartwright (1939:286) found it at Florence, Summerton, and Georgetown. In **Alabama**, Loding (1945:103) listed it from Mobile Co., Springhill, and Chickasaw. In **Mississippi**, Langston (1927b:29) recorded it only from Gulfport and Ocean Springs, both on the Gulf coast.

FLORIDA DISTRIBUTION (fig. 564): Blatchley (1929:54-56) recorded it from Lake City (one male) and, under the synonym *quadrata*, Enterprise (one female). Young & Thames (1949:127) listed Lake City, Liberty Co., and Holmes Co. Our records include the northern one-third of Florida, with one outlying record for Highlands Hammock State Park (Highlands Co.).



BIOLOGY & ECOLOGY: Luginbill & Painte (1953:59) listed it as rare from May to early Jun Young & Thames (1949:127) listed it as not uncor mon. Our Florida records (36 specimens) were fr March 20 to October 16, with the largest collecti being 4 specimens. The life cycle and the immat stages are unknown.

Adult Host Plants: Honeysuckle, walnut, wil [families] (Luginbill & Painter, 1953:59); willow, p (Langston, 1927b:29). In Georgia, Fattig (1944 listed only *Lonicera*. We have no Florida host rec

SPECIMENS EXAMINED: over 50, of whic were from 10 Florida counties. The greatest nu taken at one time was 4. For complete data Appendix 27.

SELECTED REFERENCES: Blatchley, Cartwright, 1939:285-286; Dalla Torre, 1912:196 (as *qua* 197); Davis, 1920:338, plate 40; Fattig, 1944:7, 17; 1916:373, 375; Horn, 1887b:229, 233, 293; Langston, 1927 81, plate 4, figure 14; Loding, 1945:103; Luginbill & Painte 59, figure 53, plate 54(1-6); Sim, 1928:3; Smith, 1889b:498, plate 50 (as *quadrata* p. 507, plate 53, figure 38); Young & 1949:127.

Phyllophaga profunda (Blanchard)

(fig. 45, 105, 165, 225, 258, 348, 351, 411, 566-568)

Ancylonycha profunda Blanchard 1850:132.
Lachnosterna profunda, Horn 1887a:142.
Lachnosterna biimpressa Smith 1889a:97.
Lachnosterna grandior Linell 1896:727.
Phyllophaga profunda, Glasgow 1916:371.

TYPE LOCALITY: "Amer. bor. (Texas)".

DIAGNOSIS: This is a large (18.7-25.2mm long), dark brown to piceous, glabrous species (fig. 411) superficially similar to *hornii* and *knochii*, the latter most similar. The male genitalia are asymmetrical with a unique carina on the outside of the left clasper which forms a cup-shaped area (fig. 258, 566). The genitalia of the 3 species can be compared (figures in parentheses): *hornii* (male: 28, 88, 148, 208, 249; female: 312, 315); *knochii* (male: 32, 92, 152, 212, 253; female: 319, 322); and *profunda* (male: 45, 105, 165, 225, 258; female: 348, 351).

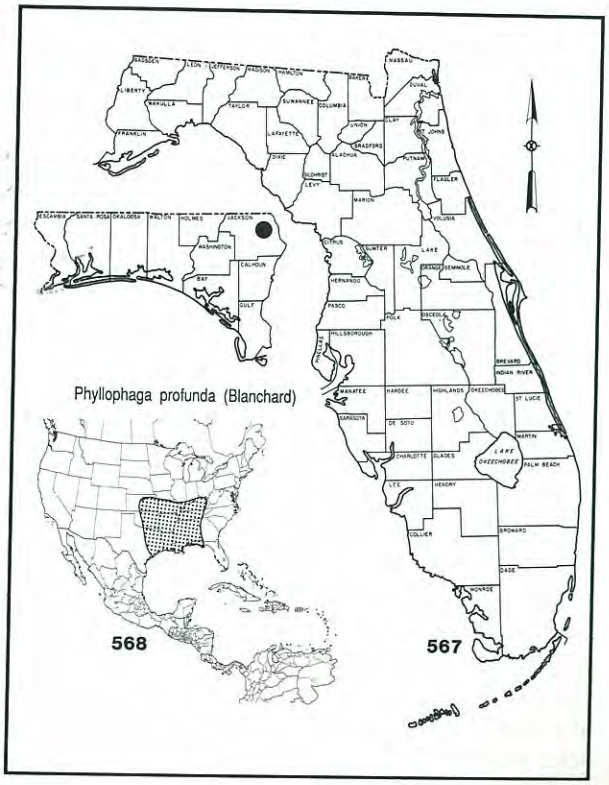
DESCRIPTION: **Length**: 18.7-25.2mm; **Width**: 9.5-11.0mm (12.1mm, Riley). **Shape**: oblong, slightly broader behind, robust. **Color**: castaneous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: emargination, broad, moderately deep; margin narrowly reflexed. **Tarsal Claws**: curved; tooth stout, long, median. **Male Posterior Tibial Spurs**: lower fixed, two-thirds length of upper. **Female Genitalia**: fig. 348 (ventral), 351 (lateral). **Male Genitalia**: fig. 45 (caudal), 105 (ventral), 165 (dorsal), 225 (right lateral), 258, 566 (left lateral).

TAXONOMIC NOTES: Horn (1887b:258) established the identity of *profunda* by having specimens compared with Blanchard's type in Paris by A. Sallé. LeConte (1856:262) listed it as one of the "unknown or unrecognized species." The synonymy of *biimpressa* Smith and *grandior* Linell was established by Glasgow (1916:371).

U.S. DISTRIBUTION (fig. 568): Luginbill & Painter (1953: fig. 84) recorded it from **Alabama, Arkansas, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma**, and **Texas**. Smith (1889b:513) recorded it from the **District of Columbia, Louisiana**, and **Virginia**. In **Illinois**, Forbes (1916:229) stated that it is "... strictly confined to southern Illinois." In **Kentucky**, Ritcher (1940:94, fig. 7) found it only in 5 western

fig. 566. *Phyllophaga profunda*: male genitalia, left lateral, with unique carina (arrow) on outside of left paramere (8mm = 0.5mm).

counties. In **Texas**, Reinhard (1950:46) found it "... throughout east Texas ranging westward to Travis and Erath Counties." In **Missouri**, Owens (1950:47) recorded it only from Marble Cave, Stone county. In **Mississippi**, Langston (1927b:55) recorded it "... principally in the northern half of the state." In **Louisiana**, Riley (1988: map 32) found it in all but the extreme southeastern corner.



FLORIDA DISTRIBUTION (fig. 567): We have seen 2 specimens from Florida Caverns State Park (Jackson Co.), constituting the first record for Florida.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:90) listed it as common in some sections, from mid-March to mid-July. Our 2 Florida specimens were collected April 13, 29 years apart. Sanderson (1944:19) listed it and *bipartita* (Horn) as the earliest appearing species in Arkansas. In Louisiana, Riley (1988:218) stated that it "...inhabits hardwood forests, and it can be fairly abundant in this habitat." Davis (1919:112) recorded a parasitic fly, *Eutrixa exile* Coquillett (Diptera: Tachinidae), being reared from *profunda*.

Adult Host Plants: Beech, ebony, elm, laurel, planetree, pulse, rose, walnut, willow [families] (Luginbill & Painter, 1953:90); pecan, willow oak, black oak, post oak, white oak, black jack oak, persimmon, sassafras, hickory, rose, hackberry (Sanderson, 1944:19); prefers oak and blackberry, but also found on willow oak, Spanish oak, red oak, post oak, elm, persimmon (Ritcher, 1940:112). In Illinois, Forbes (1916:229) recorded 90% from oak and hickory and 7% from persimmon. In Mississippi, Langston (1927b:55) listed favorite food plants as hickory and pecan, and also apple, locust, elm, oak, plum, poplar, rose, sycamore, and willow. Riley (1988:218) added *Quercus nigra*. No Florida hosts were recorded.

Immatures: The third instar larva was described and illustrated by Boving (1942:50-51, fig. 173-176), and he placed it in his group 21, along with *delata, forsteri, fraterna, hirticula, hornii, ilicis, kentuckiana, knochii, rugosa*, and *subtonsa*. His description follows: "Posterior part of labrum with a transverse, very irregular, medianly forward curved, in some places double series of about 10 setae on each side. Anterior marginal region of frons with a transverse, double, very irregular series of 6 setae on each side in front and 4 or 5 smaller setae on each side behind. Epicranium on each side opposite the posterior concave part of frontal suture and epicranial suture with an oblique series of 3 long and 2 short setae. Dorso-molar region of right mandible (Fig. 173) with a patch of about 25 setae; dorso-exterior region with 10 or fewer punctures and about 20 setae of varying lengths; scrobis with longitudinal series of many punctures and 4 or 5 setae partly in the dorso-lateral carina; ventro-lateral carina with a row of 3 small and 7 long setae; baso-lateral region with a patch of about 9 setae. Epipharynx (Fig. 175) with about 12 heli; proplegmatium subelliptical, slightly spatulate with 8 to 10 rather long, curved proplegmata; chaetopariae with many punctures among the setae on right side only; crepidal punctures about 45. Septula (Fig. 174) subelliptical, slightly constricted medianly and with the sides somewhat converging anteriorly and posteriorly; palidium with one slightly irregular row of about 30 pali, usually with one or a few more pali in one row than in the other; pali approximately uniform in size; palus (Fig. 176) moderately long, depressed, with the lateral edges concave proximally and convex distally, tip pointed; bases of pali rather close; preseptular setae about 7. (Length of body about 45 mm.; width of head about 6mm.)."

Hayes (1929: fig. 179) illustrated the raster, but he did not describe the larva. Ritcher (1966:87-88, fig. 208) included it in his Key and illustrated the dorsoexterior region of the mandible.

SPECIMENS EXAMINED: over 50, of which only were from Florida: (1) Jackson Co., Florida Caverns State Park, 13-IV-60, H. A. Denmark, at light; (1) loc. cit. 13-IV-89, Woodruff, Beck & Skelley, blacklight trap.

SELECTED REFERENCES: Boving, 1937:4; 1942:7, 29, 50, 60-61, figure 173-176; Crotch, 1874:60; Dalla Torre, 1912: (as *grandior* p. 191); Davis, 1919:112; Forbes, 1916:217-218, 237-239, 242, 247-248, 252, 256; Glasgow, 1916:371, 375; Ha 1929:80, figure 179, plate 13; Horn, 1887a:142; 1887b:253, 257, figure 38, plate 3; Langston, 1927b:7, 22, 34, 54, 86, plate 9, figur LeConte, 1856:245, 262; Luginbill & Painter, 1953:10, 89, figur plate 71(1-5); Owens, 1950:33, 47, 83, 88, figure 14, plate 3; Rein 1939:55; 1950:46; Riley, 1988:36, 61, 186, 216-219, figure 306 map 32, table 3-4; Ritcher, 1940:76, 84-85, 94, 112, 123, 130, 7, plate 1, table 3, 9-10, 14; 1949a:19, 26, 34, figure 34, pl 1966:88, 94, figure 95, plate 18; 1944:16-17, 19, table 1-2 1928:20, 52, plate 4; Smith, 1889b:493, 513, figure 52, plate *biimpressa* p. 511-512, plate 50, figure 47); Wickham, 189 Woodruff, 1973:28; Wray, 1950:18; 1967:45.

Phyllophaga prununculina (Burmeis

(fig. 46, 106, 166, 226, 349, 352, 386, 400, 44 569, 570)

Trichestes prununculina Burmeister 1855:36
Lachnosterna cerasina LeConte 1856:241.
Lachnosterna prununculina, Horn 1887a:14
Phyllophaga prununculina, Glasgow 1916:3

TYPE LOCALITY: "Nord-Amerika".

DIAGNOSIS: In the pruinose body coating it is similar to *cupuliformis, latifrons*, and *sub*

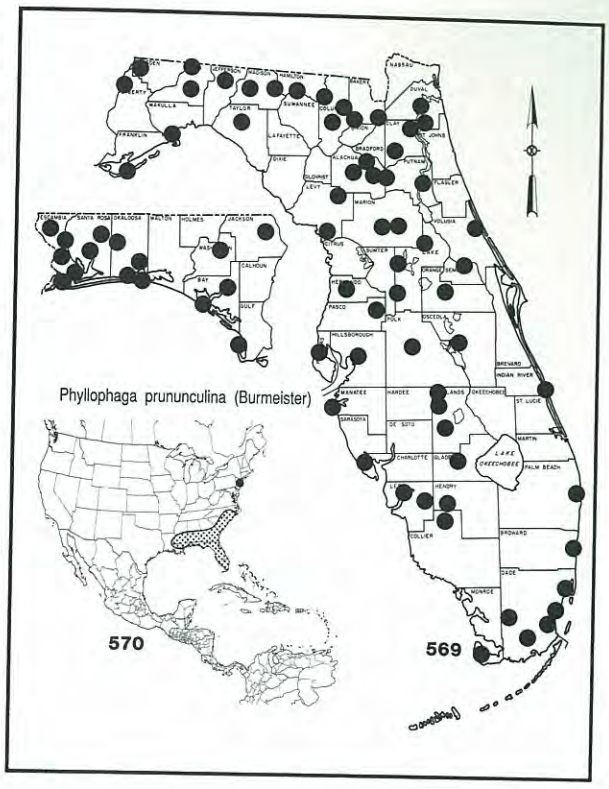
It appears closer in genitalia characters to *glaberrima*. From *latifrons* it can be separated by the lack of a bidentate protuberance on the margin of sternum 8 in the male. Genitalia of the pruinose species can be compared in the figures (in parentheses): *cupuliformis* (male: 10, 70, 130, 190; female: 276, 279); *glaberrima* (male: 25, 85, 145, 205; female: 306, 309); *latifrons* (male: 33, 93, 153, 213; female: 323, 326); *micans* (male: 37, 97, 157, 217; female: 330, 333); *prununculina* (male: 46, 106, 166, 226; female: 349, 352); and *subpruinosa* (male: 52, 112, 172, 232; female: 361, 364).

DESCRIPTION: **Length**: 14.0-18.5mm; **Width**: 7.2-8.9mm (7.1-9.3mm, Riley). **Shape**: robust, convex, cylindrical. **Color**: reddish-brown to black. **Vestiture** (fig. 386): glabrous, usually pruinose, sometimes shining. **Antenna**: 10-segmented; male club longer than stem. **Clypeus**: emarginate, broadly, feebly; margin moderately reflexed. **Tarsal Claws**: tooth near base in both sexes. **Male Posterior Tibial Spurs** (fig. 400): lower fixed, usually missing, sometimes an aborted spur; upper spur long, slender. **Female Genitalia**: fig. 349 (ventral), 352 (lateral). **Male Genitalia**: fig. 46 (caudal), 106 (ventral), 166 (dorsal), 226 (right lateral), 446-448 (paramere tips), 449-450 (aedeagus).

TAXONOMIC NOTES: LeConte (1856:262) listed *prununculina* as one of the species "unknown or unrecognized" by him. As a result, he described the synonym *cerasina*. Horn (1887b:224) pointed out the synonymy, stating that "... it seems incomprehensible that Burmeister's good description should have escaped recognition." However, the name *cerasina* continued to be used, often along with *prununculina* (e.g., Fattig, 1944:14; Young & Thames, 1949:126; and Cartwright, 1939:285). Young & Thames (1949:126) even suggested that it was "Probably a variety or subspecies of *prununculina*."

Variation occurs primarily in color (from bluish black to reddish brown) and the extent of the pruinosity or "bloom". In both these characters it varies as does *latifrons* LeConte. However, the genital characters appear to be constant.

U.S. DISTRIBUTION (fig. 570): Luginbill & Painter (1953: fig. 21) recorded it from **Alabama, Florida, Georgia, Louisiana, Mississippi, New Jersey, North Carolina** and **South Carolina**. In **Georgia**, Fattig (1944:14) recorded it from Albany, Atlanta, Hazelhurst, Head River, Perry, Thomasville, and Waycross. In **Alabama**, Loding (1945:103) recorded it from Mobile



and Madison counties. In **North Carolina**, Brimley (1938:204) recorded it from Lumberton, Southern Pines, and Winston-Salem. In **Mississippi**, Langston (1927b:13) recorded it from 12 localities in the Gulf coast region. In **South Carolina**, Luginbill (1928:76) recorded it from Yonges Island, Stokes, and Columbia. In **Louisiana**, Riley (1988: map 34) found it in the 6 southeastern parishes bordering Mississippi.

FLORIDA DISTRIBUTION (fig. 569): Blatchley (1929:53) recorded it from Cedar Key, Capron, Tampa, Crescent City, Ft. Myers, St. Petersburg, Gainesville, Lake City, Dunedin, and West Palm Beach. Young & Thames (1949:126) reported it "... locally abundant throughout the state." Our records include all areas of the state as far south as Cape Sable (Monroe Co.)

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:31-32) listed it as common in the "Sand Hill regions of South Carolina," from late March to mid-July, (although calling it a "midsummer species"). In Florida it was our second most abundant species (6,825 specimens). Over half (3,879) were from Gainesville with months and records as follows: IV(1), V(27), VI(93), VII(83), VIII(47), IX(30), X(1). Most specimens were collected at blacklight, with the largest single catch (570) at Torreya State Park, August 16.

Yeager (1950:179) stated that the life cycle was probably 2 to 3 years and that larvae were very destructive to nursery stock [pine]. Davis (1919:114) reared a parasitic fly, *Biomyia lachnosternae* Townsend (Diptera: Tachinidae), from *prununculina*.

Adult Host Plants: Beech, ebony, rose, pine [families] (Luginbill & Painter, 1953:33); persimmon, crataegus, water oak, white pine, long-leaf pine (Fattig, 1944:14). In Mississippi, Langston (1927b:13) recorded it only from pine, and Luginbill (1928:76) (in South Carolina) listed only loblolly pine. Baker (1972:148, 1985:268) stated that they "... feed on pines, preferably loblolly and longleaf, and sometimes oaks and persimmon." Young & Thames (1949:126) recorded it in damaging numbers on *Pinus taeda*. Davis (1916b:10) quoted a report by Loding, near Mobile, Alabama, that this species and *micans* feed on longleaf pine "... which indeed appears to be their favorite and in some cases their sole food."

Immatures: The first and third instar larvae were described and illustrated by Boving (1942:38-39, fig. 78-81), who placed it in his group 11, along with *ephilida*, *forbesi*, and *glaberrima*. His description of the third instar follows: "Posterior part of labrum with transverse, irregular, double series of about 12 setae of varying lengths on each side. Anterior marginal region of frons with about 8 setae of varying lengths on each side. Epicranium on each side opposite posterior concave part of frontal suture and epicranial suture with 3 long and 1 short setae. Dorso-molar region of right mandible (Fig. 79) with a patch of about 12 setae; numerous punctures anterior to the patch along the edge of the scissorial part of mandible; dorso-exterior region with about 15 punctures; scrobis with longitudinal row of about 8 punctures and a single or two setae; ventro-lateral carina with 7 setae; baso-lateral region with a patch of about 6 setae and several punctures. Epipharynx (Fig. 81) with about 12 heli; proplegmatium distinct, long and broadly elliptical with about 25 or more very long and fine, interrupted proplegmata; chaetopariae with a few or no punctures among the setae; crepidal punctures 45 or more. Raster (Fig. 80) with subrectangular septula; palidia extending slightly beyond the tegilla each with one approximately regular series of about 25 or a few more pali; palus slightly hooked; distance between the bases of the pali anteriorly about equal to the length of a palus, posteriorly much shorter; preseptula-setae absent. (Length of body about 32 mm.; width of head 4.5 mm.)."

SPECIMENS EXAMINED: over 10,000, of which 6825 were from 47 Florida counties. More than half (3879), representing 378 collection records, were from Gainesville. For complete data, see Appendix 28.

SELECTED REFERENCES: Baker, 1972:148; 1985:268; Blatchley, 1929:52; Boving, 1937:6; 1942:3, 7, 9-10, 12, 21-22, 26, 38-39, 59, 61, figure 78-81, 226; Brimley, 1938:204; Cartwright, 1939:285 (as *cerasina*); Crotch, 1874:61; Dalla Torre, 1912:196; Davis, 1913a:10; 1916b:10; 1919:114; 1920:335; Fattig, 1944:7-8, 14; Frost, 1964:142; 1966:189, 191; Glasgow, 1916:372, 375; Horn, 1887a:142-143; 1887b:212, 221, 223, 243, 277, 282, 293, figure 16, plate 3; Langston, 1927b:9, 12, 78, figure 3, plate 1; LeConte, 1856:262; Loding, 1945:103; Luginbill, 1928:56, 75-76, figure 22, male A-C, female D-E; Luginbill & Painter, 1953:6, 32, 36, figure 21, plate 19(9-12); McLemore, 1973:542; Reinhard, 1944:585; Riley, 1988:31-32, 39, 43, 55, 57, 223-226, figure 291-295, map 34, table 3-4; Schwarz, 1878:450; Smith, 1889b:495-497, figure 10, plate 48; Woodruff, 1973:28; Yeager, 1950:179; Young & Thames, 1949:126.

Phyllophaga pseudofloridana new species, Woodruff & Beck

(fig. 47, 107, 167, 227, 259, 353, 356, 571-575)

Phyllophaga floridana Robinson, in part, Luginbill & Painter 1953:91, pl. 76(1-6).

TYPE LOCALITY: "Tall Timbers Research Station Leon Co., Florida".

DIAGNOSIS: The general appearance is similar most of the *fraterna* complex which can be separat only by reference to genitalia characters (see figures parentheses for comparison): *floridana* (male: 18, 138, 198, 244; female: 293, 296); *foxii* (male: 21, 141, 201, 246; female: 299, 302) *fraterna* (male: 22, 142, 202, 247; female: 300, 303); and *pseudoflorid* (male: 47, 107, 167, 227, 259; female: 353, 356). *floridana* the right male genital clasper has a la cusp at the top, and the interior right lobe is sho arising further inside. Above the orifice for the aede *pseudofloridana* has a knob-like projection (see c cially fig. 227, 571, 572).

DESCRIPTION: Holotype male. **Length**: 16. **Width**: 8.3mm. **Shape**: oblong, oval, slightly behind. **Color**: dark brown, head and pronotum sl darker. **Vestiture**: glabrous, shining. **Antenn** segmented, club barely longer than 6 preceding seg **Clypeus**: emarginate, the indentation broad, ately deep; margin reflexed each side of emargi but barely raised on lateral margin. Suture slightly indented at middle. Punctures dense,

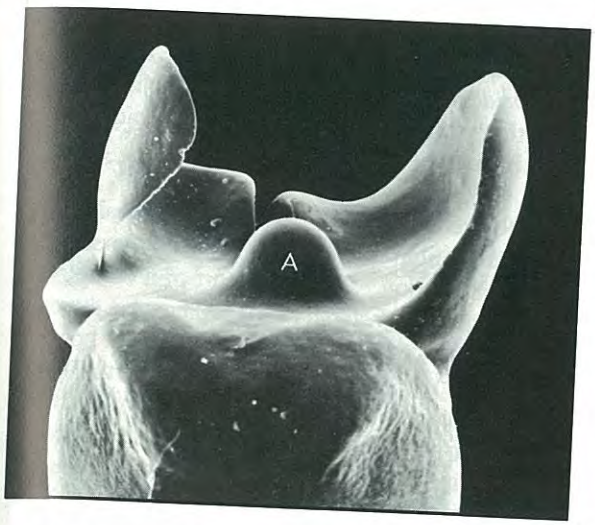


fig. 571. *Phyllophaga pseudofloridana*: male genitalia (holotype), dorsal, showing enlarged protuberance (A) above the trema (aedeagal orifice) (19mm = 0.5mm).

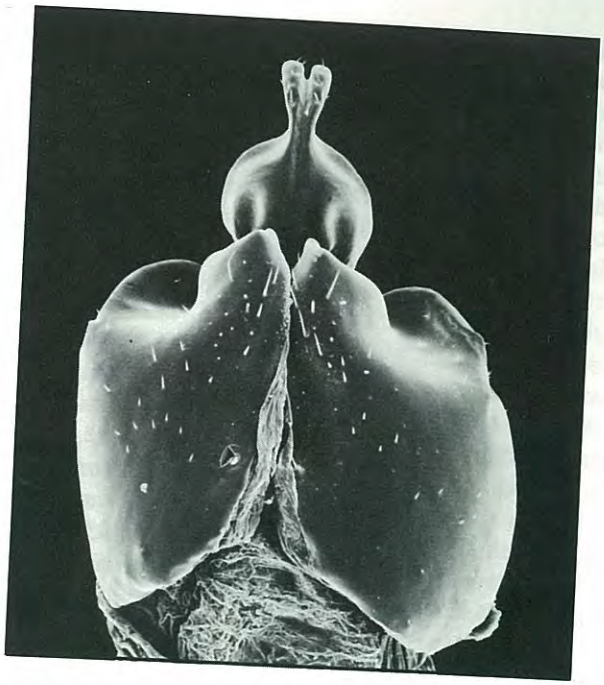


fig. 573. *Phyllophaga pseudofloridana*: female genitalia, ventral, paratopotype (compare with Lake City, Columbia Co. specimen, see fig. 353) (17mm = 0.5mm).

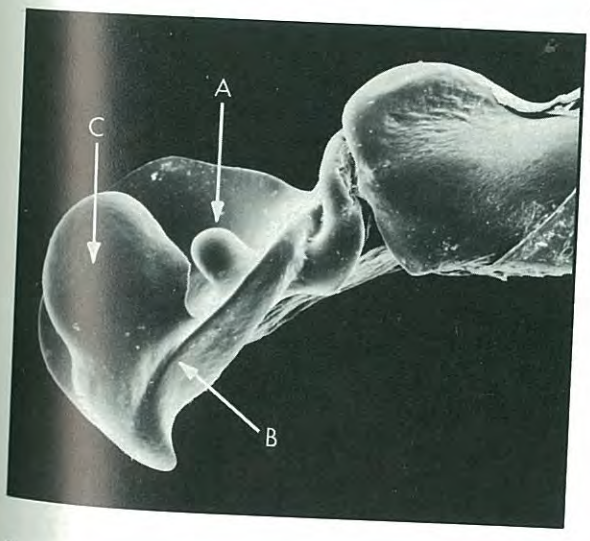
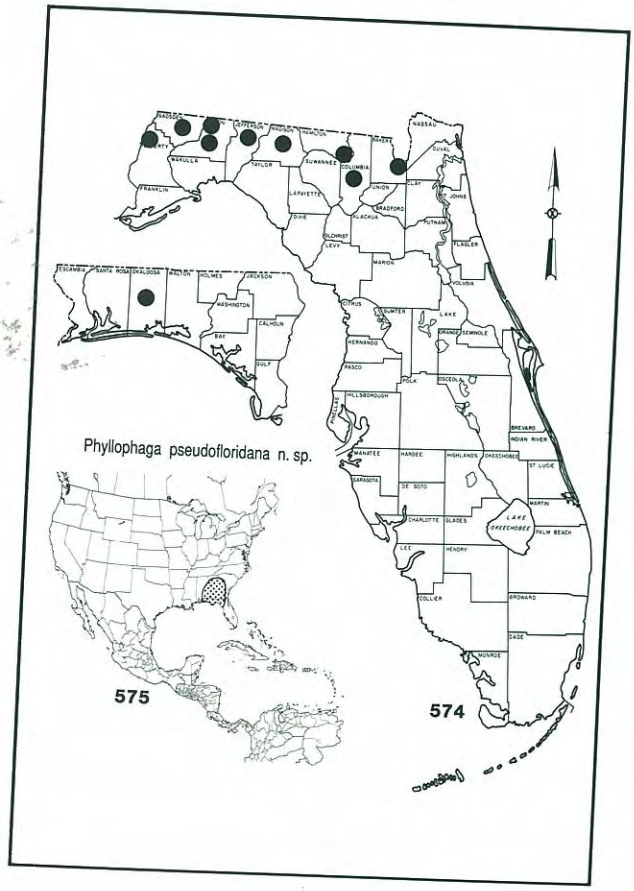


fig. 572. *Phyllophaga pseudofloridana*: male genitalia (holotype), right lateral, showing enlarged protuberance (A), reduced right paramere (B), and enlarged right internal process (C) (15mm = 0.5mm).



separated by less than their diameter, closer than on vertex of head. **Head**: punctures mostly separated by at least one diameter, rarely coalescing; becoming denser near the middle (less at sinuation) and nearly impunctate on band in front of pronotum. Depressed area present near midline, shallow, but noticeable. Eye canthus normal, each with 8 prominent setae. **Pronotum**: lateral margin entire, not crenulate, but with about 12 short, evenly spaced setae just inside margin. Surface shiny, punctate, punctures scattered, uneven, about depth of those on head posterior; separated by about 3 to 4 diameters, except slightly denser at anterior angles. Anterior marginal line complete; posterior line interrupted slightly at middle. **Scutellum**: punctate, shallower than on pronotum, punctures more numerous in chevron pattern like shape of scutellum, nearly impunctate anteromedially. **Elytra**: nearly parallel sided, slightly broader behind. Surface shiny, but less so than pronotum; striae vaguely indicated, except for prominent sutural one. Punctures shallow, scattered, losing identity over most of surface. **Pygidium**: shiny, convex, punctures shallow, scattered as on pronotum, coalescing just below elytra into shallow rugulae. **Tarsal Claws**: curved; tooth prominent, acute, triangular, nearly median but slightly nearer base than tip; base noticeably swollen. Anterior tibia tridentate, lower tooth small, one-third or less size of middle tooth. **Male Posterior Tibial Spurs**: fixed, half length of upper; both spurs concave ventrally, the shorter slightly broader nearer tip and not sharply pointed. Long spur acute, pointed, longer than first tarsal segment. Posterior tibial fringe with 19 spinules on each side. **Abdomen**: sternites IV-VIII depressed medially. **Male Genitalia**: fig. 47 (caudal), 107 (ventral), 167, 571 (dorsal), 227, 572 (right lateral), 259 (left lateral). Basic type of *fraterna*, asymmetrical, inner lobe of right paramere exceptionally well-developed, prolonged (as in fig. 572), outer lobe nearly obliterated, indicated by marginal carina with nearly no cusp surrounding the left side. The area immediately above the orifice (trema) is produced into a knob (see especially fig. 571, 572), more pronounced than in *floridana*. Entire organ noticeably smaller than in *floridana*: phallobase length 3.5mm (vs. 6mm), height of claspers 1.5mm (vs. 3mm), width of claspers 1.6mm (vs. 3.5mm).

Allotype female: **Length**: 17.6mm; **Width**:8.9mm. Nearly identical to male except as follows: **Shape**: slightly more convex. **Antenna**: club nearly as long as previous 5 segments. **Legs**: posterior tibial fringe 22 (right), 23 (left). **Abdomen**: more swollen and connate, *pygidium* more convex and more elongate. **Female Genitalia**: fig. 353, 573 (ventral), 356 (lateral). Basic type of *fraterna*, but pubic process backed by a shield as in *floridana*. Pubic process bifurcate, the tips narrower than *floridana*, the shield extending behind to the bifurcation; sunken further into plates which do not extend behind the pubic process.

TAXONOMIC NOTES: As the name implies, this species is similar to, and has been confused with, *floridana* Robinson. Both are part of a complex of species surrounding *fraterna* Harris. Although a thorough revision of this complex is needed, it was not possible during this study. The population from north Florida and south Georgia appears sufficiently distinct from both *fraterna* and *floridana* to require a name. The type series varies in size; length (males):14-16.9mm, (females): 15.1-18.3mm; Width (males): 7.3-16.9mm, (females):8.0-9.0mm.

U.S. DISTRIBUTION (fig.575:) **Georgia** and **Florida**.

FLORIDA DISTRIBUTION (fig.574): northern tier of counties and the panhandle (see Specimens Examined for details).

BIOLOGY & ECOLOGY: Little is known about this new species, except that some of the literature records for *floridana* apply to it. Seasonally it appears from March to July, with most specimens being taken in April and May. Because it is related to *fraterna* Harris some of the biology recorded for that species may provide clues for the new species. In Indiana, Davis (1916b:274) recorded a 3-year life cycle for *fraterna*.

Adult Host Plants: No host records were obtained in this survey, but the records listed earlier under *floridana* probably all pertain to this new species.

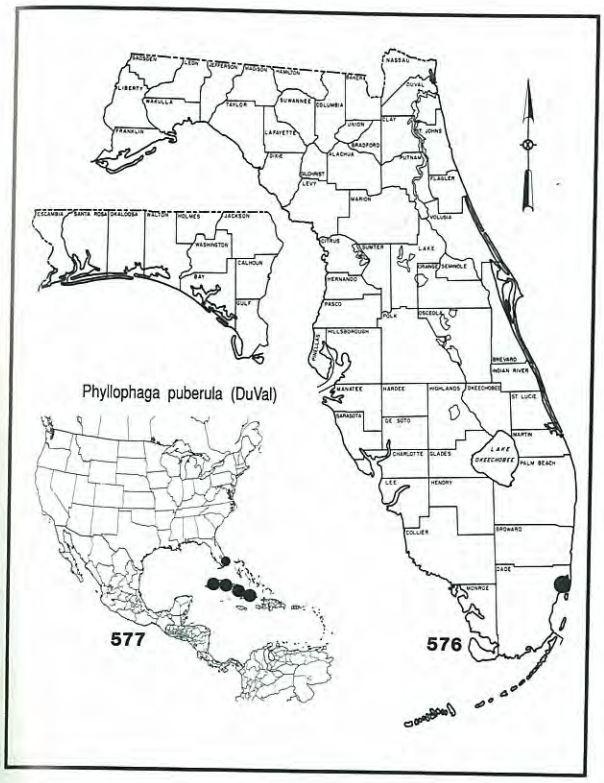
SPECIMENS EXAMINED: **Holotype**, male: Florida, Leon Co., Tall Timbers Res. Sta., 22-IV-6-V-68, L. Collins, blacklight trap (FSCA); **Allotype**, female: Florida, cit., 28-V-7-VI-68, L. Collins, blacklight trap (FSCA). **Paratypes**: 27 from Florida and 27 from Georgia. For complete data, see Appendix 29.

Phyllophaga puberula (DuVal)

(fig. 48, 108, 168, 228, 354, 357, 576, 577)

Ancylonycha puberula DuVal 1856:56.
Phyllophaga puberula, Chapin 1932:189-190.

TYPE LOCALITY: "Cuba".



DIAGNOSIS: As a member of the subgenus *Cnemarchis*, it shares with *bruneri* and *youngi* the incomplete carina of the hind and middle tibiae and their lateral margins have a separate edge or setae (fig. 426-427). It is smaller (14.5-16.7mm.) than *youngi* (15.4-17.5mm.), but larger than *bruneri* (7.8-10.3mm.). The male genitalia do not have a boot-like paramere in lateral view (fig. 228) and the female genitalia are distinctive (fig. 354, 357).

DESCRIPTION: Length: 14.5-16.7mm (12mm, Chapin); **Width:** 7.4-8.1mm. **Shape:** elongate, parallel, dorsally depressed. **Color:** medium yellow to reddish-brown. **Vestiture:** pubescent, hairs short. **Antenna:** male club nearly as long as stem. **Clypeus:** emarginate, shallow, broadly; margin narrowly reflexed. **Tarsal Claws:** thickened basally; tooth antemedian, larger than apical portion. **Male Posterior Tibial Spurs:** lower movable, two-thirds length of upper. **Female Genitalia:** fig. 354 (ventral), 357 (lateral). **Male Genitalia:** fig. 48 (caudal), 108 (ventral), 168 (dorsal), 228 (right lateral).

TAXONOMIC NOTES: This Cuban species has no known synonyms. The male genitalia were first illustrated by Chapin (1932: pl. II, fig. 21). Chevrolat (1865:24) indicated that it was related to *parallela* Blanchard and *confusa* DuVal. Garcia-Vidal (1984: fig. 4) illustrated the female genitalia, but he did not describe it.

U.S. DISTRIBUTION (fig. 577): Known only from **Cuba**, except for the one specimen listed below. In **Cuba**, Chapin (1932:189-190) recorded it from the following Provinces: Pinar del Rio, Havana, Matanzas, Santa Clara, and Camaguey.

FLORIDA DISTRIBUTION (fig. 576): The first Florida and U.S. record is based on a single specimen from Miami (Dade Co.). Although it has been nearly 30 years since this collection, no additional specimens have been found.

BIOLOGY & ECOLOGY: Although it is listed as a sugarcane pest in Cuba (Box, 1953:10), the life cycle and the immature stages are unknown. Our single Florida specimen was taken in a Japanese beetle trap.

Adult Host Plants: No host plant records were present for the large series of Cuban specimens examined.

SPECIMENS EXAMINED: over 100 from Cuba and only 1 from Florida: Dade Co., Miami, 3-VI-60, A. L. Humphries, Japanese beetle trap.

SELECTED REFERENCES: Box, 1953:10; Chapin, 1932:189-190, fig. 21; Chevrolat, 1865:24; Garcoa-Vidal 1984: fig. 4; Stahl, 1929:15-19.

Phyllophaga quercus (Knoch)

(fig. 49, 109, 169, 229, 355, 358, 401, 428, 429, 431, 578-580)

Melolontha quercus Knoch 1801:72.
Ancylonycha quercus, Burmeister 1855:340.
Endrosa quercus, LeConte 1856:234.
Phyllophaga quercus, Glasgow 1916:371.

TYPE LOCALITY: "Nordamerika".

DIAGNOSIS: Although velvety, the pruinosity of this species is different from the other pruinose species, and the body color is a rich characteristic chestnut to reddish brown (cover, 428, 429, 431, 578). The genitalia of both sexes are distinctive (male: 49, 109, 169, 229; female: 355, 358), although similar enough to show a possible relationship with the *elizoria, okeechobea, skelleyi* complex (although these all have 10-segmented antennae).

fig. 578. *Phyllophaga quercus*: mating pair, the female (left) continued carrying the mesmerized male around, even after they had dropped to the ground and had been handled during photography. The same pair are illustrated in the cover photograph.

DESCRIPTION: **Length**: 13.2-16.9mm (12.3mm, Riley); **Width**: 5.8-7.9mm. **Shape**: oblong, cylindrical, convex. **Color**: rufotestaceous. **Vestiture**: glabrous, pruinose. **Antenna**: 9-segmented; male club length equal to stem. **Clypeus**: emarginate; margin narrowly reflexed. **Tarsal Claws**: arcuate; tooth strong, median in both sexes. **Male Posterior Tibial Spurs** (fig. 401): lower movable, curved near obtuse tip, slender, two-thirds length of less obtuse upper. **Female Genitalia**: fig. 355 (ventral), 358 (lateral). **Male Genitalia**: fig. 49 (caudal), 109 (ventral), 169 (dorsal), 229 (right lateral).

TAXONOMIC NOTES: No synonyms have been created for this easily recognized species. LeConte (1856:234) made it the type species of his genus *Endrosa*. Horn (1887b:282) pointed out that this was based on the emarginate ligula, a character which has "... no value for generic distinction." Dalla Torre (1912:197) indicated that Schoenherr (1817:171) misidentified it as *fervida* Fabricius, a valid species.

Variation is found mainly in color (from light to reddish brown) and extent of pruinosity. The genitalic characters are remarkably constant throughout its wide geographic range.

U.S. DISTRIBUTION (fig. 580): Luginbill & Painter (1953: fig. 22) recorded it from **most of the eastern U.S.** except New England; as far west as **Kansas** and with 8 parishes in the north and east.

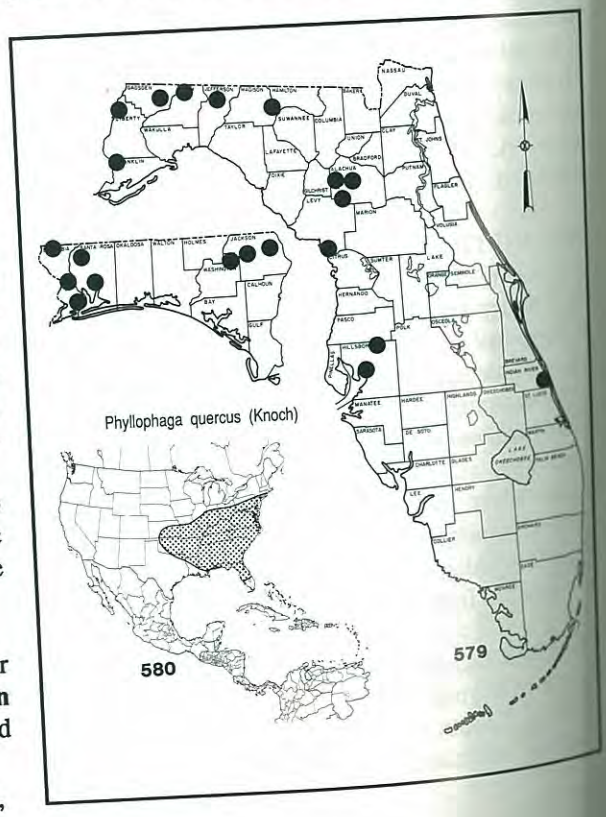
Oklahoma. Riley (1988: map 35) added **Louisiana**,

FLORIDA DISTRIBUTION (fig. 579): Blatchley (1929:70) recorded it only from "Centreville (Sz. Ms.)." Young & Thames (1949:128) repeated that record and added only Gainesville. Our records include 14 counties in the northern two-thirds, as far south as Vero Beach (Indian River Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:33) listed it as fairly common in some districts, from late April to mid-July. Our Florida records for 531 specimens are from March 24 (Hillsborough Co.) to November (Alachua Co.), with most records and specimens in July. Although common on oaks, the only economic information we obtained was a series defoliating roses, July 1, 1986. Luginbill (1928:85) considered it "very rare" in South Carolina. In Louisiana, Riley (1988:231) considered it common in hardwood forests, stating that it "...is one of the last species to make its appearance each year with peak flight activity in July and early August."

Davis (1919:114) reared a parasitic fly, *Biomyia lachnosternae* Townsend (Diptera: Tachinidae), from *quercus*.

When we were searching for a photograph for our cover, *quercus* was the most common and most readily obtained pairs at Gainesville in late June. Copulating pairs (cover) were not easily disturbed even when



accidentally dislodged from foliage and falling 3 feet to the ground. Even after they were picked up (fig. 578), the male maintained the same immobile vertical position, with anterior legs pointed upward and antennal lamellae spread. The female continued to move normally and feed, but the male appeared to be in some sort of catatonic state, perhaps throughout the night.

Adult Host Plants: Beech, ebony, elm, laurel, magnolia, pulse, rose, sumac, tupelo, walnut, willow [families] (Luginbill & Painter, 1953:33); white-heart hickory, water oak, black oak, post oak, red oak, white oak, live oak, laurel oak, black gum, black locust, persimmon, pecan, honey locust, winged elm, timothy, cow pea, tulip poplar, sassafras, pignut, redbud (Fattig, 1944:28-29). In Kentucky, Ritcher (1940:112) found it only on oak. In Mississippi, Langston (1927b:67) recorded it on pecan, persimmon, and sassafras. In Gainesville it was found defoliating roses, 1-VII-86.

Immatures: Only the first instar larva was described and illustrated by Boving (1942:31, fig. 18-22), and care should be used when comparing with the third instar of other species (e.g., in our Key). He placed it in group 2 by itself, and his description follows: "Posterior part of labrum with no setae. Anterior marginal region of frons with 1 long and 1 short seta on each side. Epicranium on each side opposite concave posterior part of frontal suture and epicranial suture with 4 setae. Dorso-molar region of right mandible with a patch of about 16 setae; dorso-exterior region with no punctures; scrobis with a longitudinal row of 6 punctures; ventro-lateral carina without setae. Maxillary articulating area (Figs. 18, 21) ventrally with about 20 short, thick, conical to dome-shaped, dark granules. Epipharynx with 7 large heli in two curved rows; proplegmatium with vestigial or no proplegmata; chaetopariae with no punctures among the setae; crepidal punctures 2 to 5. Raster with subrectangular septula; each palidium with one irregular row of from 12 to 15 gently curved, often hooked, rather short pali placed quite apart; preseptular setae none to 4, small and very irregularly placed. Hatching spine (Fig. 19) small, low, and cuspidate."

Ritcher (1966:87-88) included it in his Key next to *tristis*, because neither has proplegmatia on the epipharynx.

SPECIMENS EXAMINED: over 1000, of which 531 were from 13 Florida counties. More than half (305), representing 44 collection records, were from Tall Timbers Research Station (Leon Co.). For complete data, see Appendix 30.

SELECTED REFERENCES: Blackwelder, 1939:52; Blatchley, 1910:979-980; 1929:69; Boving, 1937:5; 1942:9, 12-13, 15, 21, 23-24, 31, 58, 61-62, figure 18-22, 208; Brimley, 1938:204; Burmeister, 1855:340; Cartwright, 1934:268; Dalla Torre, 1912:197; Davis, 1916a:264, 268; 1918:7; 1919:114; Dury, 1902:156; Fattig, 1944:7-8, 28-29; Glasgow, 1916:371, 375; Horn, 1887a:142-143; 1887b:215, 225, 272, 279, 281, 284, 295; Jaques, 1926:338; Langston, 1927b:66-67, 88, figure 42, plate 11; LeConte, 1850:226; 1883:297-298; Leonard, 1926:425; Loding, 1945:105; Luginbill, 1928:56, 85, figure 31, male A-B; Luginbill & Painter, 1953:6, 33, figure 22, plate 35(10-12); Neiswander, 1963: figure 47, table 1, 3, 6, 8; Riley, 1988:26, 31, 42-43, 55, 229-232, 238, figure 345-348, map 35, table 1, 3-4; Ritcher, 1940:76, 83-85, 95-96, 112, 128, plate 5, table 3, 9; 1949a:19, 24; 1966:87; Sanderson, 1944:16, 19, table 1; Say, 1825:195; Saylor, 1942:162; Schaeffer, 1906:258; Slingerland, 1893:85; Smith, 1889b:493, 520, figure 78, plate 60; 1910:319; Travis, 1934:314-315, 340, 364, figure 32, plate 9, table 1; Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga schaefferi Saylor

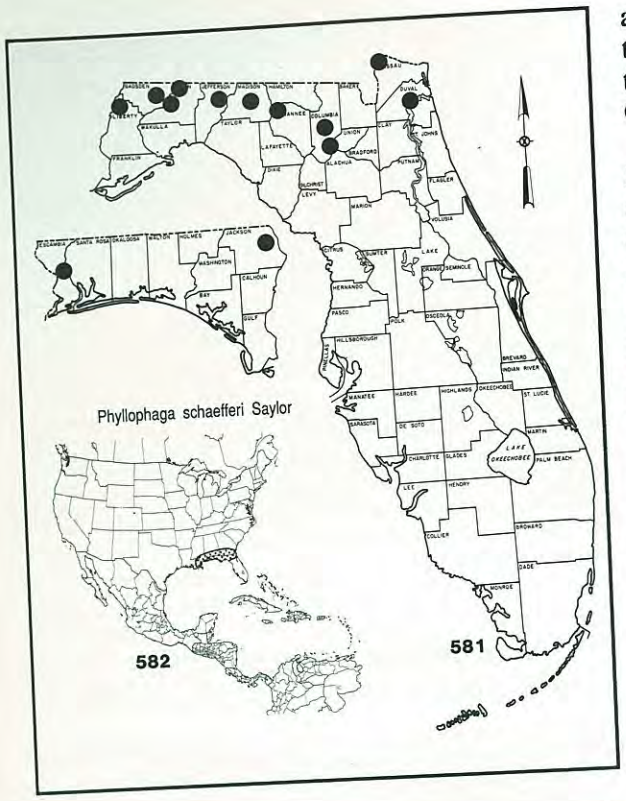
(fig. 50, 110, 170, 230, 260, 359, 362, 581, 582)

Lachnosterna georgiana Schaeffer 1909:321.
(not ***georgiana*** Horn 1885:122-123).
Phyllophaga schaefferi Saylor 1937:320.
Phyllophaga duvalus Robinson 1938:110.
(misspelled ***duvalis***, Young & Thames, 1949:127).

TYPE LOCALITY: "Georgia".

DIAGNOSIS: Externally this species has few distinctive features. Comparison of the genitalia of the following similar species is the only secure means of separation (figures in parentheses): *ephilida* (male: 17, 77, 137, 197; female: 289, 292); *forbesi* (male: 19, 79, 139, 199; female: 294, 297); *obsoleta* (male: 38, 98, 158, 218; female: 335, 338); and *schaefferi* (male: 50, 110, 170, 230, 260; female: 359, 362).

DESCRIPTION: **Length**: 15.5-18.0mm (15.1mm, Riley); **Width**: 8.1-8.6mm. **Shape**: moderately elongate, cylindrical. **Color**: rufotestaceous. **Vestiture**: glabrous, moderately shining. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: broadly emarginate; margin reflexed. **Tarsal Claws**: weakly curved; tooth moderate, median. **Male Posterior Tibial Spurs**: lower fixed, broad, obtuse, less than half length of acute, slender, upper. **Female Genitalia**: fig. 359 (ventral), 362 (lateral). **Male Genitalia**: fig. 50 (caudal), 110 (ventral), 170 (dorsal), 230 (right lateral), 260 (left lateral).



TAXONOMIC NOTES: This is a distinctive species, but with some confusion in names. Schaeffer (1909:321) unfortunately used the name *georgiana* which was preoccupied by *georgiana* Horn (1885:122-123). Saylor (1937:320) provided the new name *schaefferi*. Luginbill and Painter (1953:68) synonymized *duvalus* Robinson (1938:110). I have examined the holotypes of *duvalus* and *schaefferi* in the USNM and agree with this assessment. The type of *schaefferi* appears to have been previously dissected, but no genitalia were located in the specimen or mounted with it.

U.S. DISTRIBUTION (fig. 582): The unique holotype was from "**Georgia**." Luginbill & Painter (1953: fig. 61) recorded it only from **Florida, Georgia**, and **Louisiana**. In **Georgia**, Fattig (1944:13) recorded 621 specimens from Thomasville and Valdosta. Loding (1945:103) added **Alabama** (Mt. Vernon, Mobile Co.). Riley (1988) did not confirm the record from **Louisiana**, and we found no Louisiana specimens in the USNM.

FLORIDA DISTRIBUTION (fig. 581): Young & Thames (1949:126) recorded it from Florida for the first time, from Madison Co., along Aucilla River, opposite Lamont. Under the synonym *duvalus*, they added Lake City, Monticello, and Duval Co. (paratypes). Our records include 11 counties in the northern tier of counties, to 4 mi. N. of High Springs (Columbia Co.) on the south.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:69) listed it as uncommon, and active in March. Our Florida records for 117 specimens are about equally divided between March and April, with one record as late as May 2 (Madison Co.). Fattig (1944:13-14) recorded 621 specimens (mainly from Thomasville, Georgia). The life cycle and immature stages are unknown.

Adult Host Plants: Beech, rose, tupelo, witchhazel [families] (Luginbill & Painter, 1953:69); water oak, red oak, black gum, sweet gum, black jack oak, willow oak, scrub oak, laurel oak, crab apple (Fattig, 1944:13-14). No Florida hosts were obtained in our survey.

SPECIMENS EXAMINED: about 130, of which 117 were from 10 Florida counties; 35 of these were from Tall Timbers Research Station (Leon Co.). For complete data, see Appendix 31.

SELECTED REFERENCES: Blackwelder, 1939:52; Dall Torre, 1912:191 (as *georgiana* Schaeffer); Fattig, 1944:6-7, 13-14 Loding, 1945:103; Luginbill & Painter, 1953:9, 68, figure 61, plat 59(6-8); Riley, 1988:48, 60, 232-234, figure 321-325; Robinson 1938:110 (as *duvalus*); Sanderson, 1939:12; Woodruff, 1973:2 Young & Thames, 1949:126.

Phyllophaga skelleyi, new species, Woodruff & Beck

(fig. 51, 111, 171, 231, 360, 363, 390, 424-5, 583, 585, 587-590)

TYPE LOCALITY: "Florida: Putnam Co., Inte lachen, Paris Road".

DIAGNOSIS: This is the largest (15-19.4mm long) the 3 species closely related to *elizoria*. The genita are the most reliable character for separation (compa figures in parentheses): *elizoria* (male: 15, 75, 1 195; female: 287, 290); *okeechobea* (male: 39, 99, 1 219; female: 336, 339); and *skelleyi* (male: 51, 1 171, 231; female: 360, 363).

DESCRIPTION: Holotype male: **Length:** 17.7m **Width:** 9.5mm. **Shape:** oblong, broader behind, so what flattened dorsally, robust. **Color:** basically bro

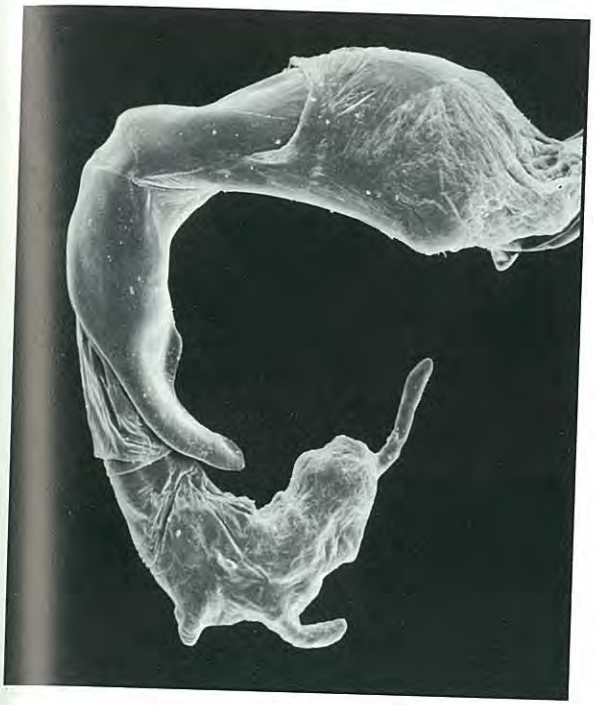


fig. 583. *Phyllophaga skelleyi*: male genitalia, lateral; aedeagus extruded and prepared by critical point drying. For comparison with other species see fig. 433, 439, 443, 444, 449, 601 (11mm = 0.5mm).

fig. 584-585. Right anterior tibiae, dorsal: 584) *Phyllophaga elizoria* (11mm = 0.5mm). 585) *Phyllophaga skelleyi* from Archer (10mm = 0.5mm). Compare size of lower tooth.

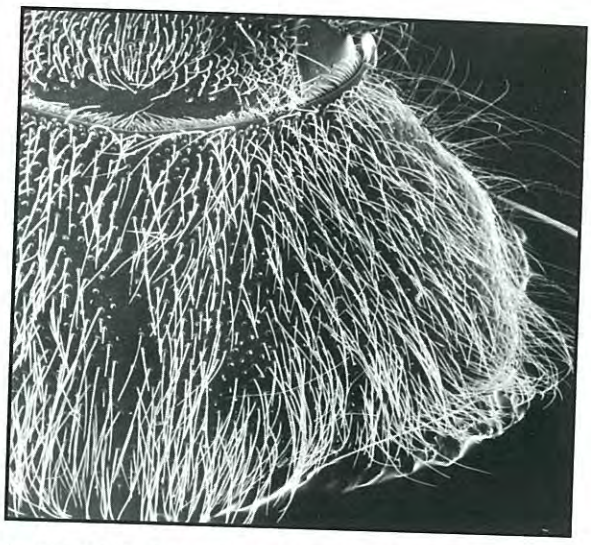


fig. 586. *Phyllophaga elizoria*: base of head and pronotum. (8mm = 0.5mm).

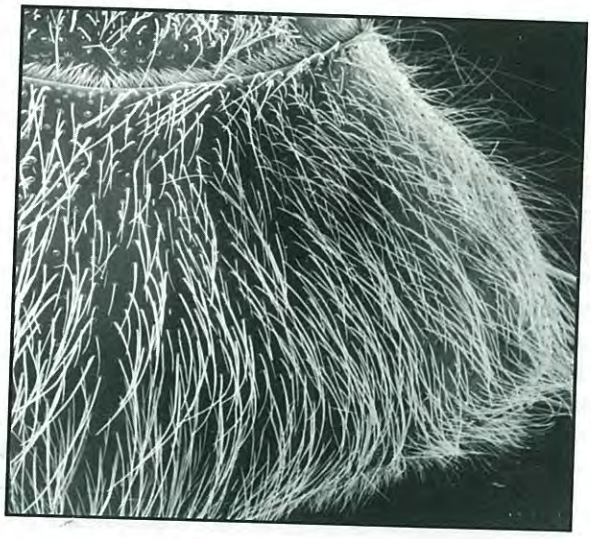


fig. 587. *Phyllophaga skelleyi*: base of head and pronotum (7mm = 0.5mm).

but appearing lighter because of the golden pubescence. **Vestiture** (fig. 390, 587): surface shiny, covered with elongate, recumbent to erect, golden hairs which are longest on pronotum. **Antenna**: 10-segmented, the club one-third longer than the stem. **Clypeus**: deeply emarginate, the resulting projections rounded (fig. 424), not reflexed at notch, moderately so elsewhere. Surface densely, coarsely punctate, punctures coalescing frequently, giving a rugose appearance; punctures separated by less than a diameter. Clypeal suture depressed, but not clearly defined because of coalescing punctures. Setae shorter in front of clypeal suture.

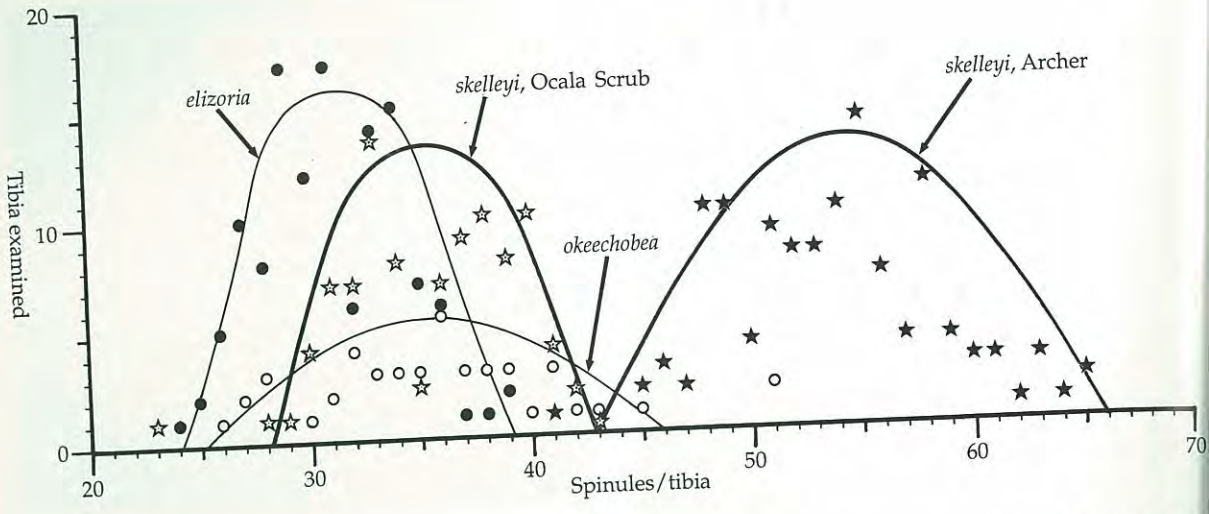
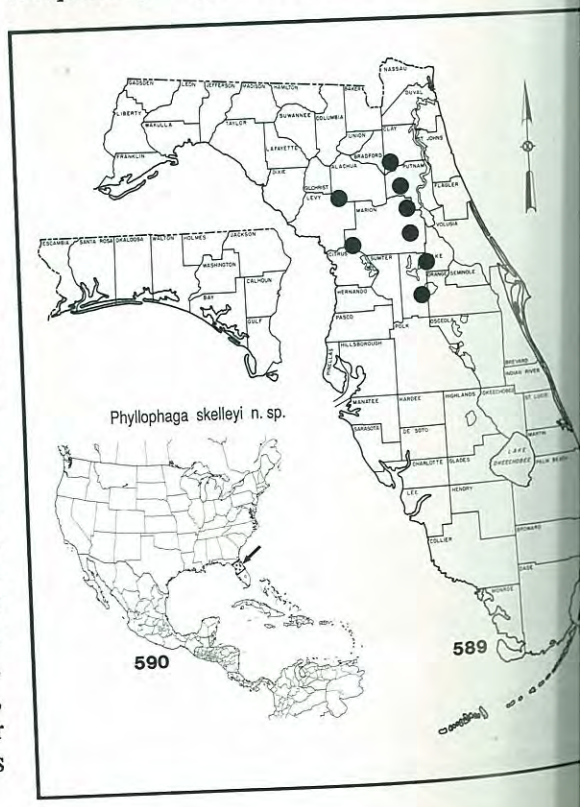


fig. 588. Graph of posterior tibia apical spinule number: ● *elizoria*, n = 123, mean = 31.4, range = 24-39; ○ *okeechobea*, n = 48, mean = 35.7, range = 26-51; ★ *skelleyi*, from Ocala scrub, n = 100, mean = 35.5, range = 23-43; ★ *skelleyi* from Archer, n= 126, mean = 54.6, range = 41-65.

Head: punctate, similar to clypeus, but less dense at base where some are separated by more than 1 diameter. Eye canthus deeply punctate, with about 16 long curved setae. Pubescence of head directed posteriorly, long, fine and golden to yellow. **Pronotum**: lateral margin crenulate, some crenulae almost tooth-like; widest just behind middle, angulate (nearly straight) to anterior gently rounded angles; indented between middle and posterior angles. Anterior marginal line absent; posterior line indicated by row of dense punctures, but not depressed except on lateral one-third. Surface shiny, punctures shallow, nearly evenly spaced, separated by 1 to 2 diameters; each puncture with exceptionally long yellow seta; pubescence denser and longer than on head and elytra. **Scutellum**: moderately, uniformly punctate, except posterior margin impunctate; setae as on elytra arising from each puncture. **Elytra**: widest behind middle, somewhat flattened. Striae nearly obliterated, except sutural one on posterior two-thirds. Pubescence pale, shorter, less dense, more recumbent, more evenly spaced, than on pronotum. Punctures shallow, evenly spaced, less dense than pronotum; surface shiny, but less so than pronotum. **Pygidium**: convex, shallowly punctate, surface duller and pubescence shorter than elytra. **Tarsal Claws**: gently curved, the tooth triangular, nearer base than tip. **Male Posterior Tibial Spurs**: lower spur movable, nearly as long as upper, both flattened beneath, lower with a central, poorly-developed carina. Both spurs about one-third longer than first tarsal segment. Posterior tibial fringe of spinules 34 (right), 35 (left) see fig. 425, 588. Anterior tibia tridentate, the basal tooth prominent, one-third size of others. Posterior femur exceptionally large, swollen, with central one-third



shiny and virtually impunctate; anterior and posterior marginal one-third with setate punctures. **Abdomen**: sternites pubescent as on pygidium, some orderly arranged. Sternum 7 depressed at middle, with few indistinct granules; otherwise non-distinctive. Surface punctate generally as pygidium. **Male Genitalia**: fig. 51 (caudal), 111 (ventral), 171 (dorsal), 231, 583 (right lateral). Basically tubular; parameres united ventrally at middle, deeply notched at tip; opening to aedeagus rounded with no internal sac visible. Sides gently curved from tip to top of orifice. In caudal view, sides nearly straight to phallobase, widest at junction; sides not produced as in *elizoria* and *okeechobea*. Ventrally a shallow carina present medially. In lateral view, a simplified form, gently curved downward from phallobase to tip, with no projections or distinctive modification.

Allotype female: Similar to male in most respects, except as follows: **Length**: 19.9mm; **Width**: 10.8mm. **Antenna**: club about as long as preceding 6 segments. **Tarsal Claws**: posterior tibial fringe of spinules 35 (right), 36 (left). **Elytra**: surface appearing more shiny, pubescence less dense. **Pygidium**: more elongate, more convex, and setae less dense than male. **Female Genitalia**: fig. 360 (ventral), 363 (lateral). Generally of the *elizoria - okeechobea* type. Basal plates apparently fused, pubic process bilobed, notch shaped like an inverted bracket medially; lobes with 8 setae each, carinate basally on each side of trough shaped middle. Outer angles of lobes nearly straight to tip, which is slightly prolonged, not sharply acute.

TAXONOMIC NOTES: This new species has been known in our collections since 1960. It is related to *elizoria* and *okeechobea*, but is easily distinguished by the genitalia. It is variable in several characters, some of which appear to coincide with geographic isolates. The number of spines of the fringe (spinules) of the posterior tibial apex varies from 23 to 43 (average 35.7) on those from the Ocala National Forest and from 41 to 65 (average 54.6) on those from Archer (see graph fig. 588 for comparison with *elizoria* and *okeechobea*). The type series varies in size; **length** (males): 14.8 to 19.2mm, (females): 16.8 to 19.7mm; **width** (males): 7.8 to 10.5, (females): 9.5 to 10.6mm.

U.S. DISTRIBUTION (fig. 590): Known only from Florida.

FLORIDA DISTRIBUTION (fig. 589): It appears to occupy a limited area of scrub habitat in the north central portion of the state; the same habitat occupied by its sister species *elizoria* in the Lake Wales Ridge.

BIOLOGY & ECOLOGY: Little is known about this new species, except that it seems to be restricted to turkey oak scrub in the north central part of Florida. It appears to replace the related *elizoria* and *okeechobea* which occupy the same habitat in the southern Lake Wales Ridge. It is a spring species; from March to May, our earliest record being March 14, and our latest was May 29. The life cycle and the immature stages are unknown.

Adult Host Plants: Found only on turkey oak (*Quercus laevis*) in Florida.

SPECIMENS EXAMINED: Holotype male, allotype female, and 13 paratypes (FSCA): Florida, Putnam Co., Interlachen, Paris Rd., 9-IV-89, R. E. Woodruff, B. M. Beck, & P. E. Skelley, on turkey oak; 104 additional paratypes from Alachua, Clay, Lake, Levy, Marion, and Putnam counties; for complete data see Appendix 32. Paratypes to be deposited in FSCA, INHS, TAMU, UMMZ, USNM, and private collections of H. F. Howden, P. J. Landolt, E. G. Riley, P. E. Skelley, K. W. Vick, and W. B. Warner.

ETYMOLOGY: It is with great pleasure that we dedicate this species to Paul E. Skelley for his many contributions to the success of this study.

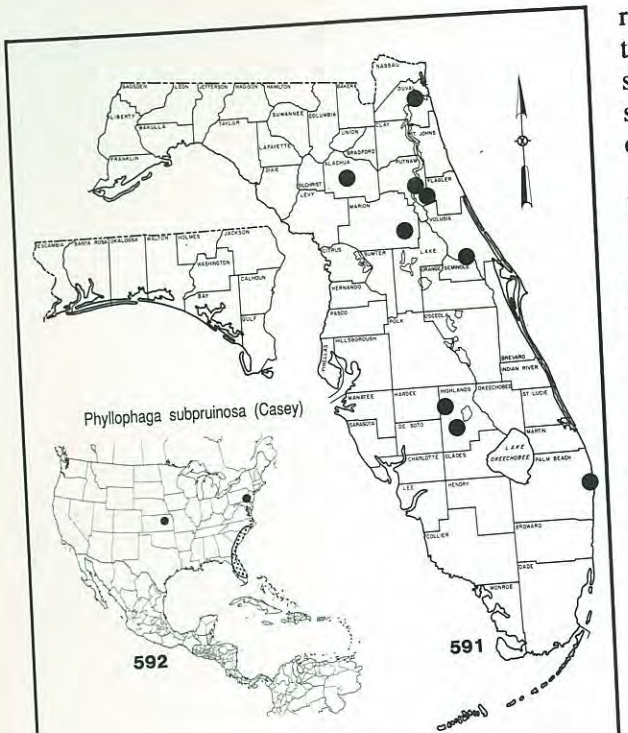
Phyllophaga subpruinosa (Casey)

(fig. 52, 112, 172, 232, 361, 364, 591, 592)

Lachnosterna subpruinosa Casey 1884:38.
Phyllophaga subpruinosa, Glasgow 1916:379.
Phyllophaga deanii Luginbill 1928:78.

TYPE LOCALITY: "Atlantic States".

DIAGNOSIS: Although it is pruinose and externally similar to *cupuliformis* and *micans*, the body color is usually lighter reddish brown instead of a purplish black. From the Florida pruinose species it can best be distinguished by the genitalia (compare figures in parentheses): *cupuliformis* (male: 10, 70, 130, 190; female: 276, 279); *latifrons* (male: 33, 93, 153, 213; female: 323, 326); *micans* (male: 37, 97, 157, 217; female: 330, 333); *prununculina* (male: 46, 106, 166, 226; female: 349, 352); and *subpruinosa* (male: 52, 112, 172, 232; female: 361, 364).



DESCRIPTION: Length: 14.1-16.6mm; **Width**: 7.7-8.0mm. **Shape**: oval, widest behind. **Color**: castaneous to dark brown. **Vestiture**: glabrous, feebly pruinose, slightly shining. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: emarginate, feebly sinuate at middle; margin moderately reflexed. **Tarsal Claws**: feebly curved; tooth small, median. **Male Posterior Tibial Spurs**: lower fixed, two-thirds length of upper. **Female Genitalia**: fig. 361 (ventral), 364 (lateral). **Male Genitalia**: fig. 52 (caudal), 112 (ventral), 172 (dorsal), 232 (right lateral).

TAXONOMIC NOTES: Luginbill & Painter (1953:33) synonymized *deanii* Luginbill, but gave no explanation.

U.S. DISTRIBUTION (fig. 592): The type locality is listed as "Atlantic States", although Smith (1889:499) stated "Mr. Casey described the species from examples taken on **Long Island** or near it." Luginbill & Painter (1953: fig. 23) recorded it from **Florida, Georgia**, and **South Carolina**. Brimley (1942:14) and Wray (1967:45) added **North Carolina** (Castle Hayne). Horn (1887b:240) reported it from **Florida**. Smith (1889b:499) reported **Pennsylvania** specimens from "the vicinity of Philadelphia" and (1910:319) stated that it was "Sure to occur in **New Jersey**." Knaus (1897:216) listed it as rare at Manhattan, **Kansas**. This record needs substantiation. In **Georgia**, Fattig, (1944:17) found only 1 specimen at Folkston. In **South Carolina** (under the synonym *deanii*), Luginbill (1928:78-79) recorded it only from Georgetown.

FLORIDA DISTRIBUTION (fig. 591): Blatchley (1929:55) recorded it only from Jacksonville, Enterprise, and Ft. Reed. Young & Thames (1949:127) added no records. Frost (1964:143; 1966:191-192) recorded it from Archbold Biological Station (Highlands Co.). Our scattered records are peninsular only, as far south as Palm Beach Co.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:34) listed the season as April and May, but they did not comment on abundance. Our records for 40 specimens include only March and April, the largest number (10) being taken on April 24 (Welaka, Putnam Co.). Most of our records are from areas with scrub habitat, but we have no clue to its limiting factors. Smith (1889b:499) mentioned specimens from "...vicinity of Philadelphia", and Casey's types were from "Long Island or near it." If these records are correct, the habitats are quite different from those in Florida. The life cycle and immature stages are unknown.

Adult Host Plants: Luginbill & Painter (1953:34) reported it from "host family ... beech." Under the synonym *deanii*, Luginbill (1928:78-79) recorded the types from water oak (*Quercus nigra*).

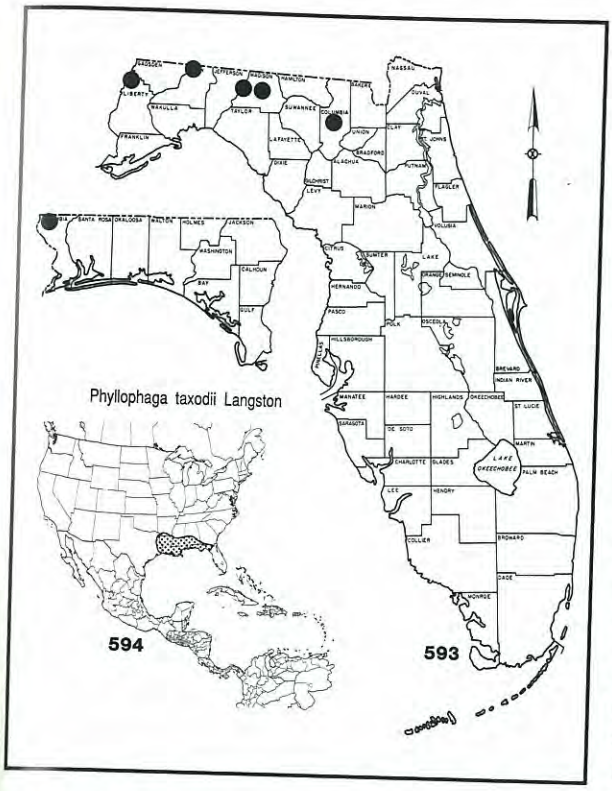
SPECIMENS EXAMINED: only 42, of which 4 were from the following 5 Florida counties: Alachua, Highlands, Marion, Palm Beach, and Putnam. For complete data, see Appendix 33.

SELECTED REFERENCES: Blackwelder, 1939:52; Blatchley, 1929:55; Brimley, 1942:14; Dalla Torre, 1912:199; Fattig, 1944:17; Frost, 1964:143; 1966:191-192; Glasgow, 1916:379; Horn, 1887b:238-239, 293; Knaus, 1897:216; Luginbill, 1928:78-79, fig. 24, male A-D (as *deanii*); Luginbill & Painter, 1953:6, 33, figure, plate 34(6-11); Smith, 1889b:499-500, figure 25, plate 50; 1910:3, Woodruff, 1973:28; Wray, 1967:45; Young & Thames, 1949:12

Phyllophaga taxodii Langston

(fig. 53, 113, 173, 233, 365, 368, 593, 594)

Phyllophaga taxodii Langston 1924:449.



TYPE LOCALITY: "Perkinston, Mississippi".

DIAGNOSIS: This is one of the larger (10.6-15.9mm long) of the small, pale yellow, glabrous species (see genitalia figures in parentheses for comparison): *clemens* (male: 7, 67, 127, 187; female: 270, 273); *debilis* (male: 11, 71, 131, 191; female: 277, 280); *gracilis* (male: 26, 86, 146, 206; female: 307, 310); *lota* (male: 34, 94, 154, 214; female: 324, 327); *taxodii* (male: 53, 113, 173, 233; female: 365, 368); and *yemasseei* (male: 58, 118, 178, 238; female: 373, 376).

DESCRIPTION: **Length**: 10.6-15.9mm; **Width**: 5.3-7.0mm. **Shape**: elongate, parallel, moderately convex. **Color**: pale yellowish-brown, head and pronotum darker. **Vestiture**: glabrous, shining. **Antenna**: 9-segmented; male club length equal to stem. **Clypeus**: entire, concave; margin widely reflexed. **Tarsal Claws**: curved; tooth nearer base than tip, small (male), larger (female). **Male Posterior Tibial Spurs**: lower fixed, two-thirds length of upper. **Female Genitalia**: fig. 365 (ventral), 368 (lateral). **Male Genitalia**: fig. 53 (caudal), 113 (ventral), 173 (dorsal), 233 (right lateral).

TAXONOMIC NOTES: Because of the early confusion surrounding *debilis* LeConte and *dispar* Burmeister (explained under *debilis*), Langston compared his new species (*taxodii*) to the *dispar* of Horn. However, that was a misidentification, and the similarity is with *debilis* (and *austricola* of Fall), both of which feed on cypress.

U.S. DISTRIBUTION (fig. 594): Luginbill & Painter (1953:42) recorded it only from **Alabama**, and **Mississippi**. Reinhard (1950:43) recorded it from Morris and Orange counties, **Texas**. Young & Thames (1949:127) recorded it from **Florida**. Riley (1988: map 37) recorded it from 5 parishes in **Louisiana**. In **Mississippi**, Langston (1927b:21) recorded it from Bradley, Columbus, and Perkinston.

FLORIDA DISTRIBUTION (fig. 593): Young & Thames (1949:127) recorded it from Madison Co., along the Aucilla River, opposite Lamont. Our records include 5 counties in the panhandle, east to Columbia Co.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:42) listed it as not common, in June and July. Our few Florida records (18 specimens) were from May 18 to July 19. Riley (1988:241-242) stated that it was infrequently taken at light, but most Louisiana specimens were hand collected from both bald cypress and pond cypress growing in pitcher plant or bog habitat. He also collected fair numbers in flight intercept traps suspended 50 feet above ground in cypress trees. The life cycle and immature stages are unknown.

Adult Host Plants: The type specimens were collected on cypress (Langston, 1927b:22), who also found specimens (although uncertain of their feeding) on ironweed (*Vernonia* sp.). Other authors who reported it on cypress are Young & Thames (1949:127), Yeager (1950:175), and Riley (1988:241). The listing of Luginbill & Painter (1953:42) from pine presumably refers to the family (to which pine and cypress both belong). It appears to be one of the few species of *Phyllophaga* that is host specific.

SPECIMENS EXAMINED: 30, of which 18 were from 5 Florida counties: (4) Columbia Co., 16-VII-58, Sathena Clark; (1) Escambia Co., Bratt, 7-VI-68, D. C. Blanton, blacklight trap; (1) Leon Co., Tall Timbers Research Station, 3-VI-68, W. W. Baker, Plot TT-1; (1) loc. cit., 18-V-69, A. Bhatkar, blacklight trap; (1) loc. cit., 11-19-VII-71, R. H. Arnett, Jr., Malaise trap; (1) Liberty Co., Torreya State Park, 19-VII-80, L. R. Davis., Jr., blacklight; (1) Madison Co., Aucilla River, 4-VI-38, F. N. Young, on cypress; (8) Madison Co.,

Madison, 4-VI-38, F. N. Young, on cypress.

SELECTED REFERENCES: Langston, 1924:449, plate 44; 1927b:19-20, 80, plate 3, figure 9; Leng & Mutchler, 1927:38; Loding, 1945:105; Luginbill & Painter, 1953:7, 42, plate 42(1-5); Reinhard, 1950:43; Riley, 1988:31, 56, 126, 191, 240-242, figure 5, 341-344, map 37, table 3-4; Sanderson, 1937a:17; Sim, 1928:3; Yeager, 1950:175; Young & Thames, 1949:127.

Phyllophaga tecta Cartwright

(fig. 54, 114, 174, 234, 261, 366, 369, 387, 595, 596)

Phyllophaga tecta Cartwright 1944:32.

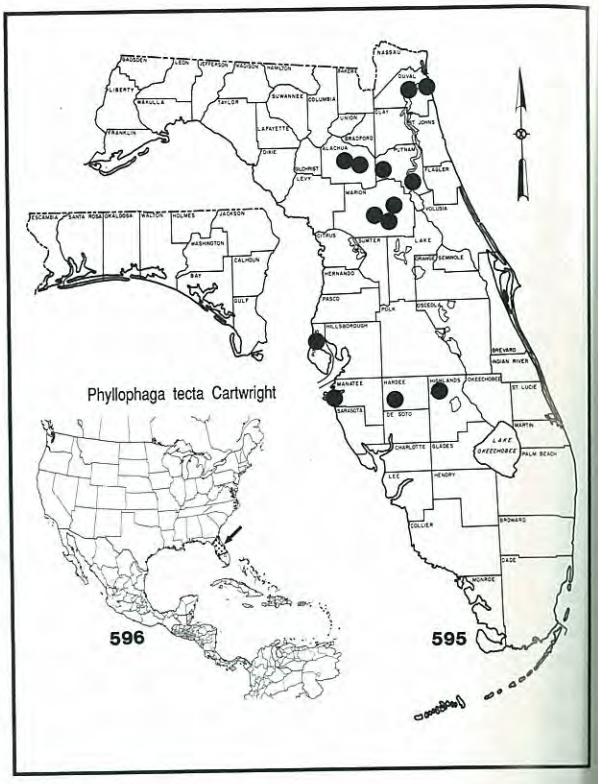
TYPE LOCALITY: "Gainesville, Florida".

DIAGNOSIS: This is a shiny, red-brown species most similar to *forsteri*, but superficially may be confused with *infidelis* and *ovalis*. They can all be easily distinguished by the genitalia (see figures in parentheses for comparison): *forsteri* (male: 20, 80, 140, 200, 245; female: 295, 298); *infidelis* (male: 31, 91, 151, 211, 252; female: 318, 321); *ovalis* (male: 40, 100, 160, 220, 255; female: 377, 340), and *tecta* (male: 54, 114, 174, 234, 261; female: 366, 369). In *forsteri* the left male genital clasper is incised deeply and (in lateral view) projects backwards toward the phallobase, whereas in *tecta* it is barely incised and has no such projection.

DESCRIPTION: Length: 16.1-21.8mm; **Width:** 8.6-11.6mm. **Shape:** oblong, oval, convex, robust. **Color:** castaneous. **Vestiture** (fig. 387): glabrous, shining to slightly polished. **Antenna:** 10-segmented; male club length equal to stem. **Clypeus:** emarginate, moderately, deeply; border moderately reflexed. **Tarsal Claws:** broadly arcuate; tooth median, well-developed, nearly right angled. **Male Posterior Tibial Spurs:** lower fixed, strong, acute, four-fifths length of thin, lanceolate, acute upper. **Female Genitalia:** fig. 366 (ventral), 369 (lateral). **Male Genitalia:** fig. 54 (caudal), 114 (ventral), 174 (dorsal), 234 (right lateral), 261 (left lateral).

TAXONOMIC NOTES: Although one of the more recently described species, *tecta* is easily separated on size and genitalic characters. Many early Florida records for *forsteri*, including the Gainesville specimens in the UMMZ, are referrable to *tecta*.

U.S. DISTRIBUTION (fig. 596): Luginbill & Painter (1953:89) listed it only from **Florida.**



FLORIDA DISTRIBUTION (fig. 595): The type series was from Gainesville (17) and Bradenton (1). Young & Thames (1949:128) added no localities, but stated that it "... is not uncommon about Gainesville." Our records include 8 north central counties, south to Manatee and Highlands, north to Jacksonville.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:89) did not comment on its abundance or season. Our Florida records (270 specimens) were from February to November, with most specimens in March and April. Nearly all specimens were collected at blacklight, and no information is available on life cycle or immature stages.

Adult Host Plants: There are no hosts reported in the literature, and we recorded none during our study.

SPECIMENS EXAMINED: over 300, of which 270 were from 8 Florida counties. Of these, 173 specimens, representing 85 collection records, were from Gainesville. For complete data, see Appendix 34.

SELECTED REFERENCES: Blackwelder & Blackwelder, 1948:32; Cartwright, 1944:30, 32-33, figure 11, plate 1; Luginbill & Painter, 1953:89, figure 75, plate 75(1-6); Woodruff, 1973:28; Young & Thames, 1949:128.

Phyllophaga tristis (Fabricius)

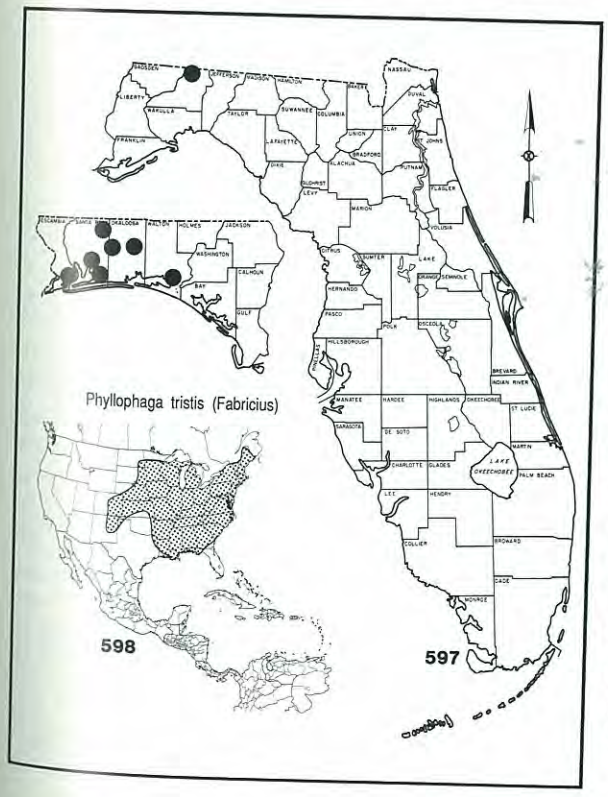
(fig. 55, 115, 175, 235, 367, 370, 421, 454, 469, 472, 473, 597, 598)

Melolontha tristis Fabricius 1781:39.
Melolontha pilosicollis Knoch 1801:85.
Trichestes pilosicollis, Erichson 1848:658.
Trichestes tristis, Blanchard 1855:141.
Lachnosterna tristis, LeConte 1856:261.
Phyllophaga tristis, Glasgow 1916:370.
Phyllophaga tristic, Fattig 1944:29 (misspelling).

TYPE LOCALITY: "America boreali".

DIAGNOSIS: This and *apicata* are the only small (10-13mm long), yellowish brown, hairy species in Florida. They are difficult to distinguish except by the aedeagus (internal sac) of the males (females can be identified only by association). For details, compare genitalia: *apicata* (fig. 4, 64, 124, 184) with *tristis* (fig. 55, 115, 175, 235). The aedeagal dorsal apex is straight, the corners angled, the distal projection double bladed in *tristis*.

DESCRIPTION: **Length**: 10.0-12.8mm (14mm, Reinhard); **Width**: 5-5.9mm (6-7.5mm, Reinhard). **Shape**: oblong, elongate, slightly broader behind. **Color**: yellowish to testaceous brown. **Vestiture**: pubescent, hairs long, erect on head and pronotum, shorter, suberect on elytra. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: entire, concave (fig. 421). **Tarsal Claws**: slightly curved; tooth acute, moderate, median (female), smaller, antemedian (male). **Male Posterior Tibial Spurs**: lower movable, two-thirds length of upper; both spurs slender, acute. **Abdomen**: fig. 403 (venter). This figure is of *apicata*, which is nearly identical to *tristis*. **Female Genitalia**: fig. 367 (ventral), 370 (lateral). **Male Genitalia**: fig. 55 (caudal), 115 (ventral), 175 (dorsal), 235 (right lateral), 469, 472, 473 (aedeagus).



TAXONOMIC NOTES: (See also discussion under *apicata*). The synonymy of *pilosicollis*-Knoch was established by LeConte (1856:261). Glasgow (1916:370) apparently had the genitalia of Fabricius' type dissected and drawn, and he agreed with the synonymy. When Reinhard (1939:57-60) treated the *tristis* complex, describing 3 new "subspecies", he stated that he had not seen the Fabrician types. The type locality is "America boreali" and he assumed that the "... common form of that region [northeastern U.S.] agrees most closely with the type species."

All of Reinhard's "subspecies" have now been raised to specific status, but the entire complex needs an extensive study before the populations can be clarified. Careful study of the aedeagus with the scanning electron microscope should provide the answers.

U.S. DISTRIBUTION (fig. 598): Nearly all distribution records, prior to Reinhard's (1939) separation of 4 forms, need to be reexamined. Luginbill & Painter's map (1953: fig. 19) applies to the whole complex and includes the eastern three-fourths of the U.S. [see also discussion under *apicata*.]. In **Texas**, Reinhard (1950:49) listed the nominate form only from Nacogdoches Co., the other 3 forms having a wider range. In **Louisiana**, Riley (1988: map 37) listed it from 6 parishes in the northern two-thirds of the state. Lago, Post, & Oseto (1979:62) recorded it from Richland and Ransom counties, **North Dakota**.

FLORIDA DISTRIBUTION (fig. 597): The records by Blatchley (1929:70) and Young & Thames (1949:128-129) for the peninsula presumably refer to *apicata*. Their records for Walton Co. are probably correct. Our records, based on recent separation, include only 5 counties in the panhandle, as far east as Tall Timbers Research Station (Leon Co.).

BIOLOGY & ECOLOGY: Because of past confusion, some of the literature records for this species are mixed with *apicata* Reinhard, *amplicornis* Reinhard, and *suttonana* Reinhard. Luginbill & Painter (1953:30) listed it as common in some of the northern states, from early March to late June. Although we have few Florida records, it was exceptionally abundant on April 14, 1989 when we hand collected 405 specimens from 2 localities on oak trees. Specimens were flying at dusk just before a rain and continued to feed even during a hard downpour. For additional data on life history, see Reinhard (1941).

Davis (1919:106-107, 112) recorded the following parasitic flies from *tristis*: *Pyrgota valida* Harris (Diptera: Pyrgotidae); *Cryptomeigenia theutis* Walker and *Eutrixa exile* Coquillett (Diptera: Tachinidae).

Adult Host Plants: Some of the following records may refer to *apicata* or others in the *tristis* complex: rose, beech, birch, dogwood, ebony, elm, heath, honeysuckle, maple, olive, pine, planetree, pulse, sumac, walnut, willow, witchhazel, saxifrage [families] (Luginbill & Painter, 1953:30); water oak, red oak, willow oak, black oak, black jack oak, white oak, post oak, chestnut oak, sweetgum, winged elm, soft maple, elderberry, dogwood, crab apple, hackberry, honey locust, willow, blackberry, black locust, pecan, sumac, white ash, apple, persimmon, yellow sweet clover, wild cherry, tree huckleberry, hawthorn (Fattig, 1944:29). In Kentucky, Ritcher (1940:112) recorded a strong preference for oaks, principally pin, red, bur, and chinquapin, but also on willow oak, Spanish oak, post oak, white oak, elm, blackberry, and maple.

In South Carolina, Luginbill (1928:62) recorded it from black jack oak, water oak, persimmon, blackberry, maple, sumac, white ash, apple, choke cherry, elm, Chickasaw plum, haw, white-heart hickory, and farkleberry. In Illinois, Forbes (1916:229) stated that it is "... most closely limited to a single food-plant, being essentially an oak species." Our Florida records are nearly all from turkey oak (*Quercus laevis*).

Immatures: The first and third instar larvae were described and illustrated by Boving (1942:33, fig. 33-36) who placed it in his group 4, along with *crinita* and *vetula*. Because of the adult similarity, it is likely that the larvae of *tristis* and *apicata* are not presently separable. Boving's description of the third instar follows: "Posterior part of labrum with a transverse, irregular series of about 7 or less, usually long setae on each side. Anterior marginal region of frons with a transverse series of 5 to 7 long setae on each side. Epicranium on each side opposite concave posterior part of frontal suture and epicranial suture with 3 long setae. Dorso-molar region of right mandible (Fig. 34) with a patch of about 12 setae; dorso-exterior region with no punctures; scrobis with a longitudinal row of about 10 punctures; ventro-lateral carina with about 8 long setae; baso-lateral region with a patch of about 10 long setae. Epipharynx (Fig. 33) with about 10 heli; proplegmatium absent; chaetopariae without punctures; crepidal punctures 6 or fewer. Raster (Figs. 35, 36) with broadly elliptical to oval septula; palidium with one regular row of from 10 to 13 short, subconical, somewhat depressed, gently curved pali; distance between bases of pali anteriorly about as long as a palus, posteriorly half as long or shorter; preseptular setae either absent or numbering 1 to 3. (Length of body 25 to 30 mm.; width of head 3.5 to 4 mm.)."

Hayes (1929) illustrated the raster (fig. 188) and the epipharynx (fig. 27), but he did not describe the larva. Ritcher (1966:87-88, fig. 225) included it in his Key and illustrated the raster and 10th abdominal segment (venter).

SPECIMENS EXAMINED: over 500, of which [illegible] were from the following 5 Florida counties: Escambia, Leon, Okaloosa, Santa Rosa, Walton. For complete data, see Appendix 35. [See also *apicata*, Appendix 35.]

SELECTED REFERENCES: Baker, 1972:148, 268; Blatchley & Blackwelder, 1948:32; Blatchley, 1910:979, figure I; 1929:70; Boving, 1937:6; 1942:4, 6, 9-10, 12-13, 21, 2 58, 61, figure 33-36, 215-216; Brimley, 1938:204; Cartw 1934:268; Chamberlin & Fluke, 1947:2, 4, 7-8, 12-13, fig Chamberlin & Seaton, 1941:467, table 1; Chamberlin, Flu Callenbach, 1943:675-680, figure 2, table 1-2, 4; Chamberlin 1938:226-228, 230-231, 233-238, 240, table 1-8; 1939:104-10 figure 2, table 1; Chandler, Taylor, & Deay, 1956:153, 1 Crotch, 1874:61; Dalla Torre, 1912:199; Davis, 1913a:8; 191 278; 1916a:262, 268, 277, table 1; 1916b:8; 1919:106-10 Dawson, 1922:223; Dury, 1879:8; 1902:156; Easton, 1909:52 1944:3, 6, 7 (as *tristic* p. 29); Felt, 1915:25; 1916:55; 1907:449-453, 455-456, table 455-456, 464; 1916:217, 229-2 239, 241-243, 245-248, 252, 255; Glasgow, 1916:370, 375 1842:29 (as *pilosicollis*); Hayes, 1920:76, figure 5, plate 8; 1 8, 11, 15, 19, 66-71, 76, 80-81, plate 1, 7, 9-10, table 53-67; 1 plate 15, figure 11; 1929:12, 28, 49, 53, 56, 58-59, 64-66, 78, 188, plate 4, 14, table 1-5, 7, 9-10, 12; Hayes & McColloch, 1 252, 257, table 2-3, 7; Henry & Heit, 1940:280-281, table 1 1887a:141-143, 145; 1887b:212, 215, 261, 285-286, 288, figure 2, plate 3; Jaques, 1926:338; 1927:315; 1928:30 1897:217; Langston, 1927b:71-72, 89, plate 12, figure 46 1856:261; 1883:143; Leonard, 1926:425; Loding, 1945 inbill, 1928:55, 60-61, figure 10A, male B-D, female E; L Painter, 1953:6, 17, 29-30, figure 19, plate 32(9-13); Schultz, 1988:95; Neiswander, 1963: fig. 50, table 1-3, 7 1950:13, 80-81, 84-85, 88, figure 27, plate 5; Peterson, 19 figure J; Popenoe, 1876:30; Reinhard, 1939:57-59; 194 table 1-11; 1950:49; Riley, 1891:133; 1988:33, 54, 77-7

figure 349-352, map 38, table 1, 3-4; Ritcher, 1938:24, 26; 1939:68-69, table 2-3; 1940:76, 79, 82-86, 96-97, 100-103, 112, 115, 117-118, 120, 128, 134, figure 6, 10, plate 6, table 1-3, 5, 9-10, 12-13, 19, 23; 1949a:19, 24, 34, 36, figure 51, plate 4; 1949b:3-4, 8, 12, table 1; 1966: fig. 225; Sanders & Fracker, 1916:256; Sanderson, 1944:16-18, table 1-2; Say, 1824:244; Saylor, 1942:162-163; Schwarz, 1878:450; Shaffer, 1920:83, 94, 98, figure 3, plate 1; Shenefelt & Simkover, 1951:219-222, table 1; Sim, 1934:8, fig. 4; Smith, 1889a:99; 1910:319; 1889b:485, 488, 490-493, 522-523, figure 86, plate 60; Travis, 1933:397-400, table 3, 5-7; 1934:316, 341, 364, figure 33, 36, plate 9, table 1; 1939:693; Uhler, 1941:1, 7-8, 13, 16, 19, figure 2, 12, 21, 30, 40, plate 1, 3, 5, 7; Wade, 1935:86; Wickham, 1894:232; Woodruff, 1961:17; 1973:28; Yeager, 1950:178; Young & Thames, 1949:128.

Note: Because of the recent recognition that several species or subspecies were involved in the *tristis* complex, the older references may not all refer to the true *tristis*; see also *apicata*.

Phyllophaga ulkei (Smith)

(fig. 56, 116, 176, 236, 262, 371, 374, 417, 442, 445, 599, 600)

Lachnosterna ulkei Smith 1889:94.
Phyllophaga ulkei, Glasgow 1916:373.

TYPE LOCALITY: "So. Car., Georgia, Tenn., E. Florida".

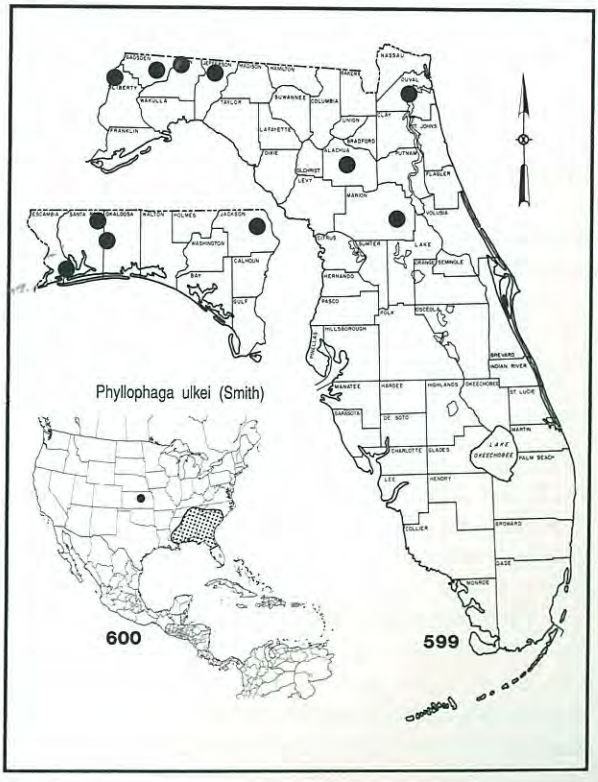
DIAGNOSIS: In body shape and color it is most similar to *postrema* (fig. 417). Although it is darker, larger, and is not recorded from Florida, *drakii* is another in the *fusca* complex with similar genitalia (compare figures in parentheses): *drakii* (male: 14, 74, 134, 194, 243; female: 283, 286); *postrema* (male: 44, 104, 164, 224, 257; female: 347, 350); and *ulkei* (male: 56, 116, 176, 236, 262; female: 371, 374).

DESCRIPTION: **Length**: 19.7-24.0mm; **Width**: 10.0-12.3mm. **Shape**: ovate, robust, broader behind, somewhat depressed dorsally. **Color**: rufocastaneous. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club length equal to stem. **Clypeus**: slightly emarginate; border moderately reflexed. **Tarsal Claws**: curved; tooth median, stronger in female. **Male Posterior Tibial Spurs**: lower fixed, two-thirds length but similar in shape to upper. **Female Genitalia**: fig. 371 (ventral), 374 (lateral). **Male Genitalia**: fig. 56 (caudal), 116 (ventral), 176 (dorsal), 236 (right lateral), 262 (left lateral), 442-445 (aedeagus).

TAXONOMIC NOTES: No synonyms have been created for *ulkei*, and it has not been confused in the literature. The genitalia are of the *fusca* type. Sim (1928:26) stated that "*Karlsioei* closely resembles this and may be a local western race." The color is quite uniform deep orange brown, and the species is often easy to pick out by color, once learned by the observer. The holotype (Type No. 1212) from "Tenn." was examined in the USNM.

U.S. DISTRIBUTION (fig. 600): Luginbill & Painter (1953:74) recorded it from **Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina**, and **Tennessee**. In **North Carolina**, Brimley (1938:204) found it only at Southern Pines. In **Alabama**, Loding (1945:104) recorded it from Mobile and Lee counties. Fattig (1944:20) found it throughout **Georgia**. In **Mississippi**, Langston (1927b:40) listed it primarily from "... the southern part of the state." In **South Carolina**, Luginbill (1928:64) stated "Not found in the lower part of the state." Knaus (1897:216) recorded it as rare at Salina, **Kansas**; a record which needs verification. In **Louisiana**, Riley (1988, map 39) recorded it from 2 southeastern parishes.

FLORIDA DISTRIBUTION (fig. 599): Smith (1889b:506) listed "East Florida" as one of the localities in the original description. This was repeated by Blatchley (1929:55). Young & Thames (1949:127)



added Monticello (Jefferson Co.). Our records include 11 counties in the northern half of the state, as far south as Juniper Springs (Marion Co.).

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:74) listed it as fairly common in some sections, from late March to mid-June. Our Florida records for 49 specimens were from March to September, with most specimens collected in April. The life cycle and immature stages are unknown.

Adult Host Plants: Beech, birch, dogwood, ebony, elm, figwort, heath, honeysuckle, laurel, magnolia, maple, olive, pine, pulse, rose, storax, sumac, tupelo, walnut, witchhazel [families] (Luginbill & Painter, 1953:74); red oak, white oak, water oak, black jack oak, black oak, willow oak, post oak, scrub oak, hickory, sumac, persimmon, sourwood, black gum, blackberry, dogwood, chinquapin, tulip poplar, wild cherry, honeysuckle, elderberry, sassafras, silver bell, sweet gum, rose, pecan, hackberry, white ash, soft maple, apple, tree huckleberry, paspalum, peanut, princess tree (Fattig, 1953:20). In Mississippi, Langston (1927b:40) recorded it from hackberry, oak, pecan, rose, and sweetgum. In South Carolina, Luginbill (1928:64-65) recorded it from black jack oak, water oak, white-heart hickory, persimmon, elm, blackberry, farkleberry, dogwood, apple, sweet gum, sumac, maple, and white ash. Our Florida records add turkey oak (*Quercus laevis*).

SPECIMENS EXAMINED: over 60, of which 49 were from 11 Florida counties. For complete data, see Appendix 36.

SELECTED REFERENCES: Blatchley, 1929:55; Brimley, 1938:204; Cartwright, 1934:240; Dalla Torre, 1912:200; Davis, 1916a:263; Fattig, 1944:3, 7-8, 20; Glasgow, 1916:373, 375; Knaus, 1897:216; Langston, 1927b:33, 39, 83, plate 6, figure 21; Loding, 1945:104; Luginbill, 1928:55, 63-65, figure 12A, male B-E, female F; Luginbill & Painter, 1953:9, 73-74, 95, figure 69, plate 64(1-6); McLemore, 1973:542; Riley, 1988:61, 133, 183, 249-251, figure 38, 353-358, map 39, table 3-4; Sanderson, 1939:10, 13, figure 1-5; Sim, 1928:26-27, plate 6; Smith, 1889a:94; 1889b:503, 507, figure 37, plate 53; Woodruff, 1973:28; Wray & Brimley, 1943:128-137; Young & Thames, 1949:127.

Phyllophaga uniformis (Blanchard)

(fig. 57, 117, 177, 237, 372, 375, 402, 415, 601-604)

Ancylonycha uniformis Blanchard 1850:133.
Lachnosterna uniformis, LeConte 1856:245.

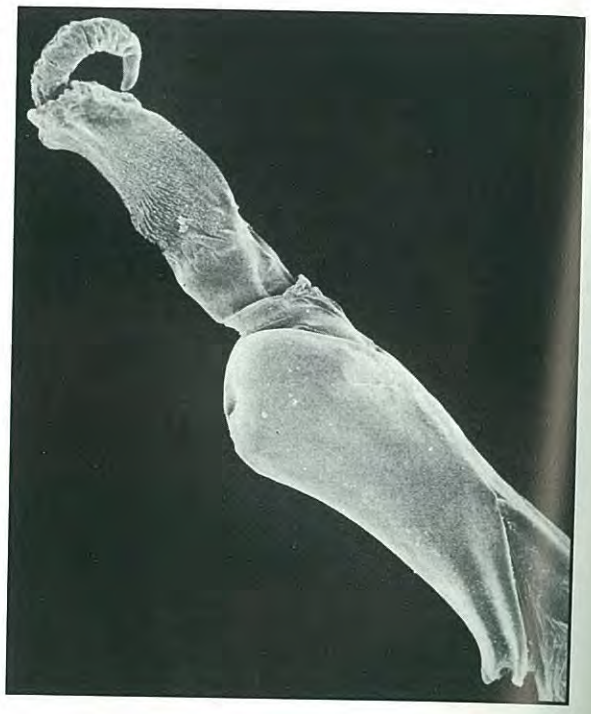
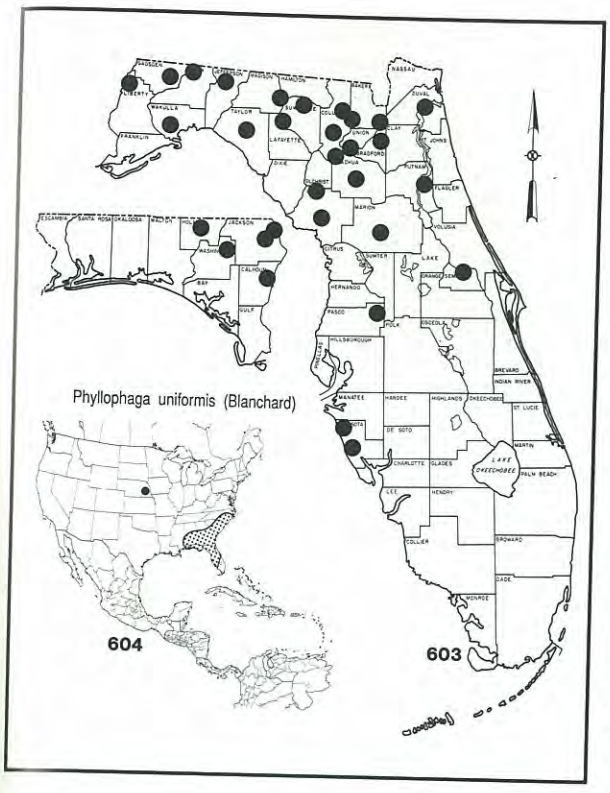


fig. 601. *Phyllophaga uniformis*: male genitalia, right lateral, aedeagus extruded (by critical point drying) (9mm = 0.5mm).

fig. 602. *Phyllophaga uniformis*: tip of aedeagus, enlarged from fig. 601 (magnified 200x).



Lachnosterna carolina Fall 1912:43.
Phyllophaga uniformis, Glasgow 1916:371.

TYPE LOCALITY: "Nouv.-Orleans", Louisiana.

DIAGNOSIS: Externally *uniformis* is characterized by the testaceous color, cylindrical body form, aborted male lower posterior tibial spur, and the distinctive genitalia, which are most similar to *ephilida*; compare figures in parentheses: *ephilida* (male: 17, 77, 137, 197; female: 289, 292) with *uniformis* (male: 57, 117, 177, 237; female: 372, 374).

DESCRIPTION: **Length**: 13.7-17.7mm; **Width**: 7.1-8.5mm (6.8mm, Luginbill & Painter). **Shape**: elongate, cylindrical, convex. **Color**: yellowish to darker testaceous, head and pronotum darker. **Vestiture**: glabrous, shining. **Antenna**: 10-segmented; male club shorter than stem. **Clypeus**: emarginate, broadly, feebly; border moderately reflexed. **Tarsal Claws**: broadly arcuate; tooth short, median, stout, acute. **Male Posterior Tibial Spurs** (fig. 402): lower fixed, aborted; upper long and slender. **Female Genitalia**: fig. 372 (ventral), 375 (lateral). **Male Genitalia**: fig. 57 (caudal), 117 (ventral), 177 (dorsal), 237 (right lateral) 601-602 (aedeagus).

TAXONOMIC NOTES: The synonymy of *carolina* Fall was established by Glasgow (1916:371). Horn (1887a:142) incorrectly synonymized *uniformis* under *ephilida* and was followed in this by Dalla Torre (1912:188). Otherwise it is constant in color and genitalic characters.

U.S. DISTRIBUTION (fig. 604): Luginbill & Painter (1953: fig. 58) recorded it from **Alabama, Florida, Georgia, North** and **South Carolina**, with an isolated record for **Nebraska**. Dawson (1922) did not find it in his survey of **Nebraska**, and the above record needs verification.

FLORIDA DISTRIBUTION (fig. 603): Young & Thames (1949:126) recorded it first from Florida (Holmes Co., near Bonifay). Ironically, it is quite common at Gainesville, and our records include 25 counties from most of the state.

BIOLOGY & ECOLOGY: Luginbill & Painter (1953:67) listed it as fairly common, from mid-May to late June. Our Florida records for 992 specimens were from March to October, with most specimens in May and June. More than half these (567) were from Tall Timbers Research Station (Leon Co.), with months and records as follows: V(17), VI(27), VII(11), VIII(4). Near the end of the writing for this paper (June 14, 1989) several hundred were seen on water oak and elm in Gainesville. Observations were made on mating behavior while making photographs (fig. 415). No copulation was seen until about 10:45 p.m., although many pairs were seen prior to this time. Males were mounted on females, the anterior legs gently stroking her pronotum, while the posterior tarsal claws were hooked beneath her pygidium, touching the anal opening. Pairs were easily disturbed, the male disengaging quickly and flying off. This is in direct contrast to the mating of *quercus* (at the same place and time) which maintained copulation even after disturbance. The life cycle and immature stages are unknown.

Adult Host Plants: Beech, ebony, rose, sumac (Luginbill & Painter, 1953:67); persimmon, black oak, scrub post oak, cinnamon oak, black jack oak, water oak, red oak, post oak, turkey oak, wild cherry, sumac, crab apple (Fattig, 1944:15). Florida hosts included water oak and elm.

SPECIMENS EXAMINED: over 1000, of which 992 were from 25 Florida counties. Over half (567), representing 51 collection records, were from Tall Timbers

Research Station (Leon Co.). For complete data, see Appendix 37.

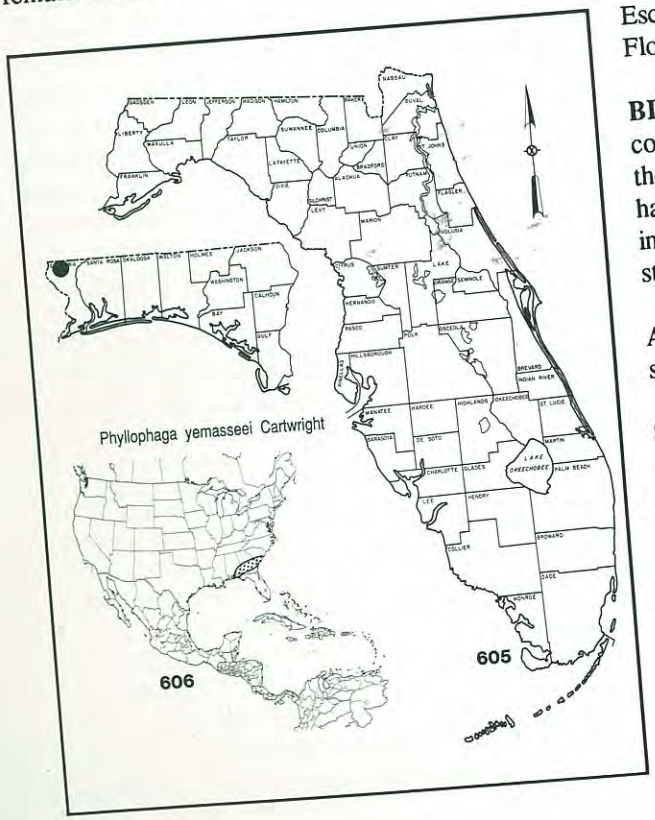
SELECTED REFERENCES: Brimley, 1938:204; Crotch, 1874:60; Dalla Torre, 1912:188; Fall, 1912:43 (as *carolina*); Fattig, 1944:7, 15; Glasgow, 1916:371, 375, 378-379; Horn, 1887a:142; 1887b:222, 293; LeConte, 1856:245; Loding, 1945:103; Luginbill & Painter, 1953:7, 49, 66, figure 58, plate 58(1-5); Melsheimer, 1853:59; Sim, 1928:3; Woodruff, 1973:28; Young & Thames, 1949:126.

Phyllophaga yemasseei Cartwright
(fig. 58, 118, 178, 238, 373, 376, 605, 606)

Phyllophaga yemasseei Cartwright 1941:30-32.

TYPE LOCALITY: "Yemassee, S.C."

DIAGNOSIS: This small (10.0-10.9mm long), pale yellow, glabrous species is externally similar to the following Florida species (see genitalia figures in parentheses for comparison): *clemens* (male: 7, 67, 127, 187; female: 270, 273); *debilis* (male: 11, 71, 131, 191; female: 277, 280); *gracilis* (male: 26, 86, 146, 206; female: 307, 310); *lota* (male: 34, 94, 154, 214; female: 324, 327); *taxodii* (male: 53, 113, 173, 233; female: 365, 368); and *yemasseei* (male: 58, 118, 178, 238; female: 373, 376).



DESCRIPTION: Length: 10.0-10.9mm; **Width:** 4.9-5.3mm. **Shape:** elongate, oblong, subdepressed. **Color:** testaceous to pale brown, head darker. **Vestiture:** glabrous, moderately shining. **Antenna:** 9-segmented; male club length equal to stem. **Clypeus:** rounded, scarcely noticeable shallow emargination, concave; margin widely, deeply reflexed. **Tarsal Claws:** tooth very small, near base. **Male Posterior Tibial Spurs:** lower fixed, obliquely truncate, three-fourths length of lanceolate, acute, upper. **Female Genitalia:** fig. 373 (ventral), 376 (lateral). **Male Genitalia:** fig. 58 (caudal), 118 (ventral), 178 (dorsal), 238 (right lateral).

TAXONOMIC NOTES: This rare, recently described species has only been reported twice in the literature. It was compared to *debilis* in the original description.

U.S. DISTRIBUTION (fig. 606): This rare species was described from a unique specimen from Yemassee, **South Carolina**. We have seen specimens from **Georgia** (Laurens, Baker and Wayne counties), and from **Florida** (Escambia Co.).

FLORIDA DISTRIBUTION (fig. 605): A single Florida specimen was taken in a light trap at Bra Escambia Co. This constitutes the first record f Florida.

BIOLOGY & ECOLOGY: The unique holotype w collected on June 6, and nothing has been published the species since the original description. Although have seen 10 additional specimens, the only la information was at blacklight. The life cycle and imma stages are unknown.

Adult Host Plants: No hosts are known for this species.

SPECIMENS EXAMINED: 10, including the holo only 1 female of which was from Florida: Esca Co., Bratt, 7-VII-68, D. C. Blanton, blacklight [FSCA].

SELECTED REFERENCES: Cartwright, 1944 Luginbill Painter, 1953:95-96.

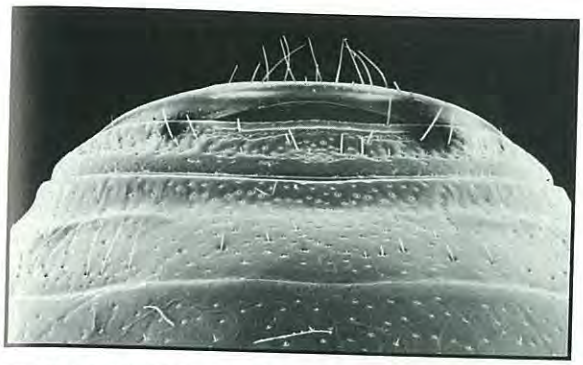


fig. 607. *Phyllophaga youngi*: ventral view, male abdomen, note the minimal modification of the last two abdominal segments (7-8), and compare with fig. 403-410 (6.5mm = 0.5).

Phyllophaga youngi Cartwright

(fig. 59, 60, 119-20, 179-80, 239-40, 377-8, 384, 456, 607-609)

Phyllophaga youngi Cartwright 1935:102.
Phyllophaga bahama Saylor 1940:311. (Sanderson, *in* Woodruff 1961:12)

TYPE LOCALITY: "Brickell Hammock, Miami, Florida".

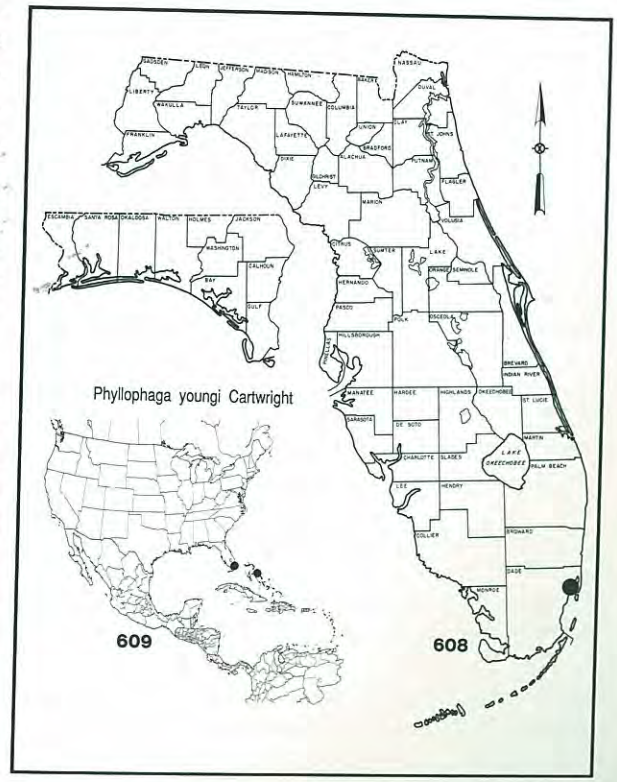
DIAGNOSIS: This West Indian species is a member of the subgenus *Cnemarachis* and shares characteristics of the other 2 introduced species: *bruneri* and *puberula*. However it is much larger (15.4-18mm long), pale testaceous, shiny, and has distinctive genitalia; compare figures in parentheses: *bruneri* (male: 6, 66, 126, 186; female: 269, 272); *puberula* (male: 48, 108, 168, 228; female: 354, 357); and *youngi* (male: 59, 119, 179, 239; female: 377, 378). The genitalia of the 3 have the aedeagus more heavily sclerotized than *Phyllophaga* (sensus strictus), and it is the most distinctive part of the genitalia (especially when comparing other West Indian species).

DESCRIPTION: **Length**: 15.4-17.5mm; **Width**: 7.1-8.6mm. **Shape**: elongate, oblong, convex. **Color**: dark castaneous. **Vestiture**: glabrous, shining, somewhat polished. **Antenna**: 9-segmented; male club less than half length of stem. **Clypeus**: moderately emarginate; margin broadly reflexed. **Tarsal Claws**: tooth median, strong, right angled in both sexes. **Male Posterior Tibial Spurs** (fig. 384): lower movable, two-thirds length of upper; both spurs slender, obtuse. **Abdomen**: fig. 607. **Female Genitalia**: fig. 377, 456 (ventral), 378 (lateral). **Male Genitalia**: fig. 59, 60 (caudal), 119, 120 (ventral), 179, 180 (dorsal), 239, 240 (lateral).

TAXONOMIC NOTES: The above synonymy of *bahama* Saylor was suggested by Sanderson (in Woodruff, 1961:12). I have since examined the types of both species in the USNM and confirm that synonymy. The type of *bahama* is labelled: Type USNM 54020, Nassau, Bahamas, Brooklyn Museum Coll. 1929; that of *youngi* is labelled: Type USNM 50837, Miami, Florida, 9-VI-1934, F. N. Young. Saylor (1940:311) compared the two, by stating that *bahama* could be "... separated by the smaller size and the different male genitalia." However, he did not illustrate these differences. I have examined series from both Florida and the Bahamas, finding no differences.

U.S. DISTRIBUTION (fig. 609): The species was described from Miami, **Florida**, but it also occurs in the **Bahamas**. Saylor (1940:311), under the synonym *bahama*, listed it from Nassau and Mangrove Cay (Andros Island).

FLORIDA DISTRIBUTION (fig. 608): It has the smallest known range of any Florida species, being found in Miami only within about 5 city blocks of the type locality, Brickell Hammock (now partly Alice Wainwright Metropolitan Park) near the entrance to Rickenbacher Causeway leading to Key Biscayne.



BIOLOGY & ECOLOGY: Luginbill & Painter (1953:44) listed it as rare, appearing in June and July. Although described over 50 years ago from Miami, we believe it conspecific with the Bahamas population, and that it probably was introduced from there. The contrast between this and the introduced Cuban *bruneri* is striking. Apparently in 50 years, *youngi* has never been found more than 5 city blocks from the type locality at Brickell Hammock, whereas *bruneri* has rapidly spread in about 30 years from Miami to Ft. Lauderdale, Homestead, and Naples. The largest series (41) was taken on July 4, 1960 in about 1.5 hours. The following night, only 16 were collected in about the same time.

At Alice Wainwright Park (Miami), June 15, 1983, R. E. Woodruff and P. J. Landolt obtained the following notes: 8:30 p.m. one female was collected about 9 ft. high on pigeon plum (*Coccoloba diversifolia*) that was heavily damaged by the weevil, *Artipus floridanus* Horn. At 8:42 p.m. a pair was taken in copula about 6 ft. high on *Trema micrantha* (L.) Blume (=*floridana*). A blacklight trap was operated from 8:15 to 10:20 p.m. and it collected 10 specimens, the first arriving at 8:30 p.m. One beetle was found struggling in the web of the giant spider (*Nephila clavipes* L.). About 2.5 hours were spent examining foliage with only the above specimens seen.

A single larva was collected on November 16, 1960, emerging as an adult on March 17, 1961. The cast skin was preserved, but the larva has not yet been described.

Adult Host Plants: Woodruff (1982:95) recorded it from *Trema micrantha* (=*floridana*). A single specimen was collected during this survey on *Coccoloba diversifolia*.

SPECIMENS EXAMINED: over 100, of which 88 were from a single locality in Florida: Dade Co., Brickell Hammock, near entrance to Rickenbacker Causeway, part of which is now Alice Wainwright Metropolitan Park. For complete data, see Appendix 38.

SELECTED REFERENCES: Blackwelder, 1939:52; Cartwright, 1935:102-104, figure 1-4; Luginbill & Painter, 1953:7, 44, plate 44(1-6); Saylor, 1940:311, figure 5 (as *bahama*); Woodruff, 1959:2; 1960:48; 1961:7, 10, 12, figure 26; 1973:28; 1982:95; Young & Thames, 1949:126.

BIBLIOGRAPHY

The references cited in this section deal almost exclusively with the genus *Phyllophaga*. Many general references on the family Scarabaeidae and many on Florida biogeography are cited in Part I of this series (Woodruff, 1973). The format is basically the same as in that publication.

Although my personal (REW) library and bibliography card file of over 8000 entries was the primary source of citations, several references were borrowed on interlibrary loan. The excellent taxonomic library of the Division of Plant Industry kept these requests to a minimum, and we especially thank June Jacobson (Librarian) and Alice Sanders (Library Technical Assistant) for their assistance in many ways during this study.

Special effort was made to obtain or check the original publications for titles, dates, pages and other pertinent bibliographic data. Although a bibliography on this genus was recently published (Pike, et al., 1976), it contains several major omissions (e.g., Dury, 1879, 1902, 1906; Frost, 1963, 1964, 1966; Hardenberg, 1907; etc.) and errors (e.g., Young and Thames cited as 1948, but should be 1949). All such items have been added and corrected herein, and recent papers were added.

References are cited basically as recommended in the "Council of Biology Editors Style Manual (4th ed.)" (Huth, 1978). However, several exceptions to these have been used: 1) "Ent." is used as an abbreviation for Entomology rather than "Entomol.", because it saves space, is not confusing, and has been used consistently in entomological literature for over 100 years; 2) all geographical names are spelled out, because abbreviations are often confusing; 3) the following are lower case and are used only in singular abbreviations, because it is obvious when they are plural: pages (p.), figures (fig.), plates (pl.); 4) the words "table" and "map" are spelled out, because abbreviations conserve little space or are confusing.

Citations are complete in the bibliography and abbreviated in the text, with only author, date, and page (e.g., Arnett, 1962:404). Notes on bibliographic information are added at the end of each citation in brackets. Special effort was made to obtain every reference to Florida species, but it is not meant to be a complete bibliography of the genus. The SELECTED REFERENCES section under each species treats the specific pages and illustrations dealing with that species, although catalogues and checklists are generally omitted.

Although the style manual recommends against citing unpublished theses in bibliographies, several major faunal studies of *Phyllohaga* are involved. Because of their significance and frequency of citation in the text, they are included here (i.e., Owens, 1954; Riley, 1988; Samol, 1968; Scott, 1954; Uhler, 1941).

All major bibliographic sources were checked, including Abstracts of Entomology, Biological Abstracts, and Bibliography of Agriculture. Chief other sources, besides the bibliography of Pike, et al., for checking accuracy of dates were: Barber and Bridwell, 1940; Blackwelder, 1949; 1957; Brown, 1964; Griffin, 1932; Hagen, 1862-1863; Henshaw, 1898; Horn & Schenkling, 1928-1929; Landin, 1956; LeConte, 1859; Zimsen, 1964.

As nearly as possible, all citations are exact copies of the title page, with spelling and punctuation as in the original, although diacritical marks and accents are omitted. If no formal title appeared, a title was derived from the information involved, and it is included in brackets (e.g., Anonymous, 1960). The presence and numbers of figures, plates, tables, and maps are noted in order to save the reader time and checking, especially when requesting interlibrary loans.

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APPENDICES

The following 38 Appendices include the label data for the more common species of Florida *Phyllophaga*. Appendix 39 includes the label data from the specimens illustrated in Plates 1 to 32. Appendix 40 is a numerical list of the figures. Species with less than 10 records have the data recorded under the SPECIMENS EXAMINED section in the text. The format is that used for Part I of this series and is basically as follows: the number of specimens; the county (alphabetically); the specific locality (alphabetically, within the county); the date [by day, month (in Roman numerals), and last 2 digits of the year], arranged chronologically; the collector(s); and any ecological information. Where voluminous records from a single locality (e.g., Gainesville) would occupy too much space, these have been summarized with the total specimens, the months, followed by the number of specimens in parentheses, and the total number of separate collection records.

All faunal studies of this nature accumulate great quantities of label data from the specimens examined. This is essentially voucher data from which the author can make general statements in the text. Most authors eliminate this data from the published volume, thus denying the reader access to the base data used by the author. Because of our previous frustration in tracking down questionable specimens and/or data, we feel strongly about the need to include it in published form as we did in Part I. The positive response to this, from many taxonomists, convinces us of the need to continue publishing the specimen data in these Appendices.

The recording of these data was done in two ways. Data from pinned specimens were first hand written under each species in a notebook. The data from alcoholic preserved specimens were produced in 2 formats used to 1) create the label for the container (vial, bottle) and 2) to produce the format of the Appendices, using a single typing (either on IBM Magcards or on an IBM-OS6 Word Processor). Eventually the data from pinned and alcoholic specimens were transferred to computer discs and combined. The finished version was generated on an IBM-AT Computer and printed camera ready on an Apple Writer laser printer.

Appendix 1. *Phyllophaga aemula* (Horn)

4	Alachua	Co. Rd. 17B	17-V-83	K.W. Vick	blacklight trap
255	Alachua	Gainesville: V(1); VI(22); VII(46); VIII(36); IX(9);X(1):Records = 125			blacklight trap
1	Gadsden	Chattahoochee	31-V-53	T.H. Hubbell	
2	Gadsden	River Junction	25-VII-25	T.H. Hubbell	
2	Jackson	Fla. Caverns St. Pk.	18-IV-63	R.E. Woodruff	
4	Jackson	Fla. Caverns St. Pk.	11-VIII-81	S. Peck	blacklight trap
14	Jefferson	Monticello:	V(1); VI(8); VII(2): Records = 11		blacklight trap
37	Leon	Tall Timbers Res. Sta.:	V(3); VI(5); VII(8); VIII(4): Records = 20		blacklight trap
1	Leon	Tallahassee	26-VII-72	C.W. O'Brien	
1	Liberty	Camp Torreya	29-V-24	T.H. Hubbell	
1	Liberty	Camp Torreya	30-V-24	T.H. Hubbell	
1	Liberty	Camp Torreya	24-VII-25	T.H. Hubbell	
1	Liberty	Camp Torreya	12-VII-35	I.J. Cantrall	
1	Liberty	Old Camp Torreya	4-IX-54	Hubbell & Cantrall	#72
5	Liberty	Sumatra	29-V-83	L.R. Davis, Jr.	
76	Liberty	Torreya St. Pk.: V(2); VI(5); VII(8); VIII(4); IX(1): Records = 20			blacklight trap
1	Marion	Ocala	15-VII-77	M.C. Thomas	blacklight trap
1	Santa Rosa	Mead Sta. #18	21-VII-55	F.W. Mead	
1	Wakulla	Wakulla	29-VI-48	E.L. Todd	

Appendix 2. *Phyllophaga apicata* Reinhard

1	Alachua		25-II-50		
1	Alachua		10-III-51	J. Morales	
1	Alachua		21-V-58	W. Chanosvi	
718	Alachua	Gainesville:	II(1); III(42); IV(5): Records = 48		blacklight trap
1	Alachua	Gainesville, 2mi. NW	1-III-74	J.B. Heppner	blacklight trap
10	Alachua	Gainesville, 2mi. NW	3-III-74	J.B. Heppner	blacklight trap
2	Alachua	Gainesville, 2mi. NW	4-III-74	J.B. Heppner	blacklight trap
2	Alachua	Gainesville, 2mi. NW	7-III-74	J.B. Heppner	blacklight trap
2	Alachua	Gainesville, 2mi. NW	8-III-74	J.B. Heppner	blacklight trap
1	Alachua	Gainesville, 2mi. NW	28-III-74	J.B. Heppner	blacklight trap
2	Union	Hwy.241,1km.N Santa Fe R.	14-III-89	C.W. Mills, III	

Appendix 3. *Phyllophaga bruneri* Chapin

2	Broward	Fort Lauderdale	22-IV-77	J. Reinert	blacklight trap
1	Broward	Fort Lauderdale	15-XI-83	D.C. Clinton	*Swietenia mahagoni*
6	Broward	Fort Lauderdale	16-V-84	Scherrer & Daigle	blacklight trap
1	Broward	Fort Lauderdale	11-XII-85	T. Phillips	
1	Broward	Hollywood	16-VI-83	L. Daigle	*Acacia auriculaeformis*
3	Broward	Hollywood	26-VI-83	L. Daigle	*Diospyros virginiana*
1	Broward	Miramar	21-V-84	Clinton & Daigle	*Eriobotrya japonica*
8	Broward	Plantation	17-V-85	T. Phillips	*Swietenia mahagoni*
1	Collier	Naples	IV-86	B. Thomas	
4	Dade		20-IV-60	P.E. Briggs	on soil
9	Dade		14-VI-66		
1	Dade		X-67		
1	Dade		VI-70	H. Teas	on *Delonyx*
2	Dade	Homestead	23-VII-72	T.E. Rogers	
1	Dade	Homestead	17-X-84	Woodruff & Stange	blacklight trap
5	Dade	Homestead, IFAS Exp.Sta.	10-IX-87	P.E. Skelley	light
2	Dade	Homestead, 4 mi. NW	9-VI-74	J.B. Heppner	at blacklight
48	Dade	Homestead, Owaissa Bauer Cmpg.	17-X-87	P.E. Skelley	light
3	Dade	Matheson Hammock	14-VI-75	Thomas & Frank	blacklight trap
5,129	Dade	Miami: II(2); III(1); IV(8); V(15); VI(10); VII(5); VIII(6); IX(4); X(5) XI(3); XII(2): Records = 61			blacklight trap
2	Dade	Perrine	2-VI-76	M.C. Thomas	blacklight trap
2	Dade	Royal Palm Hammock	28-V-83	R. Turnbow	at light

Appendix 4. *Phyllophaga clypeata* (Horn)

3	Collier		8-IV-57	H.V. Weems, Jr.	at light
2	Collier		28-IV-63	J.D. Spooner	
4	Collier	Collier-Seminole St. Pk.	4-IV-64	Arnett & Van Tassell	
1	Collier	Ochopee	30-IV-70	S.H. Brown	blacklight trap
2	Dixie	Jena, 7mi. S	22-VI-83	P.M. Choate, Jr.	blacklight trap
1	Dixie	Old Town, 15mi. S	8-VI-69	R.E. Woodruff	blacklight trap
2	Duval	Baldwin	1-VI-?		
1	Glades	Fisheating Creek	22-II-75	M.C. Thomas	at light
2	Hendry	Clewiston	7-IV-37	J.G. Franclemont	
4	Hendry	Clewiston	?-III-42	W.D. Wylie	
1	Hendry	Clewiston	3-V-42	W.D. Wylie	
1	Hendry	Clewiston	8-V-42	W.D. Wylie	
1	Hendry	Clewiston	12-V-42	W.D. Wylie	
1	Highlands	Avon Park	10-12-VI-81	J.F. Reinert	
2	Manatee	Bradenton	28-V-40	J.N. Todd	Japanese beetle trap
1	Manatee	Bradenton	23-V-55	F.W. Mead	at light
1	Okaloosa	Fort Walton, Eglin AFB	11-VI-62	T.W. Boyd	
2	Okeechobee	Okeechobee	10-IV-61	R.E. Woodruff	at light
10	Sarasota	Myakka River St. Pk.	3-VI-54	H.V. Weems, Jr.	at light
2	Seminole	Sanford	14-VI-61	G.W. Desin	blacklight trap
1	Seminole	Sanford	6-VII-61	R. Easterbrook	ground
2	St. Lucie	Fort Pierce	21-V-51	M. Robinson	
1	Volusia	Enterprise	? V-?		
1	Volusia	Enterprise	14-V-?		
1	Volusia	Enterprise	24-V-?	Hubbard	

Appendix 5. *Phyllophaga crenulata* (Froelich)

1	Alachua		23-IV-46	F.N. Young	on plum
1	Alachua		10-III-59	M.D. Rales	
1	Alachua		VI-60	Massing	
69	Alachua	Gainesville:	III(15); IV(4); V(3); VI(1): Records = 23		blacklight trap
1	Escambia	Molino	3-IV-69	E.N. Bishop	blacklight trap
1	Gadsden	Quincy	30-IV-56	W.B. Tappan	blacklight trap
1	Gadsden	Quincy	15-V-58	W.B. Tappan	blacklight trap
3	Gadsden	Quincy	30-V-61	W.B. Tappan	blacklight trap
1	Gadsden	Quincy	7-V-62	W.B. Tappan	blacklight trap
47	Jefferson	Monticello:	20-V-62	W.B. Tappan	blacklight trap
			III(2); IV(7); V(8); VII(1): Records = 18		blacklight trap

Appendix 5 (cont). *Phyllophaga crenulata* (Froelich)

1	Jefferson	Monticello, 5mi. S	8-V-83	L.R. Davis, Jr.	at light
8	Leon	I-10 exit & Rt. 319	28-IV-84	L.R. & S.L. Davis	at light
142	Leon	Tall Timbers Res.Sta.:III(5); IV(27); V(6); VI(1); VII(1):Records = 40			blacklight trap
1	Liberty	Camp Torreya	28-V-24	T.H. Hubbell	
11	Liberty	Torreya St. Pk.	22-VIII-51	I.J. Cantrall	
1	Liberty	Torreya St. Pk.	6-VI-82	M.C. Thomas	
1	Liberty	Torreya St. Pk.	21-22-V-83	K.W. Vick	blacklight trap

Appendix 6. *Phyllophaga cupuliformis* Langston

30	Alachua	Alachua, vic.	28-III-80	B. Rush	blacklight trap
5	Alachua	Archer, 2.5mi. SW	18-III-89	P.E. Skelley	turkey oak
361	Alachua	Gainesville: II(1); III(60); IV(77); V(30); VI(2); XI(2):Records = 172			blacklight trap
1	Alachua	Newberry	18-V-62	A.T. Andrews	on roses
1	Alachua	R20E, T10S, Sec. 6	20-II-49		
1	Baker	Olustee	8-VI-61	E.P. Merkel	at light
1	Baker	Olustee	20-V-63	E.P. Merkel	blacklight trap
2	Bay	St. Andrews St. Pk.	19-IV-63	R.E. Woodruff	
1	Bradford		1-V-59	H.V. Weems, Jr.	at light
1	Bradford	Melrose, 3mi. N	6-V-84	L.R. Davis, Jr.	
1	Calhoun	Clarksville	6-IV-28	W.W. Davis	
1	Clay	Keystone Heights	6-V-84	L.R. Davis, Jr.	
1	Columbia	Lake City	24-IV-80	A.E. Graham	blacklight trap
1	Duval	Jacksonville	12-IV-67	W.R. Pollard	at light
1	Duval	Jacksonville	26-V-69	R. King	blacklight trap
2	Escambia		18-IV-68	Walker & Spooner	
1	Escambia	Ala. state line, 0.9mi. E	17-V-83	L.R. Davis, Jr.	at light
35	Escambia	Pensacola:	III(1); IV(2); V(10): Records = 13		various hosts
1	Franklin	Eastpoint	31-III-70	N.M. Downie	
1	Gadsden	Quincy	26-IV-83	C. Boyles Sprenkel	at light
1	Gadsden	Quincy, 12mi. S	26-IV-83	C. Boyles Sprenkel	at light
6	Highlands	Archbold Biol. Sta.	22-24-III-78	L. Lampert	blacklight trap
1	Hillsborough	Brandon	15-III-62	J.W. Patton	at light
1	Hillsborough	Brandon	25-III-63	J.W. Patton	blacklight trap
1	Hillsborough	Tampa	10-V-50	R.W. Lindner	
2	Jackson	Fla. Caverns St. Pk.	13-IV-60	H.A. Denmark	at light
1	Lake	Tavares	23-III-36	F.N. Young	
7	Leon	I-10 exit & Rt. 319	20-IV-84	L.R. Davis, Jr.	
1	Leon	Okaloosa R., 0.5mi. E	30-IV-84	L.R. Davis, Jr.	
1	Leon	Tall Timbers Res. Sta.	12-20-IV-68	L. Collins	Plot TT-3
1	Leon	Tall Timbers Res. Sta.	22-IV-5-V-68	L. Collins	
1	Leon	Tall Timbers Res. Sta.	26-IV-7-V-69	D. Harris	blacklight trap
1	Leon	Tall Timbers Res. Sta.	6-IV-84	E.V. Komarek	Malaise trap
1	Leon	Tallahassee	16-IV-76	J. Schuh	light
2	Levy	Archer, 3.8mi. SW	18-III-89	P.E. Skelley	turkey oak
4	Levy	Archer, 3.8mi. SW	26-III-89	P.E. Skelley	turkey oak
1	Levy	Bronson	4-V-61	T.R. Adkins	Japanese beetle trap
1	Liberty		28-IV-46	F.N. Young	
2	Liberty	Sumatra	29-V-83	L.R. Davis, Jr.	at light
2	Liberty	Sumatra, 2mi. E	30-V-83	A. Hanrahan	
1	Marion	Ocala	5-IV-62	T.R. Adkins	blacklight trap
2	Marion	Ocala	13-IV-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	17-IV-68	W.O. Roberson	grass
3	Marion	Ocala	26-III-77	M.C. Thomas	blacklight trap
3	Marion	Ocala	27-III-77	M.C. Thomas	blacklight trap
1	Marion	Ocala	25-III-78	M.C. Thomas	blacklight trap
1	Marion	Ocala Nat. For.	31-III-79	Riley & LeDoux	
1	Nassau	Boulogne	1-IV-36	J.G. Franclemont	
1	Okaloosa	Blackwater Riv. St. For.	5-V-76	J. Schuh	light
2	Okaloosa	Blackwater Riv. St. For.	6-V-76	J. Schuh	blacklight
1	Okaloosa	Crestview, 2mi. S on US 85	17-V-83	L.R. Davis, Jr.	
41	Okaloosa	Holt, 1.5mi. W	14-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
2	Okaloosa	I-10, 2mi.E Rt. 85 exit	17-V-83	L.R. Davis, Jr.	at light
1	Orange	Orlando	30-III-44	H.C. Secrest	carrot
1	Orange	Orlando	2-V-61	J.R. Woodley	Japanese beetle trap
1	Osceola		15-III-56	H.A. Denmark	at light
1	Pasco	Dade City	9-IV-62	J.C. Sellers	

Appendix 6 (cont.). *Phyllophaga cupuliformis* Langston

1	Pinellas	Gulfport	29-III-25	F.M. Gaige	
1	Polk	Lakeland	9-III-48	R.F. Hussey	taken at light
1	Putnam		29-V-83	P.M. Choate, Jr.	blacklight
9	Putnam	Interlachen	23-24-IV-83	K.W. Vick	blacklight trap
1	Putnam	Interlachen	25-III-85	O.E. Hunt	at light
1	Putnam	Interlachen, 8mi. SE	20-III-53	Howden & Dozier	
1	Putnam	Welaka Res. Sta.	8-11-IV-83	E.G. Riley	
4	Santa Rosa	Holley, 1mi. N on SR 87	15-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
1	Santa Rosa	I-10,between SR 89 & SR 87	17-V-83	L.R. Davis, Jr.	
14	Santa Rosa	Navarre, 2mi. N on SR 87	15-IV-89	Woodruff,Beck & Skelley	
1	Union	Hwy.241,1km.N.Santa Fe R.	13-V-86	C.W. Mills,III	at incandescent light

Appendix 7. *Phyllophaga debilis* (LeConte)

1	Alachua		7-VI-56	J.B. Morrison	at light
1	Alachua		3-V-57	B.G. Watson	
1	Alachua		25-VI-58	S. Clark	
1	Alachua		16-VII-58	S. Clark	
1	Alachua	Edgecliff	16-V-85	D.H. Habeck	blacklight
78	Alachua	Edgecliff	1-8-VI-88	D.H. Habeck	at light
8	Alachua	Edgecliff	9-VI-88	D.H. Habeck	at light
7	Alachua	Edgecliff	26-VI-88	D.H. Habeck	at light
335	Alachua	Gainesville:	III(1); V(14); VI(10); VII(5); VIII(1):Records = 31		blacklight trap
2	Alachua	Gainesville, 15mi. NE	25-VI-66	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville, 15mi. NE	15-VII-66	L.A. Hetrick	blacklight trap
1	Alachua	Waldo	19-VII-25	T.H. Hubbell	
2	Baker	Glen St. Mary	23-VI-70	H.W. Collins	blacklight trap
1	Baker	Glen St. Mary	30-VI-70	H.W. Collins	blacklight trap
7	Baker	Macclenny	26-V-69	H.W. Collins	blacklight trap
16	Baker	Macclenny	4-VI-69	H.W. Collins	blacklight trap
10	Baker	Macclenny	11-VI-69	H.W. Collins	blacklight trap
1	Baker	Macclenny	24-VI-69	H.W. Collins	blacklight trap
2	Baker	Macclenny	23-VI-80	C. Webb	blacklight trap
78	Baker	Olustee:	V(6); VI(4); VII(2): Records = 12		blacklight trap
3	Baker	Osceola Nat. For.	5-VI-57	E.P. Merkel	blacklight trap
2	Charlotte	Punta Gorda	10-V-61	D.J. Taylor	mosquito light trap
1	Columbia	Camp Oleno	3-VI-55	L.C. Kuitert	light
1	Columbia	Lake City	24-VI-80	E. Graham	blacklight trap
3	De Soto	Arcadia	23-IV-41	J.H. Sealey	
1	De Soto	Arcadia	23-V-41	J.H. Sealey	
1	De Soto	Brownville	24-IV-62	R.H. Rhodes	Japanese beetle trap
2	Dixie	Old Town, 4mi. N	6-V-79	R. Turnbow	blacklight
1	Dixie	Shamrock, 5mi. W	8-VI-80	M.C. Thomas	
1	Duval		9-VI-56	D.R. Paulson	
80	Duval	Jacksonville:	V(4); VI(4); VII(1): Records = 9		blacklight trap
1	Escambia	Bratt	3-IV-68	F.S. Blanton	mosquito trap
1	Escambia	Bratt	28-VI-68	F.S. Blanton	blacklight trap
2	Escambia	Ensley, 3mi. NE	12-VII-66	R.E. Woodruff	at light
76	Escambia	Pensacola:	V(2); VI(3); VII(3); VIII(3); IX(1): Records = 12		blacklight trap
1	Hamilton	Rt. 6 & Suwannee R.	4-VII-83	P.M. Choate	
2	Hamilton	Rt. 6 & Suwannee R.	6-VII-81	Choate & Davis	blacklight trap
1	Highlands	Sebring	29-V-60	A.C. Crews	caught by dragonfly
1	Hillsborough	Brandon	11-V-62	J.W. Patton	at light
2	Hillsborough	Dade City, 14mi. S	11-V-74	R. Turnbow	blacklight
1	Hillsborough	Tampa	21-IV-60	R.G. Racine	
1	Hillsborough	Tampa	11-V-60	C.W. Hale	at porch light
1	Hillsborough	Tampa	27-IV-61	C.W. Hale	on person at night
1	Hillsborough	Tampa	3-V-61	R.G. Racine	
2	Hillsborough	Tampa	13-V-61	R.G. Racine	under lights
5	Hillsborough	Tampa	26-V-61	C.H. Lynch	Japanese beetle trap
3	Hillsborough	Tampa	1-VI-61	R.G. Racine	Japanese beetle trap
11	Hillsborough	Tampa	8-VI-61	H. Road	Japanese beetle trap
1	Hillsborough	Tampa	3-V-67	Fones	Bahia grass
1	Jackson	Graceville	21-VI-61	E.M. Kolmetz	Bahia grass
1	Jackson	Marianna	7-VII-61	E.L. Tipton	Japanese beetle trap
2	Jefferson	Monticello	14-V-69	R.H. Miller	blacklight trap
3	Jefferson	Monticello	28-V-69	R.H. Miller	blacklight trap

Appendix 7 (cont.). *Phyllophaga debilis* (LeConte)

1	Lake	Leesburg	22-V-61	J.R. Woodley	Japanese beetle trap
1	Lake	Tavares	1-VI-62	J.R. Woodley	Japanese beetle trap
1	Leon	Tall Timbers Res. Sta.	31-V-69	A. Bhatkar	blacklight trap
1	Leon	Tall Timbers Res. Sta.	12-VI-3-VII-69	L. Collins	Plot TT-3
1	Leon	Tall Timbers Res. Sta.	23-VI-69	A. Bhatkar	blacklight trap
1	Liberty	Sumatra	29-V-83	L.R. Davis, Jr.	
4	Liberty	Torreya St. Pk.	15-VI-69	H.V. Weems, Jr.	at blacklight
2	Liberty	Torreya St. Pk.	20-22-VI-73	G.B. Fairchild	blacklight trap
1	Liberty	Torreya St. Pk.	21-VII-79	L.R. Davis, Jr.	blacklight
11	Liberty	Torreya St. Pk.	19-VI-82	L.R. Davis, Jr.	
1	Liberty	Torreya St. Pk.	3-VII-82	E.G. Riley	
2	Liberty	Torreya St. Pk.	5-VII-82	E.G. Riley	
3	Liberty	Torreya St. Pk.	6-VII-83	P.M. Choate, Jr.	blacklight trap
1	Liberty	Torreya St. Pk.	15-VII-83	P.M. Choate, Jr.	blacklight trap
8	Liberty	Torreya St. Pk.	25-VI-81	P.M. Choate, Jr.	blacklight trap
1	Madison		4-VI-38	F.N. Young	
1	Madison		4-VII-38	F.N. Young	
2	Madison		2-V-46	F.N. Young	
1	Madison	Aucilla River		F.N. Young	# 171A
1	Marion	Ocala	19-VII-62	C.C. Maedke	Japanese beetle trap
1	Marion	Silver Springs	22-VI-61	T.R. Adkins	Japanese beetle trap
1	Okaloosa	Blackwater Riv. St. For.	5-V-76	J. Schuh	light
1	Okaloosa	Blackwater Riv. St. For.	6-V-76	J. Schuh	blacklight
1	Okaloosa	Blackwater Riv. St. For.	6-V-76	H.V. Weems, Jr.	blacklight
1	Okaloosa	Blackwater Riv. St. For.	7-V-76	J. Schuh	blacklight
1	Okaloosa	Fort Walton	24-VIII-61	T.W. Boyd	Japanese beetle trap
1	Okaloosa	Holt, 3mi. NW	8-11-VIII-79	L.A. Stange	blacklight trap
5	Okaloosa	Holt, 4.5mi. N	17-VI-78	L.A. Stange	blacklight trap
4	Okaloosa	Holt, 4.5mi. NW	15-16-VI-78	L.A. Stange	blacklight trap
1	Okaloosa	Holt, 4.5mi. NW	8-VI-80	L.A. Stange	
2	Orange	Orlando	26-V-61	J.R. Woodley	Japanese beetle trap
2	Orange	Orlando	9-VI-61	J.R. Woodley	Japanese beetle trap
2	Orange	Orlando	16-VI-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	10-VII-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	25-V-62	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	28-V-63	W.A. Avazian	Japanese beetle trap
1	Pasco	Land O'Lakes	26-V-61	C.H. Lynch	Japanese beetle trap
1	Pasco	Land O'Lakes	6-VI-61	C.H. Lynch	Japanese beetle trap
1	Putnam	East Palatka	20-VII-61	T.R. Adkins	Japanese beetle trap
6	Putnam	Welaka	3-VI-46	R.E. Bellamy	light trap
6	Putnam	Welaka	8-9-VI-46	R.E. Bellamy	light trap
43	Santa Rosa		13-V-58	R.E. Woodruff	at light
7	Santa Rosa		16-VI-59	M. Lutrick	blacklight trap
1	Santa Rosa		14-VII-59	M. Lutrick	blacklight trap
9	Santa Rosa	Blackwater Riv. St. For.	23-29-V-71	Fairchild & Weems	blacklight trap
9	Santa Rosa	Chumuckla	30-VI-59	M. Lutrick	blacklight trap
1	Santa Rosa	West Fla. Exp. Sta.	1-VIII-58	M. Lutrick	blacklight trap
3	Santa Rosa	West Fla. Exp. Sta.	24-VI-59	M. Lutrick	blacklight trap
56	Seminole	Sanford:	V(7); VI(5); VII(1): Records = 13		various hosts
1	Suwannee	Suwannee Springs	3-VI-48	R.H. Beamer	
2	Taylor	Dallas Ck. Landing Rd.	3-VI-72	R. Turnbow	at light
2	Taylor	Perry	19-29-V-67	W.L. Beers	blacklight trap
1	Taylor	Perry	5-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	17-VI-69	W.L. Beers	blacklight trap
2	Union	Hwy.241,1km.N.Santa Fe R.	13-V-86	C.W. Mills,III	incandescent light
2	Volusia	Enterprise	7-VI-46	F.N. Young	
1	Volusia	New Smyrna	31-V-61	G.W. Desin	Japanese beetle trap
1	Walton	Freeport		F.N. Young #431	cypress
4	Washington	Ebro, near	6-VI-38	F.N. Young	on cypress

Appendix 8. *Phyllophaga diffinis* (Blanchard)

1	Alachua	Co. Rd. 17B	22-IV-84	K.W. Vick	blacklight trap
1	Alachua	Gainesville	15-IV-47	H.V. Weems, Jr.	gen. slide 674
1	Alachua	Gainesville,Serenola For.	14-III-89	P.J. Landolt	at light
1	Alachua	Gainesville,Serenola For.	18-III-89	P.J. Landolt	at light
4	Alachua	Gainesville,Serenola For.	20-III-89	P.J. Landolt	at light

Appendix 8 (cont.). *Phyllophaga diffinis* (Blanchard)

4	Alachua	Gainesville,Serenola For.	5-V-89	P.J. Landolt	at light
1	Columbia	I-75 rest stop	8-IV-83	D. Rider	
1	Escambia	Pensacola	13-18-V-63	S. Hills	taken at light
2	Gadsden	Aspalaga Bluff,I-10 N	21-IV-84	L.R. Davis, Jr.	
2	Liberty	Torreya St. Pk.	16-IV-63	R.E. Woodruff	blacklight trap
1	Liberty	Torreya St. Pk.	17-IV-63	E. Hazard	at light
1	Liberty	Torreya St. Pk.	7-IV-83	E.G. Riley	
3	Liberty	Torreya St. Pk.	11-IV-83	E.G. Riley	
1	Liberty	Torreya St. Pk.	21-22-V-83	K.W. Vick	blacklight trap
1	Liberty	Torreya St. Pk.	15-IV-84	L.R. Davis, Jr.	in leaf litter
12	Liberty	Torreya St. Pk.	19-23-IV-84	E.G. & M.A. Riley	
4	Liberty	Torreya St. Pk.	30-31-III-85	M.C. Thomas	blacklight trap
1	Liberty	Torreya St. Pk.	26-27-III-88	P.E. Skelley	ex white oak
2	Liberty	Torreya St. Pk.	27-III-88	P.E. Skelley	light

Appendix 9. *Phyllophaga dispar* (Burmeister)

1	Alachua		9-X-37		
1	Alachua		28-VI-46		
2	Alachua		25-VI-58	S. Clark	
1	Alachua		9-VII-58	S. Clark	
1	Alachua		25-VII-58	S. Clark	
1	Alachua	Archer, 2.5mi. SW	26-VI-88	P.E. Skelley	in ground
958	Alachua	Gainesville: V(11); VI(120); VII(126); VIII(79); IX(11):Records = 347			blacklight trap
1	Alachua	Newberry	4-VIII-83	K.W. Vick	blacklight trap
1	Baker	Macclenny	4-VI-69	H.W. Collins	blacklight trap
4	Baker	Macclenny	11-VI-69	H. Collins	blacklight trap
2	Baker	Macclenny	24-VI-69	H.W. Collins	blacklight trap
129	Baker	Olustee:	V(10); VI(9); VII(6); VIII(1): Records = 26		blacklight trap
1	Brevard	Eau Gallie, 1.5mi. N	7-8-VIII-38	Hubbell & Friauf	
2	Brevard	Melbourne	9-VII-51	Price, Beamer, & Wood	
1	Broward	Deerfield (Beach)	29-VII-48	R.H. Beamer	
2	Broward	W. Hollywood	3-X-56	D.R. Paulson	at light
7	Calhoun	Blountstown	13-VIII-69	E. Curlee	blacklight trap
31	Charlotte	Englewood	16-23-VIII-60	H.M. Faircloth	blacklight trap
1	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	at light
1	Clay		17-VII-59	H.A. Denmark	at light
2	Clay	Gold Head Branch St. Pk.	12-VII-63	B.K. Dozier	
1	Clay	Gold Head Branch St. Pk.	13-VII-63	B.K. Dozier	
1	Collier	Immokalee	5-IV-59	H.V. Weems, Jr.	at light
1	Collier	Immokalee	2-VI-60	H.M. Faircloth	
1	Columbia	Osceola Nat. For.	14-VII-77	J.R. Wiley	blacklight trap
1	Dade		3-XI-56	D. Thornton	
1	Dade	Coral Gables	VI-58	R.W. Swanson	
1	Dade	Miami	9-VIII-38	F.N. Young	
1	Duval		9-VI-56	D.R. Paulson	
1	Duval	Jacksonville	18-VI-69	R. King	blacklight trap
1	Escambia	Pensacola	4-VI-63	T.W. Boyd	Japanese beetle trap
1	Escambia	Pensacola	6-IX-63	T.W. Boyd	Japanese beetle trap
1	Gadsden	Quincy	1-15-VIII-71	J. Reid	
1	Hamilton	Rt 6, Suwannee Riv.	18-VI-83	P.M. Choate, Jr.	
1	Hamilton	Rt 6, Suwannee Riv.	6-VII-83	P.M. Choate, Jr.	
2	Hernando	Brooksville, 3mi. S	31-VII-69	C.B. Williams	blacklight trap
4	Highlands	Archbold Biol. Sta.	1-2-VII-88	P.E. Skelley	blacklight trap
1	Highlands	Archbold Biol. Sta.	4-VII-88	P.E. Skelley	blacklight trap
1	Highlands	Avon Park, nr.	7-VI-61	T. Morris	blacklight trap
3	Highlands	Avon Park, nr.	21-VI-61	T. Morris	blacklight trap
2	Highlands	Avon Park, nr.	16-VIII-61	T. Morris	blacklight trap
2	Highlands	Avon Park, nr.	30-VII-62	T. Morris	blacklight trap
2	Highlands	Childs Crossing, 0.5mi. W	11-VIII-38	Hubbell & Friauf	
1	Highlands	Sebring	20-VI-51	Price, Beamer,& Wood	
1	Highlands	Sebring	23-V-61	T. Morris	blacklight trap
1	Highlands	Sebring	30-VII-62	T. Morris	blacklight trap
2	Highlands	Sebring	12-VIII-64	B.K. Dozier	
1	Hillsborough	Riverview	23-VI-61	R.G. Racine	Japanese beetle trap
1	Indian River	Fla. Med. Ent. Lab.	3-9-IX-75	M.C. Thomas	suction trap sample
1	Indian River	Sebastian	27-VII-48	R.H. Beamer	

Appendix 9 (cont.). *Phyllophaga dispar* (Burmeister)

1	Indian River	Vero Beach	26-IX-27	E.M. Becton	
2	Indian River	Vero Beach	20-VI-32	E.M. Becton	
2	Indian River	Vero Beach	27-VI-32	E.M. Becton	
2	Indian River	Vero Beach	30-VI-32	E.M. Becton	
1	Indian River	Vero Beach	1-VII-32	E.M. Becton	
1	Indian River	Vero Beach	16-VI-67	P. Araoz	blacklight trap
1	Indian River	Vero Beach	19-IV-75	M.C. Thomas	at light
2	Indian River	Vero Beach	18-V-75	M.C. Thomas	at light
2	Indian River	Vero Beach	21-VI-75	Thomas & Frank	ultraviolet light trap
1	Jefferson	Monticello	4-VII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	9-VII-58	A.M. Phillips	blacklight trap
1	Jefferson	Monticello	19-VII-69	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	14-VIII-69	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	11-VII-80	R.L. Crocker	incandescent light
1	Lake	Leesburg	24-VIII-38	Hubbell & Friauf	
2	Lake	Ocala Nat. For.	18-VIII-53	H.V. Weems, Jr.	at light
1	Lee	Fort Myers	2-II-44	C.S. Tuthill	*Solanum* sp.
126	Leon	Tall Timbers Res. Sta.:	VI(2); VII(9); VIII(11); IX(1):Records = 23		blacklight trap
1	Levy	Chiefland	17-VII-38	W. Stehr	
1	Levy	Williston	14-VIII-63	T.R. Adkins	Japanese beetle trap
1	Liberty	T2N, R7W	30-VII-25	T.H. Hubbell	
2	Liberty	Torreya St. Pk.	15-16-VIII-68	H.V. Weems, Jr. & III	blacklight trap
1	Marion	Dunnellon, 4mi. WNW	30-VIII-38	Hubbell & Friauf	
1	Marion	Ocala	28-VII-60	T.R. Adkins	Japanese beetle trap
1	Marion	Ocala	2-VIII-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	9-VIII-63	T.R. Adkins	blacklight trap
2	Marion	Ocala	14-VIII-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	30-VIII-63	T.R. Adkins	blacklight trap
19	Marion	Ocala	23-VII-65	W.O. Roberson	blacklight trap
1	Marion	Ocala National For.	26-VII-38	Hubbell & Friauf	
1	Marion	Ocala N.F., Juniper Sprs.	28-VII-60	T.R. Adkins	Japanese beetle trap
1	Marion	Sharpe's Ferry Field Sta.	8-VIII-75	Drummond & Wiley	blacklight trap
3	Okaloosa	Crestview, 12mi. N	31-VIII-60	W.C. Rhoades	blacklight trap
1	Okaloosa	Holt, 3mi. NW	8-11-VIII-79	L.A. Stange	blacklight trap
1	Orange	Orlando	26-VII-60	J.R. Woodley	Japanese beetle trap
2	Orange	Orlando	31-VII-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	13-VII-62	W.A. Avazian	Japanese beetle trap
1	Orange	Winter Park	21-VI-62	C.E. Mosteller	Japanese beetle trap
1	Pinellas	Clearwater	20-VI-52	F.H. Chermock	
1	Pinellas	Dunedin	10-VII-17	W.S. Blatchley	
6	Pinellas	Largo	15-VII-?		
1	Polk	Lake Streaty	10-VIII-38	Hubbell & Friauf	
2	Polk	Lakeland	10-VIII-62	R.E. Vild	soil under *Ligustrum*
1	Putnam	Melrose, 2mi. E	29-V-83	P.M. Choate, Jr.	blacklight trap
1	Putnam	Melrose, 3mi. S	2-VI-87	B. Beck	blacklight trap
2	Putnam	Satsuma, 1.7mi. NE	30-VII-38	Hubbell & Friauf	at light
1	Putnam	Welaka	13-VIII-40	J.J. Friauf	
1	Santa Rosa		27-VI-81	P.M. Choate, Jr.	
2	Sarasota	Englewood	14-IX-60	H.M. Faircloth	blacklight trap
1	Sarasota	Sarasota	16-V-61	J.W. Patton	at light
23	Seminole	Sanford:	V(3); VI(6); VII(4): Records = 13		blacklight trap
1	Taylor	Perry	29-VII-68	E.P. Merkel	blacklight trap
1	Volusia	Glenwood, 1.5mi. E	29-VII-38	Hubbell & Friauf	
1	Volusia	De Land	27-VI-61	G.W. Desin	Japanese beetle trap
1	Volusia	De Land	6-VI-62	G.W. Desin	Japanese beetle trap
1	Volusia	De Land	26-VI-62	G.W. Desin	Japanese beetle trap
1	Volusia	De Leon Springs	17-VI-60	C.R. Roberts	
1	Volusia	Ormond Beach	14-VI-61	T. Morris	blacklight trap
1	Volusia	Ormond Beach	7-VII-61	B.K. Dozier	at light
1	Volusia	Ormond Beach	2-X-61	T. Morris	blacklight trap
1	Wakulla	Panacea	12-VIII-67	C. Hilfiker	on surf

Appendix 10. *Phyllophaga elizoria* Saylor

4	Brevard	Melbourne	17-II-38	R. Kempper	at light
108	Highlands	Archbold Biol. Sta.:	II(2); III(17); IV(7): Records = 26		blacklight trap

Appendix 10 (cont.). *Phyllophaga elizoria* Saylor

1	Highlands	Avon Park	18-III-66	A. L. Collier	plastic pipe
3	Highlands	Lake Placid	27-III-61	J.C. Hanlon	blacklight trap
3	Okeechobee	Okeechobee	8-IV-47	M. Robinson	
1	Palm Beach	Boynton (Beach)	14-II-31	C. Stitts	
2	Polk	Hesperides	4-IV-60	Bielling & Stewart	

Appendix 11. *Phyllophaga elongata* (Linell)

1	Alachua	Gainesville	8-VIII-68	Corbin	
2	Alachua	Hawthorne	11-VII-64	O.E. Hunt	at light
1	Brevard		7-VII-39	Hubbell & Friauf	
1	Brevard	Eau Gallie	28-VII-41		
2	Brevard	Eau Gallie, 1.5mi. N	7-8-VII-38	Hubbell & Friauf	
1	Broward	Fort Lauderdale	6-VII-?	M. Bates	
1	Broward	Fort Lauderdale	29-VIII-25	T.H. Hubbell	
2	Broward	Fort Lauderdale	4-IX-25	T.H. Hubbell	
1	Dade	Coconut Grove	8-IV-62	D.H. Alexander	blacklight trap
1	Dade	Miami	6-8-IV-62	D.H. Alexander	blacklight trap
2	Highlands		29-IV-63	Walker & Spooner	
198	Highlands	Archbold Biol. Sta.:	IV(1); V(5); VI(4); VII(2); IX(2): Records = 14		blacklight trap
1	Highlands	Avon Park, nr.	2-VIII-61	T. Morris	blacklight trap
1	Highlands	Avon Park, nr.	30-IV-62	T. Morris	blacklight trap
2	Highlands	Avon Park, nr.	28-V-62	T. Morris	blacklight trap
1	Highlands	Avon Park, nr.	21-VI-62	T. Morris	blacklight trap
1	Highlands	Avon Park, nr.	25-VI-62	T. Morris	blacklight trap
1	Highlands	Childs Crossing, 0.5mi. W	11-VIII-38	Hubbell & Friauf	
4	Highlands	Sebring	2-V-61	T. Morris	blacklight trap
1	Highlands	Sebring	31-V-61	T. Morris	blacklight trap
1	Highlands	Sebring	22-VI-61	J.C. Hanlon	blacklight trap
2	Hillsborough	Little Manatee River	14-15-VIII-38	Hubbell & Friauf	
11	Hillsborough	Plant City, 2.1mi. W	19-VIII-38	Hubbell & Friauf	
1	Hillsborough	Tampa	?-VIII-52	J. Gross	
2	Hillsborough	Tampa	12-VIII-65	T.J. Favoroso	Japanese beetle trap
1	Hillsborough	Tampa	29-VIII-66	T.J. Favoroso	Steiner trap
2	Lake		26-VIII-38	Hubbell & Friauf	
1	Lake		21-VI-60	C. Mosteller	Japanese beetle trap
1	Lake		9-VIII-68	B. Galbreath	
1	Lake	Astor, 7mi. SW	28-VIII-38	Hubbell & Friauf	
1	Lake	Cassia, 5.5mi. NE	26-VIII-38	Hubbell & Friauf	
1	Lake	Eustis	25-VI-35	I.J. Cantrall	
1	Levy		9-IX-55	H.V. Weems, Jr.	at light
5	Marion		26-VII-38	Hubbell & Friauf	
1	Marion		27-VII-38	Hubbell & Friauf	
1	Marion	Ocala, 9mi. SSW	21-V-75	Holler & Woodruff	blacklight trap#2;turkey
1	Marion	Ocala, 9mi. SSW	28-VI-75	P.C. Drummond	blacklight trap #5
1	Marion	Ocala National Forest	23-VII-38	Hubbell & Friauf	
1	Marion	Ocala National Forest	1-IX-38	Hubbell & Friauf	
7	Marion	Silver Springs Woods	11-20-VI-84	S.A. Marshall	Malaise trap
1	Orange	Plymouth	6-IV-83	D. Phelps	
2	Palm Beach	West Palm Beach	22-V-12-VI-?		
1	Pasco	Hudson	13-VII-39	R.H. Beamer	
5	Pasco	Hudson	13-VII-39	P.W. Oman	
2	Pinellas	Tarpon Springs, 2.4mi. E	17-VIII-38	Hubbell & Friauf	
2	Polk		26-VIII-23	Alexander-Walker	
1	Polk		19-VIII-38	Hubbell & Friauf	
1	Polk	Hesperides, 0.75mi. E	9-VIII-38	Hubbell & Friauf	
4	Polk	Lake Alfred	25-26-VI	A.H. Beyer	
1	Polk	Lake Arbuckle	15-IX-87	P. Martin	pitfall trap
1	Polk	Lake Streaty	10-VIII-38	Hubbell & Friauf	
2	Polk	Winter Haven	31-V-40		
1	Polk	Winter Haven	21-V-60	W.P. Henderson	at light
1	Polk	Winter Haven	28-VI-60	W.P. Henderson	
5	Putnam	Melrose	1-VII-70	R.E. Brown	blacklight trap
4	Putnam	Vause Lake	16-VI-84	P.M. Choate, Jr.	blacklight trap
1	Santa Rosa	Jay	9-V-62	T.W. Boyd	blacklight trap
1	Sarasota	Venice	9-V-61	E.H. Frederic	Japanese beetle trap
1	Volusia		30-VIII-38	Hubbell & Friauf	
1	Volusia	Daytona Beach	5-VII-35	I.J. Cantrall	

Appendix 12. *Phyllophaga floridana* Robinson

1	Alachua	Gainesville	26-IV-84	L.R.Davis, Jr.	blacklight trap
1	Brevard		23-III-54	H.V.Weems, Jr.	light
1	Hernado	Brooksville, 3.5mi.S	11-VII-69	C.B.Williams	blacklight trap
1	Highlands	Highlands Hammock St.Pk.	4-VIII-75	M.C.Thomas & J.H.Frank	at light
2	Highlands	Highlands Hammock St.Pk.	23-25-VI-81	S.B.Peck	blacklight trap
1	Hillsborough		11-VIII-83		
1	Hillsborough	Hillsborough R.St.Pk.	25-III-59	R.E.Woodruff	
1	Hillsborough	Hillsborough R.St.Pk.	5-VI-65	J.W.Patton	at light
3	Hillsborough	Hillsborough R.St.Pk.	5-VIII-81	S.B.Peck	blacklight trap
					oak-palm forest
6	Hillsborough	Hillsborough R.St.Pk.	9-10-VIII-83	K.W.Vick	blacklight trap
1	Hillsborough	Tampa, USF campus	24-III-84	L.Brown	
1	Manatee	Bradenton	14-VI-36		at light, no.7584
1	Manatee	Bradenton, 8mi.S	7-VI-61	J.C.Courtney	Japanese beetle trap
2	Marion	Gores Landing, site #2	4-VI-75	N. Holler	blacklight trap
1	Marion	Gores Landing, downriver	4-VI-75		blacklight trap
6	Marion	Heather Isl., N end of	12-VI-75	P.C.Drummond	blacklight trap
2	Marion	Heather Isl., N end of	11-VII-75	P.C.Drummond	blacklight trap
1	Putnam	Ocala N.F.,Johnson Fld.Cpgd	13-IV-71	A.Newton	blacklight trap
2	Seminole	Sanford	24-IV-60	C.O.Voutrey	at light
1	Seminole	Sanford	25-V-61	G.W.Desin	blacklight trap
3	Seminole	Sanford	7-VII-61	G.W.Desin	blacklight trap
1	St.John's	I-95 at hwy. 206	9-IV-83	E.G.Riley	at light

Appendix 13. *Phyllophaga forsteri* (Burmeister)

4	Duval	Mayport	24-IV-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	10-V-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	31-V-61	L.W. Taylor	blacklight trap
4	Gadsden	Aspalaga Landing Rd.	8-IV-84	L.R. Davis, Jr.	
2	Gadsden	Glen Julia Springs	6-VI-54	F.N. Young	
1	Gadsden	Quincy	8-V-61	W.B. Tappan	blacklight trap
1	Jackson	Fla. Caverns St. Pk.	18-IV-63	R.E. Woodruff	blacklight trap
1	Jackson	Fla. Caverns St. Pk.	20-IV-80	R.M. Brattain	
5	Jackson	Fla. Caverns St. Pk.	30-V-88	P.E. Skelley	on oaks
1	Jackson	Fla. Caverns St. Pk.	30-VI-88	P.E. Skelley	blacklight trap
36	Jackson	Fla. Caverns St. Pk.	13-IV-89	Woodruff,Beck & Skelley	*Quercus nigra*
1	Jefferson	Monticello	26-IV-69	W.H. Whitcomb	blacklight trap
1	Liberty	Camp Torreya	30-V-24	C.F. Bellamy	
1	Liberty	Camp Torreya	26-IV-29	T.H. Hubbell	
46	Liberty	Torreya St. Pk.:	III(1); IV(9); V(2); VI(2): Records = 14		blacklight trap
1	Liberty	Torreya St. Pk.	26-27-III-88	P.E. Skelley	ex laurel oak
2	Putnam	Welaka Res. Sta.	8-11-IV-83	E.G. Riley	

Appendix 14. *Phyllophaga georgiana* (Horn)

1	Escambia	Bratt	22-VI-61	F.S. Blanton	mosquito light trap
1	Escambia	Bratt	VI-68	F.S. Blanton	mosquito light trap
1	Escambia	Bratt	29-VIII-68	D.C. Blanton	mosquito light trap
1	Escambia	Molino	12-IX-68	E.N. Bishop	blacklight trap
1	Escambia	Molino	19-VI-69	E.N. Bishop	blacklight trap
21	Hamilton	Suwannee River, Rt. 6	4-VII-81	Choate & Davis	blacklight trap
7	Hamilton	Suwannee River, Rt. 6	6-VII-83	P.M. Choate, Jr.	
1	Jefferson	Monticello, Big Bend Lab.	20-VIII-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello, Big Bend Lab.	1-IX-68	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello, Big Bend Lab.	9-VI-69	R.E. Woodruff	blacklight trap
2	Jefferson	Monticello, Big Bend Lab.	19-VI-69	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello, Big Bend Lab.	4-VII-69	R.E. Woodruff	blacklight trap
1	Jefferson	Monticello, Big Bend Lab.	6-VII-69	W.H. Whitcomb	blacklight trap
2	Jefferson	Monticello, Big Bend Lab.	10-VII-69	R.E. Woodruff	blacklight trap
1	Jefferson	Monticello, Big Bend Lab.	17-VII-69	W.H. Whitcomb	blacklight trap
1	Leon	Tall Timbers Res. Sta.	8-19-VI-68	L. Collins	Plot TT-3
1	Leon	Tall Timbers Res. Sta.	8-VI-69	A. Bhatkar	blacklight trap
1	Leon	Tall Timbers Res. Sta.	8-15-VIII-69	L. Collins	Plot TT-3
1	Leon	Tall Timbers Res. Sta.	14-VIII-69	R.E. Woodruff	blacklight trap
4	Leon	Tall Timbers Res. Sta.	4-VII-72	C.W. O'Brien	blacklight trap

Appendix 14 (cont.). *Phyllophaga georgiana* (Horn)

1	Leon	Tall Timbers Res. Sta.	8-VII-72	C.W. O'Brien	ultraviolet light
1	Leon	Tall Timbers Res. Sta.	12-VII-72	C.W. O'Brien	blacklight trap
1	Leon	Tall Timbers Res. Sta.	17-VIII-72		light trap
1	Leon	Tall Timbers Res. Sta.	7-IX-72		
1	Santa Rosa	Blackwater Riv. St. For.	27-VI-81	P.M. Choate, Jr.	
1	Santa Rosa	Jay	6-VI-62	T.W. Boyd	blacklight trap
1	Suwannee	S-136 & Rocky Creek	28-IX-76	J.R. Wiley	blacklight trap

Appendix 15. *Phyllophaga glaberrima* (Blanchard)

1	Alachua		29-VII-53	W. Whittaker	
1	Alachua		23-V-54	H.M. Van Pelt	at light
18	Alachua		25-VI-58	S. Clark	
3	Alachua		9-VII-58	S. Clark	
1	Alachua		26-V-59	Newman	
1	Alachua		3-VII-68	P. Hames	
1	Alachua		4-VII-72	R.L. Worley	
1	Alachua		8-VIII-72	B. Noel	
10	Alachua	Archer, 2.5mi. SW	20-VI-88	P.E. Skelley	blacklight trap
6,038	Alachua	Gainesville: V(36); VI(90); VII(95); VIII(84); IX(30); X(1); XI(1):		Records = 337	blacklight trap
2	Alachua	Hills	23-IV-49	S. B. Mansell	
2	Alachua	Newberry	1-VIII-83	K.W. Vick	blacklight trap
2	Alachua	Newberry	2-VIII-83	K.W. Vick	blacklight trap
1	Alachua	Newberry	4-VIII-83	K.W. Vick	blacklight trap
1	Alachua	Newberry	8-VIII-83	K.W. Vick	blacklight trap
1	Alachua	Paynes Prairie St. Pk.	1-VII-82	P.C. Drummond	blacklight trap
1	Alachua	R20E, T10S, Sec. 5	21-V-49	E.H. McConkey	
1	Alachua	Rt. 441 & Marion co.line	13-IX-81	L.R. Davis, Jr.	in road
1	Baker	Glen St. Mary	1-VIII-69	H.W. Collins	blacklight trap
2	Baker	Glen St. Mary	6-VIII-69	H.W. Collins	blacklight trap
1	Baker	Glen St. Mary	23-VI-70	H.W. Collins	blacklight trap
2	Baker	Macclenny	4-VI-69	H.W. Collins	blacklight trap
5	Baker	Macclenny	11-VI-69	H.W. Collins	blacklight trap
5	Baker	Macclenny	24-VI-69	H.W. Collins	blacklight trap
2	Baker	Macclenny	28-VI-69	H.W. Collins	blacklight trap
1	Baker	Olustee	27-V-63	E.P. Merkel	blacklight trap
1	Baker	Olustee	3-VI-63	E.P. Merkel	blacklight trap
1	Baker	Olustee	4-VI-63	E.P. Merkel	blacklight trap
4	Baker	Olustee	27-VI-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	2-4-VII-66	E.P. Merkel	blacklight trap
3	Baker	Olustee	9-10-VII-66	E.P. Merkel	blacklight trap
2	Baker	Olustee	12-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	20-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	10-15-IX-66	E.P. Merkel	blacklight trap
1	Brevard	Eau Gallie	5-VI-40		
1	Brevard	Eau Gallie	18-IX-40		
2	Brevard	Eau Gallie	?-VI-41		
1	Brevard	Eau Gallie	1-IX-41		
1	Brevard	Eau Gallie Beach	8-VII-38	Hubbell & Friauf	
1	Brevard	Orsino	4-V-62	J. Favoroso	citrus roots
2	Broward	Deerfield Beach	23-X-78	D.C. Clinton	on house plant
41	Broward	Fort Lauderdale:	IV(3); V(6); XI(1):	Records = 10	blacklight trap
1	Broward	Oakland Park	5-IV-83	D. Leone	at light
1	Broward	Pompano	5-VI-81	A. Gardner	blacklight trap
1	Broward	Pompano Beach	22-VIII-67	D.C. Clinton	blacklight trap
10	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	
1	Citrus	Inverness	19-V-39		
1	Citrus	Inverness	10-VI-39		
1	Citrus	Inverness	18-V-41		
2	Clay	Gold Head Branch St. Pk.	12-VII-63	B.K. Dozier	
7	Clay	Gold Head Branch St. Pk.	16-VI-81	S. Peck	blacklight trap
2	Clay	Kingsley Lake	6-VII-31	G.B. Merrill	
110	Collier	Immokalee	5-IV-59	H.V. Weems, Jr.	at light
1	Collier	Immokalee	13-20-IV-60	H.M. Faircloth	blacklight trap
75	Collier	Immokalee	20-27-IV-60	H.M. Faircloth	blacklight trap
8	Collier	Immokalee	27-IV-4-V-60	H.M. Faircloth	blacklight trap

Appendix 15 (cont.). *Phyllophaga glaberrima* (Blanchard)

2	Collier	Marco Beach	3-V-68	J. Stibick	
4	Collier	Marco Island	2-V-68	R.E. Woodruff	at blacklight
2	Columbia		22-VII-25	T.H. Hubbell	
6	Columbia	Camp Oleno	3-VI-55	L.C. Kuitert	light
2	Columbia	Lake City	2-VI-1899		
9	Columbia	Lake City	24-VI-80	E. Graham	blacklight trap
1	Dade		16-III-57	D. Thornton	
28	Dade	Miami:	III(4); IV(8); VI(1); VIII(2); XI(1): Records = 16 various hosts		
3	De Soto	Arcadia	23-IV-41	J.H. Sealey	
4	Duval		25-VI-83	P.M. Choate, Jr.	
199	Duval	Jacksonville:	V(1); VI(6); VII(2): Records = 9		blacklight trap
1	Duval	Mayport	31-V-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	7-VI-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	2-VIII-61	L.W. Taylor	blacklight trap
7	Duval	Mayport	6-IV-62	L.M. Taylor	blacklight trap
1	Duval	Mayport	12-VI-83	A. Cameron	
1	Duval	Mayport	24-VI-83	A. Cameron	blacklight trap
22	Escambia	Walnut Hill	12-VI-69	E.N. Bishop	blacklight trap
4	Gadsden	Quincy	30-V-61	W.B. Tappan	blacklight trap
1	Gulf	White City	5-V-62	F.I. Jeffrey	peach soil ball
1	Hardee	New Zion	29-V-63	R.H. Rhodes	Steiner trap
9	Hernando	Brooksville, 3mi. S	31-VII-69	C.B. Williams	blacklight trap
1	Hernando	Weekiwatchee Springs	20-VIII-38	Hubbell & Friauf	
2	Highlands		23-V-61	T. Morris	blacklight trap
2	Highlands		29-IV-63	Walker & Spooner	
1	Highlands	Archbold Biol. Sta.	22-24-III-78	L.L. Lampert	blacklight trap
2	Highlands	Archbold Biol. Sta.	16-IV-48	R.W. Dawson	
2	Highlands	Archbold Biol. Sta.	5-V-67	S.W. Frost	
5	Highlands	Archbold Biol. Sta.	22-24-III-78	L.L. Lampert	blacklight trap
2	Highlands	Archbold Biol. Sta.	2-5-IV-78	Weems & Klein	insect flight trap
1	Highlands	Archbold Biol. Sta.	14-18-IV-79	L. Lampert	blacklight trap
5	Highlands	Archbold Biol. Sta.	28-IV-3-V-79	L.L. Lampert	blacklight trap
1	Highlands	Archbold Biol. Sta.	1-2-VII-88	P.E. Skelley	blacklight trap
1	Highlands	Avon Park	25-IV-61	A.C. Collier	
1	Highlands	Avon Park	10-12-VI-81	J.F. Reinert	
1	Highlands	Avon Park, nr.	21-VI-61	T. Morris	blacklight trap
2	Highlands	Avon Park, nr.	15-V-62	T. Morris	blacklight trap
2	Highlands	Avon Park, nr.	7-VI-61	T. Morris	blacklight trap
4	Highlands	Highlands Hammock St. Pk.	5-V-61	Ted Morris	blacklight trap
7	Highlands	Highlands Hammock St. Pk.	23-25-VI-81	S. Peck	blacklight trap
1	Highlands	Highlands Hammock St. Pk.	30-IV-83	J.B. Heppner	
1	Highlands	Lake Letta Subdivision	5-IV-62	T. Morris	blacklight trap
2	Highlands	Lake Placid, 13mi. N	5-VI-76	R. Turnbow	at light
1	Highlands	Sebring	13-V-39	F.N. Young	
2	Highlands	Sebring	1946	H.V. Weems, Jr.	
1	Highlands	Sebring	13-VI-62	L.B. Hill	roadway
1	Hillsborough		VI-16		
2	Hillsborough	Brandon	11-V-62	J.W. Patton	at light
3	Hillsborough	Hillsborough R. St. Pk.	5-VI-65	J.W. Patton	at light
1	Hillsborough	Hillsborough R. St. Pk.	5-VIII-81	S. Peck	blacklight trap
9	Hillsborough	Hillsborough R. St. Pk.	9-10-VIII-83	K.W. Vick	blacklight trap
8	Hillsborough	Tampa	20-V-27	U.C. Zeluff	
1	Hillsborough	Tampa	26-IV-50	R.W. Lindner	Japanese beetle trap
1	Hillsborough	Tampa	10-V-50	R.W. Lindner	Japanese beetle trap
1	Hillsborough	Tampa	2-VIII-61	J.W. Patton	at light
1	Hillsborough	Tampa	18-VI-65	T.J. Favoroso	Japanese beetle trap
1	Hillsborough	USF Campus	13-VIII-83	L. Brown	
2	Indian River	Vero Beach	21-IV-76	M.C. Thomas	at light
79	Indian River	Vero Beach, 5mi. S	16-26-VI-83	J.H. Frank	Malaise trap
46	Indian River	Vero Beach, 5mi. S	26-VI-6-VII-83	J.H. Frank	Malaise trap
17	Indian River	Vero Beach, 5mi. S	6-16-VII-83	J.H. Frank	Malaise trap
5	Indian River	Vero Beach, 5mi. S	16-25-VII-83	J.H. Frank	Malaise trap
5	Indian River	Vero Beach, 5mi. S	25-VII-9-VIII-83	J.H. Frank	Malaise trap
1	Jackson	Marianna	11-VI-70	E.L. Tipton	blacklight trap
55	Jefferson	Monticello:	V(2); VI(14); VII(16); VIII(2): Records = 34		blacklight trap
1	Lake		9-VII-58	T.J. Walker, Jr.	
1	Lake	Eustis	17-V-65	L.W. Holley	on screen
1	Lake	Eustis, 8.5mi. E	25-VIII-38	Hubbell & Friauf	

Appendix 15 (cont.). *Phyllophaga glaberrima* (Blanchard)

5	Lake	Fruitland Pk., 2mi. W	24-VI-85	R.E. Woodruff	blacklight trap
1	Lake	Groveland	6-IX-60	W.P. Henderson	
2	Lake	Groveland	2-VI-80	W.P. Henderson	*Rhapis excelsa*
1	Lake	Mascotte	2-IX-64	W.P. Henderson	in soil;citrus
1	Lake	Pittman	5-VIII-69	K. Lorenzen	blacklight trap
1	Lake	Tavares, 2mi. W	4-VIII-38	Hubbell & Friauf	
1	Lee	Fort Myers	8-IV-37	J.G. Franclemont	
1	Lee	Fort Myers	29-IV-66	B.H. Crews	
1	Lee	Fort Myers	15-IV-75	V.W. Yingst	
1	Lee	Fort Myers, N	?-VI-80	L. Fisher	
1	Lee	Lehigh Acres	16-V-80	C.E. Nelson	in Steiner trap
1	Lee	Lehigh Acres	16-VI-80	C.E. Nelson	calamondin
4	Lee	Lehigh Acres	17-19-IV-82	N.M. Downie	
61	Leon	Tall Timbers Res. Sta.:	V(1); VI(15); VII(11); VIII(2): Records = 29		blacklight trap
1	Levy	Archer, 3.8mi. SW	19-26-VI-88	P.E. Skelley	Malaise trap
1	Levy	Bronson	10-VI-60	T.R. Adkins	Japanese beetle trap
1	Levy	Chiefland	18-VII-63	T.R. Adkins	Japanese beetle trap
1	Levy	Williston	19-VI-63	T.R. Adkins	Japanese beetle trap
3	Levy	Williston	14-VIII-63	T.R. Adkins	Japanese beetle trap
1	Levy	Yankeetown	16-VII-83	T.H. Lillie	truck trap
2	Levy	Yankeetown	25-VII-83	T.H. Lillie	vehicle trap
1	Levy	Yankeetown	2-VIII-83	T.H. Lillie	truck trap
1	Liberty	Camp Torreya	1925	T.H. Hubbell	
1	Liberty	Torreya St. Pk.	23-VIII-51	I.J. Cantrall	
1	Liberty	Torreya St. Pk.	5-VII-82	E.G. Riley	
1	Madison	Aucilla River	4-VI-38	F.N. Young	
1	Madison	Aucilla River, nr.	6-VI-38	F.N. Young	
3	Madison	Lee, 3mi. N	14-VI-77	R. Mercer	blacklight trap
2	Madison	Lee, 3mi. N	20-VI-77	R. Mercer	blacklight trap
2	Madison	Lee, 3mi. N	13-VIII-77	R. Mercer	blacklight trap
1	Manatee	Bradenton	20-VI-36		at light
2	Manatee	Bradenton	28-IV-62	E.H. Frederic	on screen
1	Manatee	Bradenton	15-XII-64	E.H. Fredrich	
2	Manatee	Bradenton	25-V-65	E.H. Frederic	Japanese beetle trap
2	Manatee	Bradenton	14-17-VI-80	C.D.F.	
1	Manatee	Oneco		P. Dillman	
2	Manatee	Palmetto	12-V-65	E.H. Frederic	Japanese beetle trap
2	Manatee	Palmetto	18-V-66	E.H. Frederic	Japanese beetle trap
1	Manatee	Palmetto	1-V-67	C.J. Bickner	at night on screen
2	Manatee	Palmetto Key	10-III-42	C.M. Breeder	
217	Marion	Ocala: V(1); VI(5);	VII(6); VIII(5); IX(2); XI(1): Records = 20		blacklight trap
48	Marion	Ocala, 14mi. SW	12-VI-75	P.C. Drummond	blacklight trap
1	Marion	Ocala National For.	13-VI-38	Hubbell & Friauf	
1	Marion	Ocala National For.	24-VII-38	Hubbell & Friauf	
1	Marion	Ocala National For.	28-VII-38	Hubbell & Friauf	
1	Marion	Ocala N.F., Juniper Sprs.	10-VII-63	B.K. Dozier	at light
6	Marion	Sharpe's Ferry	1-8-VIII-75	N. Holler	Malaise trap
2	Marion	Sharpe's Ferry Field Sta.	8-VIII-75	Drummond & Wiley	blacklight trap
1	Martin	Bluefield	16-VI-82	E. Campbell	McPhail trap
1	Martin	Hobe Sound	3-V-78	E.W. Campbell	white mangrove
1	Monroe	Plantation	5-VI-73	J.A. Tucoulat	orange
11	Okeechobee	Okeechobee	10-VI-61	R.E. Woodruff	at light
1	Orange	Orlando	4-III-20	F.W. Walker	
1	Orange	Orlando	24-V-62	J.L. Woodley	Japanese beetle trap
13	Orange	Orlando	21-VI-62	C.E. Mosteller	Japanese beetle trap
1	Orange	Orlando	28-VI-62	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	29-VI-62	W.A. Avazian	Japanese beetle trap
2	Orange	Orlando	29-IV-63	J.R. Woodley	Steiner trap
1	Orange	Orlando	4-VI-84	W. Eckles	*Malus* sp.
2	Orange	Winter Park	22-VII-39		light
3	Orange	Winter Park	28-V-40	H.T. Fernald	light
1	Orange	Winter Park	21-VI-40	H.T. Fernald	light
1	Orange	Winter Park	8-VIII-40	H.T. Fernald	light
1	Orange	Winter Park	23-V-41	H.T. Fernald	light
1	Orange	Winter Park	9-VII-42	H.T. Fernald	light
1	Orange	Winter Park	7-VIII-42	H.T. Fernald	light
1	Orange	Winter Park	16-VIII-42	H.T. Fernald	light
1	Orange	Winter Park	19-VIII-43	H.T. Fernald	light

Appendix 15 (cont.). *Phyllophaga glaberrima* (Blanchard)

1	Orange	Winter Park	31-V-62	J.R. Woodley	Japanese beetle trap
1	Orange	Winter Park	8-VII-79		
5	Palm Beach		24-III-69	P.M. Choate, Jr.	
6	Palm Beach	Greenacres City	26-IV-52	W.G. Genung	
1	Palm Beach	Lake Worth	9-IV-53	W.G. Genung	at light
2	Pasco	Dade City	22-VIII-61	J.C. Sellers	St. Augustine lawn
10	Pinellas	St. Petersburg	1-3-VI-62	R.H. Forsyth	blacklight trap
1	Pinellas	St. Petersburg	17-V-66	R.H. Forsyth	
1	Pinellas	St. Petersburg	10-VI-69	W.C. Carroll	Calamondin
1	Polk	Bartow	3-VII-62	R.E. Vild	Steiner trap
1	Polk	Winter Haven	29-V-62	R.W. Robnett	blacklight trap
1	Putnam	Johnson, 1mi. S	16-VI-84	P.M. Choate, Jr.	blacklight trap
1	Putnam	Little Orange Lake	3-VI-84	K.W. Vick	blacklight trap
1	Putnam	Little Orange Lake	20-VI-84	K.W. Vick	blacklight trap
8	Putnam	Little Orange Lake	23-VI-84	K.W. Vick	blacklight trap
2	Putnam	Little Orange Lake	26-VI-84	K.W. Vick	blacklight trap
5	Putnam	Little Orange Lake	28-VI-84	K.W. Vick	blacklight trap
11	Putnam	Melrose	1-VII-70	R.E. Brown	blacklight trap
5	Putnam	Melrose, 3mi. S	31-V-83	B. Beck	blacklight trap
11	Putnam	Melrose, 3mi. S	8-VI-83	B. Beck	blacklight trap
11	Putnam	Melrose, 3mi. S	9-VI-83	B. Beck	blacklight trap
5	Putnam	Melrose, 3mi. S	3-VI-87	B. Beck	blacklight trap
1	Putnam	Palatka	15-VII-63	T.R. Adkins	Japanese beetle trap
1	Putnam	Ravine Gardens St. Pk.	10-VI-83	G.B. Edwards	
1	Putnam	Satsuma, 1.7mi. NE	30-VII-38	Hubbell & Friauf	
3	Santa Rosa	Jay	9-V-62	T.W. Boyd	blacklight trap
1	Santa Rosa	Milton	2-VI-53		
1	Sarasota	Englewood	16-IV-82	N.M. Downie	
1	Sarasota	Myakka River St. Pk.	2-VI-54	H.V. Weems, Jr.	
1	Sarasota	Myakka River St. Pk.	21-VI-73	J.B. Heppner	at blacklight
24	Sarasota	Myakka River St. Pk.	27-VI-81	S. Peck	blacklight trap
1	Sarasota	Sarasota	25-V-65	E.H. Frederic	Japanese beetle trap
1	Sarasota	Venice	14-V-62	C.L. Yax	Japanese beetle trap
1	Sarasota	Venice	31-V-62	C.L. Yax	Japanese beetle trap
1	Seminole	Sanford	11-VII-51	Price, Beamer, Wood	
1	Seminole	Sanford	22-VI-60	G.W. Desin	
1	Seminole	Sanford	1-VII-61	G.W. Desin	
3	Seminole	Sanford	2-V-62	G.W. Desin	blacklight trap
16	Seminole	Sanford	22-V-62	G.W. Desin	blacklight trap
3	Seminole	Sanford	1-VI-62	G.W. Desin	Japanese beetle trap
3	Seminole	Sanford	19-VI-62	G.W. Desin	blacklight trap
4	St. Johns	Crescent Beach	25-VI-60	R.E. Woodruff	
1	St. Lucie	Fort Pierce	13-V-83	K. Hibbard	soil
1	Sumter	Wildwood	11-VIII-61	J.C. Sellers	soil
5	Suwannee	Suwannee River St. Pk.	8-VIII-81	S. Peck	blacklight trap
1	Suwannee	Suwannee Springs	15-VI-51	Price, Beamer,& Wood	
45	Taylor	Perry: IV(1); V(1); VI(12); VII(2); VIII(4); IX(1): Records = 21			blacklight trap
1	Union	Hwy.241,1km.N.Santa Fe R.	2-VIII-85	C.W. Mills,III	
1	Union	Hwy.241,1km.N.Santa Fe R.	28-VII-87	C.W. Mills,III	
1	Volusia		6-VIII-56	H.A. Denmark	sweeping grasses
1	Volusia	Enterprise	7-VI-46	F.N. Young	
2	Volusia	New Smyrna Beach	12-V-?	M. Wright	
1	Volusia	New Smyrna Beach	31-V-62	G.W. Desin	Japanese beetle trap
1	Volusia	New Smyrna Beach	1-VI-62	G.W. Desin	Japanese beetle trap
1	Wakulla	Ochlockonee Riv. St. Pk.	22-I-73	Fairchild & Wilkerson	
9	Wakulla	Panacea	17 & 19 VI-67	C. Hilfiker	on surf
7	Wakulla	Panacea	17-19-VI-67	C. Hilfiker	P-1
3	Wakulla	Panacea	21-29-VI-67	C. Hilfiker	P-1
3	Wakulla	Panacea	10-VIII-67	C. Hilfiker	on surf
1	Walton	Freeport		F.N. Young #432	cypress

Appendix 16. *Phyllophaga gracilis* (Burmeister)

2	Alachua		19-VI-77	L. Ferreira	
1	Alachua		20-VI-86	P.T. Grady	
1	Alachua	Alachua	18-V-76	W.D. Pope	blacklight trap
90	Alachua	Gainesville: V(4); VI(8); VII(5): Records = 17			blacklight trap

Appendix 16 (cont.). *Phyllophaga gracilis* (Burmeister)

16	Baker	Macclenny	11-VI-69	H. Collins	blacklight trap
4	Baker	Olustee	29-V-63	E.P. Merkel	blacklight trap
1	Escambia	Gonzalez	27-VI-84	R. Hill	
23	Escambia	Molino	19-VI-69	E.N. Bishop	blacklight trap
21	Escambia	Molino	26-VI-69	E.N. Bishop	blacklight trap
42	Escambia	Molino	3-VII-69	E.N. Bishop	blacklight trap
31	Escambia	Molino	10-VII-69	E.N. Bishop	blacklight trap
1	Escambia	Pensacola	19-VI-83	O.E. Hunt	
1	Hillsborough	Springhead	27-IV-79	Simmons & Hale	*Lycopersicon esculentum*
355	Jefferson	Monticello:	V(1); VI(30); VII(16):Records = 47		blacklight trap
1	Leon	Lake Jackson	5-22-VI-22	J.S. Alexander	
735	Leon	Tall Timbers Res. Sta.:	V(9); VI(20); VII(18); VIII(2): Records = 49		blacklight trap
160	Liberty	Torreya St. Pk.:	V(1); VI(6); VII(14); VIII(2): Records = 23		blacklight trap
1	Marion	Ocala	16-VI-61	T.R. Adkins	Japanese beetle trap
5	Marion	Ocala	2-VI-62	T.R. Adkins	blacklight trap
30	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
10	Marion	Ocala	20-VII-62	T.R. Adkins	blacklight trap
5	Marion	Ocala	26-VII-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	11-VI-63	T.R. Adkins	Japanese beetle trap
1	Marion	Ocala	20-VI-63	T.R. Adkins	Japanese beetle trap
1	Marion	Ocala	29-VI-77	M.C. Thomas	blacklight trap
4	Marion	Ocala	8-VII-77	M.C. Thomas	blacklight trap
1	Okaloosa	Holt, 4.5mi. NW	15-16-VI-78	L.A. Stange	blacklight trap
1	Santa Rosa		13-V-58	R.E. Woodruff	at light
12	Santa Rosa	Milton, Avalon Bch.	15-IX-83	R. Hill	blacklight trap
1	Taylor	Perry	25-VI-69	W.L. Beers	blacklight trap

Appendix 17. *Phyllophaga hirticula* (Knoch)

3	Jackson	Fla. Caverns St. Pk.	13-IV-60	H.A. Denmark	at *Quercus*
4	Jefferson	I-10 exit at Rt. 59	28-IV-84	L.R. & S.L. Davis	
1	Leon		23-III-21	W.A. McRae	at *Prunus* sp.
19	Leon		23-III-25	J.T. Diamond	*Prunus*
1	Leon		8-IV-62	E. Ellis	
3	Leon	I-10 exit & Rt. 319	20-IV-84	L.R. Davis, Jr.	
18	Leon	I-10 exit & Rt. 319	28-IV-84	L.R. & S.L. Davis	at light
1435	Leon	Tall Timbers Res. Sta.:	III(5); IV(36); V(37); VI(1): Records = 78		blacklight trap
1	Leon	Tallahassee	23-III-25	J.T. Diamond	
18	Leon	Tallahassee	16-IV-76	J. Schuh	light
1	Okaloosa	Holt, 3.5mi. NW, FAMU	9-VI-72	R. Turnbow	

Appendix 18. *Phyllophaga infidelis* (Horn)

1	Alachua		13-V-?		
5	Alachua		17-III-38		
1	Alachua	Co. Rd. 17B	29-IV-83	K.W. Vick	blacklight trap
1	Alachua	Co. Rd. 17B	3-V-83	K.W. Vick	blacklight trap
1	Alachua	Co. Rd. 17B	9-V-83	K.W. Vick	blacklight trap
1	Alachua	Co. Rd. 17B	27-V-83	K.W. Vick	blacklight trap
1	Alachua	Co. Rd. 17B	22-IV-84	K.W. Vick	blacklight trap
1	Alachua	Gainesville	17-IV-89	P.E. Skelley	light
123	Alachua	Gainesville: III(4); IV(35); V(39); VI(39); VII(6): Records = 123			blacklight trap
1	Alachua	Gainesville, 3mi. SW	30-V-73	J.B. Heppner	at blacklight
1	Alachua	Gainesville, 6mi. SW	29-III-75	L.R. Davis, Jr.	blacklight trap
1	Alachua	Gainesville, Serenola For.	14-IV-89	P.J. Landolt	at light
1	Columbia	Lake City		Wickham colln.	
2	Dixie	Old Town, 3.5mi. N	8-V-78	M.C. Thomas	
1	Hillsborough	Tampa	24-V-54	F.W. Mead	
1	Hillsborough	USF Campus	24-III-84	L. Brown	
24	Jefferson	Monticello:	III(1); IV(1); V(8); VI(7): Records = 17		blacklight trap
1	Leon		30-IV-35	H.S. Peters	
1	Leon	I-10 exit & Rt. 319	20-IV-84	L.R. Davis, Jr.	
1	Leon	Rt. 20 & 263	28-IV-84	L.R. Davis, Jr.	
1	Leon	Tall Timbers Res. Sta.	18-VI-69	A. Bhatkar	blacklight trap
1	Leon	Tall Timbers Res. Sta.	13-20-V-70	D. Harris	blacklight trap
2	Leon	Tallahassee	28-IV-48	R.W. Dawson	

Appendix 18 (cont.). *Phyllophaga infidelis* (Horn)

5	Marion	Ocala	5-IV-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	27-IV-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	2-VI-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	27-III-77	M.C. Thomas	blacklight trap
1	Okaloosa	Crestview	17-VI-61	D.R. Paulson	at lights
2	Putnam	Interlachen	?-IV-51	H. & A. Howden	on *Quercus falcata*
1	Union	Hwy.241,1km.N.Santa Fe R.	13-V-86	C.W. Mills,III	at incandescent light

Appendix 19. *Phyllophaga knochii* (Schoenherr & Gyllenhal)

4	Escambia	Molino	22-V-69	E.N. Bishop	blacklight trap
2	Escambia	Molino	5-VI-69	E.N. Bishop	blacklight trap
2	Escambia	Molino	19-VI-69	E.N. Bishop	blacklight trap
7	Escambia	Pensacola	22-28-IV-63	S. Hills	at light
6	Escambia	Pensacola	13-18-V-63	S. Hills	at light
2	Gadsden	Aspalaga Landing Rd.	8-IV-84	L.R. Davis, Jr.	
2	Gadsden	Glen Julia Springs	6-VI-54	F.N. Young	
1	Gadsden	Quincy, 12mi. S	14-VI-83	C. Boyles-Sprenkel	light at night
2	Gadsden	Rt. 269; Flat Creek	8-IV-84	L.R. Davis, Jr.	
5	Jackson	Fla. Caverns St. Pk.	13-IV-60	H.A. Denmark	at light
43	Jackson	Fla. Caverns St. Pk.	18-IV-63	R.E. Woodruff	blacklight trap
10	Jackson	Fla. Caverns St. Pk.	13-IV-89	Woodruff,Beck & Skelley	blacklight
3	Jackson	Marianna	1-V-70	E.L. Tipton	blacklight trap
1	Jackson	Marianna	7-V-70	E.L. Tipton	blacklight trap
2	Jackson	Marianna	26-V-70	E.L. Tipton	blacklight trap
4	Jackson	Marianna	11-VI-70	E.L. Tipton	blacklight trap
1	Jefferson	Monticello	27-IV-59	A.M. Phillips	blacklight trap
1	Leon	Ochlocknee R., 0.5mi. E	20-IV-84	L.R. Davis, Jr.	
1	Leon	Tall Timbers Res. Sta.	2-IV-68	W. Baker	Plot TT-1
1	Leon	Tall Timbers Res. Sta.	28-IV-84	L.R. Davis, Jr.	
1	Leon	Tallahassee	23-V-24	T.H. Hubbell	
1	Leon	Tallahassee	15-IV-45	T.H. Hubbell	
1	Leon	Tallahassee	21-IV-74	H. Flaschka	light trap
1	Liberty		28-IV-46	F.N. Young	
2	Liberty		29-III-79	P.M. Choate, Jr.	
1	Liberty	T2N R7W	25-IV-24	T.H. Hubbell	
1	Liberty	T2N R7W	26-V-24	T.H. Hubbell	
1	Liberty	T2N R7W	28-V-24	T.H. Hubbell	
1	Liberty	T2N R7W	30-V-24	T.H. Hubbell	
107	Liberty	Torreya St. Pk.: III(16); IV(9); V(15); VI(12); VII(2): Records = 24			blacklight trap
1	Santa Rosa	Jay	9-V-62	T.W. Boyd	blacklight trap
1	Santa Rosa	Munson, 4mi. N	8-IV-82	E.G. Riley	

Appendix 20. *Phyllophaga latifrons* (LeConte)

1	Alachua		4-VI-34		
1	Alachua		3-VII-34		
1	Alachua		4-III-35		
1	Alachua		4-IV-35		
1	Alachua		20-IV-59	W. Hollingsworth	
1	Alachua		17-V-85	R.S. Buik	ground
1	Alachua		29-V-85	D.H. Habeck	at light
1	Alachua	Edgecliff	3-VI-85	D.H. Habeck	
1	Alachua	Edgecliff	1-8-VI-88	D.H. Habeck	at light
6	Alachua	Edgecliff	9-VI-88	D.H. Habeck	at light
1	Alachua	Edgecliff			
1253	Alachua	Gainesville: III(1); IV(2); V(31); VI(70); VII(29); VIII(1); IX(1); XI(2): Records = 137			blacklight trap
29	Alachua	Gainesville, 15mi. NE	25-VI-66	L.A. Hetrick	blacklight trap
5	Alachua	Gainesville, 15mi. NE	9-VII-66	L.A. Hetrick	blacklight trap
11	Alachua	Gainesville, 15mi. NE	15-VII-66	L.A. Hetrick	blacklight trap
18	Alachua	Gainesville, 15mi. NE	16-17-VII-66	L.A. Hetrick	blacklight trap
12	Alachua	Gainesville, 15mi. NE	28-30-VII-66	L.A. Hetrick	blacklight trap
2	Alachua	Gainesville, 15mi. NE	10-IX-66	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville, 3mi. SW	5-VI-73	J.B. Heppner	at blacklight
3	Alachua	Hawthorne	11-VII-64	O.E. Hunt	
1	Baker	Glen St. Mary	10-VI-60	E.W. Holder,Jr.	at light

Appendix 20 (cont.). *Phyllophaga latifrons* (LeConte)

1	Baker	Glen St. Mary	1-VIII-69	H.W. Collins	blacklight trap
1	Baker	Glen St. Mary	23-VI-70	H.W. Collins	blacklight trap
18	Baker	Macclenny	4-VI-69	H.W. Collins	blacklight trap
25	Baker	Macclenny	11-VI-69	H.W. Collins	blacklight trap
20	Baker	Macclenny	11-VI-69	H.W. Collins	blacklight trap
12	Baker	Macclenny	17-VI-69	H.W. Collins	blacklight trap
39	Baker	Macclenny	24-VI-69	H.W. Collins	blacklight trap
21	Baker	Macclenny	28-VI-69	H.W. Collins	blacklight trap
485	Baker	Olustee: III(1); V(13); VI(9); VII(8); VIII(2); IX(2): Records = 35			blacklight trap
1	Bay		6-VI-38	F.N. Young	
1	Bay		8-VI-38	F.N. Young	
1	Broward	Davie	-V-65	G. Butler	
1	Broward	Davie	29-V-79	D. Phillips	*Citrus* sp.
1	Broward	Fort Lauderdale	10-IV-28	D.M. Bates	on ground
1	Broward	Fort Lauderdale	11-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	18-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	22-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	21-V-28	D.M. Bates	
1	Broward	Fort Lauderdale	11-IV-60	G.F. Spencer	
1	Broward	Fort Lauderdale	9-V-60	G.F. Spencer	blacklight trap
6	Broward	Fort Lauderdale	26-IV-62	G.F. Spencer	blacklight trap
1	Broward	Fort Lauderdale	1-V-62	G.F. Spencer	blacklight trap
1	Broward	Pompano	8-VI-81	K. Tyson	blacklight trap
1	Calhoun	Blountstown	5-VI-81	A. Gardner	at night near lights
8	Charlotte	Punta Gorda	13-VIII-69	E. Curlee	blacklight trap
1	Charlotte	Punta Gorda	15-V-59	R.E. Woodruff	blacklight trap
4	Charlotte	Punta Gorda	13-IV-61	Collins & Walsh	at light
4	Collier	Big Cypress Pres.,Bear Isl.	10-V-61	D.J. Taylor	*Philodendron cordatum*
1	Collier	Collier-Seminole St. Pk.	10-VI-88	Matthews & Lott	New Jersey light trap
7	Collier	Immokalee	27-VI-81	S. Peck	mercury vapor light
81	Collier	Immokalee	5-IV-59	H.V. Weems, Jr.	blacklight trap
1	Collier	Immokalee	20-27-IV-60	H.M. Faircloth	at light
1	Collier	Immokalee	11-V-60	H.M. Faircloth	blacklight trap
3	Collier	Marco Island	13-20-VI-60	H.M. Faircloth	*Mangifera indica*
1	Collier	Naples	2-V-68	R.E. Woodruff	blacklight trap
1	Collier	Naples	19-IV-57	D.R. Paulson	at blacklight
1	Columbia	Lake City	27-IV-84	R.A. Belmont	at light
2	Columbia	Mikesville, 3mi. N	24-VI-80	E. Graham	blacklight trap
5	Columbia	Osceola Nat. For.	8-V-74	R. Turnbow	blacklight trap
1	Dade		2-24-VI-77	J.R. Wiley	at light
1	Dade		3-VI-56	D.R. Paulson	Malaise trap
1	Dade		16-III-57	D. Thorton	
1	Dade	Coral Gables	?-VI-58	R.W. Swanson	at light
1	Dade	Coral Gables	6-VI-58	R.W. Swanson	in flight
2	Dade	Cutler Ridge	20-V-59	R.W. Swanson	at light
1	Dade	El Portal	21-III-62	R.T. McMillan, Jr.	at house light
1	Dade	Everglades Nat. Pk.	24-IV-70	D.R. DeHaven	Steiner trap;guava
1	Dade	Everglades Nat. Pk.	16-III-77	Platt & Riley	blacklight trap
1	Dade	Everglades Nat. Pk.	13-V-77	R. Turnbow	at light
2	Dade	Everglades Nat. Pk.	5-V-78	R. Turnbow	at light
1	Dade	Everglades Nat. Pk.	27-28-III-79	Riley & LeDoux	
1	Dade	Fisher Island	8-VII-81	S. Peck	blacklight trap
1	Dade	Goulds	2-V-62	J.E. Porter	
1	Dade	Goulds	10-VIII-61	J.H. Knowles	on ground at night
1	Dade	Hialeah	6-VI-73	S. LeQuier	window
2	Dade	Hialeah	23-V-60	J.L. Weaver	Japanese beetle trap
197	Dade	Hialeah	14-VI-61	J.L. Weaver	Japanese beetle trap
1	Dade	Homestead:	16-VII-67	W.T. Rowan	at light
6	Dade	Long Pine Key	IV(3); V(5); VI(2): Records = 10		blacklight trap
1	Dade	Long Pine Key	5-V-77	R. Turnbow	at light
1	Dade	Matheson Hammock	13-V-77	R. Turnbow	at light
124	Dade	Matheson Hammock	2-V-57	D.R. Paulson	at light
		Miami: III(6); IV(23); V(16); VI(9); VII(2); IX(1); X(1); XI(1):	26-IV-58	D.R. Paulson	at light
				Records = 59	
1	Dade	Miami Springs	12-VI-61	J. L. Weaver	blacklight trap
5	Dade	Miami Springs	2-VI-61	J.L. Weaver	Japanese beetle trap
2	Dade	Naranja	9-IV-62	R.M. Baranowski	Japanese beetle trap

Appendix 20 (cont.). *Phyllophaga latifrons* (LeConte)

1	Dade	North Miami	11-V-59	L.J. Daigle	on ground
1	Dade	North Miami	14-VII-60	D.A. Palmer	in drainage ditch
1	Dade	Opa Locka	26-VI-61	D.A. Palmer	*Trema* sp.
1	Dade	Perrine	3-VII-60	P.E. Briggs	light trap
1	Dade	Perrine	8-V-68	S.E. Simpson	night light
1	Dade	Perrine	27-IV-70	J.F. Dillon	
3	Dade	Plant Introd. Sta.	4-V-62	H.S. Creamer	blacklight trap
3	Dade	Ross-Castello Hammock	1-V-68	R.H. Arnett, Jr.	blacklight trap
9	Dade	Royal Palm Hammock	28-V-83	R. Turnbow	at light
1	Dade	West Miami	7-VI-60	R.W. Swanson	at light
1	Dade	West Miami	20-III-61	R.W. Swanson	at light
1	Dixie	Jena at 361, 10mi. S	13-VI-83	L. R. Davis, Jr.	
1	Dixie	Old Town	?-V-67	D.R. Lenczy	
1	Dixie	Steinhatchee, 10mi. S	6-VI-83		
1	Duval		9-VI-56	D.R. Paulson	
109	Duval	Jacksonville:	V(1); VI(5); VII(2); VIII(1): Records = 9		blacklight trap
1	Duval	Mandarin	25-VI-83	P.M. Choate, Jr.	blacklight trap
1	Duval	Mayport	7-VI-61	L.W. Taylor	blacklight trap
1	Escambia	Molino	19-VI-69	E.N. Bishop	blacklight trap
1	Escambia	Pensacola	12-VI-61	T.W. Boyd	Japanese beetle trap
1	Escambia	Pensacola	13-18-V-63	S. Hills	at light
15	Escambia	Walnut Hill	12-VI-69	E.N. Bishop	blacklight trap
5	Escambia	Warrington	26-27-V-63	V.F. Grant	blacklight trap
1	Franklin	Appalachicola, 3.3mi. W	6-VI-38	C. Hubbs	
1	Gadsden	Quincy	1-15-VIII-71	J. Reid	
15	Glades	Lykes Bros. Farm	14-VI-73	J.R. McGraw	*Pinus elliottii*
3	Gulf	St. Joseph	13-VI-69	H.V. Weems, Jr.	flourescent light
1	Hamilton	Suwannee R., Rt. 6	6-VII-83	P.M. Choate, Jr.	
3	Hardee	Ona	3-V-67	B. Fagan	blacklight trap
1	Hardee	Wauchula Hills	12-VI-76	F.N. Young	at light
1	Hendry	Felda, 1mi. S	16-V-77	R. Turnbow	
1	Highlands	Archbold Biol Sta.	2-V-75	J.B. Heppner	
6	Highlands	Archbold Biol. Sta.	22-24-III-78	L.L. Lampert	blacklight trap
12	Highlands	Archbold Biol. Sta.	16-V-79	R. Turnbow	blacklight
1	Highlands	Archbold Biol. Sta.	29-VI-88	P.E. Skelley	blacklight trap
3	Highlands	Archbold Biol. Sta.	30-VI-88	P.E. Skelley	blacklight trap
1	Highlands	Archbold Biol. Sta.	1-VII-88	P.E. Skelley	blacklight trap
7	Highlands	Archbold Biol. Sta.	1-2-VII-88	P.E. Skelley	blacklight trap
1	Highlands	Highlands Hammock St. Pk.	15-VII-56	H.V. Weems, Jr.	
12	Highlands	Highlands Hammock St. Pk.	5-V-61	T. Morris	blacklight trap
2	Highlands	Highlands Hammock St. Pk.	10-VII-63	B.K. Dozier	at light
1	Highlands	Highlands Hammock St. Pk.	3-V-74	J.B. Heppner	at blacklight
9	Highlands	Highlands Hammock St. Pk.	23-25-VI-81	S. Peck	blacklight trap
1	Highlands	Lake Placid, 6mi. SE	5-V-75	J.B. Heppner	
1	Highlands	Sebring	13-V-39	F.N. Young	
1	Highlands	Sebring		H.V. Weems, Jr.	
1	Hillsborough	Brandon	11-V-62	J.W. Patton	at light
1	Hillsborough	Davis Island	24-V-60	C.H. Lynch	Japanese beetle trap
2	Hillsborough	Odessa	25-V-60	J. Gross	
1	Hillsborough	Plant City	2-VI-66	T.J. Favoroso	Japanese beetle trap
1	Hillsborough	R21E T29S	23-IV-49	S.B. Mansell	
1	Hillsborough	Tampa	24-V-60	C.H. Lynch	
1	Hillsborough	Tampa	26-IV-61	J.F. Kearney	window at light
1	Hillsborough	Tampa	1-VI-61	R.G. Racine	
1	Hillsborough	US 301 at Rhodin Rd.	26-IV-61	R.G. Racine	residence
1	Holmes			F.N. Young	
2	Indian River	State Road 512	9-12-V-76		
3	Indian River	State Road 512	16-20-V-76		
25	Indian River	Vero Beach:	III(2); IV(3); V(1); VI(8); VII(1): Records = 15		various hosts
1	Jackson	Marianna	11-VI-70	E.L. Tipton	blacklight trap
59	Jefferson	Monticello: VI(8); VII(9); Records = 17			black lightlight
1	Lake	Bay Lake	8-V-62	W.P. Henderson	sphagnum moss
1	Lake	Groveland		W.P. Henderson	at lights
1	Lake	Groveland	14-VI-67	W.P. Henderson	soil
6	Lake	Leesburg	24-26-VI-73	H.J. Lee	blue neon light
1	Lee	Estero	16-IV-73	T. McGuire	
1	Lee	Fort Myers	16-V-60	H.M. Faircloth	native grass
2	Lee	Lehigh Acres	17-19-IV-82	N.M. Downie	

Appendix 20 (cont.). *Phyllophaga latifrons* (LeConte)

176	Leon	Tall Timbers Res. Sta.: V(3); VI(21); VII(15);VIII(6);IX(2): Records = 47			blacklight trap
2	Leon	Tallahassee	11-VIII-69	T.E. Gilliland	blacklight trap
1	Madison		4-VI-38	F.N. Young	
1	Madison	Lee	20-VI-77	R. Mercer	blacklight trap
1	Manatee	Bradenton	20-IV-60	E.G. Kelsheimer	*Phaseolus* sp.
1	Manatee	Bradenton	19-V-60	E.H. Frederic	house lights
1	Manatee	Bradenton	3-VI-61	E.H. Frederic	house light
1	Manatee	Bradenton	11-VI-63	E.H. Frederic	Japanese beetle trap
4	Manatee	Bradenton	14-17-VI-80	C.D.F.	
1	Manatee	Palmetto	1-VI-65	E.H. Frederic	Japanese beetle trap
1	Marion	Ocala	9-III-34		
1	Marion	Ocala	2-VI-62	T.R. Adkins	blacklight trap
2	Marion	Ocala	8-VI-62	T.R. Adkins	blacklight trap
1	Marion	Ocala	7-VI-85	M. Frentz	blacklight trap
1	Marion	Silver Springs	22-VI-61	T.R. Adkins	Japanese beetle trap
1	Marion	Silver Springs	12-VII-61	T.R. Adkins	Japanese beetle trap
1	Martin	Stuart	26-IV-61	E.W. Campbell	ground
1	Monroe	Everglades Nat. Pk.	9-IV-52	R.E. Woodruff	at light
1	Monroe	Everglades Nat. Pk.	26-III-67	L.R. Davis, Jr.	
5	Okaloosa	Holt, 3mi. NW	8-11-VIII-79	L.A. Stange	blacklight trap
4	Okaloosa	Holt, 4.5mi. N	17-VI-78	L.A. Stange	blacklight trap
7	Okaloosa	Holt, 4.5mi. NW	15-16-VI-78	L.A. Stange	blacklight trap
2	Okaloosa	Baker	31-V-77	C. Webb	blacklight trap
1	Okaloosa	Fort Walton	11-VI-62	T.W. Boyd	Japanese beetle trap
1	Orange	Christmas	15-VI-69	D.R. Estes	
1	Orange	Orlando	22-VI-60	J.R. Woodley	*Rosa* sp.
1	Orange	Orlando	9-VI-61	J.R. Woodley	Japanese beetle trap
3	Orange	Orlando	16-VI-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	26-VI-61	J.R. Woodley	Japanese beetle trap
2	Orange	Orlando	14-VII-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	23-VIII-61	J.T. Fulford	Japanese beetle trap
18	Orange	Orlando	5-VI-62	J.L. Beck	blacklight trap
19	Orange	Orlando	21-VI-62	C.E. Mosteller	Japanese beetle trap
1	Orange	Orlando	18-VI-80	T.L. Kipp	lawngrass
2	Orange	Orlo Vista	29-IV-75	F.L. Ware	peat
5	Orange	Pine Castle	23-VI-81	W.P. Henderson	cargo area at airport
1	Orange	Plymouth	16-VI-83	D. Phelps	near greenhouse
1	Orange	Rt. 192, Jellystone Pk.	11-VI-83	L.R. Davis, Jr.	
1	Orange	Tangelo Park	11-VI-81	W.P. Henderson	*Juniperus* sp.
1	Orange	Vineland	26-V-81	F.L. Ware	on sidewalk
1	Orange	Winter Garden	7-VIII-60	G.W. Desin	on ground
9	Osceola	Canoe Creek I-75	9-V-74	R. Turnbow	blacklight trap
2	Palm Beach		23-V-69	P.M. Choate, Jr.	blacklight
12	Palm Beach	Boynton Beach	2-IV-85	K.O. Lawrence	
1	Palm Beach	Lake Worth	7-V-49		
1	Palm Beach	West Palm Beach	6-VI-66	M.J. Kuck	on vegetation
1	Pinellas	Clearwater	2-V-61	R.G. Racine	Japanese beetle trap
1	Pinellas	Largo	6-VI-62	C.E. Bingaman	light
1	Pinellas	St. Petersburg	1-VI-59	C.E. Bingaman	light trap
1	Pinellas	St. Petersburg	28-V-63	W.C. Carroll	Steiner trap;grapefruit
16	Polk	Lake Kissimmee	17-VI-88	Matthews & Lott	light trap
1	Polk	Lakeland	8-VI-60	J. Hayward	Japanese beetle trap
1	Polk	US 27 & SR 640, S jct.	2-VI-60	J. Hayward	Japanese beetle trap
1	Polk	Winter Haven	29-V-62	R.W. Robnett	blacklight trap
1	Putnam		20-VI-46	R.E. Bellamy	light trap 3
1	Putnam		28-VI-46	R.E. Bellamy	light trap 3
1	Putnam		29-VI-46	R.E. Bellamy	light trap 3
1	Putnam	Melrose, 3mi. S	8-VI-83	B. Beck	blacklight trap
2	Putnam	Melrose, 3mi. S	9-VI-83	B. Beck	blacklight trap
7	Putnam	Melrose, 3mi. S	2-VI-87	B. Beck	blacklight trap
1	Putnam	Melrose, 3mi. S	3-VI-87	B. Beck	blacklight trap
1	Putnam	Vause Lake	2-3-VI-84	P.M. Choate, Jr.	blacklight trap
1	Putnam	Welaka	5-VI-40	J.J. Friauf	
1	Putnam	Welaka	3-VI-46	R.E. Bellamy	
1	Putnam	Welaka	6-VI-46	R.E. Bellamy	
11	Santa Rosa	Milton	2-VI-53		
1	Santa Rosa	Milton, Avalon Bch.	15-IX-83	R. Hill	blacklight trap
1	Sarasota	Englewood	16-IV-82	N.M. Downie	

Appendix 20 (cont.). *Phyllophaga latifrons* (LeConte)

1	Sarasota	Longboat Key	28-VI-77	F.N. Young	at light
1	Sarasota	Myakka River St. Pk.	3-VI-54	H.V. Weems, Jr.	Japanese beetle trap
1	Sarasota	Sarasota	17-V-60	C.L. Yax	Japanese beetle trap
1	Sarasota	Sarasota	12-VII-60	C.L. Yax	at light
1	Sarasota	Sarasota	16-V-61	J.W. Patton	Steiner trap
1	Sarasota	Sarasota	4-VI-62	C.L. Yax	Japanese beetle trap
1	Sarasota	Sarasota	27-IV-65	E.H. Frederic	Japanese beetle trap
1	Sarasota	Sarasota	12-V-65	E.H. Frederic	
1	Sarasota	Venice	13-VI-61	E.H. Frederic	Japanese beetle trap
1	Sarasota	Venice	20-VI-63	E.H. Frederic	*Carya illinoiensis*
1	Seminole	Maitland	9-VI-60	C.O. Youtsey	various hosts
81	Seminole	Sanford:	V(10); VI(8); VII(6): Records = 24		light trap
1	St. Lucie	North Beach	18-V-60	E.W. Campbell	blacklight trap
1	Taylor	Perry	30-IV-2-V-67	W.L. Beers	blacklight trap
3	Taylor	Perry	19-29-V-67	W.L. Beers	blacklight trap
1	Taylor	Perry	3-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	9-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	10-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	15-VI-69	W.L. Beers	fruitfly trap;calamondin
1	Volusia	Daytona Beach	23-VI-60	G.W. Desin	
1	Volusia	Daytona Beach	17-V-61	G.W. Desin	Japanese beetle trap
1	Volusia	Daytona Beach	24-V-61	G.W. Desin	Japanese beetle trap
2	Volusia	Daytona Beach	31-V-62	G.W. Desin	Japanese beetle trap
3	Volusia	Daytona Beach	6-VI-62	G.W. Desin	Japanese beetle trap
1	Volusia	De Land	31-V-61	G.W. Desin	Japanese beetle trap
3	Volusia	De Land	24-V-62	G.W. Desin	Japanese beetle trap
2	Volusia	De Land	6-VI-62	G.W. Desin	Japanese beetle trap
1	Volusia	De Leon Springs	6-VI-60	C.R. Roberts	porch and patio
3	Volusia	Holly Hill	22-V-80	J.N. Pott	lawn
1	Volusia	Ormond Beach	18-V-60	Desin & Smith	on dunes by sea
1	Volusia	Ormond Beach	18-VI-83	K. Vick	on surf
39	Wakulla	Panacea	17 & 19 VI-67	C. Hilfiker	P-1
7	Wakulla	Panacea	21-29-VI-67	C. Hilfiker	on surf
1	Wakulla	Panacea	14-VII-67	C. Hilfiker	on surf
1	Wakulla	Panacea	10-VIII-67	C. Hilfiker	on surf
1	Wakulla	Panacea	12-VIII-67	C. Hilfiker	on surf
2	Wakulla	Panacea	14-VIII-67	C. Hilfiker	
1	Wakulla	Panacea	7-VI-72	R. Turnbow	

Appendix 21. *Phyllophaga lota* Luginbill

1	Alachua		14-VII-54	H.V. Weems, Jr.	
1	Alachua	Gainesville	4-VI-46	F.N. Young	
1	Alachua	Gainesville	VII-46	F.N. Young	
1	Alachua	Gainesville	VIII-46	F.N. Young	
1	Alachua	Gainesville	19-20-VI-68	R.E. Woodruff	blacklight trap
2	Baker	Olustee	4-VII-72	H.W. Collins	soil
1	Calhoun	Blountstown	3-IX-68	H. Paulk	blacklight trap
1	Dade	Opa Locka	3-IV-57	L. Daigle	in house
2	Escambia	Pensacola	12-VII-60	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	20-VI-62	T.W. Boyd	blacklight trap
2	Escambia	Pensacola	7-VIII-84	R. Hill	blacklight trap
1	Escambia	Warrington	26-27-V-63	V.F. Grant	blacklight trap
1	Jefferson	Monticello	10-VI-69	R.H. Miller	blacklight trap
1	Leon	Tall Timbers Res. Sta.	26-VIII-67	Smith	
1	Okaloosa	Ft. Walton Beach	11-VI-62	T.W. Boyd	Japanese beetle trap
1	Taylor	Perry	19-29-V-67	W.L. Beers	blacklight trap
38	Wakulla	Panacea	17 & 19 VI-67	C. Hilfiker	on surf
40	Wakulla	Panacea	21-29-VI-67	C. Hilfiker	
2	Wakulla	Panacea	5-VII-67	C. Hilfiker	on surf
6	Wakulla	Panacea	10-VIII-67	C. Hilfiker	on surf
2	Wakulla	Panacea	14-VIII-67	C. Hilfiker	on surf
11	Wakulla	Panacea	23-VIII-67	C. Hilfiker	on surf
1	Wakulla	Sopchoppy	5-VI-38	F.N. Young	
1	Wakulla	Sopchoppy, N.	5-VI-38	F.N. Young	

Appendix 22. *Phyllophaga luctuosa* (Horn)

1	Alachua	Co.Rd.17B 4mi.S Co.Rd.38	8-IV-83	K. Vick	blacklight trap
2	Alachua	Co.Rd.17B 4mi.S Co.Rd.38	23-IV-83	K. Vick	blacklight trap
1	Alachua	Gainesville	8-VI-36	K. Wheeler	
2	Alachua	Gainesville	23-III-78	B.J. Smittle	blacklight trap
1	Alachua	Gainesville	12-IV-84	P.J. Landolt	mercury vapor light
1	Alachua	Gainesville	20-IV-84	P.J. Landolt	mercury vapor light
2	Escambia	Pensacola	17-V-60	R.E. Woodruff	at light
2	Escambia	Pensacola	17-V-69	R.E. Woodruff	
2	Escambia	Pensacola	16-V-80	T.W. Boyd	*Carya illinoiensis*
1	Gadsden	Quincy	21-IV-59	W.B. Tappan	blacklight trap
1	Gadsden	Quincy	30-IV-62	W.B. Tappan	blacklight trap
1	Jackson	Fla. Caverns St. Pk.	18-IV-63	R.E. Woodruff	
1	Jackson	Fla. Caverns St. Pk.	13-IV-89	Woodruff,Beck & Skelley	*Quercus laurifolia*
1	Jackson	Marianna	7-V-70	E.L. Tipton	blacklight trap
1	Jefferson	Monticello	30-V-33	F.W. Walker	
1	Jefferson	Monticello	10-IV-35	F.N. Young	
3	Jefferson	Monticello	17-IV-69	R.H. Miller	blacklight trap
1	Jefferson	Monticello	6-V-69	R.H. Miller	blacklight trap
2	Jefferson	Monticello	14-V-69	R.H. Miller	blacklight trap
47	Leon	Tall Timbers Res. Sta.:	III(1); IV(10); V(8); VI(2): Records = 21		blacklight trap
1	Leon	Tallahassee	16-II-39	F.N. Young	
38	Liberty	Torreya St. Pk.:	III(2); IV(7); V(3): Records = 12		blacklight trap
1	Marion	Ocala	12-IV-63	T.R. Adkins	blacklight trap
7	Marion	Ocala	26-III-77	M.C. Thomas	blacklight trap
24	Marion	Ocala	27-III-77	M.C. Thomas	blacklight trap
1	Marion	Ocala	29-III-77	M.C. Thomas	blacklight trap
2	Marion	Ocala	31-III-77	M.C. Thomas	at blacklight trap
1	Okaloosa	Holt, S. on I-10	14-IV-89	Woodruff,Beck & Skelley	at light
1	Okaloosa	Holt, 4.5mi. NW	29-IV-1-V-74	W.L. & J.G. Peters	
1	Okaloosa	Holt, 4.5mi. NW	2-V-74	W.L. & J.G. Peters	
2	Okaloosa	Holt, 4.5mi. NW	15-16-VI-78	L.A. Stange	blacklight trap
7	Santa Rosa	Blackwater Riv. St. For.	23-V-71	Fairchild & Weems	at light
1	Wakulla	Ochlocknee St. Pk.	28-III-79	M. Brattain	

Appendix 23. *Phyllophaga mariana* Fall

1	Alachua	Gainesville	3-V-24	P.R. Bishop	
1	Escambia		10-IV-58	M.A. Tidwell	
1	Escambia		17-IV-60	H.S. Barrett	
1	Escambia	Pensacola	7-V-41	T.W. Boyd	Japanese beetle trap
5	Escambia	Pensacola	13-18-V-63	S. Hills	taken at light
1	Gadsden	Quincy, 12mi. S	26-IV-83	C. Boyles-Sprenkel	
1	Gadsden	Quincy, 12mi. S	11-V-83	C. Boyles-Sprenkel	light at night
1	Jackson	Blue Springs Creek	5-IV-33		at light
5	Levy	Archer, 3.8mi. SW	23-IV-87	P.E. Skelley	at light
7	Levy	Archer, 3.8mi. SW	30-IV-87	P.E. Skelley	ex turkey oak
1	Levy	Archer, 3.8mi. SW	30-IV-87	P.E. Skelley	at light
1	Levy	Archer, 3.8mi. SW	18-III-89	P.E. Skelley	blacklight trap
4	Levy	Archer, 3.8mi. SW	26-III-89	P.E. Skelley	turkey oak
3	Levy	Archer, 4 mi. W	24-III-53	Howden & Dozier	flying
2	Liberty	Camp Torreya	24-IV-24	T.H. Hubbell	
1	Liberty	Camp Torreya	25-IV-24	T.H. Hubbell	
1	Liberty	Torreya Ravine	3-V-41	F.N. Young	
1	Liberty	Torreya Ravine	28-IV-46	F.N. Young	on sumac
4	Liberty	Torreya St. Pk.	17-IV-63	R.E. Woodruff	at light
1	Liberty	Torreya St. Pk.	9-V-68	J.W. McReynolds	
1	Liberty	Torreya St. Pk.	29-V-88	D.L. Matthews	mercury vapor light
1	Marion	T13S R25E Sec.4	2-V-84	Davis & Vick	blacklight trap
7	Okaloosa	Holt, 1.5mi. W	14-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
1	Okaloosa	Holt, 4.5mi. N	2-V-74	W.L. & J.G. Peters	
1	Okaloosa	Holt, 4.5mi. N	17-VI-78	L.A. Stange	blacklight trap
1	Okaloosa	Holt, 4.5mi. NW	29-IV-1-V-74	W.L. & J.G. Peters	
5	Okaloosa	Holt, S. on I-10	14-IV-89	Woodruff,Beck & Skelley	at light
10	Orange	Orlando	6-IV-47	H.V. Weems, Jr.	
1	Orange	Winter Park	21-III-35	E.M. Davis	
1	Orange	Winter Park	15-IV-41	H.T. Fernald	at light
10	Putnam	Welaka Res. Sta.	8-11-IV-83	E.G. Riley	

Appendix 23 (cont.). *Phyllophaga mariana* Fall

9	Santa Rosa	Blackwater Riv. St. For.	23-V-71	Fairchild & Weems	at light
3	Santa Rosa	Navarre, 2mi. N on SR 87	15-IV-89	Woodruff,Beck & Skelley	at light
1	Walton		19-V-63	H.V. Weems, Jr.	*Sarracenia*
1	Walton	DeFuniak Springs	19-IV-76	F. Hovore	
1	Washington	Vernon	30-III-84	W. Gidney	

Appendix 24. *Phyllophaga okeechobea* Robinson

2		Lake Stearns	15-IV-25	C.M. Hunt	on avocado
2		Avalon	10-III-48	A.C. Crews	citrus,S.P.B.98239
1	Highlands	Archbold Biol. Sta.	9-V-84	M. Deyrup	Malaise trap
1	Highlands	Archbold Biol. Sta.	14-IV-85	J. & P. Woods	sandhill
2	Highlands	Archbold Biol. Sta.	25-IV-86	J. Sivinski	mating on sand
1	Highlands	Archbold Biol. Sta.	25-IV-86	M. Deyrup	sand pine scrub
1	Highlands	Archbold Biol. Sta.	9-III-87	M. Deyrup	*Crotolaria mucronata*
1	Highlands	Avon Park	27-IV-48	C. Bickner	on citrus
2	Highlands	Avon Park	22-II-49	C. Bickner	on citrus
2	Highlands	Avon Park	10-II-50	A.L. Baker	citrus,S.P.B.107437
4	Highlands	Avon Park	1-IV-59	W.P. Henderson	*Citrus sinensis*
1	Highlands	De Soto City	25-IV-47	W.G. Genung	on citrus
4	Highlands	De Soto City	3-V-47	F.N. Young	
1	Highlands	De Soto City, nr.	4-V-47	Thames & Young	on young citrus
6	Highlands	De Soto City, S	8-II-50	C. Bickner	on citrus
1	Highlands	Lake Placid	4-IV-78	C.H. Barker	*Citrus paradisi*
1	Highlands	Lake Placid	25-III-80	H.V. Weems, Jr.	fossil sand dunes
1	Highlands	Sebring, nr. Airport	21-III-75	H.V. Weems, Jr.	fossil sand dunes
1	Highlands	Sebring, 5mi. S	18-IV-61	W.P. Henderson	*Citrus* sp.
1	Lake	Clermont	8-IV-47	M. Robinson	
1	Okeechobee	Okeechobee	8-IV-63	Norton & Hebb	*Citrus* sp.
4	Polk	Haines City	4-IV-60	J.C. Denmark	on citrus
2	Polk	Hesperides			

Appendix 25. *Phyllophaga panorpa* Sanderson

1	Highlands	Archbold Biol. Sta.	23-IX-78	N.M. Downie	
2	Highlands	Archbold Biol. Sta.	4-7-V-79	L.L. Lampert	blacklight trap
1	Highlands	Lake Letta Subdiv.	7-VI-61	T. Morris	blacklight trap
1	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.	2-VII-61	T. Morris	blacklight trap
19	Highlands	Lake Letta Subdiv.	19-VII-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	25-VII-61	T. Morris	blacklight trap
3	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.	16-VIII-61	T. Morris	blacklight trap
13	Highlands	Lake Letta Subdiv.	22-VIII-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	23-VIII-61	T. Morris	blacklight trap
18	Highlands	Lake Letta Subdiv.	6-IX-61	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	2-X-61	T. Morris	blacklight trap
10	Highlands	Lake Letta Subdiv.	12-VI-62	T. Morris	blacklight trap
5	Highlands	Lake Letta Subdiv.	25-VI-62	T. Morris	blacklight trap
2	Highlands	Lake Letta Subdiv.	10-VII-62	T. Morris	blacklight trap
1	Highlands	Lake Letta Subdiv.	30-VII-62	T. Morris	blacklight trap
2	Highlands	Lake Placid	13-VII-48	H.W. Crowder & R.H.Beamer	(paratypes)
2	Highlands	North Sebring	2-VII-62	T. Morris	blacklight trap
2	Highlands	Sebring	23-V-61	T. Morris	blacklight trap
1	Polk		10-VIII-38	Hubbell and Friauf	(paratype)

Appendix 26. *Phyllophaga parvidens* (LeConte)

1	Alachua		1901		
1	Alachua		25-IV-16	F. Young	on plum
1	Alachua		21-III-38	H. Hixson	
1	Alachua		9-VII-58	S. Clark	
1	Alachua		1960	Addison	

Appendix 26 (cont). *Phyllophaga parvidens* (LeConte)

1	Alachua		27-II-60	N.L. Benzina	
1	Alachua		11-IV-60	Hooten	
1	Alachua		5-VII-60	R. Ferlita	
1	Alachua		7-V-62	P. Carson	
1	Alachua	Archer	IV-73	R.B. Baker	
462	Alachua	Gainesville: III(17); IV(35); V(78); VI(52); VII(7); XI(1):Records = 190			blacklight trap
1	Alachua	Gainsville, 15mi. NE	1966	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville, 3mi. SW	26-IV-73	J.B. Heppner	at blacklight
5	Alachua	Melrose	6-V-84	L.R. Davis, Jr.	
25	Alachua	Monteoca	11-V-77	J.F. Butler	insect flight trap
45	Alachua	Monteoca	24-V-77	J.F. Butler	insect flight trap
2	Alachua	Monteoca	1-VI-77	J.F. Butler	insect flight trap
2	Alachua	R20E, T10S, Sec. 6	23-III-49	B.W. Cooper	
1	Alachua	R20E, T10S, Sec. 6	30-III-49	B.W. Cooper	
1	Alachua	R20E, T9S, Sec. 19	14-V-49	S.B. Mansell	
1	Baker	Glen St. Mary	30-IV-59	E.W. Holder, Jr.	at light
1	Baker	Glen St. Mary	21-V-60	E.W. Holder, Jr.	*Eupatorium* sp. roots
1	Baker	Macclenny	1-V-60	E.W. Holder, Jr.	sidewalk
1	Baker	Macclenny	28-VI-69	H.W. Collins	blacklight trap
1	Baker	Olustee	20-V-63	E.P. Merkel	blacklight trap
2	Bradford	Melrose, 3mi. N	6-V-84	L.R. Davis, Jr.	
1	Clay	Keystone Heights	6-V-84	L.R. Davis, Jr.	
1	De Soto	Arcadia	28-V-58	J.C. Denmark	soil
1	Dixie	Old Town, 4mi. N	6-V-79	R. Turnbow	blacklight
1	Duval	Jacksonville	5-V-61	T.S. Josey	Japanese beetle trap
4	Duval	Jacksonville	5-V-69	R. King	blacklight trap
5	Duval	Jacksonville	19-V-69	R. King	blacklight trap
1	Duval	Jacksonville	4-VI-69	R. King	blacklight trap
1	Duval	Mayport	10-V-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	7-VI-61	L.W. Taylor	blacklight trap
2	Escambia	Pensacola	9-IV-62	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	16-V-62	T.W. Boyd	
4	Escambia	Pensacola	13-18-V-63	S. Hills	taken at light
1	Gilchrist	Trenton	V-52	G.B. Riley	
1	Hamilton	Welcome Center I-75	12-V-77	R. Turnbow	at light
1	Hillsborough	Odessa	25-V-60	J. Gross	
2	Hillsborough	Tampa	19-IV-60	Stokes & Sellers	*Eremochloa ophiuroides*
1	Hillsborough	Tampa	19-IV-60	D. Stokes	
1	Hillsborough	Tampa	21-IV-60	Lynch & Racine	blacklight trap
1	Hillsborough	Tampa	10-V-60	R.G. Racine	flower bed
2	Hillsborough	Tampa	25-III-61	J.W. Patton	at light
1	Hillsborough	Tampa	8-V-61	R.G. Racine	Japanese beetle trap
2	Jackson	Marianna	28-VII-64	J.W. Patton	at light
1	Jefferson	Monticello	7-XI-34	G.B. Fairchild	
1	Jefferson	Monticello	19-VI-35	G.B. Fairchild	
4	Jefferson	Monticello	1-VI-60	A.M. Phillips	at light
9	Jefferson	Monticello	31-V-63	A.M. Phillips	on screen door
9	Jefferson	Monticello	28-V-63	A.M. Phillips	at light
1	Jefferson	Monticello	15-V-69	W.H. Whitcomb	blacklight trap
1	Lake	Leesburg	28-III-63	W.C. Adlerz	at light
4	Lake	Leesburg	8-IV-63	W.C. Adlerz	at light
1	Lake	Leesburg	10-IV-63	W.C. Adlerz	at light
1	Leon	Tallahassee	15-V-76	J. Schuh	
3	Liberty	Apalachicola Nat. For.	16-V-71	G.B. Fairchild	
1	Liberty	Camp Torreya	29-V-24	T.H. Hubbell	
1	Liberty	Camp Torreya	30-V-24	T.H. Hubbell	
1	Liberty	Torreya St. Pk.	9-V-68	J.W. McReynolds	
3	Madison		2-V-46	F.N. Young	
1	Madison	Lee	14-VI-77	R. Mercer	blacklight trap
2	Madison	Lee	20-VI-77	R. Mercer	blacklight trap
28	Manatee	Oneco	12-13-IV-66	R.E. Woodruff	blacklight trap
1	Marion	Lynne, nr.	10-IV-48	F.N. Young	
1	Marion	Ocala	24-V-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	9-VIII-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	21-VII-75	T.E. Rogers	
11	Martin	J. Dickinson St. Pk.	19-III-83	L. Davis	at light
2	Okaloosa	Baker	31-V-77	C. Webb	blacklight trap
1	Okaloosa	Blackwater Riv. St. For.	9-VI-72	R. Turnbow	blacklight

Appendix 26 (cont). *Phyllophaga parvidens* (LeConte)

1	Alachua		27-II-60	N.L. Benzina	
1	Alachua		11-IV-60	Hooten	
1	Alachua		5-VII-60	R. Ferlita	
1	Alachua		7-V-62	P. Carson	
1	Alachua	Archer	IV-73	R.B. Baker	
462	Alachua	Gainesville: III(17); IV(35); V(78); VI(52); VII(7); XI(1):Records = 190			blacklight trap
1	Alachua	Gainsville, 15mi. NE	1966	L.A. Hetrick	blacklight trap
1	Alachua	Gainesville, 3mi. SW	26-IV-73	J.B. Heppner	at blacklight
5	Alachua	Melrose	6-V-84	L.R. Davis, Jr.	
25	Alachua	Monteoca	11-V-77	J.F. Butler	insect flight trap
45	Alachua	Monteoca	24-V-77	J.F. Butler	insect flight trap
2	Alachua	Monteoca	1-VI-77	J.F. Butler	insect flight trap
2	Alachua	R20E, T10S, Sec. 6	23-III-49	B.W. Cooper	
1	Alachua	R20E, T10S, Sec. 6	30-III-49	B.W. Cooper	
1	Alachua	R20E, T9S, Sec. 19	14-V-49	S.B. Mansell	
1	Baker	Glen St. Mary	30-IV-59	E.W. Holder, Jr.	at light
1	Baker	Glen St. Mary	21-V-60	E.W. Holder, Jr.	*Eupatorium* sp. roots
1	Baker	Macclenny	1-V-60	E.W. Holder, Jr.	sidewalk
1	Baker	Macclenny	28-VI-69	H.W. Collins	blacklight trap
1	Baker	Olustee	20-V-63	E.P. Merkel	blacklight trap
2	Bradford	Melrose, 3mi. N	6-V-84	L.R. Davis, Jr.	
1	Clay	Keystone Heights	6-V-84	L.R. Davis, Jr.	
1	De Soto	Arcadia	28-V-58	J.C. Denmark	soil
1	Dixie	Old Town, 4mi. N	6-V-79	R. Turnbow	blacklight
1	Duval	Jacksonville	5-V-61	T.S. Josey	Japanese beetle trap
4	Duval	Jacksonville	5-V-69	R. King	blacklight trap
5	Duval	Jacksonville	19-V-69	R. King	blacklight trap
1	Duval	Jacksonville	4-VI-69	R. King	blacklight trap
1	Duval	Mayport	10-V-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	7-VI-61	L.W. Taylor	blacklight trap
2	Escambia	Pensacola	9-IV-62	T.W. Boyd	blacklight trap
1	Escambia	Pensacola	16-V-62	T.W. Boyd	
4	Escambia	Pensacola	13-18-V-63	S. Hills	taken at light
1	Gilchrist	Trenton	V-52	G.B. Riley	
1	Hamilton	Welcome Center I-75	12-V-77	R. Turnbow	at light
1	Hillsborough	Odessa	25-V-60	J. Gross	
2	Hillsborough	Tampa	19-IV-60	Stokes & Sellers	*Eremochloa ophiuroides*
1	Hillsborough	Tampa	19-IV-60	D. Stokes	
1	Hillsborough	Tampa	21-IV-60	Lynch & Racine	blacklight trap
1	Hillsborough	Tampa	10-V-60	R.G. Racine	flower bed
2	Hillsborough	Tampa	25-III-61	J.W. Patton	at light
1	Hillsborough	Tampa	8-V-61	R.G. Racine	Japanese beetle trap
2	Jackson	Marianna	28-VII-64	J.W. Patton	at light
1	Jefferson	Monticello	7-XI-34	G.B. Fairchild	
1	Jefferson	Monticello	19-VI-35	G.B. Fairchild	
4	Jefferson	Monticello	1-VI-60	A.M. Phillips	at light
9	Jefferson	Monticello	31-V-63	A.M. Phillips	on screen door
9	Jefferson	Monticello	28-V-63	A.M. Phillips	at light
1	Jefferson	Monticello	15-V-69	W.H. Whitcomb	blacklight trap
1	Lake	Leesburg	28-III-63	W.C. Adlerz	at light
4	Lake	Leesburg	8-IV-63	W.C. Adlerz	at light
1	Lake	Leesburg	10-IV-63	W.C. Adlerz	at light
1	Leon	Tallahassee	15-V-76	J. Schuh	
3	Liberty	Apalachicola Nat. For.	16-V-71	G.B. Fairchild	
1	Liberty	Camp Torreya	29-V-24	T.H. Hubbell	
1	Liberty	Camp Torreya	30-V-24	T.H. Hubbell	
1	Liberty	Torreya St. Pk.	9-V-68	J.W. McReynolds	
3	Madison		2-V-46	F.N. Young	
1	Madison	Lee	14-VI-77	R. Mercer	blacklight trap
2	Madison	Lee	20-VI-77	R. Mercer	blacklight trap
28	Manatee	Oneco	12-13-IV-66	R.E. Woodruff	blacklight trap
1	Marion	Lynne, nr.	10-IV-48	F.N. Young	
1	Marion	Ocala	24-V-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	9-VIII-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	21-VII-75	T.E. Rogers	
11	Martin	J. Dickinson St. Pk.	19-III-83	L. Davis	at light
2	Okaloosa	Baker	31-V-77	C. Webb	blacklight trap
1	Okaloosa	Blackwater Riv. St. For.	9-VI-72	R. Turnbow	blacklight

Appendix 26 (cont). *Phyllophaga parvidens* (LeConte)

5	Okaloosa	Blackwater Riv. St. For.	6-V-76	J. Schuh	blacklight trap
1	Okaloosa	Blackwater Riv. St. For.	7-V-76	J. Schuh	blacklight trap
4	Okaloosa	Holt, 4.5mi. NW	15-16-VI-78	L.A. Stange	blacklight trap
2	Okaloosa	Holt, 4.5mi. NW	17-VI-78	L.A. Stange	blacklight trap
1	Orange	Orlando	1-V-61	J.R. Woodley	in vacant lot
1	Orange	Orlando	2-V-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	16-VI-61	J.R. Woodley	Japanese beetle trap
1	Orange	Orlando	2-IV-62	J.R. Woodley	
1	Pinellas	Largo	14-IV-61	C.E. Bingaman	light
1	Pinellas	Seminole	14-IV-78	B. Bellville	*Citrus* sp.
1	Pinellas	St. Petersburg	IV-44	P. Brodkorb	
1	Pinellas	St. Petersburg	22-IV-60	L.B. Hill	*Hibiscus* sp.
1	Pinellas	St. Petersburg	5-II-63	R.H. Forsyth	blacklight trap
2	Polk	Lake Alfred	19-IV-60	V.K. Norton	on ground
1	Polk	Lakeland	1949	J. Freeman	
1	Polk	Lakeland	23-V-60	C.D. Risk	light
2	Putnam	Melrose	16-VII-81	B. Beck	on screen
1	Putnam	Melrose, 3mi. S	12-VI-82	B. Beck	in water dish
4	Putnam	Melrose, 3mi. S	31-V-83	B. Beck	blacklight trap
1	Putnam	Vause Lake	2-3-VI-84	P.M. Choate, Jr.	blacklight trap
1	Putnam	Welaka	24-IV-40	J.J. Friauf	
1	Putnam	Welaka	30-IV-40	J.J. Friauf	
1	Putnam	Welaka	29-IV-55	L.N. Bell	at light
15	Putnam	Welaka, 2mi. S.	20-IV-73	J.B. Heppner	at blacklight
46	Santa Rosa	Blackwater Riv. St. For.	23-V-71	Fairchild & Weems	at light
6	Seminole	Sanford	29-III-61	G.W. Desin	blacklight trap
10	Taylor	Hwy. 19, Econfina River	26-V-83	R. Turnbow	at light
1	Taylor	Perry	21-V-69	H.V. Weems, Jr.	at light
1	Taylor	Perry	12-VI-69	W.L. Beers	blacklight trap
1	Union	Hwy.241,1km.N.Santa Fe R.	13-V-86	C.W. Mills,III	
1	Union	Hwy.241,1km.N.Santa Fe R.	16-V-86	C.W. Mills,III	at incandescent light
1	Union	Hwy.241,1km.N.Santa Fe R.	1-VI-86	C.W. Mills,III	

Appendix 27. *Phyllophaga postrema* (Horn)

1	Alachua	Gainesville	1935	F.N. Young	
1	Alachua	Gainesville	25-IV-59	J.Q. Platt	at light
1	Alachua	Gainesville	16-X-60	B. Platt	at light
1	Alachua	Gainesville	IV-64	G. Thomas	at light
1	Alachua	Gainesville	16-V-80	B. Platt	at light
2	Alachua	Gainesville	24-IV-82	P.M. Choate, Jr.	in leaf litter
1	Baker	Olustee	9-VI-69	E.P. Merkel	blacklight trap
1	Baker	Osceola Nat. For.	16-V-77	J.R. Wiley	blacklight trap
1	Bay	Panama City	12-VI-40	S.W. Simmons	Japanese beetle trap
1	Escambia	Molino	8-V-69	T.C. Bishop	blacklight trap
1	Escambia	Molino	5-VI-69	E.N. Bishop	blacklight trap
1	Escambia	Pensacola	16-V-62	T.W. Boyd	blacklight trap
1	Highlands	Highlands Hammock St. Pk.	20-III-57		
3	Highlands	Highlands Hammock St. Pk.	30-III-79	Riley & LeDoux	
1	Holmes		30-IV-46	F.N. Young	
1	Jefferson	Monticello	30-V-33	F.W. Walker	
1	Jefferson	Monticello	17-V-38	S.O. Hill	Japanese beetle trap
1	Jefferson	Monticello	30-V-38	S.O. Hill	Japanese beetle trap
1	Jefferson	Monticello	28-V-63	A.M. Phillips	at light
1	Jefferson	Monticello	5-VI-63	A.M. Phillips	at light
1	Jefferson	Monticello	26-V-69	W.H. Whitcomb	blacklight trap
1	Jefferson	Monticello	10-VI-69	W.H. Whitcomb	blacklight trap
1	Liberty		9-VI-38	F.N. Young	
4	Liberty	Sumatra	28-29-V-83	L.R. Davis, Jr.	
1	Liberty	Torreya St. Pk.	25-VI-81	P.M. Choate, Jr.	blacklight trap
1	Liberty	Torreya St. Pk.	15-17-VII-87	Matthews & Skelley	at light
1	Okaloosa	Holt, 4.5mi. NW Holt	15-16-VI-78	L.A. Stange	blacklight trap
1	Putnam	Johnson, 1mi.S, Vause Lake	28-V-84	P.M. Choate	blacklight trap
2	Putnam	Welaka	25-26-VI-46	R.E. Bellamy	

Appendix 28. *Phyllophaga prununcu1ina* (Burmeister)

1	Alachua		7-VIII-38	H. Hixon	
1	Alachua		20-X-40		
1	Alachua		31-V-54	F.W. Mead	Station 3
9	Alachua		25-VI-58	S. Clark	
3879	Alachua	Gainesville: IV(1); V(27); VI(93); VII(83); VIII(47); IX(30); X(1): Records = 282			blacklight trap
255	Alachua	Gainesville, 15mi. NE:	VI(3); VII(5); IX(1): Records = 9		blacklight trap
1	Alachua	Hawthorne	23-VI-63	B.K. Dozier	
1	Alachua	R20E, T10S, Sec. 14	21-V-49	S.B. Mansell	
1	Alachua	R20E, T10S, Sec. 532	21-V-49	E.H. McConkey	
1	Alachua	San Felasco Hammock	20-X-73	J.B. Heppner	at blacklight
1	Baker	Glen St. Mary	6-VIII-69	H.W. Collins	blacklight trap
59	Baker	Macclenny:	V(1); VI(6): Records = 7		blacklight trap
8	Baker	Olustee	22-VI-79	R.A. Belmont	
967	Baker	Olustee: III(7); V(5); VI(6); VII(7); VIII(2); IX(1): Records = 22			blacklight trap
1	Bay		6-VI-38	F.N. Young	
1	Bay	Panama City	12-VII-61	E.L. Tipton	Japanese beetle trap
1	Bay	Panama City, 3.9mi. W	19-VII-38	Hubbell & Friauf	
1	Brevard	N County Line	25-VI-76	M.C. Thomas	at light
1	Broward	Fort Lauderdale	26-III-28	D.M. Bates	
1	Broward	Fort Lauderdale	7-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	10-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	11-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	14-IV-28	D.M. Bates	
1	Broward	Fort Lauderdale	9-V-60	G.F. Spencer	light trap
1	Broward	Fort Lauderdale	26-IV-62	G.F. Spencer	blacklight trap
2	Charlotte	Englewood	16-23-VIII-60	H.M. Faircloth	blacklight trap
2	Clay		9-VI-56	D.R. Paulson	
1	Clay	Doctors Inlet	25-VI-79	D. Culbert	*Paspalum notatum*
10	Clay	Goldhead Branch St. Pk.	16-VI-81	S. Peck	blacklight trap
1	Collier		15-V-81	K. Delate	in soil
4	Collier	Immokalee	5-IV-59	H.V. Weems, Jr.	at light
2	Columbia		10-VII-58		
2	Columbia	Lake City	V-67		
2	Columbia	Lake City	27-VI-73	H.J. Lee	found dead
1	Columbia	Lake City	24-VI-80	E. Graham	blacklight trap
2	Columbia	Lake City	2-VI-1899		
10	Columbia	Osceola Nat. For.	2-24-VI-77	J.R. Wiley	Malaise trap
4	Dade	Homestead, 4 mi. NW	10-VI-74	J.B. Heppner	at blacklight
4	Dade	Cutler	22-V-69	R.L. Westcott	
11	Dade	Everglades Nat. Pk.	8-VII-81	S. Peck	blacklight trap
1	Dade	Homestead	28-IX-68	R.M. Baranowski	blacklight trap
2	Dade	Long Pine Key	13-V-77	R. Turnbow	at light
41	Dade	Miami: III(1); IV(4); V(4); VI(1); VII(1); X(1): Records = 12			various hosts
1	Dade	Perrine	1-VII-60	P.E. Briggs	light trap
2	Dade	Perrine	8-9-V-77	D. Urban	blacklight trap
13	Dade	Plant Introduction Sta.	4-V-62	H.S. Creamer	blacklight trap
1	Dade	South Miami	10-VIII-61	J.H. Knowles	on ground at night
3	Duval	Jacksonville	4-VI-69	R. King	blacklight trap
9	Duval	Jacksonville	11-VI-69	R. King	blacklight trap
9	Duval	Jacksonville	18-VI-69	R. King	blacklight trap
2	Duval	Jacksonville	16-VII-69	R. King	blacklight trap
2	Duval	Jacksonville	23-VII-69	R. King	blacklight trap
3	Duval	Mandarin	25-VI-83	P.M. Choate, Jr.	blacklight trap
1	Escambia	Fort Barrancas	6-VI-24	T.H. Hubbell	
1	Escambia	Gonzalez	27-VI-84	R. Hill	
2	Escambia	Molino	26-VI-69	E.N. Bishop	blacklight trap
2	Escambia	Molino	3-VII-69	E.N. Bishop	blacklight trap
1	Escambia	Pensacola	26-VI-48	H.W. Crowder	
2	Escambia	Pensacola	21-VI-61	T.W. Boyd	on door
1	Escambia	Pensacola	5-VII-61	T.W. Boyd	Japanese beetle trap
1	Escambia	Pensacola	14-VI-62	T.W. Boyd	blacklight trap
3	Escambia	Pensacola	13-18-V-63	S. Hills	taken at light
26	Escambia	Walnut Hill	12-VI-69	E.N. Bishop	blacklight trap
7	Escambia	Warrington	26-27-V-63	V.F. Grant	blacklight trap
6	Franklin	St. George Island	27-VI-72	W.W. Baker	at lights
1	Franklin	St. George Island	5-VIII-72	W.W. Baker	light
1	Gadsden	Bristol Road	2-VIII-25	T.H. Hubbell	

Appendix 28 (cont.). *Phyllophaga prununcu1ina* (Burmeister)

1	Glades	Palmdale	10-IV-57	J. Hardin	
17	Gulf	St. Joseph St. Pk.	13-VI-69	H.V. Weems, Jr.	at fluorescent light
1	Gulf	St. Joseph St. Pk.	2-X-83	H.V. Weems, Jr.	blacklight
1	Hamilton	Rt. 41	22-IX-76	J.R. Wiley	blacklight trap
20	Hamilton	Rt. 6 & Suwanee Riv.	4-VII-81	Choate & Davis	blacklight trap
1	Hendry	Felda, 1mi. S	16-V-77	R. Turnbow	
1	Hernando	Brooksville, 3mi. S	31-VII-69	C.B. Williams	blacklight trap
1	Highlands	Archbold Biol. Sta.	22-24-III-78	L.L. Lampert	blacklight
1	Highlands	Archbold Biol. Sta.	16-V-79	R. Turnbow	blacklight
1	Highlands	Avon Park	10-12-VI-81	J.F. Reinert	
6	Highlands	Highlands Hammock St. Pk.	5-V-61	T. Morris	blacklight trap
1	Highlands	Highlands Hammock St. Pk.	3-V-74	J.B. Heppner	blacklight trap
10	Highlands	Highlands Hammock St. Pk.	23-25-VI-81	S. Peck	blacklight trap
1	Highlands	Sebring	15-V-28	D.M. Bates	
1	Highlands	Sebring	13-VI-62	L.B. Hill	roadway
4	Hillsborough		25-V-60	J. Gross	
1	Hillsborough	Brandon	11-V-62	J.W. Patton	at light
1	Hillsborough	USF Campus	13-VIII-83	L. Brown	
1	Indian River	Vero Beach	7-VI-32	E.M. Becton	
1	Indian River	Vero Beach	16-V-75	M.C. Thomas	at light
1	Indian River	Vero Beach	30-III-76	M.C. Thomas	at light
1	Jackson	Marianna	19-VI-61	A.R. Gary, Jr.	outside light
4	Jackson	Marianna	5-VI-70	E.L. Tipton	blacklight trap
10	Jackson	Marianna	11-VI-70	E.L. Tipton	blacklight trap
22	Jefferson	Monticello:	VI(6); VII(3); VIII(1): Records = 10		blacklight trap
1	Lake		21-VI-60	C.E. Mosteller	Japanese beetle trap
1	Lake	Groveland	25-VI-63	W.P. Henderson	in soil
1	Lake	Groveland	9-VII-63	Henderson & Fatic	in soil
1	Lake	Leesburg	20-VI-38	C.C. Goff	
1	Lake	Leesburg	20-V-61	C.H. Curran	
7	Lake	Pittman	5-VIII-69	K. Lorenzen	blacklight trap
1	Lee	Fort Myers	22-IV-12		
2	Lee	Lehigh Acres	17-19-IV-82	N.M. Downie	
63	Leon	Tall Timbers Res. Sta.:	VI(10); VII(15); VIII(7); IX(3): Records = 35		blacklight trap
1	Leon	Tallahassee	26-VI-70	G.H. Nelson	
6	Levy	Hwy.24,.2mi.S Alachua Co.	20-VI-77	R. Turnbow	at light
1	Levy	Lebanon Station	21-VIII-62	T.R. Adkins	Japanese beetle trap
2	Levy	Williston	14-VIII-63	T.R. Adkins	Japanese beetle trap
25	Liberty		16-VI-58	T.J. Walker, Jr.	
1	Liberty	Camp Torreya	29-V-24	T.H. Hubbell	
1	Liberty	Camp Torreya	31-V-24	T.H. Hubbell	
1	Liberty	Camp Torreya	VI-24	T.H. Hubbell	
1	Liberty	Camp Torreya	24-VII-25	T.H. Hubbell	
1	Liberty	Camp Torreya	13-VII-35	I.J. Cantrall	
692	Liberty	Torreya St. Pk.:	VI(3); VII(5); VIII(4); IX(1): Records = 13		blacklight trap
82	Liberty		25-VI-81	P.M. Choate, Jr.	blacklight trap
1	Madison	Greenville	2-IX-32	L.K. Gloyd	
1	Madison	Lee, 3mi. N. Lee	14-VI-77	R. Mercer	blacklight trap
1	Manatee	Bradenton	9-VII-63	E.H. Frederic	Japanese beetle trap
1	Marion	Ocala	22-VI-61	T.R. Adkins	Japanese beetle trap
1	Marion	Ocala	14-VI-63	T.R. Adkins	Japanese beetle trap
2	Marion	Ocala	2-VIII-63	T.R. Adkins	blacklight trap
2	Marion	Ocala	30-VIII-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	6-IX-63	T.R. Adkins	blacklight trap
2	Marion	Ocala	20-IX-63	T.R. Adkins	blacklight trap
2	Marion	Ocala	27-IX-63	T.R. Adkins	blacklight trap
1	Marion	Ocala	4-X-63	T.R. Adkins	blacklight trap
30	Marion	Ocala	23-VII-65	W.O. Roberson	blacklight trap
1	Marion	Ocala Nat. For.	23-VII-38	Hubbell & Friauf	
1	Marion	Ocala Nat. For.	25-VII-38	Hubbell & Friauf	
1	Marion	Ocala N.F., Juniper Sprs.	22-VI-77	M.C. Thomas	blacklight trap
1	Marion	Silver Springs	21-VI-63	T.R. Adkins	Japanese beetle trap
2	Marion	Silver Springs Woods	11-20-VI-84	S.A. Marshall	Malaise trap
1	Monroe	Cape Sable	6-IV-58	D. Thornton	
1	Okaloosa	Baker	31-V-77	C. Webb	blacklight trap
1	Okaloosa	Destin	17-VI-71	H. Flaschka	
1	Okaloosa	Fort Walton	24-VIII-61	T.W. Boyd	Japanese beetle trap
5	Okaloosa	Holt, 1.7mi. N	16-VI-78	L.A. Stange	blacklight trap

dix 28 (cont.). ***Phyllophaga prununcu1ina*** (Burmeister)

	Holt, 3mi. NW	8-11-VIII-79	L.A. Stange	blacklight trap
	Holt, 4.5mi. NW, FAMU	9-VI-72	R. Turnbow	
	Holt, 4.5mi. NW	15-16-VI-78	L.A. Stange	blacklight trap
	Holt, 4.5mi. NW	17-VI-78	L.A. Stange	blacklight trap
	Valparaiso	?-VII-43	G.A. Edwards	
	Orlando	3-VIII-61	J.R. Woodley	Japanese beetle trap
	Canoe Creek Serv. Plaza	9-VI-74	R. Turnbow	blacklight
h	Lake Worth	29-III-49		at light
h	Lake Worth	13-V-49		
h	Lantana	30-V-79	W.C. Churchill	in soil
h	Lantana	30-V-79	D.C. Clinton	
	Dade City	17-VII-38	W.C. Stehr	
	Dade City	20-VI-63	Hill & Sellers	in soil
	Dunedin	15-VI-15	W.S. Blatchley	
	Dunedin	7-IV-23	W.S. Blatchley	
	Largo	17-VII-?		
	Winter Haven	15-V-62	W.J. Poole	blacklight trap
	East Palatka	28-VI-63	T.R. Adkins	Japanese beetle trap
	Melrose, 2mi. E	29-V-83	P.M. Choate, Jr.	blacklight trap
	Melrose, 3mi. S	12-VI-82	B. Beck	in water dish
	Melrose, 3mi. S	31-V-83	B. Beck	blacklight trap
	Melrose, 3mi. S	8-VI-83	B. Beck	blacklight trap
	Melrose, 3mi. S	9-VI-83	B. Beck	blacklight trap
	Vause Lake	2-3-VI-84	P.M. Choate, Jr.	blacklight trap
	Welaka	14-VIII-40	J.J. Friauf	
sa	Blackwater Riv. St. For.	27-VI-81	P.M. Choate, Jr.	
sa	Milton	30-VIII-68	B. Zain	blacklight trap
	Sanford	1-VI-60	G.W. Desin	water-ground
	Sanford	9-V-62	G.W. Desin	blacklight trap
	Sanford	22-V-62	G.W. Desin	blacklight trap
	Sanford	19-VI-62	G.W. Desin	blacklight trap
	Sanford	31-VII-62	G.W. Desin	blacklight trap
	Sanford	6-VI-63	G.W. Desin	Japanese beetle trap
	Dallas Creek Landing	3-VI-72	R. Turnbow	
	Perry	30-IV-2-V-67	W.L. Beers	blacklight trap
	Perry	29-VII-68	E.P. Merkel	blacklight trap
	Perry	19-VIII-68	E.P. Merkel	blacklight trap
	Perry	11-VI-69	W.L. Beers	blacklight trap
	Perry	15-VI-69	W.L. Beers	blacklight trap
	Perry	18-VI-69	W.L. Beers	blacklight trap
	Perry	25-VI-69	W.L. Beers	blacklight trap
	Perry	19-VIII-69	W.L. Beers	blacklight trap
	Daytona Beach	5-VII-35	I.J. Cantrall	
	Daytona Beach	31-VII-61	C. Tolbot	ground
	Panacea	17-19-VI-67	C. Hilfiker	on surf
	Panacea	21-29-VI-67	C. Hilfiker	P-1
	Panacea	14-VII-67	C. Hilfiker	on surf
	Panacea	10-VIII-67	C. Hilfiker	on surf
	Panacea	23-VIII-67	C. Hilfiker	P-1
	Panacea	23-VIII-67	C. Hilfiker	P-1
ton	Falling Waters St. Pk.	29-VI-70	G.H. Nelson	light

Appendix 29. ***Phyllophaga pseudofloridana*** n.sp.

ypes

Tallahassee, Rt.90	28-IV-84	L.R.Davis, Jr.	
I-10 exit at Rt.319	28-IV-84	S.L. & L.R.Davis, Jr.	at lights
Tall Timbers Res.Sta.	17-VI-67	A.Bhatkar	blacklight trap
Tall Timbers Res.Sta.	28-III-1-IV-68	L.Collins	TT-3
Tall Timbers Res.Sta.	28-III-11-IV-68	L.Collins	TT-3 blacklight trap
Tall Timbers Res.Sta.	12-20-IV-68	L.Collins	TT-3
Tall Timbers Res.Sta.	22-IV-5-V-68	L.Collins	TT-3
Tall Timbers Res.Sta.	22-IV-6-V-68	L.Collins	blacklight trap
Tall Timbers Res.Sta.	7-17-V-68	D.Harris	blacklight trap
Tall Timbers Res.Sta.	15-V-68	W.W.Baker	blacklight trap
Tall Timbers Res.Sta.	16-V-68	W.W.Baker	TT-1

Appendix 29 (cont.). *Phyllophaga pseudofloridana* n.sp.

1	Leon	Tall Timbers Res.Sta.	18-27-V-68	L.Collins	blacklight trap
2	Leon	Tall Timbers Res.Sta.	28-V-7-VI-68	L.Collins	blacklight trap
1	Leon	Tall Timbers Res.Sta.	3-4-IV-69	W.W.Baker	TT-1
1	Leon	Tall Timbers Res.Sta.	20-21-IV-69	A.Bhatkar	blacklight trap
1	Leon	Tall Timbers Res.Sta.	28-IV-70	F.W.Mead	blacklight trap

FLORIDA: Non-Paratypes

1	Baker	Macclenny	5-V-69	H.W.Collins	blacklight trap
9	Columbia	Lake City, Santa Fe R.	18-IV-80	A.E.Graham	blacklight trap
7	Columbia	Lake City, RFD	24-IV-80	A.E.Graham	blacklight trap
1	Gadsden	Quincy	30-IV-62	W.B.Tappan	blacklight trap
1	Gadsden	Quincy	7-V-62	W.B.Tappan	blacklight trap
6	Hamilton	Stephen Foster Memorial	29-III-77	J.R.Wiley	blacklight trap
1	Jefferson	Monticello	13-VI-38	S.O.Hill	Japanese beetle trap
1	Jefferson	Monticello	20-IV-60	A.M.Phillips	blacklight trap
1	Liberty	Torreya St.Pk.	11-VII-81	P.M.Choate	flood plain forest on tree at night
1	Liberty	Torreya St.Pk.	30-V-82	P.M.Choate	leaf litter flood plain forest
1	Madison		2-V-46	F.N.Young	431, at light
1	Okaloosa	Milligan	12-V-85	S.W.Dunkle	

GEORGIA: Paratypes

1	Baker	Newton,Emory Un.Field Sta.	24-VI-52		light
1	Brooks	Quitman	24-IV-37	P.W.Fattig	
3	Dougherty	Albany	VI-36	G.F.Moznette	
1	Dougherty	Albany	26-V-39	P.W.Fattig	persimmon
1	Houston	Perry	29-IV-38	P.W.Fattig	persimmon
1	Newton	Covington	5-V-36	P.W.Fattig	
4	Thomas	Thomasville	30-III-38	P.W.Fattig	oak
2	Thomas	Thomasville	31-III-38	P.W.Fattig	oak
1	Thomas	Thomasville	5-IV-38	P.W.Fattig	oak
1	Thomas	Thomasville	7-IV-38	P.W.Fattig	oak
3	Thomas	Thomasville	12-IV-38	P.W.Fattig	oak
1	Thomas	Thomasville	12-IV-38	P.W.Fattig	oak
2	Thomas	Thomasville	21-IV-38	P.W.Fattig	oak
2	Thomas	Thomasville	22-IV-38	P.W.Fattig	oak
1	Thomas	Thomasville	3-IV-39	W.H.Thames	Jr., water oak
1	Thomas	Thomasville	9-V-40	P.W.Fattig	light
1	Thomas	Thomasville	15-V-40	P.W.Fattig	black gum

Appendix 30. *Phyllophaga quercus* (Knoch)

1	Alachua		XI-38		
1	Alachua	Archer	20-VI-77	R. Turnbow	at light
3	Alachua	Co. Rd. 17B	11-VIII-83	K.W. Vick	blacklight trap
1	Alachua	Co. Rd. 17B	13-VIII-83	K.W. Vick	blacklight trap
1	Alachua	Co. Rd. 17B	17-VIII-83	K.W. Vick	blacklight trap
5	Alachua	Gainesville	25-VI-67	M.M. Cole	roses at night
1	Alachua	Gainesville	2-5-VII-70	F.W. Mead	blacklight trap
1	Alachua	Gainesville	23-VI-77	B.J. Smittle	blacklight trap
1	Alachua	Gainesville	4-VII-77	B.J. Smittle	blacklight trap
4	Alachua	Gainesville	26-VI-78	F.W. Mead	blacklight trap
3	Alachua	Gainesville	30-VI-2-VII-78	F.W. Mead	blacklight trap
3	Alachua	Gainesville	5-VII-78	F.W. Mead	blacklight trap
3	Alachua	Gainesville	28-30-VII-78	F.W. Mead	blacklight trap
1	Alachua	Gainesville	2-VII-80	L.A. Stange	blacklight trap
10	Alachua	Gainesville	1-VII-86	R.C. Wilkinson	*Rosa* sp.
1	Alachua	Newberry	6-VIII-83	K.W. Vick	blacklight trap
11	Escambia	Bratt	VI-68	F.S. Blanton	mosquito light trap
1	Escambia	Bratt, 3mi. SE	4-VI-68	A.J. Blanton	blacklight trap
1	Escambia	Gonzalez	27-VI-84	R. Hill	
1	Escambia	Molino	5-VI-69	E.N. Bishop	blacklight trap
3	Escambia	Molino	19-VI-69	E.N. Bishop	blacklight trap
5	Escambia	Molino	26-VI-69	E.N. Bishop	blacklight trap

;ndix 30 (cont.). *Phyllophaga quercus* (Knoch)

Molino	3-VII-69	E.N. Bishop	blacklight trap
Pensacola	3-VII-62	T.W. Boyd	blacklight trap
Apalachicola Nat. For.	10-VIII-71	H.V. Weems, Jr.	
Quincy	1-15-VIII-71	J. Reid	
JSF Campus	24-III-84	L. Brown	
Vero Beach, 5mi. S	16-26-VI-83	J.H. Frank	Malaise trap
	6-VIII-58	T.J. Walker, Jr.	
Cottondale, nr.	30-VI-57	Thornton & Bell	at light
Fla. Caverns St. Pk.	11-VIII-81	S. Peck	blacklight trap
Fla. Caverns St. Pk.	21-23-VIII-84	J.B. Heppner	blacklight trap
Fla. Caverns St. Pk	28-VII-64	J.W. Patton	at light
Monticello	8-VII-69	R.E. Woodruff	blacklight trap
Monticello	10-VII-69	R.H. Miller	blacklight trap
Monticello	18-VII-69	W.H. Whitcomb	blacklight trap
Monticello	6-VIII-69	R.H. Miller	blacklight trap
Monticello	11-VII-80	R.L. Crocker	
Tall Timbers Res. Sta.:	VI(7); VII(27); VIII(9); IX(1): Records = 44		blacklight trap
Tankeetown	10-VII-83	T.H. Lillie	vehicle trap
	15-VII-83	P.M. Choate, Jr.	blacklight trap
	25-VI-81	P.M. Choate, Jr.	blacklight trap
Camp Torreya	31-VII-25	T.H. Hubbell	
Torreya St. Pk.	4-VII-65	H.V. Weems, Jr.	blacklight trap
Torreya St. Pk.	21-VII-79	L.R. Davis, Jr.	blacklight trap
Torreya St. Pk.	19-VII-80	L.R. Davis, Jr.	blacklight trap
Torreya St. Pk.	3-VII-82	E.G. Riley	
Torreya St. Pk.	5-VII-82	E.G. Riley	
Tree	14-VI-77	R. Mercer	blacklight trap
Tree	20-VI-77	R. Mercer	blacklight trap
Tray	27-VII-62	T.W. Boyd	blacklight trap
Tilton, Avalon Bch.	15-IX-83	R. Hill	blacklight trap
Tripley, 5mi. E	31-VIII-60	W.C. Rhoades, Jr.	blacklight trap

ppendix 31. *Phyllophaga schaefferi* Saylor

Tigh Springs, 4mi. N	19-III-53	Howden & Dozier	light
-75 rest stop	12-III-77	D.C. Iftner	
-75 rest stop	8-IV-83	D. Rider	
-75,4.2mi.S Fla.S349	18-III-79	R. Turnbow	at light
Lake City		Wickham colln.	
		Schaeffer colln.	
Molino	3-IV-69	E.N. Bishop	blacklight trap
Quincy	9-IV-62	W.B. Tappan	
Fla. Caverns St. Pk.	13-IV-60	H.A. Denmark	at light
Fla. Caverns St. Pk.	18-IV-63		
Monticello:	III(6); IV(7): Records = 13		blacklight trap
-10 at Ochlocnee R.	20-IV-84	L.R.Davis, Jr.	
Tall Timbers St. Pk:	III(1); IV(9): Records = 10		blacklight trap
Tallahassee, 2mi. W	15-IV-45	T.H. Hubbell	
Torreya St. Pk.	11-IV-83	E.G. Riley	
Torreya St. Pk.	19-23-IV-84	E.G. & M.A. Riley	
	2-IV-46	F.N. Young	
	2-V-46	F.N. Young	
Tulogne	1-IV-38	J.G. Franklemont	
Twannee Riv. St. Pk.	29-III-77	J.R. Wiley	blacklight trap

dix 32. *Phyllophaga skelleyi* Woodruff & Beck

Archer, 2.5mi. SW	18-III-89	P.E. Skelley	turkey oak
Camp Crystal	31-III-1-IV-82	M.C. Thomas	
Crystal Lake	30-III-85	S. Gross	lights
Crystal Lake	7-IV-84	S. Gross	blacklight trap
Crystone Heights	6-V-84	L.R. Davis, Jr.	
Camp McQuarrie	29-IV-76	M.C. Thomas	blacklight trap
Camp McQuarrie	30-IV-76	M.C. Thomas	blacklight trap
Estis	7-IV-60	Denmark & Woodruff	light
Estis	14-IV-83	R.E. Woodruff	light

Appendix 32 (cont.). *Phyllophaga skelleyi* Woodruff & Beck

1	Lake	Minneola	14-III-56	H.A. Denmark	at light
8	Levy	Archer, 3mi. SW	30-III-89	Skelley & Woodruff	blacklight trap
2	Levy	Archer, 3.8mi. SW	19-IV-87	P.E. Skelley	at light
7	Levy	Archer, 3.8mi. SW	23-IV-87	P.E. Skelley	at light
1	Levy	Archer, 3.8mi. SW	30-IV-87	Skelley & Lundgren	at light
4	Levy	Archer, 3.8mi. SW	30-IV-87	Skelley & Lundgren	turkey oak
1	Levy	Archer, 3.8mi. SW	7-VI-87	P.E. Skelley	turkey oak
3	Levy	Archer, 3.8mi. SW	23-III-88	P.E. Skelley	blacklight trap
3	Levy	Archer, 3.8mi. SW	24-31-III-88	P.E. Skelley	window trap
2	Levy	Archer, 3.8mi. SW	24-31-III-88	P.E. Skelley	Malaise trap
4	Levy	Archer, 3.8mi. SW	1-10-IV-88	P.E. Skelley	Malaise trap
2	Levy	Archer, 3.8mi. SW	10-17-IV-88	P.E. Skelley	Malaise trap
1	Levy	Archer, 3.8mi. SW	17-23-IV-88	P.E. Skelley	Malaise trap
1	Levy	Archer, 3.8mi. SW	23-IV-1-V-88	P.E. Skelley	Malaise trap
1	Levy	Archer, 3.8mi. SW	21-29-V-88	P.E. Skelley	turkey oak
9	Levy	Archer, 3.8mi. SW	18-III-89	P.E. Skelley	turkey oak
4	Levy	Archer, 3.8mi. SW	26-III-89	M.C. Thomas	
1	Marion	Ocala,Rainbow Spr.Village	2-5-V-82	P.J. Landolt	netted
6	Marion	Ocala N.F., Grassy Pond	29-IV-84	Woodruff & Landolt	blacklight trap
7	Marion	Ocala N.F., Grassy Pond	1-V-84	P.J. Landolt	mercury vapor light
5	Marion	Ocala N.F., Grassy Pond	17-IV-89	M.C. Thomas	at light
1	Marion	Ocala N.F., Juniper Sprs.	9-IV-75	K.W. Vick	blacklight trap
2	Putnam	Interlachen	23-24-IV-83	O.E. Hunt	blacklight trap
2	Putnam	Interlachen, nr.	25-III-85	Woodruff,Beck & Skelley	turkey oak
15	Putnam	Interlachen,Paris Rd.	9-IV-89		

Appendix 33. *Phyllophaga subpruinosa* Casey

1	Alachua		III-49	J.W. Maddox	
1	Alachua		21-IV-50		
1	Alachua		29-IV-60	Jordan	
1	Alachua	Gainesville	10-IV-24	F.W. Crumley	
1	Alachua	Gainesville	17-IV-76	L. Davis	street light
2	Highlands	Archbold Biol. Sta.	8-III-64	S.W. Frost	
4	Highlands	Archbold Biol. Sta.	14-III-64	S.W. Frost	
1	Highlands	Archbold Biol. Sta.	20-III-64	S.W. Frost	
3	Highlands	Archbold Biol. Sta.	18-III-77	Platt & Riley	blacklight
9	Highlands	Archbold Biol. Sta.	29-III-1-IV-78	L. Lampert	blacklight trap
1	Highlands	Highlands Hammock St. Pk.	19-III-57	H. Dietrich	
1	Marion	Ocala N.F., Juniper Sprs.	11-IV-75	M.C. Thomas	at light
1	Palm Beach	Palm Beach	24-IV-06	C. & H. Cory	
1	Putnam	Crescent City		Hubbard & Schwarz	
1	Putnam	Crescent City		Hubbard & Schwarz	
1	Putnam	Welaka	3-IV-40	J.J. Friauf	
10	Putnam	Welaka	24-IV-40	J.J. Friauf	

Appendix 34. *Phyllophaga tecta* Cartwright

7	Alachua		1-V-47		
1	Alachua		16-V-51		
1	Alachua		V-60	R. Parsons	
1	Alachua		XI-60	K. McCreanor	
1	Alachua		X-61	M. Varn	
1	Alachua		V-62	T. Wilkinson	
3	Alachua	Chantilly Acres	23-IV-68	F.S. Blanton	blacklight trap
173	Alachua	Gainesville: II(1); III(31); IV(30); V(19); VI(3); VII(3):Records = 87			blacklight trap
1	Alachua	R19E, T10S, Sec.,12	19-II-49	B.W. Cooper	
2	Alachua	R20E, T10S, Sec. 6	23-III-49	B.W. Cooper	
1	Alachua	R20E, T10S, Sec. 6	III-49	B.W. Cooper	
1	Duval	Jacksonville	5-V-61	T.S. Josey	Japanese beetle trap
1	Duval	Mayport	10-V-61	L.W. Taylor	blacklight trap
1	Duval	Mayport	7-VI-61	L.W. Taylor	blacklight trap
1	Hardee	Ona	3-V-67	Brad Fagan	blacklight trap
2	Highlands	Highlands Hammock St. Pk.	13-III-77	Platt & Riley	blacklight
2	Highlands	Highlands Hammock St. Pk.	14-III-77	Platt & Riley	blacklight
1	Manatee	Bradenton	12-IV-55	E.G. Kelsheimer	in light trap

Appendix 34 (cont.). *Phyllophaga tecta* Cartwright

itee	Oneco		P. Dillman	
itee	Oneco	12-13-IV-66	R.E. Woodruff	blacklight trap
itee	Oneco, Oneco Nurs.	8-IV-69	F.W. Mead	blacklight trap
ion	Heather Island, N end	28-VI-75	P.C. Drummond	blacklight trap
ion	Lake Eaton	8-IV-75	P.C. Drummond	blacklight trap
ion	Ocala	5-IV-62	T.R. Adkins	blacklight trap
ion	Ocala	13-IV-62	T.R. Adkins	blacklight trap
on	Ocala	12-IV-63	T.R. Adkins	blacklight trap
llas	Largo	1-IV-58	C.E. Bingaman	in leaves on ground
am	Little Orange Lake	1-IV-84	K.W. Vick	blacklight trap
am	Little Orange Lake	2-IV-84	K.W. Vick	blacklight trap
am	Little Orange Lake	13-IV-84	K.W. Vick	blacklight trap
am	Little Orange Lake	20-IV-84	K.W. Vick	blacklight trap
am	Little Orange Lake	25-IV-84	K.W. Vick	blacklight trap
am	Red Water Lake, nr.	15-IV-61	H.V. Weems, Jr.	at light
am	Welaka	17-20-III-86	J.B. Heppner	blacklight trap

Appendix 35. *Phyllophaga tristis* (Fabricius)

mbia	Ft. Barrancas	9-IV-13		
	Tall Timbers Res. Sta.	9-15-V-72	D. Harris	pitfall Rep. 2-A
oosa	Crestview	5-V-65	J.W. Patton	*Quercus* sp.
oosa	Holt, 1.5mi. W	14-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
a Rosa	Blackwater Riv. St. For.	18-19-IV-84	E.G. & M.A. Riley	beating oak
a Rosa	Holley, 1mi. N on SR 87	15-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
a Rosa	Milton	4-V-1949		No.9661
a Rosa	Munson, 4mi. N	8-IV-82	E.G. Riley	
a Rosa	Navarre, 2mi. N on SR 87	14-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
on	Freeport		F.N. Young #426	

Appendix 36. *Phyllophaga ulkei* (Smith)

	St. Nicholas		Ashmead	
ua	Gainesville	2-V-22	F.W. Walker	
ua	Gainesville	6-V-22	F.W. Walker	
ua	Gainesville	24-IX-34	F.N. Young	
l?			A.T.Slosson Colln.	
l?	E. Florida		Ashmead	
bia	Pensacola	19-V-41	T.W. Boyd	Japanese beetle trap
bia	Pensacola	16-V-62		
len	Quincy	5-IV-29	F.S. Chamberlin	Japanese beetle trap
on	Fla. Caverns St. Pk.	13-IV-60	H.V. Weems, Jr.	at light
rson	Monticello	29-III-60	A.M. Phillips	blacklight trap
rson	Monticello	31-V-63	A.M. Phillips	on screen door
	Tall Timbers Res. Sta.	28-III-11-IV-68	L. Collins	Plot TT-3
	Tall Timbers Res. Sta.	2-IV-68	W.W. Baker	Plot TT-1
	Tall Timbers Res. Sta.	12-20-IV-68	L. Collins	Plot TT-3
	Tall Timbers Res. Sta.	3-4-IV-69	W.W. Baker	Plot TT-1
	Tall Timbers Res. Sta.	3-6-IV-72	R.L. Jacques, Jr.	
ty	Camp Torreya	29-V-24	T.H. Hubbell	
n	Ocala N.F., Juniper Sprs.	7-11-IV-75	M.C. Thomas	at light
osa	Holt, S. on I-10	14-IV-89	Woodruff,Beck & Skelley	at light
osa	Holt, 4.5mi. NW	20-21-IV-74	W.L. & J.G. Peters	
osa	Holt, 1.5mi. W	14-IV-89	Woodruff,Beck & Skelley	*Quercus laevis*
Rosa	Munson, 4mi. N	8-IV-82	E.G. Riley	

Appendix 37. *Phyllophaga uniformis* (Blanchard)

ua		1-VII-72	M. Grown	
ua		8-VI-85	A. Waters	grass
ua	Co. Rd. 17B	30-V-83	K.W. Vick	blacklight trap
ua	Gainesville:	III(3); V(31); VI(91); VII(2): Records = 127		blacklight trap
ua	High Springs	8-VI-61	T.R. Adkins	Japanese beetle trap
ua	High Springs	21-VI-61	T.R. Adkins	Japanese beetle trap
ua	High Springs	28-VI-61	T.R. Adkins	Japanese beetle trap
	Glen St. Mary	23-VI-70	H.W. Collins	blacklight trap

Appendix 37 (cont.). *Phyllophaga uniformis* (Blanchard)

1	Baker	Macclenny	26-V-69	H.W. Collins	blacklight trap
1	Baker	Macclenny	4-VI-69	H.W. Collins	blacklight trap
10	Baker	Macclenny	11-VI-69	H.W. Collins	blacklight trap
8	Baker	Macclenny	24-VI-69	H.W. Collins	blacklight trap
1	Baker	Olustee	20-V-63	E.P. Merkel	blacklight trap
3	Baker	Olustee	22-V-63	E.P. Merkel	blacklight trap
3	Baker	Olustee	29-V-63	E.P. Merkel	blacklight trap
1	Baker	Olustee	30-V-63	E.P. Merkel	blacklight trap
3	Baker	Olustee	4-VI-63	E.P. Merkel	blacklight trap
1	Baker	Olustee	13-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	20-VII-66	E.P. Merkel	blacklight trap
1	Baker	Olustee	11-VI-69	E.P. Merkel	blacklight trap
1	Bradford	Starke, 8Km. NW	23-30-VI-80	A. Wilkening	window trap, slash pine
5	Calhoun	Blountstown	20-VI-61	E.L. Tipton	Japanese beetle trap
2	Calhoun	Blountstown	21-VIII-61	E.L. Tipton	Japanese beetle trap
1	Columbia	Camp Oleno	3-VI-55	L.C. Kuitert	light
1	Columbia	Lake City	VI-67		
5	Columbia	Lake City	24-VI-80	E. Graham	blacklight trap
2	Columbia	Oleno St. Pk.	16-VI-51	Price,Beamer,& Wood	
2	Columbia	Osceola Nat. For.	2-VI-77	J.R. Wiley	blacklight trap
1	Columbia	Osceola Nat. For.	2-24-VI-77	J.R. Wiley	Malaise trap
1	Dade	Coral Gables	28-III-59	R.W. Swanson	at light
1	Dade	Coral Gables	3-IV-59	R.W. Swanson	at light
2	Dade	Coral Gables	18-IV-59	R.W. Swanson	at light
1	Dade	South Miami	19-IV-60		
1	Duval	Jacksonville	17-V-49	R. Baker	
2	Duval	Jacksonville	3-VI-49	H.A. Carrell	
1	Duval	Jacksonville	11-VI-54	R. Baker	
2	Duval	Jacksonville	23-24-VI-82	F.N. Young	blacklight trap
1	Gadsden	Quincy	8-VI-50	H.K. Townes	at light
3	Gadsden	Quincy	20-VI-61	E.L. Tipton	Japanese beetle trap
2	Gadsden	Quincy	1-15-VIII-81	J. Reid	
1	Holmes			F.N. Young	
2	Jackson	Graceville	21-VI-61	E.M. Kolmetz	*Paspalum notatum*
1	Jackson	Marianna	10-VI-58	R.E. Woodruff	at light
2	Jackson	Marianna	21-VI-61	T.R. Gary, Jr.	outside light
1	Jackson	Marianna	19-VII-68	E.L. Tipton	medfly trap
2	Jackson	Marianna	11-VI-70	E.L. Tipton	blacklight trap
7	Jackson	T5N, R7W, Sec. 5	12-VI-53	T.H. Hubbell	
101	Jefferson	Monticello:	V(4); VI(17); VII(13): Records = 34		blacklight trap
567	Leon	Tall Timbers Res. Sta.:	V(17); VI(27); VII(11); VIII(4): Records = 59		blacklight trap
1	Levy	Chiefland	15-VI-61	T.R. Adkins	Japanese beetle trap
1	Levy	Gulf Hammock	10-VI-60	T.R. Adkins	Japanese beetle trap
2	Liberty	Torreya St. Pk.	23-24-VI-56	Cohn & Kannowski	picnic area
1	Liberty	Torreya St. Pk.	15-VI-69	H.V. Weems, Jr.	at blacklight
1	Liberty	Torreya St. Pk.	5-VII-82	E.G. Riley	
1	Madison	Lee, 3mi. N	20-VI-77	R. Mercer	blacklight trap
1	Marion	Ocala	5-VII-61	T.R. Adkins	Japanese beetle trap
1	Pasco	Dade City	18-VI-51	Price, Beamer, Wood	
1	Putnam	East Palatka	7-VI-61	T.R. Adkins	Japanese beetle trap
1	Putnam	East Palatka	27-VI-61	T.R. Adkins	Japanese beetle trap
1	Putnam	Palatka	31-V-61	T.R. Adkins	Japanese beetle trap
1	Sarasota	Sarasota	16-V-61	J.W. Patton	at light
1	Sarasota	Venice	9-V-61	C.L. Yax	
1	Seminole	Sanford	10-VII-61	G.W. Desin	Japanese beetle trap
1	Seminole	Sanford	24-V-62	G.W. Desin	Japanese beetle trap
2	Seminole	Sanford	1-VI-62	G.W. Desin	Japanese beetle trap
5	Seminole	Sanford	7-VI-62	G.W. Desin	Japanese beetle trap
2	Seminole	Sanford	6-VI-63	G.W. Desin	Japanese beetle trap
1	Suwannee	Dowling Park, 5mi. S	7-8-X-76	Wiley & Woodruff	blacklight trap #119
2	Suwannee	Suwannee Springs	30-VI-48	H.W. Crowder	
2	Suwannee	Suwannee Springs	3-VII-48	R.H. Beamer	
1	Suwannee	Suwannee Springs	15-VI-51	Price, Beamer, Wood	
1	Taylor	Perry	19-29-V-67	W.L. Beers	blacklight trap
12	Taylor	Perry	15-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	17-VI-69	W.L. Beers	blacklight trap
1	Taylor	Perry	18-VI-69	W.L. Beers	blacklight trap
1	Union	Hwy.241,1km.N.Santa Fe R.	28-IV-86	C.W. Mills,III	

ppendix 37 (cont.). *Phyllophaga uniformis* (Blanchard)

	Hwy.241,1km.N.Santa Fe R.	26-V-86	C.W. Mills,III	
	Hwy.241,1km.N.Santa Fe R.	28-V-86	C.W. Mills,III	
	Hwy.241,1km.N.Santa Fe R.	2-VI-86	C.W. Mills,III	
	Hwy.241,1km.N.Santa Fe R.	1-VIII-86	C.W. Mills,III	
	Millers Slough Hwy. 319	7-VI-72	R. Turnbow	at light
ton	Chipley	15-VI-10	A.G. Davis	
ton	Chipley	7-VII-61	E.L. Tipton	Japanese beetle trap

Appendix 38. *Phyllophaga youngi* Cartwright

Miami, Brickell Hammock	27-VI-35	F.N. Young	
Miami, Brickell Hammock	28-VI-35	F.N. Young	
Miami, Brickell Hammock	1-VII-35	F.N. Young	
Miami, Brickell Hammock	6-V-46	F.N. Young	
Miami, Brickell Hammock	15-VI-58	D.R. Paulson	
Miami, Brickell Hammock	4-VII-60	R.E. Woodruff	*Trema mollis*
Miami, Brickell Hammock	5-VII-60	R.E. Woodruff	*Trema mollis*
Miami, Brickell Hammock	27-V-63	B.K. Dozier	
Miami, Richenbacker Caus.	17-III-62	P.E. Briggs	reared
Miami, Wainwright Park	15-VI-83	R.E. Woodruff	blacklight trap

Appendix 39.
The following data are from the labels of the specimens used for the illustrations in plates 1-32.

MALES:

aemula: Florida, Jefferson Co., Monticello, Big Bend Hort. Lab., 22-VI-69, W. H. Whitcomb, blacklight trap.
anxia: (No. form) North Carolina, Todd, 1984, M. Klein, blacklight trap.
anxia: (So. form) Florida, Liberty Co., Torreya St. Pk., T2N R7W Sec. 17, 14-IV-79, L. R. Davis, blacklight trap.
apicata: Florida, Alachua Co., Gainesville, nr. Garden Club, 29-III-77, B. J. Smittle, blacklight trap (int. sac in place).
apicata: Florida, Alachua Co., Gainesville, 12-III-84, L. R. Davis & S. L. Davis (int. sac in place).
bruneri: Florida, Dade Co., Miami, 2-V-60, P. E. Briggs, blacklight trap.
clemens: Florida, Leon Co., Tall Timbers Res. Sta., 8-19-VI-68, L. Collins, blacklight trap.
clypeata: Florida, Dixie Co., 15 mi. S Old Town, Rt. 349, 8-VI-68, R. E. Woodruff, blacklight trap.
crenulata: Florida, Leon Co., Tall Timbers Res. Sta., 22-IV-5-V-68, L. Collins, blacklight trap.
cupuliformis: Florida, Putnam Co., Welaka, U.F. Cons. Res., near sawmill, 9-IV-64, H. A. Denmark, blacklight trap.
debilis: Florida, Baker Co., Olustee, 11-VII-56, E. P. Merkel, blacklight trap.
diffinis: Florida, Alachua Co., Gainesville, 15-IV-47, H. V. Weems, Jr., at light.
dispar: Florida, Leon Co., Tall Timbers Res. Sta., 14-VII-69, Wilson Baker, blacklight trap.
drakii: Wisconsin, Eau Claire, 21-V-39, R. W. Dawson, 13517.
elizoria: Florida, Highlands Co., Archbold Biol. Sta., 2-5-IV-79, L. L. Lampert, blacklight trap.
elongata: Florida, Marion Co., 9 mi. SSW Ocala, 21-V-75, R. E. Woodruff & N. Holler, blacklight trap.
ephilida: New Jersey, Moorestown, 24-VII-62, D. Jones.
floridana: Florida, Marion Co., N End Heather Is., 12-VI-75, P. C. Drummond, blacklight trap.
forbesi: Florida, Santa Rosa Co., Milton, Avalon Beach Cmpg., 15-IX-83, R. Hill, blacklight trap.
forsteri: Florida, Liberty Co., Torreya St. Pk., 17-IV-63, R. E. Woodruff, at light.
foxii: Florida, Seminole Co., Sanford, 28-II-62, G. W. Destin, blacklight trap.
fraterna: Indiana, Clarke Co., 2 mi. NE Memphis, 15-VI-84, K. W. Vick, blacklight trap.
futilis: Florida, Jackson Co., Florida Caverns St. Pk., 18-IV-63, R. E. Woodruff, blacklight trap.
georgiana: Florida, Jefferson Co., Monticello, Big Bend Hort. Lab., 19-VI-69, W. H. Whitcomb, blacklight trap.
glaberrima: Florida, Alachua Co., Gainesville, Doyle Conner Bldg., 21-VIII-69, F. W. Mead, blacklight trap.
gracilis: Florida, Alachua Co., Gainesville, nr. Garden Club, 5-VII-77, B. J. Smittle, blacklight trap.
hirticula: Florida, Leon Co., Tall Timbers Res. Sta., 10-IV-69, A. Bhatkar, blacklight trap.
hornii: Florida, Liberty Co., Torreya St. Pk., 11-IV-83, E. G. Riley.
ilicis: North Carolina, Todd, 6-18-VI-84, M. Klein, blacklight trap.
implicita: Kentucky, Marshall Co., 29-V-57, R. E. Woodruff.
infidelis: Florida, Alachua Co., Gainesville, Doyle Conner Bldg., 1-VI-70, F. W. Mead, blacklight trap.
knochii: Florida, Liberty Co., Torreya St. Pk., 24-VII-71, G. W. Rawson, blacklight trap.
latifrons: Florida, Baker Co., Olstee, 10-15-IX-66, E. P. Merkel, blacklight trap.
lota: Florida, Wakulla Co., Panacea, 14-VIII-67, C. Hilfiker, on surf.
luctuosa: Florida, Leon Co., Tall Timbers Res. Sta., 24-V-69, A. Bhatkor, blacklight trap.
mariana: Florida, Liberty Co., Torreya St. Pk., 17-IV-63, R. E. Woodruff, at light.
micans: Illinois, Union Co., Pine Hills Rec. Area, nr. Wolf Lake, 2-V-87, P. Skelley.
obsoleta: Florida, Leon Co., Tall Timbers Res. Sta., 28-VI-69, A. Bhatkar, blacklight trap.
okeechobea: Florida, Highlands Co., Archbold Biol. Sta., 25-IV-86, J. Sivinski.
ovalis: Florida, Santa Rosa Co., 4 mi. N Munson, 8-IV-82, E. G. Riley.
panorpa: Florida, Highlands Co., nr. Avon Park, Lake Letta subdivision, 6-IX-61, T. Morris, blacklight trap.
parvidens: Florida, Alachua Co., Gainesville, nr. Airport, 29-V-87, P. E. Skelley, at light.
perlonga: Florida, Gadsden Co., Aspalaga Bluff, 5mi. W Sycamore, 13-III-83, P. M. Choate, Jr.
postrema: Florida, Baker Co., Osceola Nat. For., Ocean Pond Rec. Area, 16-V-77, J. R. Wiley, blacklight trap.
profunda: Texas, Angelina Co., Lufkin, 29-IV-5-V-81, R. Turnbow, blacklight trap.
prununculina: Florida, Alachua Co., Gainesville, nr. Garden Club, 5-VI-77, B. J. Smittle, blacklight trap.
pseudofloridana: Florida, Columbia Co., Lake City, Santa Fe River, 18-IV-80, A. E. Graham, blacklight trap.
puberula: Cuba, Santiago de Cuba.
quercus: Florida, Alachua Co., Gainesville, nr. Garden Club, 12-VII-77, B. J. Smittle, blacklight trap.
schaefferi: Florida, Leon Co., Tall Timbers Res. Sta., 12-IV-69, A. Bhatkar, blacklight trap.
skelleyi: Florida, Putnam Co., Interlachen, 23-23-IV-83, K. W. Vick, blacklight trap.
subpruinosa: Florida, Highlands Co., Archbold Biol. Sta., 20-II-67, C. W. Frost.
taxodii: Florida, Leon Co., Tall Timbers Res. Sta., 18-V-69, A. Bhatkar, blacklight trap.
tecta: Florida, Alachua Co., Gainesville, Doyle Conner Bldg., I4-IV-70, F. W. Mead, blacklight trap.
tristis: Florida, Okaloosa Co., 1.5 mi. W Holt, Bryant Bridge Cutoff Rd., 14-IV-89, R. Woodruff, B. Beck, & P. Skelley, turkey oak (int. sac removed).
tristis: Florida, Okaloosa Co., 1.5 mi. W Holt, Bryant Bridge Cutoff Rd., 14-IV-89, R. Woodruff, B. Beck, & P. Skelley, turkey oak (int. sac in place).
ulkei: Florida, Leon Co., Tall Timbers Res. Sta., 28-III-11-IV-68, L. Collins, plot TT-3.
uniformis: Florida, Jefferson Co., Monticello, Big Bend Hort. Lab., 8-VI-69, W. H. Whitcomb, blacklight trap.
yemasseei: Georgia, Wayne Co., Jesup, 2-VII-72, J. P. Huether.
youngi: Florida, Dade Co., Miami, Brickell Hamm., 5-VII-60, R. E. Woodruff. (int. sac removed)
youngi: Florida, Dade Co., Miami, Brickell Hamm., 5-VII-60, R. E. Woodruff. (int. sac in place)

Appendix 39 (cont.).
The following data are from the labels of the specimens used for the illustrations in plates 1-32.

lachua Co., Gainesville, 22-23-VII-68, R. E. Woodruff, blacklight trap.
lina, Todd, 22-IX-83, M. Klein, turf soil Christmas tree.
Alachua Co., Gainesville, 20-II-88, R. E. Woodruff, emerging ex lawn.
Dade Co., Miami, 30-VIII-60, P. E. Briggs, blacklight trap.
Leon Co., Tall Timbers Res. Sta., 18-V-7-VI-68, L. Collins, TT3.
Glades Co., Fisheating Creek, 22-II-75, M C. Thomas, at light.
, Leon Co., Tall Timbers Res. Sta., 30-III-6-IV-70.
ida, Alachua Co., Gainesville, 26-III-61, R. E. Woodruff, at light.
Liberty Co., Torreya St. Pk., 20-22-VI-73, G. B. Fairchild, blacklight trap.
Liberty Co., Torreya St. Pk., 17-IV-63, E. Hazard, at light.
lachua Co., Gainesville, Doyle Conner Building, 31-VII-2-VIII-70, F. W. Mead, blacklight trap.
lina, Todd, 18-VI-84, M. Klein, blacklight trap.
Highlands Co., Archbold Biol. Sta., 30-III-67, W. Suter, at light.
Highlands Co., nr. Avon Park, Lake Letta subdivision, 30-IV-62, T. Morris, blacklight trap.
efferson Co., 4.6 mi. NE Winnie, 22-VI-65, Neil Chernoff.
Marion Co., N end Heather Is., 22-VI-75, P. C. Drummond, blacklight trap.
Santa Rosa Co., Milton, Avalon Beach Cmpg., 15-IX-83, R. Hill, blacklight trap.
Jackson Co., Florida Caverns St. Pk., 18-IV-63, R. E. Woodruff, at light.
inole Co., Sanford, 28-II-62, G. W. Desin, blacklight trap.
Dunes Park Beach, 10-VI-65, C. E. White.
ackson Co., Florida Caverns St. Pk., 18-IV-63, R. E. Woodruff, at light. (fig. 301a)
Champaign Co., Urbana, 23-25-V-84, R. E. Woodruff, at light. (fig. 301b)
Jefferson Co., Monticello, Big Bend Hort. Lab., 20-VIII-68, W. H. Whitcomb, blacklight trap.
, Alachua Co., Gainesville, 18-VI-1969, F. W. Mead, blacklight trap.
Liberty Co., Torreya St. Pk., 15-17-VII-87, Matthews & Skelley, at light.
Leon Co., Tall Timbers Res. Sta., 18-IV-68, W. Baker, TT-1.
berty Co., Torreya St. Pk., 29-30-III-79, P. M. Choate, Jr.
ppecanoe Co., 5-10-63, N. M. Downie.
, Cook Co., Chicago, 11-VI-20, E. Liljeblad.
Alachua Co., Gainesville, Doyle Conner Bldg., 4-VI-70, F. W. Mead, blacklight trap.
ackson Co., Florida Caverns St. Pk., 18-IV-63, R. E. Woodruff, at light.
Baker Co., Glen St. Mary, 23-VI-70, H. W. Collins, blacklight trap.
lla Co., Panacea, 17 & 19-VI-67, C. Hilfiker, on surf.
eon Co., Tall Timbers Res. Sta., 18-IV-69, A. Bhatkar, blacklight.
vy Co., 3.8 mi. SW Archer, 19-IV-87, P. Skelley, at light.
Sturgis, 18-IV-78, O. E. Hunt, at light.
k Co., 9-10-32, Hubbell & Friauf, note #110 [Holotype].
eon Co., Tall Timbers Res. Sta., 28-VI-69, A. Bhatkar, blacklight trap.
Highlands Co., Archbold Biol. Sta., 25-IV-86, J. Sivinski.
ta Rosa Co., 4 mi. N Munson, 8-IV-82, E. G. Riley.
ghlands Co., nr. Avon Park, Lake Letta subdivision, 12-VI-62, T. Morris, blacklight trap.
Alachua Co., Gainesville, nr. Airport, 29-V-87, P. Skelley, at light.
adsden Co., Aspalaga Bluff, 5 mi. W Sycamore, 13-III-83, P. M. Choate, leaf litter.
oberta, 6-5-39, P. W. Fattig, light.
Monroe, 20-IV-62, W. W. Gibson, at light.
a, Alachua Co., Gainesville, 15-VII-1969, F. W. Mead, blacklight trap.
ida, Columbia Co., Lake City, Santa Fe River, 18-IV-80, A. E. Graham, blacklight trap.
lad, Las Villas, 1-VI-59, M. J. Westfall.
ambia Co., Molino, 19-VI-69, E. N. Bishop, blacklight trap.
Jefferson Co., Monticello, 14-IV-69, W. H. Whitcomb, blacklight trap.
vy Co., 3.8 mi. SW Archer, 21-29-V-88, P. E. Skelley, Malaise trap.
Putnam Co., Welaka, 24-IV-40, J. J. Friauf, F-57.
n Co., Tall Timbers Res. Sta., 3-VI-68, W. Baker, TT-1.
ua Co., Gainesville, Chantilly Acres, 18-IV-68, F. S. Blanton, mosquito light.
loosa Co., 1.5 mi. W Holt, Bryant Bridge Cutoff Rd., 14-IV-89, R. Woodruff, B. Beck, & P. Skelley, turkey oak.
ty Co., Torreya St. Pk., 17-IV-63, E. Hazard, at light.
eon Co., Tall Timbers Res. Sta., 8-VI-68, W. Baker, TT-1.
anta Rosa Co., Bratt, 7-VI-68, D. C. Blanton, blacklight trap.
Co., Miami, Brickell Hammock, 4-VII-60, R. E. Woodruff, on **Trema mollis**.

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okeechobea
ı ovalis
ı panorpa
ı parvidens
ı perlonga
ı postrema
ı profunda
ı prununculina
ı pseudofloridana
ı puberula

): male genitalia, ventral view
ı quercus
ı schaefferi
skelleyi
subpruinosa
taxodii
tecta
tristis
ulkei
uniformis
yemasseei
youngi (with internal sac)
youngi (internal sac removed)

: male genitalia, dorsal view
aemula
anxia (southern form)
anxia (northern form)
apicata (with internal sac)
apicata (internal sac removed)
bruneri
clemens
clypeata
crenulata
cupuliformis
debilis
diffinis

male genitalia, dorsal view
dispar
drakii
elizoria
elongata
ephilida
floridana
forbesi
forsteri
foxii
fraterna
futilis
georgiana

male genitalia, dorsal view
glaberrima
gracilis
hirticula
hornii
ilicis
implicita
infidelis
knochii
latifrons
lota
luctuosa
mariana

male genitalia, dorsal view
micans
obsoleta

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fig. 224. *Phyllophaga postrema*
fig. 225. *Phyllophaga profunda*
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