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Cyrtophora citricola (Araneae: Araneidae), a Colonial Tentweb Orbweaver Established in Florida[1]

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INTRODUCTION: Few species of spiders can be considered truly social, but a greater number of species, particularly web-building spiders, live in close proximity to one another, potentially gaining a number of benefits by this association. Among these benefits are sharing of frame threads (Kullman 1959), improved defense against predators and parasites (Cangialosi 1990), improved prey capture efficiency (Rypstra 1979; Uetz 1989), and greater egg production (Smith 1983).

Of the three main types of aggregative behaviors exhibited by spiders, the one with the least social interaction involves individuals making and maintaining their own webs within a colonial matrix of interconnected webs (Buskirk 1975). One such species, which has become highly successful through a lifestyle of colonial aggregation, is the orbweaver *Cyrtophora citricola* Forskål. This species is known as a tentweb spider in Africa (Dippenaar-Schoeman and Jocqué 1997). In 2000, this species was found in southern Florida in Miami-Dade County. The first localities where the species was discovered were: 20700 SW 167 Ave, 8 March 2000, one juvenile (Duraid Hanna, DPI Inspector #322; sample #2000-545), and at the same locale, 12 April 2000, one female, one juvenile (Julieta Brambila, DPI Technician; sample #2000-965); junction Silver Palm Rd (= SW 232 St) and Old Dixie Hwy, 9 May 2000, two males (Julieta Brambila, DPI; sample #2000-1337); Fruit and Spice Park, 24801 SW 187 Ave, 9 August 2000, one female, one juvenile, two eggsacs (Julieta Brambila, DPI; sample #2000-2597). All of these locales are north of Homestead. The first published report (Halbert 2000) listed the first two records above. Initial spread of this species was reported by Mannion *et al.* (2002).

DISTRIBUTION: *Cyrtophora citricola* is widespread in subtropical and tropical areas of Asia, Africa, Australia, and in the warm coastal Mediterranean areas of Europe (Blanke 1972; Leborgne *et al.* 1998). Recently, it has been found in Colombia in 1996 (Levi 1997; Pulido 2002), the Dominican Republic in 1999 (Alayón 2001), Florida in 2000, and Cuba in 2003 (Alayón 2003).

I conducted survey work in August 2000, April 2001, and July 2002 to document the spread of the species in Florida. I was greatly facilitated in this effort by a tendency for *C. citricola* to make its webs on the guardrails of canal bridges (Fig. 6). I obtained a map of the canals (South Florida Water Management District, Miami-Dade County Canal Maintenance, Water Resources Operations, Revised 7/6/00) with associated roads and bridges. Beginning at the sites recorded above as the core area, I examined bridges away from the core area in all directions. I also looked for telltale webbing on trees and bushes as I drove from bridge to bridge.

The survey work in 2000 established a preliminary periphery of infestation in a narrow band from west of Homestead to northeast of Homestead. Outer boundaries were SW 217 Ave at canal C-113 to the southwest, SW 217 Ave at C-103 to the northwest, SW 320 St at C-103S in Homestead on the southeast, and from there on a diagonal line northeast to SW 232 St at C-1. Some gaps existed in this distribution, most noticeably on canal C-103N where I did not find *C. citricola* at that time.

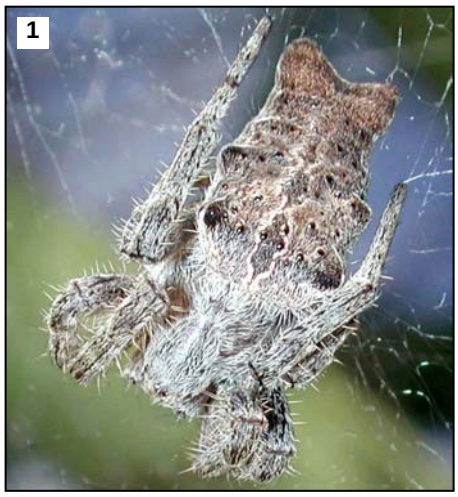

Fig. 1. *Cyrtophora citricola* female (4x) in cryptic resting pose, showing details of color pattern. **Fig. 2.** Female *Cyrtophora citricola* (1.5x) in web-monitoring pose. **Fig. 3.** Female *Cyrtophora citricola* (lifesize) with two eggsacs.
Photography credits: Figs. 1-3: Ian McGuire; Figs. 4-8: author.

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Fig. 4. Extensive covering of *Cyrtophora citricola* webbing on upper half of *Eugenia coronata*.

Fig. 5. Colony of *Cyrtophora citricola* filling space between palm leaves.

The second survey in 2001 mostly filled in the gaps, especially on C-103N, extended the distribution eastward to SW 117 Ave at C-103 and SW 107 Ave at Military Canal, and northward to SW 177 Ave at C-102, SW 184 St at C-1, and SW 145 St at C100A.

The third survey in 2002 filled in other gaps, and extended the distribution northward to SW 177 Ave at C-1W and SW 135 St at C-100C. A record from nearby Fairchild Botanical Gardens to the east was also reported [18 April 2002, 1 female (Richard Campbell, FBG, DPI sample; #2002-1296)].

To date, the known distribution of *C. citricola* in Florida is a parallelogram-shaped area from east of the Everglades National Park to the east coast of Florida, bounded on the south by a latitudinal line extending through Homestead, and on the north by a similar line extending through Pinecrest and Coral Gables.

IDENTIFICATION: Adult female spiders average just over 10 mm in body length and are fairly robust. Males are very small, averaging about 3 mm in length (Levi 1997). Genitalic details are used to distinguish this species from congeners in other parts of the world. Females and males are typically medium brown in color, but may have a darker foliate mark on the dorsum of the abdomen. Both can change the background color of the abdomen from very pale to very dark (Blanke 1972). Florida males often appear black, whereas females vary considerably in overall appearance. Females (Figs. 1 and 2), despite their larger size, are very cryptic in color and shape, and sometimes hard to see in the web. They resemble a piece of dead leaf, and may sometimes hide on dead leaves that have fallen into the web. A characteristic of the species which will distinguish it from all other genera in Florida, except *Allocyclosa* (which has a much smaller female; Levi 1999), is the horizontally oriented bifurcation at the posterior of the abdomen.

BIOLOGY: A number of extensive studies have been conducted on the biology of *C. citricola*, including those from Andalusia (Blanke 1972), Sardinia (Kullman 1958, 1959), Sicily (Leborgne *et al*. 1998), Gabon (Rypstra 1979), and Colombia (Suárez 1998). Blanke (1972) found that *C. citricola* could not survive when temperatures fell below -1EC.

This species is known to have a lifestyle which varies from existing as solitary individuals to occurring in large colonies of hundreds of individuals (Leborgne *et al.* 1998). A prerequisite for a colonial existence might be a certain amount of tolerance for conspecifics, which is exhibited by *C. citricola* when encountering other individuals on common threads. However, when the personal prey-capture web is invaded by another spider, *Cyrtophora* individuals will exhibit aggressive behavior (Kullman 1959; Lubin 1974).

These spiders build a horizontal orb web which has a dense vertical barrier of silk strands above the orb, and a less dense barrier below it. Individuals hang under the middle of their own orb web, and catch insects which are intercepted by

Fig. 6. Colony of *Cyrtophora citricola* on guardrail of canal bridge. Note the string of five eggsacs in the right middle of the picture, just above a horizontal web.

Fig. 7. Dead leaves accumulated in *Cyrtophora citricola* webbing on *Eugenia coronata*.

Fig. 8. Multiple dead twigs due to *Cyrtophora citricola* webbing on *Eugenia coronata*.

the upper barrier, from which they fall onto the orb. The webs are non-adhesive, so the silk acts only as a temporary restraining device. This is a less efficient web than those that have sticky spirals, so living in an aggregation of webs is advantageous by potentially increasing the number of prey that hit the web (Rypstra 1979; Uetz 1989). Leborgne *et al.* (1998) found that spiders that lived in colonies had smaller webs than those which were solitary, but they caught an equal amount and size of prey as solitary individuals; therefore it appeared that the colonial webs were indeed more efficient.

Eggsacs (Fig. 3) have a flattened, elliptical shape, about 12-20 mm in greatest diameter, and have a bluish or greenish tinge. They are laid in a long chain of up to 10 eggsacs above the web. The newest eggsacs are closest to the web. Eggsacs average 112-157 eggs, depending on the year's productivity, and lifestyle (colonial or solitary) of the mother (Leborgne *et al.* 1998). Colonies in Florida appear to form around a single female, with the young attaching their webs to the mother's web rather than dispersing. Colonies can eventually be several square meters in area and cover entire trees (*e.g.*, of *Citrus* spp.).

Other spider species can be found associated with *C. citricola* colonies. Some are other orbweaving spiders which utilize the framework and benefit from other advantages provided by these aggregations. In Florida, such species include *Mecynogea lemniscata* (Walckenaer), *Metepeira labyrinthea* (Hentz), and *Nephila clavipes* (L.). Several kleptoparasitic species of *Argyrodes* have also been found in these colonies. Elsewhere (Leborgne *et al.* 1998), *C. citricola* colonies are victimized by *Argyrodes argyrodes* (Walckenaer) [*sub A. gibbosus* (Lucas)], which steal prey and eat unguarded *Cyrtophora* eggs, and by pholcid spiders [*Holocnemus pluchei* (Scopoli)], which use the colony communal network to attach their own webs, and they attack juveniles and adults of *C. citricola* (Blanke 1972; Leborgne *et al.* 1998). Leborgne *et al.* (1998) reported another benefit for *C. citricola* living in a colony was a lower number of kleptoparasitic spiders per web in colonies vs. solitary webs, although Rypstra (1979) noted that larger colonies attracted more predators and kleptoparasites. When attacked, *C. citricola* will drop several cms on a dragline and resume a cryptic pose, or drop to the ground where its color blends in with the soil and litter, or retreat to a sheltered area if available, where it will attempt to hide (*e.g.*, behind a guard rail post).

HOSTS: The following plants cannot be truly considered hosts, as the spiders do not feed on them. However, these plants have been documented as being used for web attachment (Figs. 4-5), therefore are subject to potential damage by heavy spider populations. Florida hosts include akee, *Blighia sapida* K. Koenig; Australian brush-cherry, *Syzygium paniculatum* Gaertn.; balsam apple, *Clusia rosea* Jacq.; Barbados cherry, *Malpighia glabra* L.; beggarticks, *Bidens* sp.; citrus, *Citrus* sp.; gardenia, *Gardenia augusta* (L.) Merr.; grapefruit, *Citrus* x *paradisi* Macfad.; a hedge plant, *Eugenia coronata* Schumach. & Thonn.; lime, *Citrus aurantifolia* (Christm.) Swingle; mamey sapote, *Pouteria sapota* (Jacq.) H. E. Moore & Stearn; mango, *Mangifera indica* L.; orange, *Citrus sinensis* (L.) Osbeck; pygmy date palm, *Phoenix roebelenii* O'Brien; sausage tree, *Kigelia africana* (Lam.) Benth.; and weeping fig, *Ficus benjamina* L. Hosts documented in Colombia (Pulido 2002) include acacia, *Acacia* sp.; almond, *Prunus dulcis* (Mill.) D. A. Webb; araucaria, *Araucaria* sp.; banana, *Musa acuminata* Colla; cacao, *Theobroma cacao* L.; caucho, *Clusia* sp.; cedro (Spanish cedar), *Cedrela odorata* L.; chiminango, *Pithecellobium dulce* (Roxb.) Benth.; eucalyptus, *Eucalyptus* sp.; ficus, *Ficus* sp.; fique, *Agave* sp.; guanábana, *Annona muricata* L.; guava, *Psidium guajava* L.; lemon, *Citrus limon* (L.) Burm. f.; madroño, *Garcinia madruno* (kunth) B. Hammell.; mango, *Mangifera indica* L.; maracuyá (passion fruit), *Passiflora* sp.; matarraton, *Gliricidia sepium* (Jacq.) Kunth ex Walp.; orange, *Citrus sinensis* (L.) Osbeck; plantain, *Musa* x *paradisiaca* L.; swinglea, *Swinglea glutinosa* (Blanco) Merr.; totumo (calabash), *Crescentia cujete* L.; veranera, *Bougainvillea* sp.; and yuca, *Manihot esculenta* Crantz. Coffee, *Coffea arabica* L. (Cárdenas-Murillo *et al.* 1997), has also been reported from Colombia as a substrate for *C. citricola*. It is likely that any plant providing the appropriate substrate to support a web framework could be colonized.

ECONOMIC IMPORTANCE: Possibly, *C. citricola* is both beneficial and deleterious. Undoubtedly, the cover of webs on a plant would capture pest insects associated with that plant. However, multiple observations have been reported of leaf loss (Fig. 7), terminal twig dieback (Fig. 8), and sometimes plant death where heavy populations of this spider have become established, allegedly due to "asphyxiation" of the plant (Levi 1997). It has been proposed that the extensive web cover absorbs the sun's radiation and raises the temperature, causing the leaves and young fruit to desiccate (Cárdenas-Murillo *et al.* 1997). This seems unlikely *per se*, as the white silk would seem to reflect sunlight rather than absorb it. A suggestion worth investigating is that the density of the webbing might restrict air flow over the leaves, with the same result of raising the temperature (Richard Weaver, personal communication 2003). Palms seem to be resistant to the damage caused to plants with small leaves.

CONTROL: Mechanical control is recommended on a small scale (Pulido 2002). Chemical controls will depend on labelling for the type of plant and for spiders. Because of the amount of debris that accumulates in affected plants, chemical control is likely to be unreliable due to incomplete coverage. While this might be overcome by high pressure sprayers, pressure spraying using only water was found to facilitate dispersal of the spiders (Pulido 2002).

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