Oestrophasia (*Cenosoma*) *sabroskyi* (Diptera: Tachinidae), a Parasitoid of *Artipus floridanus* (Coleoptera: Curculionidae): Taxonomy and Bionomics

PETER W. KOVARIK[1] AND STUART R. REITZ[2]

Ann. Entomol. Soc. Am. 98(3): 245–251 (2005)

ABSTRACT *Oestrophasia* (*Cenosoma*) *sabroskyi* (Guimarães) (Diptera: Tachinidae) is recorded as a parasitoid of adults of *Artipus floridanus* Horn (Coleoptera: Curculionidae). This report is the first host record for *O. sabroskyi.* The adult male and the immature stages are described and the adult female is redescribed.

KEY WORDS *Oestrophasia* (*Cenosoma*) *sabroskyi*, Tachinidae, parasitoid, citrus root weevil

THE TAXONOMY AND LIFE histories of tachinid flies in the New World genus *Oestrophasia* Brauer & Bergenstamm (Diptera: Tachinidae)are poorly known. The few published host records suggest that hosts of all *Oestrophasia* are adult beetles (Guimarães 1977, Grillo and Alvarez 1984, Spangler and Burger 1999). Grillo and Alvarez (1984) were the first to publish on the bionomics of a species of *Oestrophasia* (*Cenosoma*). Their study of an undescribed species revealed that females oviposit in foliage, a practice that was previously unknown among the Tachinidae (O'Hara 1985). In this case, the parasitoid's host, citrus root weevil, *Pachnaeus litus* (Germar) (Coleoptera: Curculionidae), apparently ingests the parasitoid eggs while feeding on plant foliage. In contrast, females of *Oestrophasia* s. str. have unmodified genitalia and apparently are incapable of ovipositing into vegetation. According to Townsend (1936), females of *Oestrophasia* s. str. apparently deposit microtype eggs on plant stems, and the eggs are consumed by hosts as the hosts forage.

Here, we focus on morphological and biological aspects of *Oestrophasia* (*Cenosoma*) *sabroskyi* (Guimarães). Adults of this species are rather small (<4 mm) and have patterned wings reminiscent of tephritid fruit flies. This species was originally described as *Cenosoma sabroskyi* Guimarães 1977. The genus *Cenosoma* van der Wulp subsequently was synonomized with *Oestrophasia* by Wood (1987), but O'Hara and Wood (2004) currently recognize *Cenosoma* and *Oestrophasia* as subgenera of *Oestrophasia. O. sabroskyi* was formerly known from a pair of female specimens taken in southern Florida. Our recent fieldwork in Coral Gables, Miami-Dade County, Florida, yielded both a host, *Artipus floridanus* Horn (Coleoptera: Curculionidae), and the first males of this species. *O. sabroskyi* is the second known parasitoid of *A. floridanus.* A braconid wasp of the genus *Micronotus* also is known to parasitize adults of this weevil in Florida (Bullock 1984). Because *A. floridanus* belongs to a complex of economically important citrus root weevils, this small tachinid might be useful as a biological control agent.

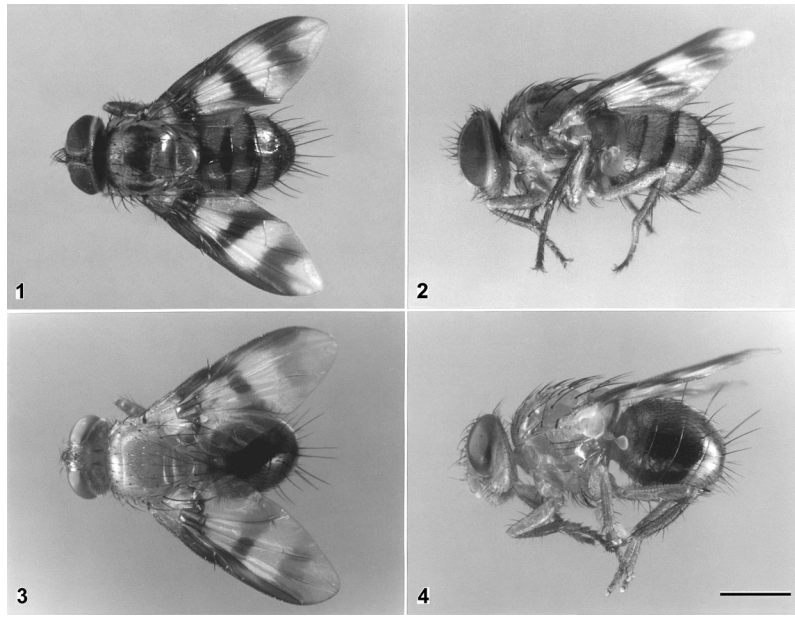
Materials and Methods

Adults of *A. floridanus* were collected from foliage of *Coccoloba diversifolia* Jacquin (Polygonaceae) on 21 May 1997 and 17 August 1999 at the Montgomery Botanical Center, Coral Gables, Miami-Dade County, in a remnant tropical hardwood hammock. The weevils were collected in an effort to obtain the immature stages, and the discovery of these parasitoids was serendipitous. All weevils collected, including those that were parasitized, were maintained on *C. diversifolia* foliage, at 23–27°C. *O. sabroskyi* that egressed from these hosts were maintained under similar conditions until adult eclosion. Terminology for adults and larvae follows that of McAlpine (1981) and Teskey (1981). A single third instar of *O. sabroskyi* was dissected from a parasitized adult weevil and was the only intact larva available to us for study. Exuviae of the first and second instars were recovered from the body cavity of the parasitized weevil. Each set of exuviae contained an intact cephalopharyngeal skeleton, which are illustrated. Voucher specimens of both parasitoid and host are deposited in the collections of the National Museum of Natural History, Washington, DC (USNM), and the Florida State Collection of Arthropods, Gainesville, FL (FSCA).

This article reports the results of research only. Mention of a proprietary product does not constitute an endorsement or a recommendation for its use by the USDA.

[1] 239 Crestview Rd., Columbus, OH 43202.

[2] USDA–ARS, 6383 Mahan Dr., Tallahassee, FL 32308 (e-mail: sreitz@saa.ars.usda.gov).



Figs. 1–4. *O. sabroskyi.* (1) Male dorsal habitus. (2) Male, lateral habitus. (3) Female, dorsal habitus. (4) Female, lateral habitus. Line scales, 1.0 mm.

Results

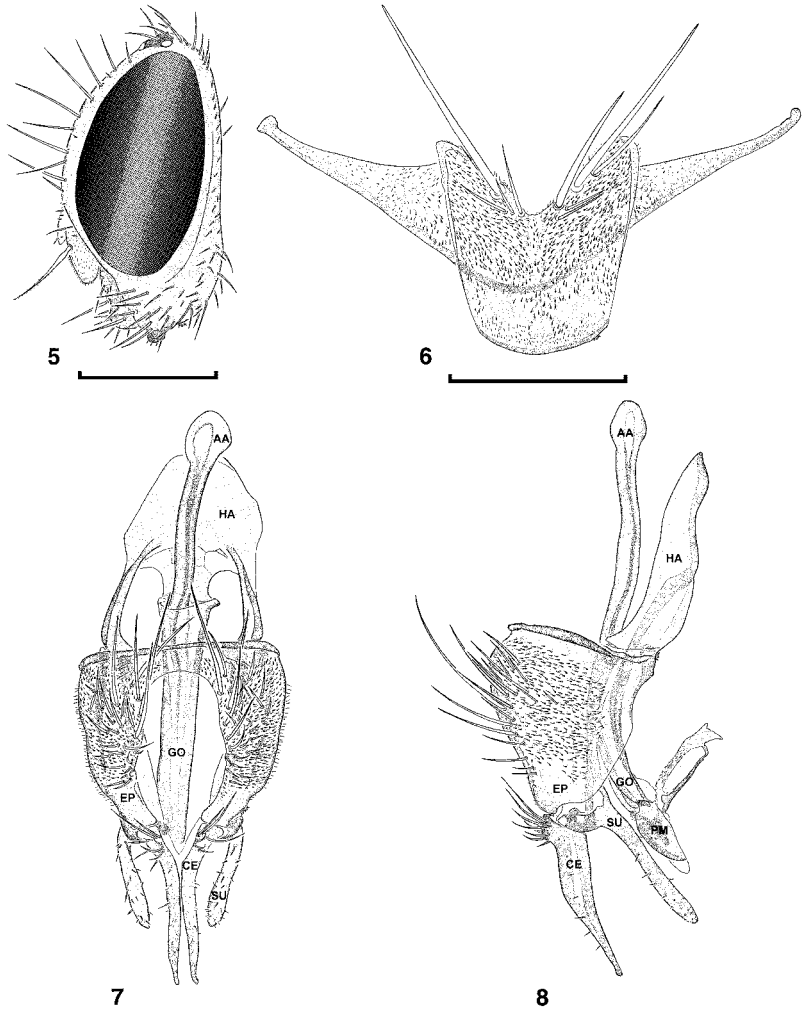
Oestrophasia sabroskyi (Guimarães)

Cenosoma sabroskyi Guimarães 1977: 223

Male (Figs. 1 and 2, 5–8) (n = 3). Length 3.4–3.8 mm. *Head* (Fig. 5). Yellow-orange, elongate. Height in lateral view 1.10–1.45 mm. Width in anterior view 1.20–1.50 mm. Setae of head black. Eyes dark red, bare; eye height 0.85–1.15 mm. Face slightly concave, not visible in profile; facial ridge length 0.42–0.55 mm; row of 9–12 major inclinate frontal setae and 1–3 additional minor frontals present just outside main row; parafacial bare, not expanded. Vertex width 0.15–0.20 mm; vertical setae short, weakly developed; ocellar triangle black. Antennae with first flagellomere length 0.22–0.25 mm. Vibrissal angle bearing several setae, innermost seta longer and stouter than others. Proboscis short and barely protruding below gena in lateral view. Claviform palpus narrow basally and gradually expanded apically; palpal setae subequal in length, present on lateral and ventral surfaces. Labella narrowly elongate, bearing relatively long setae.

Thorax. Ground color yellow-orange with black setae and silver microtrichia. Postpronotum with two major setae. Proepimeron with pair of anterodorsally directed setae; upper seta longer and stouter than lower one. Presutural area of scutum with irregular dark brown vittae on lateral margin; postsutural area with irregular dark brown vittae medially and on lateral margin; two major presutural and three major postsutural acrostichal setae; two major presutural and three major postsutural dorsocentral setae; two somewhat slender presutural and two major postsutural intra-alar setae; two supra-alar setae, anterior seta very short and slender, posterior robust. Notopleuron with two major setae. Postalar callus with two major setae and one minor seta. Scutellum concolorous yellow-orange; four pairs of marginal setae and a pair of discal setae, discal setae arising about as far apart as apical setae; basal and apical setae longer and stouter than all other scutellar setae; basal setae directed dorsoposteriorly; lateral and subapical setae oriented in parallel; apical setae crossed. Subscutellum well developed, infuscated. Anepisternum with one anterodorsal seta; posterior row with five setae, third and fourth in series longer and stouter than remainder. Katepisternum with two or three linearly arranged major setae and several minor setae. Anepimeron bearing two or three setae. Katepimeron bare. Meron with narrow brown vitta near posterior margin and with vertical row of seven to 10 long, slender setae. Lappets of posterior thoracic spiracle unequally developed; posterior lappet large, anterior lappet not apparent. Wings hyaline, patterned with black bands as in Fig. 1; tegula black; costa with prominent spine proximal to subcostal break; bend of media right angled, with media ending in wing margin below apex of R_{4+5}; base of R_{4+5} setose dorsally; upper calypter whitish; lower calypter strongly infuscated; halter pale yellow. Legs with coxae and femora yellow-orange; tibiae and tarsi infuscated; pulvilli white.

Abdomen. Abdomen broadly ovoid. Syntergite 1 + 2 yellow-orange with posterior margin brown and fading ventrally; middorsal depression extended roughly halfway to hind margin; syntergite lacking major setae. Tergites 3 and 4 yellow-orange with posterior brown banding uninterrupted and more extensive than in preceding tergite; pair of major median marginal setae on both tergites along with additional major marginal setae forming transverse rows on each segment; one or



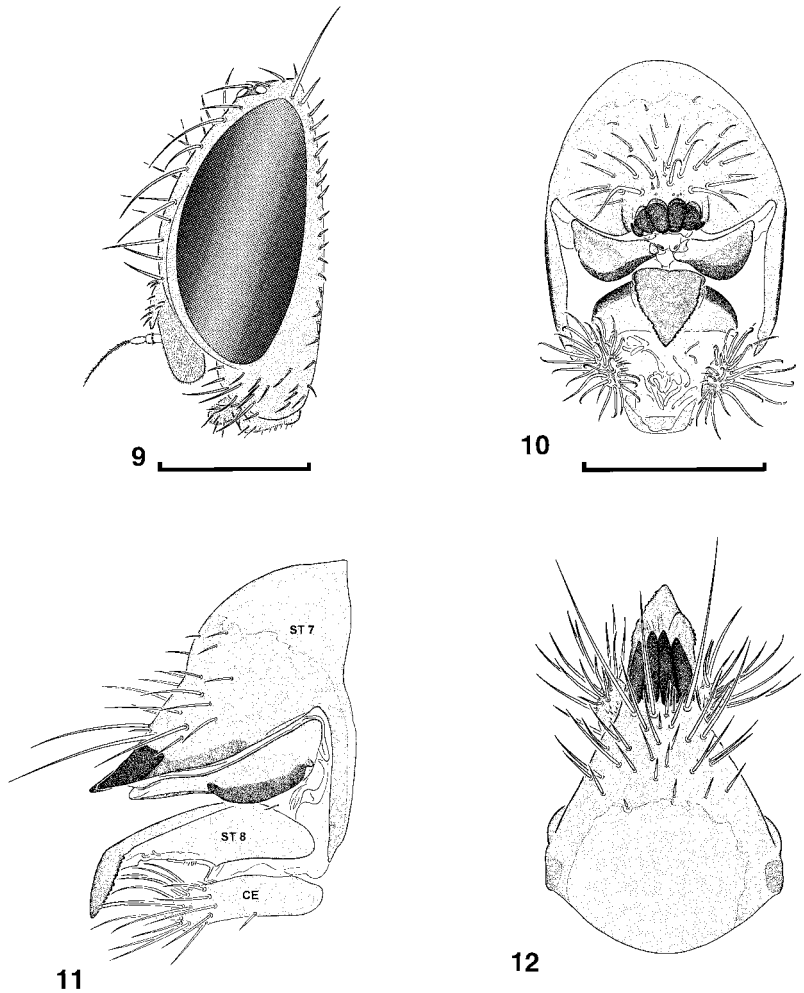
Figs. 5–8. *O. sabroskyi.* Male head and genitalia. (5) Male head, lateral view. Line scale, 0.5 mm. (6) Fifth abdominal sternite of male and associated structure, likely derived from sternites 6 and 7. (7) Male genitalia, ventral view. (8) Male genitalia, lateral view. AA, aedeagal apodeme; CE, cercus; EP, epandrium; GO, gonopod; HA, hypandrium apodeme; PM, paramere; SU, surstylus. Line scales, 0.25 mm.

two major lateral marginal setae on tergite 3 and three on tergite 4, each lateral marginal about as long and stout as median marginal setae. Tergite 5 dark brown dorsally and posteriorly, yellow-orange laterally, with transverse whorl of 10 major setae, including pair of median marginals and four laterals on each side. Sternites yellow and nearly concealed by adjacent tergites; sternite 5 with shallow V-shaped apical cleft (Fig. 6).

Male terminalia (Figs. 7 and 8). Epandrium with ventral surface bearing numerous major setae; ventral and lateral surfaces with dense covering of short setae. Cerci elongate, narrow apically and protuberant basoventrally; dorsal and lateral surfaces with short setae; basoventral protuberance bearing setal tuft. Surstylus elongate, digitiform, bearing numerous short setae. Aedeagal apodeme slender and proximally expanded. Hypandrium with apodeme broadly flattened, somewhat spade-shaped in ventral view. Gonopods fused along midline, partially enclosing basiphallus. Parameres short, broad, somewhat triangular. Basiphallus short, similar in shape to parameres. Distiphallus about as long as basiphallus, hinged to basiphallus dorsally.

Female (Figs. 3 and 4, 9–12) ($n = 4$). Length 3.0–3.9 mm. Similar to male except as follows. *Head* (Fig. 9). Height in lateral view 1.20–1.50 mm. Width in anterior view 1.20–1.55 mm. Eye height 0.95–1.20 mm. Facial ridge length 0.39–0.45 mm; row of nine to 11 major inclinate frontal setae; six major proclinate orbital setae. Vertex width 0.40–0.45 mm; vertical setae well developed; ≈1.5× length of male vertical setae; ocellar triangle light brown to black. Antennae with first flagellomere length 0.25–0.35 mm.

Thorax. Entirely yellow in color. Proepimeron with one or two anterodorsally directed setae. Scutum lack-



Figs. 9–12. *O. sabroskyi.* Female head and ovipositor. (9) Female head, lateral view. Line scale, 0.5 mm. (10) Female ovipositor, posterior view. (11) Female ovipositor, lateral view. (12) Female ovipositor, ventral view. CE, cercus; ST 7, sternite 7; ST 8, sternite 8. Line scales, 0.25 mm.

ing vittae. Postalar callus with single minor seta present or absent. Subscutellum with dorsal margin variably infuscated. Meron with vertical row of four or five major setae. Legs with coxae and femora yellow.

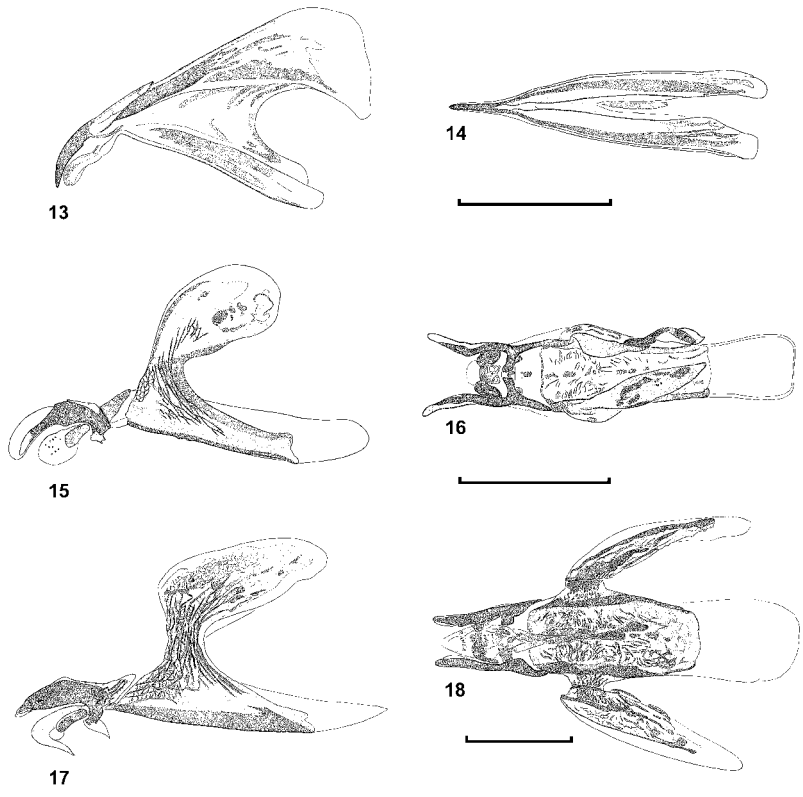
Abdomen. Tagma globose in shape. Syntergite 1 + 2 mostly yellow laterally and ventrally; mostly shining dark brown dorsally; middorsal depression extended roughly one-third to hind margin. Tergites 3, 4, and 5 shiny brown. Sternites 4, 5, and 6 dark brown with setose posterior margins.

Ovipositor (Figs. 10–12). Sternite 7 enlarged, bulbous, and bearing four stout black spines apically and dorsally projecting strap-like processes posteriorly; anteroventral surface bearing numerous major setae. Sternite 8 modified into piercing structure with acutely pointed, toothed apex; apex strongly curved dorsally. Cerci narrowly ovoid in lateral view; apex bearing cluster of major setae.

Immature Stages. *First instar* (Figs. 13 and 14). Cephalopharyngeal skeleton 0.17 mm in length; anterior end (mouth hook) pointed and strongly decurved apically; posterior margin of dorsal cornu with ventral extension; dorsal cornu extended beyond posterior margin of ventral cornu; maximum height of ventral cornu 0.25 times maximum height of dorsal cornu.

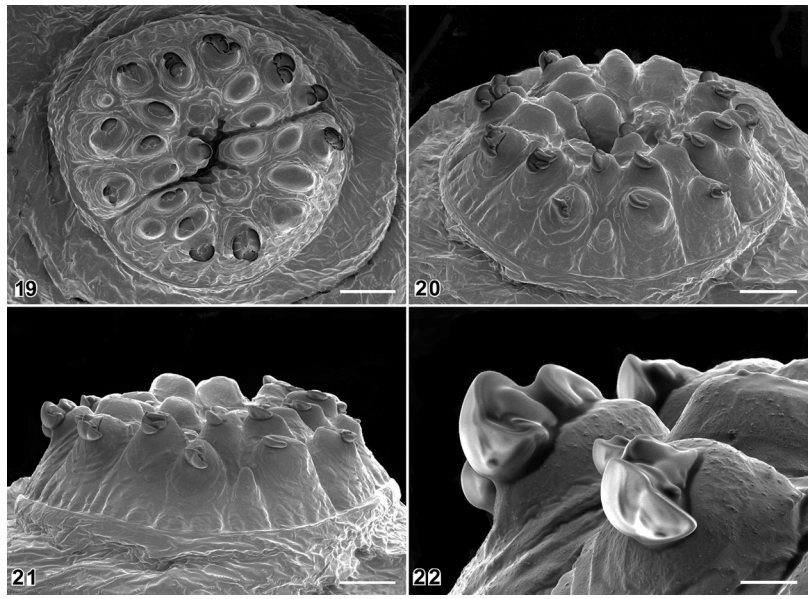
Second instar (Figs. 15 and 16). Cephalopharyngeal skeleton 0.25 mm in length; mandibles strongly decurved, diverging apically; hypopharynx subquadrate in lateral view, fused with tentoropharyngeal sclerite; dorsal cornu arising at near perpendicular angle to hypopharynx, flared posteriorly; ventral cornu as long as dorsal cornu, posterior margin concave.

Third instar (Figs. 17 and 18, 19–22, 24). Cephalophyangeal skeleton 0.34 mm in length; mandibles stout, not strongly decurved; dorsal and ventral cornua nearly equal in length; dorsal cornu arising at nearly

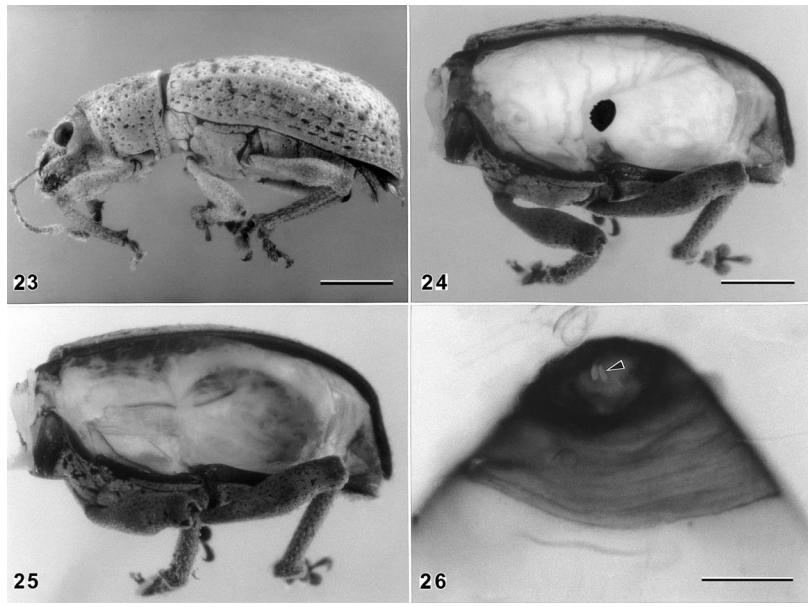


Figs. 13–18. *O. sabroskyi*. Larval cephalopharyngeal skeletons. (13) First instar, lateral view. (14) First instar, dorsal view. (15) Second instar, lateral view. (16) Second instar, dorsal view. (17) Third instar, lateral view. (18) Third instar, dorsal view. Line scales, 0.1 mm.

perpendicular angle to hypopharynx; posterior margin of ventral cornu concave. Cuticle smooth, lacking spicules. Posterior spiracles prominent, elevated, semicircular; black spiracular plates (Figs. 19–22, 24) closely appressed, forming circle; each plate with 12 irregularly spaced spiracular slits, some slits sinuous;



Figs. 19–22. *O. sabroskyi*. Third instar spiracular plate. (19) Posterior view. Line scale, 75 μm. (20) Oblique view. Line scale, 60 μm. (21) Lateral view. Line scale, 50 μm. (22) Tubular extension detail. Line scale, 1.5 μm.



Figs. 23–26. *A. floridanus* and third instar of *O. sabroskyi.* (23) Parasitized adult *A. floridanus*, lateral habitus. Line scales, 1.5 mm. (24) Third instar of *O. sabroskyi* within body of adult *A. floridanus.* (25) Parasitized *A. floridanus*, with parasitoid larva removed. Line scales, 1.0 mm. (26) Respiratory funnel of *O. sabroskyi*, with host spiracle visible near apex. Line scale, 0.25 mm.

slits set at end of separate, sclerotized, tubular extensions.

Puparium. Barrel shaped; rounded anteriorly; posterior spiracles as in third instar.

Material Examined. FLORIDA: Dade Co., Coral Gables, Native Hammock on Grounds of Montgomery Foundation 21-V-1997, P. Kovarik & C. O'Brien collectors, parasitoids reared from field collected adults of *Artipus floridanus* Horn (two males, mounted with *A. floridanus* hosts) (USNM); 1 female, same collection data (mounted with *A. floridanus* host) (FSCA); Coral Gables, Montgomery Foundation 17-VIII-1999, W. Tang, P. Kovarik, C. O'Brien, tropical hardwood hammock, reared from adult *Artipus floridanus* beaten from *C. diversifolia* (one female, one male) (FSCA); Monroe Co. Cudjoe Key 26-III-1971, Sweeping Grasses, Type No 75248 USNM, HOLOTYPE *Cenosoma sabroskyi* G. (female); Coral Gables, Wm. S. Brewton coll. 13-VIII-1964, in Steiner Trap, PARATYPE *Cenosoma sabroskyi* Guim. (female) (USNM).

Diagnosis. Males of the Nearctic subgenus *Cenosoma* are distinguishable from those of the subgenus *Oestrophasia* by their black tegulae, lack of a distinct row of orbital setae, and the presence of an inner vibrissa stronger and longer than all other vibrissae. Males of *O. sabroskyi* can be distinguished from males of the only other U.S. species of the subgenus *Cenosoma*, *O. signiferum* (Wulp), by the presence of uninterrupted bands of pigment on abdominal syntergite 1 + 2 and tergites 3 and 4, absence of a completely infuscated meron, and evenly infuscated first subcostal, second subcostal, and first radial cells. Although portions of these cells may be infuscated in males of *O. signiferum*, the pigmentation in these cells is uneven.

Females of the subgenus *Cenosoma* are separable from those of the subgenus *Oestrophasia* by the presence of a pointed ovipositor. Females of *O. sabroskyi* are readily distinguishable from females of *O. signiferum* by their nearly concolorous shiny dark brown abdomen. Females of *O. signiferum* have a yellow abdomen.

Biology. Females of *Oestrophasia* apparently deposit their eggs in foliage, and the eggs are subsequently ingested by their host (Grillo and Alvarez 1984). *O. sabroskyi* possibly oviposits in the foliage of *C. diversifolia*, as all of the parasitized weevils were collected from these small trees. Efforts were made to find eggs inserted in fresh leaves of *C. diversifolia*, but none proved successful. Although adults of *A. floridanus* might ingest more than one tachinid egg, multiple parasitization was not observed. All captive parasitized individuals of *A. floridanus* yielded only a single *O. sabroskyi.* In addition, third instars virtually filled the abdominal and meso- and metathoracic cavities of their host (Fig. 24), making it unlikely that an individual of *A. floridanus* could support multiple parasitoids. Any supernumerary parasitoids therefore might be eliminated through intraspecific competition (Reitz 1995). The larval respiratory funnel (Fig. 26) terminated in association with one of the host's abdominal spiracles. Larvae of *O. sabroskyi* egressed through the terminalia of hosts 7 d after collection, leaving the host cuticle virtually intact (Fig. 23). At 24–27°C, adult females (n = 2) eclosed 10 d after

pupariation, and adult males ($n = 3$) eclosed 11 d after pupariation.

The collection dates suggest *O. sabroskyi* is multivoltine. Based on our rearing data, the rate of parasitization seems to be ≈5%. *A. floridanus* is the first and only recorded host for *O. sabroskyi.* However, given the oviposition method, *O. sabroskyi* could parasitize other citrus root weevil adults that feed in the same manner as *A. floridanus.*

Acknowledgments

We appreciate the assistance of Willie Tang (USDA–APHIS) during field collections. Paul Skelly (Florida State Collection of Arthropods) assisted with the scanning electron micrographs. Paul Arnaud (California Academy of Sciences [retired]) confirmed the tachinid identification. We thank Norm Woodley (Systematic Entomology Laboratory–USDA) for arranging the loan of type material of *C. sabroskyi* and males of U.S. species of *Oestrophasia.* We appreciate the assistance of Charles W. O'Brien (Florida A&M University [retired]) for identifying the weevil host and for making this study possible. We acknowledge Peter Adler (Clemson University), Woodbridge Foster and Charles Triplehorn (The Ohio State University), and two anonymous reviewers for valuable comments on an earlier draft of this article.

References Cited

Bullock, R. C. 1984. Endoparasitic braconid (Hymenoptera: Braconidae) attacks little leaf notcher *Artipus floridanus* (Coleoptera: Curculionidae) in Florida USA. Fla. Entomol. 67: 571–572.

Grillo, H., and M. Alvarez. 1984. Estudios biológicos de *Cenosoma* n. sp. (Diptera; Tachinidae; Oestrophasiini) parásito de los adultos de *Pachneus litus* Germar (Coleoptera: Curculionidae). Centro Agricola 11: 95–118.

Guimarães, H. H. 1977. A review of the tribe Oestrophasiini Brauer and Bergenstamm (Diptera: Tachinidae). Papeis Avulsos de Zoologia (Sao Paulo) 30: 215–238.

McAlpine, J. F. 1981. Morphology and terminology - adults, pp. 9–63. *In* J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood [eds.], Manual of Nearctic Diptera, vol. 1. Agriculture Canada, Ottawa, Canada.

O'Hara, J. E. 1985. Oviposition strategies in the Tachinidae, a family of beneficial parasitic flies. Univ. Alberta Agric. For. Bull. 8(2): 31–34.

O'Hara, J. E., and D. M. Wood. 2004. Catalogue of the Tachinidae (Diptera) of America north of Mexico. Associated Publishers, Gainesville, FL.

Reitz, S. 1995. Superparasitism and intraspecific competition by the solitary larval-pupal parasitoid *Archytas marmoratus* (Diptera: Tachinidae). Fla. Entomol. 78: 578–585.

Spangler, H. G., and J. F. Burger. 1999. *Oestrophasia clausa* (Diptera: Tachinidae), a parasite of adult *Diplotaxis moerens* (Coleoptera: Scarabaeidae). Entomol. News 110: 123–124.

Teskey, H. J. 1981. Morphology and terminology - larvae, pp. 65–88. *In* J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood [eds.], Manual of Nearctic Diptera, vol. 1. Agriculture Canada, Ottawa, Canada.

Townsend, C.H.T. 1936. Manual of myiology in twelve parts. Part III. Oestroid classification and habits. Gymnosomatidae to Tachinidae. C.H.T. Townsend, São Paulo, Brazil.

Wood, D. M. 1987. Tachinidae, pp. 1193–1269. *In* J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood [eds.], Manual of Nearctic Diptera, vol. 2. Agriculture Canada, Ottawa, Canada.

Received 30 April 2003; accepted 19 January 2005.