

dicators of *bolivari*. Unfortunately for the value of these simple differences, they are variable in many specimens from Panama and Costa Rica. This is a weak division of a species ranging from the United States to Argentina.

I collected a female at Lake Texoma near Willis, Oklahoma, in June, 1965. Extracted from her provisioned nest in sandy ground were nine nymphal and adult leafhoppers in the genera *Carneocephala* and *Graphocephala* (det. N. Frazier).

Bembecinus strenuus (Mickel), **new status**

Stizus strenuus Mickel 1917:331. Holotype male, Bridgeport, Nebraska (LINCOLN).

Bembecinus nanus strenuus Krombein and Willink 1951:707.

I have studied 25 males and 33 females of this species. Its relationship to *nanus* is indicated by the black outstanding hair laterally on the last two abdominal segments. However, in all my specimens the sterna are black, except a few males with tiny whitish spots laterally on S-II-III. Males have T-VI-VII black, females have T-V usually with a medium pale spot. Both sexes have the inside of the hindtibia and hindbasitarsus extensively black. Markings of the terga are whitish or whitish yellow. These are differences from *nanus*. The clypeus and supra-clypeal spot in both sexes are uniformly yellow. Also, there is a marked hair tuft apicolaterally on the male and female clypeus. Occasional females have submarginal cell II with a short but distinct petiole.

Krombein and Willink (1951:707) recorded *strenuus* from Nebraska, South Dakota, Wyoming, and several counties in Texas. My material is from Marshall Co., Oklahoma (Lake Texoma); Alcorn Co., Mississippi (Alcorn); and Texas: Lee Co., Wade Co., Guadalupe Co., Willacy Co., Dimmit Co., Bastrop Co., I have also seen specimens from near Medicine Lodge, Barber Co., Kansas; Rogan, Weld Co., Colorado; and Tucumcari, Quay Co., New Mexico.

I collected nesting females in sandy areas along Lake Texoma. The prey were adults and nymphs of several species of leafhoppers in the genera *Carneocephala* and *Graphocephala* (det. N. Frazier).

Bembecinus wheeleri Krombein and Willink
(Fig. 3)

**Bembecinus wheeleri* Krombein and Willink 1951:709. Holotype male, Fort Grant, Pinaleño Mts., Arizona (CAMBRIDGE).

The almost perfectly rounded propodeal flange (UA) is characteristic of this species. The female clypeus has two pale spots, but I have one specimen with the clypeus all black as in *ater*. However, the mandible is basally yellow, whereas in *ater* it is black. The propodeal flange is different, too (compare Figs. 3, 9). *B. wheeleri* may be confused with *clypeatus*, but females of that have the clypeus two shades of yellow, and UA is slightly irregular (compare Figs. 3, 4). Male *clypearis* is flavid, and this condition is not known in *wheeleri*.

The type series was all from Arizona: Fort Grant, Tucson and south of Tucson, Peña Blanca, Peppersauce Canyon. The 24 males and 9 females in the Bohart Museum are mostly from Arizona also: Sabino Canyon, Tucson, Dragoon Mts., Bowie, Nogales. However, the distribution includes much more of the Southwest. Some of our specimens are from west Texas: Presidio; New Mexico: Rodeo, 8 mi. w. Animas; California: Scissors Crossing (San Diego Co.). Mexico is also represented: Sonora: near Alamos, near Magdalena; Baja California: Puerto Escondido; Baja California Sur: Cataviña.

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**MEUNIERIELLA AVICENNIAE (COOK) (DIPTERA: CECIDOMYIIDAE)
THE LEAF GALL MAKER OF BLACK MANGROVE IN
THE AMERICAN TROPICS**

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Abstract.—The male, female, pupa, and larva of *Meunieriella avicenniae* Cook, **n. comb.**, are described for the first time. The species was previously known only as "*Cecidomyia*" *avicenniae* from its galls on New World mangroves. This species is remarkable because it shows the most primitive state of the male postabdomen in the genus. It is now possible to confirm that *Meunieriella* belongs to the tribe Alycaulini because it shares with all other members of that tribe the smooth, asetulose area on the dorsum of the female ninth abdominal segment, a character unique to the tribe.

Key Words: gall midges, *Avicennia*, West Indies

Leaf galls made by the cecidomyiid *Cecidomyia avicenniae* Cook on black mangrove, *Avicennia* spp., were first reported by Cook (1909) from Cuba. Galls are about 5 mm in diameter, rounded and smooth on the top of the leaf and warty on the bottom of the leaf. Galls are first green, then turn brown after the larvae are fully fed. The larva pupates in the gall. A craterlike exit hole eventually develops, the pupa pushes halfway through the exit, and the adult breaks through the pupal head.

Cook (1909) recorded his galls from *Avicennia nitida* Jacq., which is listed in Tomlinson (1986) as a synonym of *Avicennia germinans* (L.) Stearn. Tomlinson (1986) records the occurrence of only two species of *Avicennia* on the Atlantic side of the Americas. These are *A. germinans*, ranging from southern Florida and the Bahamas throughout the Caribbean to Mexico and Central America, and *A. schaueriana* Stapf and Leechman ex Moldenke 1939 from the

Lesser Antilles and along the coast of South America from Guyana to Uruguay. Subsequent collections of galls similar to those found by Cook were recorded from Bahia, Brazil on *Avicennia tomentosa* (Tavares 1918) and from French Guiana on *Avicennia officinalis* (Houard 1924). Tomlinson (1986) lists *A. tomentosa* as a synonym of *A. germinans* but cautions that past determinations as *tomentosa* could have been in error. *Avicennia officinalis* is an Old World species, so the actual host in French Guiana was either *A. germinans* or *A. schaueriana*. More recently, similar galls have been reported from Florida, USA, and Belize from *A. germinans* (Gagné 1994), and are newly reported here from Guadeloupe and Saint Martin, also on *A. germinans*.

Cecidomyia avicenniae Cook was based on a three-line description of the gall. According to present rules of nomenclature, such a name published before 1931 is valid because it was based on the work of an an-

imal. Cook placed the species in *Cecidomyia* only because that genus was at the time a catchall category for species that could otherwise not be placed to a definite genus (Gagné 1989). Only now, with the recent collection of larvae, pupae, and adults by one of us (JE) in Guadeloupe and Saint Martin, can this species be described and assigned to its correct genus. We are not fully certain that the species from Guadeloupe is the same as that from Cuba, but we presume it is because pupae and larvae taken from similar galls from Belize, farther from Guadeloupe than is Cuba, are similar to those from Guadeloupe.

Meunieriella avicenniae is of more than passing interest for several reasons. Unlike all other Neotropical *Meunieriella* species, which are inquilines in galls made by other gall midges, this species is a gall maker. It shows the most primitive state of the male postabdomen in the genus, and we point out for the first time a peculiarity in this genus, that the male sixth through eighth abdominal segments are retractable. In addition, we now realize that the dorsal, smooth, asetulose area on the ninth segment of the female abdomen is a shared derived characteristic of all species of the tribe Alycaulini, confirming that *Meunieriella* belongs to this tribe.

METHODS

Larvae and pupae were obtained by dissecting fresh field-collected galls. Adults were reared from galls kept in transparent, plastic containers. Specimens were stored in 70% ethanol. All stages were mounted for microscopic study in Canada balsam, using the method outlined in Gagné (1989, 1994). In the descriptions that follow, anatomical terminology of the adult stage follows McAlpine et al. (1981) and that of the larval stage follows Gagné (1989). Specimens are deposited in the National Museum of Natural History, Washington, D.C., in the Muséum National d'Histoire Naturelle, Paris, and in the Station de Zoologie et Lutte Biologique, INRA, Guadeloupe.

Meunieriella avicenniae (Cook), new combination

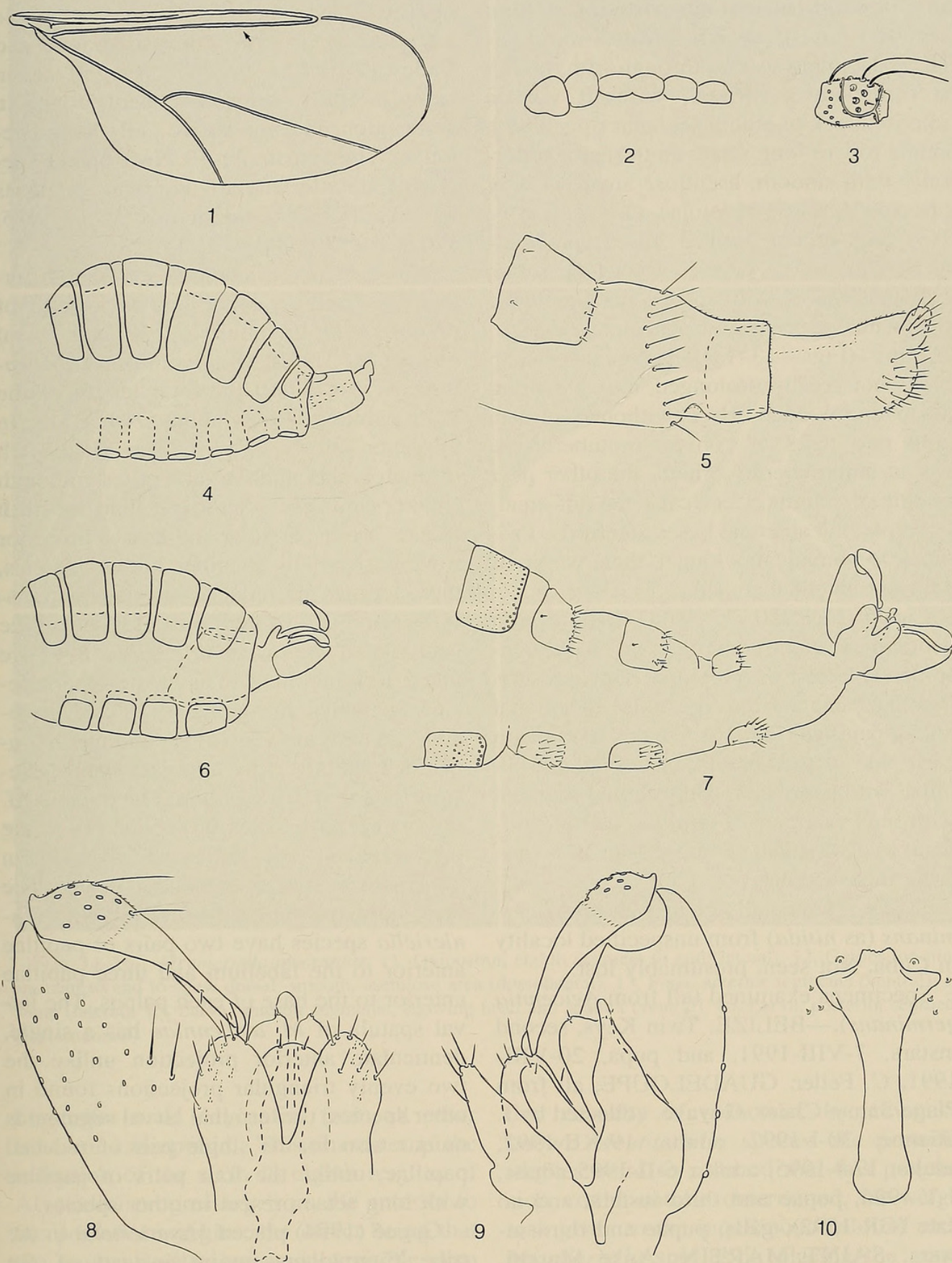
Cecidomyia avicenniae Cook 1909: 145.

Adult.—Head: antenna (Figs. 2–3) with 14–16 flagellomeres, all longer than wide and slightly more than half diameter of spherical pedicel; first and second flagellomeres connate. Palpus four segmented. Labella hemispherical.

Thorax: Wing (Fig. 1), 1.4–1.6 mm long; R_5 0.72–0.75 length of wing. Scutum with four longitudinal rows of setae and scales, the scales more extensive than the setae, almost contiguous between rows; scutellum with a group of setae and a few scales on each side; anepisternum bare; mesepimeron covered with setae and a few scales. Tarsal claws with large tooth; empodia as long as claws.

Male abdomen (Figs. 6–9): Sixth through eighth segments retractable into anterior part of abdomen; first through fifth tergites rectangular, with anterior pair of trichoid sensilla, posterior margin with single to double row of setae, otherwise covered with scales; sixth through eighth tergites rectangular, narrower than fifth tergite, weakly sclerotized, each with anterior pair of trichoid sensilla and apical row of setae; second to fifth sternites rectangular, with anterior pair of trichoid sensilla, setae across midlength and posterior margin, and covered elsewhere with scales; sixth through eighth sternites rectangular, weakly sclerotized, each with scattered setae on posterior half; gonocoxite cylindrical, not greatly attenuate; gonostylus tapered beyond midlength, about two-thirds length of gonostylus; cerci rounded apically; hypoproct slightly shorter than cerci, rounded apically; gonostylus with only two lobes apically, each with an apical seta; aedeagus more than half length of gonocoxite.

Female abdomen (Figs. 4–5, 11–12): First through seventh tergites rectangular as for male first through fifth, seventh tergite much narrower than sixth; eighth tergite narrower than seventh, bare except for an-



Figs. 1–10. *Meunieriella avicenniae*. 1, Wing (arrow points to R₅ wing vein). 2, Scape, pedicel, and first four flagellomeres of antenna (lateral). 3, Detail of fourth flagellomere (lateral). 4, Female abdomen (dorsolateral). 5, Female postabdomen, eighth segment to end (dorsolateral). 6, Male abdomen, showing sixth through eighth segments retracted into anterior part of abdomen (lateral). 7, Male abdomen, fifth segment to end, (lateral except genitalia dorsal). 8, Male genitalia (dorsal). 9, Same (lateral, the near gonopod removed). 10, Larval spatula and associated papillae.

terior pair of trichoid sensilla and single row of short setae along posterior margin; second through seventh sternites rectangular, as for male second through fifth; eighth sternum unsclerotized, without visible sclerite; apex of eighth segment ringed with single row of long setae; ninth segment dorsally with smooth, asetulose area, partially bisected by a line of setulae, elsewhere covered with minute setulae; fused cerci bulbous, spheroidal, covered with long setae; hypoproct short, with apical setae; venter of ovipositor apex covered with long setae.

Pupa (Figs. 13–14).—Antennal sheath bases not greatly prolonged, carinate along apicoventral edge. Face without papillae, with two pairs of convex protuberances, one at anterolateral corners, the other near middle of sclerite. Cervical setae not greatly surpassing antennal bases anteriorly. Prothoracic spiracle no longer than width of adjacent antennal sheath.

Larva (Figs. 10, 15–16).—Spatula with denticulate anterior projection with conspicuous lateral development subanteriorly. Papillae basic to tribe Alycaulini except that lateral papillae (Fig. 10) reduced to three on each side of the spatula, each of these papillae with short seta, and terminal segment with only one pair of papillae that are difficult to distinguish among the spicules covering this segment.

Types.—Leaf galls on leaves of *A. germinans* (as *nitida*) from unspecified locality in Cuba. Not seen, presumably lost.

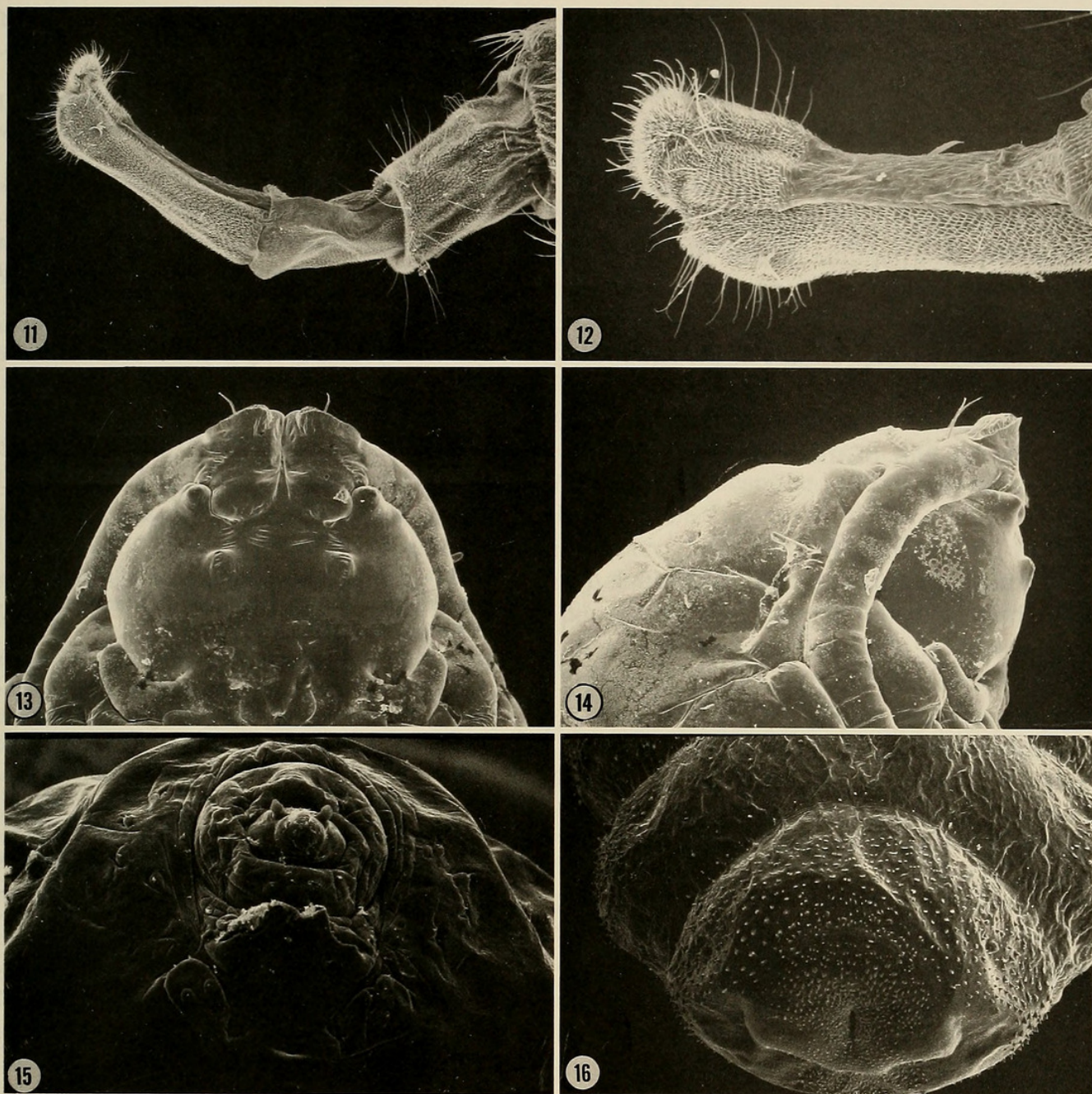
Specimens examined (all from *Avicennia germinans*).—BELIZE: Twin Keys, second instars, 7-VIII-1991, and pupa, 20-VIII-1991, C. Feller. GUADELOUPE, all from Plage Sainte Claire, Goyave, collected by J. Etienne: 30-I-1992, adults; 19-XII-1992, adults; 17-I-1995, adults; 6-II-1995 adults; 4-V-1995, pupae and third instars; and no date (GR-1592), galls, pupae and third instars. SAINT MARTIN: Anse Marcel, 19-V-1995, J. Etienne, galls, adults.

Comments.—*Meunieriella avicenniae* is one of 21 species of *Meunieriella*, 20 of them Neotropical, one Nearctic. Together

with the Nearctic species, *Meunieriella aquilonia* Gagné, responsible for simple leaf blisters on honey locust (Gagné and Valley 1984), *M. avicenniae* is a gall maker, being the only species repeatedly found in association with mangrove galls in Guadeloupe. The remaining 19 Neotropical species of *Meunieriella* are inquiline or guests in galls of other cecidomyiids (Möhn 1975, Wunsch 1979, Gagné 1994).

Meunieriella avicenniae can be differentiated from all other known species of *Meunieriella* by adult, pupal, and larval characters. The R_5 wing vein of *M. avicenniae* is about 7/10 the total length of the wing, while it is only about 5/10 as long in all other known species. The male sixth through eighth abdominal tergites, although smaller and less sclerotized than the fifth tergite, are rectangular and have a posterior row of setae. In all other known species, these tergites are reduced to a narrow transverse band and lack all posterior setae. The genitalia of *M. avicenniae* (Figs. 8–9) are much less modified than in the other species, in which the gonocoxites and gonostyli are extremely attenuate and much longer in relation to the hypoproct and aedeagus than in *M. avicenniae*. The pupa of *M. avicenniae* has convex protuberances on the face (Figs. 13–14), unlike all other known *Meunieriella* species, which have none. The face lacks papillae; all other known *Meunieriella* species have two pairs of papillae anterior to the labellum and three papillae anterior to the base of each palpus. The larval spatula of *M. avicenniae* has a single, denticulate anterior projection unlike the two evenly triangular projections found in other species; the terminal larval segment is unique also for its single pair of reduced papillae, unlike the four pairs of papillae with long setae present in other species.

Gagné (1994) placed *Meunieriella* in the tribe Camptoneuromyiini instead of the tribe Alycaulini, to which it now obviously belongs. The male postabdomens of then known *Meunieriella* spp. were too reduced and modified to show the character that dis-



Figs. 11–16. *Meunieriella avicenniae*. 11, Ovipositor, eighth segment to end (lateral). 12, Ovipositor, ninth segment to end to show dorsal, smooth, aetulous area (dorsolateral). 13, Pupa, anterior segments (ventral). 14, Same (lateral). 15, Larva, anterior segments, showing head and spatula (ventral). 16, Larva, posterior segments (posterodorsal).

tinguishes male Alycaulini from all other tribes of Lasiopteridi. This character is the reduction of the sixth to eighth tergites of Alycaulini progressing from the anterior to the posterior margins, the effect being that the posterior setae are usually visible even on greatly reduced male tergites in Alycaulini. In the other tribes of Lasiopteridi, reduction progresses from the posterior margin of the tergites, so posterior setae are the

first casualty of reduction. In previously known *Meunieriella* species the posterior tergites were so reduced that this progression could not be determined, so weight was given to the inquiline habit of most *Meunieriella* species in placing the genus with the Camptoneuromyiini. Not only are the male sixth through eighth tergites of male *Meunieriella avicenniae* fully setose posteriorly, but we now appreciate, after a

recent canvass by one of us (RJG) that the dorsal, smooth, asetulose area on the ninth segment of the female (Fig. 12) is a unique shared derived character of all Alycaulini. These characters of the male and female postabdomens serve to place *Meunieriella* with certainty in the Alycaulini. That larvae have only 3–4 papillae instead of 6 on each side of the spatula is further confirmation that this genus belongs here, even though that character is not unique to the tribe. The complete retractability of the male sixth through eighth abdominal segments within the anterior part of the abdomen is unique to this genus.

ACKNOWLEDGMENTS

We are grateful to several individuals for their help with this paper: I. C. Feller and P. Hanson for their interest and help with galls of *Avicennia*; P. Malikul for preparing the microscopic slides; W. Brown and S. Braden for their help with the SEM photos; and I. C. Feller, D. R. Miller, A. L. Norrbom, G. J. Steck, and an anonymous reviewer for their comments on drafts of the manuscript.

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