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NEOTROPICAL TINEIDAE, V: A NEW GENUS AND SPECIES OF TINEIDAE ASSOCIATED WITH SOCIAL HYMENOPTERA AND RE-EXAMINATION OF TWO POORLY KNOWN GENERA WITH SIMILAR BIOLOGY (LEPIDOPTERA: TINEIDAE, LYONETIIDAE)

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Abstract.—The larva and adult of a **new genus** and **species** of tineid moth, ***Sphecioses acignathus* D. and M. Davis**, are described from the Neotropical Region. The case-bearing larva of this species is believed to feed primarily as a scavenger within the nests of certain social bees and wasps (Apidae and Vespidae). The comparative morphology and family relationships of two other Neotropical and monobasic genera, *Antipolistes* Forbes and *Taeniodictys* Forbes, with similar biology and previously assigned to the Tineidae are also reviewed. The family placement of *Antipolistes* within Tineidae has been reconfirmed, with *Taeniodictys* now reassigned to Lyonetiidae.

Key Words: Lyonetiidae, Tineidae, adult and larval morphology, larval biology, scavenger, bee/wasp associate, Apidae, Vespidae

More than 11 genera and 20 species of Tineidae have been discovered living in the nests of social Hymenoptera, including Apidae, Formicidae, and Vespidae (Rau 1941, Hinton 1951, Petersen 1963, Hölldobler and Wilson 1990, Pierce 1995, Yamane 1996). This is the largest number of species reported utilizing this association for any moth family. Unfortunately, the precise biological interactions that have evolved between the moths and Hymenoptera remain unknown for more than a third of the reported instances. Most species are known or believed to be detritovores, feeding upon the papery nest material, pollen, organic waste, and possible chitinous remains within abandoned nests. A few may be mycetophagous, feeding upon fungal remains in the nests of leafcutting ants. A few species have been observed to be both detritivorous on wasp meconia and carnivorous on the sealed brood of Vespidae. The larva of *Hypophrictis dolichoderella* (Roepke 1925) has been observed to be predaceous on the ant brood of *Dolichoderus thoracicus* (F. Smith) in central Java.

A new genus and species of tineid moth, *Sphecioses acignathus* D. and M. Davis, is described herein from the Neotropical Region. Nearly 200 adults of this species were reared by DRD from a single vacant nest of *Chartergus* species (Vespidae) collected at a lowland Amazonian rainforest site in southern Venezuela. The case-bearing larva of this species was observed feeding primarily as a detritovore within the nests of its host.

Also reviewed are the morphology and classification of two genera previously described by Forbes (1933) and assigned to the Tineidae. Examination of their adult morphology has reconfirmed *Antipolistes* Forbes as a member of Tineidae (possibly Meessiinae) and *Taeniodictys* Forbes is tentatively assigned to Lyonetiidae.

Tineidae

Sphecioses D. and M. Davis, new genus

Type species.—*Sphecioses acignathus*, new species

Adult (Fig. 1).—Small moths with forewing length 3.8–6.0 mm.

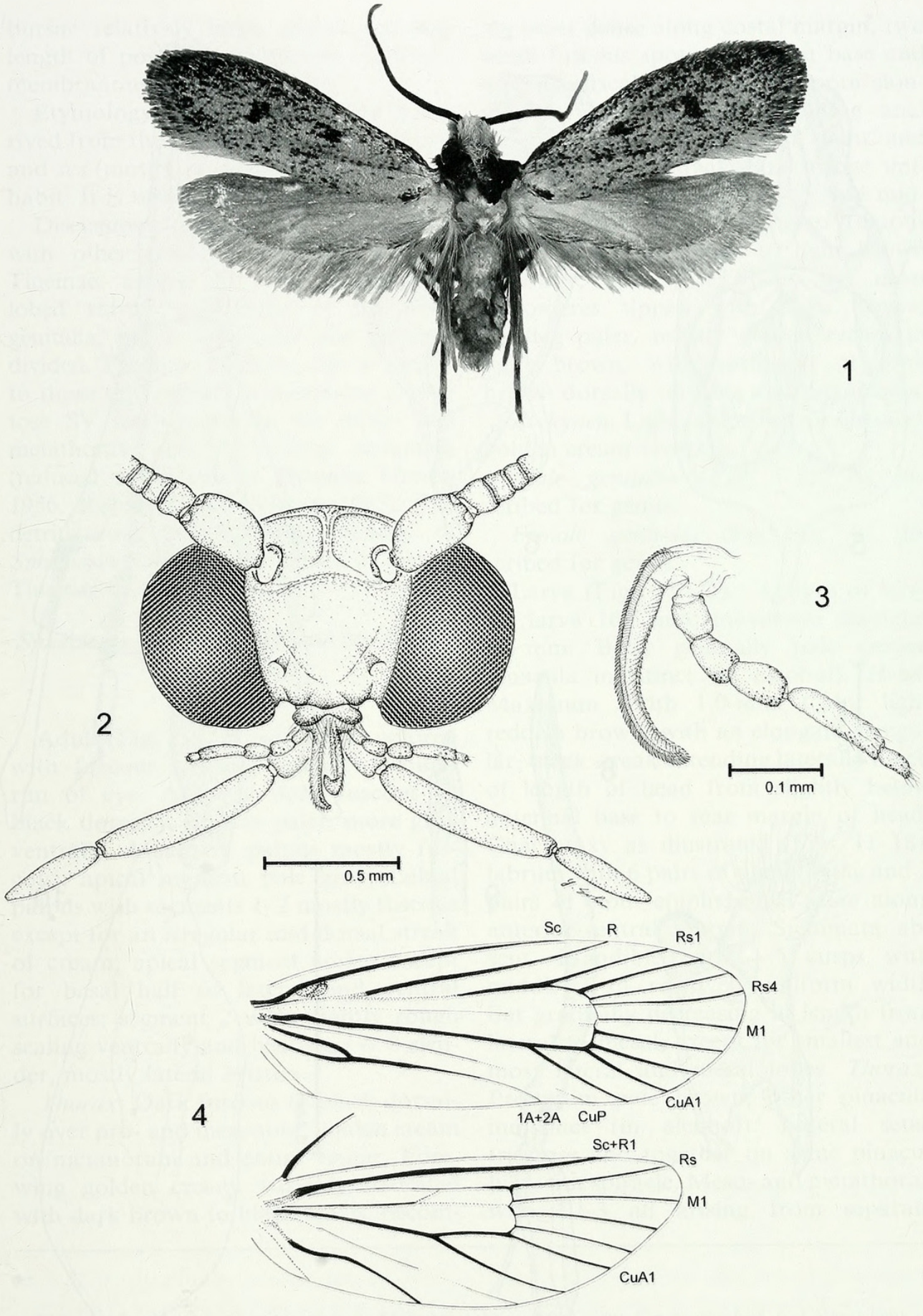
Head (Figs. 2–3): Vestiture rough; vertex and frons densely covered with erect, piliform scales with acute apices. Antenna simple, ~0.85–0.9× length of forewing; scape slightly flattened, without pecten; flagellum with a single row of slender, appressed scales encircling each segment. Eye well developed; vertical diameter ~2× length of scape; frons narrow, interocular index ~1.25. Pilifer well developed, bilobed. Mandible absent. Galea reduced, ~0.8× length of maxillary palpus. Maxillary palpus elongate, 5-segmented, with apical segment the shortest; length ratio of segments from base: 1.0:1.2:1.4:2.5:0.9. Labial palpus well developed; length ratio of segments from base: 1.0:3.1:1.4; vestiture smooth dorsally, moderately short, rough ventrally with 5–7, dark, elongate bristles arising mostly lateroventrally along segment 2; apical segment slightly flattened.

Thorax: Forewing (Fig. 4) moderately slender, W/L ratio ~0.33, apex moderately rounded. Venation well preserved with most veins distinct. Forewing with all 5 branches of R present and separate; accessory cell indistinct, open; M1-3 all separate; CuA1-2 well preserved; CuP indistinct; A1 and 2 with basal fork, then fused ~2/3 their length; male retinaculum strongly curved; female retinaculum consisting of a loose concentration of elongate hairs from ventral base of Sc. Hindwing W/L ratio ~0.35; M1-3 all separate; CuA1 and 2 well developed; 1A + 2A well preserved; 3A faint; frenula a single stout bristle in male, 2 bristles in female. Legs with tibial spur pattern of 0-2-4; epiphysis well developed, ~3/5× length of foretibia.

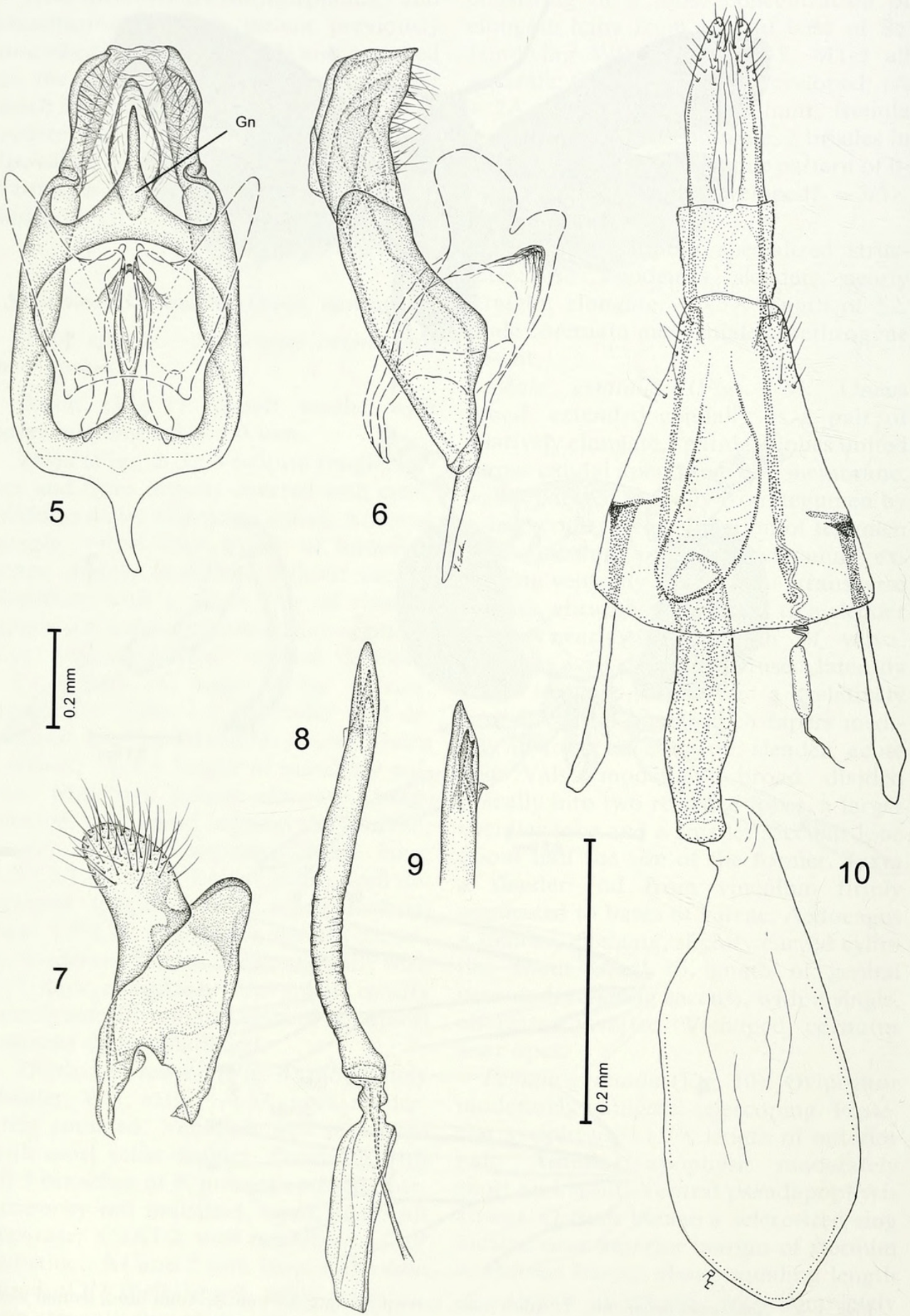
Abdomen: Without specialized structures; S2 apodemes slender, nearly straight, elongate, ~0.5× length of S2. Male coremata and female corethrogyne absent.

Male genitalia (Figs. 5–9): Uncus broad, extended caudally as a pair of relatively elongate, spatulate lobes united across caudal apex by strong membrane, well separated laterally from tegumen by a deep constriction. Junction of tegumen with vinculum indistinct; vinculum extending ventrally as a narrow, transverse sclerite, abruptly constricted to a slender saccus nearly 0.4× length of valva. Gnathos well developed, fused laterally with tegumen, forming a relatively broad, ventral band which tapers medially to form an elongate, slender, acute rod. Valva moderately broad, divided apically into two rounded lobes, a larger cucullar lobe and a smaller saccular lobe about half the size of the former. Juxta a slender rod from vinculum firmly connected to bases of valvae. Aedoeagus a slender, elongate, slightly curved cylinder about equal to length of genital capsule (excluding saccus), with a single, elongate, inverted V-shaped cornutus near apex.

Female genitalia (Fig. 10): Ovipositor moderately elongate, telescoping. Posterior apophysis ~1.7× length of anterior pair. Anterior apophysis moderately short and stout. Ventral pseudapophysis absent. Ostium bursae a sclerotized ring located near anterior margin of sternum 8. Ductus bursae about equaling length of anterior apophysis, with completely sclerotized, cylindrical walls. Corpus



Figs. 1–4. *Sphecioses acignathus*. 1, Adult male, forewing length 4.8 mm. 2, Adult head, frontal view. 3, Right maxilla of Fig. 2. 4, Wing venation.


Gn
5
6
0.2 mm
8
9
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bursae relatively large, about equaling length of posterior apophysis, elliptical, membranous, without signum.

Etymology.—The generic name is derived from the Greek *sphekia* (wasp nest) and *ses* (moth), in reference to the larval habit. It is masculine in gender.

Discussion.—*Sphecioses* generally agrees with other members of the subfamily Tineinae except for the prominently lobed valvae and uncus of the male genitalia, which is broader and partially divided. The larva of *Sphecioses* is similar to those of Tineinae in possessing a bisetose SV setal group on the meso- and metathorax and in lacking stemmata (reduced to 0–1 pair in Tineinae, Hinton 1956, Robinson and Nielsen 1993). The detritivorous larval feeding biology of *Sphecioses* is also similar to that of several Tineinae.

Sphecioses acignathus D. and M. Davis, new species

(Figs. 1–26)

Adult (Fig. 1).—*Head*: Cream colored with fuscous shading laterally around rim of eye. Antenna dark fuscous to black dorsally, slightly paler, more gray ventrally. Maxillary palpus mostly fuscous; apical segment pale gray. Labial palpus with segments 1–2 mostly fuscous except for an irregular mid-dorsal streak of cream; apical segment cream except for basal half of lateral and ventral surfaces; segment 2 with slightly rough scaling ventrally and bearing ~6–8 slender, mostly lateral bristles.

Thorax: Dark fuscous to black dorsally over pro- and mesonota, golden cream on metanotum and entire venter. Forewing golden cream, variably irrorated with dark brown to black scales, becoming most dense along costal margin; two small fuscous spots present at base and apex of discal cell, another, more elongated, small fuscous spot along anal margin; fringe banded with light and dark brown. Hindwing and fringe uniformly light shiny gray. Fore- and midlegs generally dark brown to fuscous dorsally, golden cream to light brown ventrally; apices of tibiae and most tarsomeres tipped with dark brown; hindleg paler, mostly golden cream to light brown, with suffusion of dark brown dorsally on tibia and tarsomeres.

Abdomen: Light, shiny brown dorsally, golden cream ventrally.

Male genitalia (Figs. 5–9): As described for genus.

Female genitalia (Fig. 10): As described for genus.

Larva (Figs. 11–22).—Length of largest larva 16.5 mm; maximum diameter 1.5 mm. Body generally pale cream; pinacula indistinct (in alcohol). *Head:* Maximum width 1.0 mm. Color light reddish brown, with an elongate, irregular, black streak extending laterally much of length of head from slightly below antennal base to rear margin of head. Chaetotaxy as illustrated (Figs. 11–18); labrum with 6 pairs of dorsal setae and 3 pairs of stout epiphryngeal setae along anterior-ventral margin. Stemmata absent. Mandible with 4–5 cusps with middle 3 of relatively uniform width but gradually decreasing in length from lateral to mesal, except for smallest and most lateral and mesal lobes. *Thorax:* Pronotum pale brown; other pinacula indistinct (in alcohol). Lateral setae trisetose and together on same pinaculum with spiracle. Meso- and metathorax with L1-3 all arising from separate

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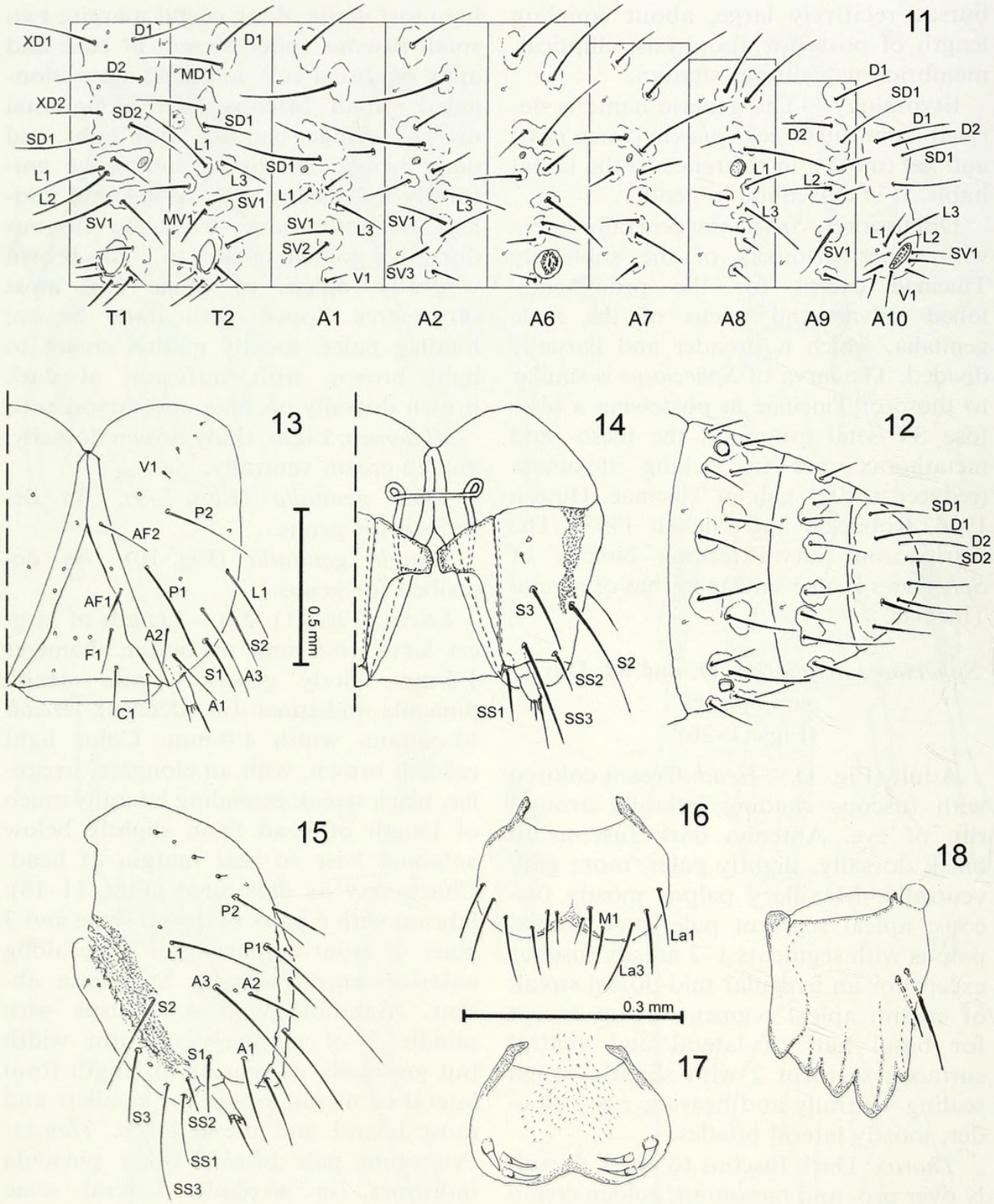
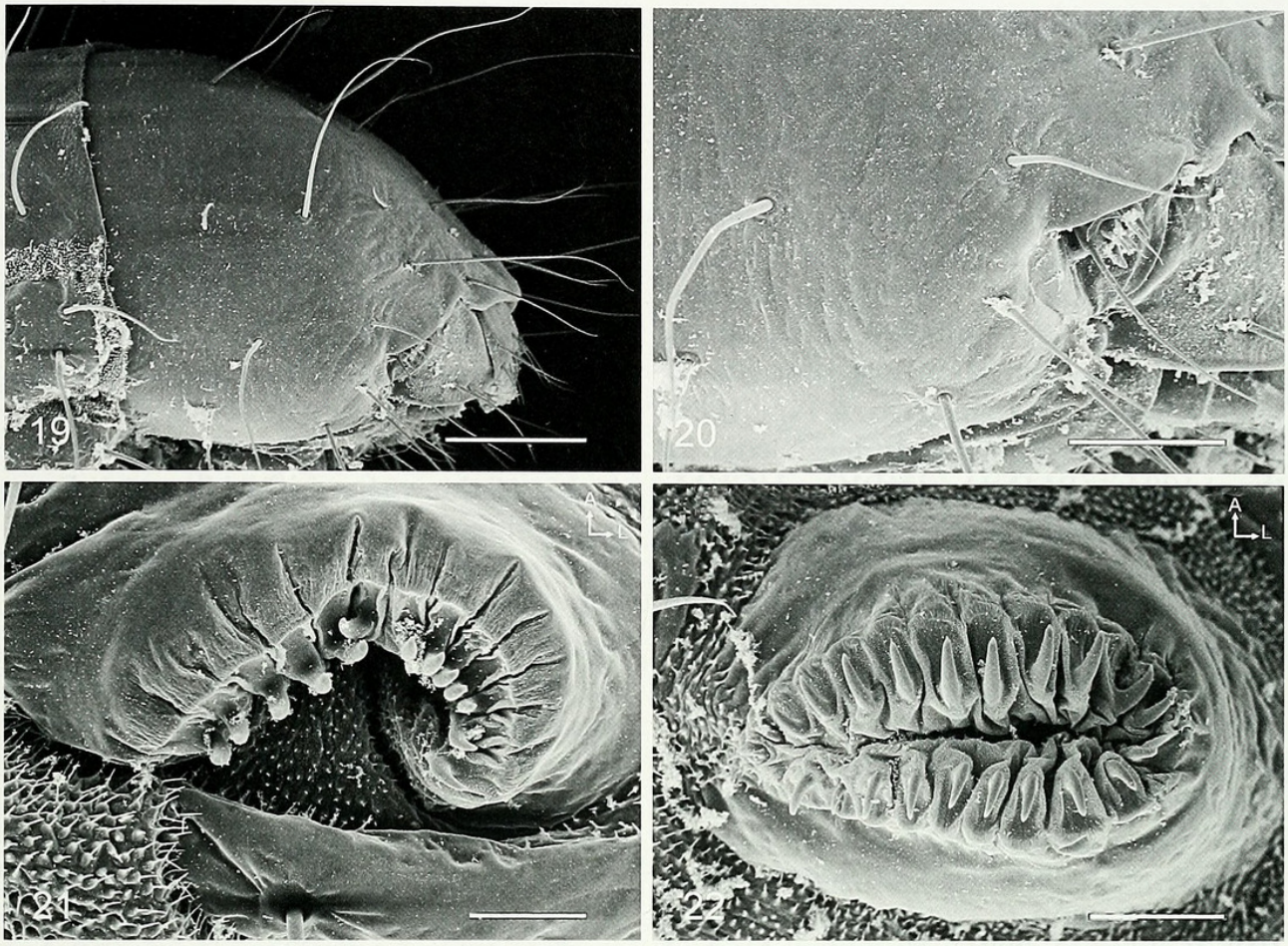
Figs. 5–10. *Sphecioses acignathus*. 5, Male genitalia, ventral view, Gn = gnathos. 6, Lateral view of Fig. 5. 7, Lateral (mesal) view of valva. 8, Aedoeagus, lateral view. 9, Apex of aedoeagus, dorsal view. 10, Female genitalia, ventral view.



Figs. 11–18. *Sphecioses acignathus*, chaetotaxy of late instar larva. 11, Lateral schematic of prothorax, mesothorax, metathorax, and abdominal segments 1, 2, 6–10. 12, Dorsal view of abdominal segments 8–10. 13, Head, frontal view. 14, Ventral view. 15, Lateral view. 16, Labrum, dorsal view. 17, Labrum, ventral view. 18, Mandible.

pinacula. Legs well developed; coxae nearly contiguous on T1, progressively more widely separated on T2 and 3. Pretarsal claw relatively short and stout; apical half moderately curved. *Abdomen*: D1 and 2 on separate pinacula on A1-8, A9 with D2 on same pinacula as SD1. SD 1 and 2 together on same pinacula on



Figs. 19–22. *Sphecioses acignathus*, larval morphology. 19, Head, lateral view (200 μm). 20, Head, detail of stemmatal region (100 μm). 21, Right anal proleg (40 μm). 22, Right ventral proleg (100 μm), A6. A = anterior; L = lateral. (scale lengths in parentheses).

A1-8; SD 2 absent on A9, SD1 together with D2. L1-3 on separate pinacula on A1-8; L2-3 together on same pinacula separate from L1 on A9. Subventral setae bisetose on A1, A7-9; trisetose on A2-6. Dorsal plate of A10 with 4 pairs (D1, D2, SD1, SD2) of elongate setae. Prolegs present on A3-6, 10; crochets A3-6 uniordinal, uniserial, and arranged in a complete ellipse of ~18–20 hooks; prolegs smooth, not covered with minute spines; crochets on A10 consisting of a single row of ~12–14 hooks along anterior edge of planta.

Larval case (Fig. 25).—Maximum length 12 mm, width 4 mm, relatively flat with a maximum depth of 2.5 mm. Light to dark brown in color; texture rough, covered primarily with small, cylindrical balls of dark frass and irregular pieces of nest detritus, including minute insect fragments. The dried frass pellets ranged in size to a maximum length of 0.7 mm and width of 0.5 mm.

Holotype.—♂; VENEZUELA: Territorio Amazonas: Cerro de la Neblina, basecamp, 0°50′N, 66°9′44″, 140 m, 10 Feb 1984, em. 24 Feb 1984 ex nest of *Chartergus* sp. probably *chartarius* (Olivier), DRD 501, D. R. Davis, (USNM).

Paratypes.—COSTA RICA: Heredia: Estación Biológica La Selva, Puerto Viejo de Sarapiqui, 50–150 m: 1 ♂, 1 Dec 2000, E. F. Smith, ex nest of *Mischocyttarus collarellus*, nest P.33A, (USNM). VENEZUELA: Territorio Amazonas: Cerro de la Neblina, basecamp, 0°50′N, 66°9′44″, 140 m: 6 ♂, 2 ♀, 10 Feb 1984, em. 24 Feb 1984 ex nest of *Chartergus* sp. probably *chartarius* (Oli-

vier), DRD 501, D. R. Davis; same data except: 13 ♂, 11 ♀, em. 25 Feb 1984; 7 ♂, 8 ♀, em. 26–29 Feb 1984; 4 ♂, 3 ♀, em. 29 Feb 1984; 3 ♂, 3 ♀, em. 1 Mar 1984; 4 ♂, 4 ♀, em. 2 Mar 1984; 2 ♂, 5 ♀, em. 4 Mar 1984; 4 ♂, 9 ♀, em. 5 Mar 1984; 6 ♂, 6 ♀, em. 6 Mar 1984; 7 ♂, 5 ♀, em. 8 Mar 1984; 7 ♂, 7 ♀, em. 10 Mar 1984; 4 ♂, 8 ♀, em. 12 Mar 1984; 7 ♂, 12 ♀, em. 13 Mar 1984; 3 ♂, 2 ♀, em. 18–21 Mar 1984; 1 ♂, 2 ♀, em. 1–2 Apr 1984; 1 ♀, em. 7–8 Apr 1984; 1 ♂, em. 12 Apr 1984; (BMNH, INBIO, UCVM, USNM). Cerro de la Neblina, basecamp, 0°50′N, 66°9′44″, 140 m: 1 ♀, 31 Jan 1984, light trap, 1 ♂, 10–20 Feb 1985, malaise trap in rainforest, P. J. & P. M. Spangler, R. A. Faitoute, & W. E. Steiner, (USNM); 1 ♂, 13–15 Mar 1984, Malaise trap over small stream at east side of basecamp, O. Flint & J. Louton, (USNM).

Host.—Apidae: Nests of *Bombus atratus* Franklin and *B. transversalis* (Olivier) (Whitfield et al. 2001). Vespidae: Nest of *Chartergus* sp. probably *chartarius* (Olivier); nest of *Mischocyttarus collarellus* Richards, Polistinae (Smith 2005).

Parasitoid.—Braconidae: *Apanteles nidophilus* Whitfield and Cameron.

Flight period.—Adults collected from December to March.

Distribution.—Probably widespread through the lowland Neotropical Region from Costa Rica to Brazil (Whitfield et al. 2001).

Etymology.—The species name is derived from the Greek *akis* (point, beak) and gnathos (jaw) in reference to the diagnostic, pointed gnathos in the male genitalia.

Discussion.—This species was first discovered by DRD during a 1984 expedition to Cerro de la Neblina, Amazonas, Venezuela. Nearly 200 adults were reared from a single vacant nest of *Chartergus* sp. (probably *chartarius* (Olivier), Figs. 23–24) collected 10 Feb 1984 at a site near the Rio Baria and adjacent to the Neblina Expedition basecamp. The nest was immediately opened, and numerous larval cases were observed suspended from the undersides of the transverse combs. The larvae appeared to be feeding on detritus in the combs (probably on meconia within the cells) as well as the cell walls of the comb. The remains of minute, chitinized insect fragments attached to the larval case also suggest that the larvae of *S. acignathus* feed on the remains of various stages of the wasps within the nest. Even more significant were the abundant insect remains found tightly packed within the larval frass of *acignathus* (also attached to the larval case, Fig. 25).

More recently other entomologists working on various groups of Hymenoptera have reared this moth and sent specimens or images to DRD for identification. Whitfield et al. (2001) reared *S. acignathus* from underground nests of Neotropical bumble bees, *Bombus atratus* Franklin and *B. transversalis* (Olivier) in Colombia, Brazil, and Ecuador. They reported that the moth appeared to be a scavenger which destroyed the nest cells while foraging. They also discovered *S. acignathus* to be parasitized by a braconid that differed from those described previously from *Bombus* nests. While studying the ecology of the paper wasp *Mischocyttarus collarellus* at the La Selva Biological Station, Puerto Viejo, Costa Rica, E. Smith (2004, 2005) reared *S. acignathus* from the nests (Fig. 26) of that wasp. The larvae of the moth were observed to have burrowed through the nest and cell walls of its host, leaving frass and silk, and possibly devouring brood.

Antipolistes Forbes

Antipolistes Forbes 1933: 91.—Davis 1984: 20.—Nye and Fletcher 1991: 22.

Type species.—*Antipolistes anthracella* Forbes 1933; by monotypy.

Adult (Fig. 27).—Very small moths with forewing length 2.3–2.7 mm.

Head (Figs. 28, 29): Vestiture rough; Vertex and frons densely covered with erect, piliform scales with acute apices. Antenna simple, ~0.75× length of forewing; scape slightly flattened, without pecten; flagellum with a single row of slender, appressed scales encircling each segment. Eye reduced; vertical diameter ~1.3× length of scape; frons very broad, interocular index ~0.5. Pilifer undeveloped. Mandible and galea absent. Maxillary palpus greatly reduced, normally not visible on uncleared head, 2-segmented, with a minute, apical spine projecting from segment 2 (Fig. 29). Labial palpus well developed, widely divergent from base of head; length ratio of segments from base: 1.0:1.5:1.4; vestiture generally smooth, with numerous (>12), elongate bristles arising laterally and apically along segment 2; apical segment cylindrical.

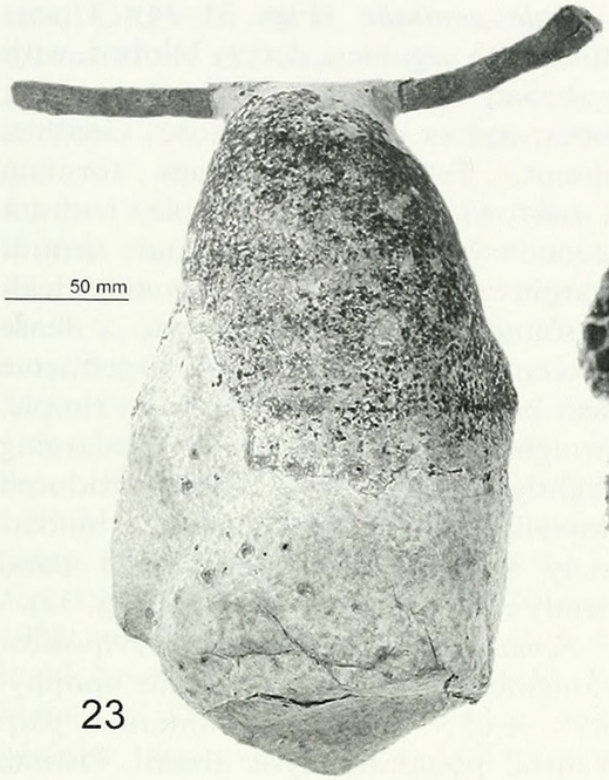
Thorax: Forewing (Fig. 30) relatively slender, W/L ratio ~0.26, apex subacute. Venation generally reduced; base of most veins indistinct. Forewing with Rs1 and 2 fused; Rs3 & 4 variably stalked 1/4–1/2 their length; accessory cell absent; M2 absent, possibly fused with M1 which is variably stalked to Rs4; CuA2 absent; CuP indistinct; 1A and 2A completely fused; male retinaculum a strongly curved process. Hindwing W/L ratio ~0.18; M1 vestigial, present only near margin; M2 absent, possibly fused with M1; M3 almost completely preserved; CuA1 and 2 variable, either completely fused or minutely branched in male, more divided in female; anal veins undeveloped; frenulum a single stout bristle in male, 2 bristles in female. Legs with tibial spur pattern of 0-2-4; epiphysis absent.

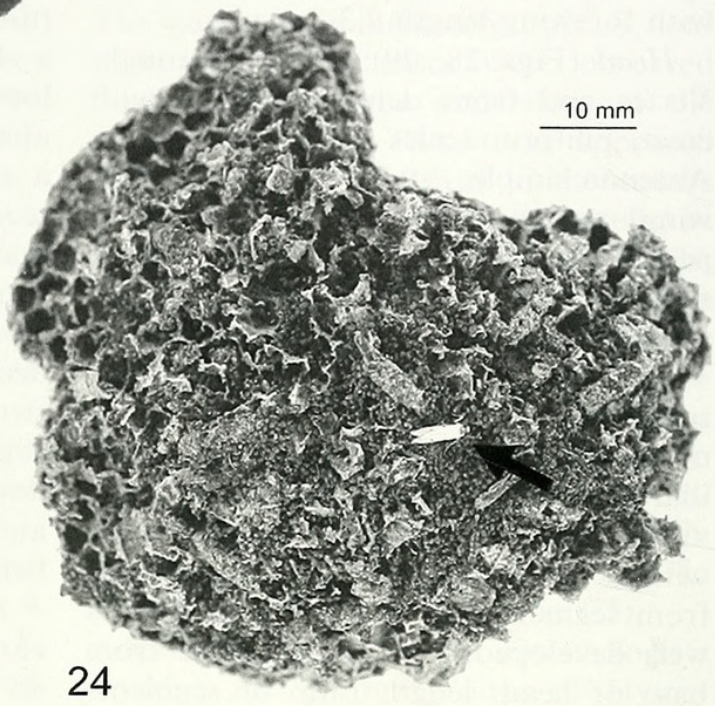
Abdomen: Without specialized structures; S2 apodemes relatively elongate and slender, slightly curved. Male coremata and female corethrogyne absent.

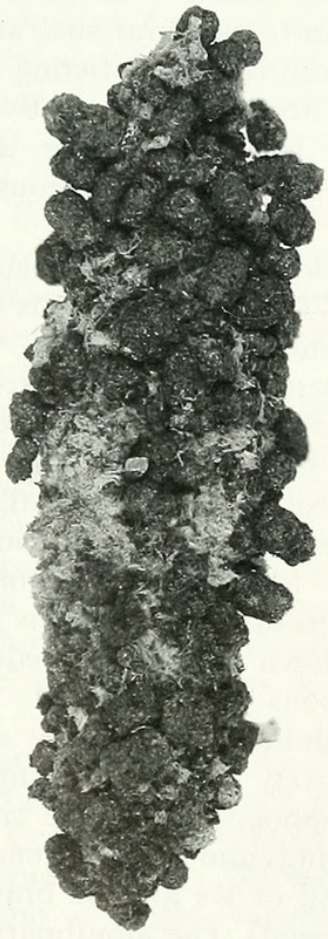
Male genitalia (Figs. 31–34): Uncus fused with tegumen, deeply bilobed, with a broad U-shaped cavity separating lobes; apices of uncus setose. Gnathos absent. Tegumen—vinculum forming a narrow ring. Valva simple, without secondary lobes; dorsal and ventral margins subparallel; apex asymmetrically rounded; mesal surface with a dense concentration of relatively enlarged setae near base. Aedoeagus a relatively simple, straight cylinder, gradually enlarging slightly to base; apex slightly produced dorsally; cornuti absent. Juxta a moderately slender, lightly sclerotized band firmly attached to aedoeagus (Fig. 33).

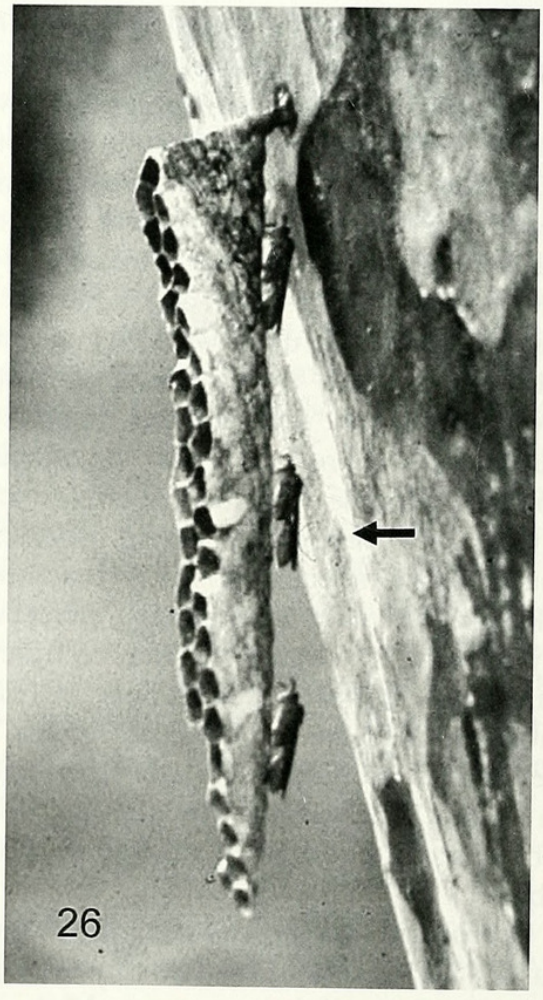
Female genitalia (Fig. 35): Ovipositor elongate, telescoping. Posterior apophysis ~1.65× length of anterior pair. Ventral pseudapophysis absent. Ostium bursae moderately broad, U-shaped, located near middle of sternum 8. Ductus bursae short, membranous, antrum V-shaped, gradually constricting to corpus bursae. Corpus bursae relatively large, nearly as long as anterior apophysis, elliptical in form, membranous, without signum.

Discussion.—The family placement of *Antipolistes* within Tineidae is supported by such adult characters as the erect, piliform setae of the head, erect bristles arising from the second segment of the maxillary palpus, and elongate, telescoping ovipositor. Subfamily affinities for the genus are uncertain but appear nearest to Meessiinae, a probably polyphyletic group of more than 20 genera whose known larvae are predominantly lichenivorous (Davis and Robinson 1998). Adults of Meessiinae often possess relatively simple forewing patterns of large spots or transverse bands, with slender wings and reduced venation (loss or stalking of Rs and M branches, 3A rarely present). The mouthparts of most genera of Meessiinae are typically fully developed but may be greatly reduced









Figs. 23–26. *Sphecioses acignathus*. 23, Nest of *Chartergus* probably *chartarius*, Base Camp, Cerro de la Neblina, T. F. A., Venezuela. 24, Internal comb from nest in Fig. 23, with resting adult (arrow) of

(without maxillae) in some genera (e.g., *Tenaga*, Robinson and Nielsen 1993).

Future studies involving all taxa currently associated with Meessiinae will probably result in the restriction of this subfamily to just those genera allied to the type genus, *Eudarcia*. The larvae of *Eudarcia* are unusual among what little we know of the immature stages of Tineidae in possessing an extremely long subdorsal seta (SD1) extending anteriorly from the pronotum and sometimes a similarly elongated SD1 from the anal plate, in addition to an anal comb for flicking frass (Dominguez 1996, Davis unpub.). None of these specializations are present in *Antipolistes*.

Antipolistes anthracella Forbes
(Figs. 27–59)

Antipolistes anthracella Forbes 1933: 92.—Davis 1984: 20.

Tinea latebrivora Meyrick, 1935: 575.—Davis 1984:20 (synonym of *Antipolistes anthracella* Forbes).

Tinea latebricola [sic] Vesey-Fitzgerald 1938:182.—Nelson 1968: 1530.—Jeanne 1979: 306.—Makino 1985:20.

Adult (Fig. 27).—*Head*: Uniformly light brown. Antenna shiny light brown to gray. Labial palpus shiny light brown to gray. *Thorax*: Dark fuscous to black dorsally, shiny light brown to gray ventrally. Forewing dark fuscous to black, with 4 irregular whitish spots; one pair along middle and distal 3/4 of costa; another pair at basal 1/3 and distal 2/3 of dorsal margin; fringe fuscous to black. Hindwing dark fuscous with faint purplish luster. Legs generally dark fuscous dorsally, shiny light brown to gray ventrally, with faint whitish apices to tibiae and tarsomeres. *Abdomen*: Dark fuscous dorsally, shiny light gray ventrally.

Male genitalia (Figs. 31–34): As described for genus.

Female genitalia (Fig. 35): As described for genus.

Larva (Figs. 36–59).—Maximum length examined 4.3 mm; maximum body width 0.5 mm. Vesey-Fitzgerald (1938) briefly described the larva as 5 mm long at maturity, and "white with a few white hairs on the body and light brown heads"; pinaculae indistinct (in alcohol). *Head*: Maximum width 0.4 mm. Chaetotaxy as illustrated (Figs. 36–43); labrum with 6 pairs of dorsal setae and 3 pairs of stout epiphryngeal setae along anterior-ventral margin. Stemmata absent. Antenna with sensilla as shown (Figs. 49–52). Mandible with 3–4 cusps along distal margin with lateral cusp the longest and most acute; a small, subapical dorsal cusp also present (Fig. 43). *Thorax*: Pronotum and pinacula indistinct (in alcohol). Lateral setae trisetose and together on same pinaculum with spiracle. Meso- and metathorax with L1-3 all arising from separate pinacula. Legs moderately well developed; procoxae narrowly separated; meso- and metacoxae well separated. Pretarsal claw with relatively slender basal half; apical half only slightly curved (Fig. 54). *Abdomen*: D1 and 2 on separate pinacula on A1-8, together on same pinacula on A9. SD 1 and 2 on separate pinacula on A1-8; SD 2 absent on A9. L1-3 on separate pinacula on A1-9; L3 together with SV1 on same pinacula on A9. Subventral setae bisetose on A1-2, A7-8; trisetose on A2-6; only SV1 present on A9. Dorsal plate of A10 with 4 pairs (D1, D2, SD1, SD2) of elongate setae. Prolegs present on A3-6,

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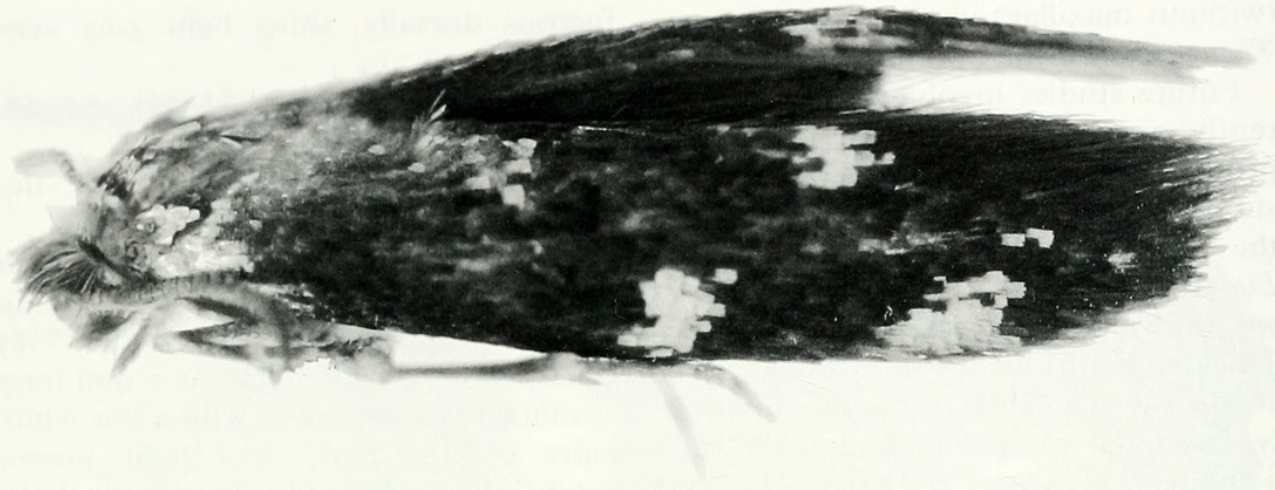
S. acignathus. 25, Larval case (length 11 mm). 26, Nest of *Mischocyttarus collarellus* with 3 wasps (arrow), La Selva, Heredia, Costa Rica.



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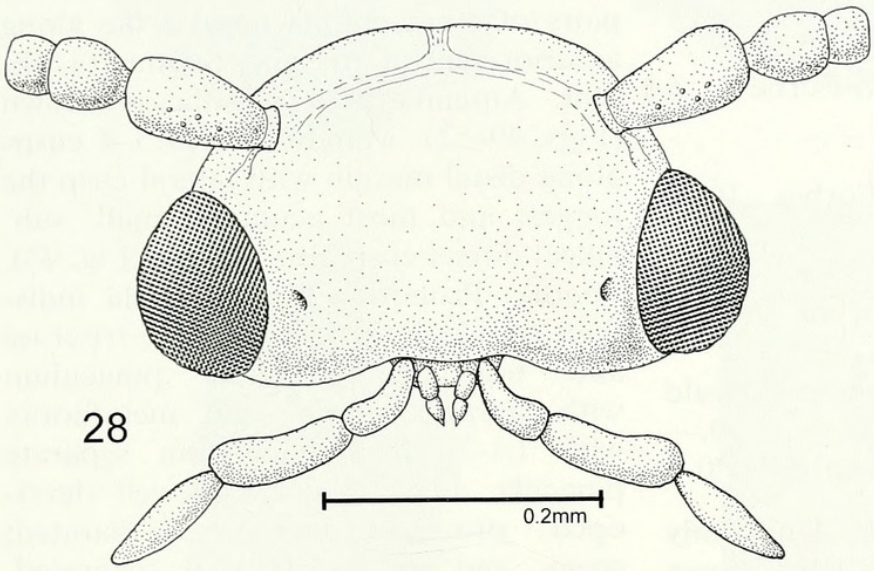

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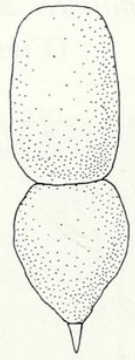

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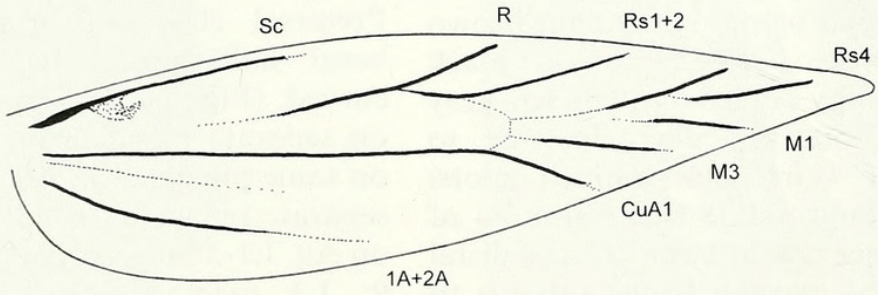

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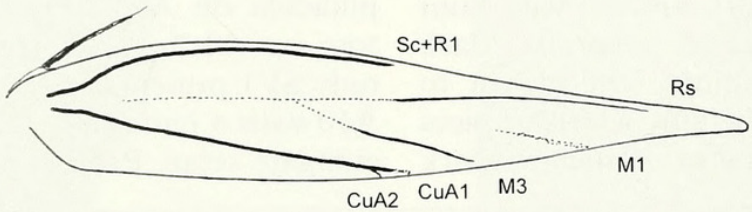
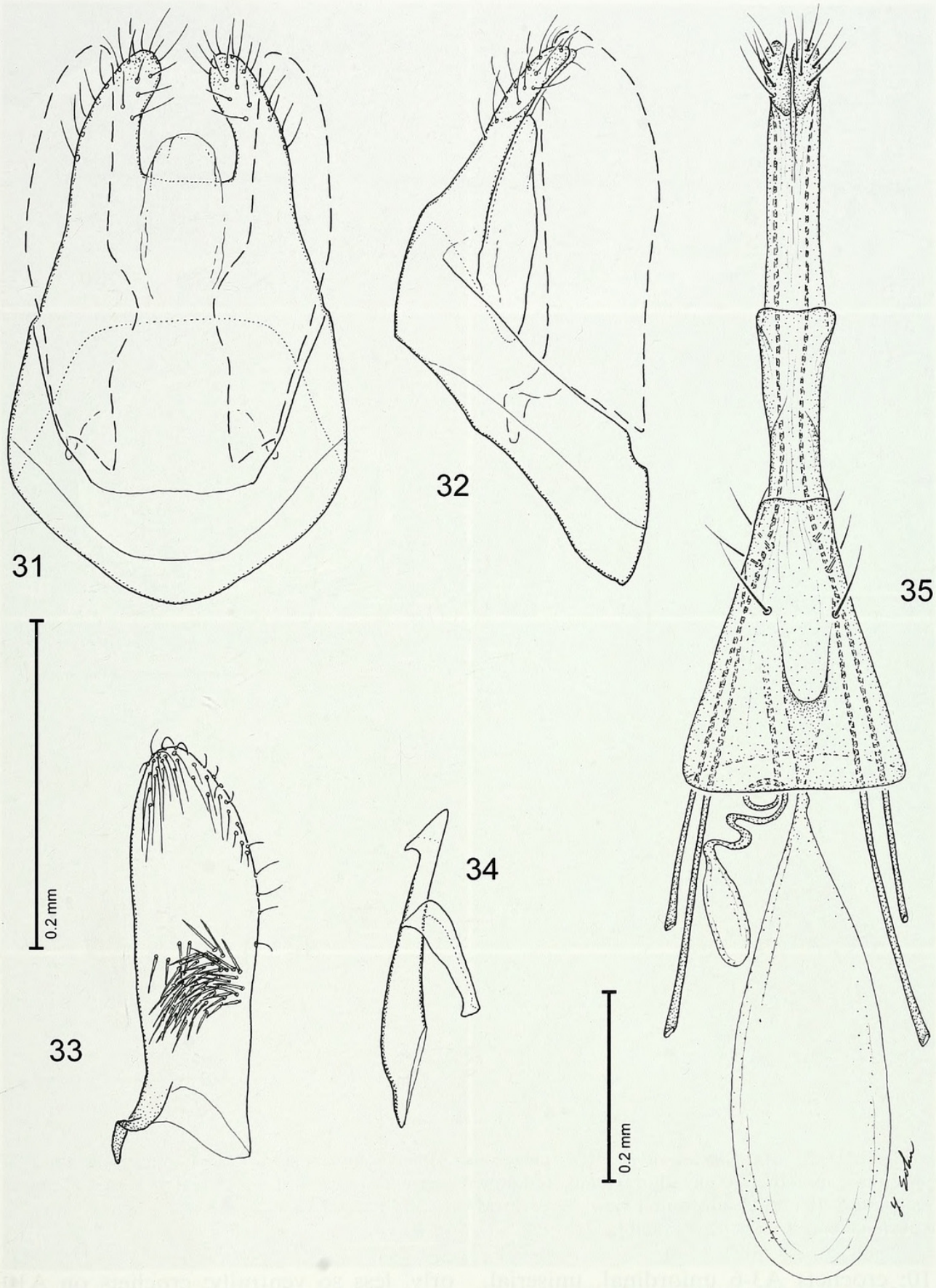
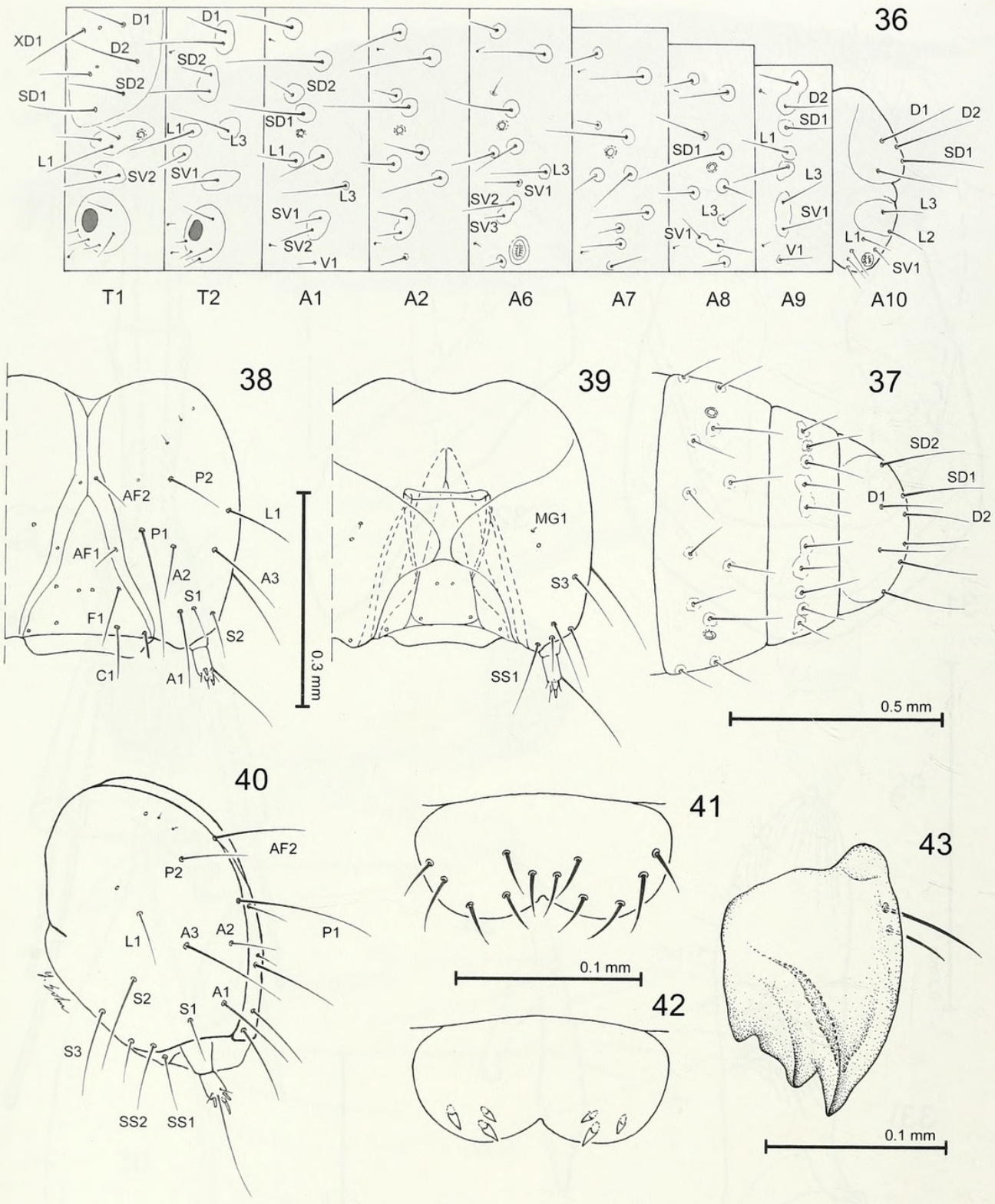


Figs. 27–30. *Antipolistes anthracella*. 27, Adult male, forewing length 2.5 mm. 28, Head, frontal view. 29, Right maxilla of Fig. 28. 30, Wing venation.

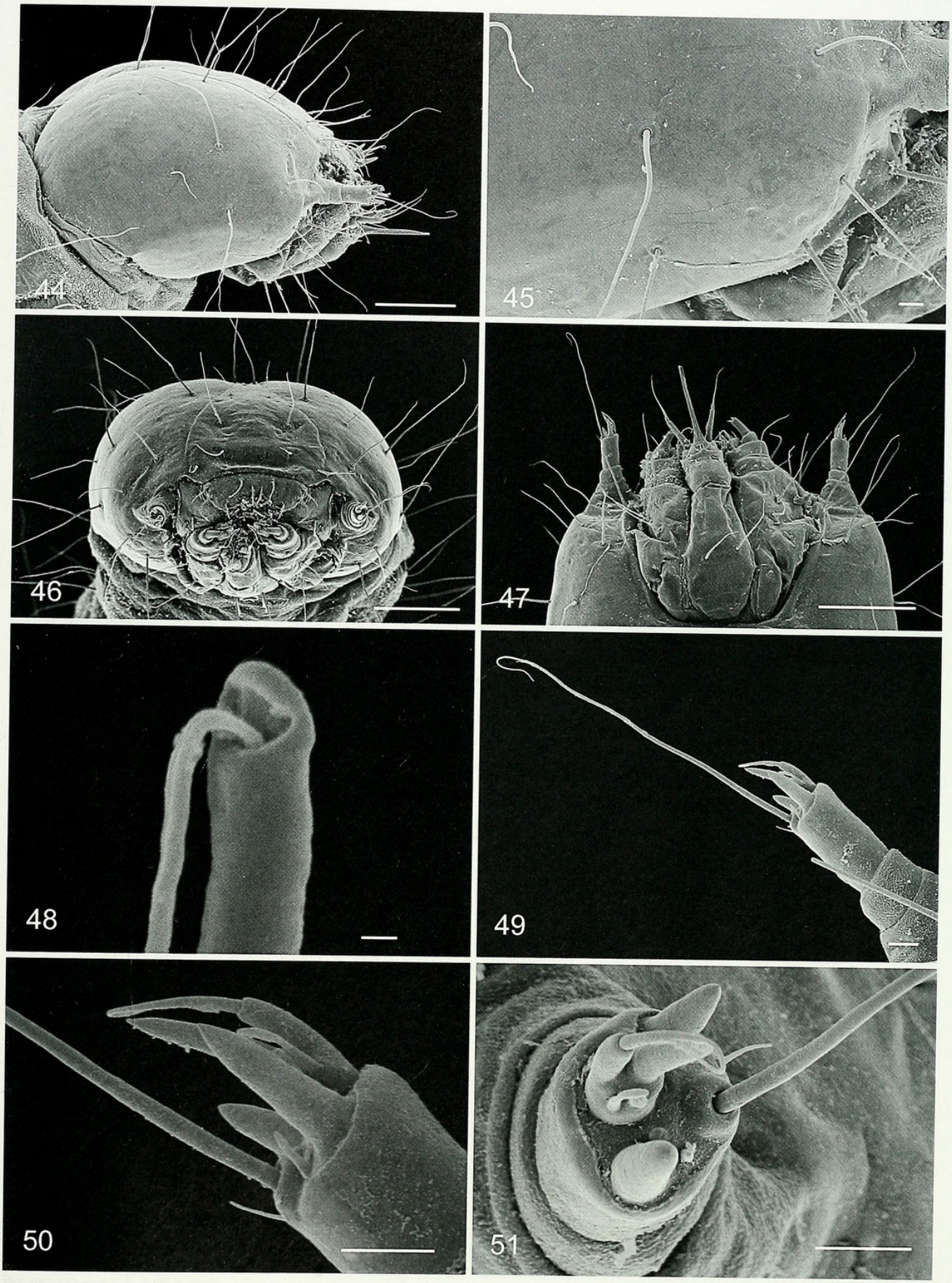


Figs. 31–35. *Antipolistes anthracella*. 31, Male genitalia, ventral view. 32, Lateral view of Fig. 31. 33, Lateral (mesal) view of valva. 34, Aedoeagus, lateral view. 35, Female genitalia, ventral view.

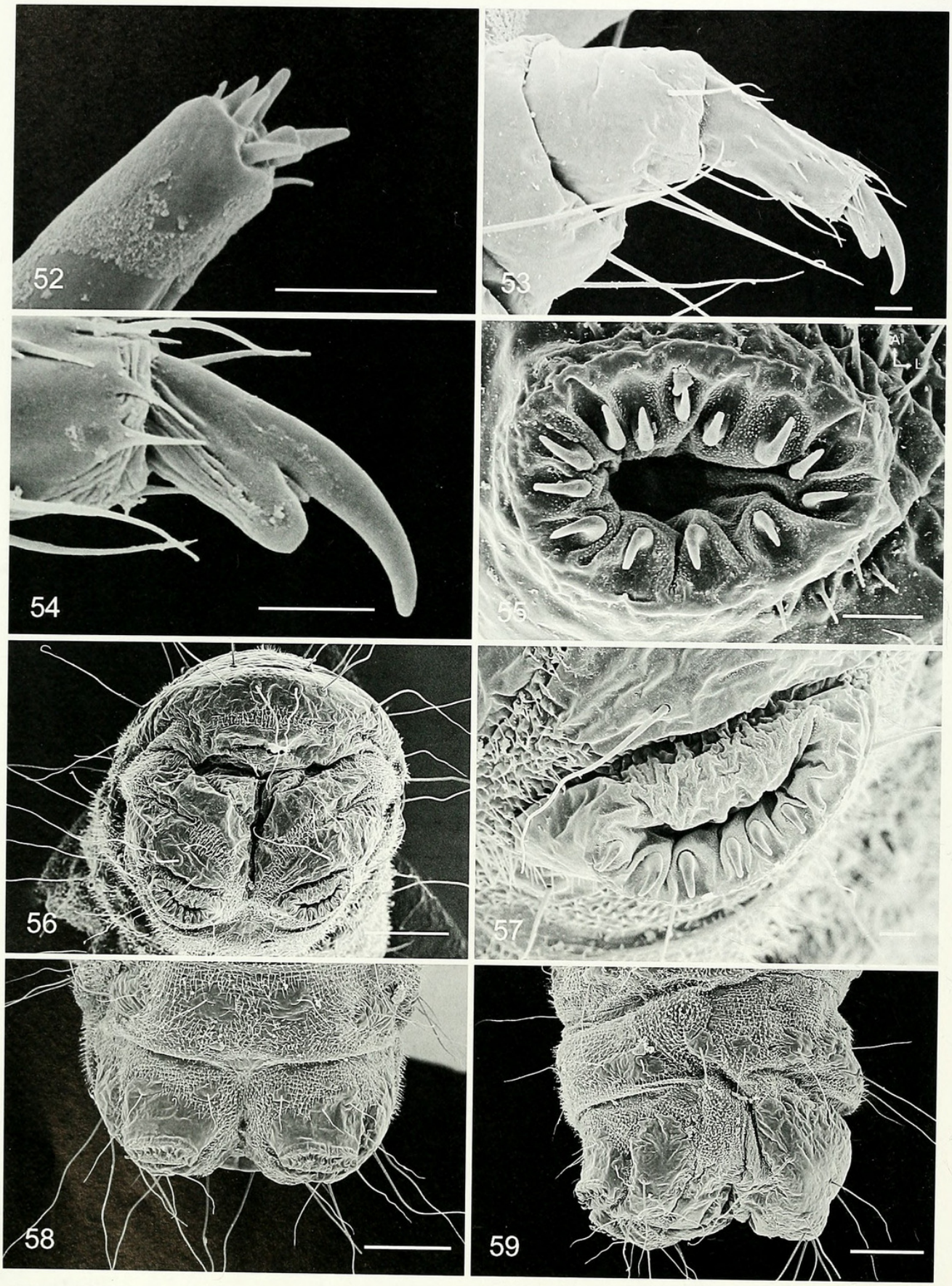


Figs. 36–43. *Antipolistes anthracella*, chaetotaxy of late instar larva. 36, Lateral schematic of prothorax, mesothorax, metathorax, and, abdominal segments 1, 2, 6–10. 37, Dorsal view of abdominal segments 8–10. 38, Head, frontal view. 39, Ventral view. 40, Lateral view. 41, Labrum, dorsal view. 42, Labrum, ventral view. 43, Mandible.

10; crochets A3-6 uniordinal, uniserial, and arranged in a complete ellipse of ~13 hooks (Fig. 55); prolegs sparsely covered with minute spines anteriorly, less so ventrally; crochets on A10 consisting of a single row of ~7–8 hooks along anterior edge of planta (Fig. 57).



Figs. 44–51. *Antipolistes anthracella*, larval morphology. 44, Head, lateral view (100 μm). 45, Head, detail of stemmatal region (10 μm). 46, Head, anterior view (100 μm). 47, Head ventral view (100 μm). 48, Apex of spinneret with silk thread emerging, ventral view (1 μm). 49, Right antenna, ventral view (10 μm). 50, Antennal sensilla, ventral view (10 μm). 51, Antennal sensilla, anterior view (10 μm). (scale lengths in parentheses).



Figs. 52–59. *Antipolistes anthracella*, larval morphology. 52, Left maxillary palpus, dorsal view (10 μm). 53, Left prothoracic leg (10 μm). 54, Detail of pretarsus in Fig. 53 (10 μm). 55, Crochets of right proleg of abdominal segment 6 (A = anterior; L = lateral; 10 μm). 56, Caudal end of abdomen (100 μm). 57, Crochets of right anal proleg (10 μm). 58, Ventral view of abdominal segments 9 and 10 (100 μm). 59, Lateral view of Fig. 58 (100 μm). (scale lengths in parentheses).

Pupa.—Not examined. Description from Forbes (1933): "Pupa (from Sein) similar to *Tinea pellionella* as figured by Miss Mosher (Bull. Ill. State Lab. Nat. Hist. xii, pl. 20, figs. 30, 31), sutures not clearly seen, prothorax depressed dorsally, maxillae shorter, nearly obsolete, but maxillary palpi large and transverse; antennae barely longer than fore wings; angulations of terminal segment ventral rather than lateral. The small round eyes are also more completely visible below the antennae. Abdomen dorsally with first three segments unarmed; fifth and sixth with anterior rows of fine spinules; 7th and 8th also with coarser rows near the mid-segments, the latter rather sparse; ninth segment with two subdorsal clusters of about three spinules each and last with small pointed subdorsal cones."

Types.—♂ (holotype, *Antipolistes anthracella*); Puerto Rico: Lares, (CU). ♀ (lectotype, *Tinea latebrivora*, present designation); bearing following labels: "Lectotype/Trinidad 1990, 24.vi.33, D.V.F.G./ BM 1934-614/*Tinea latebrivora* Meyr., Type" (BMNH). A lectotype has been designated to ensure the stability of the name.

Material examined.—BRAZIL: Pernambuco: Parnambuco: 2 ♂, 1 ♀, 1983 [USDA lot 1983:3631], M. Arcanjo, reared from beehives, (USNM). Pará: Fazenda Taperinha, 2°32′S, 54°20′W, ~40 km E of Santarém [on lower Amazon River]: 4 ♂, 6 ♀, slides USNM 20794, 21565, 21566, 22156, 22157, 22169, 33181; Santarém, Taperinha, 2°54′S, 54°20′W: 5 larvae, 23 Jul 1977, R. Jeanne, larval slides USNM 33726, 33727 (USNM). CUBA: Cienfuegos: Guabairo, Central Soledad: 1 ♀ (paratype), 1 Sep 1930, R. Dow, reared from nest of *Polistes cubensis*, (USNM). PUERTO RICO: Lares: 1 ♂ (holotype, *Antipolistes anthracella*), (CU); (CU); 4 ♂, 2 ♀, (paratypes), Dec 1931, bred from nest of *Polistes crinitus*, slides USNM 22198, 33180; 1 ♂, 1 ♀, (USNM). TRINIDAD: 1 ♀ (lectotype, *Tinea latebrivora*), 24 Jun 1933; 2 ♀ (paralectotypes, *Tinea latebrivora*), 24 May 1933; 3 ♀ (paralectotypes), bred May 1933; D.V.F., (BMNH); 3 ♀, Dec 1934, Fitzgerald, reared from refuse at bottom of cells of *Polistes canadensis*; 1 ♂, Jan 1935, Fitzgerald, reared from old *Polistes* nest, (BMNH).

Host.—Scavenger/predator in nests of *Polistes canadensis* (L.), *Polistes canadensis panamensis* Holmgren, *Polistes crinitus* (Felton), *Polistes cubensis* Lepeletier, beehives [? *Apis mellifera* L.].

Flight period.—Adults are probably active most of the year, with records in January, May, June, September, and December.

Distribution.—Greater Antilles south to Brazil.

Discussion.—*Antipolistes anthracella* was first reared from *Polistes* nests by F. Sein, Jr. in Puerto Rico (Forbes 1933). Vesey-Fitzgerald (1938) later reared the moth in Trinidad from nests of *Polistes canadensis*, where *anthracella* larvae were reported to be an important pest of this wasp. Unaware that Forbes had already described the species, Meyrick redescribed it as *Tinea latebrivora* (later misspelled *latebricola* by Vesey-Fitzgerald) two years later. The larvae were believed by Vesey-Fitzgerald to feed primarily as scavengers within the wasp nest, but were seen to feed on living *Polistes* pupae just prior to the emergence of the wasp. *Antipolistes* larvae were reported to enter the body of its host through the tip of its abdomen. Live pharate *Polistes* adults were observed to still be able to move their legs and antennae although their abdomens were full of feeding *Antipolistes* larvae. Three moths in the collections of the USNM bear labels as being "reared from beehives".

The most complete account of the biology of this species is by Jeanne

(1979), who reported this moth to be present in 56% of the colonies of *P. canadensis canadensis* L. surveyed at Fazenda Taperinha, a site on the lower Amazon River approximately 40 km east of Santarém, Pará. Jeanne reports the moth to lay its eggs in clusters of two or more under the edge of the wasp meconium. As the larvae mature, their feeding and tunneling activities break down the meconium, and the larvae begin to spin silken tunnels throughout the frass and remains of the meconium. Larvae were observed to penetrate the paper walls of their cell to feed on meconia in adjacent cells. Jeanne also noted the larvae to feed occasionally on the wasp brood. Pupation occurs in the lower parts of the cells amidst the tangles of silk webbing and frass. The total development from egg to adult was estimated to require between 25–30 days.

Jeanne hypothesized that several behaviors exhibited by the wasp, including multiple comb building, were adaptations that reduced brood loss to these moths. It was noted that colonies infested by the moth did not use their combs to rear a second batch of brood, while uninfested colonies did. Since a comb cannot be invaded by moths until a meconium is exposed by the production of the first adult, dividing the brood into many small isolated periods of short age range reduces the risk that a given pupa will be attacked by moth larvae. It also reduces the risk that brood will be lost due to the nest-weakening effects of moth infestation.

Antipolistes anthracella probably is widely distributed over the Neotropical Region as suggested by its occurrence in both Brazil and the greater Antilles. Rau (1933) refers to a 'minute Lepidopteron' that emerged from webbed, empty cells of *Polistes canadensis panamensis* in Panama. The moths were examined by August Busck, who could not identify them except to suggest that they might be a species of *Antispila* (Heliozelidae). No specimens of what Busck examined are known to exist. Considering the predominantly leaf-mining biology of *Antispila* and general similarity in size and color pattern (a black forewing with 3–4 small whitish spots) between most *Antispila* and *Antipolistes anthracella*, we conclude that the latter insect is what Rau actually collected and sent to Busck for identification.

Lyonetiidae

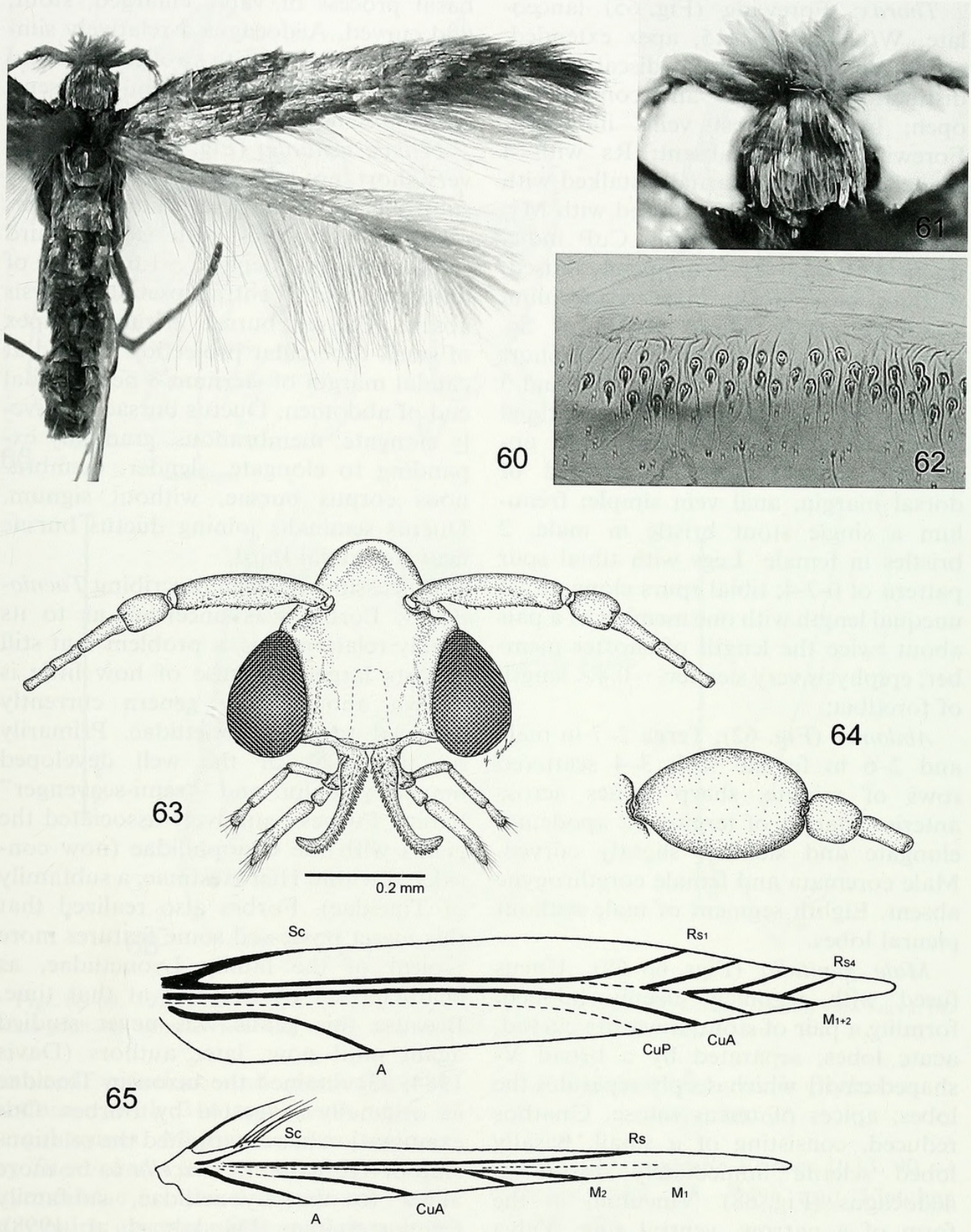
Taeniodictys Forbes

Taeniodictys Forbes 1933: 89.—Davis 1984: 5, 23.—Nye and Fletcher 1991: 295.

Type species.—*Taeniodictys sericella* Forbes 1933; by monotypy.

Adult (Figs. 60).—Very small moths with lanceolate wings; forewing length 3.0–3.4 mm.

Head (Figs. 61, 63): Frons strongly inclined; vestiture of frons and occipital area smooth, with moderately broad scales. Vertex of cranium produced, broadly subconical, with a prominent, erect tuft of piliform scales bearing acute apices. Antenna simple, ~0.65× length of forewing; scape elongate, broadly flattened, maximum width ~0.7× vertical diameter of eye, forming an eyecap in repose; pecten absent but with dorsal scales projecting over anterior margin; flagellum with a single row of slender, appressed scales encircling each segment. Eye moderately developed; vertical diameter ~0.8× length of scape; frons broad, interocular index ~1.0. Ocelli absent. Pilifer undeveloped. Mandible absent. Galea naked, reduced, ~0.9× length of maxillary palpus. Maxillary palpus well developed, exceeding length of labial palpus, 4-segmented; length ratio of segments from base: ~1.0:1.0:1.5:0.7. Labial palpus moderately developed; length ratio of segments from base: ~1.0:0.8:2.5; vestiture smooth.



Figs. 60–65. *Taeniodictys sericella*. 60, Adult male, forewing length 3.0 mm. 61, Head, dorsal view. 62, Tergal spines of 4th abdominal tergum. 63, Head, frontal view. 64, basal three segments of antenna, dorsal view. 65, Wing venation.

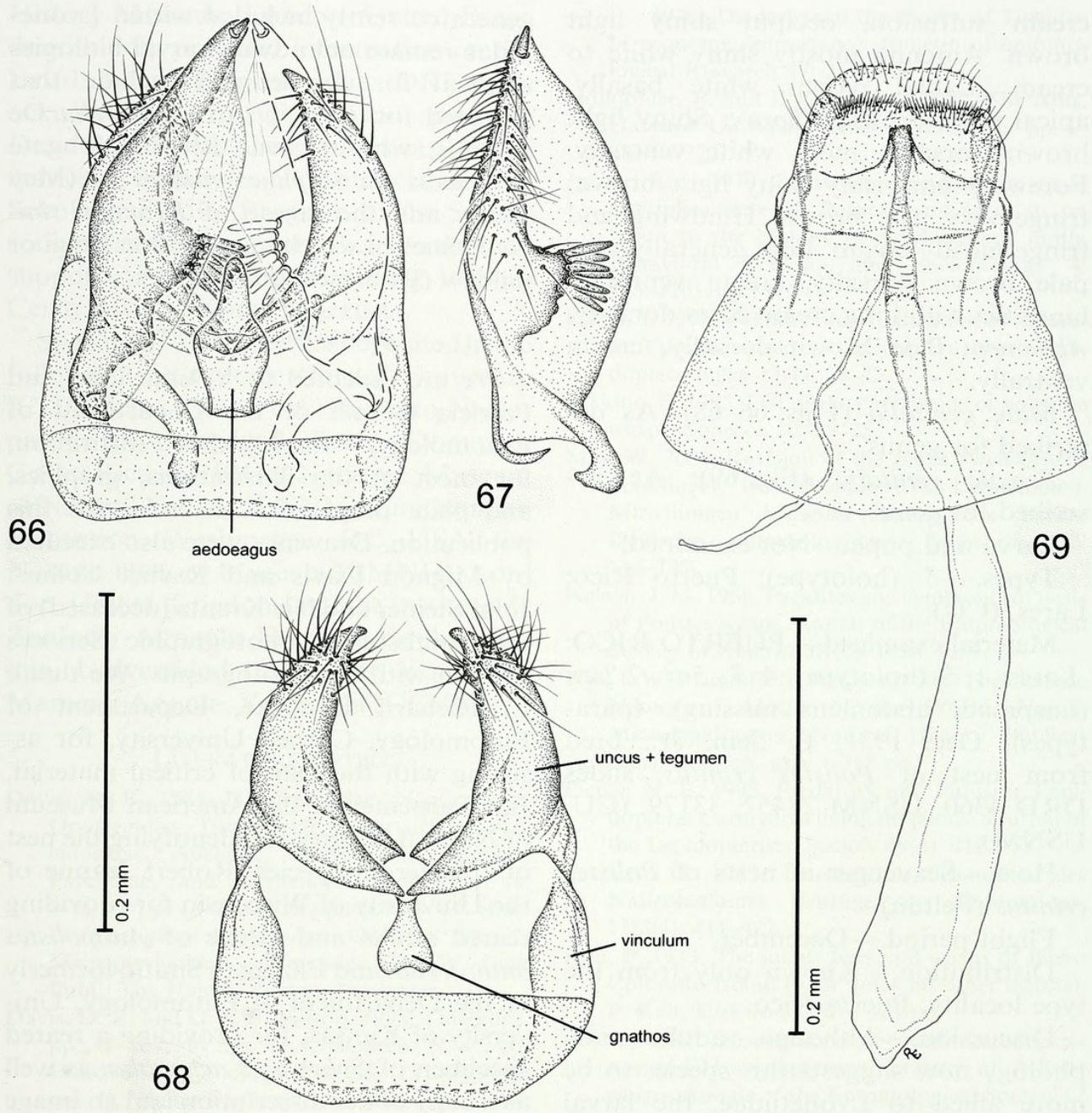
Thorax: Forewing (Fig. 65) lanceolate, W/L ratio ~0.15, apex extended, acute. Venation reduced; discal cell indistinct, very narrow and compressed, open; base of most veins indistinct. Forewing with R absent; Rs with 4 branches; Rs3 & 4 partially stalked with M1; M2 absent, perhaps fused with M1; CuA undivided to margin; CuP indistinct; 1A and 2A completely fused, without basal fork; male retinaculum a shallow ridge along venter of Sc. Hindwing W/L ratio ~0.09; Sc a short spur to base of costal margin; M2 and 3 distinct; M1 barely evident as a vestigial branch toward apex of wing; CuA undivided, present near basal third of dorsal margin; anal vein simple; frenulum a single stout bristle in male, 2 bristles in female. Legs with tibial spur pattern of 0-2-4; tibial spurs elongate, of unequal length with one member of a pair about twice the length of shorter member; epiphysis very slender, ~0.4× length of foretibia;.

Abdomen (Fig. 62): Terga 2–7 in male and 2–6 in female with 3–4 scattered rows of minute, sharp spines across anterior margin of tergite. S2 apodemes elongate and slender, slightly curved. Male coremata and female corethrogyne absent. Eighth segment of male without pleural lobes.

Male genitalia (Figs. 66–68): Uncus fused with tegumen, deeply bilobed, forming a pair of stout, inwardly curved, acute lobes, separated by a broad V-shaped cavity which deeply separates the lobes; apices of uncus setose. Gnathos reduced, consisting of a small, basally lobed sclerite immediately dorsal to aedoeagus (Fig. 68). Vinculum in the form of a narrow, ventral ring. Valva elongate, acute, with costal half thickened, bearing a relatively stout tubercule near middle of valva bearing ~6–7 stout spines; ventral half of valva much thinner, with entire margin; a single, short stout spine arising subapically; basal process of valva enlarged, stout, and curved. Aedoeagus a relatively simple, short cylinder with swollen sides and relatively broad base; cornuti absent. Juxta absent.

Female genitalia (Fig. 69): Ovipositor very short, not telescoping; apex broadly subtruncate. Apophyses short, slender; posterior apophysis with caudal third thickened; total length ~1.6× that of anterior pair. Ventral pseudapophysis absent. Ostium bursae arising at apex of small tubercular projection located at caudal margin of sternum 8 near caudal end of abdomen. Ductus bursae relatively elongate, membranous, gradually expanding to elongate, slender, membranous corpus bursae, without signum. Ductus seminalis joining ductus bursae near its caudal third.

Discussion.—When describing *Taeniodictys*, Forbes was uncertain as to its family relationships, a problem that still persists largely because of how little is known about many genera currently assigned to the Lyonetiidae. Primarily on the basis of the well developed maxillary palpi and "semi-scavenger" habits, Forbes tentatively associated the genus with the Oinophilidae (now considered within Hieroxestinae, a subfamily of Tineidae). Forbes also realized that this insect possessed some features more typical of the family Lyonetiidae, as characterized by Meyrick at that time. Because this genus was never studied again until now, later authors (Davis 1984: 23) retained the taxon in Tineidae as originally suggested by Forbes. Our examination has determined the relationship of *Taeniodictys sericella* to be more allied to the Lyonetiidae, subfamily Cemiostominae (Dugdale et al. 1998). Characters supporting this placement include: 1) frons smooth and strongly inclined; 2) vertex with prominent tuft of piliform scales; 3) antennal scape well developed, flattened and forming a partial eyecap; 4) wings lanceolate with



Figs. 66–69. *Taeniodictys sericella*. 66, Male genitalia, ventral view. 67, Lateral (mesal) view valva. 68, Male genitalia, ventral view with valvae removed. 69, Female genitalia, ventral view.

reduced venation; and particularly 4) abdomen with 3–4 transverse rows of tergal spines. Major features possessed by *Taeniodictys* that are atypical of most Lyonetiidae are the 4-segmented maxillary palpi, absence of pleural lobes in the male, presence of greatly reduced, nonpiercing ovipositor, and detritivorous larval biology. To resolve such incongruencies, a review of all genera currently assigned to the Lyonetiidae is needed.

Taeniodictys sericella Forbes (Figs. 60–69)

Taeniodictys sericella Forbes 1933: 90.—Davis 1984: 23.—Nye and Fletcher 1991: 295.

Taeniodictys servicella [sic] Nelson 1968: 1530.—Makino 1985: 25.—Yamane 1996: 85.

Adult (Figs. 60, 61).—*Head*: Frons shiny white; vertex mostly white with

cream suffusion; occiput shiny light brown. Antenna mostly shiny white to cream. Labial palpus white basally, apical third brown. *Thorax*: Shiny light brown dorsally, more white ventrally. Forewing uniformly shiny light brown; fringe very pale brown. Hindwing and fringe mostly cream. Legs generally very pale brown dorsally, cream ventrally; hindtibia with long cream hairs dorsally. *Abdomen*: Pale brown dorsally, cream ventrally.

Male genitalia (Figs. 66–68): As described for genus.

Female genitalia (Fig. 69): As described for genus.

Larva and pupa.—Not examined.

Types.—♂ (holotype); Puerto Rico: Lares, (CU).

Material examined.—PUERTO RICO: Lares: 1 ♂ (holotype), 4 ♂, 5 ♀, 2 ?sex (unspread, abdomens missing), (paratypes), Dec. 1931, F. Sein, Jr., bred from nest of *Polistes crinitus*, slides DRD 4360, USNM 28457, 33179, (CU, USNM).

Host.—Scavenger in nests of *Polistes crinitus* (Felton).

Flight period.—December.

Distribution.—Known only from the type locality, Puerto Rico.

Discussion.—Although adult morphology now suggests this species to be more allied to Lyonetiidae, the larval habit of *Taeniodictys sericella* remains as puzzling as it probably was to Forbes. Forbes reported several specimens (12 examined in the current study) reared from the nests of *Polistes crinitus* by Francisco Sein, Jr. Because there is no reason to question the accuracy of the rearing data, this may constitute the only known record of a larval scavenging habit within the family. Nearly all other species of Lyonetiidae are known to be leaf miners on a broad range of monocot and dicot families (Kyrki 1990, Dugdale et al. 1998). It should be mentioned, however, that the life histories of several genera currently included within Lyonetiidae remain unknown. Larval biologies atypical for Lyonetiidae include that reported for *Phyllobrostis eremitella* De Joannis, whose larvae live in elongate twig galls on *Daphne gnidium* L. (Mey 2006), and the larvae of *Lyonetia simplella* Snellen which may feed on fungi or mildew (Robinson et al. 2002).

Acknowledgments

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History Museum, London, United Kingdom, kindly provided information on the larval hosts of Lyonetiidae. DRD also acknowledges La Fundacion para el Desarrollo de las Ciencias Fisicas, Matematicas y Naturales of Venezuela and the Scholarly Studies Program of the Smithsonian Institution for their combined support of his fieldwork during 1984 at Cerro de la Neblina, Venezuela.

Specimens examined are deposited in the following institutions: Cornell University (CU), Ithaca, New York; Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica (INBIO), National Museum of Natural History (USNM), Smithsonian Institution, Washington, DC, USA, the Natural History Museum (BMNH), London, United Kingdom, and the Instituto de Zoologia Agricola Facultad de Agronomia, Universidad Central de Venezuela, Maracay-Aragua, Venezuela (UCVM).

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