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DESCRIPTION OF LIFE STAGES AND DISTRIBUTION OF *METAPONPNEUMATA ROGENHOFERI* (LEPIDOPTERA: NOCTUIDAE)

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ABSTRACT.– The life stages of *Metaponpneumata rogenhoferi* Möschler, a pest of sorghum and maize in Honduras, are described. The egg, larva, pupa, imago, wing venation, and male and female genitalia are illustrated. Distribution records document a range from central Texas to southern California, south through Central America to Venezuela. The tribal relationship of *Metaponpneumata* is discussed relative to larval and adult characters of Eustrotiini and Acontiini.

RESUMEN.– Los estados de vida de *Metaponpneumata rogenhoferi* Möschler, una plaga del sorgo y maiz en Honduras, son descritos. Ilustraciones del huevo, larva, pupa, imago, venacion del ala, y genitales del macho y hembra son presentadas. Archivos sobre la distribucion de esta especie muestran un rango que comprende desde Texas hacia el sur de California, luego continua al sur pasando por Centro america hasta Venezuela. La relacion de *Metaponpneumata* con otros especies de las tribus Eustrotiini y Acontiini es discutida segun las caracteristicas de la larva y adulto.

KEY WORDS: Acontiinae, Acontiini, Asteraceae, Bagisarinae, Bagisarini, biology, California, Central America, chaetotaxy, Compositae, Convolvulaceae, Costa Rica, Cuba, Cydosiini, Dominican Republic, egg, El Salvador, Eublemiini, Eustrotiini, Gramineae, *Homophoberia*, Honduras, hostplants, larva, Louisiana, Mesoamerica, Mexico, *Neoerastria*, Neotropical, Nicaragua, Portulacaceae, Puerto Rico, pupa, South America, taxonomy, Texas, USA, Venezuela, West Indies.

The monotypic genus, *Metaponpneumata*, and its type species, *rogenhoferi*, were described by Möschler (1890) based on two male and four female adults from Puerto Rico. This species and its junior synonym, *Thalpochares daria* (Druce, 1898; type locality: Jalapa, Mexico), are now included in the tribe Eustrotiini of Acontiinae (Franclemont and Todd, 1983).

The Eustrotiini includes 28 genera and 80 species in America north of Mexico (Franclemont and Todd, 1983). These 28 genera include 541 species worldwide (Poole, 1989); of these, larvae have been described for only 13 (Beck, 1960; Crumb, 1956; Gardner, 1941; Inoue *et al.*, 1982). Five species have been reported as feeding on Gramineae; other species appear to be monophagous on hosts in Lythraceae, Polygonaceae, Euphorbiaceae, Chenopodiaceae, Asteraceae, Nymphaceae, Malvaceae, and Sarraceniaceae.

Little was known about *M. rogenhoferi* until it was discovered causing economic damage to sorghum and maize in southern Honduras with the larvae causing extensive defoliation and often complete plant destruction (Pitre, 1988).This species is one of the two most common insects damaging these grain crops during early plant growth stages in Honduras, but it is less common or absent in later plant growth stages (Castro, 1990; Portillo *et al.*, 1991). *Metaponpneumata rogenhoferi* has been listed as a pest of cotton as well as sorghum in Colombia (Anonymous, 1989), but the identities of larvae feeding on cotton were not confirmed in this present study.

In a study on larval feeding preferences in Honduras, Portillo *et al.* (1996) found that *M. rogenhoferi* preferred *Ipomoea* sp. (Convolvulaceae), *Portulaca oleracea* L. (Portulacaceae), and *Melampodium divaricatum* L. (Asteraceae) over sorghum and the latter two plants over maize. Portillo *et al.* (1998) found that percent survival and pupal weights of *M. rogenhoferi* were lower on maize and sorghum than on broadleaf noncrop species, suggesting that the larvae performed better on selected broadleaf plants than on grain crops. However, imagos reared from larvae on these crops and examined in this study were not smaller than those that were field collected.

This study was made to describe and illustrate the life stages of *M. rogenhoferi* and to provide new distribution data. The assignment of this genus to Eustrotiini is evaluated also.

Materials and Methods

Descriptions were based on 54 male and 63 female imagos in the U. S. National Museum (USNM) and 18 male and 10 female imagos, two eggs, 42 larvae, and 52 pupae in the Mississippi Entomological Museum (MEM). Eggs and larvae were collected from maize and sorghum in Honduras and reared following methods of Portillo *et al.* (1996) to obtain representatives of all stages. Specimen data were obtained from identified material in collections of Los Angeles County Museum, San Diego Natural History Museum, Ron Leuschner, Eric Metzler, and Tomas Mustelin.

Selected eggs, fifth instar larvae, and pupae were examined, measured, and photographed with a LEO S 360 scanning electron microscope at an acceleration voltage of 15.0 kV. Specimen preparation for scanning electron microscopy followed Adamski and Brown (1987). Other specimens were examined with compound and dissecting microscopes, the latter with an ocular micrometer for measurements. Measurements were based on one specimen unless indicated otherwise by number of specimens (n) measured.

Genitalia of five male and two female specimens were dissected as described by Clarke (1941). One male specimen was dissected with the head, one labial palpus, thoracic segments, abdomen, and genitalia separated and mounted individually under two cover slips on one slide. Wings of a single male were cleared and slide mounted in Canada balsam. Drawings of genitalia and wing venation were made with a microprojector, and those of larvae and pupae with a camera lucida. The Methuen Handbook of Colour (Konerup and Wanscher, 1978) was used as a standard for description of the adult. Terminology for the larva followed Stehr (1987).

Description

Adult (Fig. 1-2).– *Head*: Frons protuberant, with broad, curved groove bordering clypeus, yellowish brown mixed with varying amounts of brownish

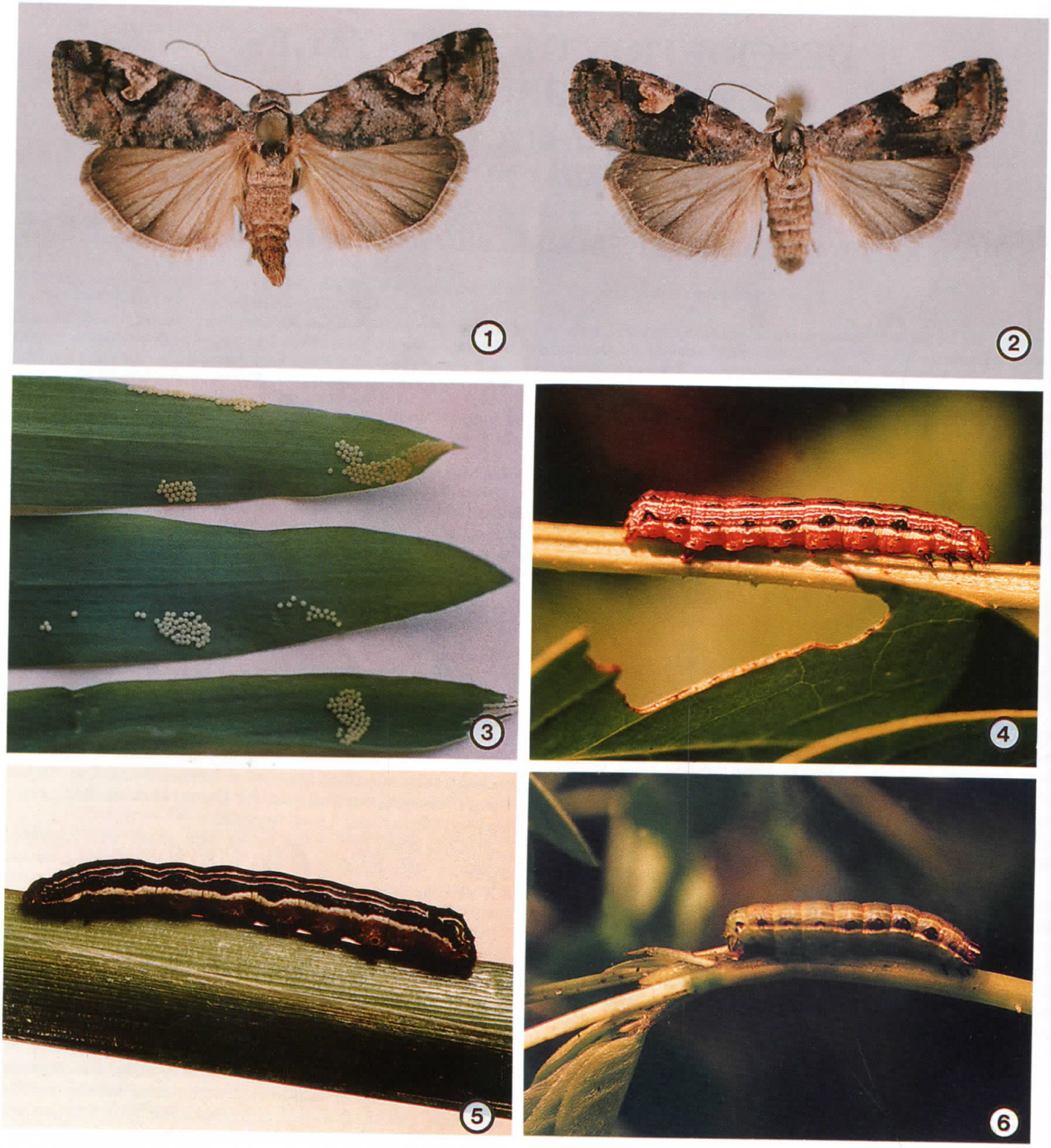

Fig. 1-6. *Metaponpneumata rogenhoferi* from Honduras: 1. Imago, male. 2. Imago, female. 3. Eggs on corn. 4-6. Color forms of larvae.

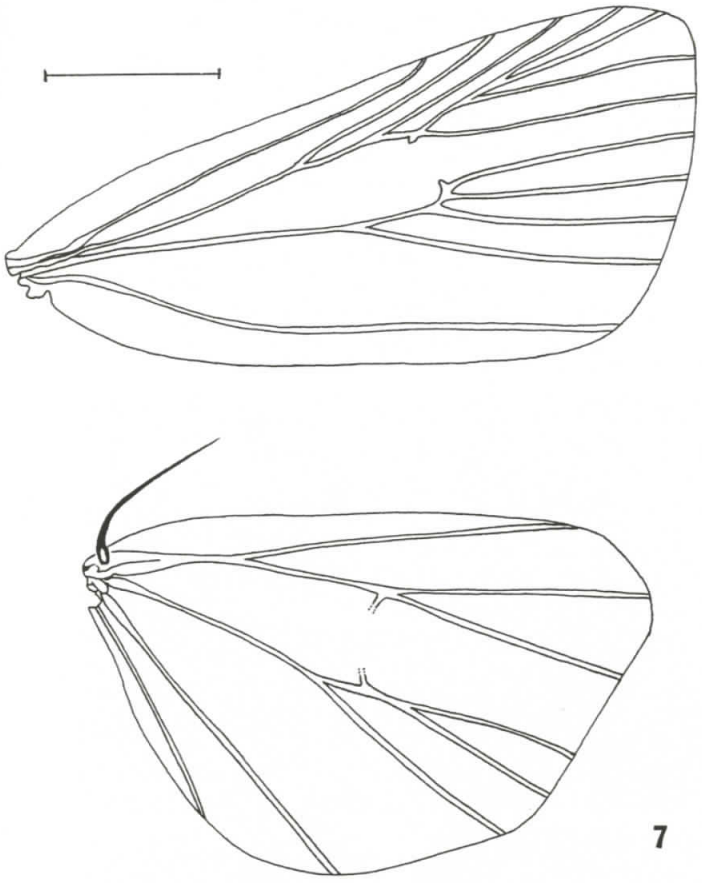

Fig. 7. Wing venation of *Metaponpneumata rogenhoferi* (scale bar = 2mm).

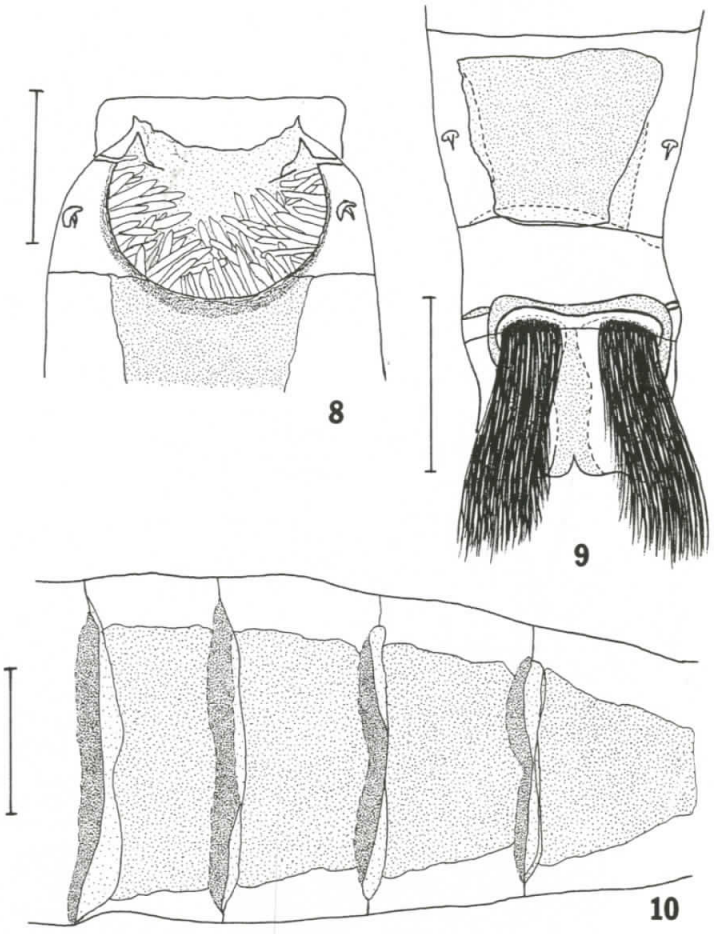

Fig. 8-10. Abdomen of male *Metaponpneumata rogenhoferi*. 8. Sternite II with sex scales. 9. Sternites VII and VIII with hair pencils. 10. Tergites III-VII with intersegmental pockets (scale bars = 1mm).

gray or brown, scales in groove paler, usually yellowish white.Vertex concolorous with frons. Labial palpi short, not exceeding frons, first segment length 0.5mm, second segment length 0.3mm, third segment length 0.2mm, organ of von Rath length 0.5 third segment length; concolorous with frons, apical segment usually darker than basal segments. Proboscis length 4.1mm.

Thorax: Collar, tegulae, and mesonotum concolorous with head, with narrow bands of darker brown scales on collar near posterior third and on mesonotum posterior to collar; posterior tuft well developed.Legs brownish gray to grayish orange, tarsomeres ringed with orange white at apices; spines present only on tarsi. Male mesotibia with thick hair pencil originating from base and extending to third tarsomere.Male metaepisternum (visible with abdomen removed) with patch of erect, orange white sex scales near middle, remainder scaleless; female metaepisternum covered with flat, white to orange white scales.Tympanum with well developed hood, alula not enlarged or heavily sclerotized.

Forewing: Length 8.4-9.6 (mean 8.8) in males (n = 11), 8.3-9.9 (mean 9.3) in females (n = 6). Ground color light brownish gray, margins of most scales with varying amounts of white to orange white; antemedial line sinuate from costa to inner margin, dark brown mixed with brown; medial line, margin of reniform spot, and post-medial line dark brown mixed with brown from near radius to inner margin, medial line often indistinct, some specimens with post-medial line directed basally near radius, partly closing costal side of reniform spot; reniform spot of ground color or mixed with varying amounts of orange white, more so in females than males; subterminal line indistinct; terminal line extending from apex to tornus, dark brown; apex with broad, dark brown, v-shaped mark in some specimens; outer fringe scales gray to brownish gray with white apices.Some females with area between antemedial and postmedial lines suffused with dark brownish gray or brown, other females similar to males. Venation (Fig. 7) with R3 and R4 stalked, R3+4 and R5 stalked; accessory cell absent.

Hindwing: light grayish brown, darker on veins.Venation (Fig. 7) trifid with M2 absent; with Sc and R fused, slightly separated near base.

Abdomen (Fig. 8-10): Male sternite II with invaginated pocket containing dense, elongate scales, 0.5mm or less in length, sternal pocket supported by two lateral apodemes and median flange; male sternite VIII heavily sclerotized, u-shaped, enclosing two shallow pockets holding hair pencils, hair pencils about 1.3mm long; male tergite VIII forming longitudinal band, becoming wide posteriorly. Both male and female with intersegmental areas between terga III and VII invaginated to form transverse pockets.

Male genitalia (Fig. 11-12): Tegumen broad, densely setose; uncus round in cross section, basal half strongly curved, apical half straight, narrowing to sharp apex, setose from near base to 2/3 length, setae longer and denser near middle; area between base of uncus and dorsal edge of tegumen microtrichiate; subscaphium forming weakly sclerotized band, apically notched; transtilla heavily sclerotized, v-shaped; juxta u-shaped, forming two flat plates surrounding aedoeagus; aedoeagus straight, vesica with 16-20 heavily sclerotized spines; saccus long, sclerotized laterally, with sharp apex; valva flat, with short, longitudinal fold from base to saccular region and longer fold from saccular region to near cucullus; apex of cucullus with row of spiniform setae on outer margin (n = 6).

Female genitalia (Fig. 13): Tergite VIII with setae on posterior border; papillae anales short, facing laterally, moderately setose; posterior apophyses about 0.75 length of anterior apophyses; antrum of ostium bursae lightly sclerotized; ductus bursae enlarging gradually towards corpus bursae; corpus bursae spiraled near middle, posterior portion with sclerotized folds internally, anterior portion with signa consisting of more than 30 spines (n = 2).

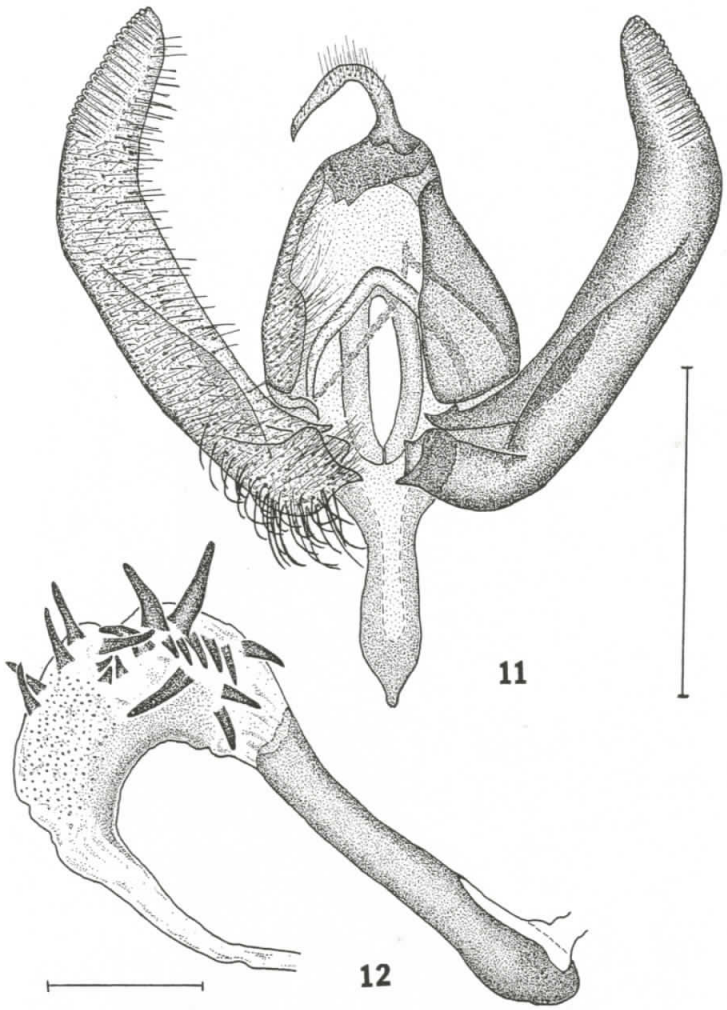

Fig. 11-12. Male genitalia with detached aedoeagus of *Metaponpneumata rogenhoferi* from Choluteca, Honduras. 11. MEM slide 791. 12. MEM slide 789 (scale bars = 1mm).

Egg (Fig. 3, 14, 15). Spheroid and upright; 0.45 mm width; grayish white; chorion with 40-46 longitudinal ribs but with only 14 ribs connected to micropyle area; four micropyles surrounded by rosette-like sculpture consisting of 11-14 lobes (n = 2).

Larva (Fig. 4-6). *General*: Length 23-29mm (n = 11).Larva confluenta (sensu Crumb, 1956), with venter of A10 having elongate area between prolegs not occupying full width of segment and confluent with subanal area.Prolegs normal on A3-6, crochets uniordinal mesoseries.Head and body smooth.Setae short, simple. Color and pattern variable, with red to brownish red form being most common (Fig.4) and black form (Fig.5) and green form (Fig.6) being less common.All forms with head freckled with small brown spots; prothoracic shield divided into four, dark brown bars; L setae on thorax with large dark brown pinacula; SD setae and spiracles on A1-4 and A7-8 surrounded by dark brown spots, spots dorsal and separated from spiracles on A5-6, spots confluent to form dark band in black form.Striped forms with narrow middorsal line between D1 setae, a broader line between D2 and SD setae, a narrow line between SD1 and L setae, and a broad line below spiracles; middle areas of abdominal segments tending to have two longitudinal brown bars between middorsal stripe and D2-SD stripe. Coxae and proleg bases heavily sclerotized, with sclerotized bars extending laterally onto plantae of prolegs.

Head (Fig. 16, 22): Width in longest larva 1.5mm; epicranial suture 0.33mm long; frons 0.63mm high.P2, AF1, AF2, A2, F1 setae blunt; P1, L1, A1, A3 setae tapered.Distance from F1 to anterior edge of clypeus 0.05mm; F1-F1 interspace 0.24mm; P1-P1 interspace 0.62mm, distinctly less than P2-P2 interspace (0.79mm). AF2 anterior to frons apex; A1-3 forming right to slightly obtuse angle at A2; A1 and A3 subequal in length and both longer than A2; L1 ventral to transverse line through P1s; P1s ventral to juncture of adfrontal and ecdysial lines.Seta S1 closer to stemma 4 than stemma 3.Stemmatal spacing with 1-2 = 0.10mm, 2-3 = 0.12mm, 3-4 = 0 mm, 4-5 = 0.16mm, 5-6 = 0.11mm. Labrum with eight setae on ventral margin (Fig. 17).Mandible with seven flat teeth distally, without teeth or ridges on inner surface (Fig. 23). Spinneret wider than long, with pore concealed in median depression at apex (Fig. 18). Sensilla of maxilla (Fig. 19), labial palpus (Fig. 20), and antenna (Fig. 21) as figured.

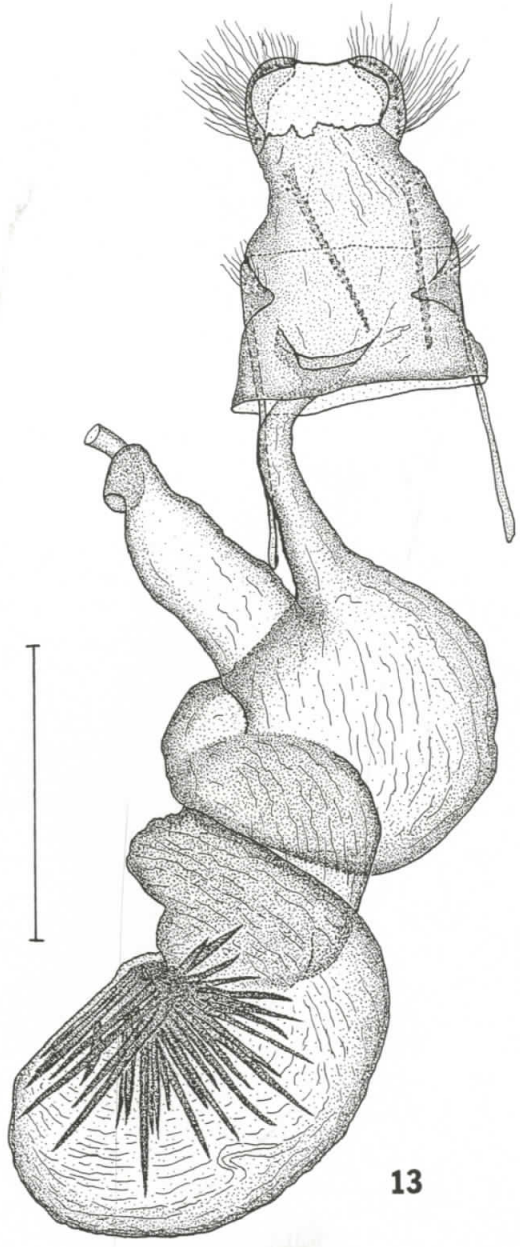

Fig. 13. Female genitalia of *Metaponpneumata rogenhoferi* from Choluteca, Honduras. MEM slide 790 (scale bar = 1mm).

Thorax (Fig. 24): Ventral eversible gland cylindrical, 0.25mm wide and 0.5mm long, with apical pore (Figs. 16, 27). Tarsal claws on all legs with narrowed bases (Fig. 28); coxae heavily sclerotized.

T1 with D2 posterior to line between D1 and XD2; SD1 longer than SD2, both on same pinaculum; L2 hairlike, distinctly thinner than L1, both on same pinaculum; SV1 and SV2 on same pinaculum; MV3 present; spiracle height 0.14 mm (Fig. 29).

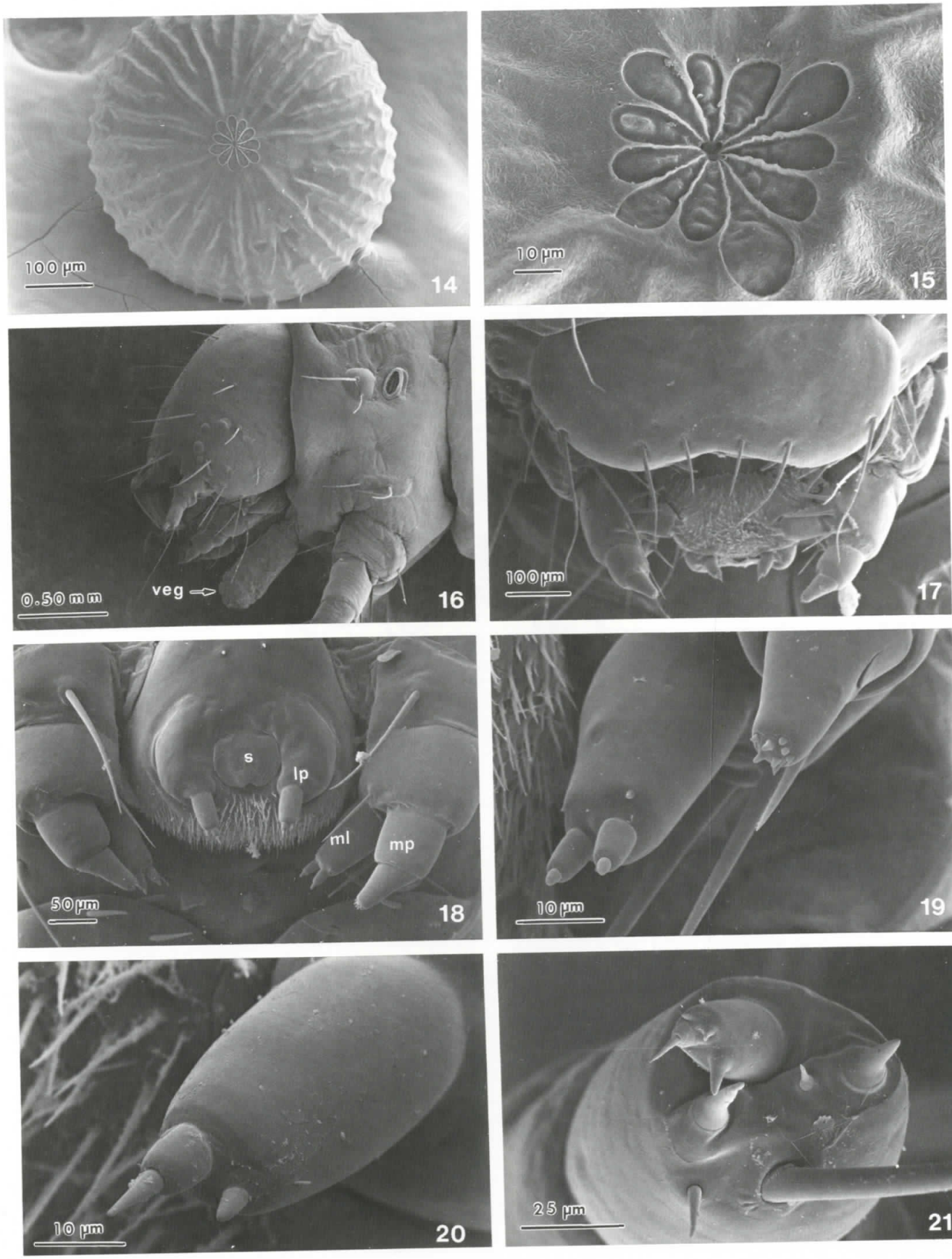

Fig. 14-21. Egg and Larva of *Metaponpneumata rogenhoferi*. 14. Egg, 157X. 15. Egg micropyles, 1010X. 16. Head and prothorax with ventral eversible gland (veg), 42X. 17. Labrum, 145X. 18. Maxilla with mesal lobe (ml) and palp (mp), labial palp (lp), and spinneret, 220X. 19. Sensilla of mesal lobe and palp, 752X. 20.Sensilla of labial palp, 1,950X. 21. Antennal sensilla, 814 X.

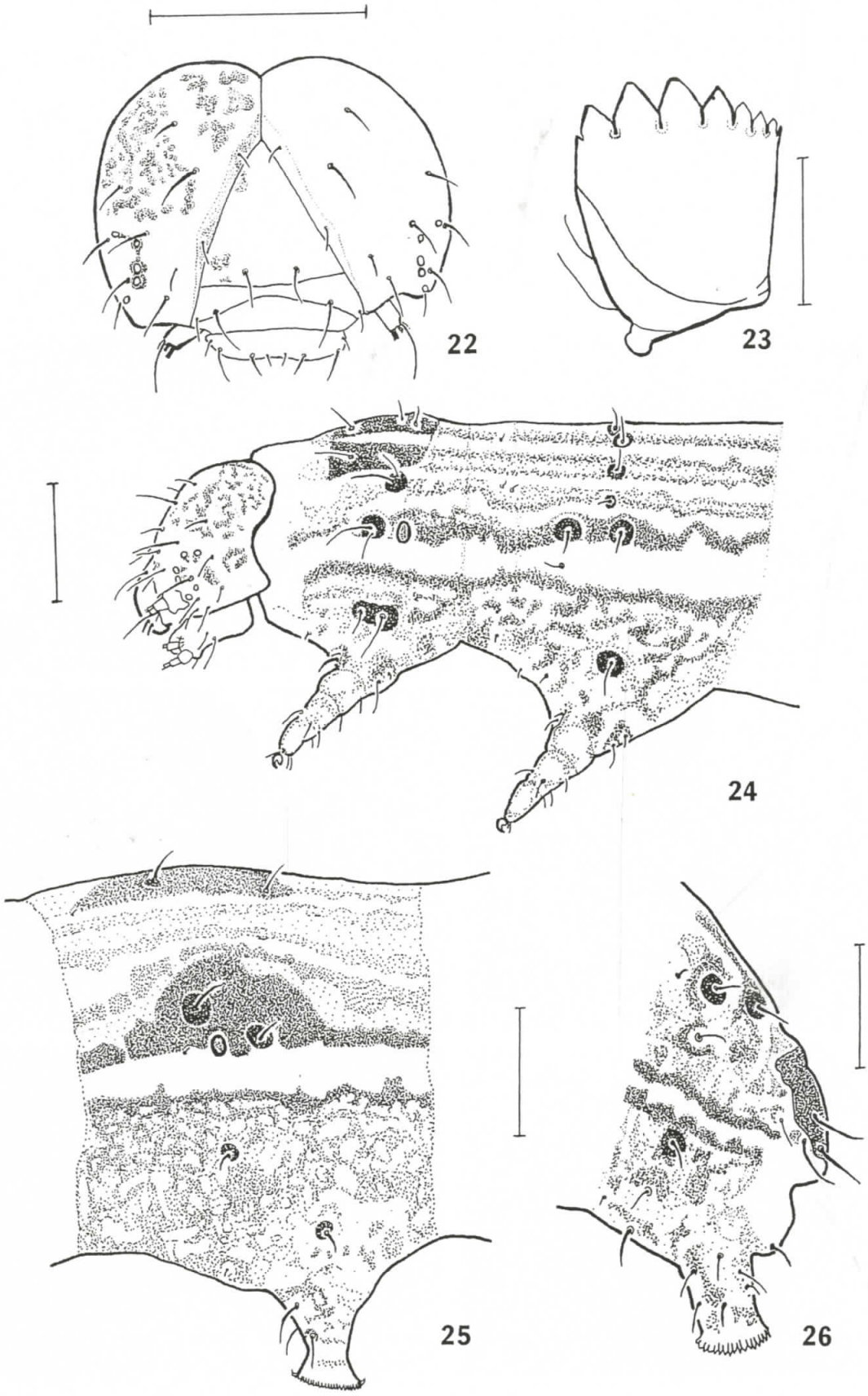

Fig. 22-26. Larva of *Metaponpneumata rogenhoferi* (scales = 1mm, except Fig. 23 = 0.5mm). 22. Head. 23. Right mandible, oral face. 24. Head and Thoracic segments 1 and 2. 25. Abdominal segment 3. 26. Abdominal segment 10.

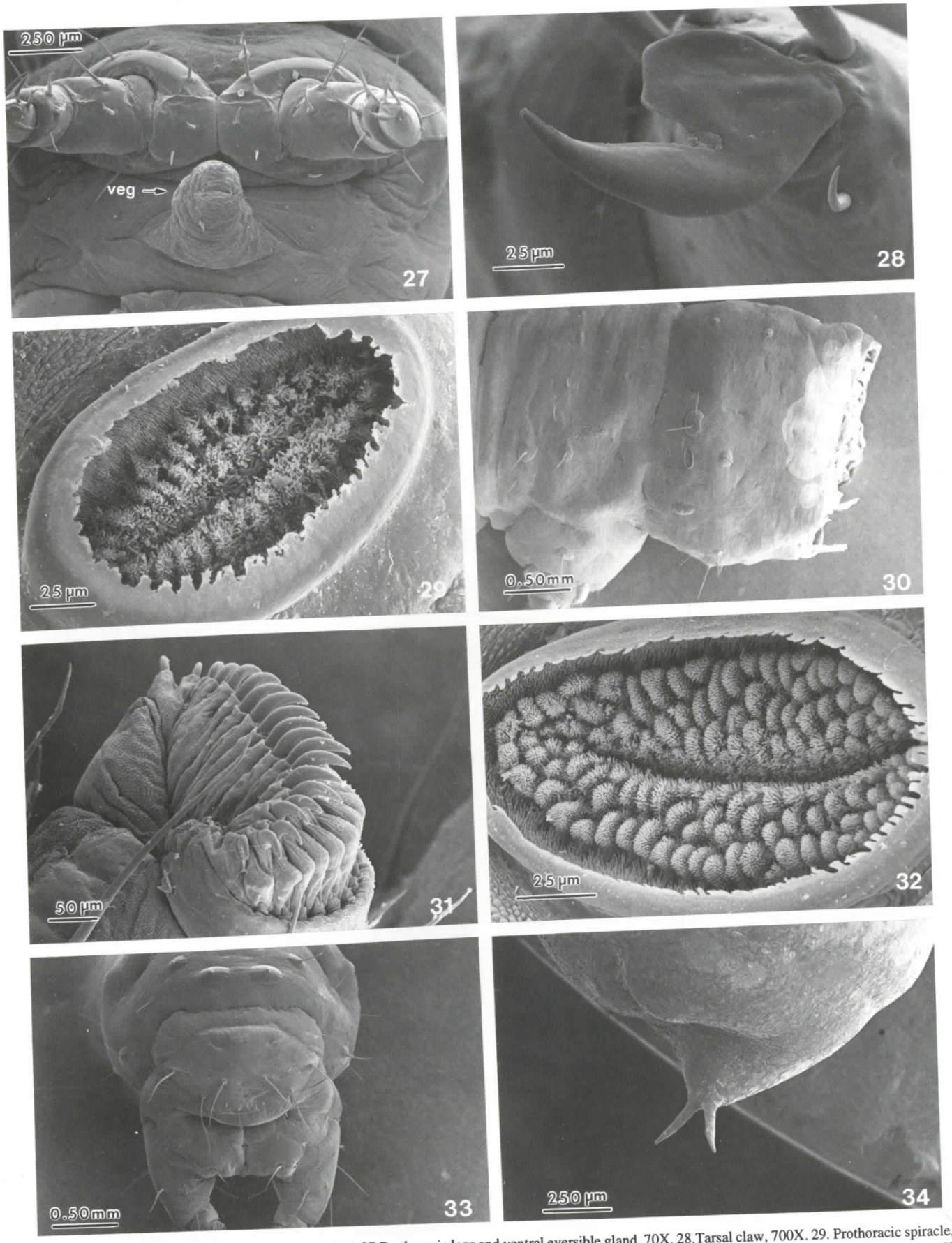

Fig. 27-34. Larva and pupa of *Metaponpneumata rogenhoferi*. 27.Prothoracic legs and ventral eversible gland, 70X. 28.Tarsal claw, 700X. 29. Prothoracic spiracle, 643X. 30. Metathorax and Abdominal segment 1, 30X. 31.Crochets, 222X. 32. Abdominal spiracle, 767X. 33. Abdominal segment 10, 30X. 34. Pupal cremaster, 69X.

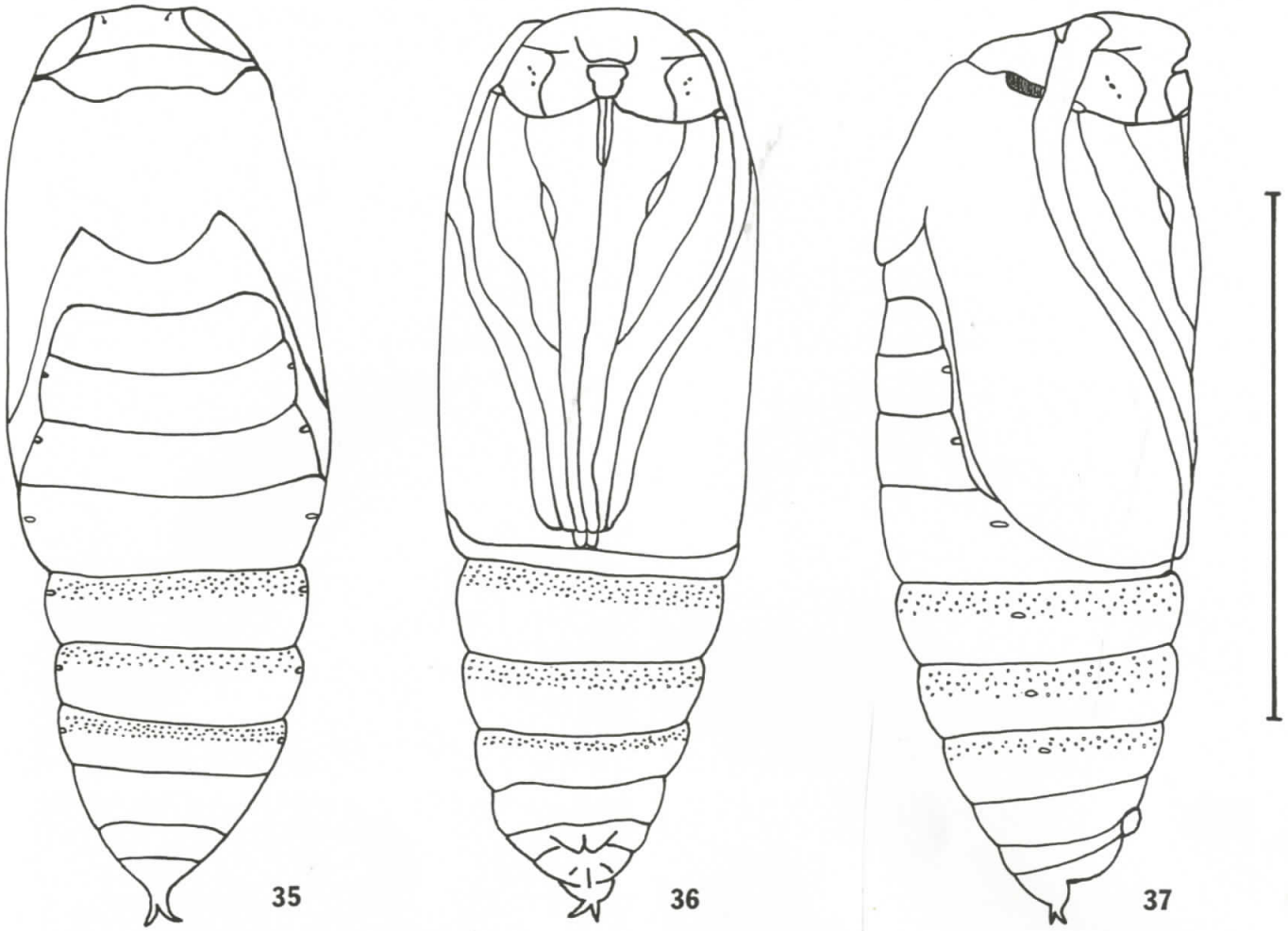

Fig. 35-37. Pupa of *Metaponpneumata rogenhoferi.* Scale bar = 0.5cm. 35.Dorsal view. 36. Ventral view. 37. Lateral view.

T2 and T3 with D and SD setae in relatively straight line at center of segment, on separate pinacula; SD1 anterior of line between SD2 and L3; L1, L2, and L3 with more than 90° angle; L2 without pinaculum, shorter and thinner than L1 and L3; SV1 on pinaculum; MV1, MV2, and MV3 anterior to SV1.

Abdomen (Fig. 25-26, 30): A1 with D1 slightly posterior to spiracle; MD1 anterior to D2; SD2 dorsal and distant from spiracle; SD2 without pinaculum, distinctly smaller than SD1; L1 posterior to spiracle; L1, L2 and L3 with 80° angle, all on separate pinacula; SV group bisetose, on separate pinacula; MV3 present; maximum diameter of spiracle 0.15mm.

A3-6 with D1s and D2s on separate pinacula; MD1 present; SD1 on separate pinaculum dorsoanterior to spiracle; SD2 anterior to spiracle, very small and lacking pinaculum; L group trisetose, L1 on pinaculum posterior to spiracle, L2 on pinaculum below segment midline; L3 on pinaculum above proleg; SV1, SV2, SV3, and MV3 present, without pinacula; maximum diameter of spiracle 0.15mm (Fig. 32); prolegs with crochets (Fig. 31) numbering 12-16 (mode = 12) on A3, 14-17 (mode = 15) on A4, 16-19 (mode = 18) on A5, 17-19 (mode = 17) on A6, and 18-22 on A10 (mode = 20) (n = 10).

A7-8 with SD1 and SD2 subequal in length; one SV seta; spiracle 0.18mm in diameter.

A9 with D1 and D2 on separate pinacula, D1 and SD1 setae subequal in length, SD1 without pinaculum, subequal in length with but thinner than D1; MD1 present; SV unisetose; MV3 present.

A10 with anal shield moderately sclerotized and surrounding D1 and D2; SD1 and SD2 without pinacula, SD2 shorter and thinner than SD1 (Fig. 26, 33).

Pupa (Fig. 34-37): Length 8-9.1mm (mean = 8.14mm, n = 52), weight 12-92mg (mean = 70mg, n = 34) in live pupae. Head with clypeus projecting beyond frons; labial palpi, maxillae, and antennae exposed in ventral view.Thorax with all legs partly visible; metathoracic legs with only apices exposed posterior to maxillae. Abdomen with punctations on anterior thirds of segments 5-7; A9 and A10 subequal in length; A10 with forked cremaster. Pupation occurs within a cell made of cemented soil particles.

Distribution and Flight Periods

The species occurs in the West Indies and from southern Louisiana to southern California south through Central America to Venezuela. Abbreviated collection records of identified material include the following:

CUBA.– Baracoa (no date).

DOMINICAN REPUBLIC.– 7 km SW Dajabon, Rio Massacre, 40m (26 May); San Cristobal (8-9 Jun.).

PUERTO RICO.– Isla Maguey, Parguera (20 Dec.); Coamo Springs (5 Jun); Guanica (11 Aug); Salinas (5 Aug).

UNITED STATES.– *Arizona*: Cochise Co., Huachuca Mts., Sunnyside (12 Jul), Huachuca Mts., Miller Canyon 19-27 Jun, 3-31 Jul., 10-12 Aug), Ash Canyon (12 Jul.), Chiricahua Mts., SW Research Sta. (15 Sep); Gila Co., Pinal Mts. (17 Aug); Maricopa Co., Gila Bend (20 Aug), Seven Springs (8 Aug), Wickenburg (25 Aug), 14 mi E Wickenburg, 1000' (12 Aug); Mohave Co., Hualapai Mts., (6 Aug); Pima Co., Santa Rita Mts., Madera Canyon (23 Jun - 7 Sep), Baboquivari Mts., Sabino Cyn. (Jun - Sep); Pinal Co., Stanfield (11 Jul); Santa Cruz Co., Nogales (14 Aug), Pena Blanca Lk., 3000' (13-16 Jul, 29 Aug.); Yavapai Co., Prescott (20 Jul). New Mexico: Dona Ana Co.,

Las Cruces, 4000' (10 Aug). *California*: San Bernardino Co., New York Mts., Keystone Cyn. (24 Aug); Imperial Co. (10 Apr); Kern Co., Walker Pass (9 Jul); Riverside Co., Palm Springs (21 Mar). *Louisiana*: Orleans Par., New Orleans City Park (20 Jun). *Texas*: Hidalgo Co., Bentsen St. Pk. (1 Jul); Kerr Co., Kerrville (11 Jul); Kimble Co., Junction (17 Jun); Uvalde Co., Uvalde (9 Mar); Ward Co., Monahans Sandhills, 31°37'59"N, 102°48'59"W (17 Aug); Webb Co., Laredo (Sept.).

MEXICO.– *Baja California*: La Purissima (18 Sep);Baja California Sur: Isla Coronados (17-18 Jul), Isla Santa Cruz (10 Jul). *Coahuila*: 25 mi S Cuidad Acuna, 300m (30 Jun). *Durango*: Rodeo (22 Jul). *Nuevo León*: 3 mi E Galeana, 5000' (7-9 Aug), Linares, Rio Camacho (21-22 Jun). *San Luis Potosí*: 2 mi N Tamazunchale, 400m (16-18 Jul). *Sonora*: Guaymas (7 Jul), Alamos (25 Jul - 7 Aug). *Tamaulipas*: 6 mi S Ciudad Victoria (6 Aug), 26 mi W Antiguo Morelos, El Salto Falls, 2000' (11-14 Jul). *Oaxaca*: S Tehuantepec, Pte. Tiacotepec (8 Jun).

HONDURAS.– *Choluteca*: Pavana (em. 10 Sept - 11 Oct.). *Francisco Morazan*: El Zamorano (22 Jun.). *Valle*: La Coyota (2 Jun.).

EL SALVADOR.– Santa Tecla, 900m (18-31 May).

NICARAGUA.– 43 km N Managua, 122m (3 Jun).

COSTA RICA.– *Guanacaste Prov.*: Colorado (31 Mar.), Arizona (30 Mar.).

VENEZUELA.– *Guarico*: 44 km S Calabozo (11-19 May).

Discussion

The checklist of Noctuidae in America north of Mexico included five tribes of Acontiinae (Franclemont and Todd, 1983); of these, Eustrotiini and Acontiini have been considered to be the two main groups (Forbes, 1954), with Cydosiini and Eublemiini restricted to single genera. Bagasarini has been treated as a separate subfamily, Bagisarinae, by Poole (1989).

Forbes (1954) differentiated adults of Eustrotiini (*sensu* Erastriini) from Acontiini by the former having a tympanum with a well developed hood, an alula not forming a large flap over the tympanum, the thorax usually with rough scaling, palpus with long second segment, hindwing tending towards trifid venation, male anal tube without paired hair masses, and male valva without a corona. *Metaponpneumata* agrees with these characters, except it is similar to genera in Acontiini in having a smooth thorax with large posterior tuft, the palpal first segment being longer than the second, and a male valva with a corona.

Crumb (1956) separated larvae of Eustrotiini (*sensu* Lithacodiinae) from Acontiini (*sensu* Acontiinae) by the former having "larvae confluentae," in which the posterior end of the A10 venter is confluent with the subanal area, and the latter including "larvae liberae," which have the posterior end of the A10 venter separated from the subanal area by a suture-like line (Godfrey, 1985).In addition all larvae of Acontiini examined by Crumb had prolegs absent on segments A3 and A4, whereas larvae of Eustrotiini have prolegs present, absent, or partially reduced on A3 and A4. In Crumb, the larva of *Metaponpneumata rogenhoferi* keys to Lithacodiinae and to *Neoerastria*, now a junior synonym of *Homophoberia*.

Metaponpneumata appears to be a member of Eustrotiini based on larval characters, but adult characters suggest a relationship with Acontiini. The tribal placement cannot be resolved until apomorphic character states are determined and phylogenetic relationships of Eustrotiini and Acontiini are resolved.

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