

## Two new Neotropical species of *Bucculatrix* leaf miners (Lepidoptera: Bucculatricidae) reared from *Cordia* (Boraginaceae)

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**Two new Neotropical species of *Bucculatrix* leaf miners (Lepidoptera: Bucculatricidae) reared from *Cordia* (Boraginaceae).** - Two new species of *Bucculatrix*, each initially mining and later externally skeletonizing the leaves of two different Neotropical species of *Cordia* (Boraginaceae), are described and illustrated. *Bucculatrix caribbea* Davis & Landry, sp. n. was reared from the leaves of *Cordia sebestena* L. on Glovers Reef, Belize and Cozumel, Mexico. The biology of this species is briefly summarized and all primary stages, except that of the egg, are illustrated. The adult of *Bucculatrix cordiaella* Davis & Landry, sp. n. is described from six islands of the Galápagos archipelago. This represents the first record for Bucculatricidae from the Galápagos. The larva feeds on the leaves of *Cordia lutea* Lam. Both species are morphologically allied to *Bucculatrix ilecella* Busck, a leaf miner on *Ilex* sp. from southern Texas, USA.

**Key-words:** larva - leaf mining - hypermetamorphosis - pupa - Belize - Mexico - Galápagos Islands.

### INTRODUCTION

Because of their typically small size and rich diversity, leaf-mining Lepidoptera are among the poorest known groups of Lepidoptera. The larvae of some plant-mining families are particularly interesting in that they undergo hypermetamorphic development, with certain instars exhibiting not only distinctly different morphology but also divergent biology. Hypermetamorphosis is especially prevalent in the large family Gracillariidae (Needham *et al.*, 1928; Kumata, 1978; Davis, 1987; Davis & Robinson, 1999; Wagner *et al.*, 2000). It also has been reported in Bucculatricidae (Braun, 1963), Opostegidae (Davis, 1989), as well as in the ectoparasitic family Epiropidae (Davis, 1987). Larval hypermetamorphosis in *Bucculatrix* is particularly

evident between the leaf-mining instars and the later externally feeding instars. For example, instars 3-4 of *Bucculatrix caribbea* possess thoracic legs but lack prolegs and possess more depressed bodies; whereas the body of the last two instars is cylindrical with five pairs of well developed prolegs, and a head possessing generally longer cranial setae and a more shallow epicranial notch. The first two mining instars are believed to be apodal.

The predominantly leaf-mining family Bucculatricidae currently includes about 250 species worldwide (Davis & Robinson, 1999). In the New World the Bucculatricidae are represented only by the genus *Bucculatrix* which includes 104 described species, of which only four have been described from the Neotropical region (Davis, 1983; Davis & Miller, 1984; Rubinoff & Osborne, 1997). A recent outbreak of a species of *Bucculatrix* on *Cordia lutea* Lam. in the Galápagos Islands has necessitated a study of that insect, as well as that of another closely related leaf miner on *Cordia sebestena* L. from the western Caribbean region. Both species appear closely allied to *Bucculatrix ilecella* Busck, a species reared from a deciduous holly (*Ilex* sp.) from southern Texas, USA. Braun (1963) recognized *B. ilecella* as the sole member of her section VII, which was characterized in part by the male valva divided nearly its entire length, broad vinculum, and unusual female signa, consisting of a series of radiating, dentate rods extending part way into the ductus bursae. Descriptions of both previously undescribed species are presented herein, including a brief discussion of the pupa and hypermetamorphic larva of *B. caribbea*.

The following abbreviations are used: BL, Bernard Landry; BMNH, The Natural History Museum, London, England; CDRS, Charles Darwin Research Station, Santa Cruz Island, Galápagos, Ecuador; CNC, Canadian National Collection of Insects, Ottawa, Ontario, Canada; DLW, David L. Wagner; DRD, Donald R. Davis; LR, Lazaro Roque-Albelo; MHNG, Muséum d'histoire naturelle, Geneva, Switzerland; USNM, National Museum of Natural History, Washington, D.C., U.S.A.

## TAXONOMIC TREATMENT

*Bucculatrix caribbea* Davis & Landry sp. n. Figs 1, 3, 4-46, 49, 50, 53, 54

Holotype ♂, BELIZE: Glovers Reef, Northeast Cay, 16°46'N 87°46'30"W, larva 19 Jan[uary] 1991, em[erged] 4 Feb[ruary] 1991 (D. R. Davis, DRD 859), Host: *Cordia sebestena* (USNM).

Paratypes with same data as holotype except: 2 ♂, 1 ♀, em. 22.i.1991; 1 ♂, 1 ♀, em. 1.ii.1991; 1 ♀, em. 9.ii.1991, slides USNM 30907, 30911, 30912, 30939, 30943, 30944, 30962, 30963 (USNM). MEXICO: Cozumel: Punta Norte: 4♂, 1 ♀, 1 cocoon, larva 24/28.xii.1990, em. 21/28.i.1991 (D. L. Wagner, DLW 90M122), *Cordia sebestena*, slide USNM 32387 (DLW, USNM).

*Diagnosis.* This species can be distinguished from the following closely allied species, *B. cordiaella*, by the generally darker forewings with fewer white strigulae (fig. 1). The male valva is divided almost to its base into lobes of similar size (fig. 45), and the anterior end of the female corpus bursae is not attenuated and contains shorter, broader signa (figs 49, 50).

*Description* (fig. 1). Frons white; vertex rough, consisting of long erect piliform scales mostly dark brownish fuscous with slight mixture of white in the



1



2

FIGS 1-2

Adults. 1, *Bucculatrix caribbea* (Forewing length = 2.1mm). 2, *Bucculatrix cordiella* (Forewing length = 2.0mm).

center and all white peripherally; occipital scales white, broader; maxillary palpi not visible, apparently absent; pilifers not produced, with 2-3 short setae; labial palpi one segmented, short, not extending beyond margin of labrum; antenna about  $\frac{3}{4}$  the length of forewing; scape mostly white with a few scattered fuscous scales; pecten consisting of about 12-16 white scales; flagellum with one row of scales per segment, flagellomeres alternately white and fuscous except over distal third, where the pattern becomes one white flagellomere to three fuscous; haustellum not much longer than diameter of eye. Thorax pale grey, heavily irrorated with dark brown-tipped scales. Foreleg grayish fuscous dorsally, white ventrally; tarsi with 4 white basal bands on tarsomeres I-IV. Midleg mostly white to pale cream with two large diagonal dorsal bands of fuscous near base and subapex; basal half of tarsomeres I-IV white, remainder fuscous. Hindleg mostly white except for pale fuscous over dorsum of tibia and pale fuscous bands medially and dorsally on tarsomeres I-IV. Forewing length: 2.0-2.3 mm (holotype = 2.1mm). Forewing white, densely covered with dark brownish fuscous scales; dark scales concentrated in basal anal area and over much of distal half except where interrupted by two white costal strigulae and one larger, white dorsal strigula near tornus; basal most of the two white costal strigulae located at  $\frac{3}{5}$  and usually smaller, sometimes indistinct; fringe scales white. Hindwing pale gray with pale gray fringe scales; male frenulum with one large spine; female with two smaller spines. Abdomen dark greyish brown dorsally, white ventrally; male abdomen without eversible scale sac between tergites II and III.

Male genitalia (figs 45, 46). Tenth tergite (uncus) mostly membranous; gnathos and socii absent. Tegumen a moderately broad dorsal ring. Vinculum broadly U to V-shaped, nearly length of valva. Transtilla and juxta absent. Valva divided nearly to base; costal lobe approximately equal in width to saccular lobe; both lobes with scattered, elongate setae near apex. Aedoeagus cylindrical, approximately 1.3X length of valva; distal end of vesica with single large, apparently sclerotized cornutus.

Female genitalia (figs 49, 50). Papillae anales rounded, weakly sclerotized, spiculate, moderately setose. Apophyses posteriores basally very thin for short length before connection with papillae; with short subbasal extension directed ventroapically; straight on apical  $\frac{2}{3}$  and reaching basal third of segment VIII. Apophyses anteriores absent. Sternum VIII reduced, mostly unsclerotized, with ostium bursae arising from base or in intersegmental membrane between VII and VIII. Sternum VII with caudal margin excavated to level of ostium. Ductus bursae constricted to corpus; ductus seminalis arising near midlength. Corpus bursae slender, with caudal ring of 8-10 elongate signa, relatively short and broad; each signum with sparse row of 4-5 small teeth (fig. 50).

*Larva* (10 specimens examined) (figs 4-37). Initial mining instars not examined, probably apodal with flattened bodies (Braun, 1963). Third/ fourth(?) Instar: Maximum length 4 mm. Head moderately depressed, dark reddish brown; epicranial notch well developed, extending half length of head (fig. 5); 5 pairs of stemmata; cranial setae more reduced in length than in later instars; P 1 greatly reduced; P 2 absent. Labrum with 3 pairs of setae; M 3 and L 3 reduced. Hypopharynx 4-lobed, densely covered with short spines (figs 11, 12). Maxilla as in

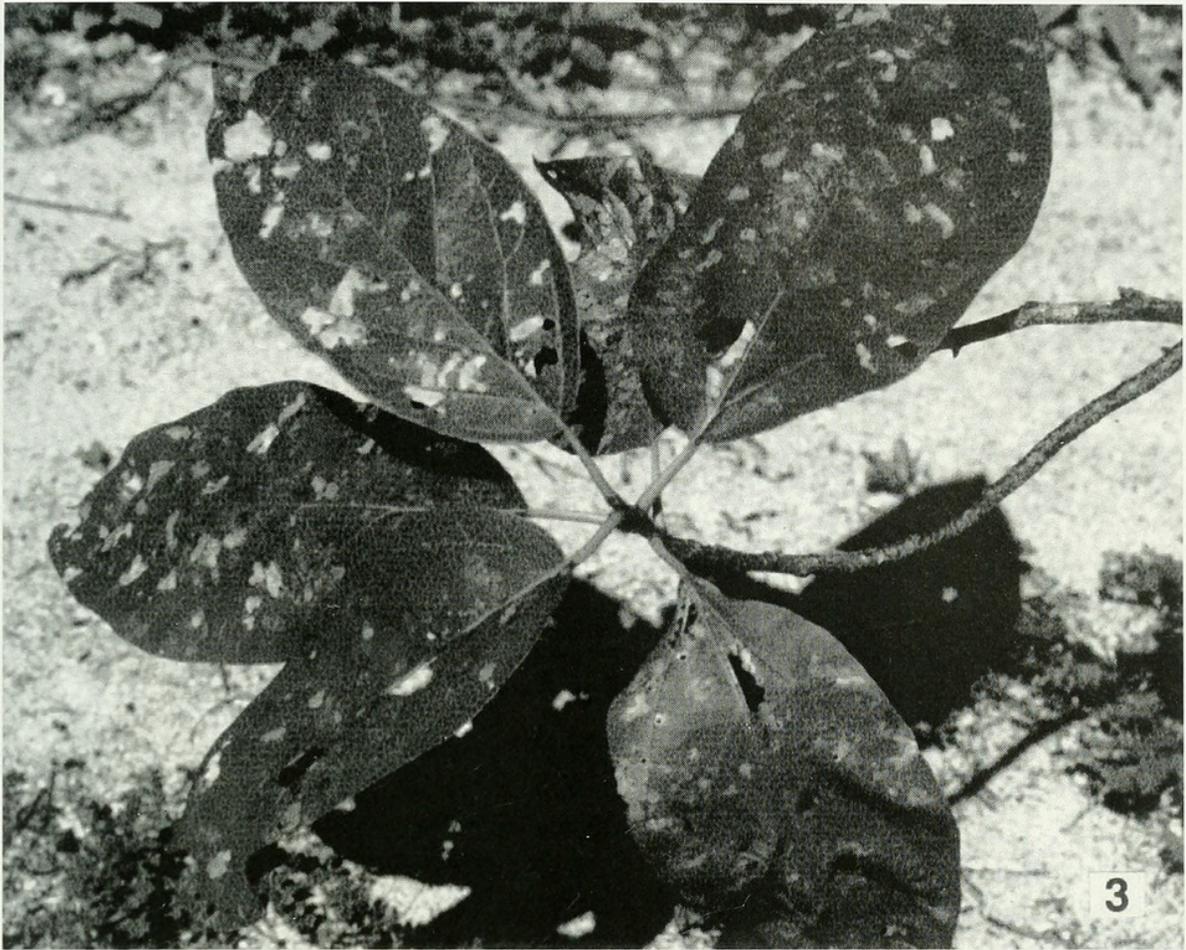
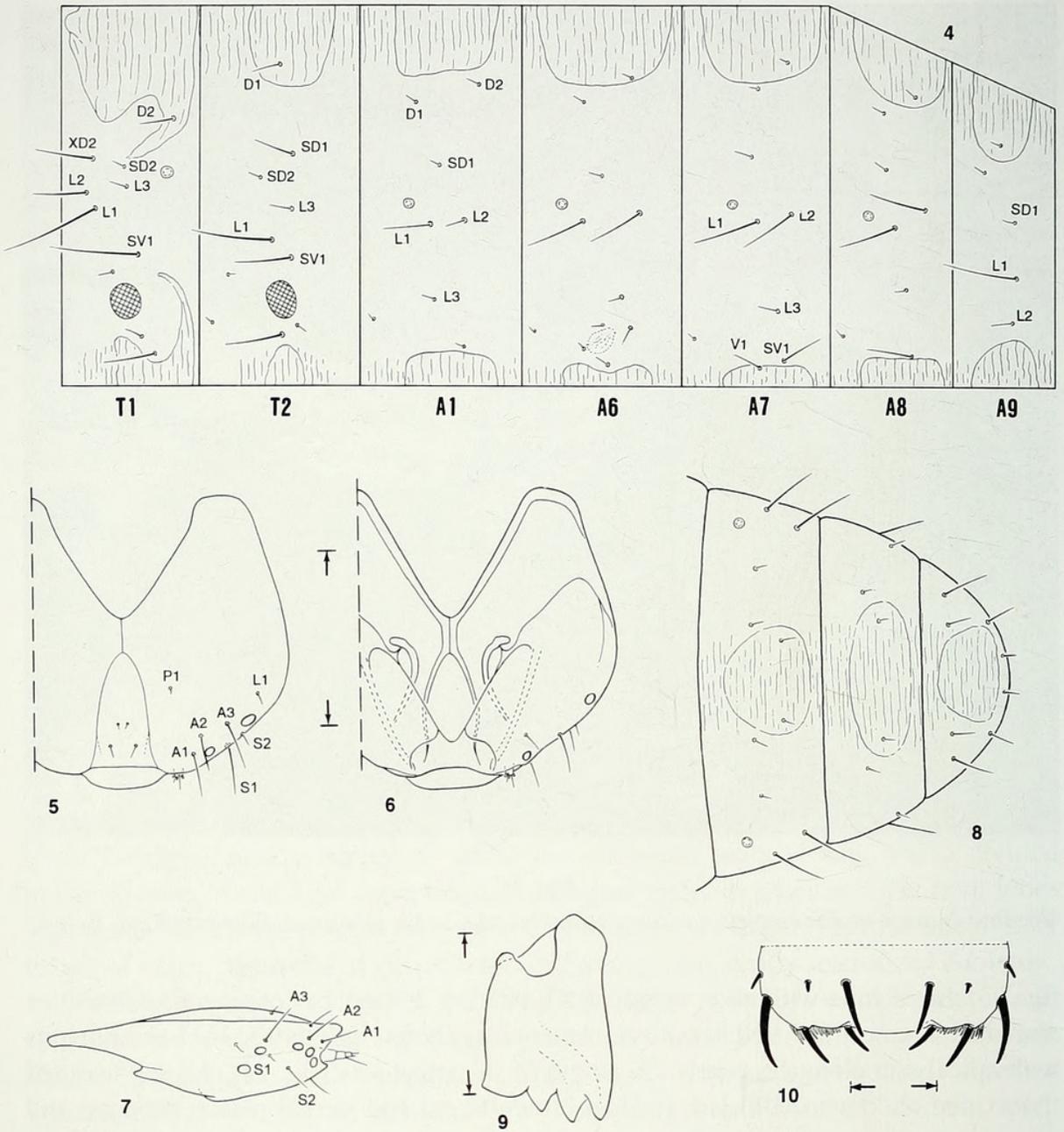


FIG. 3

Feeding damage of *Bucculatrix caribbea* on leaves of *Cordia sebestena*; Glover's Reef, Belize.

fig. 13; mesal lobe with short segment III, bearing 3 short basiconic apical sensillae and one extremely reduced sensillum. Antenna as shown in Figs 15, 16. Labial palpus with apical seta elongate, nearly 2X length of subapical seta (fig. 14). All segments of thorax and abdomen with dark reddish brown tergal and sternal plates; pronotal and prosternal plates with slender, curved extensions from caudal-lateral margins; prothorax (T 1) with D 1, SD 1, and XD 1 absent; L series trisetose; T 2-3 with D 2 absent; three pairs of legs present, with pretarsal claw of T 1 highly modified, strongly curved and greatly extended (fig. 18); legs of T 2-3 with slightly reduced but otherwise normal claws; large, paired spatulate setae (fig. 19) present on T 2-3 legs, absent from T 1. Prolegs and crochets absent, but with paired ventral ambulatory callosities on A 3-6, 10 (fig. 20); A1-8 with L series trisetose. Final (Fifth?) Instar: Maximum length 4 mm. Head generally similar to preceding instar except less depressed, with more shallow epicranial notch; cranial setae more elongate than in preceding instars; P 2 present. Hypopharynx smoother, less spinose. Mesal lobe of maxilla with segment III much more elongate, with one apical sensillum greatly elongated, approximately as long as segment III (fig. 30). Antenna as shown in figs 31, 32, similar to preceding instar. Thorax and abdomen without darkly pigmented

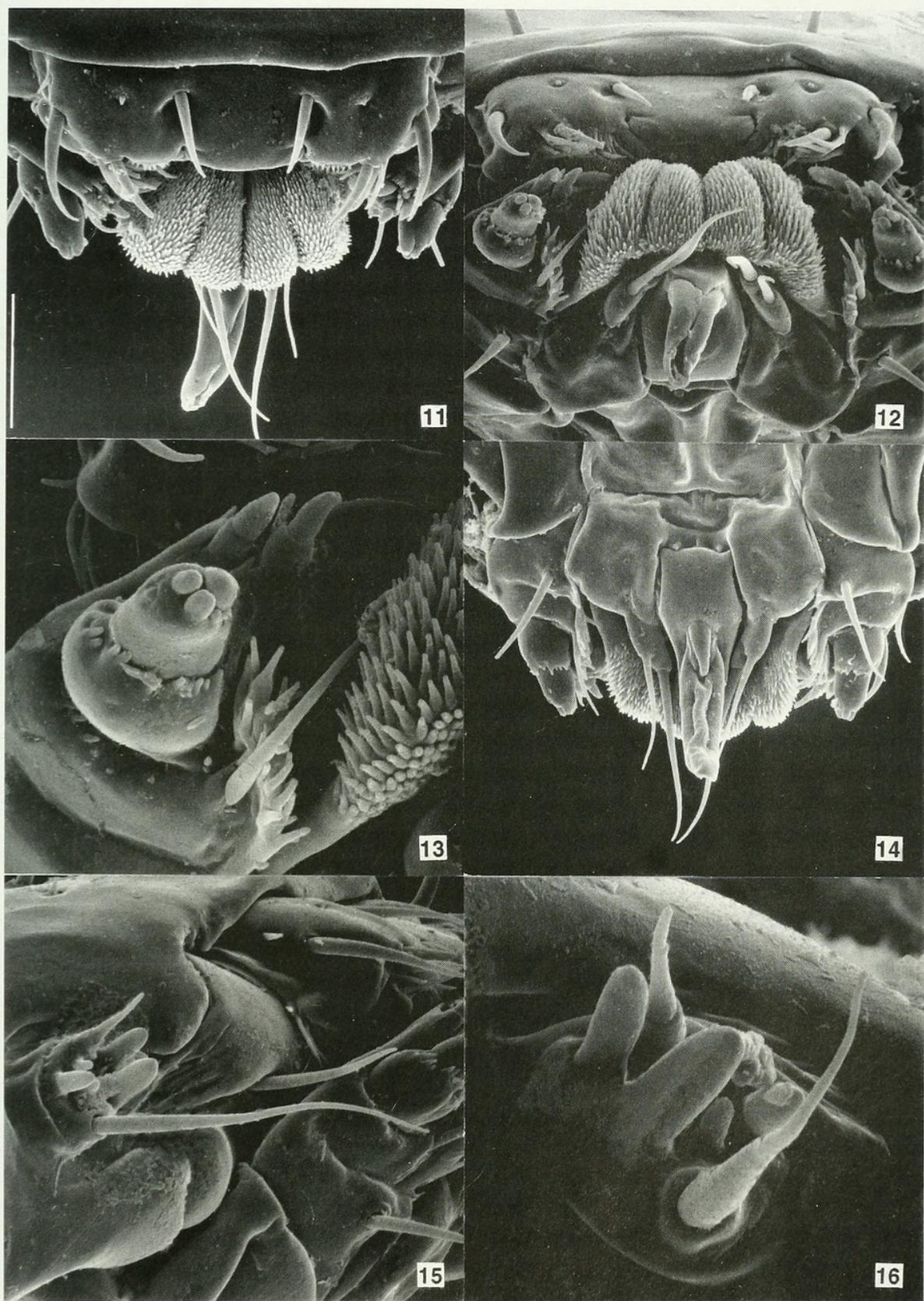


FIGS 4-10

*Bucculatrix caribbea*. Chaetotaxy of third/fourth (?) instar larva. 4, Lateral schematic of prothorax, mesothorax, metathorax, and abdominal segments 1, 2, 6-10. 5, Head, dorsal view (0.1mm). 6, Ventral view. 7, Lateral view. 8, Dorsal view of abdominal segments 8-10. 9, Mandible (0.02mm). 10, Labrum, dorsal view (0.02mm). (Scale lengths in parentheses.)

plates; chaetotaxy generally similar to preceding instar. Prothoracic leg with pretarsal claw similarly modified as above but with claw straight (fig. 33); T 1 leg also lacking paired, enlarged spatulate setae present on T 2-3. Prolegs present on A3-6, 10; ventral prolegs relatively elongate, tubular, with a partial circle of 6-7 crochets (figs 35, 36); anal prolegs much shorter, with approximately 4 crochets (fig. 37).

*Pupa* (1 specimen examined) (figs 38, 53, 54). Length: 2 mm. Frontal process (cocoon cutter) a small, simple, broadly triangular median spine (viewed laterally;



FIGS 11-16. *Bucculatrix caribbea*. Head morphology, third/fourth (?) instar larva. 11. Dorsal view of mouthparts (20 $\mu$ m). 12. Anterior view of mouthparts (20 $\mu$ m). 13. Maxilla (7.5 $\mu$ m). 14. Ventral view of mouthparts (25 $\mu$ m). 15. Lateral view of antenna (15 $\mu$ m). 16. Anterior view of antenna (6.7 $\mu$ m). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 11.)

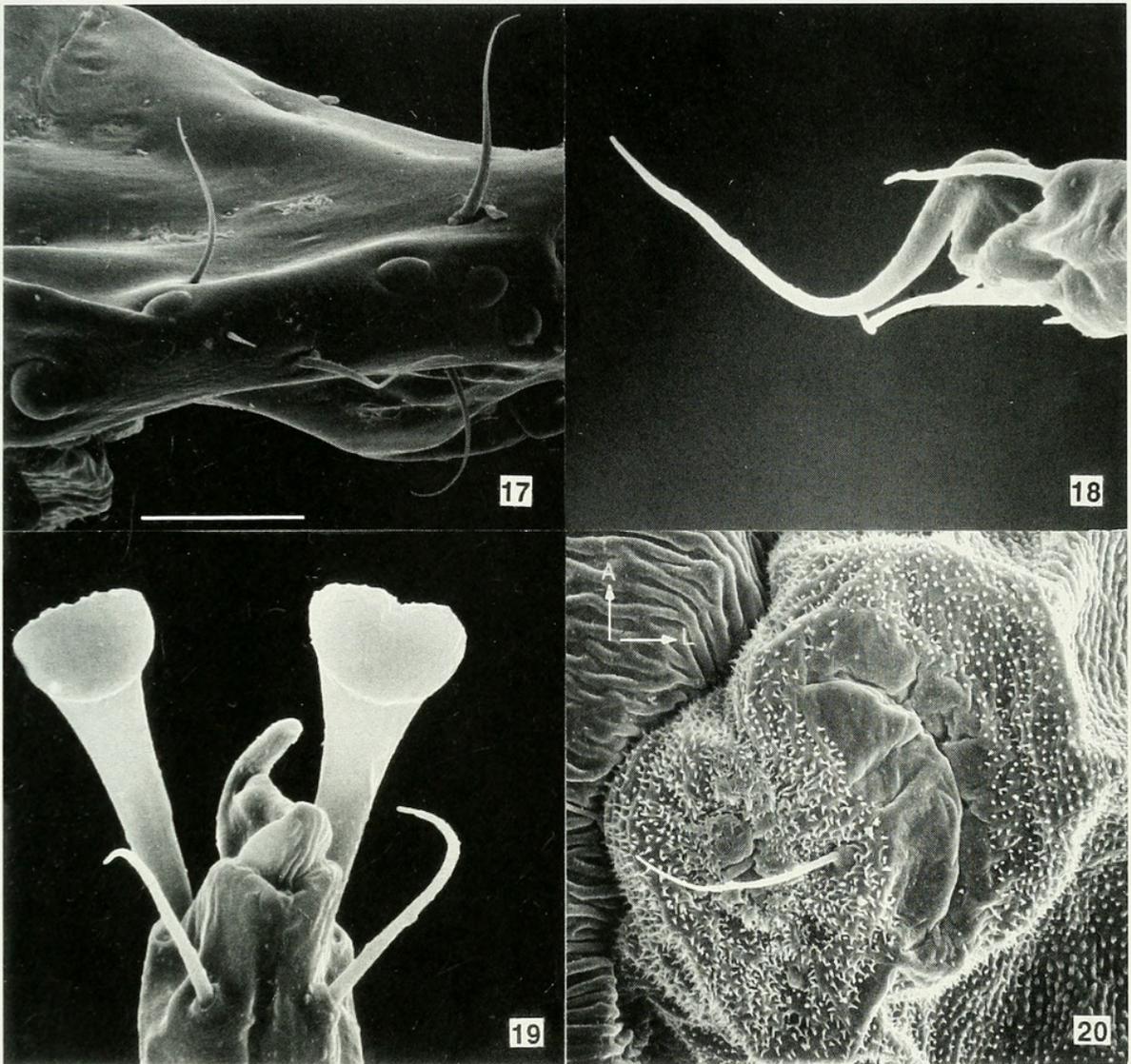
figs 38, 54). Antenna extending to caudal margin of A6. Forewings largely concealing hindwings, extending to middle of A7. Abdomen with segments 3-7 movable in male and 3-6 in female; a single transverse anterior row of small spines on A-3-8; A 10 relatively smooth, with 2 pairs of minute spines laterally.

*Cocoons* (figs 39-44). At least one and probably two flat, circular molting cocoons are constructed most likely by the third and fourth instar larvae respectively; molting cocoon about 1.5-2.0mm in diameter, constructed of loose, randomly spun, pale whitish silk (figs 39, 43, 44). Cocoon spun by final instar typical for genus in being white, elongate, 0.5mm wide and 2.2mm long, more intricately constructed (than molting cocoons), consisting of two parts of multi-layered, criss-cross silk strands reinforced by about 10 thickened, mostly dorsal, longitudinal ridges and 6-7 shorter, incomplete lateral ridges (figs 39-42); distinction between two parts obvious near anterior third where ridges are interrupted. Prior to adult emergence, pupal exuvium protrudes about halfway ventrally beneath anterior end.

*Etymology*. The specific name is derived from the geographical regional name Caribbean.

*Biology*. The egg is flat and cemented to the upper surface of the leaf of *Cordia sebestena*. The early instar larvae of *B. caribbea* commence feeding as upper side serpentine leaf miners and later enlarge the mine to a small, full depth blotch. In *B. caribbea* the mine usually extends a total length of 15-20mm and reaches a width of 5-6mm. The black larval frass is packed tightly into the serpentine portion of the mine and partway along either side of the blotch. Later the larva (probably third instar) exits near the terminal end of the mine on the underside of the leaf and spins a flattened, oval molting cocoon (figs 39, 43). The number of larval instars for this species was not determined. Five instars have been observed as typical for leaf-mining *Bucculatrix* (Braun, 1963), but this may vary somewhat. In those species whose larvae complete their feeding externally, it has been noted that only the first two instars and part of the third are passed within the mine. A similar cycle may be true for *B. caribbea*, but this requires confirmation. Thus, it is suspected that the third instar of *B. caribbea* also exits the mine and spins a molting cocoon, from which emerges the fourth instar that begins feeding externally, skeletonizing small patches of leaf. When the larval density becomes relatively high, leaf damage can be even more severe than illustrated (fig. 3). Evidently, the fourth instar constructs a second molting cocoon. The final instar (probably the fifth) completes its feeding and eventually constructs an elongate, ribbed cocoon (figs 39-42) on the underside and most frequently near the midrib of the leaf. Immediately prior to emergence, the pupa (or pharate adult) exits the cocoon, for approximately half its length, ventrally near the anterior end of the cocoon.

*Distribution*. This species is probably widespread along costal habitats in many parts of the Caribbean region where its host has become established. Currently it is known only from the island of Cozumel, Mexico and Glovers Reef, Belize. *Cordia sebestena* is widely cultivated in tropical areas and probably occurs naturally through much of the Caribbean region, from the Antilles and the Caribbean coasts of Central America, along the northern coasts of South America.

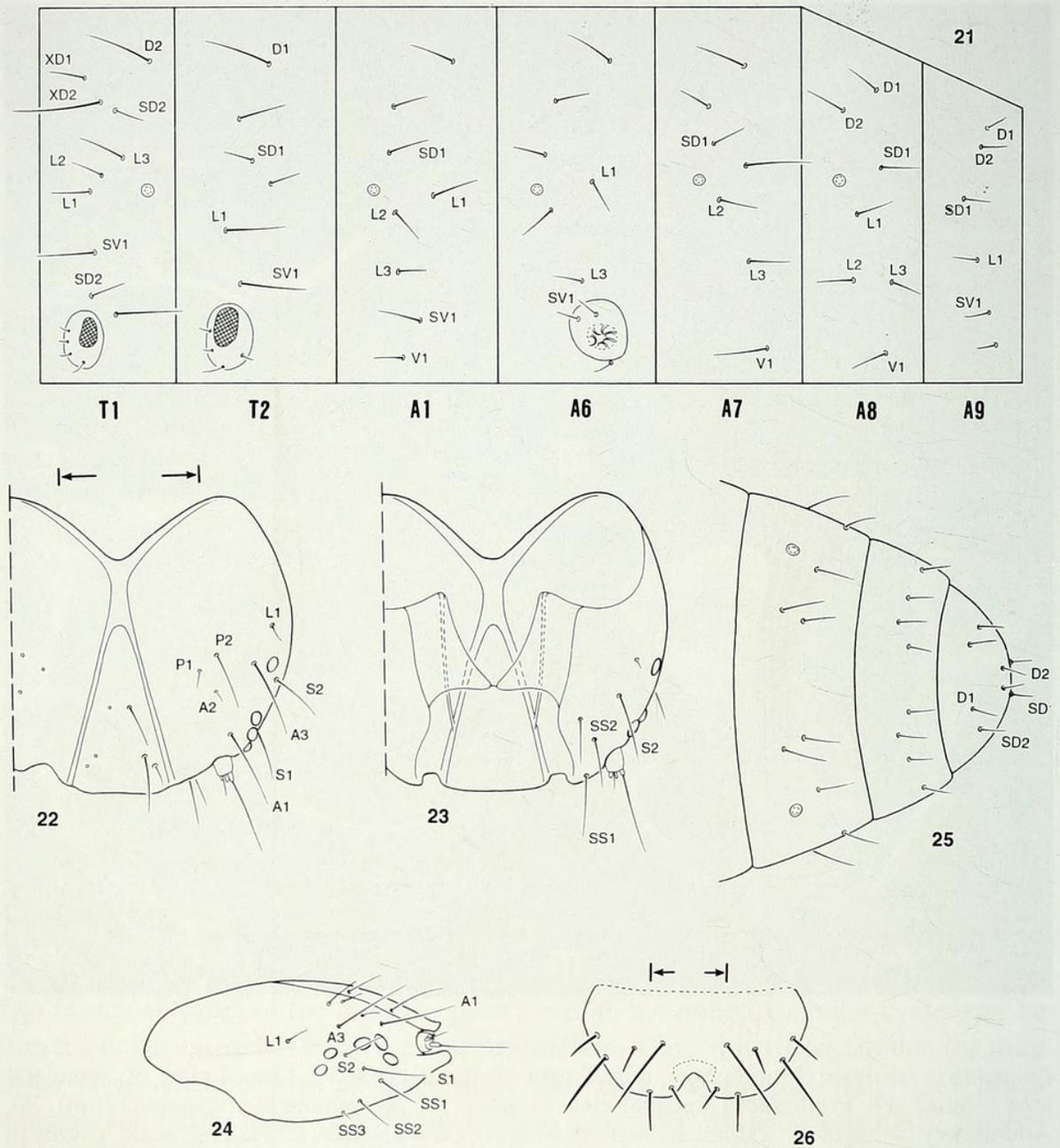


FIGS 17-20

*Bucculatrix caribbea*. Morphology, third/fourth (?) instar larva. 17, Lateral view of stemmatal area (38 $\mu$ m). 18, Prothoracic pretarsal claw (12 $\mu$ m). 19, Mesothoracic pretarsus (12 $\mu$ m). 20, Ambulatory callus of 4<sup>th</sup> abdominal sternum (33 $\mu$ m). (A = anterior; L = lateral; scale lengths in parentheses; bar scale for all photographs shown in fig. 17.)

*Remarks.* During a preliminary survey conducted by D. Davis and C. Feller (Davis, 1993) on leaf-mining Lepidoptera associated with mangrove habitats in Belize, a population of this moth was encountered on the small island of Northeast Cay, the most forested and uninhabited of the Glovers Reef system of small, low islands. Adults were reared by DRD from a small cluster of heavily infested, shrubby trees of *Cordia sebestena* growing along the southeast shore of the Cay.

The extreme specialization of the prothoracic pretarsus in the larva merits further investigation throughout the genus. Because elongation of the tarsal claw is believed to occur only in those instars that spin cocoons, this may represent a specialization that assists in cocoon construction. The observed absence of a dorsal seta on the prothorax (and mesothorax of the penultimate instar) of the larva also



FIGS 21-26

*Bucculatrix caribbea*. Chaetotaxy of fifth (?) instar larva. 21, Lateral schematic of prothorax, mesothorax, metathorax, and abdominal segments 1, 2, 6-10. 22, Head, dorsal view (0.1mm). 23, Ventral view. 24, Lateral view. 25, Dorsal view of abdominal segments 8-10. 26, Labrum, dorsal view (0.02mm). (Scale lengths in parentheses.)

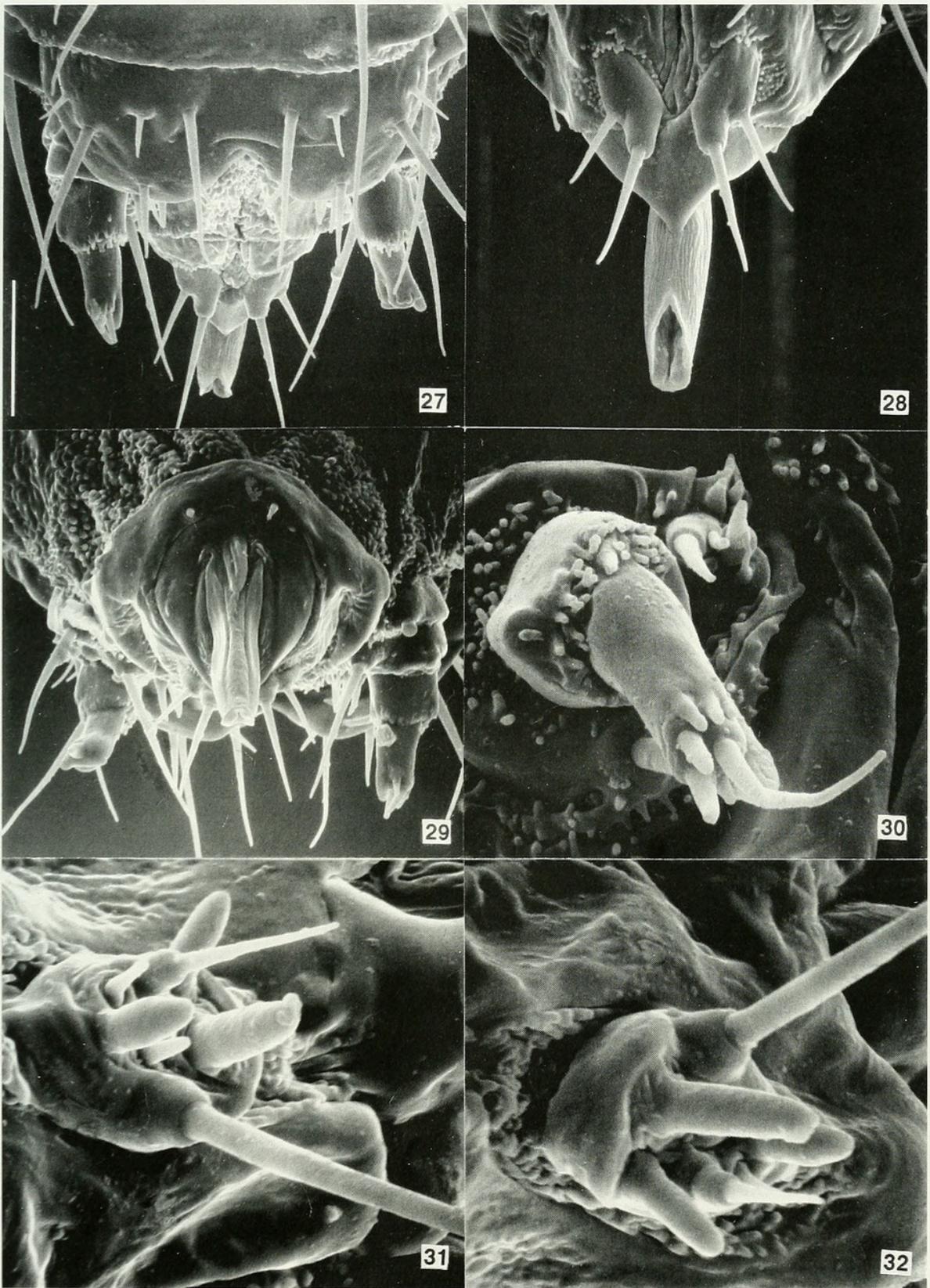
needs to be confirmed with more material. Both Braun (1963) and MacKay (1972) show both setae present in *Bucculatrix*.

***Bucculatrix cordiaella* Davis & Landry sp. n.**

Figs 2, 47, 48, 51, 52

Holotype ♂, ECUADOR: Galápagos, Genovesa, Bahía Darwin, 25.iii.1992, M[ercury] V[apour] L[amp] (B. Landry), slide BL 1321 (MHNG).

Paratypes. 7 ♂, 18 ♀, 1 of sex undetermined (unspread and not dissected) from the Galápagos islands: Floreana: 2 ♀ (slide BL 1319), Punta Cormoran, 21.iv.1992, M[ercury]



FIGS 27-32. *Bucculatrix caribbea*. Head morphology, fifth (?) instar larva. 27, Dorsal view of mouthparts (20 $\mu$ m). 28, Dorsal view of labial palpi and spinneret (15 $\mu$ m). 29, Ventral view of mouthparts (20 $\mu$ m). 30, Maxilla (6 $\mu$ m). 31, Antenna, lateral view (8.6 $\mu$ m). 32, Antenna, anterior view (8.6 $\mu$ m). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 27)

V[apour] L[amp] (B. Landry). Genovesa: 2 ♂ (slide BL 1320), 2 ♀, same data as holotype; one of sex undetermined, same data as holotype except date (10.iii.1992); 2 ♂ (slide BL 1308 [genitalia], BL 1323 [head]), 4 ♀ (slide BL 1309), same data as holotype except date (26.iii.1992). Isabela: 2 ♂, 2 ♀, Alcedo, low arid zone, 17.iv.1998, minadores de *Cordia lutea* (L. Roque). Santa Cruz: 1 ♂, 6 ♀ (slides USNM 32335, 32336), Tortuga Bay, 10 m, 18.iii.2001, reared from *Cordia lutea* (L. Roque). Santiago: 1 ♀ (slide BL 1322), Cerro Inn [= Bahía Sullivan], 28.iii.1992, M[ercury] V[apour] L[amp] (B. Landry). Seymour Norte: 1 ♀, arid zone, 23.i.1989, M[ercury] V[apour] L[amp] (B. Landry). (BMNH, CDRS, CNC, MHNG, USNM).

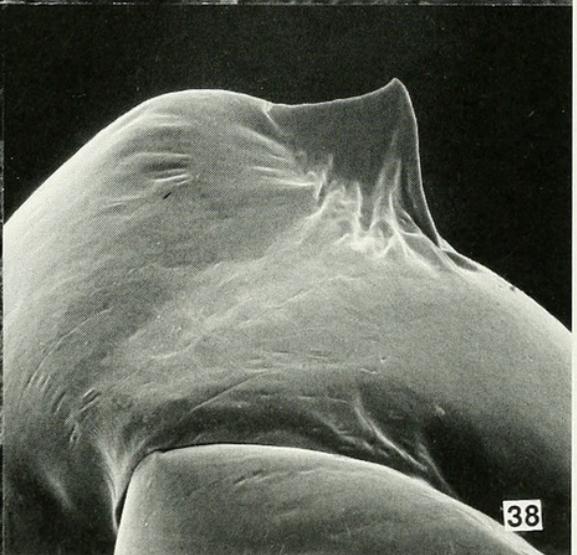
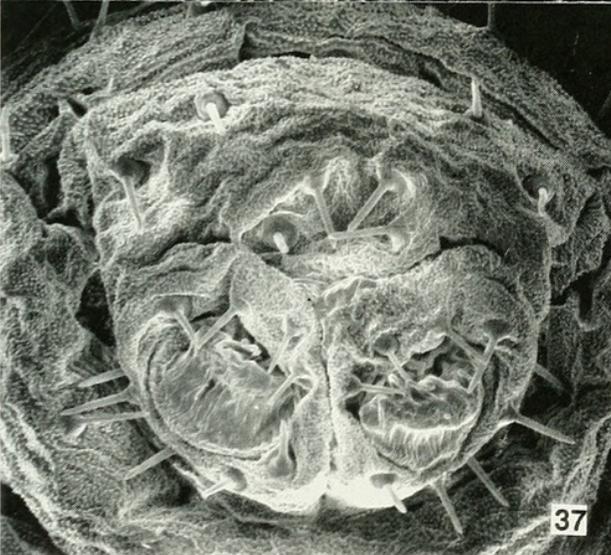
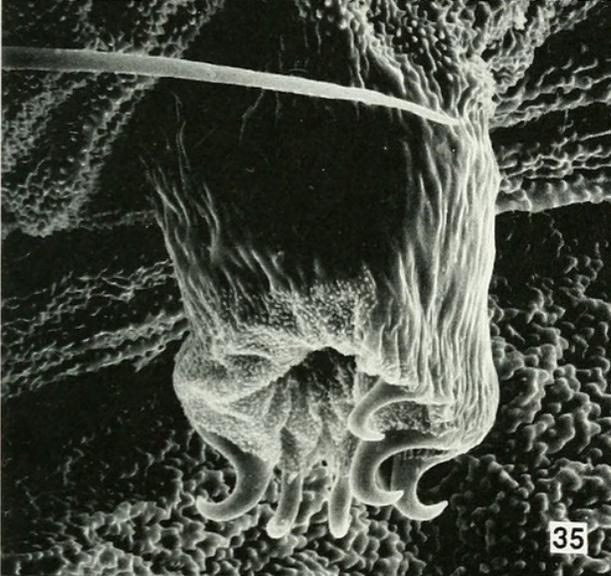
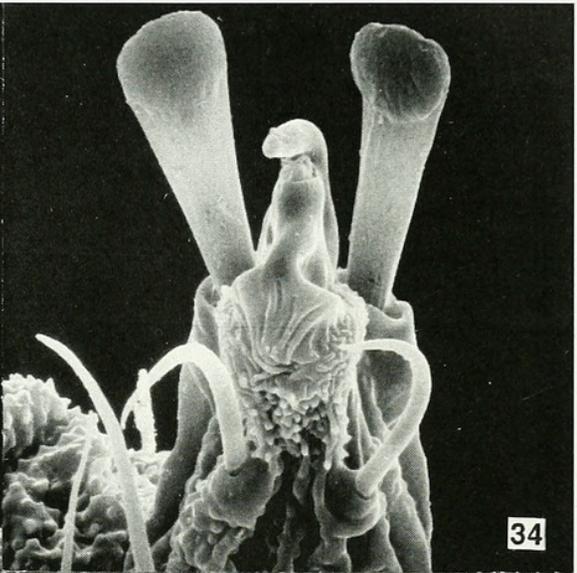
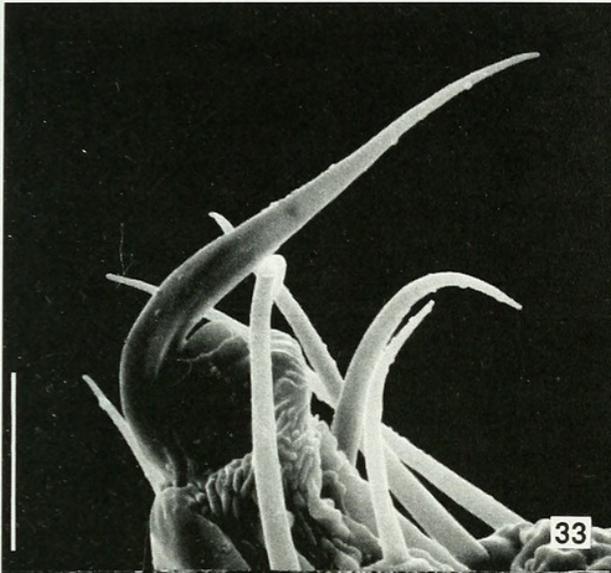
*Diagnosis.* With a wingspan of about 5 mm, this is among the smallest of all Lepidoptera species of the Galápagos. Its wing pattern, biology (an early instar leaf miner on *Cordia lutea*), and general shape and structure of the ribbed cocoon will immediately separate it from other moths of the archipelago. From its sister species, *B. caribbea*, it differs in possessing more distinct forewing strigulae (fig. 2), the male valva has a more slender, curved costal lobe (fig. 47), and the anterior portion of the female corpus bursae is more attenuated and possesses a more elongate, slender signa (figs 51, 52).

*Description* (fig. 2). Frons white; vertex with long and erect piliform scales mostly brown in middle, with more white scaling peripheral to tuft than in *B. caribbea*, with few broader, white scales along occiput; maxillary palpi and pilifers as in *B. caribbea*; labial palpi one segmented, kidney-shaped, poorly sclerotized, especially toward apex, not extending beyond margin of labrum; antenna 2/3 length of forewing; scape mostly white, with few brown-tipped scales; pecten made of 12-15 white scales; flagellum with alternate brown and white rings throughout, 19-segmented (n=1); first male flagellomere not curved, about twice as long as pedicel (first two flagellomeres apparently fused); haustellum not much longer than diameter of eye. Thorax mostly covered with brown-tipped white scales. Foreleg white with brown laterally on femur, tibia, tarsomere I, and apex of tarsomeres II-IV. Midleg white with brown laterally on femur, on tibia laterally as two large diagonal bands at base and subapically, on second half of tarsomere I, and apex of tarsomeres II-IV. Hindleg white with pale greyish brown on most of lateral surface of tibia, and brown dorsally on second half of tarsomere I, and apex of tarsomeres II-IV. Forewing length: 1.83 - 2.17 mm (holotype = 2.0 mm). Forewing white with pattern of brown and brown-tipped scales as large band subbasally, sometimes appearing diagonal; large V-shaped marking connecting middle of costa to inner margin at about 2/3 and costa again at 3/4; posterior branch of V connected to apical patch by narrow longitudinal band near middle; subbasal band loosely connected with V-shaped marking by few scales near cubital fold; larger basal scales of fringe pale greyish brown at base and

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FIGS 33-38

*Bucculatrix caribbea*. Larval morphology, fifth (?) instar; pupa. 33, Prothoracic pretarsal claw (10µm). 34, Mesothoracic pretarsus (12µm). 35, Proleg, 4<sup>th</sup> abdominal segment (17.6µm). 36, Crochets of fig. 35 (12µm). 37, Abdominal segment 10, caudal view (60µm). 38, Pupa, lateral view of frontal process (cocoon cutter) (60µm). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 33)



dark brown at apex, thinner scales pale grey. Hindwing pale greyish brown with concolorous fringe. Frenulum similar to that of *B. caribbea* in both sexes. Abdomen as described for *B. caribbea*.

Male genitalia (figs 47, 48). Uncus membranous, densely setose laterally; gnathos and socii absent. Tegumen a narrow dorsal ring; more slender than in *B. caribbea*. Vinculum broadly V-shaped, about 0.3 length of valva. Transtilla, juxta absent. Valva divided nearly 0.75 its length; costal lobe slightly curved dorsally, about 1/3 width of saccular lobe at middle; cluster of 4-6 stout, subapical spines present; saccular lobe slightly longer than costal lobe, apically narrower than base and rounded, with rather short setae from 1/3 to apex and shorter spines at about 2/3 on median side. Aedoeagus simple, cylindrical, almost straight except for slightly angled short coecum penis; vesica scobinate, without cornuti.

Female genitalia (figs 51, 52). Papillae anales and apophyses posteriores similar to those of *B. caribbea*. Sternite VIII with large, circular unsclerotized region medially between basal and apical margins at base of which is membranous ostium bursae; basal margin with short, rounded projection on each side; with longitudinal groove medially from middle of sternite to beyond middle of following intersegmental membrane. Caudal margin of sternite VII medially with wide (2/5 width of segment), short, and more strongly sclerotized extension that is shallowly emarginate apically. Ductus bursae membranous and of medium girth on basal 1/4, subsequently enlarged slightly, with ring of approximately 12-14 elongate, rodlike signa which are smooth for 1/4 their caudal length and sparsely dentate for remainder (fig. 52); apical ends of signa radiating from inflated anterior end of ductus bursae. Connection of ductus seminalis with ductus bursae at about 2/5. Corpus bursae rather large, ovate, with narrow band of quasi-alveolate pattern near middle.

*Immature stages.* Unknown.

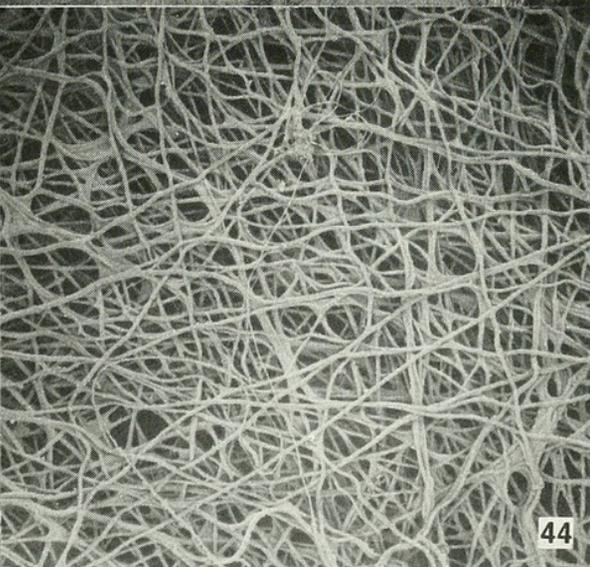
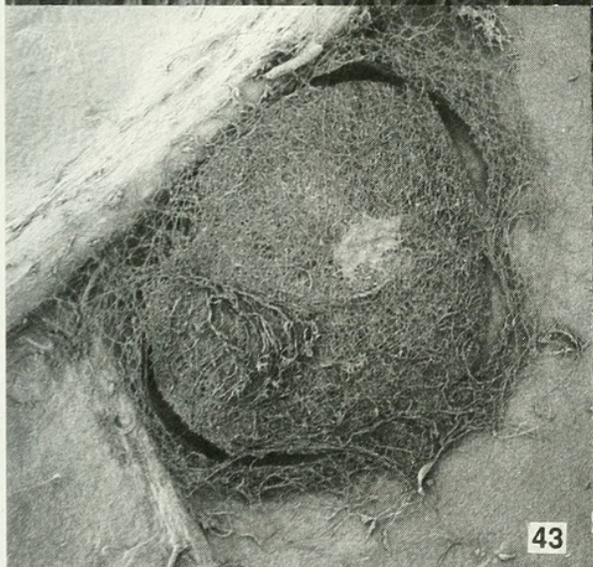
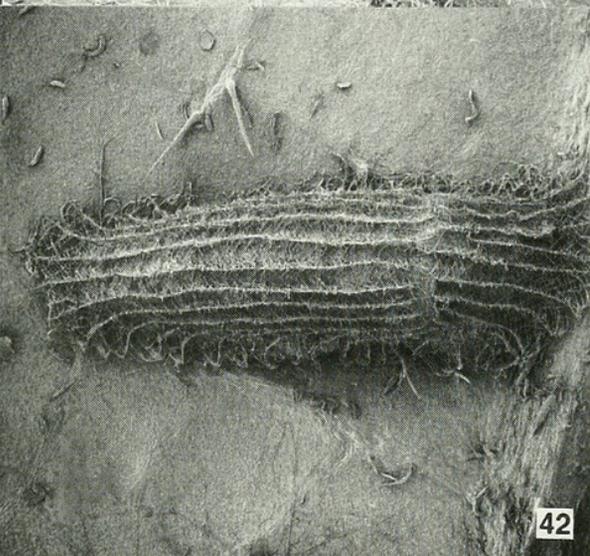
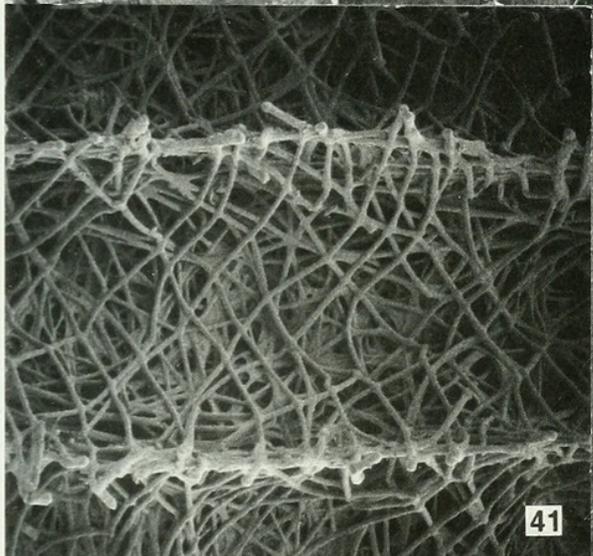
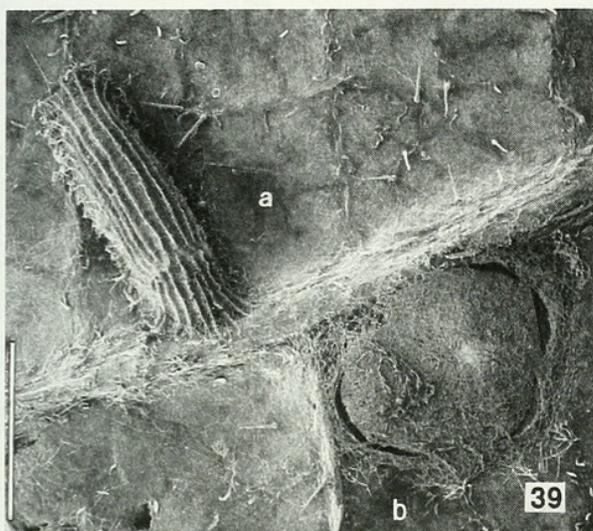
*Etymology.* The specific epithet is derived from the generic name of the host plant, *Cordia*.

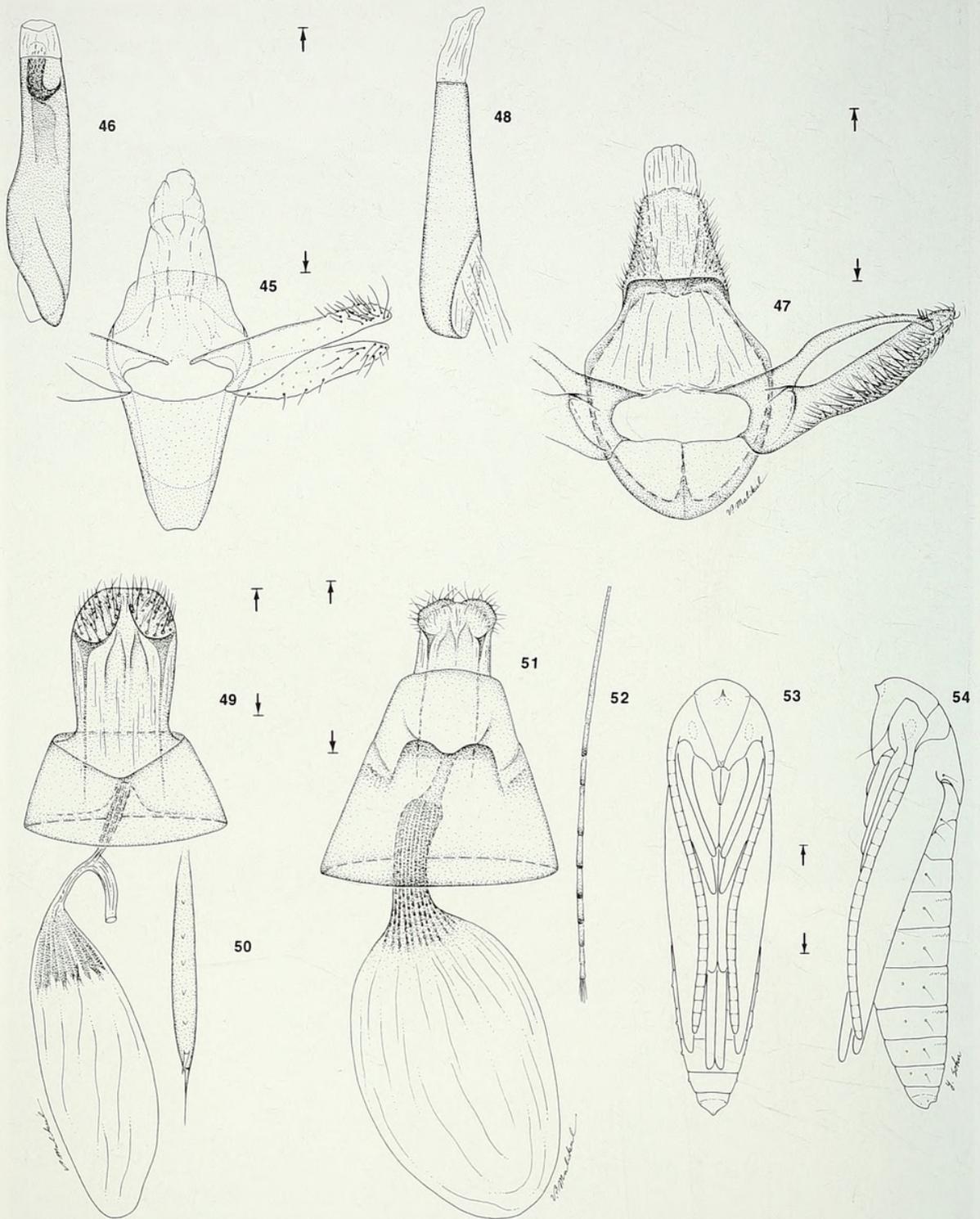
*Biology.* Early instar larvae mine the upper leaf surfaces of *Cordia lutea* Lam. (Boraginaceae). Later instar larvae apparently feed outside the mines, but this requires confirmation. Mature mines are up to 5mm wide and 15mm long, of which the narrow, 0.5-1.0mm broad serpentine mine often comprises half the length. In early June 2001, LR observed larvae suspended from silk threads in great numbers toward the end of the day. Many of these larvae were preyed upon in midair by wasps identified as *Pachodynerus gaullei* Brèthes, 1920 (syn. = *P. galapagensis* (Williams, 1926)) (Vespidae). The *Bucculatrix* larvae were taken to the wasps' nests and fed upon by the wasps or given to the wasps' larvae. Moths come to light and were collected in January, March, and April.

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#### FIGS 39-44

*Bucculatrix caribbea*. Cocoon morphology. 39, Ribbed pupal cocoon (a) of last instar larva and molting cocoon (b) of third/fourth instar larva (1.5mm). 40, Lateral view of pupal cocoon (0.86mm). 41, Detail of rib construction of pupal cocoon (75µm). 42, Dorsal view of fig. 40 (0.86mm). 43, Molting cocoon of third/fourth instar larva (0.86mm). 44, Detail of molting cocoon construction (75µm). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 39)





FIGS 45-54

*Bucculatrix*, male and female genitalia; pupal morphology. 45, *B. caribbea*, ventral view of male genitalia (0.25mm). 46, Aedeagus. 47, *B. cordiella*, ventral view of male genitalia (0.25mm). 48, Aedeagus. 49, *B. caribbea*, ventral view of female genitalia (0.25mm). 50, Enlarged detail of signum in fig. 49. 51, *B. cordiella*, ventral view of female genitalia (0.25mm). 52, Enlarged detail of signum in fig. 51. 53, *B. caribbea*, ventral view of pupa (0.5mm). 54, Lateral view of fig. 53. (Scale lengths in parentheses.)

*Distribution.* The species has been collected on the Galápagos islands of Floreana, Genovesa, Isabela, Santa Cruz, Santiago, and Seymour Norte, always near sea level.

*Remarks.* Collected first in 1989 by BL, *B. cordiaella* attained high population levels at the Charles Darwin Research Station (CDRS), Santa Cruz Island, in March 2001. Because the host plant, *Cordia lutea* Lam., is rather common at lower elevations, the authorities of the Galápagos National Park were alarmed by the intensive leaf damage caused by larval feeding. An electronic message with an image of the leaf damage was sent to BL by LR, and forwarded to DRD for his advice. After an exchange of messages between Washington and the CDRS, a generic identification was made on the basis of the characteristic cocoon structure, and this identification was further confirmed after DRD received material from LR. The species proved to be the same as the one collected by BL on four other islands of the archipelago in 1989 and 1992 that had been identified as a *Bucculatrix* by DRD in 1992. Examination of the types of the New World *Bucculatrix* species in the National Museum of Natural History, Washington, D.C. (USNM) and The Natural History Museum, London (BMNH) by BL and DRD had revealed that the species was new to science.

*Cordia lutea*, also known as Yellow cordia, or muyuyo, is native to the Galápagos and to mainland Ecuador and Peru. It is a small tree or shrub that inhabits the arid lowlands. In addition to the islands mentioned above, where the moth was found, *Cordia lutea* is found on the islands of Baltra, Española, Marchena, Pinta, Pinzón, Rábida, San Cristóbal, Santa Fé, Wolf, and some islets (McMullen 1999).

A color illustration of the forewing of *B. cordiaella* is presented on the web site of the MHNG: [www.geneva-city.ch:80/MUSINFO/mhng/page/photgala.htm](http://www.geneva-city.ch:80/MUSINFO/mhng/page/photgala.htm).

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