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BIOLOGY AND MORPHOLOGY OF THE BANANA MOTH, *OPOGONA SACCHARI* (BOJER), AND ITS INTRODUCTION INTO FLORIDA (LEPIDOPTERA: TINEIDAE)

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Abstract.—The general distribution and recent introduction into Florida of the banana moth, *Opogona sacchari* (Bojer) is reviewed. Currently, the principal damage caused by this species in Florida consists of larval stem boring in certain nursery stock and ornamental palms in particular. The biology of the species is summarized and all stages of the insect are described, supplemented by numerous illustrations.

Key Words: Lepidoptera, Tineidae, *Opogona sacchari,* banana moth, moth biology, immature stages

The banana moth, *Opogona sacchari* (Bojer), is known from several tropical-subtropical humid regions around the world but has yet to be reported from the Indo-Australian region. Originally reported from the Mascarene Islands in the Indian Ocean (Bojer 1856, Walker 1863, Butler 1876), the species was later discovered in Africa (Vari and Kroon 1986) as well as islands near the African continent (Walker 1875, Durrant 1925) and Europe (Ciampolini 1973, D'Aguilar and Martinez 1982, Mourikis and Vassilaina-Alexopoulon 1983). More recently the species has spread to South America (Cintra 1975, Giannoti et al. 1977) and the West Indies (Alam 1984). The earliest evidence we have of this species in the New World is represented by adult specimens in the Smithsonian Institution (USNM) that were collected in 1970 from Aragua, Venezuela on potato.

Specimens received for identification from B. Kumashiro of the Hawaiian Department of Agriculture just prior to publication indicate that *O. sacchari* is now established in Hawaii. The species has been reared from rotting coconut tree tops (central whorl of leaves) from Kaneohe, Oahu and from an unidentified palm at Kohala, Hawaii.

Within the last few years *O. sacchari* has become established on various nursery stock in southern Florida, particularly in Dade and Palm Beach Counties (Heppner, Peña, and Glenn 1987). Nursery stock particularly affected in Florida include corn plant or casse (*Dracena fragrans* (L.) Ker-Gaus, variety *massangeana*) and bamboo palms (*Chamaedorea* sp.) as well as Hawaiian good luck plant (*Cordyline terminalis* (L.) Kunth) and aralias (*Polyscias* sp.). Although sugar cane is a major host, *O. sacchari* has not yet been reported on that plant in the United States.

The appearance of this new pest in the United States has necessitated a careful examination of all developmental stages and a report of its biology pertinent to its current significance as a pest of nursery stock in Florida.

Opogona sacchari (Bojer)

Alucita sacchari Bojer 1856: 21, pl. 5, figs. 1–10.

Opogona sacchari (Bojer).—Vinson, 1938: 56 (synonym of *Opogona subcervinella*).—Viette, 1957: 145; 1958: 4.—Ciampolini, 1973: 221.—Cintra, 1975: 223.—Giannoti et al., 1977: 209.—Declercq and Van Luchene, 1977: 499.—Zimmerman, 1978: 386.—Cintra et al., 1978: 3.—Pigatii, 1978: 21.—Pigatii et al., 1979: 61.—Veenenbos, 1981: 235.—D'Aguilar and Martinez, 1982: 28.—Rotundo and Tremlay, 1982: 123.—Suplicy and Sampaio, 1982: 174.—Bennett and Alam, 1985: 41.—Heppner et al., 1987: 1.

Tinea subcervinella Walker, 1863: 477.

Opogona subcervinella (Walker).—Walsingham, 1907: 713; 1919: 259.—Meyrick, 1930: 321.—Vinson, 1938: 56.—Viette, 1951: 339; 1957: 145 (synonym of *Opogona sacchari*); 1958: 4.—Paulian and Viette, 1955: 147.—Box, 1953: 34.—Davis, 1978: 14; 1984: 22.—Vari and Kroon, 1986: 84, 156.

Hieroxestis subcervinella (Walker).—Meyrick, 1910: 375; 1911: 298.—Cockerell, 1923: 247.—Meyrick, 1924: 556.—Durrant, 1925: 12.—Oldham, 1928: 147.—Rebel, 1939: 63; 1949: 56.—Jannone, 1966: 24.

Gelechia sanctaehelenae Walker, 1875: 192.—Durrant, 1925: 12 (synonym of *Hieroxestis subcervinella*).

Euplocamus sanctaehelenae (Walker).—Wollaston, 1879: 417.

Hieroxestis sanctaehelenae (Walker).—Durrant, 1923: xvii.

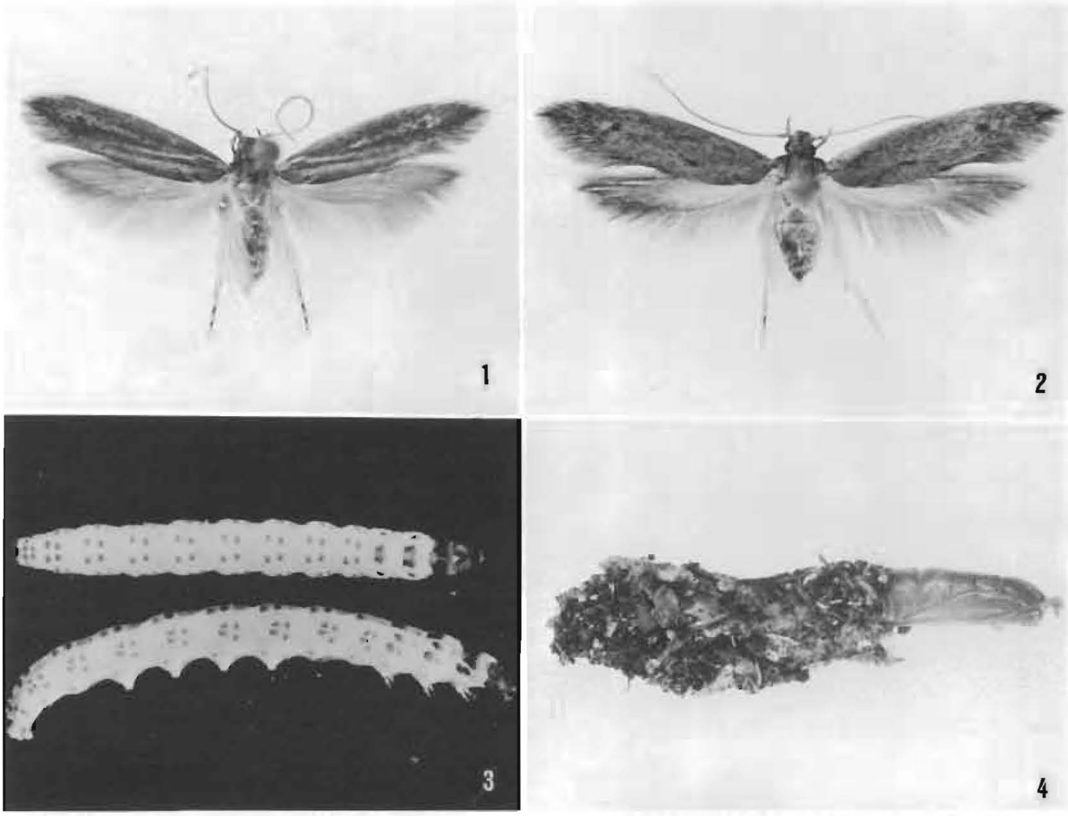
Gelechia ligniferella Walker, 1875: 192.—Durrant, 1925: 12 (synonym of *Hieroxestis subcervinella*).

Laverna plumipes Butler, 1876: 409.—Walsingham, 1907: 713 (synonym of *Opogona subcervinella*); 1919: 259.

Adult (Figs. 1, 2).—Length of forewing: ♂, 7.3–11.2 mm; ♀, 9–12.5 mm. Moderately large, generally dark grayish brown moths with a small, black subapical spot on forewing near apex of discal cell and a similar one at basal third on anal fold; male slightly paler in color with faint longitudinal streaks of light brown or buff.

Head: Vestiture smooth except for a pair of bilateral tufts of erect, pale brown to cream, piliform scales between antennal bases; scales of frons broad, cream colored; vertex covered by a dense row of broad cream scales that curve over frons; caudal portion of vertex with broad, grayish brown scales; occiput light brown with a scattered arch or median patch of dark fuscous scales. Antenna 103–125 segmented, approximately 0.8 the length of forewing; scape cream dorsally, with scattered fuscous scales ventrally; flagellum uniformly covered with small but moderately broad, cream to buff scales arranged in a single row, completely encircling each flagellomere (Fig. 12); sensilla chaetica (with spiral grooves) and trichodea (longitudinal grooves) relatively dense and randomly scattered over each flagellomere; a few pair of sensilla coeloconica located near distal margin (Figs. 13, 14). Pilifers moderately developed with setae nearly meeting at midline (Fig. 9). Labrum densely covered with microtrichia. Mandible vestigial but exceeding pilifer setae in length. Maxillary palpus 5-segmented, elongate, exceeding length of relatively short haustellum; dorsal and lateral surfaces densely covered with cream scales; venter naked with dense sensilla; apex of fifth segment with a slender basiconic sensillum and another slightly smaller one at subapex (Figs. 15, 16). Haustellum with a series of shallow plates over basal half; largest plates with a pair of short sensilla basiconica (Fig. 10). Labial palpus upcurved, smoothly covered with cream scales except for a lateral, subapical series of 3–4 cream bristles and a ventral subapical tuft of 6–8 bristles; third segment with an elongate, narrow sensory pit located just beyond middle (Figs. 17, 18).

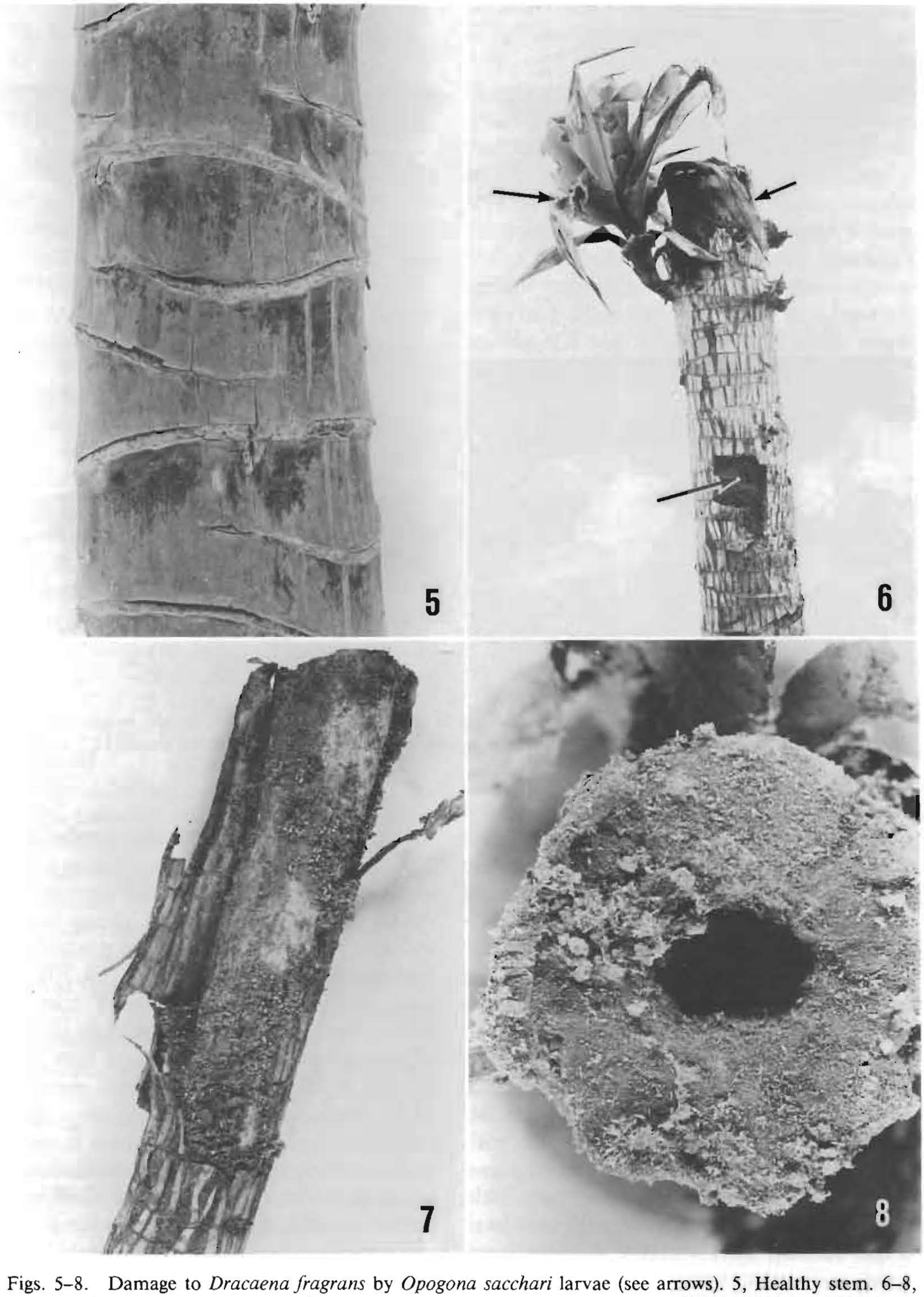
Thorax: Pronotum light brown with heavy to sparse scattering of fuscous scales and usually with a small to large median patch of fuscous on anterior margin and on tegula. Venter uniformly shiny cream. Forewing



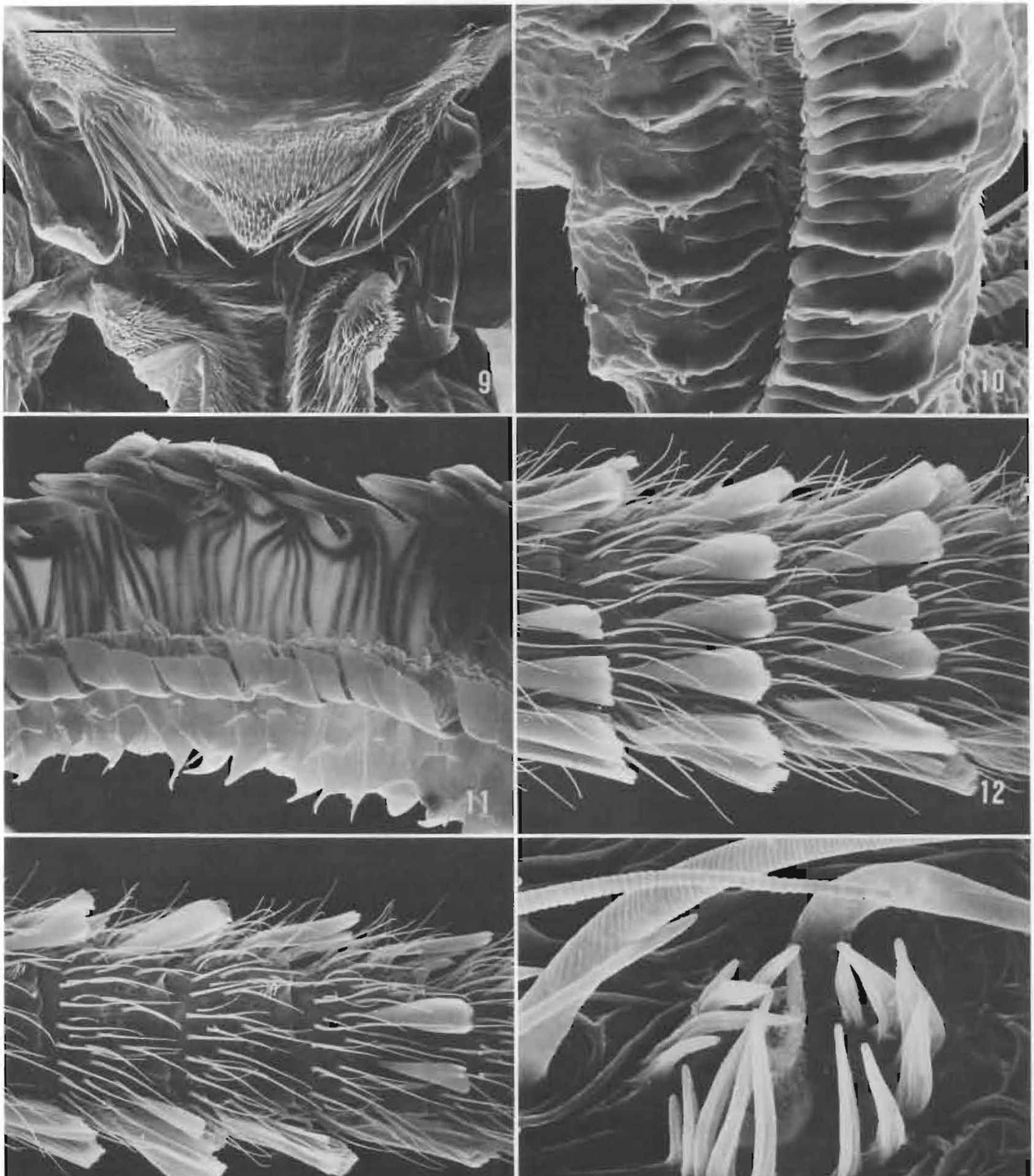
Figs. 1–4. *Opogona sacchari.* 1, Adult male, length of forewing 9.5 mm. 2, Adult female, length of forewing 12.5 mm. 3, Larvae, maximum length 30 mm. 4, Cocoon with pupal exuvium, cocoon length 12.5 mm.

light brown in female with an almost equal amount of scattered dark brown scales; male with dark brown scales more concentrated into longitudinal streaks, particularly evident along upper and lower margins of discal cell; a small, dark fuscous subapical spot near apex of cell and a more elongate fuscous spot along anal fold at basal third in both sexes; male retinaculum a relatively elongate flap from ventral subcostal margin, with apical margin rolled under (Figs. 24, 25). Hindwing light yellowish brown with slender scales in male, more shiny gray and with slightly broader scales in female; male with elongate hair pencil from dorsal base (Figs. 28–30); ultrastructure of pencil sex scales as illustrated (Figs. 31–33); male frenulum a single stout bristle (Fig. 26); female with usually five stout frenular bristles (Figs. 27). Foreleg mostly cream; coxa with a small amount of grayish fuscous suffusion at base; dorsal surfaces of tibia and tarsus heavily suffused with grayish fuscous; normal pectinated epiphysis present (Figs. 19, 20). Pretarsus of all legs normal, with relatively broad unguitractor plate bearing 7–10 ranks of scutes in a single transverse row (Figs. 21–23). Midleg uniformly cream except for slight grayish fuscous suffusion over dorsal surface of tarsus. Hindleg similar to midleg in color except with less grayish fuscous on tarsus and with dense, elongate piliform setae from tibia.

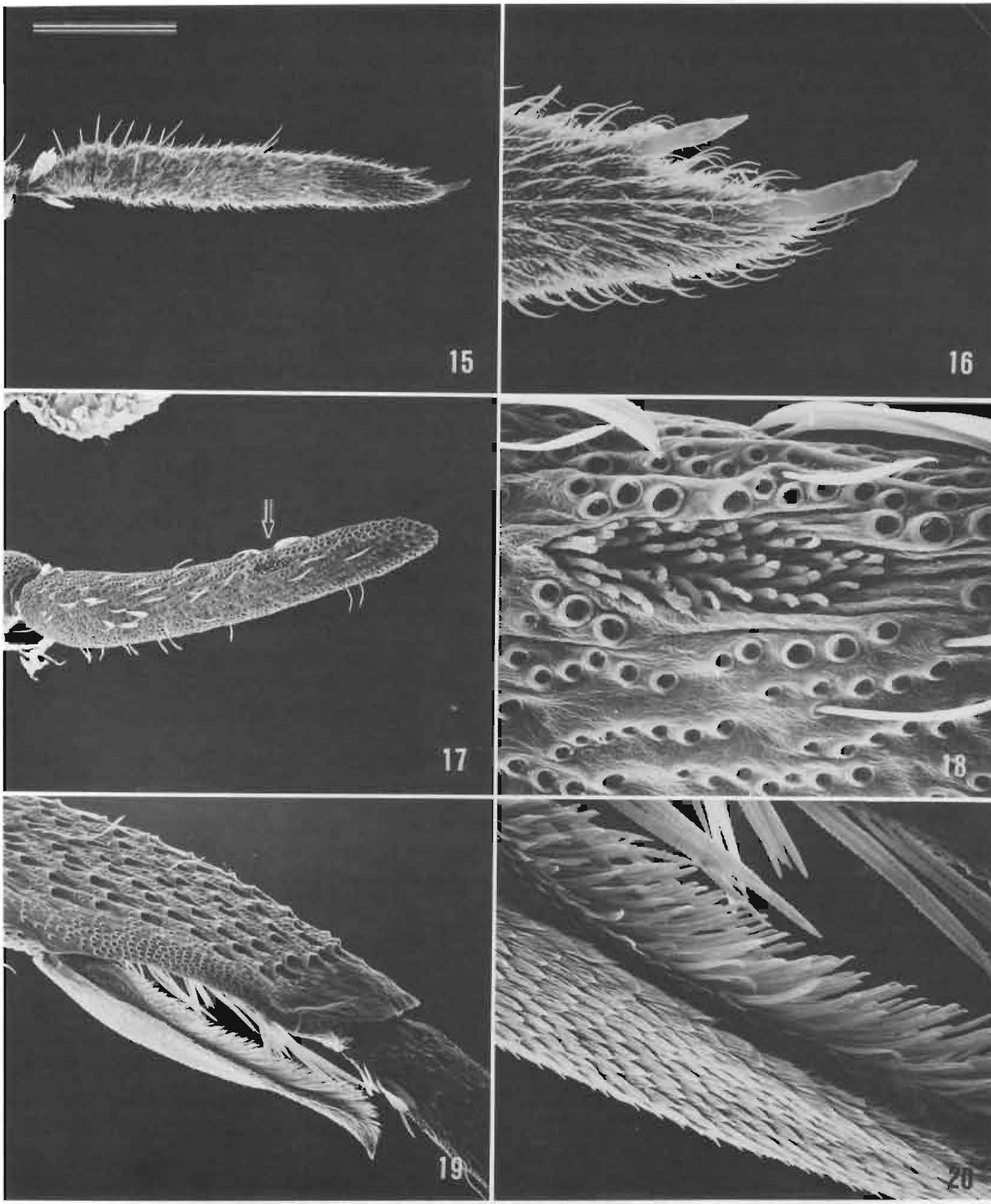
Abdomen: Terga mostly grayish brown with caudal margins and pleura buff to cream colored; venter of female uniformly cream,



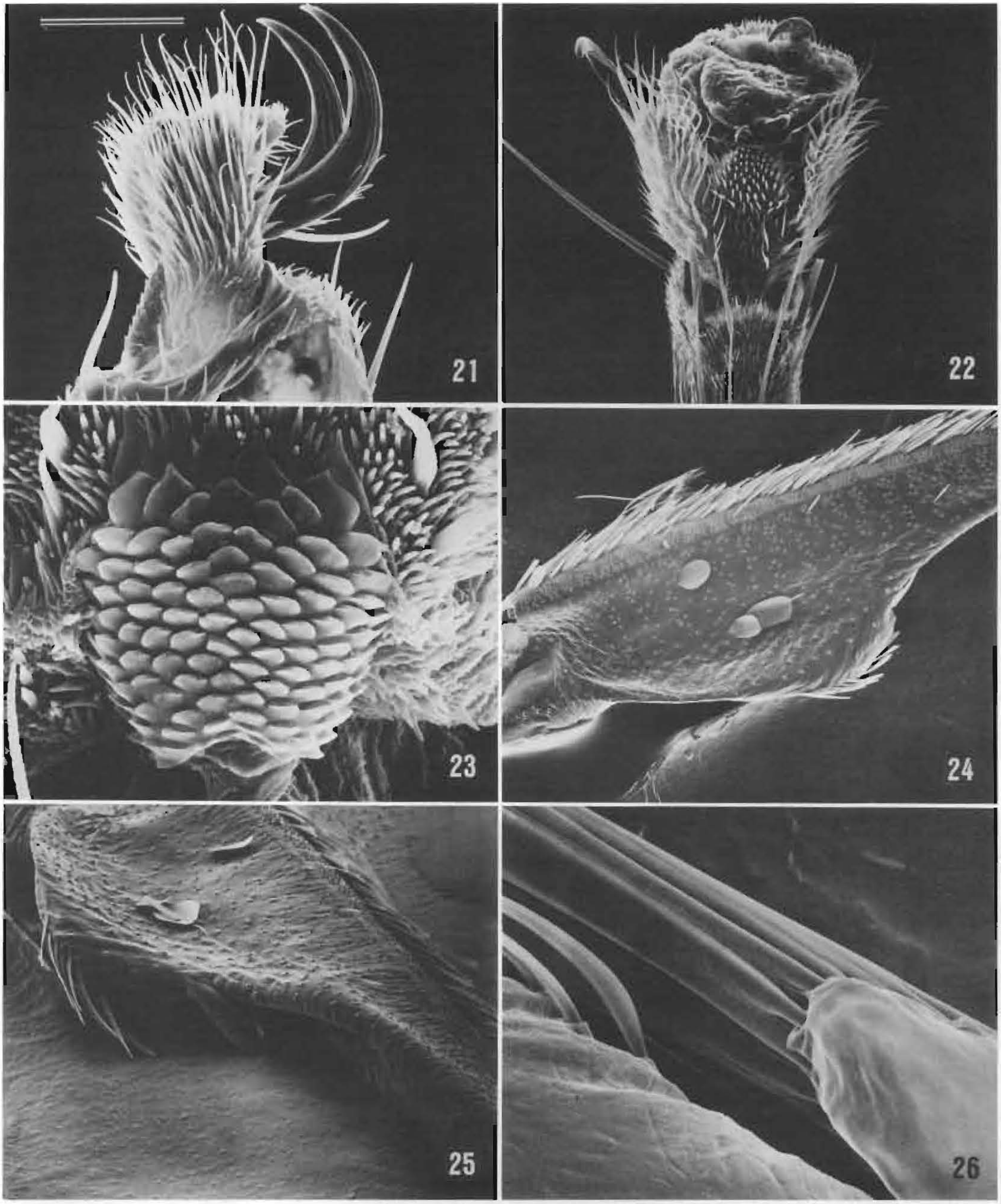
Figs. 5–8. Damage to *Dracaena fragrans* by *Opogona sacchari* larvae (see arrows). 5, Healthy stem. 6–8, Typical feeding damage to *Dracaena fragrans* canes.



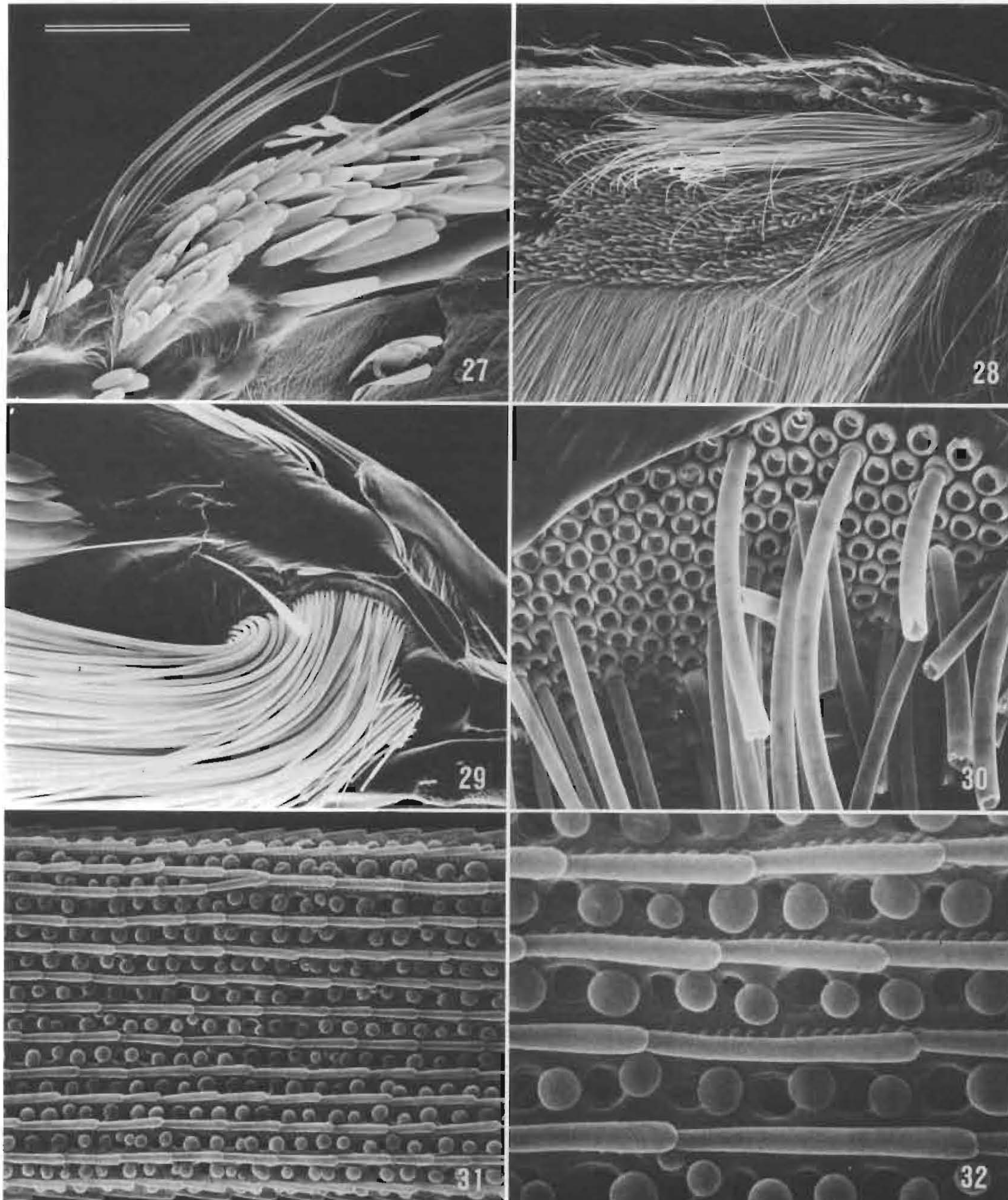
Figs. 9–14. *Opogona sacchari,* adult morphology. 9, Labrum, anterior view (100 μm). 10, Base of haustellum (38 μm). 11, Haustellum, food canal (15 μm). 12, Antenna, scale pattern (50 μm). 13, Antenna, sensilla (60 μm). 14, Sensillum coeloconicum of antenna (4.3 μm). (Scale lengths in parenthesis; bar scale for all photographs = Fig. 9.)



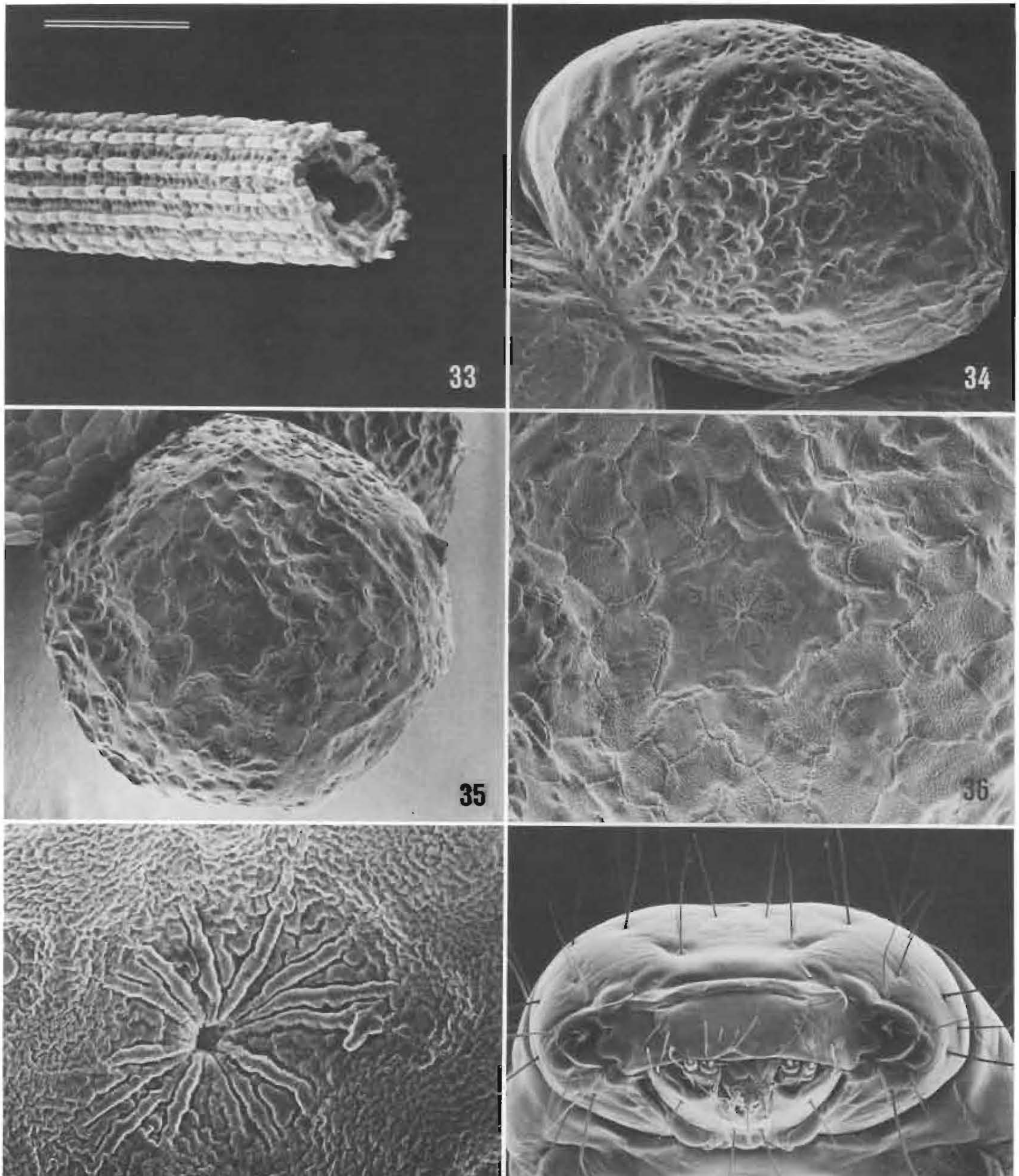
Figs. 15–20. *Opogona sacchari,* adult morphology. 15, Maxillary palpus, apical (fifth) segment (100 μm). 16, Apex of Fig. 15 (23.1 μm). 17, Labial palups, apical (third) segment (176 μm). 18, Detail of sensory pit in Fig. 17 (see arrow) (25 μm). 19, Epiphysis (120 μm). 20, Detail of pecten on epiphysis (27 μm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 15.)



Figs. 21–26. *Opogona sacchari,* adult morphology. 21, Pretarsus of midleg, lateral view (20 μm). 22, Ventral view (50 μm). 23, Unguitractor plate of pretarsus (7.5 μm). 24, Subcostal retinaculum of male forewing (0.27 mm). 25, Distal-lateral view of Fig. 24 (176 μm). 26, Male frenulum (38 μm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 21.)



Figs. 27–32. *Opogona sacchari,* wing morphology. 27, Female frenulum (250 μm). 28, Hair pencil of male hindwing, dorsal wing (1 mm). 29, Base of male hair pencil (176 μm). 30, Raised scale sockets of hair pencil (30 μm). 31, Surface ultrastructure of a single hair pencil scale (3.8 μm). 32, Detail of Fig. 31 (1.2 μm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 27.)



Figs. 33–38. *Opogona sacchari,* adult, egg, and larval morphology. 33, Cross section of hair pencil scale (Fig. 31) (3.8 μm). 34, Egg, lateral view (150 μm). 35, Micropyle (136 μm). 36, Detail of Fig. 35 (75 μm). 37, Detail of central disk (Fig. 36) (17.6 μm). 38, Head of larva, anterior view (60 mm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 33.)

grayish brown in male; both sexes with a lower lateral series of five dark fuscous spots on A3–7.

Male genitalia (Figs. 79–82): Uncus deeply divided into two large widely separated lobes arising beneath tegumen and bearing numerous stout elongate setae on their mesal surfaces. Tegumen a relatively broad ring dorsally. Vinculum tapering to a broad, relatively truncate saccus. Valva prominently divided into a large, elongate, rounded apical lobe and a much smaller, acute cucullar lobe. Aedoeagus a relatively small, straight, slender tube without cornuti; phallobase much larger and greatly inflated.

Female genitalia (Figs. 83, 84): Tertiary apophyses present in A10. Genital plate moderately divided into a pair of rounded lobes. Corpus bursae with a single large sagitate signum bearing elongate anterior arms.

Egg (Figs. 34–37).—Length, 0.5–0.55 mm; diameter, 0.38 mm; oval in shape, round in cross section; color light yellow at oviposition, gradually becoming yellowish brown prior to eclosion. Surface irregularly pitted. Micropyle consisting of a single, centrally positioned opening with small radiating grooves forming an enlarged, reticulate pattern of low ridges over entire end of egg; reticulations mostly 5–6 sided.

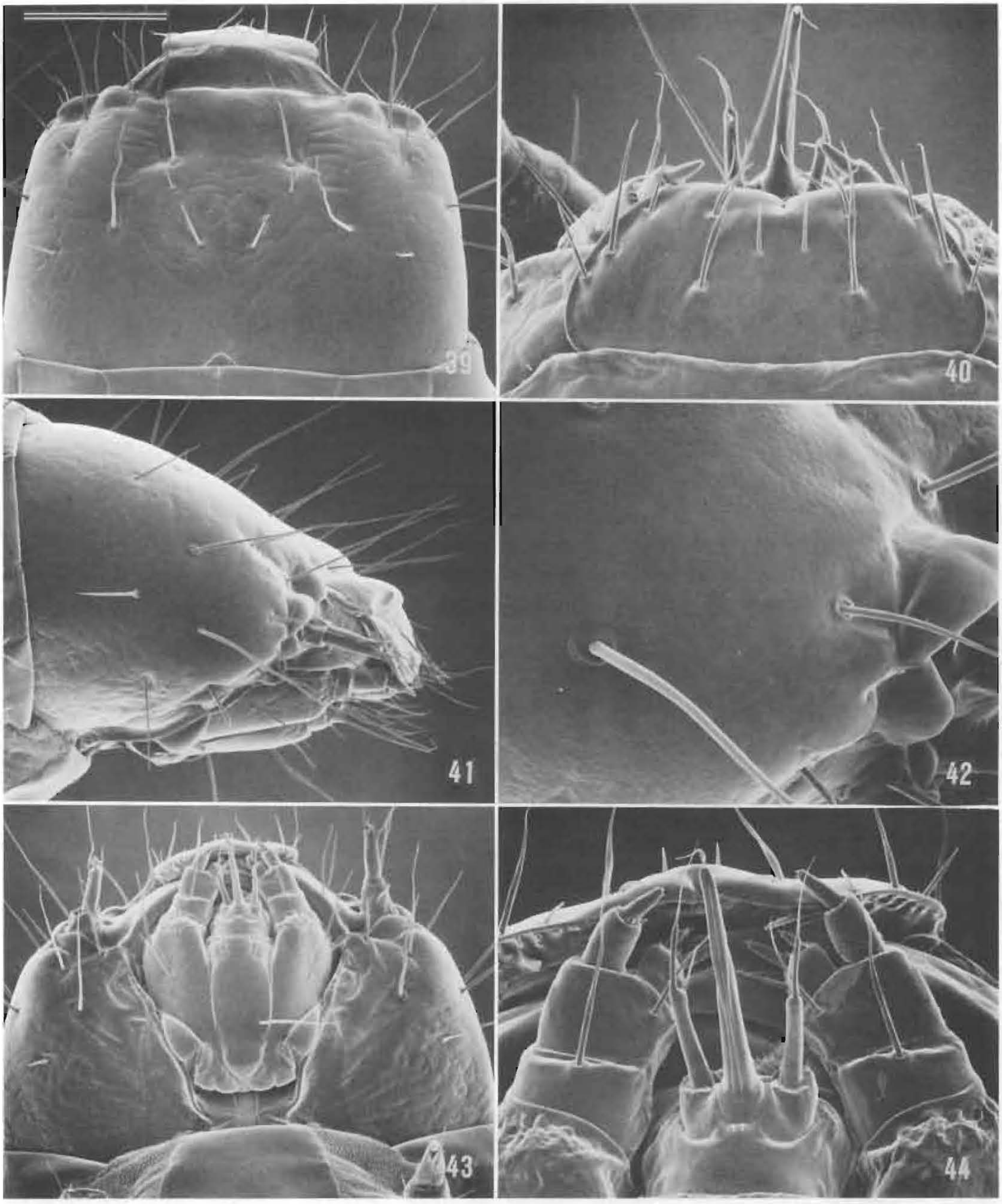
Larva (Figs. 3, 38–66).—Length of largest larva 30 mm, maximum diameter 3 mm. Body generally white with dark brown plates and pinacula.

Head: Maximum width 2.5 mm. Color reddish brown, becoming darker anteriorly and over frons. Chaetotaxy as illustrated. Stemmata rudimentary, consisting of a pair of widely separated, clear lenses, probably corresponding to stemmata 1 and 5; the most anterior (5) located ventral to antennal socket; the most posterior (1) midway between A3 and S2. Mandible with five cusps. Spinneret long and slender with a minute orifice. Labial palpus 2-segmented, elongate and slender, equalling or slightly exceeding length of spinneret; apical seta one-third the length of entire palpus. Apex of mentum with a pair of minute secondary labial setae.

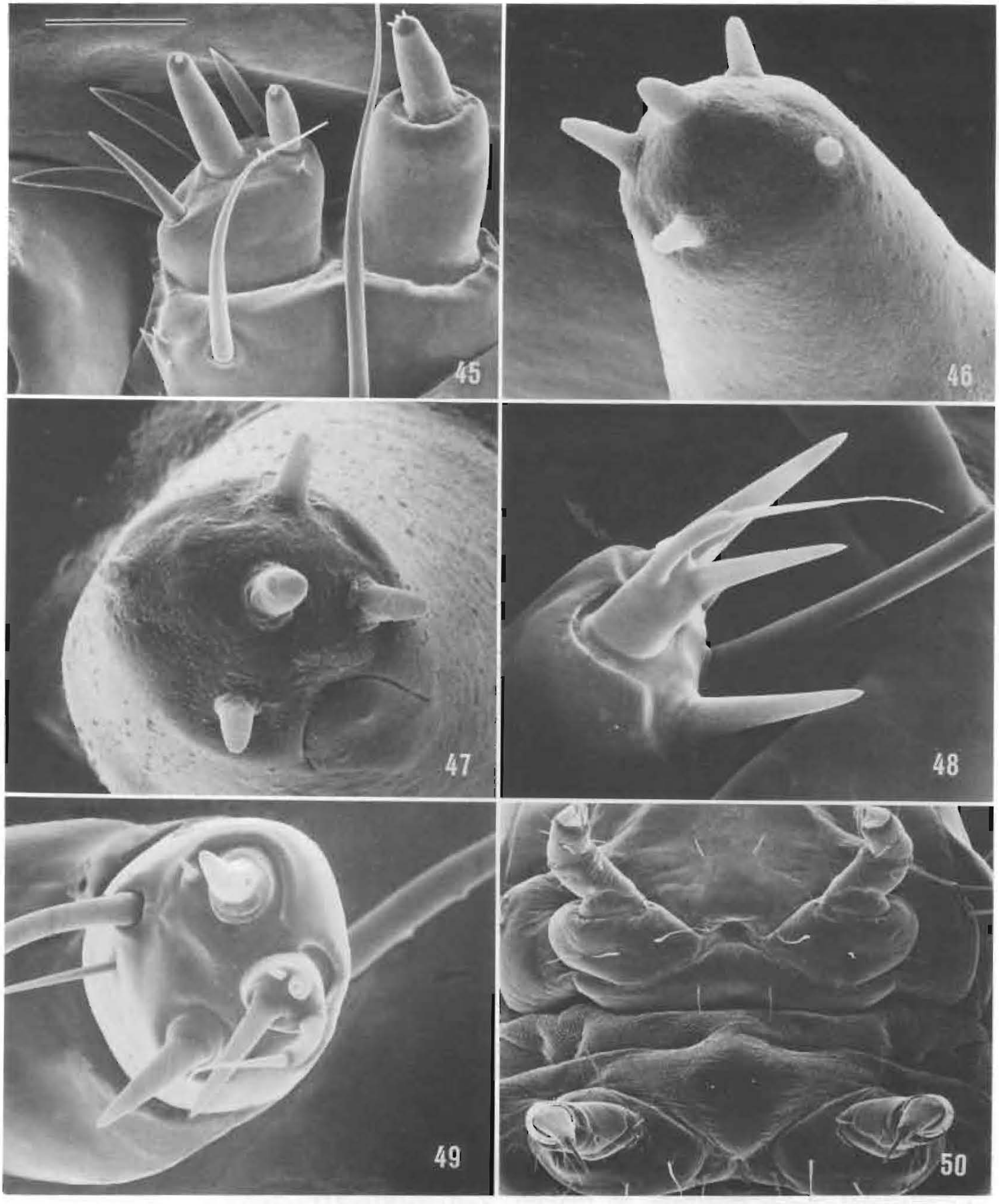
Thorax: Pronotum and spiracular plate dark reddish brown, lighter in color along margins; spiracle together with L setae on same plate. Pinacula over entire body relatively large, dark brown and very distinct on whitish integument. Meso- and metathorax with L2 arising on a separate pinacula from L1 and 3. MSD1 and 2 of similar length and reduced. Legs well developed; tarsal claw elongate; basal lobe actually bilobed and with a minute conical seta from inner angle (Figs. 51, 52).

Abdomen: Whitish in color with brownish pinacula. L2 on separate pinacula from spiracle. Prolegs well developed on A3–6 and 10; crochets A3–6 uniordinal, uniserial, and arranged in a complete ellipse composed of approximately 43–45 hooks; a scattered band of much smaller, numerous spines encircling apex of planta (Fig. 53); crochets on A10 with 20–22 hooks and a dense, scattered band of much smaller spines along anterior edge of planta (Figs. 55, 56).

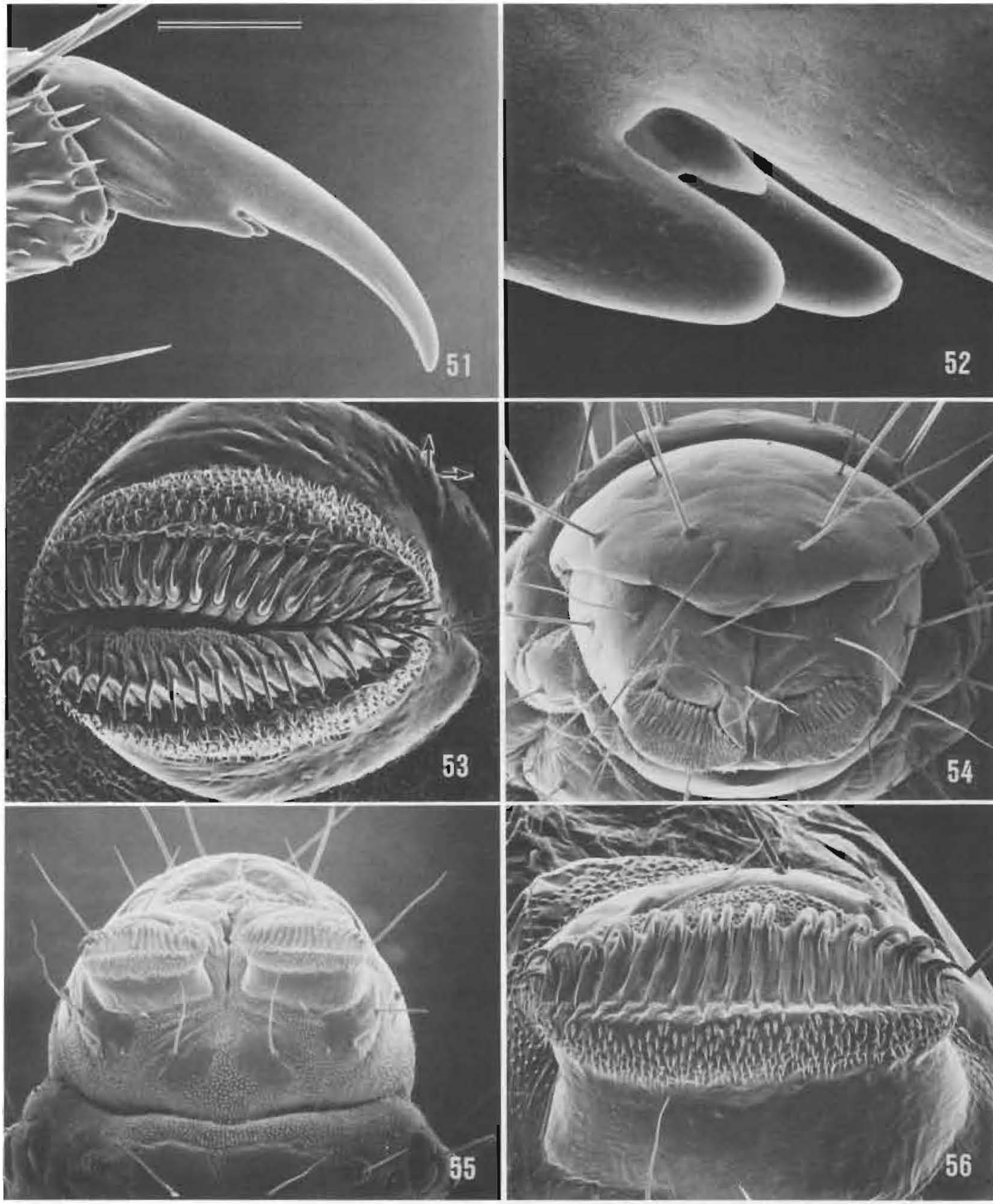
Pupa (Figs. 67, 68).—Length, 9–12.8 mm; maximum width, 2–3.5 mm. Color usually light brown ventrally and dark reddish brown dorsally; wing cases becoming darker with maturity; frontal process, cremaster, and adjacent areas extremely dark, often black. Head with frontal process (cocoon cutter) moderately developed, with a broad, triangular apex (Figs. 68, 78); labrum with a pair of lateral setae. Anterolateral margins of mesonotum with a pair of perforated bands composed of minute, raised slit openings (Figs. 69–71). Forewings extending to middle of A5. Hindlegs to A6. A simple, anterior row of short, stout, dorsal spines present on segments A4–8; tabulation of spines as follow: A4 = 56–70, A5 = 53–72, A6 = 57–71, A7 = 44–50, A8 = 8–18. Last pair (A8) of spiracles on raised, swollen bases (Figs. 74–76). Cremaster consists of a large pair of stout hooks arising dorsally from



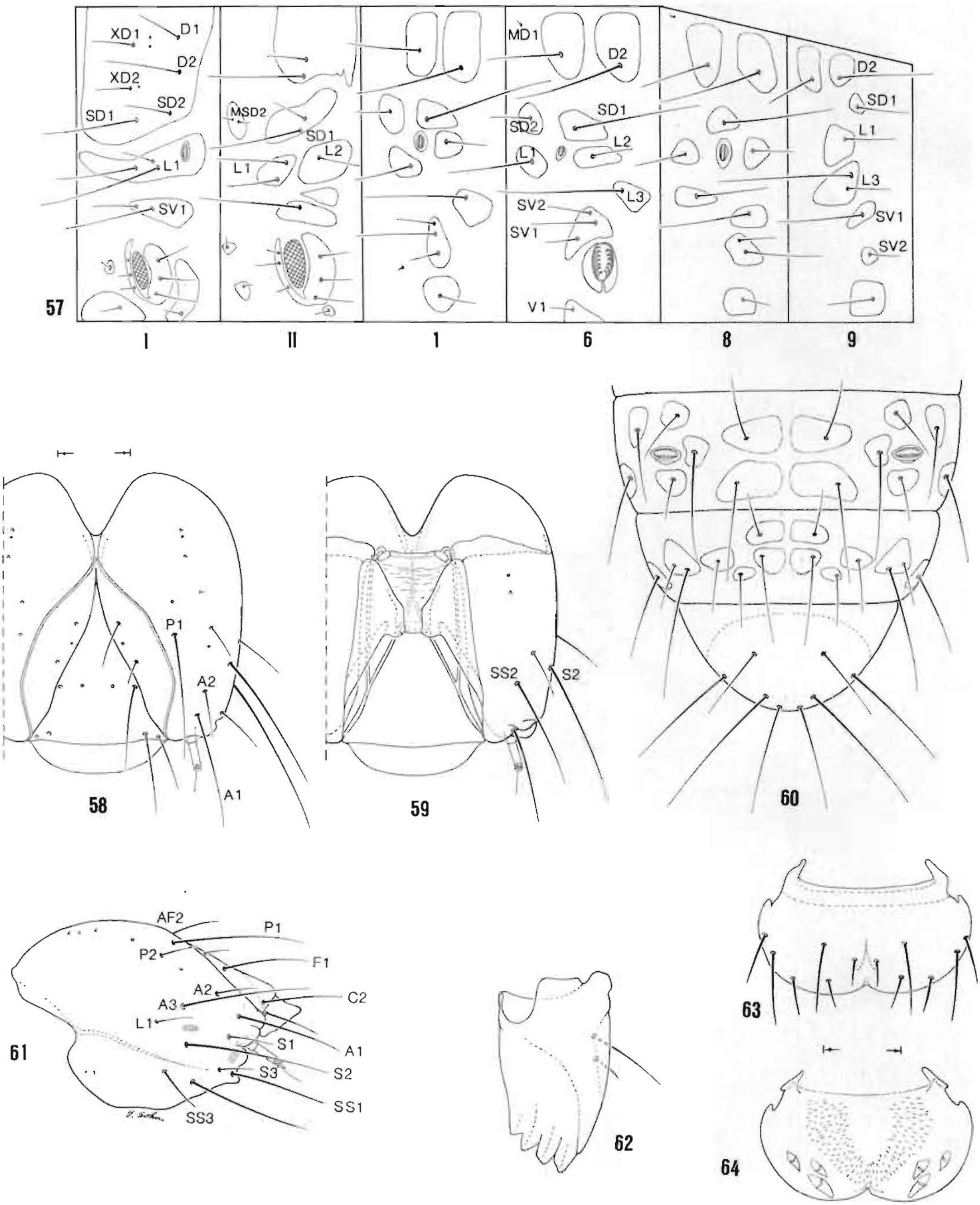
Figs. 39–44. *Opogona sacchari*, larval morphology. 39, Head, dorsal view (0.6 mm). 40, Labrum, dorsal view (176 μm). 41, Head, lateral view (0.43 μm). 42, Stemmal area (136 μm). 43, Head, ventral view (0.5 mm). 44, Maxilla and labium (150 μm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 39.)



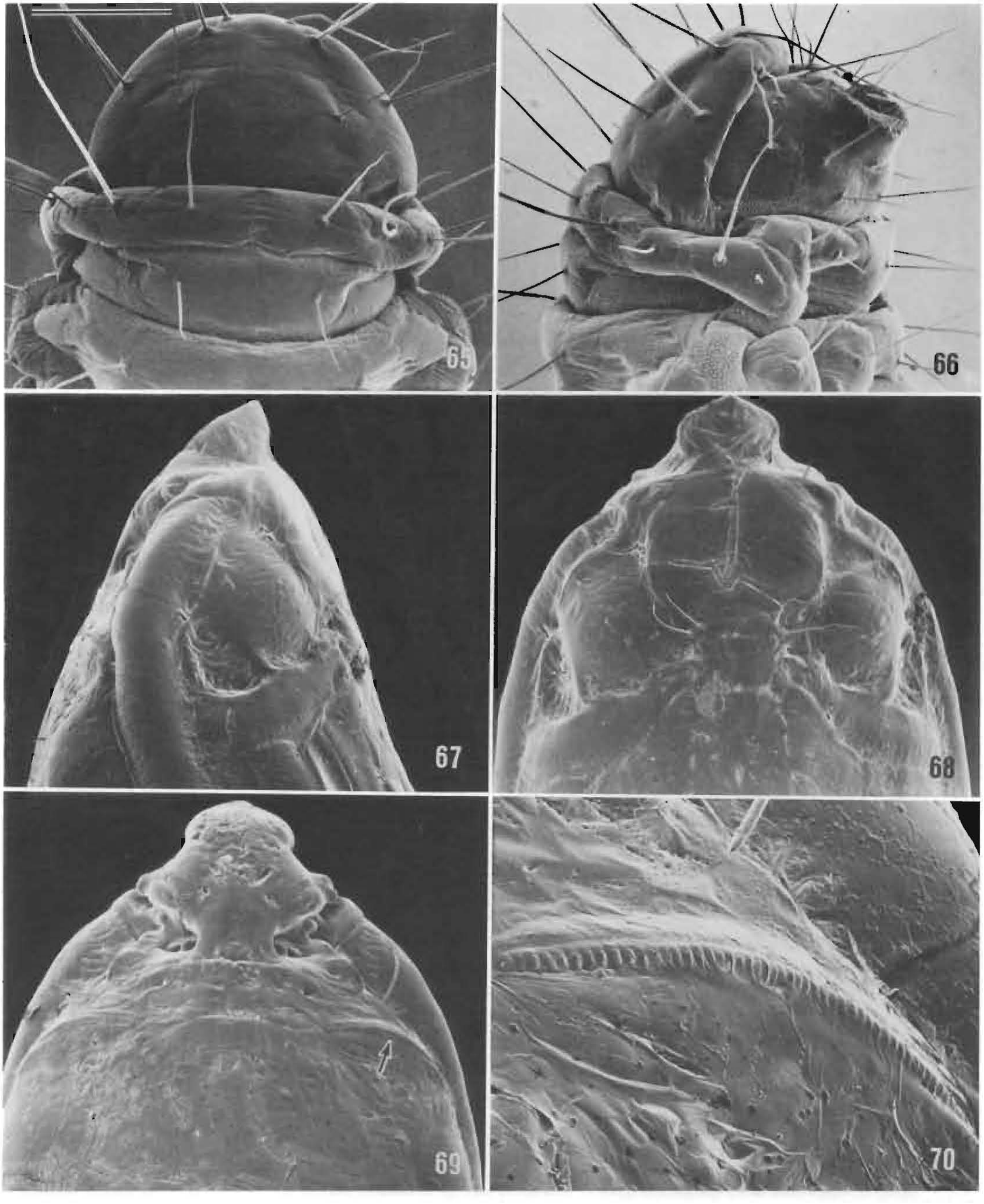
Figs. 45–50. *Opogona sacchari,* larval morphology. 45, Maxilla (60 μm). 46, Apex of maxillary palpus (6 μm). 47, Apex of maxilla (5 μm). 48, Apex of antenna (30 μm). 49, Apex of antenna (27 μm). 50, Ventral view of pro- and mesothorax (0.6 mm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 45.)



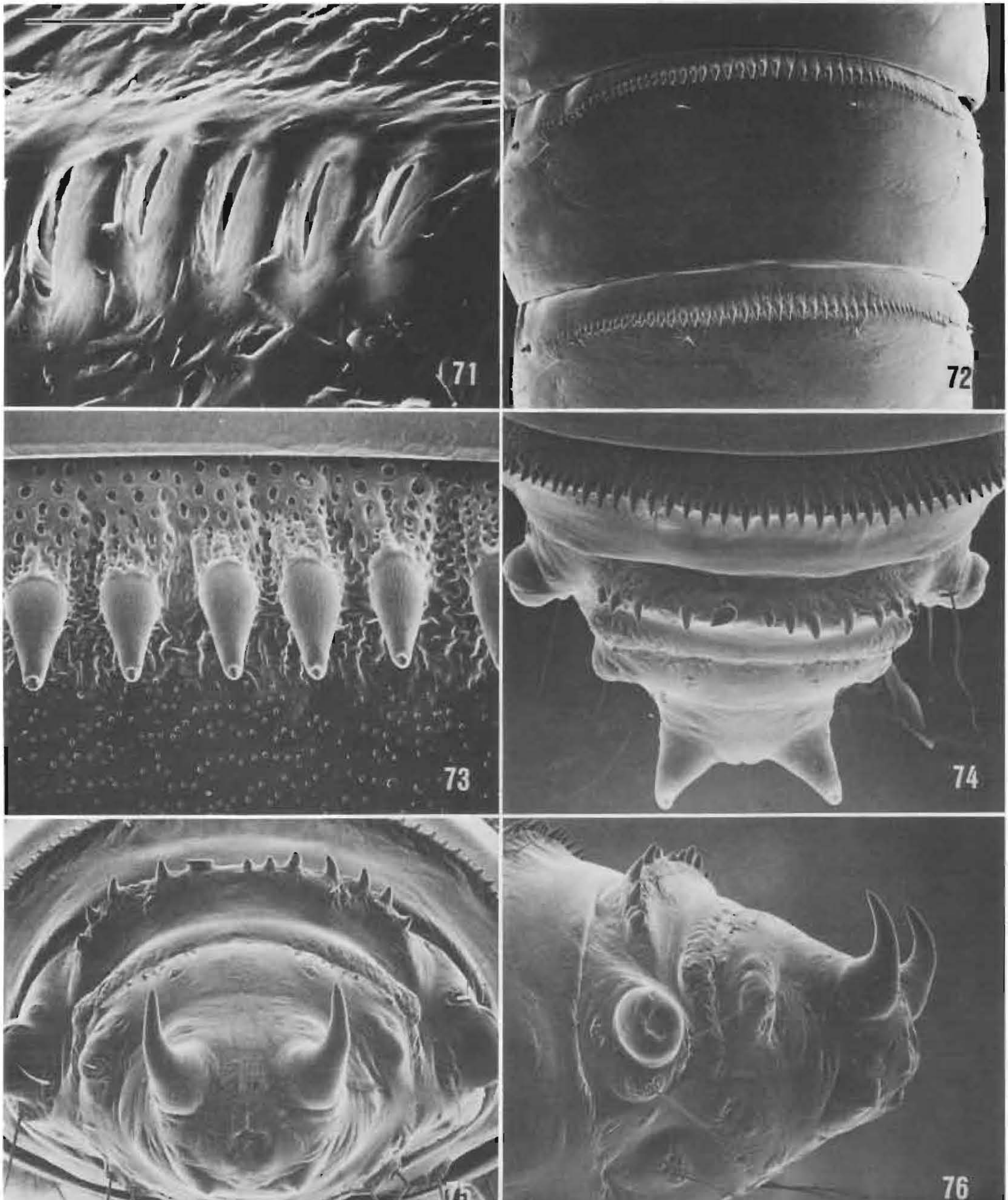
Figs. 51–56. *Opogona sacchari,* larval morphology. 51, Pretarsal claw of prothorax (50 μm). 52, Detail of axial lobes and seta of Fig. 51 (6 μm). 53, Proleg of A3, ↑ anterior, → meson (136 μm). 54, Caudal view last abdominal segment, A10 (0.5 mm). 55, Ventral view, A9, 10 (0.5 mm). 56, Anal proleg, A10 (150 μm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 51.)



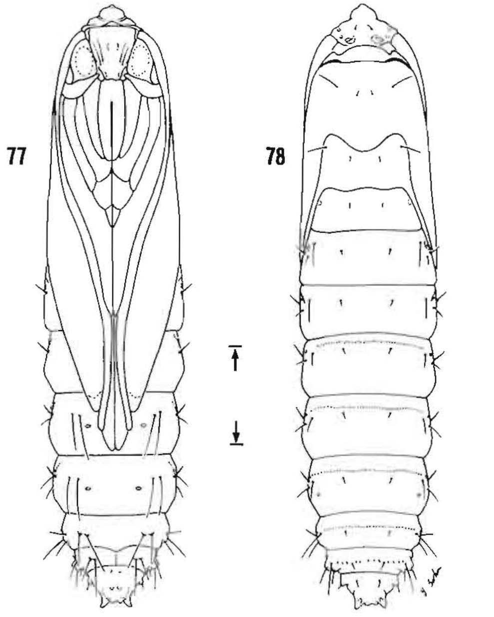
Figs. 57–64. *Opogona sacchari,* larval chaetotaxy. 57, Body segments T1–2, A1, 6, 8–9. 58, Head, dorsal view (0.5 mm). 59, Ventral view. 60, Segments A8–10, dorsal view. 61, Head, lateral view. 62, Mandible. 63, Labrum, dorsal view (0.25 mm). 64, Ventral view. (Scale lengths in parentheses.)



Figs. 65–70. *Opogona sacchari,* larval and pupal morphology. 65, Larval segments A8–10, dorsal view (0.6 mm). 66, Lateral view of Fig. 65 (0.6 mm). 67, Pupa, lateral view of head (0.6 mm). 68, Ventral view of Fig. 67 (0.6 mm). 69, Dorsal view of Fig. 67, perforated band (see arrow) (0.6 mm). 70, Detail of dorsal perforated band (136 μm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 65.)



Figs. 71–76. *Opogona sacchari,* pupal morphology. 71, Detail of openings in perforated band (see Fig. 69) (15 μm). 72, Dorsum of A4–5 (0.75 mm). 73, Dorsal spines of A4 (100 μm). 74, Dorsal view of A7–10 (0.5 mm). 75, Caudal view of A8–10 (0.5 mm). 76, Lateral view of A8–10 (0.5 mm). (Scale lengths in parentheses; bar scale for all photographs = Fig. 71.)



Figs. 77, 78. *Opogona sacchari,* pupa. 77, Ventral view (2 mm). 78, Dorsal view. (Scale lengths in parentheses.)

A10 (Figs. 74–76); a much smaller pair of conical tubercules also present ventrally.

Pupation occurs in a cocoon (Fig. 4) of white silk usually covered with dark frass and plant debris, 14–18 mm long, 3–4 mm in diameter. Normally, the cocoon is constructed somewhere in or near the feeding site.

Types.—Syntypes ♂, ♀, deposition unknown (*sacchari*); Holotype, BMNH (*subcervinella*); syntypes, ♂, ♀, BMNH (*sanctaehelenae*); holotype, sex unstated, BMNH (*ligniferella*); syntype(s)?, sex and number of specimens unstated, BMNH (*plumipes*).

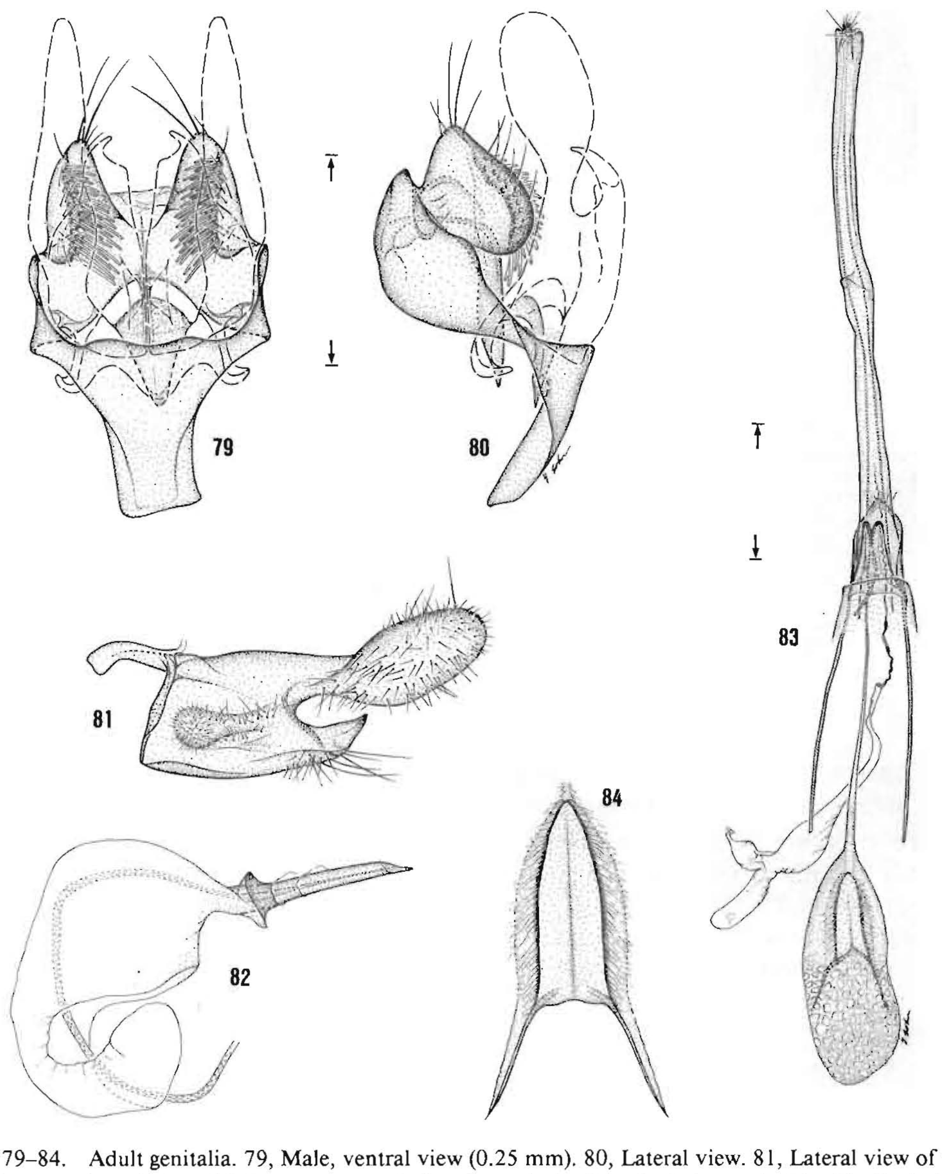
Type localities.—Mascarene Islands: Mauritius (*sacchari, subcervinella*), St. Helena (*sanctaehelenae, ligniferella*); Mascarene Islands: Rodriguez (*plumipes*).

Hosts.—46 plant hosts reported (see Table 1).

Distribution (maps 1, 2).—A widely ranging, partly pantropical species, early reported from several circum-African islands (Canary Islands, St. Helena, Mauritius, Rodriquez and the Seychelles), as well as South Africa; frequently intercepted in several European countries (Belgium, France, Great Britain, Greece, and the Netherlands). More recently, *O. sacchari* has been introduced into South America and the West Indies, including Bermuda, and is now established in nurseries over much of southern Florida.

Discussion.—By its relatively large size and predominantly brown color, *Opogona sacchari* is easily distinguished from nearly all other members of this large complex. Its affinities are with *O. omoscopa* (Meyrick) as suggested by their similar male genitalia and shared presence of a dorsal hair pencil in the hindwings of the male. Present evidence suggests that this complex of obviously related species warrants recognition under and resurrection of the currently synonymized genus *Hieroxestis.* Hopefully this and similar generic uncertainties can be resolved following a revision of the large cosmopolitan genus *Opogona.* The larva of *O. sacchari* may be recognized by the presence of two stemmata, separation of the spiracle from the pinaculum bearing L2 on the first eight abdominal segments, by the large number of crochets (A3–6 = 43–45, A10 = 20–22), and by complete encirclement of the abdominal planta by a band of small, secondary spines. In *O. omoscopa,* a pantropical species recently introduced into California (Davis 1978), only one anterior stemma has been observed, the first eight abdominal spiracles are united with L2 on a common pinaculum, the crochets are fewer in number, and the abdominal planta A3–6 have spines only along the anterior margin. The pupae of these two species are also similar but may be distinguished by the raised spiracle on A8 and larger cremaster spines of *O. sacchari.*

A peculiar structure of unknown function in the pupa of this species deserves further comment. It consists of a bilateral pair of perforated bands curving around the anterolateral margins of the mesonotum (Figs.



Figs. 79–84. Adult genitalia. 79, Male, ventral view (0.25 mm). 80, Lateral view. 81, Lateral view of valva. 82, Aedoeagus, lateral view. 83, Female, ventral view (1 mm). 84, Detail of signum in Fig. 83. (Scale lengths in parentheses.)

69–71). The bands are narrow and elongate and under high magnification can be observed to comprise raised, slitlike openings. The senior author has not noted this in other species, perhaps because the bands were simply overlooked. Possibly their function is merely to weaken the cuticle, thereby facilitating rupture of the pupal shell during eclosion. The band was observed to have been expanded or further separated in most pupal exuviae examined, although the major breaks in this region of the pupal shell during ecdysis did not occur through the perforated bands but were located anterior to the pronotum and down the mid-dorsal line of the pro- and mesonotum.

Table 1. Plant hosts of *Opogona sacchari.*

Plant Species	Reference	Country
Agavaceae		
Cordyline terminalis (L.) Kunth	Heppner et al. 1987	United States
Dracaena fragrans (L.)	Declercq and Van Luchene 1977	Belgium
Dracaena fragrans (L.) Ker-Gaus, "var. *massangeana*"	Heppner et al. 1987	United States
Dracaena marginata Lam.	Heppner et al. 1987	United States
Dracaena reflexa Lam.	Heppner et al. 1987	United States
Yucca elephantipes Regel	Heppner et al. 1987	United States
Yucca sp.	Heppner et al. 1987	United States
Araceae		
Colocasia esculenta Schott.	Cintra 1975	Brazil
Philodendron scandens Lindl.	Süss 1974	Italy
Araliaceae		
Polyscias fruticosa (L.) Harms	Heppner et al. 1987	United States
Polyscias fruticosa (L.) Harms, "elegans"	Heppner et al. 1987	United States
Asteraceae		
Dahlia sp.	Cintra 1975	Brazil
Bromeliaceae		
Aechmea fasciata (Lindl.) Baker	Süss 1974	Italy
Aechmea fasciata (Lindl.) Baker "Variegata"	Süss 1974	Italy
Guzmania lingulata var. × *magnifica* [Hort.]	Süss 1974	Italy
Nidularium tricolor [species name unknown, possibly = *Neoregelea* 'Perfecta Tricolor,' a cultivar]	Süss 1974	Italy
Caricaceae		
Carica papaya L.	Viette 1951	Madagascar
Convolvulaceae		
Ipomoea batatas Lam.	USNM (new record)	Peru
Cycadaceae		
Cycas revoluta Thunberg	Heppner et al. 1987	United States
Dioscoreaceae		
Dioscorea sp.	Heppner et al. 1987	United States
Gesneriaceae		
Gloxinia sp.	Süss 1974	Italy
Saintpaulia sp.	Süss 1974	Italy
Iridaceae		
Gladiolus sp.	Cintra 1975	Brazil
Leguminosae		
Albizia julibrissin Durazz.	Heppner et al. 1987	United States
Enterolobium sp.	Heppner et al. 1987	United States
Erythrina variegata L.	FSCA (new record)	United States
Liliaceae		
Sansevieria laurantii Wildem.	Süss 1974	Italy
Sansevieria trifasciata laurentii Wildem.	Declercq and Van Luchene 1977	Belgium
Malvaceae		
Hibiscus sp.	Moreton 1974	Great Britain

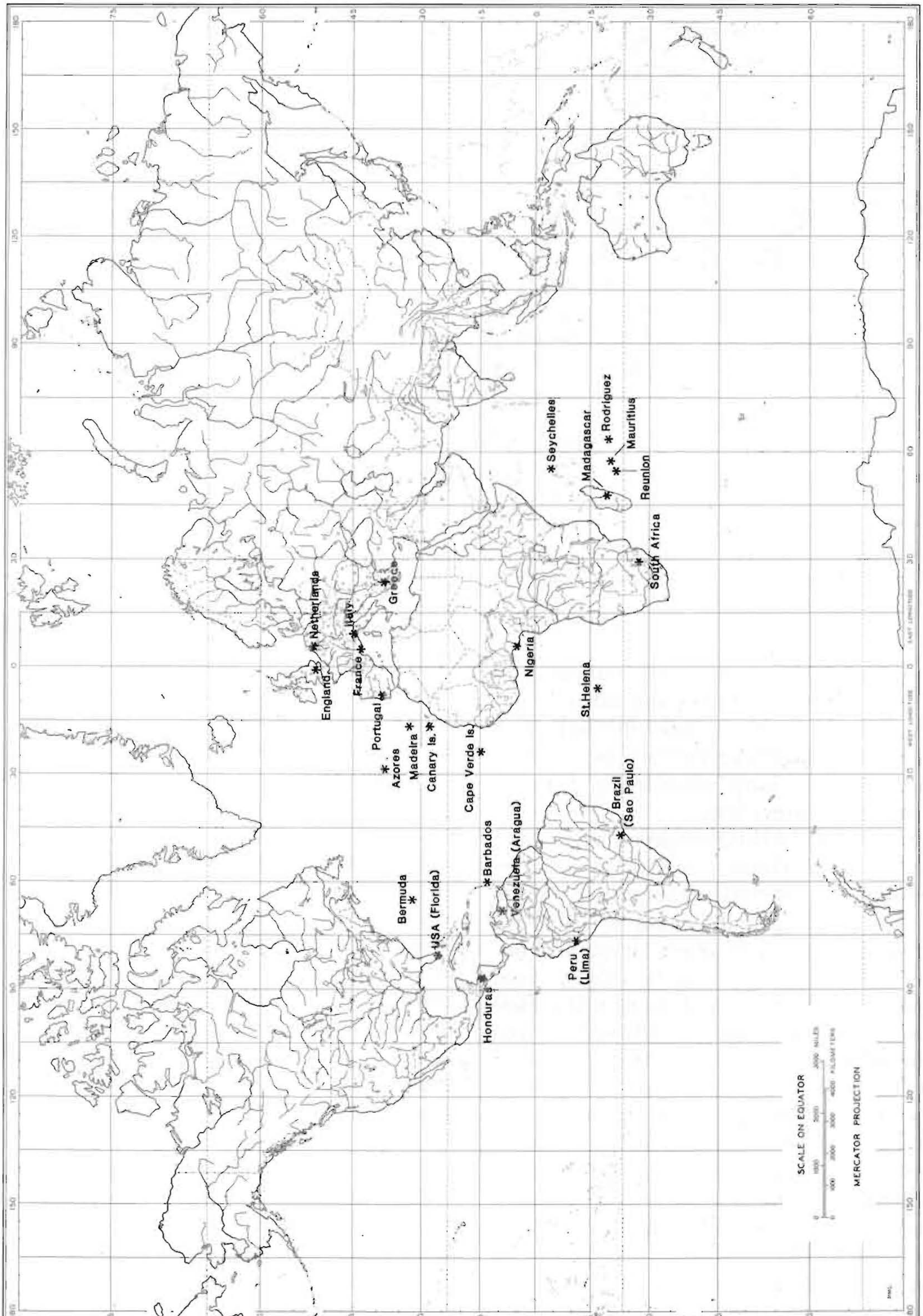
Table 1. Continued.

Plant Species	Reference	Country
Marantaceae		
Maranta leuconeura massangeana Schum.	Süss 1974	Italy
Stromanthe sanguinea Sonder	Süss 1974	Italy
Moraceae		
Ficus elastica (H. A. Siebrecht)	Moreton 1974	Great Britain
Musaceae		
Musa cavendishii Paxt	Oldham 1928	Canary Islands
Musa paradisiaca L.	Heppner et al. 1987	United States
Musa sapientum L.	Oldham 1928	Canary Islands
Strelitzia sp.	Zandvoort 1972	Netherlands
Orchidaceae		
"Orchids"	Heppner et al. 1987	United States
Palmae		
Arecastrum sp.	Heppner et al. 1987	United States
Bactris [= *Guilielma*] *gasipaes* HBK	Heppner et al. 1987	United States
Chamaedorea elegans Mart.	Heppner et al. 1987	United States
Chamaedorea erumpens H. E. Moore	Heppner et al. 1987	United States
Chamaedorea seifrizii Burret	Heppner et al. 1987	United States
Poaceae		
"Bamboo"	Oldham 1928	Canary Islands
Saccharum officinarum L.	Bojer 1856	Mauritius
Zea mays L.	Oldham 1928	Canary Islands
Solanaceae		
Capsicum sp.	Süss 1974	Italy
Solanum melongena L. var. *esculentum* Nees	Süss 1974	Italy
Solanum tuberosum L.	Oldham 1928	Canary Islands
Verbenaceae		
Clerodendrum sp.	Heppner et al. 1987	United States

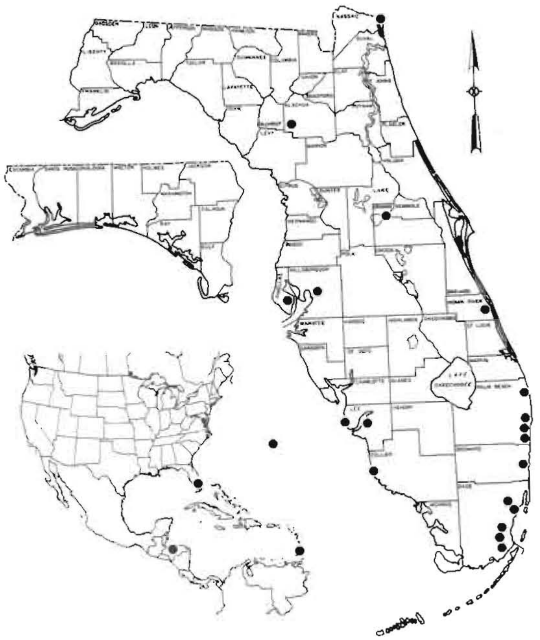
Biology

The larvae of most species of *Opogona* for which we have information are detritus feeders and rarely feed on living plant tissue. *Opogona sacchari* thus departs from the norm and can be a serious pest of banana, maize, potato, sweet potato, sugar cane, and certain greenhouse crops (Alam 1984, Durrant 1925, Oldham 1928, Süss 1975, Veenenbos 1981). A total of seven instars are indicated, based on head capsule measurements of larvae reared on artificial diet (Table 2). All measurements were based on pooled data for both sexes. The discreteness of the last two instars as interpreted from head capsule measurements presumably would be better had males only or females only been used. The SD values do not overlap as it is, so likely the conclusion reached as to instar number is correct. More precise data, however, might have shown indication of variation in instar numbers, which seems likely in a generalist feeder of this sort.

Oldham (1928) observed that *O. sacchari* larvae feed on nearly all parts of the banana plant except the roots and leaf blades. Larvae accepted leaves as a food in rearings but normally avoided this part of the plant in nature. The most serious damage occurred in the banana inflorescence. Larvae seldom feed exposed but burrow into the substra-



Map 1. Reported occurrence of *Opogona sacchari.*



Map 2. Distribution of *Opogona sacchari* in Florida (after Heppner et al. 1987).

Table 2. Larval head capsule width for 7 instar groupings of *Opogona sacchari* (Bojer).

Instar	N	Range (mm)	Mean ± SD (mm)	Ratio of Increase
1	26	0.16–0.24	0.18 ± 0.03	
2	20	0.26–0.32	0.31 ± 0.02	1.72
3	27	0.36–0.56	0.49 ± 0.01	1.51
4	20	0.58–0.88	0.91 ± 0.02	1.85
5	20	0.91–1.16	1.02 ± 0.04	1.12
6	20	1.20–1.44	1.42 ± 0.04	1.39
7	32	1.52–2.56	2.17 ± 0.04	1.42
			Average	1.52

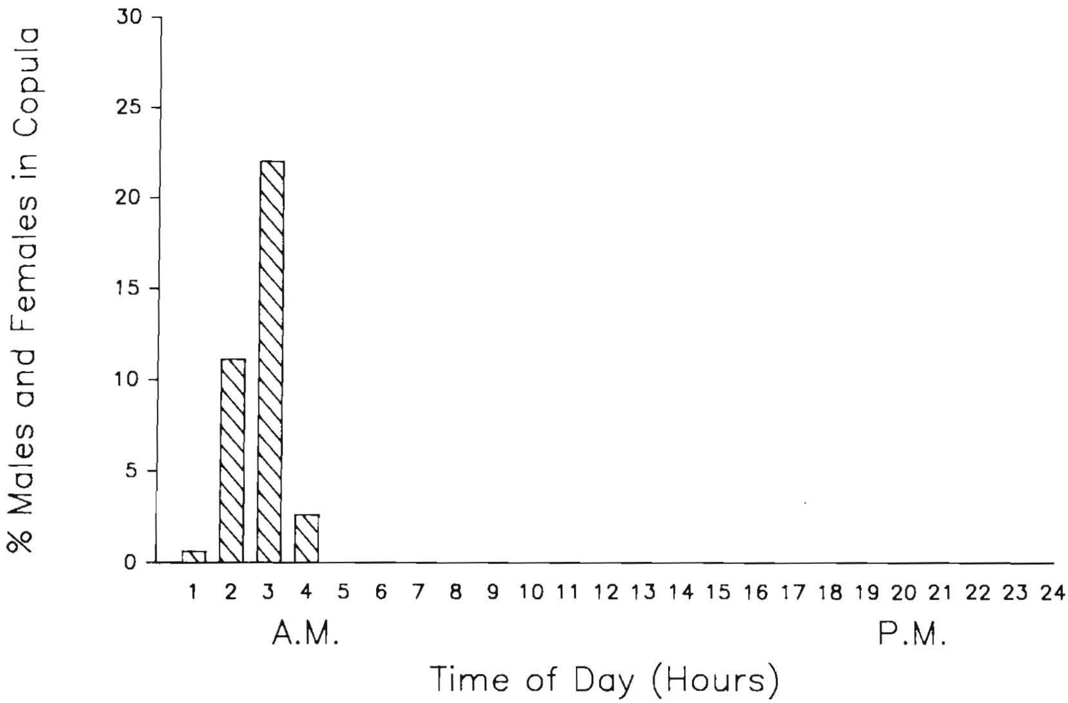
tum. Their presence is usually indicated by the accumulation of frass and other debris entangled in larval silk over the surface of the injury. The larvae are voracious feeders and construct long meandering galleries through the injury site.

Reports of larval damage on sugar cane has varied markedly. On Barbados, Alam (1984) noted extensive damage to live sugar cane, exceeding that caused by *Diatraea saccharalis* (F.). The young larvae feed under the leaf sheaths and, as they mature, penetrate the stalks and destroy the cane tissue. Infested stalks are hollowed out and gradually filled with larval frass. As in the case on banana, pupation occurs at the feeding site inside the stalks. At the infestation sites studied by J. E. Jones (in litt.), also on Barbados, *O. sacchari* was most abundant in dead or dying stumps and dead canes, suggesting they moved in following an infestation by *Diatraea*. Jones also found that the high incidence of *Opogona* on green canes was associated with a high infestation of *Diatraea*, again suggesting that *O. sacchari* invades burrows previously created by *Diatraea*. Thus, the observations by Jones agree most closely with those originally reported by Bojer (1856).

Observations in Florida

A laboratory colony of *O. sacchari* was initiated in 1985 with larvae and pupae collected from infested *Dracaena* canes found at a nursery in Homestead, Florida. Pupae were held individually in 36 ml diet cups until eclosion. Emerging adults were sexed and 17 pairs were placed in 11 cm × 14.5 cm plastic oviposition chambers along with folded filter paper. Adults were provided honey and water. Pairs were held until the female died, males were replaced as needed. The preoviposition period, fecundity and longevity of females and the time required for egg to hatch were determined. First instars were gathered from the oviposition chambers and placed on one of 3 artificial diets in an attempt to rear this species in the laboratory. The 3 diets used were: velvet bean caterpillar diet (VBC), sugar cane borer diet, and the elm spanworm diet (Fedde 1974). All rearing and diet tests were conducted in a rearing room with a photoperiod of 12:12 (L:D) (0600 to 1800 photophase), temp 24 ± 2°C, and RH 65–70%. Larvae were collected at different days from the diet, and preserved in a 70% alcohol for later measurement of head capsule width. Larvae

Table 3. Mating activity of moths in rearing chamber.



were checked daily for onset of pupation and pupal development time was recorded for 175 pupae.

Emerging adults were also placed in 53 × 53 × 50 cm screen cages with *Dracaena* and *Chamaedorea* potted plants. Number of eggs and oviposition site on each plant species was inspected daily.

Results and Discussion

Based on laboratory observations, development of an *Opogona* generation required 50–70 days. More eggs were present on unexpanded leaves and stems than on expanded leaves. Eggs are laid singly or in groups up to 328. They are light yellow at oviposition, turn a dark yellow color ca. 2 days later, and finally yellowish brown prior to eclosion. Eggs hatched in 7.02 ± 0.02 days at 24°C in the laboratory. The preoviposition period for newly emerged females in the laboratory was 1.66 ± 0.14 days at 25°C. Female longevity ($\bar{x} \pm$ SD, n = 20) in the laboratory was 9–17 days with a mean of 11.45 ± 0.72 days. Sixty first instar larvae were placed individually on each of the 3 diets tested. Survivorship on the artificial diet was low with the exception of velvet bean caterpillar diet. The highest percentage survivorship, 83%, was on VBC diet.

Experiments were conducted to monitor *O. sacchari* sexual activity throughout the night. Sets (n = 30) of 2–3-day-old virgin males and females were placed in petri dishes (9 cm in diameter) with water and honey as source of food. Each set was placed in an environmental chamber (LD 12:12, 24 ± 2°C, 75–80% RH). The experiment was replicated 4 times. Diel activity was monitored hourly from 6:00 pm to 7:00 am. The period of activity occurred between 1:00 am to 4:00 am. No sexual activity was observed before 1:00 am or after 4:00 am. Through this experiment it became apparent that the optimal response period for *O. sacchari* occurs 3 h before the end of scotophase (darkness) (Table 3).

The pupal stadium of larvae placed on VBC diet lasted 12.53 ± 0.33 days. The average weight of pupae was 0.043 g. Table 2 lists a 7 instar model which best fits the data according to Dyar's rule (Dyar 1890). As noted previously, these measurements are based on pooled data for unsexed larvae.

Typical damage of *O. sacchari* on *Dracaena* is characterized by removal of the bark and phloem. Cuttings of *Dracaena* having *Opogona* larvae show exterior debris and frass (Figs. 7, 8) deposits, and have internal feeding damage on dead and living portions of the cortex, pith, roots and leaves (Fig. 6). Damage is not evident 4–6 weeks after infestation. Typical damage to *Chamaedorea* palms can be observed 2–3 weeks after infestation. Each larva feeds at the base and roots of *Chamadorea,* and frass accumulates at the plant base from feeding into roots and petioles. In palms the leaf blades of the growing point become bleached and necrotic.

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