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THE IMMATURE STAGES OF *OXYTENIS MODESTIA*, WITH COMMENTS ON THE LARVAE OF *ASTHENIDIA* AND *HOMOEOPTERYX* (SATURNIIDAE: OXYTENINAE)

ANNETTE AIELLO

Smithsonian Tropical Research Institute, P. O. Box 2072, Balboa, Ancon, Republic of Panama

AND

MANUEL A. BALCAZAR L.[1]

Florida State Collection of Arthropods, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, P. O. Box 147100, Gainesville, Florida 32614, USA

ABSTRACT. The immature stages of *Oxytenis modestia* are described, with special attention to the first instar, the larval food plants are reported, and larval and adult behaviors are described. Limited information is given for the genera *Homoeopteryx* and *Asthenidia*, and they are compared and contrasted with *Oxytenis*.

Additional key words: Life history, *Alibertia edulis*, *Genipa americana*, Rubiaceae.

The genus *Oxytenis* Hübner includes 17 described species of medium-sized moths (Jordan 1924) that are patterned to resemble dried, brown leaves (Fig. 1c). *Oxytenis* and two other genera, *Asthenidia* Westwood and *Homoeopteryx* Jordan, have been treated as the family Oxytenidae (Jordan 1924). Minet (1994) showed that these three genera do form a monophyletic group and, because he considered them to represent the most 'primitive' lineage of the Saturniidae, he reassigned them to that family as the subfamily Oxyteninae.

Unfortunately, technical descriptions for the larvae of Oxyteninae are still lacking. Brief, superficial descriptions are available for the larvae of some species: *Oxytenis naemia* Druce, *O. angulata* (Cramer), *O. ferruginea* Walker, *O. modestia* (Cramer) and *Asthenidia lactucina* (Cramer) (Jordan 1924, Draudt 1929). Nentwig (1985) described and illustrated

[1] Present address: Departamento de Zoología, Instituto de Biología, Universidad Nacional Autonoma México, Apdo. Postal 70-153, 04510 Mexico D. F., MEXICO

the striking sequence of mimicry presented by various instars of *O. naemia*. Miles Moss produced a series of beautiful water color paintings of various oxytenine larvae, but these were never published and are in the Natural History Museum, London. Here we describe the immature stages and larval biology of *Oxytenis modestia*.

MATERIALS AND METHODS

Oxytenis modestia (Fig. 1) was reared by the senior author on several occasions, from larvae collected on *Alibertia edulis* (A. Rich.) A. Rich. and *Genipa americana* L. (Rubiaceae) (see Table 1 for list). The only eggs obtained (Aiello Lot 80-9) were from a female collected at light on Barro Colorado Island, Panama, on 8 March 1980.

Of the 96 eggs produced by the female, ten were preserved in 70% ethanol. The remaining 86 eggs were divided into four groups, placed in petri dishes, each with a piece of moist folded paper towel, and kept in ZipLoc bags in an air conditioned laboratory. Upon hatching, the larvae were offered squares of 11 different species of plants, all members of the Rubiaceae: *Alibertia edulis*, *Alseis blackiana* Hemsl., *Coussarea curvigemmia* Dwyer, *Faramea occidentalis* (L.) A. Rich., *Hamelia patens* Jacq., *Isertia haenkeana* DC., *Ixora coccinea* L., *Palicourea guianensis* Aubl., *Psychotria grandis* Sw., *Psychotria marginata* Sw., and *Randia armata* (Sw.) DC. The larvae preferred young leaves of *Alibertia* but ate small amounts of young *Alseis*, *Ixora*, and *Randia* as well. They were reared on *Alibertia edulis*. As they developed, the majority of the 86 individuals were preserved at various stages as vouchers, and only 12 individuals were reared to adults.

Specimens reared before 1981 are at the National Museum of Natural History (NMNH), Washington DC; those reared from 1981 to the present are at the Smithsonian Tropical Research Institute (STRI), Panama. Voucher specimens of all instars reared from eggs were preserved in 1:1 xylene : ethanol-95% (XA) and are at the NMNH. To study the morphology of the first instar in detail, two larvae were prepared for viewing in a Scanning Electron Microscope (SEM). The larvae were dehydrated in graded series of ethanol (70%, 80%, 90%, and 100%), then critical point dried in a DCP-1 Denton Vacuum with carbon dioxide. Specimens were then mounted on points and coated with a Denton Vacuum Desk II sputter coater, using a gold target, for 6 minutes (15 Ma). Prepared specimens were held on micro test clips (Radio Shack 270-373) and mounted on stubs for observation with a Hitachi 570s (15kV) SEM.

Morphological terms follow Dethier (1941) for the antennae, Grimes and Neunzig (1986a, 1986b) for the maxillae, Beck (1961) and Miller (1991) for tarsal setae, Stehr (1987) for chaetotaxy and general morphology, and Mosher (1916) for the pupae.

FIGS 1–7. **1–4,** *Oxytenis modestia:* **1 (upper):** adult male (Aiello Lot 85-26), **1 (middle):** adult female (Aiello Lot 81-65), **1 (lower):** adult female (natural position) (Aiello Lot 84-55 no.4), 6.5 cm across; **2,** final instar (green morph) (Aiello Lot 80-9 no.1), 3.6 cm long; **3,** final instar (brown morph) (Aiello Lot 87-52 no.1); **4,** fourth instar (Aiello Lot 87-63), 2.6 cm long. **5,** bird-dropping, 2.1 cm long. **6,** *Homoeopteryx malecena* early final instar (Aiello Lot 79-122), 3.1 cm long. **7,** *Asthenidia transversaria* final instar (Aiello Lot 81-37), 3.5 cm long.

IMMATURE STAGES

Stock source. The female moth, collected as Aiello Lot 80-9, on 8 March, began ovipositing shortly after being placed in a wire and petri dish cage with a leaf of *Faramea occidentalis*. Before dying on 12 March, she laid 96 eggs on the floor paper and the wire walls, as well as on the leaf.

Egg. Duration 5 days. Ellipsoid, approximately 1.3 mm in length, green. The eggs were green when fresh, but gradually faded to yellow by day five. By day three, the stemmata began to show through the chorion of some individuals, and by day four the mandibles were visible. On day five, the final day of the egg stage, the larvae could be seen clearly. They were folded twice to form a condensed 'S,' and they slowly shifted position within the egg.

First instar, general. Duration 4–5 days. Pale beige in color; head 0.6 mm wide; body 3.8–4.2 mm long; primary setae represented by granulate setae and chalazae with bulbous glandular tips that secrete a sticky substance. ***Head:*** (Figs 8, 9), hypognathous; surface smooth with long primary setae and without secondary setae, F1 very short, C2 arises from the lateral margin of the clypeus and runs parallel to the head surface, A1 shortest A seta, S2 and A3 well above the stemmatal semicircle; stemmata 1–2 and 3–4 very close forming a semicircle, stemma 5 distant and ventral to 6; ecdysial line and fronto-clypeal suture inconspicuous; adfrontal suture conspicuous only for upper half of the frons; anteclypeus grooved; labrum with six pairs of setae, without notch; mandibles quadrate with five opposable teeth; antennae (Fig. 11) prominent, segment 1 short; segment 2 with two sensilla trichodea (ST) on the external side, sensillum anterior several times larger than caudal sensillum, with three sensilla basiconica (SB), the larger ones near the anterior and posterior margins of the segment, the small SB half-way between the anterior SB and ST; segment 3 projecting, located medially with respect to S2; sensillum styloconicum (SC) as long as longest sensillum basiconicum, and located in the posterior and anterior margins respectively, two small SB medially and laterally; maxillary lobe with STI removed ventrolaterally from and larger than STII–III, all acicular; MSS and LSS subequal; all other sensilla inconspicuous; maxillary palpus with all eight sensilla basiconica subequal; spinneret (Fig. 12) dorsoventrally compressed, truncate. ***Thorax:*** relatively smooth; spiracle oval, as large as that on A7; primary setae XD, D and SD represented by chalazae with setae bearing bulbous glandular tips (Figs. 9, 10, 16), except for D1 and D2 on T1 and D2 on T2, which are thick setae; L group with two setae on T1, and one on T2–3; two SV and one V on all three segments; thoracic legs with seta 2 (Ts2) acicular (Fig. 13), Ts3 and Ts1 lanceolate, Ts3 slightly longer than Ts1. ***Abdomen:*** A1–8 with D1 and SD1 as chalazae with gland-tipped setae, only one SD, L, and SV setae; a minute, round spiracle on A1–6, A7 with an oval larger spiracle, A8 with largest, circular spiracle; a chalaza with gland-tipped seta as D1 on anal shield. Crochets 6 or 7, in a uniordinal homoideous mesoseries plus 4–5 crochet remnants of a uniordinal lateroseries. Crochets not deeply set in the spatula on the proleg; the fleshy lobe of the proleg gives the crochets a more or less C-shaped pattern (Fig. 15). The first instars emerged from their eggs the morning of day six and, after testing them with a variety of rubiaceous plants, all were reared on *Alibertia edulis*.

Second instar. Duration 3–5 days. Similar to first instar except that the chalazae are larger and are drawn out to form a stalk, tipped by a sticky gland; the metathoracic, L chalaza is located on a tiny triangular lateral flange and is gland-tipped; the D1 chalazae of A8 are located at the tip of a fleshy 'tail,' and the larva is now darker and has the overall appearance of a bird dropping.

Third instar. Duration 4–6 days. A larger version of the second instar, except that it is black with large brown chalazae (Fig. 4) and is an excellent mimic of a bird dropping filled with seeds (Fig. 5).

Fourth instar. Duration 3–5 days. Essentially the same as the third, only larger.

Fifth instar. Duration 6–7 days if final, 3–4 days if not final. This species has a variable number of stadia, independent of sex, and the final instar is different from the others, whether instar 5 or 6. If the fifth instar is not the final instar, it looks essentially the same as the three previous instars, only larger. If the fifth instar is the final instar, it takes on a different appearance, a description of which appears under "sixth instar."

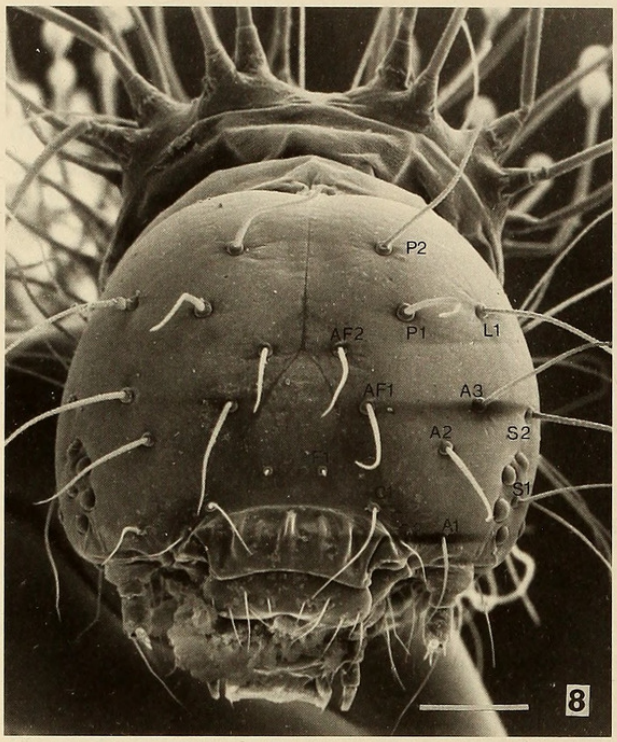
TABLE 1. *Oxytenis modestia*, *Homeopteryx macelena*, and *Asthenidia transversaria* reared by the senior author.

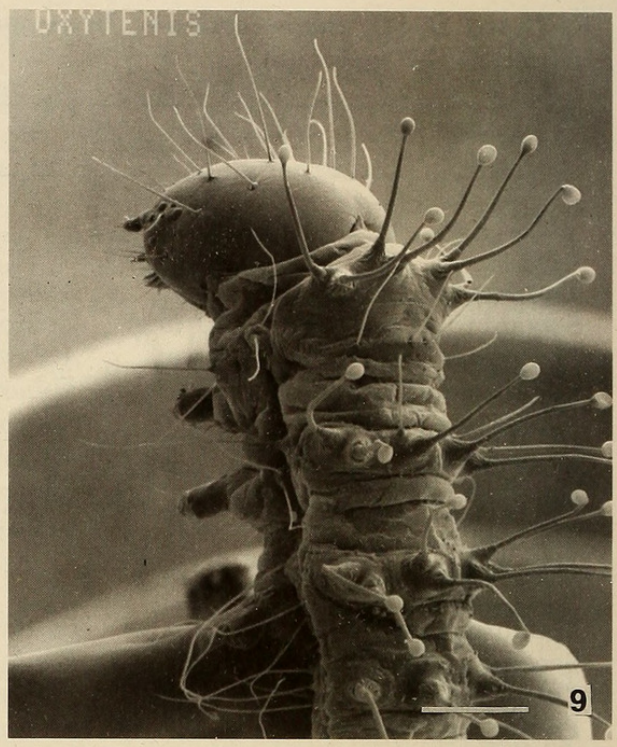
Stage collected	Number adults obtained	Larval food plant (Rubiaceae)	Aiello lot #
Oxytenis modestia			
Eggs	7 m, 5 f		80-9
Third to final instar	1 f	*Genipa americana* L.	84-55
Second to final instar	1 m	*Genipa americana* L.	85-126
Penultimate instar	1 m	*Alibertia edulis* (A. Rich.) A. Rich. in DC.	81-43
Penultimate instar	1 f	*Alibertia edulis* (A. Rich.) A. Rich. in DC.	81-65
Penultimate instar	1 m	*Genipa americana* L.	87-52
Final instar	1 f	*Alibertia edulis* (A. Rich.) A. Rich. in DC.	80-46
Final instar	1 f	*Genipa americana* L.	78-90
Pupa	1 f	*Genipa americana* L.	78-91
Homoeopteryx malecena			
Penultimate instar	1 f	*Faramea occidentalis* (L.) A. Rich.	82-24
Second to final instar	1 f	*Faramea occidentalis* (L.) A. Rich.	82-49
Third to final instar	1 m	*Faramea occidentalis* (L.) A. Rich.	82-78
Penultimate instar	1 f	*Faramea occidentalis* (L.) A. Rich.	79-122
Final instar	1 f	*Faramea occidentalis* (L.) A. Rich.	80-74
Asthenidia transversaria			
Final instar	1 f	*Calycophyllum candidissimum* (Vahl) DC.	81-37
Penultimate instar	1 m	*Warscewiczia coccinea* (Vahl) Kl.	81-67

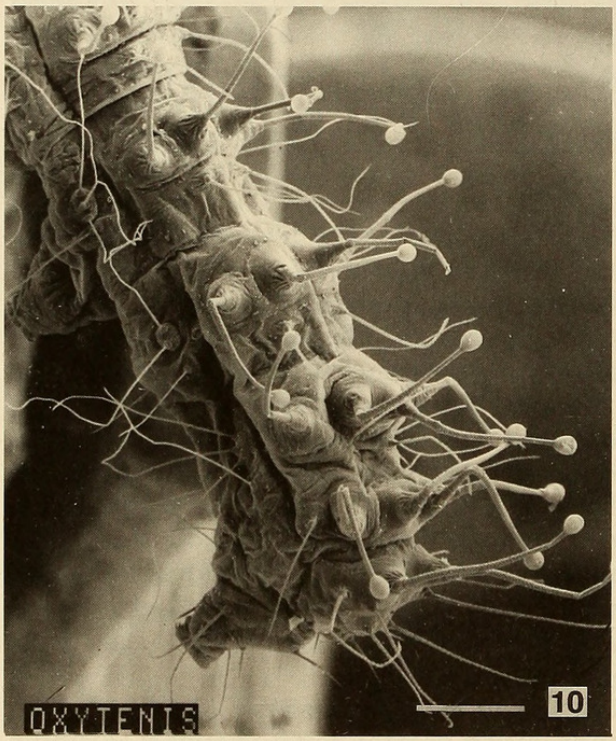
Sixth instar: Duration 6–8 days. Regardless of whether it is the fifth or the sixth, the final instar looks quite different from any of the preceding instars and it occurs as either a green or a brown morph, with variations. In all cases, the metathorax bears subdorsal eye spots (black, bordered by yellow) towards the anterior margin. These 'eyes' are located in a fold of cuticle and thus can be 'opened' and 'closed' by raising or lowering blood pressure to the thorax. At rest the eyes are closed, but a highly disturbed larva inflates the thorax, thus opening the 'eyes,' and rears up, waving back and forth like an angry serpent. In this stadium, the glands are tiny and sessile on the body, and the L gland of the metathorax is missing. The green morph (Fig. 2) is dark green with a bright green dorsal stripe that widens on A4, narrows on A5, then widens again to cover the sides of the body on A6–8. A long black dorsal diamond mark on A6–8 terminates with the 'tail.' Occasional individuals have the dorsal stripe cryptically marked with brown, yellow, green, and black. Brown individuals (Fig. 3) are like the green ones except that the ground color and dorsal stripe are brown; the head remains green, however.

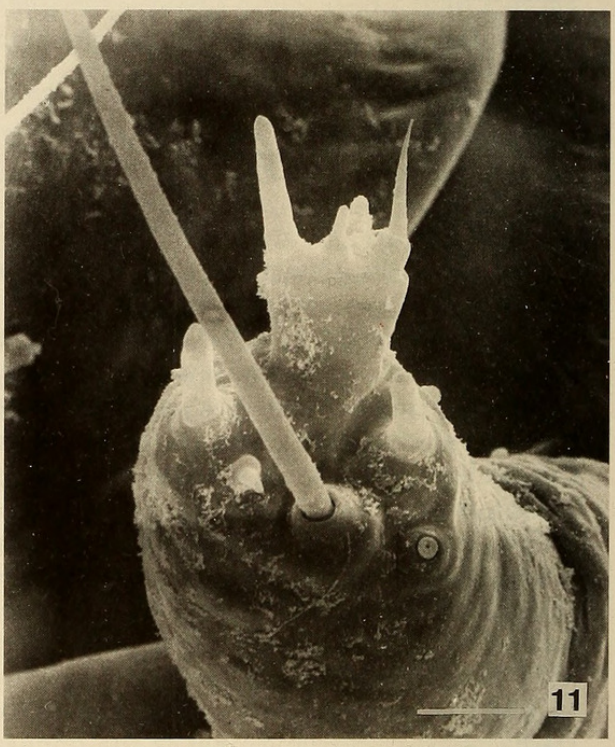
Larvae, general: Individuals passed through five to six larval instars (Table 2). Larval stadia were trimorphic, that is the general appearance of each larva changed abruptly upon the molt to second instar and changed again upon molting to the final instar, regardless of whether that final instar was the fifth or the sixth. The condition of trimorphic larval stadia together with a variable number of larval instars occurs as well in the nymphalid *Dynastor darius* (Fabricius) (Aiello, 1978), and in the saturniid *Arsenura batesii* (Aiello, pers. obs.). In the case of *Oxytenis* the situation is more complex because, in addition, the larvae are polymorphic for color pattern within the later intermediate stadia and the final stadium; some individuals are green (Fig. 2) and some are brown (Fig. 3), regardless of sex, and they show varying degrees of pattern complexity. As the result of this variation in color and development the larger larvae of a brood tend not to resemble one another; the multiple search images resulting from such variation perhaps make them less easy for a predator to locate.

From the outset, the larvae assumed a 'J' position, with the head and thorax turned back



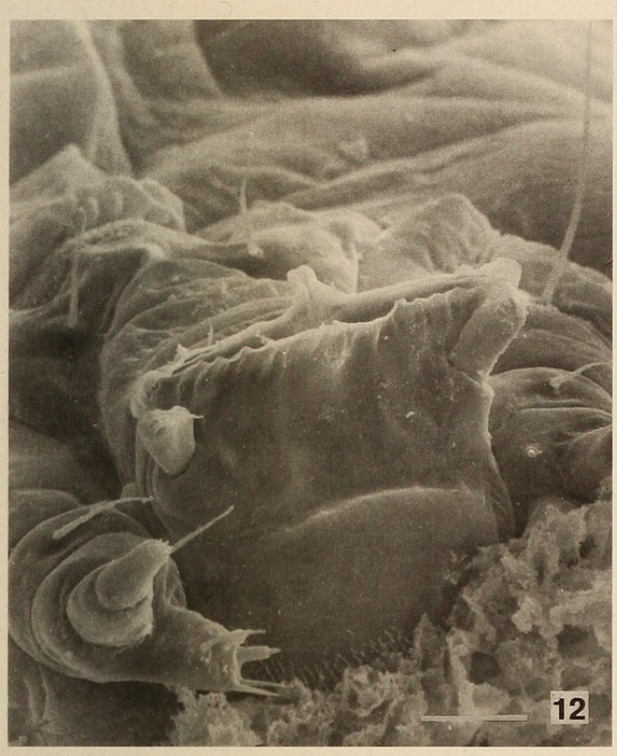


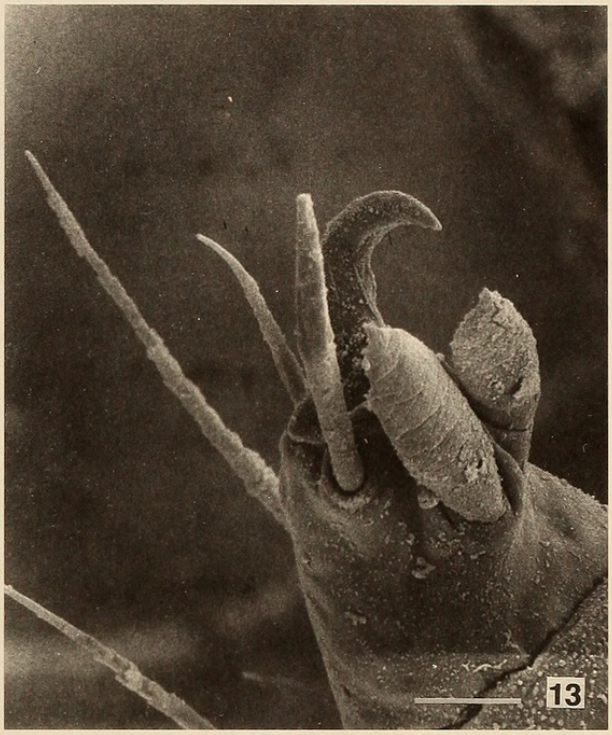


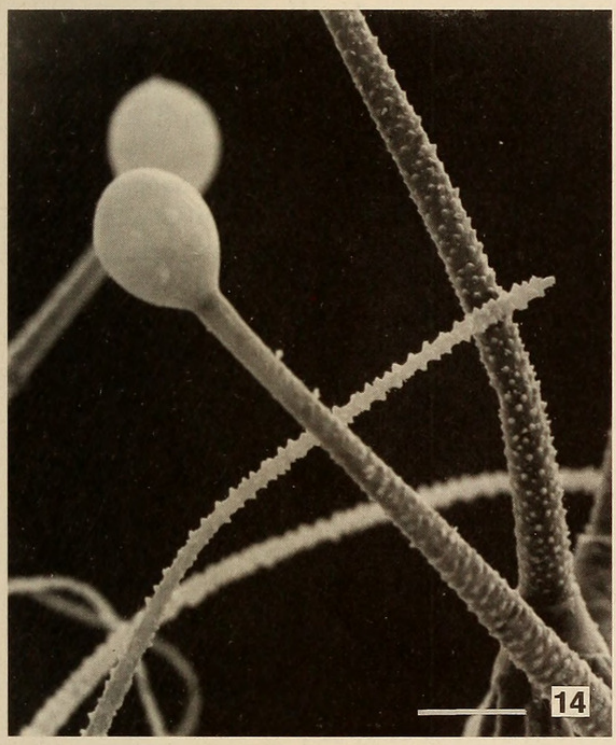


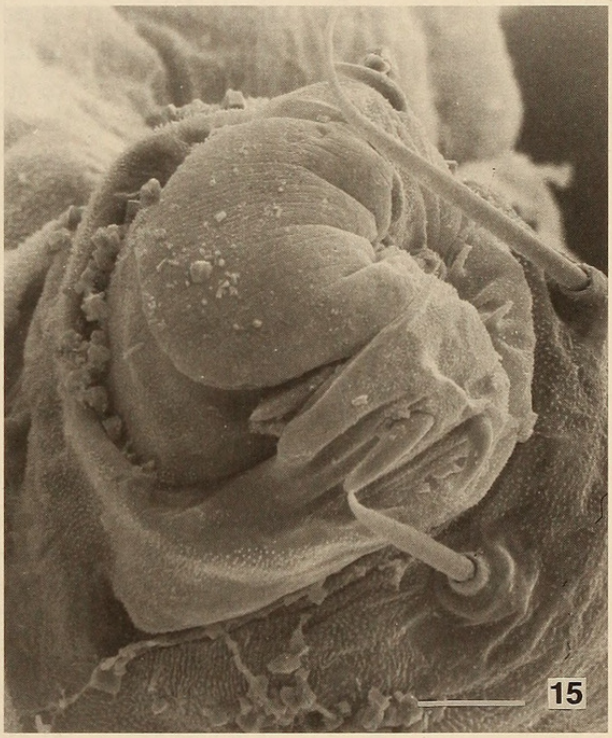
FIGS. 8–11. **8,** *Oxytenis modestia* first instar, head (front view) (Aiello Lot 80-9). A = anterior setae, AF = adfrontal setae, C = clypeal setae, F = frontal setae, L = lateral setae, P = posteriodorsal setae, S = stemmatal setae. Scale line = 0.15 mm; **9,** *Oxytenis modestia* first instar, head and thorax (lateral view) (Aiello Lot 80-9). Scale line = 0.3 mm; **10,** *Oxytenis modestia* first instar, abdominal segments 6–10 (lateral view) (Aiello Lot 80-9). Scale line = 0.25 mm; **11,** *Oxytenis modestia* first instar, right antenna (ventral view, with anterior at top) (Aiello Lot 80-9). Scale line = 11.55 um.

to one side and pressed against the abdomen when mildly disturbed or when at rest, a behavior that continued throughout larval life, and which, especially in the intermediate instars, gave the larva the appearance of a bird dropping. All larval instars bore sticky glands. Perhaps to avoid contamination of these glands, the larvae grasped their fecal pellets in









FIGS. 12–15. **12,** *Oxytenis modestia* first instar, hypopharingeal complex (dorsal view with anterior at top). (Aiello Lot 80-9). Scale line = 37.5 um; **13,** *Oxytenis modestia* first instar, right pretarsus of mesothoracic leg (mesal view) (Aiello Lot 80-9). Scale line = 25 um; **14,** *Oxytenis modestia* first instar, gland-tipped setae (D on A2–3, detail) (Aiello Lot 80-9). Scale line = 37.5 um; **15,** *Oxytenis modestia* first instar, left proleg (Aiello Lot 80-9). Scale line = 25 um.

their mandibles as they were produced and dropped them off the leaf. Interestingly, the earliest instars of various *Oxytenis* species are superficially similar, in color and pattern, to the earliest instars of various species of *Adelpha* Hübner (Nymphalidae) that feed on the same array of rubiaceous plants (Aiello, pers. obs.). The larvae remained on the upper surface of their food leaves except during molting, at which time they moved to the wall of

TABLE 2. Development times of the twelve *Oxytenis modestia* reared as Aiello Lot 80-9; e = egg, 1 = first instar, 2 = second instar, 3 = third instar, 4 = fourth instar, 5 = fifth instar, 6 = sixth instar, P = pupa. Boldface marks the onset of the final instar, which was fifth instar for some individuals and sixth for others.

Day	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5
Individual	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
1	e	e	e	e	e	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	**5**	5	5	5	5	5	P	P	P	P	P	P	P	P	P	P	P	P	male									
2	e	e	e	e	e	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	**5**	5	5	5	5	5	5	P	P	P	P	P	P	P	P	P	P	P	P	male								
3	e	e	e	e	e	1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	5	5	5	**6**	6	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	female								
4	e	e	e	e	e	1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	**6**	6	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	female								
5	e	e	e	e	e	1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	**6**	6	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	female								
6	e	e	e	e	e	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	**5**	5	5	5	5	5	5	P	P	P	P	P	P	P	P	P	P	P	P	P	male								
7	e	e	e	e	e	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	**6**	6	6	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	male
8	e	e	e	e	e	1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	**6**	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	male								
9	e	e	e	e	e	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	5	**6**	6	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	female
10	e	e	e	e	e	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	**6**	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	female								
11	e	e	e	e	e	1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	**6**	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	male								
12	e	e	e	e	e	1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	6	6	6	6	6	6	P	P	P	P	P	P	P	P	P	P	P	P	male								

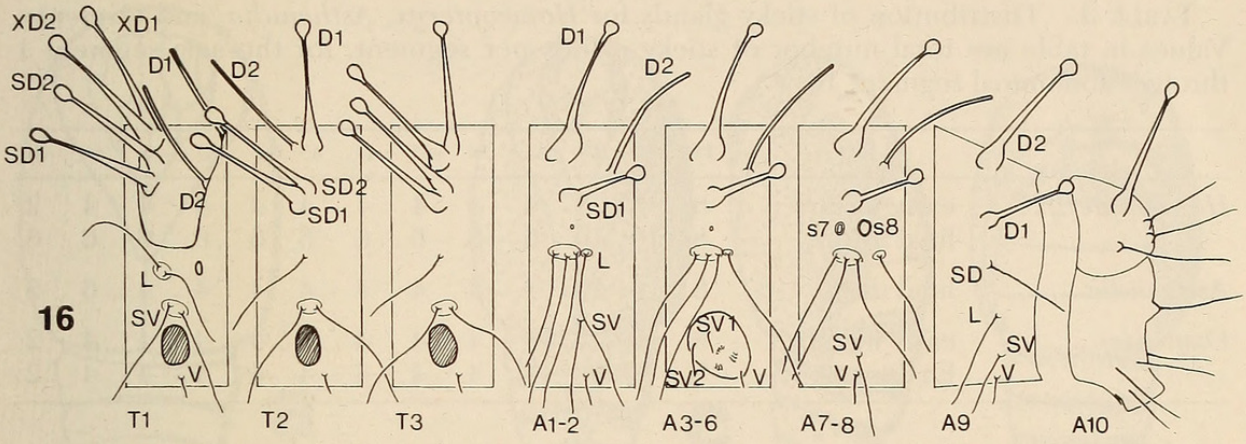


FIG. 16. *Oxytenis modestia* first instar, setal map. A = abdominal segment, D = dorsal setae, L = lateral setae, s = spiracle, SD = subdorsal setae, SV = subventral setae, V = ventral seta, XD = extradorsal setae.

the petri dish. In the wild, larvae of *Oxytenis modestia* usually move to the petioles and branches to molt, although they may remain on the blade (Aiello, pers. obs.).

Pre-pupa: Much faded and shortened, with the 'eyes' opened. Mature larvae constructed very loose cocoons of leaves and wet, stretchy, reddish silk on the floor of the cage, and they produced a copious puddle of liquid in which the pre-pupae rested. Being shrunken, faded, and wet, they appeared dead and rotten, but, the next morning, they pupated. The production of liquid by pre-pupae has been reported for two sphingids, *Manduca* (as *Protoparce*) *rustica* (Fabricius) (Moss 1912) and *Xylophanes mossi* Clark (Moss 1920).

Cocoon: Very loose cocoon of leaves and wet, stretchy, reddish silk.

Pupa (Fig. 17a shows *Oxytenis naemia*): Duration 12–14 days. Obtect; fronto-clypeal suture obsolete; labial palpi not visible; pilifer lobes absent; the maxillae and prothoracic legs the only appendages visible within the area delineated by the antennae; antennae broadly pectinate, touching for the apical 0.5–2 mm, the width one seventh the length; mesothoracic wings, on the ventral surface of the body at meson, shorter than caudal margin of the fourth abdominal segment; abdominal segments with scattered minute setae not visible without magnification; cremaster with approximately 24 reddish hooks, which are quite tangled together.

Larval food plants:. *Alibertia edulis* and *Genipa americana* (Rubiaceae).

Adults. Adults eclosed around 11 pm and the females began emitting pheromone about 2.5 hours later. The resemblance of the adults to dried, brown leaves is greatly enhanced by the behavior of the moths, which rest with the wings held so as to form a 'leaf,' complete with midrib, petiole, and drip tip. When disturbed, the moths release their grip on the substrate and gently waft to the ground.

Distribution and flight period. Guatemala to Bolivia and southeastern Brazil, presumably occurring also in Mexico and northern Argentina; flying during March to December (Jordan, 1924). On Barro Colorado Island, adults can be seen at any time of year, although they are rare from November through April, and are most abundant from May through July.

NOTES ON *HOMOEOPTERYX* AND *ASTHENIDIA*

Homoeopteryx malecena Druce has been reared by the senior author on three occasions from larvae found on *Faramea occidentalis*, and *Asthenidia transversaria* Druce has been reared twice from larvae, once on *Calycophyllum candidissimum* (Vahl) DC. and once on *Warscewiczia coccinea* (Vahl) Kl. (Table 1). All three plants belong to the Rubiaceae.

TABLE 3. Distribution of sticky glands for *Homeopteryx*, *Asthenidia*, and *Oxytenis*. Values in table are total number of sticky glands per segment, for thoracic segment 1 through abdominal segment 10.

		T1	T2	T3	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Homoeopteryx	early instars	8	8	8	4	4	4	4	4	4	4	4	4	2
	final instar	8	10	10	6	6	6	6	6	6	6	6	6	6
Asthenidia	final instar	8	6	10	4	4	4	4	4	4	4	4	6	2
Oxytenis	early instars	8	6	8	4	4	4	4	4	4	4	4	4	2
	final instar	8	6	10	4	4	4	4	4	4	4	4	4	2

Homoeopteryx. Although adults of *Homoeopteryx* are superficially very similar to those of *Oxytenis* in general appearance, the larvae of the two genera differ in several respects. Although all instars we have seen bear sticky glands and rest in a 'J' position, they lack the flanges and eyespots of *Oxytenis*, and the gland pattern of *Homoeopteryx* appears to be more complete than that of *Oxytenis* (Table 3).

The youngest larva seen (Aiello Lot 82-78), was cream colored along the dorsum and purple-brown along the sides. Its sticky glands were at the ends of long setae and were distributed as shown in Table 3 for early instars. The head had long white setae, without glands, and glandless setae were also found among the gland-tipped ones. The distribution of setae with glands was the same as for early instar *Oxytenis* except that *Oxytenis* had only 6 gland-tipped setae on T2, whereas *Homoeopteryx* had 8. Judging by the long, gland-tipped setae, it is most probable that this early larva was a first instar, and if so, then that individual had only four larval instars.

The next instar was cream, cryptically patterned with black, and had a poorly-defined cream saddle on segments A4–A6. The glands were sessile on slender chalazae instead of at the tips of setae. The chalazae of T3 were located on an annular swelling, which could be folded forward against the body. The D chalazae (with sticky glands) of A8 were at the apex of a short 'tail' giving that protuberance a slightly forked appearance. The gland pattern changed (Table 3) in that T2 and T3 now had 10 instead of 8 glands, and the abdominal segments now each had 6 glands instead of 4.

The following instar was a larger, paler version of the previous one, except that the T3 swelling was more pronounced and the 'tail' was rather thick.

The final instar was at first quite dark, although the cream saddle was still visible. As the larva matured, it became less dark, more evenly cryptically marked, and the saddle mark darkened somewhat. In general, the larva became an excellent twig mimic, a resemblance that was greatly enhanced by the T3 annular swelling, the slightly paler saddle mark, and

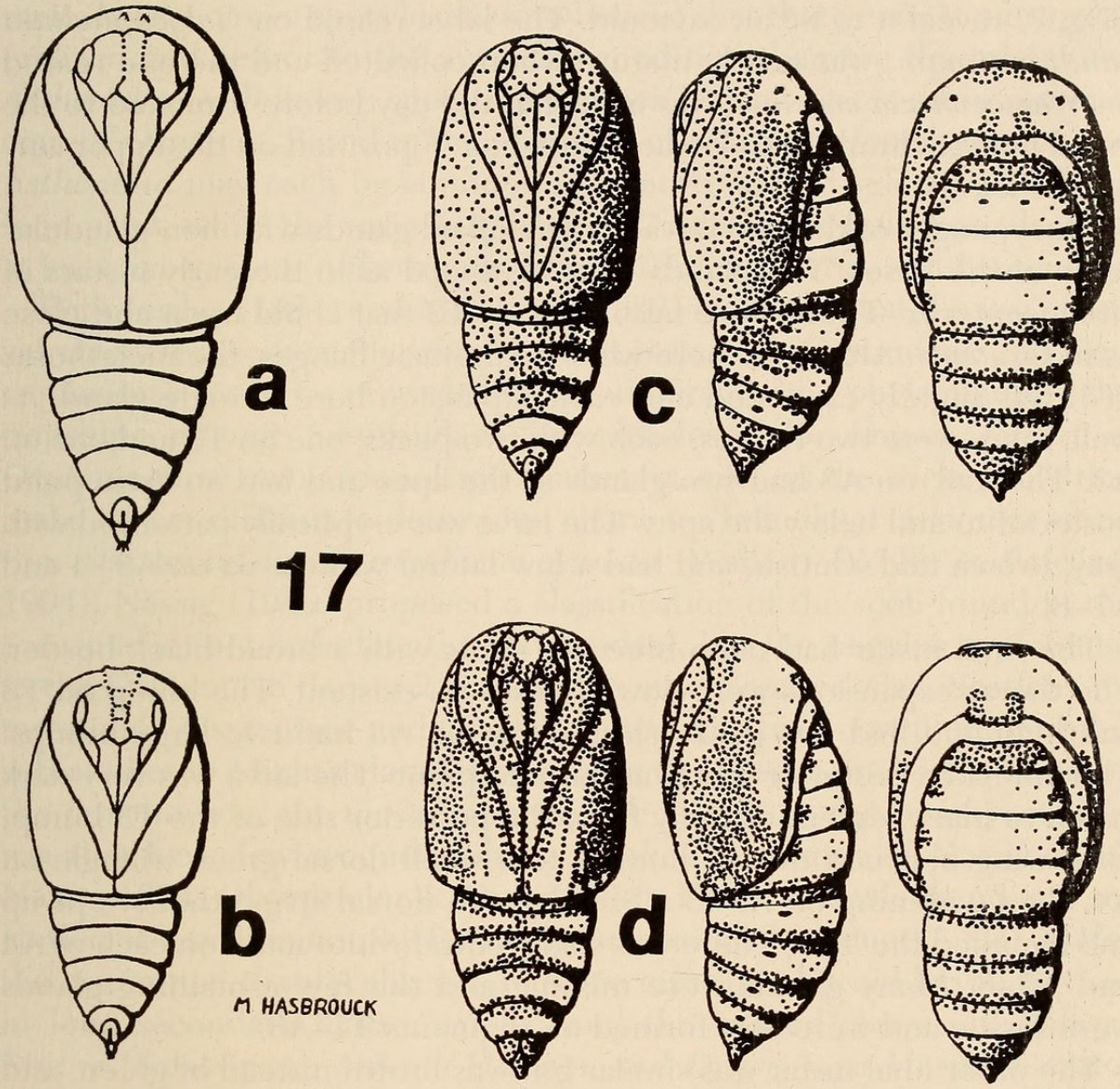


FIG. 17. Pupae. **a,** *Oxytenis naemia*, ventral view (Lot 81-80 no.4), 2.4 cm long; **b,** *Asthenidia transversaria*, ventral view (Lot 82-67), 1.4 cm long; **c–d,** *Homoeopteryx malecena*, ventral, lateral, and dorsal views (c: Lot 82-78, d: Lot 82-24), each 2.2 cm long.

the fact that the larva rested with the body held rigid with the anterior end held up at a slight angle, in the manner of many geometrids.

Among other individuals reared, the intermediate instars were gray and cryptically marked with a green and brown lichen-like pattern. Mature larvae may also be cryptically marked or may be the same mossy green of their food plant leaves (Fig. 6).

The larva made a leaf and silk cocoon in which it pupated several days later. The pupa (Fig. 17c,d), instead of the uniform dark brown to black of an *Oxytenis* was dark beige with black markings, and the pattern varied among individuals.

Asthenidia. Adults of *Asthenidia* bear no resemblance to either *Oxytenis* or *Homoeopteryx*, and instead look like small, white swallowtail butterflies. However, the 'tail' and eyespots of the mature larva

(Fig. 7) reveal it to be an oxytenid. The larva reared on *Calycophyllum candidissimum*, was nearly mature when collected and the one reared on *Warscewiczia coccinea* was collected the day before it molted to the larval final stadium. Both larvae rested in a 'J' position on the upper surface of leaves.

The younger of the two larvae bore stalked glands with non-glandular setae at the bases. The glands were arranged as in the early instars of *Homoeopteryx*. There were false eyes on T3 that could open and close as in *Oxytenis*. Although there were no thoracic flanges, the metathorax (T3) was slightly expanded and each expansion bore a single gland. As well, there were two humps, each with two peaks, one on T3 and one on A3. The 'tail' on A8 had two glands at the apex and had an extra point posterior to and below the apex. The larva was cryptically patterned with gray, brown and whitish, and had a low lateral white area on A3–4 and A7–8.

The final instar had deep blue eye spots with a broad black border. The thorax expansions were now almost non-existent. The hump on T3 was high and had two peaks close together. A3 had two large bumps. The tail had a posterior bump at the mid point. The larva was very dark green to black, except dorsally from the posterior side of the T3 hump, narrowing between the A3 humps, to a small dorsal green triangle on A4, then widening on A5 to a broad green dorsal stripe that swept up and included the 'tail.' There was a subventral white mark on each of A4 and A7–8. Many glands were missing and the few remaining glands were sessile and were best formed on segments T1–A8.

The other final instar was similar but was brown instead of green, and the black was confined to the subventral areas and to bold oblique lateral marks on A3, A4, small lateral triangles on A6 and A7, and a dark lateral crescent on A4–6. It also had a subventral white mark on A7–8. The only definite glands were on the prothorax, in two groups of four, and they were sessile.

Both larvae made loose cocoons of leaf and silk. The pupae (Fig. 17b) were short compared with those of *Oxytenis*, and the abdomen came to a more acute point.

SYSTEMATIC RELATIONSHIPS

The possession of sticky glands by the larvae, the habit of resting in a 'J' position, the utilization of rubiaceous food plants, and the similarities of pupal morphology seem to tie the three genera, *Homoeopteryx*, *Asthenidia*, and *Oxytenis* together. The distribution of sticky glands is similar for the three genera in the early stadia. In later stadia, the distribution is more complete for *Homoeopteryx* than for *Oxytenis* or *Asthenidia* (Table 3). That, plus the fact that *Homoeopteryx* has no tho-

racic flanges or eye spots leads us to believe that that genus is more generalized and nearer to the ancestral condition than are the other two. *Asthenidia*, with its eye spots and thoracic expansions is more reminiscent of *Oxytenis*. Based upon a handful of rearings, *Homoeopteryx* and *Asthenidia* may each be confined to a more limited selection of larval food plant, while the various species of *Oxytenis* are found on plants of at least five genera, *Alibertia*, *Faramea*, *Genipa*, *Isertia*, and *Posoqueria*.

Both Jordan (1924) and Michener (1952) indicated that the use of larval characters, especially from the first instars, in Oxyteninae and Cercophaninae could be of great help in understanding phylogenetic relationships among Saturniidae. Nevertheless, the known larvae of *Oxytenis* show many specialized characters, such as the sticky scoli, that make it very difficult to determine character homology. A similar situation was found for *Cercophana venusta* (Walker) (Wolfe & Balcázar 1994). Nässig (1989) proposed a classification of the scoli found in the Saturniidae (not including the Oxytenidae), but the peculiar type found in the Oxyteninae does not conform to any proposed classification. Interestingly, Oxyteninae and Cercophaninae, the two most plesiomorphic subfamilies in Minet's classification, have the D scoli on A8 not fused on the dorsomeson, the most characteristic feature of the bombycoid larvae that have few secondary hairs ("naked") (Lampe & Nässig 1989, Nässig 1994, Oberprieler & Duke 1994). Fused D scoli on A8 was regarded as a synapomorphy for the Bombycoidea by Minet (1994), under the asumption that its absence in some taxa (bombycoid larvae clothed in long secondary hairs, "wooly," and the "naked" larvae of *Salassa* Moore [Salassinae], *Anisota* Hübner, and *Dryocampa* Harris [Ceratocampinae]) is the result of secondary loss. It remains to be resolved whether these structures are synapomorphic or the result of convergence reflecting the same groundplan (cf. Oberprieler & Duke 1994).

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