

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024
Number 2807, pp. 1–24, figs. 1–32, tables 1–4 January 31, 1985

A Revision of the Moth Genus *Acronyctodes*, With a Review of the New World Bistonini (Lepidoptera, Geometridae)

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ABSTRACT

The genus *Acronyctodes* is revised for the first time. The included species are *cautama* (Schaus), *colorata* (Warren), *eximia* (C. C. Hoffmann and Vazquez), *leonilaria* (C. C. Hoffmann), and *mexicanaria* (Walker); all these specific names form new combinations with *Acronyctodes*. The type species for the genus is *insignita* Hy. Edwards; it is placed as a synonym of *mexicanaria*. Keys to the adults and the genitalia of both sexes are given; all species are described and illustrated. The members of the genus occur from the mountains of Mexico as far south as western Panama. The early stages of three of the species have been described; the larval food plant is *Buddleia* (Loganiaceae).

One unique feature of the females of *Acronyc-*

todes is the presence of thick groups of minutely spinose areas on the ventral surface of the fifth tarsal segment on the mid and hind legs of the females. It is possible that these areas may represent chemical receptors of some sort, and that they might play a possible role in oviposition. Insofar as I know, such structures have not heretofore been reported in the Geometridae.

Acronyctodes is placed in the Bistonini, and a discussion and analysis of tribal characters are given for the New World genera. With the inclusion of this genus, the distribution for this tribe is extended into the tropical areas of the Western Hemisphere for the first time.

INTRODUCTION

The moths of this genus are some of the larger and more prominently marked geometrids of Mexico and Central America. When an attempt was made to identify the adults, difficulties were encountered on both the generic and specific levels; further, nothing was known about the tribal affinities of

the group. These difficulties led to the preparation of the present paper. The first portion of this study is a generic revision, complete with descriptions and keys to the five included species; the second part is concerned with the tribal placement, and it includes a comparative analysis of the New World Bistonini.

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During my research for this revision, I not only dissected the genitalia but also made slide mounts of the antennae and legs of both sexes of each species. Genitalic structures have served as a primary means of identification in recent years; these organs can be used in both sexes to identify the species of *Acronyctodes*. On the other hand, the antennae and legs have received relatively little attention, except for the most obvious characters, such as pectinate or simple antennae, the presence or absence of a tibial hair pencil in the male, and the like. Once slide mounts of the legs are prepared it is a simple matter to study and measure these structures. One set of measurements that is used in the following descriptions is the length of the first, or basal, segment of the tarsus for all legs. It is possible to divide the genus into two groups by the use of this one character, and this has been utilized in the key to the adults. These two groups can also be separated by the height of the palpi in relation to the eyes, the length and presumed use or non-use of the proboscis, the shape of both the aedeagus and the exerted vesica, and the presence or absence of the signum in the female genitalia. With this many characters available to define the groups, it would appear that the tarsal length can also be considered to be one of basic importance, at least in this genus.

Of the five species of *Acronyctodes*, the adults of *mexicanaria* tend to turn "greasy"; this condition has not been noted for the other four. This particular state is manifested by the body turning dark and oily, with the scales becoming matted, and with this oily substance often spreading onto the wings; in some examples, white crystals appear on the body, especially the abdomen. In my opinion, there is a direct correlation between this greasy condition and whether or not the moth is able to use its proboscis for the intake of liquids. When moths have vestigial, non-functioning mouthparts, the adults have to obtain all their energy from stored products within their body; in so doing, some waste products are produced and, in dried specimens, these tend to work their way through the integument, causing the oily or greasy condition. On the other hand, moths with a functional proboscis use this structure for the intake of liquids, and this apparently acts to dilute or flush out

waste products, in addition to possibly furnishing an external source of energy. In the North American Bistonini, those genera (*Biston*, *Cochisea*, and *Lycia*) with thick-bodied species tend to become greasy, while the slender-bodied species do so to a much lesser degree. As noted in the descriptions for *Acronyctodes*, the length of the proboscis is apparently variable for the different species, and this may be correlated with possible usage; *mexicanaria* has a vestigial tongue which is presumably non-functional, and it is this species that turns greasy. This phenomenon is not restricted to members of the Geometridae but appears in a number of other families of moths; the correlation between being greasy and having a short, presumably non-functioning proboscis apparently is a relatively widespread one (Quinter, personal observ.).

In general, the early stages and food plants of geometrids that occur in Mexico and Central America are usually almost completely unknown. It comes as a very pleasant surprise, therefore, to find that three of the species covered in this paper have been reared, with published descriptions of the early stages. The food plants are *Buddleia* (Loganiaceae), known to the Mexicans as "tepozanes."

During the course of this study I have examined 91 specimens (55 males, 36 females), 22 genitalic dissections (13 males, 9 females), and 19 slide mounts of antennae and legs (10 males, 9 females). Each dissection and slide mount was made by me. The primary types of four taxa (in AMNH, USNM) have been studied and dissected; the other three (in BM) have been identified by the use of color transparencies. All the specimens I studied have had identification labels placed on their pins, excepting the primary types. The majority of specimens (66), genitalic dissections (19) and slide mounts (17) are in the collection of the American Museum of Natural History.

THE MODIFIED TARSUS OF THE FEMALES

One of the interesting results of making slide mounts of the antennae and legs was the discovery that the ventral surface of the fifth, or most distal, tarsal segment (or tarsomere) of the middle and hind legs of the females is highly modified. This change is not present

on the forelegs of the females or on any of the male tarsi. When present, this character is visible on the specimens at low power magnification. The normal tarsus in the many New World geometrids that I have studied on slide mounts is completely covered with scales. In *Acronyctodes* the tarsal segments in question are devoid of scales; in their place are a number of slender setae and a large area of minute structures, each with a very slender projection. Modified tarsal areas have been reported in a few species of butterflies and moths, and this alteration has been assumed to play a possible role in oviposition (Fox, 1966; Ma and Schoonhoven, 1973; Calvert, 1974). Insofar as I know, structures of this nature have not heretofore been reported in the Geometridae.

To pursue these modified structures in greater detail, the middle and hind tarsi of *Acronyctodes mexicanaria* females were studied with the aid of a scanning electron microscope (SEM); see figs. 1–6. Two types of elongate setae are present. Along the outer margins of the fifth tarsomere are a series of large striated setae; in the central area are a number of more slender setae with a smooth surface (figs. 2–4). Both types appear to be set in membranous sockets; this is more obvious for the smooth than the striated setae. Close to the tarsal surface are a large number of structures, each with a bulbous basal portion and a long slender tapering projection (figs. 3–6).

The illustrations of Fox (1966) and Calvert (1974) for the tarsal receptors in butterflies they studied have only a slight similarity to what is found in *Acronyctodes*. But when those of *Acronyctodes* are compared with those of the fifth tarsomere of *Pieris brassicae* (Linnaeus; Pieridae), as illustrated by Ma and Schoonhoven (1973, fig. 1a, b), the physical resemblance is very similar and striking. In the above paper the outer setae with ribbed sides were called Type A setae, the median group with the smooth sides are Type B, and the short structures were termed microtrichia. The Type B setae in *P. brassicae* are set in membranous sockets, and each one was associated with five bipolar sense cells; it is possible that four of the cells are primarily chemoreceptors, whereas the fifth is a mechanoreceptor cell. In both *Pieris brassicae*

and *A. mexicanaria* the ventral surface of the fifth tarsal segment have Type A and B setae; in *mexicanaria* the B-type are more numerous and only slightly smaller than Type A setae, and the surrounding field of microtrichia is denser and the individual structures are more crowded together, when compared with the SEM photographs of *brassicae*.

Ma and Schoonhoven also carried out electrophysiological experiments with the B-type setae; their conclusion was that these tarsal hairs are used by egg-laying females to perceive chemical oviposition stimuli from the substrate, presumably the food plant in nature. It is possible that the tarsal hairs of *Acronyctodes* serve a similar purpose.

ACKNOWLEDGMENTS AND ABBREVIATIONS

I acknowledge with thanks the cooperation of Dr. D. C. Ferguson for the United States National Museum, Smithsonian Institution (USNM) for the loan of material and of Mr. D. S. Fletcher for the Department of Entomology, British Museum (Natural History) (BM) for photographs of type specimens in his charge and for other assistance. Nearly all the specimens illustrated are from the collection of the American Museum of Natural History (AMNH), and have been so labeled. I am also grateful to Mr. James S. Miller, at the Department of Ecology and Systematics, Cornell University, for furnishing me with references to tarsal chemical receptors, and to Mr. Eric Quinter of Jackson Heights, New York.

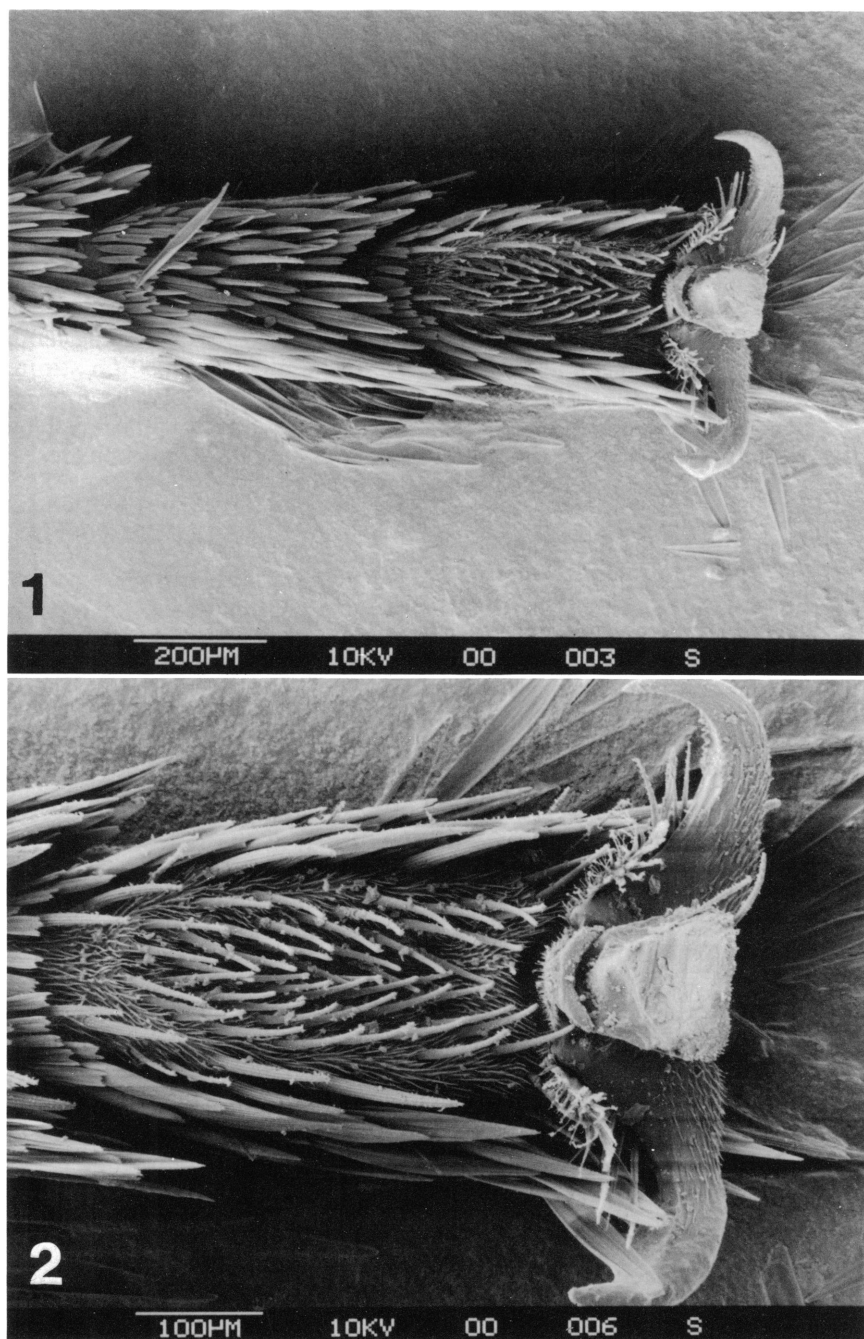
Thanks also go to Ms. Joan Whelan, Interdepartmental Facilities Coordinator, AMNH, for taking the scanning electron microscope photographs, and to Mr. Juan C. Barberis, Department of Graphics, for preparing the genitalic drawings and for mounting all the figures. The adults were photographed by the author with the exception of the specimens in the British Museum.

GENUS *ACRONYCTODES* HY. EDWARDS

Acronyctodes Hy. Edwards, 1884, p. 78.

Collopsiodes Warren, 1901, p. 483. NEW SYNONYMY.

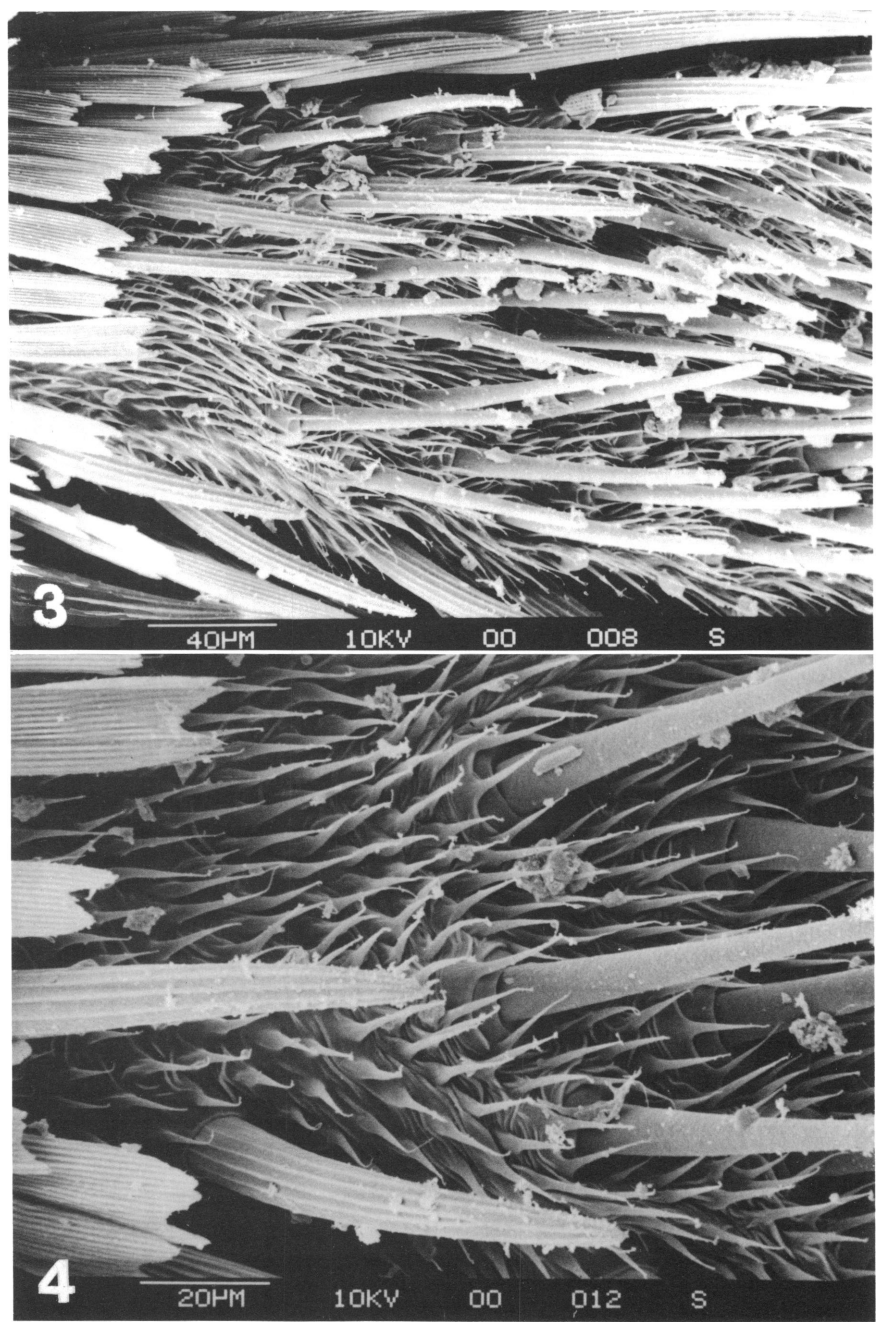
DIAGNOSIS: The moths of both sexes of this genus are large (length of forewings 19 to 29



FIGS. 1, 2. Ventral surface of middle tarsus of female *Acronyctodes mexicanaria* (Walker). 1. Third (part, at left), fourth, and fifth segments. $\times 85$. 2. Fifth segment. $\times 170$.

mm), have bipectinate antennae in both sexes, elongate palpi that extend well beyond the

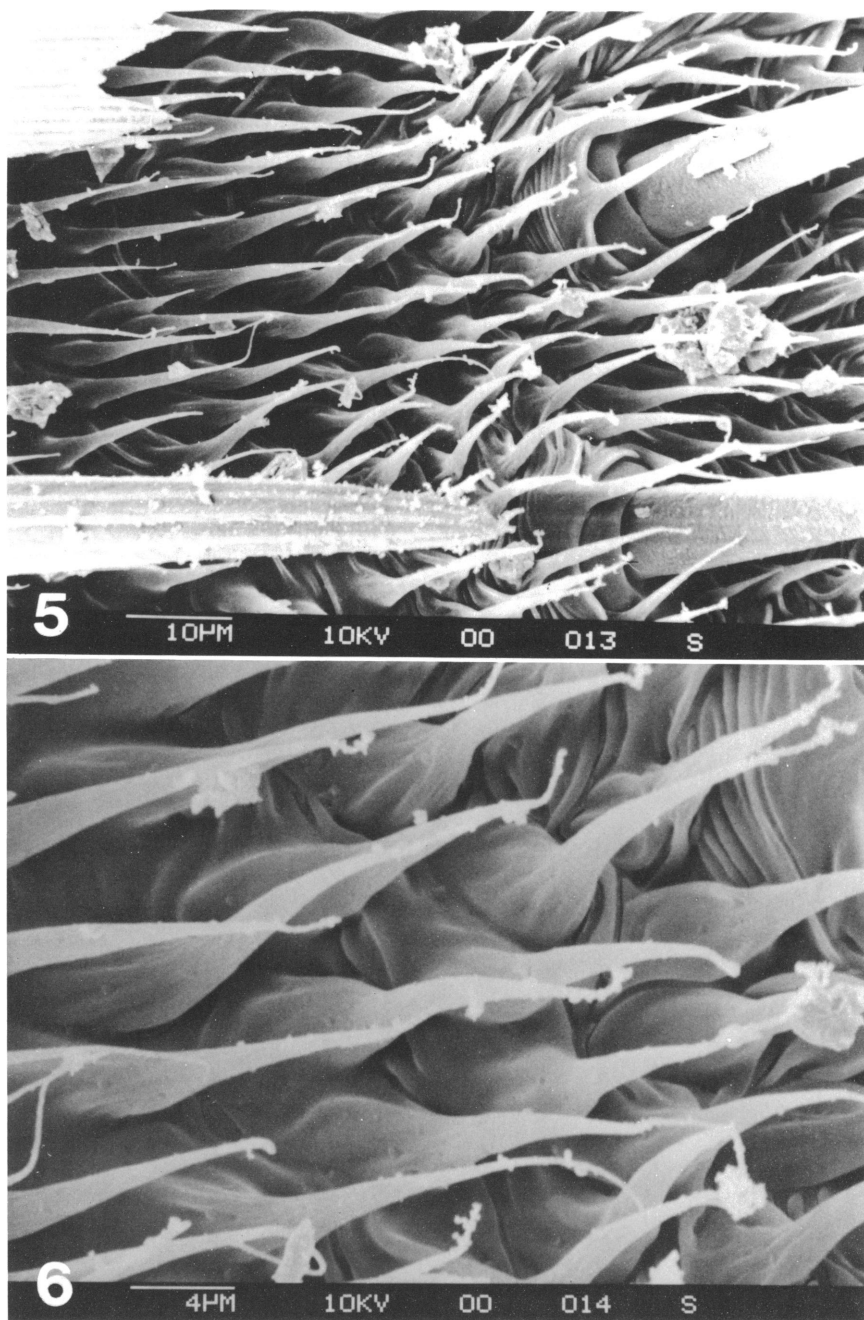
front, the proboscis is of normal size or reduced, a small hair pencil on the hind tibia



FIGS. 3, 4. Ventral surface of middle tarsus of female *Acronyctodes mexicanaria* (Walker). 3. Basal portion of fifth segments. $\times 425$. 4. Same. $\times 850$.

of the male, the females have minutely spinose areas on the under surface of the terminal segment of the meso- and metathoracic

tarsi, and both sexes usually have two accessory cells in the forewings. The male genitalia have the uncus with the lateral margins



FIGS. 5, 6. Ventral surface of middle tarsus of female *Acronyctodes mexicanaria* (Walker). 5. Basal portion of fifth segment. $\times 1400$. 6. Microtrichia. $\times 3500$.

convex medially and the apex terminating in a rounded ridge, the gnathos has a finely spinose median process, the apex of the valves

end in a costal spinelike protuberance and a smaller anterolateral projection, and the vesica has a row of from about seven to 28 elon-

gate spines. The female genitalia are of two types: one has a prominent curved lamella antevaginalis, a large bulbous lamella postvaginalis, a broad, heavily sclerotized ductus bursae, a corpus bursae with an elongate, parallel-sided, longitudinally striate posterior portion and a much smaller anterior part, and lacks a signum; the second type has a flat, minutely spiculate lamella antevaginalis, lacks the lamella postvaginalis, has a slender ductus bursae, the corpus bursae is partly or almost entirely covered with zigzag ridges, and a prominent signum.

ADULTS: Head with both sexes having large naked eyes; front flat; palpi of both sexes with second segment 0.9 to 1.3 mm long, third segment 0.4 to 0.6 mm, extending well beyond front; proboscis apparently either normal and functional or reduced and non-functional; antennae of both sexes bipectinate, of 55 to 67 segments, terminal four to six simple, males with longest pectinations 0.7 to 1.0 mm long, being from three to four times as long as their basal segments, females 0.4 to 0.7 mm long and about twice as long as basal segments. Thorax moderately stout, covered with hairlike scales; forelegs with epiphysis of males arising between two-fifths and one-half length of segment, and being one-half to three-fourths its length, of females arising at one-half length and being from three-sevenths to three-fifths as long; hind tibia of males with small diffuse hair pencil; females with terminal segment of meso- and metathoracic tarsi with double areas of minute spines on lower surface. Abdomen stout, barely extending beyond hind wings; males without row of setae on ventral surface of third segment.

Forewings broad, apex attenuate and pointed, outer margin angulate or strongly swollen; with two accessory cells in most specimens; vein R_1 going to Sc , R_2 from top or end of discal cell, R_{3+4} from end of cell, R_5 from bottom of cell; mdc and ldc variably curved, angled or biconcave. Hind wings broad, outer margin rounded; Sc paralleling R for one-fifth to one-third length of cell; m and ldc angled.

Upper surface of forewings various shades of gray and brown, t. a. and t. p. lines prominent, former biconcave or biangulate, t. p. line scalloped to dentate, and with black dis-

cal spot. Hind wings paler than forewings, more or less unicolorous, with extradiscal line represented. Under surface gray, forewings slightly darker than hind wings, all wings with small discal dots and outer cross line.

Length of Forewings: Males, 19 to 25 mm; females, 20 to 29 mm.

MALE GENITALIA: Uncus 0.7 to 1.3 mm long, base 0.7 to 1.5 mm wide, with lateral margins tapering posteriorly, with convex swelling in middle, apex with posterodorsal swelling, terminating ventrally in curved ridge; socius small, membranous, padlike or shortly digitate, with from about three to 12 setae on each one; gnathos U- or V-shaped, with shortly dentate median swelling; each valve with sclerotized costa extending to end of valve, costa terminating in apical spine, apex of valve adjacent to costa concave, lightly sclerotized, with projecting point; anellus with apically rounded median projection, 0.9 to 1.9 mm long; cristae absent; aedeagus 3.3 to 4.9 mm long, 0.35 to 0.60 mm wide, posterior end either sharply pointed and sclerotized or with large, heavily sclerotized, curved structure and with smaller sclerotized points on opposite sides of aedeagus; vesica, when exerted, either a straight tube extending from 30° to 45° angle to aedeagus or an apically recurved tube, both with row of seven to 28 spines.

FEMALE GENITALIA: Sterigma with sclerotized lamella antevaginalis, lamella postvaginalis either not differentiated or heavily sclerotized and with large median swelling; ductus bursae sclerotized, either slender, with parallel sides and smooth, or broad, tapering and rugose; ductus seminalis arising either at ventral junction of corpus bursae and ductus bursae or from small ventral sac extending from anteroventral portion of ductus bursae; corpus bursae either elongate, rugose and partly or almost entirely covered with zigzag ridges, or with slender, striate, sclerotized posterior portion and shorter globular membranous anterior portion; signum either large, round, with rayed edge or absent. Papillae anales with scattered elongate setae; apophyses posteriores 1.9 to 2.9 mm long, apophyses anteriores 0.9 to 1.8 mm in length.

EARLY STAGES: The caterpillar and pupa of *A. mexicanaria* were described by Vazquez (1936, figs. 4, 5 [caterpillar, pupa]) and this

was followed by a comparative table for the above species and *A. leonilaria*. The egg, mature larva, and pupa of *A. eximia* were described by Hoffmann and Vazquez (1939, fig. 3 [egg]).

FOOD PLANTS: *Buddleia* spp. (Loganiaceae) for the three species mentioned in the preceding paragraph.

TYPE SPECIES: For *Acronyctodes*, *insignita* Hy. Edwards; sole included species. For *Callopsides*, *colorata* Warren; by original designation.

DISTRIBUTION: The mountains of Mexico and Guatemala, south to the mountains of western Panama.

FLIGHT PERIOD: April through early December.

REMARKS: At first glance, the adults may seem to be strikingly similar to one another and hence difficult to identify; this problem is magnified by the amount of individual variation in at least one species. Two of the included species are known to me only from their holotypes and allotypes; obviously much remains to be learned about the amount of variability in these species. Age plays a role in the picture too, as older specimens tend to fade in color, to become greasy, or both. Nevertheless, most specimens can probably be placed to species using the key to external characters; if there are any doubts, the genitalia of both sexes offer good specific characters for making correct identifications.

KEY TO SPECIES

BASED ON EXTERNAL CHARACTERS

1. Fore tarsus with basal segment 2.5 to 3.2 mm long; palpi extending to near top of eyes 2
- Fore tarsus with basal segment 2.0 to 2.1 mm long; palpi extending one-fourth to one-third height of eyes 4
2. Palpi with second segment 1.0 to 1.1 mm long; length of forewings 20 to 24 mm *colorata*
- Palpi with second segment 1.2 to 1.3 mm long; length of forewings 26 to 29 mm 3
3. Forewings with upper surface slightly suffused with pink, median area relatively pale *cautama*
- Forewings with upper surface more olivaceous, and with median area suffused with olive-green and brown scales *eximia*

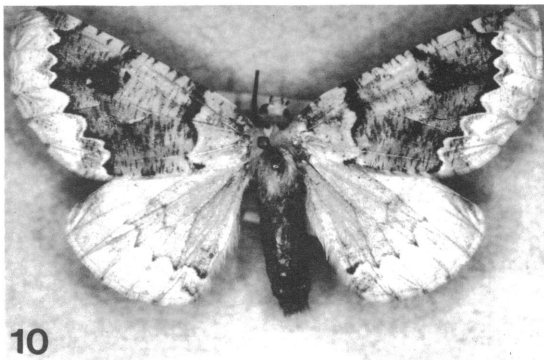
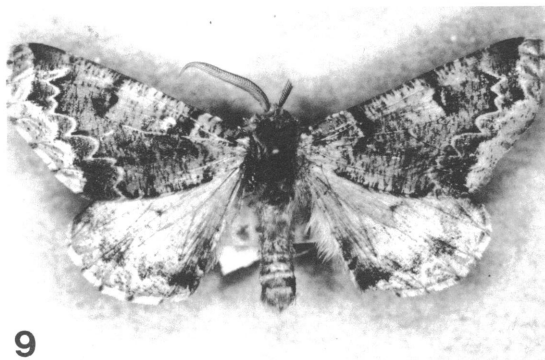
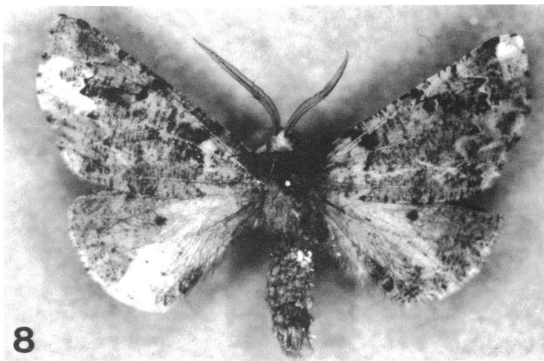
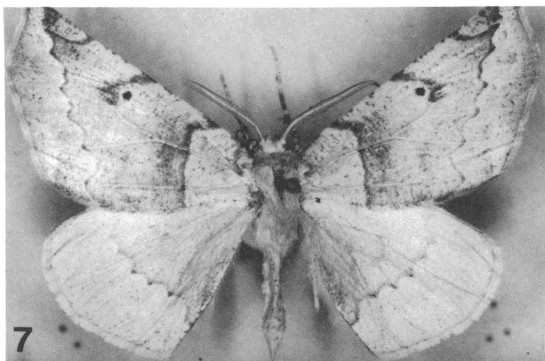
4. Front grayish brown; metathorax without small posterolateral tufts; length of forewings 19 to 20 mm *leonilaria*
- Front white; metathorax with small posterolateral tufts; length of forewings 21 to 29 mm *mexicanaria*

BASED ON MALE GENITALIA

1. Aedeagus with posterior end tapering to point; exerted vesica straight 2
- Aedeagus with posterior end not as above; exerted vesica terminally recurved 4
2. Vesica with about 13 or 14 spines; anellus 0.75 to 1.00 mm long *colorata*
- Vesica with about seven or eight spines; anellus 1.40 to 1.65 mm long 3
3. Exserted vesica with spines on anterodistal surface; aedeagus with posterior end rounded *cautama*
- Exserted vesica with spines on posteromedian surface; aedeagus with posterior end tapering to elongate point *eximia*
4. Aedeagus with posterior end having median tapered point, flanked on each side by large lobate structure about as long as median point *leonilaria*
- Aedeagus with posterior end asymmetrical, having large, median structure curving to right, flanked on each side by much shorter apical dentate structures *mexicanaria*

BASED ON FEMALE GENITALIA

1. Signum present 2
- Signum absent 4
2. Corpus bursae with posterior one-half lightly and smoothly sclerotized, with deep, straight longitudinal striations, with median swelling, and with anterior portion swollen, mostly smoothly membranous; signum flat, outer margin weakly serrate *colorata*
- Corpus bursae with entire surface more or less covered with zigzag ridges, the surface corneous and not divisible into discrete areas; signum invaginated, outer margin and inner surface dentate 3
3. Lamella antevaginalis with median area flatly recessed or concave; ductus bursae asymmetrical, with left side slightly longer than right side *cautama*
- Lamella antevaginalis with truncate posterior margin; ductus bursae symmetrical *eximia*
4. Apophyses posteriores 1.9 mm long; ductus bursae asymmetrical, right side longer than left side, very wide for entire length, anterior end truncate *leonilaria*
- Apophyses posteriores 2.4 to 2.9 mm long; duc-



FIGS. 7-10. Adults of *Acronyctodes* in BM. 7. *A. colorata* (Warren), holotype, male, Chiriqui, Panama. 8. *A. mexicanaria* (Walker), holotype, male, Mexico. 9, 10. *A. hedemanni* (Felder and Rogenhofer), Huahuapan, Puebla, Mexico. 9. Lectotype, male. 10. Syntype, female. All photos courtesy of BM. All $\times 1.35$.

tus bursae asymmetrical, decreasing in width anteriorly, with caudal end about one-half width of posterior end *mexicanaria*

Acronyctodes cautama (Schaus),
new combination

Figures 11, 12, 23, 28

Callopsiodes cautama Schaus, "1900" (1901), p. 178.

Synopsis cantema [sic]: Hoffmann and Vazquez, 1939, p. 341.

DIAGNOSIS: The palpi extend to the upper portion of the eyes, the front is grayish brown, and the upper surface of the forewings has faint greenish and pink tints, with a thick black bar or wedge extending from near the discal spot to the t. p. line. The male genitalia have the aedeagus with a simple tapering posterior end that is apically rounded, the exerted vesica is straight and has about eight anterodistal spines, and the anellus is 1.4 mm

long. The female genitalia have a prominent dentate signum, the corpus bursae has the entire corneous surface more or less covered with zigzag ridges, and the finely spiculate lamella antevaginalis has the median area concave.

MALES: Head with vertex and front grayish brown, scales narrowly white tipped; palpi concolorous with front, rising to upper portion of eye, second segment long scaled below, 1.3 mm long, third segment 0.6 mm in length, tightly scaled, decumbent; tongue apparently of more or less normal length and functional; antennae of about 58 segments, longest pectinations 0.8 mm long, being three times as long as their basal segments, and with about five simple segments at the end of antenna. Thorax above concolorous with vertex, collar with faint dark band distally, terminally paler; below dark anteriorly, becoming paler posteriorly; legs pale grayish

white or brownish white, with variable amounts of dark brown scaling; tarsi with lengths of basal segments 2.8 mm, 2.8 mm, and 2.2 mm, respectively; forelegs with epiphysis arising about two-fifths length of segment, and being two-thirds its length. Abdomen concolorous with thorax, with variable number and amount of pale brown scaling.

Upper Surface of Wings: Forewings grayish brown, with variable amounts of dark brown, grayish brown, faintly pinkish, and olivaceous green scaling; basal area more or less dotted with dark scales, having faint suggestion of pinkish; t. a. line arising about one-fourth length of costa, narrowly pale gray, weakly angulate; median area dark brown basally and posteriorly, sharply contrasting with basal area, becoming light brown or faintly pinkish brown around prominent discal spot, with blackish brown spot on costa above discal spot continued as line curving around latter, then going to t. p. line as broad bar, enclosing elongate pale area costad; t. p. line arising about 6 mm from apex, sharply angled outward, with broad blackish brown shade extending to near apex, line grayish white, concave between veins, straight in course; terminal area basally olivaceous brown or brown, wider posteriorly, distally variably dark brown in middle of wing; fringe concolorous with wing, darkened opposite veins and narrowly white distally between dark areas. Hind wings grayish brown, with variable amounts of darker suffusion; discal spot small, obscure; extradiscal line complete, dark, concave between veins; fringe with basal half concolorous with wings, distally grayish white.

Under Surface of Wings: All wings grayish brown, with variable amounts of dark brown scaling; forewings reflecting pattern of upper surface, with discal dot and t. p. line most prominent; hind wings with discal dot and extradiscal line weakly represented, median line varying from broad and prominent to absent.

Length of Forewings: 24 to 26 mm.

FEMALES: Head with palpi equal to or slightly shorter than those of males; antennae of about 60 to 64 segments, longest pectinations 0.5 to 0.7 mm long, two to two and one-half times as long as their basal segments.

Thorax with tarsi having lengths of basal segments 2.8 to 3.2 mm, 1.9 to 3.1 mm, and 2.0 to 2.2 mm, respectively; forelegs with epiphysis arising between one-half and three-fifths length of segment, and about one-half its length.

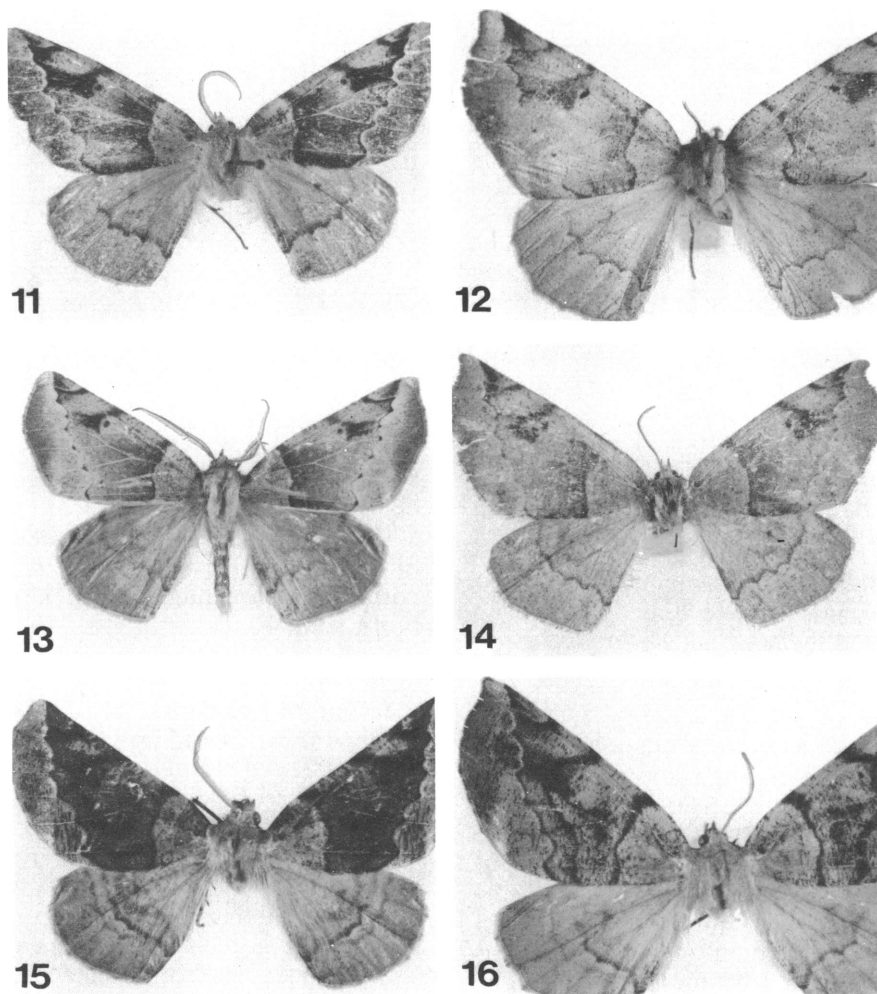
Upper Surface of Wings: Similar to that of males or with less dark scaling, with faint greenish and pinkish tints more prominent.

Under Surface of Wings: Similar to that of males.

Length of Forewings: 26 to 29 mm.

MALE GENITALIA: Uncus 0.8 mm long, base 0.8 mm wide, ventral surface weakly concave, lateral margins weakly biconcave, posterodorsal portion laterally flattened, becoming quite thick, posterior margin vertical, apically rounded, with slight median point; gnathos rounded, U-shaped, with triangular median spinose swelling; valves with each costal margin straight, with small, apical spinelike swelling, valvula with posterodistal region lightly sclerotized, apically flattened or weakly concave, having small projection at junction of sclerotized and membranous areas, and with linear area of elongate spines on membranous area from apex to costa; transtilla flat, elongate, meeting at midline; anellus 1.4 mm long, posterior portion long, slender, digitate, swollen ventrally, with dorsal wedge-shaped sides; aedeagus 3.3 mm long, 0.4 mm wide, posterior end sclerotized, elongate, apex rounded; vesica, when exerted, a simple tube extending at about 45° to aedeagus, having anterodistal row of about eight prominent setae, longest being 0.7 mm in length.

FEMALE GENITALIA: Sterigma with finely spiculate lamella antevaginalis extending width of abdomen, posterior margin more or less truncate, with median section flatly recessed or concave, of greater length laterally and medially, lamella postvaginalis absent; ductus bursae slender, about twice as long as wide, with sides either parallel or very slightly concave, asymmetrical, with left side slightly longer than right side; ductus seminalis from distal end of corpus bursae on right side near junction with ductus bursae; corpus bursae elongate, rugose and partly or almost entirely covered with zigzag ridges, anterior end with circular ridges around signum, posterior end relatively smooth; signum large, near ante-



FIGS. 11–16. Adults of *Acronyctodes*. 11, 12. *A. cautama* (Schaus). 11. Male, Guerrero Mill, Hidalgo, Mexico (Mann and Skewes; AMNH). 12. Holotype, female, Jalapa, Mexico (USNM). 13, 14. *A. colorata* (Warren). 13. Male, Rio Guajolote, Oaxaca, Mexico, November 9, 1980 (E. C. Welling; AMNH). 14. Female, Tuis, Costa Rica, August 26, 1908 (USNM). 15, 16. *A. eximia* (Hoffmann and Vazquez), Desierto de los Leones, D.F., Mexico (C. C. Hoffmann; AMNH). 15. Holotype, male, July 1, 1939. 16. Allotype, female, June 27, 1939. All $\times 1.8$.

rior end of corpus bursae on dorsolateral surface, with round central area, invaginated portion flat, with prominently rayed margin and weakly rayed flat surface. Papillae anales large, with both short and long setae, having median attachment to apophyses posteriores; apophyses posteriores 2.4 to 2.8 mm long, apophyses anteriores 1.0 to 1.2 mm in length.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: Schaus apparently described this

species from a single female, although he did not mention either the number or sex of his type specimens in the original description. The holotype is USNM 12439 (see fig. 12); its genitalia are mounted on slide FHR 19301A and the right antenna and right legs are on slide FHR 19301B.

TYPE LOCALITY: Jalapa, Veracruz, Mexico.

DISTRIBUTION: The mountains of eastern Mexico (Hidalgo, Nuevo Leon, Veracruz; two specimens with no other indication than the

country). Only two specimens have indications of altitude on their labels; they are 9000 ft (Hidalgo) and 10,500 ft (Nuevo Leon), or 2744 and 3200 m, respectively.

FLIGHT PERIOD: Only a single specimen bears the date of capture, and that is September 1 for the female from Nuevo Leon.

REMARKS: Seven specimens (three males, four females), one male and three female genitalic dissections, and the same number of slide mounts of antennae and legs have been studied.

The adults, based on the small series available to me, appear to be fairly consistent in the color and pattern of the upper surface of the wings. The holotype is paler than the other, more recently caught, females; this could be due to its greater age and the resulting fading.

Acronyctodes colorata (Warren),
new combination

Figures 7, 13, 14, 24, 29

Callopsiodes colorata Warren, 1901, p. 484.

DIAGNOSIS: This is the smallest and palest member of the genus, with the upper surface of the forewings tending to be less contrastingly marked than the other species, with the t. a. line straight for most of its length. The male genitalia have the aedeagus with a simple, elongate, tapering posterior end, the exserted vesica is straight and has about 13 or 14 anterodistal spines, and the anellus is between 0.75 and 1.00 mm in length. The female genitalia have a large, flat signum, with the outer margin shortly and bluntly serrate, the inner surface smooth; the corpus bursae has a curved, sclerotized, longitudinally striate posterior one-half, a median collar-like area, and a more membranous anterior portion.

MALES: Similar to those of *cautama*, differing mainly as follows: head with palpi with second segment 1.0 to 1.1 mm long, third segment 0.5 mm in length; antennae of about 63 to 66 segments, longest pectinations 0.8 mm long, being four times as long as their basal segments, and with about six simple segments at end of antenna. Thorax with tarsi having lengths of basal segments 2.5 to 2.6 mm, 2.6 to 2.8 mm, and 2.0 mm, respectively.

Upper Surface of Wings: Paler than those of *cautama*, lacking the numerous dark brown

scales, with the resulting color having more of a faint pinkish and greenish tint; maculation similar, but t. a. line either straight or with only ends curved, and with thick dark bar distad of discal spot reduced or only partly represented. Hind wings grayer, with less brown scaling.

Under Surface of Wings: Paler than those of *cautama*, with more olivaceous color.

Length of Forewings: 20 to 22 mm.

FEMALES: Head with antennae of about 57 segments, longest pectinations 0.5 mm long, one and one-half times as long as their basal segments. Thorax with tarsi having lengths of basal segments 2.5 mm, 2.6 mm, and 1.9 mm, respectively; forelegs with epiphysis arising at one-half length of segments, and one-half its length.

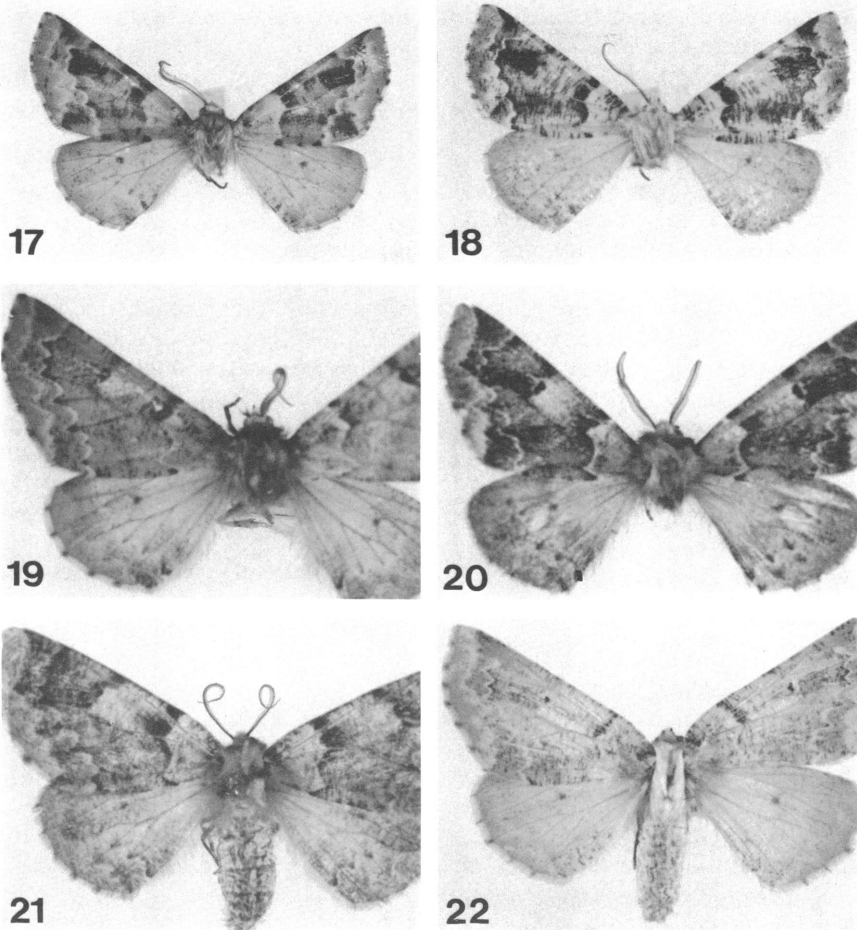
Upper Surface of Wings: Similar to that of males but tending to have less dark scaling, with faintly greenish and pink tints more prominent.

Under Surface of Wings: Similar to that of males.

Length of Forewings: 23 to 24 mm.

MALE GENITALIA: Similar to those of *cautama*, differing mainly as follows: uncus 0.7 mm long, base 0.70 to 0.75 mm wide, ventral surface tending to be more concave, with more curved apical portion, median area broader; gnathos more broadly U-shaped; valves with each costa having slight median swelling in middle and more prominent apical spinelike swelling, valvula with smaller lightly sclerotized area, resulting in small projection being closer to spinelike swelling, spinose area tending to be more diffuse; anellus shorter, 0.75 to 1.00 mm long, posterior portion wedge-shaped or triangular, flat; aedeagus longer, 3.4 to 3.7 mm in length, 0.35 mm. wide, posterior end sclerotized, terminating in elongate point; vesica, when exserted, a simple tube extending at 30° to 45° to aedeagus, with 13 or 14 anterodistal spines, longest being 0.65 to 0.80 mm in length.

FEMALE GENITALIA: Similar to those of *cautama*, differing mainly as follows: sterigma with finely spiculate lamella antevaginalis having rounded posterolateral areas, broadly concave medially, spiculate area of approximately equal width; ductus bursae about as wide as long, with right side slightly longer than left; ductus seminalis from center of cor-



FIGS. 17–22. Adults of *Acronyctodes*. 17, 18. *A. leonilaria* (Hoffmann), Cerro de San Miguel, D.F., Mexico (C. C. Hoffmann; AMNH). 17. Holotype, male. 18. Allotype, female. 19–22. *A. mexicanaria* (Walker). 19. *A. insignita* Hy. Edwards, lectotype, male [Veracruz, Mexico] (AMNH). 20. Male, Orizaba, Veracruz, Mexico, November, 1948 (AMNH). 21. Female, Guerrero Mill, Hidalgo, Mexico (Mann and Skewes; AMNH). 22. Female, Jalapa, Mexico (W. Schaus; AMNH). All $\times 2.0$.

pus bursae; corpus bursae with posterior one-half curved, with left side posteriorly membranous, remainder sclerotized, with deep longitudinal striations, median area swollen, corneous, ridged, posterior portion becoming progressively more membranous anteriorly; signum flat, margin shortly and bluntly serrate, inner surface smooth. Apophyses posteriores 2.2 mm long, apophyses anteriores 0.9 mm in length.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: Holotype, male, in BM (see fig. 7).

TYPE LOCALITY: Chiriqui, Panama.

DISTRIBUTION: The mountains of southern Mexico (Veracruz, Oaxaca), Guatemala (Alta Verapaz), Costa Rica (Cartago), and Panama ("Chiriqui"). The species is probably more widely distributed than these few records indicate. Those specimens with altitude data indicate that these moths have been caught between 1300 and 2500 m.

REMARKS: Eight specimens (six males, two females), three male and one female genitalic dissections, and two male and one female slide mounts of antennae and legs have been

studied. A photograph of the holotype is before me for comparative purposes.

There is some variation in the color of the upper surface of the forewings. Three males from Oaxaca are before me (in AMNH); the two from Rio Guajolote, 2000 m, Municipio Suchixtepec (see fig. 13) have a rather even and smooth appearance, with pinkish and olivaceous tints, whereas the other specimen from Vista Hermosa, 1420 m, Municipio Comaltepec, is much more suffused with dark brown scales, giving a darker and more finely speckled appearance. Old specimens of this species appear to lose some of their original color, as is the case with *cautama*.

Acronyctodes eximia
(C. C. Hoffmann and Vazquez),
new combination
Figures 15, 16, 25, 30

Synopsia eximia Hoffmann and Vazquez, 1939,
p. 335, figs. 1, 2 (adults), 3 (egg).

DIAGNOSIS: Similar in appearance to *cautama*, but larger and darker. The upper surface of the forewings is more olivaceous, the median area of the male is heavily suffused with blackish brown scaling, and the t. p. line is less strongly dentate. The male genitalia have the aedeagus with a simple, elongate, tapering posterior end, the exserted vesica is straight and has about seven posteromedian spines, and the anellus is 1.65 mm in length. The female genitalia have a prominent dentate signum, the corpus bursae has the entire corneous surface more or less covered with zigzag ridges, and the finely spiculate lamella antevaginalis has a truncate posterior margin.

MALE: Similar to those of *cautama*, differing mainly as follows: thorax with tarsi having length of basal segments 3.0 mm, 3.0 mm, and 2.2 mm, respectively; forelegs with epiphysis arising at one-half length of segment, and being slightly more than half its length.

Upper Surface of Wings: Forewings slightly darker, tending to be more olivaceous, without pink tints; t. a. line weakly curved medially; median area more heavily suffused with dark brown, partially obscuring discal spot and dark bar distad of spot; t. p. line with costal area near apex dark brown, with line apparently arising 1.5 mm from apex, line

less dentate crossing wing. Hind wings with more maculation weakly indicated in center of wing.

Under Surface of Wings: Similar to those of *cautama* but tending to be slightly more contrastingly marked.

Length of Forewings: 26 mm.

FEMALE: Thorax with tarsi having lengths of basal segments 3.1 mm, 3.3 mm, and 2.6 mm, respectively.

Upper Surface of Wings: Paler and more olivaceous than male, having but small amount of dark brown scaling in median area, with prominent, strongly curved median line.

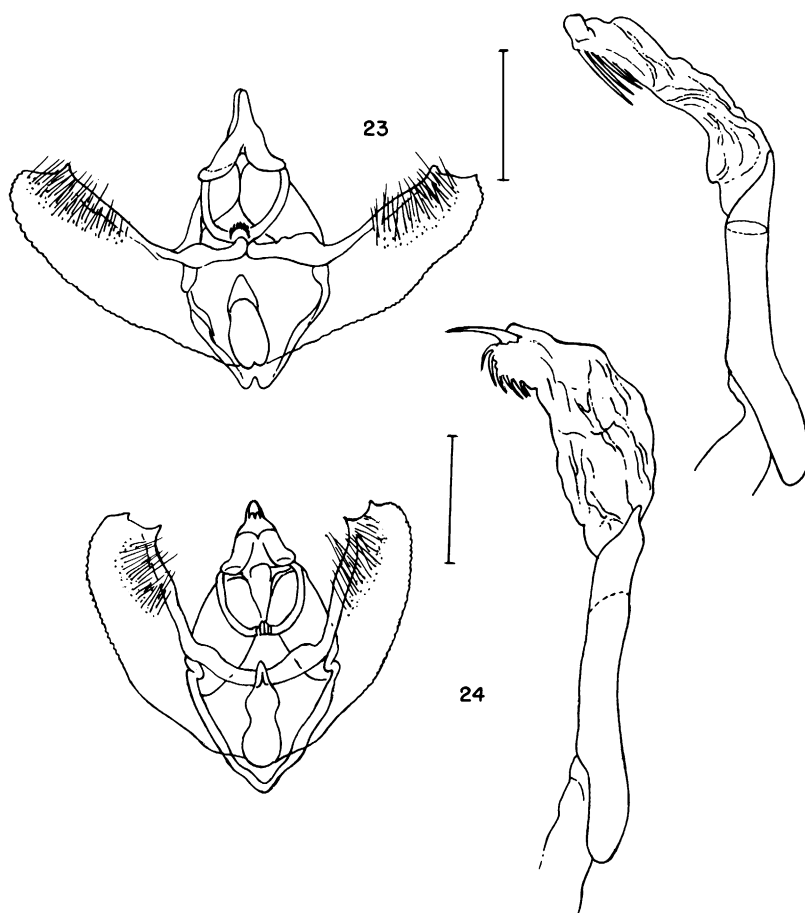
Under Surface of Wings: Similar to that of male, but less contrastingly marked.

Length of Forewings: 28 mm.

MALE GENITALIA: Similar to those of *cautama*, differing mainly as follows: uncus 0.8 mm long, base 0.8 mm wide, in form of broader triangle, with less constriction posterior of base, apically more curved ventrally, with posteroventral margin more broadly rounded; gnathos more broadly U-shaped, with median spinose swelling not reaching posterior margin of transverse portion of gnathos; valves with each costa with more prominent apical spinelike swelling, valvula with smaller lightly sclerotized area, with larger projection being closer to spinelike swelling, spinose area tending to be more diffuse; anellus longer, 1.65 mm in length, posterior portion broadly triangular, flat; aedeagus 3.4 mm long, 0.4 mm wide, posterior end elongate, sharply pointed; vesica, when exserted, a simple tube extending at about 45° to aedeagus, having posteromedian row of about seven prominent spines, longest being 0.6 mm in length.

FEMALE GENITALIA: Similar to those of *cautama*, differing mainly as follows: sterigma with finely spiculate lamella antevaginalis, truncate, of greater width laterally and medially, with spiculate area extending narrowly anteriad for 0.6 mm; ductus bursae slender, with width two-thirds that of length, with sides of equal length; ductus seminalis arising slightly to right of center of corpus bursae; corpus bursae more irregular in outline, with anterior end more strongly extended to right. Apophyses posteriores 2.5 mm long, apophyses anteriores 1.3 mm in length.

EARLY STAGES: The egg, last instar cater-



FIGS. 23, 24. Male genitalia of *Acronyctodes*. 23. *A. cautama* (Schaus), Guerrero Mill, Hidalgo, Mexico (Mann and Skewes; AMNH). 24. *A. colorata* (Warren), Vista Hermosa, Oaxaca, Mexico, October 1, 1962 (E. C. Welling; AMNH). Bar equals 1 mm.

pillar, and pupa were described by the authors when naming this species; the egg was illustrated (Hoffmann and Vazquez, 1939, fig. 3).

FOOD PLANT: *Buddleia*.

TYPES: The holotype, male, and allotype, female, are in the collection of the American Museum of Natural History (see figs. 15, 16). The genitalia of the holotype are mounted on slide FHR 19106A, and those of the allotype are on FHR 19209A.

TYPE LOCALITY: Desierto de los Leones, elevation 3000 m, Distrito Federal, Mexico.

DISTRIBUTION: Known only from the type locality.

FLIGHT PERIOD: June and July.

REMARKS: Two specimens, two genitalic preparations, and two slide mounts of antennae and legs have been studied; these are of the holotype and allotype.

Acronyctodes leonilaria (C. C. Hoffmann),
new combination
Figures 17, 18, 26, 31

Synopsia leonilaria Hoffmann, 1936, p. 59, figs. 1, 2 (holotype, allotype). Vazquez, 1936, pp. 65, 73.

DIAGNOSIS: This is the smallest species in the genus, with the length of the forewings 19 to 20 mm; the upper surface of the forewings is whitish, more or less heavily suffused with

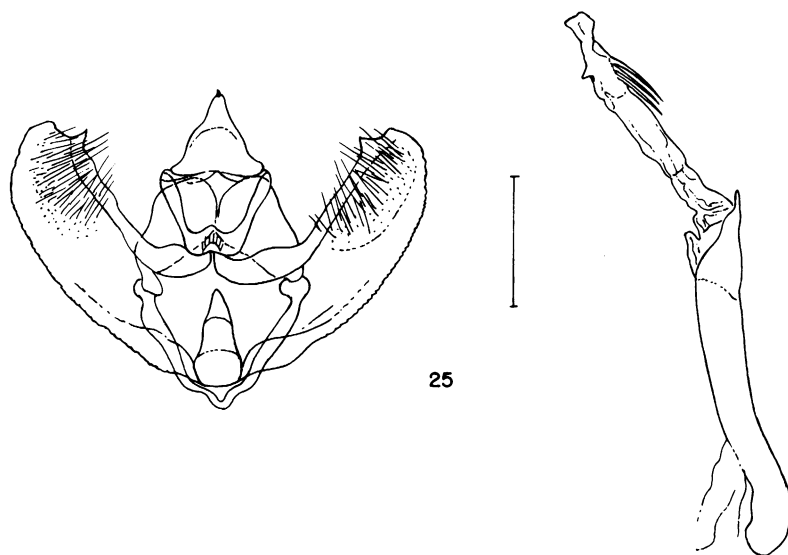


FIG. 25. Male genitalia of *Acronyctodes eximia* (Hoffmann and Vazquez), holotype, Desierto de los Leones, D.F., Mexico, July 1, 1939 (C. C. Hoffmann; AMNH). Bar equals 1 mm.

beige, brown, and blackish brown scaling. The palpi only rise to the lower quarter of the eyes, and the tongue is reduced. The male genitalia are distinguished by the S-shaped costa, by the aedeagus terminating in a median tapered point flanked on each side by a large structure about as long as the median point, and by the exerted vesica being apically recurved. The female genitalia are without a signum, the ductus bursae is asymmetrical and very broad for its entire length, and the apophyses posteriores are 1.9 mm long.

MALE: Similar to *cautama*, differing mainly as follows: head with palpi tending to be darker than front, less densely scaled, appearing more slender, rising to one-fourth height of eye; second segment 1.0 mm long, third segment 0.6 mm in length; tongue reduced. Thorax with tarsi having lengths of basal segments 2.0 mm, 2.0 mm, and 1.5 mm, respectively; tibia with epiphysis arising about two-fifths length of segment, and being three-fourths its length.

Upper Surface of Wings: Forewings paler, with less dark scaling, lacking olivaceous and pinkish tints; t. a. line more prominent, thicker, biangulate; median area medium brown, with discal spot ringlike and having broad black or blackish brown area distally, ex-

tending to t. p. line but not connected to costa; t. p. line white, slender, truncate opposite dark discal area; terminal area with tornus darkened, and with darkened area from costa to near t. p. line, not connected thereto; fringe more strongly darkened at vein endings. Hind wings paler, pale grayish white.

Under Surface of Wings: All wings grayish white, paler, with maculation of upper surface weakly reflected.

Length of Forewings: 19 mm.

FEMALE: Head paler; antennae of about 58 segments, longest pectinations 0.4 mm long, twice as long as their basal segments. Thorax with tarsi having lengths of basal segments 2.0 mm, 2.1 mm, and 1.5 mm, respectively; forelegs with epiphysis arising at middle of segment, and being one-half its length.

Upper Surface of Wings: Paler, with more white scaling; forewings with median area having less brown scaling, and with more white in terminal area, making t. p. line appear more contrasting.

Under Surface of Wings: Similar to that of male.

Length of Forewings: 20 mm.

MALE GENITALIA: Nearly one-half again as large as those of *cautama*; uncus 1.0 mm long, base 1.0 mm wide, lateral margins strongly

biconcave, posterodorsally with ridge but not prominently laterally flattened or thick, apically bluntly pointed; gnathos U-shaped, with shortly dentate anteroventral projection; valves with each costa S-shaped, deeply concave near base, distal portion with irregular, short longitudinal ridges, terminating in small rounded point, apical part of valvula sclerotized, not differentiated from costa, distal margin concave, with sharp point at outermost part of valve, without spinose area, sacculus with median swelling; transtilla slender, tapering to point, widely separated medially; manica finely convoluted; anellus 1.1 mm long, rounded, anterior part recessed dorsally, posterior part with lateral, inwardly directed rodlike swellings, posterior end raised ventrally, distally sclerotized and pointed; aedeagus 4.2 mm long, 0.35 mm wide, posterior end sclerotized, asymmetrical, with median elongate point, large prominent swelling on left side slightly longer than median point, smaller prominent, concave projection on right side, with weakly dentate margin, shorter than median point; vesica, when exerted, in form of apically recurved tube, with transverse striation, and having about 16 prominent setae projecting to left, longest ones 0.4 mm in length.

FEMALE GENITALIA: Sterigma with wide, straight lamella antevaginalis, irregularly convoluted medially, lamella postvaginalis heavily sclerotized, posterolateral margins asymmetrical, left side rounded and extending posteriorly, right side rectangular and folded anteriorly, and with large, approximately bowl-shaped, minutely setose median structure; ductus bursae subrectangular, longer than wide, smoothly sclerotized; ductus seminalis arising dorsally from small anteromedian swelling on ductus bursae; corpus bursae with slender, longitudinally striate, sclerotized posterior portion and much smaller, partially rounded, corneous anterior portion, having irregular surface; signum absent. Apophyses posteriores 1.9 mm long, apophyses anteriores 1.0 mm in length.

EARLY STAGES: Hoffmann (1936) briefly described both the larva and pupa. Vazquez (1936) has given a comparison of the last instar larva and pupa as compared with those of *mexicanaria*.

FOOD PLANT: *Buddleia*.

TYPES: The holotype, male, and allotype, female, are in the collection of the American Museum of Natural History (see figs. 17, 18). The genitalia of the holotype are mounted on slide FHR 19126A, and those of the allotype are on FHR 19207A.

TYPE LOCALITY: Cerro de San Miguel, elevation 3200 m, Distrito Federal, Mexico.

DISTRIBUTION: Known only from the type locality.

FLIGHT PERIOD: Unknown (the holotype and allotype are reared specimens and their date of emergence from the pupa was not recorded in either the original description or on the specimen labels).

REMARKS: Two specimens, two genitalic preparations, and two slide mounts of antennae and legs have been examined. The abdomen of the allotype had been glued onto the thorax; however, it looked like the one illustrated in the original description. It is obviously impossible to discuss the variability of this species due to lack of material. As the two specimens that were studied were reared, it is possible that their size may not be the same as moths that developed under natural conditions.

Acronyctodes mexicanaria (Walker),
new combination

Figures 1–6, 8–10, 19–22, 27, 32

Biston mexicanaria Walker, 1860, p. 305.

Synopsia mexicanaria: Druce, "1891–1900" [1892], p. 71. Vazquez, 1936, p. 65, figs. 1, 2 (adults), 4 (caterpillar), 5, 6 (setal patterns), 7 (pupa).

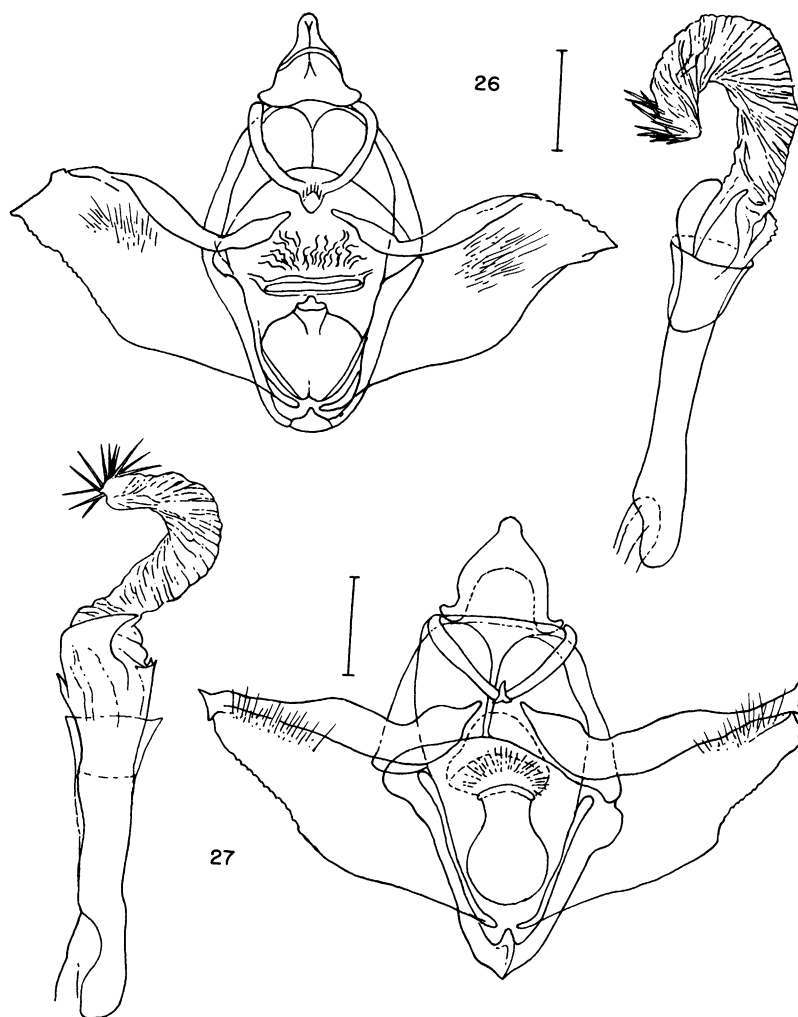
Callopsiodes mexicanaria: Warren, 1901, p. 484.

Synopsia hedemanni C. Felder and Rogenhofer, 1875, pl. 125, figs. 14, 15. Druce, "1891–1900" [1892], p. 71 (placed as synonym of *mexicanaria*).

Acronyctodes insignita Hy. Edwards, 1884, p. 78.

NEW SYNONYMY.

DIAGNOSIS: The adults can be recognized by the white frons. The male genitalia have the posterior end of the aedeagus with a broad, flat projection that is sharply angled to the right, and a short, variably dentate projection on each side. The female genitalia are without a signum, the ductus bursae is asymmetrical, decreasing in width anteriorly, and the apophyses posteriores are 2.4 to 2.9 mm long.

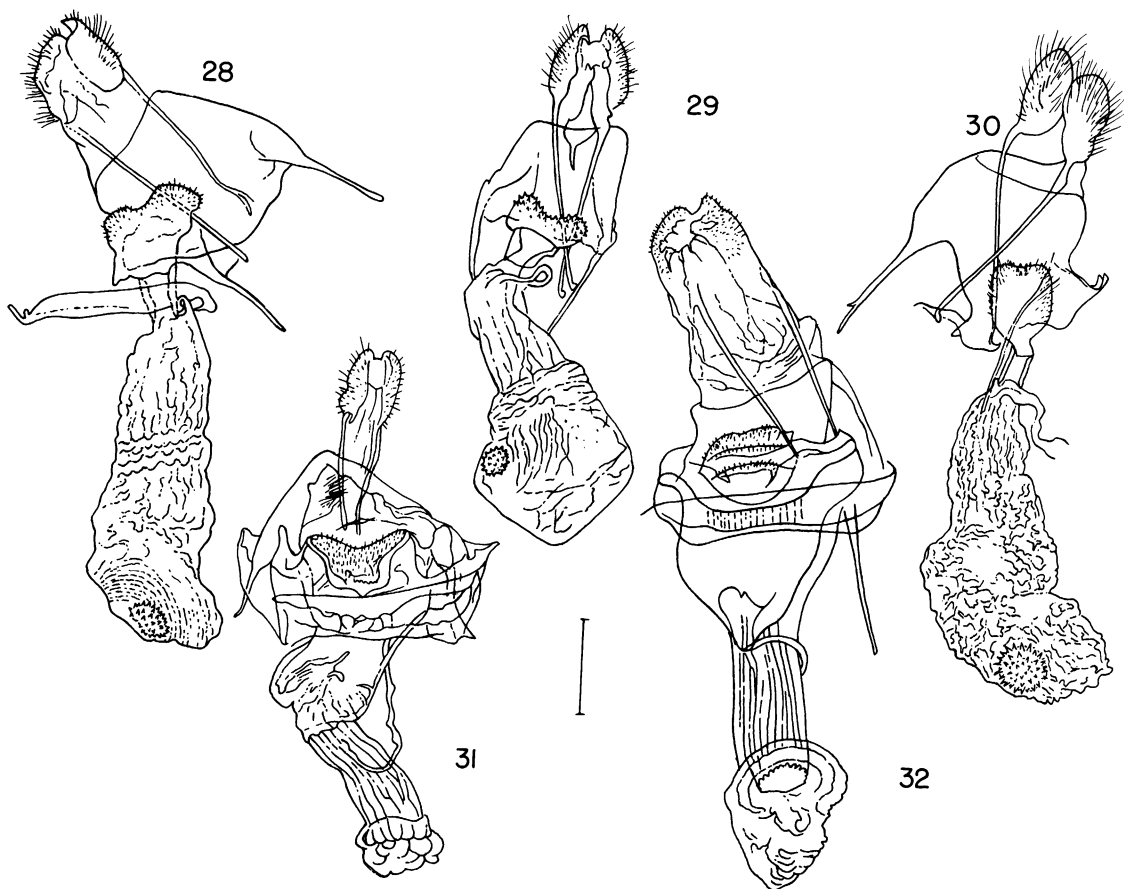


FIGS. 26, 27. Male genitalia of *Acronyctodes*. 26. *A. leonilaria* (Hoffmann), holotype, Cerro de San Miguel, D.F., Mexico (C. C. Hoffmann; AMNH). 27. *A. mexicanaria* (Walker), lectotype of *A. insignita* Hy. Edwards (AMNH). Bar equals 1 mm.

MALES: Similar to those of *leonilaria*, differing mainly as follows: head with vertex and front white; palpi with second segment 0.9 mm long, third segment 0.5 to 0.6 mm in length; antennae of from 55 to 67 segments, longest pectinations 0.6 to 1.0 mm long, being from three to four times as long as their basal segments. Thorax grayish white above, collar slightly darker, terminally grayish black; posterolateral margins long scaled, giving impression of tufting; tarsi with lengths of basal segments 2.0 to 2.2 mm, 2.0 to 2.3 mm, and 1.5 to 1.6 mm, respectively.

Upper Surface of Wings: Forewings grayish white, with variable amounts of dark scaling; pattern variable in intensity, ranging from weak to strongly contrasting; discal spot small; post discal dark area rarely present; t. p. line strongly dentate; terminal area with basal one-half concolorous with median area, distal portion paler. Hind wings with maculation variable.

Under Surface of Wings: Maculation very variable, similar to that of upper surface; discal spots black, usually prominent on all wings.



FIGS. 28–32. Female genitalia of *Acronyctodes*. 28. *A. cautama* (Schaus), Cerro Potosi, Nuevo Leon, Mexico, September 1, 1972 (L. P. Gray; AMNH). 29. *A. colorata* (Warren), Tuis, Costa Rica, August 26, 1908 (USNM). 30. *A. eximia* (Hoffmann and Vazquez), allotype, Desierto de los Leones, D.F., Mexico, June 27, 1939 (C. C. Hoffmann; AMNH). 31. *A. leonilaria* (Hoffmann), allotype, Cerro de San Miguel, D.F., Mexico (C. C. Hoffmann; AMNH). 32. *A. mexicanaria* (Walker), Jalapa, Mexico (AMNH). Bar equals 1 mm.

Length of Forewings: 21 to 24 mm.

FEMALES: Similar to males. Thorax with tarsi having lengths of basal segments 2.0 to 2.2 mm, 2.0 to 2.3 mm, and 1.5 to 1.8 mm, respectively.

Upper Surface of Wings: Either similar to that of males or slightly paler, with median area of forewings tending to have somewhat less dark scaling.

Under Surface of Wings: Similar to that of males.

Length of Forewings: 21 to 25 mm.

MALE GENITALIA: Similar to those of *leonilaria*, differing mainly as follows: uncus 1.1

to 1.3 mm long, base 1.30 to 1.45 mm wide, posterolaterally more strongly convex, apical region less attenuate, apex wedge-shaped; gnathos V-shaped, with shortly dentate, small recurved projection; valves with each costa straight except for median swelling, terminating in ventrally curving point, apical part of valvula sclerotized, not differentiated from costa, distal margin truncate or weakly concave, with point at end, with a few scattered elongate setae, sacculus swollen, with median swelling; transtilla prominent, tapering to rounded point, widely separated medially; manica with mostly slender longitudinal con-

volutions; anellus 1.4 to 1.9 mm long, flat, longer anterior portion elliptical or ovate, narrower posterior projection variably rounded; aedeagus 4.2 to 4.9 mm long, 0.4 to 0.6 mm wide, posterior end sclerotized, with broad, flat projection angled sharply to right, terminating in curved hook or sharp point, each side with short, variably dentate projection of approximately equal size; vesica, when exerted, tending to be slightly narrower than that of *leonilaria*, with from about 12 to 28 prominent setae, longest ones 0.3 to 0.5 mm in length.

FEMALE GENITALIA: Similar to those of *leonilaria*, differing mainly as follows: sterigma with lamella antevaginalis broader, curved, more convoluted, lamella postvaginalis rounded anteriorly, with wider, flared, minutely setose posterior flange; ductus bursae slightly wider than long, symmetrical, with wrinkled surface; ductus seminalis arising from small ventral sac extending from anteroventral portion of ductus bursae; corpus bursae with more numerous longitudinal striations on slender posterior portion, and with slightly larger, more membranous anterior part. Apophyses posteriores 2.4 to 2.9 mm long, apophyses anteriores 1.0 to 1.8 mm in length.

EARLY STAGES: Vazquez (1936, figs. 4–7) described the egg, first and last larval instars, and the pupa, illustrating the larval setal pattern, mature caterpillar, and pupa. She also gave a table in the same paper with the larval and pupal differences between *mexicanaria* and *leonilaria*.

FOOD PLANT: *Buddleia*.

TYPES: Walker described *mexicanaria* from a single male; the holotype is in the BM (see fig. 8).

Felder and Rogenhofer described *hedemanni* from a male and a female, both of which were illustrated by the authors; both specimens are in the BM. I hereby designate the male specimen as the lectotype (see fig. 9).

Edwards described *insignita* from two males and two females that were "captured chiefly in the State of Vera Cruz, Mexico, by Mr. William Schaus, Jr.," with the types being either in the Edwards or Neumoegan collections (1884, p. 11). The former collection is now in the AMNH; only one specimen can

safely be called a syntype. This is a male, without a locality label, bearing Henry Edwards' holographic label, "*Acronyctodes insignita* Hy. Ed. Type," this museum's printed label "No. 14707 [the number itself being handwritten] Collection Henry Edwards," and a red AMNH type label. A check of the Department of Entomology catalogue for no. 14707 indicates that this specimen was registered as the type of *insignita*; there are other specimens of this species, also collected by Wm. Schaus at Jalapa, Mexico, but they bear no. 14706. The Neumoegan collection, formerly in the Brooklyn Museum, is now in the USNM. There are two specimens labeled as being from the Brooklyn Museum collection, and both are females; one has no additional label data, whereas the other has "Mexico," Edwards' holographic label "*Acronyctodes insignita* H. Eds.," and a red "Type No. 34320 U.S.N.M." label. This latter specimen can be assumed to be one of the syntypes. The status of the remaining syntype or syntypes is unclear, although there is one male in the AMNH from the Brooklyn Museum collection; it bears a handwritten "Jalapa, Mex." label, and a printed "F. Lemmer Coll. from O. Buchholz" label. Of the two labeled specimens, I hereby designate the male in the AMNH as the lectotype (see fig. 19); its genitalia are mounted on slide FHR 19110A, with the abdomen being on FHR 19110B.

TYPE LOCALITIES: For *mexicanaria*, Mexico. For *hedemanni*, "Huahuapan, Puebla, Mexico"; this locality is now called Huajuapán, northern Oaxaca, Mexico, 5510 ft (Selandier and Vaurie, 1962, p. 34). For *insignita*, the State of Veracruz, Mexico; Jalapa (see preceding paragraph) may or may not be the true locality, as this was placed on many Schaus specimens but it is my understanding that this indicated more of a generalized locality than a specific one.

DISTRIBUTION: The mountains of eastern and southern Mexico (Distrito Federal, Guerrero, Hidalgo, Mexico, Morelos, Oaxaca, Veracruz). Those specimens with elevation data give a range of from about 1240 to 2750 m.

FLIGHT PERIOD: April through December, although no September specimens have been studied.

REMARKS: Seventy-two specimens (43 males, 29 females), seven male and three female genital dissections, plus five male and three female slide mounts of antennae and legs have been studied. Photographs of the three syntypes in the BM have been furnished to me.

This appears to be the most variable of the species, but this could be an artifact due to the much larger sample studied. Fresh, clean specimens have a white frons; on older, faded, and greasy examples the frons may appear to be some shade of grayish brown. The maculation of the upper surface of the forewings is variable, ranging from specimens with weakly developed maculation and with only a small degree of contrast in the median area, to very dark, strongly contrastingly colored individuals; this range of variation occurs in both sexes.

A REVIEW OF THE NEW WORLD BISTONINI

It has been assumed that the New World *Bistonini* occur in the United States and Canada, without extending south into tropical America (Forbes, 1948; Rindge, 1975). One species is known from northern Mexico, as *Biston betularia cognataria* (Guenée) was reported from Chihuahua (Rindge, 1975); a second specimen is before me (in AMNH) from the mountains of eastern Sonora at 8000 ft (2439 m) elevation. These two localities are about 185 km apart in a straight line, and both are in the Sierra Madre Occidental, definitely a Nearctic area.

When doing the dissections and studies for my generic revision of the New World *Nacophorini* (1983) I attempted to identify certain large moths from Mexico and Central America; as stated above, this led to the revision of *Acronyctodes*. The members of this genus were obviously not members of the *Nacophorini*, as the males are without any traces of the processes of the anellus; further studies have led me to place them in the *Bistonini*. By so doing, the distribution of the tribe is extended into tropical America as far as Panama.

One heretofore diagnostic character used in recognizing the New World *Bistonini* has been the short or atrophied proboscis. Now that *Acronyctodes* is included in this tribe,

this character no longer holds for the entire group. However, this is not a unique situation; according to Forbes (1948, p. 64), eastern Asia has the most primitive forms in the tribe, with the proboscis "still preserved" (by which I assume he meant fully developed and usable).

The methodology used in the tribal placement was similar to that utilized in my study of the *Nacophorini*, wherein a much more detailed set of observations and analyses were used than ever before (1983, pp. 150–159). In order to do this, the species of the six genera previously included in the New World *Bistonini* were restudied, and the data for some 150 character states were recorded and summarized for each genus; all of this was added to similar data available for *Acronyctodes*. This information was distilled down to 12 characters on the external portion of the adults and six for the genitalia; these 18 characters are defined by their plesiomorphic and apomorphic states, and the data are listed in four accompanying tables. The polarities of many of the characters have been discussed and summarized in my earlier paper on the *Bistonini* (1975, pp. 74, 75, table 1). The other characters were included in the same revision but not tabulated, as the members of the included genera all had shared character states; the only ones not used heretofore is the autopomorphic tarsal modification found in the females of *Acronyctodes*.

The information contained in the tables is comparable to that presented for the *Nacophorini*, although identical structures are not necessarily present in both sets of tables. Based on my analysis, the *Bistonini* are a more plesiotypic group than are the *Nacophorini*, at least in the New World; the two tribes are not closely related, as Forbes (1948, p. 64) has pointed out. It may be due to the relative plesiotypic nature of the *Bistonini* that forced me to use a much smaller number of external and genitalic characters than was done for the *Nacophorini*; in the latter tribe 13 external characters, 11 for the male genitalia, and eight for the female genitalia, were tabulated. One noticeable difference between the two tribes is in the genitalia of both sexes, as these structures in the *Bistonini* are simpler and more uniform than those of the *Nacophorini*.

TABLE 1
Nature of External Characters in the *Bistonini*

	Plesiomorphic State	Apomorphic State
1. Tongue	Normal or slightly reduced	Vestigial or absent
2. Palpi	Projecting well beyond eyes, 1.5 to 1.7 mm long	Not extending beyond eyes, 0.3 to 1.0 mm long
3. Eyes	Naked	Hairy
4. Covering of dorsal surface of abdomen	Scales only	Scales plus spines
5. Tympanic organs of females	Same size as males	Smaller than males
6. Male antennae	Bipectinate	Four-pectinate or ciliate
7. Fore tibia with apical spur	Absent	Present
8. Female fore tibial epiphysis	Present	Absent
9. Spurs on hind tibia	Two pairs	One pair
10. Hair pencil on male hind tibia	Absent	Present
11. Middle and hind tarsi with terminal segment with minute setae instead of scales	Absent	Present
12. Wings of females	Fully developed	Brachypterous

In my keys to the genera of the New World *Bistonini* (1975, p. 78), the adults of *Acronyctodes* key out to *Biston*, based on morphology and color. The moths of the present genus may be separated from those of *Biston* by the shorter palpi, by the naked eyes, by the presence of the small, diffuse hair pencil on the hind tibia of the males, by the minutely spinose areas on the terminal tibial segment of the middle and hind legs of the females, and by the evenly dentate t. p. line on the upper surface of the forewings. The male genitalia key out to *Lycia*; compared with that genus, these structures in *Acronyctodes* are distinguished by the shortly dentate median portion of the gnathos, by the pointed end of the costa of the valves, by the elongate posterior end of the aedeagus, and by the much larger number of spines in the vesica. The female genitalia key out to couplet 5; the species of *Acronyctodes* can be separated from those of *Phigalia*, *Paleacrita*, and *Erannis* by the shape and nature of the corpus bursae.

The tribal placement of the genus *Hypagyrtis* Hübner is as varied as the opinions of the authors who have attempted to assign it to a higher category. Forbes (1948) placed it in the *Melanolophiini*, based primarily on the structures of the pupae, male genitalia, and antennae; he associated it with *Epimecis* Hübner, *Melanolophia* Hulst, *Protoboarmia* McDunnough, and *Eufidonia* Packard. McGuffin (1977) moved *Hypagyrtis* to the closely related *Boarmiini*, based on his studies of the adults, genitalia, eggs, mature larvae, and pupae; of the four supposedly related genera listed above, he retained only *Melanolophia* and *Eufidonia* in the *Melanolophiini*, with the other two joining *Hypagyrtis* in the

TABLE 2
Presence or Absence of External Characters^a

	1	2	3	4	5	6	7	8	9	10	11	12
<i>Acronyctodes</i>	—	—	—	—	—	—	—	—	—	+	+	—
<i>Biston</i>	—	+	+	—	—	—	—	—	—	—	—	—
<i>Cochisea</i>	+	+	+	—	—	—	+	—	+	—	—	—
<i>Erannis</i>	+	+	—	—	+	+	—	—	—	—	—	+
<i>Lycia</i>	+	+	—	—	±	—	—	—	+	—	—	+
<i>Paleacrita</i>	+	+	—	+	+	+	—	+	—	—	—	+
<i>Phigalia</i>	—	+	—	±	+	—	—	+	—	—	—	+

^a Numbers at top of columns are those of table 1.
Symbols: +, apomorphic state; —, plesiomorphic state; ±, both found in same taxon.

TABLE 3
Nature of Genitalic Characters in the Bistonini

	Plesio- morphic State	Apomorphic State
13. Apex of uncus	Single point	Widely bifurcate
14. Median enlargement of gnathos	Simple	Shortly dentate
15. Inner face of valves	Simple	With raised spinose swelling
16. Posterodistal end of costa	Simple	Attenuate
17. Aedeagus	Simple tube	Posterior end modified
18. Signum	Present	Absent

Boarmiini, along with a number of other genera. Ferguson moved this genus once again, this time to the Bistonini, placing it between *Lycia* Hübner and *Phigalia* Duponchel; the reason given for this is that because the transfer "was indicated in a manuscript revision of geometrid classification by the late L. R. Rupert" (1983, p. xviii).

The present basic subdivision of the Ennominae is based on the pupae; those with a bifid cremaster are collectively called the boarmid group, whereas those with eight cremaster setae are the ennomid group (Forbes, 1948; McGuffin, 1977). All three tribes, mentioned in the preceding paragraph, are members of the boarmid group. McGuffin (1972, 1977) has studied intensively the members of this group, based primarily on the Canadian fauna. The summaries of his studies are presented in his discussions of the phylogeny, ancestral character states (adult, male and female genitalia, first instar and mature larva, and pupa), the boarmid ancestor, and the evolution of the boarmid tribes and genera of the Boarmiini (McGuffin, 1977, pp. 112–118, fig. 206). Based on McGuffin's detailed and thoughtful conclusions, there does not appear to be much basis for placing *Hypagyrtis* in the Bistonini. A detailed study of the eggs of two species of *Hypagyrtis* shows that these ova are more similar to the eggs of *Ectropis* (a genus placed in the Boarmiini by both McGuffin and Ferguson) than to the Canadian species of Bistonini. This is additional

TABLE 4
Presence or Absence of Genitalic Characters^a

	13	14	15	16	17	18
<i>Acronyctodes</i>	–	+	–	+	+	+
<i>Biston</i>	+	–	–	–	–	±
<i>Cochisea</i>	+	–	–	–	–	–
<i>Erannis</i>	–	–	+	–	–	+
<i>Lycia</i>	–	–	–	–	–	–
<i>Paleacrita</i>	–	–	+	–	–	±
<i>Phigalia</i>	–	–	+	–	–	±

^a Numbers at top of columns are those of table 3.

Symbols: +, apomorphic state; –, plesiomorphic state; ±, both found in same taxon.

evidence that *Hypagyrtis* is correctly placed in the Boarmiini (Salkeld, 1983, p. 52).

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