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A Revision of the Moth Genus *Ceratomyx* (Lepidoptera, Geometridae)

FREDERICK H. RINDGE¹

ABSTRACT

The genus *Ceratomyx* is revised for the first time. Twelve species are included and five described as new: *crassa* (Mexico), *fessa* (Chile), *crebra* (Chile), *aculeata* (Chile), and *tora* (Mexico). In addition, *constantia* Dyar is placed in the genus for the first time. The species of the genus are found in the southern portion of the United States to the mountains of central Mex-

ico, and in the Andes of central Chile. *Ceratomyx* is divided into two species groups based primarily on the characters of the male genitalia. All species are described; keys and photographs are presented for the adults, and for both male and female genitalia. The tribal placement of *Ceratomyx* is discussed, as are possible evolutionary changes within the genus.

INTRODUCTION

The genus *Ceratomyx* has never been revised. Capps (1950) made the first attempt to list the species included in *Stenocharis*, as the present genus was then known; Franclemont (1967) gave a slightly more informative listing. Neither author made any attempt to diagnose or describe the included species. It is the purpose of the present paper to revise *Ceratomyx*, to describe the species, and to discuss the placement of the genus in a tribe.

The tribal placement of *Ceratomyx* is in doubt. Based primarily on the characters of the male genitalia, principally the presence of the paired processes of the anellus, I would place the genus in the Nacophorini. The moths in this revision would go in the second, or nonnominate,

group of the tribe; this assemblage of genera is primarily Andean in distribution (Rindge, 1971, 1973), with at least two genera (*Gabriola*, *Animomyia*) present in North America (Rindge, 1974a, 1974b). The apparent disjunct distribution of *Ceratomyx* would fit this pattern of occurrence, as it has three species from Chile and nine from Mexico and the southern United States. On the other hand, the primary subdivision of the Ennominae now in use is based on whether the cremaster of the pupa is composed of two spines or of eight setae (Forbes, 1948). The pupa of only one species of *Ceratomyx* is known (*arizonensis* Capps), and it has a cremaster of two stout, curved hooks (Franclemont, 1967, p. 14). Insofar as they are known, the

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pupae of the Nacophorini have eight setae. However, very few life histories are known for the species included in this tribe; it is indeed rare to have published biological information on more than one species per genus. There are four genera in the nominate section of the tribe and, of these, life histories are known only from one; in the second section pupal descriptions are available in only two of the nine genera. Whether the character of the cremaster will prove valid when more life histories become known remains to be seen. It also must be pointed out that the two species of *Ceratomyx* whose last instar larvae are known have highly modified caterpillars; they possess a pair of stout filaments on the prothoracic segment and a single, shorter one on the eighth abdominal segment. It is not known whether the pupae of *Ceratomyx* are as highly modified.

This genus is still probably better known as *Stenocharis*; Grossbeck described it and its then sole included species, *permagnaria*, in 1912. Capps (1950) described *arizonensis*, and transferred three Mexican species, described earlier by Dyar, to this genus. Smith (1890) described *Bombycia candida* as a member of the Thyatiridae; due primarily to its extreme rarity, it remained in that family as an unrecognized species until 1961, when I transferred it to the Geometridae, and placed it in *Stenocharis*.

Guenée described both *Ceratomyx* and *satania* in 1857. Neither the species nor the genus were recognized during the next century; the first positive clue as to their identity was published by Kimball (1965). Meanwhile Franclemont had reared a very distinctive caterpillar in southern Arizona in 1959 which reminded him of the figure of the larvae of *satania*, published with the description of that species. Franclemont's larvae matured into *arizonensis*. It was from these two peculiar caterpillars that he was able to identify *Ceratomyx*, and to place *Stenocharis* as its synonym.

Members of *Ceratomyx* are usually poorly represented in collections, with the possible exception of *permagnaria*; this species has been collected fairly commonly in southern Arizona in recent years. Perhaps due to their scarcity, the members of the group have undergone little or no study; most species are known from their

original description only or are described as new in this paper.

A study of the male genitalia proves to be most helpful in understanding the relationships of the species. I am dividing *Ceratomyx* into two groups, the first containing those species with genitalia having a flattened, bifurcate uncus and a vesica without spines, and the second having a rounded or triangular, pointed uncus and a vesica with a group of elongate spines. The two characters of group I are considered more primitive than those of group II. Some species have large, sclerotized, curved lateral processes of the anellus, whereas others have reduced, digitate processes; the former condition is thought to be the more primitive. The triangular and elongate posterior margin of the juxta is thought to be the primitive condition; a lobate or digitate margin is the derived state.

Females are poorly represented in collections. Four of the 12 species are unknown for this sex. In the material studied for the present revision, males outnumbered females by a ratio of about 13 to 1.

There is variability in the pattern of the species of *Ceratomyx*. The cross lines on the upper surface of the forewings are partially represented, reduced or obsolescent in the first two species of group I and in all three of the species from Chile (group II). In the second two species in group I the t. a. line is clearly and sharply represented, but the t. p. line is only more or less complete. Both cross lines are present in the last four species of group II, two of which occur in central Mexico and two in the southern United States. The t. p. line in the males of these four species has shifted basally so that it occurs in about the middle of the wing; the females have this line in its more usual position, distally on the wing. This sexual dimorphism in the position of the outer cross line is a derived character, and is not known to me to occur in related genera. In those few species in which series of specimens have been available for study, such as the males of *permagnaria*, the course of the t. p. line shows a considerable degree of individual variation.

Another characteristic of the genus is the difference in size between the adult males and the females of most species. In the material studied to date there has been practically no

overlapping in the length of the wings; the males are smaller than the females. In some cases the largest male may have the same measurement as the smallest female; in other cases there may be a gap of between 1 and 2 mm. in wing length between the two sexes. In two species there is an overlap of 1 or 2 mm. in wing length.

During the course of this study I have examined 382 specimens (351 males, 31 females), including all the primary types known to be in existence. In addition, I have studied 50 genitalic dissections (35 males, 15 females); all of these, with the exception of nine, were prepared by me. I also made 22 slides (13 males, nine females) of antennae and legs of both sexes, where known, from each species.

More than 90 percent of the specimens are to be found in two collections: The American Museum of Natural History with 204, and the Natural History Museum of Los Angeles County with 135. The next largest museum collection is that of the National Museum of Natural History with 28.

All the photographs in this revision were taken by me. Whenever possible, material from the collection of the American Museum of Natural History was used; some of the adults and genitalia are from other collections, and this is specifically noted. The following abbreviations have been used:

AMNH, the American Museum of Natural History

AB, André Blanchard

CAS, California Academy of Sciences

LAM, Natural History Museum of Los Angeles County

USNM, National Museum of Natural History, Smithsonian Institution

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GENUS *CERATONYX* GUENÉE

Ceratonyx Guenée, 1857, p. 193. Walker, 1860, p. 296. Gumpfenberg, 1896, p. 293. Franclemont, 1967, p. 11.

Stenocharis Grossbeck, 1912, p. 399. Capps, 1950, p. 12. Franclemont, 1967, p. 12 (synonym of *Ceratonyx*).

Diagnosis. The wings of both sexes are elongate and have variable venation, being either with or without an areole. The antennae have many segments, ranging from 53 to 70 in the males and from 56 to 77 in the females; those of the males are shortly bipectinate, with the pectinations arising basally, medially, or terminally, of the females simple or weakly serrate. The males lack the tibial hair pencil on the hind legs and the row of setae ventrally on the third abdominal segment. The male genitalia have a very long, simple uncus, a slender gnathos, simple valves, and moderately well-developed processes of the anellus; the vesica may have a bunch of small setae or be unarmed. The female genitalia are rather simple, with a reduced sterigma, a lamella antevaginalis, a short ductus bursae, a membranous corpus bursae, and with signum present or absent.

Adult. Head with eyes of males large, round, wider than front, tending to be smaller and elliptical in females; front raised, varying from swollen to conical, more strongly so in females than in males; tongue present; palpi rising to middle of eye, second segment long, third segment short, horizontal or slightly decumbent, longer in females than in males; antennae of male with from 53 to 70 segments, either shortly bipectinate, with pectinations arising basally, medially, or distally, in length two to four times as long as basal segments, longest pectinations extending to apex or with last few segments

simple, or weakly dentate; antennae of female with from 56 to 77 segments, simple or weakly serrate. Thorax moderate, with weakly developed posterior tufts; fore tibia unarmed, with process in male arising near middle, often flattened distally, in female smaller and arising more distally; hind tibia with two pairs of spurs in both sexes, males without either groove or hair pencil. Abdomen relatively slender and elongate, with or without dorsal tufts; males having ventral surface of third segment without row of setae and last segment without modification.

Forewings elongate, slender, with oblique outer margin and bluntly pointed apex; 12 veins present; areole present or absent; R_1 free or stalked with R_{2+4} or R_{2+5} ; R_{3+4} stalked from cell or from stem of R_2 ; R_5 from areole, stalked with R_{2+5} or R_{3+4} ; M_1 from upper angle; dc curved; Cu_1 from shortly below lower angle; fovea absent. Hind wings elongate, broad, with rounded outer margin; frenulum strong in both sexes; Sc paralleling R for about half length of cell; R and M_1 from before upper angle; m+ldc curved or angled; M_3 from, or before, lower angle; cell elongate, extending beyond middle of wing; Cu_1 from about one-fourth of distance between angle and Cu_2 . Females larger than males.

Upper surface of forewings various shades of gray and brown, with cross lines either reduced and obsolescent, or prominent and complete, alike in both sexes or somewhat dimorphic; hind wings grayish white to gray, with maculation obsolescent. Under surface of wings grayish white to gray, with maculation reduced or absent except for discal dots.

Male Genitalia. Uncus very long and slender, curving ventrally, rounded or triangular with apex terminating in simple point or flattened and with apex broadly bifurcate; socius inconspicuous; gnathos elongate, approximately as long as uncus, evenly tapering or gently rounded to slender median point; valves slender, of equal width throughout, simple, costa sclerotized, enlarged distally in some species, cucullus weakly sclerotized, extending inwardly to fuse with small anellus; juxta small, flat or raised along center line, distally pointed or rounded; lateral processes varying from large, heavily sclerotized, apical attenuate structures to small elliptical protuberances; cristae absent; tegumen and saccus elongate; aedeagus slender, slightly longer than combined lengths of

tegumen and saccus, posterior end pointed, sclerotized; vesica unarmed or with group of slender setae.

Female Genitalia. Sterigma simple, with lamella antevaginalis varying from broad, asymmetrical, subtriangular plate to slender, transverse strip; ductus bursae short, square or rectangular, sclerotized or membranous; ductus seminalis arising ventrally near junction of ductus bursae and corpus bursae; corpus bursae membranous, varying from ovate to having posterior portion slender then enlarged anteriorly into rounded sac; signum present or absent, variable when represented, ranging from large, square, and having two anteriorly directed points to small, thornlike. Apophyses posteriores 1.6 to 2.0 mm. in length, with median attachment to weakly sclerotized anterior margin of membranous papillae anales.

Early Stages. Comstock (1959, p. 41) described the egg and first instar larva of *permagnaria*. The caterpillar of *satanaria* Guenée (1857, p. 193) was described and figured from an Abbot manuscript plate (Franclemont, 1967, p. 11). Franclemont (*op. cit.*) described the last instar larva and pupa of *arizonensis*. The mature larvae of these last two species possess a pair of stout filaments on the prothoracic segment and a shorter, single one on the eighth abdominal segment; these appendages are absent on the first instar caterpillar.

Food Plants. *Liquidambar styraciflua* Linnaeus (Hamamelidaceae) and "*Quercus dentata*" for *satanaria* (Guenée, 1857, p. 194). *Viguiera multiflora* (Nuttall) Blake (Compositae) for *arizonensis* (Franclemont, 1967, p. 14).

Type Species. For *Ceratonyx*, *satanaria* Guenée, 1857. Guenée included two new species when describing *Ceratonyx*, *satanaria* and *carmelitaria*; the latter species was designated as *Ceratophora carmelitaria* by Boisduval and Guenée, 1858, pl. 3, fig. 6, and was thus removed from *Ceratonyx*. Gumpfenberg (1896, pp. 293, 294) was the first to have *satanaria* as the sole included species in *Ceratonyx*; this automatically makes that species the type species, even though it was not so designated at that time. Franclemont (1967, p. 12) was the first to officially name *satanaria* as the type of *Ceratonyx*.

For *Stenocharis*, *permagnaria* Grossbeck, 1912; sole included species.

Distribution. Southern United States, from

South Carolina and Florida to Arizona, south into temperate Mexico (eight species), and the Andes of central Chile (three species).

KEY TO SPECIES

Based on Maculation, Color, and Distribution

1. From Chile 2
From Mexico and the southern United States 4
- 2(1). Male antennae shortly dentate *aculeata*
Male antennae bipectinate 3
- 3(2). Forewing with t. p. line in center of wing, with area distad broadly brownish gray; veins R_{2+5} stalked *fessa*
Forewing with t. p. line more distad, with outer portion of wing gray; vein R_2 free, veins R_{3+5} stalked *crebra*
- 4(1). Forewings white or pale gray, with longitudinal brown streaks; cross lines, when present, broad and diffuse 5
Forewings gray or brownish gray, without longitudinal maculation; cross lines narrow, distinct 7
- 5(4). Hind wings above white *rhadinaria*
Hind wings above grayish white, shaded with brown distally 6
- 6(5). Front with ventral margin rounded and without ridge; forewings with median area tending to be white, and to have prominent discal dot; Arizona *arizonensis*
Front with ventral margin U-shaped and with small ridge at base; forewings with median area not differentiated, having reduced areas of white scaling, and without prominent discal dot; Durango *crassa*
- 7(4). Forewings with t. a. and t. p. lines roughly parallel, enclosing relatively narrow median area darker than remainder of wing; United States 8
Forewings not as above; Mexico 9
- 8(7). Forewings broadly white along costa *satanaria*
Forewings with costa concolorous with rest of wing *permagnaria*
- 9(7). Forewings with t. p. line either outwardly angled or becoming obsolescent 10
Forewings with t. p. line evenly rounded *tora*
- 10(9). Front flattened dorsally, with shallow, inverted U-shaped transverse crest,

weakly concave ventrally, and having small, ventral median tubercle or transverse ridge; forewings with t. a. line angled basad in lower portion of wing *cornifrons*

Front not as above, without ventral tubercle; t. a. line in lower portion of wing at right angle to inner margin, or slightly angled outwardly 11

- 11(10). Both sexes with similar maculation; basal area pale gray, contrasting with brownish gray median area; forewing length of males 12 to 15 mm., of females 16 to 17 mm. *hoplitaria*
Sexes with chromatic dimorphism; males above with all wings dark brown or dark grayish brown, with maculation tending to be obscure; females gray or pale brownish gray, with clearly defined maculation; forewing length of males 14 to 18 mm., of females 18 to 22 mm. *constantia*

Based on Male Genitalia¹

1. Uncus flattened, with bifurcate apex; vesica unarmed (group I) 2
Uncus slender, with pointed apex; vesica with group of slender spines (group II) 6
- 2(1). Uncus 0.1 mm. wide, with apical points close together *hoplitaria*
Uncus 0.2 mm. wide, with broadly bifurcate apex 3
- 3(2). Each valve with pointed apex 4
Each valve with apex broadly rounded *cornifrons*
- 4(3). Uncus of equal width or with apex swollen 5
Uncus constricted medially, swollen distally, narrowing to apex *rhadinaria*
- 5(4). Gnathos shorter, 0.7 mm. in length, with sides 0.1 mm. wide *crassa*
Gnathos longer, 0.8 to 0.9 mm. in length, with sides 0.06 mm. wide *arizonensis*
- 6(1). Lateral processes of anellus long, 0.65 to 0.85 mm. in length, heavily sclerotized, curved and pointed 7
Lateral processes of anellus shorter, 0.25 to 0.60 mm. in length, mostly membranous, digitate, with short point 9
- 7(6). Uncus with ventral surface of distal one-fourth concave; lateral processes of

¹The males of *tora* are not known.

- anellus with distal 0.6 mm. needle-like
 *aculeata*
 Uncus with ventral surface rounded;
 lateral processes of anellus with distal
 0.3 to 0.4 mm. tapering to point . . 8
 8(7). Lateral processes of anellus with each
 base evenly rounded, flat, sloping,
 with anterior end almost 0.2 mm.
 higher than juxta *crebra*
 Lateral processes of anellus with each
 base irregular in shape, with postero-
 dorsal lobe, anterior portion level and
 only slightly higher than juxta . . *fessa*
 9(6). Lateral processes of anellus 0.50 to 0.60
 mm. in length *permagnaria*
 Lateral processes of anellus 0.25 to 0.45
 mm. in length 10
 10(9). Lateral processes of anellus 0.25 to 0.30
 mm. in length; vesica armed with short
 band of spines 0.4 mm. long
 *constantia*
 Lateral processes of anellus 0.40 to 0.45
 mm. in length; vesica armed with
 longer and thicker band of spines 0.6
 to 0.7 mm. long *satanaria*

Based on Female Genitalia¹

1. Signum absent 2
 Signum present 3
 2(1). Ductus bursae heavily sclerotized, 0.4 mm.
 in length and 0.2 mm. in width
 *hoplitaria*
 Ductus bursae membranous, short and
 broad *satanaria*
 3(1). Ductus bursae heavily sclerotized 4
 Ductus bursae membranous 6
 4(3). Signum 0.3 mm. wide 5
 Signum less than 0.1 mm. wide *fessa*
 5(4). Signum having anterior transverse ridge
 with three toothlike projections
 *arizonensis*
 Signum with ridge having two toothlike
 projections, one at each end of ridge . .
 *rhadinaria*
 6(3). Signum with two anterolateral points
 *constantia*
 Signum with single, median projection . . 7
 7(6). Corpus bursae with smooth surface, having
 very few longitudinal striations
 *permagnaria*
 Corpus bursae with numerous longitudinal
 and irregular striations and ridges . . *tora*

¹The females of *crassa*, *cornifrons*, *crebra*, and *aculeata* are unknown.

GROUP I

The moths placed in this group are recognized by the male genitalia having a flattened, terminally bifurcate uncus, and being without spines in the vesica. The ductus bursae of the female genitalia is heavily sclerotized. Abdominal tufts are either absent or, rarely, present.

Five species are included: *arizonensis*, *crassa*, *rhadinaria*, *cornifrons*, and *hoplitaria*. The first occurs in Arizona, the other four in Mexico.

Ceratomyx arizonensis (Capps)

Figures 1, 2, 13, 21, 26, 40

Stenocharis arizonensis Capps, 1950, p. 12, pl. 4, figs. 1 (male genitalia), 2 (female genitalia), 3, 4 (adult male and female).

Ceratomyx arizonensis: Franclemont, 1967, p. 13, fig. 2 (larva).

Diagnosis. This species can be recognized by the large areas of white scaling on the upper surface of the forewings, and by the brown scaling along both the cubital vein and cells and the anal vein. Two types of maculation are present; one has clearly defined dark cross lines and the second has the cross lines obsolescent.

Male. Head with vertex white, with a few pale brown or dark brown scales; front bulbous, rounded, extending beyond eye a distance equal to one-third diameter of eye, ventral margin rounded and without ridge, brown or grayish brown; palpi brown, slightly paler than front, with third segment short, horizontal, extending beyond eye a distance equal to three-fifths diameter of eye; antennae with about 66 segments, pectinations arising in distal half of segments, being up to 0.6 mm. in length. Thorax above white or grayish white, with variable number of brown and grayish brown scales; below white or grayish white; legs grayish brown or brown; fore tibia with process extending beyond end of tibia, terminal one-fourth narrowed. Abdomen without tufts; white, upper and under surfaces heavily and evenly covered with grayish scaling.

Venation of Forewings: Cell present; vein R_{2+5} , or veins R_{2+4} and R_5 separately, from its apex.

Upper Surface of Wings: Forewings white with either dark, contrasting maculation or paler, dull markings; both with longitudinal streaks of

brown, dark brown or grayish black from base, below radial vein to apex, and of pale brown to brown along both cubital vein and expanding into cubital cells, and anal vein; cross lines either brownish black or black, prominent, or obsolescent; when present, t. a. line crossing cubital cell, reduced before reaching inner margin slightly more than one-fourth distance from base; median line absent; t. p. line in middle of wing, course and position variable, arising from longitudinal streak in cell, deeply toothed basad, absent across cubital vein, with basal tooth in fold, meeting inner margin two-thirds distance from base; discal spot usually present; subterminal line present in lower part of wing as broad shade band; terminal line brown to dark brown; fringe concolorous with wing. Hind wings white, becoming heavily and evenly covered with brown scales distally; discal spot absent; extradiscal line a broad band in heavily marked specimens, absent in lightly marked ones; terminal line present or absent; fringe grayish white.

Under Surface of Wings: Forewings grayish brown, with traces of longitudinal striations of upper surface; hind wings white or grayish white; all wings without maculation, except for faint discal spot on forewings in some specimens.

Length of Forewing: 16 to 19 mm.

Female. Similar to male, differing mainly as follows: front more protruding, extending beyond eye a distance equal to one-half diameter of eye; palpi longer, extending beyond eye a distance equal to diameter of eye; antennae shortly serrate, with short seta from each serration; abdomen with three or four small erect tufts, with scales gray basally, brown distally.

Length of Forewing: 17 to 21 mm.

Male Genitalia. Uncus very long, flattened, narrowed medially, apex concave, with two widely separated points 0.12 to 0.20 mm. apart; gnathos medially attenuate into long, tapering, pointed process; valves with each costa weakly concave, sclerotized area slightly widened at base and distally, apex of valve bluntly pointed, valvula with distal two-thirds setose, sacculus broadly but weakly sclerotized; anellus with deeply concave anterolateral area at base of each valve, juxta rounded posteriorly; processes of anellus arising from posterior end of each concave area, large, 0.55 mm. in length, heavily

sclerotized, arising from broad base 0.3 to 0.4 mm. long, gently tapering, sharply curved posteriorly and terminating in sharp point, and with inner surface finely setose; aedeagus 2.0 to 2.2 mm. in length, with heavily sclerotized, tapering point.

Female Genitalia. Sterigma sclerotized, with several small transverse ridges, and with lamella antevaginalis asymmetrical, slightly wider on left side than on right; ductus bursae heavily sclerotized, approximately square in outline but with right side slightly longer than left; corpus bursae slender posteriorly, weakly and irregularly striate, anterior end bulbous; signum large, 0.3 mm. wide, posteriorly rounded, with anterior ridge having three indented teeth. Apophyses posteriores 1.9 to 2.2 mm. in length; papillae anales strongly setose.

Early Stages. The egg and early instar larvae are unknown. The last instar caterpillar has been described and illustrated by Franclemont (1967, p. 13, fig. 2). It is about 40 mm. long and has a pair of long, stout, black hornlike prothoracic filaments that are 10 mm. in length, and a shorter (3 mm.), black, median hornlike filament on the eighth abdominal segment. The head is grayish white with numerous black dots. The body dorsally is grayish white with black spotting; there are 11 crimson subdorsal blotches. The subdorsal line is broad and black; the stigmatal band is very broad and yellow, and this is bordered ventrally by a narrow, black substigmatal band. The ventral surface is grayish white. The spiracles are black.

The pupa was also described by Franclemont (1967, p. 14). It has a cremaster of two stout, curved hooks.

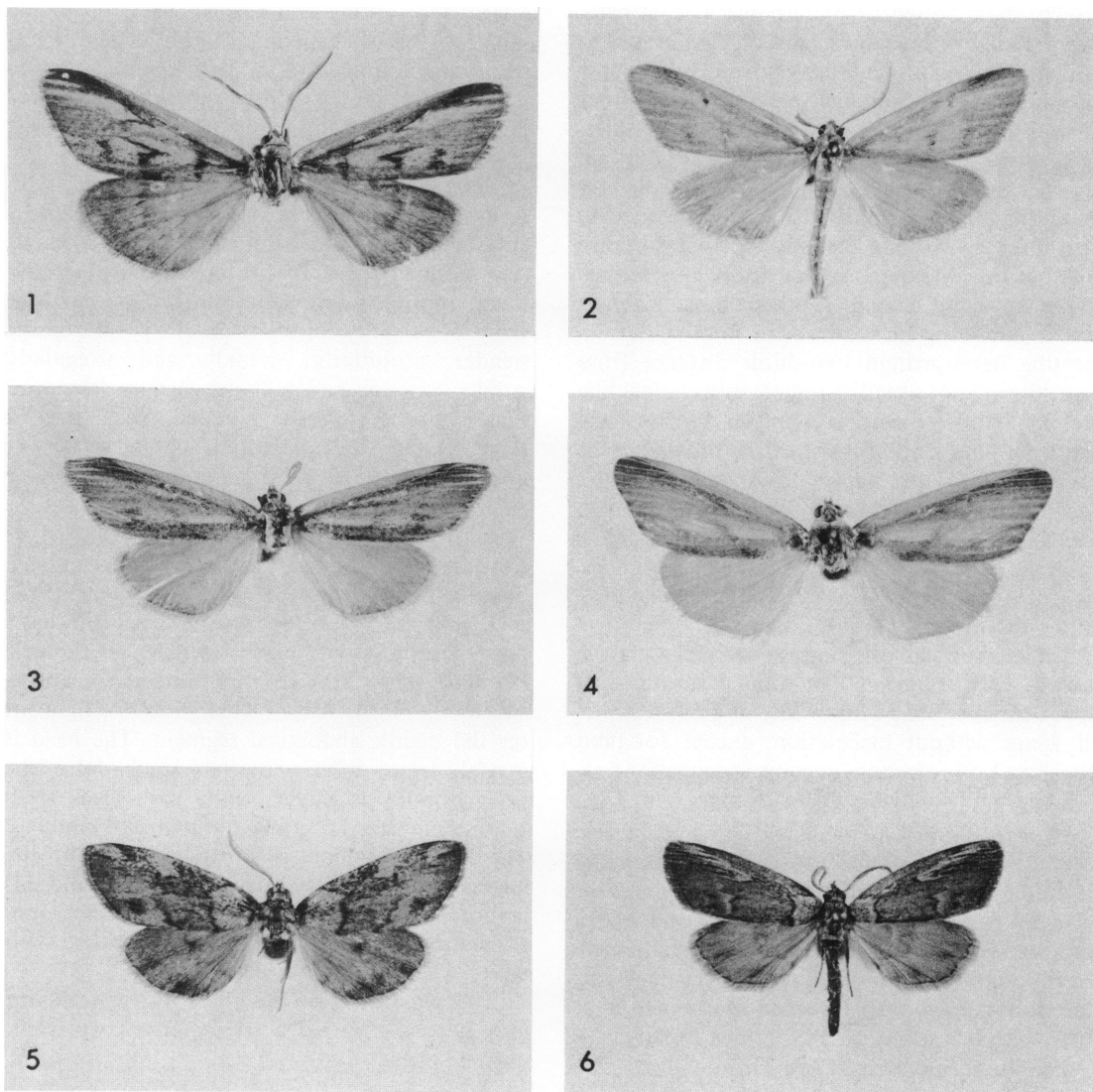
Food Plant. *Vigueria multiflora* (Nuttall) Blake (Compositae).

Types. Holotype, male, USNM 59498; its genitalia are mounted on slide HWC 1576. Allotype, female, in the collection of the Natural History Museum of Los Angeles County; its genitalia are mounted on slide HWC 7622.

Type Locality. Hereford, Cochise County, Arizona.

Distribution. Southern Arizona, being known only from the mountains of Cochise and Santa Cruz counties (see fig. 40).

Flight Period. May, June, July, and August.

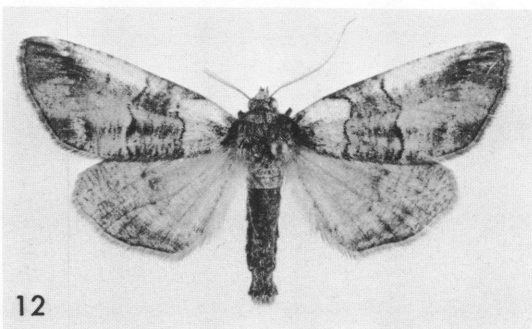
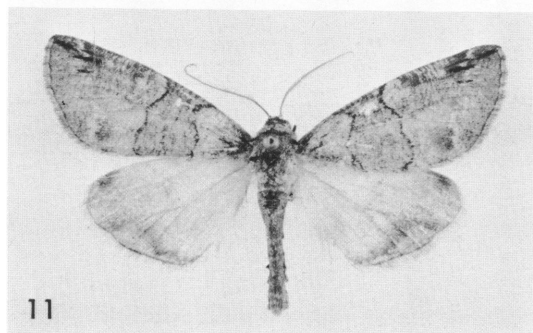
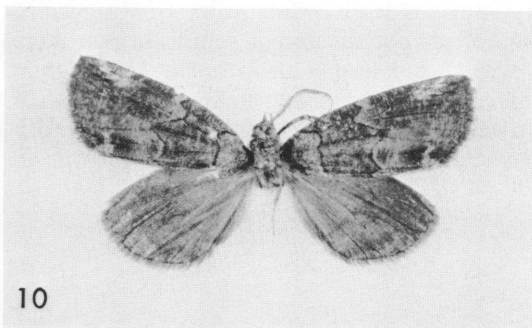
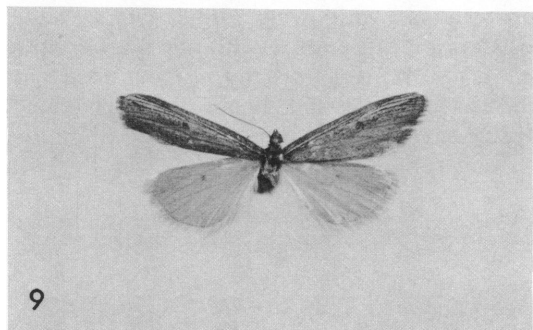
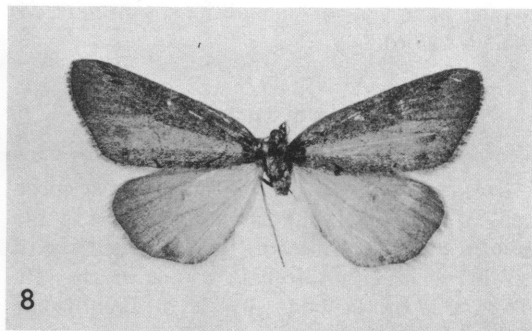
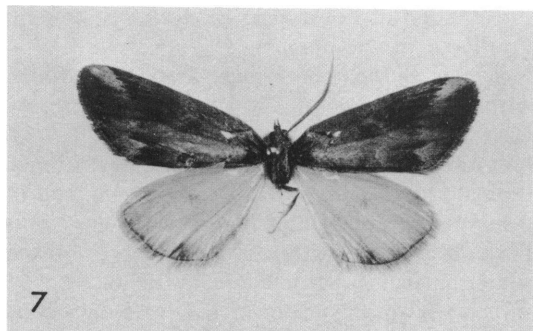


FIGS. 1-6. Males of *Ceratonyx*. 1, 2. *C. arizonensis* (Capps). 1. Paratype, Chiricahua Mts., Arizona (AMNH). 2. Ramsey Canyon, Arizona, May 9, 1969 (R. F. Sternitzky; AMNH). 3. *C. crassa*, new species, holotype, Encino, Durango, Mexico, July 27, 1947 (Gertsch and Cazier; AMNH). 4. *C. rhadinaria* (Dyar), Zacualpan, México, Mexico, July, 1922 (R. Muller; USNM). 5. *C. cornifrons* (Dyar), Iguala, Guerrero, Mexico, August, 1932 (C. C. Hoffmann; AMNH). 6. *C. hoplitaria* (Dyar), Mezquitlan, Hidalgo, Mexico, May 25, 1952 (Dawson; AMNH). All $\times 1.5$.

Remarks. Twenty-one specimens (16 males, five females), eight genitalic dissections (five males, three females) and two slide mounts (one male, one female) of antennae and legs have been studied.

Only two of the five females studied still had

their abdomens attached; both had small but well-defined tufts that stood erect and were contrastingly colored, being darker than the abdomen. None of the males studied had tufts; one specimen had one or two dark brown scales that were matted down that might possibly have



FIGS. 7-12. Males of *Ceratonyx*. 7. *C. fessa*, new species, holotype, Las Trancas, Ñuble, Chile, November 21-30, 1964 (L. E. Peña; AMNH). 8. *C. crebra*, new species, holotype, Piscicultura, Río Aconcagua, Aconcagua, Chile, November 26-30, 1958 (L. E. Peña; AMNH). 9. *C. aculeata*, new species, holotype, Los Maitenes, Santiago, Chile, October 30, 1964 (L. E. Peña; AMNH). 10. *C. constantia* (Dyar), Tehuacán, Puebla, Mexico, September 15, 1937 (C. C. Hoffmann; AMNH). 11. *C. permagnaria* (Grossbeck), McMillan Camp, New Mexico, July 13, 1964 (F., P., and M. Rindge; AMNH). 12. *C. satanaria* Guenée, Tennessee Colony, Texas, March 14, 1966 (A. and M. E. Blanchard; AMNH). All X1.5.

represented a tuft. It is possible that having abdominal tufts is a character restricted to the female of this species.

There is considerable difference between the

female genitalia of the allotype illustrated by Capps (1950, pl. 4, fig. 2) and my figure. The specimen studied by Capps had not been mated, and so has a much more slender corpus bursae;

my specimen was mated and the corpus bursae is swollen accordingly.

***Ceratomyx crassa*, new species**

Figures 3, 23

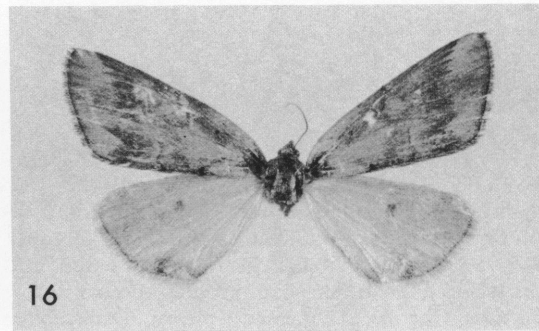
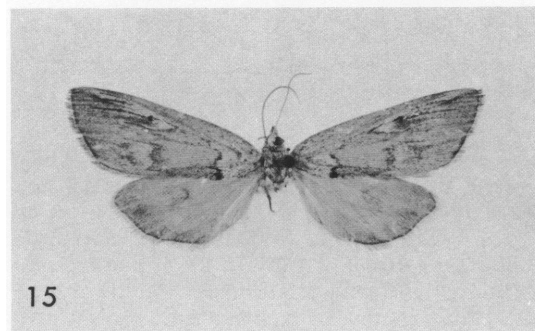
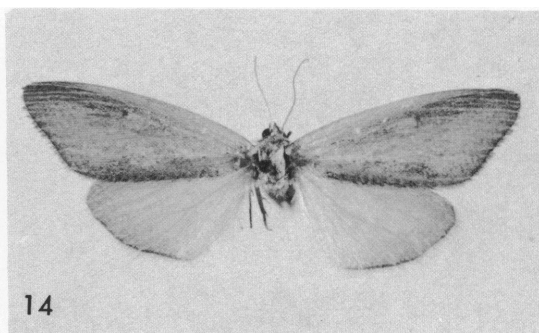
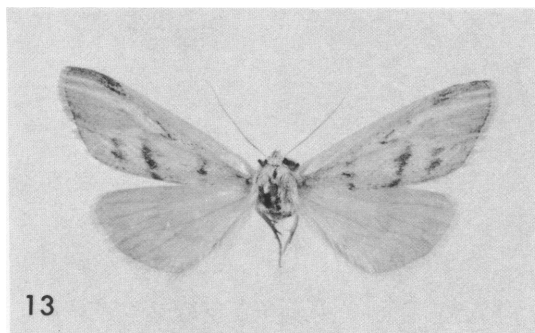
Diagnosis. This species is similar to pale specimens of *arizonensis* but can be recognized by the reduced areas of white on the upper surface of the forewings, by more dark scaling on the ventral surface of the body, by the different shape of the front, and by the male genitalia.

Male. Head with vertex gray and blackish gray, surrounded by white scales; front similar to that of *arizonensis* except ventral margin more U-shaped and having small sclerotized ridge at base. Thorax and abdomen similar to those of *arizonensis* but having more gray and blackish gray scaling.

Venation of Forewings: Elongate cell present; vein R_{2+5} from its apex.

Upper Surface of Wings: Forewings white, with scattered grayish brown and brown scales, leaving less white area than in *arizonensis*; pattern similar to that of *arizonensis*, with longitudinal streaks of gray below radial vein, and of pale brown along cubital and anal veins; cross lines obsolescent, with t. a. line absent, t. p. and subterminal lines represented by nebulous grayish brown scaling in lower half of wing; discal spot absent; terminal line dark brown, interrupted by white scales in center of cells; fringe concolorous with wing. Hind wings white, becoming evenly covered with pale brown or pale grayish brown scales distally; without discal spot or maculation; terminal line weakly represented, fading out anteriorly; fringe white.

Under Surface of Wings: Forewings grayish



FIGS. 13-16. Females of *Ceratomyx*. 13. *C. arizonensis* (Capps), allotype, Madera Canyon, Arizona, August 3, 1947 (Comstock and Martin; LAM). 14. *C. rhadinaria* (Dyar), holotype, Cuernavaca, Morelos, Mexico, May, 1914 (R. Muller; USNM). 15. *C. hoplitaria* (Dyar), Tehuacán, Puebla, Mexico, June, 1911 (R. Muller; USNM). 16. *C. fessa*, new species, paratype, west of Angol, Malleco, Chile, January 23, 1951 (Ross and Michelbacher; CAS). All $\times 1.5$.

brown, becoming paler posteriorly, with faint traces of longitudinal striations of upper surface; hind wings white, sparsely marked with scattered dark brown scales; all wings without maculation.

Length of Forewing: 17 mm. (holotype).

Female. Unknown.

Male Genitalia. Similar to those of *arizonensis*, differing mainly as follows: uncus broader, apex swollen, apical points 0.20 mm. apart; gnathos shorter, with wider sides and shorter median process; valves broader at base due to more swollen sacculus, narrower medially, apex slightly more pointed; juxta bluntly pointed medially; processes of anellus more evenly curved distally; aedeagus 2.0 mm. in length.

Female Genitalia. Unknown.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Holotype, male, Encino, Durango, Mexico, elevation 6200 feet, July 27, 1947 (W.

Gertsch, M. Cazier). The genitalia of the holotype are mounted on slide FHR 8229.

The holotype is in the collection of the American Museum of Natural History.

Distribution. This species is known only from the type locality in northern Durango. The village of Encino is on the eastern side of the Sierra Madre Occidental; the moth was collected in the oak-juniper zone (Spieth, 1950, p. 33).

Flight Period. Late July.

Remarks. One specimen and one genitalic dissection have been studied.

Etymology. The specific name is from the Latin *crassus*, thick, in relation to the gnathos.

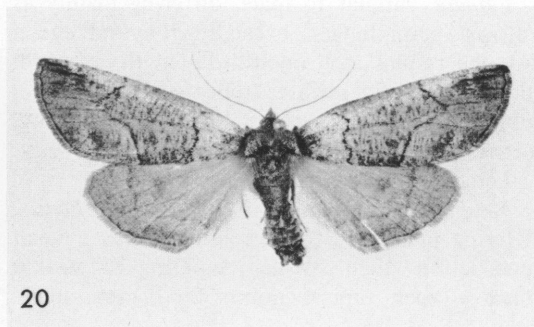
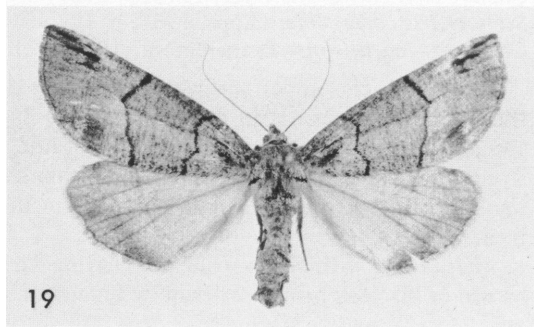
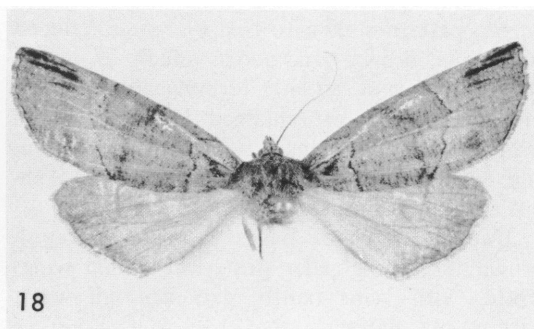
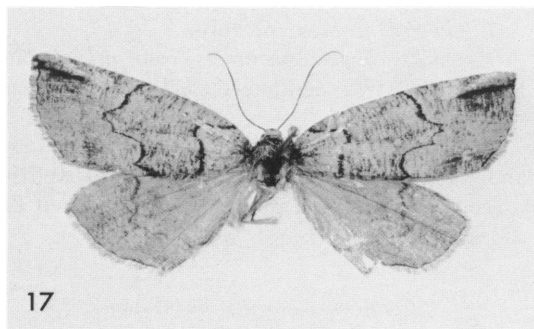
Ceratomyx rhadinaria (Dyar)

Figures 4, 14, 24, 27

Caenocharis [*sic*] *rhadinaria* Dyar, 1917, p. 30.

Stenocharis rhadinaria: Capps, 1950, p. 12.

Ceratomyx rhadinaria: Franclemont, 1967, p. 13.



FIGS. 17-20. Females of *Ceratomyx*. 17. *C. constantia* (Dyar), holotype, Tehuacán, Puebla, Mexico, September, 1910 (R. Muller; USNM). 18. *C. tora*, new species, holotype, San Angel, Distrito Federal, Mexico, May 28 (C. C. Hoffmann; AMNH). 19. *C. permagnaria* (Grossbeck), Pinery Canyon, Arizona, July 7, 1956 (Martin, Comstock, and Rees; LAM). 20. *C. satanaria* Guenée, Tennessee Colony, Texas, March 4, 1967 (A. and M. E. Blanchard; AB). All $\times 1.4$.

Diagnosis. This species can be separated from the preceding ones by having white hind wings. The male genitalia can be recognized by the median swelling of the uncus, the female genitalia by the differently shaped signum and by the longer apophyses posteriores.

Male. Head with vertex pale gray; front similar to that of *arizonensis* but with ventral sclerotized ridge, pale grayish brown; palpi grayish white, slightly darker distally, third segment short, horizontal. Thorax similar to that of *crassa* but with more gray scaling.

Venation of Forewings: Elongate cell present; veins R_2 and R_{3+4} arising from its end, R_5 from two-thirds its length; in female, similar but with vein R_5 arising separately from end of cell.

Upper Surface of Wings: Forewings white, similar to those of preceding species but with more extensive brown scaling along veins and grayish black scaling below radial vein and along anal vein, reducing white areas more than in *crassa*; pattern similar to that of *crassa*, reduced to oblique brown band across middle of cubital cell; discal spot absent; terminal line weakly indicated, somewhat enlarged into cells. Hind wings white, with veins very faintly pale brown, and with a few pale brown scales distally; without discal spot or maculation; fringes white.

Under Surface of Wings: Forewings grayish brown, becoming paler posteriorly; hind wings white, with veins faintly darkened; all wings without maculation.

Length of Forewing: 18 mm.

Female. Similar to male, differing mainly as follows: palpi longer, extending beyond eye a distance equal to one-third length of eye; antennae shortly serrate; upper surface of forewing more broadly suffused with brown scaling, further reducing white areas.

Length of Forewing: 20 mm.

Male Genitalia. Similar to those of *arizonensis*, differing mainly as follows: uncus with median constriction, then swollen, tapering to weakly concave apex, apical points 0.17 mm. apart;

valves broader at base due to more swollen sacculus, narrower medially; processes of anellus more evenly curved distally and with slightly more slender points; aedeagus 2.1 mm. in length.

Female Genitalia. Similar to those of *arizonensis*, differing mainly as follows: corpus bursae with slender posterior portion, broadly swollen anteriorly; signum 0.3 mm. wide, anterior and anterolateral margins raised ventrally, and with two lateral indented points. Apophyses posteriores 2.2 mm. in length.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Holotype, female, USNM 19274. The genitalia are mounted on slide HWC 1653. Dyar described this species from a single specimen.

Type Locality. Cuernavaca, Morelos, Mexico.

Distribution. The Mexican states of México and Morelos. The moths have been captured in mountainous regions at elevations of from 7400 to 8000 feet.

Flight Period. May and July.

Remarks. Two specimens (one male, one female) and two genitalic dissections have been studied.

The male antennae, and the legs and abdomens of both sexes have not been studied (except for the last, mounted and descaled on slides).

Ceratomyx cornifrons (Dyar)

Figures 5, 22

Coenocharis cornifrons Dyar, 1915, p. 390.

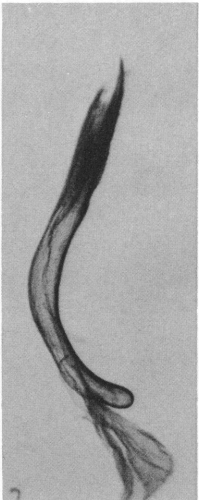
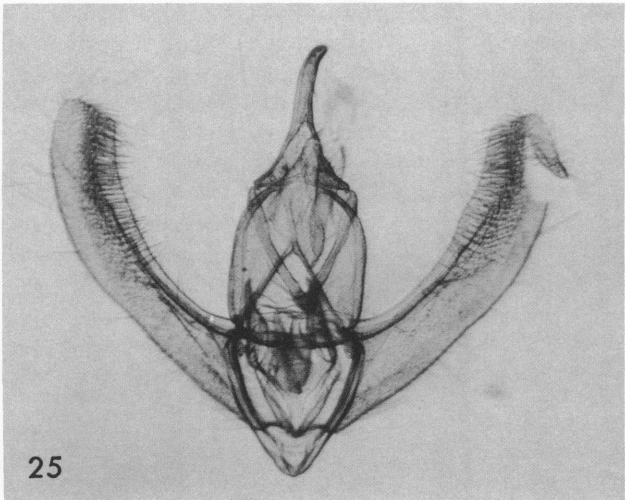
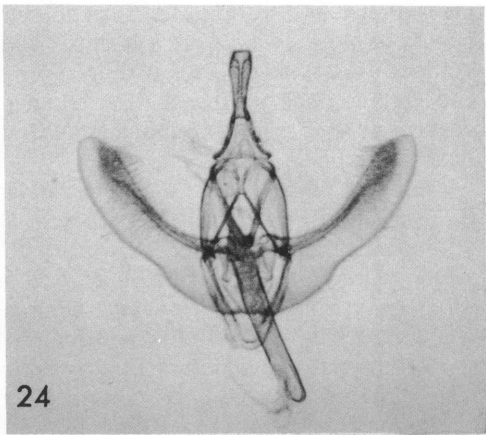
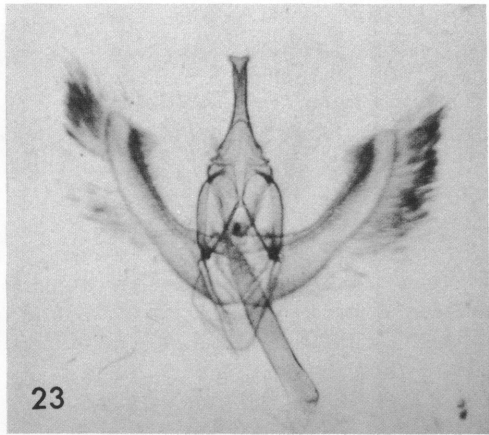
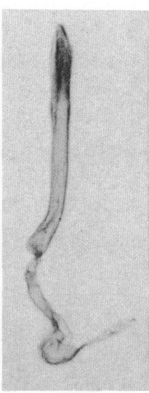
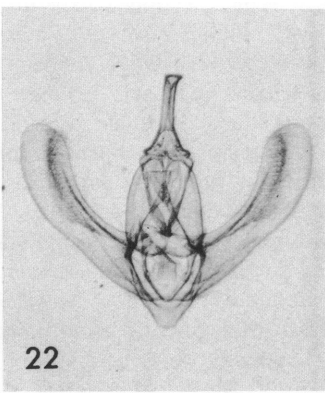
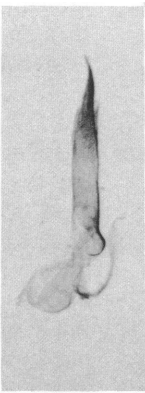
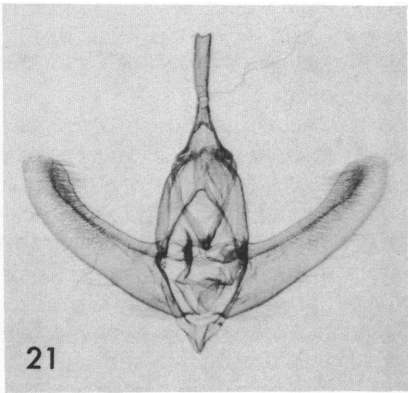
Stenocharis cornifrons: Capps, 1950, p. 12.

Ceratomyx cornifrons: Franclemont, 1967, p. 13.

Diagnosis. The upper surface of the wings of this species is darker than that of the preceding species, and the forewings lack the longitudinal striations. The basal area occupies the proximal one-third of the forewings, and is paler than the median area.

Male. Head with vertex pale gray, having dark brown or blackish brown scales between antennal

FIGS. 21-25. Male genitalia of *Ceratomyx*. 21. *C. arizonensis* (Capps), Ramsey Canyon, Arizona, May 3, 1968 (R. F. Sternitzky; AMNH). 22. *C. cornifrons* (Dyar), Iguala, Guerrero, Mexico, August, 1932 (C. C. Hoffmann; AMNH). 23. *C. crassa*, new species, holotype, Encino, Durango, Mexico, July 27, 1947 (Gertsch and Cazier; AMNH). 24. *C. rhadinaria* (Dyar), Zacualpan, México, Mexico, July, 1922 (R. Muller; USNM). 25. *C. hoplitaria* (Dyar), Totolapan, Oaxaca, Mexico, May 10, 1952 (Dawson; AMNH).



bases; front extending beyond eye a distance equal to one-half diameter of eye, flattened dorsally, with shallow, inverted U-shaped transverse crest, flattened or weakly concave ventrally, and having second, small, ventral median tubercule or transverse ridge; front dorsally gray or blackish gray, becoming darker distally; palpi with first segment mainly pale gray, distal segments blackish gray, with third segment short, partially covered by scaling of second segment; antennae with about 61 segments, pectinations arising in basal half of segments, being up to 0.5 mm. in length. Thorax above pale grayish brown; patagia with dull black transverse stripe, becoming white distally; below white; legs grayish white, outer surfaces with variable number of gray, brown, and black scales, fore tibia broadly grayish white at ends of segments. Abdomen without tufts; above gray, with grayish brown and grayish black scaling, the last tending to be concentrated near base of abdomen; below without dark scaling.

Venation of Forewings: Cell present; veins R_2 , R_{3+5} and R_5 from, at, or near its apex.

Upper Surface of Wings: Forewings with basal area pale gray, median area dark gray or brownish gray, terminal area gray and more or less suffused with dark gray and brownish gray scales, and with costal area in outer half or two-thirds of wing more or less pale gray; cross lines grayish black; t. a. line arising on costa one-fifth distance from base, extending outwardly into lower part of cell, curving or angled posteriorly, slightly sinuous, meeting inner margin one-third distance from base; median line absent; small, black discal spot present; t. p. line obsolescent or absent anteriorly, appearing below discal spot, slightly dentate, meeting inner margin two-thirds distance from base; s. t. line represented by grayish black spot above tornus; terminal line grayish black, complete; fringe with narrow basal grayish white band, then concolorous with wing. Hind wings gray, becoming grayish brown distally; without maculation except for nebulous discal spot; terminal line similar to that of forewing; fringe grayish white.

Under Surface of Wings: Forewings pale grayish brown, with apical area more or less broadly darkened with brown scales; hind wings faintly paler than forewings, having very few brown scales; all wings without maculation except for

brownish black discal spots, larger on hind wings than on forewings, and for dark terminal line.

Length of Forewing: 14 to 16 mm.

Female. Unknown.

Male Genitalia. Similar to those of *arizonensis*, differing mainly as follows: uncus shorter, tending to have parallel sides, apex slightly broadened, with apical points 0.16 to 0.20 mm. apart; gnathos with sides becoming wider in distal portion; valves slightly wider, with each apex broadly rounded; juxta more heavily sclerotized, finely denticulate, bluntly pointed apically; processes of anellus straighter, with apex only weakly curved, surface without setae; aedeagus 2.1 to 2.3 mm. in length, more slender, apex bluntly pointed.

Female Genitalia. Unknown.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Holotype, male, USNM 18203. The genitalia of the type are mounted on slide HWC 1651. Dyar described this species from a single specimen.

Type Locality. Sierra de Guerrero, Mexico.

Distribution. The Mexican states of Guerrero and Morelos. Most of the specimens examined have been from Balsas and Iguala, Guerrero; these two localities are at elevations of about 1500 to 2400 feet.

Flight Period. June, July, and August.

Remarks. Twelve specimens (all males) and four genitalic dissections have been examined.

Dyar's type is a rather worn specimen that shows very little maculation; the front has the ventral tubercle more strongly developed than in most specimens of the species. The basic pattern of the type can be made out, however, and a study of the genitalia shows that we are dealing with a single species.

Ceratomyx hoplitaria (Dyar)

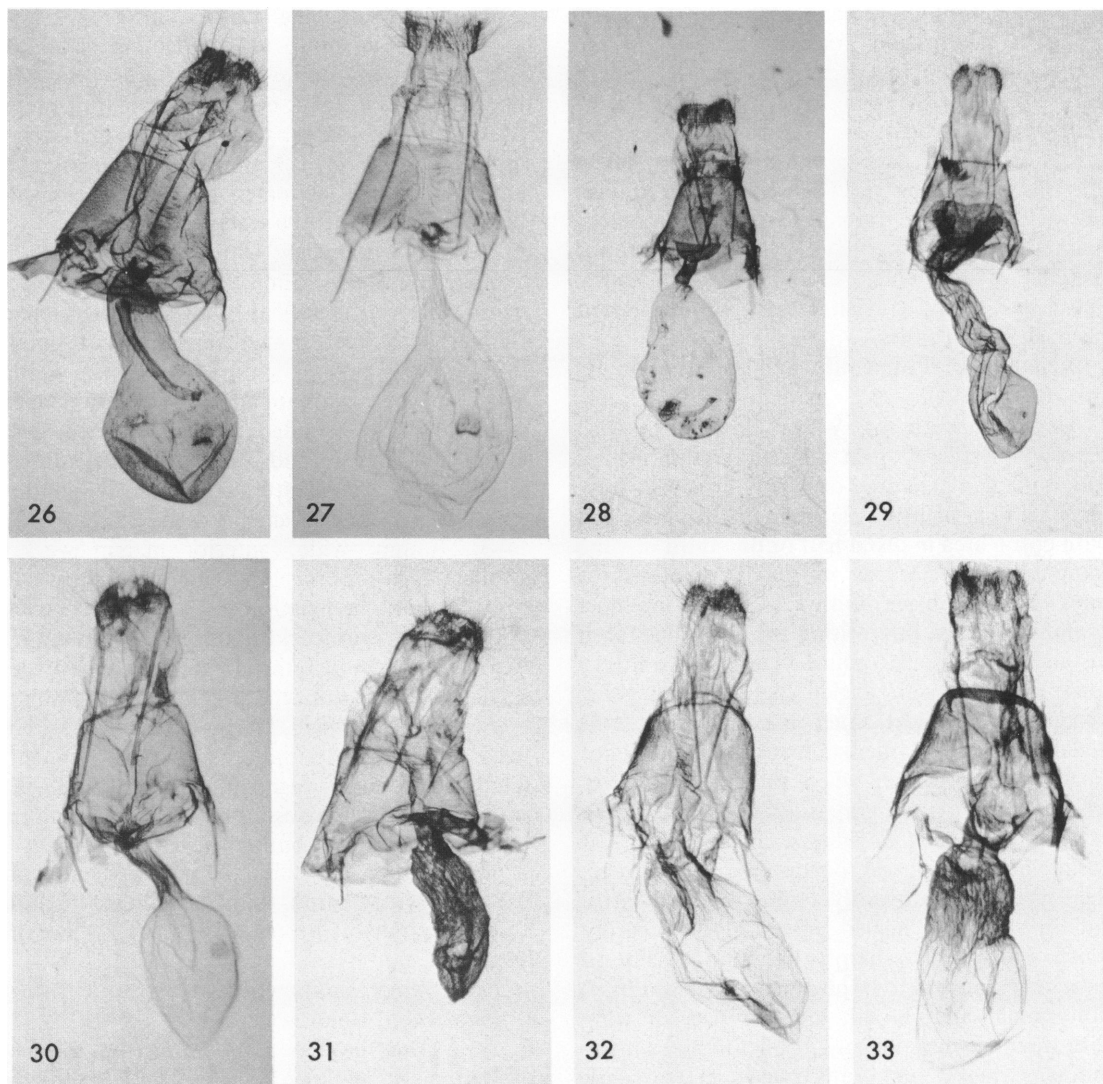
Figures 6, 15, 25, 28

Coenocharis hoplitaria Dyar, 1912, p. 92.

Stenocharis hoplitaria: Capps, 1950, p. 12.

Ceratomyx hoplitaria: Franclemont, 1967, p. 13.

Diagnosis. This is the smallest species in group I. The upper surface of the forewings is paler gray than in *cornifrons*; the basal area of the present species is much narrower than in the preceding species. In the male genitalia, the



FIGS. 26-33. Female genitalia of *Ceratonyx*. 26. *C. arizonensis* (Capps), Nogales, Arizona, August 19, 1906 (A. Koebele; CAS). 27. *C. rhadinaria* (Dyar), holotype, Cuernavaca, Morelos, Mexico, May, 1914 (R. Muller; USNM). 28. *C. hoplitaria* (Dyar), Tehuacán, Puebla, Mexico, June, 1911 (R. Muller; USNM). 29. *C. fessa*, new species, allotype, Guardia Vieja, Aconcagua, Chile, December 3, 1958 (L. E. Peña; AMNH). 30. *C. constantia* (Dyar), Tehuacán, Puebla, Mexico, September 13, 1958 (L. E. Hoffmann; AMNH). 31. *C. tora*, new species, holotype, San Ángel, Distrito Federal, Mexico, May 28 (C. C. Hoffmann; AMNH). 32. *C. permagnaria* (Grossbeck), Sierra Vista, Arizona, July 1, 1965 (R. F. Sternitzky; AMNH). 33. *C. satanaria* Guenée, Spring, Texas, March 2, 1963 (A. and M. E. Blanchard; AB).

uncus of *hoplitaria* is the narrowest of any of the species in group I.

Male. Head with vertex gray or brownish gray; front swollen, rounded, extending beyond eye a

distance equal to one-third diameter of eye, ventral margin weakly rounded; front grayish brown; palpi grayish brown, elongate, extending well beyond front and eye a distance slightly less

than diameter of eye; antennae with about 53 segments, pectinations arising in basal half of segments, being up to 0.5 mm. in length. Thorax gray above, with some scattered dark brown scales; dark brown or blackish brown scales across middle of patagia and posteriorly; below grayish white; legs grayish white, with grayish brown scaling on outer surface, tibia variably marked, some being dark with pale posterior margins of segments. Abdomen without tufts; above and below grayish brown, with scattered blackish brown scales.

Venation of Forewings: Cell absent; vein R_2 free, R_{3+4} stalked.

Upper Surface of Wings: Forewings with narrow basal area pale gray or grayish white, broad median area gray or faintly brownish gray, terminal area slightly paler than median area, and with costal area in distal half or one-third of wing more or less pale gray or grayish white; cross lines brownish black, with t. a. line being most prominent; t. a. line arising on costa one-tenth distance from base, going sharply outward to lower part of cell, angled basally, then going posteriorly to meet inner margin three-tenths distance from base; median line absent; discal dot small or obsolescent, when present situated in basal portion of pale gray or grayish white streak extending to apex of wing; t. p. line absent at costa, outlining basal portion of pale streak, sharply curved outwardly to just beyond discal dot on vein Cu_1 , angled posteriorly, outwardly toothed on veins, sharply indented basally to meet inner margin two-thirds distance from base; subterminal area broad, anterior part of wing with three or four elongate, brownish black intravenular streaks, and with two sagittate, dark brown spots bordered distally by white above tornus; terminal line either absent or partially represented, dark gray; fringe concolorous with wing. Hind wings pale gray, with faint brownish suffusion; maculation obsolescent or with diffuse, irregular line crossing middle of wing just outside of faint discal dot; terminal line dark gray or grayish black; fringe concolorous with wing.

Under Surface of Wings: Forewings brownish gray; hind wings pale gray, with faint brownish tinge; maculation absent except for small nebulous discal dots, larger on hind wings than on forewings, and for dark terminal line.

Length of Forewing: 12 to 15 mm.

Female. Similar to male, differing mainly as follows: front more protruding, extending beyond eye a distance equal to one-half diameter of eye; palpi longer, extending beyond eye a distance equal to 1.3 times diameter of eye; antennae simple; abdomen with a few elongate blackish brown tuftlike scales.

Length of Forewing: 16 to 17 mm.

Male Genitalia. Similar to those of *arizonensis*, differing mainly as follows: smaller; uncus thinner, apex scarcely swollen, with apical points 0.03 to 0.08 mm. apart; valves of uniform width, apical end of costa with angular projection, apex of valve bluntly rounded; juxta sclerotized, with longitudinal ventral ridge and extremely finely denticulate surface, attenuate, bluntly pointed apically; processes of anellus with each base 0.23 to 0.27 mm. wide, anterior margin weakly swollen, then process elongate and tapering, 0.46 to 0.50 mm. in length, with slightly recurved pointed apex, surface without setae; aedeagus 1.7 to 1.8 mm. in length, dorsoventrally curved, slender, apex sclerotized, tapering to sharp point.

Female Genitalia. Sterigma weakly sclerotized, scarcely differentiated, with prominent, semicircular sinus vaginalis, and with lamella antevaginalis having posteromedian projection on each side; ductus bursae heavily sclerotized, slender, with parallel sides, 0.4 mm. in length and 0.2 mm. wide; corpus bursae bulbous; signum absent. Apophyses posteriores 1.5 to 1.8 mm. in length.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Dyar described *hoplitaria* from a series of four males and one female. The lectotype is hereby designated as the male bearing Dyar's holographic type label, and with its genitalia mounted on slide HWC 1647. It is USNM 14228.

Type Locality. Tehuacán, Puebla, Mexico.

Distribution. The mountainous areas of the central Mexican states of Hidalgo, Puebla, and Oaxaca.

Flight Period. May, June, August, September, and October.

Remarks. Twenty-six specimens (24 males, two females), eight genitalic dissections (six males, two females), and two slide mounts (both males) of antennae and legs have been studied.

GROUP II

The moths placed in this group are characterized by the male genitalia having a rounded or triangular uncus with a single point, and by the vesica having a group of elongate spines. The ductus bursae of the female genitalia is either heavily sclerotized or membranous. Abdominal tufts are present.

Seven species are included: *fessa*, *crebra*, *aculeata*, *constantia*, *tora*, *permagnaria*, and *satanaria*. The first three occur in Chile, the next two in Mexico, and the last two in the southern United States.

***Ceratonyx fessa*, new species**

Figures 7, 16, 29, 34

Diagnosis. The males of this Chilean moth have bipectinate antennae; their forewings are gray, more or less suffused with brown in outer portion, and have poorly defined maculation.

Male. Head with vertex gray; front rounded, extending beyond eye one-third diameter of eye, ventral margin with small transverse ridge; front dark gray; palpi concolorous with front, paler below, third segment elongate, horizontal, extending beyond eye a distance about equal to diameter of eye; antennae bipectinate, of 57 or 58 segments, pectinations arising in basal portion of segments, being up to 0.6 mm. in length. Thorax gray above, becoming blackish gray posteriorly; below grayish white; legs grayish white, darker gray on outer surface; fore tibia with process arising at three-fifths length of segment. Abdomen with small, dark tufts anteriorly; gray or brownish gray above and below, tending to become paler dorsodistally.

Venation of Forewings: Cell either present or absent, with vein at end tending to be weakly or partially represented; vein R_{2+5} stalked.

Upper Surface of Wings: Forewings gray, with some white scaling basad of t. a. line and in outer portion of wing, and with area distad of t. p. line broadly shaded with brown; cross lines reduced or obsolescent, often with only t. a. line present; basal area with black dash; t. a. line black, arising on costa one-tenth distance from base, paralleling inner margin to radial vein, forming right angle and proceeding to middle of cubital cell, then angled outward to meet inner margin one-third

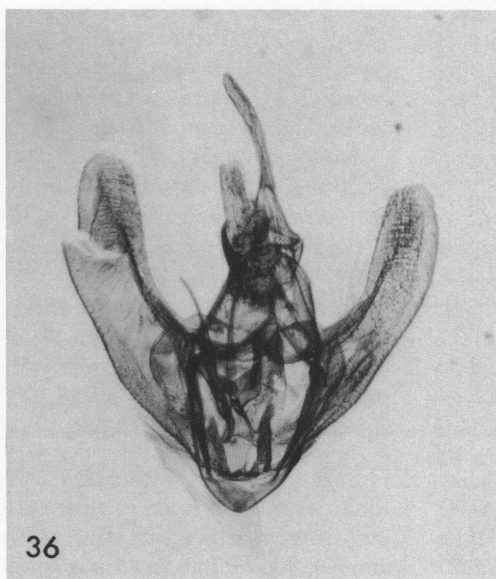
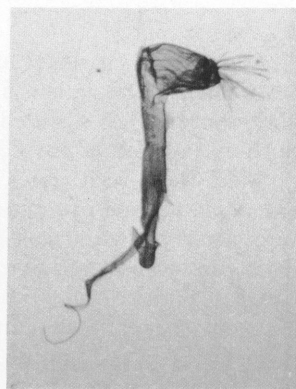
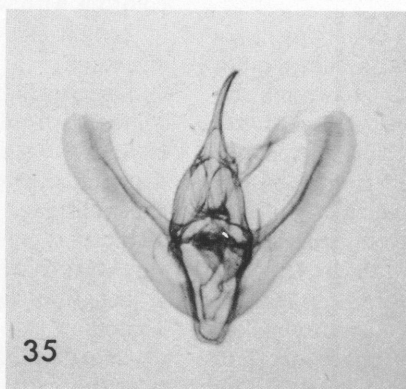
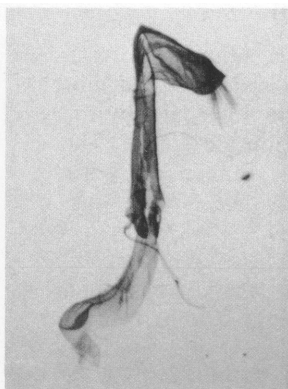
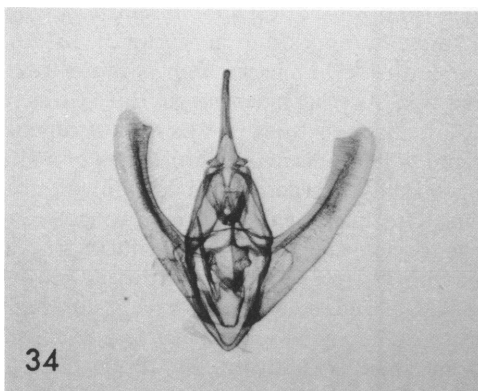
distance from base; discal spot absent; t. p. line, when present, appearing in posterior half of wing, more or less concave, with outward tooth on anal vein, meeting inner margin three-fifths to two-thirds distance from base; s. t. line absent, but more or less indicated by broad area of white scaling distally bordering broad brown area; terminal line black, narrow; fringe concolorous with wing, elongate. Hind wings white or grayish white, with variable number of brown or brownish scales; maculation absent except for faint trace of median line in some specimens, nebulous discal spot, and extradiscal line repeated more strongly from upper surface; terminal line present on all wings; fringes paler at base, then concolorous with wings.

Length of Forewing: 15 to 17 mm.; holotype, 17 mm.

Female. Similar to male, differing mainly as follows: front more protruding, extending beyond eye a distance slightly less than one-half diameter of eye; palpi longer, extending beyond eye a distance equal to one and one-third times diameter of eye; antennae of about 64 segments, very weakly serrate.

Length of Forewing: 16 to 19 mm.; allotype, 16 mm.

Male Genitalia. Similar to those of *arizonensis*, differing mainly as follows: uncus slender, 0.08 mm. wide, apex rounded, terminating in single curved point; gnathos shorter, sides slightly wider, and median extension less produced, concave anteriorly; valves tapering in width from broad base, costa with apical end strongly projecting, apex rounded, base of each valve with C-shaped membranous area extending into valve; anellus without deeply concave area at base of each valve, located dorsally, well removed from ventral surface of valve; juxta flat, with small, rounded digitate projection posteriorly; processes of anellus longer, apically much thinner and more attenuate, arising from irregularly shaped base 0.5 mm. wide, having dorsal projection posteromedially, then slanting ventrally, leaving anterior digitate process about 0.1 mm. in length, with anterior margin of process evenly curved posteriorly, posterior margin arising ventrally, then sharply curved to form elongate, thin, pointed posterior projection, with entire process about 0.7 mm. long, and having smoothly sclero-



tized surface; aedeagus 2.2 mm. in length, anterior end narrowed, posterior end bluntly pointed, ventral surface covered with rasplike teeth; vesica, when exerted, projecting anteriorly at 45- to 60-degree angle to aedeagus, with group of approximately 15 to 20 slender, terminal spines, longest ones about 0.6 mm. in length.

Female Genitalia. Sterigma with weak elliptical ridges, and with large, broad, well-sclerotized, asymmetrical lamella antevaginalis, posteriorly bilobed, right side larger than left; ductus bursae more or less square or rectangular, with posterior end slightly more elongate and with swelling; corpus bursae with posterior end slender, having parallel striations, anterior end slightly swollen; signum very small, ovate. Apophyses posteriores 1.2 to 1.6 mm. in length.

Early Stages. Unknown.

Food Plant. Unknown.

Types. Holotype, male, Las Trancas, mountains in Chillan area, Ñuble Province, Chile, November 21-30, 1964 (L. E. Peña); allotype, female, Guardia Vieja, Andes, Aconcagua Province, Chile, December 3, 1958 (L. E. Peña). The genitalia of the holotype are mounted on slide FHR 17283, and those of the allotype on 14424. Paratypes, all from Chile: same data as holotype, October, 1967, November 21-30, 1964, December 1-10, 1964, December, 1968, January-March, 1971, January-March, 1972, 16 males; Lago Gualletue, Cordillera Lonquimay, Andes, Malleco Province, December 10-12, 1963 (L. E. Peña), 43 males; Pehuenco, Cordillera Lonquimay, Andes, elevation 1100 meters, Malleco Province, December 13-16, 1963 (L. E. Peña), one male; west of Angol, crest of Sierra Nahuelbuta, elevation 1200 meters, [Malleco Province], January 23, 1951 (Ross and Michelbacher), one female; Guardia Vieja, Andes, Aconcagua Province, December 3, 1958 (L. E. Peña), one female; Juncal, Andes, Aconcagua Province, November 2, 1958 (L. E. Peña), two females; Río Blanco, Andes, Aconcagua Province, December 5-8, 1961 (L. E. Peña), one female.

The holotype and allotype are in the collection of the American Museum of Natural History; paratypes are in the collections of that institution and of the California Academy of Sciences.

Distribution. The Andes of central Chile in the provinces of Aconcagua, Ñuble, and Malleco. This may correspond to the southern portion of the Central Andean Cordillera and the Southern Andean Cordillera regions (Peña, 1966).

Flight Period. October through January.

Remarks. Sixty-five specimens (59 males, six females), six genitalic dissections (four males, two females), and four slide mounts (three males, one female) of antennae and legs have been studied.

Etymology. The specific name is from the Latin *fessus*, weak or feeble, in relation to the maculation of the forewings.

***Ceratomyx crebra*, new species**

Figures 8, 35

Diagnosis. This species can be separated from *fessa* by the larger number of antennal segments and by the forewings having a straighter outer margin, less brown scaling, and the t. p. line being more distad and more completely represented.

Male. Head with vertex covered with grayish brown scales, edged with whitish gray; front similar to that of *fessa*, extending beyond eye two-fifths diameter of eye, and tightly covered with mixture of gray and dark grayish brown scales; palpi concolorous with front, paler below, third segment elongate, decumbent, extending beyond eye a distance equal to diameter of eye; antennae bipectinate, with about 66 segments, pectinations arising in basal portion of segments, being up to 0.7 mm. in length. Thorax grayish brown above, collar narrowly edged with grayish white, posterior tufts grayish black; below and legs, similar to those of *fessa*. Abdomen with small dorsal tufts, pale basally, darkened distally; grayish brown above and below.

FIGS. 34-36. Male genitalia of *Ceratomyx*. 34. *C. fessa*, new species, holotype, Las Trancas, Ñuble, Chile, November 21-30, 1964 (L. E. Peña; AMNH). 35. *C. crebra*, new species, holotype, Piscicultura, Río Aconcagua, Aconcagua, Chile, November 26-30, 1958 (L. E. Peña; AMNH). 36. *C. aculeata*, new species, holotype, Los Maitenes, Santiago, Chile, October 30, 1964 (L. E. Peña; AMNH).

Venation of Forewings: Cell absent; vein R_2 free, R_{3+5} stalked.

Upper Surface of Wings: Forewings gray, evenly and heavily suffused with brown and blackish brown scales except for slightly paler, entire cubital cell; cross lines reduced, not prominent; basal dash and t. a. line similar to those of *fessa*; discal spot absent; t. p. line usually obsolescent anteriorly, when present arising on costa near center of wing, S-shaped to middle of cell, outwardly curved over basal portions of veins Cu_1 and Cu_2 , concave in fold, outwardly angled on anal vein, meeting inner margin two-thirds distance from base; outer portion of wing concolorous with median area, apex with elongate white dash having two or three reddish brown streaks on veins, and with two nebulous brown spots above tornus; terminal line either absent or faintly represented; fringe concolorous with wing. Hind wings grayish white, becoming covered with grayish brown scales distally; maculation absent in most specimens, rarely with faint trace of discal spot showing through from under surface; terminal line and fringe similar to those of forewings.

Under Surface of Wings: Forewings gray, slightly paler posteriad of cubital vein, with faint discal dot and with dark gray or brownish gray blotches distally on costa and above tornus; hindwings white or pale grayish white, with variable number of pale brown scales, discal dot present, extradiscal line represented by dark brown or dark grayish brown spots on costa and near anal angle; terminal lines and fringes similar to those on upper surface.

Length of Forewing: 16 to 18 mm.; holotype, 17.5 mm.

Female. Unknown.

Male Genitalia. Similar to those of *fessa*, differing mainly as follows: uncus with apex more slender; gnathos with median extension less attenuate, broader, more flattened; valves with costal projection more pointed; processes of anellus longer, 0.8 mm. in length, with more even base set on greater angle, having anterior digitate

process 0.2 mm. in length, being less sharply tapered and with shorter posterior projection; aedeagus 2.1 to 2.2 mm. in length; vesica, when exerted, at more of right angle to aedeagus, and having fewer but longer spines, about 15 in number, longest ones about 0.8 mm. in length.

Female Genitalia. Unknown.

Early Stages. Unknown.

Food Plant. Unknown.

Types. Holotype, male, Piscicultura, Río Aconcagua, Aconcagua Province, Chile, November 26-30, 1958 (L. E. Peña). The genitalia of the holotype are mounted on slide FHR 17285. Paratypes: Guardia Vieja, Aconcagua Province, Chile, December 3, 1958 (L. E. Peña), eight males.

The holotype and all paratypes are in the collection of the American Museum of Natural History.

Distribution. The Chilean province of Aconcagua in the Andes. This may correspond to the Central Andean Cordillera region (Peña, 1966).

Flight Period. November and December.

Remarks. Nine specimens (all males), two genitalic dissections, and one slide mount of antennae and legs have been studied.

Etymology. The specific name is from the Latin *creber*, numerous, in reference to the antennal segments.

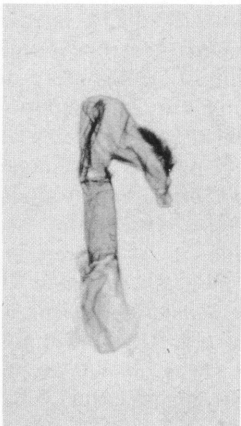
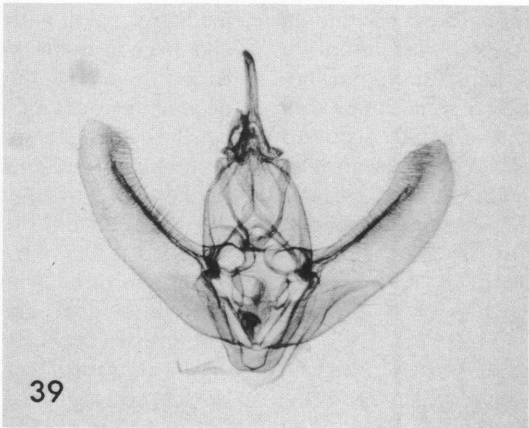
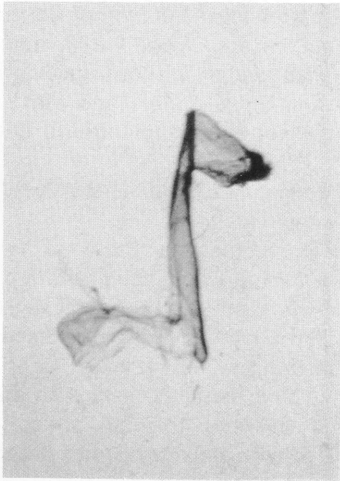
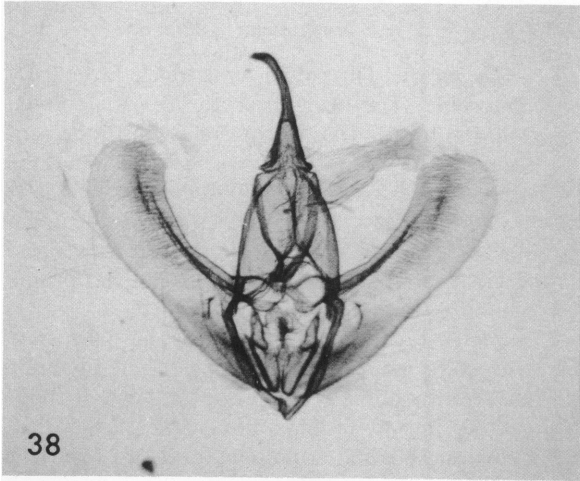
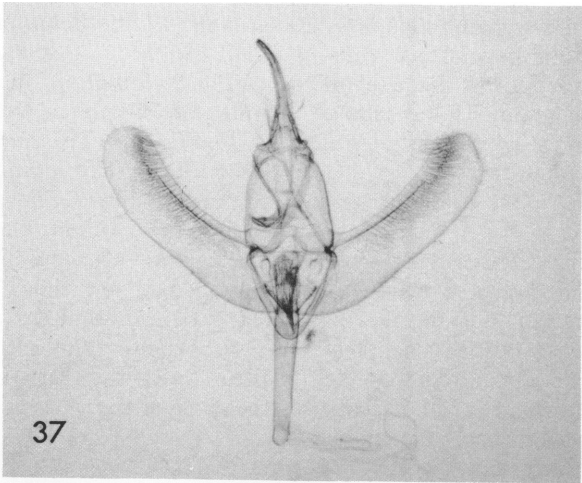
Ceratomyx aculeata, new species

Figures 9, 36

Diagnosis. This is the only known species of *Ceratomyx* that has dentate male antennae. It is smaller than the two preceding species, and the upper surface of the forewings is without cross lines.

Male. Head with vertex covered with grayish brown scales with pale gray apices; front swollen, rounded, extending beyond eye one-third diameter of eye; front grayish white medially, grayish brown dorsally, brownish black laterally; palpi with mixture of pale gray, grayish brown, and

FIGS. 37-39. Male genitalia of *Ceratomyx*. 37. *C. constantia* (Dyar), Mezquititlan, Hidalgo, Mexico, May 25, 1952 (Dawson; AMNH). 38. *C. permagnaria* (Grossbeck), Bear Trap Camp, New Mexico, July 5, 1965 (F., P., and M. Rindge; AMNH). 39. *C. satanaria* Guenée, Tennessee Colony, Texas, March 5, 1967 (A. and M. E. Blanchard; AMNH).



brownish black scales, third segment apparently short, decumbent, extending beyond eye a distance equal to about three-fourths diameter of eye; antennae shortly dentate. Thorax above grayish brown; below grayish white; legs grayish white, outer surfaces grayish brown.

Venation of Forewing: Cell present; veins R_{2+5} stalked from its apex.

Upper Surface of Wings: Forewings grayish white, costal and posterior margins suffused with brownish black scales; anterior portion of wing with costal and radial veins brownish black, outlined by white; center of wing, from base to outer margin, paler, with ochereous white scaling on veins; cross lines absent; fringe concolorous with wing. Hind wings white, outer portion of wing and veins faintly ochereous; terminal line pale ocher; fringe concolorous with wing.

Under Surface of Wings: Forewings pale grayish brown; hind wings white, with faintly ochereous veins; all wings without maculation except for nebulous discal dot on hind wing; terminal line and fringes similar to those of upper surface.

Length of Forewing: 12.5 mm. (holotype).

Female. Unknown.

Male Genitalia. Similar to those of *fessa*, differing mainly as follows: uncus with apical portion concave ventrally; gnathos much shorter, more heavily sclerotized, sides broader, median extension much longer and sharply pointed; valves scarcely swollen basally, costa with distal portion enlarged but not forming projection, base of each valve with only small membranous area; processes of anellus with extremely long, narrow distal portion, each base angled medially, with slender, anterior digitate process 0.2 mm. in length, ventroposterior margin curving anteriorly almost to digitate process, then forming posteriorly curved distal portion 0.6 mm. long, with entire process being 0.8 mm. in length; aedeagus 1.6 mm. in length, weakly curved dorsoventrally, posterior end rounded, with smooth surface; vesica with about 12 to 15 setae, with longest ones about 0.5 mm. in length.

Female Genitalia. Unknown.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Holotype, male, Los Maitenes, high in Río Maipo basin on Río Colorado, Santiago Province, Chile, October 30, 1964 (L. E. Peña). The

genitalia of the holotype are mounted on slide FHR 15675.

The holotype is in the collection of the American Museum of Natural History.

Distribution. The Andes in Santiago Province, Chile. This may correspond to the Central Andean Cordillera region (Peña, 1966).

Flight Period. Late October.

Remarks. One specimen, one genitalic dissection, and one slide mount of antennae and legs have been studied.

Etymology. The specific name is from the Latin *aculeatus*, sharp pointed, in reference to the shape of the processes of the anellus.

Ceratomyx constantia (Dyar), new combination
Figures 10, 17, 30, 37

Ishnopteryx constantia Dyar, 1912, p. 85.

Diagnosis. This Mexican species is sexually dimorphic. The males have the darkest colored wings of any species in the genus; the upper surface of the wings is brownish black, and the maculation is obscurely represented. The females are considerably larger than the males; the upper surface of their forewings is grayish brown and finely irrorate with black scales and has prominent cross lines.

Male. Head with vertex gray or dark gray, with some grayish black scaling at base of antennae; front moderately swollen, flattened, without ventral lip or swelling but with ventral tuft, extending beyond front one-fourth to one-third diameter of eye, and covered with dark grayish brown scales laterally, brownish black scales medially; palpi with mixture of grayish brown and brownish black scales, tending to become darker distally, third segment tightly scaled, decumbent, extending beyond eye a distance equal to diameter of eye; antennae bipectinate, with about 57 segments, segments with each base swollen and with pectinations arising medially just distally of swelling, longest pectinations being up to 0.5 mm. in length. Thorax dark grayish brown or brownish black above; below grayish white; legs grayish white, with variable amount of grayish brown and blackish gray scaling on outer surfaces, tarsi with ends of segments broadly pale gray, fore tibia with process flattened, arising near middle of segment. Abdomen

with tufts on three basal segments and another near posterior end of abdomen; above grayish brown, with variable number of brownish black scales; below pale gray basally, becoming dark distally.

Venation of Forewings: Cell present; veins R_{2+5} stalked from its apex.

Upper Surface of Wings: Forewings unicolorous dark gray, heavily and evenly covered with dark grayish brown and brownish black scales and rows of scales; cross lines black, narrow, in some specimens absent anteriorly of radial vein; t. a. line, when present anteriorly, arising on costa one-tenth distance from base, paralleling inner margin for 1.5 to 2.0 mm., curving posteriorly and running more or less straight to meet inner margin one-third distance from base; t. p. line, when present anteriorly, arising on costa basad of center, angled outwardly crossing costa, swinging sharply basad into cell, then broadly outwardly curved to vein Cu_1 or to junction of veins M_3 and Cu_1 , concave to vein Cu_2 , with outward tooth, and then either broadly and evenly concave or broadly concave with small median tooth, to anal vein, then inwardly oblique to meet inner margin three-fifths distance from base; discal spot absent; outer portion of wing having apical area with white scaling near costa and brownish black dash in cell R_5 ; s. t. line more or less incompletely represented, grayish white, occurring above tornus as grayish white mark, either interrupting or being distal margin of nebulous brownish black spot in cubital cell; terminal line grayish black, more or less interrupted by veins; fringe concolorous with wing. Hind wings unicolorous dark brownish gray; discal spot absent; with or without narrow, weakly represented, irregular line across middle of wing; terminal line similar to that of forewing; fringe slightly paler than wing.

Under Surface of Wings: Paler than upper surface, with all wings dark gray or grayish brown, having scattered darker gray scales; maculation usually absent, some specimens with faint t. p. and extradiscal lines; terminal line grayish black, narrow; fringe concolorous with wing, with some white intravenular scaling anteriorly on forewing.

Length of Forewing: 18 to 22 mm.

Female. Head with vertex pale gray to gray, with grayish black scaling at base of each antenna; front gently rounded, scarcely extending

beyond eyes, ventral margin long scaled, covered with pale gray scales laterally, brownish gray, then grayish black medially; palpi grayish white, slightly darkened distally, and with scattered brownish black scales, extending beyond eye a distance equal to 1.5 times diameter of eye; antennae simple, of 56 to 63 segments. Thorax above grayish brown, with mixture of flattened and hairlike scales, patagia with narrow, dark grayish brown transverse band, and with posterior tuft dark grayish brown; below pale gray; legs pale gray, with variable amount of dark brown scaling, tarsi tending to be brown with ends of segments gray. Abdomen above and below with mixture of gray and brown scales, posterior segments narrowly pale gray at each posterior margin above.

Upper Surface of Wings: Forewings gray or faintly brownish gray, paler gray in basal area and along costa distad of t. p. line, median and distal areas darker, latter with brown suffusion posteriad of vein M_3 , and entire wing covered with scattered darker scales; maculation absent or with faint angulate extradiscal line; terminal line and fringe similar to those of forewing.

Under Surface of Wings: Forewings grayish brown, with white scaling along costa near apex; hind wings gray, with scattered brown scaling; discal dots either small and nebulous, or absent; partial t. p. and extradiscal lines present on some specimens; terminal line narrow, weakly indicated on all wings; fringes concolorous with wings.

Length of Forewing: 18 to 22 mm.

Male Genitalia. Similar to those of *hoplitaria*, differing mainly as follows: uncus with ventral ridge; gnathos more elongate, sides more slender, and with much longer median extension; valves longer, with distal portion of costa swollen, curving evenly to rounded apex of valve, and base of valve without indented membranous area; anellus flat, more triangular, with much wider posterior end, and with minutely denticulate posterior projection of juxta; processes of anellus greatly reduced, in form of small lobate structures, 0.25 to 0.30 mm. in length, weakly swollen medially and more or less pointed apically; tegumen longer; aedeagus 2.9 to 3.3 mm. in length, posterior end with longitudinal striations and bluntly rounded; vesica with about 10 spines, longest ones 0.4 mm. in length.

Female Genitalia. Sterigma membranous, with very slender, elongate lamella antevaginalis slightly reduced in width medially; ductus bursae slender, longer than wide, membranous; corpus bursae with slender, membranous, deeply longitudinally striate posterior portion, with large, elliptical or oval anterior end; signum 0.3 mm. wide, smoothly sclerotized, with or without anterior transverse ridge connecting two small, widely separated, inwardly pointing teeth. Apophyses posteriores 1.7 to 2.2 mm. in length.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Holotype, female, USNM 14225. Its genitalia are mounted on slide FHR 17375. Dyar described this species from a single female.

Type Locality. Tehuacán, Puebla, Mexico.

Distribution. The central Mexican states of Guerrero, Hidalgo, Jalisco, Oaxaca, and Puebla. Most of the localities are in mountainous areas; those few labels that indicate elevations are from 5000 to 5500 feet.

Flight Period. Bivoltine, with a May flight and the second one in August and September.

Remarks. Forty-four specimens (33 males, 11 females), eight genitalic dissections (three males, five females), and five slide mounts (one male, four females) of antennae and legs have been studied.

At first glance one would not necessarily associate the two sexes of this species, because of their chromatic dimorphism. Both sexes are represented in the collection of the American Museum of Natural History from Tehuacán (C. C. Hoffmann), the type locality. In the Natural History Museum of Los Angeles County are examples of both sexes from 12 miles southeast of Huajuapán de León, Guerrero, and from 20 miles northwest of Magdalena, Jalisco, both caught in the first half of September, 1970, by E. M. and J. L. Fisher. This was the only species of *Ceratomyx* caught by the Fishers; it was primarily this fact that led me to associate the two sexes of this species.

***Ceratomyx tora*, new species**

Figures 18, 31

Diagnosis. This species can be distinguished from *constantia* by the female having more elon-

gate and pointed forewings, a more evenly curved t. p. line, a more projecting front, and a greater number of segments in the antennae.

Male. Unknown.

Female. Head with vertex gray, without dark scaling at antennal bases; front broadly swollen, rounded, projecting beyond eye by two-thirds diameter of eye, covered by gray and grayish brown scales; palpi gray or grayish brown, paler below, with a few scattered black scales, third segment tightly scaled, slightly decumbent, extending beyond eye a distance equal to 1.3 times diameter of eye; antennae simple, medially feebly serrate, of about 77 segments. Thorax above dark grayish brown anteriorly, becoming paler posteriorly; below gray anteriorly, becoming pale gray posteriorly; legs grayish brown, tarsi blackish brown. Abdomen with small tufts on all segments, decreasing in size posteriorly, scales gray basally, becoming dark grayish brown distally, some narrowly gray at apices; above and below gray, with a few scattered darker scales.

Venation of Forewings: Cell present; veins R_{2+5} stalked from its apex.

Upper Surface of Wings: Forewings elongate, with pointed apex, rounded outer margin and outer angle; gray, with scattered grayish brown and brownish black scales; basal area pale gray, with diffuse brownish black area in middle of area; cross lines black, narrow, more or less complete; t. a. line similar to that of *constantia* but with costal portion 3 mm. in length and with concave bend in cubital cell; median line present, nebulous, about 1 mm. wide; discal dot absent; t. p. line arising on costa about three-fifths distance from base, extending outwardly, being almost straight, to junction of veins M_3 and Cu_1 , then angled basad and going straight, with slight concavity below vein Cu_2 , to meet inner margin shortly beyond middle; outer portion of wing with three prominent, narrow, black streaks below apex; s. t. line indicated by a few white scales above tornus, distad of nebulous brown patch; terminal line black, slender, reduced at vein endings in middle of wing; fringe concolorous with wing, darkened opposite vein endings anteriorly. Hind wings pale gray, with numerous, long hairlike scales, wing becoming darker gray or brownish gray distally; without maculation except for trace of extradiscal line anteriorly; ter-

minimal line narrow, black, fading out anteriorly; fringe concolorous with wing.

Under Surface of Wings: Forewings gray, with scattered white scales apically; hind wings grayish white, with scattered grayish brown and brownish black scales; without maculation except for small, faint discal dots and for trace of t. p. and extradiscal lines; forewings with longitudinal brownish black dash below apex; terminal lines and fringes similar to those of upper surface.

Length of Forewing: 21 mm. (holotype).

Male Genitalia. Unknown.

Female Genitalia. Similar to those of *constantia*, differing mainly as follows: sterigma more heavily sclerotized, and with wider lamella antevaginalis; ductus bursae much wider, square in outline; corpus bursae with posterior end apparently wider, with less difference in width between posterior and anterior sections (described from unmated specimen); signum smaller. Apophyses posteriores 2.0 mm. in length.

Early Stages. Unknown.

Food Plant. Unknown.

Type. Holotype, female, San Angel, Distrito Federal, Mexico, May 28 (C. C. Hoffmann). The genitalia of the type are mounted on slide FHR 17162.

The holotype is in the collection of the American Museum of Natural History.

Distribution. This species is known only from the type locality, a southern suburb of Mexico City in the Distrito Federal, at an elevation of about 7400 feet.

Flight Period. Late May.

Remarks. One specimen, one genitalic preparation, and one slide mount of antenna and legs have been examined.

Etymology. The specific name is from the Latin *torus*, protuberance or bulge, in relation to the shape of the front.

Ceratonyx permagnaria (Grossbeck)

Figures 11, 19, 32, 38, 40

Stenocharis permagnaria Grossbeck, 1912, p. 400. McDunnough, 1938, p. 162. Capps, 1950, p. 12. Comstock, 1959, p. 41, pl. 14 (egg).

Stenocharis permagnarius: Barnes and McDunnough, 1917, p. 117.

Ceratonyx permagnaria: Franclemont, 1967, p. 13.

Diagnosis. This species can be separated from *tora* by its broader, more triangular wings, by the more angulate course of the t. p. line, and by the smaller number of antennal segments.

Male. Head with vertex, front and palpi similar to those of *tora*, but with front projecting beyond eye one-third diameter of eye, palpi extending beyond eye a distance equal to two-thirds diameter of eye; antennae bipectinate, of 64 to 70 segments, pectinations arising near middle of segments, being up to 0.4 mm. in length. Thorax above gray, with distal portion of collar dark, and with some dark gray and grayish black scaling as narrow transverse band across patagia and on posterior tufts in some specimens; below pale gray; legs gray, with brownish scaling on outer surface. Abdomen with small tufts on all segments, scales gray basally, becoming dark grayish brown distally; above and below gray, with scattered grayish brown scales.

Venation of Forewings: Cell absent or present, when present variable in size, some specimens with cell on one forewing only; veins R_{2+5} stalked.

Upper Surface of Wings: Forewings elongate, triangular, with pointed apex, slightly rounded outer margin, and definite outer angle; gray, with scattered grayish brown scales and rows of scales, with median area being darkest portion of wing; basal area gray basally, whitish gray distally; cross lines black, narrow, complete in most specimens, rather variable in course; t. a. line arising on costa about one-fifth of distance from base, evenly outcurved, with basal tooth in cubital cell,

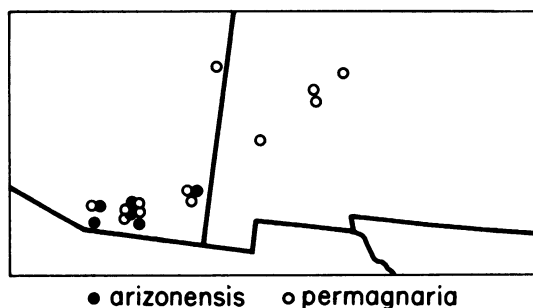


FIG. 40. Distribution of *Ceratonyx arizonensis* (Capps) and *permagnaria* (Grossbeck).

then outwardly curved, meeting inner margin one-third distance from base; median line and discal spot absent; t. p. line arising near middle of costa, concave to near base of vein Cu_1 , then variable in course to meet inner margin two-thirds distance from base; outer portion of wing with two, rarely three, prominent, narrow black streaks below apex, shaded basally by white; s. t. line indicated by grayish white scaling above tornus, distad of nebulous brownish gray patch; terminal line black, narrow; fringe concolorous with wing. Hind wings grayish white basally, becoming gray distally; discal spot absent; extra-discal line more or less complete; terminal line varying from obsolescent to complete; fringe grayish white.

Under Surface of Wings: Forewings gray along costa and outer margin, broadly pale gray medially; hind wings grayish white; maculation varying from being entirely absent on all wings to having all discal dots prominent, dark gray; terminal line black, narrow, present on all wings, fringes concolorous with wings.

Length of Forewing: 17 to 20 mm.

Female. Similar to male, differing mainly as follows: antennae weakly serrate; eyes slightly smaller; front more strongly projecting, extending almost half diameter of eye beyond front of eye; palpi longer, extending beyond eye by distance greater than diameter of eye. Upper surface of forewing with t. p. line situated more distally on wing, arising near or shortly beyond center of costa, angled outwardly to either vein M_3 or junction of veins M_3 and Cu_1 , then weakly biconcave to meet inner margin about two-thirds distance from base.

Length of Forewing: 22 to 24 mm.

Male Genitalia. Similar to those of *constantia*, differing mainly as follows: larger, more heavily sclerotized; uncus with greater ventral curvature; gnathos with shorter median extension; valves broader, with more heavily sclerotized sacculus, and with small, median, C-shaped membranous area at base; anellus W-shaped in cross section, with raised median ridge, anterior cleft, and with irregularly shaped posterior projection extending beyond middle of processes of anellus; processes of anellus larger, 0.5 to 0.6 mm. in length, more heavily sclerotized, tubular, with short curved base and posterior end tapering to point;

aedeagus 2.5 to 2.6 mm. in length, posteriorly with ventral surface sclerotized, longitudinally striate, very minutely dentate, and with rounded apex; vesica, when exerted, extended anteriorly at about 60-degree angle to aedeagus, with row of very many, closely spaced setae, longest ones about 0.3 mm. in length.

Female Genitalia. Sterigma membranous, with short collar-like lamella antevaginalis; ductus bursae short, membranous, scarcely differentiated from corpus bursae; corpus bursae elliptical, without posterior necklike section or longitudinal striations; signum less than 0.2 mm. wide, with prominent, anterior, thornlike inward projection, and with irregularly rounded posterior margin. Apophyses posteriores 1.9 mm. in length.

Early Stages. The egg and first instar larvae have been described by Comstock (1959, p. 41, pl. 14), with the former being illustrated. The eggs were laid in compact single layered patches. The individual egg stands erect, higher than wide, and is in the form of an elongate oval with a raised dentate ring around the tip.

The first instar larva is without filaments. It is black except for the light yellow stigmatal band and for ends of the prolegs and for the anal prolegs, which are translucent straw colored.

Food Plant. Unknown.

Type. Holotype, male, in the National Museum of Natural History. The genitalia of the type are mounted on slide HWC 195.

Type Locality. Chiricahua Mountains, Cochise County, Arizona.

Distribution. Southern Arizona and New Mexico (see fig. 40). The majority of specimens have been collected in the Huachuaca and Chiricahua mountains, Cochise County, Arizona. The moths have been captured at elevations of from about 5000 feet (in Arizona) to 8500 feet (in New Mexico).

Flight Period. February through October. The majority of specimens have been captured in June and July (this is also the period in which most collectors are active).

Remarks. One hundred seventy-one specimens (168 males, three females), seven genitalic dissections (six males, one female), and three slide mounts (two males, one female) of antennae and legs have been studied.

Ceratomyx satanaria Guenée

Figures 12, 20, 33, 39, 41

Ceratomyx satanaria Guenée, 1857, p. 194. Boissidaval and Guenée, 1858, pl. 2, fig. 2 (larva). Walker, 1860, p. 296. Packard, 1876, p. 565. Grote, 1882, p. 49. Smith, 1891, p. 72; 1903, p. 78. Gumpfenberg, 1896, p. 294. Barnes and McDunnough, 1917, p. 119. McDunnough, 1938, p. 165. Kimball, 1965, p. 184, pl. 22, fig. 28 (adult male). Franclemont, 1967, p. 13, fig. 1 (adult male).

Bombycia candida Smith, 1890, p. 179; 1891, p. 34; 1903, p. 61.

Euthyatira candida: Dyar, "1902" [1903], p. 259. Grossbeck, 1917, p. 85. Barnes and McDunnough, 1917, p. 96. McDunnough, 1938, p. 139. Kimball, 1965, p. 160.

Stenocharis candida: Rindge, 1961, p. 10 (placed in Geometridae).

Ceratomyx candida: Franclemont, 1967, p. 13 (synonym of *satanaria*).

Diagnosis. This species can be separated from *permagnaria* by the more extensive areas of white scaling in the basal area and along the costa of the upper side of the forewings, and by the t. p. line tending to be outwardly curved on the anal vein.

Male. Head, thorax, and abdomen similar to those of *permagnaria* but with darker gray scaling.

Venation of Forewings: Cell present or absent, some specimens with cell on one forewing only; veins R_{2+5} stalked.

Upper Surface of Wings: Forewings similar to those of *permagnaria*, differing mainly by more extensive areas of white scaling in slightly larger basal area and along costa distad of t. p. line, by the t. p. line tending to be outwardly curved at anal vein, and by more complete area of nebulous dark scaling to indicate s. t. line basally. Hind wings darker gray than those of *permagnaria*, and tending to have complete extra-discal line.

Under Surface of Wings: All wings gray, darker than those of *permagnaria*, with scattered scales and rows of dark gray scales; forewings with cross lines weakly indicated in some specimens, with area of dark scaling basad of position of s. t. line repeated from upper surface; discal spots present on all wings, prominent; hind wings with area of dark scaling in outer portion of wing.

Length of Forewing: 16 to 19 mm.

Female. Similar to male but differing mainly



● *satanaria*

FIG. 41. Distribution of *Ceratomyx satanaria* Guenée.

as follows: antennae weakly serrate; eyes smaller, more elliptical; front more strongly projecting, extending two-thirds diameter of eye beyond front of eye; palpi longer, extending beyond eye by distance slightly less than twice diameter of eye. Upper surface of forewing with t. p. line situated more distally on wing, arising on costa three-fifths distance from base, angled outwardly to vein M_3 , inwardly oblique to just below vein Cu_2 , then proceeding straight to inner margin two-thirds distance from base; hind wings paler gray, with extra discal line situated nearer outer margin of wing, and with trace of discal spot showing through from under side.

Length of Forewing: 20 to 22 mm.

Male Genitalia. Similar to those of *permagnaria*, differing mainly as follows: smaller, uncus shorter but with relatively wider and more projecting base; gnathos with more triangular median extension; valves with costal swelling more basad, apex of valve more pointed, and without basal membranous area; anellus more triangular, with less prominent median ridge, and with longer, digitate, apically rounded posterior projection; processes of anellus 0.40 to 0.45 mm. in length, base not curved, posterior end evenly curved ventrally, dorsal side sharply curving upward to form short apical point; aedeagus about 2.3 mm. in length; vesica, when exerted, extending anteriorly at about 45-degree angle to aedeagus, with wider row of slightly shorter and thicker spines.

Female Genitalia. Sterigma membranous, with lamella antevaginalis a narrow, elongate sclerotized strip, flattened laterally, projecting anterodorsally medially; ductus bursae membranous, short, broad, asymmetrical, extending further to right side; corpus bursae relatively short and broad, posterior portion with numerous longitudinal striations, anterior section slightly broader; signum absent. Apophyses posteriores 2.0 mm. in length.

Early Stages. Guenée (1857, p. 194) described the larva, which was illustrated by Boisduval and Guenée (1858, pl. 2, fig. 2); it was based on an unpublished drawing by Abbot. The caterpillar is similar in form to that of *arizonensis*, with a very long pair of prothoracic filaments, but has three small projections on the second abdominal segment and only a stump of the filament on the

eighth abdominal segment. The body is gray, with the head, filaments, subdorsal line and all legs rusty red.

Food Plants. *Liquidamber styraciflua* Linnaeus (Hamamelidaceae) and "*Quercus dentata*" (Guenée, *op. cit.*).

Types. For *satanaria*, unknown and presumed lost; the species was described from an unpublished Abbot drawing (Guenée, 1857, p. 194; Franclemont, 1967, p. 13).

For *candida*, holotype male, the American Museum of Natural History (Rindge, 1961, p. 10); its genitalia are mounted on slide FHR 9399.

Type Localities. For *satanaria*, "Georgie américaine." The type was collected by John Abbot, who came to Georgia in 1775, and spent some 58 years there, residing most of the time between Augusta and Savannah in what is now known as Screven County. It is assumed that this is probably the type locality; it is an area on the coastal plains in northeastern Georgia.

For *candida*, Florida. Smith described this species from a single male from Mrs. Annie T. Slosson's collection. According to Kimball (1965, p. 12), she collected principally at Fernandina (Nassau County), Ormond (Volusia County), Charlotte Harbor (Charlotte County), and Biscayne Bay (Dade County). Based on our present distributional knowledge of the species, I believe that the type probably was taken in northern Florida; it is known from Escambia County in western Florida, and from coastal Georgia (*satanaria*). Assuming that the type was collected by Mrs. Slosson at one of the four localities listed above, I suspect that Fernandina, in the coastal region of northeastern Florida and adjacent to Georgia, would be the most likely type locality.

Distribution. The coastal plains of the southeastern United States, extending from South Carolina to Georgia and northern Florida, to near the Mississippi River in west-central Mississippi, and to eastern Texas (see fig. 41). The records on this figure from Georgia and eastern Florida represent the possible type localities of *satanaria* and *candida*.

Flight Period. February and March.

Remarks. Twenty-nine specimens (27 males, two females), four genitalic dissections (three

males, one female), and two slide mounts (one male, one female) of antennae and legs have been studied.

This is one of the rarer species of moths found in our southeastern states. As far as I know, the only specimens that have been collected this century are five males from Charleston County, South Carolina (R. B. Dominick, D. C. Ferguson), three males from Escambia County, Florida (S. M. Hills), four males from Warren and Hinds counties, Mississippi (B. Mather), and 73 males, two females from Harris and Anderson

counties, Texas (A. and M. E. Blanchard). Practically all the Texas specimens were taken at one locality in two consecutive years. The Blanchards collected at Tennessee Colony, Anderson County, on March 12 and 14, 1966, catching 41 males, and again on March 4 and 5, 1967, obtaining 29 males and one female. Between 1963 and 1966 they caught only single specimens during four separate nights of collecting; no moths of this species have been taken since 1967 (A. Blanchard, in letter).

LIST OF SPECIES WITH THEIR KNOWN DISTRIBUTION

GENUS *CERATONYX* GUENÉE, 1857

STENOCHARIS GROSSBECK, 1912

GROUP I

- | | |
|-------------------------------------|--|
| 1. <i>arizonensis</i> (Capps), 1950 | Southern Arizona |
| 2. <i>crassa</i> , new species | Northern Mexico (Durango) |
| 3. <i>rhadinaria</i> (Dyar), 1917 | Central Mexico (México, Morelos) |
| 4. <i>cornifrons</i> (Dyar), 1915 | Central Mexico (Guerrero) |
| 5. <i>hoplitaria</i> (Dyar), 1912 | Central Mexico (Hidalgo, Oaxaca, Puebla) |

GROUP II

- | | |
|--|---|
| 6. <i>fessa</i> , new species | Central Chile (Ñuble, Malleco) |
| 7. <i>crebra</i> , new species | Central Chile (Aconcagua) |
| 8. <i>aculeata</i> , new species | Central Chile (Santiago) |
| 9. <i>constantia</i> (Dyar), 1912 | Central Mexico (Guerrero, Hidalgo, Jalisco, Oaxaca, Puebla) |
| 10. <i>tora</i> , new species | Central Mexico (Distrito Federal) |
| 11. <i>permarginaria</i> (Grossbeck), 1912 | Southern Arizona, New Mexico |
| 12. <i>satanaria</i> Guenée, 1857 | Georgia, Florida, Mississippi, eastern Texas |

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