

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE
AMERICAN MUSEUM
OF NATURAL HISTORY

CENTRAL PARK WEST AT 79TH STREET
NEW YORK, N.Y. 10024 U.S.A.

NUMBER 2710

APRIL 10, 1981

FREDERICK H. RINDGE

A Revision of the Moth Genera *Meris* and *Nemeris*
(Lepidoptera, Geometridae)

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024

Number 2710, pp. 1–28, figs. 1–43, maps 1–4

April 10, 1981

A Revision of the Moth Genera *Meris* and *Nemeris* (Lepidoptera, Geometridae)

FREDERICK H. RINDGE¹

ABSTRACT

The genus *Meris* is revised for the first time. A study showed that the group was heterogeneous, as two very different types of genitalia, venation, and antennae were represented in the included species. When a second genus is recognized, the resulting split of the species will form two morphologically homogeneous groups; as no name was available, *Nemeris*, new genus, with type species *Diastictis speciosa* Hulst, is proposed. Relationships between the two genera are discussed; *Meris* has more apomorphic characters than does *Nemeris*. Keys are given to the species of both groups, based on male and female genitalia. All species are described, and both the

adults and their genitalia are illustrated; distributional data are given for all species.

The following species are described as new: *Nemeris percne* (Arizona), *N. sternitzkyi* (Arizona), *Meris paradoxa* (Arizona), *M. patula* (Montana), and *M. cultrata* (Arizona). *Nemeris mexicola* (Dyar) is a new combination, and *Meris albocrenulata* Cassino is placed as a synonym of *Nemeris speciosa* (Hulst), new combination.

The members of *Nemeris* occur from Colorado and Utah to the Distrito Federal, Mexico, and those of *Meris* from southern British Columbia and southern Alberta to Arizona and New Mexico.

INTRODUCTION

The genus *Meris* has never been revised. A preliminary survey I made a number of years ago showed that two different types of genitalia, venation, and antennae were present in the species included in this genus. In addition, it was very difficult to apply the existing specific names with any degree of certainty. These problems led to the present revisionary study.

Meris is considered to be a member of the Cingiliini. I have already discussed the present status of this tribe, and some of the difficulties in working with it in my revision of *Somatolophia* (Rindge, 1980). The problems that were present in that paper are also present in this revisionary study.

Five species have been named and placed in *Meris*. The genus and two species were

¹ Curator, Department of Entomology, American Museum of Natural History.

named by Hulst in 1896; of the two species, one was placed in *Diastictis* and the other was named in *Meris*. The remaining three species were all placed in *Meris* when they were proposed (Dyar, "1911" [1910], Casino, 1927, and McDunnough, 1940). These specific descriptions represent the bulk of the literature on the group, although Grossbeck (1908) and McDunnough (1940) amplified Hulst's original description of the genus, and Poole (1970) presented the only notes on the early stages of the group.

One of the basic problems in this assemblage of species has been a lack of material, as specimens were seldom collected by early field workers. Hulst, in describing both *alticola* and *speciosa*, had only females; both Dyar and McDunnough named their taxa from males (the females of these two species are still unknown). It has been only comparatively recently that specimens have been collected in any numbers; ultraviolet light is apparently much more attractive to the moths than the lights used by early collectors. Now that we are beginning to get material in somewhat adequate numbers for some of the species, a study of this group becomes practical.

Considering the great importance that early workers placed on venation, I find it surprising that Hulst placed both *alticola* and *speciosa* in the same genus. The former species has two accessory cells in the forewing venation, whereas the latter has a single narrow accessory cell. A difference like this was nearly always more than enough reason to have two genera. In addition to this basic difference between these two species, the present study shows a marked difference in the antennae of both sexes, including the points of origins of the male pectinations, the point of origin of the epiphysis on the male fore tibia, and most markedly, by the genitalia of both sexes. Because of these characters, among others, it became obvious that the species heretofore placed in *Meris* consisted of a heterogeneous group. When a second genus is recognized, the resulting split of the species forms two morphologically homogeneous groups; as no name was available

I have proposed a new generic name, *Nemeris*, in the present work.

The members of both genera have highly modified genitalia, especially in the males. The male structures are unlike those of any other North American Cingiliini; they are easily recognized by the group of thick spines on the inner face of the valve distally. Because of an almost complete lack of information on the genitalia of the Neotropical members of this tribe (see Rindge, 1980), I do not know if this character is represented in the tropical fauna.

Of the two genera treated in the present paper, *Meris* has more apomorphic characters than does *Nemeris*. Some of these include shorter pectinations of the male antennae (0.45 to 0.90 mm. in *Meris*, 1.00 to 1.50 mm. in *Nemeris*), median origin of the pectinations (basal origin), shortly pectinate female genitalia (pectinations barely extending beyond the shaft), male forelegs with process arising at or beyond the middle of the segment (arising in basal half), shorter apophyses on forelegs of both sexes (1.00 to 1.45 mm. in male, 0.70 to 0.85 mm. in female for *Meris*; 1.55 to 2.15 mm. and 0.90 to 1.30 mm., respectively, for *Nemeris*), and shorter, thinner spurs on the hind legs, with the length of the longer upper spur being 0.70 to 0.95 mm. in the males and 0.65 to 0.90 mm. in the females (1.2 to 1.5 mm. and 1.1 to 1.3 mm., respectively, for *Nemeris*). The very large size of the male genitalia and the highly modified anellus of *Nemeris* are apomorphic characters, whereas the broad uncus having lamellate dorsolateral margins in *Meris* is apomorphic.

Within each genus, the species usually closely resemble one another; for this reason no keys are given to the adults based on maculation or color. To properly identify the species it is usually necessary to study the genitalia; keys are given to the genitalia of both sexes in both genera.

During the course of this study 932 specimens have been examined, including 612 *Nemeris* and 320 *Meris*. The males outnumbered the females by 1.6 to 1.0 in the former genus, and by 3.4 to 1.0 in the latter. One

hundred five genitalic dissections have been studied (34 males and 35 females of *Nemeris*, 20 males and 16 females of *Meris*). In addition, slide mounts have been made of the antennae and legs of both sexes of all species whenever possible. I have examined all the primary types and studied their genitalia. All holotypes and lectotypes are illustrated in this paper. All the specimens I studied have had either identification or type labels placed on their pins. Slightly more than half the specimens studied, three-fourths of the genitalic slides, and practically all the slides of the antennae and legs are in the collection of the American Museum of Natural History (AMNH).

ACKNOWLEDGMENTS AND ABBREVIATIONS

I acknowledge with thanks the cooperation and aid of the following colleagues who have allowed me to study the types and specimens in their charge: Mr. Klaus B. Bolte for the Canadian National Collection (CNC); Mr. Julian P. Donahue for the Natural History Museum of Los Angeles County (LAM); Dr. Douglas C. Ferguson for the National Museum of Natural History, Smithsonian Institution (USNM); Mr. Ronald H. Leuschner (RL) of Manhattan Beach, California; Dr. Robert Silberglied for the Museum of Comparative Zoology, Harvard University (MCZ); and Dr. Jerry A. Powell for the California Insect Survey Collection, University of California, Berkeley (UC).

NEMERIS, NEW GENUS

Meris of authors, in part: Barnes and McDunnough, 1917, p. 116. McDunnough, 1938, p. 171.

DIAGNOSIS: *Nemeris* can be separated from *Meris* by the longer pectinations of the male antennae (1.00 to 1.50 mm. long compared with 0.45 to 0.90 mm. in *Meris*), the pectinations arising basally on the antennal segments, the female antennae with minute pectinations barely extending beyond the antenna, the foreleg with the male apophyses

arising at about one-third length of the segment and being 1.55 to 2.15 mm. long (1.00 to 1.45 mm. in *Meris*), by the presence of one elongate narrow accessory cell in the forewing, and by the genitalia. The genitalia distinguish *Nemeris* from the other Cingiliini found in North America. No other group has the male structures with both the uncus and gnathos very long, slender, and heavily sclerotized, the valves with a curved costa plus the raised transverse band of elongate spines distally, and the anellus with the posterior end having two pairs of long slender processes. The female structures have a very large, heavily sclerotized ductus bursae with the posterolateral margins attenuate and curved.

ADULT: Head with eyes of both sexes large, those of males slightly larger than females, round, wider than front; front very slightly convex; tongue short; palpi moderate, extending slightly beyond front, not rising to middle of eye; antennae of male bipectinate, with from about 50 to 62 segments, pectinations arising basally from basal segments, extending to apex, longest pectinations about seven times longer than basal segments, 1.0 to 1.5 mm. in length, each pectination with double row of elongate, dense, slender setae below, becoming shorter at apex, antennae of female very shortly pectinate, pectinations barely extending beyond shaft. Thorax moderately stout, without dorsal tufts but with elongate scaling dorsoposteriorly, in some specimens almost bifurcate; fore tibia unarmed, with process of male 1.55 to 2.15 mm. long, arising one-third distance from base of segment and extending 0.4 to 0.7 mm. beyond apex of segment, of female shorter, 1.2 mm., arising one-half to three-fifths distance from base of segment; hind tibia with two pairs of thick spurs in both sexes, longest upper spur of male 1.2 to 1.5 mm. long, of female 0.9 to 1.3 mm., males without groove and hair pencil. Abdomen without dorsal tufts; males with ventral surface of third segment without row of setae and last segment without modification.

Forewings broad, apex angulate, outer margin rounded; 12 veins present, with one

elongate narrow accessory cell; R_1 free; R_2 paralleling R_1 , shortly united with R_{3+4} , R_{3+4} stalked; udc one-third length of mdc; mdc and ldc of about equal length, curved; Cu_1 from below lower angle; fovea absent. Hind wings broad, outer margin rounded; frenulum well developed in both sexes; Sc with broadly swollen base; R curved at base of wing, paralleling Sc for less than one-half length of cell; R and M_1 separating before upper angle of cell; m and ldc angled; M_3 from lower angle; cell slightly longer than half length of wing; Cu_1 arising near M_3 .

Wings with elongate hairlike scales on both surfaces, more numerous and tending to be at least partially erect basally on upper surface of forewing, elongate on basal portion of upper surface of hind wing; males with upper surface of forewings mottled brown or yellowish brown, with t. a. line, t. p. line, and median spot usually present, hind wings paler, with reduced maculation; females with forewings tending to be paler than in males and having ochraceous tinge. Under surface of all wings grayish white, hind wings paler than forewings, all wings with obsolescent maculation.

MALE GENITALIA: Elongate, 3.0 to 4.0 mm. long; uncus long, slender, tapering to pointed apex; socius membranous, setose, extending anteriorly on each side of anal tube; gnathos heavily sclerotized, lateral areas uniting medially to form very long, slender, tapering process, curved posterior surface near apex with row of several short spines; valves large, mostly membranous, costa sclerotized, curved posteriorly near middle of valve and widened, with elongate spines from curved, raised transverse band distally at end of costal swelling and along inner margin; transtilla flat, sclerotized, lateral margins extending posteriorly, medially concave, anteriorly with median incision; furca and cristae absent; anellus heavily sclerotized, anteriorly extending into dorsal point, posteriorly projecting as median pair of long, slender, pointed processes, and with shorter, lateral pair of pointed processes; tegumen broad, short, with median suture; saccus elongate, tapering, anterior margin

bluntly rounded; aedeagus elongate, slender, posterior end with slender sclerotized ridge and lateral projecting point; vesica extending to left at approximately right angle to aedeagus as simple tube when exerted, with group of thick spines near aedeagus.

FEMALE GENITALIA: Papillae anales elongate, membranous, with numerous setae; sterigma with lamella postvaginalis a lightly sclerotized series of closely set transverse irregular ridges; lamella antevaginalis lightly and smoothly sclerotized area on each side of ductus bursae, with anterolateral semicircular ridge on each side; ductus bursae heavily sclerotized, posteriorly with median lobe, posterolateral margins attenuate, tapering, curved, projecting widely, anterior margin asymmetrical, with left side longer than right, median boundary poorly defined; ductus seminalis arising laterally from small lobe near posterior end of corpus bursae on right side; corpus bursae with posterior end asymmetrical, bilobed, right side extending farther posterior than left lobe, right posterior margin weakly concave to deeply concave, sclerotized, extending inward as far as right margin of ductus bursae, left posterior margin of corpus bursae tapered inwardly, both sides forming slight constriction, then large, anterior membranous portion of corpus bursae becoming more or less elliptical, smooth, without striations; signum weakly sclerotized, round, about 0.2 mm. in diameter, flat, with or without partially raised outer rim sometimes reduced or absent. Apophyses posteriores attached at anterior end of papillae anales, slender, 1.6 to 2.7 mm. in length; apophyses anteriores 0.5 to 1.0 mm. long.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE SPECIES: *Diastictis speciosa* Hulst.

DISTRIBUTION: From the mountains of Colorado south to the area of the Distrito Federal, Mexico.

REMARKS: Hulst (1896) described *speciosa* from the female only; apparently it was not until many years later that males became available and properly associated with this species. The first males to be described

were those of *mexicola* Dyar ("1911" [1910]); no association was made with the closely related *speciosa*. The next males to be described were those of *albocrenulata* Cassino (1927), and once again no connection with *speciosa* (or any species, for that matter) was made, even though he included members of both sexes in his type series. Both Dyar and Cassino placed their species in *Meris*. This is rather surprising because of the marked differences between that genus and the present one. On the other hand it should be pointed out that specimens of both *Meris* and *Nemeris* were very seldom collected by early collectors, and so very little material was available for study.

Identifications within *Nemeris* are usually difficult, as the adults of all four species look very similar to one another. In some cases there appear to be slight but fairly consistent differences in pattern and color; often we need longer series of specimens to be certain that these are of specific value. The genitalia should be studied when making identifications. In general, the female structures may be more helpful than those of the male, as the configuration of the ductus bursae appears to be diagnostic for the three species that are known from that sex.

ETYMOLOGY: The generic name is formed from the Greek prefix *ne*, not, and the Greek word *meris*, an already existing generic name meaning part, portion or share; the gender is feminine.

KEY TO SPECIES

Based on Male Genitalia

- 1. Aedeagus 2.35 to 2.50 mm. in length; gnathos with posterolateral bands 0.10 mm. wide; anellus with median cleft 0.92 to 1.00 mm. long *sternitzkyi*
Aedeagus 1.65 to 2.30 mm. in length; gnathos with posterolateral bands 0.05 to 0.75 mm. wide; anellus with median cleft to 0.70 to 1.00 mm. long 2
- 2. Aedeagus 1.75 to 1.85 mm. in length; transtilla with outer margin 0.45 to 0.50 mm. long, broadly convex medially; anellus with outer processes 0.05 mm. in length, or 6.5 percent of total length of anellus *mexicola*

- Aedeagus 1.65 to 2.30 mm. in length; transtilla with outer margin 0.45 to 0.65 mm. long, biconcave to almost straight; anellus with outer processes 0.08 to 0.25 mm. in length, or 9 to 23 percent of total length of anellus 3
- 3. Transtilla with outer margin 0.45 to 0.60 mm. long, averaging 0.58 mm., biconcave, apically tending to be slender *speciosa*
Transtilla with outer margin 0.60 to 0.65 mm. long, averaging 0.63 mm., weakly biconcave to almost straight, apically tending to be broadly rounded *percne*

Based on Female Genitalia²

- 1. Posterior end of corpus bursae with sclerotized outer margin on right side straight or slightly curved *percne*
Posterior end of corpus bursae with sclerotized outer margin on right side strongly concave 2
- 2. Ductus bursae with diagonal ridge at anteroventral margin; ductus seminalis arising from slender, dorsally curved lobe at posterior end of corpus bursae, with lobe being dorsad of corpus bursae *sternitzkyi*
Ductus bursae without anteroventral ridge; ductus seminalis arising from lateral lobe, the latter being anteriad of posterior end of corpus bursae *speciosa*

Nemeris speciosa (Hulst),
new combination

Figures 1-4, 11, 15, 19

Diastictis speciosa Hulst, 1896, p. 332. Dyar, 1904, p. 225. Rindge, 1955, p. 154.
Cymatophora speciosa: Dyar, "1902" [1903], p. 315. Smith, 1903, p. 75.
Meris speciosa: Barnes and McDunnough, 1917, p. 116. McDunnough, 1938, p. 171.
Meris albocrenulata Cassino, 1927, p. 87. McDunnough, 1938, p. 171. NEW SYNONYMY.

DIAGNOSIS: This widespread species, occurring in Colorado, Utah, northern and eastern Arizona, New Mexico, and western Texas, is best recognized by a study of the genitalia. The characters that can be used for these structures are given in the accompanying key.

² The female of *mexicola* is unknown.

MALE: Head with vertex grayish white to pale gray; front gray to grayish brown; palpi grayish brown. Thorax above grayish white to pale gray; below grayish anteriorly, dull white posteriorly; legs grayish white, with outer surfaces dark gray to grayish black. Abdomen above and below grayish white.

Upper Surface of Wings: Forewings buff, with variable number of brown, dark gray and grayish black scales, with overall wing color varying from pale brown to dark gray; veins variable in color, being concolorous with or darker than wing, or various shades and intensities of brown or yellow brown; maculation weakly represented, cross lines tending to be broad, more or less incomplete; t. a. line arising on costa three-tenths distance from base, variable in course, with outward angles in cell and on vein Cu, inwardly curved to meet inner margin just basad of middle; median line absent; discal spot tending to be circular, large; t. p. line arising on costa about seven-tenths distance from base, weakly concave in upper part of wing, then angled posteriorly, meeting inner margin about two-thirds distance from base, line tending to be convex in cells, with small spot of dull white scales on some or most veins; subterminal area slightly paler than basal portion of wing, with weak s. t. line formed by change in color; terminal line represented by dark gray or grayish black cellular dots; fringe concolorous with wing, tending to be somewhat darkened opposite terminal dots. Hind wings grayish white, with variable number of grayish brown and dark gray scales, these becoming more numerous distally; small discal dot present in most specimens; extradiscal line weakly represented, usually incomplete, angled in center of wing; terminal line with small cellular dots in most specimens; fringe concolorous with wing.

Under Surface of Wings: Forewings pale gray, tending to become brownish along costa and slightly grayer distally and posteriorly; without maculation except for faint trace of t. p. line and small dark discal dot; terminal line with cellular spots small or absent; fringe concolorous with wing. Hind wings white, with a few scattered dark scales; without maculation except for small dark gray

discal dot; terminal line and fringe similar to those of forewings.

Length of Forewing: 14 to 19 mm.

FEMALE: Similar to male but with upper surface of forewings more buff colored due to fewer dark scales, and with cross lines tending to be more clearly marked.

Length of Forewing: 15 to 20 mm.

MALE GENITALIA: Uncus 0.85 to 1.25 mm. long, base 0.45 to 0.70 mm. wide, with anterolateral points rounded or weakly curved anteriorly; gnathos with posterolateral bands 0.05 mm. wide; transtilla with outer sclerotized margin 0.45 to 0.57 mm. long, biconcave, apically tending to be slender; anellus 0.90 to 1.25 mm. long, median cleft 0.70 to 1.00 mm. long, median pair of processes 0.40 to 0.60 mm. long, outer pair of processes 0.07 to 0.20 mm. long; tegumen 0.70 to 1.10 mm. in length; saccus 1.30 to 1.75 mm. long; aedeagus 1.85 to 2.30 mm. long, posterior end scarcely enlarged, with terminal sclerotized projection large, being broadly attached to and extending over end of parallel-sided aedeagus.

FEMALE GENITALIA: Sterigma with posterolateral areas weakly sclerotized, bluntly pointed posteriorly, and with raised semicircular ridge on each side, extending from near posterolateral points of ductus bursae anteriorly to near edges of ductus bursae; ductus bursae variable in shape, anterior margin not clearly delimited; ductus seminalis arising from small lobe on side of larger posteriorly extending part of corpus bursae; corpus bursae with posterior end broadly swollen on left side, extending dorsally partial length of tube of ductus bursae, on right side narrower but extending farther posteriad, right margin anterior of ductus bursae sclerotized, gently and evenly curved. Apophyses posteriores 1.65 to 2.70 mm. long; apophyses anteriores 0.50 to 1.05 mm.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Hulst had at least two females when he described *speciosa*, as he gave "expands 37-38 mm." I have examined the following specimens bearing his type labels: 1, one in AMNH (Dyar, 1904, p. 225; Rindge, 1955, p. 154); 2, 3, both in USNM,

with all of the first three bearing the identical locality label "Hot Springs, N. M. 7000 ft."; 4, another female (USNM) from "Col. B. Neumoegeen," "*Glena speciosa* Hulst Type"; 5, still another female (USNM), without locality data but labeled "*speciosa* Hlst. Comp. with type ♀ Coll. Ill. N. H. Surv. Size OK. Markings OK but type with greenish suffusion as in X. T. Rutgers specimen. F. H. B[enjamin]." Specimen 5 is an example of the southern Arizona species, described below, but the Illinois Natural History Survey specimen might be correctly placed as *speciosa*; as I have not seen it, I cannot be certain. Specimen 4 has to be a pseudotype as the type label places the species in *Glena*, whereas it was described in *Diastictis*. Specimens 1, 2, and 3 are conspecific. Number 2 lacks the left hind wing and abdomen, and number 3 is from the collection of the Brooklyn Museum, having been donated by Hulst; there is nothing in the original description to indicate that Hulst placed his type in that collection. Consequently, I hereby designate specimen number 1 as the lectotype (see fig. 2), and have so labeled it; it is in the AMNH and has its genitalia mounted on slide JGF A-91.

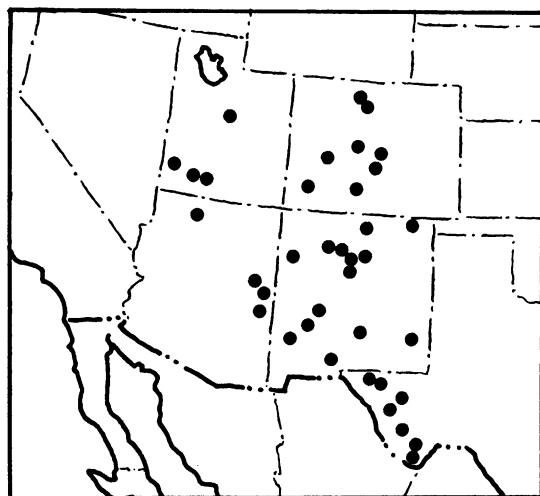
Cassino described *albocrenulata* from a holotype, male (see fig. 1), and allotype, female; they are MCZ 16942. The genitalia of the holotype are on Cassino's (?) slide 3937.

TYPE LOCALITIES: For *speciosa*, Hot Springs, elevation 7000 ft., San Miguel County, New Mexico; for *albocrenulata*, Alpine, Brewster County, Texas.

DISTRIBUTION: Colorado, Utah, northern Coconino County and the White Mountains of Arizona, New Mexico, and western Texas (see map 1).

FLIGHT PERIOD: Apparently with a single generation in Colorado, Utah, northern Coconino County and the White Mountains of Arizona, as the adults have been taken from late June into early August. The moths have been caught from May into September in New Mexico, and from March into October in western Texas; this indicates two or more broods per year in these states.

REMARKS: Three hundred seventy specimens (250 males, 120 females) and 46 geni-

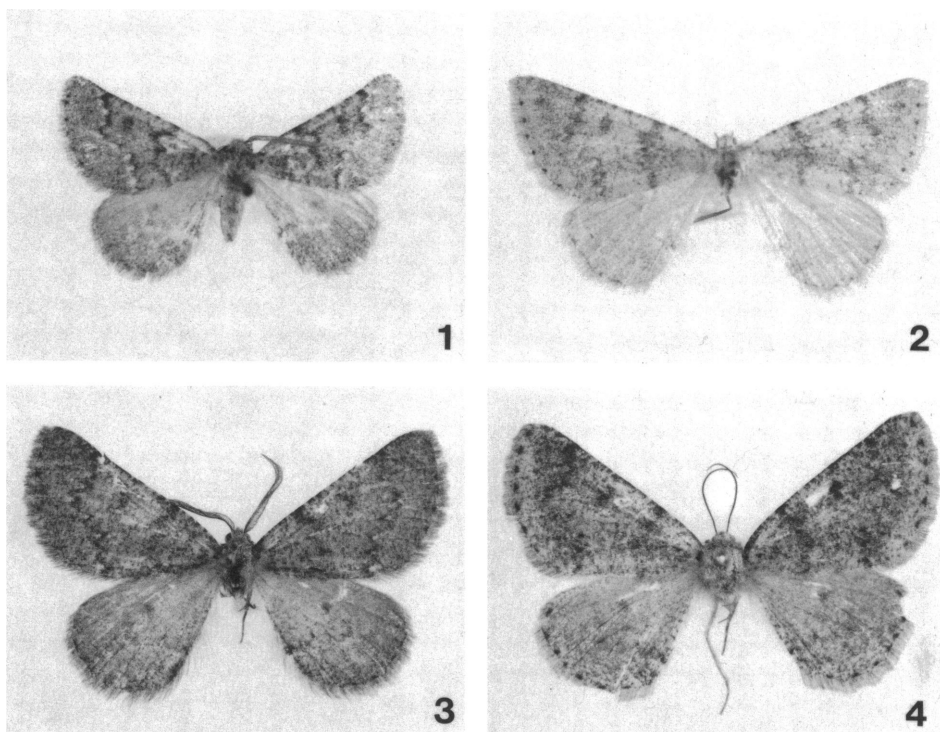


MAP 1. Distribution of *Nemeris speciosa* (Hulst).

tal dissections (22 males, 24 females) have been studied.

This appears to be the most variable species within the genus. It is the one represented in large numbers and is the only one with a wide distribution. Its widespread occurrence may reflect a greater number of habitats and a much wider range of elevations; these, in turn, could account for at least some of the variability within *speciosa*. In general, specimens from Colorado, Utah, northern and eastern Arizona, and northern New Mexico tend to be larger than those from the remainder of New Mexico. Based on capture dates, it seems probable that the northern examples have a single generation per year, and this seems to be correlated with their larger size. Specimens that fly in the spring months in western Texas are larger than those taken later in the year in that area. I have been unable to find any consistent differences, either in the wings or genitalia, within all the material being placed as *speciosa*; as a result I am treating this widespread and variable group of specimens as a single species.

Cassino's holotype of *albocrenulata* is a small male labeled as being caught between August 20 and 30. Specimens caught in late summer in western Texas are normally



FIGS. 1-4. Adults of *Nemeris speciosa* (Hulst). 1. Holotype, male, of *Meris albocrenulata* Cassino, Alpine, Texas, August 20-30 (MCZ). 2. Lectotype, female, Hot Springs, New Mexico (AMNH). 3. Male, Red Canyon Camp, Utah, August 3, 1965 (F., P., and M. Rindge; AMNH). 4. Female, 7 miles east Jacob Lake, Arizona, July 23, 1965 (F., P., and M. Rindge; AMNH). All $\times 1.56$.

smaller than those flying in the spring. This particular moth has a very clearly defined pattern; in fact, it has the most well-defined markings I have seen for this species. The genitalia do not show any differences from either of the other Texas males or specimens from elsewhere within the range of *speciosa*. I conclude, therefore, that *albocrenulata* is nothing but a somewhat abnormal member of the Texas population, and so have placed it as a synonym of *speciosa*.

***Nemeris percne*, new species**

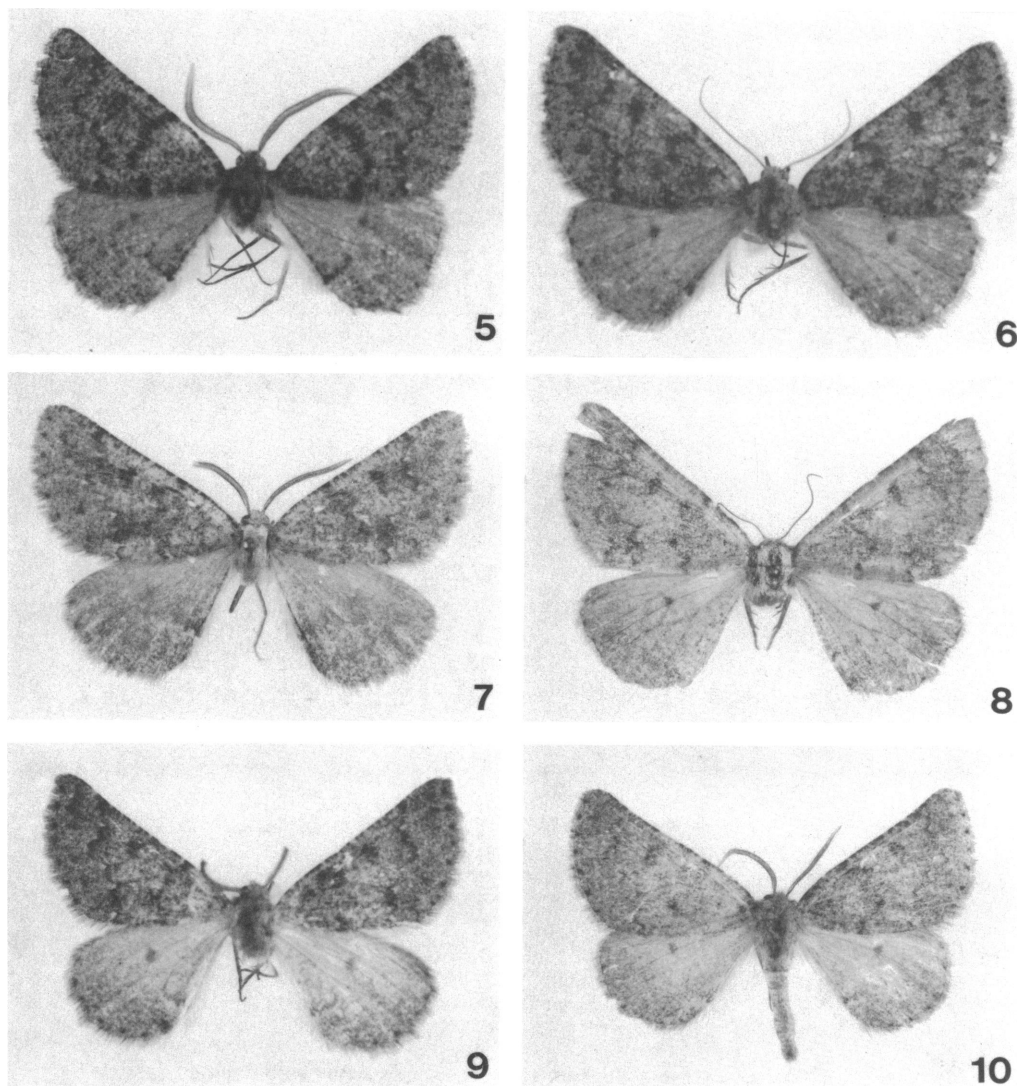
Figures 5, 6, 12, 16, 20

DIAGNOSIS: This species, known only from south of the Grand Canyon in central Arizona, can be recognized by the wings

being darker than in any other species and by the genitalia. The characters that can be used for these structures are given in the accompanying key.

MALE: Head, thorax, and abdomen similar to those of *speciosa* but darker gray.

Upper Surface of Wings: Similar to that of *speciosa*, differing mainly as follows: forewings more or less heavily and evenly suffused with gray, dark gray, and grayish black scales, making wing more evenly colored and darker; veins concolorous with wing, faintly brown in a few specimens; cross lines slender, usually fairly clearly defined, variable in course; small white venular dots on outer portion of t. p. line obsolescent; marginal dots of terminal line on all wings small or absent; hind wings dark gray.



FIGS. 5–10. Adults of *Nemeris*. 5, 6. *N. percne*, new species. 5. Holotype, male, Walnut Creek, Arizona, August 6, 1964 (R. W. Poole; USNM). 6. Allotype, female, Walnut Creek, Arizona, August 6, 1964 (R. W. Poole; USNM). 7, 8. *N. sternitzkyi*, new species. 7. Holotype, male, Miller Canyon, Arizona, July 10, 1968 (R. F. Sternitzky; AMNH). 8. Allotype, female, Miller Canyon, Arizona, September 6, 1974 (R. F. Sternitzky; AMNH). 9, 10. *N. mexicola* (Dyar). 9. Lectotype, male, Mexico City, Mexico (R. Muller; USNM). 10. Male, Guerrero Mill, Hidalgo (Mann and Skewes; AMNH). All $\times 1.56$.

Under Surface of Wings: Similar to that of *speciosa* but darker gray and with all discal dots prominent.

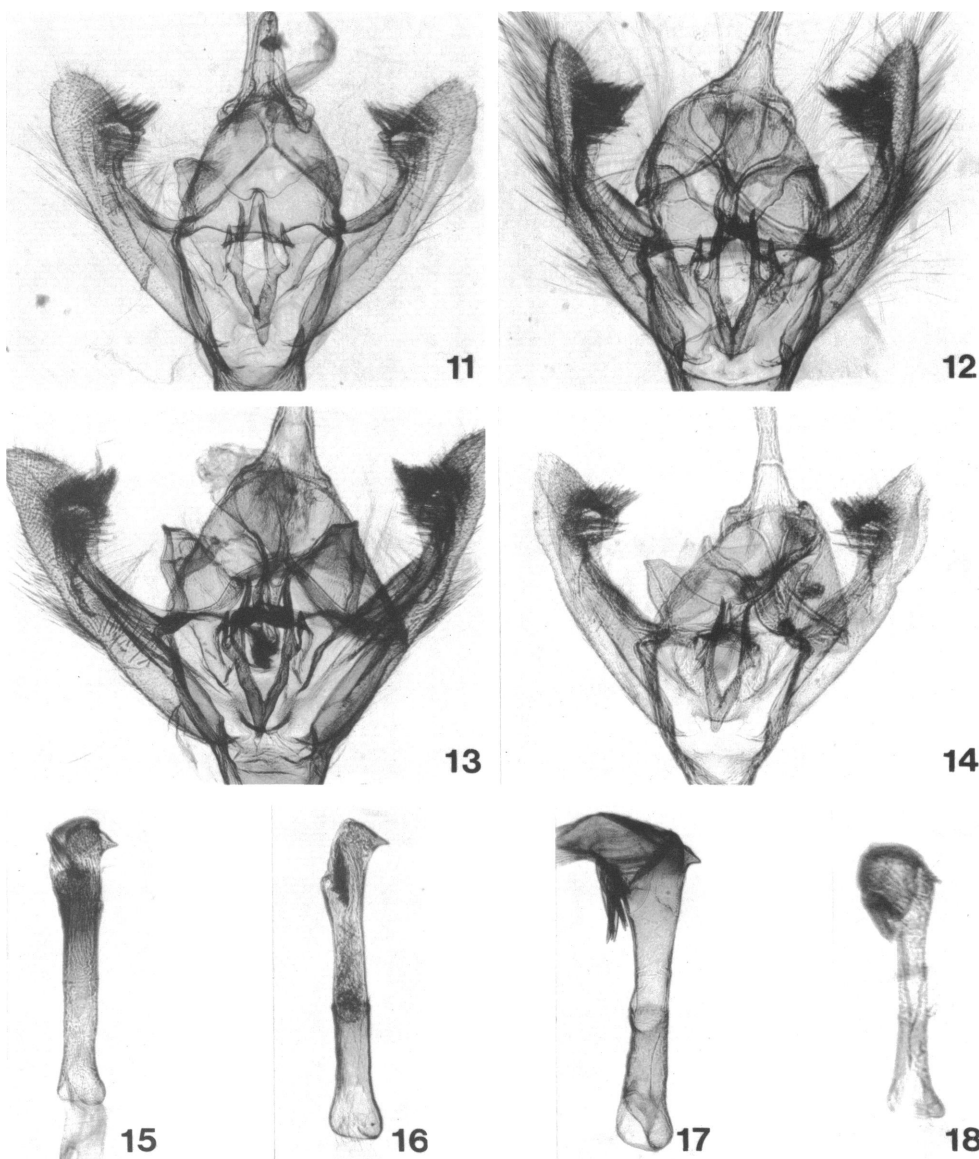
Length of Forewing: 18 to 21 mm.; holotype, 18 mm.

FEMALE: Similar to male, with upper sur-

face of wings being only slightly paler; under surface with t. p. and extradiscal lines faintly indicated.

Length of Forewing: 18 to 21 mm.; allotype, 19 mm.

MALE GENITALIA: Uncus 1.00 to 1.10 mm.



FIGS. 11-18. Male genitalia of *Nemeris*. 11-14. Male genitalia. 11. *N. speciosa* (Hulst), Basin, Big Bend National Park, Texas, April 9, 1967 (A. and M. E. Blanchard; AMNH). 12. *N. percne*, new species, holotype, Walnut Creek, Arizona, August 6, 1964 (R. W. Poole; USNM). 13. *N. sternitzkyi*, new species, paratype, Ramsey Canyon, Arizona, July 15, 1968 (R. F. Sternitzky; AMNH). 14. *N. mexicola* (Dyar), San Angel, D. F., Mexico, January 15, 1913 (C. C. Hoffmann; AMNH). 15-18. Aedeagi of same specimens. 15. *N. speciosa* (Hulst). 16. *N. percne*, new species. 17. *N. sternitzkyi*, new species, with vesica exerted. 18. *N. mexicola* (Dyar), with vesica partly exerted.

in length, base 0.60 to 0.65 mm. wide, with sclerotized anterolateral points minute or slender, pointed and curved anteriorly; gna-

thos with posterolateral bands 0.05 mm. wide; transtilla with outer sclerotized margin 0.55 to 0.65 mm. long, weakly biconcave to

almost straight, apically tending to be broadly rounded; anellus 1.00 to 1.25 mm. in length, median cleft 0.80 to 1.00 mm. long, median pair of processes 0.47 to 0.55 mm. long, outer pair of processes 0.15 to 0.25 mm. long; tegumen 0.85 to 1.10 mm. long; saccus 1.45 to 1.85 mm. long; aedeagus 2.10 to 2.30 mm. in length, increasing in width posteriorly on left side, with terminal sclerotized projection moderate to large in size, attached posterolaterally.

FEMALE GENITALIA: Sterigma with wide posterolateral areas weakly sclerotized, rounded posteriorly, and with elongate, raised, semicircular ridge on each side, extending posteriad of posterolateral points of ductus bursae anteriorly to beyond anterior edge of ductus bursae; ductus bursae variable in shape, anterior margin partially delimited by small, incomplete diagonal ridge; ductus seminalis arising from dorsal one of two small lobes at posterior end of corpus bursae; corpus bursae with posterior end weakly swollen on left side, scarcely extending beyond anterior margin of left side of ductus bursae, on right side tending to be bilobed, ventral one small, dorsal one larger and curved, right margin anteriad of ductus bursae sclerotized, straight or only very weakly concave. Apophyses posteriores 1.9 to 2.4 mm. long; apophyses anteriores 0.65 to 0.85 mm.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, and allotype, female, Walnut Creek, elevation 6500 ft., 6½ mi. ESE Flagstaff, Coconino County, Arizona, August 6, 1964 (R. W. Poole). The genitalia of the holotype are mounted on slide FHR 18823, and of the allotype on FHR 18830. Paratypes, all from Coconino County, Arizona: same data as holotype, August 1, 6, 7, 12, 1964, July 8, 30, 1965, August 2, 4, 5, 8, 1965, 10 males, 27 females (USNM, AMNH); Fort Valley, elevation 7350 ft., 7½ mi. NW Flagstaff, July 27, 28, 31, 1964, August 1, 3, 4, 7, 8, 10, 22, 1964, July 24, 1965, August 1, 1965 (R. W. Poole), five males, 20 females (USNM, AMNH); West Fork, elevation 6500 ft., 16 mi. SW Flagstaff, July 29, 1964, August 17, 1964, August 3, 1965 (R.

W. Poole), two males, four females (USNM); Slate Mountain Loop Road, elevation 6900 ft., 20 mi. NW Flagstaff, July 19, 1965 (R. W. Poole), one female (USNM); 3 mi. NW Flagstaff, elevation 7000 ft., August 11, 1950 (T. Cohn, P. Boone, M. Cazier), one male (AMNH); Flagstaff, elevation 6900 ft., July 25, 1950 (T. Cohn, P. Boone, M. Cazier), one female (AMNH); 7 mi. W Williams, July 23–28, 1957 (N. McFarland), three females (LAM); same data and date as last, collected by C. A. Hill at black light, seven females (LAM).

The holotype and allotype (see figs. 5, 6) are in the collection of the National Museum of Natural History; paratypes are in the collections of that institution, of the American Museum of Natural History, and of the Natural History Museum of Los Angeles County, as indicated above.

DISTRIBUTION: Coconino and Yavapai counties, Arizona (see map 2). A single specimen has been studied that is labeled Prescott, Yavapai County (AMNH); it apparently belongs to this species but was purposely not included in the type series.

FLIGHT PERIOD: July and August.

REMARKS: Ninety-five specimens (29 males, 66 females) and nine genitalic dissections (four males, five females) have been studied.

There is relatively little individual variation within this species. The females are only slightly paler than the males; in some cases there is practically no difference between the two sexes.

ETYMOLOGY: The specific name is from the Greek *percnos*, meaning dark colored, in reference to the color of the upper surface of the wings.

***Nemeris sternitzkyi*, new species**

Figures 7, 8, 13, 17, 21

DIAGNOSIS: This species, from southern Arizona, tends to have the upper surface of the forewings of the females a paler, pinkish buff than in the other species. The species can be best recognized by a study of the genitalia, especially of the females; the diagnos-

tic characters for both sexes are given in the accompanying key.

MALE: Head, thorax, and abdomen similar to those of *speciosa*.

Upper Surface of Wings: Similar to that of *speciosa*, differing mainly as follows: veins yellowish brown; t. a. line tending to be slightly more angulate; t. p. line more attenuate in cell M_2 ; small white venular dots on outer portion of t. p. line more consistently represented; marginal dots of terminal line on all wings small or absent; hind wings slightly darker, with extradiscal line tending to be more angulate.

Under Surface of Wings: Similar to that of *speciosa* but tending to have more scattered dark scales, and to have costal margin of forewing brown and broader.

Length of Forewing: 15 to 20 mm.; holotype, 19.5 mm.

FEMALE: Similar to male but with upper surface of forewings pale buff to buff, due to fewer dark scales, and with cross lines slightly more clearly marked.

Length of Forewing: 17 to 22 mm.; allotype, 21 mm.

MALE GENITALIA: Uncus 1.05 to 1.15 mm. long, base 0.65 to 0.70 mm. wide, with sclerotized anterolateral points prominently pointed and curved anteriorly; gnathos with posterolateral bands 0.10 mm. wide; transtilla with outer sclerotized margin 0.60 to 0.70 mm. long, convex medially, ending posteriorly in projecting point, apically truncate; anellus 1.20 mm. long, median cleft 0.92 to 1.00 mm. long, median pair of processes 0.50 to 0.55 mm. long, outer pair of processes 0.10 to 0.25 mm. long; tegumen 1.00 to 1.05 mm. in length; saccus 1.65 to 1.80 mm. long; aedeagus 2.35 to 2.50 mm. long, posterior one-half gradually increasing in diameter, with terminal sclerotized projection moderate in size, attached laterally at posterior end.

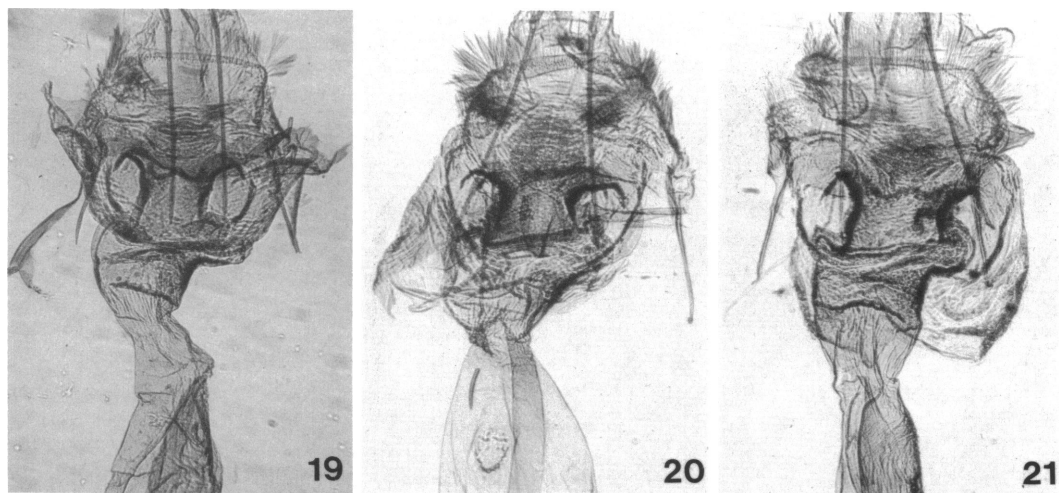
FEMALE GENITALIA: Sterigma with wide posterolateral areas weakly sclerotized, square or with obtuse angle posteriorly, and with very small semicircular ridge on each side; ductus bursae shorter than in *speciosa*, anterior margin with prominent diagonal ridge; ductus seminalis arising from apex of slender, dorsally curved lobe at posterior

end of corpus bursae; corpus bursae with posterior end angulate on left side, weakly sclerotized with diagonal ridge of ductus bursae extending beyond left margin of ductus bursae, on right side extending as diagonal lobe, curved posteriad and tapering to ductus seminalis, right margin antieriad of ductus bursae sclerotized, sharply curved. Apophyses posteriores 1.65 to 2.35 mm. long; apophyses anteriores 0.60 to 0.85 mm.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Miller Canyon, Huachuca Mountains, Cochise County, Arizona, July 10, 1968 (R. F. Sternitzky); allotype, female, same data, elevation 5000 ft., September 6, 1974; both specimens are from the author's collection. The genitalia of the holotype are mounted on slide FHR 18803, and of the allotype on FHR 18806. Paratypes, all from Cochise County, Arizona: same data as holotype, various dates between March 19 and July 25, 1968, April 17 to October 13, 1969, nine males, two females (AMNH); Carr Canyon, Huachuca Mountains, June 7, 1964, October 17 and November 10, 1967, various dates between June 19 and September 27, 1968, October 10, 1972 (R. F. Sternitzky), 13 males, September 10, 1976 (R. Wielgus), one female (AMNH); Ramsey Canyon, Huachuca Mountains, July 22, 1964, various dates between May 5 and October 2, 1965, between April 4 and October 27, 1967, between March 27 and November 11, 1968, and between August 7 and October 11, 1969 (R. F. Sternitzky), 42 males, nine females (AMNH); Ash Canyon, Huachuca Mountains, various dates between April 3 and October 1, 1968 (R. F. Sternitzky), 12 males, two females (AMNH); Parker Canyon, Huachuca Mountains, September 1, 1967 (R. F. Sternitzky), one male (AMNH); Garden Canyon, Huachuca Mountains, September 13, 1967, March 30, 1968 (R. F. Sternitzky), two males (AMNH); Huachuca Mountains, May 30, 1935 (G. H. and J. L. Sperry), no date, August, two males, one female (AMNH, USNM, CNC); Sierra Vista, September 8, 1963, October 30, 1963, August 8, 1968 (R. F. Sternitzky), two males, one female (AMNH); Montezuma



FIGS. 19–21. Female genitalia of *Nemeris*. 19. *N. speciosa* (Hulst), High Rolls, New Mexico, August 23 (AMNH). 20. *N. percne*, new species, allotype, Walnut Canyon, Arizona, August 6, 1964 (R. W. Poole; USNM). 21. *N. sternitzkyi*, new species, paratype, Ramsey Canyon, Arizona, May 11, 1965 (R. F. Sternitzky; AMNH).

Pass, September 14, 1968 (R. F. Sternitzky), one male (AMNH); Bisbee, August 23, 1967 (R. F. Sternitzky), one male (AMNH); Sunnyside, west side Huachuca Mountains, July 14, 1958 (L. M. Martin), one female (LAM); Southwestern Research Station of the American Museum of Natural History, elevation 5400 ft., 5 mi. west of Portal, August 18, 1957 (C. W. Kirkwood), June 17, 19, 1958 (C. W. Kirkwood), June 23, 1958 (M. A. Cazier), July 3, 1959 (M. Statham), September 5, 1959 (C. W. Kirkwood), April 19, 1961 (C. W. Kirkwood), three males, five females (AMNH, LAM); Douglas, October 1–7, one female (AMNH); south fork, Cave Creek, Chiricahua Mountains, May 19–20, 1966 (L. M. Martin), one female (LAM); Cave Creek, east side Chiricahua Mountains, elevation 5000 ft., April 30, 1963, October 11, 1970, August 25, 1976, April 12, 1979 (R. H. Leuschner), four females (LAM, RL); Sunny Flat C. G., Cave Creek, Chiricahua Mountains, September 6, 1969, two females (LAM); Chiricahua National Monument, September 16, 1962 (J. Wilcox), two females (LAM); Paradise, April 16–23, August, September, one male, four females (USNM); “Palmer-

ly” (Palmerlee), June, one female (USNM). I am intentionally restricting the type series to specimens from Cochise County, Arizona.

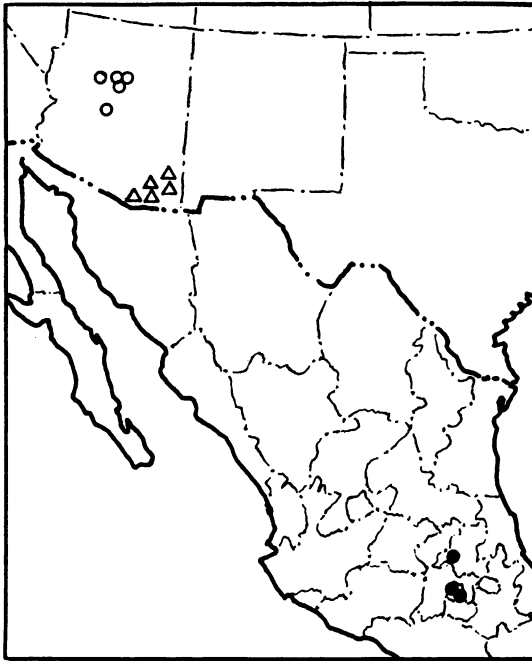
The holotype and allotype (see figs. 7, 8) are in the collection of the American Museum of Natural History; paratypes are in the collections of that institution, of the National Museum of Natural History, of the Canadian National Collection, of the Natural History Museum of Los Angeles County, and of R. H. Leuschner, as indicated above.

DISTRIBUTION: Southern Arizona (see map 2).

FLIGHT PERIOD: From March into November. The majority of specimens have been caught in the spring and fall months; this represents, at least in part, activity on the part of collectors. This species has to have two or more generations per year due to its long flight period.

REMARKS: One hundred thirty-nine specimens (92 males, 47 females) and 11 genitalic dissections (five males, six females) have been studied.

The upper surface of the wings of the males of *sternitzkyi* resemble those of *speciosa* but the hind wings tend to be darker



MAP 2. Distribution of *Nemeris percne*, new species (open circles), *N. sternitzkyi*, new species (triangles), and *N. mexicana* (Dyar; solid circles).

and to have a more prominent, more sharply angled extradiscal line. The females tend to be most dimorphic in wing coloration in the three species in which this sex is known; the median area of the forewings is noticeably paler than that of the male.

ETYMOLOGY: I take pleasure in naming this species after the late Robert F. Sternitzky, the indefatigable collector who caught most of the type series.

Nemeris mexicana (Dyar),
new combination
Figures 9, 10, 14, 18

Meris mexicana Dyar, "1911" [1910], p. 265.

DIAGNOSIS: This species, known only from the mountains of central Mexico, is best determined by a study of the male genitalia. The characters that can be used for these structures are given in the accompanying key.

MALE: Head, thorax, and abdomen similar to those of *speciosa* but tending to have more gray scaling on upper surface of thorax.

Upper Surface of Wings: Similar to that of *speciosa*, differing mainly as follows: veins narrowly and faintly yellowish brown; forewings with less buff scaling, with wings appearing slightly darker and more coarsely speckled with dark scaling; cross lines more clearly defined in some specimens, with t. p. line strongly convex in cells; small white venular dots on outer portion of t. p. line weakly represented, often in lower part of wing only; marginal line on forewings with large, prominent dots; hind wings tending to have fewer dark scales, and with extradiscal line obsolescent.

Under Surface of Wings: Similar to that of *speciosa* but tending to have more scattered dark scales, with costa of forewings pale brown with dark brown scales, and with all wings having larger discal dots and more prominent cellular dots along margins of wings.

Length of Forewing: 17 to 18 mm.

FEMALE: Unknown.

MALE GENITALIA: Uncus 1.00 to 1.10 mm. in length, base 0.60 to 0.65 mm. wide, with lateral margins rounded, not curving or pointed anteriorly; gnathos with postero-lateral bands 0.75 mm. wide; transtilla with outer sclerotized margin strongly convex medially, 0.45 to 0.50 mm. long; anellus 1.00 to 1.05 mm. in length, median cleft 0.75 to 0.80 mm. long, median pair of processes 0.47 to 0.50 mm. long, outer pair of processes 0.05 mm. long; tegumen 0.80 to 0.90 mm. long; saccus 1.35 to 1.40 mm. long; aedeagus 1.75 to 1.85 mm. in length, terminal one-third increasing in width posteriorly, with terminal sclerotized projection small, slender, attached posterolaterally.

FEMALE GENITALIA: Unknown.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Dyar described *mexicola* from two male specimens; both are in the USNM. Only one was labeled by him as the type; I hereby select this specimen as the lectotype and have so labeled it. It bears Dyar's ho-

lographic type label, is USNM 13027, and has its genitalia mounted on slide HWC 422. The specimen (see fig. 9) is in good condition although the tips of both antennae have been broken off.

TYPE LOCALITY: Mexico City, Distrito Federal, Mexico.

DISTRIBUTION: The highlands of central Mexico, in the Distrito Federal and Hidalgo (see map 2). The species apparently occurs at elevations of from about 7350 to 9000 ft. (2240 to 2750 m.).

FLIGHT PERIOD: Moths have been caught in January, March, June, and December.

REMARKS: Eight specimens (all males) and three genital dissections have been studied.

Dyar, in his original description, said that his species was similar to *alticola* but the wings were "greener and marked with distinct lines; the pectinations of the antennae are much shorter." Freshly emerged moths of the present species may be greenish; the two syntypes were taken late in 1909 and were described the following year. Unfortunately, we do not have any freshly caught specimens to study (the one with the most recent date is 1913) so nothing can be said about this. The color of the forewings of *mexicola* is indeed different from that of *alticola*, as the latter is gray. As for the pectinations of the male antennae being "much shorter," this is simply not so; in *mexicola* they are about 1.2 mm. long, whereas in *alticola* they range in length from 0.65 to 0.90 mm. After having studied the type, I think I know how Dyar came to make his statement. The pectinations are strongly curled downward and inward, and this gives the appearance, from above, of being short.

GENUS *MERIS* HULST

Meris Hulst, 1896, p. 348. Dyar, "1902" [1903], p. 322. Smith, 1903, p. 76. Grossbeck, 1908, p. 88. Barnes and McDunnough, 1917, p. 116 (in part). McDunnough, 1938, p. 171 (in part); 1940, p. 96.

DIAGNOSIS: *Meris* can be separated from *Nemeris* by the shorter pectinations in the male antennae (0.45 to 0.90 mm. long, com-

pared with 1.00 to 1.50 mm. in *Nemeris*), the pectinations arising medially on the antennal segments, the female antennae being shortly pectinate with the pectinations being 0.2 to 0.3 mm. long, the foreleg with the male apophyses arising at or beyond middle of the segment and being 1.00 to 1.45 mm. long (1.55 to 2.15 mm. in *Nemeris*), by the presence of two accessory cells in the forewings and by the genitalia. The genitalia distinguish *Meris* from the other Cingiliini found in North America. No other group has the male structures with the broad uncus having the dorsolateral margins lamellate, and the valves with the angulate costa plus the distal area of setae or thick elongate spines; the female structures with the lamella antevaginalis being semicircular, heavily sclerotized, and extending the width of the abdomen.

ADULT: Head with eyes of both sexes large, those of males slightly larger than females, round, wider than front; front flat; tongue either apparently normal or vestigial, short; palpi moderate, extending slightly beyond front, not rising to middle of eye; antennae bipectinate, with from about 52 to 59 segments, pectinations arising medially from basal segments, extending to apex in male, this sex with pectinations about three times as long as basal segments, 0.6 to 0.8 mm. long, each pectination with double row of elongate, slender setae below, becoming shorter at apex, females with shortly bipectinate antennae, longest pectination 0.2 to 0.3 mm. long, becoming shorter apically. Thorax moderately stout, without dorsal tufts but with elongate scaling dorsoposteriorly; fore tibia unarmed, with process of male 1.2 to 1.5 mm. long, arising one-half to three-fifths distance from base of segment and extending 0.2 to 0.3 mm. beyond apex of segment, of female shorter, 0.7 to 0.8 mm. in length, arising two-thirds distance from base of segment; hind tibia with two pairs of slender spurs in both sexes, longer upper spur of male 0.70 to 0.95 mm. in length, of female 0.65 to 0.80 mm., males without groove and hair pencil. Abdomen without dorsal tufts; males with ventral surface of third segment without row of setae and last segment without modification.

Forewings broad, apex angulate, outer margin rounded; 12 veins present, and with two accessory cells; R_1 uniting with Sc, R_2 separate, bisecting cell, R_3 going to costa just before apex, R_{3+4} stalked; udc short or absent; mdc and ldc of about equal length, slightly angled; Cu_1 from before lower angle; fovea absent. Hind wings broad, outer margin rounded; frenulum strong in males, vestigial in females; Sc sharply angulate at base of wings; R angled at base of wing, paralleling Sc for less than one-third length of cell; R and M_1 separating at, or just beyond, upper angle of cell; m and ldc angled; M_3 from lower angle; cell slightly longer than half length of wing; Cu_1 arising nearer angle than to Cu_2 .

Wings with elongate hairlike scales on both surfaces, more numerous on upper surface, and quite long on basal portion of upper surface of hind wings; upper surface of forewings pale to dark gray, with t. a., median, and t. p. lines usually present; hind wings grayish white, with reduced maculation. Under surface with all wings grayish white, hind wings slightly paler than forewings, all wings with obsolescent maculation. Females similar to males.

MALE GENITALIA: Shorter than those of *Nemeris*, being 2.5 to 3.2 mm. in length; uncus with wide base, length subequal to width, apex broad, rounded, curved ventrally, dorsolateral margins lamellate, with irregular margins; socius on each ventrolateral margin of uncus, in form of small swelling with several moderately long setae; gnathos with lateral margins sloping inwardly, anterior portion either membranous or heavily sclerotized, straight, broad, slightly swollen and covered with numerous spinules; valves large, symmetrical, lightly sclerotized except for outer margin, each with broad base, distal portion curved posteriorly, costa sclerotized, turned at about right angle distally, widened to include most of inner surface of valve, with or without broad band of thick, elongate spines, remainder of inner surface of valve simple; without transtilla, or with base of each costa digitate, extending inwardly to form transtilla-like process not meeting at midline; furca and cristae absent;

anellus sclerotized, with rounded or broad, flat, anterior portion extending anterodorsally and appearing slightly bulbous, with posterior portion elongate, slightly widened posteriorly, distal margin bluntly pointed or rounded; tegumen large, broad, either with prominent median suture or with very shallow, rounded posterior indentation and without median suture; saccus with sides more or less parallel, anterior margin flat or weakly bilobed; aedeagus simple, posterior end enlarged, either truncate and with five or six spines or with sclerotized bifurcate structure; vesica either unarmed or with single spinulate cornutus attached to U-shaped indentation on dorsal surface.

FEMALE GENITALIA: Papillae anales elongate, with numerous setae, posteroventrally concave medially, membranous except for sclerotized anteroventral strip; sterigma with lamella postvaginalis a raised, sclerotized, more or less triangular area having rugose surface and finely irregular posterior margin; lamella antevaginalis heavily sclerotized, extending width of abdomen, semicircular, lateral areas concave, anterior margin irregular and with lightly sclerotized outer area; ductus bursae short, membranous, inconspicuous, more or less vertical, ventral margin partially delimited by sclerotized lamella antevaginalis; ductus seminalis arising medially or slightly to right side from beneath lamella antevaginalis; corpus bursae membranous, with relatively slender posterior portion, more or less vertical, with a few longitudinal striations, slightly constricted, curving anteriorly and becoming more or less elliptical, smooth or with weakly rugose surface; signum heavily sclerotized, longer than wide, lateral and anterior margins raised, shortly stellate, median area variably denticulate. Apophyses posteriores attached anterodorsally to papillae anales, slender, 1.25 to 1.80 mm. long; apophyses anteriores reduced, 0.1 to 0.4 mm. in length.

EARLY STAGES: These have been described only partially for *alticola* (Poole, 1970). The mature larvae are marked with alternating black and white bands for their entire length, and overwinter in this stage. Additional details are given under *alticola*.

FOOD PLANT: *Penstemon* (Scrophulariaceae).

TYPE SPECIES: *Meris alticola* Hulst, by original designation and monotypy.

DISTRIBUTION: The Rocky Mountain area, from southern British Columbia and Alberta south to Arizona and New Mexico, and into Nevada.

REMARKS: Hulst described the genus based on a female only. Grossbeck (1908) properly associated the males, and made the necessary additions to the generic description. Additional notes on the generic characters were published by McDunnough (1940).

Identifications in this genus are not easy, with the exception of *paradoxa* which can be recognized by wing coloration and pattern. The remaining four species have basically the same coloration and pattern, and dissections of the genitalia should be made for identifications. An additional complicating factor is that *alticola* quite commonly collected (I have studied more than 300 specimens of it), whereas the remaining three are known only from 16 examples, and two of these from only one sex. Much more material is needed for these three species before we can obtain any sort of a picture of the variation within each.

KEY TO SPECIES

Based on Male Genitalia

1. Anellus with length equal to width; uncus with lamellae very small, trilobed, not extending within 0.6 to 0.7 mm. of apex of uncus; aedeagus with posterior end truncate, having five or six spines *paradoxa*
Anellus twice as long as wide; uncus with lamellae almost as long as uncus; aedeagus with bilobed posterior end 2
2. Anellus with each lateral margin having shoulder-like projection; gnathos with median spinose area small, slightly wider than high, 0.15 mm. high and 0.25 mm. wide *suffusaria*
Anellus with lateral margins gently rounded or straight; gnathos with median spinose area low and very wide, 0.10 to 0.20 mm. high, and 0.30 to 0.65 mm. wide 3
3. Uncus with terminal portion of dorsal surface

- with lamellae not coming within 0.20 to 0.30 mm. of apex 4
Uncus with terminal portion of dorsal surface with lamellae either tapering to apex or ending not more than 0.15 mm. from it *alticola*
4. Uncus with lamellae extending 0.10 to 0.15 mm. anterior of base of uncus; aedeagus 1.80 to 2.00 mm. long *cultrata*
Uncus with lamellae extending 0.20 to 0.25 mm. anterior of base of uncus; aedeagus 1.65 to 1.75 mm. long *patula*

Based on Female Genitalia³

1. Sterigma laterally with lightly sclerotized band on each side less than one-half as wide as heavily sclerotized, posterolateral extensions of lamella antevaginalis 2
Sterigma laterally with lightly sclerotized band on each side at least as wide as heavily sclerotized posterolateral extensions of lamella antevaginalis *patula*
2. Lamella antevaginalis with posteromedian lip terminating about middle of lateral extensions of lamella *alticola*
Lamella antevaginalis with posteromedian lip extending as elongate, pointed ridge to within 0.05 mm. of posterior margin of lamella *cultrata*

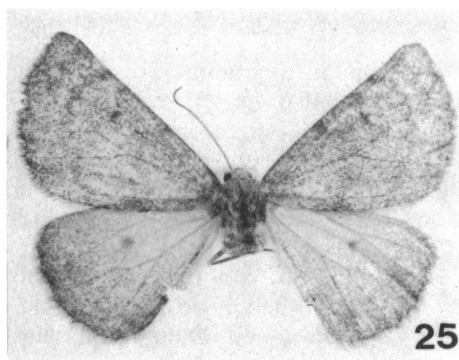
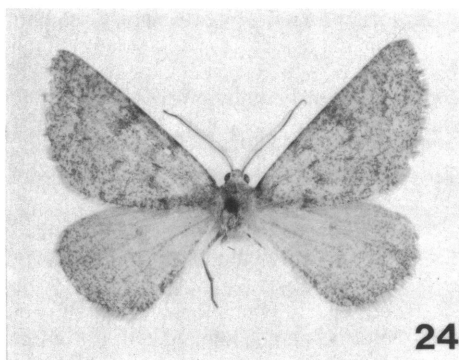
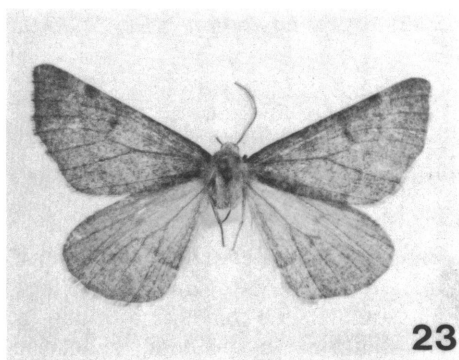
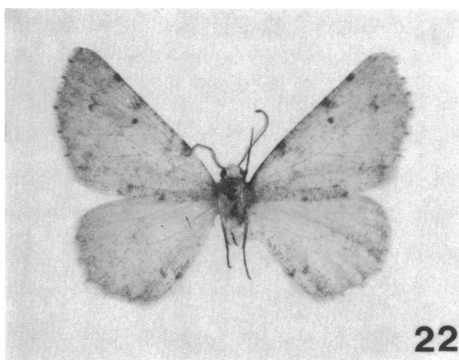
Meris paradoxa, new species

Figures 22, 32, 37

DIAGNOSIS: This is the only known species of the genus with an apparently normal tongue, and with the upper surface of the forewings pale buff with weakly represented maculation. The male genitalia differ from those of all the other species by the digitate uncus, the very small trilobed lamellae, the membranous median area of the gnathos, the lack of spines on the face of the valves, the rounded anellus, and by the posterior end of the aedeagus having five or six projecting spines.

MALE: Head with vertex white; front with dorsal portion buff, becoming brown ventrally and laterally; palpi with basal segment grayish white, terminal segments grayish brown; tongue apparently normal; antennae

³ The females of *paradoxa* and *suffusaria* are unknown.

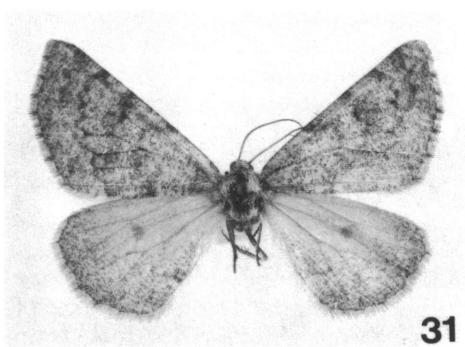
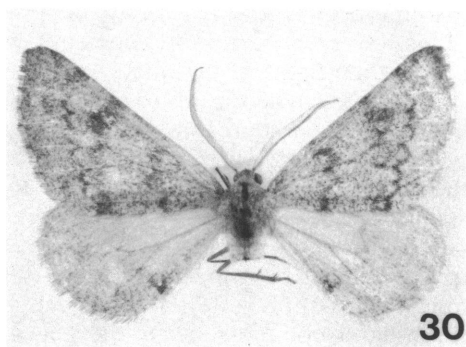
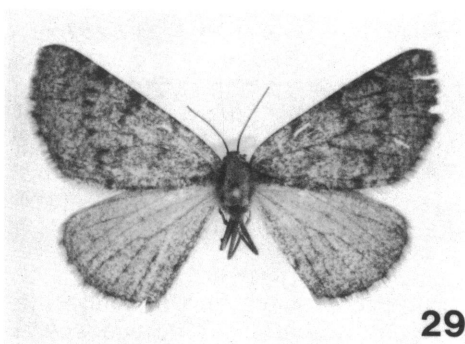
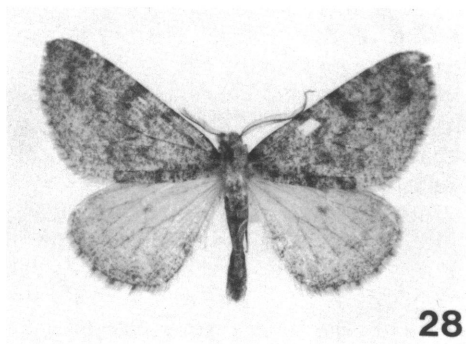
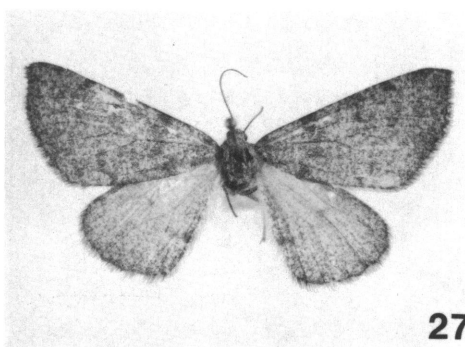
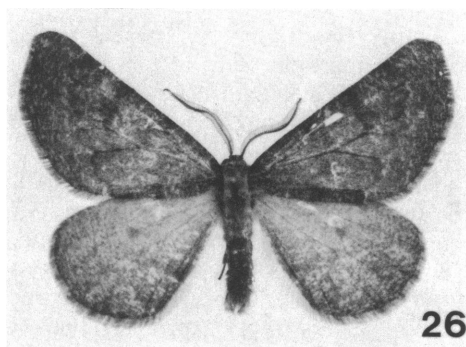


FIGS. 22–25. Adults of *Meris*. 22. *M. paradoxa*, new species, holotype, male, Madera Canyon, Arizona, August 16, 1952 (Kirkwood and Reid; LAM). 23. *M. suffusaria* McDunnough, holotype, male, Keremos, British Columbia (A. N. Gartrell; CNC). 24, 25. *M. patula*, new species. 24. Holotype, male, Richel Lodge, Montana, July 30, 1942 (G. H. and J. L. Sperry; AMNH). 25. Allotype, female, Richel Lodge, Montana, August 1, 1942 (G. H. and J. L. Sperry; AMNH). All $\times 1.56$.

of about 51 segments, with longest pectinations 0.45 mm. long. Thorax above with mixture of white, grayish white, and buff scales, tending to become darker posteriorly; below pale grayish white; legs grayish white, tending to be brown on outer surfaces. (Abdomen removed for dissection.)

Upper Surface of Wings: Forewings thinly scaled, slightly transparent, pale buff with scattered brown and grayish scaling; maculation weakly represented, cross lines grayish brown, tending to be broad, incomplete; t. a. line arising as brown or grayish brown spot on costa, extending to radial vein, line then obsolescent, with strong outward curves in cells, apparently meeting inner margin just basad of middle as small dark

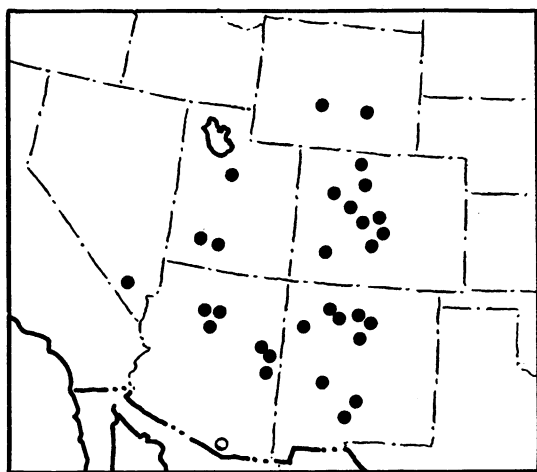
spot; median line arising on costa as brown or grayish brown spot three-fifths distance from base, extending to radial vein, then obsolescent; discal spot dark brown or blackish brown, small, distinct; t. p. line arising on costa as dark brown or grayish brown spot four-fifths distance from base, extending to vein R_4 , line then obsolescent, represented as outward bends in cells R_5 , M_1 , and Cu_2 , extending outwardly from anal vein to meet inner margin three-fourths distance from base; subterminal area slightly darkened with gray scales, without s. t. line; fringe concolorous with wing, with dark brown scales opposite vein endings. Hind wings slightly paler than forewings, with scattered brown scaling distally and along anal margin;



FIGS. 26–31. Adults of *Meris*. 26–29. *M. alticola* Hulst. 26. Male, Estes Park, Colorado, July 22, 1967 (A. Blanchard; AMNH). 27. Holotype, female, Colorado (Bruce; AMNH). 28. Male, Cedar Crest, New Mexico, August 14, 1975 (R. Holland; AMNH). 29. Female, Alpine Divide Camp, Arizona, July 16, 1965 (F., P., and M. Rindge; AMNH). 30, 31. *M. cultrata*, new species. 30. Holotype, male, North Rim, Arizona, July 18, 1957 (R. H. Leuschner; AMNH). 31. Allotype, female, North Kaibab, Arizona, June 29, 1974 (R. Wielgus; AMNH). All $\times 1.56$.

without maculation except for portion of extradiscal line near anal margin; fringe concolorous with wing, with pale brown scales opposite vein endings.

Under Surface of Wings: All wings unicolorous pale buff to grayish white, hind wings slightly paler than forewings; latter with diffuse, complete, gray t. p. line, more



MAP 3. Distribution of *Meris alticola* Hulst (solid circles) and *M. paradoxa*, new species (open circle).

or less paralleling outer margin, and with very small dark discal dot; hind wings with curved extradiscal line and minute pale discal dot; fringe concolorous with wings, narrowly darkened opposite veins on forewing, slightly darkened on hind wing.

Length of Forewing: Holotype, 18 mm.; paratype, 19 mm.

FEMALE: Unknown

MALE GENITALIA: Uncus with base 0.6 to 0.7 mm. wide, sharply narrowed above base and extending as digitate process 0.8 mm. long, with rounded apex, lateral lamellae small, trilobed, centered on ends of bases of uncus, with posterior origins 0.7 mm. from apex; gnathos with very slender lateral margins, anteromedially membranous; valves with posterior margin of costa distad of tegumen sharply curved beyond middle, terminating in pointed apex, dorsally slightly swollen and projecting anteriorly of point, without spines; transtilla absent; anellus rounded, flat or with very small indentation anteromedially; tegumen with prominent median suture; saccus with anterior margin shallowly bilobed; aedeagus with swollen anterior end, narrowed medially, enlarged posteriorly, terminally truncate and with five or

six spines arising around outer edge, entire structure (excluding spines) 2.1 to 2.2 mm. long; vesica unarmed.

FEMALE GENITALIA: Unknown.

EARLY STAGES: Unknown

FOOD PLANT: Unknown.

TYPES: Holotype, male, Madera Canyon, Santa Rita Mountains, southern Arizona, August 16, 1952 (C. W. Kirkwood and R. H. Reid). The genitalia of the holotype are mounted on slide CWK 955. Paratype: same locality as holotype, April 29, 1962 (C. W. Kirkwood), one male.

The holotype and paratype are in the collection of the Natural History Museum of Los Angeles County.

DISTRIBUTION: This species is known only from the Santa Rita Mountains, Arizona; this area includes southern Pima County and Santa Cruz County (see map 3).

FLIGHT PERIOD: April and August.

REMARKS: Two specimens (both males) and two genitalic dissections have been examined.

This is the most distinctive species in the genus, as outlined in the Diagnosis. The venation is typical for the genus except that the accessory cells of the forewings are slightly longer than those of the other species.

From the dates of capture of the two specimens it appears that at least two generations per year are present. The April specimen is the larger of the two and it appears to have slightly more dark scaling on the upper surface of the forewings. It should be noted, however, that both males are slightly worn; more and better material is needed before meaningful comparisons of the generations can be made.

ETYMOLOGY: The specific name is from the Latin *paradoxus*, strange or contrary to expectation.

Meris suffusaria McDunnough

Figures 23, 33

Meris suffusaria McDunnough, 1940, p. 96, pl. 7, fig. 7 (male genitalia).

DIAGNOSIS: This is the first of several species with a vestigial tongue, and with the forewings being gray above with both cross

lines present. The wings of *suffusaria* are more densely scaled and narrower than are those of *paradoxa*. The male genitalia of the present species are characterized by large flaring lamellae on each side of the uncus that do not come within 0.1 mm. of the apex, by an elongate anellus with each lateral margin having a shoulder-like projection, and a small, narrow and elongate median portion of the gnathos, 0.15 mm. high and 0.25 mm. wide.

MALE: Head with vertex pale buff; front grayish brown dorsally, pale buff ventrally, having semicircular line of demarcation between the two colors; palpi grayish brown; tongue vestigial; antennae with longest pectinations 0.4 mm. long (both antennae broken, so no number of segments given). Thorax above grayish brown; below grayish white; legs grayish white with outer surfaces brown. (Abdomen removed for dissection.)

Upper Surface of Wings: Forewings with outer margin angled at vein M_3 , apex pointed; grayish white, thickly and evenly covered with grayish brown scales; cross lines dark gray, rather weakly defined; t. a. line diffuse, apparently arising on costa about one-third distance from base, convex, apparently meeting inner margin two-fifths distance from base; median line absent or vaguely indicated by nebulous dark area extending to small discal dot; t. p. line arising as dark spot on costa about seven-tenths distance from base, weakly convex, with small basal indentations on veins, meeting inner margin four-fifths distance from base; subterminal area not differentiated except for faint trace of s. t. line below costa; fringe concolorous with wing, slightly darkened opposite vein endings. Hind wings slightly paler than forewings, becoming slightly darker distally and along anal margin; discal dot absent; incomplete extradiscal line straight, present in lower half of wing; fringe similar to that of forewing.

Under Surface of Wings: Similar to upper surface, with maculation more weakly represented; small discal dots present on hind wings.

Length of Forewing: 19 mm. (holotype).

FEMALE: Unknown.

MALE GENITALIA: Uncus with base 0.75 mm. wide, terminal portion of ventral surface 0.25 mm. wide and 0.12 mm. long, terminal portion of dorsal surface having lateral lamellae not coming within 0.10 mm. of apex, and with anterior end of each lamella extending only to base of uncus; each lamella with anterior portion constricted, flaring out medially, outer margin slightly irregular, extending slightly posteriad of apex of uncus, posteromedially curving anteriorly before uniting with uncus; gnathos with wide lateral margins, median spinose area only slightly wider than high, 0.15 mm. high and 0.20 mm. wide; valves with posterior margin of costa distad of tegumen shallowly biconvex, and with terminal area having numerous thick spines; transtilla-like processes with rounded apices; anellus with lateral margins having shoulder-like projection on each side; tegumen without median suture; saccus with truncate anterior margin; aedeagus with small median projection on anterior end, entire structure 1.75 mm. long, posterior end with left lobe slightly larger and longer than right lobe; vesica spined.

FEMALE GENITALIA: Unknown.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: Holotype, male, CNC 4964 (see fig. 23). The genitalia are mounted on slide Me4.

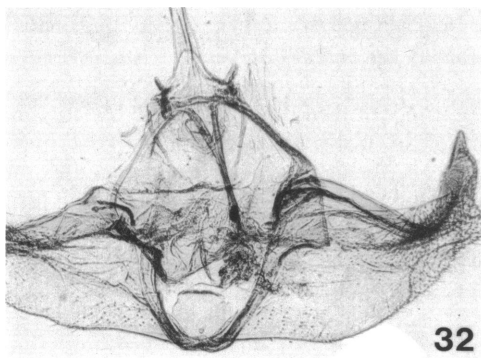
TYPE LOCALITY: Shingle Creek Road, Keremos, British Columbia.

DISTRIBUTION: This species is known only from the type locality in south central British Columbia (see map 4).

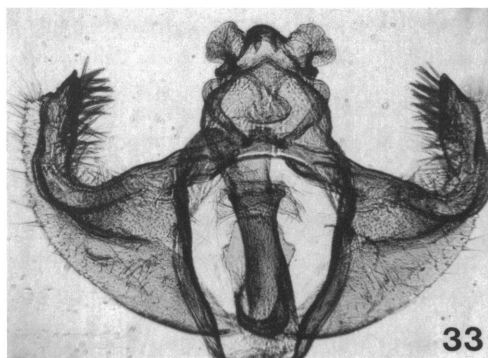
FLIGHT PERIOD: July.

REMARKS: One specimen (the holotype) and one genitalic dissection have been studied.

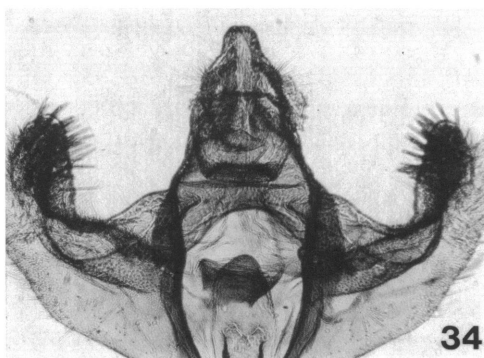
This species is similar to *paradoxa* in having short (0.40 to 0.45 mm.) pectinations on the male antennae; in all the other known species the pectinations range from 0.65 to 0.90 mm. in length. The lamellae of the uncus of *suffusaria* are somewhat intermediate in size between those of *paradoxa* and the following species, and are of a very characteristic shape. In the reduction of the tongue, the coloring of the wings, and the pattern,



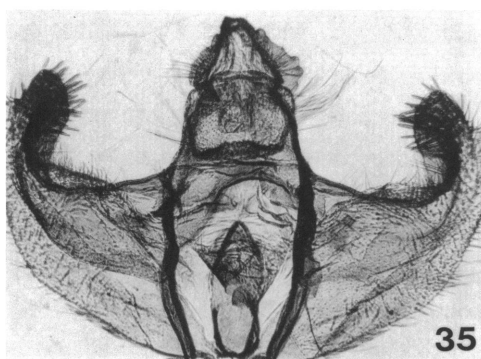
32



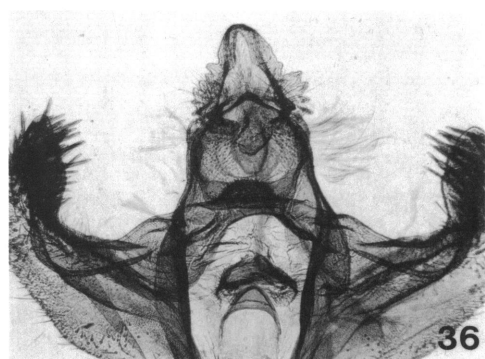
33



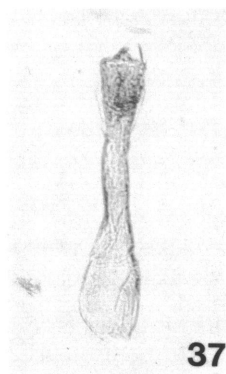
34



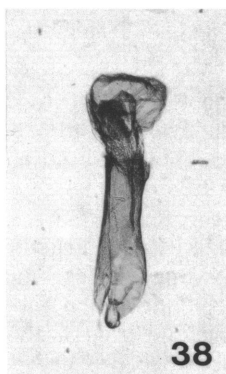
35



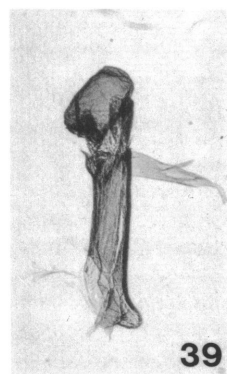
36



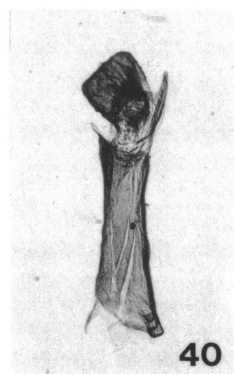
37



38



39



40

suffusaria resembles all the included species except for *paradoxa*.

***Meris patula*, new species**

Figures 24, 25, 34, 38, 41

DIAGNOSIS: The adults are similar to those of *suffusaria* but the wings are paler in color. The male genitalia have an elongate anellus with straight sides, the uncus has lamellae that extend 0.20 to 0.25 mm. anterior of the base of the uncus, and the aedeagus is 1.65 to 1.75 mm. long. The female genitalia are recognized by the broad lightly sclerotized band on each side of the heavily sclerotized posterolateral extensions of the lamella antevaginalis, and by the apophyses posteriores being 1.3 to 1.5 mm. long.

MALE: Head with vertex pale buff; front shiny pale brown to grayish brown; palpi grayish brown; tongue vestigial; antennae of about 57 segments, with longest pectinations 0.7 to 0.8 mm. long. Thorax above with mixture of shiny buff and grayish white scales; below pale grayish white; legs grayish white with some pale brown scaling, and with outer surfaces tending to be darker brown. Abdomen above with mixture of pale buff and grayish white scales; below with more pale scaling.

Upper Surface of Wings: Forewings pale grayish white, with evenly scattered light grayish brown scales; maculation similar to that of *suffusaria* but t. a. line strongly biconcave, median line varying from being absent to complete, nebulous, and including small discal dot; t. p. line more curved and more strongly indented basally on veins; fringe concolorous with wing, slightly dark-

ened opposite vein endings. Hind wings slightly paler than forewings, tending to be slightly darkened distally; discal dot small, nebulous; extradiscal line either absent or obsolescent; fringe similar to that of forewing.

Under Surface of Wings: Forewings unicolorous pale grayish white, with maculation of upper surface weakly represented. Hind wings slightly paler than forewings, with dark discal dot. Fringes of all wings similar to those of upper surface.

Length of Forewing: 19 to 21 mm.; holotype, 19 mm.

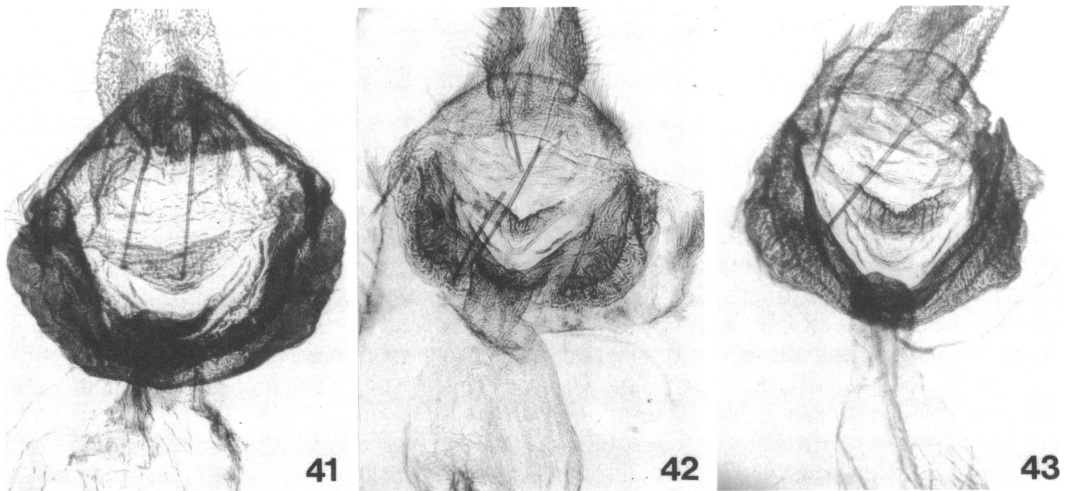
FEMALE: Similar to male; antennae of about 58 segments, with longest pectinations 0.2 to 0.3 mm. long.

Length of Forewing: 17 to 21 mm.; allotype, 21 mm.

MALE GENITALIA: Uncus with base 0.60 to 0.85 mm. wide, terminal portion of ventral surface 0.30 to 0.35 mm. wide and 0.20 to 0.25 mm. long, terminal portion of dorsal surface having lateral lamellae not coming within 0.10 to 0.25 mm. of apex, and with anterior end of each lamella extending anteriorly 0.15 to 0.30 mm. beyond base of uncus on dorsal surface; each lamella broadly semicircular, with irregular outer margin; gnathos with wide lateral margins, median spinose area much wider than high, 0.10 to 0.15 mm. high and 0.50 to 0.55 mm. wide; valves with posterior margin of costa distad of tegumen broadly convex, and with terminal area having numerous thick spines; transtilla-like processes with bluntly pointed apices; anellus elongate with lateral margins straight; tegumen without median suture; saccus with anterior margin concave or convex; aede-

←

FIGS. 32–40. Male genitalia of *Meris*. 32–36. Male genitalia. 32. *M. paradoxa*, new species, holotype, Madera Canyon, Arizona, August 16, 1952 (Kirkwood and Reid; LAM). 33. *M. suffusaria* McDunnough, holotype, Keremos, British Columbia, July 15, 1936 (A. N. Gartrell; CNC). 34. *M. patula*, new species, paratype, Richel Lodge, Montana, August 3, 1942 (G. H. and J. L. Sperry; AMNH). 35. *M. alticola* Hulst, Estes Park, Colorado, August 2, 1967 (A. Blanchard; AMNH). 36. *M. cultrata*, new species, holotype, North Rim, Arizona, July 18, 1957 (R. H. Leuschner; AMNH). 37–40. Aedeagi of same specimens. 37. *M. paradoxa*, new species. 38. *M. patula*, new species. 39. *M. alticola* Hulst. 40. *M. cultrata*, new species.



FIGS. 41–43. Female genitalia of *Meris*. 41. *M. patula*, new species, allotype, Richel Lodge, Montana, August 11, 1942 (G. H. and J. L. Sperry; AMNH). 42. *M. alticola* Hulst, Cedar Creek Camp, New Mexico, July 1, 1961 (F., P., and J. Rindge; AMNH). 43. *M. cultrata*, new species, allotype, North Kaibab, Arizona, June 29, 1974 (R. Wielgus; AMNH).

gus with small median projection on anterior end, entire structure 1.70 to 1.75 mm. long, posterior lobes of equal size and length; vesica spined.

FEMALE GENITALIA: Sterigma with lamella antevaginalis broadly U-shaped, with lateral areas slightly divergent posteriorly, slender, 0.20 to 0.25 mm. wide, thick, anteromedian margin broadly rounded, irregular, and with curved, slender ridge paralleling posteromedian lip, rounded anteriorly and terminating laterally in membranous area; lamella antevaginalis with lightly sclerotized area moderately wide anteriorly, increasing in width posteriorly, becoming wider than posterolateral areas of lamella; signum 0.3 to 0.4 mm. long, anterior margin varying from broadly rounded to pointed. Apophyses posteriores 1.25 to 1.50 mm. long; apophyses anteriores 0.3 to 0.4 mm. in length.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Richel Lodge, Montana, July 30, 1942 (G. H. and J. L. Sperry); allotype, female, same data but August 1, "1941" (should be 1942; see below). The genitalia of

the holotype are mounted on slide JLS 1858, and of the allotype on FHR 18786A, with the right antenna and right legs being on FHR 18786B. Paratypes: same data as holotype, August 9, 1941, August 2, 3, 1942, two males, one female (AMNH); 9 mi. north of Coaldale, Alberta, elevation 2700 ft., August 4, 1961 (D. F. Hardwick), one female (CNC).

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 Canadian National Collection.

I have searched through John Sperry's field notes (in AMNH) to attempt to locate Richel Lodge. Apparently this is (or was) between the Beartooth Plateau, Park County, Wyoming and Carbon County, Montana, and Red Lodge, Carbon County, Montana; no definite locality or elevation is indicated for the Sperry's visits there in 1939, 1941, and 1942 (on one page, Sperry mistakenly wrote "Richel Lodge, Wyo.>"). On the 1941 trip, August 8 through 12 were spent at Richel Lodge, hence the date on the allotype must be incorrect; on August 1 the Sperrys were in Mt. Rainier National Park, Washing-

ton. The remaining dates for the type series in both 1941 and 1942 agree with the data in the field notebook. Collecting was apparently done at lights at the lodge.

DISTRIBUTION: Southern Montana (Carbon County) and southwestern Alberta (see map 4). This species is known only from the eastern side of the Rocky Mountains.

FLIGHT PERIOD: Late July and early August.

REMARKS: Six adults (three males, three females) and four genitalic dissections (two males, two females) have been studied.

There is some variation within the specimens as to the extent and strength of the maculation on the upper surface of the forewings; this is most noticeable with the median line, which varies from being absent to complete and prominent.

ETYMOLOGY: The specific name is from the Latin *patulus*, broad or spread out, in reference to the outer band of the lamella antevaginalis.

Meris alticola Hulst

Figures 26–29, 35, 39, 42

Meris alticola Hulst, 1896, p. 348. Dyar, "1902" [1903], p. 322. Smith, 1903, p. 76. Grossbeck, 1908, p. 88. Barnes and McDunnough, 1917, p. 116. McDunnough, 1938, p. 171. Rindge, 1955, p. 136.

DIAGNOSIS: The upper surface of the wings is darker gray than that of the preceding species. The male genitalia are characterized by an elongate anellus having straight or slightly rounded lateral margins, and by the lamella of the uncus either extending to the apex or coming within 0.15 mm. of it. The female genitalia have a narrow lightly sclerotized band laterally on each side of the heavily sclerotized posterolateral extension of the lamella postvaginalis, and by the lamella antevaginalis having the posteromedian lip terminating about the middle of the lateral extension of the lamella.

MALE: Head with vertex having mixture of dark gray and grayish white scales; front dark gray with a few grayish white scales; palpi gray to dark gray, basal segment slightly paler in some specimens; tongue vestigial;

antennae with from 53 to 59 segments, with longest pectinations 0.65 to 0.90 mm. long. Thorax above dark gray, many or most scales having white tips; below grayish white; legs dark gray or brownish gray. Abdomen above and below with even mixture of gray and grayish white scales; maculation similar to that of *patula*; discal mark a minute spot, solid dot, or small circle; t. p. line slightly straighter than in *patula*.

Upper Surface of Wings: Forewings densely scaled, pale gray or gray, with thick and even dark gray or brownish gray scaling; maculation varying from weakly defined to clearly represented, cross lines dark gray. Hind wings paler than forewings, grayish white, becoming slightly darker distally; small dark discal spot present; incomplete extradiscal line represented near anal margin; terminal line weakly represented; fringe similar to that of forewing.

Under Surface of Wings: Forewings unicolorous gray, with small dark discal dot and weakly represented t. p. line; fringe as on upper surface. Hind wings grayish white to pale gray, with small dark discal dot; extradiscal line absent in most specimens; terminal line absent; fringe as above.

Length of Forewing: 17 to 22 mm.

FEMALE: Similar to male; antennae with from 51 to 56 segments, with longest pectinations 0.25 mm. long.

Length of Forewing: 16 to 20 mm.

MALE GENITALIA: Uncus with base 0.60 mm. wide, terminal portion of ventral surface 0.15 to 0.20 mm. wide and 0.20 to 0.30 mm. long, terminal portion of dorsal surface with lateral lamellae extending to apex, and with anterior end of each lamella sharply curving mediad 0.10 to 0.12 mm. anterior of base of uncus on dorsal surface; each lamella broadest anteriorly, narrowing posteriorly, and having undulating outer margin; gnathos with wide lateral margins, spinose median area low and wide, 0.10 mm. high and from 0.25 to 0.60 mm. wide; valves with posterior margin of costa distad of tegumen straight or weakly convex, and with terminal area having numerous thick spines; transtilla-like processes with rounded apices; anellus elongate, with lateral margins straight or slightly

rounded; tegumen without median suture; saccus with truncate anterior margin; aedeagus with rounded anterior end, entire structure 1.45 to 1.75 mm. long (average, 1.57 mm.), posterior lobes of equal size and length; vesica spined.

FEMALE GENITALIA: Sterigma with lamella antevaginalis tending to be broadly U-shaped, lateral areas more or less flat and wide, 0.3 mm. wide, anteromedian margin variably irregular, posterolaterally flat and bluntly pointed or rounded, and with posteromedian lip terminating about middle of lateral extensions of lamella; lamella antevaginalis with narrow, lightly sclerotized area anterior and laterally, being less than half as wide as heavily sclerotized, posterolateral extensions of lamella; signum 0.2 to 0.4 mm. long, variable in shape. Apophyses posteriores 1.4 to 1.8 mm. long; apophyses anteriores 0.2 to 0.4 mm. in length.

EARLY STAGES: These have been described in part by Poole (1970) from rearings near Flagstaff, Arizona. The eggs (not described) are laid in midsummer, after the summer rains cause considerable growth of the food plant. The young larvae feed on the flowers and to a lesser degree, the leaves. The last instar larvae (described and illustrated by Poole, *op. cit.*, figs. 1, 3, 5, 7, 9, 10) overwinter and resume feeding in the spring. At this time of year the food plants are only small rosettes of leaves, and the caterpillars wander around grazing on the rosettes; Poole (*op. cit.*) believes this behavior pattern to be unknown in any other species of geometrid larva. About two weeks are spent in the pupal stage. The larvae of *alticola* are very similar in appearance to those of *Neoterpes graefiaria* (Hulst); both species feed on different kinds of *Penstemon*. *Neoterpes* is placed in the Cingiliini.

FOOD PLANT: *Penstemon virgatus* A. Gray (Scrophulariaceae).

TYPE: Hulst apparently described this species from a single female. The holotype (see fig. 27) is in the collection of the American Museum of Natural History (Rindge, 1955, p. 136); its genitalia are mounted on slide HWC 7.

TYPE LOCALITY: Colorado, having been collected by Bruce.

DISTRIBUTION: From central Wyoming, through Colorado, south to northern and eastern Arizona, New Mexico, Utah and western Nevada (see map 3). Elevations on pin labels indicate a range from 6500 to 10,000 ft.

FLIGHT PERIOD: From late June into August.

REMARKS: Three hundred two specimens (238 males, 64 females) and 24 genitalic dissections (12 males, 12 females) have been studied.

There appears to be more variation within *alticola* than in any other species in the genus. This may be an artifact, however, as this is the only one represented in large numbers and is the only species with a wide distribution. Its widespread occurrence may reflect a greater number of habitats and a much wider range of elevations; these, in turn, could account for at least some of the variability of *alticola*. In general, specimens from Colorado, Wyoming, eastern Arizona (the White Mountains) and western Nevada tend to be larger and to have relatively pale forewings with obvious maculation. Material from most of New Mexico and from southern Coconino County, Arizona are smaller and often have the upper surface darker, whereas the moths from Utah tend to be intermediate between the two extremes. I have been unable to find any consistent genitalic differences in all the material being placed as *alticola*. As a result I am treating this widespread and variable group of specimens as a single species.

***Meris cultrata*, new species**

Figures 30, 31, 36, 40, 43

DIAGNOSIS: As the adults of this species are superficially indistinguishable from those of *alticola*, the genitalia should be used for identification. The structures of the present species can be separated from those of *alticola* by the uncus of the male having the terminal portion of the dorsal surface with the lamellae not coming within 0.2 to 0.3 mm. of the apex, and by the female having the lamella antevaginalis with the posteromedian lip extending as an elongate, pointed ridge

extending to within 0.05 mm. of the posterior margin of the lamella.

MALE: Head with vertex, front and palpi slightly paler than those of *alticola*; antennae of about 55 segments, with longest pectinations about 0.7 mm. long; tongue vestigial. Thorax above paler than those of *alticola*, below similar. Abdomen similar to those of *alticola*.

Upper Surface of Wings: Forewings pale gray, more or less evenly covered with brownish gray scales; cross lines and discal spot clearly represented, similar to those of *alticola*. Hind wings slightly paler than those of *alticola*, with similar maculation but without terminal line.

Under Surface of Wings: Similar to that of *alticola* but paler.

Length of Forewing: 20 to 22 mm.; holotype, 22 mm.

FEMALE: Similar to male; antennae with about 57 segments, with longest pectinations 0.2 mm. long.

Length of Forewing: 18 to 21 mm.; allotype, 20 mm.

MALE GENITALIA: Uncus with base 0.70 mm. wide, terminal portion of ventral surface 0.30 mm. wide and 0.30 mm. long, terminal portion of dorsal surface with lateral lamellae extending to apex, and with anterior end of each lamella sharply angled mediad just anterior of base of uncus on dorsal surface; each lamella broadest anteriorly, narrowing posteriorly, and having broadly serrate outer margin; gnathos with wide lateral margins, swollen median spinose area 0.15 mm. high and 0.30 mm. wide; valves with posterior margin of costa distad of tegumen broadly convex, and with terminal area having numerous thick spines; transtilla-like process with bluntly pointed apices; anellus elongate, with lateral margins straight; tegumen without median suture; saccus with anterior margin weakly convex; aedeagus with small median projection on anterior end, entire structure 2.00 mm. long, posterior lobes of equal size and length; vesica spined.

FEMALE GENITALIA: Sterigma with lamella antevaginalis having anterolateral margins increasing in width posteriorly, lateral areas slender, 0.25 mm. wide, thick, anteromedian margin varying from having small median in-

dentation to variably irregular, posterolaterally thick, having sharply pointed ventral or posteroventral ridge, and with posteromedian lip extending as elongate sharply pointed ridge to within 0.05 mm. of posterior margin of lamella; lamella antevaginalis with narrow, lightly sclerotized area anteriad and laterally, being about half as wide as heavily sclerotized, posterolateral extensions of lamella; signum 0.3 to 0.4 mm. long, anterior margin broadly curved. Apophyses posteriores 1.55 to 1.70 mm. long; apophyses anteriores 0.1 mm. in length.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, North Rim, Grand Canyon, Coconino County, Arizona, elevation 8200 ft., July 18, 1957 (R. H. Leuschner); allotype, female, North Kaibab, North Rim, Grand Canyon National Park, Arizona, elevation 8153 ft., June 29, 1974 (R. Wielgus). The genitalia of the holotype are mounted on slide FHR 18787, and those of the allotype on FHR 18804. Paratypes, all from Coconino County, Arizona; same data as holotype, one male (RL); North Rim, July 1949 (N. Crickmer), one male (AMNH); North Rim, elevation 8000–9100 ft., June 28, 1934 (E. L. Bell), one female (AMNH); North Rim, July 24, 1938 (L. Schellbach), one male (USNM); 7 mi. east of Jacob Lake, elevation 6800 ft., July 23, 1965 (F., P., and M. Rindge), three females (AMNH).

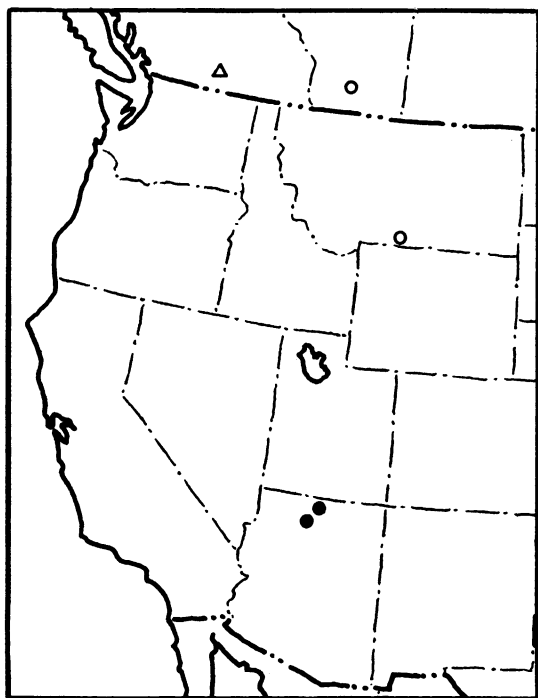
The holotype and allotype are in the collection of the American Museum of Natural History; paratypes are in the collection of that institution, the National Museum of Natural History and of R. H. Leuschner, as indicated above.

DISTRIBUTION: Northern Arizona, north of the Grand Canyon in Coconino County (see map 4).

FLIGHT PERIOD: Late June and July.

REMARKS: Nine adults (four males, five females) and five genitalic dissections (three males, two females) have been studied.

Most of the specimens of *cultrata* are not in the best of condition, as they are worn and rubbed; as a result it is difficult to make adequate comparisons of the wing color and maculation with the much commoner *alticola*. More material of the present species is



MAP 4. Distribution of *Meris suffusaria* McDunnough (triangle), *M. patula*, new species (open circles), and *M. cultrata*, new species (solid circles).

needed to ascertain the amount of individual variability within *cultrata*.

The known distribution of this species and of *alticola* is basically the same as is found in *Somatolophia vatia* and *pallascens* (Rindge, 1980), with *cultrata* and *vatia* being only known from a relatively small area north of the Grand Canyon, Arizona.

ETYMOLOGY: The specific name is from the Latin *cultratus*, knife-shaped, in reference to the posterior rim and lip of the lamella antevaginalis.

LITERATURE CITED

- Barnes, William, and J. H. McDunnough
1917. Check list of the Lepidoptera of boreal America. Decatur, Illinois, the Herald Press, vii + 392 pp.
- Cassino, Samuel E.
1927. Some new Geometrids. *The Lepidopterist*, vol. 4, pp. 84–88.
- Dyar, Harrison G.
“1902” [1903]. A list of North American Lepidoptera and key to the literature of this order of insects. *Bull. U.S. Natl. Mus.*, no. 52, xix + 723 pp.
1904. A few notes on the Hulst collection. *Proc. Ent. Soc. Washington*, vol. 6, pp. 222–229.
- “1911” [1910]. Descriptions of some new species and genera of Lepidoptera from Mexico. *Proc. U.S. Natl. Mus.*, vol. 38, pp. 229–273.
- Grossbeck, John A.
1908. Additions to the list of North American Geometridae, with notes on some described species. *Proc. Ent. Soc. Washington*, vol. 10, pp. 85–91.
- Hulst, G. D.
1896. A classification of Geometrina of North America with descriptions of new genera and species. *Trans. Amer. Ent. Soc.*, vol. 23, p. 245–386, pls. 10, 11.
- McDunnough, J. H.
1938. Check list of the Lepidoptera of Canada and the United States of America. *Mem. Southern California Acad. Sci.*, vol. 1, pp. 1–275.
1940. New North American Geometridae with notes, III. *Canadian Ent.*, vol. 72, pp. 90–103, pl. 7.
- Poole, Robert W.
1970. Convergent evolution in the larvae of two *Penstemon*-feeding geometrids (Lepidoptera: Geometridae). *Jour. Kansas Ent. Soc.*, vol. 43, pp. 292–297, figs. 1–11.
- Rindge, Frederick H.
1955. The type material in the J. B. Smith and G. D. Hulst collections of Lepidoptera in the American Museum of Natural History. *Bull. Amer. Mus. Nat. Hist.*, vol. 106, pp. 91–172.
1980. A revision of the moth genus *Somatolophia* (Lepidoptera, Geometridae). *Ibid.*, vol. 165, pp. 291–334, figs. 1–59, maps 1–3, table 1.
- Smith, John B.
1903. Check list of the Lepidoptera of boreal America. Philadelphia, American Ent. Soc., v + 136 pp.

