

A REVISION OF THE GENUS *TORNOS* MORRISON (LEPI- DOPTERA, GEOMETRIDAE)

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INTRODUCTION

THE SPECIES COMPRISING the genus *Tornos* form a distinct and compact group within the Ennominae. While the adults of both sexes are easily distinguished by their elongate wings, somber colors, and by having a prominent raised tuft of scales in place of the usual discal dot on the upper surface of the forewings, the problem of properly applying specific names is a very difficult one, in the light of our present knowledge. This is due to the general uniformity of most of the species in size, color, and maculation. Not until a careful study of the genitalia is made do the specific entities within the genus become at all clear. It is the purpose of this paper to try to reevaluate this group of moths, to try to answer some of the questions pertaining to its phylogeny, distribution, and taxonomy, and to propose a more satisfactory systematic arrangement of the species.

A number of facts are obvious from the results of this study. Much more collecting is needed before any clear picture can be obtained of the distribution on a specific or sub-specific level, the extent of intraspecific variability, and the full extent of the flight periods of the adults. While a modest beginning has been made along some of these lines for the several species that occur within the United States, much more information is still needed. At the present time it is virtually impossible to hazard even a guess as to the above-mentioned points on the species that occur from Mexico to South America, as such a small amount of material is available. There is also particular need for life history work, as the early stages of only one species in the genus have been recorded in the literature.

Several species have been described in the genus *Tornos* or its predecessor, *Lepiodes*, from tropical America; however, in the light of our present knowledge, most of these belong in other genera. Mr. D. S. Fletcher has kindly checked the types in the British Museum (Natural History) and has informed the author of the placement of the following species: *Lepiodes chrodna* Druce (1898, *Biologia Centrali-Americana*, Insecta, Lepidoptera-Heterocera, vol. 2, p. 148) and *L. (?)*

perieria Druce (*tom. cit.*, p. 148) belong in *Eupithecia* Curtis; *Lepiodes (?) maxima* Druce (*tom. cit.*, p. 542) belongs in *Euphyia* Hübner; *Lepiodes unicolor* Druce (*tom. cit.*, p. 542) shows certain relationships with *Holochroa* Hulst; *Lepiodes exilis* Warren (1900, *Novitates Zool.*, vol. 7, p. 197) goes into the Cleorini.

The following abbreviations have been used in the captions:

A.M.N.H., the American Museum of Natural History, New York

B.M.N.H., British Museum (Natural History), London

U.S.N.M., United States National Museum, Washington, D. C.

MATERIALS AND METHODS

MATERIALS STUDIED: This revision is based on a study of the specimens in some of the major eastern and western museums, the collection of the British Museum (Natural History), and the private collections of several individuals; these are referred to specifically under the section on acknowledgments. All the type specimens in this country have been studied by the author. None of the types in the British Museum (Natural History) has been personally examined, but through the generous cooperation of Mr. D. S. Fletcher, the genitalia of those types have been studied and compared.

Eight hundred and forty-five specimens have been studied in the preparation of this paper. The great majority of these are from the United States, and, of these, the greater number were of one species. A large number of genitalic slides were prepared by the author, and a considerable number, prepared by Mr. Hahn W. Capps, were examined from the collection of the United States National Museum. Included among these slides were the genitalia of all the types.

DESCRIPTIONS: A binocular dissecting microscope was used throughout when the descriptions of the adults and genitalia were written. The same basic pattern of descriptions was followed throughout this paper for all specific descriptions. All species are char-

acterized by a detailed description of the adult male, with comparative notes on the female, and full descriptions of the genitalia of both sexes are given, when both sexes are known.

GENITALIC FIGURES: Drawings of the genitalia were prepared by the author. In all cases, the genitalia of each sex were drawn to the same scale and received a uniform reduction; however, the genitalic organs of the two sexes were not drawn to the same scale. Some caution must be taken in the use of these figures, as in several instances insufficient material was available to make dissections in series. Consequently, it was not always possible to ascertain the limits of individual variability within the species, and, further, it was not possible to check and recheck some of the finer structural details. When more material becomes available, it may be necessary to amend either the genitalic descriptions or the drawings, or both.

ACKNOWLEDGMENTS

The author wishes to acknowledge with thanks the cooperation and aid of the following men who have allowed him to study the types and specimens in their charge: Mr. H. W. Capps of the United States National Museum; Dr. J. G. Franclemont, formerly of that institution; Dr. E. S. Ross of the California Academy of Sciences; Mr. L. M. Martin of the Los Angeles County Museum; Dr. E. G. Munroe of the Division of Entomology, Department of Agriculture, Ottawa; Dr. P. J. Darlington, Jr., of the Museum of Comparative Zoölogy, Harvard College; Mr. H. K. Clench of the Carnegie Museum; Dr. J. B. Schmitt of Rutgers University; Dr. W. T. M. Forbes of the Department of Entomology, Cornell University; and Dr. A. N. Tissot of the Department of Entomology, University of Florida. A special word of thanks is given to Mr. D. S. Fletcher of the British Museum (Natural History) for his hearty cooperation in lending material, making dissections of the various types in that institution, and comparing material with these types. Thanks also go to Mr. John L. Sperry of Riverside, California; Mr. Otto Buchholz of Roselle Park, New Jersey; Mr. Charles P. Kimball of Sarasota, Florida; and

Mr. Alex K. Wyatt of Chicago, Illinois, for the privilege of studying specimens from their private collections.

HISTORICAL BACKGROUND

Things have been complicated in this genus from the very beginning, as Guenée included one African and one American species in his genus *Lepiodes*. It was not until 1896 that Hulst finally straightened matters out, as he recognized that these two species were not congeneric. By designating the African species as the type of *Lepiodes*, he thereby removed this name from our fauna, and in its place the name *Tornos* Morrison became available.

Walker, in part 24 of his "List of the lepidopterous insects in the collection of the British Museum," followed Guenée exactly, giving the same two species. In the 1891 "List of the Lepidoptera of boreal America" by J. B. Smith, a rather varied list of species is included under *Lepiodes* from several different genera in both the Ennominae and Larentiinae; however, the genus was placed in what is known today as the Ennominae. On the other hand, Druce, in the section on moths of the "Biologia Centrali-Americana," placed *Lepiodes* in the Larentiinae immediately after *Eupithecia* Curtis; perhaps this is why only one of the species described in this genus by Druce has been retained in *Tornos*.

Packard followed Morrison's usage of *Tornos* in his "A monograph of the geometrid moths . . . of the United States," where the genus is redescribed and a figure of the venation is given. Packard's treatment was followed by C. F. von Gumpenberg in his "Systema geometrarum zonae temperationis septentrionalis" in 1896. In the same year Hulst restricted the usage of the generic terms, and *Tornos* has been in use ever since.

The only revisionary work that has been done in this genus has been on the North American species. The first article was a short paper by Pearsall in 1908 entitled "The species of *Tornos* Morr.," where a brief review and a listing of the species are given. At that time, only *scolopacinarius* and *cinctarius* were recognized as belonging in this genus. When the genus was revised by Grossbeck in 1912 in his "Review of the species comprising

the *Glaucina-Coenocharis* group," the number of species was increased to four, as two species from the western United States were included, and a key to the adults was given, together with a figure of the male genitalia of the type species.

Since the appearance of this revision, the only additions to the United States fauna have been five names by Cassino and Swett between 1922 and 1925, based on material from the southern and western portions of this country.

The tropical fauna is very imperfectly known. Druce described a few species from Central America, only one of which is retained in the genus in this paper. Dyar named two species, one from Mexico and one from Panama, while Warren described a single one from northern South America.

PHYLOGENY

When the genitalic structures are carefully studied, good diagnostic characters to separate the species can be seen in both sexes. The present study indicates that the female genitalia can be separated into six definite groups, and that these are paralleled, to a less obvious degree, by corresponding group differences in the male genitalia and maculation of the adults. Accordingly, the genus has been divided into six species groups, based primarily on the female genitalia; these are characterized in the body of the text. These six groups show a beautiful picture of the development and evolution of the female genitalia within this genus. A similar picture emerges from the study of the male genitalia, although this tends to be a bit obscured by the complexity of these organs, as the evolutionary processes have affected a number of different structures in different ways.

The evolutionary changes that have occurred on the specific level may be briefly summarized as follows. In the female genitalia, the change has been from the primitive condition, in which there is a very long, thin, sclerotized ductus bursae with a large number of striations, through progressive stages of reduction and fusion with the bursa copulatrix, until only a very short sclerotized collar remains. The bursa copulatrix, in the primitive state, is very distinctly separated

from the ductus bursae, but the line of demarcation is soon lost, as these two structures become fused, the posterior portion of the fused bursa retaining some of the sclerotization and striations of the primitive ductus bursae. As a result of this process, the shape of the bursa changes from globular to oval to elongate. A corresponding alteration in the signum also takes place, as it changes from a large sclerotized patch to a stellate form and, by further reduction, is completely lost.

The evolutionary changes in the male genitalia are numerous. The uncus in the primitive condition terminates in a single point, with a tendency to become bifurcate in the more highly developed species. The valvula undergoes a considerable change, from having two rather short and widely separated arms, to an elongation and superimposition of them, with their ultimate fusing, and then a migration to the lower part of the valve where they become quite large and slightly asymmetrical. The spinose apical process of the valvula shows a gradual reduction in both size and number of the spines, finally becoming fused with the united arms when they move to the sacculus. The dorsal U-shaped process of the aedeagus is rather poorly developed in most groups, but in the most highly evolved forms it becomes enlarged and forms a very prominent part of the aedeagus. The vesica of the aedeagus shows the trend of reduction in the number and size of the spines.

The changes in the adults are various. The males in the primitive condition have their hind tibia with a prominent hair pencil and the venter of the third abdominal segment with a row of bristles. The more highly evolved forms lose both these modifications, and some intermediate species have a deciduous row of bristles. The wings of both sexes are very similar in pattern and coloration in the primitive forms, while the tendency is for the females to lose part of the pattern and to have their wings broadly suffused with ochraceous scaling. In the most highly developed species, this sexual dimorphism in coloration of the females is very marked. To complicate this picture further, two of the species in the most highly evolved group have males in which the color of the wings begins to ap-

proach that of the normally strongly dimorphic female in part of the range of the species.

The distributional pattern of these groups can be only rather sketchily given, owing to lack of material. The present day center of distribution seems to be Central America (Costa Rica and Guatemala both having four species) and Mexico (seven species). It would appear that the most primitive group is mainly South American, as two of the three species in this group occur there, while the two most highly developed groups, consisting of a total

of four species, are apparently restricted to the United States. Of the remaining three groups, comprised of 10 species, one species is South American, one species occurs in Arizona but is known from Mexico by a single specimen, and the remaining eight species are from Central America and Mexico. Two of these eight species are known to occur in the southernmost part of Texas, but as this area is faunistically more closely related to Mexico than to the remainder of the United States, these two species are considered as part of the Central American fauna.

SYSTEMATIC DESCRIPTIONS

GENUS *TORNOS* MORRISON

Lepiodes GUENÉE, 1857, Histoire naturelle des insectes, vol. 10, p. 359 (partim). WALKER, 1862, List of the specimens of lepidopterous insects in the . . . British Museum, pt. 24, p. 1250. J. B. SMITH, 1891, List of the Lepidoptera of boreal America, p. 71. DRUCE, 1893, Biologia Centrali-Americana, Insecta, Lepidoptera-Heterocera, vol. 2, pp. 148, 542. HULST, 1896, Trans. Amer. Ent. Soc., vol. 23, p. 351 (restriction of genus).

Tornos MORRISON, 1875, Proc. Boston Soc. Nat. Hist., vol. 17, p. 217. PACKARD, 1876, A monograph of the geometrid moths . . . of the United States, p. 214. HULST, 1896, Trans. Amer. Ent. Soc., vol. 23, p. 351. GUMPENBERG, 1896, Nova Acta Deutschen Akad. Naturf., Halle, vol. 65, p. 310. DYAR, "1902" [1903], Bull. U. S. Natl. Mus., no. 52, p. 323. PEARSALL, 1908, Canadian Ent., vol. 40, p. 133. GROSSBECK, 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 401. BARNES AND McDUNNOUGH, 1917, Check list, p. 116. McDUNNOUGH, 1938, Check list, pt. 1, p. 161. FORBES, 1948, Cornell Univ. Agr. Exp. Sta. Mem. 274, p. 51, fig. 14 (venation).

Head, front flat or slightly swollen, rough scaled; eyes large, round, wider than front; antennae of male pectinate, with apex simple, the pectinations arising in terminal portion of segments, of female simple, with a single pair of setae at end of each segment; tongue present; labial palpi strongly developed, heavily scaled, rising to middle of eyes, middle segment extending beyond front, terminal segment small, slightly longer than high. Thorax without tufts; fore tibia with moderate process; hind tibia not dilated, with two pairs of spurs, with or without hair pencil in males. Abdomen without crests; ventral surface of third segment with or without row of bristles in males, and eighth segment without plate. Forewings elongate, apex somewhat produced, 11 veins, usually a single areole delimited by a weak cross vein; R_{1+2} from top of cell, with a cross vein to R_{3+4} , R_3 to R_5 stalked, from upper angle, R_5 from stalk before R_3 ; M_1 from upper angle, M_2 from upper portion of dc; Cu_2 from well before outer angle; fovea absent. Hind wings elongate, apex produced, frenulum strong in both sexes; Sc approximate to R near base for one-half of length of cell; R and M_1 from just before or at

upper angle; M_3 from angle, approximate with Cu_1 at base; Cu_2 from well before outer angle. Forewings and hind wings concolorous brown or grayish brown, rarely secondaries lighter in color, with relatively obscure maculation (the females of some species tending to be more ochraceous than the males); primaries above with t. a., t. p., and subterminal lines usually rather weakly indicated, discal dot in both sexes with a prominent scale tuft; secondaries with discal dot and extradiscal line represented. Beneath similar to upper surfaces or paler, with obsolescent maculation.

MALE GENITALIA: Uncus simple, long, tapering to apex from broad base, the apex with a single point or bifurcate; socius not differentiated; gnathos strongly developed, heavily sclerotized, produced medioventrally into a prominent, somewhat spatulate enlargement; valves large, symmetrical, costal region produced apically and narrowed, the valves being widest medially, with sclerotized strip across base next to saccus connecting costa and sacculus, costa sclerotized almost to apex of valve, valvula either undifferentiated or with elongate single or anterior and posterior sclerotized arms terminating in a spinose apical process, sacculus either undifferentiated or sclerotized and covered with numerous spines; transtilla absent; cristae present; juxta elongate, lightly sclerotized; furca absent; tegumen with many long, narrow setae arising on dorsal surface near uncus and extending beyond apex of uncus; saccus projecting short distance beyond base of valves, broadly rounded, longer than length of uncus; aedeagus elongate, subequal to, or longer than, combined length of tegumen and saccus, tapering to apex, with or without median U-shaped sclerotized process dorsally; vesica unarmed or with one or more elongate sclerotized spines.

FEMALE GENITALIA: Ostium with dorsal, lateral, and ventro-anterior sclerotized plates, these sometimes reduced or absent; operculum absent; ductus bursae sclerotized, variable in length, ranging from shorter than length of ovipositor lobes to longer than combined lengths of lobes and apophyses, some-

times apparently fused with adjacent portion of bursa copulatrix so that there is no definite separation between the two; ductus seminalis arising ventrally or on right side from ductus bursae or posterior part of bursa copulatrix; bursa copulatrix often not clearly differentiated from ductus bursae, membranous or lightly sclerotized, the sclerotized areas often with longitudinal striations, with or without variously shaped signum. Segment VIII with dorsal surface more heavily sclerotized than ventral surface.

EARLY STAGES: The type species has been reared and the larval instars have been described by Barnes and McDunnough. This fact, plus the figures in Packard for the same species and the brief notes by Forbes, constitutes our knowledge of the early stages in the genus. The larval notes below are based on these sources. In the material of the United States National Museum there is a single female of nominate *scolopacinaris* Guenée that has a cast pupal shell; this serves as the basis for the pupal description.

EGGS: Undescribed.

LARVA: Body cylindrical, thoracic segments rather swollen; abdominal segment III with tubercle 1 in form of a bifid conical wart, and segments II, IV, and VIII with conical tubercles.

PUPA: Head, antennae equal in length to other appendages and wing cases; labrum prominent, with small, well-defined, triangular, caudolateral projections; labial palpi extremely small, as long as only one antennal segment; maxillae equal in length to wing cases. Thorax, mesothoracic wings extending to posterior portion of fourth abdominal segment; metathoracic wings narrowly exposed to anterior portion of fourth abdominal segment; prothoracic legs approximately three-fourths of length of maxillae, coxae not exposed; mesothoracic legs equal in length to maxillae and antennae; metathoracic legs not exposed. Abdomen, spiracles with weak furrow and with elevated rims; surface of segments with many pits; dorsal and lateral furrows of segments IX and X absent; cremaster of two heavy lateral spines.

TYPE SPECIES: *Lepiodes scolopacinaris* Guenée (Hulst, 1896).

DISTRIBUTION: The moths of this genus

are widely distributed in the New World. They are distributed through the eastern half of the United States as far north as southern New York and Wisconsin, into the southern portion of Arizona and California, south through Mexico, into Central America and South America, going as far south as Bolivia and Paraguay.

The problem of making identifications in this genus is a most difficult one, unless the genitalia are used. The present study has been greatly handicapped by a dearth of material, not only from parts of the United States, but more especially from Mexico and Central and South America. The majority of the tropical specimens studied were old, somewhat worn, and perhaps faded. Much new material, in long study series, will be needed before the problem of identifying the various species by maculation alone can be satisfactorily handled. There appears to be another factor involved here also, namely, that the adults apparently lose a part of their brightness and pattern after they have been on the wing a short time. This may account for some of the relatively large differences that occur on the wings of the adults within a given species.

It appears very likely, based on the limited material available, that the problem of subspeciation will be present in several of the species occurring south of the United States. The problem of subspeciation within the United States is a rather involved one, and even with the amount of material that is available the final answer to this is certainly not given in this paper. The difficulties are very much magnified in the tropical regions, owing to the extreme scarcity of specimens available for study.

It might be mentioned in passing that the distributional picture of many of the tropical species is unfortunately complicated by lack of adequate locality data on the specimens. While all the species studied had data, some were so indefinite that they were of very little use. It is earnestly hoped that future collectors will be more specific and give their data in greater detail.

No attempt has been made to make a key to all the adults in this genus, as it is practically an impossibility at this time. However,

one has been made for the species occurring in the United States. It should be kept in mind that this is, at best, a rather generalized breakdown and should not be relied on too completely. Once again it is stressed that any identification work should be based primarily on the genitalia.

KEY TO MALE GENITALIA¹

1. Valves with valvula in form of elongate sclerotized arm or arms, sacculus not differentiated. 2
- Valves with valvula undifferentiated, and with sacculus as a prominent sclerotized structure covered with numerous spines 12
- 2(1). Apex of uncus bifurcate 3
- Apex of uncus ending in a single point. 5
- 3(2). Aedeagus slightly widened basally, of even width medially or with slight taper to pointed anterior end. 4
- Aedeagus narrowest basally, increasing in width anteriorly to broadly truncate anterior end *brutus*
- 4(3). Valves with valvula very broad basally, tapering and curving posteriorly, with spinose apical process approximately five times longer than broad, the spines being located terminally *spinosus*
- Valves with valvula of uniform width, straight, with spinose apical process round, the spines being located on inner surface *pusillus*
- 5(2). Aedeagus with unarmed vesica *mistus*
- Aedeagus with one or more spines in vesica 6
- 6(5). Aedeagus with one elongate spine in vesica *erectarius*
- Aedeagus with two or more spines in vesica 7
- 7(6). Aedeagus with seven to 10 short heavy spines of various lengths, these ranging in length from shorter than, to one and one-half times, the length of the uncus 8
- Aedeagus with several long narrow spines, these ranging in length from two to three and one-half times the length of the uncus 9
- 8(7). Valves sharply indented above apex of valvula, this terminal portion of valves being of equal width; aedeagus tapering distally, spines of vesica not ar-

- ranged in a row *benjamini*
- Valves tapering apically, without a sharp indentation; aedeagus widened near distal end, seven of the 10 spines of vesica in a row with their bases on the left side *umbrosarius*
- 9(7). Valvula with anterior arm roughly S-shaped, with spinose apical process extending anterolateral to junction of arms of valvula. *capitaneus*
- Valvula with anterior arm straight or curving with outer margin of sacculus, with spinose apical process extending posterior to junction of arms of valvula. 10
- 10(9). Aedeagus very long and narrow, one and one-fourth times as long as combined lengths of uncus, tegumen, and saccus, constricted two-thirds from base; juxta with posterolateral margins spiculate *hoffmanni*
- Aedeagus elongate, subequal in length to combined lengths of uncus, tegumen, and saccus, without constriction distally; juxta with posterolateral margins non-spiculate. 11
- 11(10). Aedeagus one-sixth longer than combined lengths of uncus, tegumen, and saccus; valvula with posterior arm arising at anterior angle of costa. *quadripunctus*
- Aedeagus subequal to, or slightly longer than, combined lengths of uncus, tegumen, and saccus; valvula with posterior arm arising from inner surface of costa *punctatus*
- 12(1). Aedeagus with unarmed vesica *scolopacinaris*
- Aedeagus with one or more spines in vesica 13
- 13(12). Aedeagus with three spines, these being slightly longer than length of uncus *abjectarius*
- Aedeagus with one large and one small spine, the former being much broadened at base and about twice as long as length of uncus *cinclarius*

KEY TO FEMALE GENITALIA

1. Bursa copulatrix with well-defined signum or large sclerotized area 2
- Bursa copulatrix without any signum 15
- 2(1). Ductus bursae well defined and elongate, subequal to, or longer than, apophyses of ovipositor lobes, with many fine longitudinal striations, and with area of junction with bursa copulatrix well de-

¹ The males of *apiatus*, *pennubrosus*, and *phoxus* are unknown.

- fined 3
 — Ductus bursae very short, being subequal to length of ovipositor lobes at most, usually not distinctly separated from bursa copulatrix 9
 3(2). Ductus bursae as long as combined lengths of ovipositor lobes and their apophyses, and very slender, the ratio of width to length ranging from 1/13 to 1/18 4
 — Ductus bursae slightly shorter than length of apophyses of ovipositor lobes, broader, the ratio of width to length ranging from 1/4 to 1/6 6
 4(3). Ductus seminalis located medially on ductus bursae *capitaneus*
 — Ductus seminalis located near ostium 5
 5(4). Signum of bursa copulatrix an elongate band, much wider than high *apiatus*
 — Signum of bursa copulatrix as wide as high, roughly circular in outline *quadripunctus*
 6(3). Ostial plate not extending posteriad of posterior margins of lateral plates 7
 — Ostial plate extending posteriorly as far as, or farther than, posterior margins of lateral plates 8
 7(6). Posterior margin of lateral plate truncate, extending straight across venter almost as far as lateral margins of ostial plate *hoffmanni*
 — Posterior margin of lateral plate curving anteriorly to lateral margins of ostial plate, the outer portion of the former thus extending farther posteriad than the central portion *punctatus*
 8(6). Posterior margin of ostial plate rounded and becoming widest medially *penebrosus*
 — Posterior margin of ostial plate with sides flattened and forming an obtuse angle, this being the widest part of the plate *phoxus*
 9(2). Bursa copulatrix with broadly sclerotized area 10
 — Bursa copulatrix with stellate signum 12
 10(9). Bursa copulatrix with convoluted, raised, membranous fold posteriad of sclerotized area, and extending from ventral surface around the left side to the dorsal surface *umbrosarius*
 — Bursa copulatrix without raised fold 11
 11(10). Sclerotized area extending down side of bursa copulatrix but not reaching anterior margin *benjamini*
 — Sclerotized area of bursa copulatrix located at anterior end, and not extending up the side *brutus*
 12(9). Bursa copulatrix with signum very small, being shorter than width of ovipositor lobe *scolopacinaris*
 — Signum prominent 13
 13(12). Ostial plate sclerotized and fairly well defined; lateral plates with posterior margin tending to be truncate *pusillus*
 — Ostial plate membranous or very poorly defined; lateral plates with posterior margin not truncate 14
 14(13). Ostial region large and subtriangular in shape; lateral plates weakly sclerotized *mistus*
 — Ostial region not subtriangular; lateral plates well sclerotized *spinosis*
 15(1). Ductus bursae well defined, well sclerotized, and much longer than bursa copulatrix *erectarius*
 — Ductus bursae poorly defined, apparently combined with posterior portion of bursa copulatrix, without distinct area of demarcation 16
 16(15). Bursa copulatrix short and broad, roughly pear shaped *abjectarius*
 — Bursa copulatrix long and slender 17
 17(16). Ostium with two transverse, heavily sclerotized, vertical plates *scolopacinaris*
 — Ostium with one sclerotized plate that is chiefly horizontal in position *cinctarius*

KEY TO THE ADULTS FOUND IN THE UNITED STATES

1. The sexes more or less dimorphic in coloration, the males being darker in color than the females, the latter usually more suffused with ochraceous than the males 2
 — The sexes alike in coloration *cinctarius*
- 2(1). The forewings above with the cross lines indistinctly represented, the t. p. line being represented by a series of dark dots on the veins when present; males without a tibial hair pencil and without a bristle tuft on the ventral surface of the third abdominal segment . . . 3
 — The forewings above with at least the t. p. line distinct and complete; males with both a tibial hair pencil and bristle tuft on the third abdominal segment . . . 9
- 3(2). The two sexes strongly dimorphic in coloration

- ration, the males varying from dark gray to light gray, and the females being creamy or white.4
- The sexes moderately dimorphic in coloration, the males varying from gray or ochraceous to whitish gray, and the females being ochraceous or creamy.5
- 4(3). Males with wings above gray or gray-brown, with maculation obsolescent; females with ground color creamy or white, with maculation better defined than in male; extradiscal line of upper surface of secondaries in both sexes more or less weakly defined, weakly toothed on veins; eastern United States. *scolopacinaris scolopacinaris*
- Males with wings above gray or gray-brown, overlain with ochraceous and dark brown scales, with cross lines usually indicated, the t. p. line of primaries and extradiscal line of secondaries being emphasized by an external light gray band; females with ground color creamy or white, with maculation distinct; extradiscal line of upper surface of secondaries in both sexes well defined, strongly toothed on the veins and concave between; southern Florida *scolopacinaris forsythae*
- 5(3). Males with upper surface of wings creamy or whitish gray, overlain with ochraceous and dark brown scales; females whiter than males; both sexes with obsolete maculation but with complete, well-defined, whitish gray, subterminal line on primaries above; central Florida *scolopacinaris spodiis*
- Males with upper surface of wings ochraceous or gray-brown, with scattered dark and reddish brown scales; females tending to be more ochraceous or cream colored than males; both sexes with subterminal line absent or represented by a series of light gray dots6
- 6(5). Males with upper surface of wings a unicolorous ochraceous or light gray-brown, with scattered dark brown scales, and with terminal area only slightly darkened; females as in males, but lighter in color; Texas *abjectarius abjectarius*
- Males with upper surface of wing dark ochraceous or dark gray-brown, more or less heavily overlain with dark scales, and with terminal area contrastingly colored, gray-black to black; females more ochraceous or cream colored, with maculation somewhat stronger.7
- 7(6). Males with upper surface of wings creamy or ochraceous, more or less heavily overlain with pale reddish brown scales, with maculation obsolescent, and with terminal area of primaries dull blackish, contrasting rather sharply with remainder of wing; females slightly more cream colored, and with maculation better defined; central Florida *abjectarius rarus*
- Males with upper surface of wings dark ochraceous, more or less heavily overlain with reddish brown, dark gray and black-brown scales, with at least the t. p. line represented, and with terminal area of primaries gray-black or black-brown; females lighter in color, with maculation well defined.8
- 8(7). Males with upper surface of wings dark ochraceous, overlain with reddish brown, dark gray, and black-brown scales, becoming gray-black near outer margin, with median area of forewings concolorous with remainder of wing or only very slightly suffused with darker scales; females slightly more ochraceous; southeastern United States *abjectarius calcasianus*
- Males with upper surface of wings dark ochraceous, heavily overlain with reddish brown, dark gray, and black-brown scales, becoming blackish near outer margin, contrasting, with median area of forewings shaded with dark scales, appearing darker than adjacent areas; females slightly more ochraceous; southern Florida *abjectarius kimballi*
- 9(2). Wings above dark brown, more or less broadly suffused with ochraceous, especially basad of t. a. line and distad of t. p. line above vein Cu_2 ; t. p. line on upper surface of primaries arising from costa at less than a right angle, angled below cell and going straight to inner margin *benjamini*
- Wings above light gray, more or less heavily dusted with dark brown scales and lightly suffused with ochraceous; t. p. line on upper surface of primaries arising from costa at an obtuse angle, swinging broadly around end of cell, then angled sharply basad.10

- 10(9). Forewings above without broad ochraceous suffusion; t. p. line above tending to be more or less sharply concave below cell, with outward projection on anal vein, meeting inner margin in outer half of wing. *punctatus*
- Forewings above with broad ochraceous suffusion, especially distad of t. p. line; t. p. line above angled basad very sharply below cell, meeting inner margin in basal half of wing 11
- 11(10). Males with upper surface of wings gray or ochraceous, heavily overlain with brown or black-brown scales; females more suffused with ochraceous scales and with fewer brown and black-brown scales; southern Arizona *erectarius erectarius*
- Males with upper surface of wings light gray or light ochraceous, with scattered dark brown scales; females more suffused with ochraceous scales and with fewer brown scales; southern California *erectarius fieldi*

GROUP I

In this species group the female genitalia have the ductus bursae very long and slender, being subequal in length to the combined lengths of the ovipositor lobes and their apophyses. The surface has many striations, and the line of demarcation between the ductus bursae and the bursa copulatrix is very distinct. The bursa is membranous and has a large signum.

The male genitalia have the uncus with a single point, and the valvula with both the anterior and posterior arms well separated and rather short, terminating in a relatively large, spinose, apical process with many spines. The juxta is widened medially and has a slight median thickening. The aedeagus tapers apically from near the base, and it has a broad, U-shaped, dorsal process with its arms coming together apically. The vesica is apparently armed with three elongate spines arising from a basal corneous area, the spines being approximately one-half of the length of the aedeagus.

The wings of both sexes are similar in pattern and color, although the females tend to be very slightly more ochraceous than the males above. The males have the row of bristles on the ventral surface of the third abdominal segment and, presumably, have a hair pencil on the hind tibia. This latter character will have to be checked when more material becomes available, as none of the males under study has any legs at all.

Of the three species placed in this group, two occur in South America and one in Central America.

Tornos capitaneus, new species

Figures 5, 19

MALE: Head, vertex and front gray-brown; palpi gray-brown, with scattered dark brown scales. Thorax grayish brown or ochraceous above, lighter in color below. Abdomen gray-brown above and below; ventral surface of third segment with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown, lightly sprinkled with darker scales; costa with slightly darker bands and spots, these being most prevalent in basal half of wing; basal line absent; t. a. line faintly suggested by a few dark brown scales; median cross line very faintly suggested below discal tuft; discal tuft of dark gray-brown scales; t. p. line weakly indicated by small groups of brown-black scales that are located chiefly on the veins, being strongest in anterior portion of wing, arising on costa two-thirds of distance from base, swinging with a broad curve around the end of the cell, then being slightly concave but subparalleling outer margin, swinging slightly outward to meet anal vein; subterminal and terminal areas slightly darker than basal portion of wing; subterminal line represented by a series of small, light gray, intravenular dots, these becoming obsolescent in lower portion of wing; a series of small, brown-black, intravenular, marginal spots; fringe concolorous with wing in basal half, slightly paler in distal half. Hind wings concolorous with forewings, except anterior portion which is not so heavily shaded with

brown scales, posterior portion of wing with scattered dark brown scales, these coalescing in some places to indicate the cross lines; basal line present; intradiscal line weakly indicated on anal margin; discal dot dark brown or grayish brown; extradiscal line extending at an angle across most of the wing to meet t. p. line of primaries, tending to become obsolescent anteriorly; a group of dark brown scales in cells M_1 and M_2 just outside of extradiscal line, the latter being narrowly shaded externally by light gray; subterminal line absent; terminal portion of wing slightly darkened, with the suggestion of an incomplete terminal line; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray, heavily overlain with brown and black-brown scales; cross lines absent except for t. p. line; discal dot large, diffuse, brown-black; terminal line broad, gray-brown, interrupted by veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot prominent, brown-black; extradiscal line incompletely indicated; terminal line and fringe as on primaries.

EXPANSE: 24 mm. (holotype).

FEMALE: Similar to male, but with the upper surface of wings tending to be slightly more suffused with ochraceous scales, and with the maculation tending to be a bit more weakly represented. Under surface of wings almost without maculation, the discal dots and terminal lines on both wings being faintly indicated.

EXPANSE: 29 to 30 mm.; allotype, 29 mm.

MALE GENITALIA: Uncus elongate, sharply tapering from broad base to just beyond middle, then the sides extending almost parallel to the rounded apex with a single point; arms of gnathos only slightly thickened dorsally, uniting to form median oblong process, with its sides slightly more heavily sclerotized than the central area and with the posterior surface rugose; valves elongate, with terminal portion narrowed; costa sclerotized, tending to be slightly wider distally than at base, with numerous setae along inner portion of sclerotized band; valvula with anterior arm somewhat S-shaped, terminating in laterally situated spinose apical process, with narrower posterior arm slightly curving, with inwardly

projecting sclerotized projection distally, and the arm extending posteriad of both anterior arm and spinose apical process, the latter somewhat elliptical in outline, with its spines on the outer surface curving posteriorly; sacculus undifferentiated, lightly sclerotized; juxta weakly sclerotized, with a short median thickening near base, widened medially, slightly enlarged apically; aedeagus slightly longer than combined lengths of uncus, tegumen, and saccus, in width slightly narrower than base of uncus, anterior end slightly extended on right side, rounded, with slight constriction just anterior thereto, then slightly tapering, the apex bluntly pointed, with a weakly sclerotized, U-shaped process on dorsal surface, the arms in approximation apically; vesica apparently with three elongate spines arising from basal corneous area, the spines being about one-half of the length of the aedeagus.

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, roughly ovate in outline, being slightly wider than long, the surface with several transverse ridges; lateral plates rather weakly sclerotized, elongate, extending anteromedially; ventral plate widest medially, tapering laterally; ductus bursae well sclerotized, extremely long and narrow, equal in length to combined lengths of ovipositor lobes and their apophyses, the region between ostium and origin of ductus seminalis without ornamentation, the surface from ductus seminalis to bursa copulatrix with numerous striations; ductus seminalis arising ventrally from near the middle of the ductus bursae; bursa copulatrix membranous, roughly ovate in shape, subequal in length to length of ductus bursae, the surface with numerous wavy indentations; the signum a large subtriangular sclerotized area located in middle of bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, San Sebastian, Retalhuleu, Guatemala (L. Thiel), and allotype, female, Guatemala City, Guatemala, October (Schaus and J. Barnes); both in the United States National Museum. Paratypes, two females: Volcan Santa Maria, Guatemala, June (Schaus and J. Barnes); Cuernavaca, Mexico, August, 1906; both in the

United States National Museum.

RANGE: Guatemala and Mexico. On the wing in June, August, and October.

REMARKS: This is the largest species of group I. It can be distinguished from *quadripunctus* by the fact that the t. p. line is more prominent in the upper portion of the wing and tends to become obsolescent in the lower part. In addition, this species is characterized by a strong terminal line below. The single female from Mexico is more ochraceous than are the females from Guatemala, and the maculation is more strongly represented; much more material is needed before the status of this variability can be properly assessed.

The male genitalia can be distinguished from those of *quadripunctus* by the position of the spinose apical process. In this species, this process is located anterolateral to the junction of the arms of the valvula, with the spines being situated on the outer portion thereof, while in *quadripunctus* the process is located at the posterior margin of the junction of the valvula arms, with the spines being situated on the posterior portion. The female genitalia can be separated from those of other known species in this group by the position of the ductus seminalis, which is located medially on the ductus bursae; in the other species, the ductus seminalis is situated near the ostium.

Tornos apiatus, new species

Figure 20

MALE: Unknown.

FEMALE: Head, vertex and front ochraceous; palpi with mixed gray, ochraceous, and brown scales. Thorax ochraceous above, suffused with light gray below. Abdomen ochraceous.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray, overlain with ochraceous and brown scales, the latter tending to be arranged as striations in basal portion of wing; costa with slightly darker bands and spots; basal, t. a., and median lines absent; discal tuft of gray scales, becoming dark brown distally; t. p. line weakly indicated by small groups of dark brown scales on the veins, arising on costa two-thirds of distance from base, swinging out-

ward around cell, turning posteriorly and becoming obsolete in lower portion of wing; subterminal and terminal areas slightly darker than basal portion of wing; subterminal line represented by a series of small, light gray, intravenular dots, these becoming obsolescent in lower portion of wing but reappearing above inner angle; a series of dark brown, intravenular, marginal spots; fringe concolorous with wing, tending to have a few gray scales opposite marginal spots. Hind wings concolorous with forewings, the outer half being rather heavily shaded with brown scales; basal and intradiscal lines absent; discal dot weakly indicated; extradiscal line weakly indicated, extending across wing to meet t. p. line of primaries, narrowly bordered with ground color externally; the dark brown scales interrupted in cells M_1 and M_2 to show ground color outside of extradiscal line; subterminal line weakly indicated by a few light gray spots and by a white patch at anal angle; terminal line dark brown, being represented by a series of expanded intravenular dots that tend to coalesce; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray, heavily overlain with ochraceous and brown scales; cross lines absent; discal dot weakly represented; terminal line dark brown, narrow, interrupted by veins; fringe as above. Hind wings concolorous with forewings; discal dot large, diffuse; cross lines absent; terminal line and fringe as on primaries.

EXPANSE: 28 mm. (holotype).

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, in outline being slightly more than twice as long as wide, the surface with several longitudinal ridges and the posterior end with the ridges roughly paralleling the outer margin; lateral plates rather weakly sclerotized, large, subtriangular, the surface rugose; ventral plate widest laterally, tapering medially, scarcely reaching midventral line; ductus bursae well sclerotized, extremely long and narrow, equal in length to combined lengths of ovipositor lobes and their apophyses, the surface with numerous, very fine striations; ductus seminalis arising on right side below ostium; bursa copulatrix membranous, elongate, with central area en-

larged on both sides, longer than ductus bursae, the surface, especially in central area, with numerous wavy indentations; the signum a very wide and relatively narrow sclerotized band, the right side tapering to a point, extending the full width of the ventral surface at posterior one-third of the bursa, and with the anterior one-half of the signum covered with a fold of the bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: Holotype, female, Paraguay (Pouillon); in the collection of the United States National Museum.

RANGE: Known only from the unique type specimen.

REMARKS: This species, as far as can be told from the unique type, can be distinguished from both *capitaneus* and *quadripunctus* by the striated appearance of the upper surface of the wings, and by the fact that the terminal and subterminal areas are darker than the basal portion of the wing. The genitalia of the female type are similar to those in *quadripunctus*, but can be distinguished by the longer ductus bursae and larger bursa copulatrix, and by the fact that the signum extends the full width of the bursa, being much wider than high.

Tornos quadripunctus (W. Warren)

Figures 6, 21

Exelis quadripuncta W. WARREN, 1897, Novitates Zool., vol. 4, p. 467.

Tornos quadripunctata (sic!), DYAR, 1910, Proc. U. S. Natl. Mus., vol. 38, p. 264 (err. det.); 1914, *ibid.*, vol. 47, p. 243.

MALE: Head, vertex and front dark gray-brown; palpi dark gray-brown, with black-brown scales and with a few light gray scales basally and apically. Thorax ochraceous above, shaded with light gray below. Abdomen ochraceous; ventral surface of third segment with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown, lightly sprinkled with darker scales; costa with slightly darker bands and spots; basal line absent; t. a. line suggested by a few brown-black scales on veins, leaving costa at an oblique outward angle, turning sharply on

radial vein and going to inner margin; median cross line absent; discal tuft of dark gray-brown scales, sometimes becoming brown distally; t. p. line usually complete, black-brown, arising on costa two-thirds of distance from base, swinging outward around cell, then turning and subparalleling outer margin, becoming reduced or partially obsolescent in lower portion of wing, then reappearing on anal vein; subterminal and terminal areas slightly darker than basal portion of wing; subterminal line represented by a series of small, light gray, intravenular dots, these becoming obsolescent in lower portion of wing but reappearing above inner angle; marginal spots small, black-brown, intravenular; fringe concolorous with wing. Hind wings concolorous with forewings, except anterior portion which is not so heavily shaded with brown scales; area along anal margin with scattered dark brown scales; basal and intradiscal lines absent; discal dot black or black-brown; extradiscal line brown-black, extending across wing, subparallel with outer margin, tending to be concave between the veins; a patch of ground color in cells M_1 and M_2 outside of extradiscal line; subterminal line absent; terminal line dark brown, becoming interrupted anteriorly; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray, heavily overlain with brown and black-brown scales; cross lines absent except for t. p. line, which is represented by groups of darker scales on anterior half of wing; discal dot large, diffuse, brown-black; terminal line gray-brown, interrupted at veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot prominent, brown-black; all cross lines absent; terminal line and fringe as on primaries.

EXPANSE: 22 to 24 mm.

FEMALE: Similar to male, but the upper surface of the wings tends to be slightly more suffused with ochraceous scales; apparently the light gray subterminal line more strongly represented on both wings. Under surface of wings almost without maculation, the discal dots and terminal lines on both wings being faintly indicated.

EXPANSE: 23 mm.

MALE GENITALIA: Uncus elongate, with

broad base and with a marked constriction beyond middle, the apex with a single point; arms of gnathos widest dorsally, constricted medially, uniting to form median oblong process, with its sides slightly more heavily sclerotized than the central area and with the posterior surface rugose; valves elongate, with posterior portion narrowed, well rounded apically; costa sclerotized, tending to be slightly wider distally than at base, with numerous setae along inner half of sclerotized band; valvula with anterior arm curving slightly posteriorly, widest medially, with constriction near distal end, then enlarged once again, with the subtriangular-shaped enlargement extending towards outer margin of valve to just beyond outer margin of spinose process, with narrower posterior arm arising from anterior angle of costa, slightly thickened or prominently enlarged medially, the swollen portion extending ventroposteriorly, with a constriction near distal end, before uniting with anterior arm, the spinose apical process arising at this junction and extending posteriorly, being somewhat elliptical in outline and concave medially, with its numerous heavy spines on the outer surface pointing posteriorly and towards uncus; sacculus undifferentiated, weakly sclerotized; juxta weakly sclerotized, widened basally, with median constriction and a central median thickening, slightly enlarged posteriorly, tapering to broadly rounded apex; aedeagus one-sixth longer than combined lengths of uncus, tegumen, and saccus, in width slightly narrower than base of uncus, anterior end extended on right side, rounded, with slight constriction just anterior thereto, then enlarged, the remainder being narrowed and of a uniform width medially, the apex bluntly pointed, with a weakly sclerotized, U-shaped process on dorsal surface, with a wide base and each arm tending to be bifurcate apically, the apexes in approximation to each other; vesica apparently armed with three elongate spines arising from basal corneous area, the spines occupying slightly more than one-half of the length of the aedeagus.

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, in outline being less than twice as long as wide, the anterior end tapering rather sharply, the surface with a

few incomplete transverse ridges in posterior half, the anterior half smooth; lateral plates very weakly sclerotized and hardly distinguishable; ventral plate widest laterally, tapering medially, scarcely reaching midventral line; ductus bursae well sclerotized, extremely long and narrow, slightly shorter than combined lengths of ovipositor lobes and their apophyses, the surface with numerous, very fine striations; ductus seminalis arising on right side below ostium; bursa copulatrix membranous, apparently elongate, the surface with numerous wavy indentations; the signum a large, more or less circular, sclerotized area, with the anterior portion covered with a fold of the bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In British Museum (Natural History).

TYPE LOCALITY: According to the original description, the type locality was Castro, Parana, Brazil; however, the type specimen is labeled Cucuta, Venezuela, which is more likely to be the true locality. The author was unable to locate a Cucuta in Venezuela. The only town of this name that was found in the general area is in Colombia near the Venezuela border.

RANGE: Venezuela and Colombia.

SPECIMENS EXAMINED: *Colombia:* Tumba, February, 1909 (Fassl), two males. *Venezuela:* Patao, Guiria, August, 1891, one female.

REMARKS: Three specimens examined. Mr. Fletcher of the British Museum kindly dissected the genitalia of the male type and sent a photograph of this structure to the author. The photograph of the type genitalia is matched fairly well by the author's dissection of a specimen from Tumba, Colombia; however, another genitalic mount from the same locality, made by Mr. Capps of the United States National Museum, shows several differences. These are found in the shape of both the anterior and posterior arms of the valvula. The latter dissection has the anterior arms narrower, and the protruding tooth-like structure along the posterior margin is smaller; the posterior arm has a rather prominent median swelling that extends ventroposteriorly, with a more prominent constriction be-

low the spinose apical process. The specimen illustrated was drawn from the author's preparation.

Under this name, Dyar (1910, p. 264) included specimens from three Mexican localities. Unfortunately, none of these specimens is referable to this species, as *quadripunctus* is known only from northern South America. It is impossible to say which species Dyar had before him, as specimens are known from the three localities cited by Dyar under four different species. Later, Dyar (1914, p. 243) indicates that this species is equal to *punctatus* Druce, but this is also incorrect.

This species can be separated from the other species of group I by the fact that the

t. p. line of the upper surface of the forewings is relatively well represented, and by its course, which is almost straight after swinging around the cell. This species is apparently the smallest in this section of the genus.

The male genitalia can be distinguished from *capitaneus* by the position of the spinose apical process, which is located at the posterior margin of the junction of the valvula arms in this species, while in the former species the process is located laterally. The female genitalia are similar to those of *apiatus*, but differ by the shorter ductus bursae and the smaller bursa copulatrix, and by the signum, which is more or less circular rather than very wide and narrow as in *apiatus*.

GROUP II

This group is characterized by the fact that the ductus bursae of the female genitalia is shorter and wider than in group I, but still is well defined, being two-thirds or three-fourths as long as the apophyses of the ovipositor lobes. The posterior end has a well-defined collar, set off on each side by a narrow membranous area, and the remainder of the surface has many striations. The line of demarcation between the ductus bursae and the bursa copulatrix is still distinct, but the ductus bursae is flared out to make it less sharply defined than in group I. The bursa copulatrix is membranous and has a large ovate signum, the anterior portion of which is covered by a fold of the bursa; the striations of the ductus bursae tend to be continued down the ventral surface of the bursa copulatrix to the signum.

The uncus of the male genitalia terminates in a single point, and the valvula has both the anterior and posterior arms well separated, although they may be nearer to each other than in group I. They terminate in a smaller, spinose, apical process than is found in the previous group, and the individual spines tend to be smaller. In the juxta, the widened area tends to be posterior to the center, but the median thickening is still present. The aedeagus may be of equal width throughout, with just the apical portion tapered, or it may be tapered from near the base, as in

group I. The U-shaped dorsal process is rather well defined. The vesica is armed with from two to five slender, elongate spines that are clearly defined individually, arising from a basal corneous area, the spines being approximately one-half of the length of the aedeagus.

The wings of both sexes are similar in pattern and color, although the females tend to have the maculation a bit more weakly represented, and they are more suffused with ochraceous above. In two of the species the ochraceous becomes quite prominent and contrasts with the black-brown outer portion of the wing; the males of these are unknown. The known males have both the hair pencil on the hind tibia and the row of bristles on the third abdominal segment.

All four species in this group occur in Central America and Mexico, with two of the species just crossing the United States line into the lower Rio Grande Valley of Texas.

Tornos penumbrosus Dyar

Figure 22

Tornos penumbrosa DYAR, 1914, Proc. U. S. Natl. Mus., vol. 47, p. 243.

MALE: Unknown.

FEMALE: Head, vertex ochraceous or gray-brown, becoming darker brown between an-

tenal bases; front dark gray-brown; palpi with mixed gray and gray-brown scales. Thorax ochraceous above, with scattered brown scales; ventral surface lighter gray; legs light gray, with numerous brown scales, especially on forelegs. Abdomen gray-brown, with faint median stripe, darker on the sides; slightly paler below.

UPPER SURFACE OF WINGS: Forewings, ground color gray-brown, broadly suffused with ochraceous and more or less heavily overlain with gray-brown and dark brown scales as far as t. p. line, exterior thereto heavily shaded with black-brown except at apex of wing; t. a. line absent, although sometimes very faintly suggested by a few scales; median cross line absent, rarely suggested by a faint diffuse shade below discal tuft; discal tuft of gray-black scales; t. p. line indicated by groups of black-brown scales that are located chiefly on the veins, these venular spots usually connected in anterior portion of wing, arising on costa approximately two-thirds of distance from base, swinging outward around cell and then subparalleling outer margin to inner margin; outer portion of wing black-brown except at apex, with a rather indistinct shading going to discal tuft, and tending to expand basad of t. p. line below cubital vein; the median and cubital veins tending to be ochraceous distad of t. p. line; subterminal line represented by a series of small, light gray, intravenular dots, these becoming obsolescent in lower portion of wing; a series of black-brown, intravenular marginal spots; fringe concolorous with wing in basal half, slightly paler in distal half. Hind wings concolorous with forewings, without ochraceous suffusion; intradiscal and extradiscal lines absent or faintly suggested; discal dot black-brown; the dark brown scales interrupted in cells M_1 and M_2 to show two spots of ground color in outer part of wing, and again above anal angle; terminal line incompletely represented; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown, heavily overlain with brown scales, especially along basal half of costa and outer portion of wing, and with pale ochraceous scales along distal half of costa; cross lines absent; discal

dot diffuse, dark brown; terminal line black-brown, narrowly interrupted by veins, which tend to become ochraceous at ends; fringe as above. Hind wings concolorous with forewings; cross lines absent; discal dot diffuse, dark brown; terminal line and fringe as on primaries.

EXPANSE: 25 to 27 mm.

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, elliptical in outline, being longer than wide, and with the outer portion rugose, especially at the posterior end, which extends as far as, or farther posteriorly than, the lateral plates; lateral plates broad, overlying the anterolateral margins of the dorsal plate, the surface with numerous longitudinal ridges; ventral plate poorly defined; ductus bursae well sclerotized, shorter than length of apophyses of ovipositor lobes, with a short, smoothly sclerotized collar below the ostium, with a narrow membranous area on each side, the ductus widened at origin of ductus seminalis and enlarged again at junction with bursa copulatrix, the surface anterior to the collar with numerous striations; ductus seminalis arising ventrally or on right side just anterior to collar of ductus bursae: bursa copulatrix membranous, elongate, approximately twice as long as ductus bursae, the surface of the posterior portion, especially ventrally, with several striae, the surface lateral and anterior to the signum with numerous wavy indentations; the signum large, roughly ovate, well sclerotized, with several longitudinal ridges posteriorly, and with the anterior one-third covered with a fold of the bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In United States National Museum.

TYPE LOCALITY: La Chorrera, Panama.

RANGE: Panama, Canal Zone, and Costa Rica. On the wing in May.

SPECIMENS EXAMINED: *Panama:* La Chorrera, May, 1912 (A. Busck), one female type; Chiriqui (Ribbe), one female. *Canal Zone:* Tabernilla (A. Busck), two females. *Costa Rica:* San Jose (H. Schmidt), two females.

REMARKS: Six specimens examined. This species can be distinguished from both *quadripunctus* and *punctatus* in the female by the broad suffusion of ochraceous basad of the

t. p. line on the wings and by the dark, contrasting brown of the outer portion of the wing. Within this species, the specimens from Costa Rica are less strongly marked, less suffused with ochraceous, and slightly larger than the specimens from Panama and the Canal Zone.

The female genitalia differ markedly from those of the species in group I, as outlined above for the species of group II. In this species, the ostial plate is elliptical in outline, with the posterior portion rugose and the lateral plates rather weakly sclerotized, but their surfaces have a number of fine longitudinal ridges.

***Tornus phoxus*, new species**

Figure 23

Lepiodes punctata DRUCE, 1898, *Biologia Centrali-Americana*, Insecta, Lepidoptera-Heterocera, vol. 2, p. 542 (*partim*, 1 ♀).

MALE: Unknown.

FEMALE: Head, vertex gray-brown; front and palpi dark gray-brown. Thorax above ochraceous, with scattered light gray, gray-brown, and dark brown scales; lighter in color below; legs gray-brown, mesothoracic and metathoracic legs suffused with light gray on inner surfaces. Abdomen gray-brown.

UPPER SURFACE OF WINGS: Forewings, ground color gray-brown, broadly suffused with ochraceous, the basal one-third of wing with scattered dark brown scales, the outer one-third heavily shaded with black-brown except at apex of wing, which is ochraceous; costa dark brown, with scattered ochraceous scales; basal, t. a., median, and t. p. lines absent or obsolescent, although the last may be faintly suggested by a few dark scales; discal tuft of gray-black scales; outer third of wing black-brown except at apex, with a rather narrow basal extension going to discal tuft, and a broader area extending almost halfway to base along inner margin, the space between these two basal extensions deeply concave; subterminal line represented by a series of small and inconspicuous, light gray, intravenular dots; marginal spots small, black, intravenular, some of them tending to be narrowly attenuated basally, extending towards subterminal spots; fringe

concolorous with wing in basal half, slightly paler in distal half. Hind wings concolorous with forewings, but without ochraceous suffusion; intradiscal and extradiscal lines absent; discal dot dark brown; the dark brown scales interrupted in cells M_1 and M_2 to show two spots of ground color in outer part of wing, and again above anal angle; terminal line incompletely represented; fringe as on primaries, but with a few light gray scales in center of cells in anterior portion of wing, and with a broader light gray patch above anal angle.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray, heavily overlain with brown scales, especially along basal half of costa and outer third of wing, and with pale ochraceous scales along distal half of costa; cross lines absent; discal dot diffuse, dark brown; terminal line black-brown, narrowly interrupted by veins, which tend to become ochraceous at ends; fringe as above. Hind wings slightly less heavily overlain with brown scaling; cross lines absent; discal dot diffuse, dark brown; terminal line as on primaries; fringe as on upper surface of secondaries.

EXPANSE: 22 to 25 mm.; holotype, 22 mm.

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, longer than wide, widest posteriorly, the posterior margin being roof shaped, the two sides being flattened, the surface smooth except for the widened posterior portion which is rugose, and extending posteriorly beyond the lateral plates; lateral plates narrow, extending antero-medially; ventral plate poorly defined; ductus bursae well sclerotized, approximately five-eighths as long as apophyses of ovipositor lobes, with a short, smoothly sclerotized collar below the ostium, with a narrow membranous area on each side, the ductus becoming widest medially, slightly narrowed before junction with bursa copulatrix and then broadly flared to form the junction, the surface anterior to the collar with numerous fine striations; ductus seminalis arising ventrally just anterior to collar of ductus bursae; bursa copulatrix membranous, elongate, approximately twice as long as ductus bursae, the surface of posterior portion of ventral surface with several striae, the surface lateral

and anterior to the signum with numerous wavy indentations; the signum large, well sclerotized, with several longitudinal ridges posteriorly, and with the anterior one-third covered with a fold of the bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, female, San Sebastian, Retalhuleu, Guatemala (L. Thiel); in United States National Museum. Paratype, one female, Volcan de Atitlan, Guatemala, 2500-3500 feet (Champion; cotype of *Lepiodes punctata* Druce); in British Museum (Natural History).

RANGE: Guatemala.

REMARKS: The females of this species are very similar in appearance to the females of *penumbrosus*. However, they can be separated from the latter by the virtual absence of cross lines above, and by the fact that the wings are more broadly suffused with ochraceous. The genitalia of these two species are similar, but this species has an elongate ostial plate, the posterior margin of which is roof-like, with flattened sides, and the plate is widest at this point.

Tornos punctatus (Druce), new combination

Figures 7, 24

Lepiodes punctata DRUCE, 1898, Biologia Centrali-Americana, Insecta, Lepidoptera-Heterocera, vol. 2, p. 542, vol. 3, pl. 99, fig. 23 (♂ holotype, nec ♀).

MALE: Head, vertex cream colored or ochraceous, becoming dark brown between antennal bases; front dark brown; palpi dark brown, with scattered gray scales. Thorax cream colored or ochraceous above, with scattered brown scales; ventrally light gray; legs light gray or gray-brown, with dark brown scales, metathoracic legs with tibial hair pencil. Abdomen gray-brown or ochraceous; ventral surface of third segment with row of bristles, although this tends to be deciduous.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray, more or less heavily overlain with gray-brown and ochraceous scales, and sometimes with black-brown striations or scattered scales; costa with gray-brown or black-brown bands and

spots; t. a. line incomplete or absent; when present, represented by black-brown scales on costa and veins, swinging outward across base of cell, then curving strongly basad, meeting inner margin closer to base than its origin on costa; median cross line absent; discal tuft of dark gray or gray-brown scales; t. p. line usually complete, narrow, black or black-brown, tending to be concave between veins, arising on costa two-thirds of distance from base, swinging with a broad curve around the end of the cell, then being concave but roughly subparalleling outer margin, with outward bend on anal vein; subterminal area slightly darkened basad of the indistinct row of light gray, intravenular dots that represent the subterminal line; a series of black, intravenular, marginal spots, strongest in anterior portion of wing; fringe concolorous with wing. Hind wings concolorous with forewings, the anterior portion tending to be less heavily dusted with dark scales than remainder of wing; basal line present; intradiscal line absent; discal dot dark brown or black-brown, diffuse; extradiscal line complete, rarely partially obsolete in anterior portion of wing, subparalleling outer margin, concave between veins, tending to be narrowly shaded with ground color distally; subterminal line absent, or weakly represented by a few faint patches of ground color; terminal line incomplete, sometimes represented by small intravenular spots only; fringe as on primaries, but tending to become light gray opposite intravenular spots and near anal angle.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray, heavily overlain with brown scales; cross lines absent except for t. p. line, varying from complete to obsolescent; discal dot large, diffuse, brown-black; terminal line present, narrow to fairly wide, interrupted by veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot prominent, brown-black; extradiscal line varying from complete to obsolescent; terminal line and fringe as on primaries.

EXPANSE: 19 to 25 mm.

FEMALE: Similar to male, but with the upper surface of the wings tending to be slightly more suffused with ochraceous, and

with the maculation tending to be a bit more weakly represented.

EXPANSE: 20 to 25 mm.

MALE GENITALIA: Uncus elongate, tapering from base to beyond middle, then attenuated, the apex with a single point; arms of gnathos only slightly thickened dorsally, uniting to form median oblong process, with its sides slightly more heavily sclerotized than the central area and with the posterior surface rugose; valves elongate, with terminal portion narrowed; costa sclerotized, tending to be slightly wider distally than at base, with numerous setae along inner portion of sclerotized band; valvula with anterior arm extending straight up the valve, widened medially, terminally narrowed and partially twisted, with narrower posterior arm going from inner face of base of costa to join anterior arm, the spinose apical process arising at this junction, being somewhat elliptical in outline, tending to have the posterolateral margin curved ventrally, the ellipse extending posteriorly, and its many slender spines on the outer surface pointing posteriorly and towards uncus; sacculus undifferentiated, lightly sclerotized; juxta weakly sclerotized, with a short median thickening near base, slightly widened medially, apically rounded; aedeagus subequal to, or slightly longer than, combined lengths of uncus, tegumen, and saccus, in width slightly narrower than base of uncus, anterior end extended on right side, rounded, or uniform width medially or with very slight taper, the apex bluntly pointed and with the dorsal surface thereof with a slender, weakly sclerotized area extending to the apex, with a weakly sclerotized, U-shaped process on dorsal surface, the arms rather broad and with the apexes narrowly, heavily sclerotized; vesica armed with two or three elongate spines arising from a basal corneous area, the spines being about one-half of the length of the aedeagus.

FEMALE GENITALIA: Ostium with a well-sclerotized dorsal plate, elliptical or oval in outline, being longer than wide, situated in between and well anterior to the posterior portion of the lateral plates, with all or part of the surface rugose; lateral plates narrow, widest medially, extending anteromedially; ventral plates poorly defined, weakly sclero-

tized laterad of lateral plates; ductus bursae well sclerotized, approximately two-thirds as long as apophyses of ovipositor lobes, with a short finely punctate collar below the ostium, with a narrow membranous area on each side, the ductus slightly widened below collar and flared to form junction with bursa copulatrix, the surface anterior to the collar with numerous striations; ductus seminalis arising ventrally or towards right side just anterior to collar of ductus bursae; bursa copulatrix membranous, elongate, approximately twice as long as ductus bursae, the surface of posterior portion of ventral surface with numerous weak striations, the surface lateral and anterior to the signum with numerous wavy indentations; the signum large, roughly ovate, well sclerotized, with several longitudinal ridges posteriorly, and with the anterior one-fourth covered with a fold of the bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In British Museum (Natural History).

TYPE LOCALITY: Volcan de Irazu, Costa Rica.

RANGE: Costa Rica, Mexico, and southern Texas. On the wing in February, May, June, September, November, and December.

SPECIMENS EXAMINED: *Costa Rica*: Irazu, 6000-7000 feet (H. Rogers), one male cotype; Orosi, 1200 meters (coll. Fassl), one male; Juan Vinas, November, one male. *Mexico*: Orizaba, December, 1907 (R. Muller), one male, May, 1911 (R. Muller), one male, no dates (coll. Schaus), one male, one female; Cordoba, May 6, 1908 (F. Knab), one male. *United States*: Texas: Brownsville, February 28, 1925 (E. Piazza), one female, February 9, 1937 (T. N. Freeman), one male, no dates (coll. Barnes), two males; San Benito, June 16-23, September 8-15 (coll. Barnes), two females.

REMARKS: Fourteen specimens examined. This species can be easily separated from both *penumbrus* and *phoxus* by the lack of the broad ochraceous shadings on the upper surface of the wings, and by the fact that the terminal portion of the wings is not a deep, contrasting brown. In this species, the maculation is better defined than in the two preceding species. However, this character is

apparently one that varies within the species, as the specimens from Texas are both brighter in color and have more prominent markings than the specimens from Mexico and Costa Rica; it should be noted, though, that the Texas specimens appear to be fresher and of a more modern vintage than the others, which may have a bearing on the situation.

The male genitalia are similar to those of *quadripunctus* but can be distinguished by the smaller spinose apical process, with smaller individual spines, and by the more strongly defined, U-shaped dorsal process on the aedeagus, and by the more heavily sclerotized spines of the vesica. The female genitalia, while similar to those of the two preceding species, can be identified by the smaller ostial plate and the fact that the lateral plates extend posterior to the ostial plate.

Tornos hoffmanni, new species
Figures 8, 25

Tornos punctata DRUCE, 1898, Biologia Centrali-Americana, Insecta, Lepidoptera-Heterocera, vol. 2, p. 542 (*partim*, ♀ allotype).

MALE: Head, vertex cream colored or ochraceous, becoming dark brown between antennal bases; front dark brown; palpi dark brown, with scattered gray scales. Thorax cream colored or ochraceous above, with scattered brown scales; ventrally light gray; legs light gray or gray-brown, with dark brown scales, metathoracic legs with tibial hair pencil. Abdomen gray-brown or ochraceous; ventral surface of third segment with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray, heavily overlain with ochraceous and gray-brown scales, and with scattered black-brown scales; costa with gray-brown or black-brown bands and spots; t. a. line complete, black-brown, arising on costa one-fifth of distance from base, swinging outward across base of cell, then curving strongly basad, meeting inner margin closer to base than its origin on costa; median cross line absent; discal tuft of dark gray scales; t. p. line complete, narrow, black or black-brown, preceded and followed by a narrow band of ground color, tending to be concave between the veins, arising on costa

two-thirds of distance from base, swinging with a broad curve around the end of the cell, subparalleling outer margin but with inward bend in cell Cu_2 , with outward bend on anal vein, then going strongly basad to meet inner margin; subterminal area slightly darkened basad of the indistinct row of light gray, intravenular dots that represent the subterminal line; a series of black, intravenular, marginal spots, strongest in anterior portion of wing; fringe concolorous with wing, or faintly checkered. Hind wings concolorous with forewings, with outer one-third of wing tending to be slightly darker than basal two-thirds; basal line present; intradiscal line weakly represented on anal margin; discal dot black or black-brown, diffuse; extradiscal line complete, rarely partially obsolete in anterior portion of wing, tending to be concave between the veins, black-brown, with a narrow band of ground color distally, subparalleling outer margin; subterminal area with a few indistinct patches of ground color forming subterminal line, and with a white dash at anal angle; terminal line complete or partially obsolete, black, narrow; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous grayish brown, heavily overlain with brown scales; cross lines absent except for t. p. line, which is diffuse and rather poorly defined; discal dot large, diffuse, brown; terminal line present, narrow, interrupted by ochraceous veins; fringe as above, or slightly lighter. Hind wings less heavily overlain with brown scales; discal dot large, diffuse; extradiscal line varying from complete to obsolescent; terminal line and fringe as on primaries.

EXPANSE: 23 to 26 mm.; holotype, 25 mm.

FEMALE: Similar to male, but with the upper surface of the wings suffused with ochraceous or dull, pale reddish brown and with the maculation more weakly represented.

EXPANSE: 23 to 28 mm.; allotype, 24 mm.

MALE GENITALIA: Uncus with sides evenly tapering to a single point; arms of gnathos widest dorsally, slightly constricted medially, uniting to form median oblong process, with its sides more heavily sclerotized than the central area and with the posterior surface rugose; valves elongate, with terminal por-

tion narrowed; costa narrowly sclerotized, with numerous setae along inner margin of sclerotized band; valvula with anterior arm curving slightly posteriorly, broadest medially and with a basally pointing projection, with the terminal portion curving or twisted, with the narrower posterior arm extending from anterior margin of base of costa straight up the valve for two-thirds of its length, then curving posteriorly and uniting with anterior arm, the spinose apical portion arising at this junction, being ovate in shape, its tip and the many spines on the outer surface extending posteriorly, sometimes the outer margin of this spinose apical portion curved ventrally; sacculus undifferentiated, weakly sclerotized; juxta weakly sclerotized basally, slightly constricted medially, more heavily sclerotized posteriorly, the two lateral edges being extended and finely spiculate; aedeagus very long and thin, one and one-fourth times as long as combined lengths of uncus, tegumen, and saccus, anterior end extended on right side, rounded, with slight constriction above this, then slightly swollen, with area above middle of aedeagus broadly constricted, slightly increasing in thickness again apically, the apex bluntly pointed, the width of the median constriction being about one-half of width of the base of the uncus, dorsal surface with median, U-shaped, sclerotized process, the arms being narrow, curving outward and with tips approximated; vesica armed with four or five very long and slender spines arising from a corneous area, in length about one-half of length of the aedeagus.

FEMALE GENITALIA: Ostium with a well-sclerotized dorsal plate, elliptical in outline, being longer than wide, situated in between and slightly anterior to the posterior portion of the lateral plates, with the surface rugose; lateral plates broad, the posterior portion almost truncate, extending medially almost to lateral margins of dorsal plate before turning anteriorly, their surface rugose posteriorly; ventral plates situated laterad of lateral plates, uniting anteriorly, often with a median indentation; ductus bursae well sclerotized, approximately two-thirds to three-fourths as long as apophyses of ovipositor lobes, with a short, finely punctate collar below the ostium, with a narrow membranous

area on either side, the ductus widened below collar and flared out to form junction with bursa copulatrix, the surface anterior to the collar with numerous striations; ductus seminalis arising ventrally or on right side just anterior to collar of ductus bursae; bursa copulatrix membranous, elongate, approximately twice as long as ductus bursae, the surface of posterior portion of ventral surface with numerous striations, these often being connected with striations of ductus bursae, the surface lateral and anterior to the signum with numerous wavy indentations; the signum large, roughly ovate, sometimes broader than long, well sclerotized, the posterior portion with or without a few longitudinal ridges posteriorly, and with the anterior one-third covered with a fold of the bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Tehuacan, Puebla, Mexico, May 27, 1937 (C. C. Hoffmann), in the American Museum of Natural History; allotype, female, Orizaba, Veracruz, Mexico (collection W. Schaus), in United States National Museum. Paratypes, four males and 17 females: Volcan Santa Maria, June, July (Schaus and J. Barnes), two males; Tehuacan, Mexico, September, 1912 (R. Muller), one male; Guadalajara, Mexico, one male; Jalapa, Mexico, June, 1896 (Schaus), one female, no date (M. Trujillo), one female, no date or collector, six females; Orizaba, Mexico, April, 1896 (W. Schaus), one female, no date or collector, four females; Oaxaca, Mexico, June, 1896 (Schaus), one female; Misantla, Veracruz, Mexico (W. Gugelmann; "recu en juin 1912"), one female; Valles, San Luis Potosi, Mexico, May 18, 1952 (Cazier, Gertsch, Schrammel), one female; Brownsville, Texas, June 10, 1932 (J. O. Martin), one female. Paratypes to be distributed among the United States National Museum, the British Museum (Natural History), the California Academy of Sciences, and the American Museum of Natural History.

RANGE: Guatemala, Mexico, and southern Texas. On the wing from April through July, and September.

REMARKS: The maculation of this species is very similar to that of *punctatus*. However, in *hoffmanni* the males tend to have a

stronger t. a. line on the upper surface of the forewings, and the t. p. line is more oblique in the lower part of the wing, especially below the anal vein. The females of this species are more strongly dimorphic in coloration than in *punctatus*, and they can often be recognized by their reddish brown coloration.

The male genitalia of this species can be easily separated from those of *punctatus* by the extremely long aedeagus and the fact that

the posterolateral angles of the juxta are spiculate. The female genitalia have a small ostial plate, as in *punctatus*, but the lateral plates are large and truncate, extending posteriorly of the ostial plate.

This species is named in honor of the late C. C. Hoffmann, who not only collected the type specimen of this species, but who did so much to advance the knowledge of the Lepidoptera of Mexico.

GROUP III

This group of three species apparently represents a rather highly modified offshoot from the main line of development in this genus. The female genitalia have the ductus bursae well defined but very broad and short, usually being wider than long. It is usually collar-like in form and is without any striations. The bursa copulatrix is membranous or weakly sclerotized in part, and the surface has a large number of striations. The signum is represented by a large sclerotized area occupying a considerable portion of the surface of the bursa.

The male genitalia have the uncus with either a single or a double point, and the valvula is more highly developed than heretofore. The anterior and posterior arms are both present and distinct, but they show a tendency to be in close proximity with each other, usually with the anterior arm being above the posterior. The spinose apical process is small, with a small number of short spines that are directed anteriorly. The juxta is often widest posteriorly. The aedeagus is the thickest of any group, usually with a tapering point, although the apex may be truncate; the dorsal U-shaped process is greatly reduced or absent. The vesica is very distinctive, being armed with from four to 12 short heavy spines.

The adults in this group have the largest wing expanse in the genus. The sexes are similarly marked, and the females may or may not be more ochraceous above than the males; the pattern varies from prominent to absent. The males may or may not have the hind tibia with the hair pencil and the row

of bristles on the third abdominal segment below.

The three species range from Central America through Mexico and into Arizona.

Tornos umbrosarius Dyar

Figures 9, 26

Lepiodes punctata DRUCE, 1898, Biologia Centrali-Americana, Insecta, Lepidoptera-Heterocera, vol. 2, p. 542 (*partim*, 1 ♀).

Tornos umbrosarius DYAR, 1910, Proc. U. S. Natl. Mus., vol. 38, p. 264.

MALE: Head, vertex brown or gray-brown, front dark brown; palpi dark brown, with scattered gray and gray-brown scales, especially basally. Thorax ochraceous or ochraceous brown above, becoming darker posteriorly, gray-brown below; legs gray-brown and brown. Abdomen above dark brown, with white dorsal stripe extending for first seven segments, laterally with some reddish and ochraceous brown shading, beneath ochraceous white with faint brown subventral and ventral lines, the former being most prominent on posterior margins of segments, the two uniting on terminal segment to form a trifold brown mark; ventral surface of third abdominal segment with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous grayish brown, broadly suffused with ochraceous in basal two-thirds of wing, with scattered dark brown scales, the outer one-third heavily shaded with brown-black except at apex of wing, which is ochraceous; costa with scattered dark brown bands and spots; t. a. and median cross lines absent, although the former

may be suggested at costa by a few dark scales; discal tuft of dark gray scales; t. p. line represented by groups of dark brown or black-brown scales on costa and veins, strongest in anterior portion of wing, swinging outward around cell, then paralleling outer margin to inner margin, and tending to be faintly shaded distally in lower part of wing by some ochraceous scales; outer third of wing brown-black except at apex, with a basal extension going to discal tuft, and with a broader area extending basad of t. p. line in cell Cu_2 ; subterminal line represented by a series of small, grayish white, intravenular dots; marginal spots diffuse, dark brown, intravenular; fringe concolorous with wing. Hind wings concolorous with forewings, but without ochraceous suffusion; intradiscal line absent; discal dot small, inconspicuous; extradiscal line inconspicuous, defined chiefly by a narrow, pale, distal edging, extending across wing subparallel with outer margin; subterminal area with a few very faint patches of light gray scales, and with a whitish gray patch at anal angle; marginal spots diffuse; fringe concolorous with wing but with a few light gray scales opposite marginal spots.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray, heavily overlain with brown scales, especially in outer third of wing; costa becoming ochraceous in outer part of wing; cross lines absent; discal dot weakly represented, diffuse; terminal line narrow, interrupted by ochraceous veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot dark brown, diffuse; cross lines absent; terminal line and fringe as on primaries.

EXPANSE: 30 mm.

FEMALE: Similar to male, but with the upper surface of the forewings more broadly suffused with ochraceous.

EXPANSE: 28 to 35 mm.

MALE GENITALIA: Uncus with broad base, tapering to a single point; arms of gnathos widest dorsally, sharply constricted medially, uniting to form the very narrow median process, with its sides more heavily sclerotized than the central area and with the posterior surface rugose; valves broad, elongate, with apical portion tapering in width from shallow constriction above apex of valvula;

costa broadly sclerotized, with numerous fine setae along inner portion of sclerotized band; valvula with anterior arm extending straight up the valve, with posterior arm straight, joining the anterior arm in the posterolateral portion of the latter, with the spinose apical process situated just beyond their junction, being rather small, somewhat concave, and both the process and the short terminal spines extending towards base of valves; sacculus undifferentiated; juxta weakly sclerotized basally, enlarged posteriorly; aedeagus about one-fourth longer than combined lengths of uncus, tegumen, and saccus, in width subequal to base of uncus except for posterior portion which is slightly wider, anterior end extended on right side, rounded, of uniform width medially and with posterior one-fourth swollen, tapering to a pointed apex, apparently without dorsal U-shaped process; vesica armed with approximately 10 short, heavy, tapering spines usually enlarged basally, varying in length from shorter than to almost twice the length of uncus, a continuous row of seven spines located with the bases on the left side, extending posteriorly into center of aedeagus, the two longest spines located apically, and with several more spines situated dorsally on right side and medially.

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, posterior end rounded, becoming membranous anteriorly, the surface with several more or less concentric, hemispherical ridges that are incomplete anteriorly; lateral plates heavily sclerotized, narrow, extending anteromedially, often with anterior margin indented medially, the ventral margins tending to be convoluted; ventral plate absent; ductus bursae well sclerotized, collar-like, broad, being slightly broader than long; ductus seminalis arising ventrally just below ductus bursae; bursa copulatrix partially membranous, elongate, longer than combined lengths of ovipositor lobes and their apophyses, roughly ovate in outline, with a raised convoluted fold extending from posterior third of right side of ventral surface, across the ventral surface, around the left side, and extending obliquely across dorsal surface towards anterior end, the surface posterior to this fold lightly

sclerotized and with a number of deeply indented striations on dorsal surface and laterally, anterior to the fold membranous, with several striations, these sometimes becoming wavy and irregular; signum represented by a large, smoothly sclerotized area on left side, mainly on the dorsal surface, roughly bounded posteriorly by the convoluted fold, becoming membranous ventrally and bounded by the striations.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In United States National Museum.

TYPE LOCALITY: Orizaba, Mexico.

RANGE: Central Mexico. On the wing in January, July, and November,

SPECIMENS EXAMINED: *Mexico*: Orizaba, January, 1909 (R. Muller), one female type, no dates, three females; Coatepec, November, one male; Cuernavaca, July, 1906, one female; Morelos (Kruger), one female; Jalapa (Hoega), one female cotype of *punctata* Druce.

REMARKS: Eight specimens examined. This is the first of the three very large species that form group III, and it can be distinguished from any of the preceding species by its size alone. The type of maculation is similar to that found in *phoxus* and *penumbrus*, with the basal two-thirds of the wings above being more or less broadly suffused with ochraceous, but in the present species the ochraceous extends beyond the t. p. line.

The genitalia are very distinct from those of any of the preceding species. In the male, the aedeagus has about 10 short, heavy spines, a character that is found only in this species. The female genitalia are distinct in having the large smoothly sclerotized area of the bursa copulatrix on the left side, with the prominent raised and convoluted fold extending around most of bursa.

Tornos benjamini Cassino and Swett

Figures 10, 27

Tornos benjamini CASSINO AND SWETT, 1925, Lepidopterist, vol. 4, p. 43.

MALE: Head, vertex ochraceous or ochraceous brown, becoming dark brown between antennal bases; front dark brown; palpi dark

brown, with scattered gray and gray-brown scales, especially basally. Thorax ochraceous above, becoming darker posteriorly, gray-brown below; legs gray-brown and brown, hind tibia with hair pencil. Abdomen ochraceous, with a faint, pale, median stripe, bordered by darker scales at base of abdomen and on terminal half; slightly darker below, with faint subventral and ventral lines; ventral surface of third abdominal segment with row of bristles, although this tends to be deciduous.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous grayish brown, broadly suffused with ochraceous from base to t. a. line, and distad to t. p. line and extending to apex, and with dark brown and black-brown scales between t. a. and t. p. lines and in outer one-fourth of wing; costa with scattered brown spots and bands; t. a. line black-brown, complete or partially obsolescent, arising on costa one-fourth of distance from base, running outward oblique to cell, then turning sharply and going straight to inner margin, meeting the latter about one-half as far from base as its origin on costa; median area broadly suffused with dark brown and black-brown scales; median line absent; discal tuft of dark gray scales, becoming gray-black at apex; t. p. line black-brown, complete or sometimes partially obsolescent between veins, arising on costa two-thirds of distance from base, going at a right angle to costa and then curving evenly basad around cell, meeting inner margin one-half of distance from base and shaded distally with a narrow band of ground color and a broader band of ochraceous in anterior portion of wing, sometimes being continued completely across wing; the veins tending to be ochraceous distad to t. p. line, hence interrupting the dark brown terminal portion of wing; subterminal line represented by a series of small, grayish white, intravenular dots; marginal spots black-brown, intravenular, tending to form a terminal line, interrupted by veins; fringe concolorous with wing, except for a light-colored base, and distal portion slightly paler. Hind wings concolorous with forewings, but without dark brown suffusion on anterior portion; intradiscal line absent; discal dot

diffuse, situated in an indistinct median shade; extradiscal line black-brown, complete, subparalleling outer margin, with a distal edging of light gray and ochraceous scales; area distad of t. p. line with less dark brown shading than basal portion of wing, the veins becoming ochraceous, and with an ochraceous patch in cells M_3 and Cu_1 ; subterminal line weakly indicated by light gray scales, and with a whitish gray patch at anal angle; marginal line black-brown, interrupted by veins; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray, lightly sprinkled with brown scales, the veins tending to be pale ochraceous; costa ochraceous, with scattered dark brown scales; cross lines absent, but sometimes t. p. line indistinctly indicated in anterior part of wing; discal dot dark brown, diffuse; terminal line narrow, interrupted by veins; fringe as above. Hind wings concolorous with forewings; discal dot dark brown, diffuse; extradiscal line weakly indicated; terminal line and fringe as on primaries.

EXPANSE: 21 to 30 mm.

FEMALE: Similar to male, but with upper surface of forewing more broadly suffused with ochraceous; t. a. and t. p. lines tending to be represented by groups of scales on veins rather than as a complete line; terminal portion of wing tending to be more broadly interrupted at veins M_3 and Cu_1 by ochraceous scaling; distal portion of hind wings slightly more suffused with ochraceous, especially outside of extradiscal line, appearing as a broad geminate band. Under surface of both wings heavily suffused with dark brown and black-brown scales in basal two-thirds of wing and especially in outer portion, these two areas being separated by a band of ground color.

EXPANSE: 28 to 32 mm.

MALE GENITALIA: Uncus with broad base, tapering to a single point, sometimes with slight constriction near apex; arms of gnathos widest dorsally, slightly constricted medially, uniting to form the narrow median process, with its sides more heavily sclerotized than the central area and with the posterior surface with numerous small sclerotized eleva-

tions; valves elongate, with narrower terminal portion set off by sharp constriction above valvula; costa broadly sclerotized, with numerous fine setae along inner portion of sclerotized band; valvula with anterior arm extending straight up the valve, with posterior arm straight, joining the anterior arm and the two forming a broadly swollen sclerotized area, with spinose apical process situated at posterolateral edge thereof, being rather small, somewhat coiled, and with both the process and the short terminal spines extending towards base of valves; sacculus undifferentiated, with a deciduous tuft of hair arising from outer surface; juxta weakly sclerotized basally, constricted medially, the posterior portion enlarged and with many minute teeth medially, with medioventral, broadly U-shaped area, and with many elongate, hair-like setae; aedeagus slightly longer than combined lengths of uncus, tegumen, and saccus, in width subequal to width of base of uncus, anterior end extended on right side, rounded, of uniform width medially, tapering to a pointed apex, without dorsal U-shaped process; vesica armed with from seven to 10 short, heavy, tapering spines usually enlarged basally, ranging in length from shorter than, to one and one-half times length of, uncus, two or three of these located on left side basad of middle of aedeagus, one or two on right side slightly posteriad of the first group, and the remainder located in the posterior half of aedeagus.

FEMALE GENITALIA: Ostium with heavily sclerotized dorsal plate, subovate, becoming membranous anteriorly, the surface being rugose, especially in posterior portion; lateral plates weakly sclerotized, inconspicuous; ventral plate absent; ductus bursae well sclerotized, collar-like, broad, being wider than long, sometimes slightly longer on right side than on left, the surface finely punctate; ductus seminalis arising ventrally just below ductus bursae; bursa copulatrix membranous, elongate, slightly longer than apophyses of ovipositor lobes, tending to have the left side and dorsal surface more swollen or convex than right side and ventral surface, the surface of the bursa with numerous longitudinal striations, these tending to become wavy and

irregular in anterior portion of bursa; signum represented by a large sclerotized area on ventral surface, best defined in anterior half, swollen, smoothly sclerotized, with a small protuberance at or near anterior end, weakly sclerotized posteriorly with a few striations.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In Museum of Comparative Zoölogy, Harvard College.

TYPE LOCALITY: Baboquivari Mountains, Pima County, Arizona.

RANGE: Baboquivari Mountains, Arizona, and extending into Mexico. The single Mexican specimen is labeled "Zacualpan; Draudt, 1924; Dognin Collection." Just which Zacualpan this label refers to is impossible to say at this time, as there are towns by this name in the states of Colima, Guerrero, Mexico, Morelos, Nayarit, and Veracruz. In Arizona the species is on the wing in April, May, June, August, September, and October.

SPECIMENS EXAMINED: *Arizona*: Baboquivari Mountains, Pima County, April 27, 1936, April 24, 1947, May 22, 1937 (G. H. and J. L. Sperry), one male, two females; April 1-15, 1924, one female paratype; June 1-15, 1924 (O. C. Poling), one male, one female; July 1-15, 1924 (O. C. Poling), one male; July 15, 1923, one male paratype; August 15-30, 1924 (O. C. Poling), one male; September 15-30, 1923, one female allotype; October 2, 1923, one male holotype; no date, one female paratype. *Mexico*: Zacualpan, 1924 (Draudt), one female.

REMARKS: Thirteen specimens examined. In appearance, this species is similar to *umbrosarius*, although it can usually be distinguished by the more mottled appearance of the wings above. In addition, the t. p. line of the upper surface of the forewings tends to be more strongly represented in *benjamini* and the subterminal area of the secondaries is ochraceous, while in *umbrosarius* it is not differentiated.

The male genitalia of this species can be separated from those of *umbrosarius* by the fact that the vesica has a smaller number of spines and they are arranged in a different pattern. In addition, the arms of the valvula are quite different, and the spinose apical process is much smaller and semicircular in

shape in this species. The large sclerotized area of the bursa copulatrix is located ventrally, and the convoluted fold that is found in *umbrosarius* is not present here.

Tornos brutus, new species

Figures 11, 28

MALE: Head, vertex gray-brown, becoming dark brown between antennal bases; front dark brown; palpi dark brown, with scattered gray and gray-brown scales, especially basally. Thorax ochraceous or ochraceous brown above, gray-brown below; legs gray-brown and brown; hind tibia without hair pencil. Abdomen above ochraceous, becoming dark brown posteriorly, with white dorsal stripe, laterally with some reddish and ochraceous brown shading, beneath ochraceous, with faint brown subventral and ventral lines; ventral surface of third abdominal segment without row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous grayish brown, with scattered dark brown scales; costa very faintly marked with darker bands and spots, the area between the costa and the radial vein faintly dusted with ochraceous brown; all cross lines absent, although t. p. line may be very faintly suggested by a few dark scales on the veins in anterior portion of wing; discal tuft of dark gray scales, relatively small; outer third of wing only very slightly darker than basal portion; subterminal line represented by a series of small, grayish white, intravenular dots; marginal spots faint, intravenular; fringe concolorous with wing. Hind wings concolorous with forewings, but with slightly less brown shading in anterior portion; intradiscal line absent; discal dot obsolete; extradiscal line obsolescent, suggested by a faint, narrow, gray, distal band; subterminal area with a few very faint patches of light gray scales, and with a whitish gray patch at anal angle; a faint marginal line; fringe concolorous with wing but with a few gray scales between veins.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray, evenly overlain with brown scales, especially along costa, at apex, and along outer margin; costa becoming ochraceous in outer part of wing;

cross lines absent; discal dot weakly represented; terminal line narrow, interrupted by ochraceous veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot brown, small; cross lines absent; terminal line and fringe as on primaries.

EXPANSE: 32 mm. (holotype).

FEMALE: Similar to male, but with upper surface of forewings more suffused with ochraceous in basal two-thirds of wings, especially along costa and distad to t. p. line, this latter being slightly better defined than in male; outer one-third of wing contrasting more with basal portion owing to the ochraceous scaling.

EXPANSE: 33 to 37 mm.; allotype, 37 mm.

MALE GENITALIA: Uncus elongate, basal half broad, then concave and curving ventrally to a rather weakly bifurcate apex; arms of gnathos widest dorsally, tapering medially, uniting to form a rather short, broad, median process, with its posterior surface slightly rugose; valves broad, with apical portion tapered or slightly constricted; costa narrowly sclerotized, with numerous setae apically and a few along inner margin; valvula with very broad anterior arm extending three-fourths of length of valve, occupying two-thirds of valve at base, more heavily sclerotized medially, widened apically, the apex somewhat truncate, the posterior arm narrow, angled posteriorly midway and extending posteriorly and curving ventrally around end of anterior arm, uniting with spinose apical process at posterolateral margin of the latter, the apical process extending basad, subrectangular in shape, with the spines as long as the apical process, five in number, extending basad; sacculus undifferentiated; juxta with slight median constriction, enlarged posteriorly, with several transverse striations; aedeagus slightly shorter than combined lengths of uncus, tegumen, and saccus, rounded anteriorly, increasing in width posteriorly to a subtruncate apex which is approximately twice the width of base of uncus, with a finger-like sclerotized protuberance medially, extending beyond truncate apex, with a rather weakly sclerotized, U-shaped process on dorsal surface; vesica armed with a compound group of four or five heavy spines on left side posteriorly, and with a single stout spine apically on right side.

FEMALE GENITALIA: Ostium with dorsal plate not differentiated; lateral plates strongly sclerotized, extending around to dorsal side, less heavily sclerotized ventrally, with a small, longitudinal, dorsoventral flange laterad of each side of ductus bursae, medially the surface convoluted and with several longitudinal folds; ventral plate absent; ductus bursae well sclerotized ventrally, broad, wider than long, the lateral margins convex, with a more heavily sclerotized band extending crosswise across the middle of the ventral surface; ductus seminalis arising ventrally just below ductus bursae; bursa copulatrix membranous, rather short and broad, subequal in length to length of apophyses of ovipositor lobes, tending to have the left side more swollen than right side, the surface of the bursa heavily marked with striations, these being longitudinal below the ductus bursae but soon becoming zigzag and wavy; signum represented by a rounded, heavily and smoothly sclerotized area at anterior margin of bursa.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Volcan Turrialba, Costa Rica, August; allotype, female, Purulha, Guatemala, July (Schaus and J. Barnes); both in United States National Museum. Paratypes, five females: Purulha, Guatemala, July (Schaus and J. Barnes), one female; Volcan Santa Maria, Guatemala, July, October (Schaus and J. Barnes), three females; "Hamburgo," Chiapas, Mexico, June, 1933 (C. C. Hoffmann), one female. Paratypes in the collections of the United States National Museum and the American Museum of Natural History.

RANGE: Costa Rica, Guatemala, and Mexico. On the wing in June, July, August, and October.

REMARKS: This is the most immaculate of the three species in this group, and it can be separated from the two preceding species by this lack of pattern and by the smaller amount of ochraceous shading on the wings above. It also can be distinguished from *umbrosarius* and *benjamini* by the absence of both the tibial hair pencil and the row of bristles on the third abdominal segment in the males.

In the male genitalia, the spines of the vesica have been further reduced, so that there are only about five spines remaining; in addition, the aedeagus has a terminal finger-like protuberance that is not found in the other two species of this group. Both *umbrosarius* and *benjamini* have the uncus ter-

minating in a single point, but in *brutus* the point is bifurcate. The ductus bursae is very broad in this species, being much wider than in any other species. The sclerotized area of the bursa copulatrix is located at the very tip rather than on the left side (*umbrosarius*) or ventrally (*benjamini*).

GROUP IV

This species group appears to be a direct development from group II, in which most of the ductus bursae and the posterior portion of the bursa copulatrix have become fused, and the distinct line of demarcation has become lost as a result. The only distinct portion of the bursa that remains is a narrow collar-like structure, much as in group II. The ductus seminalis still arises just below the collar, and the area of fusion between the ductus and bursa still retains the sclerotization and striations that are found in the ductus bursae in the earlier group. The remainder of the bursa copulatrix is membranous, and it has a well-defined stellate signum.

The male genitalia have either a bifurcate or a single point on the uncus. The valvula shows a tendency to have the two arms fused into a single arm, terminating in a spinose apical process that is usually rather small. The juxta is variable in shape, while the aedeagus is usually tapered, and the rather weakly defined, dorsal, U-shaped process tends to be long and narrow. The vesica either has from six to nine minute, rather weakly sclerotized spines, or a corneous area instead.

The sexes are dimorphic in the pattern and coloration. The males are rather poorly marked, but show traces of both t. a. and t. p. lines; the latter tends to arise on the costa closer to the base than in the other groups. The females are broadly marked with ochraceous, with the outer portion of the wing a contrasting dark brown, and have lost the cross lines. In addition, there is a marked size difference between the sexes, as the males are quite small and the females considerably larger. The males have both the tibial hair pencil and row of bristles on the venter of the third abdominal segment.

Of the three species included here, one

flies in South America, while the other two are in Central America and Mexico.

Tornos pusillus, new species

Figures 12, 29

Lepiodes punctata DRUCE, 1898, Biologia Centrali-Americana, Insecta, Lepidoptera-Heterocera, vol. 2, p. 542 (*partim*, 1 ♂).

MALE: Head, vertex gray-brown, becoming dark brown at or between antennal bases; front dark brown; palpi dark brown, with scattered gray scales. Thorax ochraceous above, light gray below; legs light gray and brown. Abdomen gray-brown above, paler below; ventral surface of third segment with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown, lightly dusted with ochraceous and dark brown scales; costa dark brown, with scattered patches of ground color, as far as origin of t. p. line, then chiefly gray-brown; t. a. line arising on costa one-fourth of distance from base as a dark brown patch, extending across cell, swinging basally and meeting inner margin at a sharp angle about half as far from base as origin on costa, the t. a. line often becoming obsolescent below cell; a faint, median shade line sometimes present; discal tuft of dark gray scales; t. p. line arising on costa three-fifths of distance from base as a dark brown patch, swinging sharply distally around end of cell, then turning posteriorly and becoming obsolescent, sometimes indicated again by a small patch of dark scales on anal vein; subterminal line represented by an incomplete series of small, light gray, intravenular dots, these sometimes strongest opposite cell and above inner angle; marginal spots absent, or weakly suggested opposite

cell; fringe concolorous with wing. Hind wings concolorous with forewings, the basal portion, as far as extradiscal line, with numerous black-brown scales; basal line present; intradiscal line absent or weakly indicated; discal dot dark brown or black-brown; extradiscal line black-brown, weak, tending to be concave between veins, subparalleling outer margin, with a distal band of grayish white; subterminal line light gray, more or less complete, widened above anal angle; terminal line weakly represented or absent; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown, with scattered brown scales, especially along costa; cross lines absent, or with t. p. line faintly suggested; discal dot dark brown; terminal line weakly represented, interrupted by veins; fringe as above. Hind wings slightly less heavily overlain with brown scales; discal dot dark brown; extradiscal line absent or faintly suggested in anterior portion of wing; terminal line and fringe as on primaries.

EXPANSE: 20 to 22 mm.; holotype, 20 mm.

FEMALE: Forewings with upper surface broadly suffused with ochraceous; costa and upper portion of cell with numerous dark brown scales as far as origin of t. p. line; distal portion of wing dark brown, except at wing tip, with basal extensions to discal tuft and in cell Cu_2 ; all cross lines obsolescent. Hind wings above a unicolorous dark brown, with discal dot and t. p. line faintly represented, the latter with the light distal edging obsolescent except in cells M_1 and M_2 . Under surface of both wings broadly suffused with gray-brown and dark brown scales, and with some ochraceous scaling, especially along the costa.

EXPANSE: 24 to 29 mm.; allotype, 29 mm.

MALE GENITALIA: Uncus elongate, the sides tapering to the rounded bifurcate apex; arms of gnathos only slightly thickened dorsally, uniting to form median oblong process, with its sides slightly more heavily sclerotized than the central area and with the posterior surface rugose; valves elongate, with narrower terminal portion set off by sharp constriction above valvula; costa sclerotized, with numerous setae along inner margin of sclerotized band; valvula with a single

sclerotized arm extending straight up the valve, with a transverse sclerotized ridge extending from the anterobasal to the posterodistal portions of valvula, with the spinose apical process situated in a depression at the end of valvula, the transverse sclerotized ridge extending to the posterior portion of the depression, the apical process round, its spines being on the inner surface and extending posteriorly; sacculus undifferentiated; juxta widest basally, slightly narrowing posteriorly; aedeagus slightly longer than combined lengths of uncus, tegumen, and saccus, in width subequal to width of base of uncus, anterior end rounded, with slight constriction near this end, then of uniform width medially, tapering to rather sharply pointed apex, with a rather weakly sclerotized, U-shaped process on dorsal surface, being distinguishable mainly by the more membranous inner area; vesica with a row of eight or nine short spines on the left side near apical end, the longest of these being shorter than the length of the uncus.

FEMALE GENITALIA: Ostium with dorsal plate sclerotized, roughly ovate in outline, with the posterior margin attenuated, usually extending beyond the lateral plates, the surface of the posterior portion with a number of transverse ridges, anteriorly the surface smooth; lateral plates broad, tending to be more or less truncate posteriorly, with a large median indentation, the surface with several short ridges; ventral plate well defined laterally, becoming more membranous medially, the surface with a number of ridges or striations; ductus bursae a short sclerotized collar, widening into the fused ductus-bursa copulatrix; ductus seminalis arising ventrally just anterior to collar of ductus bursae; bursa copulatrix lightly sclerotized in posterior one-third to one-half, the surface with a number of striations, the bursa becoming enlarged and membranous anteriorly, the length of the bursa, measured from the anterior margin of the collar of the ductus bursae, being longer than the combined lengths of the ovipositor lobes and their apophyses; the signum strongly stellate, wider than long, in width being slightly more than one-half of the length of an ovipositor lobe.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Cordoba, Mexico, May 2, 1908 (F. Knab); allotype, female, Cordoba, Mexico, May, 1906 (collection W. Schaus; both in United States National Museum. Paratypes, two males and two females, all from Mexico: Teapa, Tabasco, March (H. H. Smith, cotype of *Lepiodes punctata* Druce), one male; Misantla, Veracruz (W. Gugelmann, "recu en juin 1912"), one male, April, 1910, one female; Orizaba, one female. Paratypes to be deposited in the collections of the United States National Museum and the British Museum (Natural History).

RANGE: Mexico. On the wing in March, April, and May.

REMARKS: The males are small and rather weakly marked, while the females are larger and have the primaries above strongly washed with ochraceous; this is a combination of characters not heretofore encountered. The male genitalia are very distinctive in that the spinose apical process is small and round and the vesica is armed with a row of eight or nine short spines. The female genitalia are characterized by the fact that the ostial plate is sclerotized and the posterior margins of the lateral plates are truncate.

Tornos spinosus, new species

Figures 13, 30

Tornos sp., DYAR, 1914, Proc. U. S. Natl. Mus., vol. 47, p. 243 (specimen from Costa Rica).

MALE: Head, vertex gray-brown; front dark brown; palpi dark brown, with scattered gray scales. Thorax light gray and ochraceous above, light gray below; legs light gray and brown, hind tibia with hair pencil. Abdomen gray-brown above, paler below; ventral surface of third segment with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray-brown, with scattered dark brown scales; costa with numerous dark brown scales as far as origin of t. p. line; t. a. line arising on costa one-fourth of distance from base as a dark brown patch, and meeting inner margin at a sharp angle about half as far from base as origin on costa; discal tuft of gray-black scales; t. p. line arising on costa three-fifths of distance from base as a dark brown patch, swinging distally around end of cell, becoming obsoles-

cent in lower portion of wing; subterminal line represented by a few indistinct, light gray, intravenular dots; marginal spots obsolescent, sometimes very faintly indicated; fringe concolorous with wing. Hind wings concolorous with forewings, more or less heavily dusted with black-brown scales, especially basad of extradiscal line and along anal margin; basal line present; intradiscal line weakly indicated; discal spot black-brown; extradiscal line weakly defined, but bordered distally by a rather broad band of light gray, subparalleling outer margin; subterminal line light gray, incomplete, most prominent in cells M_1 and M_2 , which have some dark scales and a second light-colored patch halfway to t. p. line, and widened again above anal angle; terminal line dark, incomplete; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray-brown, with scattered brown and ochraceous scales; cross lines absent; discal dot dark brown; terminal line weakly defined, interrupted by veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot dark brown; extradiscal line indistinctly indicated; terminal line and fringe as on primaries.

EXPANSE: 22 mm.

FEMALE: Forewings with upper surface broadly suffused with ochraceous; costa and upper part of cell with numerous dark brown scales as far as origin of t. p. line; outer portion of wing brown-black except at wing tip, with a paler basal extension to discal tuft, and again in cell Cu_2 and below anal vein; cross lines absent except for subterminal row of light gray, intravenular spots. Hind wings similar to male, but with entire wing black-brown. Under surface of both wings broadly suffused with gray-brown scales.

EXPANSE: 27 mm.

MALE GENITALIA: Uncus elongate, the sides of the basal portion convex, terminally tapering to the rounded bifurcate apex; arms of gnathos only slightly thickened dorsally, uniting to form median oblong process, with its sides more heavily sclerotized than the central area and with the posterior surface rugose; valves elongate, with terminal portion narrowed; costa sclerotized, with numerous setae along inner half of sclerotized band; valvula with anterior arm very broad at base,

the width being subequal to length of uncus, tapering and curving posteriorly to middle of valve, with posterior arm being very weakly sclerotized and mainly indicated by a fold in the membrane, the spinose apical process arising at the apex of the anterior arm, with the posterior arm joining the basal portion of the apical process, the latter shallowly C-shaped, convex outwardly, with the apex extending posteriorly, subequal in length to the length of the uncus, approximately five times longer than broad, the spines being located terminally and with a few along the inner side, curving towards uncus; sacculus undifferentiated, weakly sclerotized; juxta with broad base, narrowing posteriorly; aedeagus slightly shorter than combined lengths of uncus, tegumen, and saccus, its maximum width slightly greater than base of uncus, anterior end rounded, slightly enlarged medially, then tapering to a blunt sclerotized point, with a weakly sclerotized, rather poorly defined, U-shaped process on dorsal surface, being distinguishable mainly by the more membranous inner area and by the apexes of the arms of the U; vesica armed with a row of approximately six very short, weakly sclerotized spines arising from a corneous area, on left side near apical end.

FEMALE GENITALIA: Ostium without a sclerotized dorsal plate, its position being indicated by a few weak transverse ridges; lateral plates well sclerotized, with a small lateral protuberance extending posteriorly on each side, the posterior margin with rounded lobes on each side of midventral line, and with a transverse ridge extending from the posterior margin near the lateral protuberances medially and then curving anteriorly, leaving a rather wide median area, the lateral areas thus demarcated with a few ridges; ventral plates poorly defined; ductus bursae a short sclerotized collar, which widens into the fused ductus-bursa copulatrix; ductus seminalis arising ventrally just anterior to collar of ductus bursae; bursa copulatrix lightly sclerotized in posterior one-fourth, the surface with a number of short striations, the bursa becoming enlarged and membranous anteriorly, the length of the bursa, measured from the anterior margin of the collar of the ductus bursae, being shorter than the combined lengths of the ovipositor lobes and their apophyses; the

signum weakly stellate, wider than long, in width less than one-half of the length of an ovipositor lobe.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Juan Vinas, Costa Rica, 3000 feet, February, 1925 (G. A. Martin), in British Museum (Natural History); allotype, female, Sixola River, Costa Rica, March, in United States National Museum.

RANGE: Costa Rica. On the wing in February and March.

REMARKS: Unfortunately, the holotype is rather worn, so that the maculation has become obscured. However, as far as can be told, the t. p. line of the primaries above is more strongly represented in this species than in *pusillus*, and the general color of the wings appears to be more of a light gray-brown. The female has the same type of maculation as *pusillus*, but the ochraceous is overlain with dark scales, giving a slightly mottled appearance to this species; in addition, the subterminal line is more strongly represented.

The male genitalia are very distinctive, as this species has the most strongly developed and elongate spinose apical process of the valves in the entire genus. The female genitalia can be separated from those of *pusillus* by the fact that the ostial plate is not sclerotized, by the different shape of the sclerotized lateral plates, and by the shorter bursa copulatrix.

Tornos mistus, new species

Figures 14, 31

MALE: Head, vertex gray-brown, becoming dark brown between antennal bases; front dark brown; palpi dark brown, with scattered gray scales. Thorax ochraceous above, light gray below; legs light gray and brown; tibial hair pencil present on metathoracic legs. Abdomen gray-brown above, with an indistinct dorsal line; light gray below, with traces of subventral and ventral lines; ventral surface of third segment with row of bristles, tending to be deciduous.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown or ochraceous brown, sprinkled with dark brown scales along the costa as far as t. p. line; t. a. line arising on costa one-fourth of distance from base as a dark brown patch, extending

across cell, swinging basally and meeting inner margin at a sharp angle about half as far from base as origin on costa, the t. a. line often becoming obsolescent below cell; median line absent; discal tuft of dark gray scales; t. p. line arising on costa three-fifths of distance from base as a dark brown patch, swinging sharply distally around end of cell, then turning and subparalleling outer margin, meeting inner margin one-half of distance from base, often absent or obsolescent in lower part of wing, with a narrow, grayish white, shade line distally; subterminal line represented by a series of small, light gray, intravenular dots, these sometimes becoming connected opposite cell and above inner angle; a series of small, brown-black, intravenular, marginal spots; fringe concolorous with wing in basal half, slightly paler in distal half. Hind wings concolorous with forewings, the basal portion, as far as extradiscal line, with numerous black-brown scales; basal line present; intradiscal line absent or weakly indicated; discal dot dark brown or black-brown; extradiscal line black-brown, complete, concave between veins, subparalleling outer margin, with prominent grayish white, distal edging; subterminal line light gray, more or less complete, widened in cells M_1 and M_2 , which have some dark scales and a second light-colored patch halfway to t. p. line, and widened again above anal angle; a series of small, brown-black, intravenular, marginal spots, sometimes forming an incomplete marginal line; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous light gray, with scattered brown and gray-brown scales, especially in outer third of wing; costa tending to become grayish ochraceous distally; t. a. line absent; discal dot dark brown, large; t. p. line represented at costa and extending around cell, obsolete in posterior portion of wing; terminal line gray-black, interrupted by veins; fringe as above. Hind wings less heavily overlain with brown scales; discal dot dark brown, large; extradiscal line present in anterior portion of wing; terminal line and fringe as on primaries.

EXPANSE: 19 to 25 mm.; holotype, 24 mm.

FEMALE: Forewings with upper surface broadly suffused with ochraceous, especially

below the cell from base of wing to beyond t. p. line, and again at wing tip; distal portion of forewing dark gray-brown, with a basal extension to discal tuft, and again in cell Cu_2 ; all cross lines obsolescent. Hind wings similar to male, but with outer portion dark gray-brown; extradiscal line indistinct, without distal edging of light gray; an ochraceous patch in cells M_1 and M_2 . Under surface of both wings broadly suffused with gray-brown scales.

EXPANSE: 27 mm.

MALE GENITALIA: Uncus elongate, the sides of the basal portion slightly convex, terminally with slight taper to apex of a single point, the terminal portion being somewhat dorsoventrally flattened; arms of gnathos widest dorsally, slightly constricted medially, united to form median oblong or ovate process, with its posterior surface rugose; valves elongate, with apical portion narrowed; costa rather narrowly sclerotized, with numerous setae along its inner margin; valvula with a single sclerotized arm extending straight up the valve, widest basally, with outer one-half of uniform width, the apex extending posteriorly and curving ventrolaterally and then anteriorly to form the spinose apical process, which is almost twice as long as wide, with its spines located terminally and extending anteriorly and ventrally; sacculus undifferentiated; juxta with median constriction and a central median thickening, widest and more heavily sclerotized posteriorly; aedeagus slightly longer than combined lengths of uncus, tegumen, and saccus, in width slightly narrower than base of uncus, anterior end rounded, with constriction near this end, then slightly increasing in width to median area, which is of equal width, then tapering to bluntly pointed apex, with a rather weakly sclerotized, U-shaped process on dorsal surface, being distinguishable mainly by the more membranous inner area and by the apical portions of the broad arms of the process, terminal portion dorsally with several longitudinal indented striations; vesica without spines, but with a corneous area instead.

FEMALE GENITALIA: Ostium with a weakly sclerotized dorsal plate, indicated mainly by a series of transverse ridges, these becoming angulate anteriorly posteriad of lateral plates;

lateral plates rather weakly sclerotized, broad, with a number of well-spaced striations; ventral plate smoothly sclerotized, roughly triangular in outline, the apex membranous and leading to the ductus bursae; ductus bursae a short sclerotized collar, wider than long, set off on each side by a membranous area; ductus seminalis arising from ventral surface from membranous area anterior to ductus bursae; bursa copulatrix lightly sclerotized in posterior one-fourth, the surface with a number of broad striations, the bursa becoming enlarged and membranous anteriorly, the length of the bursa, measured from the anterior margin of the collar of the ductus bursae, being greater than the combined lengths of the ovipositor lobes and their apophyses, the surface of the entire bursa very finely punctate; the signum strongly stellate, twice as wide as long, the width being slightly more than one-half of the length of the ovipositor lobes.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Buenavista, east Bolivia, July–October, 1906 (J. Steinbach); allotype, female, Sapucay, Paraguay, "3-11-04" (W. Foster). Both types in British Museum (Natural History). Paratypes, 15 males: Rio Yapacani, east Bolivia, 600 meters, February, 1914 (J. Steinbach), two males; Buenavista, east Bolivia, 400 meters, August, 1914 (J. Steinbach), four males; "Prov. del Sara,"

central Bolivia, 400–450 meters, April, 1910, August, 1914, September (J. Steinbach), five males; Rio Suruta, Department of Santa Cruz, Bolivia, 400 meters, May, August (J. Steinbach), four males. Paratypes to be placed in the collections of the British Museum (Natural History), the Carnegie Museum, and the American Museum of Natural History.

RANGE: Bolivia and Paraguay. On the wing in February, April, May, August, and September.

REMARKS: This is the most clearly marked of the species of group IV, as both the t. p. and subterminal lines are usually present. In addition, the former has a narrow shade line that has not been noted on the other species. The female looks very similar to the female of *pusillus* but can be distinguished therefrom by the presence of an ochraceous patch on the secondaries in cells M_1 and M_2 , distad of the extradiscal line.

The male genitalia have the two arms of the valvula united, with the spinose apical process extending anteriorly. Another differentiating character is found in the unarmed vesica, as this is the only species in this group with this character. The female genitalia are larger than those of *pusillus* and *spinosis* and can be distinguished by the subtriangular ostial region, with both the ostial and lateral plates being weakly sclerotized.

GROUP V

The single species assigned to this group has the ductus bursae very long and well sclerotized, with a distinct break between the ductus and the bursa copulatrix. The latter is considerably smaller than the ductus bursae and is membranous. In addition the signum is completely lacking.

The male genitalia have a slender uncus with a single point. The valvula consists of incomplete anterior and posterior arms, these not extending from the base of the valves; the spinose apical process is elongate, with very short spines. The juxta has the basal portion more heavily sclerotized than the re-

mainder. The aedeagus has a slight taper and a weakly sclerotized, dorsal, U-shaped process. The vesica has a single elongate spine arising from a basal corneous area.

Both males and females have a similar pattern on the wings, but the females tend to be more ochraceous. The males have both the tibial hair pencil on the metathoracic legs and a weak row of bristles on the venter of the third abdominal segment.

The species is known only from the southwestern portion of the United States but may occur in northern Mexico.

***Tornos erectarius erectarius* Grossbeck**

Figures 15, 32

Tornos erectarius GROSSBECK, 1909, Canadian Ent., vol. 41, p. 155; 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 404. BARNES AND McDUNNOUGH, 1912, Contributions to the natural history of the Lepidoptera of North America, vol. 1, no. 4, p. 33, pl. 15, fig. 21. W. S. WRIGHT, 1920, Bull. Amer. Mus. Nat. Hist., vol. 42, p. 487.

Tornos scolopacinarius W. S. WRIGHT (not Guéneé), 1920, Bull. Amer. Mus. Nat. Hist., vol. 42, p. 487.

Tornos pimensarius CASSINO AND SWETT, 1923, Lepidopterist, vol. 4, p. 4 (new synonymy).

MALE: Head, vertex cream colored or ochraceous, with dark scales between antennal bases; front slightly swollen, dark brown; palpi variable in color, ranging from cream colored with a few dark scales distally to black-brown with a few creamy scales at base. Thorax creamy or ochraceous, with scattered brown scales above and below; legs concolorous with thorax, tending to be more heavily marked with dark scales, hind tibia of male with hair pencil. Abdomen ochraceous, heavily overlain with dark brown scales above and below, with posterior portions of segments above marked with a few dark scales on both sides of middorsal line, ventral surface of third abdominal segment in male with a weak row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color light gray or light ochraceous, heavily overlain with brown or black-brown scales, the veins tending to be ochraceous; costa with numerous dark striations, these sometimes uniting to form wider bands extending to radial vein; basal line absent; t. a. line rather indistinct, black or brown-black, arising on costa approximately one-fifth of distance from base, going sharply outward to radial vein, then angled posteriorly and running to anal vein, then turning basad to meet inner margin one-fourth of distance from base; median line absent or faintly indicated, diffuse, dark brown; discal tuft of dark gray scales; t. p. line prominent, black, narrow, arising on costa approximately seven-tenths of distance from base, going at right angle to radial vein, swinging outward around cell and then slightly basad to anal vein, then sharply basad to meet inner margin at ap-

proximately one-half of distance from base, the line sometimes slightly thickened on veins and concave between same, and with a narrow white shade line externally; subterminal area shaded with ochraceous scales; subterminal line absent or formed of light gray, lunulate markings in the cells; terminal area concolorous with basal part of wing, with black, intravenular, marginal spots; fringe concolorous with wing, checkered with light gray scales opposite marginal spots. Hind wings concolorous with forewings, anterior portion sometimes not overlain with dark scales and hence appearing contrastingly colored; intradiscal line absent or weakly indicated on anal margin near extradiscal line; discal spot brown-black or black, prominent, elongate; extradiscal line prominent but tending to fade out near costal margin, black or brown-black, paralleling outer margin with rather strong outward projections on veins, concave between, with grayish white shade line externally; subterminal and terminal areas concolorous with basal portion of wing, the former sometimes slightly browner than the latter, with the incomplete whitish s. t. line represented near anal angle, terminal line complete, black; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color light gray, with a few scattered ochraceous and brown scales, these being concentrated in cell and distally; maculation indistinct, with t. a. line absent and with t. p. line represented by dark scales, course as above; discal dot dull brown-black, elongate; area external to t. p. line undifferentiated except for some dark scales near costa, and for small, black, intravenular, terminal dots; fringe checkered, as above. Hind wings concolorous with forewings, with a few scattered dark scales; cross lines absent, although extradiscal line suggested by dark scales on veins; discal spot black-brown, elongate; terminal line weakly indicated; fringe as on forewings.

EXPANSE: 18 to 30 mm.

FEMALE: Like male, except upper surface of wings more suffused with ochraceous scales and with fewer brown and black-brown scales, the ochraceous scales tending to be concentrated in basal area of forewing and in subterminal areas of both wings; under surface

more ochraceous than in male, and with more scattered dark scales.

EXPANSE: 22 to 31 mm.

MALE GENITALIA: Uncus with sides slightly convave or evenly tapering to single point; arms of gnathos widest dorsally, slightly constricted medially, then broadening to form median spatulate enlargement, which is widest at its ventral margin and with its sides more heavily sclerotized than the central area; valves elongate, with terminal portion narrowed; costa narrowly sclerotized, produced medially, with numerous setae along inner margin of sclerotized band; valvula with anterior arm broadly sclerotized basally, occupying approximately the anterior half of the valve near base, then narrowing sharply and turning posteriad and terminating in a heavily sclerotized point, with posterior arm a narrow, band-like sclerotization in posterior half of valve near base extending laterally past sclerotized point of first part of valvula, turning sharply posteriad and forming a prominent sclerotized piece twice as long as wide, terminating in a dense cluster of short spines, and connected basally to the first part of the valvula; sacculus undifferentiated; juxta with anterior one-third and with a short median extension well sclerotized, the posterior portion of equal width and rounded apically; aedeagus slightly longer than combined lengths of uncus, tegumen, and saccus, in width subequal to width of base of uncus, anterior end rounded, slightly tapering posteriorly to a bluntly pointed apex, with weakly sclerotized, U-shaped process medially on dorsal side; vesica armed with a single long spine arising from a basal corneous area.

FEMALE GENITALIA: Ostium with dorsal plate weakly sclerotized, scarcely differentiated; lateral plates heavily sclerotized, somewhat wing-like, extending laterally and posteriorly from small anteromedian sclerotized piece as two side pieces, with median indentation on posterior margin, these side pieces being in an almost vertical plane, tapering at their ends to a point, the surface varying from smooth to having a number of ridges and with the posteroventral margin slightly crenulate; ventral plate lightly sclerotized, rounded anteriorly, subparalleling anterior margin of

lateral plates; ductus bursae elongate, subequal in length to combined lengths of ovipositor lobes and apophyses, sclerotized, with collar-like neck below ostium, increasing in width anteriorly, becoming swollen on left side and dorsally near junction with bursa copulatrix, with numerous longitudinal striations posteriorly, these absent on swollen area and reduced to four or six large ones ventrally on right side; ductus seminalis arising ventrally from ductus bursae below collar; bursa copulatrix rounded, shorter than ductus bursae, extending farther posteriorly on dorsal surface than on ventral, membranous, the surface near junction with ductus bursae rugose; signum absent.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Of *erectarius*, in the American Museum of Natural History; of *pimensarius*, in the Museum of Comparative Zoölogy, Harvard College.

TYPE LOCALITY: Santa Catalina Mountains, Pinal County, Arizona.

RANGE: Southern Arizona. (See fig. 1.) This species has been taken in every month of the year except January, although most records are from April through August.

REMARKS: One hundred and twenty-six specimens examined. Nominate *erectarius* is rather variable in size and color. Specimens taken in midsummer at lower elevations tend to be several millimeters smaller than specimens taken in the spring or fall in the same locality. Examples captured in the spring

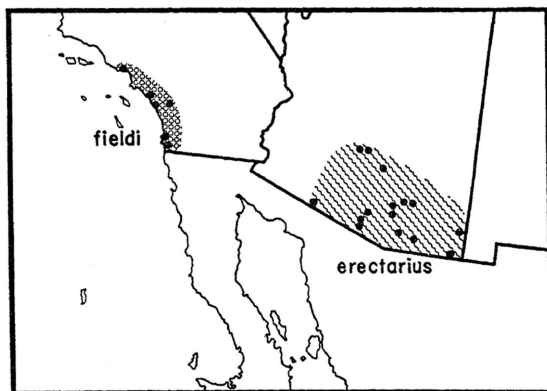


FIG. 1. Distribution of *Tornos erectarius* Grossbeck.

tend to have the wings less heavily suffused with dark scales than fall specimens. The sexes are slightly dimorphic, as the females are more heavily suffused with ochraceous, especially in the basal and subterminal areas of the wings above. In addition, this species can be distinguished from all others by the course of the well-defined cross lines above, which are much nearer together at the inner margin than they are at the costa.

The male genitalia of this species can be distinguished from all other known species in the genus that have the uncus terminating in a single point by the long single spine of the vesica in the aedeagus. The female genitalia are distinct in having the long curving ductus bursae, which gradually increases in width to its junction with the globular bursa copulatrix.

All that remains of the holotype of *pimensarius* Cassino and Swett is the head, thorax, and left secondary, plus the genitalia on slide 1943. A study of the latter shows that this name should be placed in the synonymy of *erectarius*.

***Tornos erectarius fieldi* Grossbeck,
new status**

Tornos fieldi GROSSBECK, 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 404.

MALE: Head, vertex light gray, front ochraceous brown or brown. Thorax and abdomen light gray, with scattered darker scales.

UPPER SURFACE OF WINGS: Forewings, ground color light gray or light ochraceous, with scattered dark brown scales; maculation as in nominate *erectarius*. Hind wings colorous with forewings.

UNDER SURFACE OF WINGS: As in the nominate subspecies.

EXPANSE: 22 to 30 mm.

FEMALE: Like male, except upper surface of wings more suffused with ochraceous scales and with fewer dark brown scales, the ochraceous scaling slightly stronger in basal and subterminal areas of forewings; under surface more ochraceous than in male and with more scattered dark scales.

EXPANSE: 24 to 31 mm.

MALE GENITALIA: As in the nominate subspecies.

FEMALE GENITALIA: As in the nominate subspecies.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In the American Museum of Natural History.

TYPE LOCALITY: San Diego, California.

RANGE: Coastal regions of southern California. (See fig. 1.) On the wing from February through November.

REMARKS: Eighty-three specimens examined. This population represents *erectarius* in the coastal regions of southern California. It is easily distinguished from the Arizona population by the lighter color and more washed-out appearance.

GROUP VI

This species group shows the highest state of development in the genus. The female genitalia are apparently an offshoot from the type found in group IV. The ductus bursae shows a further reduction, so that it has become almost entirely lost. It is still possible to see the remains of the collar-like ductus that is present in group IV, but it is not a distinct entity. The posterior portion of the bursa copulatrix is similar to that of group IV, as it still shows the lightly sclerotized area, usually with some striations, which resulted from the combining of the ductus and the bursa. The remainder of the bursa is mem-

branous, and the signum is either rudimentary or entirely absent.

The male genitalia are also very distinctive. The uncus has a bifurcate tip. The valvula is undifferentiated, as the fused arms have apparently migrated to the lower edge of the valves, or sacculus, and have formed a large, rounded, well-sclerotized arm that extends beyond the margin of the valve. The spinose apical process has apparently expanded so that the spines cover part of the inner and posterior surface. The juxta is tapered posteriorly from a lightly sclerotized base. The aedeagus is tapered or rounded apically, and

has a strong, dorsal, U-shaped process. The vesica is unarmed or has two to three heavy spines.

The wings of both sexes have a similar pattern, but there is a tendency for a more or less strong dimorphism in coloration, as the females tend to be lighter in color than the males. However, this does not hold true for one of the species and it varies within the geographical range of the other two species. In the latter case, it is the male that shows the variability in color of the wings rather than the female, as the males approach the lighter ground color of their opposite sex. These last-mentioned two species, one of them being the type species of the genus, do not have either the tibial hair pencil or the row of bristles on the third abdominal segment, while the one non-dimorphic species has both these structures in the male.

The three included species are known only from that portion of the United States that lies to the east of the one hundredth meridian.

Tornos cinctarius Hulst

Figures 16, 33

Tornos rubiginosarius var. *cinctarius* HULST, 1887, Ent. Amer., vol. 2, p. 192.

Lepiodes scolopacinararia cinctaria, J. B. SMITH, 1891, List of the Lepidoptera of boreal America, p. 71.

Tornos scolopacinaris cinctarius, DYAR, "1902" [1903], Bull. U. S. Natl. Mus., no. 52, p. 323.

Tornos cinctarius, DYAR, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 225. PEARSALL, 1908, Canadian Ent., vol. 40, p. 133. GROSSBECK, 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 404; 1917, *ibid.*, vol. 37, p. 96.

MALE: Head, vertex gray-brown, with dark scales between antennal bases, front dark brown; palpi gray-brown, the scales tipped with dark brown. Thorax gray-brown above and below; legs gray-brown, the tarsi shaded with dark brown, hind tibia of male with hair pencil. Abdomen gray-brown or brown above and below, the posterior margins of segments above narrowly marked with gray and a few dark scales on both sides of middorsal line, ventral surface of third abdominal segment in male with row of bristles.

UPPER SURFACE OF WINGS: Forewings, ground color a unicolorous ochraceous, more

or less heavily overlain with dark brown scales so as to appear mostly dark brown in color; costa with a few slightly darker strigae; basal line absent; t. a. line prominent, black or brown-black, arising on costa approximately one-fourth of distance from base, outwardly oblique to cell, curving sharply basad to meet inner margin approximately one-fifth of distance from base; median line ochraceous or dark brown, broad, diffuse, often incomplete, arising on costa approximately one-half of distance from base, swinging outward through cell, then subparalleling outer margin to inner margin; discal tuft of dark gray scales, some of which are darkened apically; t. p. line prominent, black or brown-black, arising on costa approximately two-thirds of distance from base, broadly curved outward around cell and then slightly basad to cell Cu_2 , with an outward projection on anal vein, then basad again to inner margin, the line sometimes thickened slightly on the veins, and with a narrow white shade line externally, sometimes with scattered whitish scales inside of t. p. line opposite cell and in cell Cu_2 ; subterminal area rather heavily shaded with dark brown; subterminal line white, incomplete, appearing as lunulate intravenular spots, with the spot in cell Cu_2 being the largest and sometimes shaded with dark scales basally; terminal area concolorous with subterminal area or slightly lighter, with small black, intravenular, marginal spots; fringe concolorous with wing. Hind wings concolorous with forewings, with scattered brownish black scales in basal portion of wing; intradiscal line brown-black, tending to be rather broad and diffuse, fading out in anterior part of wing, running more or less straight across wing and curving to meet anal margin; discal spot prominent, black-brown, in shape an elongate ellipse; extradiscal line prominent, black-brown, complete, roughly paralleling outer margin with outward projections on veins, concave between, with grayish white shade line externally, this latter usually wider than extradiscal line; subterminal and terminal areas concolorous with basal portion of wing or slightly browner, with the whitish s. t. line represented near anal angle, occasionally with a faint dark terminal line; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings, ground color light gray, more or less heavily overlain with ochraceous and dark brown scales, the latter concentrated in basal part of cell and posterior thereto; maculation indistinct, with t. a. line absent and with t. p. line represented by dark scales, course as above; discal dot dull black, elongate; area external to t. p. line undifferentiated except for some dark scales near costa; fringe as above. Hind wings concolorous with forewings, more or less evenly overlain with dark brown scales, these being concentrated to form intradiscal and extradiscal lines, in course as on superior surfaces; discal spot black-brown, long, and very narrow; subterminal line incompletely indicated by dark scales; fringe as on forewings.

EXPANSE: 22 to 28 mm.

FEMALE: Like male.

EXPANSE: 24 to 29 mm.

MALE GENITALIA: Uncus with sides evenly tapering to strongly bifurcate apex; arms of gnathos widest dorsally, tapering ventrally, median spatulate enlargement rounded, rugose; valves with costa well sclerotized, concave medially, subequal in width, and with numerous setae distally and along inner margin of sclerotized band; valvula undifferentiated; sacculus well sclerotized, inner and dorsal surfaces with numerous short spines, prominently swollen one-half of distance from base and terminally, with small blunt projection near base pointing posteriad; juxta with transverse fold near anterior end, of even width, rounded apically; aedeagus subequal in length to combined lengths of uncus, tegumen, and saccus, subequal in width to base of uncus, of equal width throughout with anterior end rounded, posterior end bluntly pointed, dorsal surface with U-shaped process posterior to middle of aedeagus, ventral surface near posterior end with many fine, longitudinal, impressed striae; vesica armed with two prominent, superimposed spines, one large and the other smaller, both with broadly swollen bases.

FEMALE GENITALIA: Ostium with dorsal surface weakly sclerotized, rounded posteriorly; ventral surface more heavily sclerotized, extending laterally as broad plate, the posterior margin usually with a pair of out-

ward pointing projections midway between the ostium and outer angle of plate, the sides of the plate anterior of the outer angle tapering medially and fusing with the broad antero-ventral plate, the latter with its anterior margin broadly rounded; ductus bursae not clearly differentiated from bursa copulatrix, with a collar-like neck indicated below ostium; ductus seminalis arising ventrally from ductus bursae near ostium; bursa copulatrix very long and slender, almost twice the combined lengths of the ovipositor lobes and their apophyses, posterior one-third to one-half sclerotized, the surface with several striations, the bursa membranous and slightly swollen anteriorly, the surface tending to be rugose; signum absent.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In the American Museum of Natural History.

TYPE LOCALITY: None given in original description, but the type specimen is labeled Florida.

RANGE: Florida to North Carolina. (See fig. 2.) On the wing from December through February, April, May, and August.

REMARKS: Twenty-one specimens examined. This species does not have the sexual

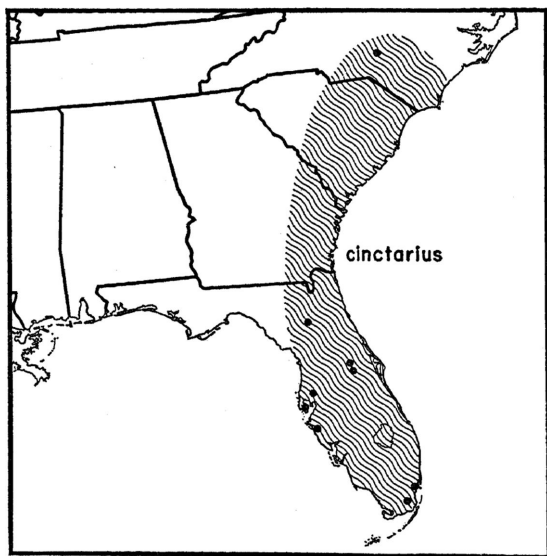


FIG. 2. Distribution of *Tornos cinctarius* Hulst. This species has also been recorded in the literature from Georgia.

dimorphism found in the two other species in this group, so it can be distinguished from them on that fact alone. In addition, its dark brown color, with the prominent black t. a. and t. p. lines, and the bristle tuft of the third abdominal segment and the tibial hair pencil of the males are characters that separate *cinctarius* from *scolopacinaris* and *abjectarius*.

The male genitalia are similar to those of the other species in this group, but are quite distinctive. In this species, the aedeagus is bigger than in the others, enlarged basally, the dorsal U-shaped process is small but the arms are fairly well sclerotized, and the vesica is armed with two superimposed spines with broadly swollen bases. In addition, the sacculus is much more swollen apically than in the other two species. The female genitalia are distinguished by the elongate and sclerotized ductus bursae, which is slightly shorter than the combined lengths of the ovipositor lobes and apophyses, and by the elongate bursa copulatrix.

The specimen on which Pearsall (1908, p. 133) based his description of the male is in the collection of the American Museum of Natural History and bears the label "Type ♂." As Grossbeck has already pointed out (1912, p. 404), this specimen cannot be a type but is a plesiotype.

Tornos scolopacinaris scolopacinaris
(Guenée)

Figures 17, 34

Lepiodes scolopacinaris GUENÉE, 1857, Histoire naturelle des insectes, vol. 10, p. 360. WALKER, 1862, List of the specimens of lepidopterous insects in the . . . British Museum, pt. 24, p. 1250. PACKARD, 1876, A monograph of the geometrid moths . . . of the United States, p. 565. J. B. SMITH, 1891, List of the Lepidoptera of boreal America, p. 71.

Tornos scolopacinaris, HULST, 1896, Trans. Amer. Ent. Soc., vol. 23, p. 351. BARNES AND McDUNNOUGH, 1912, Psyche, vol. 19, p. 16. BRITTON, 1920, State Geol. and Nat. Hist. Surv. Bull., Connecticut, no. 31, p. 118. BARNES AND BENJAMIN, 1928, Pan-Pacific Ent., vol. 4, p. 133. FORBES, 1928, in Leonard, Cornell Univ. Agr. Exp. Sta. Mem. 101, p. 602; 1948, Cornell Univ. Agr. Exp. Sta. Mem. 274, p. 52. BRIMLEY, 1938, Insects of North Carolina, p. 290. JERREL AND JAQUES, 1944, Proc. Iowa Acad. Sci., vol. 51,

p. 465. TIETZ, 1952, The Lepidoptera of Pennsylvania, p. 136.

Tornos scolopacinaris, GROSSBECK, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 342; 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 402, fig. 13 (male genitalia); 1917, *ibid.*, vol. 37, p. 96. PEARSALL, 1908, Canadian Ent., vol. 40, p. 133.

Tephрина? pervelata WALKER, 1862, List of the specimens of Lepidopterous insects in the . . . British Museum, pt. 26, p. 1760. PACKARD, 1876, A monograph of the geometrid moths . . . of the United States, p. 276. HULST, 1895, Ent. News, vol. 6, p. 105.

Cymatophora pervelata, DYAR, "1902" [1903], Bull. U. S. Natl. Mus., no. 52, p. 314.

Tornos pervelata, BARNES AND McDUNNOUGH, 1917, Check list, p. 116 (synonymy).

Tornos rubiginosus MORRISON, 1875, Proc. Boston Soc. Nat. Hist., vol. 17, p. 218. PEARSALL, 1908, Canadian Ent., vol. 40, p. 133. GROSSBECK, 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 402.

Tornos rubiginosus (sic), GROTE, 1882, New check-list of North American moths, p. 48. HULST, 1895, Ent. News, vol. 6, p. 103.

Lepiodes rubiginosus (sic), J. B. SMITH, 1891, List of the Lepidoptera of boreal America, p. 71.

Tornos rubiginosaria (sic), PACKARD, 1876, A monograph of the geometrid moths . . . of the United States, p. 214, pl. 9, fig. 39 (adult), pl. 13, figs. 3, 3a (larva, pupa). GUMPPENBERG, 1896, Nova Acta Deutschen Akad. Naturf., Halle, vol. 65, p. 310.

Tornos rubiginosarius (sic), HULST, 1887, Ent. News, vol. 3, p. 11 (synonymy).

Tornos rubiginosarius var. *abjectarius* HULST, 1887, Ent. Amer., vol. 2, p. 192 (*partim*).

Tornos kerrvillaria CASSINO AND SWETT, 1922, Lepidopterist, vol. 3, p. 188 (*partim*).

Tornos calcasiana CASSINO AND SWETT, 1923, Lepidopterist, vol. 4, p. 2 (*partim*).

Tornos piazzata CASSINO AND SWETT, 1923, Lepidopterist, vol. 4, p. 3. BARNES AND BENJAMIN, 1928, Pan-Pacific Ent., vol. 4, p. 133 (synonymy).

MALE: Head, vertex gray-brown or ochraceous, with dark scales between antennal bases, front gray-brown, with scattered dark brown scales; palpi gray-brown. Thorax gray-brown or ochraceous above, gray-brown below; legs gray-brown, hind tibia without hair pencil. Abdomen gray-brown above and below, with a pair of subdorsal black spots on posterior margins of segments above; ventral surface of third abdominal segment without row of bristles.

UPPER SURFACE OF WINGS: Forewings elongate and narrow, the ratio of the length of the costa to the length of the outer margin being approximately 2/1; ground color a unicolorous gray-brown, lightly sprinkled with darker scales, becoming darker near outer margin; costa with slightly darker bands or spots; basal, t. a., and median cross lines obsolete, rarely indicated by a few dark scales; discal tuft of dark gray scales that are black-brown apically; t. p. line weakly indicated, arising from gray-brown patch on costa three-fourths of distance from base, its course being indicated by an indistinct gray band and by a few brown-black scales on the veins in the upper half of wing, swinging outward opposite cell, turning and subparalleling outer margin; subterminal area lightly shaded with brown or red-brown; subterminal line light gray, faint, extending from dark patch on costa that extends distally from subterminal area, complete or interrupted by the veins, paralleling outer margin into cell Cu_2 , then swinging outward towards outer angle; terminal area dark gray, with small, brownish black, intravenular, marginal spots, or an incomplete terminal line; fringe concolorous with wing in basal half, slightly paler in distal half. Hind wings concolorous with forewings, but somewhat more heavily overlain with pale brown scales; intradiscal line absent or weakly indicated on anal margin; discal dot obsolescent or weakly suggested; extradiscal line formed of scattered brown scales, complete or partially obsolescent, roughly paralleling outer margin; area beyond this slightly lighter in color than, or concolorous with, basal portion of wing, becoming suffused with brown or reddish brown exteriorly, forming an indefinite band across wing; subterminal line suggested by a few light gray scales bounding the brown or reddish brown subterminal band; terminal area dark gray, with a more or less complete terminal line; fringe as on primaries, with white scales in the intravenular spaces.

UNDER SURFACE OF WINGS: Forewings, ground color a unicolorous gray-brown, with scattered brown scales; all cross lines usually absent, rarely indicated on costa by dark patches; discal dot weakly indicated by dark gray scales; costa near apex with darkened

area; terminal spots or line weakly indicated; fringe as above. Hind wings slightly lighter gray than forewings, evenly dusted with gray-brown and dark brown scales; discal dot, extradiscal and subterminal lines weakly indicated; terminal line and fringe as on forewings.

EXPANSE: 21 to 29 mm.

FEMALE: Thorax and abdomen tending to be lighter colored than in the male, with the double row of brown and black spots down the dorsal surface of abdomen more prominent, and with brown and black spots on lateral surfaces near thorax and distally.

UPPER SURFACE OF WINGS: Forewings, ground color white or creamy, with scattered ochraceous and dark brown scales and striations; maculation as in male but tending to be more completely represented and appearing more prominent owing to lighter ground color; subterminal area yellow-brown or reddish brown; terminal area gray-brown or gray-black, the veins a contrasting yellowish or reddish brown. Hind wings concolorous with forewings, but more heavily dusted with gray-black or dark brown scales; maculation as in male but better defined.

UNDER SURFACE OF WINGS: Ground color cream or light gray, more or less heavily overlain with dark scales and striations; maculation as in male but better defined; subterminal area varying from a contrasting yellowish brown, this color continuing distally on veins to margin, to a poorly defined darker brown area. Hind wings concolorous with forewings, heavily overlain with dark scales and striations; maculation as in male.

EXPANSE: 23 to 30 mm.

MALE GENITALIA: Uncus with sides evenly tapering to bifurcate apex; arms of gnathos widest dorsally, tapering ventrally, median spatulate enlargement with slight constriction dorsally, rounded apically, rugose; valves with costa well sclerotized, slightly concave medially, slightly swollen and with numerous setae distally; valvula undifferentiated; sacculus well sclerotized, the right side being longer and broader and with apex blunter than left side, inner surface with numerous short spines, both valvulae becoming slightly wider distally, with strong, tooth-like projection near base pointing posteriad; juxta

with median fold near anterior end, slightly swollen medially, rounded apically; aedeagus subequal in length to combined length of tegumen and saccus, subequal in width to base of uncus, anterior end rounded, with a slight constriction just posteriad thereof, widest medially, with posterior half tapering to a blunt point, ventral surface extending farther posteriad than dorsal surface, the latter with lightly sclerotized, U-shaped process just posterior to middle of aedeagus, the arms parallel and subequal in length to length of uncus, ventral surface of posterior one-third of aedeagus with numerous longitudinal, impressed striae; vesica unarmed.

FEMALE GENITALIA: Ostium surrounded by sclerotized plates, dorsally with median V-shaped indentation, laterally with several ridges running towards ostium, posterior margin irregular; ventrally more heavily sclerotized and more complex than dorsal plate, extending laterally in a ventroposterior plane from narrow, weakly sclerotized, median region, widest medially and more or less evenly tapering posteriorly, fused with dorsal plate along dorsal margin, with a second heavily sclerotized strip anterior to the first, extending laterally in a more or less vertical plane, and curving posteriad laterally to unite with dorsal plate; the two ventral plates united with a more lightly sclerotized plate ventrally, this extending anterior of the second sclerotized strip a distance slightly greater than the distance between the first ventral plate and the sclerotized strip, broadly rounded laterally and indented medially; ductus bursae extremely short, membranous; ductus seminalis arising ventrally from posterior portion of bursa copulatrix near ductus bursae; bursa copulatrix elongate, longer than combined lengths of ovipositor lobes and their apophyses, slightly increasing in width anteriorly, with distal end more or less truncate, posterior end lightly sclerotized and with from five to 10 longitudinal striations, the remainder of bursa membranous; with small indented signum near anterior end, this sometimes variously reduced or absent.

EARLY STAGES: All the larval instars have been described by Barnes and McDunnough (1912, p. 16), and in addition the caterpillar

and pupa have been figured by Packard (1876, pl. 13, figs. 3, 3a). The eggs are undescribed, and the structures of the pupae are described above. The mature caterpillar, according to Barnes and McDunnough, is reddish brown to deep brown, granulate in appearance, with indistinct dorsal and subdorsal stripes, with V-shaped, pale yellowish marks on the legless abdominal segments, the apex of the V pointing backward. They feed principally on the flower heads (A. Wyatt, *in litt.*).

FOOD PLANTS: *Coreopsis auriculata* Linnaeus and *C. grandiflora* Hogg (Gumppenburg, 1896, p. 310, based on Abbot's manuscript); aster (Barnes and McDunnough, 1912, p. 17); *Aster multiflorus* Aiton (A. Wyatt, *in litt.*).

TYPES: Of *scolopacinaris*, male and female, in United States National Museum, and the male is hereby designated as the lectotype; of *pervelata*, lost; of *robiginosus* and *piazata*, in the Museum of Comparative Zoölogy, Harvard College. The male specimen of *robiginosus* with the author's genitalic preparation of August 19, 1952, is hereby designated as the lectotype.

TYPE LOCALITIES: "Etats-Unis d'Amérique" (*scolopacinaris*); Georgia (*pervelata*); Waco, Texas (*robiginosus*); Lake Charles, Louisiana (*piazata*).

RANGE: The eastern half of the United States, from Long Island, southern Connecticut (Britton, 1920), southern Pennsylvania, and southern Wisconsin south to Georgia and Texas and west to central Texas, Oklahoma, and Kansas. (See fig. 3.) On the wing every month of the year in the south and during the summer months in the north.

REMARKS: Three hundred and forty-five specimens examined. This species and *abjectarius* Hulst are unique in this group in having sexual dimorphism in the color of the wings and, in the males, by lacking both the bristle tuft on the ventral surface of the third abdominal segment and the tibial hair pencil. The male genitalia of these two species, plus *cinctarius* Hulst, are easily distinguished from those of all the other known species in the genus by the combination of a bifurcate uncus, the undifferentiated valvula, and by the elongate sclerotized sacculus.

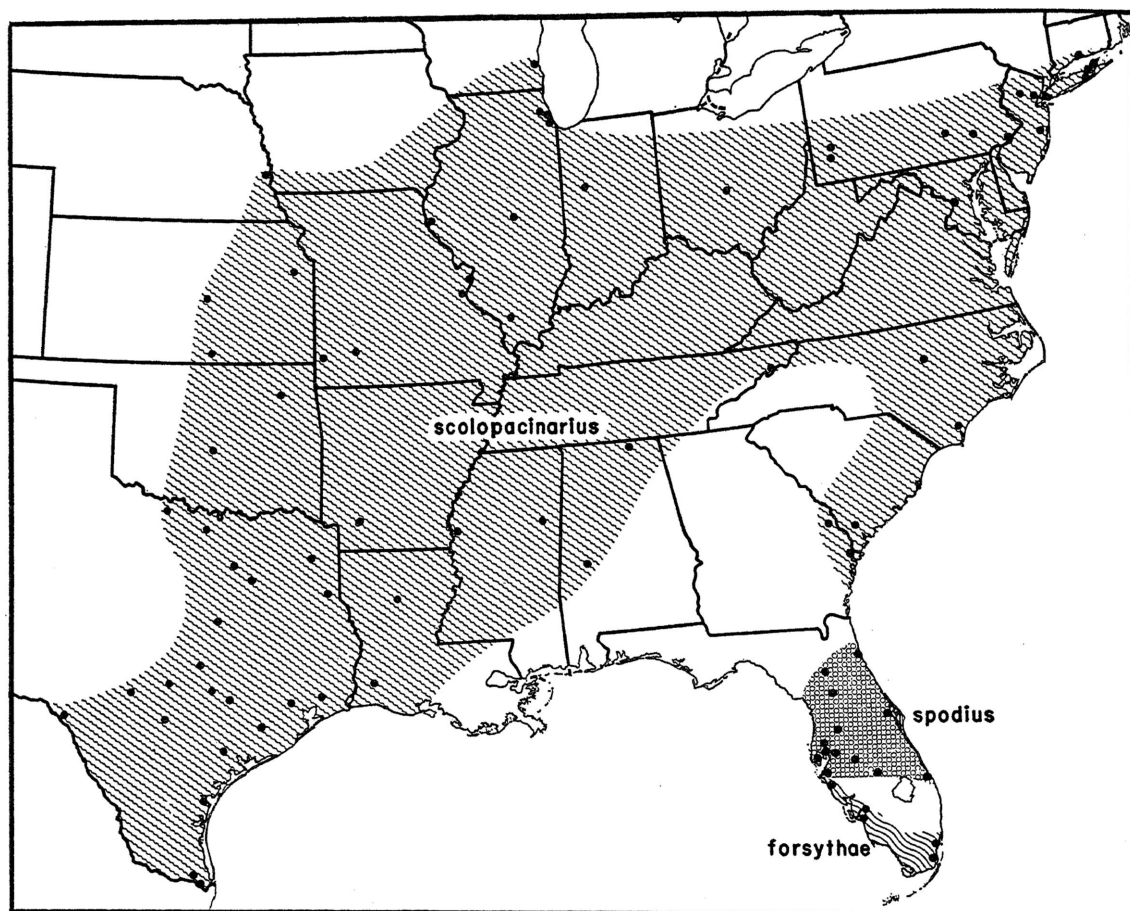


FIG. 3. Distribution of *Tornos scolopacinaris* (Guenée). Specimens have also been examined from Virginia and Mississippi, without additional data, and recorded in the literature from Iowa.

Hence it can be seen that *scolopacinaris* and *abjectarius* form a small, easily recognized section of the genus and are connected to the remaining and larger section by *cinctarius*, which has the male genitalia of the typical section but the bristle tuft and hair pencil of the remainder.

The species is fairly constant in size, color, and maculation in the northern portion of its range. It shows a tendency to become somewhat variable in the south, requiring the separation of Florida specimens from the nominate subspecies. The geographical boundary or zones of overlap between typical *scolopacinaris* and the northern Florida subspecies are unknown as yet, owing to lack of material. Specimens from Texas and the

other southern states are inclined to show more variation than more northerly specimens and, as they can easily be confused with *abjectarius*, extreme care should be taken when doing identification work. The only sure method of separating these two species is by making genitalic preparations.

***Tornos scolopacinaris* *spodius*, new subspecies**

Tornos scolopacinaris, GROSSBECK, 1917, Bull. Amer. Mus. Nat. Hist., vol. 37, p. 96 (*partim*).

MALE: Head, vertex whitish gray to ochraceous; front and palpi ochraceous, with scattered dark brown scales.

UPPER SURFACE OF WINGS: Forewings creamy or whitish gray, overlain with ochraceous scales, and with scattered dark brown

scales, becoming dark gray or gray-black near outer margin; cross lines obsolete, the t. a. and t. p. lines sometimes weakly represented by a few dark scales on costa, and rarely the t. p. line by a few scattered dark scales across wing; median cross line usually absent, rarely indicated by indistinct broad shade line; subterminal area reddish brown, narrow, sometimes partially obsolete; subterminal line light gray, usually complete and distinct, running from apical area to outer angle; terminal area dark gray or gray-black except at apex, being interrupted by the ochraceous veins; marginal spots black. Hind wings concolorous with forewings, with area from base of wing to extradiscal line tending to be more heavily overlain with dark brown scales; discal dot distinct, dark brown; extradiscal line distinct, sometimes weakly represented, with outwardly projecting teeth on veins; subterminal and terminal areas reduced in width, usually separated by an indistinct light gray, subterminal line.

UNDER SURFACE OF WINGS: Ground color a unicolorous light gray-brown, heavily overlain with dark gray and brown scales; all veins ochraceous or pale reddish brown; subterminal area of both wings weakly defined, with terminal area darkened.

EXPANSE: 24 to 29 mm.; holotype, 28 mm.

FEMALE: Body and wings tending to be whiter than male, more heavily suffused with dark scales, and with cross lines more prominent, the median cross line sometimes being quite broad; subterminal area narrower and tending to be a darker brown than in male, and terminal area slightly darker. Hind wings heavily dusted with dark scales basally, with markings tending to be better defined. Under surface as in male, but more suffused with brown and ochraceous scales, and maculation tending to be better defined.

EXPANSE: 26 to 29 mm.; allotype, 29 mm.

MALE GENITALIA: As in the nominate subspecies, but approximately one-fifth larger; sacculus with both sides tending to be more elongate and extending farther laterad of valvula.

FEMALE GENITALIA: As in the nominate subspecies, but larger.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, St. Petersburg, Florida, March 8, 1914, and allotype, female, Florida (Mrs. A. T. Slosson); in the American Museum of Natural History. Paratypes, 14 males and 22 females, all from Florida: same data as holotype, various dates in January, February, March, September, and October, eight males and seven females; St. Augustine, one male; Dade City, August, one male; Gainesville, Alachua County, February 25, 1953 (C. P. Kimball), one female; Short Wave Station, University of Florida campus, Gainesville, August 30, 1945, one female; Stemper, one male; Ocala, February 17, 1918, one female; Lutz, September 4, 1917, two females; Fort Meade, December, 1923, one female; Archbold Biological Station, Lake Placid, July 15-31, 1948 (A. B. Klots), one female; Bradentown, April 9, 1915, one female; Tampa, September 20, 1944 (V. K. Wyatt), one female; Port Sewall, Martin County, January 11-15, 1950 (L. J. Sanford), one female; Florida (Mrs. A. T. Slosson), three males and five females, and others without additional data, one of these dated September 26 (Engel collection). Paratypes to be distributed as follows: the American Museum of Natural History; the Carnegie Museum; the Museum of Comparative Zoology, Harvard College; the United States National Museum; the California Academy of Sciences; the University of Florida; and the collection of C. P. Kimball.

RANGE: Central Florida. (See fig. 3.) On the wing in every month except May and June.

REMARKS: Thirty-eight specimens examined. The light-colored males have been known for many years, but apparently no one has recognized that they appear to form a subspecific population restricted to Florida. Grossbeck (1907, Trans. Amer. Ent. Soc., vol. 33, p. 342; 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 402) mentions the light-colored males from Florida, but we cannot definitely be certain that he had this species before him, so these references can be only tentatively referred to this species. The differentiating character is best shown in the males, as they approach the females in the coloration of the wings, while in nominate *scolopacinaris* the males are much darker in

color than the females. The terminal area of both wings above, but more particularly the forewings, in this population are as dark as or darker than the terminal area of the nominate subspecies, and so *spodius* appears to have its wings more contrastingly marked. The females of this Florida population are similar to the females of the nominate subspecies, but tend to have the terminal area of the forewings above darker and more contrasting. Some of the females from the interior portion of Florida appear darker than the corresponding females from the coastal regions; unfortunately, no males have been seen from this area. These females [Fort Meade (December), Gainesville (February), and, to a lesser extent, Archbold Biological Station (July) and Ocala (February)] are rather heavily suffused with dark scales and, as a result, appear different from the others. On the other hand, a single female from Gainesville (August) is not nearly so heavily suffused and agrees quite well with the balance of the series. Much more accurately dated material caught throughout the flight period of this subspecies is needed before an answer to the problem of possible seasonal dimorphism can be given.

The geographical limits of this subspecies are as yet unknown, as virtually no material from Georgia and Alabama is available. Walker described *pervelata* from Georgia, but according to the original description he probably had a dark male of the nominate subspecies. The southern limit of distribution is similarly unknown. Unfortunately, the four records that are most southerly are represented by single females. As mentioned above, the best diagnostic characters are found in the males, so these records can possibly be in error owing to confusion with the following subspecies.

***Tornos scolopacinaris forsythae*, new subspecies**

MALE: Head, vertex light gray or ochraceous; front and palpi with mixed brown and gray scales.

UPPER SURFACE OF WINGS: Forewings gray-brown, overlain with ochraceous scales and scattered dark brown scales, becoming dark gray near outer margin; t. a. and t. p. cross lines indicated by dark scales on veins,

sometimes partially obsolete; median shade line often complete, sometimes weakly represented; the area between the median shade and to just laterad of t. p. line lighter in color than median portion of wing; subterminal area lightly shaded with dull reddish brown, filling most of the space between t. p. and subterminal lines; subterminal line light gray, distinct, running from apical area to outer angle; terminal area dark gray, the apical portion lightly dusted with light gray scales; marginal spots black. Hind wings concolorous with forewings, with area from base of wing to extradiscal line tending to be more heavily overlain with dark brown scales; discal dot distinct, dark brown; extradiscal line distinct, strongly concave between veins; area bordering extradiscal line distally light gray, contrasting with basal portion of wing, rather broad, merging with narrower dull brown, subterminal band; subterminal line light gray, sometimes indistinct; terminal area as on primaries, but slightly narrower.

UNDER SURFACE OF WINGS: Ground color a unicolorous gray-brown, heavily overlain with dark gray and brown scales; veins lightly marked with ochraceous; subterminal areas of both wings lighter in color than remainder of wing, and terminal area heavily shaded with gray.

EXPANSE: 23 to 26 mm.; holotype, 25 mm.

FEMALE: Body and wings whiter than in male, the maculation appearing more prominent owing to lighter ground color, which, on the wings above, is a white or creamy white; maculation fairly distinct as in male, but subterminal line more prominent and terminal area darker, the latter being interrupted by the ochraceous veins. Hind wings heavily dusted basally with dark scales, with markings tending to be better defined. Under surface as in male, but lighter in color and more suffused with brown and ochraceous scales, with maculation better defined, and with veins ochraceous.

EXPANSE: 25 to 28 mm.; allotype, 25 mm.

MALE GENITALIA: As large as in *scolopacinaris spodius*, but with the sacculus shorter, as in nominate *scolopacinaris*.

FEMALE GENITALIA: As in *scolopacinaris spodius*.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Florida City, Florida, April 27, 1938 (Mrs. L. E. Forsyth), and allotype, female, same data and collector, May 26, 1938; both *ex* collection G. H. and J. L. Sperry, and in the American Museum of Natural History. Paratypes, 19 males and nine females, all from Florida: same data as types, April 27, 1938, May 1, 1938, June 4-8, 1937, November 10-23, 1938-1941, December 5, 1936, 10 males and two females; Miami, June 15, 1937, July 22-31, August 1-7, October 18, 1938 (Mrs. Forsyth), five males and three females; Dade County, March, 1949, one female; Bonita Springs, March 20, 1939, December 31, 1938 (E. C. Blaicher), two males; Fort Myers, May 1-7, one male and two females; Sarasota, April 24, 1953 (C. P. Kimball), one male and one female. Paratypes to be distributed as follows: the American Museum of Natural History; the United States National Museum; the Carnegie Museum; the Museum of Comparative Zoölogy, Harvard College; and the collections of John L. Sperry, Otto Buchholz, and C. P. Kimball.

RANGE: Southern Florida. (See fig. 3.) On the wing in every month except January, February, and September.

REMARKS: Thirty specimens examined. This subspecies superficially resembles nominate *scolopacinaris* more than the adjacent Florida population of *spodius*. This southern Florida population shows a much more definite sexual dimorphism, with the maculation being better defined than in *spodius*. From nominate *scolopacinaris*, *forsythae* has a lighter ground color with a more mottled and contrasting appearance to the wings, the maculation is better defined, and the extradiscal line of the secondaries above is more dentate and is shaded outwardly by a usually prominent, light-colored area. This subspecies has a smaller alar expanse than *spodius*; a series of 12 males of *forsythae* average 24.4 mm., while 12 males of *spodius* average 26.75 mm. In comparison, a random set of 12 males of nominate *scolopacinaris* from Texas averages 24.3 mm. in expanse. The females are similar to those of *spodius* but tend to have the maculation better defined.

The specimens from Dade County are

fairly uniform in color and markings, although there is some variation in the degree to which the cross lines are indicated. The three males from Lee County tend to be a trifle lighter in color, with the maculation not quite so strongly indicated as in the type; they agree in the darker ground color of the wings and small size. One or two of the paratype males of *spodius* from St. Petersburg show a darkening of the typical ground color and thus begin to approach *spodius* in this respect; however, they have the obsolete maculation and larger size that is found in *spodius*. Somewhere between these two specific localities, as well as anywhere else across the state of Florida, an area of hybridization or overlap may occur; more material is needed before this question can be answered.

Tornos abjectarius abjectarius Hulst

Figures 18; 35

Tornos rubiginosarius var. *abjectarius* HULST, 1887, Ent. Amer., vol. 2, p. 192.

Lepiodes scolopacinaris abjectaria, J. B. SMITH, 1891, List of the Lepidoptera of boreal America, p. 71.

Tornos abjectarius, HULST, 1896, Trans. Amer. Ent. Soc., vol. 23, p. 351. GROSSBECK, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 342 (synonym of *scolopacinaris*); 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 402.

Tornos kerrvillaria CASSINO AND SWETT, 1922, Lepidopterist, vol. 3, p. 188. BARNES AND BENJAMIN, 1928, Pan-Pacific Ent., vol. 4, p. 133 (synonym of *scolopacinaris*). (New synonymy.)

Tornos keerrvillaria (sic), CASSINO AND SWETT, 1923, Lepidopterist, vol. 4, p. 5.

MALE: Head, vertex gray-brown or ochraceous, with dark scales between antennal bases, front dark gray-brown or brown; palpi gray-brown. Thorax ochraceous above, gray-brown below; legs gray-brown, hind tibia without hair pencil. Abdomen above ochraceous, with brown scaling and with a pair of subdorsal black spots on posterior margins of segments, beneath gray-brown or ochraceous, with an incomplete brown ventral stripe; ventral surface of third abdominal segment without row of bristles.

UPPER SURFACE OF WINGS: Forewings long and broad, the ratio of the length of the

costa to the length of the outer margin being approximately $5/3$; ground color a unicolorous ochraceous or light gray-brown, with scattered dark brown scales, becoming slightly darker near outer margin; costa with darker bands or spots; basal line absent; t. a. line weakly indicated by darker scales, these often being concentrated on the veins, arising on costa one-fourth of distance from base, going outwardly oblique to radial vein, swinging sharply posteriad and subparallel-ing outer margin to anal vein, then swinging basad to meet inner margin; median cross line absent, or rarely weakly indicated in lower portion of wing; discal tuft of gray scales that are black-brown apically; t. p. line usually complete, usually being indicated by concentrations of dark scales on the veins, the t. p. line thus appearing as a series of fairly prominent dots, arising on costa approximately two-thirds of distance from base, swinging outward around cell, with a small basal bend in cell Cu_2 , then outward again to anal vein; subterminal area of ground color, or suffused with ochraceous, subterminal line usually absent, rarely weakly indicated by a few light gray scales; terminal area gray-brown, with small, brownish black, intravenular, marginal spots; fringe concolorous with wing in basal half, slightly paler in distal half. Hind wings concolorous with forewings, tending to be somewhat more heavily overlain with dark scales; intradiscal line absent or weakly indicated on anal margin; median line slightly stronger than intradiscal line, sometimes extending almost to discal dot; discal dot present, weakly indicated; extradiscal line usually complete, dark brown, roughly paralleling outer margin, concave between the veins, often shaded exteriorly by a narrow contrasting band; subterminal and terminal areas as on primaries, with a dark mark at anal angle, and with a more or less complete terminal line; fringe as on primaries.

UNDER SURFACE OF WINGS: Forewings a unicolorous gray-brown, with scattered brown scales; all cross lines usually absent, rarely indicated on costa by dark patches; discal dot weakly indicated by dark gray scales; costa near apex often with darkened area; terminal spots weakly indicated; fringe

as above. Hind wings slightly lighter gray than forewings, evenly dusted with gray-brown and dark brown scales; discal dot and extradiscal line usually indicated; terminal line and fringe as on forewings.

EXPANSE: 20 to 28 mm.

FEMALE: Thorax and abdomen tending to be slightly lighter in color than the male.

UPPER SURFACE OF WINGS: Forewings, ground color ochraceous or creamy, more or less overlain with brown scales; maculation as in male, but tending to be slightly more weakly represented; subterminal area yellow-brown; subterminal line often better defined than in male, appearing as a series of light gray, intravenular dots; terminal area gray-brown or gray-black, except at apex of wing, which is paler, with the veins concolorous. Hind wings concolorous with forewings, but more heavily dusted with gray-black or dark brown scales; maculation as in male.

UNDER SURFACE OF WINGS: As in male.

EXPANSE: 22 to 30 mm.

MALE GENITALIA: Uncus with sides tapering to bifurcate apex; arms of gnathos widest dorsally, tapering ventrally, median spatulate enlargement without dorsal constriction, rounded or bluntly tapering apically, rugose; valves with costa well sclerotized, slightly concave medially, slightly swollen or not enlarged distally, with numerous setae; valvula undifferentiated; sacculus well sclerotized, symmetrical, of more or less even width throughout, inner surface with numerous short spines, with minute needle-like projection near base pointing posteromedially; juxta with median fold near anterior end, slightly swollen medially, rounded apically; aedeagus slightly longer than combined length of tegumen and saccus, subequal in width to base of uncus, anterior end truncate or bluntly rounded, with slight constriction just posteriad thereof, widest medially, with posterior half tapering to a blunt point, ventral surface extending farther posteriad than dorsal surface, the latter with prominent, heavily sclerotized, U-shaped process just posteriad of middle of aedeagus, the arms with rough edges and curving outward at distal end, being slightly longer than length of uncus, ventral surface of posterior one-third of aedeagus with a few weak, longi-

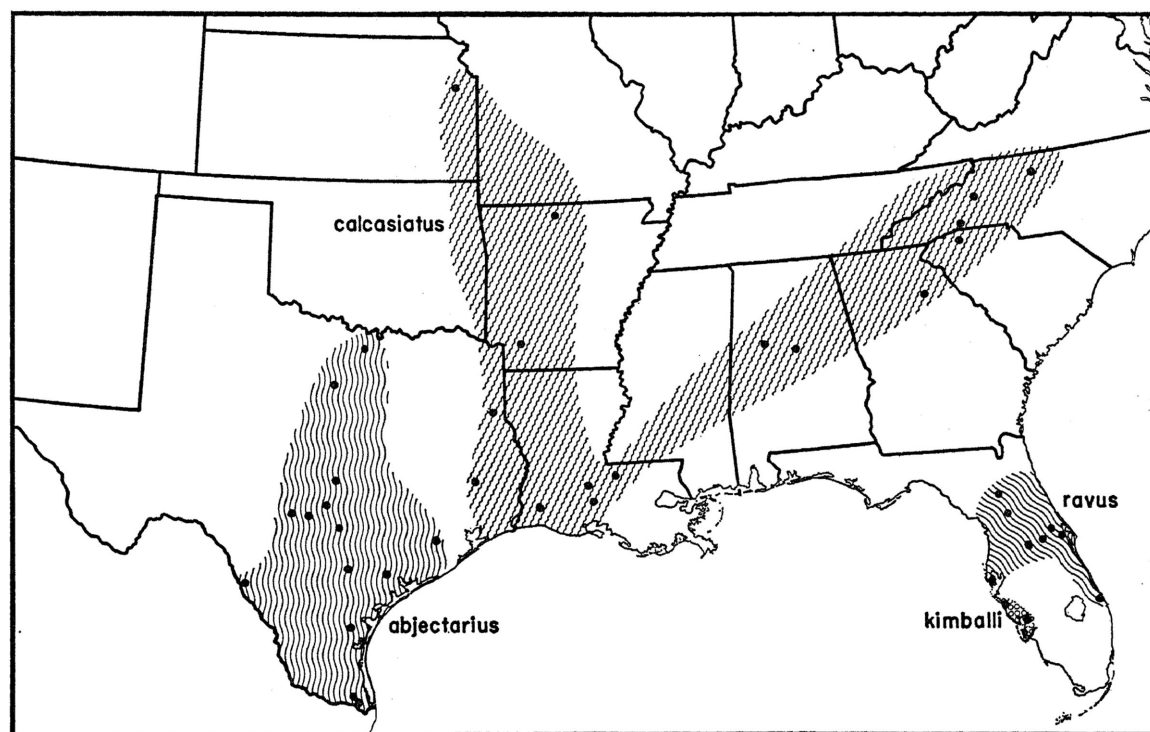


FIG. 4. Distribution of *Tornos abjectarius* Hulst. Specimens have also been examined from Tennessee, without additional data.

tudinal striae; vesica armed with three heavy spines.

FEMALE GENITALIA: Ostium with dorsal surface weakly sclerotized, rounded posteriorly; ventral surface more heavily sclerotized, in form of slightly asymmetrical subtriangular plate, posterior side rounded, with small median indentation, the right side extending farther interiad than left, the subtriangular plate joining broad anteroventral plate posteriorly, the latter constricted opposite junction of ostium and ductus bursae, then widening, with small U-shaped slit medially, the left side sometimes more strongly developed than the right, the anterior margin broadly rounded and with slight median indentation; ductus bursae not clearly differentiated from bursa copulatrix, with a membranous connection to ostium; ductus seminalis arising ventrally from wide base near ostium, extending to right side; bursa copulatrix sclerotized in posterior one-third, the surface with several striations, the remainder membra-

nous and swollen anteriorly, the entire structure subequal in length to length of apophyses of ovipositor lobes; signum absent.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Of *abjectarius*, in the American Museum of Natural History; of *kerrvillaria*, in Museum of Comparative Zoölogy, Harvard College.

TYPE LOCALITIES: None given in original description, but the type is labeled Texas (*abjectarius*); Kerrville, Texas (*kerrvillarius*).

RANGE: Central Texas. (See fig. 4). On the wing in February, March, April, June, July, August, and October. There is a single female in the collection of the United States National Museum (*ex* Barnes collection) labeled "Colo."; this locality should be verified.

REMARKS: Thirty-three specimens examined. This species is very similar in color and maculation to *scolopacinaris*; the only way to be absolutely certain of the identification is to make genitalic preparations. A number

of characters can be used as an aid in separating the adults: *abjectarius* tends to be slightly smaller, to have the forewings slightly shorter and broader than in *scolopacinaris*, and the sexual dimorphism is less marked in this species. The upper surface of the wings in the males of nominate *abjectarius* tends to be slightly lighter in tone, more ochraceous, more mottled, and with the t. a. and t. p. lines better defined than in *scolopacinaris*. The females of nominate *abjectarius*, on the other hand, tend to be slightly darker in color than the females of *scolopacinaris*, with the maculation slightly less well defined, and without the usually prominent subterminal line and light colored veins in the terminal area which are present in *scolopacinaris*.

The adults are differentiated more easily by means of the genitalia than by the maculation of the wings. In *abjectarius* the male has three short heavy spines in the vesica of the aedeagus, and the dorsal U-shaped process is heavily sclerotized, slightly longer than the length of the uncus, and has a rough surface; in *scolopacinaris* the vesica is unarmed, and the dorsal U-shaped process is more weakly sclerotized, subequal in length to the length of the uncus, and has a smooth surface. In the female genitalia *abjectarius* has the ventral plate of the ostium subtriangular, the ductus bursae and bursa copulatrix not clearly differentiated, and no signum; *scolopacinaris* has the ventral plate of the ostium complex and transverse, the ductus bursae is very short and membranous, while the bursa copulatrix is very long and usually has a minute signum.

In the original description of *abjectarius*, Hulst gave no indication of the type locality or number of specimens that he had. Grossbeck (1912, p. 404) mentions three males as bearing this name; these specimens have all been examined and genitalic preparations have been made and studied. The two specimens in the collection of the United States National Museum are not conspecific with the specimen from the collection of Rutgers University; the former are *scolopacinaris*. In order to be certain that no confusion will arise in the future, the male from the Rutgers collection, labeled "Tex.," and with my genitalic slide no. 3719, is hereby designated as the lectotype.

The type series of *kerrvillarius* Cassino and Swett also have both these species represented. A slide (no. 1867) was made of the holotype by the authors of this name and, if it is correctly associated with the right specimen, this name becomes a synonym of *abjectarius*. The type male is not so mottled as the majority of specimens of this species, and it could easily be mistaken for an example of *scolopacinaris*. The two paratypes from San Benito are not conspecific with the type, as they are *scolopacinaris*.

***Tornos abjectarius calcasatus* Cassino and Swett,
new combination**

Tornos calcasata CASSINO AND SWETT, 1923, Lepidopterist, vol. 4, p. 2. BARNES AND BENJAMIN, 1928, Pan-Pacific Ent., vol. 4, p. 133.

Tornos calasiata (sic), CASSINO AND SWETT, 1923, Lepidopterist, vol. 4, p. 4.

Tornos scolopacinaris form ♂ *calcasata*, BARNES AND BENJAMIN, 1928, Pan-Pacific Ent., vol. 4, p. 133.

MALE: Head, vertex ochraceous, brown or reddish brown; front and palpi brown or dark brown.

UPPER SURFACE OF WINGS: Forewings dark ochraceous, more or less overlain with reddish brown, dark gray, and black-brown scales, becoming gray-black near outer margin; cross lines as in nominate subspecies, well defined; area above discal tuft and extending outward to t. p. line tending to be suffused with dark scales; subterminal area reddish brown, contrasting with basal portion of wing; subterminal line obsolescent, sometimes appearing as groups of light gray scales between veins; terminal area quite dark, contrasting. Hind wings ancolorous with forewings, with area from base of wing to extradiscal line heavily shaded with dark scales; subterminal and terminal areas as on primaries but not quite so contrasting.

UNDER SURFACE OF WINGS: Unicolorous dark gray, with subterminal area shaded with brown.

EXPANSE: 22 to 29 mm.

FEMALE: Body and wings lighter in color than in male, being ochraceous, the wings not so heavily overlain with dark scales; subterminal area of forewings only weakly differentiated adjacent to terminal area, which

is gray-black or black, with a faint purplish tinge. Hind wings heavily dusted with dark scales basally, and with narrower subterminal area than on primaries. Under surface as in male, but more suffused with brown and ochraceous scales, and maculation tending to be slightly better defined.

EXPANSE: 21 to 30 mm.

MALE GENITALIA: As in the nominate subspecies, but tending to be slightly larger.

FEMALE GENITALIA: As in the nominate subspecies.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPE: In the Museum of Comparative Zoölogy, Harvard College.

TYPE LOCALITY: Lake Charles, Louisiana.

RANGE: Extending northward from Louisiana and eastern Texas through Arkansas to Kansas, and to the northeast through Alabama to Tennessee and the Carolinas. (See fig. 4.) On the wing from December through March, and from May through August.

REMARKS: Thirty-six specimens examined. This subspecies can be distinguished from nominate *abjectarius* by its darker color and larger size. The upper surface of the wings in this subspecies is a reddish brown or dark ochraceous, with a reddish brown subterminal area and a contrasting dark terminal area, while in the nominate population the wings are a paler ochraceous without the darker and more contrasting colors. Although the range in size between the two populations does not differ much, the average expanse does. A series of 12 males from Texas averages 22.9 mm., while a series of seven *calcasianus* males averages 25.1 mm.

This subspecies can usually be separated from specimens of *scolopacinaris* that occur in the same general area by the brighter and more contrasting colors, and by the more clearly defined maculation. Some examples of the two species, especially some females, are quite similar, and genitalic preparations should always be made to make certain of the identification.

The type series of *calcasianus* contains at least two specimens, both females, of *scolopacinaris*; the remainder of the specimens studied appear to be conspecific, although the entire paratype series has not been examined.

At the present time it is not feasible to subdivide this widely ranging subspecies, because of lack of material. As far as can be told at the present time, there are no obvious differences between the specimens from the extremes of the range. Much more material is needed before this problem can be adequately worked out.

Tornos abjectarius rarus, new subspecies

MALE: Head, vertex ochraceous, brown, or reddish brown; front and palpi brown, with scattered dark brown scales.

UPPER SURFACE OF WINGS: Forewings creamy or ochraceous, more or less heavily overlain with pale reddish brown scales, and with scattered dark brown scales, becoming dull black near outer margin; cross lines obsolete, the t. a. and t. p. lines sometimes weakly represented by a few dark scales on costa, and rarely the t. p. line by a few scattered dark scales across wing; area above discal tuft only rarely suffused with dark scales; subterminal area reddish brown, narrow, sometimes partially obsolete; terminal area very dark, wide, contrasting, except at apex of wing. Hind wings concolorous with forewings, with area from base of wing to extradiscal line heavily shaded with dark scales; subterminal and terminal areas reduced in width, sometimes partially obsolescent.

UNDER SURFACE OF WINGS: Both wings ochraceous, heavily overlain with dark gray and brown scales; subterminal area of both wings only lightly suffused with dark scales, appearing lighter in color than remainder of wing; terminal area broadly darkened; veins of both wings ochraceous or pale reddish brown.

EXPANSE: 24 to 30 mm.; holotype, 24 mm.

FEMALE: Body and wings slightly more cream colored than male, tending to be more heavily suffused with dark scales, with t. p. line usually represented opposite cell, with subterminal area brighter, with subterminal line represented by a series of light gray dots, and with terminal area blacker than in male. Hind wings heavily dusted with dark scales basally, especially along anal margin; subterminal and terminal areas better defined than in male, sometimes with subterminal line weakly represented. Under surface as in

male, but more suffused with brown and ochraceous scales, and maculation tending to be better defined.

EXPANSE: 24 to 28 mm.; allotype, 28 mm.

MALE GENITALIA: As in the nominate subspecies, but slightly larger.

FEMALE GENITALIA: As in the nominate subspecies.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Port Sewall, Martin County, Florida, February 13, 1938 (L. C. Sanford), and allotype, female, same locality, March 10-15, 1943 (L. J. Sanford); in the American Museum of Natural History. Paratypes, 10 males and nine females, all from Florida: same data as holotype, February 13, 18, 1938, March 31, 1938, December 18, 1938, February 17, 1948 (L. C. and L. J. Sanford), three males and two females; Titusville, January 24, 29, February 17, March 2, 9, October 12, November 18, five males and two females; Lake Lucy, Lake County, February 1, one female; Sanford, June 18, 1926 (F. R. Cole), one female; Orlando, April, 1919, two females; Ocala, December 24, 1917, one male; St. Petersburg, January 22, one female; Short Wave Station, University of Florida campus, Gainesville, May 28, 1945, one male. Paratypes to be distributed as follows: the American Museum of Natural History; the Carnegie Museum; the California Academy of Sciences; the Museum of Comparative Zoölogy, Harvard College; and the University of Florida.

RANGE: Central Florida. (See fig. 4.) On the wing from September through April, and in June and July.

REMARKS: Twenty-two specimens examined. This subspecies can be distinguished from nominate *abjectarius* by its darker color and larger size, and from *calcasatus* by the fact that the wings above are a lighter color, but with the terminal area very dark and quite contrasting, and the cross lines are obsolete. In addition, this Florida subspecies does not have the dark shading above the discal tuft that is present in *calcasatus*, and the lower surface of the wings tends to be lighter in color. This subspecies is slightly larger than *calcasatus*, as a series of eight

males averages 26.7 mm. in expanse, while a series of seven *calcasatus* males averages 25.1 mm.

This subspecies can usually be separated from *scolopacinarius spodius* by the brighter and more contrasting color; in general, this moth has the wings more suffused with reddish brown and other than does its corresponding member of *scolopacinarius* from central Florida.

Tornos abjectarius kimballi, new subspecies

MALE: Head, vertex ochraceous or brown, front and palpi dark brown.

UPPER SURFACE OF WINGS: Forewings dark ochraceous, more or less heavily overlain with reddish brown, dark gray, and black-brown scales, becoming blackish near outer margin; cross lines as in nominate subspecies, well defined; costal area to origin of t. p. line tending to be suffused with black-brown scales, and with median portion of wing shaded with reddish brown and dark gray scales; area distad of t. p. line of ground color, contrasting with median area, and merging with reddish brown subterminal area; subterminal line light gray, represented by groups of scales in the cells; terminal area quite dark, contrasting. Hind wings concolorous with forewings, less heavily shaded with reddish brown scales, with area from base of wing to extradiscal line heavily shaded with dark scales; area distad of extradiscal line of ground color, contrasting with basal area; subterminal and terminal areas as on primaries but not quite so contrasting.

UNDER SURFACE OF WINGS: Both wings unicolorous dark gray, with subterminal areas shaded with brown.

EXPANSE: 23 to 27 mm.; holotype, 25 mm.

FEMALE: Body and wings lighter in color than in male, being ochraceous, the wings not so heavily overlain with dark scales, but with distinct maculation; median area of wing shaded with reddish brown, and with median shade distinct; area distad of t. p. line slightly wider and more distinct than in male; terminal area darker than in male, with a faint purplish tinge. Hind wings as in male, the extradiscal line not quite so dentate. Under surface as in male, but more suffused with brown and ochraceous scales, and macu-

lation tending to be slightly better defined.

EXPANSE: 24 mm. (allotype).

MALE GENITALIA: As in the nominate subspecies, but slightly larger.

FEMALE GENITALIA: As in the nominate subspecies.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Siesta Key, Sarasota County, Florida, February 11, 1951 (C. P. Kimball), and allotype, female, Sarasota County, Florida, May 9, 1946 (C. P. Kimball); in the American Museum of Natural History. Paratypes, three males, all from Florida: Punta Gorda, March 1-5, 1951, December 12, 1947 (H. Ramstadt). Paratypes to be distributed as follows: the American Museum of Natural History and

collection of Alex Wyatt.

RANGE: Coastal regions of southwestern Florida. (See fig. 4.) On the wing in February, March, May, and December.

REMARKS: Five specimens examined. This subspecies is closest to *calcasianus* in appearance, but can be distinguished from that subspecies by its smaller size and the more heavily suffused and contrastingly colored wings. It is quite distinct from *ravus*, the central Florida subspecies, as the latter is larger, lighter in color, and with less maculation.

This subspecies can be separated from *forsythiae*, the southern Florida subspecies of *scolopacinaris*, by the brighter and more contrasting colors; in general, this moth has the wings more suffused with reddish and ocher.

LIST OF SPECIES, WITH THEIR KNOWN DISTRIBUTION

GROUP I

- | | |
|-------------------------------------|---------------------|
| 1. <i>capitaneus</i> Rindge | Guatemala, Mexico |
| 2. <i>apiatus</i> Rindge | Paraguay |
| 3. <i>quadripunctus</i> (W. Warren) | Colombia, Venezuela |

GROUP II

- | | |
|-----------------------------|--------------------------------|
| 4. <i>penebrosus</i> Dyar | Panama, Canal Zone, Costa Rica |
| 5. <i>phoxus</i> Rindge | Guatemala |
| 6. <i>punctatus</i> (Druce) | Costa Rica, Mexico, Texas |
| 7. <i>hoffmanni</i> Rindge | Guatemala, Mexico, Texas |

GROUP III

- | | |
|---------------------------------------|-------------------------------|
| 8. <i>umbrosarius</i> Dyar | Mexico |
| 9. <i>benjamini</i> Cassino and Swett | Arizona, Mexico |
| 10. <i>brutus</i> Rindge | Costa Rica, Guatemala, Mexico |

GROUP IV

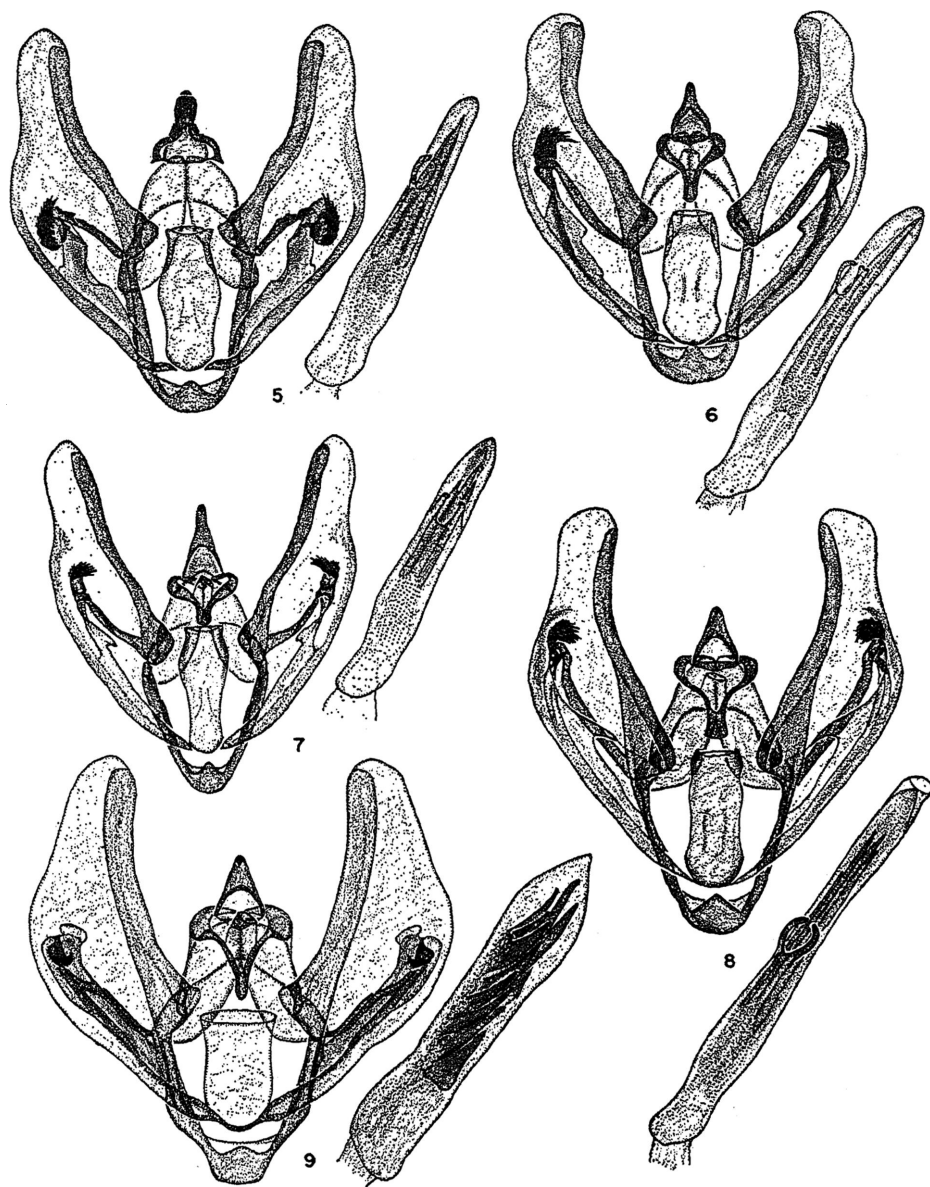
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| 11. <i>pusillus</i> Rindge | Mexico |
| 12. <i>spinosus</i> Rindge | Costa Rica |
| 13. <i>mistus</i> Rindge | Bolivia, Paraguay |

GROUP V

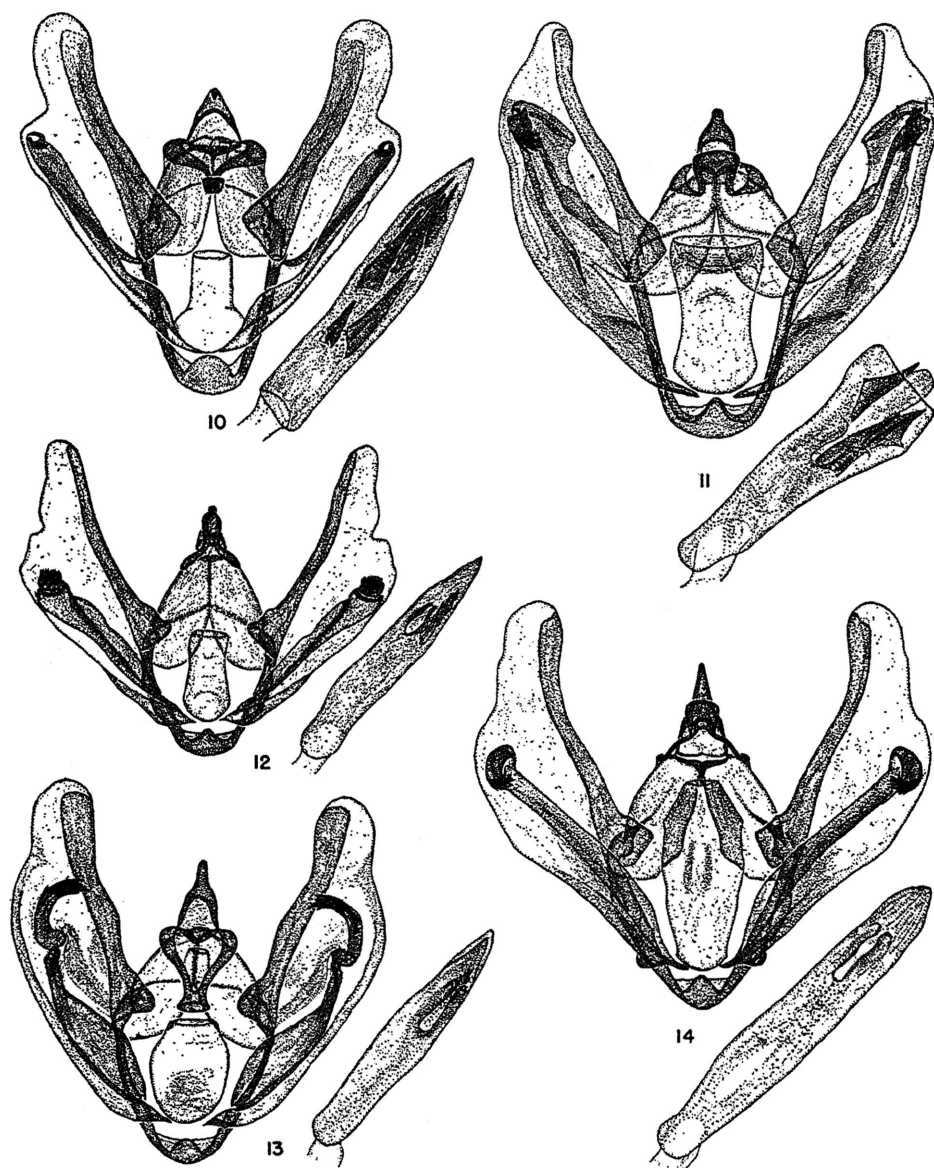
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| 14a. <i>erectarius erectarius</i> Grossbeck | Arizona |
| b. <i>erectarius fieldi</i> Grossbeck | California |

GROUP VI

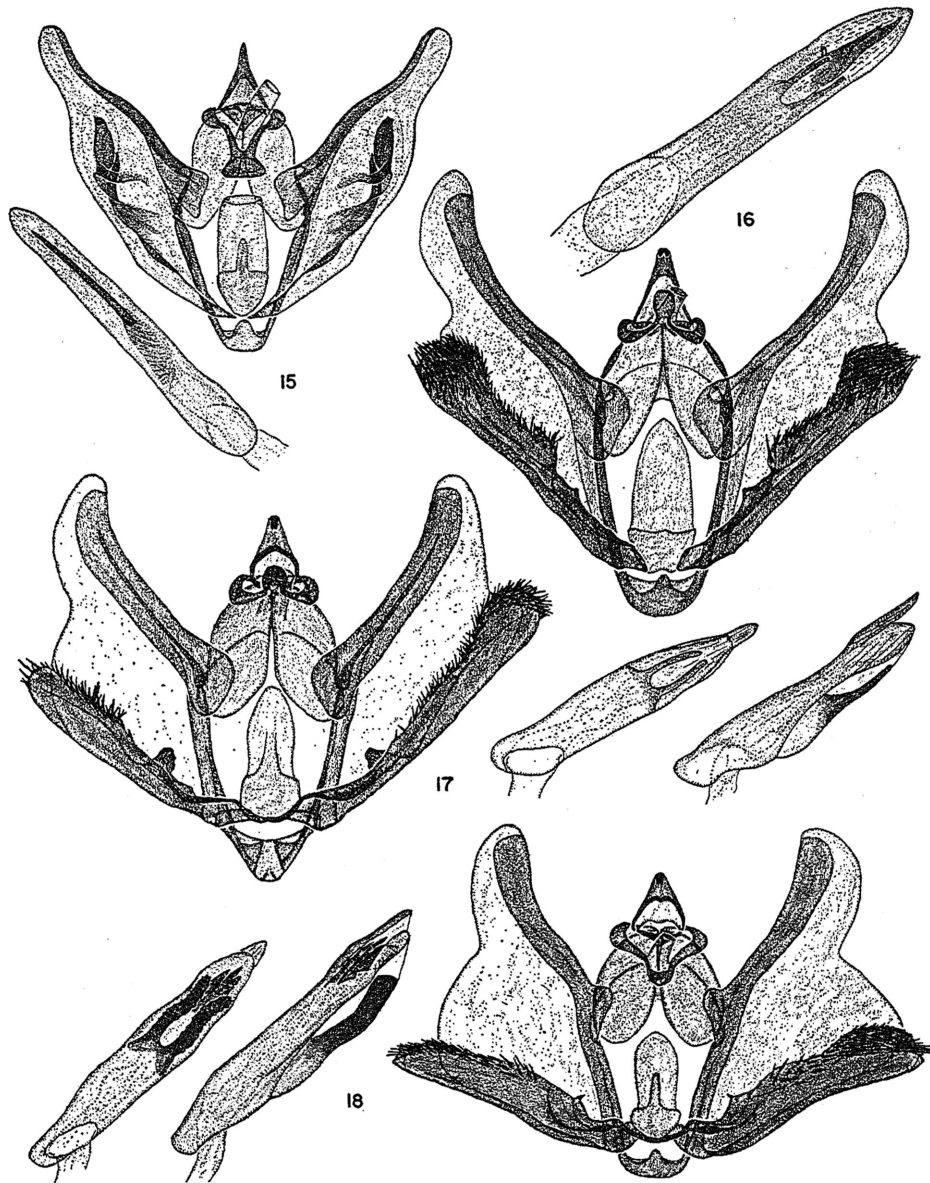
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| 15. <i>cinctarius</i> Hulst | Southeastern United States |
| 16a. <i>scolopacinaris scolopacinaris</i> (Guenée) | Eastern United States |
| b. <i>scolopacinaris spodiarius</i> Rindge | Central Florida |
| c. <i>scolopacinaris forsythiae</i> Rindge | Southern Florida |
| 17a. <i>abjectarius abjectarius</i> Hulst | Texas |
| b. <i>abjectarius calcasianus</i> Cassino and Swett | Southeastern United States |
| c. <i>abjectarius ravus</i> Rindge | Central Florida |
| d. <i>abjectarius kimballi</i> Rindge | Southern Florida |



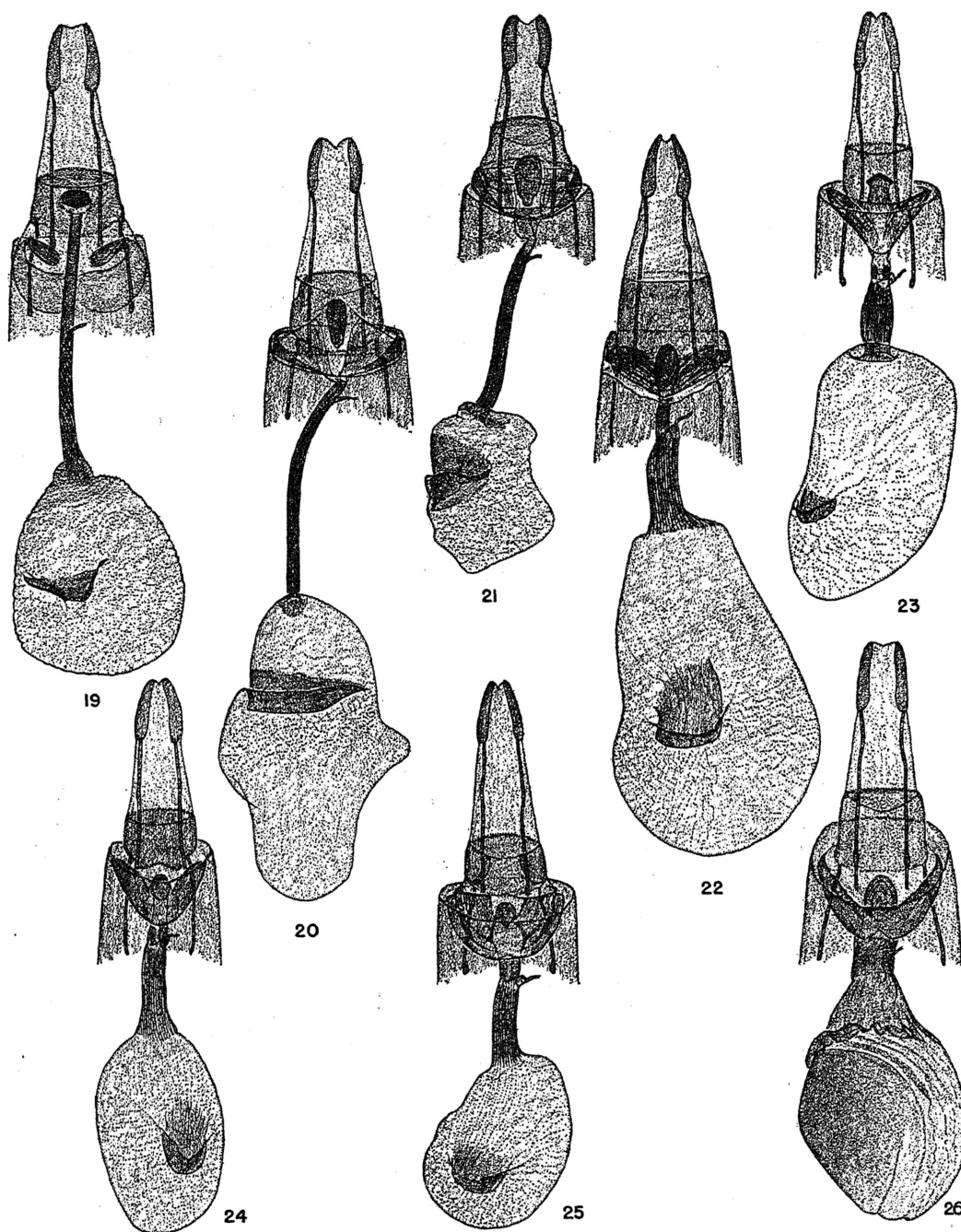
FIGS. 5-9. Male genitalia, with the aedeagus shown in dorsal view, except as noted. 5. *Tornos capitaneus* Rindge, holotype, San Sebastian, Retalhuleu, Guatemala (L. Thiel; U.S.N.M.). 6. *T. quadripunctus* (W. Warren), Tumba, Cauca, Colombia, February, 1909 (Fassl; U.S.N.M.). 7. *T. punctatus* (Druce), Brownsville, Texas (U.S.N.M.). 8. *T. hoffmanni* Rindge, holotype, Tehuacan, Puebla, Mexico, May 27, 1937 (C. C. Hoffmann; A.M.N.H.). 9. *T. umbrosarius* Dyar, Coatepec, Mexico, November (U.S.N.M.); aedeagus shown in ventral view.



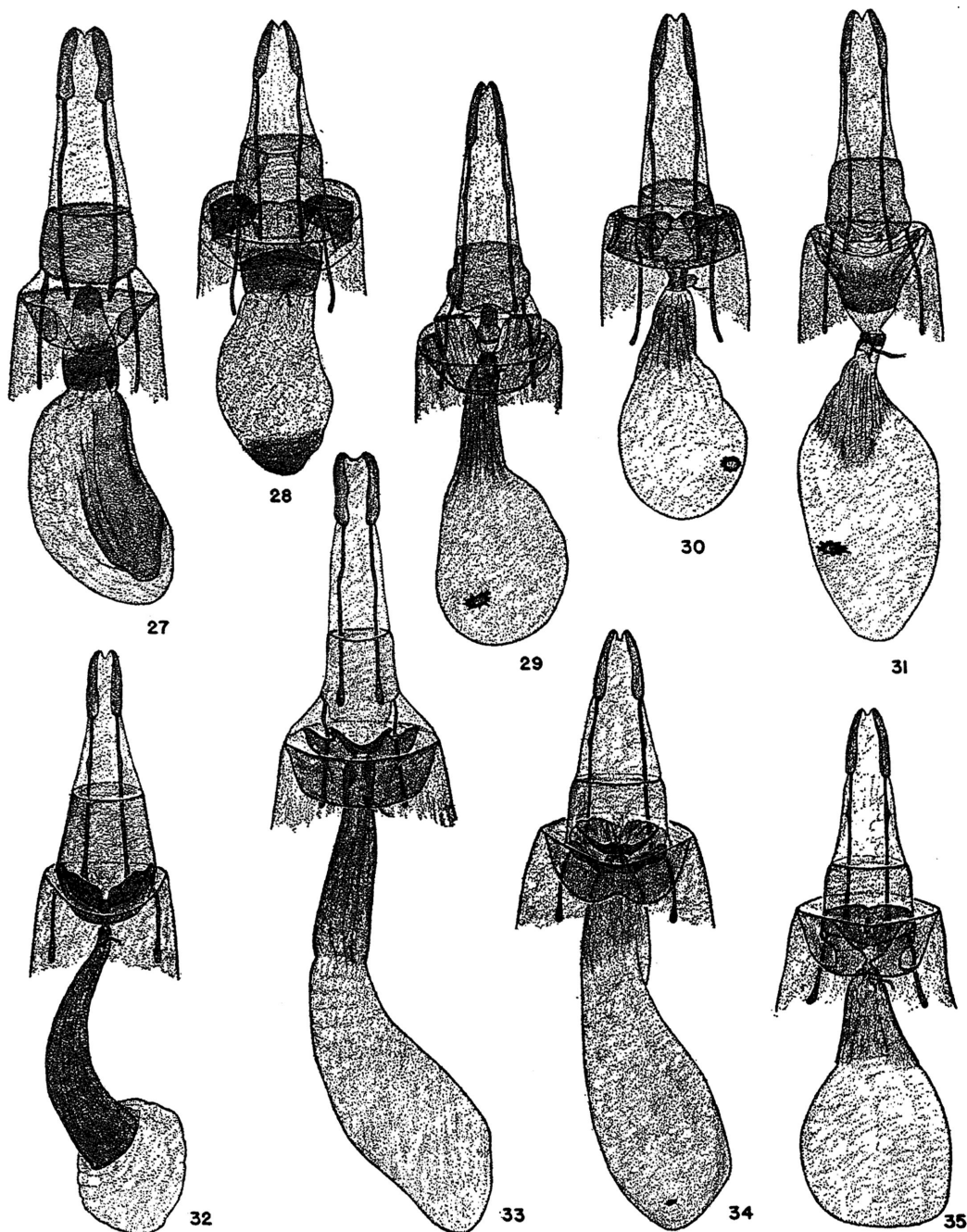
FIGS. 10-14. Male genitalia, with the aedeagus shown in dorsal view, except as noted. 10. *Tornos benjamini* Cassino and Swett, Baboquivari Mountains, Arizona, June 1-15, 1924 (O. C. Poling; U.S.N.M.); aedeagus shown in ventral view. 11. *T. brutus* Rindge, holotype, Volcan Turrialba, Costa Rica, August (U.S.N.M.). 12. *T. pusillus* Rindge, holotype, Cordoba, Mexico, May 2, 1908 (F. Knab; U.S.N.M.). 13. *T. spinosus* Rindge, holotype, Juan Vinas, Costa Rica, February, 1925 (G. A. Martin; B.M.N.H.). 14. *T. mistus* Rindge, paratype, Rio Suruta, Dept. Santa Cruz, Bolivia, May (J. Steinbach; B.M.N.H.).



FIGS. 15-18. Male genitalia. 15. *Tornos erectarius erectarius* Grossbeck, holotype, Santa Catalina Mountains, Arizona, July 24-31 (A.M.N.H.); aedeagus shown in ventral view. 16. *T. cinctarius* Hulst, Biscayne Bay, Florida (Mrs. A. T. Slosson; A.M.N.H.); aedeagus shown in dorsal view. 17. *T. scolopacinarus scolopacinarus* (Guenée), Montague County, Texas, August 3, 1940 (L. H. Bridwell; A.M.N.H.); aedeagus shown in dorsal (left) and lateral views. 18. *T. abjectarius abjectarius* Hulst, holotype, Texas (A.M.N.H.); aedeagus shown in dorsal (left) and lateral views.



FIGS. 19-26. Female genitalia. 19. *Tornos capitaneus* Rindge, allotype, Guatemala City, Guatemala, October (Schaus and J. Barnes; U.S.N.M.). 20. *T. apiatatus* Rindge, holotype, Paraguay (U.S.N.M.). 21. *T. quadripunctus* (W. Warren), Patao, Guiria, Venezuela, August, 1891 (B.M.N.H.). 22. *T. penumbrosus* Dyar, San Jose, Costa Rica (H. Schmidt; B.M.N.H.). 23. *T. phoxus* Rindge, holotype, San Sebastian, Retalhuleu, Guatemala (L. Thiel; U.S.N.M.). 24. *T. punctatus* (Druce), San Benito, Texas, June 16-23 (U.S.N.M.). 25. *T. hoffmanni* Rindge, paratype, Jalapa, Mexico (U.S.N.M.). 26. *T. umbrosarius* Dyar, Orizaba, Mexico (U.S.N.M.).



FIGS. 27-35. Female genitalia. 27. *Tornos benjamini* Cassino and Swett, Baboquivari Mountains, Arizona, April 24, 1947 (G. H. and J. L. Sperry; A.M.N.H.). 28. *T. brutus* Rindge, paratype, Volcan Santa Maria, Guatemala, July (U.S.N.M.). 29. *T. pusillus* Rindge, paratype, Misantla, Mexico, April, 1910 (B.M.N.H.). 30. *T. spinosus* Rindge, allotype, Sixola River, Costa Rica, March (U.S.N.M.). 31. *T. mistus* Rindge, allotype, Sapucay, Paraguay, "3-11-04" (W. Foster; B.M.N.H.). 32. *T. erectarius erectarius* Grossbeck, north side, Kits Peak, Baboquivari Mountains, Arizona, August 7-9, 1916 (A.M.N.H.). 33. *T. cinctarius* Hulst, holotype, Florida (A.M.N.H.). 34. *T. scolopacinaris scolopacinaris* (Guenée), Brownsville, Texas, February 18 (A.M.N.H.). 35. *T. abjectarius abjectarius* Hulst, Forestburg, Texas, August 18, 1941 (L. H. Bridwell; A.M.N.H.).