

Genitalia of some nearctic and neotropic members of the tribe Gnorimoschemini (Lepidoptera, Gelechiidae)

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During my investigation of the palearctic members of the tribe Gnorimoschemini (Povolný 1964), the fact has been pointed out that this tribe is thoroughly holarctic, with several branches or ecological groups of species living in the Oriental, Ethiopian and Neotropic Region. It became apparent that no definitive taxonomical conclusions concerning generic and other supraspecific taxa could be made for any of the phylogenetically natural groups of Gnorimoschemini without a basic knowledge of the most important representatives of the tribe inhabiting the regions mentioned. Thence, after the investigation of most of the Old World species, it appeared that the most important task was to study their natural relation to the species inhabiting the New World, in order to work out their natural supraspecific taxonomy. Yet the first attempts showed that the number of species and genera populating the New World is greater in extent than had been presumed and, also, a substantial generic heterogeneity among the chosen representatives was found. These facts showed that the Gnorimoschemini of the New World present a complex taxonomic problem, to be solved only on the basis of the knowledge of a relatively high number of species and in simultaneous consideration of the New World taxa with those of the Old World. This appeared to be a difficult problem of organization since only a very few of the New World species were accessible during the first years of my investigation. This situation brought about my study trip to the United States of America and Great Britain which I could undertake during the last few years. I was thus able to study many important type specimens and other material of New World Gnorimoschemini and to compare the results of this study with my former conclusions on the taxonomy of the Old World, especially palearctic species, of which I could revise the majority of species and their types. As for the present position of the New World Gnorimoschemini, it appears absolutely necessary to reevaluate their generic taxonomy, because practically only two genera (*Gnorimoschema* and *Phthorimaea*) were applied, mostly according to the subjective viewpoint of various authors, or these genera were simply considered to be basically synonymous. Yet I could show (Povolný 1964) that, in the Old World as well as in the New World, these traditional genera (especially the former genus *Lita* auct. of western Palearctic and the genera *Gnorimoschema* and *Phthorimaea* of America) do not nearly cover the real phylogenetic relationship of the species concerned and that, in fact, these traditional groups of species consist of several other genera,

described and undescribed, which belong to one large evolutionary branch in the frame of the Gelechiidae. This branch can be well defined morphologically as well as ecologically, and I therefore established a new tribe Gnorimoschemini for it. Whilst the monographic study of the palearctic species is nearly finished, our present knowledge of the real state of taxonomy of the American species is very poor and no fundamental change or progress can be expected without a new conception of the present knowledge. This is evidently due to the fact that only a small fraction of them was studied as to the morphology of the genitalia. I therefore decided to point out that also the American Gnorimoschemini consist in fact of several generic groups, some of which can clearly be defined at present, whilst the other ones must be studied in future to elucidate their true taxonomic positions. The present study is based mainly on material which has been compared with type specimens and on actual type specimens. I am aware of the preliminary character of this paper, the purpose of which is to formulate a new basis for the revaluation of the members of the New World Gnorimoschemini, which must follow. My decision was influenced by the knowledge of the greatest material of species of the tribe ever studied by an individual. It is hoped that this paper will inspire further specialists to deal with the New World species, representing, without doubt, a very interesting but confused group of Gelechiidae. Finally, it is my wish to express my sincere thanks to many entomologists and institutions who have supported and contributed to my endeavour. These are, in the first place, the authorities of the British Museum (Natural History), Department of Entomology, London, who enabled me to study the type specimens of many American species during my stay in London in 1964; and the authorities of the United States National Museum, Department of Entomology, Washington, who placed at my disposal several important species of the tribe from North America. Many individuals contributed greatly to this paper: Mr John D. Bradley, of London; Dr. John F. Gates Clarke, of Washington; Professor Dr. Alexander B. Klots, of New York; and Dr. Ronald W. Hodges, of Washington. Also, I am extremely grateful to individuals and institutions who organized and sponsored my study trip to California, which was an invaluable important opportunity to see some of the typical biotopes of species found in America. I am especially indebted to Professor Dr. Robert L. Usinger, Department of Entomology and Acarology, University of California, Berkeley, and his collaborators, especially Dr. Jerry A. Powell, and also to Dr. Edward S. Ross, Department of Entomology, California Academy of Sciences, San Francisco, and his collaborators. I was greatly assisted, during my field work in California, by Dr. Peter Rubtsoff, who accompanied me to the most important habitats in California. I wish to thank all other entomologists who helped in any way in the origin of this paper. My study in London was financially supported by the Deutsche Forschungsgemeinschaft and organized by Dr. H. G. Amsel, Karlsruhe.

Abbreviations used in the paper:

- BMNH, British Museum (Natural History), London.
- USNM, U.S. National Museum, Washington, D.C.
- CAS, California Academy of Sciences, San Francisco.

Genus *Symmetrischema*, n. gen.

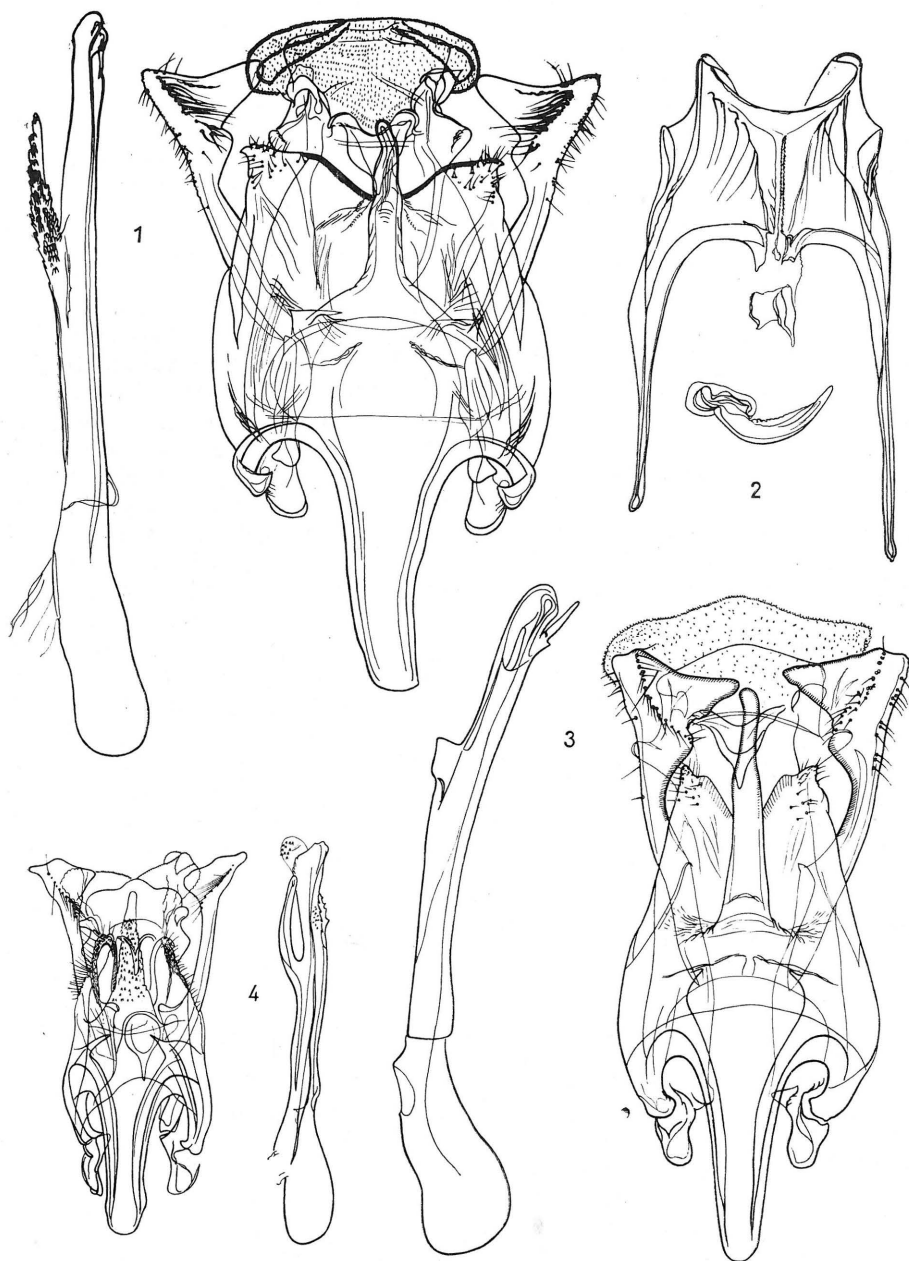
Type-species: *Gnorimoschema plaesiosema* Turner

This genus is definitively characterized by several conspicuous characters of the male genitalia. First is the tendency towards the formation of an unpaired process in the wall of the sacculus above the saccus, being present between the inner pair of the processes of sacculus either in the form of a quite inconspicuous process (*S. striatellum*, *S. ardeolum*, *S. lectuliferum*) or as a more conspicuous process between the paired processes mentioned (*S. loquax*, *S. lavernellum*, *S. fercularium*) or, finally, reaching the shape of a long tapering and rounded tongue, protruding far beyond the level of the saccular processes. This is a singular structure among the Lepidoptera. Another specific character of the male genitalia of this genus is the terminal enlargement of valvae to form peculiar, irregularly trapezoidal planes with typical chaetotaxy (a row of hairs passing from the tip obliquely towards the base of this structure). In the species *S. lectuliferum* and *S. fercularium*, this structure is probably secondarily narrowed. Gnathos either reduced to form a mere chitinous half-ring (especially in the species with short unpaired saccular process, such as, e.g., *S. ardeolum*, *S. lavernellum*, *S. striatellum*) or transformed to a short triangular beak. Saccus either very similar to that of the typical representatives of the genus *Gnorimoschema* (relatively short with a broad base and a blunt tip, e.g., in *S. loquax*, *S. lavernellum*, *S. striatellum*, showing, at the same time, a short unpaired saccular process) or, on the contrary, conspicuously produced and slender with pointed tip (*S. plaesiosema*, *S. lectuliferum*, *S. fercularium*, *S. aquilinum*, showing a long unpaired saccular process). Circumanal membrane (scaphium and subscaphium) strongly developed and forming a conspicuous, richly ruffled or doubled structure often covering, and reaching beyond, the uncus. Aedeagus characterized by a peculiar lateral process, most strongly developed in species showing the longest unpaired saccular process.

The female genitalia of this group are insufficiently known due to lack of comparative material. Apart from the genitalia being very similar to those of the genus *Gnorimoschema*, there seems to be a tendency towards a reduction of the signum bursae (*S. lavernellum*, *S. loquax*, *S. fercularium*, etc.). Also, the entire eighth sternite and its appophyses show a tendency towards secondary simplification.

Habitually, the species of this group are characterized by secondary simplification of the wing pattern typical of the tribe Gnorimoschemini, tending to the formation of longitudinal dusky lines, with a simultaneous loss of the circular or point-like dots. In phylogenetical respect, the genus *Symmetrischema* is obviously related to the classical genus *Gnorimoschema* (as indicated especially by the similar structure of the uncus and the female genitalia), representing probably a lateral branch, specific to the New World, very likely having evolved as a result of the selective influence of the environment on the evolutionally older forms related to the palearctic ones, with which certain American species of the genus *Gnorimoschema* are closely related.

In America, this genus is certainly represented by a far greater number of species than are mentioned here. Very likely, also the species "*Phthorimaea*"



Genitalia of : 1 — *Symmetrischema plaesiosema* ♂ (Paratypus of "*Phthorimaea melanoplintha* Meyrick", New Zealand); 2 — idem ♀ (California, Keifer); 3 — *S. aquilinum* ♂ (Lectotypus), 4 — *S. atrifascis* ♂ (Lectotypus)

ventralella and other species the males of which I could not examine belong to this genus.

The genus is distributed over the southern part of North America, South America (eastern USA, Texas, Missouri, California, Peru, Paraguay, Argentina); the occurrence of *S. plaesiosema* in the Australian Region is obviously secondary (introduced as a pest), as this species is probably autochthonous in the mountains of Peru. The host plants of this genus are not known for certain but they are very likely *Solanaceae*, *Physalis viscosa* (*S. lavernellum-physalivorellum*). In South America, the species of this genus inhabit mainly high elevations of the Andes.

***Symmetrischema plaesiosema* (Turner, 1919), n. comb.**

Turner, Proc. R. Soc. Queensld., 31, p. 126, 1919 (*Phthorimaea*)

Syn.: *Phthorimaea melanoplintha* Meyrick, 1926

Gnorimoschema tuberosella Busck, 1931

This species is a quite typical representative of the genus *Symmetrischema*, especially in its conspicuously developed intersaccular process, distinctly protruding over both lateral saccular processes of unusual width. Valvae broad, irregularly trapezoidal above, gnathos short with broad base and slender point, scaphial structure heavy, saccus relatively slender and prolonged. Aedeagus with a lateral bifurcation, the lateral branch covered with minute processes.

Material: 1 ♂ *Phthorimaea melanoplintha* Meyrick, New Zealand, D. Miller (paratypus) (BMNH); 1 ♀ Ex *Solanum nigrum*, 22 Feb. 1945, Veniec, L. 2, L. t. 45—7543 (USNM); 1 ♀ *Solanum nigrum*, R. 25. 7. 1933, Saticoy, Cal., leg. Keifer.

***Symmetrischema aquilinum* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 44, 1917 (*Phthorimaea*)

In structure, the male genitalia of the lectotype are markedly similar to those of *S. plaesiosema*. As in this species, they show a conspicuous unpaired saccular process and very similar paired saccular processes. Apart from other less conspicuous characters, *S. aquilinum* is specifically differentiated from *S. plaesiosema* mainly by the structure of the aedeagus the bifurcation of which is only indicated by a lateral process; but terminally, the aedeagus is provided with another finger-like lateral process. Four additional paratypoids have not been studied as to their anatomy. They are South American form (Peru) from high elevations of the Andes.

Material: 1 ♂, Matucana and Huancayo, Peru, 10,650 ft, July (leg. Parish), lectotypus. I have examined one of the four additional paratypoids (BMNH).

***Symmetrischema atrifascis* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 45, 1917 (*Phthorimaea*)

The male genitalia of this species are extensively congeneric with those of the two preceding species. Unpaired saccular process covered with minute

coarse scales; aedeagus with a strong lateral bifurcation. The holotype (BMNH) comes from Peru from a high elevation.

Material: 1♂, Peru Chosica, 2,800 ft, July, leg. Parish, lectotypus.

***Symmetrischema fercularium* (Meyrick, 1929), n. comb.**

Meyrick, Exot. Microl., 3, p. 492, 1929, Texas (*Phthorimaea*)

The genitalia of the male lectotype (BMNH) show infallible indications of a relationship with the preceding species, especially in the structure of the unpaired saccular process, gnathos and the heavy scaphial structure, and also in the apical part of the valvae with typical row of bristles (evolved very likely by the narrowing of the trapezoidal valva of the remaining species). On the contrary, the species differs by the lateral saccular processes (two pairs), the long and slender saccus and the conspicuous, long aedeagus without lateral bifurcation but with a distinct subapical process. Female genitalia characterized by a great simplification of the 8th sternite, short apophyses and reduced signum. The species is known from Texas (numerous specimens collected at a considerable elevation).

Material: 1♂, Texas, Fort Davis, 5,000 ft. March, May, November, lectotypus. From the other paratypoids (30 specimens according to the description), I examined 1♀, Brenster Co., Texas, 5,000 ft, 4—26, paralectotypus.

***Symmetrischema lectuliferum* (Meyrick, 1929), n. comb.**

Meyrick, Exot. Microl., 3, p. 493, 1929, Texas (*Phthorimaea*)

The genitalia of the male lectotype show undoubted characters of its generic affinity with the preceding species, mainly in the presence of an unpaired saccular process, rounded broad uncus, and short pointed gnathos. Structure of valvae similar to *S. fercularium*. Aedeagus provided with a lateral serrate ledge, typical of many *gnorimoschemoid* species. The species occurs in the same locality as the preceding one.

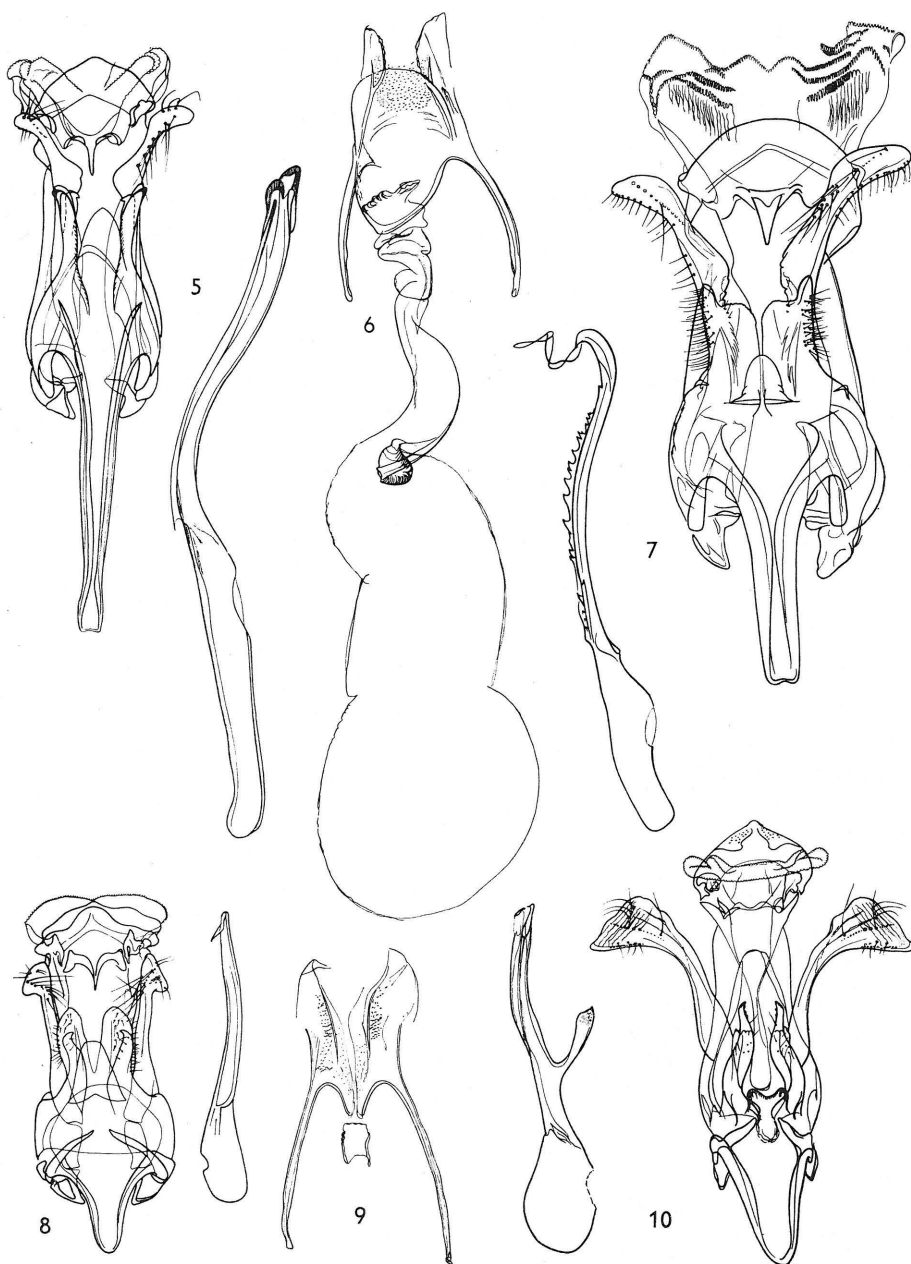
Material: 1♂, Texas, Fort Davis and Alpine, 5,000 ft, March, April, lectotypus. The second specimen mentioned in the original description is not in the BMNH.

*** *Symmetrischema loquax* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 45, 1917 (*Gnorimoschema*)

The genitalia of the male lectotype show typical characters of the genus as well as specific differences (two pairs of lateral saccular processes). Apical part of valvae substantially trapezoidal as in the generically typical species but with reduced surface. Unpaired saccular process relatively short, so that its length does not exceed that of the paired saccular processes. Aedeagus without lateral bifurcation but with a subterminal process. Female genitalia with simplified 8th sternite and reduced signum bursae.

Material: 1♂, Peru, Chosica, 2,800 ft, July (Parish), lectotypus (BMNH). The BMNH also has a smaller series of paratypoids (a total of 13 specimens



Genitalia of : 5 — *Symmetrischema fercularium* ♂ (Lectotypus); 6 — idem ♀ (Paralectotypus); 7 — *S. lectuliferum* ♂ (Lectotypus); 8 — *S. loquax* ♂ (Lectotypus); 9 — idem ♀ (Paralectotypus); 10 — *S. ardeolum* ♂ (Holotypus)

according to the original description), of which I examined 1♀ (paralectotypus with the same data as above).

***Symmetrischema ardeolum* (Meyrick, 1931), n. comb.**

Meyrick, Journ. Linn. Soc. Zool., 37, p. 280, 1931 (*Phthorimaea*)

The genitalia of the male holotype show a series of generic characters (strong laral bifurcation of aedeagus, trapezoidal ends of valvae, obtuse uncus). The generically typical unpaired saccular process is conspicuously low and situated below between the bases of the paired saccular processes. Gnathos considerably reduced to form a chitinous semi-ring.

Material: 1♂, Makthawaiya, Paraguay, G.S.C., 15.27, holotypus.

***Symmetrichema striatellum* (Murtfeldt, 1900), n. comb.**

Murtfeldt, Canad. Ent., 32, p. 163, 1900 (*Eucatoptus*)

The male genitalia show the typical characters of the genus, especially the valvae trapezoidally widened at apex and bearing typical chaetotaxy, the distinctly bifurcate aedeagus, the broad uncus, etc. Unpaired saccular process very short. The species is known from USA (Missouri, California). Female genitalia with signum bursae absent, surface of 8th sternite without any particular structure save for two chitinous arches. Ostium bursae very broad and passing into a funnel-like part. The structure of the female genitalia of this species corroborates the opinion that these species, previously arranged under the genus *Gnorimoschema*, constitute a separate group. In the general collection of the BMNH, I found two specimens of this species labelled as *Lita solani* Bg, Buen. Air., Zell. coll.

Material: A series of specimens labelled San Francisco, Cal., 12. 9. 1928, reared from *Solanum nigrum*, coll. H. H. Keifer (CAS), 1♂ Alameda Co., Cal., (CAS). According to the literature, *Solanum* is the only host plant of this species.

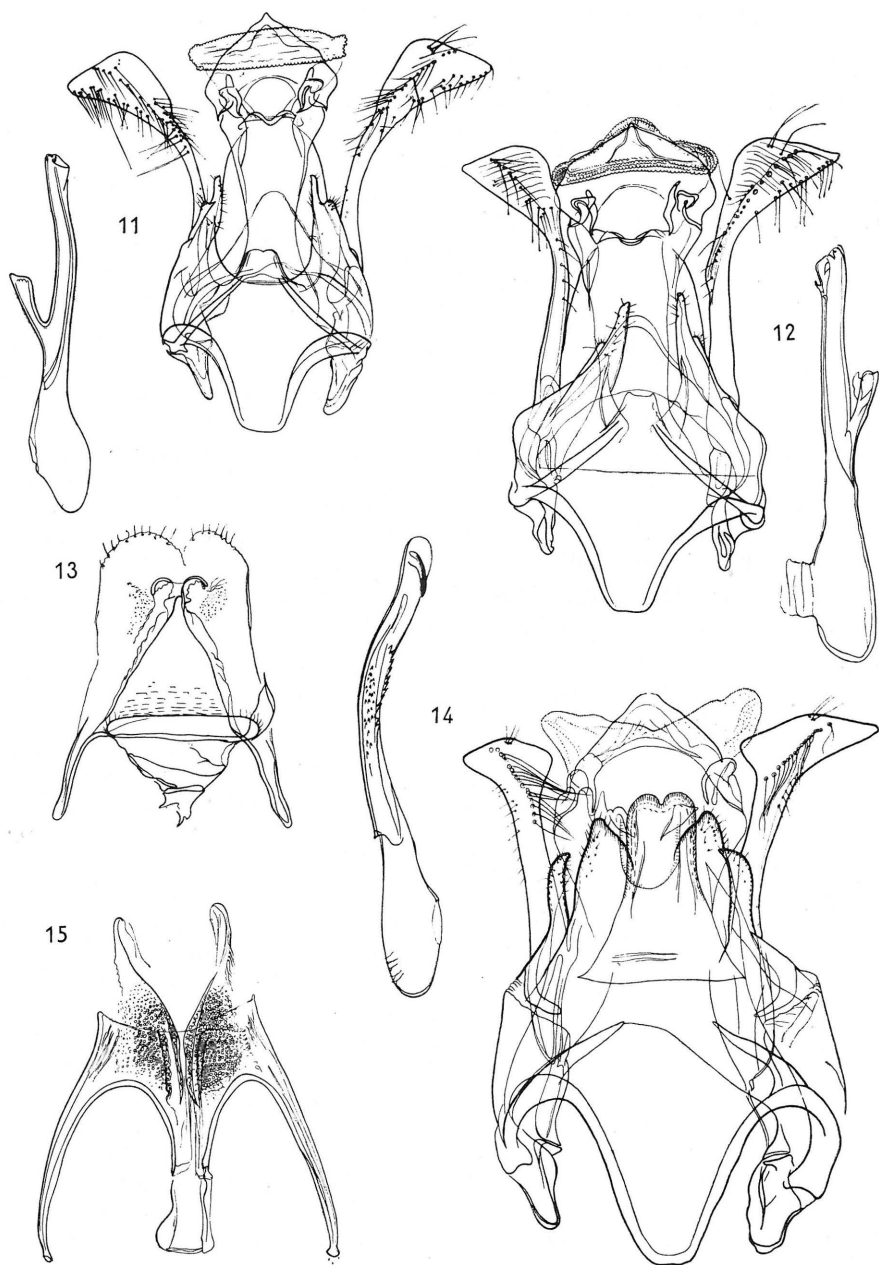
***Symmetrischema lavernellum* (Chambers, 1874), n. comb.**

Chambers, Canad. Ent., 6, p. 242, 1874 (*Gelechia*)

Syn.: *Gelechia physalivorella* Chambers 1878

A typical representative of the genus in North America, showing a series of characters transitory to the genus *Gnorimoschema*, from which it differs by the typical heavy unpaired saccular process, the trapezoidal apex of valvae, and the tendency of the aedeagus towards lateral bifurcation (serrate ledge), etc. Female genitalia with signum bursae reduced, ostium bursae conspicuously produced but surface of 8th sternite conspicuously narrowed behind. In general, the 8th sternite resembles, in the length of ostium bursae and its foamy structure, the genitalia of the genus *Phthorimaea*, but this is an obvious convergence.

Material: 2♂♂ and 1♀, Ft. Collins, Colo., 15. 9. 1933, from seed pods of *Physalis hederifolia*, A. B. Klotz; 1♀, St. Louis, Mo., from fruit of *Physalis viscosa*, 15. 9. 1884, Murtfeldt (BMNH), 1♀ Putnam Co., Ill., 9. 9. 1936, M. O. Glenn.



Genitalia of : 11, 12 — *Symmetrischema striatellum* ♂ (San Francisco); 13 — idem ♀ (San Francisco); 14 — *S. lavernellum* ♂ (Fort Collins Colo.); 15 — idem ♀ (St. Louis Mo.)

***Symmetrischema ventralellum* (Zeller, 1877), n. comb.**

Zeller, Horae Soc. Ent. Ross., 13, p. 348, t. 4, f. 116 (*Gelechia*)

The genitalia of the female holotype (Ubagin (?), 27. 3., Columbia) indicate that this species is very likely a member of this genus. The male is still unknown. The species is undoubtedly a member of the tribe Gnorimoschemini, but the present generic assignment must be regarded as provisional.

Material: 1 ♀, Ubagin [?], 27. 3. (BMNH).

***Symmetrischema altisonum* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 46, 1917 (*Phthorimaea*)

The genitalia of the male holotype show some significant differences from the typical species of the genus (the unpaired saccular process is absent, the gnathos is similar in shape to that of certain more derived forms of the genus *Scrobipalpula*, the valvae are not widened apically). However, they have a heavy scaphial structure, a typically broad uncus, and above all, the aedeagus is strongly bifurcate. This species may therefore be regarded as a very much modified but distinct form of the genus *Symmetrischema*.

Material: 1 ♂, Huancayo, Peru, 10,630 ft, leg. Parish, July (lectotypus) (BMNH). I have not examined the syntype.

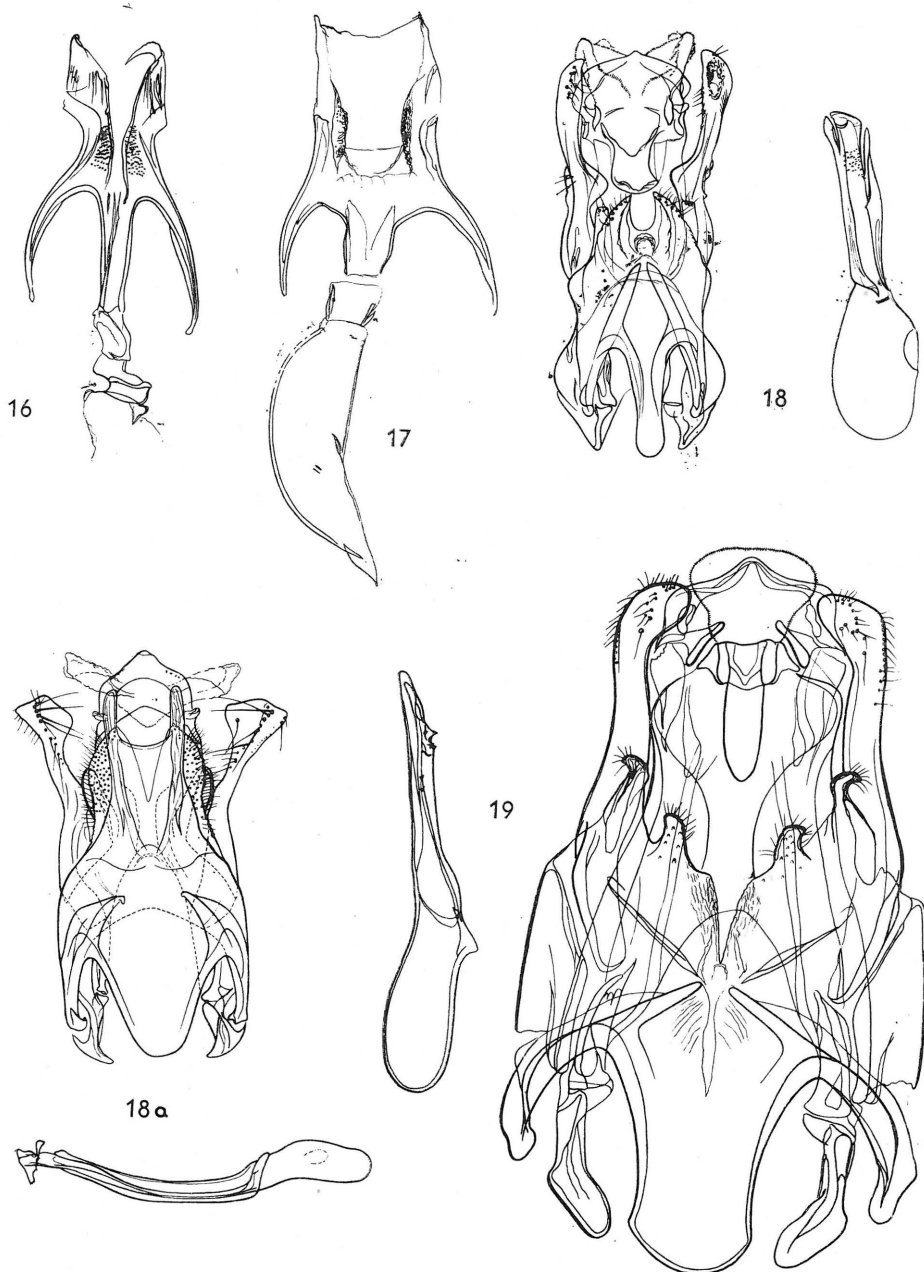
***Symmetrischema inexpectatum*, n. sp.**

The male genitalia show an indisputable relationship to the remaining species of this genus, especially, in the reduction of signum bursae and the general shape of the 8th sternite as well as its shortened and inwardly curved apophyses. The rather conspicuous chitinization of ductus bursae seems to be a new element.

The general coloration is ochreous-yellow. Head, thorax and tegulae with pale yellowish scales. The long scales covering the basal segment of palpi are dark spotted, the apical segment of palpi covered with clinging scales forming two darker rings (a basal and subapical one). Base of fore wing with two spots, the first of which is near the costal margin, the other below the first spot. Three additional darker spots, of which the medial one is the largest and most distinct, are situated in the basal third of the wing. The position of two of these spots corresponds to the position of the basal spots, the largest medial spot is positioned more obliquely towards the tip of the wing. On the costal margin of the wing there are two further dark spots probably replacing the reduced bands in the area of the wing, of which only indistinct spots are present. At the apex of the wing an isolated spot is placed before the cilia, having a more elongate, semi-elliptical shape. Hind wings shiny, semi-transparent, covered with brownish scales.

Length of the fore wing, 4.8 mm.

Holotype: 1 ♀, Brownsville, Texas, 11. 12. 1925, E. Piazza coll. (CAS).



Genitalia of : 16 — *Symmetrischema ventralellum* ♀ (Ubagin ?); 17 — *S. inexpectatum* ♀ (Holotypus); 18 — *S. altisonum* ♂ (Holotypus); 18a — *S. capsicum* (Paratypoid); 19 — *Gnorimoschema busckellum* ♂ (Caldwell, New Jersey)

***Symmetrischema capsicum* (Bradley & Povolný, 1965), n. comb.**

Bradley & Povolný, Bull. Ent. Res., 56, p. 58

This species was previously known under the name *Gnorimoschema* (or *Phthorimaea*) *gudmannella* in America (West Indies) and is generally recorded as a pest of red pepper (*Capsicum*). As the description of the species was prepared during my stay in the British Museum, Dept. of Entomology, in the summer of 1964, when the manuscript of the present paper was not finished, it was described under the generic name *Gnorimoschema*. The exact analysis of the male genitalia now shows that this is a specialized form of the genus *Symmetrischema* and another interesting representative of this genus in the Neotropic Region. The great specialization of this species is demonstrated in the peculiarities of the sacculus. The typical pair of processes is similar to two leaf-blades, of which two strongly chitinized ledges protrude and reaching the tip of valvae. The heavy scaphial membrane is well developed as are some other typical features of this genus: the subtrapezoidal form of the valva tip with a longitudinal row of medial bristles, the broad rounded uncus, the reduced gnathos, the strong saccus with an obtuse tip. The costal processes of valvae are well developed and hidden laterally behind the saccular lobes. Aedeagus comparatively slender, without lateral bifurcation but with a dense sculpture in the tip. Further details are given in the original description.

Genus *Gnorimoschema* Busck 1900

The revision of the available material has clearly shown that the previous conception of this genus, as appearing for example in the cataloguing works (e.g., Meyrick 1925, Gaede 1937, Busck 1939), is quite unsatisfactory. It has become evident that this otherwise rather homogeneous genus contains species quite heterogenous in phylogenetical sense. This is a situation similar to that in the genus *Phthorimaea* which is equally unnatural assemblage of species as it stands. The purpose of the present paper cannot be the definitive delimitation of the genus *Gnorimoschema* because many of the important nearctic representatives of the genus are inaccessible to me. On the other hand, it has appeared that, after the removal of those species which obviously do not belong to this genus, the genus *Gnorimoschema* retains a relative homogeneity. Also, the distribution of the thus selected species of *Gnorimoschema* s.str. indicates that this is a case of a substantially holarctic genus which is probably absent from the Neotropical region, which is certainly a very important fact in both zoogeographical and phylogenetical respects. The Palearctic region is certainly inhabited by far fewer species of this genus than North America, the species being mainly distributed in the western Palearctic. But in view of the existing inadequate insufficient knowledge of the fauna of *Gnorimoschemini* in the eastern Palearctic, this conclusion cannot be considered conclusive. The palearctic species are considerably homogeneous in both morphological (structure and genitalia) and habitual (pattern of fore wing) respects, some of them resembling the remaining *gnorimoschemoid* genera by their habitus (character of wing pattern). On the other hand, the nearctic species are much more varied and show numerous secondary changes and specialization both in

structure of their genitalia and in the character of wing pattern, which is reflected in their bionomics (gall producers). Of considerable importance is also the phylogenetical relationship of the genus *Gnorimoschema* to other nearctic and neotropical groups of the tribe Gnorimoschemini which, however, does not exist in any group of palearctic genera so that, in the Palearctic, the genus *Gnorimoschema* is quite isolated in the phylogenetical sense. Moreover, certain close if not identical species inhabit the northern United States, Greenland, Iceland, the British Isles and (western) Europe, so that they preserve even the territorial and zoogeographical continuity typical of other groups of North American origin.

The male genitalia of the genus *Gnorimoschema* are characterized by the following: Uncus broadly lanceolate or quite rounded, gnathos resembling a broad lower mandible of a bird's bill with rounded tip. Valvae long and cylindrical, their tip often cudgel-like, enlarged. Saccus broad (high), with two or three pairs of mutually symmetrical processes, very typical of individual species. Saccus greatly developed as a rule but usually short and bluntly rounded. Its shape is rather characteristic of various evolutionary branches within the genus. Aedeagus moderately long with thicker base from which it usually tapers gradually towards the tip. Very often it is provided with a lateral serrate ledge, sometimes reduced to individual spiny processes.

The female genitalia are much more constant and provide a more characteristic criterion for the arrangement of dubious species under this genus than the male genitalia. The eighth sternite is rather broad, its surface being sometimes provided with secondary chitinized ledges, but the foam-like structure characteristic of the scrobipalpoid branch of the tribe is invariably absent. Anterior margin of eighth sternite frequently semicircularly excised between ostium bursae and apophyses. Caudally, the ostium is provided with a rather strong chitinous ring; a conspicuous, hook-like, moderately curved signum bursae is invariably present in the bursa.

***Gnorimoschema busckiiellum* Kearfott, 1903**

Kearfott, Jour. N. York Ent. Soc., 11, p. 158, t. 9, f. 7, 1903

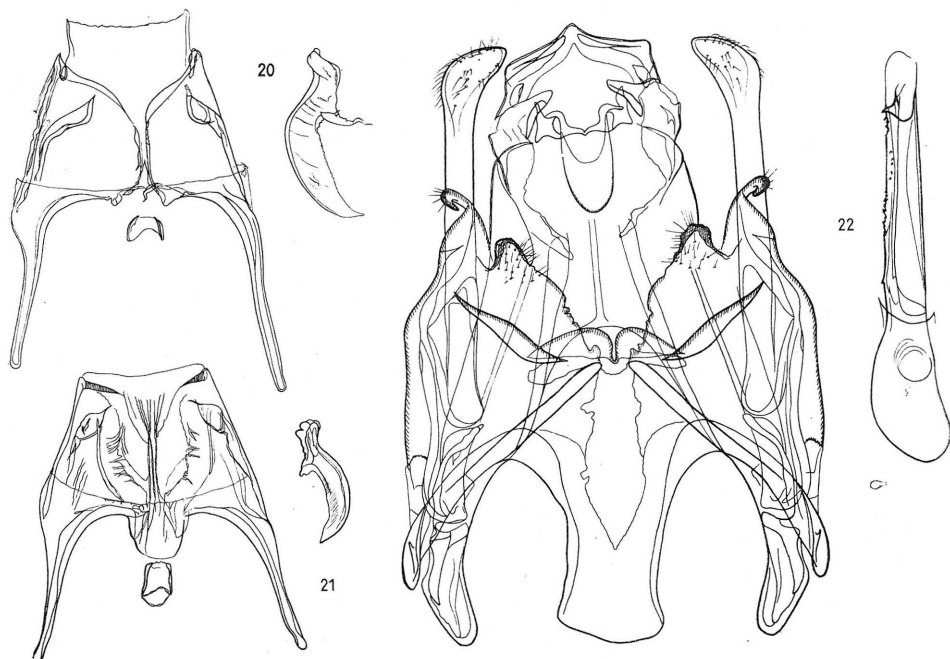
A typical representative of a relatively unspecialized New World evolutionary branch of the genus. The genitalia show far-reaching congeneric affinities with the typical species *G. gallaesolidaginis*. They show a heavy short saccus, valvae only slightly thickened above; aedeagus rather short, provided with short spiny processes subapically. In wing pattern, this species is characterized by a secondary reduction of the typical pattern, the wings being covered with unicolorous brownish-black scales. Female genitalia (of the lectotype) are conspicuous in the structure of signum bursae, which is strong, with inner edge flattened.

Material: 1♂ Caldwell, New Jersey, Busck 1905 33300 (BMNH), 1♀ Caldwell, New Jersey, W. D. Kearfott, Oct., Type No. 6818 (USNM).

***Gnorimoschema gallaeasteriellum* (Kellicot, 1878)**

Kellicot, Canad. Ent., 10, p. 203, 1878

Syn.: *Gelechia gallaediplopappi* Fyles, 1891, Canad. Ent. 22, p. 248



Genitalia of : 20 — *Gnorimoschema busckellum* ♀ ("Type", USNM); 21 — *G. gallaesolidaginis* ♀ (Wisconsin); 22 — *G. gallaesolidaginis* ♂ (Putnam)

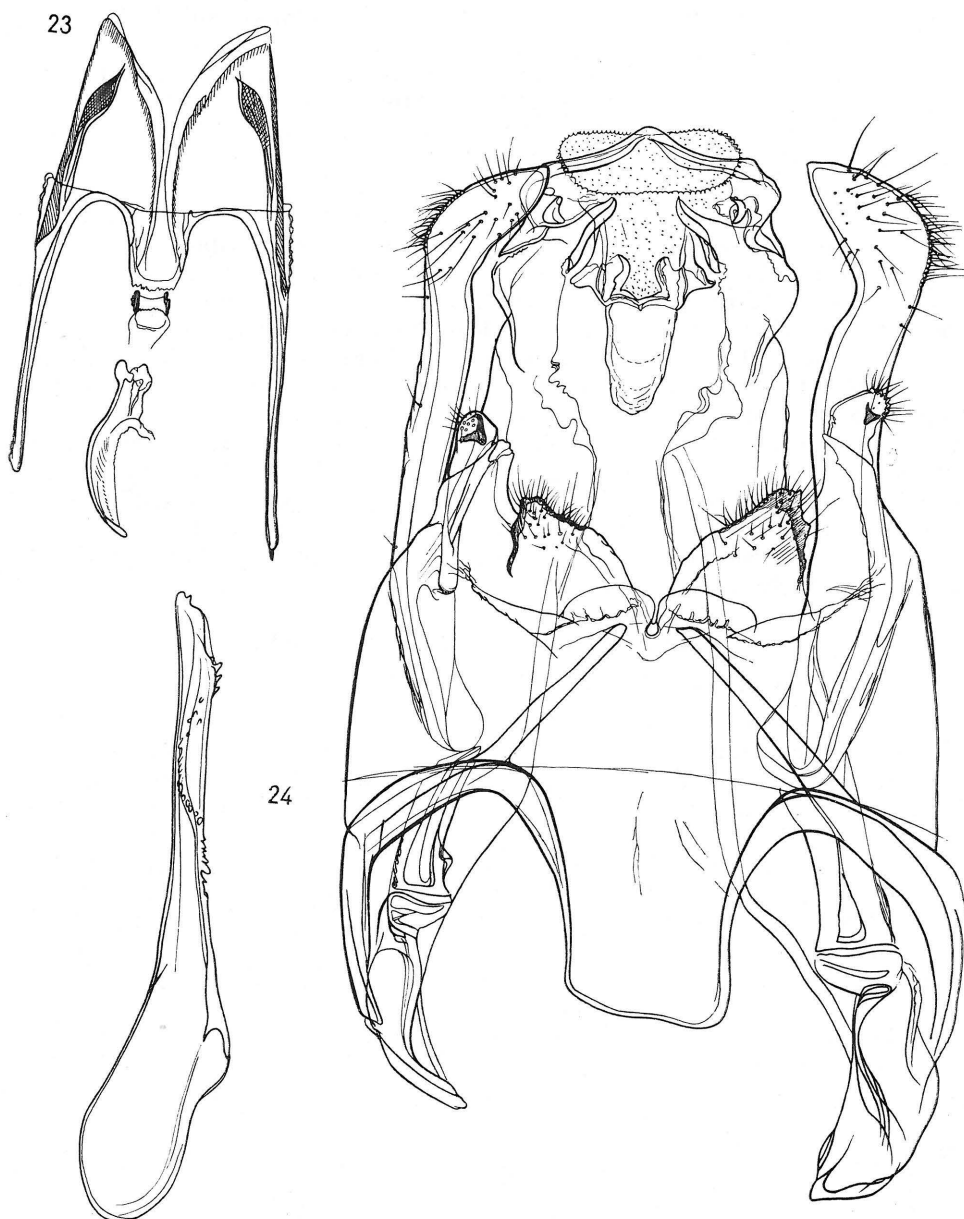
The male genitalia suggest that the species is related to, although obviously specifically different from, *G. gallaesolidaginis*. The same is suggested also by the identical scheme of their wing pattern. Both these forms belong to the specific North American line of species of the genus *Gnorimoschema* s.str. having developed (very likely secondarily) permanent adaptation to the endogenous development of larvae producing characteristics stem galls on certain Compositae. In habitual respect, these species also constitute a distinctive group. According to the literature, various species of the genus *Aster* are the host plants of this species.

Material: 1♂ 15. 12. 1881, Murtfeldt; 1♀ Wisconsin, Morrison 1883 (USNM)

***Gnorimoschema gallaesolidaginis* (Riley, 1869)**

Riley, Rep. Nat. Inst. Missouri, 1, p. 173, 1869.

This well-known North American species is typical of the genus *Gnorimoschema*. The male genitalia contains all typical elements and obviously have been subjected to only minor secondary changes which otherwise appear conspicuously both in the habitus of the adult and in its biology. The genitalia are well developed and their most specific character seems to be the medial saccular process narrowly excised at the middle. The presence of this process, being probably homologous with the conspicuous unpaired saccular process of



Genitalia of : 23 — *Gnорimoschema gallaesolidaginis* ♀ (Putnam); 24 — *G. salinare* ♂ (Beach Slaven)

the genus *Symmetrischema*, is typical of many New World species of this tribe. Apart from this, the genitalia of this species show a many-sided agreement with the secondarily little altered American and western European members of the genus *Gnorimoschema* s.str. Also, the female genitalia do not significantly differ from the generic norm. They are characterized by the slightly produced anterior margin of the 8th sternite, towards ostium bursae, and by two lateral ledges before the outer margin of the sternite. The signum is large with a flattened inner margin.

In its habitus this species is modified to the extent that it has (together with a complex of related forms whose taxonomy is not properly known) no analogy within the genus. The background of the fore wing is olive brown. Near the hind margin of the wing there is a pale stripe passing obliquely to the margin of the wing before its base and forming a conspicuous loop before the outer cross-bar. The primary morphological characters of the habitus have been subject to extensive changes, as evidenced both by the falciform fore wings and the conspicuously long palpi. These characters have very likely evolved as a result of a sudden progressive change (mutation) connected with different biology. *Solidago* spp. are the host plants of this species. The species are unambiguously defined also in zoogeographical respect, being distributed in the central States as well as in the east of the USA and Canada.

Material: Numerous series (Putnam, Conn.), Nepera Park, Yonkers, N.Y., New Brighton, Pennsylvania.

Gnorimoschema salinare Busck, 1911

Busck, Canad. Ent., 43, p. 4, 1911

This is a species closely related to *G. gallaesolidaginis* and *G. gallaeasteriellum*. From the latter, it differs only by the more flattened paired processes of the sacculus and by aedeagus tapering apically, as well as by shorter saccus. The female genitalia are large, with a huge, moderately curved, signum with inner margin flattened.

In general habitus and wing pattern this species resembles closely *G. gallaesolidaginis* and *G. gallaeasteriellum* but the wing pattern typical of *G. gallaesolidaginis* is disguised by the longitudinal striation of the wings. There can be little doubt that the speciation in this group has been strongly influenced by geographic isolation and/or specialization to a complex of related host plants.

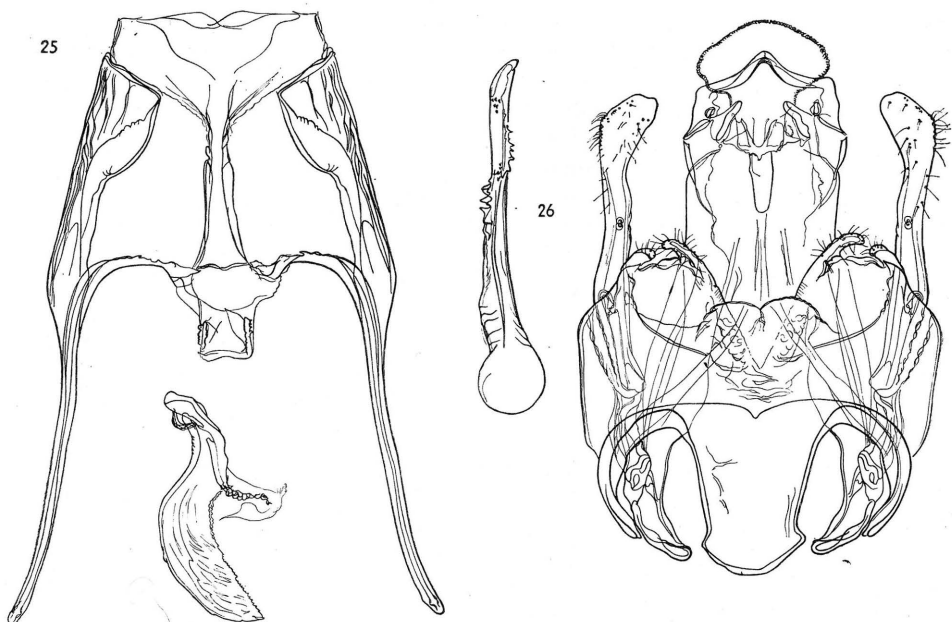
Material: 1♂ Beach Slaven, 12. 9. 48; 1♀ Atlantic City, on *Solidago sempervirens*, Oct. 1, 86, 4023 (USNM).

Gnorimoschema subterraneum Busck, 1911

Busck, Canad. Ent., 43, p. 5, 1911

This species also belongs in the *G. gallaesolidaginis* species group in morphological as well as ecological respect and is a representative of the genus *Gnorimoschema* s.str. However, it is relatively furthest from the group *gallaesolidaginis-gallaeasteriellum* which is especially apparent from the structure of its genitalia. These are characterized by a large and only slightly excised

unpaired saccular process placed in the middle of upper margin of sacculus, by the conspicuously narrow paired saccular processes and by the diminished paired processes joining the bases of valvae. Also, the saccus is short. The genitalia of this species are comparatively short along their longitudinal axis, so that they appear low (short) and broad. Aedeagus spherically dilated at base, its lateral sides provided with a serrate ledge.



Genitalia of : 25 — *Gnorimoschema salinare* ♀ (Atlantic City); 26 — *G. subterraneum* ♂ (Boston Mass.)

Female genitalia conspicuous by the large process on anterior margin of 8th sternite towards the ostium bursae. Signum large, hook-like.

Material: 1 ♂, 1 ♀, Rootgall on Aster, Boston, Mass., C. H. Clark, e. l. Sept. 7—8, 1910 (USNM).

Gnorimoschema batanellum Busck, 1903

Busck, Proc. U. S. Nat. Mus., 25, p. 833, 1903

The structure of its male and female genitalia shows this species to be another very typical New World representative of the genus, with relatively little specialization. It is characterized by a short aedeagus, with conspicuously ampulaceous part of coecum aedeagi, and by a comparatively short, slender saccus. Female genitalia with 8th sternite smooth, without conspicuous sculptures, and with a large hooklike signum.

Material: 1 ♂, 1 ♀, Toronto, Canada, Parish, 7. 23 (BMNH).

Gnorimoschema octomaculellum (Chambers, 1875)

Chambers, Cincinn. Quart. Journ. Sci., 2, p. 291, 1875

This species belongs to the group of more specialized species, especially evident in the great modification of the sacculus and base of valvae, which is very broad; from thence, the valvae are curved inwardly so that the upper part of genitalia is narrower than the lower part. Gnathos transformed into a short pointed tongue with a broad base. Saccus shorter than the lower projections of the tegumen, of equal width throughout its length, ovally terminated below. Paired processes on upper margin of sacculus relatively small, the latter rather strongly excised in middle. Morphologically, the genitalia of this species resemble those of *G. albimarginellum*.

Female genitalia distinguished by having the 8th sternite slightly tapering towards posterior end. Signum of typical shape for this genus.

The fore wing pattern consists of ochreous spots bordered with yellowish, among these are groups of greyish-black scales obscuring the pale ashy background. This is a secondarily altered pattern, substantially based on the original spots typical of the tribe as a whole. According to the literature *Acamptopappus sphaerocephalus* is the host plant of this species.

Material: 1 ♂, 1 ♀, Snake River, Wn, Whitman County, opp. Clarkston, 16. 6. 1933, reared from *Chrysothamnus viridiflorus albicaulus*, J. F. G. Clarke (USNM).

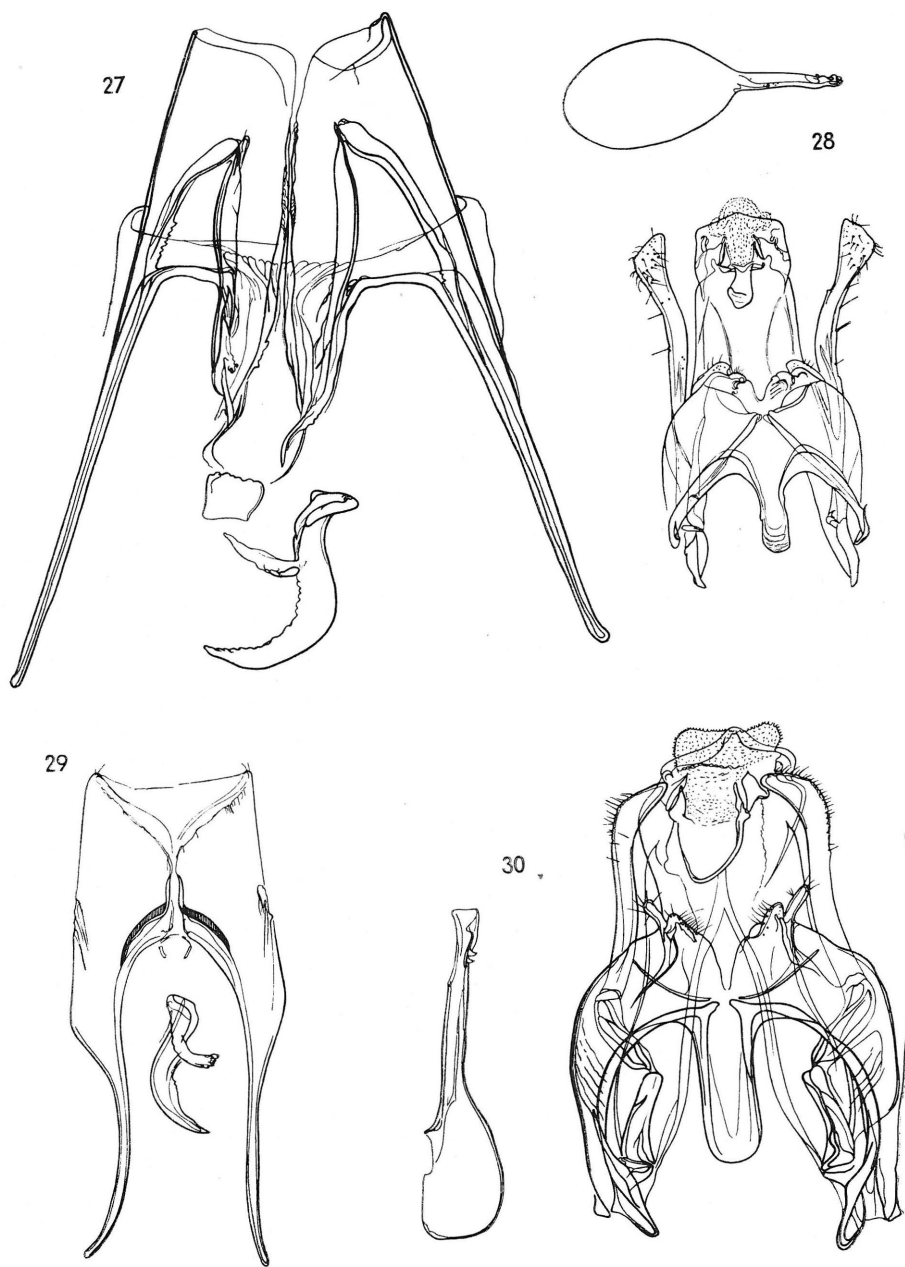
Gnorimoschema albimarginellum (Chambers, 1875)

Chambers, Cincinn. Quart. Journ. Sci., 2, p. 291, 1875

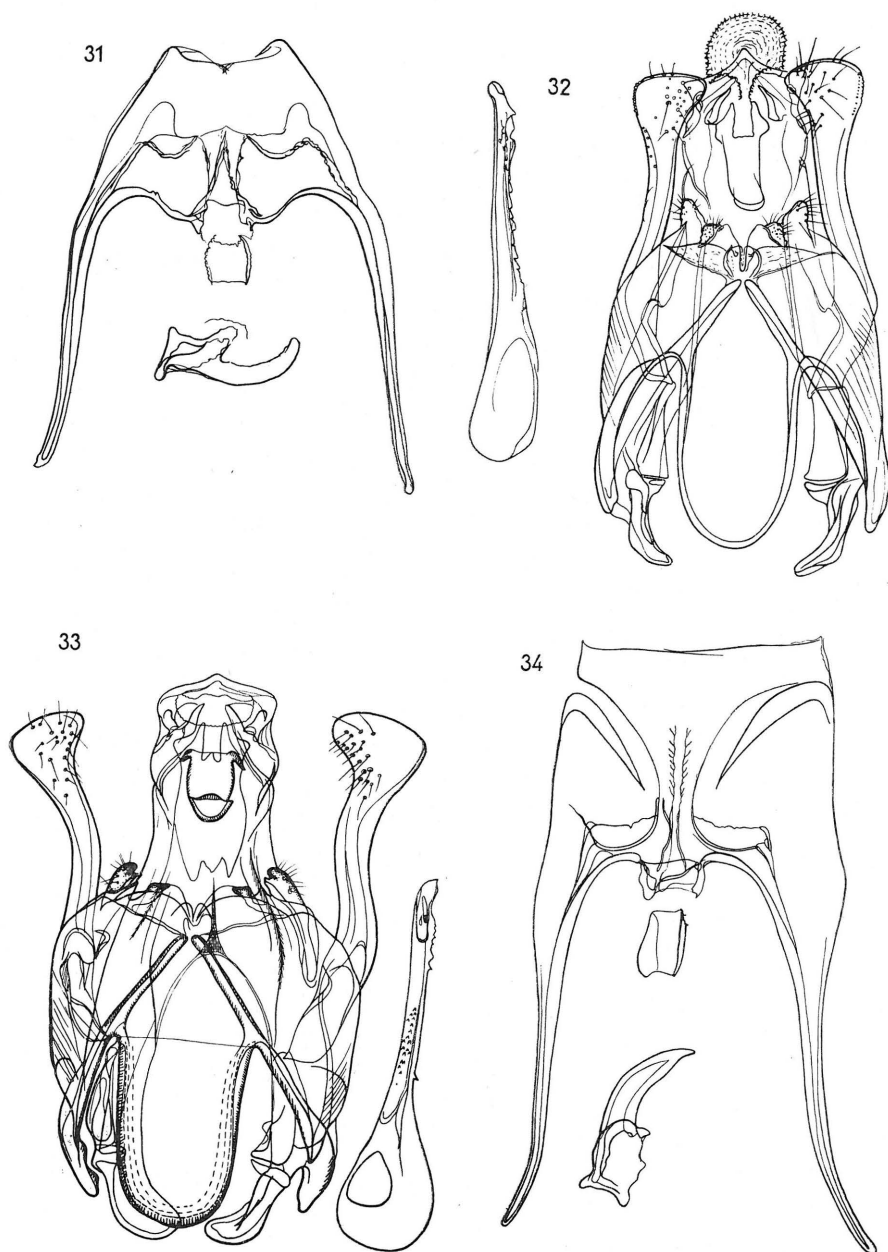
On the one hand, the male genitalia of this species show, in their general structure (especially of the uncus and the valvae and the aedeagus), the typical characters of the genus *Gnorimoschema*; on the other hand, they possess a number of very specialized characters (a long saccus, ovally rounded below; conspicuous heavy saccular part which is nearly disproportionate compared to the length of the uncus and the valvae; small and aggregate paired processes on the upper margin of the sacculus and a suggestion of an unpaired process among them). The female genitalia are characterized by a relatively simple and smooth 8th sternite provided, on each side of ostium bursae, with a single transverse lunular, chitinous ledge. Signum bursae is a large, moderately curved hook.

The wing pattern is distinctive by reason of its secondarily altered pattern, consisting of a shining white line arising from the base of the wing, forming its border and passing through two transverse bars, one near the base of the wing and one at the apex, both bars distinctly diverging towards the costal margin of the wing. The remaining surface of the wing is covered with nearly uniform brown scales and is without any spots typical of the tribe. Head white; thorax marked with longitudinal white stripes.

Material: 1 ♂, Little Tesque Canyon, Vic. Santa Fe, N. Mex., Alt. 9,200 ft, July 27-August 10, 1932, det. A. Buseck; 1 ♂, 1 ♀, Flying August 24. 16, Pecos, Nat' 1, For, N. Mex. Alt. 10,000 ft, C. Heinrich coll.



Genitalia of : 27 — *Gnorimoschema subterraneum* ♀ (Boston, Mass.); 28 — *G. batanellum* ♂ (Toronto); 29 — *idem* ♀ (Toronto); *G. octomaculellum* ♂ (Snake River)



Genitalia of : 31 — *Gnorimoschema octomaculellum* ♀ (Snake River); 32 — *G. albimarginellum* ♂ (Santa Fe); 33 — *idem* ♂ (New Mexico); 34 — *idem* ♀ (New Mexico)

Dr. Ronald W. Hodges forwarded to me a preparation labelled "*Gnorimoschema albimarginella* Ch.", Jackson Hole, Wyo., Klots coll. AB Apr. 15. 1937, which obviously belongs to a completely different species (I have not seen the adult).

***Gnorimoschema baccharisellum* Busck, 1903**

Busck, Proc. U. S. Nat. Mus., 25, p. 825, 1903

This species is one of the most specialized representatives of this genus in the Nearctic, which is apparent in both the structure of the male genitalia and in the pattern of the wings. The male genitalia are distinctive by the long, slender saccus and by the strongly specialized structure of the sacculus. The latter bears two symmetrical, slender processes and is deeply excised. The bases of the valvae each bear one rather short process (similar to those of certain species in the genera *Caryocolum* or *Ephysteris*). Aedeagus very long (of nearly equal length to the whole copulatory apparatus from the tip of saccus to the tip of uncus), rather stout and straight, only moderately dilated at base.

The female genitalia are quite typical of the genus *Gnorimoschema*, including the hook-like signum bursae. The wing pattern shows considerable secondary modification (pale honey coloured base of wings, centre of wings brown, a trace of a paler outer band; however, these criteria are very variable), the spots typical of the tribe are present. *Baccharis pilularis* is the host plant of this species.

Material: 1 ♀, 1 ♂ Mt. Siskiyou Co., California, 2. 8.—1. 9. 1871, coll. Wlsm. (BMNH).

***Gnorimoschema compsomorphum* Meyrick, 1929**

Meyrick, Exot. Microl., 3, p. 491, 1929.

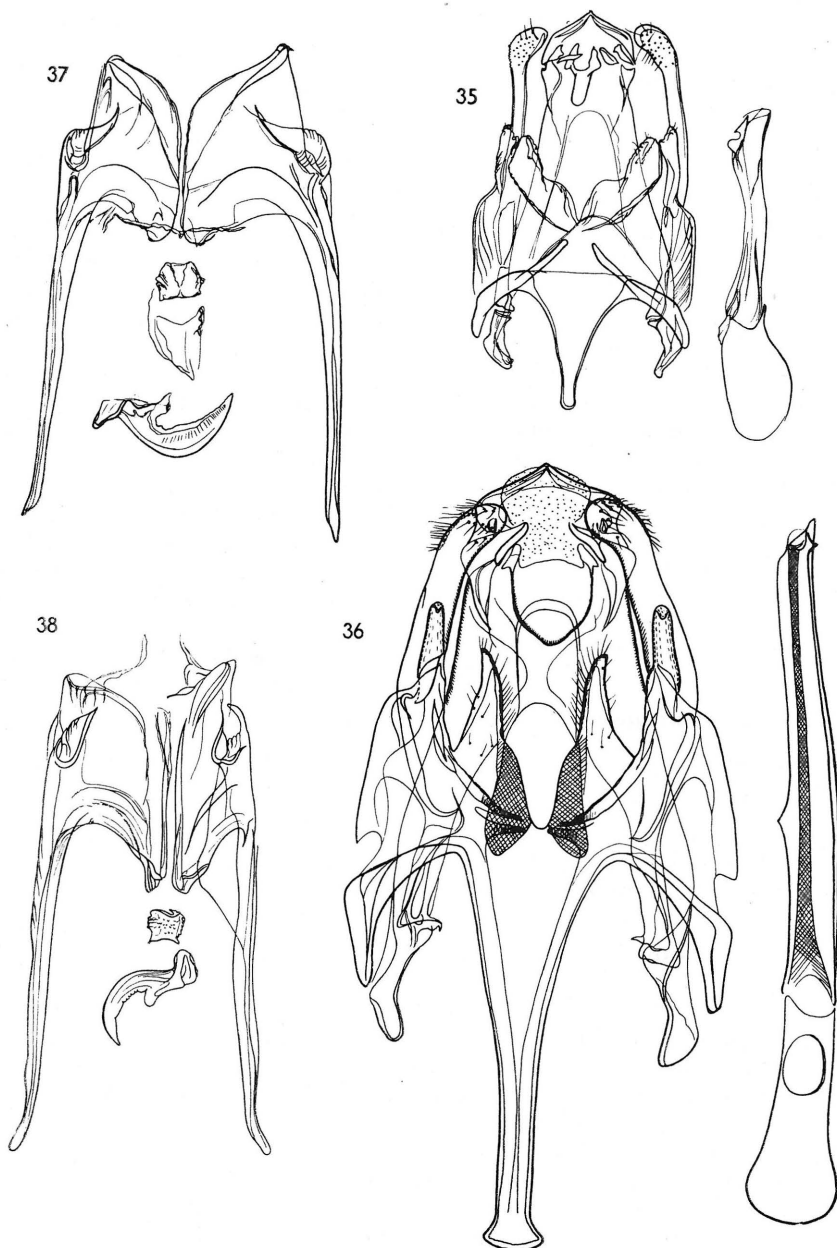
The genitalia of the female holotype (BMNH) show characters typical of the genus *Gnorimoschema*, with signs of secondary specialization of the 8th sternite, which is provided with a nodular chitinous process laterally.

Material: 1 ♀, New Mexico, Mountain Park, 6,700 ft, August, holotypus (BMNH).

***Gnorimoschema coquilletellum* Busck, 1902**

Busck, Proc. U. S. Nat. Mus., 25, p. 204, 1902

The morphology of the genitalia and the habitus of the adults show this to be a highly specialized and isolated species, which may be given as an example of a highly modified member of the genus *Gnorimoschema* in the Nearctic (on a level similar to that of *G. baccharisellum*). The genitalia are distinctive by their long, slender saccus, broad throughout its length, by the exceptionally broad, low saccular processes, by the short basal process of the anterior branch of the valvae, and by the very broad gnathos. The long and slender saccus, the structure of sacculus, the basal processes of valvae and the broad and short gnathos closely resemble those of *G. baccharisellum*. Also, the peculiar nodular processes lateral to the 8th sternite of the female genitalia suggest a certain relationship between both these species. However the specialization of *G. coquilletellum* seems even more advanced than that of *G. baccharisellum*, and this is especially



Genitalia of : 35 — "*Gnorimoschema albimarginella*" ♂ (Wyoming); 36 — *Gnorimoschema baccharisellum* ♂ (California); 37 — idem ♀ (California); 38 — *G. compsomorphum* ♀ (Holotypus)

indicated by the conspicuous prolongation of the chitinization of ductus bursae and the prolongation of the anterior margin of the 8th sternite towards the ostium bursae which is only evident in *G. baccharisellum*. Of specific structure are the valvae which are strongly club-like and enlarged above, and especially the aedeagus which is shorter compared with that of *G. baccharisellum*, thickened basally and provided with a long and strongly curved thorn apically. *Applopappus pinifolius* is the host plant of this species.

These two species are similar to each other even in their habitus (base of wings bearing contrasting colours) and their pattern is obviously secondarily altered.

Material: 1 ♂, 1 ♀, Phoenix Lake, Marin Co., Cal. 22. 5., 23. 6. 1928, reared from *Ericameria arborescens*, H. H. Keifer coll. (CAS).

Gnorimoschema ericameriae Keifer, 1933

Keifer, Mon. Bull. Dept. Agric., Cal., 22, p. 361, 1933

In habitus this species resembles a small but otherwise almost exact copy of *G. coquillettellum*. The moths have a very similar fore wing pattern, essentially differing from that of *G. coquillettellum* by the absence of the honey-coloured basal blotch, the group of basal scales having retained their dark basic colouring. The rather unicolorous area of the fore wing, which in *G. coquillettellum* has the isolated spots typical of the genus, is interrupted by groups of pronounced pale scales in *G. ericameriae*. However, the basic pattern of fore wings of both species is identical.

A very great similarity is also observed in the female genitalia (fig. 41); and the host plants are the same for both species.

The existence of these two forms is of considerable importance for the elucidation of speciation within this genus. Beyond doubt, they are sister species ("Schwesterarten"), the origin of which could be explained by selective influence of the environment upon certain variants in a population isolated for a longer period of time, or, on the other hand, by a sudden change of a mutational character resulting in the origin of a related but independent species. Essentially, they are close "sibling species".

Material: 2 ♀ San Francisco, Cal. 6.—8. 8. 1927, Gall on *Ericameria ericoides*, coll. H. H. Keifer.

Gnorimoschema dudiellum Busck, 1903

Busck, Proc. U. S. Nat. Mus., 25, p. 828, 1903

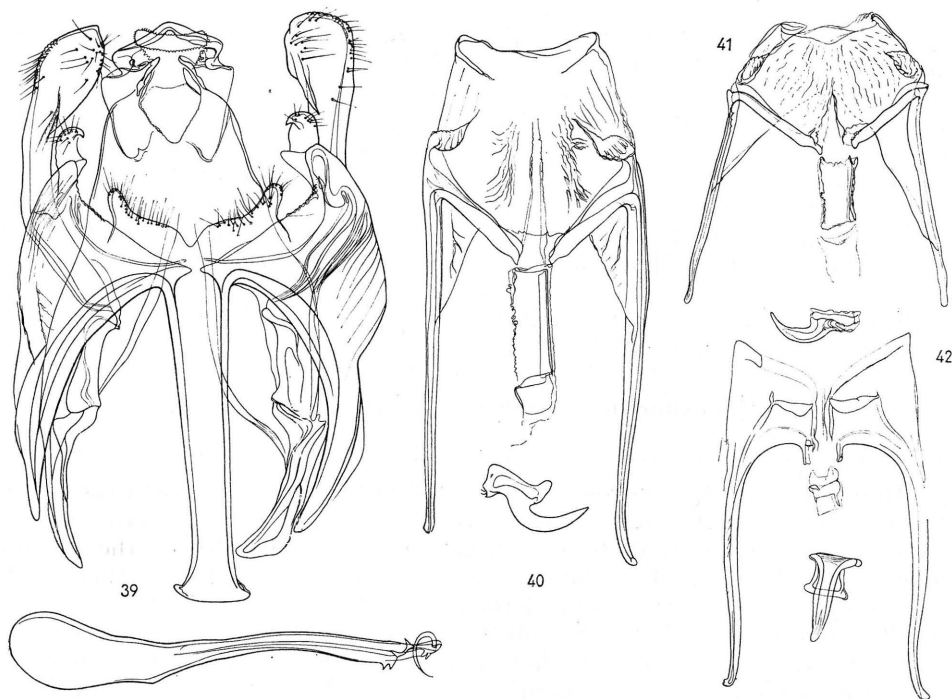
The female genitalia show characters typical of this genus and are of a relatively simple structure with a typical signum bursae.

Material: 1 ♀, Amula, 6,000 ft, Guerrero, Mexico, 8. 18 (H. H. Smith) (BMNH).

Gnorimoschema saphirinellum (Chambers, 1873)

Chambers, Cincinn. Quart. Journ. Sci., 2, p. 250, 1875

The female genitalia are quite typical of the genus *Gnorimoschema*. The wing pattern, consisting of longitudinal brown stripes, is somewhat specialized.



Genitalia of : 39 — *Gnorimoschema coquillettellum* ♂ (Phoenix Lake); 40 — idem ♀ (Phoenix Lake); 41 — *G. ericameriae* ♀ (San Francisco); 42 — *G. dudiellum* ♀ (Mexico)

This species seems to belong to a group of rather specialized and relatively isolated species inhabiting the arid areas of the south of the U. S. A.

Material: 2 ♀, Brenster Co., Texas, 5,000—7,000 ft, 4. 7. 1926 (BMNH).

***Gnorimoschema sporomochlum* Meyrick, 1929**

Meyrick, Exot. Microl., 3, p. 491, 1929

The female genitalia of the holotype are quite typical of the genus *Gnorimoschema* but in view of the relative uniformity of this structure, even in highly specialized forms, no definite statement as to the position of the present species can be made.

Material: 1 ♀, Texas, Fort Davis, 5,000 ft, May (holotypus) (BMNH).

***Gnorimoschema valesiellum charcoti* (Meyrick, 1934), n. comb.**

Meyrick, Entom., 67, p. 59, 1934 (*Phthorimaea*)

The male genitalia as well as the habitus of this species indicate a close relationship with the European *G. valesiellum* (Staudinger 1877) complex, so that the present species is conspecific or at most subspecifically different as a geographic race. A thorough comparison has not revealed a single character in

which the genitalia of these two species differ, whether in the structure of the uncus, valvae, saccus or the shape of the paired saccular processes (or the basal parts of valvae). Moreover, this circumstance is strongly corroborated by the occurrence of *G. valesiellum* in Iceland (Hallormsstaour, O. Island, 12. 7. 1950, leg. Niels L. Wolf) as well as by the occurrence of its subspecies in Alaska (St. Paul). This geographical distribution of *G. valesiellum* from western Europe over Scandinavia, Iceland, Greenland up to Alaska in locally very widely isolated and habitually rather different populations bearing a character of geographical races provides both evidence of close relationship and phylogenetical relations of certain members of this genus in Europe and North America and further recent faunistic evidence of their continental connection in the Tertiary period. It appears at the same time that in both these continents these species are faunistic relics of at least tertiary age.

Material: 1 ♂, Cape Dalton, East Greenland, 20. 8. 33, leg. D. Lack, lectotypus (BMNH).

***Gnorimoschema valesiellum alaskense*, n. ssp.**

The structure of the male genitalia of this species is very similar to those of the European species *G. valesiellum*. They are best distinguished by two S-shaped processes joining with peculiar crescent-shaped convex ledges arising on both sides of sacculus. The latter is feebly indented in middle. At the level of this medial indentation, the surface of sacculus bears two oblique ledges with upper margins shallowly dentate. The remaining parts of the genitalia show a structure typical of the genus *Gnorimoschema* s. str.

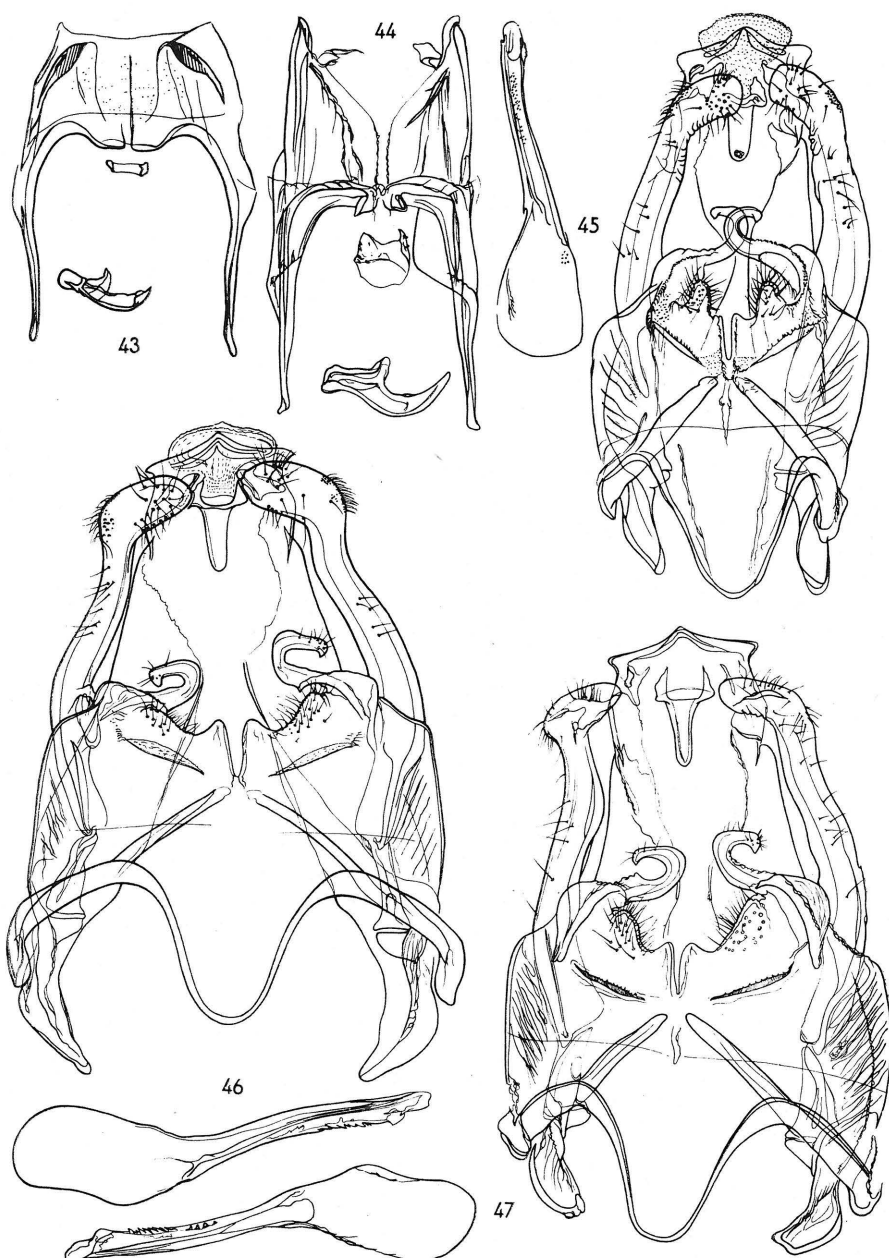
The female genitalia also show a close similarity with those of *G. valesiellum* but the 8th sternite is broader. In the place of its concave excision on both sides of ostium bursae the anterior margin of the 8th sternite is not provided by as broad a ledge as that of the European forms.

The coloration of the male is a dull dirty greyish-brown. In the wing area there are two indistinct eye-like dark spots, the first one in the middle of the wing, the second more towards the tip of the wing, bearing a suggestion of an indistinct darker transverse bar. Blotches consisting of yellowish scales are sparsely scattered before the posterior margin of fore wing. Head and thorax with graphitic lustre. Wings rather narrow. Length of fore wing, 7.2—7.8 mm.

The colouring of the female is much more pronounced, showing an obvious sexual dimorphism. On an altogether paler background the posterior margin of the wing is pronouncedly pale, forming an irregular wave passing into a pale transverse bar at the tip of the wing, being interrupted by a medial eye-like dark spot. Also, the anterior margin of fore wing and its tip bear scattered pale cream-coloured scales, suppressing the dark brown background in places. The fore wings of the two female specimens examined are distinctly broader and shorter (6.1 and 5.9 mm, resp.).

Material: 1 ♂, St. Paul Id., Alaska, 6., 9., 11. VII. 1939, Pres. E. C. Johnston col. (holotypus), 1 ♂ and 2 ♀♀ (paratypi) CAS).

This is either an independent and well defined geographical race, or a little pronounced species closely related to the European *G. valesiellum*.



Genitalia of : 43 — *Gnorimoschema saphirinellum* ♀ (Texas); 44 — *G. sporomochlum* ♀ (Holotypus); 45 — *G. valesiellum charcoti* ♂ (Lectotypus); 46 — *G. valesiellum alaskense* ♂ (Holotypus); 47 — *idem* ♂ (Paratypus)

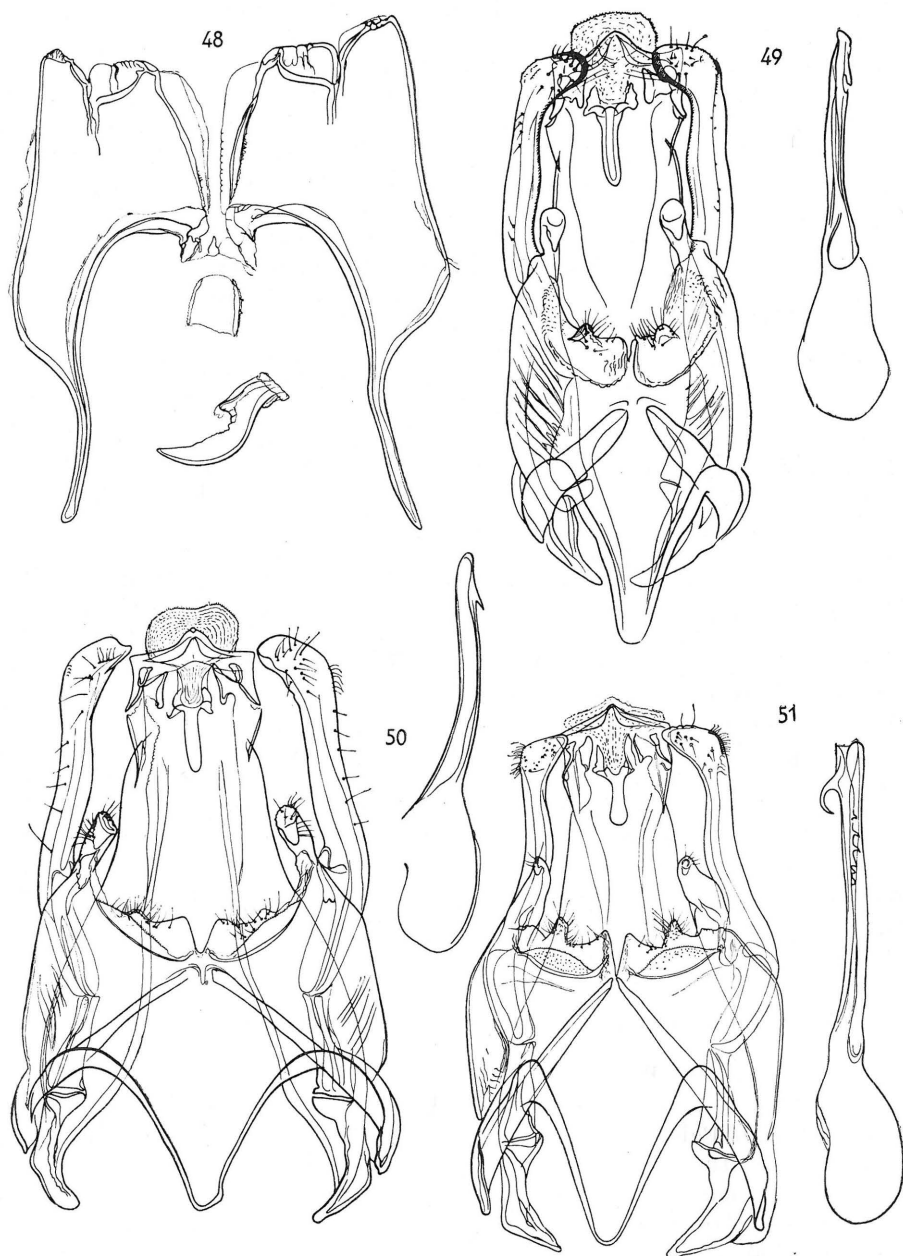
Note: My conclusions on the distribution of *Gnorimoschema valesiellum* in the Subarctic zone were recently confirmed by Wolff 1964, as far as Greenland and Iceland are concerned. Wolff 1964 also cited the very close similarity, or identity, of male genitalia of the European "*Phthorimaea*" *valesiella* (Staudinger) with those of "*Phthorimaea*" *charcoti* Meyrick from Greenland. The above author also confirms the identity of the specimens originally determined as "*Phthorimaea*" *streliciella* (Herrich-Schäffer) from Iceland, with "*Phthorimaea*" *valesiella* (Staudinger). However, it appears that these data on the distribution of *G. valesiellum* in the New World do not cover its real distribution as demonstrated by the presence of this species in Alaska. This indicates that the species must be present also in the vast areas between Greenland and Alaska in Canada. Concerning the complicated problem of the subspecific taxonomy of *G. valesiellum* to be solved in future, it appears that the species probably consists of several isolated populations having some peculiar characters. I am therefore not inclined to consider them to be simple synonyms of the nominate form of the *G. valesiellum*, because at least their subspecific differentiation is possible. As a matter of fact, many species of the tribe Gnorimoschemini show a far-reaching polytypy. As regards *G. valesiellum*, I have pointed out (Povolný 1964), as also did Wolff (1964), that the species *diabolicella* and *hackmanni* were doubtless synonyms of *valesiellum*. It is, however, necessary to consider also their possible subspecific characters, which are certainly striking as far as the habitus of these forms is concerned. In particular the form *charcoti* Meyrick should be separated as a subspecies, similar to the form occurring in Alaska which also has features of a geographical race. But I am not quite sure if this species is really a boreo-alpine form. This category (boreo-alpine element in European zoogeography) is in several respects a little confused. I therefore prefer to consider *G. valesiellum* to be a relic species of considerable age, the distribution of which is of insular character at present. The individual insular populations tend to manifest important habitual differences, whereas their genitalia are nearly identical. It cannot be excluded that in this way sibling species can develop from such isolated populations or local races with existing reproductive isolation. The presence of *G. valesiellum* in the New World is extremely important not only for the understanding of important questions of zoogeography of the tribe as a whole.

***Gnorimoschema nordlandicolellum eucaustum* (Meyrick, 1929)**

Meyrick, Exot. Microl., 3, p. 492, 1929 (*Gnorimoschema*)

The genitalia of the male holotype (BMNH) show a far reaching identity with the western Palearctic species *B. nordlandicolellum*; also the habitus of both specimens studied is in substantial accordance with that of the latter species, so that there is almost no doubt of their being conspecific.

Uncus broad, rather angular, gnathos in form of a relatively slender, unpointed jaw. Valvae long and cylindrical, feebly S-shaped, indistinctly enlarged on upper ends. Saccus shallowly and narrowly excised at middle, a concavely excised, broad and low paired process arising on both sides of this excision. Bases of valvae bear one thumb-like process curved forward. Saccus trape-



Genitalia of : 48 — *Gnorimoschema valesiellum alaskense* ♀ (Paratypus); 49 — *G. nordlandicoellum eucaustum* ♂ (Lectotypus); 50 — *G. nordlandicoellum eucaustum* ♂ (Arizona); 51 — *G. banksiellum* ♂ (Santa Fe)

zoidal, with its tip reaching the level of the lower corners of tegumen. Aedeagus moderately long, with lower third dilated, the slender part of the body of aedeagus bearing a minute tooth-like process below the tip.

Fore wings of inconspicuous ashy colour, bearing three dark eye-like dots bordered with brown. The first one lies roughly in middle of the wing area, the second one is shifted towards the tip of the wing, the third one is shifted obliquely forward and somewhat towards the posterior margin, ahead of the first blotch. At the tip of the wing, near the fringes, blackish scales produce several (5—7) little wedges arranged radially. Head and thorax grey, front white. Hind wings paler grey in colour.

The presence of this species in the Nearctic (whether as an identical species, a mere geographical race or a little differentiated independent species) is further evidence of the direct phylogenetic connection of certain western Palearctic and Nearctic species of the genus *Gnorimoschema*, and, at the same time, evidence of the considerable geological age of these species (at least tertiary).

Material: 1 ♂, Texas, Alpine, 5,000—6,000 ft, April, May (lectotypus). The paratypoid (syntype) has not been studied. 1 ♂, Hart Prairie, 8,500', 10 mi NNW Flagstaff, Coconino Ob., Arizona, July 1961, Ronald W. Hodges (USNM).

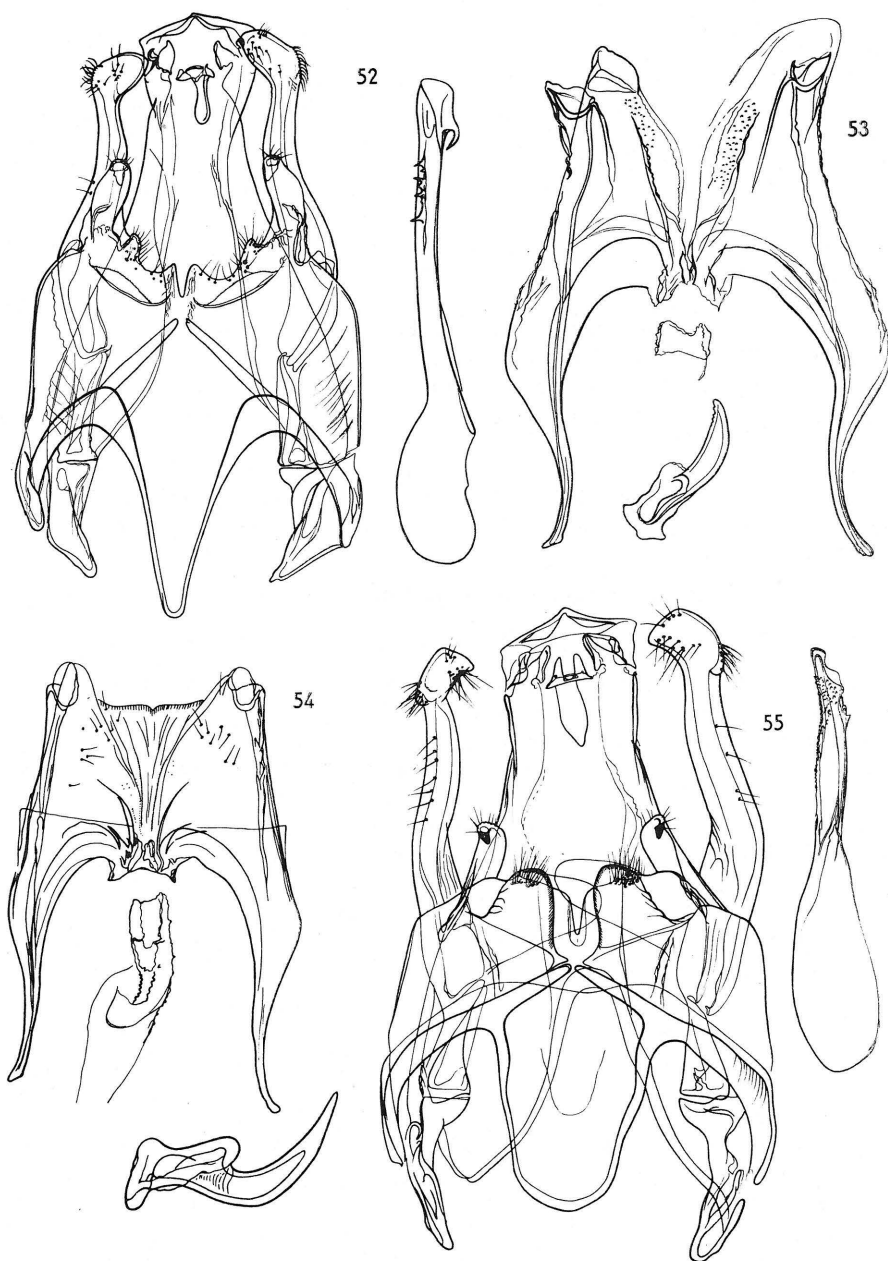
***Gnorimoschema banksiellum* Busck, 1903**

Busck, Proc. U. S. Nat. Mus., 25, p. 832, 1903

As appears from the structure of the male and female genitalia, this species is a typical representative of a relatively little specialized group of species of this genus in the Nearctic, showing very close relationship with the western Palearctic species complex *Gnorimoschema valesiellum-strelicellum*. On the whole, the male genitalia show much the same structure as those of this palearctic group. Saccus slender and pointed (as in the western European *G. strelicellum*), anterior process of base of valvae rather heavy. The most specific character of the male genitalia is the conspicuous hooklet placed on the tip of the aedeagus and pointing downwards arch-like to the wall of aedeagus.

The female genitalia are also somewhat similar to those of the European *G. valesiellum*; the most typical characters are the rather long chitinized section of ductus bursae (fig. 33, 54) and the heavy, slenderly pointed signum bursae.

According to Gaede (1937), the species is distributed in north-eastern U.S.A. and in Canada. Among the material of the CAS in San Francisco I discovered another male of this species (the specificity of which is best confirmed by its genitalia, fig. 51), agreeing also with the typical wing pattern of this species. The male comes from the environs of Santa Fé, New Mexico. From the same locality comes also a female which is somewhat paler in colour, and the 8th sternite of which, whilst being very similar to that of the females of the Canadian origin, is heavier and has the chitinized section of the caudal part of ductus bursae absent. Whilst the above-mentioned male provides evidence of the occurrence of this species in the south-west of the U.S.A., the possibility cannot be excluded that this is a case of an independent subspecies or a closely related species.



Genitalia of : 52 — *Gnorimoschema banksiellum* ♂ (Oak Station); 53 — idem ♀ (Santa Fe); 54 — idem ♀ (Toronto); 55 — *G. triocellatum* ♂ (Denver)

Material: A small series of specimens from Toronto, Canada; 1 ♂, 1 ♀, Little Tesuque Canyon, Vic. Santa Fé, N. Mex., Alt. 9,200 ft, July 27—August 10, 1922; 1 ♂, Oak Station, Alleg. Co., 14. 6. 11, Fred Marloff.

Gnorimoschema triocellellum (Chambers, 1879)

Chambers, Bull. U. S. Geol. Surv., 3, p. 127, 1897

Substantially, the male genitalia of this species resemble those of certain palearctic species; however, they show a quite specific paired process, obviously homologous with the longitudinal ledges occurring in this region in a number of species and having evolved by a great enlargement of this ledge in the upward direction so that it reaches beyond the level of the sacculus. In other respects, the genitalia resemble those of the European *G. nordlandicollum* and *G. pasziczkyi*. The fore wing pattern, with its typical eye-like dots, is also characteristic of this group of species.

Material: 1 ♂, Denver 197, Col.

Gnorimoschema spec.

The female genitalia are characterized by the 8th sternite being of very simple structure, having a smooth surface without any chitinous structures. The excision of the anterior margin of the 8th sternite is shallow, the chitinized ring of the caudal part of ductus bursae is broad, signum is a heavy and feebly curved hook.

The considerably worn female specimen, with only traces of the fore wing pattern, somewhat resembles the pale individuals of *Gnorimoschema pasziczkyi* from Europe (but it cannot be conspecific with this species by reason of the structure of its female genitalia). I have seen similar types of female genitalia also in the Palearctic but I have not succeeded in finding the corresponding male specimens even to these; consequently, this problem still remains open.

Material: 1 ♀, S. Francisco Co., Cal., Oct. (CAS).

Note: The female genitalia of this species resemble rather closely those of the species „*Phthorimaea*“ *vibei* Wolff, 1964 which undoubtedly belongs to the genus *Gnorimoschema*, and was described by Wolff from western Greenland. Another suspected female specimen of this species, which I have not dared to describe for years as I did not know the male sex of this form, comes from Amrum Island near the north German coast (1. 9. 1936). *Gnorimoschema vibei* (Wolff 1964), therefore, is not endemic to Greenland as it appeared but has a greater geographic distribution, similar to *G. valesiellum*. The worn condition of all known individuals, including the type material of *vibei*, suggests that this species apparently has peculiar bionomics so that it appears rare, as all the above specimens had been caught by chance.

Gnorimoschema (*Neoschema*, n. subg.) **klotsi**, n. sp.

While having most of the elements typical of the genitalia of this genus, the genitalia of the male holotype show considerable and obviously secondary changes. The uncus is broad and strongly arched, the tip is bent forward and



Genitalia of : 56 — *Gnorimoschema* spec. ♀ (S. Francisco Co., Cal., Oct. — CAS); 57 — *G. (Neoschema) klotsi* n. sp. ♂ (Holotypus)

ends in a bifurcate process. The gnathos consists of two branches passing into an unpaired membranous, feebly chitinized, bladder-like structure. The sacculus is relatively heavy and broad, tapering towards the paired processes, and has a rather deep indentation between them. The second pair of processes, usually fused with the bases of valvae, is permanently fused with sacculus and consists of two peculiar twisted finger-like processes, somewhat resembling the same structures of the European species *G. valesiellum*. The lower part of tegumen is heavy and broad, rather deeply excised below; the saccus is short, subtrapezoidal, with a truncate and slightly enlarged tip. Valvae feebly S-shaped, enlarged in middle and widened above to form peculiar spherical structures provided with somewhat pointed processes projecting towards the uncus. Aedeagus relatively short and curved, with its base somewhat enlarged.

The basic colouring of the adult is black-and-white mottled. Head and thorax substantially white, posterior end of thorax with a black tip, a stripe of black scales crossing the middle of the thorax. Basal segment of palpi covered below with hirsute black and white scales, the black ones prevailing especially on its outer part. Second segment of palpi with clinging scales, black with a white tip and a white ring near its base, which is black. Fore wings with milky white background, covered with scattered black scales forming either small groups or pronounced black dots in the arrangement typical of the tribe. In addition, pale brown scales are loosely scattered over the wing area. Hind wings shining whitish grey, antennae and legs white, ringed with black.

Beyond doubt, this species represents a highly isolated gnorimoschemoid form showing pronounced specialization in the genitalia. But despite the obvious relationship of this species with the genus *Gnorimoschema*, its present arrangement under this genus is provisional.

Material: 1 ♂ (holotypus), environs of Mono-Lake, edge of Nevada desert, beginning of September, 1963, leg. Povolný.

I name this species after Professor Dr. Alexander B. Klots, of New York, who has helped me greatly in the study of this group.

Genus *Scrobipalpa* Povolný 1964

The generic diagnosis (Povolný 1964) must be supplemented in the sense that the New World (mainly the Neotropic Reigon) is inhabited, apart from the species which show a far-reaching conformity with the European species complex *S. psilella-difflluella*, by forms showing substantial specific specializations, the eventual subgeneric separation of which from the genus *Scrobipalpa* may be necessary in the future. Otherwise, this is a mainly homogeneous group containing a number of species the morphological separation of which (both as regards copulatory organs and habitus) presents quite exceptional difficulties and will probably require cytogenetic and experimental methods. Beyond doubt, this is a rather ancient group which is little differentiated with the exception of the neotropic forms.

The following are their common characters: Gnathos is not hook-like and pointed (as in most of the *Gnorimoschemini*) but is semicircularly enlarged at its tip to a lancet-like structure. The second of processes on upper margin of

sacculus on both sides of the large blade-like processes of the first pair is greatly reduced (or absent) to form short cone-like hairy processes. Valvae flattened, mostly long, moderately curved inwardly. Uncus arched as a rule, frequently rounded. Aedeagus rather long, tending to form a strong subterminal thorn. Female genitalia characterized by a prolongation of the anterior margin of 8th sternite towards the ostium bursae and by a conspicuous foamy structure in places where the anterior apophyses arise from the 8th sternite. Signum bursae hook-like but rather slight.

***Scrobipalpula henshawiella* (Busck, 1903), n. comb.**

Busck, Proc. U. S. Nat. Mus., 25, p. 831, 1903 (*Gnorimoschema*)

In its habitus, this form is markedly similar to the European *S. psilella* f. *ramosella*. In fact, there are neither habitual nor anatomical characters permitting the separation of these forms. In Europe, f. *ramosella* inhabits alpine habitats, similar to f. *compositella* (in the mountains of the Balkan Peninsula) which is a mere extreme phenotype of this pattern tendency (cf. Povolný 1964).

Material: 1 ♀, Oak Station, Alleg. CO. Pa., May 19, 1907, Fred Marloff. I examined further specimens with similar results during my stay in the USA (USNM).

***Scrobipalpula artemisiella* (Kearfott, 1903), n. comb.**

Kearfott, Journ. N. York Ent. Soc., 11, p. 160, 1903 (*Gnorimoschema*)

In habitus, both the specimens examined resemble closely the European *S. psilella* f. *difflluella* but the basic colour of their wings is somewhat more brownish, due to the presence of larger areas of brown and testaceous scales. Anatomically, they cannot be separated from the European forms of the *S. psilella* complex.

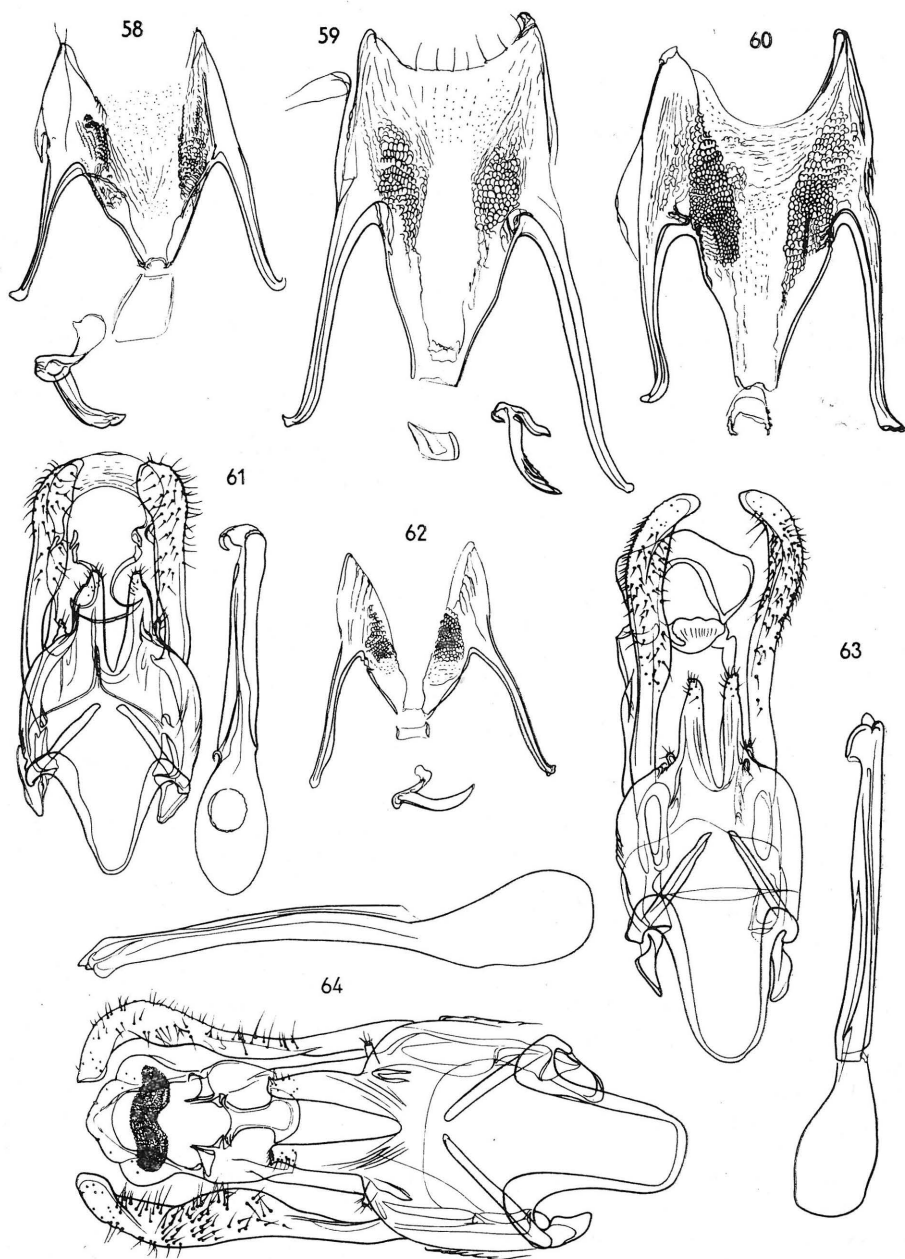
Material: 2 ♀, Chicago, Ills, 15. 7. 1922, K. 2A1, *Gnorimoschema artemisiella* Kearfott (type and cotype) (USNM). Obviously, this is the holotype and the paratype in the modern sense. I also examined additional material during my stay in the USNM and the BMNH.

***Scrobipalpula potentella* Keifer, 1936), n. comb.**

Keifer, Mo. Bul. Cal. Dept. Agri., 25, p. 238, 1936 (*Gnorimoschema*)

The wing pattern of this form is identical with that of the preceding one except that the pale testaceous scales are absent from the wing area, only reduced longitudinal stripes remaining. Consequently, the general colouring of the fore wing is rather greyish. In other respects, this form shows a strong resemblance to the European *S. psilella* f. *difflluella*.

Genitalia: it may be inferred both from the figure by Keifer (1939, p. 250, fig. 2 and 3a) and from my own studies, that this is a form with comparatively small genitalia. This opinion is corroborated by the female examined which, with a generally smaller extent of the 8th sternite, shows rather shortened process of the anterior margin compared with that of female *S. artemisiella* (fig. 62).



Genitalia of: 58 — *Scrobipalpula henshawiella* ♀ (Oak Station); 59 — *S. artemisiella* ♀ ("Type" — USNM); 60 — *S. artemisiella* ♀ ("Cotype" — USNM); 61 — *idem* ♂ (Oak Station); 62 — *S. potentella* ♀ (San Francisco); 63 — *S. semirosea* ♂ (Lectotypus); 64 — *idem* ♂ (Paralectotypus)

Material: 1 ♀ San Francisco, Ca., 10. II. 1934, *Potentilla* sp., R. 5. III. 1934, Keifer. Additional material seen during my stay in the CAS.

***Scrobipalpula semirosea* (Meyrick, 1929), n. comb.**

Meyrick, Exot. Microl., 3, p. 492, 1929 (*Gnorimoschema*)

The series of five specimens of this form is very similar to the European *S. psilella* f. *ramosella*, differing from it somewhat by the colouration tending to be reddish-brown rather than brown. All specimens are relatively robust, as is evident also from the considerable dimensions of their genitalia (fig. 63, 64). However, except for their size which is merely a quantitative character, the genitalia do not differ from those of the remaining forms of the *S. psilella* complex; on the contrary, they agree with them even in other details (uncus, gnathos, paired processes on upper margin of sacculus, shape of saccus, aedeagus).

Material: 1 ♂, Forestburg and Alpine, 5,000 ft, April-June, (lectotypus), dtto 5 ex (BMNH); 1 ♂, same data, paralectotypus (BMNH).

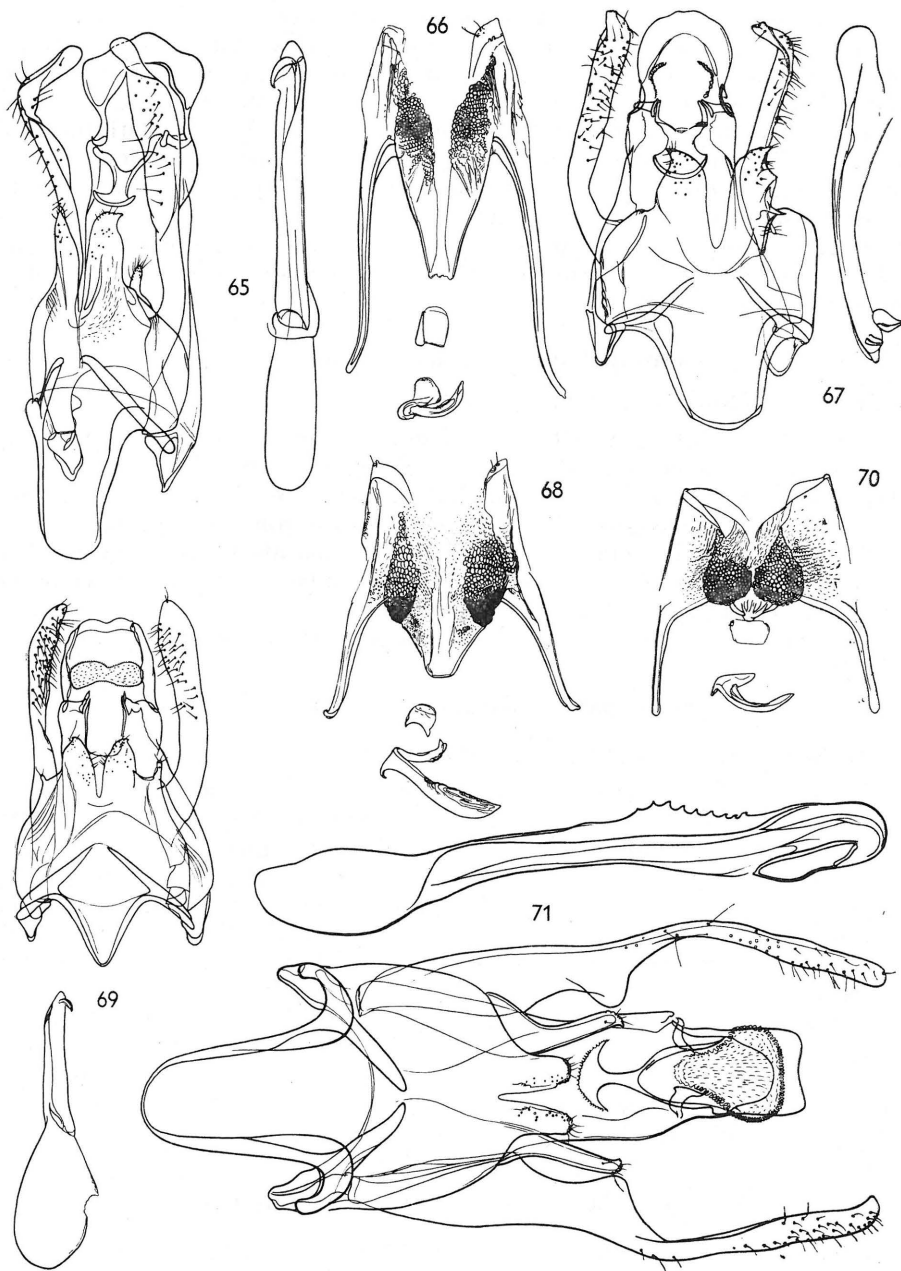
***Scrobipalpula ochroschista* (Meyrick, 1929), n. comb.**

Meyrick, Exot. Microl., 3, p. 494, 1929 (*Phthorimaea*)

This form described by Meyrick in the genus *Phthorimaea* (contrary to the preceding species which was described in *Gnorimoschema*), belongs to the above genus. The morphology of the genitalia of both sexes is positive evidence of its close relationship, if not absolute identity with *S. semirosea*, from which *S. ochroschista* differs in coloration. However, the coloration may be conditioned either trophically or seasonally, since both these forms occur in the same locality.

Material: 1 ♂, Texas, Alpine and Fort Davis, 5,000 ft, April, October (lectotypus) (BMNH); 1 ♀, Brenster Co., Texas (paralectotypus). Additional 48 specimens examined (BMNH).

After a critical evaluation of all five above mentioned forms, we arrive at the same conclusions as in the case of the European *S. psilella* complex. Objectively, they can be separated neither from one another nor, fundamentally, from the European forms. In so far as some of them are a little more different in appearance (*S. artemisiella*, *S. ochroschista*), it appears that there is the same fundamental wing pattern and that the differences are based merely on the intensity of the colouring of various groups of scales. Thus, the differences are purely phenotypic. However, even from the U.S.A. material it is possible to compose a continuous series of forms from those completely lacking in wing pattern and having fore wings uniformly grey and shining (e.g. 1 ♂, Oak Station, Alleg. Co. Pa., May 8, 09, Fred Marloff, fig. 61) to those with a weak (*S. potentilla*) or more pronounced pattern (*S. artemisiella*) to those with a conspicuous wing pattern (*S. henshawiella*, *S. semirosea*, *S. ochroschista*), similar to the European forms. Similarly, in the genitalia one can observe a variation in size, similar to that of the European material, and, moreover, still more extreme forms (*S. semirosea*). Thus it appears that on the Ame-



Genitalia of: 65—*Scrobipalpula ochroschista* ♂ (Lectotypus); 66 — idem ♀ (Paralectotypus).
 67 — *S. gregariella* ♂ (Bogota); 68 — idem ♀ (Bogota); 69 — *S. daturae* ♂ (Paratypus).
 70 — idem ♀ (Paratypus); 71 — *S. lutescella* ♂ (Pullman Wn.)

rican continent also, this is substantially a complex of closely related forms or a single species in the process of speciation, probably caused by geographic, trophic and maybe even phenological conditions. In America, too, the host plants vary considerably (*Artemisia*, *Eryophyllum lanatum*, *Potentilla*). It is my opinion that the forms described from the USA are synonymous with the European *S. psilella*, and that these are no more than products of various environments. The knowledge of the close relationship of the American forms manifested itself in the past in the synonymization of the species *S. axenopsis* Meyrick, 1919 with *S. artemisiella* and on the close relationship of *S. henshawiella* and *S. ochreostrigella* cited by Chambers 1877, which species were (even for formal reasons) later synonymized.

***Scrobipalpula gregariella* (Zeller, 1877)**

Zeller, Horae Soc. Ent. Ros., 13, p. 339, 1877.

Although exhibiting all the generalized generic characters, the genitalia of this species show considerable specific differences. Distinctive in the male are the less complicated and more rounded uncus and particularly the curiously constructed short aedeagus with a peculiar subterminal lanceolate process. The 8th sternite of the female is, in spite of its manifest similarity with the female genitalia of the preceding species, also peculiar mainly on the character of the foamy structure in the periostial region.

Material: 1 ♂, Bogota (BMNH); 1 ♀, Bogota (paratype) (BMNH).

***Scrobipalpula daturae* (Zeller, 1877)**

Zeller, Horae Soc. Ent. Ros., 13, p. 359, 1877.

This species belongs to the group of pronouncedly differentiated neotropical members of this genus, retaining, however, all the generic characters. Of specific structure is the uncus (truncate above); the gnathos is evenly broad throughout its length; also, the saccular processes are specifically formed although generically typical (especially, their cone-like lateral processes!). The 8th sternite of the female is not produced on the anterior margin, but has the typical foamy structure in the periostial region. The signum bursae is specific in form.

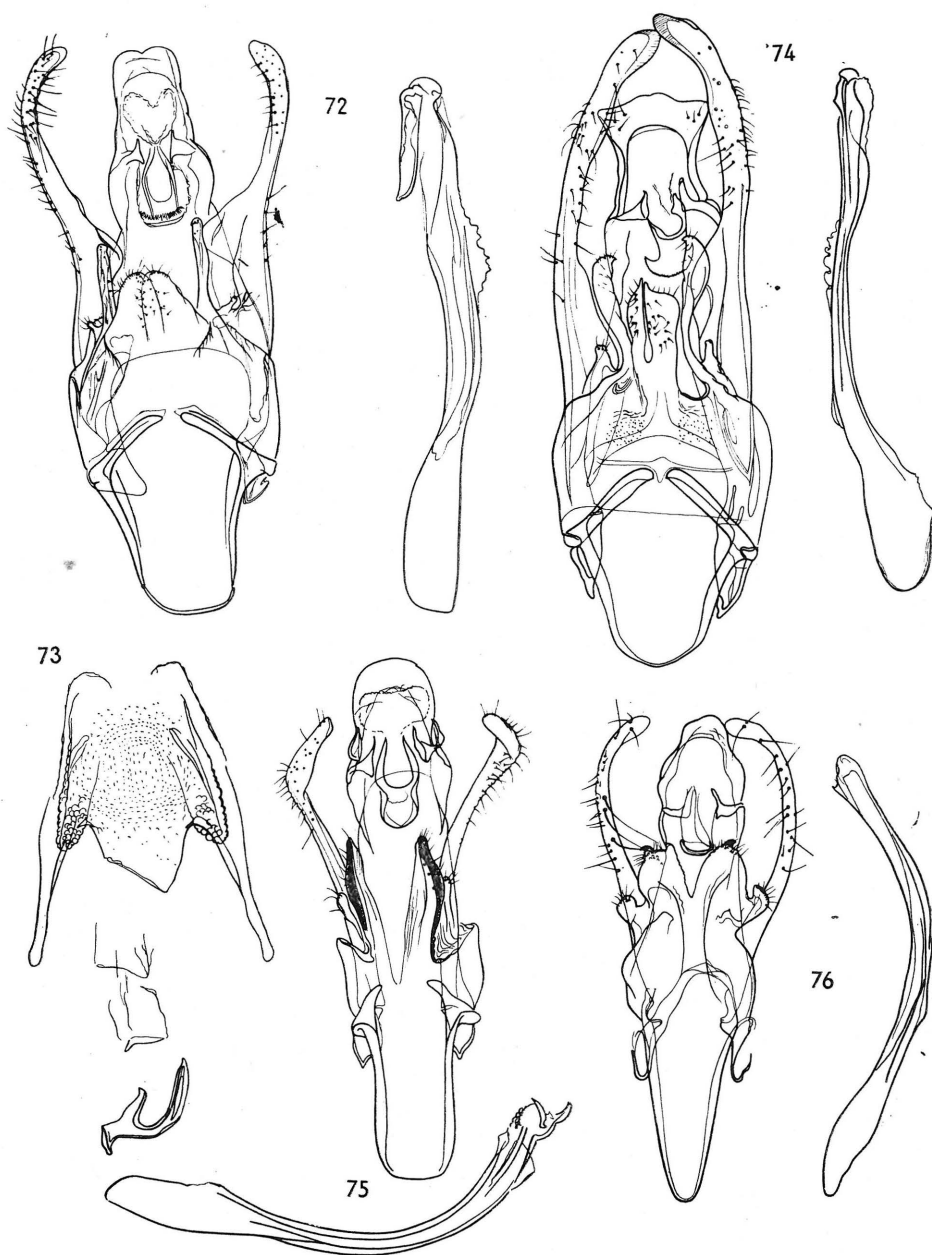
Material: 1 ♂, 1 ♀, Bogota (both paratypes) (BMNH). Additional material examined in the BMNH.

The habitus of these moths is characterized by the uniform brown coloration of the fore wings, with scattered individual black scales in place of the usual typical eye-like dots, and with a tuft of dark scales at the apex.

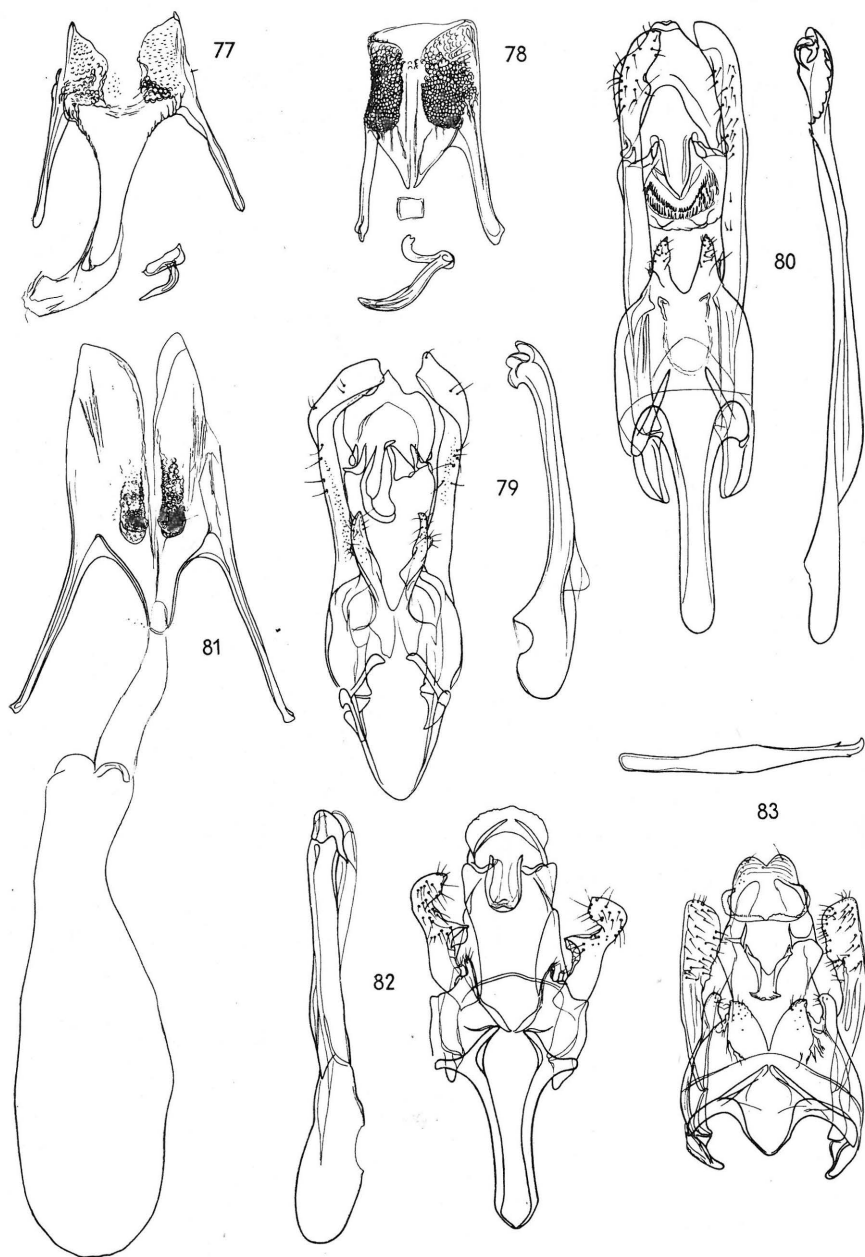
***Scrobipalpula lutescella* (Clarke, 1934), n. comb.**

Clarke, Canad. Ent., 66, p. 172, 1934 (*Gnorimoschema*)

This is a much specialized but quite typical species of the genus *Scrobipalpula*, the existence of which is interesting evidence of the fact that, as in the genus *Gnorimoschema* and other genera of this tribe, great differentiating



Genitalia of : 72 — *Scrobipalpula lutescella* ♂ (Paratypus); 73 — idem ♀ (Paratypus);
 74 — *S. stirodes* ♂ (Holotypus); 75 — *S. gregalis* ♂ (Lectotypus); 76 — *S. chiquitella* ♂
 (Paratypus)



Genitalia of : 77 — *Scrobipalpula chiquitella* ♀ (Paratypus); 78 — *S. trichinapsis* ♀ (Paratypus); 79 — idem ♂ (Lectotypus); 80 — *S. crustaria* ♂ (Lectotypus); 81 — idem ♀ (Paralectotypus); 82 — *S. absoluta* ♂ (Holotypus); 83 — *S. densata* ♂ (Paralectotypus)

processes have taken place in the New World. Such specialized species, with generic characters strongly modified, can considerably confuse the natural generic structure of the tribe which can be detected only when sufficient comparative material of representatives of various species is available.

Generically typical in particular are the structure of the gnathos and the presence of the cone-like processes on the sacculus. The saccular processes of the first pair show strong secondary modification, and there is an additional pair of stick-like processes, which is similarly an outstanding specific criterion. Strongly altered also is the narrowed uncus, the long and strong aedeagus with a membranous lateral border and a heavy terminal process pointing downwards.

The female genitalia also show typical generic characters (the foamy perioestial structure, the shape of signum) but the prolongation of the anterior margin of the 8th sternite (likewise characteristic) ends asymmetrically.

The wing pattern of the adults is very important for demonstrating the specialization of this species. The fore wing has two longitudinal shades: a narrower pale shade near the posterior margin and a dark shade covering the major part of the wing. Towards the tip of the wing, this dark shade passes into a darker medial stripe. Thus, the generically typical dots are secondarily obliterated by the prevailing longitudinal pattern indicated already in certain forms of the *S. psilella* complex.

Material: 1 ♂, Pullman, Wn., J. F. G. Clarke, reared from *Castilleja lutescens*, *Gnorimoschema lutescella* Clarke, 1934 (paratypus) (USNM) 6. 8. 1932; 1 ♂, same data (paratypus) (BMNH); 1 ♀, same data (paratypus), 15. 8. 1933 (USNM).

***Scrobipalpula stiroides* (Meyrick, 1931), n. comb.**

Meyrick, Anales Mus. Buenos Aires, 36, p. 385, 1931 (*Phthorimaea*)

The indisputable relationship of this species to the genus *Scrobipalpula* is evidenced by the shape of gnathos, the presence of the cone-like lateral processes on the saccus and slightly altered shape of valvae, uncus and saccus. Of secondary character is the presence of a third (medial) pair of saccular processes as well as the structure of aedeagus showing characteristically waved membranous lateral ledge. This, too, is a strongly specialized and probably purely neotropical species of this genus.

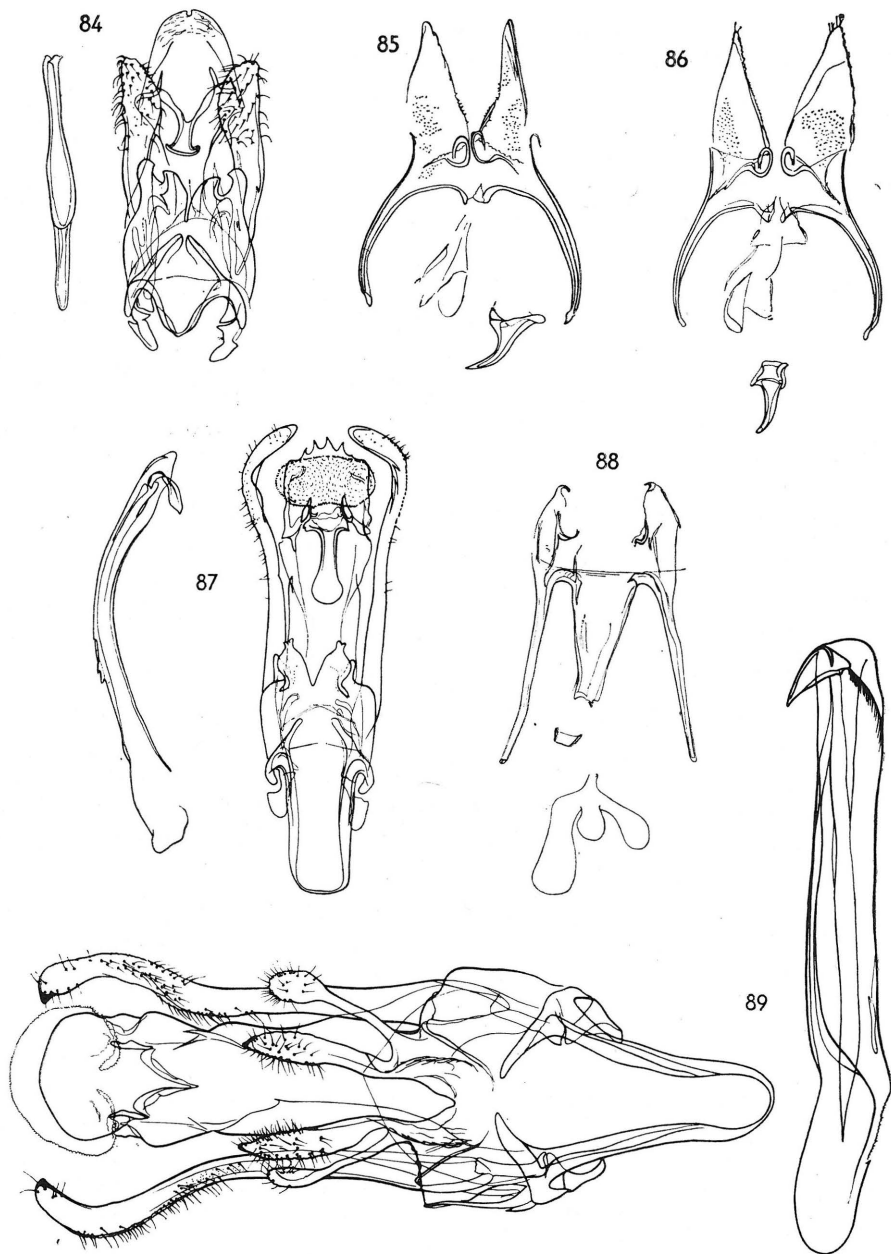
Material: 1 ♂, Bariloche, Argentina, Perr. Rio Negro, 28...—1. 12. 1926, F.—M. Edwards (holotypus) (BMNH).

***Scrobipalpula gregalis* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 43, 1917 (*Phthorimaea*)

This species belongs to a group of strongly altered but still indisputably congeneric species of the genus *Scrobipalpula* which will perhaps require a separate subgenus in future.

Even in this species, the gnathos as well as the pair of somewhat prolonged cone-like lateral processes on the sacculus are generically typical. The medial processes of the sacculus are altered, as is the saccus and, partly, the valvae. Aedeagus slightly curved, its tip provided with two thorny processes.



Genitalia of : 84 — *Scrobipalpula densata* ♂ (Lectotypus); 85 — *Phthorimaea laciniosa* Meyrick ♀ (Lectotypus); 86 — *S. densata* ♀ (Paralectotypus); 87 — *S. isochlora* ♂ (Holotypus); 88 — *Scrobipalpula spec.* ♀ ("*Gnorimoschema aquilina* Meyrick" — Syntypus); 89 — *S. (Eurysacca) melanocampta* ♂ (Holotypus)

Material: 1 ♂, Peru, Lima, August, leg. Parish (lectotypus) (BMNH). Additional four syntypes not examined.

***Scrobipalpula chiquitella* (Busck, 1909), n. comb.**

Busck. Proc. Ent. Soc. Wash., 11, p. 176, 1909 (*Gnorimoschema*)

This species is likewise strongly derived and specialized but bears indisputable characters making it congeneric with the remaining species of this genus. The lateral cone-like processes are broadly blade-like, with a tooth at their tip. Aedeagus slender, bow-like with a subapical tooth.

Female genitalia with conspicuously prolonged anterior margin of 8th sternite, passing into a long chitinized section of ductus bursae, exceeding the length of the apophyses. Signum is a small hooklet arising from a small plate. Periostial region with typical foamy structure. Both of the adults examined were defective.

Material: 1 ♂, Mesilla, N. Mexico (paratypus) (USNM); 1 ♀, same data, (paratypus) (USNM).

***Scrobipalpula trichinaspis* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 41, 1917. (*Phthorimaea*)

The uncus, pointed above, and the shovel-like gnathos are distinctive, but the presence of lateral cone-like processes on the sacculus, the inner pair of saccular processes, the shape of valvae and the structure of the aedeagus indicate clearly the relationship of this species with the typical representatives of the genus *Scrobipalpula*. This is even more conspicuously expressed by the structure of the 8th sternite of the female genitalia which not only shows the pronounced foamy structure but is characteristically prolonged on anterior margin. Even more conspicuous is the signum bursae the structure of which is almost identical with that of the *S. psilella* group.

Material: 1 ♂, Lima, Peru, 500 ft, leg. Parish, August 8—14 (lectotypus) (BMNH); 1 ♀, same data (paratypus) (BMNH).

***Scrobipalpula crustaria* (Meyrick, 1917), n. comb.**

Meyrick, Trans. Ent. Soc. Lond., p. 42, 1917 (*Phthorimaea*)

This species, undoubtedly derived from the evolutionary branch of the tribe represented by the genus *Scrobipalpula*, can serve as evidence of how deeply the environment may change certain typical structures of male genitalia. It is my opinion that with regard to two characters of the male and female genitalia one cannot doubt the inclusion of the present species in this genus. On the one hand, there is the pair of very minute but still preserved cone-like saccular processes; on the other hand, the typical foamy structure in the periostial region of the 8th sternite. Less distinct evidence of the indisputable phylogenetical relationship of this species to the genus *Scrobipalpula* is seen in the blade-like flattened valvae even if this character is already somewhat suppressed, and in the presence of the lateral serrate ledge of the aedeagus.

gus, which character also occurs in other less derived species of this genus (*lutescella*, *stirodes*) whose morphological relationships to the typical representatives of the genus are quite obvious. All the remaining characters of the genitalia of *S. crustaria* are greatly altered. The existence of such species is very important, as the knowledge of their generic relationship enables us to follow the secondary changes of their habitus and morphological characters, to which the changing species are subject during the process of speciation. The uncus is heavy, arched above to form a double protuberance, the gnathos has entirely lost its generically typical shape and changed into a membranous, broadly sac-like structure, the saccus has lost its generically typical shape and changed into a slender, tongue-like structure. The prolongation of the saccus (cf. also *Gnorimoschema*) seems in this tribe, to be a character of considerable secondary derivation of the forms. The aedeagus is conspicuously long and slender. Obviously, the most important change in the female genitalia is the secondary reduction of signum bursae, being also characteristic of the derived forms of other gnorimoschemoid genera.

Material: 1 ♂, Peru, Lima, August, Parish (lectotypus) (BMNH); 1 ♀, same data (paralectotypus) (BMNH). Additional 12 specimens not examined.

Scrobipalpula absoluta (Meyrick, 1917), n. comb.

Meyrick, Trans. Ent. Soc. Lond., p. 44, 1917 (*Phthorimaea*)

This species also shows important evidence of the deep secondary morphological changes affecting the representatives of this genus in the Neotropical Region in the process of speciation. While certain parts of male genitalia show the generically typical structure (cone-like processes of sacculus, gnathos) other parts show far reaching changes. Uncus arch-like, valvae shortened and provided with a peculiar, pointed, medial process; first pair of saccular processes reduced to minute short digits separated by a broad and deep excision so that the sacculus itself is considerably diminished. Saccus long and slender. Aedeagus long but rather stout, with a subapical thorn-like process.

Material: 1 ♂, Peru, Huancayo, 10,650 ft. July, leg. Parish (holotypus) (BMNH).

Scrobipalpula (?) *densata* (Meyrick, 1917)

Meyrick, Trans. Ent. Soc. Lond., p. 42, 1917.

Syn.: *Phthorimaea laciniosa* Meyrick 1931, Anal. Mus. Buenos Aires, 36, p. 386 (pro parte)

Both the male and female genitalia of this species show a number of quite distinct scrobipalpoid characters, but the generic arrangement of this species seems to me problematical. The possibility cannot be excluded that it will require a separate generic position. Uncus rather sharply excised above, gnathos enlarged apically as in the typical species of the genus *Scrobipalpula*. Valvae flat, roundedly truncate above. Outer and inner paired saccular processes bent towards each other, the inner pair is bent towards the middle owing to the strong convex shape of its inner edges, while the outer processes, being too large for a member of the genus *Scrobipalpula*, are feebly curved inward. Saccus

shorter than the lateral corners of tegumen. Aedeagus slender, tapering at both ends so that it is broadest in middle. Female genitalia with very characteristic 8th sternite bearing a peculiar chitinous ledge in the area above the ostium bursae, forming two symmetrical loops bent first inward and then back again. Anterior apophyses strongly arched outwardly to form the letter O. Signum present in the form of a small hook without thorns and with smooth surface.

Material: 1 ♂, Peru, Lima, 5,000 ft, Parish, 8—14 August (lectotypus) (BMNH); 1 ♂, same data (paralectotypus) (BMNH); 1 ♀, same data (paralectotypus) (BMNH). Additional 24 specimens (syntypes) not examined. 1 ♀ of *Phthorimaea laciniosa* Meyrick, Gutierrez, Argentina, Terr. Rio Negro, F. Edwards, 3.—14. IX. 1926 (lectotypus) (BMNH).

Thus, the name *laciniosa* Meyrick is synonymous with *densata* Meyrick. Unfortunately, the specimens in the series of syntypes of *Phthorimaea laciniosa* Meyrick are not conspecific, as shown by my examination.

Scrobipalpula (?) *isochlora* (Meyrick, 1931)

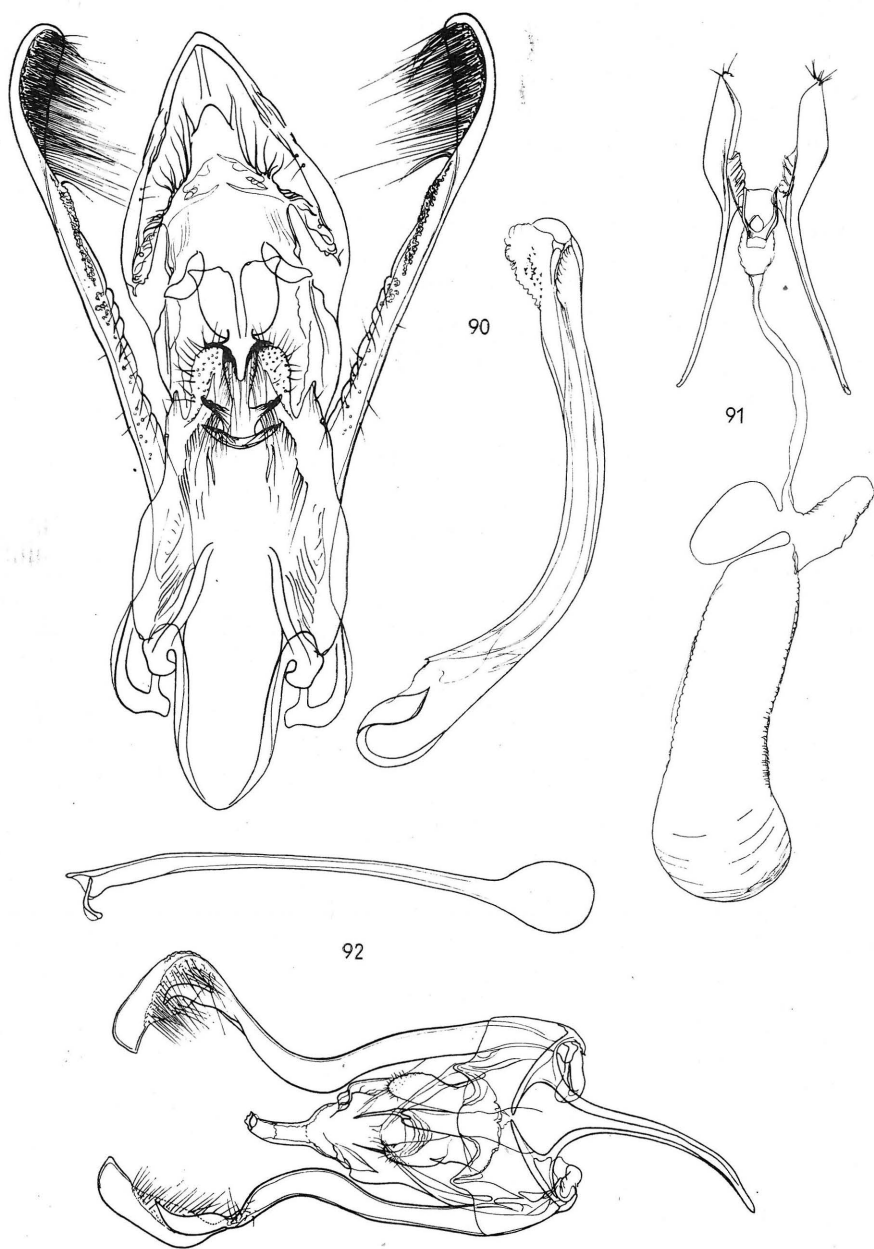
Meyrick, Journ. Linn. Soc. Zool. Lond., 37, p. 280, 1931. (*Phthorimaea*)

While the male genitalia of the holotype (BMNH) resemble those of the representatives of the genus *Phthorimaea* in general appearance, especially by their slenderness and length, by their long, flattened and inwardly curved valvae, and somewhat also by two pairs of saccular processes and by the shape of saccus, a far-reaching convergence cannot be excluded. The latter is especially indicated by the somewhat unusual shape of the gnathos which is not oval but rather longitudinally shovel-like with tip semicircularly enlarged. Also, the shape of valvae can very well be derived from the genus *Scrobipalpula*. Also, the shape of saccus resembles that of the genus *Scrobipalpula* as well as that of the genus *Phthorimaea*. Similarly, one could object that the second pair of saccular processes is homologous with the cone-like processes of the genus *Scrobipalpula*. The pointed processes on the upper margin of the uncus are quite specific. An interesting structure is found in the aedeagus, the arched curvature of which and, in particular, the subterminal lanceolate process, strongly resemble those of the more derived forms of the genus *Scrobipalpula*. The female, the genitalia of which could elucidate the generic relationship of this form, is unknown.

Material: 1 ♂, Makchthalawaiya, Paraguay, G.S.C., 5.27 (holotypus) (BMNH).

Scrobipalpula spec.?

The female genitalia shown in fig. 88 belong to a specimen in the collection of the BMNH under the name of *Gnorimoschema aquilina* Meyrick as a syntype of this species and bearing a label: Huigra, 4,300 ft, Ecuador, Parish 6—14. However, it is obvious that this is neither a conspecific nor a congeneric form. From the appearance of the female genitalia, this could perhaps be a strongly specialized form of an evolutionary branch of the genus *Scrobipalpula*, showing both reduction of signum and loss of the foamy structure in the peristial



Genitalia of : 90 — *S. (Magnifacia) aulorrhoea* ♂ (Lectotypus); 91 — idem ♀ (Paralectotypus); 92 — *Keiferia lycopersicella* ♂ (Kern Co., Potato leaves)

region. Moreover the bursa copulatrix is tripartite. The taxonomic position of this form is obscure. Three additional syntypes of *Gnorimoschema aquilina* Meyrick, which should be in the BMNH, have not been traced.

Eurysacca, n. subg.

Type-species *Phthorimaea melanocampta* Meyrick.

Within the frame of the genus *Scrobipalpula*, the general construction of the male genitalia of „*Phthorimaea*“ *melanocampta* Meyerick is different to the extent that I am of the opinion that it should be given at least subgeneric independence. The generic relationship of this species to the genus *Scrobipalpula* is shown, in spite of important differences from the characters typical of this genus, by the general structure of the male genitalia. The generically typical shape is retained especially by the valvae, the saccus and the uncus. The valvae are rather long and somewhat flattened, strongly resembling those of the genus *Scrobipalpula*, especially by their being bent downwards in their upper third. The inner pair of sacculus processes resemble rather conspicuously in shape those of the genus *Scrobipalpula*, s. str. The second pair of sacculus processes is changed into broad pestle shapes process attached to pedunculate stalks. Whilst the uncus is broadly rounded, the gnathos has, due to obvious reduction, a secondary hook-like shape which I evaluate as a convergence in this case. The saccus is altogether generically typical. The aedeagus is conspicuously long and stout, provided with a conspicuous bull-like thorn subterminally.

Scrobipalpula (Eurysacca) melanocampta (Meyrick 1917), n. comb.

Meyrick, Trans. Ent. Soc. Lond., p. 44, 1917 (*Phthorimaea*)

The phylogenetical relationship of this species to the representatives of the genus *Scrobipalpula* s. str. is beyond doubt. However, it is an obviously secondarily modified form, as are a number of similar isolated species of this evolutionary branch in South America. With the present imperfect knowledge of the South American microlepidopterous fauna, it cannot be excluded that this isolation is only apparent and that further forms will be discovered in future that will link with the genus *Scrobipalpa* more naturally. However, the present species is certainly a representative of a strongly specialized branch of this genus, which seems to be the general tendency of a number of members of this tribe in the Neotropical Region.

Material: 1 ♂, Peru, Lima, August, 500 ft, Parish, 8.14 (holotypus) (BMNH).

Magnifacia, n. subg.

It is necessary to establish this subgenus for the species „*Phthorimaea*“ *aulorrhoea* Meyrick. I consider the generic relationship of this species with the complex *Scrobipalpula* to be obvious. On the other hand, the species *aulorrhoea* is one of the most specialized forms of the entire tribe and the most specialized species of the genus *Scrobipalpula* so far known.

Diagnosis: As in the representatives of the genus *Scrobipalpula* s. str.,

the gnathos is semicircularly lancet-like apically but still longer, the gnathos is branched so that at its end, two transverse, parallel, semilunar structures are seen. Uncus in shape of a large isosceles triangle the apex of which is the tip of the uncus. Sacculus with two pairs of processes. The inner pair is higher than the outer one, rounded, and both lobes are separated by a shallow but narrow excision. The second pair, corresponding to the cone-like processes, is small, glossoid and pointed. The valvae are heavy and broadly shovel-like flattened above, the surface covered with long and fine dense hairs. Saccus is relatively short and moderately broad. Aedeagus conspicuously arched, with moderately enlarged base and membranous theca prolapsing from its tip bearing an area of fine thorns. Female genitalia comparatively small. The area of the 8th sternite small, deeply excised nearly down to ostium bursae on both sides of which rudiments of the sternite are preserved in the form of two short ledges. Ostium bursae leading into a membranous funnel, ductus bursae conspicuously narrow, bursa tripartite, long, sac-like, without a signum.

In examining the type material of this species, I doubted the specific identity of the sexes, since the size of the female genitalia are quite disproportionate to the size of the male genitalia. However, a more detailed study reveals a clear specific identity of the sexes. During copulation, the penis seems to be introduced only into the trough-like eighth sternite while only the membranous endotheca enters the membranous mouth of the ostium.

***Scrobipalpula (Magnificia) aulorrhoea* (Meyrick, 1935), n. comb.**

Meyrick, Exot. Microl., 4, p. 560, 1935 (*Phthorimaea*)

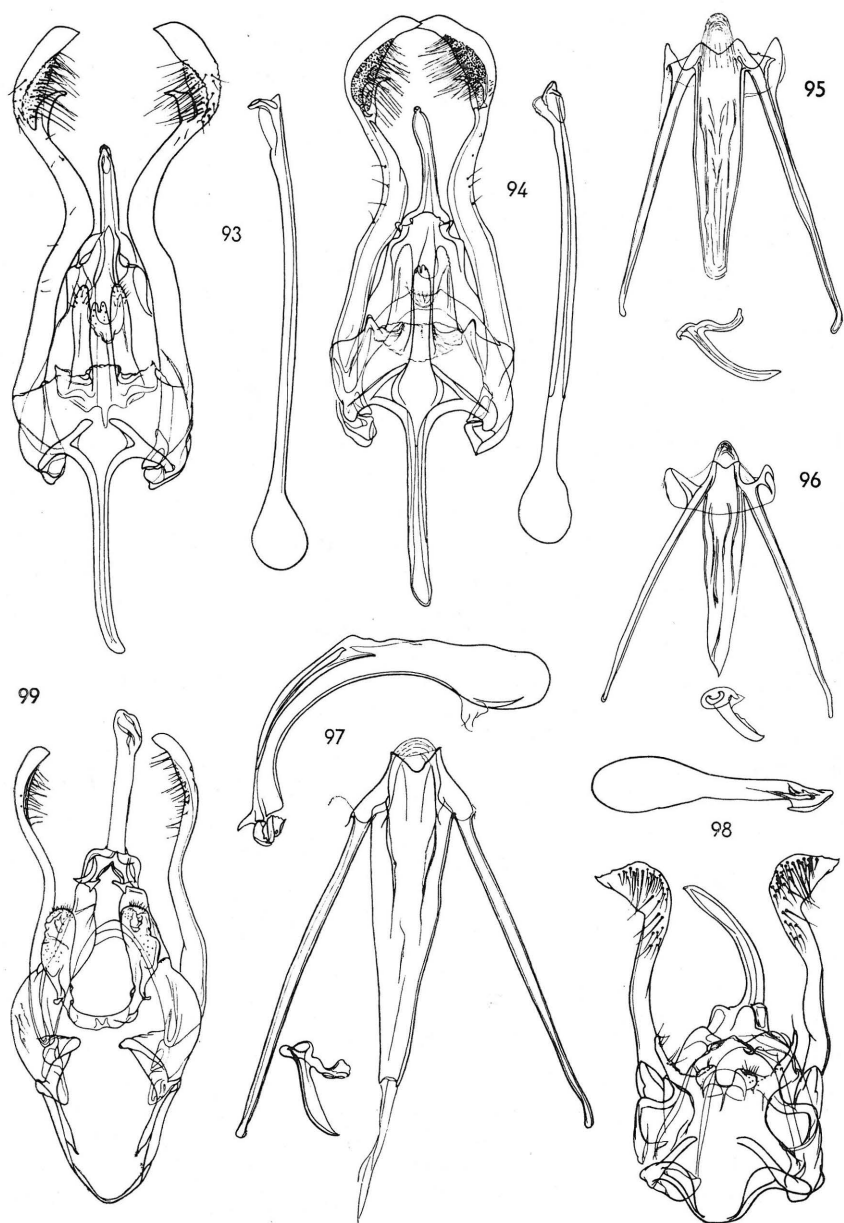
The single species of this subgenus represents the most specialized species of the genus *Scrobipalpula* so far known.

Material: 1 ♂, Argentina, Alta Gracia, C. Bush C. B. 2.34 (lectotypus) (BMNH); 1 ♀, same data (paralectotypus) (BMNH).

Genus *Keiferia* Busck, 1939

This apparently monotypic gnorimoschemoid genus is an example of highly specialized New World form, being absolutely isolated, according to our present knowledge, from all the remaining natural groups of the entire tribe. The indisputable evidence of the relationship of this genus with the tribe Gnorimoschemini is seen in the shape of the signum bursae of the female genitalia. Only this character enables us to consider the degree of relationship or morphological relations of certain parts of the male and female genitalia and the eventual homologization of these structures with the corresponding parts of genitalia of simpler gnorimoschemoid forms.

Diagnosis: Uncus bearing above a heavy thorn-like process which, whilst being known as an independently developed organ of the genitalia in many groups of Lepidoptera, is very seldom formed in the tribe Gnorimoschemini. The sacculus also has two characteristic pairs of processes but the sacculus itself is short (low) and the inner pair of processes is fused to form one long tongue-like structure with the original paired character indicated by a slight bifur-



Genitalia of : 93 — *Keiferia lycopersicella* ♂ ("*Gnorimoschema lenta* Meyrick" — Lectotypus); 94 — idem ♂ ("*Aristotelia lycopersicella* Walsingham" — Lectotypus); 95 — idem ♀ ("*Gnorimoschema lenta* Meyrick" — Paratypoid); 96 — idem ♀ (Busck — USA); 97 — idem ♀ (Phoenix Lk, *Solanum xanthii*); 98 — *Tildenia glochinella* ♂ (Paratypoid); 99 — *T. gudmanella* ♂ (Holotypus)

cation above. The other pair of lateral processes resembles small elongate leaves, longer than the medial process but varying considerably in width and shape. Valvae slender, S-shaped, strongly widened above and provided with a falciform process at the base of this widening; inner surface of widened part covered with dense, fine, rather long hairs. Saccus in the form of a conspicuously long and slender process. Aedeagus extraordinarily long and slender, with a short spherically inflated caecum.

Female genitalia characterized by an unusually narrow 8th sternite the anterior margin of which bears a long, conspicuous, trough-like structure, probably developed by the chitinization of the proximal section of the ductus bursae, the tip of which attains the level of the tips of the apophyses. Ostium bursae entering this structure in the posterior margin of the 8th sternite which has a very transparent and rounded plate protruding over its margin. Signum bursae of the same shape as that of the genus *Scrobipalpula*.

The two species *glochinella* and *altisolani* have also been placed in the genus *Keiferia* Busck, but do not properly belong to here. *Keiferia lycopersicella* is distributed in California, Mexico, Peru, Brazil, Cuba, the West Indies and Hawaii.

Keiferia lycopersicella (Walsingham, 1897)

Walsingham, Proc. Zool. Soc. Lond., p. 71, 1897.

Syn.: *Phthorimaea lycopersicella* Busck, Proc. Hawaii Ent. Soc., 7, p. 171, 1928. (Syn. nov.)

Gnorimoschema lenta Meyrick, Trans. Ent. Soc. Lond., p. 41, 1917, Syn. nov.)

Gnorimoschema elmorei Keifer, Mo. Bul. Cal. Dept. Agr., 25, p. 349, 1936. (Syn. nov.)

The characters of male and female genitalia correspond to the generic diagnosis. The specific criteria on which Keifer (1936) separates the species *Gnorimoschema lycopersicella* Busck and *G. elmorei* Keifer, are subject to considerable subspecific variation (as observed in my own studies) resulting in varying size of the genitalia, varying shape of the paired sacculus processes, varying length of apophyses and ductus bursae, saccus, etc. This variation can be explained by the considerable oligophagy of this species with respect to the genus *Solanum* as well as by wide geographic distribution. Moreover, this species has been introduced as a pest of *Solanaceae* (Keifer, 1936) into areas outside that of its autochthonous distribution, which fact may certainly contribute to the variability. This, too, may help to explain the existence of the supposed hybrids between these species (Keifer, 1936). On the other hand, certain hybridization experiments indicate that some population of this species complex tend to form sterility barriers (sibling species). Whether it is a case of actual sterility barriers or absence of scent attraction in adults reared from different host plants (known also in other instances of mining Lepidoptera) remains to be solved. However they are forms very similar morphologically so that they are obvious synonyms in this respect.

This species was first described by Walsingham, 1897 in the genus *Aristotelia*, and (by coincidence) the same specific name (*lycopersicella*) was used by Busck later on. This has been verified by the results of my own study on Walsingham's classical material (BMNH). Moreover, the species was described

as „*Gnorimoschema lenta*“ by Meyrick. This circumstance is explained by the fact that it is a widely distributed pest known as the „tomato pinworm“.

Material: 1 ♂, *Aristotelia lycopersicella* Walsingham, St. Croix, Dan. West Indies (lectotypus teste R. W. Hodges) (BMNH); 1 ♂, *Gnorimoschema lenta* Meyrick, Peru, Lima, August, leg. Parish, 500 ft (lectotypus) (BMNH); 1 ♀, same data (paratypoid) (BMNH). The remaining six specimens are deposited in the BMNH. A series of specimens of both sexes (*Gnorimoschema elmorei*, det. Keifer): Newport Beach, Cal., 17. 4. 1936, ex *Solanum umbelliferum*, 10. 5. 1936; Phoenix Lk Maria Co Cal, 5. 3.—11. 4. 1927. Larva on *Solanum xantii*, H. H. Keifer coll.; a series of specimens of both sexes (*Gnorimoschema lycopersicella* Busck, det. Keifer): Shafter dist., Kern Co., 26. 3. 1934, reared from Potato leaves, 12. 4. 1934.

Thus, the species complex *Keiferia lycopersicella* is widely distributed in the subtropics and tropics of the New World, reaching to the West Indies and Hawaii. It has perhaps, been introduced in some of these areas, so that its occurrence there is secondary. Its host plants are various cultivated (*Solanum lycopersicum*) and wild forms of American *Solanum* spp. (*xantii*, *umbelliferum*).

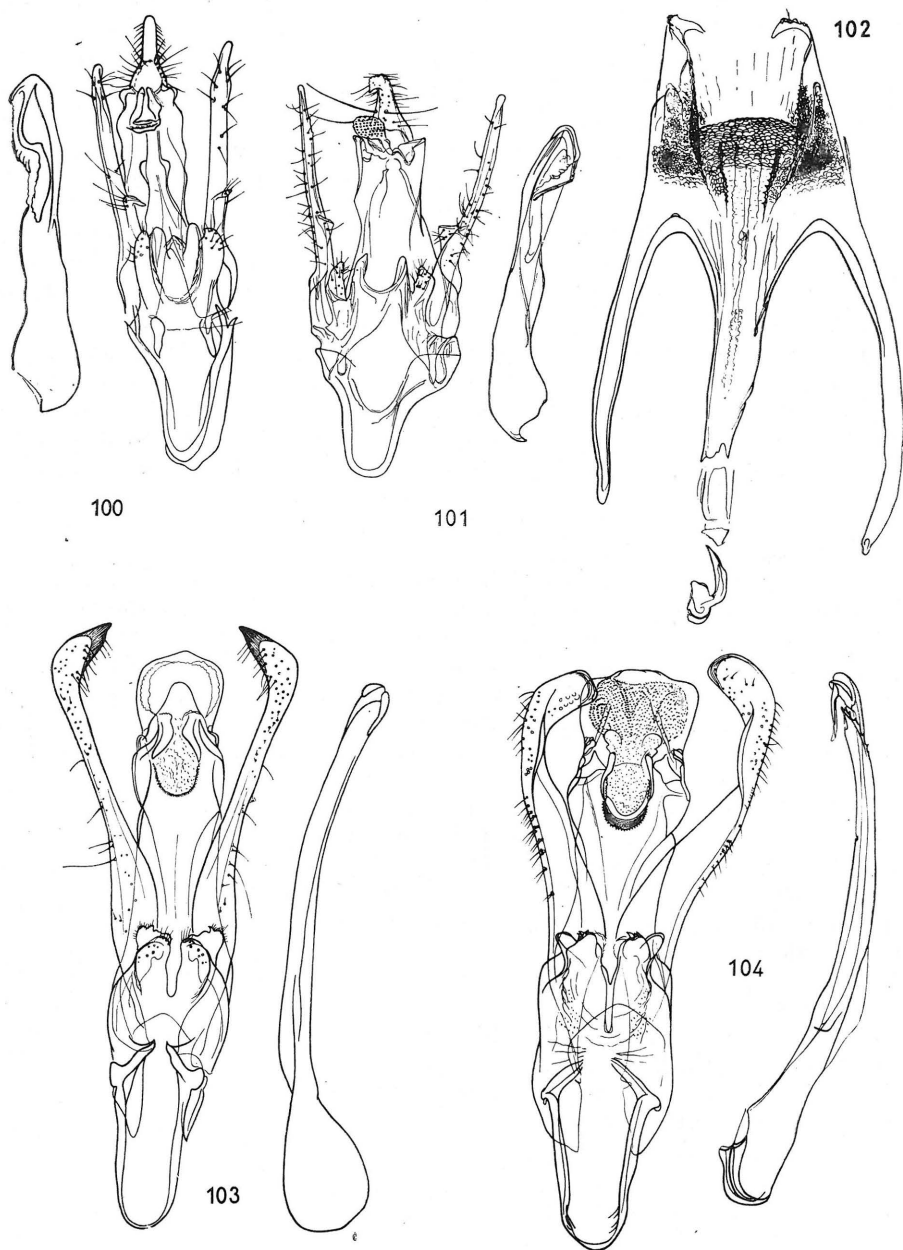
Genus *Tildenia*, n. gen.

This new genus is erected for three already described New World species of the tribe Gnorimoschemini, which are outside the frame of the remaining genera of this tribe. They are: *Gelechia gudmanella* Walsingham 1897, *Gelechia glochinella* Zeller 1873 and *Gnorimoschema altisolani* Keifer 1936. The character common to them is the conspicuous shortening of the teguminal parts of the male genitalia, causing the valvae to protrude high above the uncus itself. The uncus is provided with a heavy thorn-like process. The saccus is rather short, and obtusely rounded. The valvae are slender, sometimes conspicuously enlarged above. As in all genera of the tribe Gnorimoschemini the sacculus is provided with one or two pairs of symmetrical processes of various shape. Aedeagus of moderate size. The female genitalia are characterized by a strong reduction of the surface of the 8th sternite which forms an oblong subgenital plate arising directly from the base of the anterior apophyses. Bursa copulatrix with a hook-like signum in its lateral wall which, together with the paired saccular processes, is the only evidence of the relationship of this genus with the other gnorimoschemoid groups where it undoubtedly belongs. The above species represent a quite independent, strongly specialized lateral branch of the New World Gnorimoschemini, inhabiting the warmest part of the subtropics and tropics of the New World. *Tildenia glochinella* (Zeller) is the type species of the genus, named after Professor J. W. Tildén, of San José, California, eminent American lepidopterist.

Tildenia glochinella (Zeller, 1873), n. comb.

Zeller, Verh. Zool. Bot. Ges. Wien, 23, p. 263, 1873 (*Gelechia*)

It is necessary to supplement the generic diagnosis by the following: Valvae spade-like above, with a sharp point. Saccus conspicuously short and



Genitalia of : 100 — *Barticeja epitricha* ♂ (Lectotypus); 101 — idem ♂ (Paralectotypus); 102 — *Phthorimaea operculella* ♀ ("*Phthorimaea epicentra* Meyrick" — Paraty-poid); 103 — *Ph. perfidiosa* ♂ (Lectotypus); — 104 — *Ph. euchthonia* ♂ (Lectotypus)

rounded. First pair of saccular processes considerably reduced, the processes low with obtuse tips, separated by a rather broad but shallow excision. Second pair of saccular processes long, finger-like. Tegumen short, uncus low, ending in a long thorn-like process. Aedeagus rather short, with lower third dilated and with tip bearing a group of chitinous ledges.

Material: 1 ♂, Bosque Co., Texas, 16. VII. 1876, Belfrage (paratypoid) (BMNH).

In the U.S. literature (e. g., Keifer, 1936), this species is considered to be the pest known as the „eggplant leafminer“. However it is evident that faunistic data are not sufficiently clear in taxonomic respect, and that the species is frequently confused with *K. lycopersicella*, as was shown by Keifer, 1936. This confusion arose because the genitalia of this Zeller species were not sufficiently studied in the determinations and in drawing conclusions on the synonymy, and it will be necessary to reevaluate all the existing data on the geographic distribution. Zeller's, 1873 illustration of the male genitalia of this species, referred to by Busck, 1900, is quite inadequate for identification.

Tildenia gudmannella (Walsingham, 1897), n. comb.

Walsingham, Proc. Zool. Soc. Lond., p. 77, 1897 (*Gelechia*)

The thorn-like process of the uncus is large, valvae only slightly enlarged apically, saccus longer and somewhat more pointed than in the preceding species. Sacculus provided with only one pair of processes with obtuse tips, separated by a rather deep and conspicuously broad excision. Aedeagus arched, bearing a thorn-like process below its tip.

Material: 1 ♂ St. Thomas, Danish West Indies, Solanum ex 25. III. 1894 (holotypus) (BMNH).

Tildenia altisolani Keifer is the third species belonging to this genus, as seen from the original drawing of its genitalia by Keifer, 1936 as well as by Busck, 1939. Another possible member seems to be the species *Phthorimaea vorax* Meyrick, 1939 (Trans. R. Ent. Soc. Lond., 89, p. 53). The male genitalia of the holotype of this species are badly damaged. There exists a not very satisfactory photograph of the lateral posture, and from this it appears that the uncus is long and broad, curved below towards the abdominal cavity. The first pair of saccular processes is broadly leaf-like, the second pair of processes fuses with the base of valvae and bifurcates into an anterior and a posterior part, both resembling slender and sharp thorns, the first of which is nearly straight and only slightly curved forwards at its base, the second is arched anteriorly. The teguminal part and the uncus are considerably damaged. The aedeagus is slender, not very thick, tapering slightly towards its apex. It will be possible to present an opinion on the taxonomic position of this species only after undamaged specimens have been examined. This would be the sole member of this tribe the larvae of which, according to the statement by Meyrick, are predacious, feeding on the coccid *Tachardiella argentina* Dom.

The occurrence of further species of this genus in America cannot be excluded.

Barticeja, n. gen.

This genus is represented by a single, quite exceptionally altered species of the tribe Gnorimoschemini, whose tribal affinity was at first in some doubt. However, a more detailed comparative study has shown that the relationship of this species is more than probable. On the other hand, however, the position of this species is isolated from all the remaining known generic groups to such an extent that I can see no other possibility than to express it by establishing a separate genus.

Diagnosis: The relationship of this genus with the tribe Gnorimoschemini is evidenced by two paired saccular processes and partly also by the shape of an entirely altered form, being narrow and resembling the upper mandible of an aquiline beak. Valvae narrow, slender and obtusely pointed, their walls bearing a peculiar chitinous tubercle in the lower third. In general shape the saccular processes resemble those of the genus *Phthorimaea*. They are low, the inner pair forming a small shallow trough, the outer pair is somewhat broader, sparsely covered with setae. Saccus feebly arched. Gnathos spatulate, resembling in shape the gnathos of certain members of the genus *Scrobipalpula*. Aedeagus of moderate length, rather broad with base slightly inflated, its upper third membranous ventrally, chitinous dorsally, a peculiar arched ledge running from this dorsal wall to the membranous part.

Barticeja epitricha (Meyrick, 1917), n. comb.

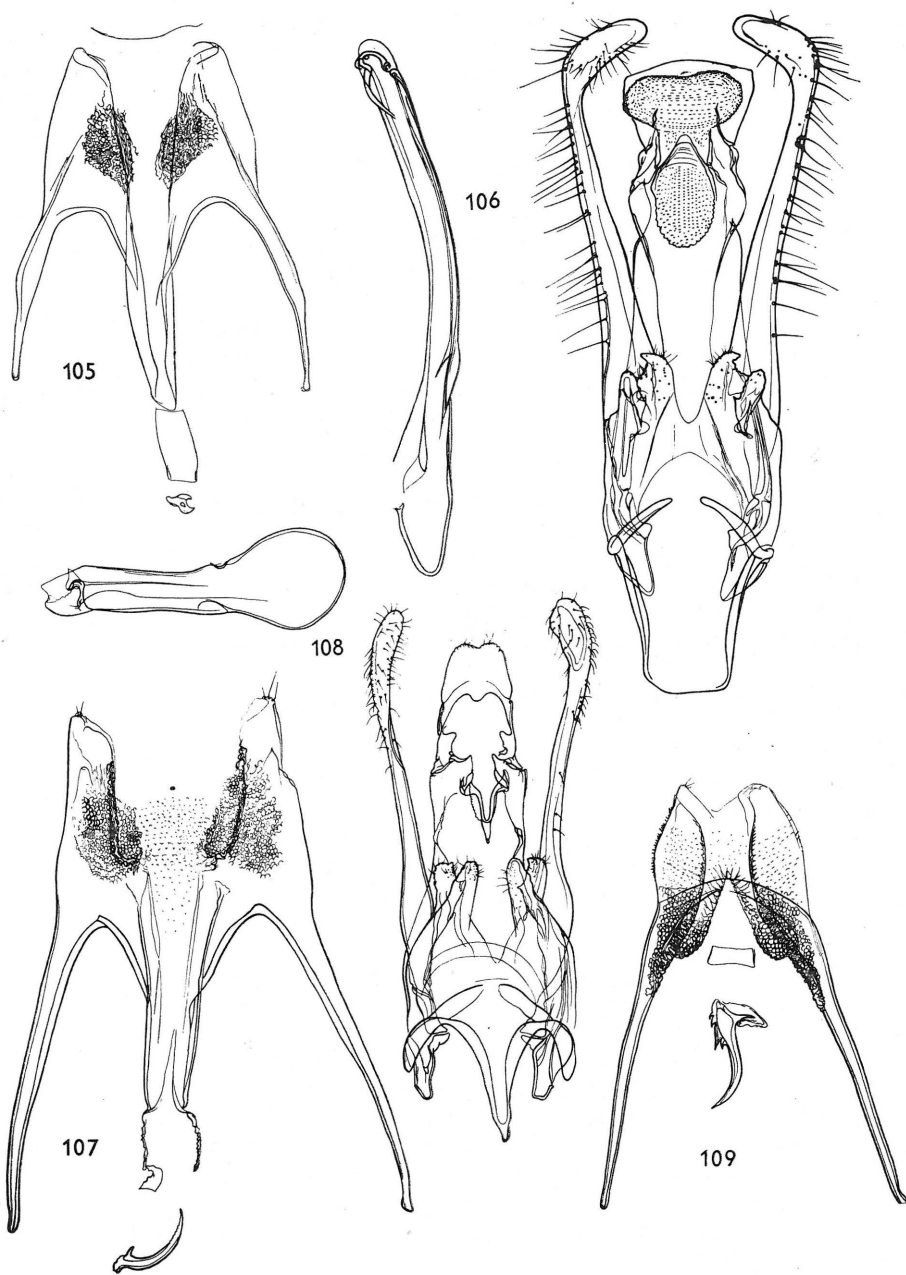
Meyrick, Trans. Ent. Soc. Lond., p. 47, 1917 (*Phthorimaea*)

The only species of this genus occupies a quite extraordinary position within the entire tribe owing to the uniqueness of the general structure of its male genitalia, so that its relationship with the tribe Gnorimoschemini seemed dubious. Also, in the habitus of adults, there are no distinct characters that would suggest a relationship to the other natural groups of the tribe.

Material: 1 ♂ British Guiana, Bartica, Parish, December — February (lectotypus) (BMNH); 1 ♂, same data (paralectotypus) (BMNH). There seems not to be a single female among the remaining eight syntypes.

Genus **Phthorimaea** Meyrick, 1902

I have redescribed this genus in an earlier paper (Povolný, 1964). Contrary to such genera containing numerous species, as e.g., *Gnorimoschema*, *Scrobipalopsis*, *Scrobipalpula*, *Caryocolum*, being substantially holarctic with incidental strongly derived representatives in the Neotropic Region, the genus *Phthorimaea* is purely a New World one, namely a nearctic and neotropic one. The number of species belonging to this genus is still not known; it certainly does not correspond to the conception of this genus by, e.g., Gaede (1937) according to which most of the species listed under *Phthorimaea* belong to the genus *Scrobipalpa*. In morphological respect, the genus is quite clearly defined by the long and slender teguminal part, giving the whole genitalia a conspicuously long and slender shape. On the contrary, the sacculus is relatively short (low) and the saccular processes are greatly reduced. The valvae are



Genitalia of : 105 — *Phthorimaea euchthonia* ♀ (Paralectotypus); 106 — *Ph. pheromotopa* ♂ (Holotypus); 107 — *idem* ♀ (Paratypus); 108 — *Scrobipalpa atriplicella* ♂ (Santa Paula, Cal.); 109 — *idem* ♀ (San Francisco)

long and slender, flattened and curved inwardly at their ends. The female genitalia are conspicuous by the great prolongation of the anterior margin of the 8th sternite, due to the chitinization of a considerable section of the ductus bursae. Signum is hook-like, sometimes very small or completely reduced.

***Phthorimaea operculella* (Zeller, 1873)**

Zeller, Verh. Zool.-Bot. Ges. Wien, 23, p. 262, 1873.

Syn.: *Phthorimaea epicentra* Meyrick, 1909, Ann. S. Afr. Mus., 5, p. 370. (Syn. nov.)

This species was first described by Walker (1864, List. Lep. Het. Br. Mus., 30, p. 1024) under the name *terrella*. The name *terrella* therefore has priority, but since it has not been generally used, the name *operculella* Zeller is retained having become widely known and used in the literature (the species is a serious pest), and is generally regarded as a nomen conservandum. Under these circumstances, enforcing the adoption of Walker's name *terrella* at this time seems inappropriate.

To the generally known and cited synonyms of this species, another one must be added. This is Meyrick's *Phthorimaea epicentra* Meyrick (1909, Ann. S. Afr. Mus., 5, p. 370), the paratypoid of which I have examined in the BMNH. The synonymy is quite certain because *P. operculella* is the only species of this genus widely distributed in the subtropics and tropics of the entire Old World where it had been secondarily introduced.

Material: 1 ♀ Kalk Bay, Cape Colony, 2. 2, 95 (BMNH).

***Phthorimaea perfidiosa* Meyrick, 1917**

Meyrick, Trans. Ent. Soc. Lond., p. 41, 1917.

The structure of the male genitalia shows a close generic affinity to *P. operculella* with the preservation of important specific criteria. These are, above all, the shape of the first (inner) pair of saccular processes which are short and rounded. The rounded gnathos is rather short. Valvae slightly pointed.

Material: 1 ♂ Colombia, Caldas La Crumbre, 6,600 ft, leg. Parish (lectotypus) (BMNH). Syntype not examined.

***Phthorimaea euchthonia* Meyrick, 1939**

Meyrick, Trans. R. Ent. Soc. Lond., 89, p. 53, 1939.

A very typical representative of the genus *Phthorimaea* from South America. Male genitalia with uncus nearly quadrate, only slightly convex above, valvae rather flat, bearing a thin subterminal ledge. Saccular processes minute, inner pair thorny. Aedeagus long and slender, provided above with a thorn-like process pointing downwards. Female genitalia with generically typical foamy structure limited to two small areas. Eighth sternite produced anteriorly into a heavy process of ductus bursae. Signum strongly compressed to form a small curved hook.

Material: 1 ♂ Tigre (Tegre), Argentina, F. B. bred 4.37, coll. F. Bourquin (lectotypus) (BMNH); 1 ♀, same data (paralectotypus) (BMNH). The remaining two specimens not examined.

Phthorimaea pherometopa, n. sp.

The male genitalia show the typical generic characters. Uncus broad, with slightly convex upper edge, gnathos forming a richly membranous spatula broadly rounded below. Valvae distinctly protruding over the uncus, typically flattened and curved inwardly. Inner pair of saccular processes somewhat resembling that of *P. operculella* but its curved corners are longer. The second pair of saccular processes diminished and rounded. Saccus broad, slightly tapering towards the apex which is truncate. Aedeagus feebly curved, with rounded tip below which there is a small arched ledge.

The female genitalia somewhat resembling those of *P. operculella* but their foamy structure is less distributed over the surface of the 8th sternite and forms a suggestion of an arch-like horseshoe with its arch interrupted towards the ostium bursae. Signum bursae is a slender, slightly curved hook.

Head and thorax covered with pale brown scales of high density. Fore wings covered with continuous pale brown scales. On this background, indistinct broken longitudinal stripes are formed by dark brown scales along the longitudinal veins. The generically typical spots are preserved in about the middle of the wing area where there are two dark spots situated not far from each other, and another oblong darkish spot below them towards the posterior margin of the wing. There is no other marking on the fore wing. Hind wings shining grey with long fringes.

Length of fore wing: 4.9 mm (holotypus) and 4.7 mm or 5.1 mm (paratypi).

Material: 1 ♂, Socorro Id. Brthwte Bay, May 6, 1925, H. Keifer collector (holotypus) (CAS); 2 ♀♀, same data (paratypi) (CAS).

The systematic relationship of the other American forms listed under the genus *Phthorimaea* must be investigated. It is possible that this genus is represented by more numerous species in America.

Genus *Scrobipalpa* Janse, 1951

This quite homogeneous genus contains species only occasionally conspicuous in their habitus, i.e. mostly uniform. The same also appears true of the structure of the genitalia.

Diagnosis: The genitalia are characterized by a hook-like gnathos, a slender uncus, simple, slender, pest-like valvae and short saccus. Females with signum slenderly hook-like, with 8th sternite covered, as a rule, all over its surface with greatly developed foamy structure. The genus is mostly palearctic with tens of species, of which many are still undescribed. In number of species, this genus is probably the largest one of the entire tribe. The American species of this genus are insufficiently known and certainly few in number. The generically indisputable species of this genus seem to be secondary in America. Other scrobipalpoid species endemic to North America belong to other, more derived groups standing near to the genus *Scrobipalpa*.

Scrobipalpa artiplicella (Fischer v. Röslerstamm, 1839)

Fischer v. Röslerstamm, Schmetterlingskde, p. 223, 1839

Syn.: *Gnorimoschema chenopodiella* Busck, Proc. Ent. Soc. Wash., 18, p. 143, 1916. (Syn. nov.)

The examination of extensive material of this species from the USA and the examination of the literature revealed a very close similarity between Busck's species *chenopodiella* and the western palearctic *atriplicella*, and there can be no doubt their synonymy. Moreover, a critical evaluation of captures of this species in USA as well as the gradual spread of this species over North America indicates that its occurrence in USA is probably secondary. This has been partly pointed out already by Keifer 1936 who had frequently observed this species in San Francisco to cause extensive damage to inflorescences of *Chenopodium murale*, a plant secondarily to that area. The species also occurs in the area of Sacramento in the Californian alluvium where, apart from the findings of Keifer, 1936, I myself observed it in September, 1963. Keifer, 1936 states that the species occurs also in Massachusetts, Toronto, Washington and California.

Apart from the absolute similarity of the genitalia of the American specimens with the European ones, the American populations show the same individual and geographic variability as the European, that is, from small to large individuals and from those coloured indistinctly grey through those showing pronounced spots on fore wings on brown background to those coloured blackish. This variability often appears even in populations not far from one another and, with the obviously secondary occurrence of this species in North America, is evidence of immediate responses of entire groups of individuals to their environment, so that a geographic character can hardly be ascribed to it.

Material: Large series of specimens: San Francisco, 8—24. 5. 1928, leg. Keifer; Davis Yolo Co., Cal., 21. 8. 1956, leg. Powell; Walnut Creek, Cal., Contra Costa Co., 6. 5. 1958, light trap, leg. Kelly; Santa Paula, Cal., 5. 8. 1923, leg. Keifer; Lewittown, Pa., USA, 9, 5. 1957.

Scrobipalpa obsoletella (Fischer v. Röslerstamm, 1840)

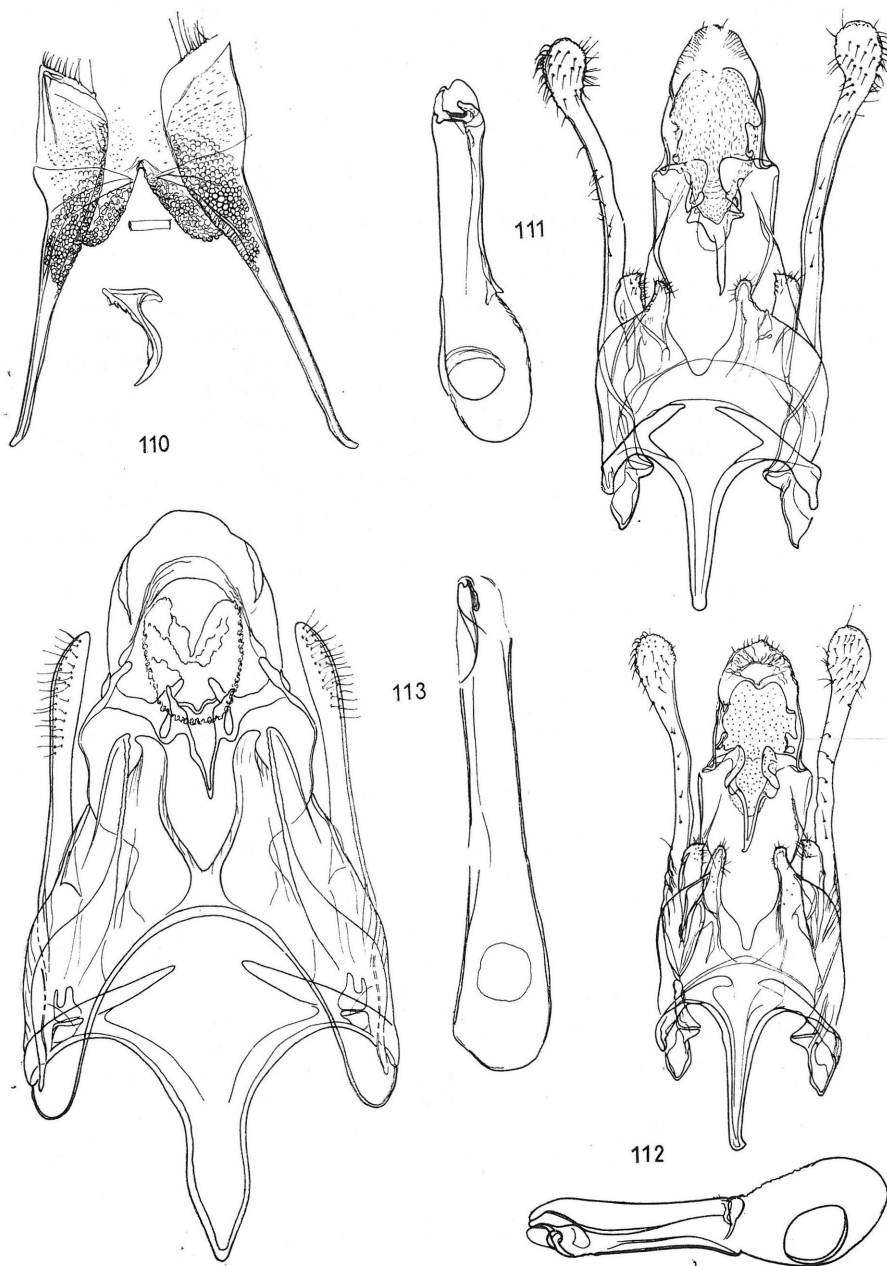
Fischer v. Röslerstamm, Schmetterlingskde, p. 225, 1840.

Syn.: *Gnorimoschema miscitella* Clarke, Canad. Entomol., 64, p. 66, 1932. (Syn. nov.)

This species has been recorded in USA by Keifer 1936 who correctly defines its morphological characters by comparison with the preceding species, remarking that this species has obviously been introduced to California together with its host plant, *Chenopodium murale*. He records the occurrence of this species in the area of Sacramento and San José where the species damages inflorescences of its host plants.

To my surprise, this species is indisputably identical with a pair of specimens submitted to me by Dr. R. W. Hodges, of the USNM, and determined as *Gnorimoschema miscitella* Clarke (1932, Canad. Entomol., 64, p. 66). Very likely, this species will appear in other areas of the USA.

Material: 1 ♂, Tulare, Tulare 6, Calif., 29. 3. 1957, leg. Powell; 1 ♂, Walla Walla, Wn., 5. 7. 1931, D. N. Nannon (USNM); 1 ♂, Yakoma Wash., A. Rolfs;



Genitalia of : 110 — *Scrobipalpa atriplicella* ♀ (Davis Cal.); 111 — idem ♂ (Yakima Wash.); 112 — *S. obsoletella* ♂ (Tulare, Cal.); 113 — *Scrobipalpopsis petasitis* ♂ (Coll. Staudinger)

1 ♂, Walla Walla, Wn., 5. 7. 31, D. R. Rannon (miscitalella); 1 ♂, Yakima Wash., 20. 5. 33, A. Rolfs (miscitalella).

Scrobipalpopsis, n. gen.

Type-species: *Gelechia petasitis* Pfaff.

This new genus is derived from the genus *Scrobipalpa*, showing substantial number of characters that enable one, at first sight, to ascribe its members to the scrobipalpoid branch of the tribe Gnorimoschemini. On the other hand it shows habitual and anatomical characters differing to an extent that leaves no doubt of its taxonomic independence.

Diagnosis: The adults are relatively stout and broadwinged, differing at first sight from the narrow- and slender-winged forms of the genus *Scrobipalpa*. The wing colour is substantially ashy grey with darker longitudinal veins of more pronounced dark scales. The pattern typical of the tribe Gnorimoschemini consists of both a system of black dots separating the bases of fringes from the wing surface itself at its apex, and a typically arranged trinity of dots in the wing area (fig. wing-pattern). Hind wings relatively broad, with the subapical excision, typical of the tribe, relatively shallow or indistinct.

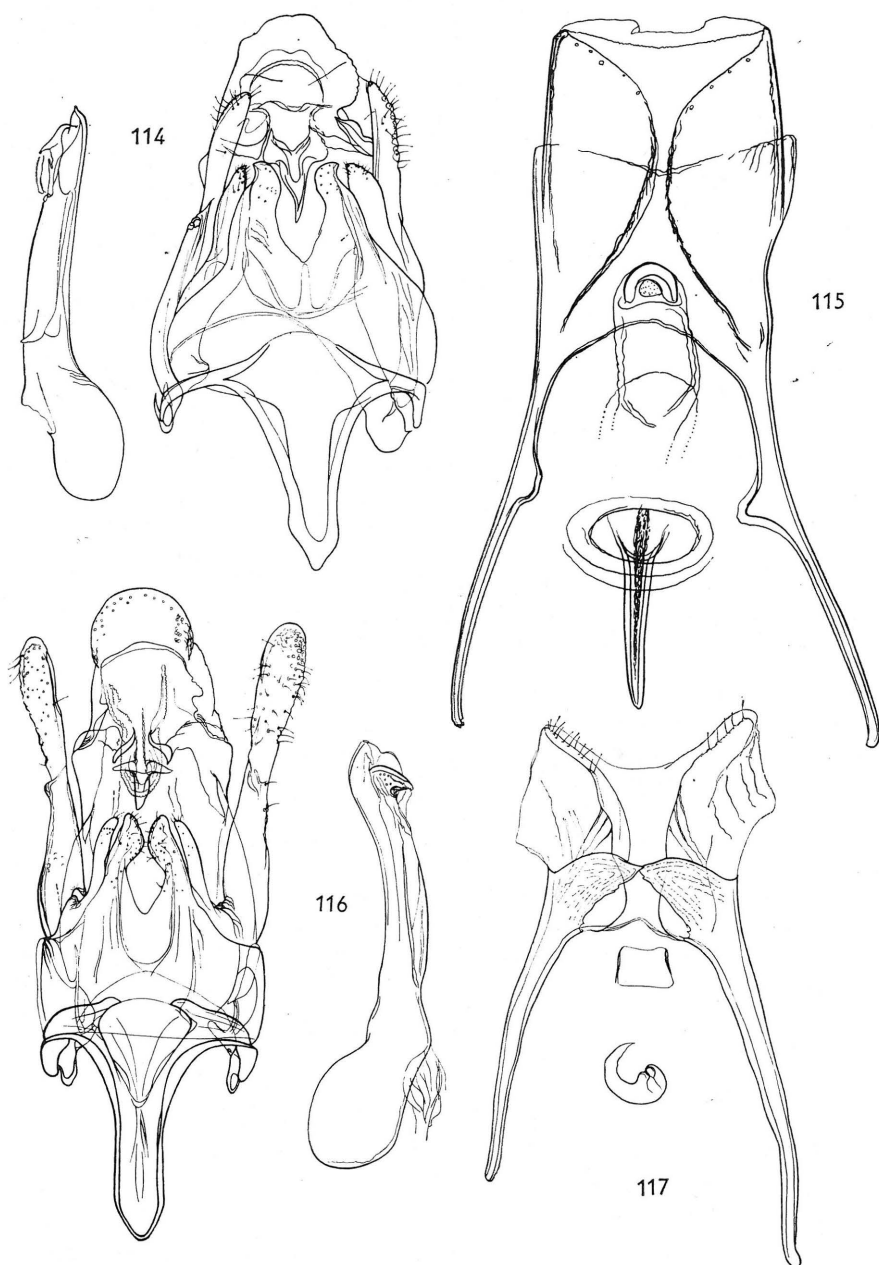
The genitalia are conspicuous, and although they resemble in their general construction those of the genus *Scrobipalpa*, they are substantially stouter, with valvae shortened, neither reaching nor extending beyond the uncus. The paired saccular processes and the basal processes of valvae, distinctly separated in this genus, are unusually stout and approximate as if fused basally. Uncus much heavier than in the genus *Gnorimoschema*, broader and more convex. Saccus also enlarged and prolongate but stout, not narrowed. Aedeagus much heavier than in the genus *Scrobipalpa*, moderately long and stout, usually with a large subapical thorn. Female genitalia characterized by a strong lateral construction of the 8th sternite above the place where it emits the anterior apophyses so that the sides of the eighth sternite are rather conspicuously concave. The surface of the 8th sternite not covered with the typical foamy structure but smooth. Signum bursae shows an obvious tendency towards a partial or total reduction, conspicuous convex processes appear on the inner edges of anterior apophyses.

The genus contains three purely American species and one species known from USA and, in a related form, from the European Alps. The American species appear to be strongly endemic, similar to the species *Scrobipalpopsis petasitis*, the occurrence of which is limited to the Alps (Bergün) and is probably purely relict. A closely related form of this species is known also from USA. This is obviously the remains of a specifically rich group with relict species. Beyond doubt, this is a group entirely independent evolutionally although closely related to the genus *Scrobipalpa*. *Scrobipalpopsis petasitis* is the typus generis.

Scrobipalpopsis petasitis (Pfaffenzeller, 1867), n. comb.

Pfaffenzeller, Ent. Ztg. Stett., 28, p. 79, 1867 (*Gelechia*)

Fore and hind wings conspicuously broad, with basic colour grey. The wing pattern consists of three black dots in the wing area, of which the first two



Genitalia of: 114 — *Scrobipalopsis petasitis* ♂ (Coll. Zeller); 115 — idem ♀ (coll. Staudinger); 116 — *S. tetradymiella* ♂ (California, Siskiyou); 117 — idem ♀ (Los Angeles)

lie roughly on the line separating its basal third, obliquely one above the other. At the base of the fringes at the apex of the wing there is a row of 8—10 oblong dots, separating the wing area from the fringes.

Male genitalia with conspicuously convex uncus, rather short and slightly enlarged valvae above and very broad part of sacculus, producing two pairs of stout processes, of which the inner one is slightly S-shaped, the outer one nearly straight, slightly pointed. Their bases are closely approximate. The hook-like gnathos is pointed. Aedeagus of moderate length, heavy, with a thorn-like subapical process. Eighth sternite of female genitalia distinctly longer than broad, concavely excised above the base of apophyses, inner edge of apophyses provided with a peculiar tubercle. Signum resembles a slightly arched hook or thorn but the plate producing this thorn shows a tendency towards reduction. This species is a rare alpine endemic.

Material: 2 ♂ and 2 ♀, sine loc., coll. Staudinger, Zool. Mus. der Humboldt-Universität, Berlin; 1 ♂, Bergün, 14. 6. 1871, coll. Zeller (BMNH).

Scrobipalopsis tetradymiella (Busck, 1903), n. comb.

Busck, Proc. U. S. Nat. Mus., 25, p. 834, 1903 (*Gnorimoschema*)

The stoutest species in this genus, with ashy grey fore wings, the pattern of which consists of longitudinal veins of dark scales. The dots in the area of the wing are reduced and the row of submarginal dots on outer margin of fore wing is only weakly indicated. Females show a tendency towards a slight brachyptery.

Male genitalia heavy, uncus convex, valvae stout but not reaching the margin of uncus. Inner pair of saccular processes broad and curved inwardly, separated by a narrow and not very deep excision. Outer pair of processes slender. Saccus rather long and strong, pointed. Aedeagus with spherical base, moderately long, with a subterminal lateral thorn.

Eighth sternite of female genitalia with a long concave excision above the bases of anterior apophyses, with paired processes at bases of apophyses, forming a subgenital ledge before the ostium bursae. Signum present as an indistinct membranously chitinous structure in the wall of bursa copulatrix, being obviously a reduction of the originally chitinous hook-like signum.

This form is so far known only from California and is probably endemic.

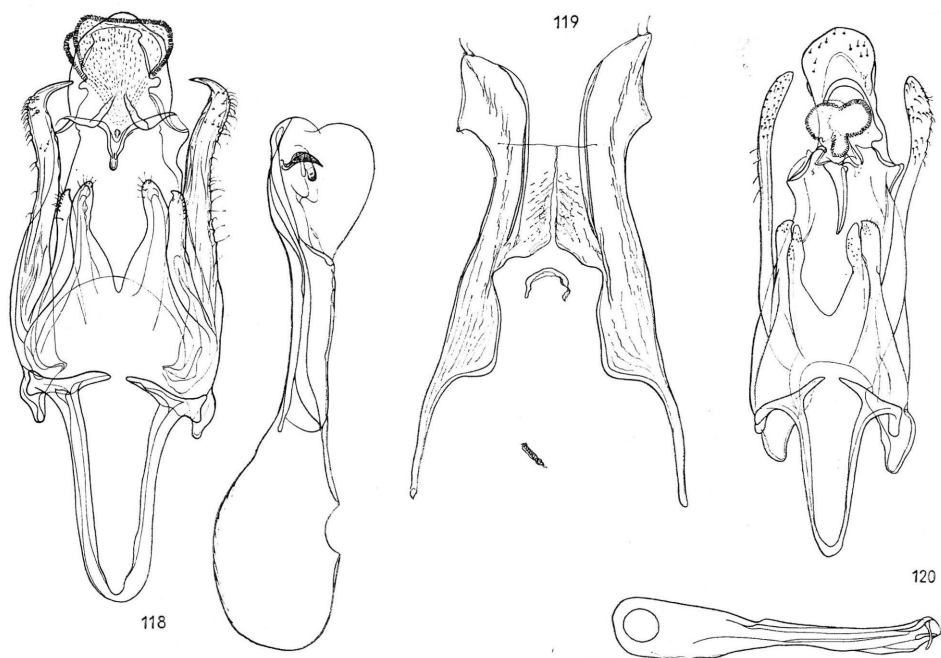
Material: 1 ♂, Willow Creek, Siskiyou Co., California, 10.—11. 9. 1871; 2 ♂, 1 ♀ Los Angeles Co., Cal., September, Gall-maker on *Tetradymia canescens* (CAS).

Scrobipalopsis petrella (Busck, 1915), n. comb.

Busck, Proc. Ent., Soc. Wash., 17, p. 83, 1915 (*Gnorimoschema*)

In its habitus, this species resembles a small specimen of *Scrobipalopsis petasitis*, even in details.

Its genitalia show conspicuous, quite specific characters: a high, convex uncus, relatively short valvae shortly sickleshaped, curved inwardly above, a heavy broad saccus and, especially, the conspicuous aedeagus with ampular base and a broadly membranous tip showing a distinctly developed chitinous



Genitalia of : 118 — *Scrobipalopsis petrella* ♂ (Falls Ch. Va); 119 — idem ♀ (Silver Lake, Chesham); 120 — *S. arnicella* ♂ (Paratypus)

thorn. Female genitalia with typically excised 8th sternite laterally above the base of anterior apophyses, the inner margin of which passes into very broad spatules. This is an unique structure, a suggestion of which occurs in *Scrobipalopsis petasitis* but is fully developed only in this species, having no equivalent in the entire tribe. Signum strongly reduced, with only an indistinct trace of the basal plate (usually producing the hook) preserved.

Material: 1 ♂, Falls Ch. Va., 28. 5. 1950, leg. J. F. G. Clarke (USNM); 1 ♀ Silver Lake, Chesham, N. H., coll. Klots, July 16, 1930, *Gnorimoschema petrella* Busck, USNM-ABK-1930, compared with type.

Scrobipalopsis arnicella (Clarke, 1942), n. comb.

Clarke, Proc. U. S. Nat. Mus., 92, p. 268, 1942 (*Gnorimoschema*)

This species, despite of the considerable similarity of its genitalia to those of the genus *Scrobipalpa*, also shows habitual and morphological characters typical of the genus *Scrobipalopsis*. Of all the known species in this genus, the adults of *arnicella* show the most distinct pattern (three black dots in the wing area, longitudinal spots on the base of fringes in the outer margin of fore wing). The genitalia have a typical strongly arched uncus and shorter, not

enlarged, valvae, not reaching the tip of the uncus. A very characteristic structure is that of the paired saccular processes, fused at their bases, and also the saccus is heavy. Aedeagus moderately long, stout.

Material: 1 ♂ Shasta Rerteat, Siskiyou Co., Cal., "probably a Gnorimoschema", Gnorimoschema arnicella Clarke, Paratype (USNM).

Genus *Exceptia*, n. gen.

Type-species: *Gnorimoschema neopetrella* Keifer

A group, absolutely isolated as to its habitus and structure of genitalia, represented by a single species so far. Nevertheless, I do not hesitate to establish this new genus as especially in the structure of the male genitalia, there is no analogy with it either among the American (nearctic) or the palearctic members of the scrobipalpoid branch of the tribe to which it belongs. Its taxonomic separation is justified even if it is a monotypic genus, as it is an extremely isolated species.

Diagnosis: The basal (second) part of the palpi of adults covered with even more hirsute scales than in the remaining groups of the tribe: in addition the head is clothed with erect scales. Male genitalia showing characters of specialization. Saccus long and slender, resembling a narrow epiglottis. Sacculus deeply and narrowly excised in middle bearing on both sides of this excision a large pointed symmetrical lobe which forms the greater part of the sacculus. On both sides of this paired process, strongly reduced processes of bases of valvae are seen (which obviously have been overlooked by Keifer when describing this species), a major part of which is covered by the heavy paired process of the sacculus. Valvae slender, slightly curved subapically, uncus convex, rounded above, gnathos hook-like as in the genus *Scrobipalpa*. Eighth sternite of female genitalia of much the same structure as in the genus *Scrobipalpa* but conspicuously heavy and without the typical foamy structure of the scrobipalpoid group. Signum unusually large, only slightly curved, basally provided with tooth-like processes.

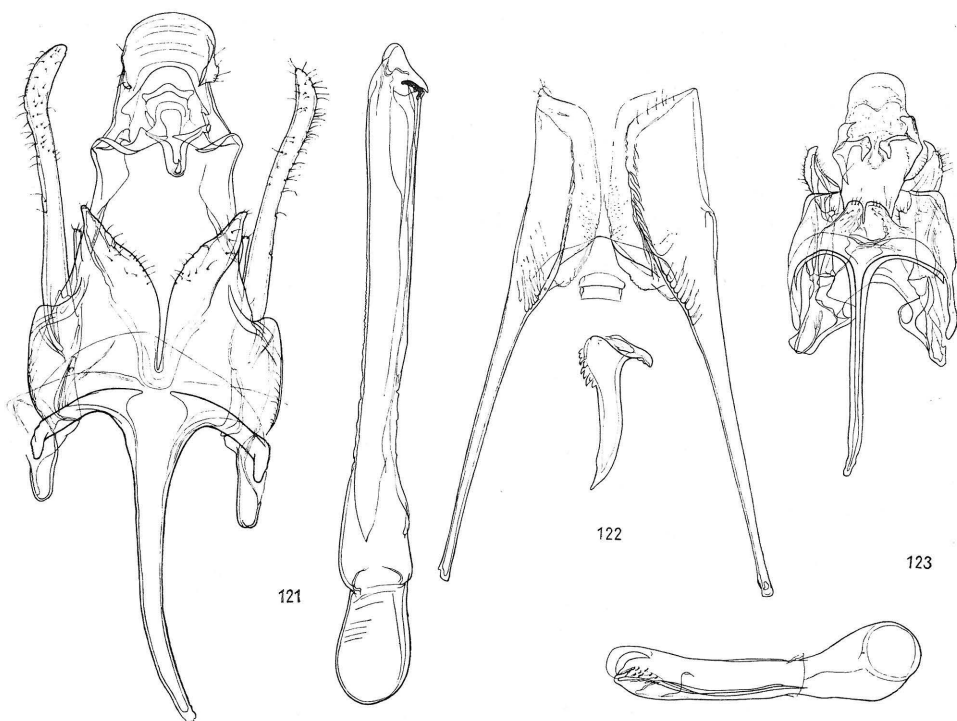
Unmistakably, this genus represents a separate evolutionary branch of scrobipalpoid Gnorimoschemini. *Exceptia neopetrella* is the type species of this genus.

Exceptia neopetrella (Keifer, 1936), n. comb.

Keifer, Mo. Bul. Cal. Dept. Agr., 25, p. 235, 1936 (*Gnorimoschema*)

The only species in this genus has been well described by Keifer, 1936. However, it is by no means related to the species *petrella* Busck. The necessary supplements to the original description are given in the generic diagnosis of *Exceptia*. So far, the species has been recorded from one Californian locality (Alma, Santa Clara County) but is probably more widely distributed over California.

Material: 1 ♂ Mill Valley, Maria Co., Cal., 3. 7. 1926, leg. Keifer; 1 ♀, Los Angeles Co., Cal., May 198 (CAS).



Genitalia of : 121 — *Exceptia neopetrella* ♂ (Mill Valley, Cal.); 122 — idem ♀ (Los Angeles); 123 — *Caryocolum* spec. ♂ (Arizona)

Genus *Caryocolum* Gregor & Povolný 1954

The observation of the occurrence of this genus in the Nearctic Region is one of the most important discoveries concerning the zoogeography of the entire tribe. Apart from the genera *Gnorimoschema* and *Scrobipalpula*, the genus *Caryocolum* is the third extensive gnorimoschemoid genus common to the Palearctic and the Nearctic Regions. All the remaining genera of this tribe are endemic to either the New or the Old World and are represented by at most somewhat related but generically different forms. The present number of the nearctic species of this genus is not known but they seem to be substantially less numerous than the western palearctic species. The American species show far-reaching congeneric characters with the European species both as to their pattern, i.e. black background of fore wings with a distinct white pattern, and the structure of the genitalia. The genitalia are absolutely characteristic in their long and narrow, epiglottis-like saccus, short valvae bifurcating basally, broad and low sacculus bearing a pair of low processes, heavy teguminal part and broad basal corners of tegumen. Uncus roundedly convex, gnathos reduced so that only its lateral branches remained. Aedeagus stout and broad, with a subterminal thorn. The identification of the species will require a special

comparison with the palearctic forms whose close relationship cannot be excluded.

Material: 1 ♂, Hart Prairie, 8,500 ft, 10 mi NNW Flagstaff, Coconino Co., Arizona, 25 June 1961, Ronald W. Hodges (USNM).

Note: The last New World genus which my investigations have shown to belong to this tribe is the genus *Frumenta* Busck, 1939 with the sole species *nundinella* Zeller 1873. I myself have not examined material of this species, however, it is evident from Busck's figure and description that this is a gnorimoschemoid form, very likely closely related to the genus *Caryocolum*, but certainly not congeneric. Busck, 1939 himself pointed out the relationship of this form with the genus *Gnorimoschema*.

Species incertae sedis

In this group, I include those species the generic relationship and taxonomic position of which remain indeterminate. All of them are forms described on the basis of a female holotype, so that no definite opinion on their position can be presented. For this reason, their generic names are applied only for the sake of completeness but they do not signify either real taxonomic or phylogenetic position and are only provisional.

„*Scrobipalpa*“ *conifera* (Meyrick, 1916), n. comb.

Meyrick, Exot. Microl., 1, p. 582, 1916 (*Gnorimoschema*)

The genitalia of the female lectotype provide certain evidence that this species belongs to the scrobipalpuloid branch of the tribe Gnorimoschemini. The signum bursae and especially the foamy structure on both lobes of the 8th sternite on both sides of ostium bursae are obvious evidence that this is a member of the genus *Scrobipalpa* or a much derived, at least subgenerically different form of the genus *Scrobipalpa*. Certainly it cannot be a member of either of the genera *Chelaria* or *Gnorimoschema* where this species has previously been placed. The existence of this species provides further evidence of the extensive changes to which the members of this tribe had been subjected in the environments of South America. Without a knowledge of its male genitalia, the position of this species in the tribe Gnorimoschemini cannot be determined.

Material: 1 ♀ *Chelaria conifera* Meyrick, Ecuador, Huigra, 4,500 ft, June, Parish (lectotypus) (BMNH).

“*Phthorimaea*” *urosema* Meyrick, 1917

Meyrick, Trans. Ent. Soc. Lond., p. 43, 1917.

Even in this case there is no doubt about the relationship of this species with the tribe Gnorimoschemini; however, it is a form extraordinarily specialized and secondarily altered to the extent that it is very likely a member of a separate genus. Its relationship with the tribe Gnorimoschemini is indicated both by the conspicuous foamy structure of its 8th sternite, the chitinization of ductus bursae and the shape of signum. Its extraordinary specialization is

indicated by the circumstance that the foamy structure covers nearly the whole of the surface of the 8th sternite, and that its anterior apophyses are exceptionally conspicuously short. Also, the kind of chitization of the ductus bursae is quite unique and the signum is strongly reduced.

Material: 1 ♀ *Phthorimaea urosema* Meyrick, Peru, Matucana, 7,780 ft, July, Parish (holotypus) (BMNH).

"Gnorimoschema" *ilyellum* Zeller, 1877

Zeller, Horae Soc. Ent. Ross., 13, p. 337, 1877.

This seems to be an entirely isolated species of the tribe Gnorimoschemini the generic relationship of which is quite obscure. On this occasion it is necessary to note that the Neotropical Region is obviously inhabited by a greater number of gnorimoschemoid species that either show only very slight affinity to the hitherto described genera of this tribe or are quite isolated forms but obviously gnorimoschemoid. Because of their extreme isolation and specialization it is extremely difficult to decide whether they are old original forms of the tribe (the origin of which should then be looked for in the neotropical fauna) or whether they are forms that had secondarily evolved in the Neotropical Region to which the gnorimoschemoid Gelechiidae had secondarily penetrated from the Nearctic (or Palearctic) Region, inhabited by most of the known species of this tribe.

The female genitalia of this species are heavy, and although strongly resembling those of certain Gnorimoschemini show a number of specific characters. The 8th sternite is relatively stout, its anterior margin is strongly extended towards the ostium bursae; ductus large and broad, its walls strongly sclerotized. The membranous part of the ductus bursae is narrow and relatively short, opening to the left part of the bipartite bursa copulatrix which is nearly symmetrical but has the left part somewhat larger than the right. 8th sternite without a more conspicuous structure, save for two symmetrically placed lobes on the sides of the anterior margin of the sternite, convexed towards the middle of the latter.

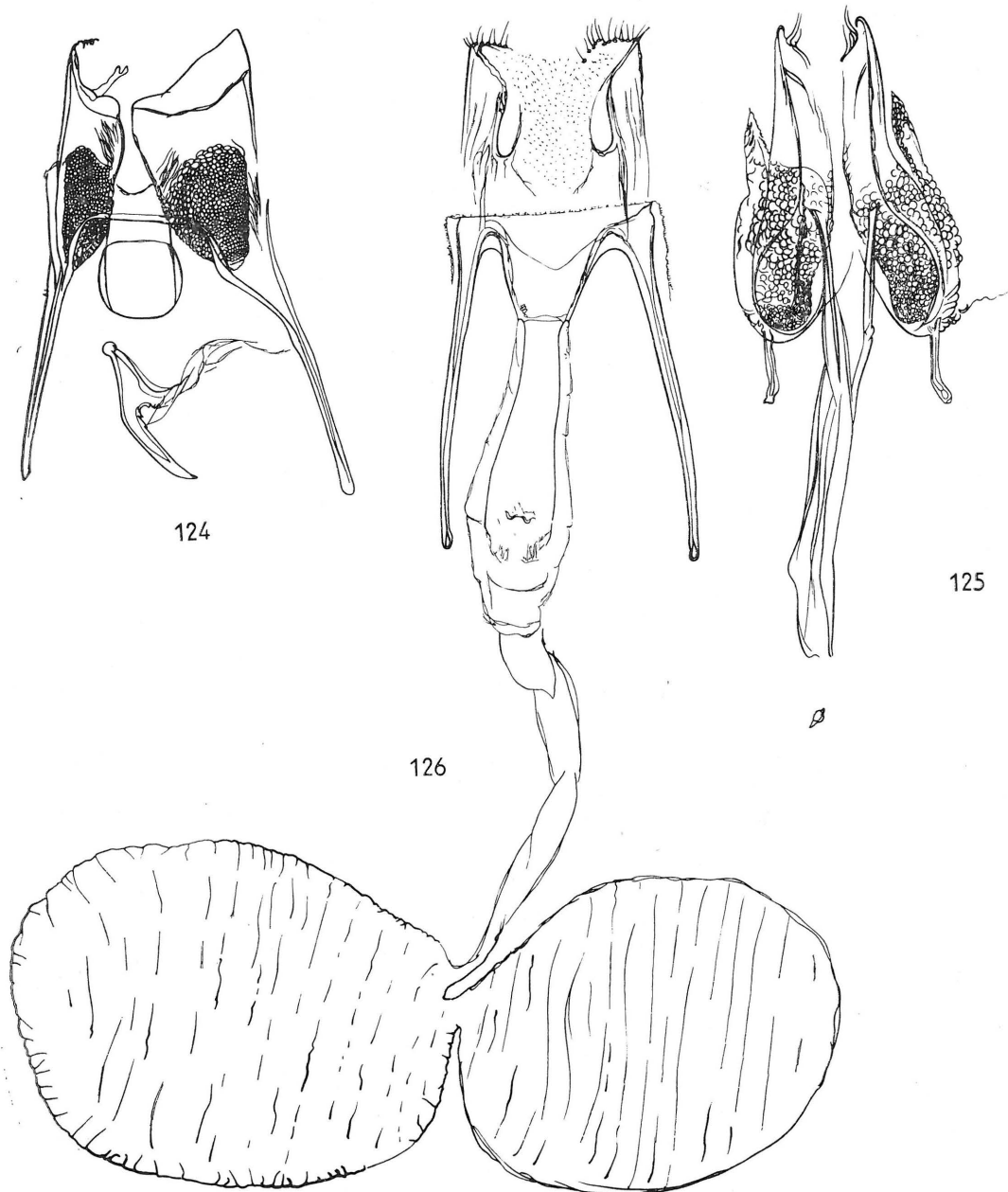
Material: 1 ♀ Bogota, 7/2 (holotypus) (BMNH).

"Phthorimaea" species Meyrick 1931

Meyrick, Anales Mus. Buenos Aires, 36, p. 386, 1931, (described as *Phthorimaea laciniosa*).

The female genitalia of this species are quite specific, they have a long chitinated section of ductus bursae, the anterior apophyses are slightly convex to the sides, and the signum is hook-like. 8th sternite rather conspicuously narrowed and provided with a peculiar, deep, invagination. The characteristic shape of the signum bursae suggests a certain relationship with the genus *Scrobipalpula*.

Material: 1 ♀ Argentina, Bariloche, 28. 11.—1. 12. 1926, Terr. Rio Negro (paratypoid) (BMNH). This female specimen, labelled "*Phthorimaea laciniosa*", has been deposited in the British Museum in London together with the lecto-



Genitalia of : 124 — *Scrobipalpula conifera* ♀ (Lectotypus); 125 — “*Phthorimaea*”
urosema ♀ (Holotypus); 126 — „*Gnorimoschema*“ *ilyellum* ♀ (Holotypus)

type of this species which is conspecific with *Scrobipalpula densata* (Meyrick). As the latter is a good species, the name *Phthorimaea densata* is a synonym. I have had no opportunity to investigate the authenticity of this paratypoid, for which a new specific name should be proposed.

"Scrobipalpopsis" chili, n. sp.

Among the undetermined material in the collection of the CAS, I found a rather conspicuous form, the habitus of which suggested that it is not only a member of the tribe Gnorimoschemini but also a form related to the scrobipalpoid branch of this tribe. This conclusion is corroborated by the female genitalia.

Head, thorax and tegulae covered with pale testaceous unicolorous scales. The second (basal) segment of labial palpi is covered with long hirsute scales, with furrow along the lower edge, the terminal segment of the palpi is covered with clinging scales, and has a dark base and a broad blackish medial ring so that only the tip is pale brown. Fore wings pale testaceous, with two pronounced insular black dots without a paler border. The first dot lies closer to the base and is joined to a group of irregular and less pronounced spots near the base of the wing. The second slightly longitudinal, dot is approximately in the middle of the wing. A suggestion of a third dark spot is formed by a group of blackish scales of the tip of the wing before the fringes. Upper part of fore wing behind the second black spot with scattered groups, or individual, milky white scales. Hind wings covered with pale dirty greyish scales but the margins of wings (including the costa) bordered with indistinct darker greyish scales. On the whole, this specimens resembles a strongly aberrant form of the European *Scrobipalpa salinella-instabilella*.

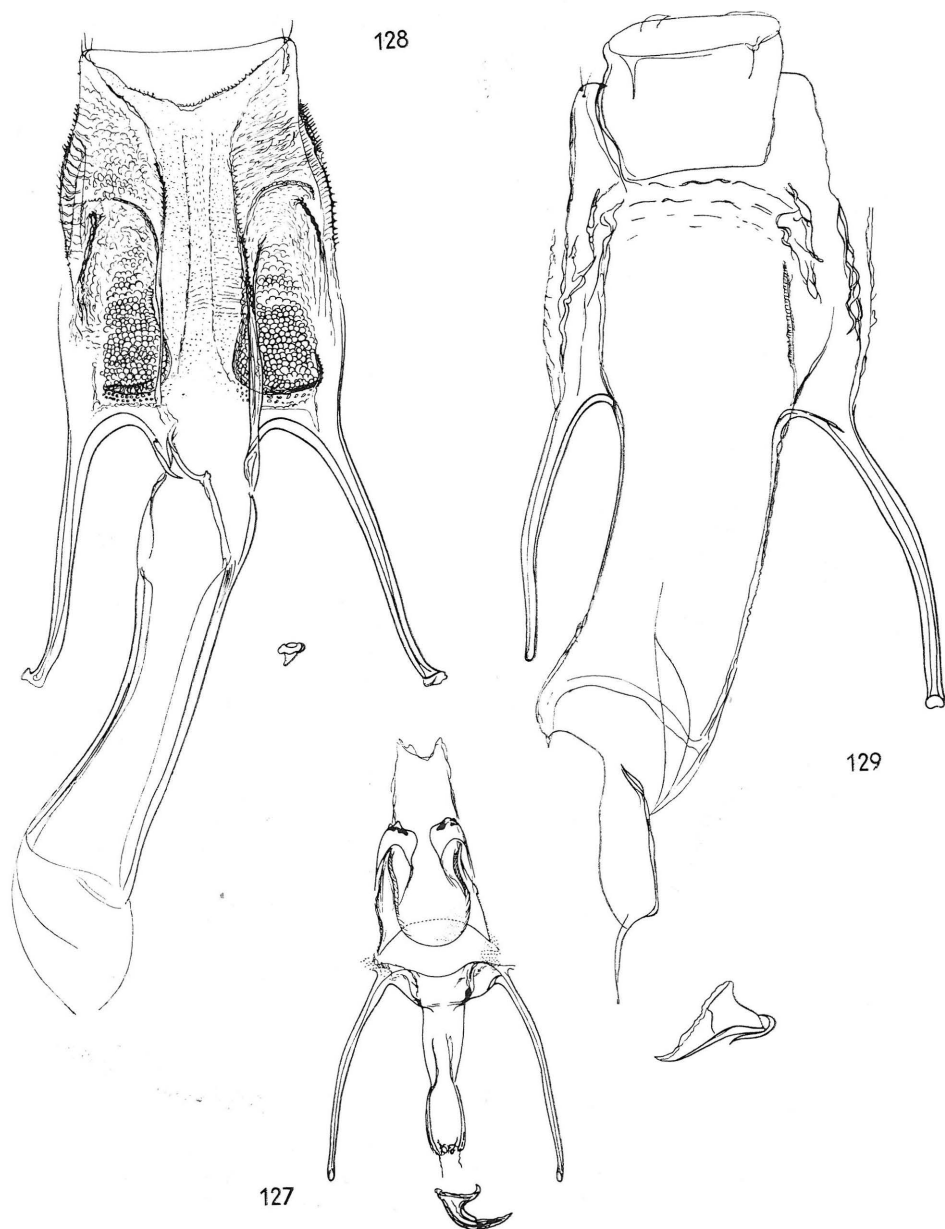
Female genitalia quite exceptionally conspicuous by the rich adornment of their 8th sternite which is covered nearly all over with a foamy or porose structure, forming two conspicuous fields near the base of anterior apophyses on both sides before the mouth of ostium bursae. The latter is large and passes into a long, chitinized, very broad section of ductus bursae. In the bursa itself there is a scrobipalpoid signum in the form of a strongly reduced but quite typical hooklet.

The generic position of this species is obscure but is near the genera *Scrobipalpa* and *Scrobipalpopsis*.

Material: 1 ♀ Chile, E. O. Reed (holotypus) (CAS).

"Ephysteris" hodgesi, n. sp.

The entire colouring of head, thorax and fore wings is uniform mouse grey and indistinct. Ends of scales on the basal part of labial palpi are more distinctly blackish, the terminal part of labial palpi with black scales and a narrow white ring at its middle. Fore wings covered with continuous, dirty whitish scales with dark tips, which is especially distinct in the upper third of the wing. This causes a peculiar uniformly greyish hue to the wings, without any pattern. In their area, rudiments of the typical spots are feebly indicated, lying roughly



Genitalia of : 127 — "*Phthorimaea*" *laciniosa* ♀ (Paratypoid); 128 — "*Scrobipalopsis*" *chili*, n. sp. ♀ (Holotypus); 129 — "*Ephysteris*" *hodgei*, n. sp. ♀ (Holotypus)

in the middle of the wing obliquely one above the other. They are indistinctly blackish, with a group of somewhat brownish scales in their lower margins. Hind wings dirty whitish, with long fringes. On the whole, this narrow-winged form resembles indistinctly coloured individuals of certain European members of the genus *Scrobipalpa* (*atriplicella*, *acuminatella*).

However, the female genitalia show quite clearly that it is not a scrobipalpoid form but, as shown by the general structure of the 8th sternite and especially the conspicuously broad and relatively long chitinization of the ductus bursae, this is obviously a form related to the Old World genus *Ephysteris*. To the latter it corresponds in the general structure of the 8th sternite, the shape of apophyses, the width of chitinization of ductus bursae, and also the shape of the signum which is rather trapezoidal, which shape is an exception among the species of the Nearctic Region.

I dedicate this species to Dr. Ronald W. Hodges, of the U.S. National Museum, Washington, who helped me greatly in procuring the material for this study.

Material: 1♀ Fort Valley, 7,350 ft, 7.1/2 mi NW Flagstaff, Coconino Co., Arizona, 12 July, 1961, leg. Ronald W. Hodges (holotypus) (USNM). Length of fore wing: 6 mm.

Conclusions

Reviewing the results of the present attempt at a taxonomic revaluation of the nearctic members of the tribe Gnorimoschemini, we arrive at the following conclusions:

1. The genera *Scrobipalpopsis*, *Caryocolum*, *Gnorimoschema* and *Scrobipalpula* are common to both the Nearctic and the Palearctic regions.

2. In the Nearctic Region, the genera *Gnorimoschema*, *Scrobipalpula* and *Scrobipalpopsis* are represented

- a. by a far larger number of species than in the Palearctic Region, and

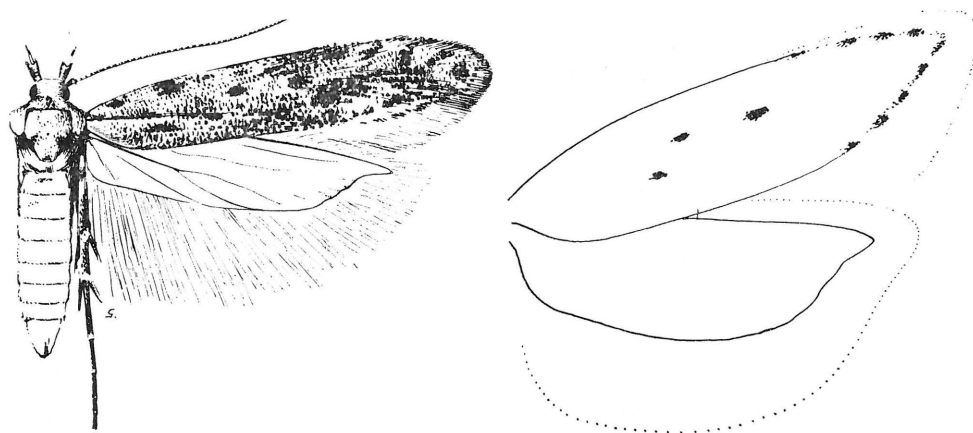
- b. by species showing greater differentiation and specialization and often considerably modified.

3. At the same time, the genus *Scrobipalpula* is well established in the Neotropical Region where it is represented by a number of extremely specialized forms, some of which bear such peculiar characters that they must be considered subgenerically or generically different. As for the gnorimoschemoid branch of the tribe, an analogical tendency is observed, differing in that in the southern part of the Nearctic Region, they form a separate group (the genus *Symmetrischema*), of relatively homogeneous species. At the same time, similar very specialized and isolated gnorimoschemoid species seem to occur in that Region the taxonomic status of which is not clear for the time being.

4. The genus *Scrobipalpa* is not an original element of the fauna of the New World and the occurrence of certain species in the Nearctic Region is obviously of secondary origin. The possibility cannot be excluded that, in addition to *Scrobipalpa obsoletella* and *S. atriplicella*, other members of this genus may be, or have been, introduced into the Nearctic Region. In this region, the genus *Scrobipalpa* is replaced by a similar but generically separate group of *Scrobipalpopsis* which is probably of a strongly relict character. The genus *Scrobipalpopsis* reaches Europe by the species *S. petasitis* occurring as a relict in the Alps; it is also known from the USA.

5. Some of the North American species of the genus *Gnorimoschema* s. str. are closely related to the western Palearctic species of that genus; they are few in number. This doubtless phylogenetic relationship between the nearctic and palearctic members of the genus *Gnorimoschema* is evidenced also by the identity of certain European and North American species of the genus *Gnorimoschema* (*G. valesiellum*, *G. nordlandicoellum*) differing only subspecifically.

6. The European *Scrobipalpula psilella-diffusella* complex is merely a representative branch of the closely related North American species of that genus (*S. hensha-*



130 — Wing-pattern of *Gnorimoschema* (*Neoschema*) *klotzi*, n. sp. (left) and the genus *Scrobipalopsis* (*petasitis* Pfaff.) (right)

wiella, *S. artemisiella*, *S. potentella*, *S. semirosea*, *S. ochroschista*) showing a habitual and morphological variability similar to that of the circle of the European forms. The taxonomic status of this entire holarctic complex is not clear, as the genitalia and wing pattern both indicate a great similarity and the specificity of these forms require elucidation in the future, probably on an experimental basis. Also, their specificity is confused due to their considerable polyphagy.

7. On the contrary, the genus *Caryocolum* is represented in the arid regions of the Nearctic by several forms closely related to (although specifically different from) the European species. This genus seems to be represented only by a torso of species in North America.

8. Apart from these genera, the New World (mainly the southern part of the Nearctic, as well as the Neotropical Region) is inhabited by many species certainly belonging to the tribe Gnorimoschemini, either showing obvious phylogenetical relationship to the specifically richer genera of this tribe (the genus *Exceptia* is obviously scrobipalpoid) or representing qualitatively independent and deeply isolated, purely New World genera (*Keiferia*, *Tildenia*, *Barticeja*) which appear to show little or no relationship to the remaining evolutionary branches of the tribe Gnorimoschemini. It seems very likely, that the subtropics and tropics of the New World are inhabited by more such deeply qualitatively differentiated and isolated groups.

9. The genus *Phthorimaea* is an entirely specific and independent branch of the New World Gnorimoschemini, probably a lateral evolutionary branch of the genus *Scrobipalpula* having become quite independent. In the Old World, this genus is represented by a single (introduced) species *Ph. operculella*.

(10) As far as they are known at all, the host plants of the American species belong to the same plant families as those of the Palearctic ones (cf. Povolný, 1964): Solanaceae (or Scrophulariaceae): *Solanum nigrum*, *S. lycopersicum*, *S. xanthii*, *S. umbelliferum*, *Solanum* spp. div., *Capsicum* spp., *Physalis hederifolia*, *Ph. viscosa*, *Castilleja lutescens*; Compositae: *Baccharis pillularis*, *Applopappus pinifolius*, *Ericameria arborescens*, *E. ericoides*, *Aster* spp., *Solidago* spp., *Acamptopappus sphaerocephalus*, *Chrysothamnus viridifolius albicaulus*, *Artemisia* spp., *Tetradymia canescens*, *Iva imbricata*, *Chenopodium murale*, *Chenopodium* spp.; Labiatae: *Scutellaria laterifolia*.

Instances in which the most host plants belong to widely separated groups are due to wider polyphagy of a group (*Scrobipalpula potentella*, being closely related to the polyplagous European *Scrobipalpula psilella-difflluella* complex) or to xenophagy of such polyphagous groups.

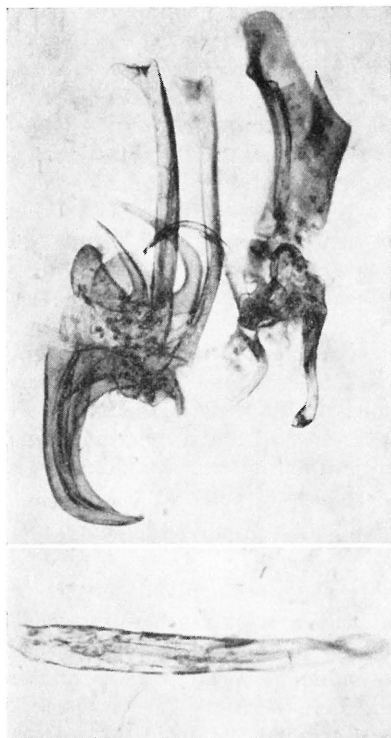
Thus it is evident that as a unit, the Gnorimoschemini are rather strictly oligophagous, their larvae occurring on a definite and relatively limited scope of plant families. It is anticipated that a more thorough knowledge of their host plants will substantially contribute to the solution of the phylogenetical and other questions (speciation) concerning this tribe and to the elucidation of many other problems.

The above conclusions result in the following basic knowledge of the present state of taxonomy of the tribe Gnorimoschemini, which is of a preliminary character:

In the Palearctic Region, the tribe Gnorimoschemini is represented by the endemic genera *Scrobipalpa* and *Ephysteris*. Probably the zoogeographic centre of these genera is the Middle East, which is inhabited by the greatest number of species. From this region these genera radiate into other regions of the Old World (mainly into the Ethiopian and the Oriental Regions). The endemic representatives of the tribe Gnorimoschemini of the New World are the genera *Phthorimaea*, *Symmetrischema*, *Keiferia*, *Tildenia* and other strongly isolated groups inhabiting the tropics and subtropics. The centre of the holarctic genera lies mostly in the Nearctic Region (*Scrobipalpula*, *Scrobipalopsis*, *Gnorimoschema*), the palearctic species of these holarctic genera occurring, it would appear, mainly in the Western Palearctic Region. The only holarctic genus, the centre of which, however, lies in the Palearctic Region and which is poorly represented in the Nearctic Region, is the genus *Caryocolum*. The pests being found in both the purely nearctic genera (*Phthorimaea operculella*, *Symmetrischema plaesiosema*) and purely Old World genera (*Scrobipalpa obsoletella*, *S. atriplicella*) may be secondarily introduced, with their host plants, to the opposite Regions.

These phylogenetic and zoogeographic relations are unerring evidence of the continental connection of the Western Palearctic Region and the Nearctic Region in the northern Atlantic (Greenland, Iceland, the British Isles) in the Tertiary, and this is confirmed by the simultaneous occurrence of certain species of the genus *Gnorimoschema* in Western Europe, in the islands mentioned above and on the American continent (*Gnorimoschema valesiellum*, partly *G. nordlandicoellum*). It is also evidence of the considerable age of these species.

Whether the Old World or the New World should be considered the birthplace of the tribe Gnorimoschemini is problematic. It is indisputable that especially the southern part of the Nearctic Region and the Neotropic Region is inhabited by the largest number of extremely isolated and, therefore, very old and probably relict



131 — Male genitalia of *Tildenia* (?) *vorax* Meyrick, 1939 in lateral position and aedeagus (bottom). According to a photograph in BMNH.

groups of the tribe. Also, it is obvious that the Western Palearctic is inhabited by stems of genera which are in their full evolution in the New World (above all, *Gnorimoschema* and *Scrobipalpa*), whilst a sole contrary case is that of the genus *Caryocolum*. Thus, in general, the number of the endemic genera or highly specialized and isolated species is distinctly higher in the New World (especially, its tropics and subtropics) than in the Old World. Furthermore, the endemic palearctic genera (especially *Scrobipalpa* and *Ephysteris*) are extremely homogeneous and far from being as greatly differentiated as the endemic genera of the New World. Also, the torsos of the holarctic species in the Western Palearctic Region (species of the genera *Gnorimoschema* and *Scrobipalpa* and, partly, also *Scrobipalopsis*) are quite homogeneous. Thus, the differentiation of the members of the tribe Gnorimoschemini is much greater in the New World than in the Old World, which indicates its greater age in the New World than in the Old World.

In general, the tribe Gnorimoschemini is divided into the following evolutionary branches:

- a. The scrobipalpoid branch distributed chiefly in the Old World, with a small group of species or isolated genera occurring in America (*Scrobipalpa*, *Ephysteris*, *Scrobipalopsis*, *Exceptia*). The host plants of this group belong to the Compositae and Chenopodiaceae; less frequently, Solanaceae and Labiatae.
- b. The gnorimoschemoid branch, distributed chiefly in the New World, with a torso of species in the Western Palearctic (*Gnorimoschema*, *Symmetrischema*). The host plants of this group are mainly Solanaceae, Compositae; less frequently, Scrophulariaceae.
- c. The scrobipalpoid branch of America, with a torso of species in the Western Palearctic (*Scrobipalpa*, *Phthorimaea*, *Keiferia*). The host plants of this group are mainly Solanaceae and Compositae.
- d. The caryocoloid branch, chiefly palearctic, with a torso of species in America (*Caryocolum*). The host plants are chiefly Caryophyllaceae.

e. The last is a conglomeration of heterogeneous genera, showing either no affinity to the above-mentioned evolutionary branches of the tribe (*Tildenia*) and being quite independent genera qualitatively, or very indistinct and veiled relations to the known groups (naturally, this can be only an apparent condition).

As shown by the taxonomic analysis of its American members, the tribe Gnorimoschemini is, in this respect, similar to the Palearctic, a clearly defined evolutionary branch of the family Gelechiidae and its taxonomic independence is thereby still more fixed.

Naturally, my suggestion of the taxonomic division of this tribe is in accordance with the present state of my knowledge which I do not consider satisfactory. In fact, the investigations on the species of this tribe are in their infancy. However, it is my opinion that such a recapitulation of the present knowledge may bring about an intensification of the work in this field. Furthermore, I sincerely hope that my present investigations may provide a basis for a better understanding of the holarctic character of the Gnorimoschemini, one of the least known groups of the so-called Microlepidoptera, which has previously been independently studied both in the Palearctic and Nearctic and erroneously considered as two separate groups. Only such a study as the present one can lead to an elucidation of the true phylogenetic relations and, thence, to the creation of a natural system. Such has been the aim of my study.

Note: After having finished the manuscript of this paper, I could study further two species related to the Gnorimoschemini of New World, viz. *Phthorimaea brackenridgella* (Busck, 1903) (1 ♂, Toronto, Canada, Parish, 6.13) and *Gelechia hungariae* Staudinger, 1870 (1 ♂, lectotypus, Zool. Mus. Berlin). The specimen of *Ph. brackenridgella* is conspecific with *Scrobipalpa atriplicella* (F. v. R.), which fact suggests the possible synonymy of the former. As for *Gelechia hungariae*, this is congeneric with *Scrobipalposis petasitis* (Pfaff.). The genus *Scrobipalposis* comprises, indeed, five species (*petasitis*, *petrella*, *arnicella*, *tetradymiella*, *hungariae*). The taxonomic individuality of the genus *Scrobipalposis* is emphasized by this statement.

Addendum:

During the print of this paper J. F. Gates Clarke published his contribution on Microlepidoptera of Juan Fernandez Island (Proc. of the U. S. Nat. Mus., 117 : 1—106). In this paper several gnorimoschemoid Gelechiids are mentioned and some of them are described as new. The descriptions and figures make it possible to revise the generic status of the following species:

(1) *Scrobipalpa absoluta* (Meyrick, 1917) — The figure of the female genitalia shows a scrobipalpoid sculpture, especially the foam-like sclerites above ♀ ostium bursae, the broad ductus and the signum tending towards a reduction. The species is certainly not congeneric with *Gnorimoschema* and its generic position is doubtless better to be considered as close to *Scrobipalpa*.

(2) *Scrobipalpa melanolepis* (Clarke, 1965), n. comb. — This is doubtless a *Scrobipalpa* being strictly congeneric with *Scrobipalpa psilella* (H. — Sch). It even is possible that this is conspecific with one of the nearctic species of this genus mentioned in this my paper (i. e. *Scrobipalpa ochroschista*, *Scrobipalpa semirosea*), all of them belonging to a closely related complex of forms, the specificity of which seems to be very problematical.

(3) *Scrobipalpula hemilitha* (Clarke, 1965), **n. comb.** — This species seems to be related to *Scrobipalpula lutescella* (Gates Clarke) and it certainly belongs with the genus *Scrobipalpula* (as seen especially in the form of gnathos, saccus, signum etc.)

(4) *Ephysteris trinota* (Clarke, 1965), **n. comb.** — The genus *Echinoglossa* described by Gates Clarke in the above paper is no doubt congeneric with the Old-World genus *Ephysteris* Meyrick, 1908 as distinctly shown by the bifurcate valva, by the slender long saccus and by the long aedeagus with an inflate basis. The same is evidenced by the female genitalia with their long ductus and, especially, by the typical shape of signum bursae. The presence of the genus *Ephysteris* in the New World fauna is very important from the viewpoint of zoogeography and history, demonstrating that *Ephysteris*, too, is an old developmental branch of the gnorimoschemoid Gelechiidae.

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