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Keeper of Entomology: R.I. Vane-Wright  
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# EDITORIAL

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This journal will soon celebrate its 'golden jubilee' (it first appeared as the *Entomology Bulletin of the British Museum (Natural History)* in June 1950). Given the long history of both the Museum and taxonomy, it could as well have started life in 1850 (and probably would have but for omnivores such as the *Annals & Magazine of Natural History*). Looking at our *Bulletin* today, as I write within a few weeks of the millennium, I am forced to ask, what sort of publication is this, and does it have a future? Is this a remnant of 20th century academic biology, or even 19th century dilettantism, when colonels and men of the cloth were numerous amongst the greats of entomology? Is this journal (and many others like it) simply struggling on, like one of those doomed lineages that just creeps past the K-T boundary, only to disappear finally a few geological milliseconds later? Specifically, has the dawn of the web-age now truly arrived, rendering print on white paper as outmoded for communicating science as tablets of stone or scrolls of papyrus for chronicling human history? The answer is very assuredly no, but a qualified no . . .

## Tasks of systematic entomology

Systematics, and systematic entomology in particular, is faced with a range of huge and seemingly unending tasks. We still have the potential need to describe, at a very conservative estimate, three times the number of insect species accounted for in the last 250 years. We need to deal with complex molecular, genetic, ontogenetic, polymorphic, phenetic, seasonal and geographical variation, and all that this means for problems in synonymy. We must strive to provide far better means of identification: even for those insects that have a more or less reliable name and diagnosis, most can still only be named by experts working with large collections. We must strive to provide a robust predictive classification: increasingly this means team-work to create enormous morphological and molecular data sets. While progress with empirical cladistics is now impressive, the vast majority of insect species (and even genera) are still either wholly unknown, or poorly sampled and little studied. Without sound predictive classifications, our attempts to understand, conserve and make best use of the vast diversity of insects will remain largely ineffectual.

## The challenge that information technology brings

With the emergence of computer technology, including the ability to store, manipulate and transmit vast amounts of data, as well as excellent digital images, all by internet, a new challenge has emerged for systematic entomologists. In addition to all the basic functions of research (and the necessary curation of huge museum collections that underpin our work), systematic entomologists are now also expected to act as information scientists and providers. The world is no longer content with the idea that, somewhere in Washington, Canberra, Paris, Berlin, London, Nairobi, Bangkok or Quito, there are obscure but incomplete lists and descriptions of various species and genera, barely accessible even to those museum workers traditionally expected to create and care for them.

Instead, we are in the age of biological informatics. Such data should be 'on the net', there for all to have access, to see what it says on the labels of all the *Noctua pronuba*, *Schistocerca gregaria*, *Carabus violaceus*, *Aedes aegypti* or a million other species in ten thousand museums, all available at the flick of a switch, the touch of an icon. Together with on-line images of the specimens, fully synonymic lists of the groups to which they belong, interactive keys for identification, and automated mapping programmes. Even better of course, rather than do any of this work yourself, the relevant specialists are only an e-mail away, to receive new data, verify it, and feed it back into the maw of the gargantuan, all-consuming internet machine that will link old museum samples, new field samples and users all together, thus to receive the wisdom and blessing of the experts. Stirring stuff, politically correct too – but consider those experts for a moment. What chance for reflection will they have, what chance to absorb impressions, form ideas, create new information, create new science? Precious little, if we get the balance wrong. Or, if we get it right, a wonderful broadening of their own horizons and a re-affirmation of their central role in biology.

If the relatively few insect taxonomists that exist are really expected to make their knowledge and expertise available to all, then unless they receive very significant extra support, they will be overwhelmed. Equally, if the professional community of systematists fails to respond to the challenge of the web, and respond well, then they will be marginalised. What government would continue to support taxonomists incapable of making their work available by the greatest new aid to communication in 500 years, a veritable technological revolution so favourable and helpful to the basic tasks of taxonomy and systematics, if only it can be tamed and used wisely?

## Pursuing and delivering basic research in taxonomy

The great threat that is implicit in the informatics imperative is that taxonomists will be pulled away from their fundamental tasks of original research (creating new knowledge) and documentation (developing and caring for the collections that record their work and provide the basis for future research), to focus on re-packaging and dissemination of what is already known. Basic research in taxonomic entomology involves a massive and unfinished task of discovery: the discovery of taxa (with a majority of species still to be found and recognised), and the discovery of taxonomic characters (fundamental for the reconstruction of phylogenetic relationships as the basis of predictive classifications). Related tasks include establishing the distribution and basic ecology of species, application of formal names (zoological nomenclature), and understanding the significance and origins of diversity (comparative and evolutionary biology).

While accepting that original research and the curation of collections are the *sine qua non* of systematic entomology, we must also acknowledge that making discoveries accessible to humanity as a whole is also fundamental to science. As discussed, the emergence of the internet can now be seen as a key means of delivering our science to the widest possible audience. However, the internet is, as yet, still essentially ephemeral. Its very existence is now dependent on events completely beyond the control of scientists. Moreover, the traditional printed word on paper still has enormous appeal and practicality.

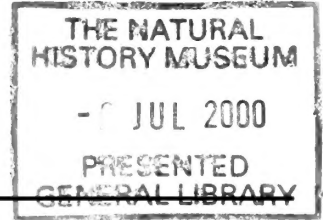
There is an emerging view, to which I subscribe, that the internet and the printed word have different strengths and weaknesses, and that we should seek to exploit the strengths of both to make our work as accessible and useful as possible. Different roles will develop for 'hard copy' and 'electronic'. With serious new investment by The Natural History Museum in electronic communication now underway, and a emerging commitment to make sure that we play our full and proper role in this access revolution, I also look to this good but still relatively obscure journal to take on a new lease of life, to take on a new role as we strive to find the way to make best use of these wonderful media, literally in our hands and at our fingertips.

Rather than just fade away like an old dinosaur, I therefore expect this *Bulletin* (and other museum publications like it) to emerge from the shadows, rather like those meek little mammals that supposedly lurked while *Tyrannosaurus* roamed. However, I was reminded by a colleague earlier today that the weight of termites per square metre of soil in a Cameroon rainforest is equivalent to the density of people on the streets of Tokyo or London. Time to get back to the microscope I think, for fear that we will have nothing new to say in this brave multi-media world. But the opportunity to communicate about our science and about our collections on a grand and more effective scale than ever before is surely here, if we can but grasp it. I look forward to seeing how we and our entomological colleagues around the world rise to these exciting challenges, confident that this *Bulletin*, like those once obscure mammals, will evolve rapidly to take full advantage of the new opportunities, and play a key role in the process. Long live the internet – and long live our vital ink on paper.

**R. I. Vane-Wright**  
Keeper of Entomology  
The Natural History Museum  
London, 1st December 1999



# A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize



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**SYNOPSIS.** Fifty-eight species of Nepticulidae are described or redescribed from Central and South America; 16 Neotropical species are redescribed, 33 are described as new and 4 are described but not named pending the availability of additional material; five species from Florida, considered to be of Neotropical affinity, are listed together with citations of descriptions and illustrations. Four new combinations are established; one new species-group is defined in *Stigmella*. The generic status of *Manoneura* Davis is restored. Almost all primary types have been examined and illustrated for the first time except for some predominantly non-tropical species. The species revised fall into seven genera: *Enteucha* (6 species), *Manoneura* (2 species), *Stigmella* (23 species), *Ectoedemia* (5 species), *Fomoria* (4 species), *Acalytris* (16 species) and *Glaucolepis* (2 species). Adults of all species treated (except for a few from Florida) are illustrated, with line drawings of genitalia and distribution maps.

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## INTRODUCTION

Committed effort to inventory the world's biota has never been more necessary than now. Growing international concern over the biodiversity crisis together with the provisions of the 1992 Rio Convention on Biological Diversity have imparted a new urgency to the need for taxonomic revisions of diverse groups and the provision of identification manuals, particularly for tropical areas. Hence this publication.

Nepticulidae are a very specialized, isolated family of primitive monotrysian Microlepidoptera with a worldwide distribution. The minute size of the adults, the concealed mining life-style of the larvae (predominantly in leaves), and the difficulty of rearing imagines goes some way towards explaining why these moths are still poorly studied in many regions. Only the northern European nepticulid fauna can be considered to have been exhaustively studied (Johansson *et al.*, 1990). Studies in other regions of the world fall some way short of reflecting the actual diversity of the group although coverage compares well with that of other groups of Microlepidoptera. The most exhaustive revisions or detailed taxonomic papers have been published for the western Palaearctic (Johansson, 1971; Nieukerken, 1983, 1985a, 1985b, 1986a; Johansson *et al.*, 1990; Nieukerken & Puplesis, 1991 *et c.*), Central and Eastern Palaearctic, including Far-eastern Russia and Japan (Kemperman & Wilkinson, 1985; Puplesis, 1994; Puplesis & Diškus, 1995, 1996a, 1996b, 1996c; Puplesis *et al.*, 1996, 1997), South Africa (Scoble, 1978a, 1978b, 1980a, 1980b, and, outstandingly significant, 1983), Nearctic (Davis, 1978; Wilkinson, 1979, 1981; Wilkinson & Scoble, 1979; Wilkinson & Newton, 1981; Newton & Wilkinson, 1982), New Zealand (Donner & Wilkinson, 1989), and recently for Australia (Hoare *et al.*, 1997; Hoare, 2000). Long neglected, the diverse Australian fauna is being further studied by Robert Hoare; the Chinese and Japanese fauna is being revised by Erik van Nieukerken (NNM); a revision of the Central Asiatic nepticulids is currently in preparation by R. Puplesis and A. Diškus (VPU).

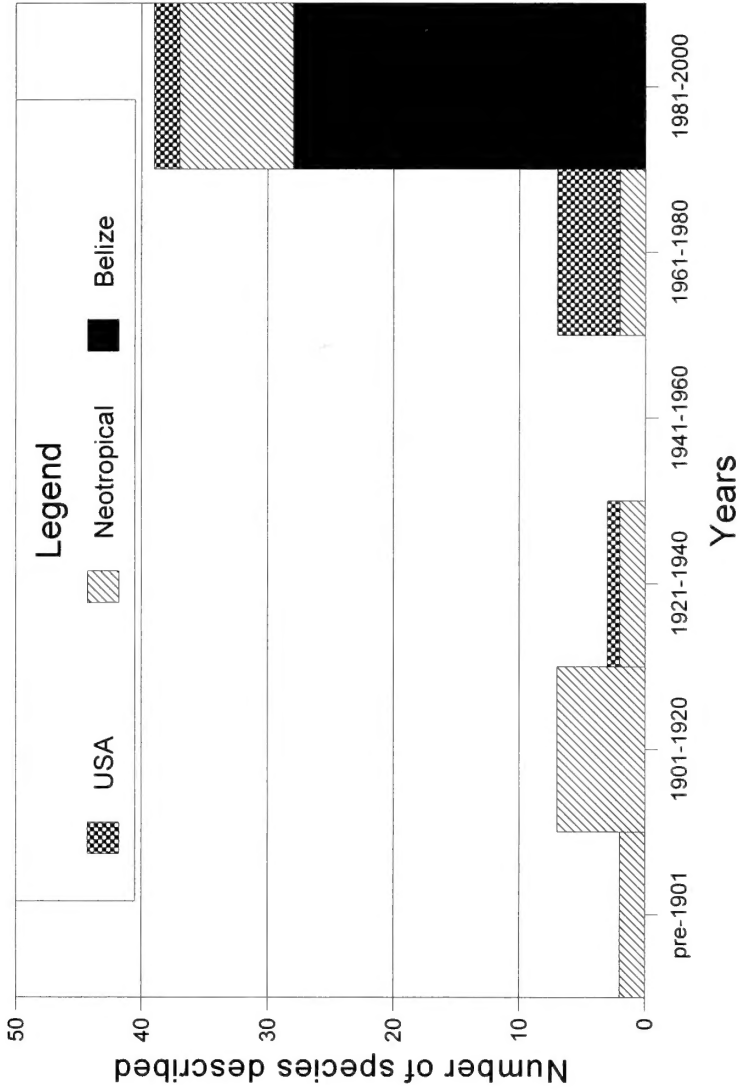
The Neotropical Region, while vast and with a hugely diverse biota, is comparatively unexplored with respect to collection and study of Nepticulidae. The first two species recorded from the region, *Stigmella johannis* and *Fomoria molybditis*, were described by Zeller (1877) (as *Nepticula*) from Colombian material collected by Johann and Nolcken in 1871. Much later, five further species were reported from Peru and two from Guyana by Meyrick (1915); however, one of the Guyanese species (*Enteucha cyanochlora*) was placed in the Lyonetiidae and only recognized as nepticulid some 70 years later (Davis, 1984; 1985). During the last seven to eight decades there have been practically no investigations of Neotropical Nepticulidae, except

for isolated descriptions of a few new species from Puerto Rico (Forbes & Leonard, 1930) and Argentina (Meyrick, 1931; Bourquin, 1962) and a few relatively recent discoveries in Florida (Davis, 1978; Wilkinson, 1981) of species with Neotropical affinities (Fig. 1). *Stigmella plumosetaeella* was described by Newton & Wilkinson (1982) from Arizona, USA, and here it is additionally recorded from south-western Mexico. However, until now only 21 species have been recorded from Central and South America and the tropical states of the USA. Thirteen of these have been listed by Davis (1984) in the Neotropical checklist, but most have never been illustrated.

In total fifty-eight species of Nepticulidae from Central and South America are treated in the present revision. We also include five species currently known from southern Florida as potential members of the Neotropical fauna; the practicality of this is confirmed by recent discovery of 'Florida species' in Belize and Dominica (e.g., *Manoneura basidactyla*). Another eight species with a distribution range from northern Florida into the northern states of the USA have not been incorporated into our revision as their hostplant data and distribution suggests they are typical members of a temperate fauna; they are listed at the end of the checklist below. The species revised here fall into seven genera: *Enteucha* Meyrick (6 species), *Manoneura* Davis (2 species), *Stigmella* Schrank (23 species), *Ectoedemia* Busck (5 species), *Fomoria* Beirne (4 species), *Acalyptis* Meyrick (16 species) and *Glaucolepis* Braun (2 species). Only *Manoneura* is known exclusively from the Neotropics.

This revision is the first attempt to demonstrate to the scientific community an example of the diversity of Neotropical nepticulids and to prepare the ground for future investigations of this fauna. Substantial unidentified material was available to us, collected during the last thirty years and deposited mainly in the University of Copenhagen and in the United States National Museum of Natural History (Smithsonian Institution), together with material that we have collected recently in Belize.

The Belize collecting trip, undertaken in April 1998 by the first author with the assistance of Simon Hill (University of Westminster, UK), has resulted in the description of a very interesting and rich rainforest fauna of nepticulids and other primitive Microlepidoptera. The nepticulid species found in Belize comprise exactly half of all species treated in the present revision. Belize has given us a baseline from which to estimate the possible extent of Neotropical nepticuloid diversity, allowed us to compare the overlap of the Belize collection with previous samples, and to supplement the existing BMNH holdings (otherwise almost entirely aged type material). Nearly one half of the country visited lies in dense protected forests, some still unexplored. Except for a



**Fig. 1** Pattern of description of Neoptropical Nepticulidae through time. Different shading indicates type localities: USA = Arizona or Florida; 'Neotropical' comprises countries in central and south America excluding Belize. Figures in final column include four species documented in this paper but not named.



**Figs 2, 3** Sites in Belize where fieldwork was conducted in April 1998. 2, site at Pook's Hill Nature Reserve; 3, habitat near Las Cuevas Research Station, Chiquibul Forest.

few local collecting trips, two main sites were used: the Las Cuevas Research Station and Pook's Hill Nature Reserve (Figs 2, 3). The Las Cuevas Station was built recently and is operated jointly by the Government of Belize and The Natural History Museum, London. It is situated deep in the hilly Maya Mountains in the Chiquibul Forest, Cayo District. The majority of the vegetation is intermediate-age (ca. 30 yrs) secondary forest, with the exception of a few pockets of relatively undisturbed or primary forest. The Chiquibul receives between 1500 and 2000 mm of rain per annum. Rainfall is not distributed regularly throughout the year for there are two dry seasons (from February to June and again for two to three weeks in August). Hilltops, hillsides, and valley bottoms have markedly different forest both in terms of structure and species composition. At our main collecting sites (on hillsides and valley bottoms) the forest has a greater proportion of evergreen species, e.g., *Manilkara zapota*, *Calophyllum brasiliense* and *Aspidosperma megalocarpon*, although deciduous species such as *Swietenia macrophylla* and *Terminalia amazonia* are still an important component. Pook's Hill is a 300-acre private Nature Reserve of pristine jungle set in the foothills of the Maya Mountains, surrounded with forest and bordered by one of Belize's largest and best-known nature reserves, the Tapir Mountain Nature Reserve (see Puplesis & Hill, 1998).

Most of the material collected by Puplesis and Hill was obtained by light trapping, with only a single species reared from the larval stage. According to our field observations and those of Dr Owen Lewis (BMNH), who has spent a continuous year studying leaf-miners at the Las Cuevas Station, mining larvae are very sparse in April but Owen (pers. comm.) collected numerous fresh mines (although not those of Nepticulidae) in November–January.

The material from Belize has yielded twenty four new species; another four species also appear to be new but they are left unnamed mainly because of the poor condition of the specimens available. Only one species collected in Belize (*Manoneura basidactyla* Davis) was previously known, from southern Florida (and it is recorded additionally here from Dominica). The taxonomic composition of the Belize nepticulid fauna has a few very interesting features. It includes a new species in the previously monobasic genus *Manoneura*, considered by Nieuwerkerken (1986b) to be a synonym of *Enteucha*, but here restored to full generic status. There are three morphologically very distinct new species in *Enteucha*, a tiny genus comprising just seven species, six from the Neotropics, four of which are described in the present revision. One of the most unexpected results of the Belize expedition was the discovery of a diverse fauna of *Acalyptis*, a total of 14 species representing 48% of Nepticulidae recorded from the area or about 19% of the known species of the

genus. The Belize *Acalyptis* exhibit a remarkable range of morphological structure. The dominance of *Acalyptis* might be a seasonal phenomenon, for the Belize collection was made during a short period at the height of the dry season when Microlepidoptera were otherwise infrequent at light. The sparse sampling of nepticulids in most of the Neotropical Region, despite the vast potential of their probable habitat, suggests that what we are seeing in Belize is just the tip of the iceberg.

The pattern of diversity of the Belizean fauna may be seen in the annotated checklist, below. The comparatively small number of species of *Ectoedemia* (s. str.) is surprising but may just be the result of under-sampling. However, only three species are known from southern Africa (Scoble, 1978a). We have not recorded representatives of *Simplimorpha*, *Bohemannia*, *Parafomoria*, *Trifurcula* (s. str.) and *Etainia* from the Neotropical region. These genera have mostly restricted distribution ranges in the eastern hemisphere or Eurasia. The Australian endemic *Pectinivalva* and recently described *Roscidotoga* have not been found in our samples either.

We have noticed unusually strong and independent reduction of wing venation among the species investigated, and this limits the use of venational characters for generic recognition in the American tropics. The genital morphology of the newly discovered or newly dissected Neotropical nepticulids includes a few interesting features not known in other faunas (see, e.g., *Stigmella ovata*, *Ectoedemia fuscivittata*).

Species from the lowland tropical forest of Belize seem morphologically more distinct and apparently more isolated both from each other (and from boreal species of the same genus) than are species from the Andes and Patagonia. Species differences in the Andean fauna are generally slight, and problems of identification of similar species are compounded by intraspecific variation. In *Stigmella epicosma*, for example, both forewing pattern and genital morphology vary with the altitude of the habitat. The preliminary impression of the neotropical nepticulid fauna is one of two distinct faunal elements. The first is a relatively young element of species with distinct boreal affinities and showing some evidence of recent, rapid speciation and localized geographical variation, occurring in the Andes and the southern temperate zone. The second element comprises more clearly differentiated and disjunct species occurring in lowland tropical forest and with perhaps older origins.

The present collaborative project was undertaken at the Natural History Museum, London, with the support of the Royal Society (London) and NATO (see Puplesis & Robinson, 1999). It combines Robinson's interests in Microlepidoptera biodiversity with Puplesis's expertise and interest in inventorying the families of primitive Microlepidoptera. We hope that

re-examination, characterisation and illustration of the 'old types' together with an overview using newly-collected material will stimulate further studies of the Nepticulidae in this much-neglected continent. The current publication is intended to provide a rough foundation upon which we and others can build a more detailed account of the diversity of the Neotropical Nepticulidae.

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## MATERIAL AND METHODS

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Primary types of practically all species were examined; depositories of types are given in the redescriptions of species. Additional material (mostly unidentified specimens) available in the BMNH collection as well as Neotropical material available from other institutions (ZMUC, USNM and VPU) was studied. Material studied includes that collected recently by the senior author and S.R. Hill in Belize (1998) and by colleagues in Mexico, Dominica, Venezuela, Peru, Chile and Argentina (1963–1987).

In Belize larvae were collected and reared, and adults were collected at light. Mined leaves (or other plant parts) were placed in Petri dishes which were then checked regularly for emerged adults. Emergence occurred within 1–2 weeks. Adult moths were collected by attracting them to mercury-vapour light from a lamp suspended slightly above eye-level and 5–10 cm in front of a white screen, rather closer than is usual in the standard method for light-collecting (described by Robinson *et al.*, 1994) in which the lamp is about 0.5 m from the illuminated surface. A Honda EX 350 generator was used as a power-source. As many different habitats and sites as possible were sampled. Moths attracted to the screen were collected into small glass tubes and pinned after killing with ethyl acetate.

Genitalia were prepared following the method described by Robinson (1976). After maceration of the abdomen in 10% KOH and subsequent cleaning, male genital capsules were removed from the abdomen and mounted ventral side uppermost. Where the genital armature was particularly complicated, the genitalia were studied and sketched in glycerin before permanent mounting. The aedeagus was removed and mounted alongside the genital armature except in the case of some paratypes or where its removal would jeopardise study of fine structure and where it did not obscure other sclerites. Female genitalia were removed entirely from the abdomen, cleaned and mounted ventral side uppermost. Genitalia and abdominal pelts of both sexes were stained with Chlorazol Black (Direct Black 38/Azo Black) or, occasionally, mercurochrome, and mounted in Euparal.

Forewing length is expressed as a range, where

availability of material made this possible, measured along the costa from the wing base to the apex of the cilia. Wingspan was measured from the tip of the left wing to the tip of the right wing, where well-mounted specimens were available; in other cases the forewing length was doubled and the thorax width added. Anal tufts of males have not always been described because they do not survive on worn specimens and tend to be lost when specimens are 'relaxed' prior to setting.

Illustrations of adults were drawn in Indian ink by Mrs Birute Noreikiene (VPU) using preliminary sketches and notes by Puplesis and with additional observations using a stereoscopic microscope. Adults are illustrated at the same scale to indicate comparative size. The condition of many of the specimens studied is poor, and the illustrations of adults are therefore idealized and generalized. In a few cases, they could be described as reconstructions from damaged specimens. Unfortunately black and white drawings cannot show the metallic lustre and coloured iridescence characteristic of most Nepticulidae; details of such colours have been incorporated into species descriptions.

Genitalia and wing venation drawings were made by Puplesis using a camera lucida, mainly from permanent slides, but occasionally from temporary glycerin mounts (see above).

Types of all newly described species are deposited in the institution from which the specimen was received, indicated in the species description. Described but unnamed species are distinguished by the number of the corresponding genitalia slide, e.g., '*Acalyptis species 29135*' is a taxon exemplified by the specimen from which male genitalia slide 29135 (BMNH collection) was made.

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## ABBREVIATIONS OF INSTITUTIONS

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ANS	Academy of Natural Sciences, Philadelphia, Pennsylvania, USA
BMNH	The Natural History Museum, London, UK (formerly British Museum (Natural History))
FSCA	Florida State Collection of Arthropods, Gainesville, Florida, USA
MACN	Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina
NNM	Nationaal Natuurhistorisch Museum (Naturalis), Leiden, Netherlands
VPU	Vilnius Pedagogical University, Vilnius, Lithuania
USNM	National Museum of Natural History, Washington DC, USA (formerly United States National Museum)
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark



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The first author is extremely grateful to Kevin R. Tuck (BMNH) for generous support during the course of this project and especially to Simon R. Hill (University of Westminster, UK) for his selfless and generous help with planning fieldwork, transport of equipment, technical assistance and companionship during the Belize expedition in 1998. He also thanks: Alex Monro and Pat Haynes (BMNH) for pre-fieldwork advice; the staff of the Las Cuevas Research Station, Belize, particularly Chris Minty, for support; the owners of Pook's Hill Nature Reserve, Belize, Vicky and Ray Snaddon, for their hospitality and interest in the project; Arunas Diškus and Virginijus Sruoga (VPU) and particularly Kasparas Puplėsis for technical assistance with preparation of equipment; Jurate Puplėsiene (Antwerp), for enthusiastic help with descriptions of mainly Argentinian species; Zita Puplėsiene for providing help and support during the final preparation of the manuscript. Special thanks are due to Paul Southwell, Bruce Agnew and Jim and Marie Hill for their generous hospitality and friendliness during Puplėsis's long-term stays in Britain. Patrick and Amanda Hills are thanked for their friendly interest in the project.

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## MORPHOLOGY AND TAXONOMIC COMPOSITION OF THE FAMILY

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### Adult morphology

The morphology of nepticulids has been extensively discussed by, particularly, Scoble (1983), Nieukerken (1986b), Johansson et al (1990) and Puplėsis (1994). Conspicuous morphological features are discussed below to provide a background to understanding the

morphological particularities of the newly describing taxa and justifying amendments in terminology.

The head-capsule of nepticulids is hypognathous, approximately oval, and slightly flattened dorsoventrally. Only a few sulci are present on the head-capsule. The clypeus is a small triangular or rounded lobe; a clypeal sulcus is absent. The mouthparts normally are only developed weakly; mandibles are absent; the maxillae are represented by galeae and maxillary palpi; laciniae are absent; the galeae together unite to form the proboscis (= haustellum) which may sometimes be functional. Occasionally the galeae are very long; the maxillary palpi are always five-segmented, with sensilla; the labial palpi are normally three-segmented and widely separated at their bases, occasionally two-segmented; the first (basal) segment of the labial palpus is usually longer than the second and third segments. In slide preparations of the head-capsule, the sucking pump and membranous hypopharynx are usually visible. Ocelli are absent; chaetosemata are present. The compound eye is generally large, its size relative to that of head-capsule varying little. The eye-index (Powell, 1973) is fairly high, in the range 0.9–1.2, and is possibly related to time of flight (diurnal species, according to Powell (1973), have a lower index than night-flying ones). There are no striking differences in eye-index among the Neotropical species dealt with here.

The antenna is always shorter, usually much shorter, than the forewing, its basal segment (scape) strongly enlarged and forming an eye-cap with a concave underside. The eye-caps cover the compound eyes when the moth is at rest. The flagellum comprises 12 to 70 segments (flagellomeres) that are more or less uniform except for the first (the pedicel) which is longer than the rest. Four types of sensilla have been found on the flagellomeres of Nepticulidae: sensilla trichodea, s. chaetica (two types), s. coeloconica and s. vesiculocladum (see Nieukerken & Dop, 1987). The sensillum vesiculocladum described by these authors occurs in all species examined but is unknown outside the family.

The tufted head is characteristic. Piliform scales arise from a large circular area on the front of the head, and also from two other patches on the vertex and are collectively named the frontal tuft; its colour has diagnostic value. Two groups of piliform or lamellar scales are attached to the back of the head, often overlapping the thorax, and collectively termed the collar. The frons is smoothly scaled below the frontal tuft.

The colour pattern of head, thorax and forewing is a very important diagnostic feature; however it is of almost no phylogenetic use, since Neotropical nepticulids (like those from other regions) show great homoplasy. A partial exception is *Manoneura*, with strikingly strong blue-purple lustre, and possibly a few Neotropical *Enteucha* with unique white-tipped forewings. The forewing may be uniform or patterned

(with one to three fasciae, with spot(s) or with both fasciae and spot(s)). Most nepticulids have uniformly grey or blackish forewings with a single fascia, the dark areas often with bright metallic lustre which may be bronze, purple, blue or green. But forewing patterns are more diverse in the Neotropical species described here: nearly 30% have a single white/light fascia on a dark background, 20% have irrorated forewings (irregularly dispersed darker scales on a paler background), 14% have a dark fascia on a paler background, 12% are unicolorous, 6% have three fasciae on a dark background; other species have two fasciae on a dark background, two opposing pale spots, and one spot. Very unusual pattern types among the Neotropical nepticulids include *Enteucha cyanochlora* with a triangular costal spot together with a white forewing tip, and two species (*Stigmella andina* and *S. pruinosa*) with striking sexual dimorphism: females of *andina* have distinctive black-tipped forewings whereas in males the forewing is uniformly pale; males of *pruinosa* have a broad band of whitish androconial scales over brown forewings, absent in females.

Generally fasciae or spot(s) vary from white to yellowish, with a silver or gold sheen or lustre, occasionally other colours. In females the scales usually appear more coarse, and pale markings (if present) are more extensive than in the male. The hindwing varies from creamy white to dark brown, and in males is sometimes covered by black or orange androconial scales (but these are not known in Neotropical species). A cilia-line, formed by dark-tipped, lamellar scales, may be present. Androconial scales may be present in males, and normally occur on the underside of the forewing or either surface of the hindwings. They may entirely cover the wing, but in other cases are distributed in patches. Sometimes, long specialized androconial scales may extend into the fringe (see *Acalyptis trifidus*, Fig. 52; *Stigmella pruinosa*, Fig. 34; partially *S. albilamina*, Fig. 26). Additionally, Nieuwerkerken (1986b) recorded patches of velvet-textured raised scales on the hindwing underside of European *Trifurcula*.

Wing-coupling in males comprises a double mechanism: firstly, a composite frenulum arising on the hindwing base hooks into the costal retinaculum, which is comprised of hooked scales; secondly, a row of costal bristles (pseudofrenular bristles), arising on the humeral lobe, couples with a subdorsal retinaculum composed of hair-scales. In females there is no frenular bristle, and only the second mechanism is present. For details see Nieuwerkerken (1986b). Some species possess pseudofrenular bristles modified into a hair-pencil (for example, a long blackish cluster in *Ectoedemia species* 29105, Fig. 40).

Wing venation is reduced in Nepticulidae (Figs 61–65), although reduction is generally not as extreme as in Opostegidae (Puplesis & Robinson, 1999). In the

largest nepticulid genus, *Stigmella*, forewing vein Sc is short and sometimes weakly visible. R + M coalesce, and there are three radial veins ( $R_1$ ,  $R_{2+3}$ ,  $R_{4+5}$ ). Cu is present as a separate vein. Veins 1A and 2A are fused along their entire length and are well-developed (Fig. 63). In the hindwing, Sc +  $R_1$  is short, and  $R_2$  and M either usually coalesce in the basal half of the hindwing or are semi-reduced (as in *Stigmella albilamina*, Fig. 63). Cu and A are separate veins. However, in the Neotropical *Stigmella ovata* (Fig. 62), uniquely for *Stigmella*,  $R_4$ ,  $R_5$ ,  $M_1$  and  $M_2$  are preserved in the forewing as four separate veins, and Cu is very long and anastomoses with the medial branch; this striking configuration is probably a plesiomorphy. The most complete venation pattern is characteristic of *Etainia* (most notably in Holarctic species). The forewing in this genus normally exhibits one subcostal, five radial, two medial, one cubital and one anal vein together with a closed cell between M and Cu. The most reduced type of venation within the Nepticulidae is characteristic of Neotropical *Enteucha* and *Manoneura* (Fig. 61). However, a few southern African *Trifurcula* and *Etainia*, and, probably, a few Neotropical *Fomoria* (Fig. 64) show independent reduction of the venation, a feature which limits the value of that character for phylogenetic purposes.

The legs are well-developed, frequently concolorous with the underside of the thorax, and varying from silvery-white to blackish. The foreleg is without spurs or epiphysis; the midleg has a single pair of spurs, the two pairs on the hindleg are situated at or near the middle and at the apex of the tibia. The position of the proximal pair of spurs is not constant.

The pregenital segments of the abdomen, including VII in females and VIII in males, are clothed uniformly with lamellar scales. The underside of the abdomen is often paler than the upperside. Tergite VIII of males and VII of females usually bears a pair of anal tufts. Large, paired tufts of extremely long piliform scales arise on tergites IV and VIII in members of the Asiatic *Acalyptis repeteki* species-group. They arise from T-shaped sclerotizations and completely cover the caudal part of the abdomen. Smaller but undoubtedly homologous tufts are present in some North American *Acalyptis* species (Wilkinson, 1979; Puplesis, 1984c), but have not been discovered in Neotropical *Acalyptis*. The phylogenetic significance of these tufts (more than half the length of the abdomen) is obscure, but they are a useful diagnostic feature at species level. The colour of the scales on the pregenital and genital segments is useful for separating at least two Neotropical species (*Stigmella albilamina* and *S. fuscilamina*) in which this is practically the only external difference.

The male genitalia are symmetrical except for the slightly asymmetrical aedeagus and asymmetrically distributed cornuti. The tegumen is fused with the



vinculum through the vinculum arms, completing a ring-shaped annulus. The tegumen, a simple band, is very variable in size. Occasionally the tegumen may be invaginated or extended posteriorly. A pseuduncus (posterior extension of the tegumen), if present, is situated dorsal to the uncus or coalesced with it (*Etainia*); usually the pseuduncus is a broad (Fig. 174) or narrow lobe (Fig. 178), but it is sometimes divided into lateral lobes (Figs 157, 164, 180, 182). There is no boundary between the pseuduncus and tegumen.

Additional rod-like apodemes arising from the tegumen may be present in the male genitalia of *Acalyptis*. In Neotropical representatives these are still not fully separated from the tegumen (Figs 170, 172, 193) or are very under-developed (Fig. 178), an apparently more plesiomorphic state than in the Palaearctic species of the genus.

The uncus is narrowly V-shaped, thickened or hood-like; it is often bilobed or even with three narrow processes (Fig. 184) and rarely takes other forms (Figs 148, 164). The unusual uncus with a single anterior process in *Manoneura* (Figs 84, 86) has been misinterpreted as 'downfolded' (Nieuwerkerken, 1986b). Occasionally, an uncus is absent (*Ectoedemia* – Figs 152, 154).

The gnathos is a small sclerite connected through its lateral arms to the tegumen (Figs 80, 90, 148, 164, 196). It consists of a transverse bar (occasionally not developed), posterior processes (or process) and lateral arms. Sometimes anterior processes are additionally developed, and in other cases posterior processes can be replaced by a central element. An unusually broadened posterior process in *Acalyptis platygnathos* partially replaces the central plate (Fig. 202). A very unusual modification of the gnathos is observed in three Neotropical species united below into the new *Stigmella eurydesma* species group: the anterior plate-like part of the sclerite is strongly reduced, but the posterior part is developed into very strongly sclerotized and melanized lateral processes. These processes partially coalesce with the more dorsal uncus, and it is sometimes difficult to recognise two separate sclerites (Figs 120, 126, 129). The very unusual gnathos in *Manoneura* (Figs 84, 86) has been misinterpreted as a complex structure comprising gnathos+uncus as a single fused sclerite (Davis, 1978). Together with the tegumen, the gnathos surrounds the tuba analis. Slightly sclerotized and sometimes spined, the dorsal part of the tuba (very rarely visible in Nepticulidae) is referred to as the scaphium, and its ventral region as the subscaphium (Klots, 1956).

The valva is always strongly sclerotized and exhibits numerous diagnostic differences between species. The apical region usually tapers to a variable distal process, in some species (predominantly in the *Stigmella salicis* group) to two processes (e.g., Figs 96, 97). In some taxa the apex of the valva remains broad. The inner

margin of the valva may bear one or more well-developed lobes or processes (Figs 174, 196), which may be numerous and elaborate in some Neotropical species (e.g., Figs 79, 157, 159, 202). In *Fomoria species 29122* the valva is actually divided into two lobes (Fig. 161). Numerous setae are distributed on the valva, especially on the inner margin and at the apex; *Stigmella barbata* has very long, strong, hair-like setae from the apical process (Fig. 140) and in this respect resembles a few Nearctic species. In some cases (notably in the Australian *Pectinivalva* Scoble and some Asiatic species of *Acalyptis*) the valva bears a pectinifer, more or less resembling the pectinifer of opostegids. There is still no general agreement as to the homology of these pectinifers. However, the pectinifers of the Asiatic *Acalyptis falkovitchi* (Puplesis), *Pectinivalva* sp. and *Opostega auritella* (Hübner) have been well illustrated and compared by Nieuwerkerken (1986b: figs 60–64), and we believe they are homologous. Only a single species in the Neotropical fauna (*Acalyptis bovicorneus*) has been discovered with a similar pectinifer (Fig. 166); other related *Acalyptis* species have none. The presence of a pectinifer may be either a parallelism, or more likely a plesiomorphy preserved in *Pectinivalva* and some *Acalyptis*; the latter explanation gains some support from the widespread but sporadic occurrence of this structure elsewhere in the monotrystian Heteroneura, notably in Incurvarioidea. The pectinifer in Opostegidae, sister group to Nepticulidae, is unambiguously derived in comparison with the hypothetical ancestral state which appears to be expressed in those Nepticulidae with a pectinifer. In Opostegidae the pectinifer is borne on a cucullar lobe well separated from the main body of the valva, a striking autapomorphy of the family expressed in all the taxa known.

The transtilla forms a dorsal connection between the apodemes of the valvae. The fully developed transtilla (with a transverse bar) is reduced or absent only in *Pectinivalva*, *Enteucha*, *Glaucolepis* and most world species of *Acalyptis* (but in less than a third of the Neotropical species). The Belizean *Ectoedemia fuscivittata* also exhibits secondary loss (reduction) of the transverse bar of the transtilla, not previously recorded for the genus. In other nepticulids the transtilla is well-developed, consisting of an uninterrupted (Fig. 164) or medially interrupted (Figs 144, 150) transverse bar.

The term 'sublateral process(es) of transtilla' is widely used in the literature on Nepticulidae and for the most part refers to the valval apodeme. Admittedly, it is difficult in some cases to determine where the transtilla bar ends and the apodeme begins, but the term is inappropriate; we use it here with considerable misgivings. 'Sublateral processes' are invariably developed (Fig. 174), sometimes strongly so (Fig. 103) but the fusion of the apodeme and transtilla may be

such that the former is indistinguishable and the whole is a continuous rounded band of sclerotization (Figs 88, 92) that could be interpreted entirely as transtilla; where the continuous structure is angular (Figs 104, 159) it could be inferred that the transverse element is the transtilla and the longitudinal elements are the apodemes, but there is no justification for this assumption. Where the apodeme runs anteriorly beyond the transtilla bar we have followed accepted practice and designated this as a 'sublateral process', i.e., 'sublateral process' is a synonym of 'apodeme'; where it does not, we have recorded the sublateral process as absent, but the apodeme may well still be present.

There is some intraspecific variability in the transtilla and apodemes; where slender sublateral processes are present, their curvature may vary; broad processes may vary in shape and quite often the left process may not be symmetrical with the right (Figs 103, 106). Although the presence or absence of the transverse bar of the transtilla is a good diagnostic feature of a few genera, and may have some phylogenetic significance, the characteristics of size and shape (discounting intraspecific variability) are significant only for species diagnosis. We treat a well-developed transtilla with a broad and enlarged transverse bar or specialized sublateral processes as a derived feature.

The juxta is a small triangular, trapezoidal or irregularly shaped sclerotization of the membrane between the valvae ventral to the aedeagus. It is variable in shape and in its degree of sclerotization and occurs irregularly in different genera of Nepticulidae with little phylogenetic predictability. However, the juxta in *Stigmella* (Fig. 97) is simpler and more plate-like, than in, for example, *Acalyptis*, where it tends to be more complicated (Figs 180, 182) or very complicated (Fig. 170) and probably contains elements derived from the posterior extension of the vinculum. In some *Stigmella* species the juxta is apparently not connected to the vinculum; sometimes the juxtal region is entirely membranous (i.e., a juxta is absent) (Fig. 96).

The vinculum is shaped like a large plate and is sometimes narrowed or bilobed anteriorly. Two types of vinculum are present in Nepticulidae. In the first, the vinculum is connected through wide and well-developed lateral arms with a large tegumen and these together form a ring surrounding the aedeagus ('ring-shaped' vinculum of Beirne, 1945). In the second type the vinculum has moderate lateral arms which connect with a strongly reduced and usually small tegumen ('U-shaped' vinculum of Beirne, 1945). In the present treatment, the complex of vinculum plus tegumen is regarded as an annulus (following Kuznetsov, 1915). The size of the ventral plate of the vinculum, lateral lobes and anterior invagination may vary strongly between species. The anterior region of the vinculum has been referred to as the saccus (Beirne, 1945; Wilkinson & Scoble, 1979; Newton & Wilkinson, 1982).

The aedeagus, in contrast to many other Lepidoptera, is broad and strongly sclerotized, cylindrical or retort-shaped, frequently broadened basally and occasionally apically; it is often 2–3 times longer than the valva. Carinae may be developed towards the apex of the aedeagus (e.g., Figs 153, 192, 200) and vary considerably between species. The vesical cornuti vary from very small and spine-like or almost granular to large, horn-like, lamellar, or elongate and irregular. The number of cornuti varies interspecifically from a few to several hundred. They have great diagnostic value, in most cases at species level, very occasionally at higher taxonomic levels (e.g., in *Trifurcula* and *Glaucolepis*). The striate thickening surrounding the base of the ductus ejaculatorius (the arcuate plate through which the ductus passes into the vesica) was regarded as a pair of striate plates (Schoorl *et al.*, 1985) and was named the cathrema by Kemperman & Wilkinson (1985). In the Australian *Pectinivalva*, the cathrema is only weakly developed and this state is plesiomorphic. In some *Stigmella* species a distinct tubular membrane (the manica) surrounds the aedeagus. This membrane is usually spinose but such a modification has yet to be discovered among the Neotropical species.

Females are of the monotrysian type, with a common terminal anogenital opening. The vagina is short, widening into a vestibulum which may sometimes be strongly folded, and almost always protrudes laterally to form an accessory sac in *Stigmella* (Fig. 208). In *Ectoedemia* a distinctive spiculate pouch is developed. In *Etainia*, *Acalyptis* and *Fomorina* (Fig. 219) additional sclerotization of the vagina-vestibulum forms structures that can be described as an antrum or sclerites of the vestibulum. The ductus spermathecae opens into the accessory sac or into the vestibulum if an accessory sac is absent (Fig. 207). Usually the ductus is coiled, and occasionally it is spiculate. The bursa copulatrix is large, usually oval, with (Fig. 208) or without pectinations or signa. The signa are reticulate (in Trifurculinae *sensu* Puplesis, 1994) (Figs 220, 221) or in a different pattern; sometimes they are large spines (in some species of the Palaearctic *Stigmella paliurella* species-group). In some species of the Palaearctic *Stigmella ruficapitella* species-group, the accessory sac has functionally replaced the bursa copulatrix, which is minute or indiscernible. The apophyses are well-developed and vary interspecifically. The anal papillae usually form a broad, flat posterior margin to the abdomen. The ovipositor is weakly developed, occasionally protruding.

## Biology

The biologies of Neotropical nepticulids are known only from very scanty reared material. Generally, nepticulid eggs are laid singly, glued to the surface of

a leaf or another (often damaged) plant organ. The precise oviposition site is sometimes characteristic, as certain species lay their eggs either on the upper- or underside of a leaf. But other species may lay on either side of the leaf. Usually just one egg per leaf is laid, but in some species (when population density is high) a few or numerous mines may be found in one leaf. For example, in the Western Palaearctic *Stigmella paliurella* (on *Paliurus spina-christi*) and *Stigmella ficulnea* (on *Ficus carica*), 10 to 30 mines have been noted in one leaf (in the Caucasus and Turkmenistan). Between 400 and 500 mines of the eastern Palaearctic *Ectoedemia picturata* have been noted on one (composite) leaf of *Rosa rugosa* in far eastern Russia (Puplesis, 1985). The duration of the egg stage varies greatly, from 8–11 days to 130–150 days. Although this has some correlation with temperature (Kino, 1981), it relates also to the voltinism of the species. Four or five larval instars are typical, but occasionally – as in the subgenus *Ectoedemia* (*Zimmermannia*) – 6–8 instars are known (Schönherr, 1958; Nieuwerkerken, 1985b; Nieuwerkerken & Johansson, 1990). After hatching, the young larvae bore into the leaf. The majority make upper-surface mines, but occasionally mines are under-surface ones (e.g., in the Asiatic *Stigmella flavescens*). The majority of Nepticulidae are leaf-miners, but sometimes larvae mine buds and shoots (*Etainia*, and some *Bohemannia* species); the summer generation of *Etainia* species makes short mines in the keys (fruits) of *Acer*; *Ectoedemia* (*Zimmermannia*) mine in young bark (cambium). The Neotropical *Ectoedemia species 29105* may be a bark-miner, because similar species of this group in the Holarctic region feed only in bark. Amongst the numerous leaf-miners, some species (*Ectoedemia populella*-group) start to mine in the petiole or midrib of a leaf and only later enter the tissues of the leaf-blade. Old mines are sometimes completely transparent, or at least translucent and easily visible (e.g., the Neotropical *Stigmella gossypii*, *Enteucha gilvafascia*). In some species, various instars make different types of tunnels, each type with characteristic frass deposition (the Neotropical *Acalyptis species 29140* on *Lonchocarpus lineatus* (Leguminosae) has uniform frass deposition throughout the whole mine, Fig. 6). The tunnels made by Nepticulidae have characteristic patterns. Mines can be generally categorized as: linear (most species) (Figs 4–6); blotch (very rare); a combination of gallery in the first half and blotch in the second half (not rare); spiral (= helical) (only in *Enteucha*). Bark mines are always linear. The mines of the majority of species are characteristic and have diagnostic value at species level. However, the shape of the mine and the colour and distribution of the frass may vary, depending (amongst many factors) on the thickness of the leaf, light conditions and hostplant species.

The larva never leaves its mine until it is full-grown.

However, in most investigated *Glaucolepis*, and some other species, the larvae use more than one leaf (Nieuwerkerken & Johansson, 1990). These species mine continuously from one leaf to another via petiole or stem. The duration of the larval stage is usually short, in the majority of cases a matter of a few days (in temperate regions, as well as in Belize), but sometimes this stage may take a few months. A prolonged larval stage is characteristic of most *Ectoedemia*, which mine from late summer to autumn, and for species overwintering as larvae (e.g., the Palaearctic *Fomoria weaveri* and *Stigmella castanopsiella*). The longest larval stages are known for species of *Ectoedemia* (*Zimmermannia*) (Nieuwerkerken, 1985b). The season of the larval stage varies, but larvae of most species mine in autumn. Larvae of certain *Ectoedemia* species mine in yellowed or even fallen leaves, with the conservation of characteristic 'green islands'.

Except in a few species (the Palaearctic *Fomoria weaveri* group, *Ectoedemia agrimoniae* and *Trifurcula eurema*), the fully-grown larva emerges from the mine and descends on a silk thread, usually to the ground. Larvae may then hide in detritus where they spin a silk cocoon. In some species the cocoon is spun on a stem or trunk of the hostplant. The duration of the pupal stage is short in the summer generation(s) of bivoltine or multivoltine species, usually 10–20 days. In the overwintering generation, fully-grown larvae do not pupate but diapause through the long, cold period in a prepupal stage. After diapause, the pupal stage is as short as that of summer generations. The pupa is protruded halfway out from the cocoon by means of its abdominal spines, before the moth emerges (Nieuwerkerken *et al.*, 1990).

The imago has a short lifespan. Indoors, when natural conditions are mimicked, the lifespan of the moths amounts to 2–3 days, or 5–6 days when fed with sugar syrup. The lifespan of adults collected in the wild and not fed is usually only one day, rarely three days. According to Johansson *et al.*, (1990), individuals of several species aestivate in southern Europe. This may also be a characteristic of some central Asiatic species. Otherwise, only when the imago is kept at a low temperature (about 10°C), may the lifespan (with the moth generally in torpid condition) be lengthened to up to 5–6 days. The duration of the flight period of a species is about 20–30 days, sometimes longer. Emergence starts at different times in the case of different species. Usually, the first males emerge earlier than the first females. The moths usually fly around their hostplants in the afternoon and evening before dusk. Adults of most species are attracted to light, males being collected rather more frequently than females.

Before copulation the male exhibits specific behaviour in the form of a 'dance'. The male runs close to or around the resting female, vibrates his raised wings and turns his abdomen slightly upward. If the female

responds by raising her wings slightly and vibrating them a little, the male instantly turns his abdomen towards her, and mating takes place. The wings of both individuals are then lowered. Duration of copulation is at least 45 minutes in the eastern Palaearctic *Stigmella kozlovi* (Puplesis, 1984a) and about 20 minutes in the western Palaearctic *Ectoedemia liebwerdella* (Schönherr, 1958).

Univoltine species are rare among the Nepticulidae. However, within the subfamily Trifurculinae, many species of *Ectoedemia* and *Trifurcula* and some *Fomoria* and *Bohemannia* have only one generation per year. In most univoltine species the larval stage is unusually long, especially in *Ectoedemia* (*Zimmermannia*). In this group this stage lasts from two to six or seven months, or even nearly two years. Bivoltine species are in the majority in the Holarctic region. Details of the biology of tropical species are largely unknown. A few species have been noted as multivoltine, but we would expect a great number of such species in the tropics. Even among the boreal fauna, the majority of the so-called bivoltine species might have three (or more) generations per year if climatic conditions permit.

Nepticulidae are trophically associated with dicotyledonous plants from the Magnoliophyta. According to Nieuwerkerken (1986a, 1986b), plants from 18 subclasses and numerous families are fed upon by nepticulid larvae. Exhaustive data on the hostplant relationships of western Palaearctic Nepticulidae have been presented by Nieuwerkerken (1986a) and by Nieuwerkerken & Johansson (1990). The majority of nepticulid species in the Holarctic mine plants from a few families: Rosaceae, Betulaceae, Salicaceae and Leguminosae. Further south, more families are involved (Puplesis, 1988, 1992; Nieuwerkerken & Johansson, 1990) But for many species the hostplant is still unknown (Puplesis *et al.*, 1996). Two new hostplant families (Cunoniaceae and Eucryphiaceae) were recently recorded by Hoare (2000) for the Australian fauna; they were considered as a part of the ancient angiosperm flora that covered large areas of Australia, Antarctica and South America in the late Cretaceous and early Tertiary (see Hoare, 2000). Currently only five nepticulid hostplant families have been recorded in the Neotropical Region: Leguminosae (*Lonchocarpus lineatus*), Compositae (*Senecio bonariensis*), Onagraceae (*Ludwigia major*), Malvaceae (*Gossypium barbadense*, occasionally *G. hirsutum*) and Polygonaceae (*Coccoloba uvifera*, the hostplant of two species).

Monophagy is known to occur within the family, but by far the greatest proportion of nepticulid species are oligophagous (Nieuwerkerken, 1986a; Puplesis, 1994). Broad oligophagy is especially characteristic of species feeding on Rosaceae. Strict oligophagy is the most common trophic type within the family and applies to

nearly 80% of all investigated Nepticulidae. A few cases of disjunct oligophagy are known in the Holarctic fauna but no actual polyphagy. There are numerous species among Nepticulidae which can be very abundant and damage the hostplant (the Neotropical *Stigmella gossypii* on *Gossypium* may fall in this category). However most species are no more than potential pests, and significant host damage appears to be an exception brought about by particularly favourable ecological conditions. Nepticulid populations appear to be able to react with very rapid increases in density.

## Taxonomic composition

The taxonomic history and classification of the Nepticulidae has been extensively discussed by Puplesis (1994) who proposed a cladogram based on 79 characters. In this cladogram, the Nepticulidae have two main lineages: Nepticulinae (including the Australian *Pectinivalva*) and Trifurculinae. Despite the exotic appearance of *Pectinivalva* (mainly due to a series of striking plesiomorphies), its apomorphic features were found insufficiently unambiguous to support its recognition as a separate subfamily. The Nepticulinae and Trifurculinae differ mainly in the basal structure of the annulus (see Morphology) and in a set of correlated apomorphic genital characters of genitalia believed to be independently derived. Within the Trifurculinae, *Bohemannia* takes the lowest phylogenetic branch, i.e., it is the sister group of the remaining Trifurculinae (for details, see Puplesis, 1984b, 1992, 1994). However, an alternative classification proposed by Scoble (1983) is better supported by characters of the immature stages and has often been followed in recent literature with some adjustments at generic level (Nieuwerkerken, 1986b; Nieuwerkerken *et al.*, 1990; Hoare *et al.*, 1997; Hoare, 2000). This latter classification recognizes two alternative subfamilies: Pectinivalvinae (including two endemic Australian genera *Pectinivalva* and *Roscidotoga*) and Nepticulinae (including all remaining genera divided between two tribes, Nepticulini and Trifurculini). In Trifurculini three genera (*Fomoria*, *Laqueus* and *Etainia*) have recently been synonymized with *Ectoedemia* and two (*Glaucolepis* and *Levarchama*) are now treated as subgenera of *Trifurcula* (Nieuwerkerken, 1986b; Nieuwerkerken *et al.*, 1990).

There is still instability in the taxonomic rank and placement of several nepticulid genera and subgenera. In total, we currently recognise a total of 16 genera worldwide. Seven of these are represented in the Neotropical region. We tend here to follow the classification of Puplesis (1994), fully cognisant of its provisional nature. Classifications sometimes collapse when challenged by the addition of large numbers of tropical species, and this may be about to happen with

the Nepticulidae. The addition of further data from tropical faunas may soon make necessary a reappraisal of nepticulid generic phylogeny.

A brief discussion of each genus follows.

## Synopsis of genera

***Pectinivalva*** Scoble, 1983. Type species: *Pectinivalva commoni* Scoble, 1983. This genus preserves many striking plesiomorphic features such as a pectinifer on the valva, and rounded or unspecialized valve apex; some of these are shared with *Roscidotoga*: 2- or 3-segmented larval antenna, long frontal setae on pupa (Hoare, 2000), vein 1A+2A of forewing not thickened, weakly developed cathrema. However, at least five autapomorphies support the monophyly of the genus (Hoare, 2000). There are several synapomorphies with *Roscidotoga* (Rs+M trunk deflected towards costa in hindwing; row of spines on anterior sclerite of second sternite; loss of fourth larval mesothoracic seta ventral to SV1), and possibly pupal characters (Scoble, 1983; Hoare, 2000). However, the polarity and consistency of these synapomorphies (which support the monophyly of *Pectinivalva* + *Roscidotoga* and thus of the Pectinivalvinae) are perhaps questionable. In the revised diagnosis of Pectinivalvinae suggested by Hoare (2000), the strongest autapomorphy of Pectinivalvinae (Rs+M trunk deflected towards costa in hindwing) is by no means an obvious character state (see *Pectinivalva warburtonensis* (Wilson) in Hoare *et al.*, 1997: fig. 36).

***Roscidotoga*** Hoare, 2000. Type species: *Roscidotoga callicomae* Hoare, 2000. Sister-group to *Pectinivalva*; recently described from Australia, and well-founded on 9 autapomorphic features (Hoare, 2000). Three strikingly coloured species without a pectinifer on the valva are currently known (Hoare, 2000).

***Simplimorpha*** Scoble, 1983. Type species: *Stigmella lanceifoliella* Vári, 1955. This genus currently comprises just two species and has a Mediterranean – South African distribution. It has not been recorded from the Neotropics. The monophyly of the genus is supported by at least three distinct autapomorphies: Anacardiaceae as hostplant family, strongly reduced gnathos and reduced uncus. Reduction or loss of gnathos is paralleled in the Australian *Roscidotoga* (and to a very minor extent in the Neotropical *Enteucha terricula*); reduction or loss of the uncus is paralleled in some *Ectoedemia* species.

***Enteucha*** Meyrick, 1915 (= *Johanssonia* Borkowski, 1972; *Artaversala* Davis, 1978). Type species: *Enteucha cyanochlora* Meyrick, 1915. This small ge-

nus is probably widely distributed; it was originally described from the Neotropics (Guyana) and, prior to this review, comprised three described species, two Neotropical and one European. The current study adds four more Neotropical species so providing a broader view of the morphology of the taxon. *Enteucha* may be easily recognized by the strongly reduced wing venation, the absence of a transverse transtilla bar, the under-developed cornuti, very large vinculum plate (in most species) and the caudally rounded or narrowed uncus. If the lack of development of the cornuti/carinae and transverse transtilla bar (paralleled in *Pectinivalva*, *Manoneura*, *Glaucolepis*, some *Acalypttris*) are eventually shown to be plesiomorphies, then Polygonaceae as a hostplant, the reduction of venation, and usually smooth elongated cathrema may still serve as evidence for monophyly. *Manoneura*, treated as a synonym of *Enteucha* by Nieuwerkerken (1986b) and Puplesis (1994), is treated below as a distinct genus. Short modified anterior apophyses in the female genitalia (a synapomorphy shared with *Manoneura*), a well-developed paired collar consisting of lamellar scales (a synapomorphy with *Manoneura* and *Stigmella*) together with other characters indicate a close relationship between the three genera.

***Manoneura*** Davis, 1979 (= *Oligoneura* Davis, 1978, preoccupied). Type species: *Oligoneura basidactyla* Davis, 1978. A small, and until recently monobasic genus which now comprises two species, *Manoneura* is endemic to the Neotropics. The unusual gnathos in *Manoneura* (Figs 84, 86) was misinterpreted as a complex structure comprising the gnathos and uncus fused to form a single sclerite (Davis, 1978). It was further misinterpreted as 'downfolded' (Nieuwerkerken, 1986b). The genus can be characterized by: 1. Well-developed paired collar consisting of lamellar scales (synapomorphy with *Stigmella* and *Enteucha*). 2. Scales with very strong blue and purple lustre (homoplasy with some *Bohemannia* and some *Stigmella*; however, the lustre in *Manoneura* is more developed and more strongly blue). 3. Strongly reduced forewing venation (Fig. 61) (autapomorphy, but paralleled with *Enteucha*). 4. Uncus with large anterior process almost touching posterior incision of gnathos (autapomorphy). 5. Gnathos with membranous lateral arms and posterior thickening, possessing a posterior incision (autapomorphy). 6. Transverse bar of transtilla lacking (probably a plesiomorphy, paralleled in *Pectinivalva*, *Enteucha*, *Glaucolepis* and some *Acalypttris*). 7. Transtilla with very long sublateral processes (apomorphy, but frequently paralleled in other nepticulids). 8. Vinculum very large (plesiomorphy, frequently paralleled in *Enteucha*, *Trifurcula* and some other nepticulids). 9. Carinae on aedeagus (apomorphy, but frequently paralleled in other nepticulids). 10.

Cornuti absent (probably a symplesiomorphy shared with *Enteucha* and paralleled in a few other nepticulids). 11. Short modified anterior apophyses in female genitalia (synapomorphy shared with *Enteucha*).

***Areticulata*** Scoble, 1983. Type species: *Areticulata leucosideae* Scoble, 1983. A monobasic genus described from South Africa, of uncertain taxonomic position. Despite the unusual structure of the vinculum (not re-examined by the present authors), it is probably related to *Stigmella*. The genitalia possess a gnathos with a long transverse bar and two lateral processes directed caudally (paralleled in some *Stigmella*). For a detailed diagnosis, see the original description.

***Stigmella*** Schrank, 1802 (= *Nepticula* Heyden, 1843; *Astigmella* Puplesis, 1984). Type species: *Phalaena (Tinea) anomalella* Goeze, 1783. This is the biggest nepticulid genus, with a world-wide distribution and well-represented in the Neotropical Region. It is characterized by a few, generally apomorphic characters: paired collar of lamellar scales (synapomorphy with *Enteucha* and *Manoneura*); generally bilobed (with possible further elaborations) uncus; gnathos with two processes (very occasionally with a single one); large or moderately large accessory sac in female genitalia. *Stigmella* comprises many monophyletic entities which are usually designated as species groups; the *salicis* group is recognized in this study as very well represented in the Andean fauna.

***Bohemannia*** Stainton, 1859 (= *Scoliaula* Meyrick, 1859). Type species: *Nepticula quadrimaculella* Boheman, 1853. This genus is currently known only from within the Palaearctic Region, and comprises 8 described species. For the intriguing peculiarities of its morphology see Nieuwerkerken (1986b) and Puplesis (1994: 34, apomorphies 43–47).

***Ectoedemia*** Busck, 1907 (= *Dechtiria* Beirne, 1945). Type species: *Ectoedemia populella* Busck, 1907. A very large, probably world-wide genus represented in the Neotropics by both subgenera: *Ectoedemia* and *Zimmermannia* Hering. The genus is characterized by a striking autapomorphy – the complete absence of an uncus (paralleled in *Simplimorpha*). The neotropical *E. fuscivittata* is unusual in that the transtilla is without a transverse bar (a secondary reduction).

***Fomoria*** Beirne, 1945 (= *Laqueus* Scoble, 1983). Type species: *Nepticula weaveri* Stainton, 1855. Large, probably worldwide genus (but not recorded from the Australian Region). Related to *Ectoedemia*. Both have the same ground plan of wing venation, but in *Fomoria* the tendency towards reduction is greater: vein Cu in the forewing tends be

shortened or completely lacking; sometimes venation is reduced to the extent that the otherwise characteristic closed cell (an independent reduction paralleled in *Acalyptis* and *Bohemannia*) is lost. The genitalia of *Fomoria* and *Ectoedemia* follow the same ground plan, but the uncus (which is entirely reduced in *Ectoedemia*) is fully preserved in *Fomoria* (plesiomorphy). Although some species of *Fomoria* may be grouped in monophyletic units (the largest of which is perhaps the subgenus *Laqueus* with 33 named species), the taxonomic status of the genus is questionable, because its monophyly is unproven; Nieuwerkerken (1986b) has suggested that it may be paraphyletic.

***Acalyptis*** Meyrick, 1921 (= *Microcalyptis* Braun, 1925; *Weberia* Müller-Rutz, 1934; *Niepelitia* Strand, 1934; *Weberina* Müller-Rutz, 1934). Type species: *Acalyptis psammophricta* Meyrick, 1921. World-wide genus, well represented in Central America, with unambiguous taxonomic status. However, there are almost no apomorphies shared by all or almost all species. The genus is characterized best by: 1. Closed cell in forewing shifted towards wing-base (the strongest autapomorphy of the group, but not always easily recognized in individual specimens). 2. Vein Cu reduced in forewing (apomorphy paralleled in some other nepticulids, not occurring in all *Acalyptis*). 3. Forewing pattern coarsely irrorated or with patches or dark fasciae formed from scales similar to those that form the irroration (not present in all species; similar patterns occur in other nepticulid genera). 4. Large, paired tufts of extremely long piliform scales arise on abdominal tergites IV and VIII (unique feature among nepticulids, distributed only among some Asiatic and Nearctic *Acalyptis*). 5. Transverse bar of transtilla absent (in most species, but not in the newly described Neotropical taxa, below). 6. Lateral rod-like apodemes developed, arising from inner posterior margin of tegumen and running anteriorly parallel to the margin beneath the valvae (in many, but not all, *Acalyptis* species); apomorphy; in contrast to Palaearctic species, these apodemes are still not fully separated from the tegumen in Neotropical taxa, and the latter appear to express a more plesiomorphous state of this character. 7. Valva with apical pectinifer (probably a plesiomorphy, paralleled in most *Pectinivalva* and shared by only a few *Acalyptis* – the *repeteki* species group and a single Neotropical species). 8. Posterior extension of ventral plate of vinculum forming a juxta (apomorphy shared by most species). 9. Aedeagus with well-developed carinae (synapomorphy shared by almost all Trifurculinae). 10. Female genitalia with rod-like or similarly elaborated sclerites in vestibulum. This genus comprises a few identifiable monophyletic subgroups – three of these have been recognized as species-groups (Puplesis, 1984c, 1989, 1990, 1994; Puplesis & Diškus, 1995).

**Parafomoria** Nieuwerkerken, 1983 (= *Parafomoria* Borkowski, 1975 [unavailable name]). Type species: *Nepticula helianthemella* Herrich-Schäffer, 1860. Small, western Palaearctic (Mediterranean-centred) genus recently revised by Nieuwerkerken (1983, 1985a); characterized by reduction of  $R_{2+3}$ , expansion of lateral arms of vinculum, some reduction of corpus bursae, loss of signa and with Cistaceae as hostplant family.

**Trifurcula** Zeller, 1848 (= *Levarchama* Beirne, 1945). Type species: *Trifurcula pallidella* Zeller, 1848. Known from Europe and the Mediterranean, also South Africa (Scoble, 1980a); characterized by forewing venation (if not reduced) with connection between  $R_{2+3}$  and  $R_{4+5}$  lost, vinculum large and usually rounded anteriorly, uncus partially bifurcate or completely divided dorsoventrally, aedeagus with well-developed carinae and cornuti including a distinct group of needle-like or curved cornuti at one side (Scoble, 1980a; Nieuwerkerken, 1986b; Nieuwerkerken & Johansson, 1990).

**Glaucolepis** Braun, 1917 (= *Fedalmia* Beirne, 1945). Type species: *Nepticula saccharella* Braun, 1912. This genus was originally described with just one Nearctic species, but numerous Palaearctic species have been added subsequently, particularly from the Mediterranean region. Resembling and related to *Trifurcula*, *Glaucolepis* is best characterized by the lack of a transverse bar to the transtilla (independently paralleled in *Enteucha*, *Manoneura* and *Acalyptis*, but not in the related *Trifurcula*), and a very long cornutus lying longitudinally within the vesica (autapomorphy).

**Etainia** Beirne, 1945 (= *Obrussa* Braun, 1915 [preoccupied]). Type species: *Lyonetia sericopeza* Zeller, 1839. *Etainia* comprises 16 species: four from Europe, one from the Caucasus, four from East Asia, two from North America (including one species with a Holarctic distribution), and four from South Africa; it has not been recorded from the Neotropics. For a full checklist and discussion of phylogeny within the genus see Puplesis & Diškus (1996a). Characterized by: 1. Vinculum with U-shaped posterior invagination (autapomorphy). 2. Vesica with H-shaped sclerotization (autapomorphy). 3. Ductus bursae with group of spines (autapomorphy). 4. Larvae mining in buds, shoots and fruits, and not in leaves. 5. Valva of almost all species with large basal apodeme(s) (autapomorphy). 6. Muscle  $m_3$  in male genitalia attached to lateral arms of transtilla, and not to inner side of valva as in other Nepticulidae (Puplesis & Kozlov, 1988) (autapomorphy). This group was treated as a subgenus of *Ectoedemia* by Nieuwerkerken (1986b) but there appears to be little justification for this. We treat *Etainia* here as a distinct genus.

**Varius** Scoble, 1983. Type species: *Stigmella ochnicola* Vári, 1955. The status of this monobasic South African genus is uncertain. The forewing venation is more complete than in its close relative *Enteucha* ( $R_{2+3}$  preserved,  $R_4$  and  $R_5$  still separate – clearly plesiomorphies), but it is probable that this species is no more than a plesiomorphous member of *Enteucha*. *Varius* is unlikely to survive as a distinct genus.

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## CHECKLIST OF NEOTROPICAL SPECIES

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The 29 species recorded from Belize are marked with an asterisk (\*) and fall into seven genera: *Acalyptis* (14 species), *Stigmella* (5), *Enteucha* and *Fomoria* (three each), *Ectoedemia* (two), *Manoneura* and *Glaucolepis* (one each).

**NEPTICULIDAE** Stainton, 1854: 295  
(=STIGMELLIDAE Hampson, 1918: 387)  
Type genus: *Stigmella* Schrank, 1802

**ENTEUCHA** Meyrick, 1915

1. *cyanochlora* Meyrick, 1915
2. *gilvafascia* (Davis, 1978)
3. *hilli* sp. n. \*
4. *contracolora* sp. n. \*
5. *terrifica* sp. n.
6. *snaddoni* sp. n. \*

**MANONEURA** Davis, 1979, **gen. rev.**

7. *basidactyla* (Davis, 1978) **comb. n. \***
8. *trinaria* sp. n.

**STIGMELLA** Schrank, 1802

- The *salicis* group
9. *andina* (Meyrick, 1915)
  10. *cuprata* (Meyrick, 1915)
  11. *johannis* (Zeller, 1877)
  12. *rudis* sp. n.
  13. *marmorea* sp. n.
  14. *peruanica* sp. n.
  15. *epicosma* (Meyrick, 1915)
  16. *schoorli* sp. n.
  17. *hamata* sp. n.
  18. *imperatoria* sp. n.
  19. *olyritis* (Meyrick, 1915)

The *eurydesma* group

20. *eurydesma* (Meyrick, 1915)
21. *albilamina* sp. n. \*
22. *fuscilamina* sp. n. \*

Unattributed to a group

23. *gossypii* (Forbes & Leonard, 1930)
24. *kimae* sp. n. \*



25. *plumosetaella* Newton & Wilkinson, 1982  
 26. *barbata* sp. n. \*  
 27. *pruinosa* sp. n. \*  
 28. *ovata* sp. n.  
 29. *hylomaga* (Meyrick, 1931)  
 30. *costalimai* (Bourquin, 1962)  
 31. *guittonae* (Bourquin, 1962)

**ECTOEDEMA** Busck, 1907

32. *reneella* Wilkinson, 1981  
 33. *helenella* Wilkinson, 1981  
 34. *mesoloba* Davis, 1978  
 35. *species 29105* \*  
 36. *fuscivittata* sp. n. \*

**FOMORIA** Beirne, 1945

37. *molybditis* (Zeller, 1877) **comb. n.**  
 38. *diskusi* sp. n. \*  
 39. *species 29122* \*  
 40. *latipennata* sp. n. \*

**ACALYPTRIS** Meyrick, 1921

41. *bovicorneus* sp. n. \*  
 42. *martinheringi* sp. n. \*  
 43. *fortis* sp. n. \*  
 44. *hispidus* sp. n. \*  
 45. *novenarius* sp. n. \*  
 46. *lascuevella* sp. n. \*  
 47. *bifidus* sp. n. \*  
 48. *trifidus* sp. n. \*  
 49. *tenuijuxta* (Davis, 1978) **comb. n.**  
 50. *unicornis* sp. n. \*  
 51. *laxibasis* sp. n. \*  
 52. *bicornutus* (Davis, 1978)  
 53. *species 29135* \*  
 54. *dividua* sp. n. \*  
 55. *platygnathos* sp. n. \*  
 56. *species 29140* \*

**GLAUCOLEPIS** Braun, 1917

57. *aerifica* (Meyrick, 1915) **comb. n.**  
 58. *argentosa* sp. n. \*

**Note.** A further eight species with distribution ranges that run from northern Florida into the northern states of the USA and into Canada have not been included in our revision. They are: *Stigmella nigriverticella* (Chambers), *S. castaneaeifolia* (Chambers), *S. ostryaefoliella* (Clemens), *S. myricafoliella* (Busck), *Ectoedemia clemensella* (Chambers), *E. similella* (Braun), *E. virgulae* (Braun), *E. obrutella* (Zeller). These are species with predominantly boreal distributions and hostplants which have no affinities with the Neotropical region.

## SPECIES REVIEW

### *ENTEUCHA* Meyrick

#### 1. *Enteucha cyanochlora* Meyrick, 1915

(Figs 7, 66–68)

*Enteucha cyanochlora* Meyrick, 1915: 241.

*Enteucha cyanochlora* Meyrick; Davis, 1984: 18; Nieukerken, 1986b: figs 87–89.

**MALE** (Fig. 7). Forewing length: 2.8 mm. Wingspan: about 6.0 mm. Head: palpi, frontal tuft and eye-caps unicolorous, pale creamish ochre; collar greyish brown, same colour as tegulae; antenna pale ochre, ca. 34 segments. Thorax grey-brown. Forewing dark brown with intensive emerald and purple lustre; oblique post-median costal spot triangular, cream, distinctive. Terminal cilia yellowish cream, distinctly contrasting with ground colour of forewing and with a few yellowish cream scales forming an apical spot; cilia on tornus brown. Underside of forewing brown. Hindwing dark brown, not contrasting with ground colour of forewing, cilia intense brown. No androconia on forewing or hindwing. Legs pale ochre with some grey. Colour of abdomen unknown.

**FEMALE.** Unknown.

**GENITALIA** ♂ (Figs 66–68). Capsule 390–400 µm long. Uncus band-shaped, not extended caudally, so indistinct. Tegumen simple, short, not extending into a pseuduncus. Gnathos with large, anteriorly rounded central plate, small oblique caudal process and long lateral arms. Valva 241–245 µm long, triangular, pointed apically, longitudinally divided with long dorsal lobe. Transtilla absent (i.e., no transverse bar); sublateral processes extending from bases of valvae relatively long and slender. Vinculum long, anteriorly rounded. Aedeagus 354 µm long, slender. Vesica with group of tiny cornuti distributed beyond middle, a spinose sclerotization at apex and another smaller sclerite just before apical spine.

**BIOLOGY.** Adults collected in February.

**DIAGNOSIS.** Externally easily distinguished (within the genus and amongst other Neotropical nepticulids) by the characteristic, triangular costal spot on the forewing and by the very characteristic and unique gnathos (Fig. 66).

**DISTRIBUTION.** Guyana.

**CONDITION OF TYPE MATERIAL.** Relatively well-preserved.

**MATERIAL EXAMINED.**

Holotype ♂, **Guyana** [British Guiana]: Bartica, ii.1913 (*Parish*), genitalia slide no. 19273 (BMNH).



REMARKS. This is the type species of the genus. However, recent discoveries of other *Enteucha* have shown that the gnathos in this species is not typical of the genus as a whole. Other distinctive features, such as the divided valva, spines on the apex of the aedeagus, the compact group of tiny cornuti, and the narrow band-shaped uncus suggest that *cyanochlora* occupies a somewhat isolated phylogenetic position within *Enteucha*.

## 2. *Enteucha gilvafascia* (Davis, 1978)

*Artaversala gilvafascia* Davis, 1978: 221–223.

*Enteucha gilvafascia* (Davis); Nieuwerkerken, 1986b: 49–54, figs 90–92.

MALE. Described and figured by Davis (1978: 221–223, fig. 5), that description summarized here. Forewing length: 1.6–1.8 mm. Head entirely and uniformly stramineous, almost white; antenna fuscous dorsally, whitish ventrally. Thorax fuscous. Forewing fuscous with a broad sharply defined pale yellowish to nearly white median fascia and a similarly coloured wing apex (before pale stramineous cilia). Hindwing pale grey.

FEMALE. Similar to male.

GENITALIA ♂. Described and figured by (Davis, 1978: 223, figs 29–31) and figured by Nieuwerkerken (1986b: figs 90–92). Uncus large, with broadly rounded posterior lobe. Tegumen simple, short, not extended into a pseuduncus. Gnathos very unusual, a transverse bar with corners extended both posteriorly and anteriorly. Valva divided into slender ventral lobe (cf. *gilvafascia*) and broad dorsal lobe that is bent slightly inward in apical one-third to one-quarter. Transtilla absent (i.e., no transverse bar); sublateral processes extending from bases of valvae moderately short (half of width of uncus). Vinculum very large, its extended ventral plate distinctly triangular. Aedeagus relatively broad and short (equal in length to vinculum); no cornuti or apical spines.

GENITALIA ♀. Described and figured by Davis (1978: 223, fig. 34).

BIOLOGY. Hostplant: *Coccoloba uvifera* (L.) (Polygonaceae). According Davis (1978), the mine is extremely long and narrow (Davis, 1978: fig. 36) and more visible on the upperside of the leaf. Most frequently the mines occur near the margin of the leaf and only occasionally cross the main midrib. Cocoon whitish to pale greyish, ca. 2–2.3 mm in length, frequently attached to the leaf surface or other debris. As far is known, adults fly in April to late June and early October to early January.

DIAGNOSIS. Differs distinctively from other *Enteucha*

and other Neotropical nepticulids in the shape of transverse band-like gnathos, the triangular vinculum and very deeply divided valva (*cyanochlora* also has a divided valva, but the dorsal lobe is underdeveloped in comparison with the ventral one; in *gilvafascia* the opposite is the case). From *snaddoni* it differs in the unreduced tegumen, very deeply divided valva, and apically broad dorsal lobe of the valva. See Remarks.

DISTRIBUTION. Currently known from its type locality, coastal southern Florida (USA), only. This species appears to be a natural element of the Neotropical fauna.

REMARKS. Like *cyanochlora*, this is a species which by nepticulid standards is positively exotic and is a very distinctive Neotropical exemplar of this family. It is closely related to *snaddoni*, which we consider to be its sister-group.

## 3. *Enteucha hilli* sp. n.

(Figs 8, 69, 70)

MALE (Fig. 8). Forewing length: 3.3–3.4 mm. Wing-span: about 7.4 mm. Head: palpi brownish cream; frontal tuft pale orange-ochre; collar cream, distinctive, consisting of broad lamellar scales, practically unpaired; eye-caps cream, large; antenna brownish, consisting of 40 segments. Thorax, tegulae and forewing grey-brown, coarsely but indistinctly irrorated with brown scales. Cilia brown to brownish. Underside of forewing brown or brownish. Hindwing lanceolate but tending to be rather wide; grey brown, almost concolorous with forewing, cilia brown to brownish. No androconia on forewing or hindwing. Legs brownish cream, darkened with fuscous brown on anterior surfaces. Colour of abdomen unknown.

FEMALE. Unknown.

GENITALIA ♂ (Figs 69, 70). Capsule 540–545 µm. Tegumen band-like laterally, slightly extended into papillate sublateral lobes. Uncus rounded with single (not paired) well-sclerotized caudal papilla. Gnathos with large posterior process and almost equally developed lateral arms; central plate weakly developed, a narrow band; anterior processes absent but a pair of small distinct anterior papillae present. Valva 310–325 µm; apical one-third constricted into a very long, slightly inward-curved process; basal two-thirds very broad, with long distinct caudal papillae. Transtilla absent (i.e., no sclerotized transverse bar), but basal region of valva with long sublateral processes. Vinculum long, triangular, smoothly rounded anteriorly; no anterior emargination or lateral lobes. Aedeagus 432–445 µm, without any visible cornutus on vesica, but with a large rhomboidal sclerite (possibly a cathrema) basally.

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** Differs from all other *Enteucha* by the uniformly coloured forewing, and combination of triangular vinculum with rounded uncus and basally very broad valva. Somewhat similar and probably closely related to the European *acetosae* and Neotropical *contracolora*, but separable by the characters above which serve also to distinguish *hilli* from Neotropical nepticulids in other genera.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The single specimen is in fair condition, the wings are not spread and slightly rubbed.

**MATERIAL EXAMINED.**

Holotype ♂, **Belize:** Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 28967 (BMNH).

**REMARKS.** This remarkable species is named in honour of Mr Simon Richard Hill, thanks to whose devoted and enthusiastic efforts many new species (including this one) were collected in Belize in 1998. It shares apomorphies with all Palaearctic *Enteucha* (the European *acetosae* and unnamed Japanese species figured by Nieuwerkerken (1986b: figs 96–100)), i.e., a single-process gnathos, basally broadened valva and rounded uncus. As the closest relative of the Palaearctic *Enteucha*, its discovery begs several questions regarding the phylogenetic and biogeographic origins of this genus.

#### 4. *Enteucha contracolora* sp. n.

(Figs 9, 71–74)

**MALE** (Fig. 9). Forewing length: 2.7–2.8 mm. Wingspan: 6.0–6.2 mm. Head: palpi cream; frontal tuft pale yellowish cream; collar comprised of dark brown lamellar scales; eye-caps pale yellowish cream, large and elongated (longer than is usual in most nepticulids); antenna pale yellowish cream (at certain angles appearing ochreous cream), with ~34 segments. Thorax, tegulae and forewing smooth-scaled, brown, with gold and weak bluish lustre. Cilia distinctly contrasting with forewing, pale yellowish cream (concolorous with head), brown at tornus. Underside of forewing brown. Hindwing lanceolate, brownish; cilia brownish. No androconia on hindwing or forewing. Legs yellowish cream, laterally blackish brown. Abdomen dark brown on upperside, with additional cream scales on underside; short rather indistinct anal tufts composed of cream scales; anal segments, visible from underside only, brownish cream.

**FEMALE.** Unknown.

**GENITALIA** ♂ (Figs 71–74). Capsule 365–390 µm.

Tegumen extended into short sublateral papillate lobes. Uncus distinctive, inverted 'V'-shaped, with small papilla-like caudal process. Gnathos with large posteriorly rounded caudal process, short but wide; each arm with anteriorly-directed papilla on 'elbow' where the arm is reflexed caudally; central plate of gnathos not developed, i.e., absent. Valva 195–219 µm, very broad [the preparation – 29114 – from which Fig. 71 was drawn is slightly squashed and the valvae look unnaturally broad]; distally constricted into huge apical process, with spine-like process on inner basal corner. Juxta absent. Vinculum very large, ventral plate narrowing anteriorly, broadly rounded at apex, without lateral lobes or anterior emargination. Aedeagus 340–358 µm, a long and relatively narrow tube, without distinct cornuti or carinae at apex (Fig. 74).

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** This species may be separated from all other *Enteucha* by the distinctive inverted 'V'-shaped uncus (see also Remarks) which feature, together with the basally broad valva and lack of a transtilla, also separates it from Neotropical Nepticulidae in other genera.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The single specimen available is well-preserved, with clear scaling; the hindwings are detached and stored in a capsule pinned beneath the specimen.

**MATERIAL EXAMINED.**

Holotype ♂, **Belize:** Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29114 (BMNH).

**REMARKS.** This species may be most closely related to *hilli*, but it is distinctive and somewhat isolated in possessing a gnathos of an autapomorphic type that is quite unlike that seen in any other species of *Enteucha*.

#### 5. *Enteucha terricula* sp. n.

(Figs 10, 75–79)

**MALE** (Fig. 75). Forewing length: 2.7–3.3 mm. Wingspan: 6.1–7.4 mm. Head: palpi grey-black; frontal tuft ferruginous; collar relatively large, comprising two groups of fuscous lamellar scales with purple and gold lustre; eye-caps fuscous, almost black, with purple lustre; antenna fuscous except for whitish apex, ca. 63 segments. Thorax, tegulae and forewing fuscous brown with strong purple and some gold lustre. Medial fascia of forewing almost straight, glossy pale gold; cilia fuscous. Underside of forewing fuscous. Hindwing relatively broad, grey-brown with purple lustre; cilia brown. No androconia on hindwing or forewing. Legs and abdomen fuscous; anal tufts of abdomen com-

prised of fuscous grey scales; genital segments dark grey in ventral view.

FEMALE. Unknown.

GENITALIA ♂ (Figs 75–79). Capsule about 600 µm. Tegumen extended into a roughly papillated and distinct lobe which analogous to pseuduncus (Fig. 77). Uncus broad, gradually narrowed towards rounded apex. Gnathos (Fig. 78) with broad but partly reduced caudal process; central plate and lateral arms of gnathos moderately developed but strongly sclerotized. Valva 320–328 µm, broad with very long apical process and highly elaborated trilobed inner surface (Fig. 79). Transtilla absent (i.e., no transverse bar), but sublateral processes (apodemes) of valvae broadened basally and very close to each other, spatulate anteriorly. Juxta absent. Vinculum very large, ventral plate gradually narrowed anteriorly, but broadly rounded at the end; no lateral lobes or anterior emargination. Aedeagus relatively small, 300–310 µm, slightly broadened medially, with elongate ventral sclerotization and some weakly sclerotized spine-like cornuti; base of aedeagus tube strongly sclerotized but not rounded as in most nepticulids; no carinae at apex.

BIOLOGY. Adults collected in late March.

DIAGNOSIS. Differs strikingly from all other *Enteucha* (and all other nepticulids) in practically all major features of the genitalia: partially reduced gnathos, oar-like sublateral processes, multilobed valva; the large lamellar fuscous collar and fuscous eye-caps are also distinctive but not uniquely so. See Remarks.

DISTRIBUTION. Peru; specimens were collected at 3000 m.

CONDITION OF TYPE MATERIAL. Fair.

MATERIAL EXAMINED.

Holotype ♂, Peru: Department Puno, 5 km E Limbani, 28.iii.1987 (*Karsholt*), genitalia slide no. Diškus 183 (ZMUC).

Paratype ♂, data and depository as holotype.

REMARKS. This is a remarkable species – a Neotropical ‘exotic’ – with unique multilobed valva with oar-like processes, reduced gnathos, huge vinculum, and very small aedeagus with long sclerotization. These autapomorphic features define *terrícola* as very isolated within *Enteucha*. However, it still fits well within the generic concept and we have no misgivings about its placement. The adjacent broadened bases of the sublateral valval processes are an interesting feature and may represent the development of a structure analogous to the transtilla. The partial reduction of the caudal process of the gnathos is a rare case of reduction of a sclerite which is usually very conservative and little modified in this family. Valval modifications are widely observed, however; in *terrícola* they are re-

markable and may be functionally connected with the tiny aedeagus, providing more precise juxtaposition than is usually required during copulation.

## 6. *Enteucha snaddonii* sp. n.

(Figs 11, 80–82)

MALE. Forewing length: ca. 2.0 mm. Wingspan: ca. 4.5 mm. Head: palpi cream; frontal tuft pale ochre; collar cream, comprising two tufts of lamellar scales; eye-caps cream; antenna brown on upperside and almost cream on underside, ca. 24 segments. Thorax and tegulae dark brown. Forewing dark brown with wide cream medial fascia; apex of forewing also cream, contrasting with ground colour of forewing and concolorous with cream outer area of cilia; tornal area of cilia brown. Underside of forewing brownish. Hindwing lanceolate, brownish, cilia brownish. No androconia on forewing or hindwing. Legs yellowish cream shaded with dark brown or fuscous. Abdomen brown on upperside and underside, small; genital segments indistinct, cream.

FEMALE (Fig. 11). Similar to male. Forewing length: ca. 2.3 mm. Wingspan: ca. 5.2 mm.

GENITALIA ♂ (Figs 80–81). Capsule 346–368 µm long. Uncus a large oval lobe, rather weakly sclerotized (Fig. 81). Tegumen partially reduced (Fig. 81). Gnathos a broad transverse bar with anteriorly directed short and narrow lateral arms. Valva 210–230 µm, with very long and slender apical process curved inwardly; inner (ventral) lobe of valva extended into a distal process with a few caudally directed spine-like outgrowths. Transtilla absent (i.e., without transverse bar); sublateral processes from valval bases short, slightly curved outwards. Vinculum large; ventral plate triangular, gradually narrowed anteriorly, without lateral lobes. Aedeagus ca. 354 µm long, slightly broadened towards base, with two spine-like cornuti, without apical processes.

GENITALIA ♀. Not studied (see Remarks).

BIOLOGY. Adults collected in April.

DIAGNOSIS. Easily distinguished from other *Enteucha* and other Neotropical nepticulids by the partially reduced tegumen and by the combination of large triangular vinculum and very long and inwardly bent distal process of the valva. This species is also well characterized by other features that are not unique, such as the whitish apex of the forewing, the huge rounded uncus, and transverse bar-like gnathos.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL.

The holotype specimen is slightly mouldy; the other known specimen (a female) is not included in the type series.

## MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, S of Teakettle Village, Pook's Hill Nature Reserve, 28–29.iv.1998 (*Puplesis* & Hill), genitalia slide no. 29117(BMNH).

Excluded from paratype series: 1 ♀, **Belize**: Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis* & Hill) (BMNH).

REMARKS. This species is named in honour of Vicki and Ray Snaddon, owners of Pook's Hill Nature Reserve, in recognition of their support for the conservation of Belizean rainforest and its scientific investigation.

*E. snaddoni* is morphologically interesting in that it exhibits a small number of very marked modifications. The partially reduced tegumen is functionally replaced by the large oval uncus. The latter is surprisingly unspecialized, however, although this is not to suggest that it represents the nepticulid ground-plan. The transverse form of the gnathos is very different from that of most other nepticulids, and links this species with *gilvafascia*; it is paralleled in a few other nepticulids in *Trifurcula* and other genera.

The single female specimen available was collected in a different area from the male holotype; no features other than external similarity suggest that the two are opposite sexes of the same species although we think this is probable. As the association is doubtful, the female is not included in the type series and its genitalia have been not documented.

**MANONEURA** Davis**7. *Manoneura basidactyla*** (Davis, 1978), **comb. n.**

(Figs 12, 61, 83–85, 207)

*Oligoneura basidactyla* Davis, 1978: 218–219.

MALE (Fig. 12). Forewing length: 1.7–2.1 mm. Wingspan: 4.9 mm. Head: palpi yellowish cream to cream; frontal tuft orange; collar a large tuft of lamellar yellowish cream scales with gold lustre; eye-caps yellowish cream; antenna brownish grey, ca. 38–39 segments. Thorax, tegulae and forewing fuscous brown with bronze and very strong blue and purple lustre. Forewing with distinct oblique yellow-gold subterminal fascia. Cilia fuscous, lighter distally. Underside of forewing brown. Hindwing lanceolate, very slender, dark brown with purple and blue lustre strongest on upperside of hindwing; cilia brownish. No androconia on forewing or hindwing. Legs grey except tarsi which are cream. Abdomen blackish on upperside, blackish grey on underside; genital segments blackish grey, not contrasting with main colour of abdomen.

FEMALE. Similar to male. Forewing length: 2.3 mm.

Wingspan: 5.2 mm. Antenna ca. 32–33 segments. Legs cream, shaded laterally with blackish. Abdomen blackish on upperside but cream on underside. Otherwise as in male.

GENITALIA ♂ (Figs 83–85). Capsule ca. 290–305 µm long. Tegumen with short, slightly bilobed, pseuduncus-like caudal extension. Uncus with strong pointed central process directed anteriorly and long narrow lateral arms directed posteriorly. Gnathos with small but complex and well-sclerotized v-shaped centre and broad, membranous lateral arms. Process of uncus (in natural position) almost touching posterior indentation at centre of gnathos, the structure appearing unified (Fig. 84). Valva ca. 205–215 µm, relatively narrow in caudal half and gradually broadened towards base; apical process long and slender. Transtilla absent, i.e., no transverse bar; however bases of valvae with remarkably very long and straight sublateral processes. Vinculum very long and broad, truncate at the anterior end; no anterior emargination or lateral lobes. Aedeagus 236–246 µm long, with two pairs of pointed lateral carinae; no cornuti on vesica. Juxta with flask-shaped outline, fused with aedeagus.

GENITALIA ♀ (Fig. 207). Total length ca. 720 µm. Anal papillae undeveloped. S8 and T8 broadly rounded. Apophyses posteriores short and complex. Apophyses anteriores very slender and twice length of apophyses posteriores. Vestibulum sclerotized. Caudal part of corpus bursae very narrow caudally, swollen anteriorly; no signa visible. Accessory sac undeveloped, represented by a small but clearly visible ring-like sclerotization; ductus spermathecae long and narrow, slightly sinuous.

BIOLOGY. Hostplant: *Coccoloba uvifera* (L.) (Polygonaceae) (according to specimen label data recorded by Davis, 1978: 218–219). Adults collected in early January, April–May and July. The suggestion by Davis (1978) that this species may be univoltine is not supported by recently-collected material.

DIAGNOSIS. *M. basidactyla* may be easily distinguished from the only other species in the genus, *M. trinaris* (below) by the relatively straight valva and anteriorly truncate vinculum; the two species are externally similar in pattern and lustre, but *basidactyla* is slightly paler. This species differs from the remaining neotropical nepticulids by the strong purple lustre of the forewing and the large anteriorly truncate vinculum together with the distinctively-shaped gnathos.

DISTRIBUTION. Known from the southwestern coast of Florida, Dominica (new record) and Belize (new record). The species is likely to have a wide distribution at least in the Caribbean region.

CONDITION OF TYPE MATERIAL. According Davis (1978) two specimens from the four comprising the

type series are glued to paper points and one of these glued specimens is lacking its abdomen. Holotype in FSCA, paratypes in FSCA and USNM.

**MATERIAL EXAMINED.**

3♂, 2♀, **Belize**: Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide nos. 29120♂, 29121♀ (BMNH); 2♂, 1♀, same data, wing venation slide no. AD0314♀ (VPU). 1♂, **Dominica**: Pont Casse, 16.v.1965 (*Davis*), genitalia slide no. Diškus 002 (USNM); 1♂, 1♀, Cabrit Swam, 10–13.v.1965 (*Davis*) (USNM); 2 exx. (without abdomens), Springfield Est., 20–26.vii.1963 (*Flint*) (USNM).

**REMARKS.** The two species of this genus represent an exotic and distinctive element of the Neotropical fauna.

### 8. *Manoneura trinaris* sp. n.

(Figs 13, 86, 87)

**MALE** (Fig. 13). Forewing length: 2.5 mm. Wing-span: about 5.6 mm. Head: palpi cream; frontal tuft orange; collar comprised of a single uniform tuft of fuscous shiny lamellar scales; eye-caps cream; antenna blackish grey, shiny, ca. 43 segments. Thorax, tegulae and forewing fuscous with very strong purple and blue lustre, which is especially intensive on forewing; at certain angles forewing may have purple and gold lustre instead of blue. Subterminal fascia slightly curved inward, gold, shiny. Cilia fuscous-brown, but tending to cream at tips. Underside of forewing fuscous. Hindwing lanceolate, fuscous, at certain angles with purple and bright grey lustre, especially along dorsal margin; cilia fuscous-brown. No androconia visible on forewing or hindwing. Legs fuscous, a little paler on tarsi. Abdomen fuscous on upperside and underside, a pair of very short anal tufts and genital segments also fuscous.

**FEMALE.** Unknown.

**GENITALIA** ♂ (Figs 86, 87). Capsule 460–473 µm long. Tegumen extended into short rounded pseuduncus-like sclerite with small lateral lobes. Uncus with relatively small strongly pointed central process directed anteriorly and very long narrow lateral arms directed posteriorly. Gnathos with small, complex, well-sclerotized v-shaped centre and rather membranous lateral arms. Process of uncus (in natural position) almost touching posterior indentation at centre of gnathos, the structure appearing unified. Valva about 170 µm long, relatively narrow and distinctly curved inward, without separate apical process and with shorter, pointed dorsal lobe. Transtilla absent, no transverse bar developed, but bases of valvae with long and broad sublateral processes. Vinculum very long and broad, narrowed in anterior half and very broadly rounded anteriorly. Aedeagus 370–382 µm long, with

two pairs of spine-like lateral carinae; no cornuti on vesica. Juxta elongate, subrectangular, fused with aedeagus.

**BIOLOGY.** Adults collected in January.

**DIAGNOSIS.** Externally this is one of the most striking nepticulid species by dint of its extremely strong purple and blue forewing lustre; it differs from *M. basidactyla* in the curved valva and long aedeagus and vinculum. It differs from all other nepticulids of the Neotropical region in the striking purple and blue forewing lustre, the curved, distally divided valvae, and long aedeagus with long straight apical carinae with slightly globose bases.

**DISTRIBUTION.** Venezuela (cloud forest).

**CONDITION OF TYPE MATERIAL.** The single specimen available is well-preserved, but the hindwings are obscured beneath the unsprung forewings, and it is difficult to study them.

**MATERIAL EXAMINED.**

Holotype ♂, **Venezuela**: Aragua [Rancho Grande], 1100 m, 17–20.i.1978 (*Heppner*), genitalia slide no. Diškus003 (USNM).

**REMARKS.** This is one of the most striking representatives of the Neotropical fauna with remarkable forewing coloration, and with distinctively modified gnathos and uncus (a feature shared only with *basidactyla*). Phylogenetically both *basidactyla* and *trinaris* are markedly apomorphic.

## *STIGMELLA* Schrank

### The *salicis* group

*S. fuscotibiella*-group Newton & Wilkinson, 1982.

The species described below are attributable on the basis of forewing pattern and male genital structure to the large *salicis*-group, first established for species of the European fauna and known in the Nearctic as the '*fuscotibiella*-group' (Newton & Wilkinson, 1982). The term '*salicis*-group' is used here for the Neotropical species below to avoid further confusion. However, the female genitalia of all the Neotropical species lack the characteristic band (signum) of tiny, dentate chitin plates encircling the bursa that is typical of the Holarctic members of the group; just *olyritis* has a similar, but most likely not homologous, structure on the bursa. Thus the numerous Holarctic species appear to share a synapomorphic character that is absent in the Neotropical ones; in the latter the where plate-like pectinations, if present, are scattered. The probability of scattered or absent pectinations being the apomorphic character-state seems intuitively less likely.

So the Holarctic representatives may form a monophyletic entity, derived from a Neotropical-type ancestor, within the *salicis*-group. Further speculation on the geographical origin of the *salicis*-group, apparently primitive and speciose in the Neotropics, is possible but perhaps should await more thorough exploration and understanding of the southern hemisphere representatives.

### 9. *Stigmella andina* (Meyrick, 1915)

(Figs. 14, 88, 89, 209)

*Nepticula andina* Meyrick, 1915: 255, 256.

*Stigmella andina* (Meyrick); Davis, 1984: 18.

**MALE** (Fig. 14, left side). Forewing length: 2.4–2.7 mm. Wingspan: 5.2–5.9 mm. Head: palpi cream; frontal tuft cream or ochreous cream to dull ochre; collar yellowish cream, indistinct; eye-caps pale cream to yellowish cream; antenna brownish, ca. 34 segments. Thorax and tegulae pale cream with yellow-ochre tints. Forewing uniformly glossy yellowish cream with a brassy tint; no dark scales at apex as in females; some whitish lustre at apex. Cilia whitish cream to ochreous cream. Underside of forewing uniformly brownish ochre or brownish. Hindwing lanceolate, cream on both sides, cilia also cream. No androconia on forewing or hindwing. Legs pale ochreous cream or cream. Abdomen greyish brown on upperside and underside, genital segments cream, distinctly contrasting in colour with rest of abdomen.

**FEMALE** (Fig. 14, right side). Head colour very similar to male; antenna a little shorter (ca. 30 segments). Apical one-quarter to one-fifth of forewing entirely covered with purple brown scales, some brownish scales overlapping on cilia. Abdomen ochreous cream, sometimes pale ochre. Slender ochre-brown ovipositor distinctly visible at end of abdomen. Otherwise as in male.

**GENITALIA** ♂ (Figs. 88, 89). Capsule 370 µm long. Uncus relatively long, well-sclerotized, with four distinct caudal papillae. Tegumen short, strip-like, with caudal concavity, strongly sclerotized and rounded laterally. Gnathos with well-developed central plate and two long posterior processes; lateral arms of gnathos narrow in lateral view. Valva 208 µm, broad, with short, bent apical process, which may not be very evident in lateral view. Transtilla curved laterally, with broad transverse bar, but without sublateral processes. Vinculum relatively broad, anterior margin with deep semicircular emargination and pointed triangular lateral lobes. Aedeagus 242 µm long, without apical processes. Vesica with about 10 very large, caudally-pointed cornuti (the number of cornuti is usually significant in this group).

**GENITALIA** ♀ (Fig. 209). Total length 1180 µm. S8 narrow, but rounded. Anal papillae not developed. T8 with a few small setae not segregated into lateral groups. Apophyses posteriores long (ca. 370 µm) and very broad, broadly curved anteriorly. Apophyses anteriores slender, as long as apophyses posteriores, curved slightly inwards anteriorly. Vestibulum relatively narrow, without pectinations or sclerites. Caudal part of corpus bursae very broad and strongly folded; remaining larger part of corpus bursae broadly oval, without distinct pectinations or signa. Accessory sac small, but broad; ductus spermathecae slender and slightly sinuous.

**BIOLOGY.** Adults collected in July.

**DIAGNOSIS.** Belongs to the *S. salicis*-group. The broad, rather square valva with a tiny, curved apical process together with 10 very large vesical cornuti distinguishes this species from all other Neotropical or world representatives of the *salicis*-group. There are slight superficial resemblances to the Nearctic *S. fuscotibiella* (Clemens) but it differs in having large vesical cornuti and a pale forewing. See Remarks.

**DISTRIBUTION.** Peru.

**CONDITION OF TYPE MATERIAL.** Most specimens are in poor condition, badly pinned and many without head scales or even lacking a head; the forewing pattern is barely visible, and sometimes very worn. The lectotype and two other specimens are in comparatively satisfactory condition.

**MATERIAL EXAMINED.**

Lectotype ♂, **Peru**: [Oroya], 12200 ft [3720 m], vii.1914 (*Parish*), genitalia slide no. 20612 (BMNH), here designated.

Paralectotypes, 13 ♂, 6 ♀, data as lectotype (genitalia slide no. 28841 ♀ (BMNH)).

**REMARKS.** According to the original description of this species (Meyrick, 1915), sexual dimorphism is characteristic (Fig. 14). However, there is no guarantee that the female paralectotypes really belong to the same species as the male lectotype. Differences in male and female forewing coloration may represent outstanding sexual dimorphism or simply indicate two different species. Work with a sample of unidentified rubbed material has shown that seven externally very similar specimens collected in adjacent areas of the Peruvian Andes may represent seven different species of *Stigmella*. So the association of males and females of this species should be treated with caution.

### 10. *Stigmella cuprata* (Meyrick, 1915)

(Figs 15, 90, 91)

*Nepticula cuprata* Meyrick, 1915: 255.

*Stigmella cuprata* (Meyrick); Davis, 1984: 18.

MALE (Fig. 15). Forewing length: 1.9 mm. Wingspan: 4.3 mm. Head: palpi greyish cream; frontal tuft yellowish; collar yellowish, consisting of piliform scales; eye-caps relatively small, whitish with metallic lustre; antenna brownish grey, ca. 32 segments. Thorax, tegulae and basal half of forewing before fascia greyish bronze. Medial fascia of forewing silvery, glossy, broad, proximal margin slightly oblique, distal margin broadly rounded. Forewing beyond fascia purplish brown with a few apical scales just before cilia which may have silver lustre at certain angles. Cilia grey. Underside of forewing brown. Hindwing and cilia brownish grey. No androconia on hindwing or forewing.

FEMALE. Not studied (see Remarks).

GENITALIA ♂ (Figs 90, 91). Total length 280–286 µm. Uncus trapezoidal with a pair of small rectangular caudal lobes and a pair of tiny lateral papillae. Tegumen small with bulged lateral corners. Gnathos with well-developed central plate, two-long close-set caudal processes and narrow sclerotized lateral arms. Valva about 185 µm, triangular, gradually narrowed into a pointed, inward-curved apical process. Transtilla with strong ribbon-like transverse bar but without sublateral processes. Vinculum with moderately large lateral lobes, which gradually narrow anteriorly; anterior emargination semicircular. Juxta absent. Aedeagus 290–305 µm. Vesica with about 11 huge cornuti and a few minute and inconspicuous thorn-like cornuti particularly on left side subapically.

BIOLOGY. Adults collected in July.

DIAGNOSIS. Belongs to the *S. salicis*-group. Externally resembles *S. johannis* (Zeller), but the male genitalia differ strongly in the closely set caudal processes of the gnathos, the caudally narrowed bilobed uncus, and large lateral lobes of the vinculum. From other species of the group, including the Nearctic *S. slingerlandella* (Kearfott), *cuprata* differs in the broad silvery medial fascia and by the group of very large cornuti in the aedeagus.

DISTRIBUTION. Peru.

CONDITION OF TYPE MATERIAL. The left antenna of the lectotype is broken, the right forewing rubbed. The other specimen in the type series (probably ♀) has badly rubbed forewings and is badly pinned.

MATERIAL EXAMINED.

Lectotype ♂, **Peru**: Matucana, 7780 ft [2370 m], vii.1914 (*Parish*), genitalia slide no. 28848 (BMNH), here designated.

Paralectotype ♀?, data as holotype.

REMARKS. Both specimens of the original syntype

series are present in the BMNH collection. We have redefined this taxon from the male lectotype. The other specimen (probably a female) is extremely rubbed, badly pinned, and with few or no traces of pattern. It is impossible to tell whether it is likely to be conspecific with the lectotype and we have therefore not dissected it. No external features remain that are worth describing.

### 11. *Stigmella johannis* (Zeller, 1877)

(Figs 16, 92, 93)

*Nepticula johannis* Zeller, 1877: 456–457.

*Stigmella johannis* (Zeller); Davis, 1984: 18.

MALE (Fig. 16). Forewing length: about 2.3 mm. Wingspan: about 5.4 mm. Head: palpi whitish cream; frontal tuft very pale orange; collar cream, slightly darkened with brownish tint, consisting of lamellar scales; eye-caps pale cream; antenna grey-brown, ca. 36 segments. Thorax, tegulae and forewing smooth brown with a gold tint. Postmedian fascia of forewing silvery, lustrous, not clearly defined. Cilia brownish. Some scales of forewing close to cilia with silvery lustre at certain angles. Underside of forewing intense brown with purple lustre along entire length. Hindwing and cilia grey or brownish. No androconia on hindwing or forewing. Legs grey-brown. Abdomen grey-brown above and below; genital segments cream.

FEMALE. Unknown.

GENITALIA ♂ (Figs 92, 93). Capsule 315–320 µm. Uncus subtrapezoidal, slightly tapered caudally, with four relatively large caudal papillae. Tegumen small, laterally slightly bulged. Gnathos with relatively small central plate and large, well-separated, almost parallel posterior processes; lateral arms moderately developed. Valva 215–225 µm, subtriangular, with two small, pointed, inwardly-curved apical processes. Transtilla with transverse bar exceeding anterior margin of vinculum; sublateral processes of transtilla absent, corners broadly rounded. Vinculum with small pointed triangular lateral lobes; anterior emargination shallow, almost square. Juxta absent. Aedeagus about 340 µm, with about nine well-sclerotized large cornuti and a smaller less sclerotized one.

BIOLOGY. The single adult known was collected in late May.

DIAGNOSIS. Belongs to the *S. salicis*-group. Differs from other representatives of the group (including the Neotropical *S. cuprata* (Meyrick) and Nearctic *S. slingerlandella* (Kearfott)) by the combination of lustrous silvery postmedian fascia, many almost equal-sized large cornuti in the aedeagus, well-separated caudal processes of the gnathos, and broad uncus with four caudal papillae.

DISTRIBUTION. Colombia.

CONDITION OF TYPE MATERIAL. The holotype is in satisfactory condition with clear wing pattern, but the wings are not spread.

MATERIAL EXAMINED.

Holotype ♂, **Colombia**: Bogotá, 27.v.1871 (*Johann*), genitalia slide no. 28843 (BMNH).

## 12. *Stigmella rudis* sp. n.

(Figs 17, 94–96, 208)

MALE (Fig. 17). Forewing length: 2.9–3.8 mm. Wingspan: 6.6–8.3 mm. Head: palpi grey to greyish cream or cream; frontal tuft pale orange or yellow; collar comprising two tufts of whitish lamellar scales; eye-caps whitish; antenna brown to dark brown, ca. 36 segments. Thorax and tegulae brown or dark brown. Forewing densely irrorated with brown, dark brown and some grey-cream scales; with two irregular and variable greyish cream postmedian spots of which the costal may be bigger than the tornal. Cilia grey to greyish cream distally. Underside of forewing brown. Hindwing lanceolate, relatively broad, grey to brown; cilia concolorous. No androconia on forewing or hindwing. Legs with tinted brown or dark grey. Abdomen fuscous brown on upperside and underside; genital segments cream (distinctly contrasting in colour with remaining abdomen) to occasionally grey.

FEMALE. Colour similar to male; antenna shorter (ca. 29 segments).

GENITALIA ♂ (Figs 94–96). Capsule 346–356 µm long. Uncus relatively long, well-sclerotized, with four distinct caudal papillae and oval caudal emargination. Tegumen very short, simple, band-shaped. Gnathos with narrow central plate and two very long almost parallel posterior processes, with a pair of broad anterior extensions and narrow and relatively long lateral arms. Valva 235–245 µm long, very broad, almost square, with two distinct pointed apical processes. Transtilla with slender transverse bar forming short triangular sublateral lobes. Vinculum relatively short, with broad, square anterior emargination and with anteriorly rounded short triangular lateral lobes. Aedeagus 268–287 µm long, without apical processes. Vesica with about 7 spine-like cornuti and with a highly characteristic large cluster of variably-sized spine-like cornuti, most of them fused at the base. Juxta not apparent in the studied preparations.

GENITALIA ♀ (Fig. 208). Total length ca. 1117 µm. S8 and T8 truncate caudally. Anal papillae not developed. Apophyses posteriores short and very slender in anterior one-third to one-fifth. Apophyses anteriores very slender and very long (ca. 235 µm). Vestibulum relatively broad, membranous, without pectinations or

sclerites. Caudal section of corpus bursae broad and strongly folded; remaining larger part of corpus bursae broadly oval, entirely covered with distinct scattered irregular pectinations. Accessory sac moderately developed, more or less oval and folded; ductus spermathecae slender, weakly sclerotized and without convolutions.

BIOLOGY. Adults common from October to February.

DIAGNOSIS. Belongs to the *S. salicis*-group. Recognisable by the unique cluster of spine-like cornuti arising from a fused base. The species is also characterized by the somewhat featureless forewing pattern which separates it from other Neotropical representatives of the group.

DISTRIBUTION. Chile and Argentina.

CONDITION OF TYPE MATERIAL. Most specimens (including the holotype) are in satisfactory or good condition, a few are rubbed.

MATERIAL EXAMINED.

Holotype ♂, **Argentina**: Rio Negro: San Carlos de Bariloche, Colonia Suiza, 800 m, 7–30.xii.1981 (*Nielsen & Karsholt*), genitalia slide no. Diškus175 (ZMUC).

Paratypes, **Argentina**: 9♂, data as holotype, genitalia slide no. Diškus180 (ZMUC); 1♂, Lago Nahuel Huapi, Puerto Blest, 770 m, 22–31.xii.1981 (*Nielsen & Karsholt*) (ZMUC); 3♂, Neuquen, San Martin de Los Andes, 640 m, 17.x–26.xi.1981 (*Nielsen & Karsholt*) (ZMUC); 3♂, 4♀, Lago Lacar, Pucara, 650–750 m, 25.xi.1978 & 28–29.xi.1981 (*Mission Científica Danesa and Nielsen & Karsholt*), genitalia slide no. Diškus176♀ (ZMUC); 1♂, Lago Lacar, 5 km E of Huahum, 640 m, 25.xi.1981 (*Nielsen & Karsholt*) (ZMUC); 3♂, 1♀, Chubut, Esquel, Lago Menendez, El Sagrario Puerto, 550–600 m, 21.ii.1979 and 2–4.i.1982 (*Mission Científica Danesa and Nielsen & Karsholt*), genitalia slide no. Diškus205♀ (ZMUC). **Chile**: 7♂, 2♀, Osorno, Parque Nacional Puyehue, Aguas Calientes, 450 m, 10.xii.1981 (*Nielsen & Karsholt*), genitalia slide nos. Diškus177♀, Diškus179♂ (ZMUC); 1♂, Anticura, 350 m, 19.xi.1981 (*Nielsen & Karsholt*) (ZMUC).

REMARKS. Externally this species varies in forewing length and pattern: some specimens may be smaller than average or darker. Genital structures, especially the highly characteristic cluster of cornuti in the aedeagus represent less variable features and are most useful for recognition of the taxon.

## 13. *Stigmella marmorea* sp. n.

(Figs 18, 97, 98, 210)

MALE (Fig. 18). Forewing length: 4.0–4.6 mm. Wing-



span: 9.0–10.1 mm. Head: palpi brownish; frontal tuft comprised of whitish cream and dark brown piliform scales; collar forming two clearly separated tufts of whitish or cream lamellar scales; eye-caps whitish or cream; antenna dark grey-brown, ca. 43–44 segments. Thorax and tegulae dark grey-brown except for greyish margins. Forewing brown with distinctive marbled pattern (hence the species' name) comprising wide cream or whitish antemedian and postmedian fasciae; some whitish scales between fasciae, and many just before the cilia that are so numerous that they form a narrow terminal fascia. Cilia brown-grey to greyish at tornus. Underside of forewing grey-brown. Hindwing lanceolate, relatively broad, grey; cilia grey. No androconia on forewing or hindwing. Legs intensely shaded with grey-black or grey-brown, tarsi black on one side. Abdomen dark grey on upperside, cream on underside; genital segments cream, not contrasting with underside of abdomen but clearly distinguishable because of large valval lobes.

FEMALE. Externally similar to male.

GENITALIA ♂ (Figs 97, 98). Capsule 478–489  $\mu\text{m}$  long. Uncus relatively long, well-sclerotized, with four slender caudal papillae and deep, oval caudal emargination. Tegumen very short, with rounded lateral angles, bulged in the middle. Gnathos with moderately narrow central plate and two very long parallel posterior processes; a pair of anterior extensions of the gnathos are very tiny, not always distinct; lateral arms of gnathos narrow, relatively short. Valva 305–312  $\mu\text{m}$  long, almost equally broad throughout entire length or gradually narrowed towards apex, with two close-set pointed apical processes. Transtilla with slender transverse bar forming short triangular lobe-like sublateral processes. Ventral plate of vinculum half or less valval length, with broad anterior emargination and almost pointed triangular lateral lobes. Aedeagus 351–365  $\mu\text{m}$  long, without apical processes but with serrated oblique apical margin. Vesica with about 9–10 large or very large horn-like cornuti and with a group of a few smaller spine-like cornuti at apex; one cornutus is huge, one-half length of aedeagus. Juxta distinct, triangular, narrowing anteriorly.

GENITALIA ♀ (Fig. 210). Total length ca. 894–907  $\mu\text{m}$ . S8 and T8 broadly rounded caudally. Anal papillae not developed. Apophyses posteriores just a little shorter than apophyses anteriores which are long (ca. 233–241  $\mu\text{m}$ .) and very slender. Vestibulum narrow, membranous, without pectinations or sclerites. Caudal region of corpus bursae broad and folded; remainder relatively small, comprising only half bursa length, with sparse and scattered pectinations. Accessory sac well-developed, folded; ductus spermathecae slender, weakly sclerotized and without convolutions.

BIOLOGY. Adults collected in March.

DIAGNOSIS. Belongs to the *S. salicis*-group. Differs from other species, including Neotropical ones, in having two white or cream fasciae on the forewing, and an apically serrated apical margin on the aedeagus which contains one huge cornutus among numerous others.

DISTRIBUTION. Peru (altitudes around 4100 m).

CONDITION OF TYPE MATERIAL. Relatively well-preserved.

MATERIAL EXAMINED.

Holotype ♂, **Peru**: Dept. Ancash, 23 km SE of Huaraz, Cerro Cahuish [Quabrada Pucavado], 4100 m, 15–18.iii.1987 (*Karsholt*), genitalia slide no. Diškus182♂ (ZMUC).

Paratypes, 1♂, 1♀, data as holotype, genitalia slide no. Diškus181♀ (ZMUC).

#### 14. *Stigmella peruanica* sp. n.

(Figs. 19, 104, 105)

MALE (Fig. 19). Forewing length: ca. 2.1 mm. Wing-span: 4.6 mm. Head: palpi grey-brown; frontal tuft pale orange; collar comprising two clearly separated tufts of fuscous grey lamellar scales with gold lustre; eye-caps cream or yellowish cream; antenna fuscous, ca. 32–33 segments. Thorax and tegulae fuscous with strong bronze-gold lustre. Forewing with three shiny fasciae: (1) moderately large, dark yellow-gold basal fascia, (2) wide whitish gold median fascia, (3) very narrow and short whitish gold terminal fascia; areas between fasciae with smoothly dark brown scales with gold and purple lustre. Cilia fuscous brown. Underside of forewing fuscous. Hindwing lanceolate, relatively broad, grey-brown; cilia concolorous. No androconia on forewing or hindwing. Legs dark grey with metallic lustre. Abdomen grey-brown on upperside, grey to ochreous cream on underside; short anal tufts grey-brown; genital segments ochreous cream, not particularly contrasting in colour with underside of abdomen.

FEMALE. Unknown.

GENITALIA ♂ (Figs 104, 105). Capsule 312–325  $\mu\text{m}$  long. Uncus relatively long, well-sclerotized, with four distinct caudal papillae and deep oval caudal emargination. Tegumen very short, simple, band-like. Gnathos with large medially narrowed central plate and two slender, elongate posterior parallel processes; anterior extensions triangular; lateral arms tapering caudally, very short. Valva 204–210  $\mu\text{m}$  long, slightly narrowed apically, with two close-set pointed apical processes. Transtilla with strong transverse bar, without sublateral processes. Ventral plate of vinculum relatively short, half or less valval length; anterior

emargination broad but shallow, lateral lobes small, anteriorly subtruncate. Aedeagus broad (98–112  $\mu\text{m}$ ) and relatively short (256–269  $\mu\text{m}$ ), without apical processes. Vesica with about 10 large or very large horn-like cornuti, four of them very long and positioned centrally and towards base, six (or more) about half that length and in a row caudally from one-half. Juxta triangular, with shallow longitudinal division at slender caudal end, rather membranous, broad anterior margin indistinct.

**BIOLOGY.** Adults collected in March.

**DIAGNOSIS.** Easily recognisable among all other species of the group by the three gold lustrous markings on the forewing and the '4 + row of 6' configuration of cornuti in the aedeagus.

**DISTRIBUTION.** Peru (altitudes around 3000 m).

**CONDITION OF TYPE MATERIAL.** Holotype in relatively good condition, however the left forewing is slightly damaged.

**MATERIAL EXAMINED.**

Holotype  $\delta$ , **Peru:** Dept. Puno, 5 km E of Limbani, 3000 m,

28.iii.1987 (*Karsholt*), genitalia slide no. Diškus189 (ZMUC).

### 15. *Stigmella epicosma* (Meyrick, 1915)

(Figs 20, 21, 99–103, 211, 212)

*Nepticula epicosma* Meyrick, 1915: 255.

*Stigmella epicosma* (Meyrick); Davis, 1984: 18.

**MALE** (Fig. 20). Forewing length: 1.8–2.0 mm. Wingspan: 4.1–4.4 mm. Head: palpi brownish cream; frontal tuft yellowish or orange-yellow; collar large, creamy white, comprised of lamellar scales (see Remarks); eye-caps relatively small, whitish, distinctly glossy; antenna grey-brown to blackish, ca. 29–32 segments. Thorax and tegulae brown with gold lustre. Forewing variable, with either two or three glossy silver fasciae with some indistinct gold lustre: (1) postmedian (sometimes median), broad and slightly oblique; (2) terminal, narrow, following the wing margin just before cilia, tending to be interrupted in the middle; (3) basal, can be present or absent – if present (as in  $\delta$  shown in Fig. 21) then narrower than median fascia, if absent then forewing base is a little lighter (Fig. 20) (see Remarks). Ground colour between fasciae brown to dark brown with gold lustre. Cilia brown distally. Underside of forewing brown. Hindwing and cilia brownish to brown or grey. No androconia on hindwing or forewing. Legs predominantly darkened with brown. Abdomen grey-fusca above and below; short anal tufts fuscous; genitalia segments (predominantly valvae) visible from underside, ochreous-cream, contrasting with main colour of abdomen.

**FEMALE** (Fig. 21). Very similar to male.

**GENITALIA**  $\delta$  (Figs 99–103). Capsule 290–317  $\mu\text{m}$ . Tegumen small, caudally slightly bulged. Uncus with two well-sclerotized papillate lobes, distinctly separated by deep medial emargination. Gnathos with very long, slender, almost parallel caudal processes, narrow lateral arms and short, wide central plate, slightly emarginate anteriorly. Valva 170–195  $\mu\text{m}$ , broad, with inwardly curved and pointed apical process. Transtilla with transverse bar (which may be narrow or broad) and very broad, lobate sublateral processes. Valvae with additional slender basal connection. Ventral plate of vinculum relatively short but broad, with weakly developed and anteriorly broadly rounded lateral lobes or with well-developed triangular lobes; anterior emargination from very shallow and indistinct to semicircular. Aedeagus 195–220  $\mu\text{m}$ , with only two huge cornuti (Fig. 102). Occasionally the left cornutus may be half the length of that illustrated (see Remarks).

**GENITALIA**  $\delta$  (Figs 211, 212). Total length about 600–645  $\mu\text{m}$ . Anal papillae weakly developed, two wide but very short setose lobes. Apophyses anteriores almost straight, curved inward anteriorly. Apophyses posteriores very slender and long, their anterior ends not exceeding apophyses anteriores. Corpus bursae relatively small and narrow, no signa or pectinations visible. Accessory sac folded, not distinctly demarcated from vestibulum; ductus spermathecae membranous, except for semicircular sclerotization at a distance from accessory sac.

**BIOLOGY.** Adults collected in February, April and August.

**DIAGNOSIS.** Belongs to the *S. salicis*-group. Distinguished from all other *Stigmella* by the glossy silver fasciae of the forewing and by the presence only two, but very large, cornuti in the aedeagus. The presence of two huge cornuti in the aedeagus is also a feature of two other Neotropical species (*schoorli* and *hamata*) but these do not have glossy silver median (or postmedian) and apical fasciae on the forewing.

**DISTRIBUTION.** Peru (widely distributed, 150–4000 m).

**CONDITION OF TYPE MATERIAL.** The paralectotype ( $\delta$ ) has the wings unspread, but is in satisfactory condition; the lectotype has a broken left antenna; it and the female paralectotype have the wings crudely spread but in the latter the forewings and head scaling are abraded.

**MATERIAL EXAMINED.**

Lectotype  $\delta$ , **Peru:** Lima, 150 m ['500 ft'], viii.1914 (*Parish*), genitalia slides no. 28849  $\delta$  (BMNH), here designated.

Paralectotypes, 1 ♂, 1 ♀, data as lectotype, genitalia slide no. 28850 ♀ (BMNH).

Non-type material: **Peru**: 7 ♂, 2 ♀, Dept. Arequipa, 8 km E Arequipa, Rio Andamayo Valley, 2920 m, 7.iv.1987 (*Karsholt*), genitalia slide nos Diškus 186 ♀, Diškus 187 ♂ (ZMUC); 1 ♂, Dept. Lima, 10 km N of Oyon, Quabrada Quichas Pueblo Quichas, 4000 m, 24–26.ii.1987 (*Karsholt*), genitalia slide no. Diškus 188 (ZMUC).

**REMARKS.** The type series of three specimens (labelled as collected at 500 ft) do not have the basal fascia developed; the basal area has a stronger gold lustre, looks paler, and a few weakly silver-lustred glossy scales can be seen on one specimen. All specimens in a recently-collected series from 2920 m in Peru have a distinct glossy silver basal fascia. One (possibly aberrant) male specimen collected at 4000 m has the basal area of the forewing glossy gold, a fuscous-gold shiny collar and greyish white palpi. The genitalia of this specimen (slide no. Diškus 188, ZMUC) are typical for the species, but the left cornutus in the aedeagus is half the length of that in a normal specimen (Fig. 102 – normal). These differences in coloration and minor details of genital structure probably represent geographical variation in mountainous, dissected terrain.

### 16. *Stigmella schoorli* sp. n.

(Figs 24, 106, 107, 213, 214)

**MALE** (Fig. 24). Forewing length: 2.5–2.7 mm. Wingspan: 5.8–6.0 mm. Head: palpi cream; frontal tuft comprised of dark brown and ochre cream piliform scales; collar forming pair of broad, clearly separated tufts of cream or golden cream lamellar scales; eye-caps whitish to golden cream; antenna dark grey to blackish grey, with gold lustre, ca. 35–36 segments. Thorax, tegulae and forewing uniformly dark grey with strong bronze and gold lustre; a few scales just before forewing cilia may appear glossy white at a certain angles. Cilia grey to dark grey. Underside of forewing dark brown with light purple lustre. Hindwing and cilia grey. No androconia on forewing or hindwing. Legs cream or grey-cream, shaded laterally with blackish grey. Abdomen fuscous.

**FEMALE.** Forewing length: 2.7–2.8 mm. Wingspan: 5.8–6.5 mm. Antenna ca. 26–27 segments. Similar to male.

**GENITALIA** ♂ (Figs 106, 107). Capsule 340–364 μm long. Uncus long, well-sclerotized, with two relatively long parallel quadrate lobes, each with a few indistinct papillae; caudal emargination of uncus u-shaped. Tegumen very short, band-like. Gnathos with moderately narrow but well-sclerotized central plate and two

very long parallel posterior processes; pair of anterior extensions very small, not always distinct; lateral arms narrow and relatively short. Valva 221–232 μm long, broad, with sinuous inner side and large pointed apical process; inner lobe of valva forming broad triangular subapical extension. Transtilla with strong transverse bar and huge lobe-like sublateral processes. Ventral plate of vinculum less than half length of valva, with very shallow and broad anterior emargination; lateral lobes weakly developed, broadly rounded anteriorly. Aedeagus 232–256 μm long, without apical processes, relatively broad (99–106 μm). Vesica with very distinctive pair of very large parallel cornuti; one about 159 μm long, the other 128 μm long. Juxta triangular, membranous, indistinct, slightly bifid at apex.

**GENITALIA** ♀ (Figs 213, 214). Total length about 750 μm. S8 and T8 almost truncate caudally. Anal papillae not developed. Apophyses anteriores a little shorter than apophyses posteriores, which are slender and long (ca. 166 μm). Vestibulum narrow, membranous, folded, without pectinations or sclerites. Caudal half of corpus bursae broad and folded; anterior half comparatively small, swollen anteriorly, without visible pectinations or signa. Accessory sac well-developed, large, elongate and folded; ductus spermathecae slender, without convolutions but with an irregularly shaped sclerotization 200 μm from the accessory sac.

**BIOLOGY.** Adults collected in February.

**DIAGNOSIS.** Belongs to the *S. salicis*-group. The most distinctive feature of the species – the presence of only two very large cornuti – is shared only with the Neotropical *epicosma* and *hamata*. From the first *schoorli* may be easily distinguished by the uniformly coloured forewing, and from the second by the short and broad aedeagus, long sublateral transtilla processes, distinctly bilobed uncus, long apical process of the valva and weak anterior emargination of the vinculum. Because of the external similarities between *schoorli* and *hamata* these species may not be reliably separated except by dissection of the genitalia. However, *schoorli* differs slightly from *S. hamata* externally: specimens are distinctly smaller, the frontal tuft is a mix of dark grey and ochreous cream scales (in *hamata* the scales are uniformly coloured), the forewings are not as gold and glossy, and the hindwings are darker.

Although belonging to the same species group and occurring in the same geographical area, having very similar external features, and sharing a similar distinctive pattern of cornuti, *schoorli* and *hamata* are not phylogenetically close and represent distinct and recognizable species.

**DISTRIBUTION.** Peru (3870 m).

CONDITION OF TYPE MATERIAL. Mostly good.

MATERIAL EXAMINED.

Holotype ♂, **Peru**: Dept. Ancash, 35 km SE of Huaraz, Cerro Cahuish [Quabrada Pucavado], 3870 m, 18.iii.1987 (*Karsholt*), genitalia slide no. Diškus 200♂ (ZMUC).

Paratypes: 3♂, 5♀, data as holotype, genitalia slide nos. Diškus 201–203♂, Diškus 204–206♀ (ZMUC).

REMARKS. This species is named in honour of Dr J.W. Schoorl (Amsterdam).

### 17. *Stigmella hamata* sp. n.

(Figs 22, 108–112)

MALE (Fig. 22). Forewing length: 3.1–3.3 mm. Wing-span: 6.8–7.0 mm. Head: palpi greyish brown; frontal tuft brownish ochre, collar and eye-caps greyish cream, glossy; antenna grey with gold lustre, ca. 38 segments. Thorax, tegulae and forewing uniformly grey with strong gold lustre; a few scales just before forewing cilia may appear glossy and whitish at certain angles; cilia brownish to brownish cream at tornus. Underside of forewing grey. Hindwing and cilia brownish. No androconia on forewing or hindwing. Legs cream with shaded with brown and grey. Colour of abdomen unknown.

FEMALE. Unknown.

GENITALIA ♂ (Figs 108–112). Capsule ca. 365 µm long. Uncus long, well-sclerotized, tapered caudally, with four distinct caudal papillae. Tegumen short, bulged in the middle, lateral angles rounded. Gnathos with moderately narrow, but well-sclerotized central plate and two very long and slender parallel posterior processes; without anterior extensions; lateral arms narrow, moderately long. Valva 260–272 µm long, almost equally broad throughout length, with pair of broad, inturned apical processes. Transtilla with short transverse bar, angles rounded and slightly extended. Ventral plate of vinculum short, with v-shaped anterior emargination; lateral lobes more or less triangular, rounded anteriorly. Aedeagus 312–324 µm long, without apical processes, narrow (47–58 µm). Vesica with three horn-like cornuti; one of them very large, about 95 µm, another at apex half this length, the third shorter, often obscured by the first. Juxta membranous and indistinct, probably triangular.

BIOLOGY. Adults collected in March.

DIAGNOSIS. Belongs to the *S. salicis*-group. Characterized by the uniformly grey forewings with strong gold lustre, and aedeagus with only two large cornuti (of three). Externally resembles *schoorli* which also occurs in the Peruvian Andes. However, *hamata* is a notably larger and with a uniformly coloured ochreous

frontal tuft, stronger gold lustre of forewing, paler hindwing and very distinctive male genitalia: the uncus has four caudal papillae whereas in *schoorli* it is bilobed; the aedeagus is narrower and the valva has distinctive broad hook-shaped apical processes.

DISTRIBUTION. Peru (3240 m).

CONDITION OF TYPE MATERIAL. Specimens of the type series are well-preserved.

MATERIAL EXAMINED.

Holotype ♂, **Peru**: Dept. Cuzco, 40 km NW Sicuani, 5 km E of Laguna Pomacanchi, 3240 m, 24.iii.1987 (*Karsholt*), genitalia slide no. Diškus 199♂ (ZMUC).

Paratype ♂, **Peru**: Dept. Puno, 15 km E of Ayaviri, 1♂, 26–27.iii.1987 (*Karsholt*), genitalia slide no. Diškus 198♂ (ZMUC).

### 18. *Stigmella imperatoria* sp. n.

(Figs 23, 113–116)

MALE (Fig. 23). Forewing length: 4.1–4.3 mm. Wing-span: 9.0–9.6 mm. Head: palpi cream to greyish or grey, distally and on underside usually fuscous; frontal tuft very large, comprised of cream or pale ochreous and numerous dark brown piliform scales, the latter mostly central; collar of mainly cream or greyish cream lamellar scales, additionally with some overlapping piliform scales; eye-caps small, almost covered by frontal tuft, glossy greyish cream with a few piliform scales anteriorly; antenna blackish brown with gold and purple lustre, ca. 54 segments. Thorax, tegulae and forewing uniformly brown with strong copper-gold lustre, no purple. Cilia brown. Underside of forewing dark grey-brown. Hindwing and cilia brown. No androconia on forewing or hindwing. Legs cream with fuscous brown or fuscous grey lateral shading. Abdomen grey-brown on upperside, yellowish cream on underside; genital segments paler but not contrasting significantly with main colour of abdominal sternites.

FEMALE. Unknown.

GENITALIA ♂ (Figs 113–116). Capsule 669–685 µm long. Uncus unusually long, very strongly sclerotized laterally, slightly broadened at apex and with two large lateral papillae and two weakly-developed central papillae; caudal emargination of uncus (usually present in related species) absent. Tegumen very short, simple, band-shaped. Gnathos with narrow central plate and two very long, almost parallel posterior processes with apices turned outwards; anterior extensions of gnathos undeveloped, but anterior margin with shallow central emargination; lateral arms narrow and moderately long. Valva ca. 434 µm long, relatively narrow and of uniform breadth, with large pointed inturned apical process; inner lobe of valva forming broad triangular subapical extension. Transtilla with short and rather

slender transverse bar characterized by pointed and anteriorly-directed angles, but without sublateral processes. Ventral plate of vinculum large, with v-shaped anterior emargination and large, anteriorly rounded lateral lobes. Aedeagus extremely long (756–767  $\mu\text{m}$ ) and slender (ca. 92–100  $\mu\text{m}$ ), without apical processes. Vesica with a apical group of about 10 large spine-like cornuti and with a long basal band of mainly very tiny needle-like or spine-like cornuti mixed with just a few larger ones. Juxta a simple, weakly sclerotized plate broadening towards caudal end.

**BIOLOGY.** Adults collected in February.

**DIAGNOSIS.** Belongs to the *S. salicis*-group. Easily distinguishable from all currently known representatives of this group by the distinctive long and narrow uncus and aedeagus, and also by the copper-gold lustre of forewing. The configuration of the cornuti in the aedeagus is diagnostic and distinctive.

**DISTRIBUTION.** Peru (4100 m).

**CONDITION OF TYPE MATERIAL.** Specimens, including the holotype, are well-preserved; the hindwings of one paratype have been broken off and placed in a small plastic capsule below the specimen.

**MATERIAL EXAMINED.**

Holotype  $\delta$ , **Peru**: Dept. Ancash, 35 km SE of Huaraz, Cerro Cahuish [Quabrada Pucavado], 4100 m, 15–18.ii.1987 (*Karsholt*), genitalia slide no. Diškus195  $\delta$  (ZMUC).

Paratypes, 2  $\delta$ , data as holotype, genitalia slide no. Diškus196  $\delta$  (ZMUC).

### 19. *Stigmella olyritis* (Meyrick, 1915)

(Figs 28, 131, 132)

*Nepticula olyritis* Meyrick, 1915: 256

*Stigmella olyritis* (Meyrick); Davis, 1984: 18.

**MALE** (Fig. 28). Forewing length: 1.7–1.9 mm. Wing-span: 3.8–4.2 mm. Head: palpi brownish white; frontal tuft white; collar rather indistinct, white, comprised of piliform scales; eye-caps small, whitish, lustrous; antenna brown. Thorax and tegulae brown. Forewing irrorated with grey-brown, brownish cream and cream scales; basal half of forewing more smoothly scaled than apical half, where pale scales are especially abundant on costal and tornal margins. Fascia absent. Cilia brownish to yellowish cream, brown at tornus. Under-side of forewing brown. Hindwing and cilia brown. No androconia on hindwing or forewing. Legs grey-brown. Abdomen brown.

**FEMALE.** Similar to male.

**GENITALIA**  $\delta$  (Figs 131, 132). Capsule 250–256  $\mu\text{m}$ .

Uncus almost semicircular, with numerous caudal papillae. Tegumen short, simple, anteriorly well-sclerotized and sinuous. Gnathos with moderately developed central plate and very large convergent posterior processes; lateral arms small. Valva 158–160  $\mu\text{m}$  long, tapering, with two slender and close-set apical spine-like processes. Transtilla with slender but well-sclerotized transverse bar; sublateral corners of transtilla extended into weakly demarcated triangular processes. Vinculum long with small triangular and anteriorly pointed lateral lobes; anterior emargination shallow, broadly semicircular. Aedeagus long, about 280  $\mu\text{m}$ . Vesica with numerous dense spine-like cornuti mostly collected into one band, additionally with very tiny spine-like or triangular cornuti distributed around the main band. Juxta present, a simple quadrate plate.

**GENITALIA**  $\text{♀}$  (Fig. 215). Total length 958–960  $\mu\text{m}$ . Narrowly constricted S8 and T8 forming a distinctly slender and rather long ovipositor. Apophyses posteriores very slender and long (320–325  $\mu\text{m}$ ), slightly divergent at anterior end. Apophyses anteriores slightly longer than apophyses posteriores, very slender in anterior half. Vestibulum narrow and folded. Caudal part of corpus bursae broad and strongly folded, remaining anterior region very large, spheroidal or near-spherical, with inverted U-shaped signum with numerous pectinations along it (see Remarks). Accessory sac almost spherical, small but well-developed; ductus spermathecae helical with about 8.5 turns.

**BIOLOGY.** Adults collected in August.

**DIAGNOSIS.** Belongs to the *salicis* species-group. The caudally almost rounded uncus together with the very long, close-set gnathos processes, the short sublateral processes of the transtilla, long vinculum and numerous subequal cornuti unequivocally distinguish this species from all other members of the group. The external features of *olyritis* are unfortunately much less helpful for immediate diagnosis.

**DISTRIBUTION.** Peru.

**CONDITION OF TYPE MATERIAL.** This species was described by Meyrick from six specimens (3  $\delta$ , 3  $\text{♀}$ ); all are in unsatisfactory condition, badly pinned and somewhat abraded.

**MATERIAL EXAMINED.**

Lectotype  $\delta$ , **Peru**: Lima, 150 m ['500 ft'], viii.1914 (*Parish*), genitalia slide no. 28851  $\delta$  (BMNH), here designated.

Paralectotypes: 2  $\delta$ , 3  $\text{♀}$ , data as holotype, genitalia slide no. 28852  $\text{♀}$  (BMNH).

**REMARKS.** The signum in the female genitalia does not look convincingly homologous with that of Holarctic representatives of the group; it is similar in

shape but not in structure, being comprised of dense pectinations.

### The *eurydesma* group

This group is newly established in the Nepticulidae for species with a unique autapomorphic configuration of gnathos and uncus: the gnathos has a pair of short, lateral, horn-like, caudally directed processes close up against the uncus, and a reduced central plate; the processes are joined by a weakly sclerotized, almost invisible anterior connection. The uncus is a small quadrate plate with or without a caudal emargination, partially occluded by the gnathos and the lateral regions difficult to view; the base appears to be partly fused with the bases of the gnathos processes. Species of this group are also distinguished by the valva being broad, and tapered towards the apex, with a well-developed pointed apical process; the aedeagus has numerous fine spine-like cornuti; a juxta, as far as is known, is always present and generally plate-shaped. The forewing is fuscous with a distinct median or postmedian fascia.

The group slightly resembles a few Nearctic *Stigmella* (such as *tiliella* Braun) in a few aspects of morphology but differs in the partially reduced gnathos and more elaborated uncus. A close phylogenetic relationship between these species and the *eurydesma*-group is possible, but further investigation is needed to support this. The group is possibly endemic to the Neotropical region.

### 20. *Stigmella eurydesma* (Meyrick, 1915)

(Figs 25, 128–130)

*Nepticula eurydesma* Meyrick, 1915: 255

*Stigmella eurydesma* (Meyrick); Davis, 1984: 18.

**MALE** (Fig. 25). Forewing length: about 1.6 mm. Wingspan: 3.6–3.7 mm. Head: palpi cream; frontal tuft ochreous orange; collar distinctly broad, composed of pale cream lamellar scales; eye-caps pale cream; antenna brown to fuscous brown, ca. 20 segments. Thorax and tegulae dark brown. Forewing fuscous brown with some purplish lustre which is most distinctive apically; fascia median – postmedian, very broad, pale cream, tending to broaden dorsally. Cilia fuscous or brown. Underside of forewing dark brown. Hindwing lanceolate, brown, cilia brown to grey-brown. No androconia on forewing or hindwing. Legs mainly ochreous cream shaded with grey-brown. Abdomen fuscous brown, genital segments dark grey brown, very weakly contrasting in colour with remainder of abdomen.

**FEMALE**. Forewing length: about 1.7 mm. Wingspan: about 3.8 mm. Number of antennal segments unknown.

Forewing fascia usually slightly broader than in males, distinctly broadening dorsally. Hindwing brown to pale ochre-brown. Abdomen fuscous brown on upperside, grey-brown to ochre-brown on underside. Otherwise as male.

**GENITALIA** ♂ (Figs 128–130). Capsule 264 µm long. Uncus small, with two well-sclerotized, quadrate lobes. Tegumen short, well-sclerotized posteriorly. Gnathos comprising two lateral horn-like processes, so strongly sclerotized as to appear black in a preparation, and with very weakly developed, almost membranous anterior transverse bar (probably representing a remnant of central plate); posteriorly directed processes of gnathos very close to uncus lobes. Valva 176 µm, pointed and strongly sclerotized apically, but very weakly sclerotized and specialized in basal one-third. Transtilla with well-developed sublateral processes and narrow, but well-sclerotized transverse bar; transverse bar connects sublateral processes not at their anterior extremities, as is usual in *Stigmella*, but half way along the length of the processes. Vinculum short, with shallow anterior emargination and small lateral lobes. Aedeagus ca. 250 µm long, without apical processes. Vesica with numerous more or less equally long spine-like cornuti concentrated towards apex and numerous very tiny spine-like cornuti concentrated towards base. Juxta present, represented by a simple plate narrowed at middle between weakly sclerotized bases of valvae.

**GENITALIA** ♀. Not studied because of very poor condition of available material (see Remarks).

**BIOLOGY**. Adults collected in April.

**DIAGNOSIS**. Externally this species could be confused with other *Stigmella* species with a white postmedian fascia. However, the shape of gnathos, in which the central plate is greatly reduced separates the species from all currently known representatives of *Stigmella* except for the related *albilamina* and *fuscilamina* from which it differs in the by weakly sclerotized bulged inner side of the valva and by the absence of very large or plate-shaped cornuti.

**DISTRIBUTION**. Guyana.

**CONDITION OF TYPE MATERIAL**. Although the wings of the lectotype are not well spread and the specimen is slightly rubbed, structures and forewing pattern are more or less well-preserved. The condition of the paralectotypes is very poor. One male is in a gelatine capsule (head structures and wing pattern well-preserved); two female specimens lack the head and are very poorly pinned; the remaining female has a head, but the abdomen is lacking.

**MATERIAL EXAMINED**.

Lectotype ♂, **Guyana**: Georgetown, iv.1913 (*Parish*),

genitalia slide no. 28842 (BMNH), here designated.

Paralectotypes: 1 ♂, 3 ♀, data as lectotype (BMNH).

REMARKS. No material additional to Meyrick's type series is known. The female genitalia of specimens from the type series have been left undissected as they are extremely fragile and very poorly pinned. We believe that removal of an abdomen cannot be accomplished without very high risk of damage. This is not commensurate with the potential gain in information. Although *Acalyptis* females do show considerable interspecific variation in genital morphology, we do not expect great differences between those of *eurydesma*, *albilamina* and *fuscilamina*. Studies of females of the latter two (which we cannot separate or unequivocally associate with males) show that the abdominal tip forms a short but strongly sclerotized ovipositor, both apophyses are long and slender, the accessory sac is oval and neatly folded, the folded part of the bursa copulatrix is long, slender and densely folded, and the corpus bursae proper is small with indistinct spinose pectinations.

## 21. *Stigmella albilamina* sp. n.

(Figs 26, 63, 117–122)

MALE (Fig. 26). Forewing length: 1.9–2.2 mm. Wing-span: 4.3–5.0 mm. Head: palpi white; face from wholly white to brown to blackish closer to tuft; frontal tuft pale to dark ochre, large; collar large, creamy white, comprised of lamellar scales; eye-caps creamy white, large; antenna black, ca. 23 segments. Thorax and tegulae brown-black. Forewing brown-black to black, occasionally dark brown, with weak, occasionally distinct, purplish lustre and postmedian, occasionally distinctly postmedian, whitish fascia; proximal margin of fascia usually transverse, sometimes slightly concave; distal margin oblique and therefore fascia usually broader on dorsum; fascia occasionally narrow. Cilia grey-brown, paler distally. Underside of forewing fuscous with weak purplish lustre. Hindwing and cilia from brown to grey-brown. Basal one-half to two-fifths of hindwing with grey androconial scales which are broad but short, overlapping nearly one-fifth length of cilia on dorsal margin, however in most specimens they are indistinct or indiscernible. No androconia on forewing. Legs pale cream on underside, usually blackish or grey on upperside or laterally. Abdomen brown-black on upperside but with distinctly contrasting cream genital segments at tip; underside cream, at least in posterior half, genital segments (valvae) visible as two broad rounded or triangular plates wholly covered with pale cream scales (in *fuscilamina* they are predominantly fuscous, in *eurydesma* – grey-brown).

FEMALE. Not studied (see Remarks).

GENITALIA ♂ (Figs 117–122). Capsule 268–270 µm.

Uncus a small quadrate plate, laterally strongly sclerotized with slightly extended corners, and with medial emargination. Gnathos with pair of short, blunt, lateral caudally-directed processes very close to uncus; processes well-sclerotized (but not black as in *fuscilamina*); central plate of gnathos reduced, lateral processes jointed by weakly sclerotized, almost invisible anterior connection. Valva 195 µm long, relatively broad, with sclerotized inner margin and slightly turned apical process. Transtilla with broad sublateral process and transverse bar. Juxta strongly sclerotized, simple, quadrate, always distinct between valvae. Ventral plate of vinculum very small, narrowed in the centre, with very short and minute pointed lateral lobes; anterior emargination very shallow, broad and slightly rounded. Aedeagus 305–330 µm, without apical carinae; vesica with numerous small and only weakly sclerotized spine-like cornuti and one huge horn-shaped cornutus (occasionally two); oval sclerite (present in *fuscilamina*) absent.

BIOLOGY. Adults collected in April; very common.

DIAGNOSIS. The shape of gnathos, with the central plate strongly reduced, separates this species from all *Stigmella* except the related *eurydesma* and *fuscilamina*. From these two *albilamina* differs in the degree of sclerotization of the gnathos which looks dark, but not black as in *eurydesma*, in the short lateral lobes of the vinculum, and the presence of one huge cornutus in addition to numerous weakly developed spine-like cornuti (in *eurydesma*, and particularly in *fuscilamina* they are bigger and more strongly sclerotized). From *eurydesma* this species differs also in the well sclerotized inner margin of the valva, the shape of the transtilla and juxta (not narrowed in the middle); from *fuscilamina* it differs in that the vinculum lobes are much shorter, the inner surface of the valva is less sclerotized, there is no plate-like cornutus (and there is no huge horn-like cornutus in *fuscilamina*), the juxta is distinctive, the uncus has a medial emargination and produced corners, there are sometimes visible androconia on the hindwing, and the genital segments are pale cream, the valvae appearing as a pair of whitish lamina (fuscous in *fuscilamina*).

DISTRIBUTION. Belize.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29113 (BMNH).

Paratypes, 58 ♂, data as holotype, genitalia slide nos 29112 (BMNH), AD0306 (VPU) (BMNH (49); VPU (9)).

REMARKS. The male genitalia of several additional specimens have been studied as temporary preparations in glycerin – these are not listed above. There is

what we presume to be a long mixed series of female *albilamina* and *fuscilamina* in BMNH, but at present we are unable to satisfactorily distinguish two species among them or to correctly associate females with males. Until this species is reared the identity of the female remains problematic and we have not described the genitalia. [See Remarks for *eurydesma*.]

*S. albilamina* and *fuscilamina* are closely related sister-species occurring in the same habitat and having coincident flight times. Nevertheless they, or at least the males, are morphologically distinct. Light trapping in Belize in April 1998 showed *albilamina* to be somewhat more common than *fuscilamina*.

## 22. *Stigmella fuscilamina* sp. n.

(Figs 27, 123–127)

MALE (Fig. 27). Forewing length: 2.0–2.2 mm. Wing-span: 4.8–5.0 mm. Head: palpi white, occasionally shaded laterally with black; face brown to black, but usually white close to tuft; frontal tuft pale to dark ochre, large; collar large, creamy white, comprised of lamellar scales; eye-caps creamy white, large; antenna black, sometimes pale at apex or underside, ca. 23–26 segments. Thorax and tegulae brown-black. Forewing brown-black to black with weak purplish lustre and with median to postmedian whitish fascia; proximal margin of fascia transverse, the distal margin oblique, thus fascia usually broader at dorsum; fascia occasionally narrow. Cilia grey-brown, paler distally, sometimes almost cream. Underside of forewing fuscous with weak purplish lustre. Hindwing and cilia brown to grey-brown. No androconia on hindwing or forewing. Legs whitish cream on underside, usually black or grey-brown on upperside and laterally. Abdomen brown-black on upperside and underside; genitalia segments visible on underside as two broad rounded or broadly triangular plates, valvae covered with brown-black scales, cream only at apex (in contrast to *albilamina*, where the entire valva is covered with whitish scales).

FEMALE. Not studied (see Remarks).

GENITALIA ♂ (Figs 123–127). Capsule 268–270 µm. Uncus a small quadrate plate with rounded corners and without caudal emargination. Tegumen small, band-shaped. Gnathos with two short, horn-like, caudally-directed lateral processes close-set to uncus; processes very strongly sclerotized, appearing black in preparations, overlapping lateral margins of uncus; central plate of gnathos reduced, lateral horn-like processes joined by weakly sclerotized, almost invisible anterior connection. Valva 178–195 µm long, relatively broad, with distinctly sclerotized inner margin, apical process curved inward. Transtilla strongly and conspicuously sclerotized laterally, with moderately

long and slender sublateral process and long transverse bar. Juxta barely visible, represented by a membranous and caudally bilobed plate. Ventral plate of vinculum relatively small, with long, slender, spine-like lateral lobes; anterior emargination quadrate. Aedeagus 305–317 µm; vesica with numerous moderately large and strongly sclerotized spine-like cornuti and large oval plate-like sclerite.

BIOLOGY. Adults collected in April.

DIAGNOSIS. The shape of the gnathos, with the central plate strongly reduced, separates this species from all currently known representatives of *Stigmella* except related *eurydesma* and *albilamina*. From these two it differs in the long lateral lobes of the vinculum, and the presence of a big plate-like cornutus in addition to numerous well-developed spinose cornuti (in *eurydesma* all cornuti are spinose, in *albilamina* they are weakly developed). It differs also in the sclerotized inner side of the valva, and almost invisible membranous juxta. It differs from *eurydesma* in the shape of the transtilla and the almost straight caudal margin to the juxta; from *albilamina* it differs in the vinculum lobes being three times as long, the black gnathos, significantly more strongly sclerotized inner side of the valva, the absence of a huge horn-like cornutus and the remaining cornuti being bigger and more strongly sclerotized. The uncus in *fuscilamina*, in contrast to *albilamina*, is not emarginated caudally and has rounded, rather than sharp corners; there are no androconia on the hindwing whereas these are sometimes visible in *albilamina*. The genital segments are fuscous-scaled – if a specimen is examined without dissection there are two clearly fuscous laminae visible – these are the valvae. In *albilamina* the valvae are cream.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. Most specimens are well-preserved.

MATERIAL EXAMINED.

Holotype, ♂, **Belize**: Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29110 (BMNH).

Paratypes, 18 ♂, data as holotype, genitalia slide nos 28111 (BMNH), AD0305 (VPU) (BMNH (12); VPU (6)).

REMARKS. The male genitalia of several additional specimens have been studied as temporary preparations in glycerin – these are not listed above. Although we have what we take to be a mixed series of females of this species and *albilamina* we are unable to differentiate them or associate them with males so we have not described the genitalia. [See also Remarks for *eurydesma*.]



**Species unattributed to a group****23. *Stigmella gossypii*** (Forbes & Leonard, 1930)

(Figs. 29, 133, 134)

*Nepticula gossypii* Forbes & Leonard, 1930: 149.*Stigmella gossypii* (Forbes & Leonard); Newton & Wilkinson, 1982: 404, 405, figs 32, 33; Davis, 1984: 18.

MALE (Fig. 29). [Adapted from Newton & Wilkinson, 1982.] Forewing length: 3.0 mm. Wingspan: about 6.5 mm. Head: palpi whitish; frontal tuft ochre; collar white; eye-caps creamy white, lustrous; antenna dark brown, number of segments unknown. Thorax and tegulae grey with metallic lustre. Forewing dark brown with purple and silver lustre, with shiny gold antemedian fascia and narrower, shiny silver postmedian fascia. Cilia greyish with metallic grey sheen, contrasting with row of pale wing scales. Hindwing lanceolate, grey, cilia shiny metallic grey. No androconia are described for this species (see Remarks). Legs brown, shiny metallic grey on lower surface. Abdomen dark brown on upperside, shiny metallic grey on underside.

FEMALE. Similar to male, but tending to be a little larger (forewing about 3.0-3.2 mm) (Newton & Wilkinson, 1982).

GENITALIA ♂ (Figs 133, 134). [Adapted from Newton & Wilkinson, 1982.] Capsule ca. 228 µm long. Uncus quadrate, corners slightly extended and pointed. Tegumen a small transverse bar. Gnathos broad U-shaped with a narrow transverse bar, very tiny anterior processes and long slender posterior processes. Valva 146 µm long, gradually narrowed towards apex and bifid apically. Transtilla with well-developed sublateral processes and narrow transverse bar, which is not fused in the middle. Vinculum relatively small with distinct pointed lateral lobes; anterior emargination semicircular. Juxta a trapezoidal membranous plate, broadening slightly towards caudal end. Aedeagus 230 µm long, without apical processes. Vesica with very numerous and very small spinose cornuti.

GENITALIA ♀ [Adapted from Newton & Wilkinson, 1982 and their fig. 33.] Total length 338 µm. S8 moderately broad. Anal papillae weakly developed, very short and broadly rounded. T8 rounded posteriorly. Apophyses posteriores long and slender (ca. 64 µm). Apophyses anteriores slender and almost as long as posterior ones. Vestibulum membranous, without scobination. Caudal part of corpus bursae relatively narrow, with few very indistinct comb-like pectinations;

remaining large and ovoid, scobination rather indistinct and represented by numerous comb-like pectinations. Accessory sac large, almost two-fifths length of corpus bursae, slightly folded transversely; ductus spermathecae slender and probably not convoluted.

BIOLOGY. According Forbes & Leonard (1930) larvae (sometimes in great number) mine leaves of *Gossypium barbadense*, occasionally *G. hirsutum*. Egg on underside of leaf, in a fork of small leaf-veins. Mine slender, sinuous, mainly on underside of leaf, more than 25 mm in straightened length. Frass granular, deposited in arcuate waves in first half of mine, in a continuous line in latter half. Mines on a single leaf may cross and anastomose frequently. Mines are almost invisible if the upperside of fresh leaves is examined. When leaves become old and dry the mines become whitish in marked contrast to the dark leaf surface. (Forbes & Leonard, 1930; Newton & Wilkinson, 1982). Larva green with pale brownish head, 2.5 mm. Cocoon white, oval, flattened, strongly narrowed to posterior end, ca. 1.8 × 1.0 mm, on underside of leaf. Forbes & Leonard, (1930) suggested that there was only one generation per year but the voltinism of this species is not proven. Adults fly in late March and April.

DIAGNOSIS. Slightly resembles a few Nearctic *Stigmella* species (*prunifoliella* (Clemens), *ceanothi* (Braun), *rhoifoliella* (Braun), *heteromelis* Newton & Wilkinson, *diffasciae* (Braun)) which also possess a broad U-shaped gnathos. However, *gossypii* differs from all similar species in the combination of distally divided valva, slender gnathos process, long pointed lobes of vinculum and two broad shiny forewing fasciae, the proximal fascia gold and the distal one silver.

DISTRIBUTION. Puerto Rico; USA (Florida).

MATERIAL EXAMINED.

None. The holotype (♀) and 6 paratypes are deposited in USNM and were studied by Newton & Wilkinson (1982); they were not re-examined by us.

**24. *Stigmella kimae* sp. n.**

(Figs 30, 135-138)

MALE (Fig. 30). Forewing length: about 1.7 mm. Wingspan: about 4.2 mm. Head: palpi cream; frontal tuft and eye-caps almost unicolorous, pale cream; collar tending to be a little darker, but still whitish; antenna dark brown, about 26 segments. Thorax, tegulae and forewing blackish brown with gold gloss and some greenish and purple lustre. Single median-postmedian fascia of forewing snow-white. Cilia brownish, well-defined at apex by row of brown lamellar wing scales. Underside of forewing fuscous. Hindwing and cilia grey. No androconia visible on forewing or hindwing. Legs ochreous grey, shaded

fuscous. Abdomen relatively small, intense fuscous on upperside and underside, genital segments (valval lobes) small, brownish cream, contrasting in colour with remainder of abdomen.

FEMALE. Unknown.

GENITALIA ♂ (Figs 135–138). Capsule 233–252  $\mu\text{m}$  long. Uncus with quadrate lateral lobes. Tegumen band-like. Gnathos broad U-shaped, with long sinuous posterior processes connected via slender but long transverse bar (central plate); anterior processes of gnathos very short, slightly bent inwards. Valva ca. 146  $\mu\text{m}$  long, oval, with very short almost blunt apical process, which is only weakly separated from bulged inner lobe of valva. Transtilla with short and slender sublateral processes and long slender transverse bar. Vinculum very short, without anterior emargination or lateral lobes. Aedeagus 287–296  $\mu\text{m}$  long, rather broad (ca. 110  $\mu\text{m}$  at broadest point), without apical processes. Vesica with numerous tiny spine-like cornuti and an apical group of about five large horn-like cornuti.

BIOLOGY. Adults collected in April.

DIAGNOSIS. Related to the Nearctic *tiliella* (Braun), but differing in the snow-white forewing fascia (shiny silver in *tiliella*), paler hindwing, whitish frontal tuft (ochreous in *tiliella*); the male genitalia primarily differ in the presence of sublateral processes on the transtilla and the single cluster of long horn-like cornuti in aedeagus. There are no other species closely related to *kimae*. See Remarks.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The wing pattern in the holotype is well-preserved and not abraded, but the specimen is badly pinned and very fragile.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29118 (BMNH).

REMARKS. *Stigmella kimae* and the Nearctic *tiliella* (Braun) represent two close and distinctive species among other *Stigmella*: both have rounded valvae, the gnathos broadly U-shaped, the uncus with quadrate well-separated lobes, very short vinculum, and the aedeagus with one or two apical clusters of spine-like cornuti. The relationships of the two are otherwise obscure; they might be related to the Palaearctic *S. prunetorum* species-group or to the widely distributed *luteella* or *ultima* species-groups. The discovery of further related species could prompt the recognition of a separate species-group to contain these distinctive taxa. *Stigmella tiliella* is known from Ohio and Kentucky (USA) and is a bivoltine leaf-miner of *Tilia americana* producing a long linear mine with a tendency towards a spiral form; frass is deposited

irregularly across the entire breadth of the mine in the first four-fifths but as a dense, central line in the terminal portion (Newton & Wilkinson, 1982).

## 25. *Stigmella plumosetaeella* Newton & Wilkinson, 1982

(Figs 31, 144, 145, 216)

*Stigmella plumosetaeella* Newton & Wilkinson, 1982: 455–456.

MALE (Fig. 31). Forewing length: 1.6–1.8 mm. Wingspan: 3.4–3.9 mm. Head: palpi cream to greyish; frontal tuft pale orange to pale ochreous; collar large, clearly divided into two lateral tufts of lamellar scales, cream or yellowish cream; eye-caps yellowish cream to shiny white (see Newton & Wilkinson, 1982: 455); antenna ochreous cream to brownish, ca. 27–28 short segments. Thorax and tegulae dark brown. Forewing base and apical area beyond fascia brown to dark brown or occasionally to orange-ochre or ferruginous; single median fascia very broad, gradually broadening towards dorsal margin, yellowish or yellowish cream. Cilia and some lamellar wing scales before cilia yellowish or yellowish cream. Underside of forewing grey to brown with some purple and some weak green lustre. Hindwing and cilia brownish or grey, sometimes even smooth cream, depending upon illumination and angle of view. No androconial patches visible on forewing or hindwing. Legs cream with brown shading laterally. Abdomen brownish or brownish cream on upperside, cream or yellowish cream on underside; distinct anal tuft cream, distinct; genital segments not contrasting in colour with rest of abdomen.

FEMALE. Antenna ca. 19–21 segments; otherwise as in male (including the lustre of the forewing underside).

GENITALIA ♂ (Figs 144, 145). Capsule 316–331  $\mu\text{m}$  long. Uncus large, rounded caudally, with small caudal emargination in centre or deeply bilobed (see Newton & Wilkinson, 1982: 455, fig. 82). Tegumen small, band-shaped. Gnathos with two long and slender posterior processes connected via slender and long transverse bar (central plate) and short anterior processes which may be rather broad and triangular. Valva 209–220  $\mu\text{m}$  long, reaching well beyond uncus, with two pointed apical lobes and with long plumose scales in apical half. Transtilla with distinct, lobate triangular sublateral processes and transverse bar which is not fused in the middle. Vinculum broad, almost trapezoidal, without anterior emargination or lateral lobes; if anterior margin concave then only very slightly so. Aedeagus 220–268  $\mu\text{m}$  long, gradually or abruptly broadened in apical two-fifths, without apical processes. Vesica with numerous tiny spine-like cornuti at

apex of aedeagus. Juxta absent, but there are small membranous lateral lobes on aedeagus.

**GENITALIA ♀** (Fig. 216). Total length 562–645 µm. Abdominal tip broadly rounded. Anal papillae undeveloped. Apophyses posteriores long (ca. 116 µm) and slender. Apophyses anteriores half as long, slender in anterior one-quarter to one-third. Vestibulum broad and wrinkled. Caudal part of corpus bursae very slender, slightly folded; remaining larger part of corpus bursae relatively small, subspherical, entirely or almost entirely lined with tiny pointed spines. Accessory sac (according to Newton & Wilkinson, 1982) large and covered with small denticles, but in Mexican specimens an accessory sac is either absent or indiscernible, and the ductus spermathecae is long, slender and sinuous.

**BIOLOGY.** Adults collected in July and August.

**DIAGNOSIS.** Externally and in features of the male genitalia this is a very distinctive species, characterized by the broad cream forewing fascia, relatively slender, apically split valvae with very long plumose setae, laterally rounded uncus, almost square ventral plate of the vinculum and apically broadened aedeagus with numerous very tiny cornuti. The presence of plumose setae on the valva suggests a possible affinity with the Neotropical *S. barbata* or with some Nearctic representatives of the *Stigmella saginella*-group (see Newton & Wilkinson, 1982). However, the specialized shape of the valva, transtilla, uncus and apically broadened aedeagus isolate *plumosetaeella* from these taxa.

**DISTRIBUTION.** USA (Arizona); Mexico.

**CONDITION OF TYPE MATERIAL.** The holotype male and paratype female were deposited in ANS following their description and illustration by Newton & Wilkinson (1982); we did not re-examine them.

**MATERIAL EXAMINED.**

12♂, 7♀, **Mexico:** 4 and 6 miles S of C. Victoria, 6.viii.1963 (*Duckworth & Davis*), genitalia slide nos Diškus004♂, Diškus005♂, Diškus006♀ (USNM).

**REMARKS.** We follow Newton & Wilkinson (1982) in regarding this species as occupying a very isolated taxonomic position. However, further detailed revision of the Nearctic *saginella*-group may indicate relationship between *plumosetaeella*, *barbata* (below) and a few Nearctic species currently belonging to the *saginella*-group.

**26. *Stigmella barbata* sp. n.**

(Figs 32, 139–143)

**MALE** (Fig. 32). Forewing length: 1.9–2.0 mm. Wingspan: 4.4–4.5 mm. Head: palpi cream; frontal tuft brown; collar and eye-caps whitish; antenna brown, ca.

22–23 segments. Thorax and tegulae brown. Forewing brown with some indistinct golden lustre; a few sparse brownish cream scales at apex of forewing and numerous long thickened brown androconial scales on the dorsal margin overlapping hindwing. Cilia and underside of forewing brown. Hindwing brown, with long and relatively broad brown androconial scales in basal two-thirds overlapping one-third length of scales of cilia; cilia brown. Legs cream with brown shading. Abdomen grey-brown on upperside, brownish cream on underside, a distinctive pair of relatively long cream anal tufts directed anteriorly; genital segments grey-cream, not contrasting in colour with ventral surface of abdomen.

**FEMALE.** Unknown.

**GENITALIA ♂** (Figs 139–143). Capsule ca. 244 µm long. Uncus distinctly bilobed, lobes triangular, turned slightly outwards. Tegumen band-shaped, slightly bulged caudally. Gnathos with two slender and relatively long posterior processes connected via slender transverse bar (central plate); anterior processes half or one-third length of posterior processes; lateral arms slender, distinct, almost same length as anterior processes. Valva about 195 µm long, with broad, inward-turned apical process and broad, bulged inner lobe; inner side of apical process with long plumose setae. Transtilla with short triangular sublateral processes and very slender transverse bar, which does not fuse in the middle. Vinculum very short, ventral plate trapezoidal, without anterior emargination or lateral lobes. Aedeagus about 170 µm long, without apical processes, simple, slightly swollen at base. Vesica with two strongly sclerotized apical spine-like cornuti which appear fused at their bases, and a few tiny weakly sclerotized cornuti; ventral side of aedeagus with narrow band-shaped sclerotization just beyond middle of tube, apex of aedeagus finely and bluntly serrated. Juxta broad at base, inconspicuous caudally.

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** A remarkable species characterized by elongate, plumose setae on the apical process of the distinctly rounded valva; a brown frontal tuft, long androconial scales on the forewing dorsum and hindwing anal margin. The plumose valval scales and similarities in the shape of the uncus, transtilla, aedeagus and valva suggest this species may possibly be attributed to the Neotropical *saginella*-group (originally designated by Wilkinson & Scoble, 1979). However, the strongly bulged inner lobe of the valva, and the slender and well-separated caudal processes of the gnathos make the diagnosis of *barbata* uncomplicated. *S. barbata* differs from *plumosetaeella* (which was not included in the *saginella*-group by Newton & Wilkinson (1982)) in the brown forewing, the simple aedeagus, bulged valva and well-separated uncus lobes.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The single specimen is relatively well-preserved but the frontal tuft is abraded.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29137 (BMNH).

REMARKS. In spite of similarities to the Nearctic *saginella*-group, this species cannot be attributed to this group without detailed revision of all the Nearctic representatives.

## 27. *Stigmella pruinosa* sp. n.

(Figs 33, 34, 146, 147, 218)

MALE (Figs 33[ right side], 34). Forewing length: 1.5–1.7 mm. Wingspan: 3.3–3.7 mm. Head: palpi cream; frontal tuft usually pale yellow to yellow-orange, occasionally pale orange-ochre; collar whitish or pale cream; eye-caps pale cream to (occasionally) yellow-cream; antenna brown to dark brown (occasionally pale brown) but brownish cream or whitish on basal part of flagellum and underside, ca. 19–20 segments. Thorax and tegulae brown, sometimes dark brown. Forewing relatively narrow, brown to dark brown with weak gold (not in all examples), occasionally bronze lustre; sometimes with very weak purplish lustre. Forewing with very numerous long and slender grey-white androconial scales on upperside, densely covering entire median area of wing and extending across the width; size of androconial patch may vary considerably from one-third to one-half length of forewing, but base and apex of wing always lack androconia. Cilia brown, usually paler at tips. Underside of forewing brownish, without androconial scales. Hindwing brownish (or grey) with very distinct androconial patch on basal one-third to two-fifths (Fig. 34); oval androconial patch comprised mainly of deep black scales, but with numerous elongate whitish androconia scattered along middle of patch. Black and whitish androconial scales overlap cilia for one-fifth of their length. Cilia brown. Underside of hindwing brown, without androconia. Legs cream with brown to dark grey lateral shading. Abdomen brown to dark brown on upperside, brownish cream on underside; anal tufts indistinct, cream; scaling of genital segments (mainly valvae) brownish cream.

FEMALE (Fig. 33, left side). Antenna ca. 18 segments. Forewing entirely brown, without greyish white androconial scales; generally paler than in males, but with some overlap – a few females are darker than the palest males. Hindwing without androconial patch, entirely brown. Otherwise similar to male.

GENITALIA ♂ (Figs 146, 147). Capsule 230 µm long. Uncus with two strongly sclerotized, quadrate lateral lobes and U-shaped caudal emargination between the lobes. Tegumen band-shaped, slightly extended caudally. Gnathos with two posterior and two anterior processes on well-developed relatively broad transverse bar (central plate); anterior processes one-third longer than posterior ones and twice as widely spaced; lateral arms short. Valva ca. 122 µm long, gradually narrowed posteriorly, with small pointed, inturned apical process. Transtilla with well developed transverse bar, rounded laterally, without sublateral processes. Vinculum relatively large, with broad emargination anteriorly and with triangular lateral lobes. Aedeagus very large, considerably longer than genital capsule (ca. 307 µm), without apical processes, slightly bent at middle. Vesica with numerous tiny spine-like cornuti and long row of considerably larger cornuti, the latter weakly sclerotized and inconspicuous.

GENITALIA ♀ (Fig. 218). Total length ca. 717 µm. Abdominal tip narrow. Apophyses posteriores and apophyses anteriores almost same length (ca. 130–160 µm), but apophyses anteriores more slender. Vestibulum narrow. Caudal part of corpus bursae broad, slightly wrinkled; remaining larger part of corpus bursae elongate, without pectination or signa. Accessory sac rounded, weakly separated from bursa; shape of ductus spermathecae unknown.

BIOLOGY. Adults collected in April.

DIAGNOSIS. A very distinctive small, brown-winged *Stigmella* species characterized by the whitish androconial scales on the upperside of the male forewing, and by the androconial patch on the hindwing (comprising black and whitish scales). See Remarks.

DISTRIBUTION. This appears to be a widespread species in Belize, its habitats including disturbed rain-forest and secondary forest areas close to settlements.

CONDITION OF TYPE MATERIAL. Wings not spread; some specimens are poorly pinned, and a few lack antennae.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, secondary forest close to research station, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29124 (BMNH).

Paratypes, 1 ♂, data as holotype (BMNH); 9 ♂, 7 ♀, San Ignacio, secondary forest at town edge, 17–18.iv.1989 (*Puplesis & Hill*), genitalia slide no. 29126 ♀ (BMNH (14); VPU (2)); 1 ♂, Pook's Hill Nature Reserve (S of Teakettle Village), primary rain forest close to main camp, 28–29.iv.1998 (*Puplesis & Hill*), genitalia slide no. AD0308 (VPU).

REMARKS. Some general features of the male genita-

lia (especially gnathos, transtilla and aedeagus) suggest that *S. pruinosa* might be related to the *S. oxyacanthella*-group (= *S. crataegifoliella*-group, *sensu* Wilkinson & Scoble, 1979) which is very widely distributed in the Holarctic Region.

## 28. *Stigmella ovata* sp. n.

(Figs 35, 62, 148–151)

**MALE** (Fig. 35). Forewing length: 2.3–2.5 mm. Wingspan: 5.3–5.6 mm. Head: palpi brown-grey to brown; frontal tuft pale yellow to orange or pale ochre; collar comprised of piliform cream scales; eye-caps cream to white; antenna brown, ca. 31–32 segments. Thorax, tegulae and base of forewing before first fascia grey-brown to dark brown with some purple and blue-green lustre (not always present). Antemedian fascia distinctly broadened towards dorsum, but generally more slender than postmedian fascia, which tends to be broader at costal margin or in middle; both fasciae cream to pale yellow-cream, but postmedian usually lighter and brighter, more intense. Area between fasciae and apex of forewing dark brown with some purple and blue-green lustre, often a little roughly scaled (not smooth). Cilia grey-brown to dark brown; no cilia-line. Underside of forewing brown. Hindwing and cilia grey-brown; basal fifth of hindwing with row of distinctly broadened scales on costal margin; these are about one-third length of cilia but hardly visible as they are concolorous with cilia. No androconia on forewing. Legs grey-brown or dark brown. Abdomen dark brown on upperside, grey-cream on underside; a pair of short, closely set piliform anal tufts dark brown; genital segments not contrasting in colour with ventral surface of abdomen.

**FEMALE.** Unknown

**GENITALIA** ♂ (Figs 148–151). Capsule 429–446 µm long, markedly oval. Uncus broad at base, gradually narrowing caudally, with two tiny, dark papillae at caudal margin. Tegumen not extended into pseuduncus, band-shaped. Gnathos inverted V-shaped; no central plate; posterior process single, pointed caudally, lateral arms long and slender. Valva 215–224 µm long, very broad in basal two-fifths, then abruptly narrowed; apex very slender, pointed caudally. Transtilla with slender transverse bar which is not fused at middle, with papilla-like sublateral corners papilla-like, processes not developed. Vinculum very long and broad, broadly rounded anteriorly, without emargination or lateral lobes. Aedeagus ca. 232 µm long, without apical processes, characteristically broadened in caudal third. Vesica with numerous small cornuti, most relatively broad, and all pointing caudally. Juxta a short, broad sclerite with a narrow bilobed caudal extension.

**BIOLOGY.** Adults collected in November–December.

**DIAGNOSIS.** This very distinctive species is easily distinguished from all other *Stigmella* by the combination of huge, oval vinculum, inverted 'V'-shaped gnathos and posteriorly bilobed juxta. See Remarks.

**DISTRIBUTION.** Argentina.

**CONDITION OF TYPE MATERIAL.** The type series is relatively well-preserved.

**MATERIAL EXAMINED.**

Holotype ♂, **Argentina:** Neuquen, Lago Lacar, Pucara, 2♂ 20.xii.1978 (*Mission Científica Danesa*), genitalia slide no. Diškus 184 (ZMUC).

Paratypes, 1♂, data as holotype; 1♂, data as holotype but 28–29.xi.1981 (*Nielsen & Karsholt*), genitalia slide no. Diškus 185, forewing venation slide no. Diškus 207 (ZMUC); 1♂, Rio Negro, San Carlos de Bariloche, Colonia Suiza, 800 m, 7.xii.1981 (*Nielsen & Karsholt*) (ZMUC).

**REMARKS.** This species possesses many remarkably archaic features: gnathos with a single process, primitively shaped uncus, very large and rounded vinculum, piliform collar and remarkably complete wing venation. In the forewing  $R_4$  and  $R_5$  are not fused and Cu is surprisingly long;  $M_1$  and  $M_2$  are retained as separate branches (Fig. 62) in contrast to other *Stigmella* (e.g., Fig. 63). This is the only species in which such a character combination is known and we can offer no explanation of affinities except to place *ovata* in the genus *Stigmella*. This is an aberrant species in many respects; among its atypical features are the structure of the gnathos and uncus (Fig. 148) and vinculum (Fig. 150); however, a few Palaearctic species do exhibit such similar unusually-shaped sclerites.

## 29. *Stigmella hylomaga* (Meyrick, 1931)

(Fig. 36)

*Nepticula hylomaga* Meyrick, 1931: 415.

*Stigmella hylomaga* (Meyrick); Davis, 1984: 18.

**ADULT** (see Remarks) (Fig. 36). Forewing length: 2.7–2.8 mm. Wingspan: about 6.0–6.1 mm. Head: palpi cream; frontal tuft very pale ochreous cream; collar not very distinctive, brownish cream, comprised of lamellar scales; eye-caps cream; antenna grey-brown with weak purple lustre, about 37 segments. Thorax and tegulae coppery brown with purple lustre. Basal part of forewing of same colour as thorax, but apex and part of basal fascia with much more intense purple lustre and therefore appearing darker. Fascia oblique, distinctly postmedial, whitish with some gold lustre.

**BIOLOGY.** The single specimen known was collected in November.

**DIAGNOSIS.** May be distinguished from other Neotropical species by its greater wingspan (about

6 mm) in combination with a broad, oblique, postmedian fascia surrounded by brown scales with a purple lustre.

DISTRIBUTION. Argentina (Rio Negro region).

CONDITION OF TYPE MATERIAL. The holotype has no hindwings or abdomen; the appendages of the head are hardly visible and the left forewing is abraded.

MATERIAL EXAMINED.

Holotype 1 ex., **Argentina**: Rio Negro Territory, Lake Correntoso, 15-25.xi.1926 (F.W. & M. Edwards) (BMNH).

REMARKS. This species was described by Meyrick from a single specimen lacking hindwings and abdomen (mentioned in the original description). It is impossible to ascertain the sex of this specimen. The current placement of this species in *Stigmella* is provisional, based on features such as the lamellar-scaled collar and forewing venation, the latter examined *in situ* rather than in a microscopic preparation.

30. *Stigmella costalimai* (Bourquin, 1962)

(Fig. 37)

*Nepticula costalimai* Bourquin, 1962: 31–32.

*Stigmella costalimai* (Bourquin); Davis, 1984: 18.

MALE. Unknown (see Remarks).

FEMALE (Fig. 37). Forewing length: about 2.0–2.1 mm. Wingspan: about 4.7–4.8 mm. Head: palpi ochreous cream; frontal tuft brownish ochre. Collar greyish, comprised of lamellar scales, lobes well-separated from each other; eye-caps yellowish cream; antenna brownish grey, number of segments unknown. Thorax greyish, tegulae greyish but cream posteriorly. Forewing glossy grey-bronze, but with irregularly distributed, paler, brownish cream scales, especially in distal half; most darker grey scales with paler, brownish cream tips. Cilia greyish. Underside of forewing brown. Hindwing and cilia brownish grey. Abdomen fuscous.

GENITALIA ♂, ♀. Unknown (see Remarks).

BIOLOGY. Adults reared in November.

DIAGNOSIS. Distinguishable among all other Neotropical *Stigmella* and species from other genera by the glossy grey-bronze forewing, with some irregularly distributed paler scales.

DISTRIBUTION. Argentina (Buenos Aires region).

CONDITION OF TYPE MATERIAL. The single female paratype examined lacks its abdomen; the wings are detached and stored in a gelatine capsule. The holotype and second paratype have not been examined.

MATERIAL EXAMINED.

Paratype, ♀, **Argentina**: Buenos Aires region, Tigre, x.1957 (MACN).

REMARKS. *S. costalimai* was described from three specimens in the Bourquin collection, Buenos Aires. The original description of the species does not mention the sex of the specimens of the type series. We have been able to examine only a single female paratype loaned by MACN through the kind offices of Dr. E. Nieukerken (NNM).

31. *Stigmella guitonae* (Bourquin, 1962)

(Figs. 38, 217)

*Nepticula guitonae* Bourquin, 1962: 32–34.

*Stigmella guitonae* (Bourquin), Davis, 1984: 18.

MALE. Not examined (see Remarks).

FEMALE (Fig. 38). Forewing length: ca. 2.3 mm. Wingspan: 4.9–5.0 mm. Head: palpi greyish cream; frontal tuft ochreous yellow; collar indistinct, comprised of yellowish cream piliform scales; eye-caps cream; antenna grey-brown, number of segments unknown. Thorax and tegulae grey-brown. Forewing grey-brown, indistinctly and very lightly irrorated with darker brown scales, slightly darker than thorax; with narrow, distinct, postmedian fascia formed by silver lustrous (or white-metallic lustrous) scales; area beyond fascia purple-brown; cilia grey-brown. Underside of forewing fuscous. Hindwing relatively broad, brownish grey; cilia concolorous. Legs grey-brown. Abdomen dark grey.

GENITALIA ♀ (Fig. 217). Total length 580–585 µm. Anal papillae weakly developed. Apophyses posteriores slender and long (144–146 µm). Apophyses anteriores slightly longer and much broader. Vestibulum slightly broadened, folded. Corpus bursae small and narrow; no signa or pectinations visible. Accessory sac relatively large, rounded, strongly folded; ductus spermathecae sclerotized only proximally, and in a tiny area, at some distance from the accessory sac.

BIOLOGY. Adults collected in February. According to Bourquin (1962) the larvae are miners on *Senecio bonariensis* (Compositae/Asteraceae) and *Jussiaea longifolia* (Onagraceae); Brummitt (1992) treats *Jussiaea* as a synonym of *Ludwigia*; the TROPICOS database suggests *Jussiaea longifolia* may now be a synonym of *Ludwigia major* (DC.) Ramamoorthy.

DIAGNOSIS. This species may be distinguished from all other Neotropical nepticulids by the narrow and distinctly postmedian oblique fascia formed by lustrous silver lustrous (or lustrous white-metallic) scales.

DISTRIBUTION. Argentina (Buenos Aires region).

CONDITION OF TYPE MATERIAL. The single female paratype examined is unsatisfactorily pinned, rather rubbed, with a damaged head and with both antennae broken. On the data label the name is incorrectly spelled as 'guittoni'. The holotype and second paratype have not been examined (see Remarks).

MATERIAL EXAMINED.

Paratype, ♀, **Argentina**: Buenos Aires Region, Tigre, ii.1960, genitalia slide no. Diškus 2043 (MACN).

REMARKS. We have retained this species in *Stigmella* as external examination of the paratype shows *Stigmella*-type venation. *S. guittonae* was described from three specimens in the Bourquin collection, Buenos Aires. The original description of the species does not mention the sex of the specimens of the type series. We have been able to examine only a single female paratype loaned by MACN through the kind offices of Dr. E. Nieuwerkerken (NNM).

### **ECTOEDEmia Busck**

#### **32. *Ectoedemia reneella* Wilkinson, 1981**

*Ectoedemia reneella* Wilkinson, 1981: 104, 105.

MALE (Described by Wilkinson, 1981: 104).

FEMALE. Unknown.

GENITALIA ♂ (Described and figured by Wilkinson, 1981: 104, 105, fig. 6).

BIOLOGY. Adults collected in April–May.

DISTRIBUTION. USA (Florida).

#### **33. *Ectoedemia helenella* Wilkinson, 1981**

*Ectoedemia helenella* Wilkinson, 1981: 105–107.

MALE (Described by Wilkinson, 1981: 105, 106).

FEMALE. Unknown.

GENITALIA ♂ (Described and figured by Wilkinson, 1981: 106, fig. 7).

BIOLOGY. Adults collected in April.

DISTRIBUTION. USA (Florida).

#### **34. *Ectoedemia mesoloba* Davis, 1978**

*Ectoedemia mesoloba* Davis, 1978: 209–212.

*Ectoedemia mesoloba* Davis; Wilkinson & Newton, 1981: 85, 86.

MALE. Described and figured by Davis (1978: 209, 210, fig. 1) and by Wilkinson & Newton (1981: 85, 86, fig. 50).

FEMALE. Unknown.

GENITALIA ♂. Described and figured by Davis (1978: 210, 211, figs 15–17) and by Wilkinson & Newton (1981: 85, 86, fig. 42).

BIOLOGY. Adults collected in November.

DISTRIBUTION. USA (extreme northwestern Florida).

### **35. *Ectoedemia species 29105***

(Figs 40, 152, 153)

MALE (Fig. 40). Forewing length: 3.2 mm. Wing-span: 7.1 mm. Head: palpi cream; frontal tuft brown-black, very large and dark; collar blackish (not off-white as in Nearctic *reneella* Wilkinson), comprised of piliform scales; eye-caps cream, large; antenna brown-grey (not off-white as in *reneella*), about 56 segments. Thorax and tegulae greyish yellow with dark brown and blackish scales especially abundant anteriorly on tegulae. Forewing greyish yellow, irregularly but not densely irrorated with blackish brown scales; a few dark scales on cilia also. Cilia greyish yellow distally, grey tornally. Underside of forewing brown with green-blue lustre. Hindwing relatively broad, distinctly narrowed apically, cream or greyish cream (at certain angles); hair-pencil of long piliform scales along costa of forewing base well-developed, cream and surrounded with tiny blackish scales. Cilia of hindwing cream to greyish cream. Legs yellowish cream to ochreous cream, shaded with black at front. Colour of abdomen unknown.

FEMALE. Unknown.

MALE GENITALIA (Figs 152, 153). Capsule 490 µm long. Uncus absent. Pseuduncus short, broad, band-shaped, with laterodorsal setose papillae. Tegumen short. Gnathos W-shaped, with relatively short but broad caudal process; lateral arms long and well-sclerotized; central plate undeveloped. Valva 377 µm long, relatively slender, gradually narrowed towards apex, slightly curved inwards, with short broad papillated median extension on dorsal surface. Transtilla with long and slender transverse bar and long slender sublateral processes. Ventral plate of vinculum short, with triangular lateral lobes; anterior emargination relatively shallow and broad. Aedeagus 547–554 µm long, with two pairs of carinae: lateral carinae short, but well-sclerotized; dorsal carinae lobate, spine-like at apices; ventral carinae hardly developed, represented by a short single plate with triangular emargination from caudal margin. Vesica with three comb-like sclerotized plates each bearing 5–6 spines, a few large spinose cornuti and numerous scattered tiny cornuti.

BIOLOGY. Adults collected in April. Larvae may be bark miners.

DIAGNOSIS. Belongs to the highly specialized



subgenus *Zimmermannia* Hering, which is characterized by pronounced costal emargination of the male hindwing, large ventral carinae on the aedeagus, elongated valvae, extremely long and narrow bursa in the female genitalia, and patternless forewing. Larvae of Holarctic representatives this subgenus are bark-miners with an atypically high number of instars – six to eight.

This species most resembles to *E. reneella* Wilkinson, from the USA (Florida). However, the valva is narrower basally, the pseuduncus broader, the lateral carinae more elaborated, the dorsal carinae abruptly narrowed the apex into spine-like processes, the ventral carinae weakly developed and demarcated, the transverse bar of the transtilla fused in the middle. The antennae are brown and the collar is black, not white as in *reneella*.

The description of *Ectoedemia species 29105* represents the first and only record of the subgenus *Zimmermannia* in the rainforest of the Neotropical Region; there are no other species currently known south of Mexico.

DISTRIBUTION. Belize.

CONDITION OF MATERIAL. The single specimen available is well-preserved.

MATERIAL EXAMINED.

1 ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3-16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29105 (BMNH).

REMARKS. This interesting species has been described but not named, because we are not persuaded from the single known specimen that this species is more than a distinct geographical variant of *reneella* Wilkinson, to which it is undoubtedly closely related.

### 36. *Ectoedemia fuscivittata* sp. n.

(Figs 39, 154–156)

MALE (Fig. 39). Forewing length: 1.7–1.8 mm. Wing-span: 4.1–4.3 mm. Head: palpi cream to ochreous cream; frontal tuft pale ochre to pale orange-ochre; collar indistinct, pale ochre, comprised of piliform scales; eye-caps ochreous cream, moderately large; antenna brownish or greyish to pale brownish ochre, 42–44 segments. Thorax anteriorly ochreous yellow, elsewhere metallic grey; tegulae ochreous yellow with a few greyish scales anteriorly. Forewing up to fascia (in basal 3/5) metallic grey with distinctive greenish blue and some indistinct purplish lustre; narrow area along costa, particularly before fascia and on tornus, as well as area beyond fascia with ochreous cream scales; fascia distinctly postmedian, oblique, fuscous brown; some specimens with dark brown scales in the area before cilia. Cilia metallic greyish. Underside of

forewing grey-brown. Hindwing and cilia greyish to brownish grey. A long patch of whitish scales may be visible on basal half of hindwing upperside, but these androconia may not always be distinctive. Legs cream shaded with grey-fuscous laterally. Abdomen fuscous brown on upperside, brown or brownish on underside; genital segments mostly covered by dark (predominantly brown) scales, not contrasting with main colour of abdomen.

FEMALE. Unknown.

GENITALIA ♂ (Figs 154–156). Capsule 268–270 µm long. Pseuduncus small, rounded, distinctly papillated. Dorsal plate of tegumen simple, small. Gnathos with triangular caudal process, slender lateral arms, and small rounded central plate. Valva 150–152 µm long, triangular, with more or less straight inner margin, tapering into a pointed, subcaudally-directed apical process. Basal margin of valva strongly sclerotized. Transtilla without transverse bar, with long and slender sublateral processes. Juxta absent, valvae connected by membranous basal. Vinculum very small, with compact, distinctively-shaped and well-sclerotized lateral lobes; anterior emargination of vinculum broad but shallow, almost quadrate. Aedeagus 231–235 µm long, strongly bulged in basal one-half to one-third, without carinae; vesica with only very few tiny and indistinct cornuti.

BIOLOGY. Adults collected in April.

DIAGNOSIS. Belongs to the nominal subgenus *Ectoedemia* Busck, which has a wide distribution, but is here recorded for the first time from the Neotropical Region south of Mexico. Although many *Ectoedemia* species are difficult to separate, *fuscivittata* is easily recognizable: a combination of features such as the subcaudally-directed valval process, basally broadened aedeagus, very short vinculum, and dark oblique forewing fascia make this species distinctive. The absence of the transverse transtilla bar in this species is the only known occurrence of this character in the genus.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype and one paratype are well-pinned and well-preserved (but unspread) specimens; the second paratype is unsatisfactorily pinned.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slides no. 29107 (BMNH).

Paratypes, 2 ♂, data as holotype, genitalia slide no. AD 0302 (BMNH, VPU).

**FOMORIA** Beirne**37. *Fomoria molybdtis* (Zeller, 1877) comb. n.**

(Figs 41, 157, 158)

*Nepticula molybdtis* Zeller, 1877: 455–456.*Stigmella molybdtis* (Zeller); Davis, 1984: 18.

MALE (Fig. 41). Forewing length: about 4.0 mm. Wingspan: 8.5–8.6 mm. Head: palpi pale grey-brown; frontal tuft pale ochre; collar pale ochre, rather indistinct, comprised of piliform scales; eye-caps ochreous cream; antenna brownish, number of segments unknown (antennae broken in single specimen available). Thorax and tegulae dark brown, lustrous. Forewing without pattern, brown and lustrous; costal margin and apical area darkened by numerous deep brown scales which are scattered universally across forewing but concentrated along costa and at apex; distinctly edged by dark brown scales just before cilia. Cilia grey-brown. Underside of forewing brown. Hindwing lanceolate, rather broad, grey-brown, cilia brown. No androconia on forewing or hindwing. Legs brown. Colour of abdomen unknown.

FEMALE. Unknown.

GENITALIA ♂ (Figs 157, 158). Capsule 560 µm long. Pseuduncus with two well-separated lateral lobes. Uncus inverted V-shaped. Tegumen small. Gnathos with slender posterior process and almost equally developed but longer lateral arms. Valva 235 µm long; apical half very slender and turned inwards; basal half broad and with small inner lobe; long and very slender spine-like process on dorsal side of valva, reaching gnathos caudally, fused basally with transtilla. Transtilla with very large transverse bar that is well-sclerotized only laterally; without sublateral processes. Vinculum narrow, elongate, longer than valva; anterior emargination shallow. Aedeagus 544 µm long, with two (sclerotized and weakly sclerotized) lobe-like apical processes, one sclerotized, the other weakly so. Vesica with numerous spine-like cornuti mostly arranged in a long row, but with separate more scattered cornuti in basal half.

BIOLOGY. Adults collected in February.

DIAGNOSIS. This species may be distinguished from other *Fomoria* and Neotropical nepticulids by the unusually long transtilla plate in combination with the long and sinuous basal process of the valva and long narrowed vinculum. It most resembles, and is most closely related to *diskusi* but is easily separable by external and male genital features (see Diagnosis for *diskusi*).

DISTRIBUTION. Colombia.

CONDITION OF TYPE MATERIAL. The single specimen is in good condition, but both antennae are missing.

MATERIAL EXAMINED.

Holotype ♂, **Colombia**: nr. Bogotá, foot of Guadalupe ['Fusse des Guadalupe bei Bogota'], 11.ii.1871 (*Nolcken*), genitalia slide no. 25651 (BMNH).

REMARKS. The present position of this species within *Fomoria* is not certain and may be clarified when more and reared material is available. In order to preserve the unique and fragile holotype, the wing venation of this species has not been studied by making a wing preparation. Little can be deduced from external examination, but even details of venation might not be particularly helpful as reduction of veins occurs repeatedly and independently throughout the Nepticulidae. The morphology of the male genitalia of *molybdtis* is very compatible with that of a *Fomoria* (see Introduction), and precludes its inclusion in *Stigmella* (= *Nepticula*) where it was originally placed. The species slightly resembles also some *Parafomoria*. However, the latter genus (currently known mainly from the Mediterranean region, feeding on Cistaceae) is characterized by the lateral arms of the vinculum being expanded and often wrinkled, unlike those of *molybdtis*, and by the lack of vein  $R_{2+3}$  in the forewing. In the possibly related *F. diskusi* the cell is closed (unusual in *Fomoria*) but  $R_{2+3}$  is present, in contrast to *Parafomoria*. On balance, placement of *molybdtis* in *Fomoria* rather than *Parafomoria* is appropriate.

**38. *Fomoria diskusi* sp. n.**

(Figs 42, 64, 159, 160, 219)

MALE (Fig. 42). Forewing length: 1.9–2.3 mm. Wingspan: 4.8–5.3 mm. Head: palpi cream to ochreous cream; frontal tuft orange-ochre, occasionally brown at front; collar pale ochreous, indistinct, comprised of piliform scales; eye-caps cream; antenna pale brownish ochre, ca. 44 segments. Thorax ochreous cream anteriorly, fuscous brown posteriorly; tegulae ochreous cream, occasionally with few fuscous brown scales. Forewing fuscous brown with broad ochreous cream area along costa connecting with broad oblique post-medial ochreous cream fascia; some fuscous brown scales sparsely distributed on pale markings of forewing. Cilia ochreous cream. Underside of forewing brown to dark grey-brown. Hindwing and cilia grey-cream to greyish. No androconia on hindwing or forewing. Legs ochreous cream shaded with grey-brown on front. Abdomen grey-brown or fuscous on upperside, ochreous cream on underside; anal tufts ochreous cream.

FEMALE. Very similar to male, but sometimes paler, especially on underside of forewing. Antenna ca. 38 segments.

GENITALIA ♂ (Figs 159, 160). Capsule 434 µm long. Pseuduncus distinctly bilobed with caudal setae. Uncus inverted V-shaped. Gnathos inverted V-shaped, with relatively short caudal element, well-sclerotized lateral arms, without central plate. Valva 230–232 µm, slender in apical two-fifths, with apical spine-like process; basally with broad ventral lobe and two huge elongate caudally-directed processes. Transtilla without sublateral processes, a very long but narrow plate, slightly broadened anteriorly and strongly sclerotized in middle. Vinculum very long, with shallow semicircular anterior emargination and small triangular lateral lobes. Juxta absent. Aedeagus 378 µm, relatively slender, especially in basal third, simple, with two pointed apical carinae. Cornuti absent.

GENITALIA ♀ (Fig. 219). Total length 560–563 µm. S8 and T8 broadly rounded. Apophyses posteriores about 154 µm long, unusually broad for most of their length, abruptly and strongly narrowed at apices. Apophyses anteriores more slender than apophyses posteriores, approximately same length. Ductus with complex bulged lobate sclerotization. Corpus bursae small, oval, with one rather distinct spine-like sclerite, but without any visible signa. Accessory sac small, rounded; ductus spermathecae broad, strongly sclerotized and with 7–8 convolutions; length of ductus spermathecae exceeds that of corpus bursae.

BIOLOGY. Adults collected in April.

DIAGNOSIS. An outstandingly distinctive species among *Fomoria* and all others nepticulids by dint of its unique forewing pattern (Fig. 42); in the resting position resembles a seed surrounded with white. The distinctive male genitalia differ from those of other species by the double basal processes of the valva together with the isolated valval lobe, unusual transtilla plate, and by the absence of cornuti in the long and slender aedeagus. *F. diskusi* is somewhat similar to and possibly closely related to *molybditis* from which it clearly differs in all the characters listed above, except the form of the transtilla.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype and most paratypes well-preserved; the single female paratype is slightly rubbed and the detached hindwings have been pinned in a gelatine capsule.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 28844 (BMNH).

Paratypes, 11 ♂, 1 ♀, data as holotype, genitalia slide nos 28845 ♂, 29130 ♂, 28846 ♀ (BMNH; VPU).

REMARKS. This remarkable species is named for Arunas Diškus (VPU), to whom we are extremely

grateful for his help in dissecting many specimens of Neotropical nepticulids and for his support for our work on leaf-miners.

This species is placed in *Fomoria* because the morphology of the male genitalia matches well with the current *Fomoria* genus concept; the unusually reduced wing venation (Fig. 64) lends additional support. The vaginal lobe-like sclerotizations and short bursa resemble those in the genus *Parafomoria*; however, in the male genitalia the vinculum arms are not expanded or wrinkled, and forewing vein  $R_{2+3}$  is present (lacking in *Parafomoria*).

### 39. *Fomoria species 29122*

(Figs 44, 161–163)

MALE (Fig. 44). Forewing length: ca. 1.8 mm. Wingspan: ca. 4.2 mm. Head: palpi cream; frontal tuft pale ochre; collar ill-defined, cream; eye-caps cream; antenna unknown. Thorax and tegulae blackish. Forewing brownish black with gold and weak purple lustre; a few glossy silver markings on forewing; at base of forewing, a narrow oblique median fascia and two narrow terminal spots which tend to fuse forming a terminal fascia. Cilia grey; some long lamellar wing scales overlap cilia. Underside of forewing creamy brown. Hindwing lanceolate, brownish cream, cilia brownish. No androconia on forewing or hindwing. Abdomen ochre-brown on upperside, ochreous cream on underside; genital segments (mainly valvae) ochreous cream, easily visible, but not contrasting in colour with ventral surface of abdomen.

FEMALE. Unknown.

GENITALIA ♂ (Figs 161–163). Capsule 340 µm long. Pseuduncus deeply bilobed, lobes large, triangular. Uncus inverted V-shaped, with short and blunt caudal process. Gnathos with single caudally directed process and equally developed lateral arms. Valva 120 µm long, very deeply divided into a longer, distally inturned dorsal lobe and triangular ventral lobe. Transtilla with large lobate transverse bar with remarkably extended and pointed sublateral angles. Vinculum very long and very broad, almost without anterior emargination. Aedeagus 160–166 µm long, with numerous large spine-like cornuti on vesica; no apical carinae are visible in the single specimen available.

BIOLOGY. Adults collected in April.

DIAGNOSIS. Easily distinguished from other *Fomoria* and all other nepticulids by the unique shape of the transtilla (Fig. 161), and by the long vinculum in combination with the divided valva with triangular ventral lobe and narrow dorsal lobe.

DISTRIBUTION. Belize.

CONDITION OF MATERIAL. The single available speci-

men is in very poor condition: the body is destroyed, the head is glued on a pin separately, and the wings are abraded.

**MATERIAL EXAMINED.**

1 ♂, **Belize:** Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29122 (BMNH).

**REMARKS.** This very remarkable and undoubtedly new species is described but it is not named because of the very poor condition of the single known specimen.

**40. *Fomoria latipennata* sp. n.**

(Figs 43, 164, 165)

**MALE** (Fig. 43). Forewing length: 2.4–2.5 mm. Wing-span: 5.4–5.5 mm. Head: palpi cream; frontal tuft brownish ochre, rather dark; collar cream, comprised of piliform scales, indistinct; eye-caps large, ochreous cream, distally shaded with greyish; antenna grey-brown, about 26 segments. Thorax and tegulae grey or dark grey. Forewing broad; basal half grey with weak bronze gloss; apical half of forewing fuscous, the demarcation from the basal half oblique; proximal third of apical fascia and apex covered with blackish brown scales with some yellowish lustre; region between these blackish areas dark grey with metallic gloss. Cilia grey with some shorter intermixed fuscous scales. Underside of forewing grey brown. Hindwing relatively broad, ochreous brown, cilia grey-brown. No androconia on hindwing or forewing. Legs irregularly coloured, brownish cream to predominantly grey-brown. Colour of abdomen unknown.

**FEMALE.** Undescribed. A single female specimen is tentatively associated with the male but is not described as its status is conjectural (see Remarks).

**GENITALIA** ♂ (Figs 164, 165). Capsule 415 µm. Pseuduncus with two large, smoothly rounded sublateral lobes and one huge central lobe. Uncus smoothly sclerotized, caudally bilobed, with two pairs of large setae on ventral side. Dorsal plate of tegumen moderately large, simple. Gnathos with large rounded caudal process, long slender lateral arms, and weakly developed (anteriorly broadly rounded) central plate. Valva 256 µm long, broadened at base, with spine-like median process and long and very slender apical process from apex of broad valval lobe. Transtilla with narrow and elongate transverse bar and very long sublateral processes extending beyond vinculum. Juxta absent. Vinculum large, ventral plate trapezoidal, gradually narrowed anteriorly, without lateral lobes and anterior emargination. Aedeagus 256 µm long, swollen in apical half and weakly sclerotized at basal margin; with three very long horn-like apical cornuti and one moderately large spinose central cornutus. The longest cornutus is strongly curved outwards.

**GENITALIA** ♀ (see Remarks).

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** The distinctive structure of the male genitalia, particularly the bilobed uncus, trilobed pseuduncus, long sublateral processes of the transtilla, and the fuscous-banded forewing distinguish this species from all other nepticulids.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The holotype is well-preserved.

**MATERIAL EXAMINED.**

Holotype ♂, **Belize:** Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 28968 (BMNH).

Excluded from paratype series: 1 ♀, data as holotype, genitalia slide no. 28969 (BMNH) (see Remarks).

**REMARKS.** We have very tentatively associated a female with this male but have not (above) allotted it paratype status. The genitalia (slide no. 28969, BMNH) exhibit a narrowed abdominal tip, very long and broad posterior and anterior apophyses, folded vestibulum, relatively short oval corpus bursae (without signa or pectinations), rather small accessory sac and short, distally strongly sclerotized ductus spermathecae (with 2.5–3 convolutions). External features of this female differ somewhat from those of the male holotype; the forewing is more roughly scaled and has a distinct metallic lustre and golden gloss.

***ACALYPTRIS* Meyrick**

**41. *Acalypttris bovicorneus* sp. n.**

(Figs 45, 65, 166–169, 220)

**MALE** (Fig. 45). Forewing length 2.3–2.5 mm. Wing-span: 5.4–5.8 mm. Head: palpi cream; frontal tuft pale to dark orange-ochre; collar comprised of cream piliform scales; eye-caps cream; antenna brown to fuscous, ca. 42–46 short segments. Thorax and tegulae varying from grey-brown and slightly irrorated paler, to fuscous, almost black, without paler irroration. Forewing colour varying from greyish cream irrorated with densely scattered brown-grey or fuscous scales to completely fuscous or black with no pale scales; a tiny greyish cream tornal spot, sometimes indistinct and fused with cilia of same colour, but always present. Cilia cream distally, greyish cream on tornus; blackish or dark grey scales overlap on cilia and may sometimes form an indistinct cilia line. Underside of forewing fuscous. Hindwing lanceolate, brownish or greyish; cilia greyish or cream. No androconia on hindwing or forewing. Legs cream with grey to fuscous irregular lateral shading. Abdomen dark brown, on underside

sometimes paler due to cream scales; scaling of genital segments ochreous cream, strongly contrasting in colour with remainder of abdomen.

FEMALE. Similar to male.

GENITALIA ♂ (Figs 166–169). Capsule 456–464 µm long. Tegumen extended into triangular, caudally papillated and setose pseuduncus. Uncus complex, with semicircular transverse bar with tiny lateral spinose processes close to gnathos arms, small and shallow ventrally-directed central lobe and two slender sublaterally-directed caudal processes. Gnathos with short triangular caudal process, short but broad and strongly sclerotized lateral arms, and small anteriorly-extended central plate. Tegumen forming lateral rod-like sclerites lying almost along valvae. Valva 310–315 µm long, simple, gradually narrowed towards apex and with distinctive brush of broad setae in apical quarter forming a pectinifer. Transtilla absent, i.e., no transverse bar; sublateral processes slender and relatively long. Posterior margin of vinculum with tiny, spine-like sclerite that may represent a fused vestige of the juxta (but see below). Ventral plate of vinculum very short, but with large triangular and anteriorly rounded lateral lobes; anterior emargination deep, inverted V-shaped. Aedeagus 437–482 µm (including long processes); tube narrow, with two very long (maximally about 210 µm) asymmetrical apical carinae, two (sometimes three) small spinose dorsal carinae and one large spinose ventral carina; ventral carina connected with aedeagus tube via long transverse extension that forms a virtual bridge between the valvae and may represent the juxta or part of the juxta; all carinae connected by a strong quadrate sclerotization. Vesica with very tiny spinose cornuti.

GENITALIA ♀ (Fig. 220). Total length 995–1024 µm. Abdominal tip almost square. Anal papillae hardly developed, ill-defined, broadly rounded. Apophyses anteriores broad and long, terminating anteriorly in a slender inward-curved claw-shaped process. Apophyses posteriores very slender, straight, distinctly longer than apophyses anteriores. Vestibulum with complex oval sclerotization. Corpus bursae irregularly shaped, extended anteriorly and laterally into an oblique sac. Signa on both sides of bursa: tiny pectens forming a chain of closed cells in two parallel bands. Accessory sac oval, relatively small; ductus spermathecae short, with 2.5 small convolutions close to accessory sac.

BIOLOGY. Adults collected in April in both rainforest and disturbed secondary forest close to settlements.

DIAGNOSIS. Differs external from many Neotropical *Acalyptis* in having a monotonous forewing pattern, but as such is similar to *platygnathos*, *species 29135*, *unicornis*, *fortis*, *bifidus*, *tenuijustus* and aberrant specimens of other species. The male genitalia differ

spectacularly from those of all other Neotropical species in the presence of a valval pectinifer; bovicorneus is also easily distinguishable by the two very long and divergent aedeagal carinae, or by the two-pronged uncus in combination with the lack of a transtilla.

The valval pectinifer differentiates *bovicorneus* from *Acalyptis* from other parts of the world except for some species of the Asiatic *repeteki*-group; however, none of these exhibit either a two-pronged uncus, very long lateral aedeagal carinae, a short triangular posterior gnathos process, or a similarly shaped pseuduncus.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype is well-preserved, but one paratype has its abdomen missing, while another has abraded forewings.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, San Ignacio, disturbed secondary forest, 17–18.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29115 (BMNH).

Paratypes: 3♂, 1♀, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide nos 29116♀, AD0307♂ (BMNH (3); VPU (1)).

REMARKS. This is an apparently very isolated, remarkable Neotropical species; its modest external appearance belies a bizarre male genital morphology with numerous highly specialized features. The presence of a pectinifer may well, however, be a plesiomorphy.

#### 42. *Acalyptis martinheringi* sp. n.

(Figs 46, 170, 171)

MALE (Fig. 46). Forewing length: 2.1–2.5 mm. Wingspan: 4.7–5.6 mm. Head: palpi cream; frontal tuft large, ochreous brown or brown; collar comprised of cream piliform scales; eye-caps large, cream; antenna brown or ochreous brown, 41–43 short segments. Thorax cream, usually with some ochre or brownish scales; tegulae cream intensely shaded with brown. Forewing cream irrorated with ochreous, ochreous brown and dark brown; dorsal area of forewing base predominantly cream, weakly irrorated; very narrow area of forewing base along costa densely shaded with small brown or fuscous brown scales; apex pale; irregular dark spots scattered everywhere on forewing, especially along tornus and costal margin. Cilia cream with some brown to fuscous brown scales. Underside of forewing brownish except for small elongated basal areas where it may be cream. Hindwing lanceolate, ochreous cream, cilia cream. No androconial patches on hindwing or forewing. Legs cream shaded laterally with brown. Abdomen ochreous brown on upperside, brownish cream or cream on underside.

FEMALE. Unknown.

GENITALIA ♂ (Figs 170, 171). Capsule 402–418 µm long. Tegumen extended into large broadly rounded and setose pseuduncus. Uncus inverted V-shaped, with tiny caudal process. Gnathos with large caudal process, broad and strongly sclerotized lateral arms; central plate, as such, undeveloped. Tegumen with lateral rod-like sclerites along capsule dorsal to valvae. Valva 261–273 µm long, narrow, without lobes or processes, strongly narrowed in basal third. Transtilla with transverse bar and long sublateral processes. Juxta strongly sclerotized, elaborated, with two sharp, outwardly curved, horn-like processes from plate-like extension of vinculum. Vinculum very short and broad, with broad triangular lateral lobes; anterior emargination broad and shallow. Aedeagus 378–385 µm long, slender, with two large horn-like, curved lateral carinae, one of them larger than the other. Vesica with numerous spine-like cornuti, most of them very small.

BIOLOGY. Adults collected in April in rainforest and in disturbed secondary forest habitats close to settlements.

DIAGNOSIS. Among congeneric Neotropical species, *martinheringi* resembles externally *fortis*, *bifidus*, *species 29135*, *unicornis*, *platygnathos*, *species 29140*, *tenuijustus*, *bicornutus* and aberrant specimens of other species in having a lightly irrorated forewing. However it may be distinguished in male genital structure by the large and strongly developed juxta with horned lateral extensions; additionally it can be characterized by the basally narrowed valva and broad pseuduncus. It differs from all other *Acalyptis* species in the highly developed and specialized two-branched juxta with lateral outgrowths.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype and most paratypes are well preserved, but the forewings are not spread.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29109 (BMNH).

Paratypes, 3♂, data as holotype, genitalia slide nos 29129, AD0304 (BMNH (2); VPU (1)); 1♂, San Ignacio, secondary forest, 17–18.iv.1998 (*Puplesis & Hill*) (BMNH).

REMARKS. This remarkable species is named in honour of Prof. Martin Hering, a pioneer of studies of leaf-mining moths and their biology, whose Memorial Fund in part financially supported this project. This is a phylogenetically isolated species with unique juxta structure but conservative and plesiomorphic pseuduncus and uncus.

#### 43. *Acalyptis fortis* sp. n.

(Figs 47, 174–177)

MALE (Fig. 47). Forewing length: 1.8–1.9 mm. Wingspan: 4.1–4.3 mm. Head: palpi pale brownish cream; frontal tuft orange-ochre; collar comprised of ochreous piliform scales; eye-caps cream with a very few brownish scales; antenna brown, ca. 33–34 segments. Thorax predominantly cream, slightly irrorated with brown. Forewing fuscous, distally cream; cream background of forewing irrorated with very numerous fuscous, fuscous-brown and brownish scales; narrow basal area along costa almost black; dark scales overlap onto cream cilia. Underside of forewing grey-brown. Hindwing narrow, lanceolate, ochreous cream; cilia cream. No androconial patches on hindwing or forewing. Legs cream with irregular fuscous and grey lateral shading. Abdomen cream.

FEMALE. Unknown.

GENITALIA ♂ (Figs 174–177). Capsule 330–342 µm. Tegumen caudally extended caudally into a large, caudally rounded and setose pseuduncus. Uncus inverted V-shaped, with short, slender caudal process. Gnathos with long, slender caudal process and lateral arms; central plate small, very broadly rounded anteriorly. Vinculum with lateral rod-like sclerites underlying valvae. Valva 243–268 µm, abruptly narrowed in apical third and broad in basal two-thirds, with huge bifid inward-directed spine-like process. Transtilla with long slender transverse bar and slender sublateral processes. Ventral plate of vinculum very short and broad, with broadly triangular lateral lobes; anterior emargination shallow. Aedeagus 378–390 µm long, simple at base but very complex in swollen apical region, with two huge horn-like lateral carinae and one horn-like carina in between them; apex with one or two rounded lobes, which at a certain angle may appear as spine-like sclerotization. Vesica with numerous tiny cornuti and three spine-like cornuti, two very large and one that is half the size placed apart from them.

BIOLOGY. Adults collected in April in rainforest, and in disturbed secondary forest close to settlements.

DIAGNOSIS. Among congeneric Neotropical species, *fortis* resembles externally *martinheringi*, *bifidus*, *species 29135*, *unicornis*, *platygnathos*, *species 29140*, *tenuijustus*, *bicornutus* and aberrant specimens of other species in having an irrorated forewing. However, in the male genitalia it has a sharp, strong and bifurcated process on the inner side of the valva which is a unique feature; additionally it may be easily separated by the long, strongly developed aedeagal carinae of aedeagus in combination with the very broad pseuduncus, broader than in any other Neotropical species. It may

be distinguished from all other *Acalyptis* by the valval process or by the combination of very broad pseuduncus and very long aedeagal carinae.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype specimen is abraded; the paratype specimens (except one) are in poor condition and stored in gelatine capsules.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, San Ignacio, secondary forest, 17–18.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29131 (BMNH).

Paratypes: 1 ♂, data as holotype, genitalia slide no. 29136 (BMNH); 1 ♂, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29139 (BMNH); 2 ♂, Pook's Hill Nature Reserve, S. of Teakettle Village, 28–29.iv.1998 (*Puplesis & Hill*), genitalia slide nos AD 0311 ♂ (BMNH; VPU).

REMARKS. A very specialized species with strongly 'armed' and relatively large male genitalia, hence the specific name.

#### 44. *Acalyptis hispidus* sp. n.

(Figs 48, 172, 173)

MALE (Fig. 48). Forewing length: 2.6 mm. Wingspan: 5.8 mm. Head: palpi ochreous cream or cream; frontal tuft intense orange-ochre; collar cream, comprised of piliform scales; eye-caps large, orange-cream; antenna ochreous brown, about 48 segments. Thorax and tegulae grey. Forewing ground colour predominantly cream with sparsely scattered grey-brown scales; dark markings comprise a basal area elongated along costa, one or two small median spots and a strongly oblique apical fascia (or anastomosing spots); dark markings predominantly blackish brown, at certain angles appearing almost black; some fuscous scales on cilia also; anal area of forewing cream, densely covered with pale grey-brown scales; oblique area between median spots and apical fuscous fascia (or anastomosing spots if fascia not developed) of ground colour; tint of grey-brown scales varying with angle of view, at certain angles they may look more cream than grey; cilia grey. Underside of forewing fuscous brown. Hindwing grey; in basal two-fifths with parallel elongate stripes of fuscous grey scales along costa and in middle; scales between these longitudinal stripes cream. Legs cream with fuscous frontal and lateral shading.

FEMALE. Unknown.

GENITALIA ♂ (Figs 172, 173). Capsule 395–398 µm. Pseuduncus distinctly papillated, relatively long and narrow, rounded caudally. Uncus broad inverted V-shaped, arms swollen laterally. Tegumen with small dorsal plate and long rod-like lateral projections along

genital capsule. Gnathos with large caudal process, broad lateral arms and quadrate central plate extended and strongly sclerotized anteriorly. Valva 220 µm, narrow and simple, without processes or lobes. Transtilla (broken in holotype, Fig. 172) with transverse bar. Juxta absent. Ventral plate of vinculum relatively small, with distinct triangular (anteriorly almost pointed) lateral lobes; anterior emargination semicircular. Aedeagus 309 µm, relatively broad, especially in apical third, at its widest approximately twice width of valval base; with one rounded apical carina. Vesica in apical part of aedeagus with group of large and broad-based cornuti together with numerous scattered tiny cornuti and with large medial plate-like sclerotization.

BIOLOGY. Adults collected in April.

DIAGNOSIS. This species externally resembles only *laxibasis* and *novenarius* among Neotropical *Acalyptis*, but it differs from both in the presence of androconia on the hindwing and the significantly larger wingspan. In the male genitalia it differs from all Neotropical *Acalyptis* species, including *laxibasis* and *novenarius*, in the combination of specialized gnathos with broad quadrate basal extension and narrow, very simple and unarmed valva. From *Acalyptis* species elsewhere with a similar valva, it differs in the characteristic structure of the gnathos and in the presence of a forewing postmedian fascia.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype is well-preserved; in the genitalia preparation the right valva has been removed and mounted separately, a procedure that unfortunately destroyed part of the transtilla.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29104 (BMNH).

REMARKS. This species exhibits a surprisingly conservative male genital structure, with the exception of the specialized gnathos. In contrast, the strongly developed forewing pattern and hindwing androconia are apomorphic within the context of *Acalyptis*.

#### 45. *Acalyptis novenarius* sp. n.

(Figs 49, 178, 179)

MALE (Fig. 49). Forewing length: 2.2–2.3 mm. Wingspan: 4.8–5.1 mm. Head: palpi cream to greyish or brownish cream; frontal tuft orange-ochre to pale ochre; collar sometimes indistinct, pale ochre or ochreous cream, comprised of piliform scales; eye-caps cream, usually with some greyish scales distally; antenna ochreous brown or pale brown, about 56 short



segments. Thorax and tegulae grey-fuscous, sometimes grey irrorated with black. Forewing grey with some bluish and purplish lustre; blackish brown post-medial fascia distinctly oblique, not clearly demarcated, but inwardly bounded by narrow zone of grey-white scales; fascia with some gold lustre, similar scales forming an irregular blackish brown spot at apex, just before cilia. Cilia grey. Underside of forewing fuscous brown or brown in apical half, but tending to be paler in basal half. Hindwing and cilia grey or greyish. No androconia on hindwing or forewing. Legs grey-brown or fuscous brown on upperside, cream or ochreous cream on underside. Abdomen fuscous on upperside, ochreous brown or pale brown on underside; tufts ochreous brown, hardly contrasting.

FEMALE. Unknown.

MALE GENITALIA (Figs 178, 179). Capsule 378  $\mu\text{m}$  long. Tegumen very large, with two ventral lobes directed inwardly. Pseuduncus short but narrow. Uncus inverted V-shaped, with long anterior extensions. Gnathos with long caudal process and well developed, broad lateral arms; central plate small, anteriorly with two close-set papillae. Valva (244  $\mu\text{m}$  long) relatively narrow, simple, without additional lobes or extensions. The two inward-directed lobes in the centre of the genital capsule are part of the tegumen, not the valvae. Transtilla with broad transverse bar and huge parallel processes. Juxta absent. Vinculum large, ventral plate almost square anteriorly, without anterior emargination; posterior margin weakly sclerotized, almost indiscernible. Aedeagus 332  $\mu\text{m}$ , with 9 large spine-like sclerites: 7 well-sclerotized carinae and two separate spines which probably represent cornuti.

BIOLOGY. Adults collected in April.

DIAGNOSIS. Among congeneric Neotropical species, *novenarius* slightly resembles only *laxibasis* and *hispidus* in external features. However, from the last it clearly differs in the absence of androconia on the hindwing and the significantly smaller wingspan; well-preserved specimens can be distinguished from *laxibasis* by the generally darker body coloration and by the distinct fuscous apical mark in the forewing (in *laxibasis* the forewing apex is irrorated with dark scales but they do not form a distinct blackish spot). The male genitalia of *novenarius* may be distinguished amongst those of similar species by the very large and truncate vinculum and by the unique configuration of spines at the apex of the aedeagus. The form of the vinculum and aedeagus in combination with the simple valva separate this from all other *Acalyptis* species.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The type series is well-preserved, with the exception of one specimen, which is stored in a gelatine capsule.

MATERIAL EXAMINED.

Holotype  $\delta$ , **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 28970.

Paratypes, 5  $\delta$ , data as holotype, genitalia slide nos 29103  $\delta$ , AD0301  $\delta$  (BMNH (3); VPU(2)).

REMARKS. The inner extensions of the vinculum are not isolated from the main structure and do not form the separate lateral apodemes so characteristic of many *Acalyptis*; the lack of separation could be interpreted as a plesiomorphy, but the extensions are in other respects quite specialized, being narrowed inwardly. They could be mistaken for processes of the valvae which partially cover them in ventral view (a disadvantage when a permanent preparation is examined).

#### 46. *Acalyptis lascuevella* sp. n.

(Figs 50, 180, 181)

MALE. (Fig. 50). Forewing length: 2.0 mm. Wing-span: 4.5 mm. Head: palpi cream; frontal tuft orange-ochre; collar comprised of ochreous cream piliform scales; eye-caps ochreous cream or yellowish cream; antenna dark grey-brown, about 29–30 segments. Thorax, tegulae and forewing densely irrorated with brown-black or fuscous scales; basal half of forewing with dark scales smaller and less distinct, scales in apical half very distinct and contrasting with greyish cream background. Forewing with two cream spots, one larger and costal, distinctly oblique, post-medial, the other about one-half the size, tornal; dark scales less dense in median area of forewing, giving a patchy appearance, probably variable, and with some asymmetry in the holotype. Cilia cream, greyish cream at certain angles, with overlapping, fuscous scales at apex, forming an irregular cilia-line. Underside of forewing fuscous. Hindwing lanceolate, greyish; cilia greyish. No androconia on hindwing or forewing. Legs greyish cream with some irregular fuscous shading. Upperside of abdomen blackish fuscous, genital segments pale ochre; underside brown, genital segments ochreous.

FEMALE. Unknown.

GENITALIA  $\delta$  (Figs 180, 181). Capsule 230–235  $\mu\text{m}$ . Dorsal plate of tegumen a moderately small sclerite forming a bilobed pseuduncus with rounded, divergent sparsely setose lobes. Uncus inverted V-shaped, with caudal process. Gnathos with large pointed caudal process, well developed lateral arms and central plate rounded at anterior corners. Tegumen giving rise to a pair of lateral rod-like processes along valvae. Valva 156–159  $\mu\text{m}$  long, straight, very narrow in apical quarter, slightly bulged inward medially, and with inward-directed basal process at about one-quarter. Sublateral processes long, but transtilla absent. Juxta

(fused with posterior margin of vinculum?) a complex and strongly sclerotized W-shaped plate with lateral arms. Vinculum very short with broadly triangular lateral lobes; anterior emargination shallow. Aedeagus 203–211  $\mu\text{m}$  long, very broad (ca. 83  $\mu\text{m}$ ); no cornuti visible on vesica.

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** The white postmedian forewing markings differentiate *lascuevella* from other Neotropical *Acalyptis*; however this feature may not be reliable in worn or aberrant specimens because irrorated wings easily lose darker scales. The male genitalia are distinguished by an unusually specialized bilobed pseuduncus, apically narrow valva and very broad aedeagus without spine-like carinae.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The holotype is well-preserved.

**MATERIAL EXAMINED.**

Holotype  $\delta$ , **Belize:** Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29119 (BMNH).

**REMARKS.** In general, the particular specializations of the aedeagal carinae in *Acalyptis* are important diagnostic features for most species. The neotropical *lascuevella* is remarkable in that carinae are absent, a presumed secondary loss that is paralleled in the otherwise only distantly related Nearctic species *A. distaleus* (Wilkinson).

#### 47. *Acalyptis bifidus* sp. n.

(Figs 51, 182, 183)

**MALE** (Fig. 51). Forewing length: 1.9 mm. Wing-span: 4.3 mm. Head: palpi cream; frontal tuft ochreous orange, rather large; collar indistinct, comprised of ochreous cream piliform scales; eye-caps yellowish cream, large; antenna grey-brown, ca. 31–32 segments. Thorax and tegulae cream densely irrorated with grey-brown except for large anterior area of thorax which is practically without brown scales. Forewing ground-colour greyish cream densely irrorated with dark-tipped scales which may be brownish, grey-brown or fuscous, almost black; basal half of wing with dark-tipped scales only slightly contrasting with ground colour, darker scales more distinct in apical half, mostly fuscous; dark scales forming relatively small postmedian and apical spots; dark scales also clearly visible on cilia. Cilia cream. Underside of forewing brown. Hindwing relatively narrow, lanceolate, grey; cilia greyish. No androconia on hindwing or forewing. Legs bright cream with blackish lateral shading. Colour of abdomen unknown.

**FEMALE.** Unknown.

**GENITALIA**  $\delta$  (Figs 182, 183). Genital capsule 340–343  $\mu\text{m}$  long. Tegumen small with huge pseuduncus bearing long and narrow lateral lobes, each shallowly bilobed at apex. Uncus inverted V-shaped, with long caudal process. Gnathos with large caudal process, short and broad lateral lobes and large, rounded central plate. Tegumen forming lateral rod-like processes beneath and roughly parallel to valvae. Valva 190–193  $\mu\text{m}$  long, remarkably straight, tapered towards apex, distal third very slender, without processes or lobes. Juxta weakly sclerotized, with caudal extension and lateral arms arising from broad base recessed into posterior margin of vinculum. Vinculum with very short ventral plate, long lateral lobes, and deep and semicircular anterior emargination. Aedeagus 296–302  $\mu\text{m}$ , with pair of narrow, strongly sclerotized, spine-like lateral carinae. Vesica with numerous small and very small cornuti.

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** The irrorated forewing gives *bifidus* a superficial resemblance to other Neotropical *Acalyptis* including *fortis*, *martinheringi*, *species 29135*, *unicornis*, *platygnathos*, *species 29140*, *tenuijustus*, *bicornutus* and aberrant specimens of other species. The male genitalia are distinctive, however, in possessing a pair of very sharp, straight and strong spine-like distal carinae on the aedeagus, a large gnathos plate, a two-pronged pseuduncus and very tapered valva. The form of the pseuduncus, aedeagus and valva distinguish this from all other *Acalyptis* species.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The holotype is well-preserved, the wings not spread.

**MATERIAL EXAMINED.**

Holotype  $\delta$ , **Belize:** Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29133 (BMNH).

**REMARKS.** This is apparently a morphologically isolated species characterized by a few distinct autapomorphies, two of which – the pseuduncus processes and the distinctive carinae – prompted the scientific name of this species.

#### 48. *Acalyptis trifidus* sp. n.

(Figs 52, 184–186)

**MALE** (Fig. 52). Forewing length: 2.2–2.4 mm. Wing-span: 5.1–5.4 mm. Head: palpi cream; frontal tuft very pale, yellowish cream; collar indistinct, comprised of cream piliform scales; eye-caps cream; antenna cream tinted ochre with irregular darker brown markings, ca. 29–30 segments. Thorax and tegulae cream.

Forewing cream with dark ill-defined postmedian fascia formed by brown and blackish to black scales; tornal region of fascia always extended distally; a few sparse brown or blackish scales medially and on cilia. Cilia cream. Underside of forewing brownish cream. Hindwing covered with cream-brownish androconial scales; very long distinctively pale brown androconial scales also overlap one-fifth length of cilia in basal two-thirds of wing. Cilia cream. Legs cream with irregular brownish shading. Abdomen entirely cream.

**FEMALE.** Similar to male; no androconial scales on hindwing.

**GENITALIA** ♂ (Figs 184–186). Capsule 280 µm long. Tegumen small, with broad, broadly rounded pseuduncus. Uncus inverted V-shaped, with three caudally directed blunt processes. Gnathos with large but relatively slender caudal process and broad caudally bent lateral arms; central plate absent. Tegumen with lateral rod-like sclerites underlying valvae along the capsule. Valva 170–178 µm long, slender and slightly sinuous, tapered towards apex; without processes or lobe. Transtilla with broad transverse bar and well-developed, but not very long sublateral process. Juxta absent, but posterior margin of vinculum forming small caudally rounded plate between valval bases. Ventral plate of vinculum very short but broad, with triangular lateral lobes; anterior emargination shallow but broad. Aedeagus 326–333 µm long, very broad, with two large, almost straight, horn-like lateral carinae with sharp tips; other more indistinct features include lobate apical carinae (including a long and broad dorsal plate). Ventral carina single, protruding some distance from tube of aedeagus with which it is connected basally via a very broad joint.

**GENITALIA** ♀. [Association is tentative only.] Total length about 617–646 µm. S8 and T8 broad, caudally truncate. Anal papillae undeveloped. Apophyses posteriores and anteriores very narrow, almost the same length (ca. 138–146 µm), apophyses anteriores slightly curved inward and pointed anteriorly. Vestibulum relatively broad, with large, posteriorly pointed, Y-shaped sclerite. Corpus bursae ovoid with a large oval signum on each side, each comprising large central oval cells surrounded by comb-like pectination. Accessory sac undeveloped; ductus spermathecae unknown (missing in the single available preparation).

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** *A. trifidus* may be distinguished among congeneric Neotropical species by its oblique fuscous postmedian forewing fascia and the long androconia overlapping the hindwing cilia; it resembles only *dividua* but the latter species has a darker forewing fascia and a paler hindwing with no androconia. Its external features in combination with the remarkable

three-pronged uncus serve to differentiate it from all other *Acalyptis* species.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** While the holotype is in good condition, two of three paratypes have abraded forewings.

**MATERIAL EXAMINED.**

**Holotype** ♂, **Belize:** Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29127 (BMNH).

**Paratypes**, 3♂, data as holotype, genitalia slide nos 29138, AD0310 (BMNH (2); VPU (1)). Excluded from paratype series: 3♀, genitalia slide no. 29142 (BMNH).

**REMARKS.** The three females (above) are excluded from the paratype series as their association with the males is tentative.

#### 49. *Acalyptis tenuijuxtus* (Davis, 1978) **comb. n.**

*Microcalyptis tenuijuxtus* Davis, 1978: 216, 217.

**MALE.** Described and figured by Davis (1978: 216, fig. 3).

**FEMALE.** Similar to male.

**GENITALIA** ♂. Described and figured by Davis (1978: 216, figs 21–23).

**GENITALIA** ♀. Described and figured by Davis (1978: 216, fig. 33).

**BIOLOGY.** Adults collected in early October to late November.

**DIAGNOSIS.** Among congeneric Neotropical species, *tenuijuxtus* is externally similar to *fortis*, *martinheringi*, *species 29135*, *unicornis*, *platygnathos*, *species 29140*, *bifidus*, *bicornutus* and aberrant specimens of other species in having an irrorated forewing. However, it differs in the structure of the male genitalia from all of these in the isolation of the apodemes from the vinculum, the 5-lobed pseuduncus + uncus and the anchor-shaped juxta (similar to that of *unicornis* but with a longer caudal process). From the closely related *bifidus* it differs in the absence of a pair of slender and pointed carinae on the aedeagus and the narrower juxta. The anchor-shaped juxta, the 5-lobed pseuduncus + uncus and the long lobes of the vinculum together differentiate this from all other *Acalyptis* species.

**DISTRIBUTION.** USA (Florida Keys).

#### 50. *Acalyptis unicornis* sp. n.

(Figs 53, 187–190)

**MALE** (Fig. 53). Forewing length: 1.8–1.9 mm. Wing-

span: 4.4–4.5 mm. Head: palpi cream; frontal tuft orange-ochre; collar indistinct, comprised of pale ochreous piliform scales; eye-caps cream; antenna brownish, ca. 32 segments. Thorax predominantly cream, with few greyish scales posteriorly; tegulae cream. Forewing cream, irregularly irrorated with grey, brownish grey and fuscous scales; one or two indistinct dorsal cream spots (without dark scales). Cilia greyish cream. Underside of forewing cream. Hindwing upperside and underside cream, relatively narrow, lanceolate; cilia concolorous. No androconia on hindwing or forewing but the unusually pale colour of the hindwing scales may indicate that they have an androconial function. Legs cream with some greyish shading at front. Abdomen cream on upperside and underside.

FEMALE. Unknown.

GENITALIA ♂ (Figs 187–190). Capsule 300–320 µm long. Pseuduncus a narrow, weakly sclerotized, apically papillate caudal extension of tegumen. Uncus very complex, with ventrally directed long spine-like process (Fig. 190 – ventral component) and two caudally directed dorsal processes, each with a small lateral papilla (Fig. 187 – not shown in Fig. 190). Gnathos with large pointed caudal process, broad lateral arms and weakly developed central plate that is almost quadrate anteriorly. Tegumen with lateral rod-like sclerites along valvae. Valva 158–182 µm long, slender, gradually narrowed apically, without any lobes or processes. Transverse bar of transtilla absent; sublateral processes very slender and short. Juxta (formed by caudal extension of vinculum or fused with vinculum) triangular, pointed and sclerotized at apex and with lateral arms. Vinculum with two large lateral lobes; anterior emargination deep and rounded. Aedeagus 280 µm long, with one very large cornutus which at certain angles can appear to be a curved sclerotized plate (Fig. 189), two large spine-like apical sclerotizations and numerous tiny cornuti on the medial and basal areas of the vesica.

BIOLOGY. Adult collected in April.

DIAGNOSIS. *A. unicornis* resembles externally several congeneric Neotropical species with an irrorated forewing: *fortis*, *martinheringi*, *species 29135*, *platygnathos*, *species 29140*, *bifidus*, *bicornutus*, *tenuijustus* and aberrant specimens of other species. The male genitalia differ from those of all other species in the combination of complex uncus (similar in outline to the pseuduncus of *tenuijustus*), specialized gnathos with ventral process, caudally pointed undivided juxta (the juxta is more elongate and apically bifid in *tenuijustus*, and much more narrowly articulated with the vinculum), evenly tapered valva (not bulged at one-third as in *tenuijustus*) and the single

large cornutus in the apical third of aedeagus (apparently absent in *tenuijustus*).

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype is in good condition.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29134 (BMNH).

REMARKS. The pseuduncus and uncus of *unicornis*, as in a few other *Acalyptis*, are difficult to interpret as the structures are adjacent and not easily distinguished in a permanent preparation where they overly one another. The simple, almost membranous pseuduncus in *unicornis* is fairly typical for *Acalyptis*. The uncus is frequently complex; the Neotropical *bovicorneus*, *trifidus* and *laxibasis*, for example, have an elaborated, strongly sclerotized uncus with caudally-directed processes similar to those of *unicornis* (Figs 166, 184, 191). In *unicornis*, these processes each have a small lateral papilla. The uncus in *unicornis* additionally has a ventrally-directed spine (Fig. 190) which is otherwise developed in the predominantly Asiatic *shafirkanus*-group (see Puplesis, 1990). The single large cornutus is not uniquely distinctive among world *Acalyptis* but is nevertheless unusual and distinctive. Both features represent autapomorphies for *unicornis*, and prompt the scientific name of the species.

### 51. *Acalyptis laxibasis* sp. n.

(Figs 54, 191, 192)

MALE (Fig. 54). Forewing length: 2.0 mm. Wing-span: 4.9 mm. Head: palpi cream; frontal tuft ochreous orange; collar indistinct, cream, comprised of piliform scales; eye-caps cream; antenna pale brown, almost cream, ca. 30 segments. Thorax generally cream, posterior region and tegulae irrorated with brown. Forewing cream or pale yellowish cream irrorated with brownish and grey brownish scales, which may look darker depending upon angle of view; dark scales most densely distributed at base of forewing, especially dark and dense along costa; oblique blackish brown postmedian fascia edged inwardly with grey-cream; apical fascia pale yellowish cream with a group of brown scales before cilia. Cilia cream to yellowish cream. Underside of forewing cream or pale brownish cream. Hindwing and cilia greyish cream. No androconial patches on hindwing or forewing. Legs pale greyish cream with some brownish shading. Abdomen cream on upperside and underside.

FEMALE. Unknown.

GENITALIA ♂ (Figs 191–192). Capsule 325–328 µm long. Pseuduncus a narrow caudal process with four

apical setae. Uncus inverted V-shaped with two relatively long subcaudally directed processes. Gnathos with large caudal process, broad lateral arms and very small rounded central plate. Tegumen with lateral rod-like sclerites along valvae. Valva 218–220  $\mu\text{m}$ , gradually narrowed towards apex, abruptly broadened at base; no processes or lobes on valva. Transtilla with long slender transverse bar and sublateral processes. Vinculum short but with large triangular lateral lobes; anterior emargination deep and rounded. Aedeagus 315–320  $\mu\text{m}$ , broad, with three short lateral carinae. Vesica with a single long rod-like sclerotization, a few indistinct spine-like cornuti, and a compact triangular group of needle-like cornuti surrounded by numerous tiny cornuti.

**BIOLOGY.** Adult collected in April.

**DIAGNOSIS.** Resembles *novenarius* and *hispidus* in the oblique dark forewing fascia but differs from the latter species in the absence of hindwing androconia and the considerably smaller wingspan; it differs from *novenarius* in the generally paler body scaling and in the apical mark being indistinct and fuscous whereas in *novenarius* it is a distinct blackish spot. The male genitalia of *laxibasis* differ from those of all other species in the combination of abruptly broadened valval base of valva, two-pronged uncus and very broad aedeagus. This species is probably most closely related to *unicornis*, but may be easily distinguished by the abruptly broadened valva, absence of large distinct apical cornuti, and much simpler uncus.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The hindwings of the holotype are detached and stored in a gelatine capsule; head and forewing scaling is well-preserved.

**MATERIAL EXAMINED.**

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29128 (BMNH).

### 52. *Acalypttris bicornutus* (Davis, 1978) **comb. n.**

*Microcalypttris bicornutus* Davis, 1978: 212–214.

**MALE.** Described and figured by Davis (1978: 212, fig. 2).

**FEMALE.** Similar to male.

**GENITALIA** ♂. Described and figured by Davis (1978: 212, figs 18–20).

**GENITALIA** ♀. Described and figured by Davis (1978: 214, fig. 32).

**BIOLOGY.** Adults collected from late September to late November.

**DIAGNOSIS.** This species resembles externally several other Neotropical congeners with an irrorated forewing: *fortis*, *martinheringi*, *species 29135*, *platygnathos*, *species 29140*, *bifidus*, *unicornis*, *tenuijustus* and aberrant specimens of other species. The male genitalia of *bicornutus* differ from all other *Acalypttris* species in the extremely long and extremely narrow lateral lobes of the vinculum.

**DISTRIBUTION.** USA (Florida Keys).

### 53. *Acalypttris species 29135*

(Figs 55, 193–195)

**MALE** (Fig. 55). Forewing length: 2.3 mm. Wingspan: 5.2 mm. Head: palpi cream; frontal tuft rather large, deep orange-ochre; collar comprised of cream piliform scales; eye-caps cream with few brown scales; antenna fuscous on upperside, ochreous cream on underside, ca. 42 short segments; antenna short by dint of reduced length of individual segments. Thorax, tegulae and forewing irrorated with blackish scales which are less distinctive on thorax and forewing base, in apical half of forewing contrasting strongly with greyish cream background; irregular spots on forewing, especially in the middle and close to tornus or costa. Cilia yellowish grey, distally almost white, cilia-line formed by greyish scales. Underside of forewing fuscous. Hindwing lanceolate, creamy grey or brownish grey (depending upon angle of view); cilia creamy grey. No androconia on hindwing or forewing. Legs greyish cream with irregular blackish lateral shading. Abdomen greyish cream in upperside and underside.

**FEMALE.** Unknown.

**GENITALIA** ♂ (Figs 193–195). Capsule 460–466  $\mu\text{m}$  long. Dorsal plate of tegumen relatively small, but caudally extended into a remarkably broad and truncate pseuduncus. Uncus inverted V-shaped with caudal process. Gnathos with large caudal process, well-sclerotized lateral arms and small trapezoidal central plate. Vinculum with lateral rod-like sclerites more or less along valvae. Valva 244–252  $\mu\text{m}$  long, very slender, just slightly broadened in basal half, without lobes or processes. Transtilla with narrow and relatively long sublateral processes and long transverse bar. Juxta unknown (specimen damaged). Ventral plate of vinculum short, 1.5 $\times$  wider than long; lateral lobes well-developed, more or less triangular, rounded anteriorly; anterior emargination shallow. Aedeagus 291–299  $\mu\text{m}$  long, relatively narrow, with a few not very distinctive carinae and a spine-like sclerite on vesica.

**BIOLOGY.** Adult collected in April.

**DIAGNOSIS.** This species resembles externally other Neotropical congeners with an irrorated forewing: *for-*

*tis*, *martinheringi*, *bicornutus*, *platygnathos*, *species 29140*, *bifidus*, *unicornis*, *tenuijustus* and aberrant specimens of other species. However, the male genitalia of *species 29135* differ from those of all Neotropical species except *martinheringi* and *bicornutus* in the caudally truncate pseuduncus; from *martinheringi* they differ in the absence of a paired juxta and long and sinuous spinose carinae on the aedeagus, and from *bicornutus* in the short and rounded vinculum lobes. The narrow, unarmed valva of this species is also distinctive. The combination of the truncate pseuduncus (paralleled in some other species) with the presence of a transtilla and apodemes fused with the vinculum separate this from all other *Acalyptis*.

DISTRIBUTION. Belize.

CONDITION OF MATERIAL. The single specimen is well-preserved, but the genitalia are damaged and we cannot be sure of the natural position of the valvae; the juxta is missing and the aedeagus may not be intact.

MATERIAL EXAMINED.

**Belize:** 1 ♂, Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29135 (BMNH).

REMARKS. This distinctive species is described but is not named because of the poor quality of the genitalia preparation.

#### 54. *Acalyptis dividua* sp. n.

(Figs 56, 196–198)

MALE (Fig. 56). Forewing length: 2.2–2.3 mm. Wingspan: 5.0–5.2 mm. Head: palpi cream to yellowish cream; frontal tuft ochreous orange; collar cream, indistinct; eye-caps yellowish or yellowish cream; antenna yellow to pale ochreous yellow, ca. 28–30 segments. Thorax, tegulae and forewing yellowish or yellowish cream; forewing with single subterminal fascia oblique, broad, extended to cilia at tornus, formed by densely distributed blackish scales. Cilia yellowish cream. Underside of forewing cream. Hindwing relatively broad, yellowish cream, cilia greyish cream to greyish yellow. No androconia on forewing or hindwing. Legs yellowish. Abdomen yellowish cream to brownish on upperside, glossy cream or yellowish on underside; anal tufts paired, piliform, relatively long, cream; genital segments not contrasting in colour with venter of abdomen.

FEMALE. Unknown.

GENITALIA ♂ (Figs 196–198). Capsule 435–444 µm long. Pseuduncus broad, almost semicircular, papillated. Uncus with two long divergent caudal processes, each with a few setae. Tegumen simple, relatively large. Gnathos with shallow U-shaped transverse bar on very long and slender lateral arms. Valva ca. 265 µm

long, with pointed, inward-directed median spine-like process and slender apical process; base of valva abruptly broadened. Transtilla with transverse bar and well-developed but not very long sublateral processes. Vinculum long, anteriorly very broadly rounded, without lateral lobes. Aedeagus ca. 341 µm long, with three very large horn-like cornuti extending beyond apex (Figs 197, 198). Juxta indistinct, a semicircular membranous lobe.

BIOLOGY. Adults collected in April.

DIAGNOSIS. This is an externally very distinctive species in the Neotropical context, resembling only *trifidus* with an oblique fuscous forewing postmedian fascia. In *dividua* the forewing fascia is darker and there are no long androconia overlapping the hindwing cilia. The U-shaped gnathos, divided uncus and long apical sclerites of the aedeagus are a unique combination, distinguishing this from all other *Acalyptis*.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The type series is well-preserved, but one paratype is slightly abraded; the wings of both specimens are not spread so the hindwings are obscured.

MATERIAL EXAMINED.

Holotype ♂, **Belize:** Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29125 (BMNH).

Paratypes, 2 ♂, data as holotype, genitalia slide no. AD039 (BMNH; VPU).

REMARKS. The species exhibits numerous distinctive features, in most cases autapomorphic. The scientific name refers to the divided uncus. The shape of the gnathos is quite atypical for *Acalyptis* and sets *dividua* apart from its congeners.

#### 55. *Acalyptis platygnathos* sp. n.

(Figs 57, 199–202)

MALE (Fig. 57). Forewing length: about 1.7 mm. Wingspan: 3.9–4.0 mm. Head: palpi greyish cream; frontal tuft greyish ochre; collar greyish cream, comprised of piliform scales; eye-caps ochreous cream; antenna grey-brown (creamy brown at certain angles), ca. 29–30 segments. Thorax, tegulae and forewing with greyish cream background densely irrorated with greyish to fuscous brown or fuscous scales which are most distinctive at apex and at middle of forewing closer to dorsal margin; forewing dorsum with elongate cream area one-third wing length without grey or fuscous scales; costal margin with irregular pale median area. Cilia and underside of forewing grey-brown. Hindwing lanceolate but not very slender; grey; cilia

grey. No androconia visible on hindwing or forewing. Legs greyish or creamy grey with some irregular fuscous markings. Abdomen grey or brownish cream.

FEMALE. Unknown.

GENITALIA ♂ (Figs 199–202). Capsule 222–230 µm long. Tegumen moderately large, extended caudally into a broad and very shallowly bilobed pseuduncus (Fig. 199). Uncus reduced, fused with pseuduncus (Fig. 199). Gnathos with an extraordinary broad, quadrate, plate-like caudal process with deep posterior emargination; lateral arms of gnathos well-developed and sclerotized; central plate, as such, absent (Fig. 201). Valva 180–185 µm long, more or less triangular in ventral view, with narrow, slightly incurved apex and papillated inner margin; with distinct bidentate medial process and huge, caudally curved horn-like process from dorsal surface at one-third. Transtilla with narrow transverse bar and slender, moderately long sublateral processes; valvae joined at their bases by membranous ventral connection. Vinculum large, ventral plate trapezoidal with broadly rounded corners, without lobes or emargination. Aedeagus 265–270 µm long, with eight almost symmetrical carinae; dorsal pair connected by strong transverse bar-like sclerotization, shorter lateral carinae appearing fused with dorsal carinae because they overlap; ventral spine-like carinae each with a smaller spinose carina at base (Fig. 200). Vesica with very many tiny cornuti.

BIOLOGY. Adults collected in April.

DIAGNOSIS. This species resembles externally other Neotropical congeners with an irrorated forewing: *fortis*, *martinheringi*, *bicornutus*, *species 29135*, *species 29140*, *bifidus*, *unicornis*, *tenuijuxtus* and aberrant specimens of other species. The male genitalia, however, are distinctive, exhibiting a uniquely broad gnathos and characteristic broad vinculum. The only other *Acalyptris* species with a broad gnathos is the southern European *maritima* Lastuvka & Lastuvka, with a triangular rounded gnathos, unarmed valva and tiny vinculum.

DISTRIBUTION. Belize.

CONDITION OF TYPE MATERIAL. The holotype has a slightly abraded frontal tuft and left forewing.

MATERIAL EXAMINED.

Holotype ♂, **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplesis & Hill*), genitalia slide no. 29132 (BMNH).

REMARKS. Extremely ordinary externally, this small species possesses comparatively large male genitalia that are morphologically extreme, the valva with two internal processes, an unusually broad vinculum, a bench-shaped pseuduncus and unique, broad, slab-shaped gnathos. These autapomorphies are paralleled

by another feature of interest in the context of *Acalyptris* morphology as a whole – the uncus is reduced, and partly fused with the pseuduncus (Fig. 199).

### 56. *Acalyptris species 29140*

(Figs 4–6, 58, 221)

MALE. Forewing length: 1.7–1.8 mm. Wingspan: 3.9–4.1 mm. Head: palpi cream; frontal tuft very pale, ochreous orange; collar indistinct, cream; eye-caps cream; antenna brownish cream, ca. 28 segments. Thorax and tegulae yellowish cream, slightly glossy. Forewing same colour as thorax but irrorated distally with brownish and further distally with black. Cilia cream. Distal area of forewing underside covered with blackish androconial scales, some blackish scales also along costal margin, elsewhere cream. Hindwing cream, lanceolate, slender; cilia cream. No androconia on hindwing. Legs cream with blackish shading. Abdomen brownish cream.

FEMALE (Fig. 58). Antenna ca. 23–24 segments. Distal area of forewing underside without blackish androconial scales, underside uniformly cream. Otherwise as in male.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 221). Total length about 676 µm. S8 and T8 broad, caudally truncate. Anal papillae undeveloped. Apophyses posteriores and anteriores almost same length (ca. 130 µm), but apophyses anteriores two to three times thicker. Vestibulum relatively broad, with large Y-shaped sclerite. Corpus bursae oval with an oval signum on each side. Accessory sac undeveloped; ductus spermathecae very slender and short, sinuous and sclerotized.

BIOLOGY. Hostplant: *Lonchocarpus lineatus* Pittier (Leguminosae – tree). Mines in leaves (Figs 4–6). Egg grey-brown, laid on upperside of leaf close to a rib. The larval mine starts as a long, very gradually broadening sinuous or contorted gallery, initially filled with dark brown frass, thereafter frass loosely dispersed in a broad band leaving narrow clear margins. Larva pale yellowish with brown central line. Cocoon ochreous brown, 1.6–1.8 mm long, 1.0–1.2 wide. Adults collected in April. In Belize isolated larvae occur along a wide forest track.

DIAGNOSIS. This species resembles to some extent other Neotropical congeners with an irrorated forewing: *fortis*, *bicornutus*, *platygathos*, *species 29135*, *bifidus*, *unicornis*, *tenuijuxtus* and aberrant specimens of other species. But it most closely resembles another pale Neotropical species, *Acalyptris martinheringi*. From all of these it tends to differ in the distinct predominance of dark scales in the apical half of the forewing while the base remains almost entirely pale; in



*martinheringi* dark scales are distributed everywhere. Diagnosis is complicated because the male genitalia are unknown; key characters for identification are currently no more than the apical distribution of dark scales of forewing and *Lonchocarpus lineatus* Pittier (Leguminosae) as a hostplant.

DISTRIBUTION. Belize.

CONDITION OF MATERIAL AVAILABLE. The single available male lacks an abdomen; the remaining female specimens are in poor condition, one in a gelatine capsule, another with a mouldy head, and the third with a single loose hindwing.

MATERIAL EXAMINED.

**Belize:** 1 ♂, 3 ♀, Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998, larvae on *Lonchocarpus lineatus* Pittier, ex. l. 26–30.iv.1998 (Puplesis & Hill), forewing venation slide 29144 ♂, genitalia slides nos 29140 ♀, AD312 ♀ (BMNH (1 ♂, 2 ♀); VPU (1 ♀); leaf-mine herbarium sheet 4431 (VPU).

## GLAUCOLEPIS Braun

### 57. *Glaucolepis aerifica* (Meyrick, 1915) comb. n.

*Nepticula aerifica* Meyrick, 1915: 255.

*Stigmella aerifica* (Meyrick), Davis, 1984: 18.

(Figs 59, 203, 204, 222)

MALE (Fig. 59). Forewing length: 2.7 mm. Wing-span: 5.8 mm. Head: palpi greyish; frontal tuft greyish yellow, very pale; collar indistinct; eye-caps greyish white, relatively small; antenna brown, 36–38 segments. Thorax and tegulae shining greenish bronze. Forewing smoothly scaled before fascia, shining greenish bronze, with gold lustre at certain angles, brown beyond fascia purple lustre; fascia poorly defined, distinctly postmedian, almost terminal, shining silvery. Cilia brownish. Underside of forewing brown. Hindwing relatively long, brown; cilia pale brown. No androconia visible on forewing or hindwing. Colour of abdomen unknown, most likely brown.

FEMALE. Forewing before fascia dark grey brown with gold and light purple lustre. Scaling coarser than in male. Otherwise similar to male, assuming the female is conspecific (see Remarks).

GENITALIA ♂ (Figs 203, 204). Capsule 410–415 µm long. Uncus band-shaped (slightly unnaturally turned ventrad in Fig. 203, but this is not the natural position), and extended caudally, papillate laterally. Tegumen very short, simple. Gnathos with very broad trapezoidal caudal process and long lateral arms. Valva 220 µm long, with long pointed apical process, with curved,

pointed inward-directed process at one-third. Transverse bar of transtilla interrupted medially, sublateral process triangular, tapered anteriorly. Juxta complex, with long pointed caudal lobes and transversely sclerotized base. Vinculum very large, anteriorly rounded and slightly but gradually narrowed, without emargination or lateral lobes. Aedeagus 290–295 µm long, with two rod-like sclerites fused caudally and two membranous caudal processes with numerous very fine spines; these processes are connected to the aedeagus wall and are not part of the vesica. Vesica with a few pointed and rounded sclerotizations.

GENITALIA ♀ (Fig. 222). Total length 976–980 µm. T8 triangular. Anal papillae not developed. Apophyses anteriores broad and blunt anteriorly. Apophyses posteriores long (260–265 µm) and slender, as long as apophyses posteriores. Vestibulum relatively narrow, without pectinations or sclerites. Caudal part of corpus bursae coarsely folded, anterior region broadly oval, densely covered with pectinations, without signa, but pectinations at anterior end of corpus bursae tending to form one or two continuous transverse lines. Accessory sac coarsely folded, broad; ductus spermathecae slender, membranous except for a ring-shaped sclerite some distance from accessory sac.

BIOLOGY. Adults collected in July.

DIAGNOSIS. This species differs from other known representatives of *Glaucolepis* and indeed all nepticulids either by the combination of the distinctly postmedial forewing fascia, the broad and bilobed juxta, broad gnathos and unique morphology of the aedeagus. This is an outstanding species, whose taxonomic position is ambiguous and which will repay more detailed study when further material becomes available.

DISTRIBUTION. Peru.

CONDITION OF TYPE MATERIAL. The lectotype is badly damaged: the head is on a pin and shows a rubbed frontal tuft and indistinct collar; the thorax and wings are pinned separately in a gelatine capsule; the scaling of thorax and wings is well preserved; damage to the thorax precludes repinning. The paralectotype is slightly rubbed but more or less satisfactorily pinned.

MATERIAL EXAMINED.

Lectotype ♂, **Peru:** Oroya, vii.1914 (*Parish*), genitalia slide no. 28965 ♂ (BMNH), here designated.

Paralectotype ♀, data as lectotype, genitalia slide no. 28966 ♀ (BMNH).

REMARKS. This species' taxonomic position is uncertain and provisional. The male genitalia possess a transverse transtilla bar which is generally uncharacteristic of *Glaucolepis*. However, the transtilla is interrupted in the middle. Some *Glaucolepis*, such as

the *raikhonae*-group (Nieukerken & Puplisis, 1991), have partially or completely reduced signa. On the other hand, the shape of sclerites in the aedeagus resemble those of *Glaucolepis*. The wing venation of this species has not been studied in order to preserve the already badly damaged lectotype.

The darker forewing colour and coarser scaling of the female paralectotype in comparison with the male holotype gives us pause in assuming that the two represent opposite sexes of the same species. Moreover, the female genitalia have no signa, atypical of *Glaucolepis*. If the female is not *aerifica*, then it might not even be a *Glaucolepis*. However, the distinctly postmedial fascia of the forewing (a character generally uncommon amongst nepticulids) is shared by both specimens.

### 58. *Glaucolepis argentosa* sp. n.

(Figs 60, 205, 206)

**MALE** (Fig. 60). Forewing length: 2.0–2.2 mm. Wing-span: 4.5–4.7 mm. Head: palpi cream; frontal tuft orange-ochre; collar comprised of ochreous cream to cream piliform scales; eye-caps ochreous cream to orange-cream; antenna brown, ca. 32 segments. Thorax and tegulae with dark metallic or silvery lustre. Forewing dark blackish brown, practically black apically, very glossy, with some gold lustre, basal third of forewing and very distinct postmedial fascia silver, glossy; silvery fasciae connected along dorsal margin of forewing. Cilia dark grey, pale-tipped, glossy silver, usually with distinct cilia line of black scales. Under-side of forewing grey to fuscous. Hindwing narrow, lanceolate, greyish cream; cilia cream or greyish cream. No androconial patches on hindwing or forewing. Legs ochreous cream with brown to blackish lateral shading. Abdomen upperside blackish, no tufts visible, genital segments ochreous or yellowish cream, indistinct; underside orange-cream or ochreous cream with distinct concolorous genital segments (valvae).

**FEMALE.** Unknown.

**GENITALIA** ♂ (Figs 205, 206). Capsule 346–353 µm long. Tegumen very large, caudally extended into a short and narrow pseuduncus which is fused with uncus. Uncus represented by two lateral processes, each with one large ventral seta. Gnathos with large caudal process and broad, strongly sclerotized, distally elaborated lateral arms; central plate weakly developed, with shallow anterior emargination. Valva 230–246 µm long, very broad, quadrate in basal half, tapered towards lateral margin in apical half; apical process hardly developed, represented by a small dentate process; apical margin with three long stout setae and numerous slender setae. Valvae joined basally by strong ventral connection that functionally replaces the transverse transtilla bar. Transtilla absent, i.e., no

transverse bar; sublateral processes (i.e., valval apodemes) straight, elongate. Vinculum very large and broad, ventral plate slightly tapered anteriorly, without anterior emargination or lateral lobes. Aedeagus 311–323 µm, very broad (approximately 146 µm in middle), with two sclerotized, distally pointed apical carinae and a short rounded lobe; with two very long and narrow longitudinal rod-like sclerotizations parallel to tube walls; vesica with many moderately or weakly sclerotized, spine- or needle-like cornuti concentrated towards apex of aedeagus; single very large, horn-like cornutus centrally, weakly sclerotized and indistinct; sparse sclerotization forming ill-defined cornuti visible in central part of vesica.

**BIOLOGY.** Adults collected in April.

**DIAGNOSIS.** The combination of unusual forewing pattern with glossy silver markings, together with the paired elongate sclerites in the aedeagus and the bifid uncus make this species unique among all nepticulids.

**DISTRIBUTION.** Belize.

**CONDITION OF TYPE MATERIAL.** The holotype is well-preserved, with distinct wing pattern; most of the paratypes have at least slightly abraded forewings; the abdomen of one paratype is missing.

**MATERIAL EXAMINED.**

Holotype ♂, **Belize:** Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16.iv.1998 (*Puplisis & Hill*), genitalia slide no. 29106♂ (BMNH).

Paratypes, 6♂, data as holotype, genitalia slide no. AD0303 (BMNH (4); VPU (2)).

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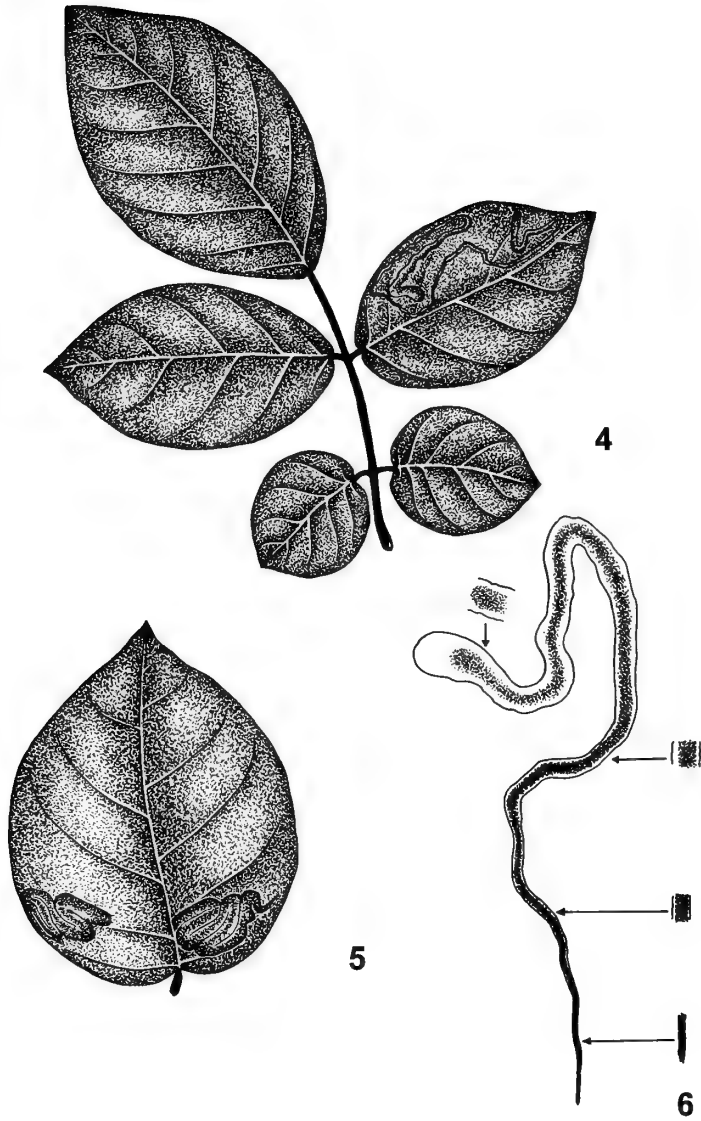
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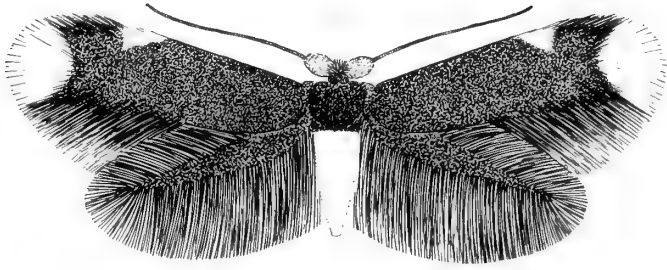
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Synonyms and misidentifications are in *italics*; principal references are in **bold**.

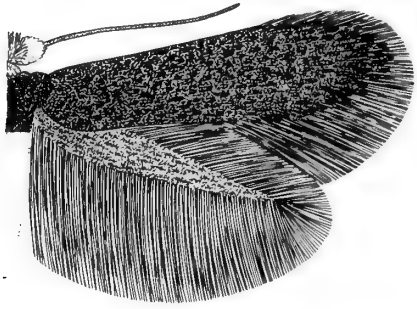
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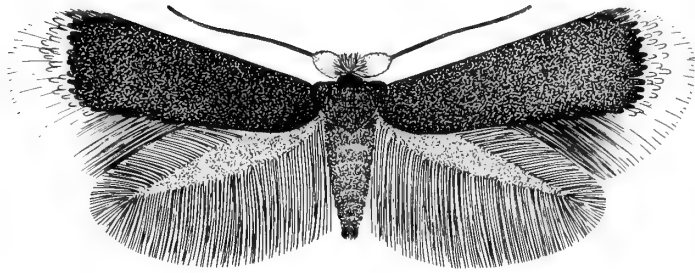
**Figs 4–6** Mines of *Acalyptris* species 29140 on *Lonchocarpus lineatus* Pittier (Leguminosae). 4, twig with two sinuous mines on one leaf; 5, leaf with two contorted mines; 6, gallery showing frass distribution.



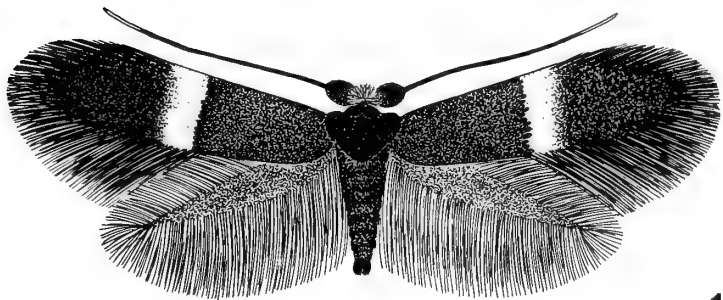
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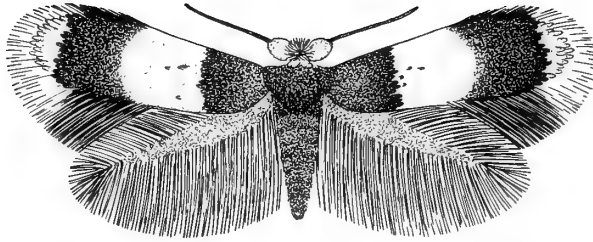


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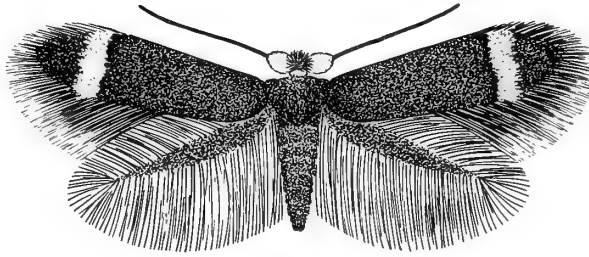


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**Figs 7–10** *Enteucha* species. 7, *cyanochlora* ♂ (Guyana); 8, *hilli* ♂ (Belize); 9, *contracolora* ♂ (Belize); 10, *terrlicula* ♂ (Peru).



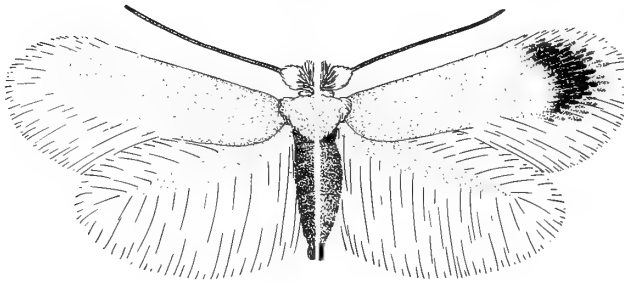
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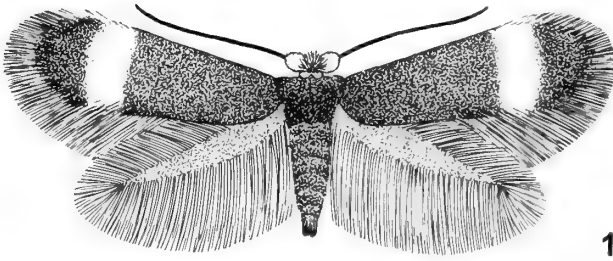
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**Figs 11–14** Neotropical Nepticulidae. 11, *Enteucha snaddonii* ♀ (Belize); 12, *Manoneura basidactyla* ♂ (Belize); 13, *Manoneura trinararia* ♂ (Venezuela); 14, *Stigmella andina* ♂ left side, ♀ right side (Peru).

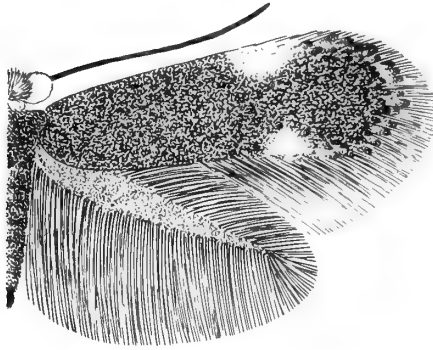




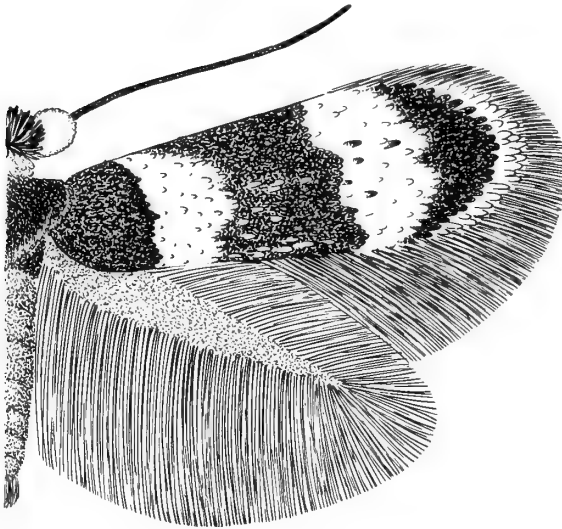
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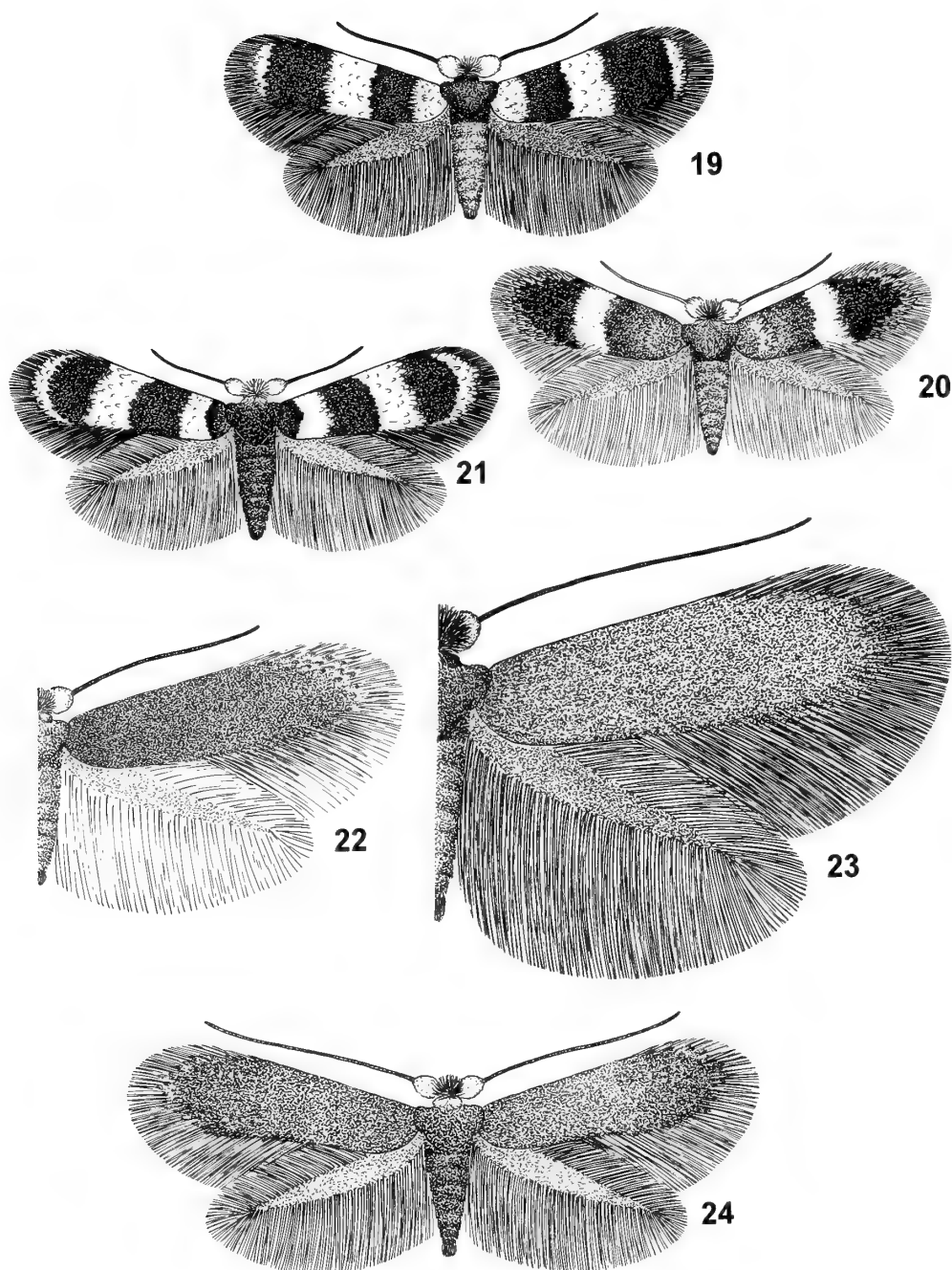


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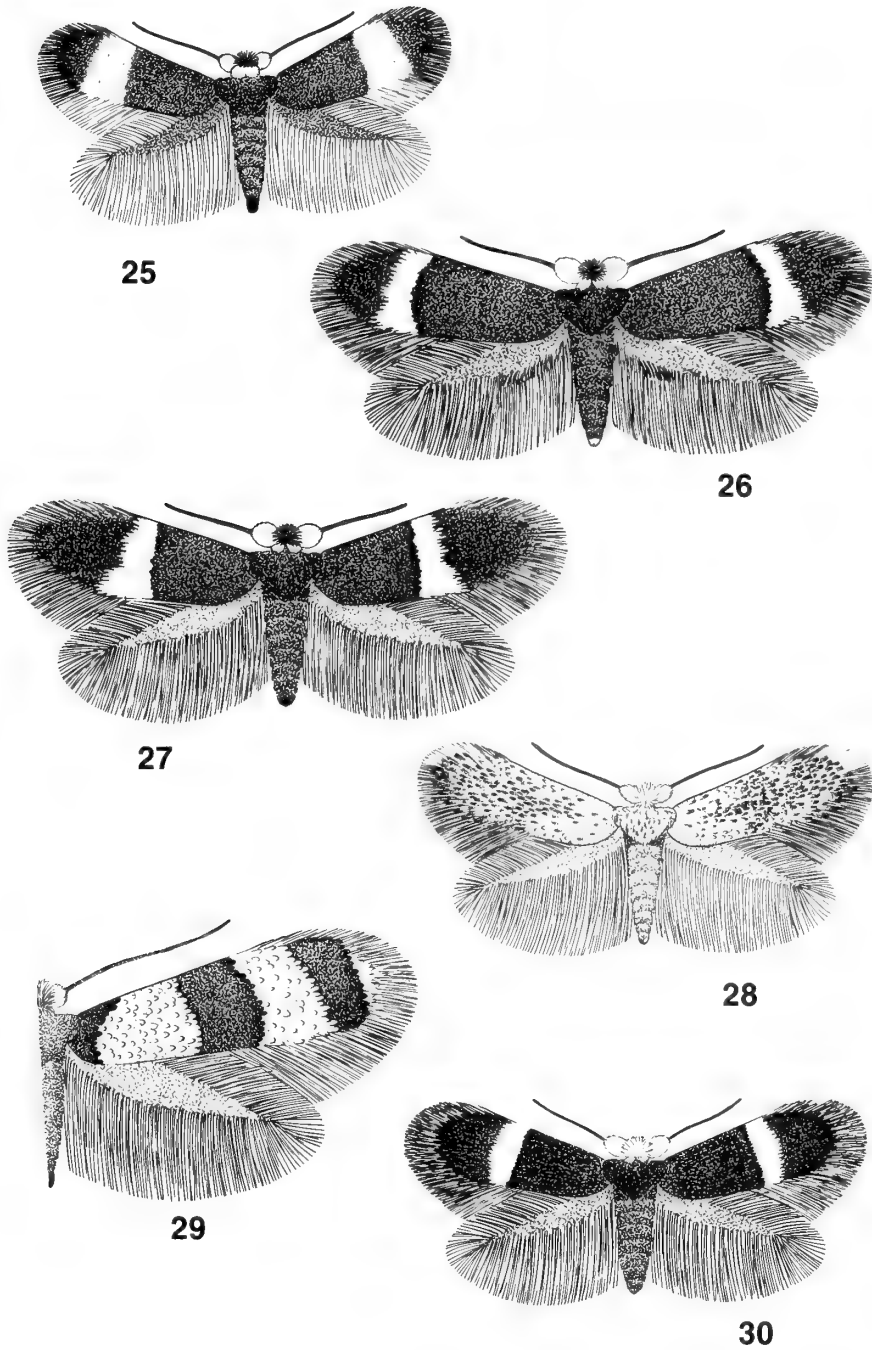


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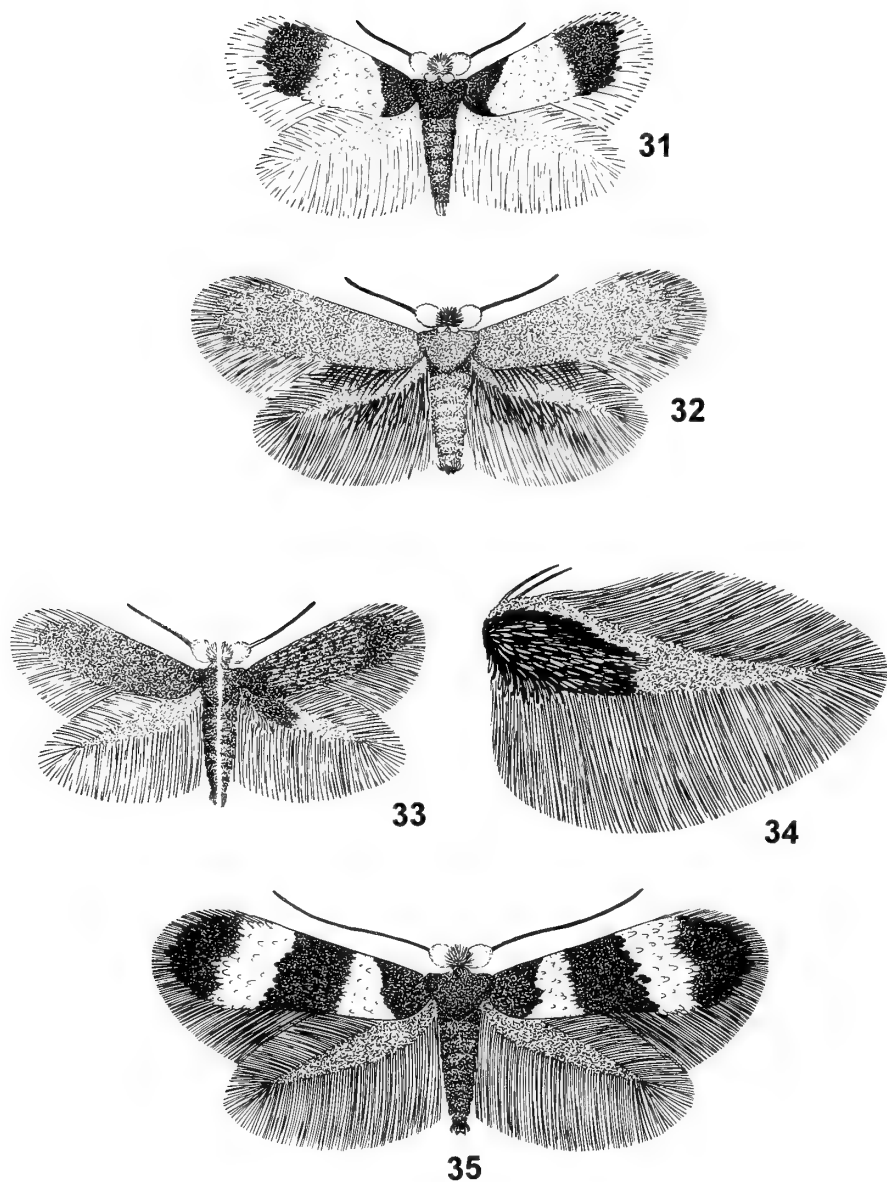
**Figs 15–18** *Stigmella* species. 15, *cuprata* ♂ (Peru); 16, *johannis* ♂ (Colombia); 17, *rudis* ♂ (Argentina); 18, *marmorea* ♂ (Peru).



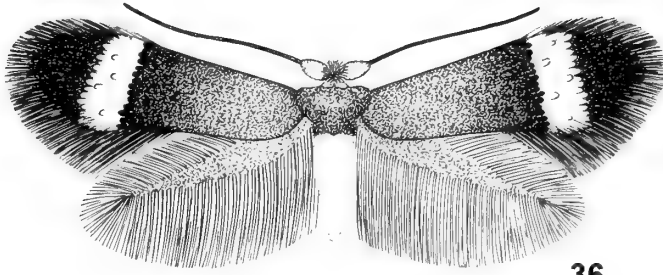
Figs 19–24 *Stigmella* species (Peru). 19, *peruanica* ♂; 20, *epicosma*, lectotype ♂ (Lima, 500 ft); 21, *epicosma* ♀, not type series (Rio Andamayo Valley, ca. 3000 m); 22, *hamata* ♂; 23, *imperatoria* ♂; 24, *schoorli* ♂.



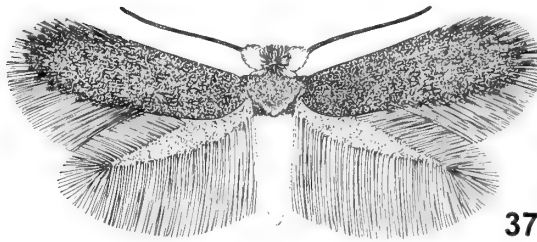
**Figs 25–30** *Stigmella* species. 25, *eurydesma* ♂ (Guyana); 26, *albilamina* ♂ (Belize); 27, *fuscilamina* ♂ (Belize); 28, *olyritis* ♂ (Peru); 29, *gossypii* ♂ (after Newton & Wilkinson, 1982) (Puerto Rico); 30, *kimae*, ♂ (Belize).



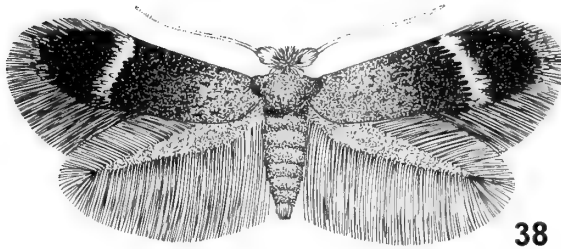
**Figs 31–35** *Stigmella* species. 31, *plumosetaeella* ♂ (Mexico); 32, *barbata* ♂ (Belize); 33, *pruinosa* ♀ left side, ♂ right side (Belize), 34, *pruinosa*, male hindwing (Belize); 35, *ovata* ♂ (Argentina).



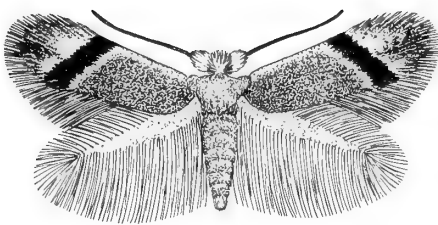
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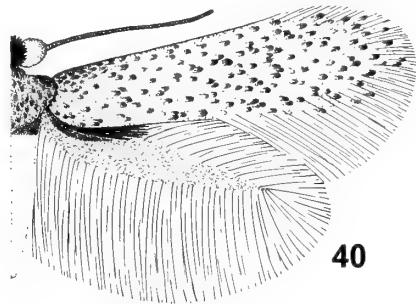
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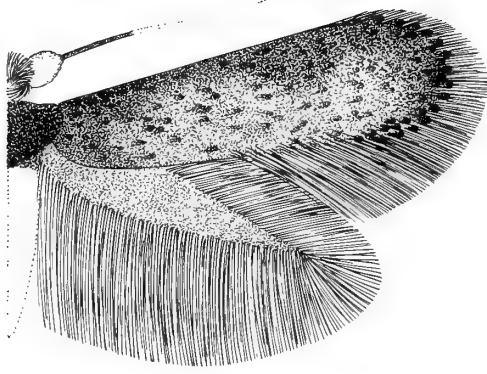


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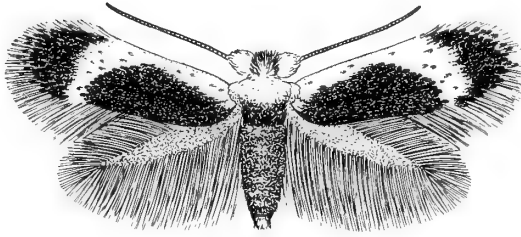


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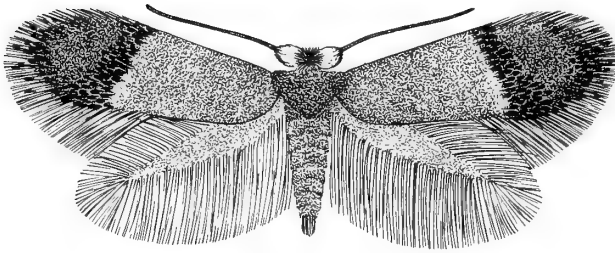
**Figs 36–40** Neotropical Nepticulidae. 36, *Stigmella hylomaga* ♀? (Argentina); 37, *S. costalimai* ♀ (Argentina); 38, *S. guittonae* ♀ (Argentina); 39, *Ectoedemia fuscivittata* ♂, (Belize); 40, *Ectoedemia* species 29105 ♂ (Belize).



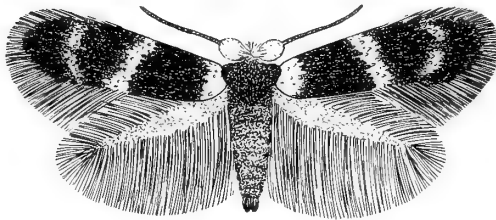
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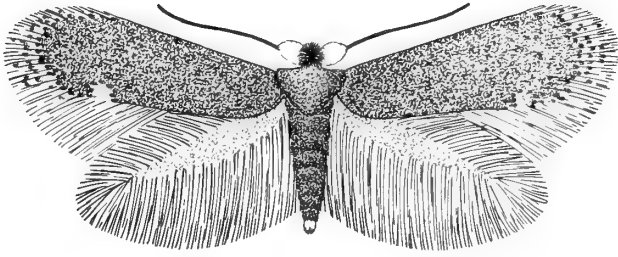


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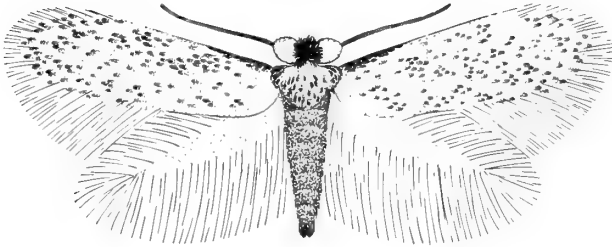


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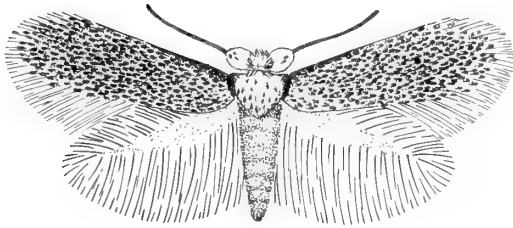
**Figs 41–44** *Fomoria* species. 41, *molybditis* ♂ (Colombia); 42, *diskusi* ♂ (Belize); 43, *latipennata* ♂ (Belize); 44, *species 29122* ♂, reconstructed (Belize).



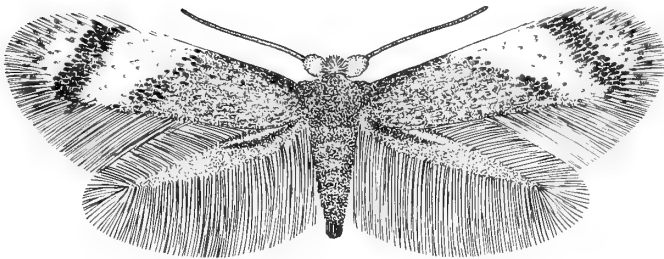
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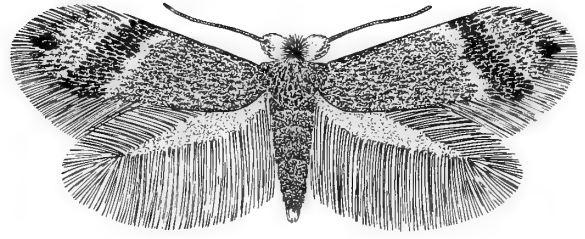
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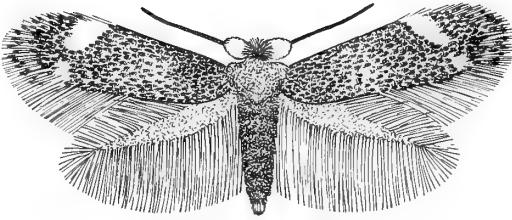
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**Figs 45–48** *Acalyptris* species, males (Belize). 45, *bovicorneus*; 46, *martinheringi*; 47, *fortis*; 48, *hispidus*.

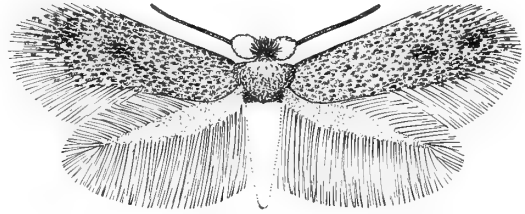




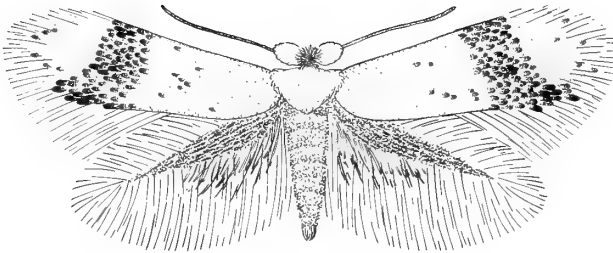
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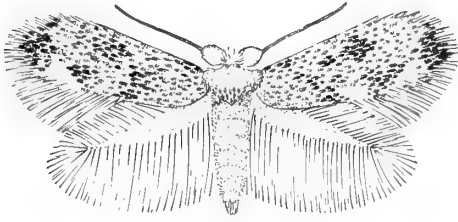


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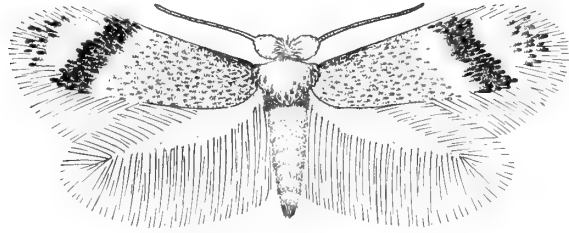


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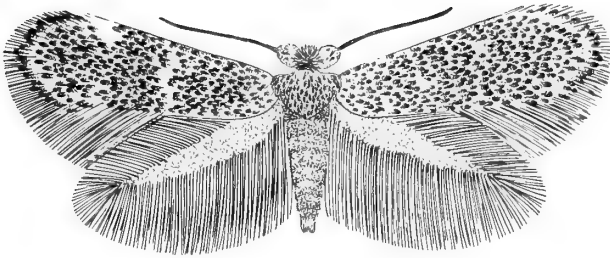
**Figs 49–52** *Acalyptris* species, males (Belize). 49, *novenarius*; 50, *lascuevella*; 51, *bifidus*; 52, *trifidus*.



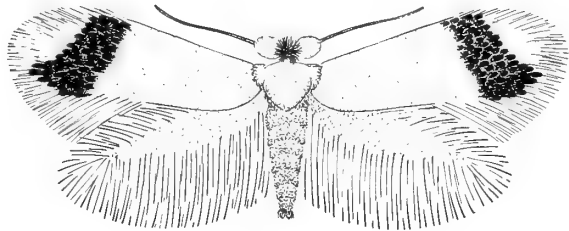
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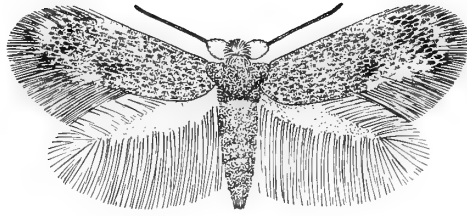


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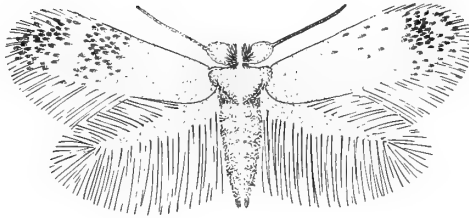


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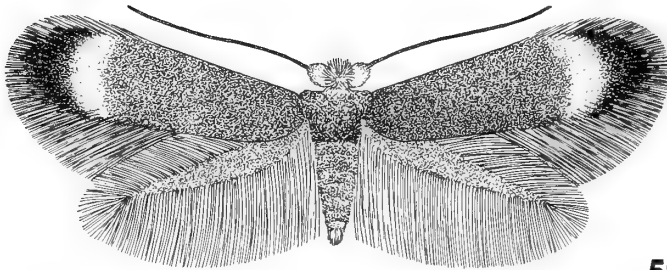
**Figs 53–56** *Acalyptris* species, ♂♂ (Belize). 53, *unicornis*; 54, *laxibasis*; 55, *species 29135*; 56, *dividua*.



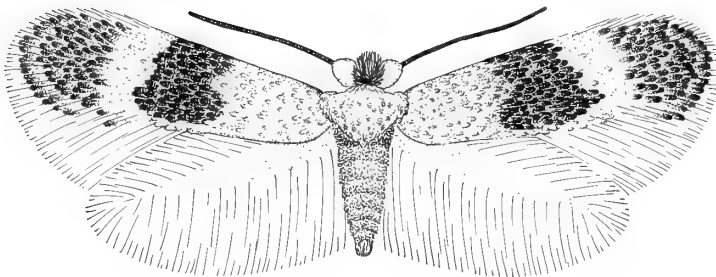
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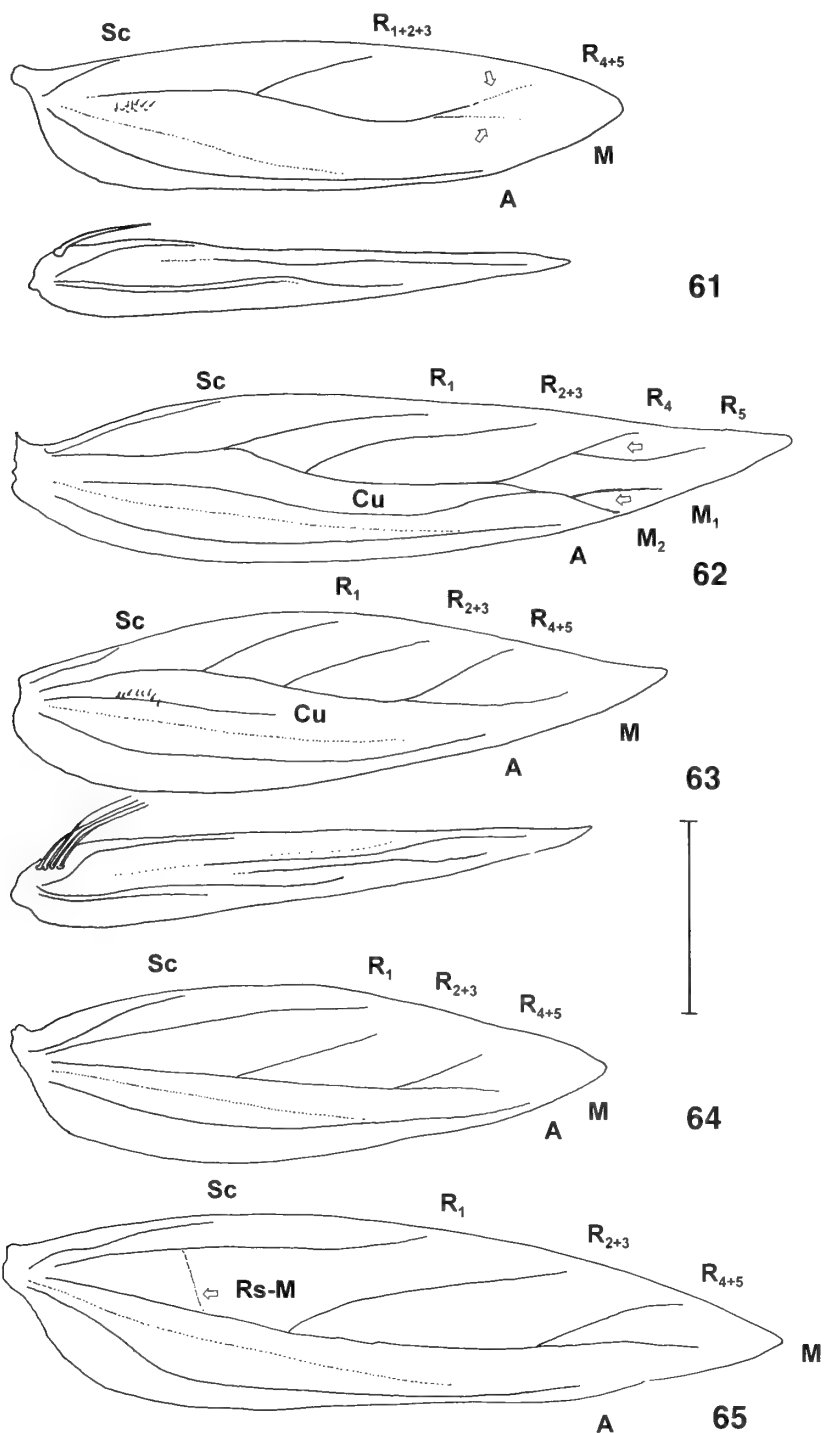


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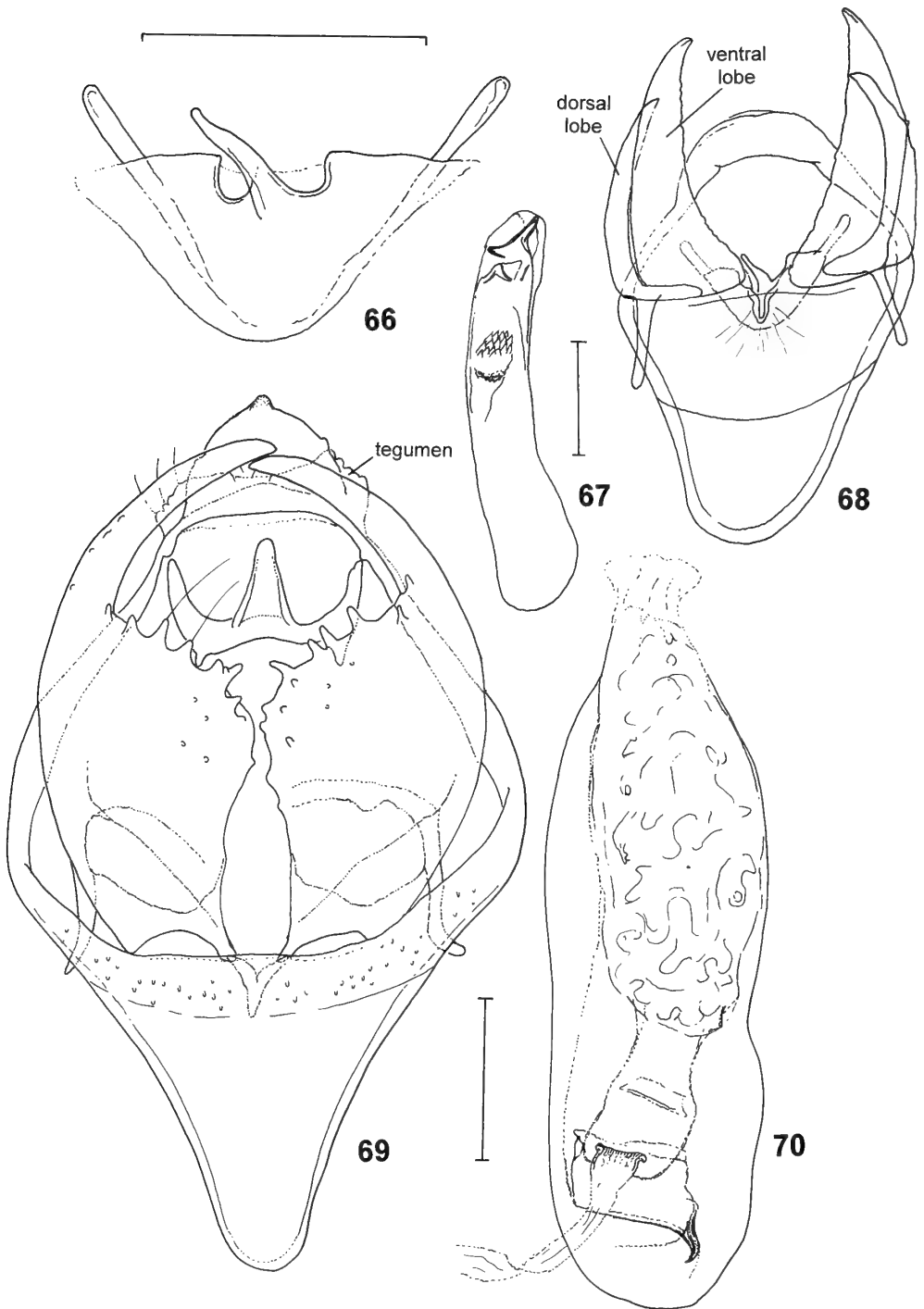


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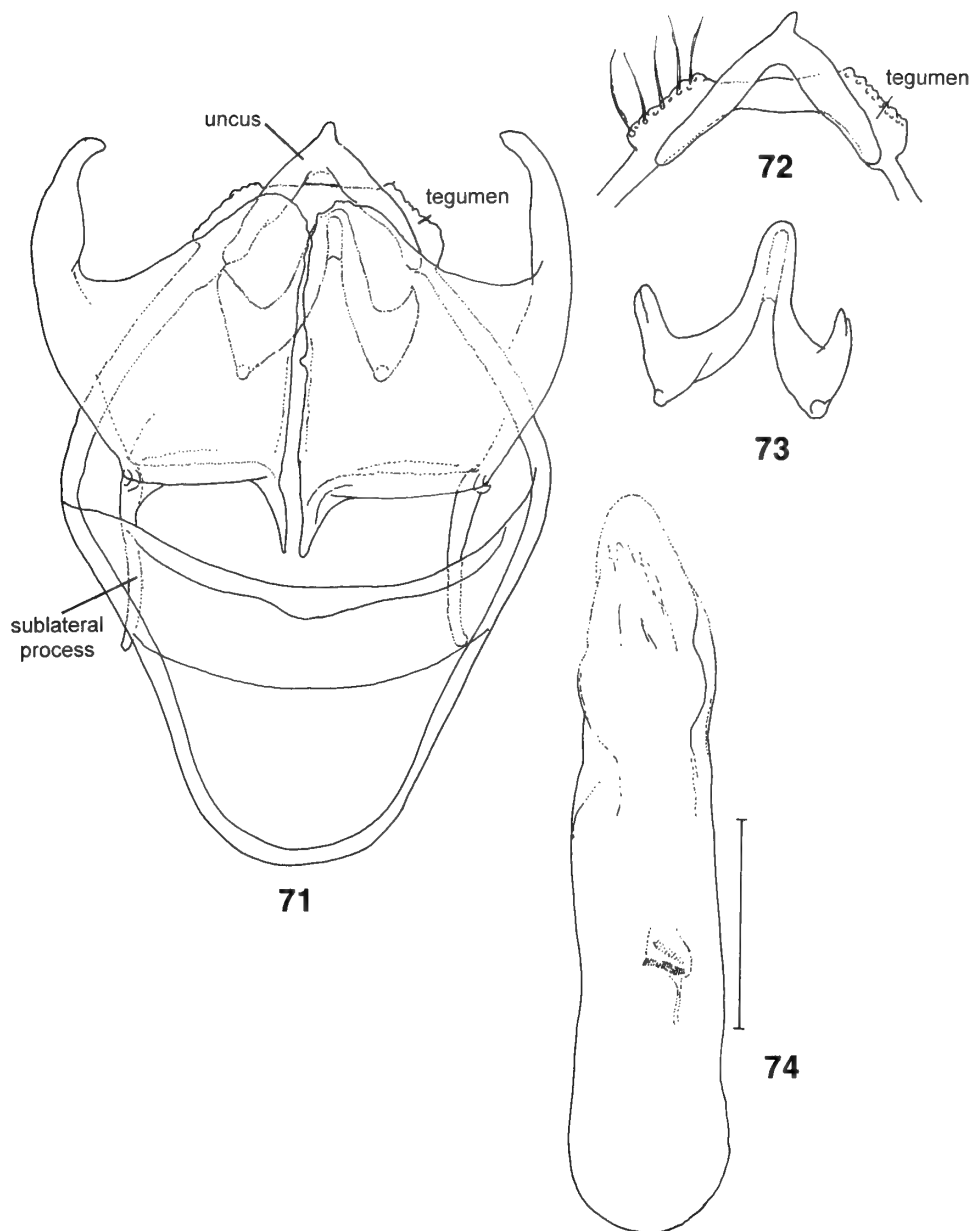
Figs 57–60 Neotropical Nepticulidae. 57, *Acalypttris platygnathos* ♂ (Belize); 58, *Acalypttris* species 29140 ♀, left & right sides (Belize); 59, *Glaucolepis aerifica* ♂ (Peru); 60, *Glaucolepis argentosa* ♂ (Belize).



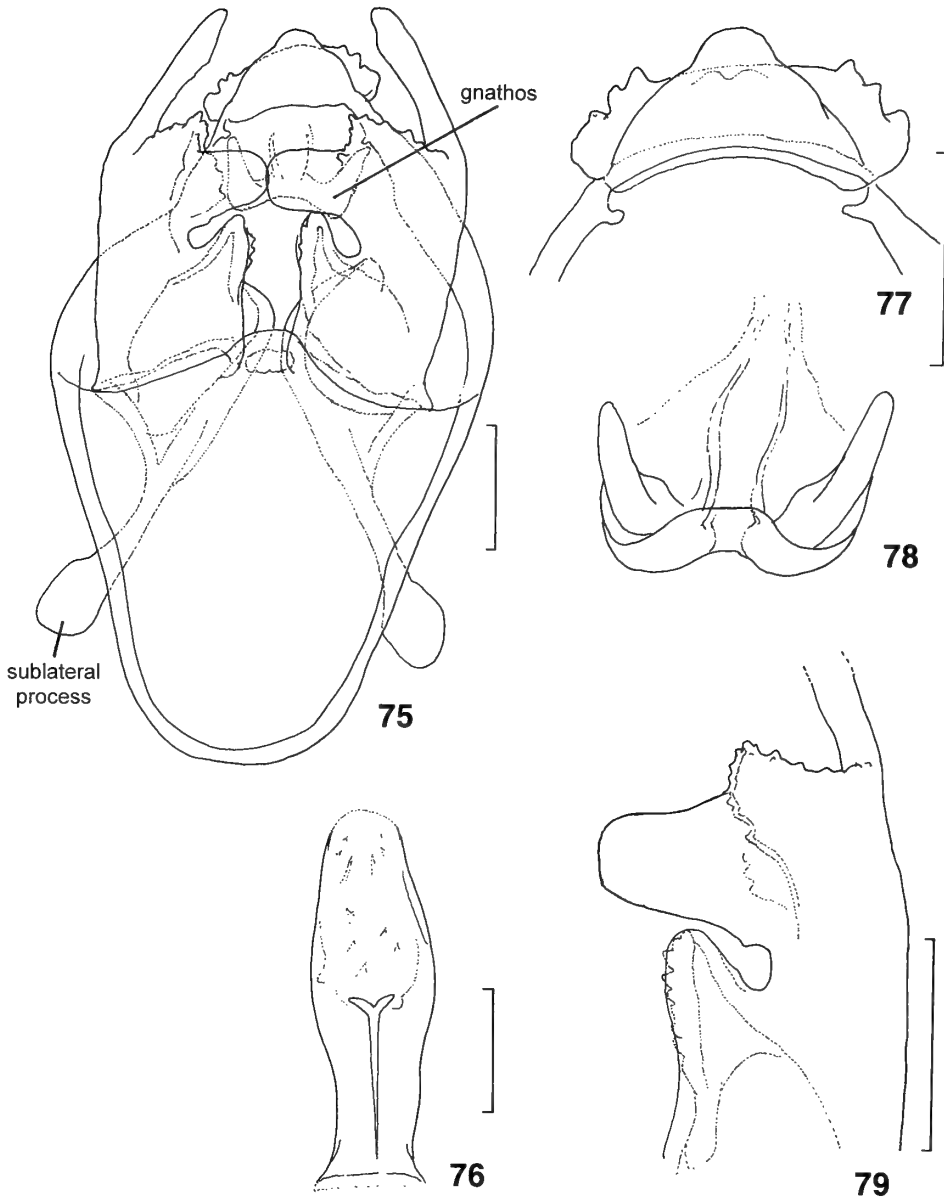
**Figs 61–65** Wing venation. 61, *Manoneura basidactyla*, ♂ forewing & hindwing; 62, *Stigmella ovata*, ♂ forewing; 63, *Stigmella albilamina*, ♀ forewing and hindwing; 64, *Fomoria diskusi*, ♂ forewing; 65, *Acalyptris bovicorneus*, ♂ forewing. Scale: 0.5 mm.



**Figs 66–70** Male genitalia of *Enteucha* species. 66, *cyanochlora*, holotype (Guyana) (12273 – BMNH), gnathos; 67, same, aedeagus; 68, same, capsule; 69, *hilli*, holotype, Belize (28967 – BMNH), capsule; 70, same, aedeagus. Scale: 0.1 mm.

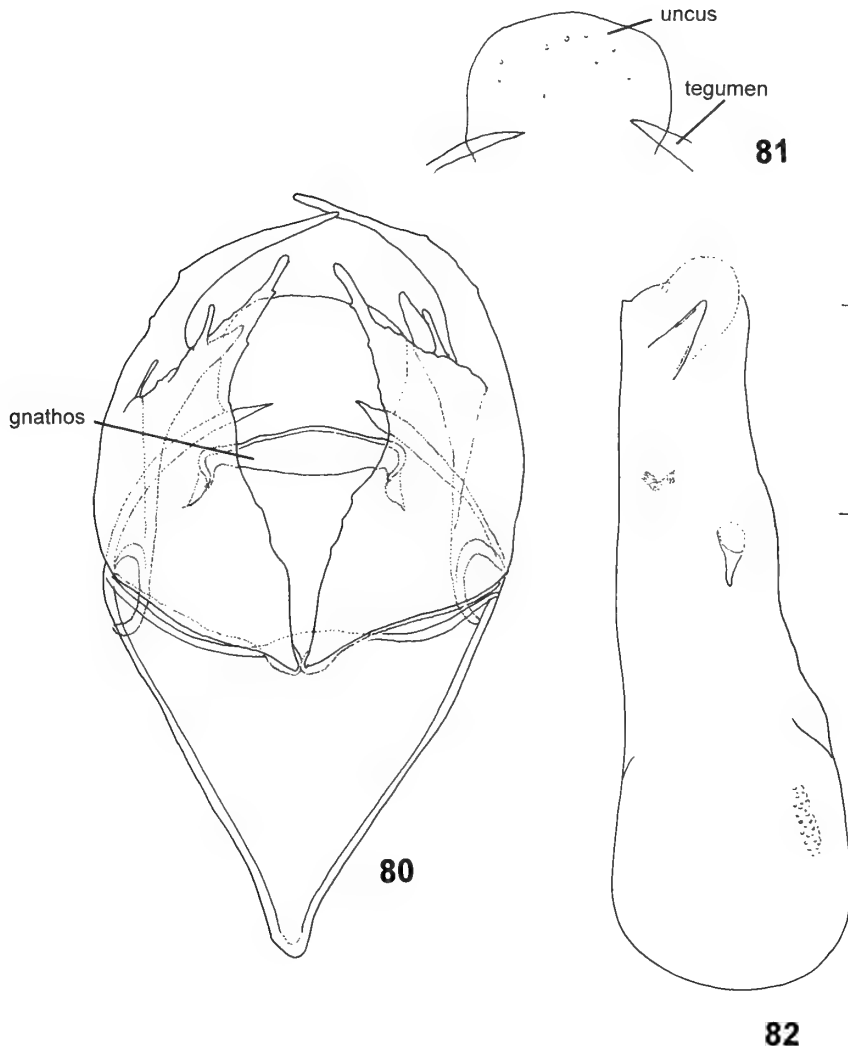


**Figs 71–74** Male genitalia of *Enteucha contracolorea*, holotype, Belize (29114 – BMNH). 71, capsule; 72, uncus and tegumen; 73, gnathos; 74, aedeagus. Scale: 0.1 mm.

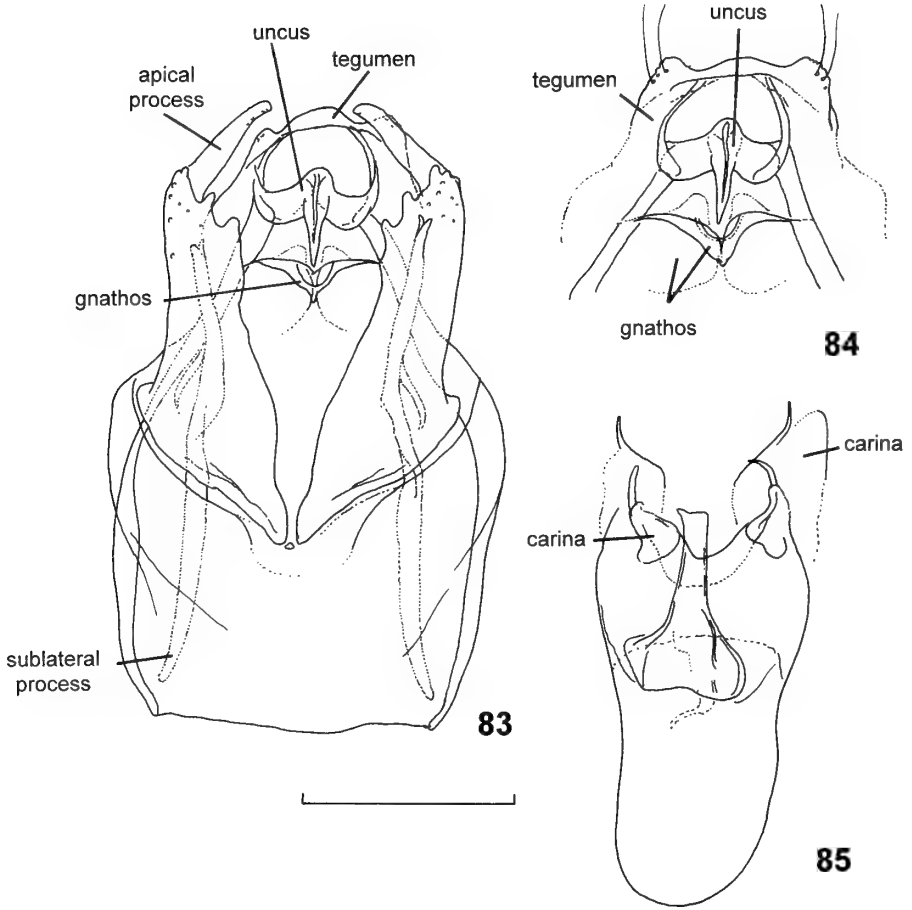


**Figs 75–79** Male genitalia of *Enteucha terricola*, holotype, Peru (Diškus183–ZMUC). 75, capsule; 76, aedeagus; 77, uncus and tegumen; 78, gnathos; 79, valva (apical process omitted). Scale: 0.1 mm.

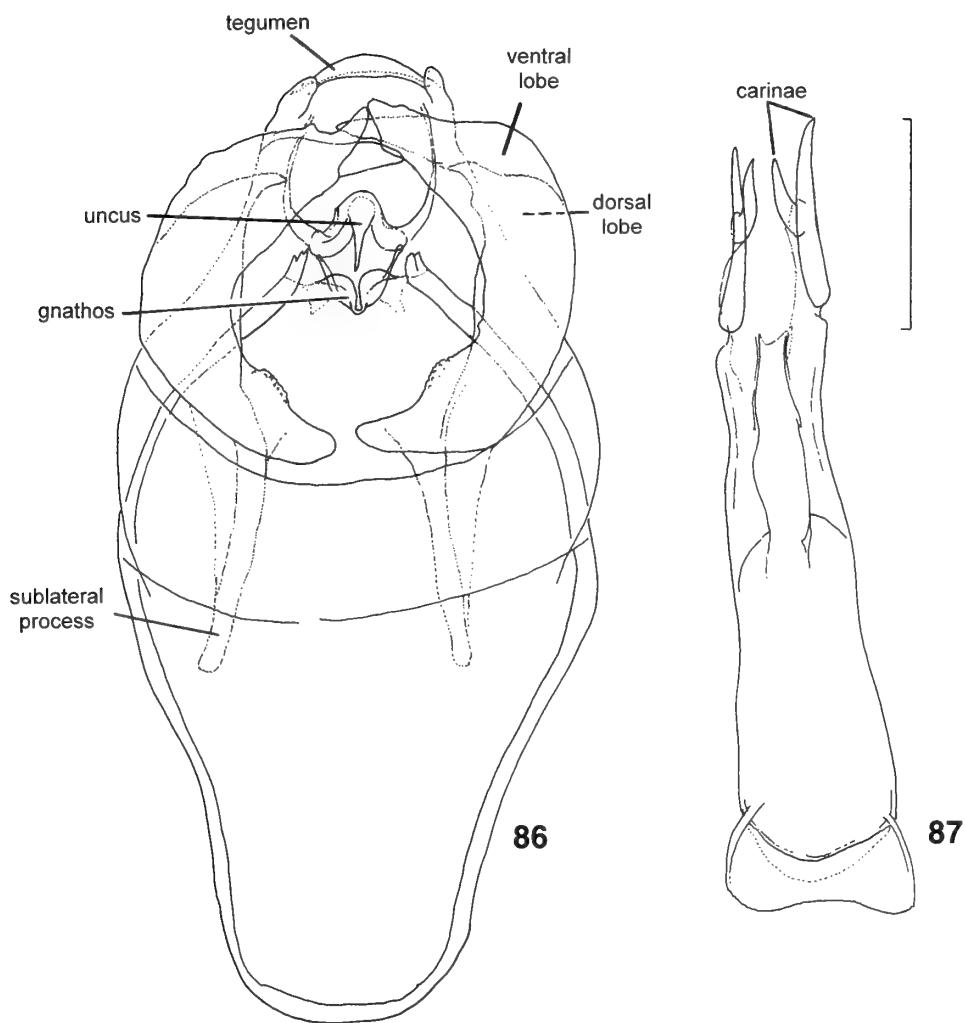




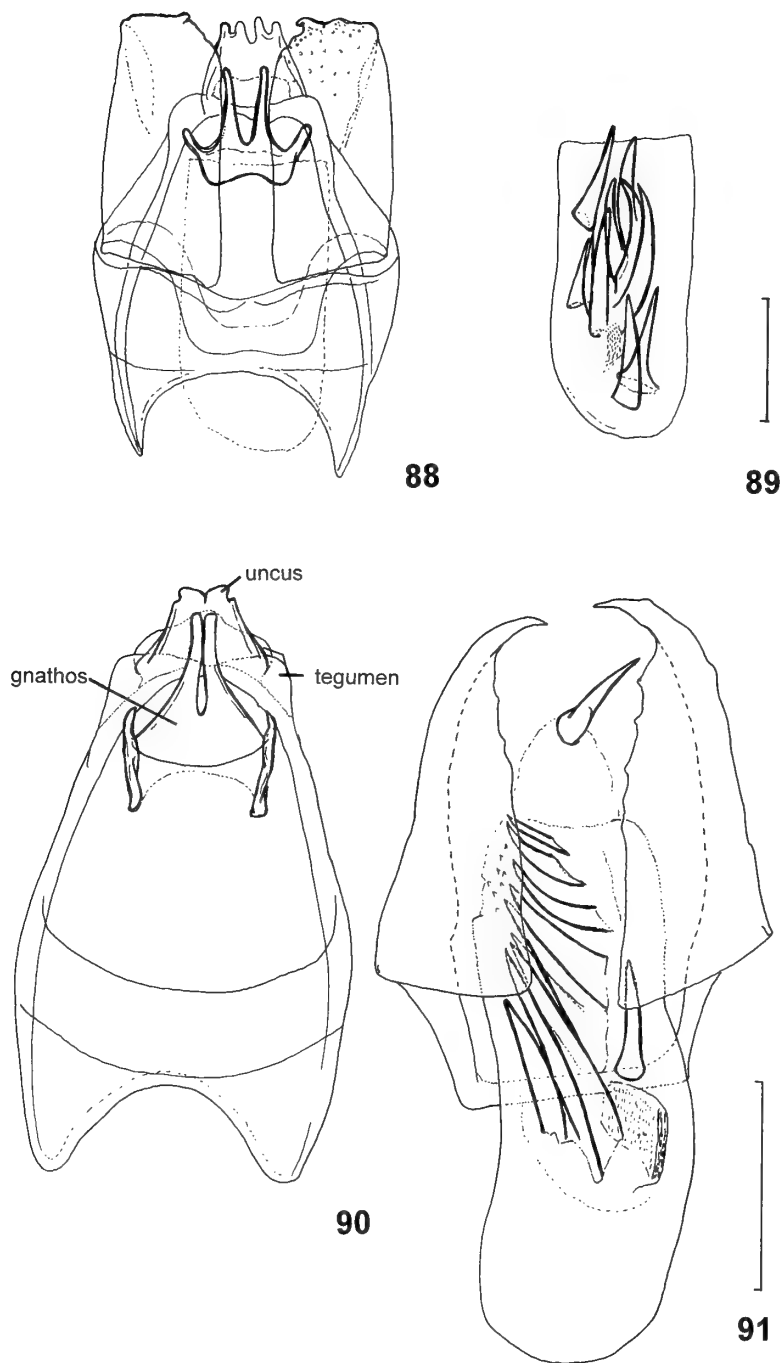
**Figs 80–82** Male genitalia of *Enteucha snaddoni*, holotype, Belize (29117 – BMNH). 80, capsule; 81, uncus and tegumen; 82, aedeagus. Scale: 0.1 mm.



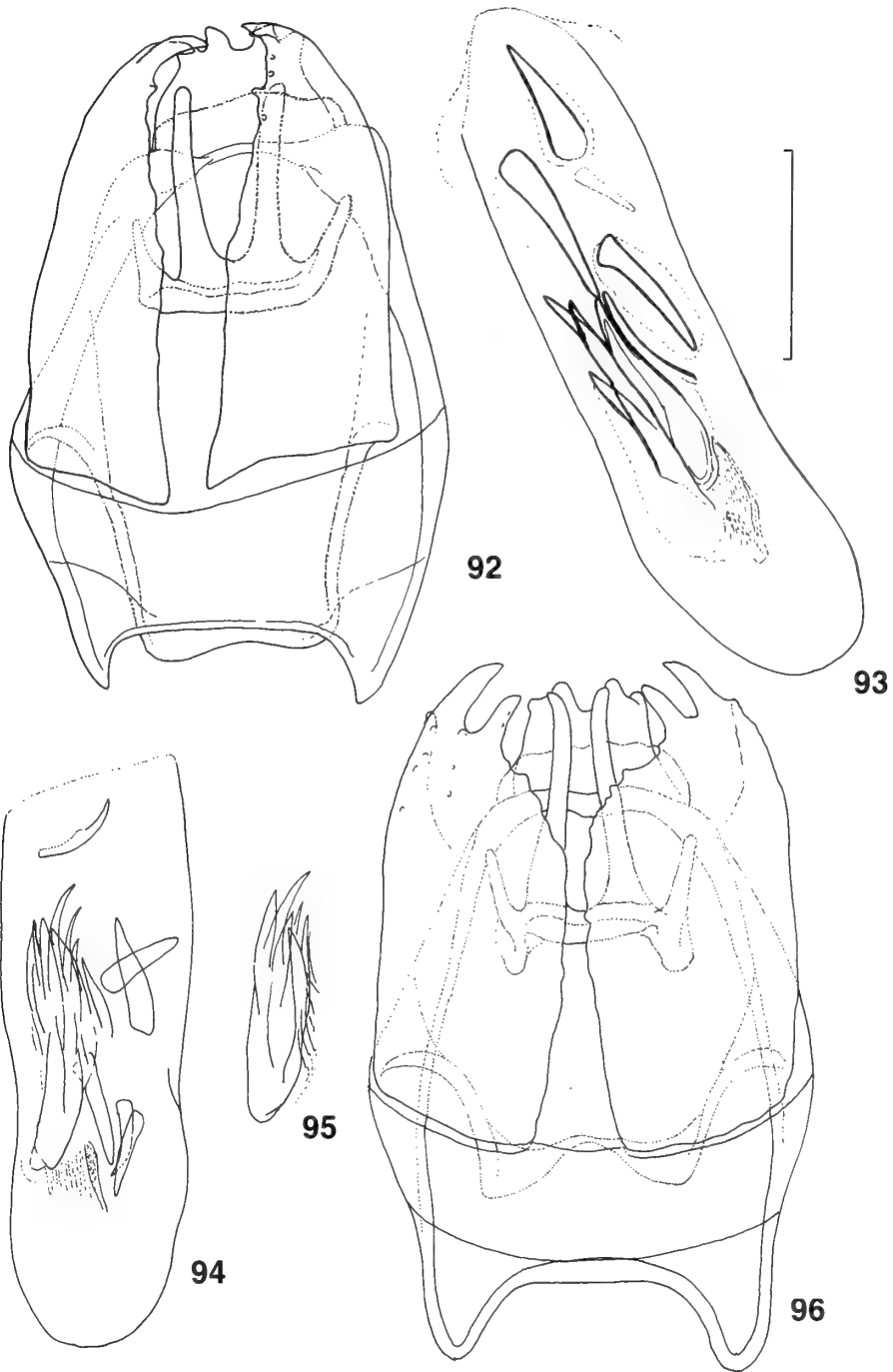
**Figs 83–85** Male genitalia of *Manoneura basidactyla*, Belize (29120 – BMNH). 83, capsule; 84, gnathos, uncus and tegumen; 85, aedeagus. Scale: 0.1 mm.



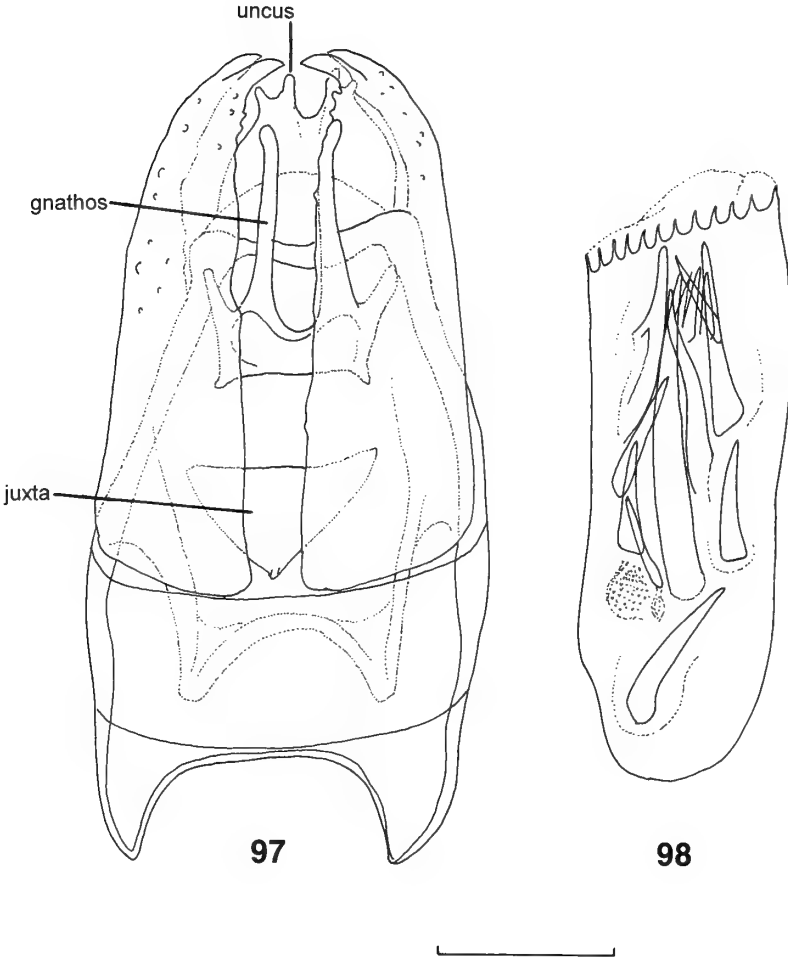
**Figs 86, 87** Male genitalia of *Manoneura tritaria*, holotype, Venezuela (Diškus003 – USNM). 86, capsule; 87, aedeagus. Scale: 0.1 mm.



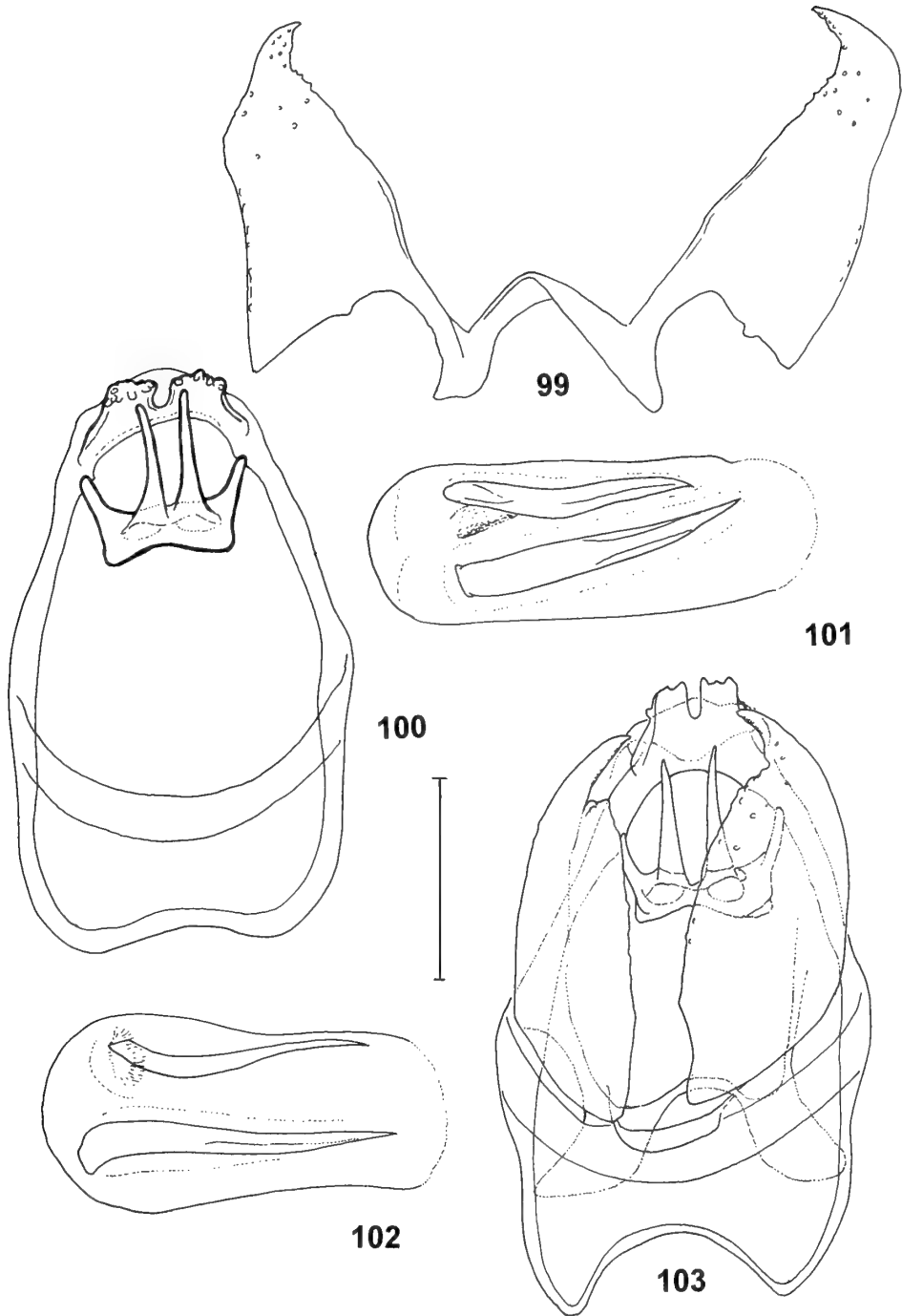
**Figs 88–91** Male genitalia of *Stigmella* species. 88, *andina*, lectotype, Peru (20612 – BMNH), capsule; 89, same, aedeagus; 90, *cuprata*, lectotype, Peru (28848 – BMNH), capsule without valvae; 91, same, valvae and aedeagus. Scale: 0.1 mm.



**Figs 92–96** Male genitalia of *Stigmella* species. 92, *johannis*, holotype, Colombia (28843 – BMNH), capsule; 93, same, aedeagus; 94, *rudis*, holotype, Argentina (Diškus175 – ZMUC), aedeagus; 95, same, paratype (Diškus180 – ZMUC), characteristic cluster of cornuti on shared base; 96, same, holotype (Diškus175 – ZMUC), capsule. Scale: 0.1 mm.

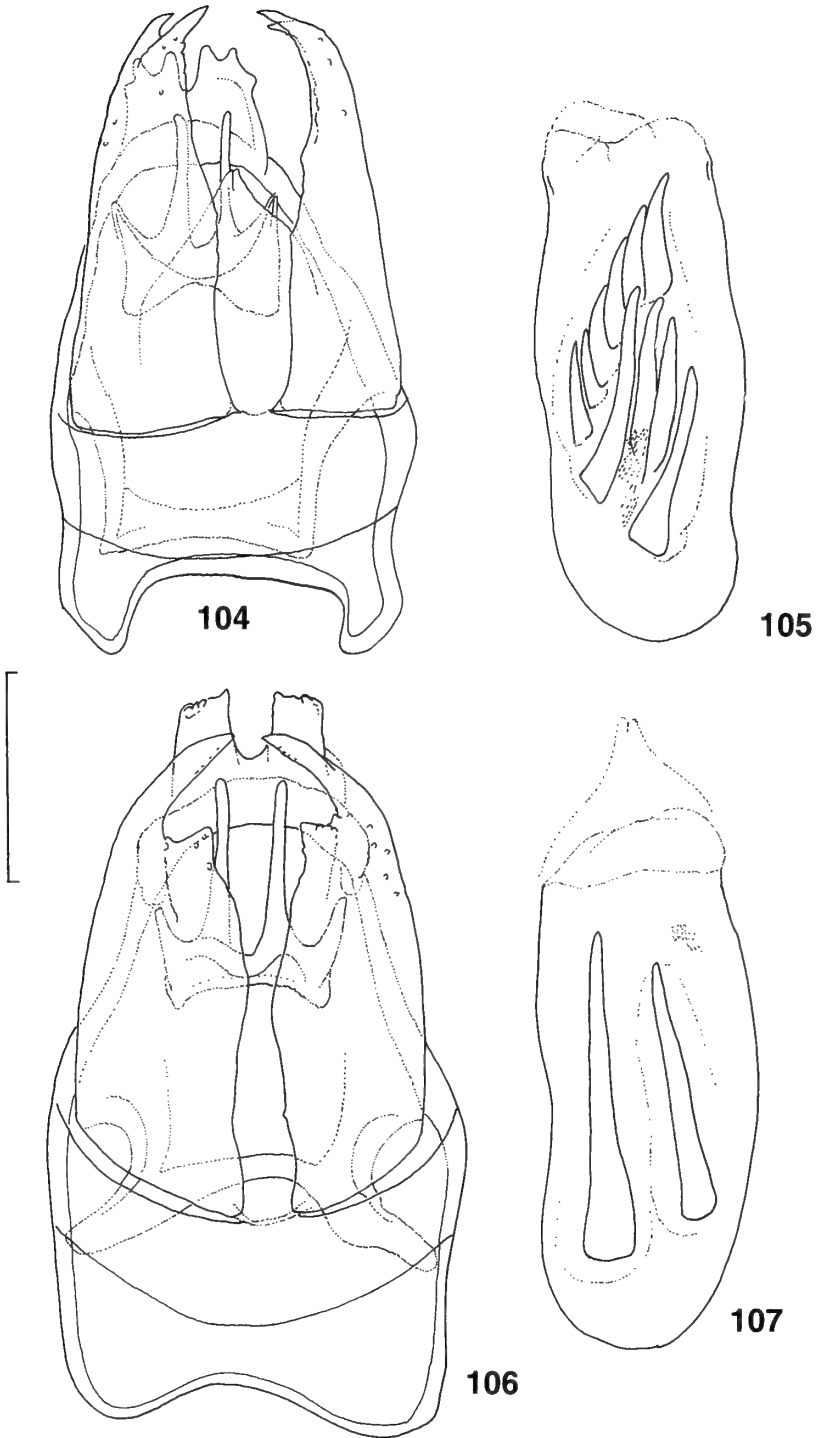


**Figs 97, 98** Male genitalia of *Stigmella marmorea*, holotype, Peru (Diškus182 – ZMUC). 97, capsule; 98, aedeagus. Scale: 0.1 mm.

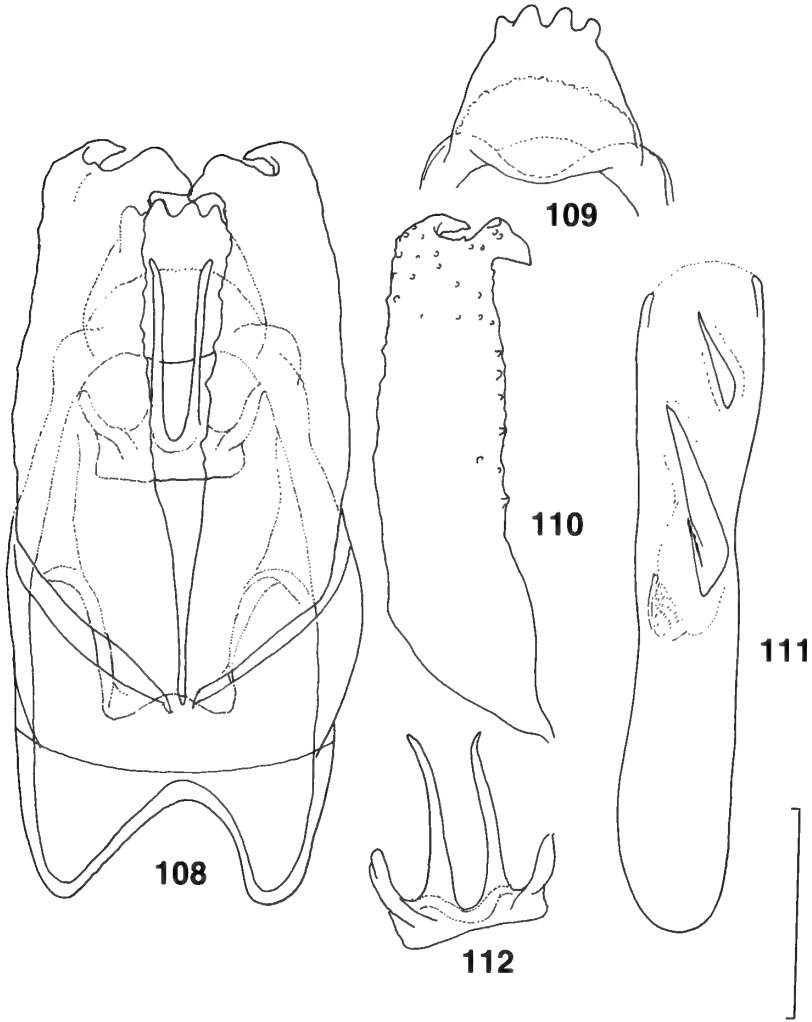


**Figs 99–103** Male genitalia of *Stigmella epicosma*, Peru. 99, lectotype: Lima (28849 – BMNH), valvae, unnaturally spread; 100, same, capsule; 101, same, aedeagus; 102, non-type male, Rio Andamayo Valley (Diškus187 – ZMUC), aedeagus; 103, same, capsule. Scale: 0.1 mm.

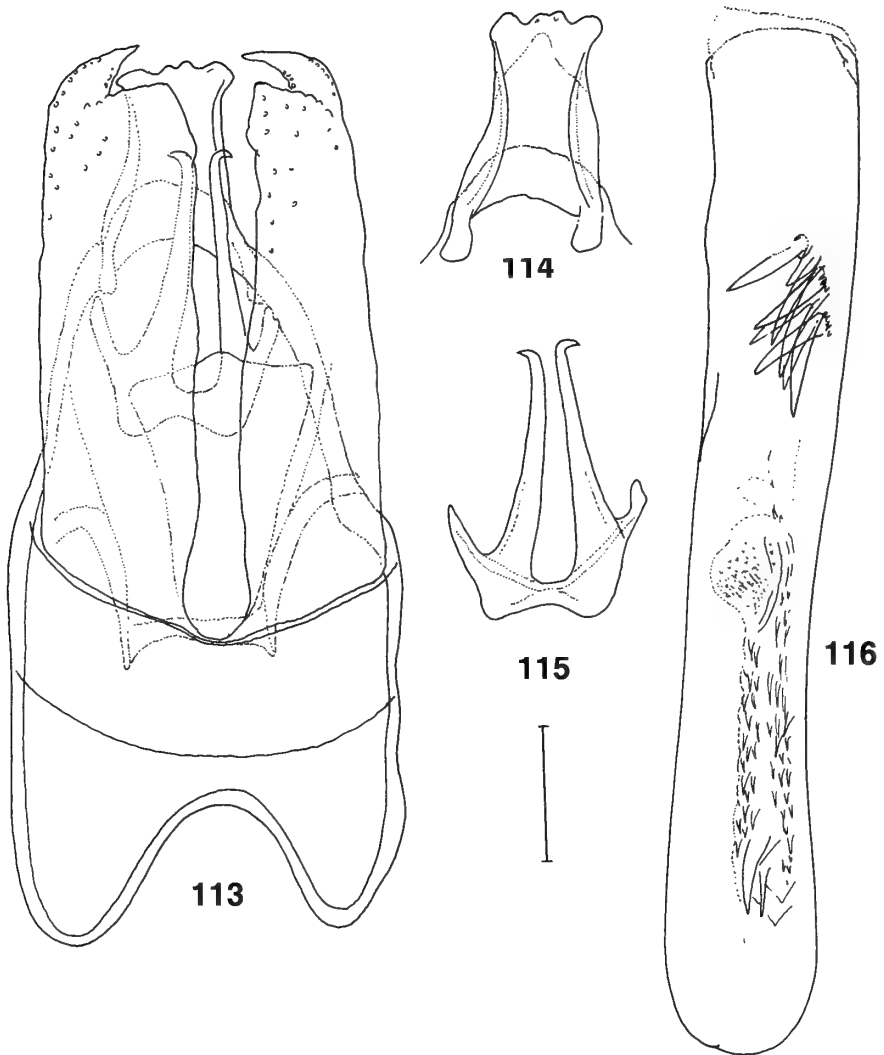




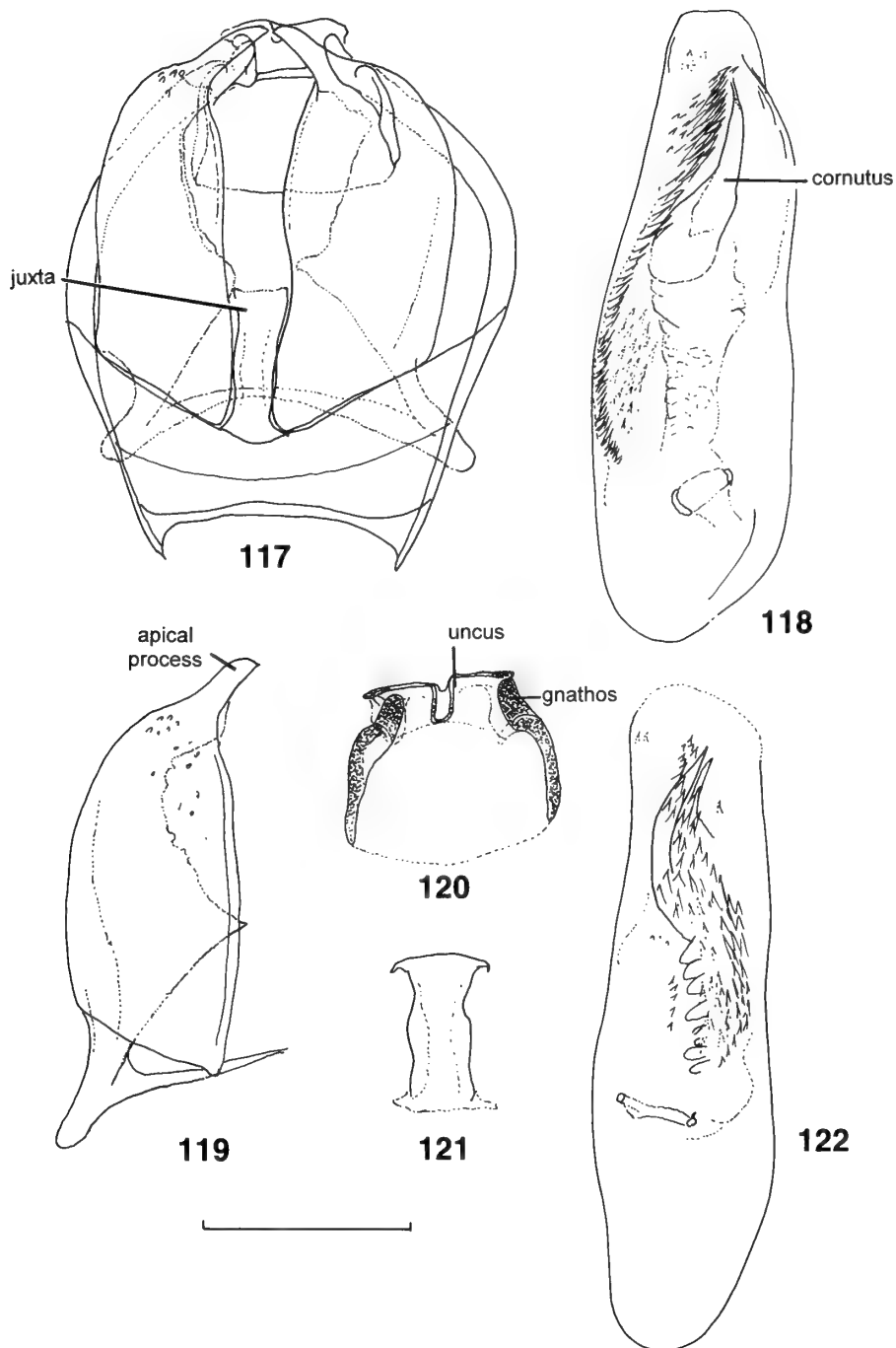
**Figs 104–107** Male genitalia of *Stigmella* species, Peru. 104, *peruanica*, holotype (Diškus189 – ZMUC), capsule; 105, same, aedeagus; 106, *schoorli*, holotype (Diškus200 – ZMUC), capsule; 107, same, aedeagus. Scale: 0.1 mm.



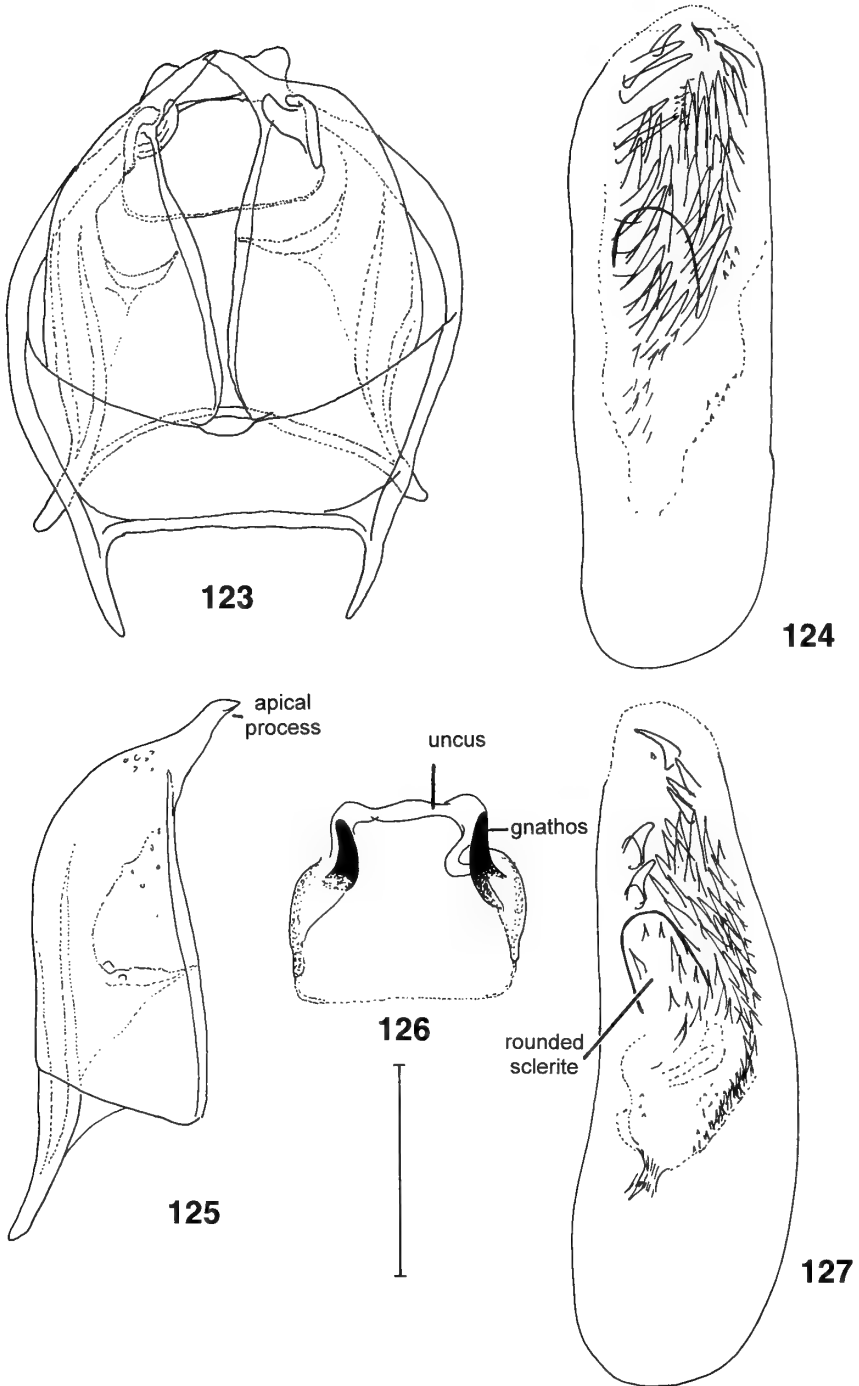
**Figs 108–112** Male genitalia of *Stigmella hamata*, holotype, Peru (Diškus 199 – ZMUC). 108, capsule; 109, uncus and tegumen; 110, left valva; 111, aedeagus; 112, gnathos. Scale: 0.1 mm.



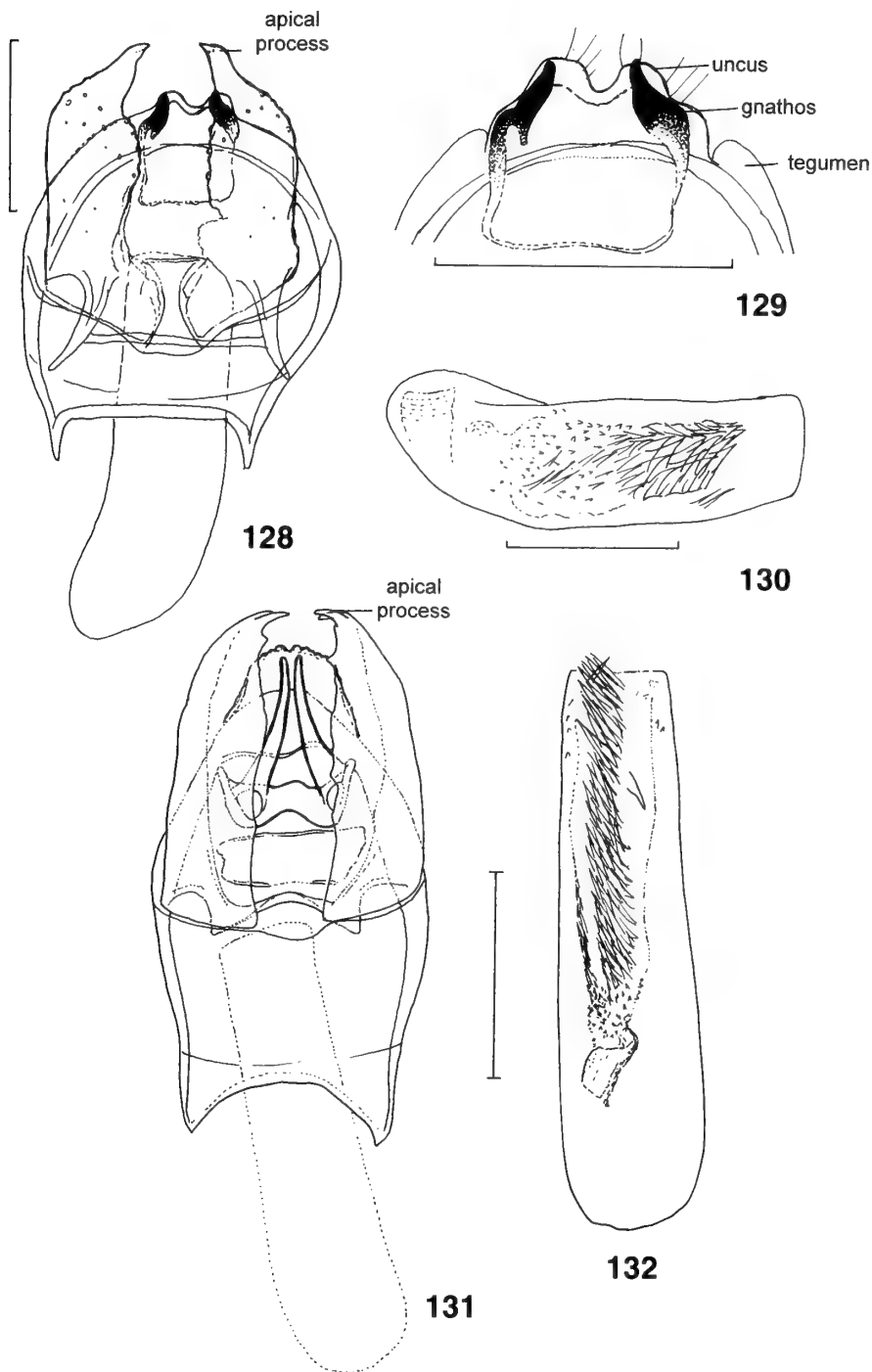
**Figs 113–116** Male genitalia of *Stigmella imperatoria*, holotype, Peru (Diškus195 – ZMUC). 113, capsule; 114, uncus and tegumen; 115, gnathos; 116, aedeagus. Scale: 0.1 mm.



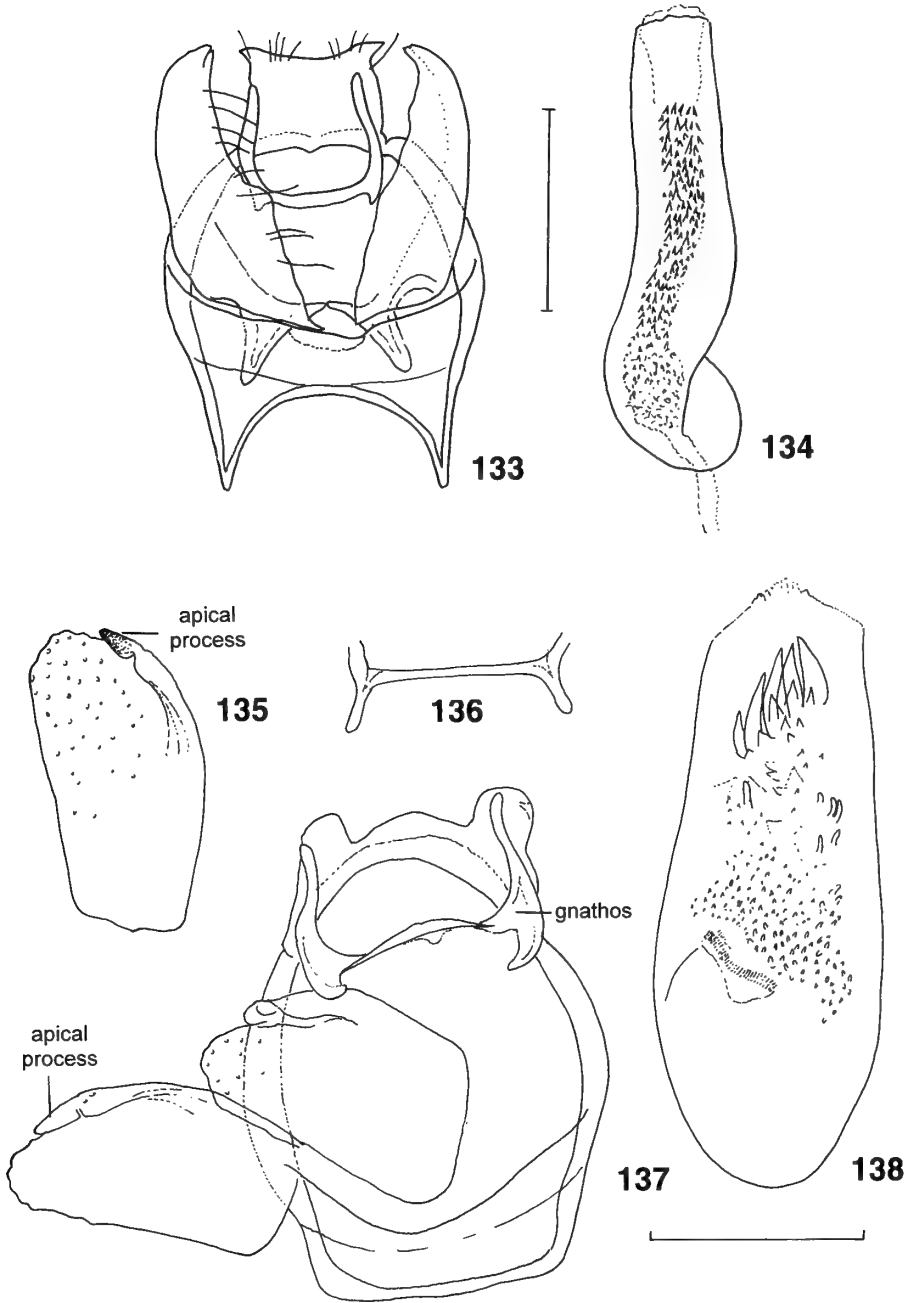
**Figs 117–122** Male genitalia of *Stigmella albilamina*, Belize. 117, holotype (29113 – BMNH), capsule; 118, same, aedeagus; 119, paratype (29113 – BMNH), left valva; 120, same, gnathos and uncus; 121, same, juxta; 122, same, aedeagus. Scale: 0.1 mm.



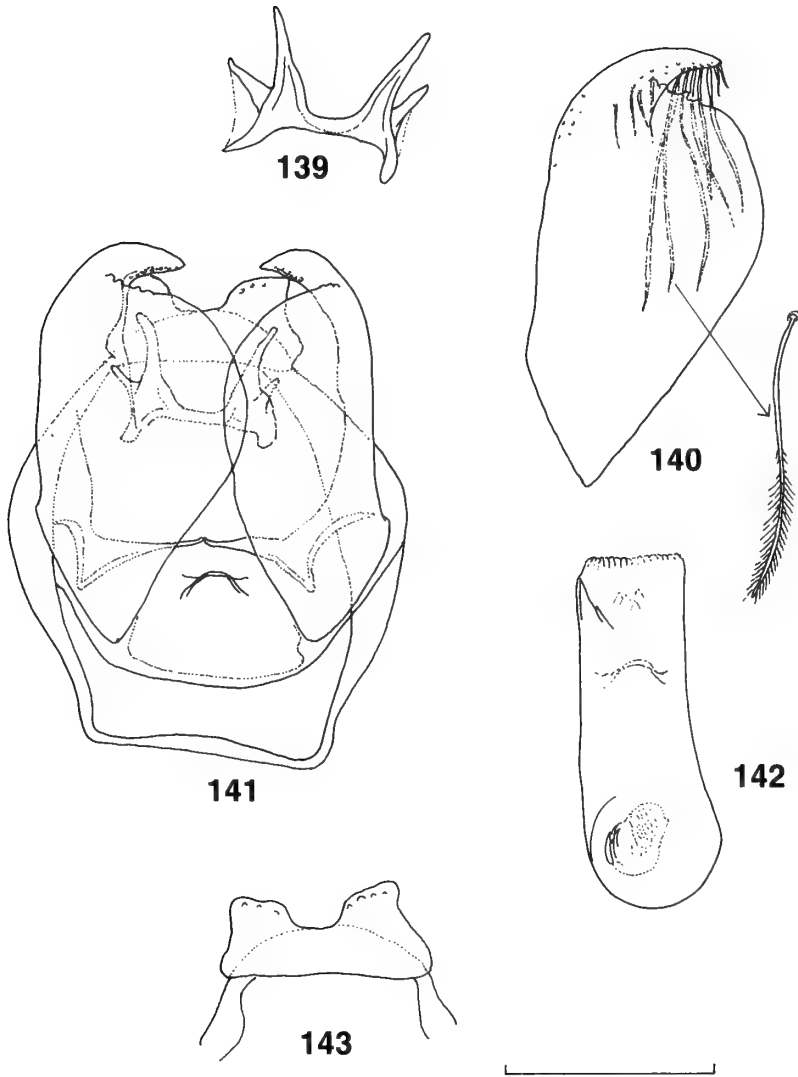
**Figs 123–127** Male genitalia of *Stigmella fuscilamina*, Belize. 123, holotype (29110 – BMNH), capsule; 124, same, aedeagus; 125, paratype (29111 – BMNH), left valva; 126, same, gnathos and uncus; 127, same, aedeagus. Scale: 0.1 mm.



**Figs 128–132** Male genitalia of *Stigmella* species. 128, *eurydesma*, lectotype, Guyana (28842 – BMNH), capsule; 129, same, gnathos and uncus; 130, same, aedeagus; 131, *olyritis*, lectotype, Peru (28851 – BMNH), capsule; 132, same, aedeagus. Scale: 0.1 mm.

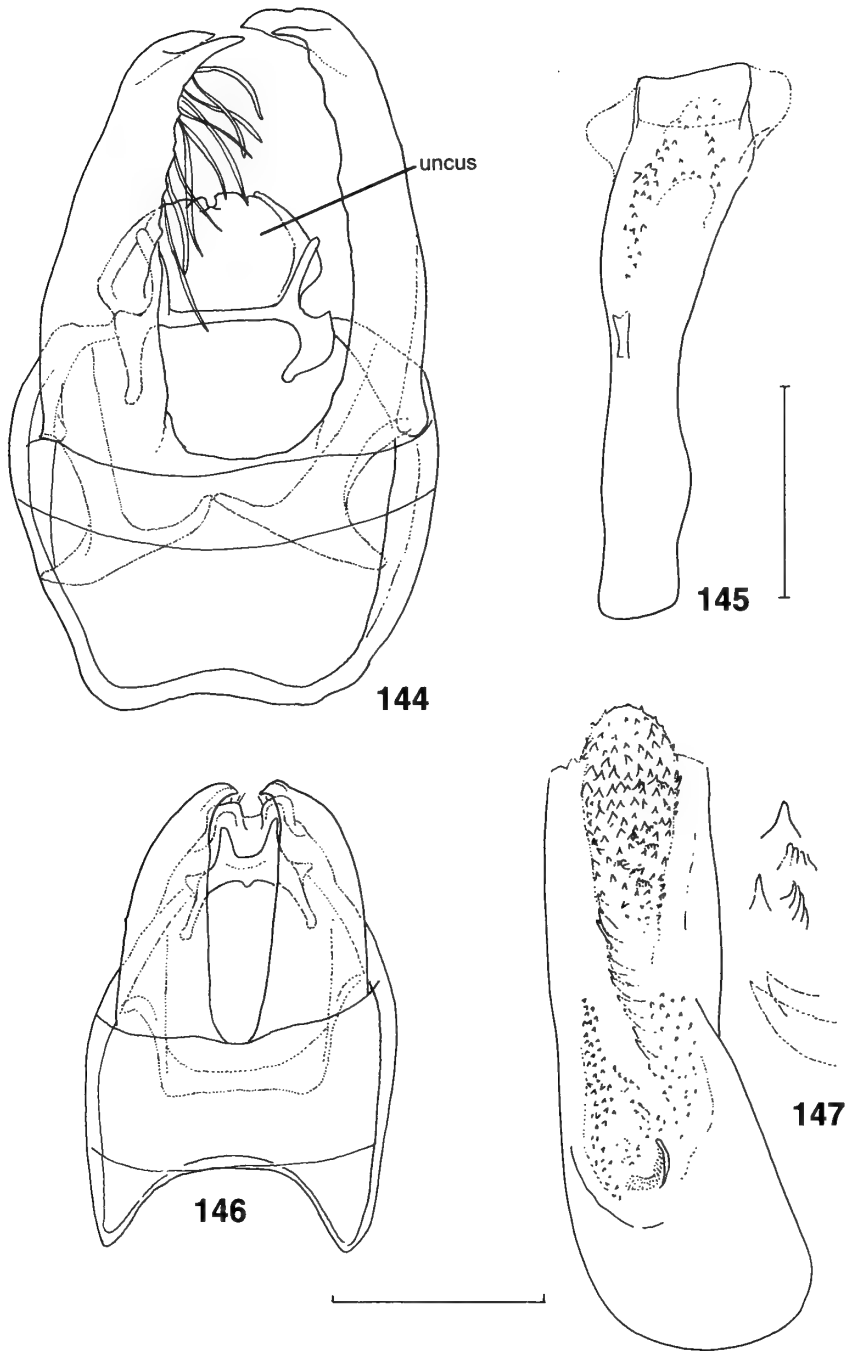


**Figs 133–138** Male genitalia of *Stigmella* species. 133, *gossypii*, Puerto Rico (after Newton & Wilkinson, 1982), capsule; 134, same, aedeagus; 135, *kimaе*, holotype, Belize (29118 – BMNH), valva; 136, same, transtilla; 137, same, capsule (with replaced and slightly squashed valvae); 138, same, aedeagus. Scale: 0.1 mm.

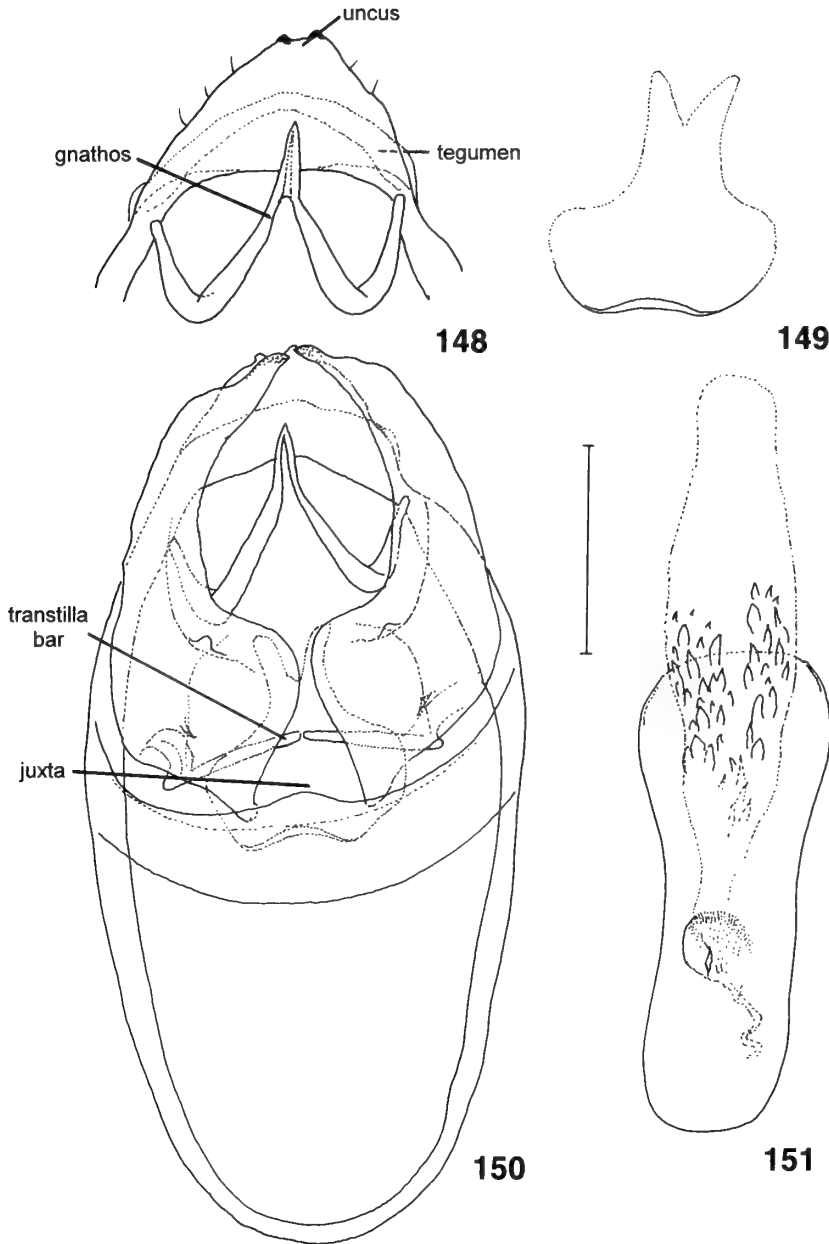


**Figs 139–143** Male genitalia of *Stigmella barbata*, holotype, Belize (29137 – BMNH). 139, gnathos; 140, valva and enlarged seta; 141, capsule; 142, aedeagus; 143, uncus and tegumen. Scale: 0.1 mm.

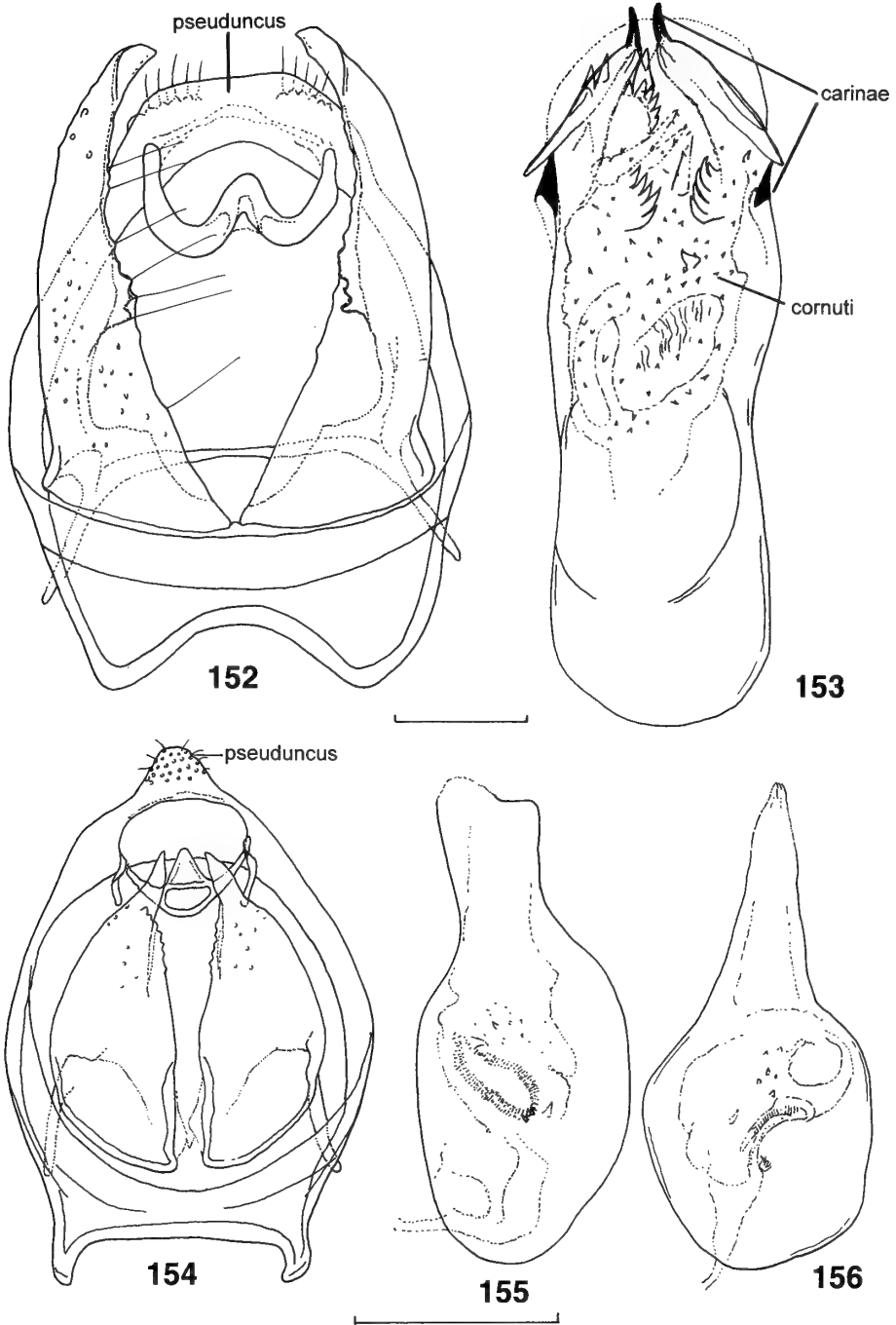




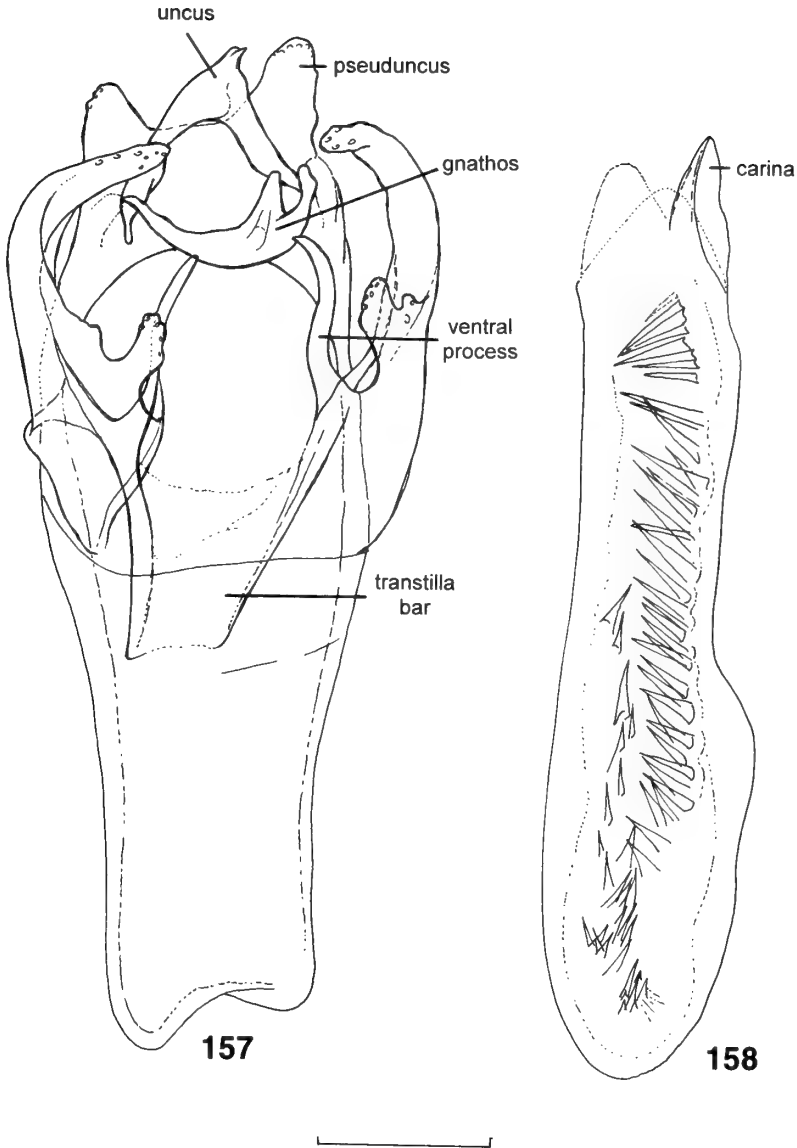
**Figs 144–147** Male genitalia of *Stigmella* species. 144, *plumosetaella*, Mexico (Diškus005 – USNM), capsule; 145, same, aedeagus; 146, *pruinosa*, holotype, Belize (29124 – BMNH), capsule; 147, same, aedeagus. Scale: 0.1 mm.



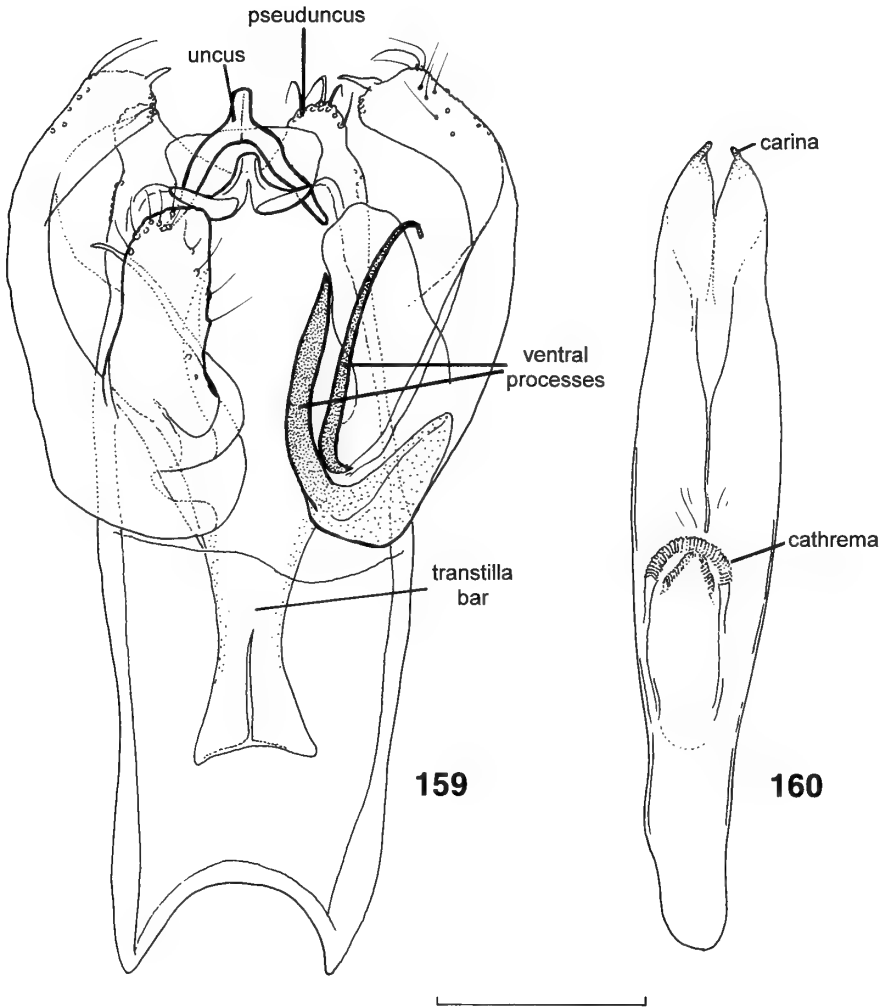
**Figs 148–151** Male genitalia of *Stigmella ovata*, holotype, Argentina (Diškus184 – ZMUC). 148, gnathos, uncus and tegumen; 149, juxta; 150, capsule; 151, aedeagus. Scale: 0.1 mm.



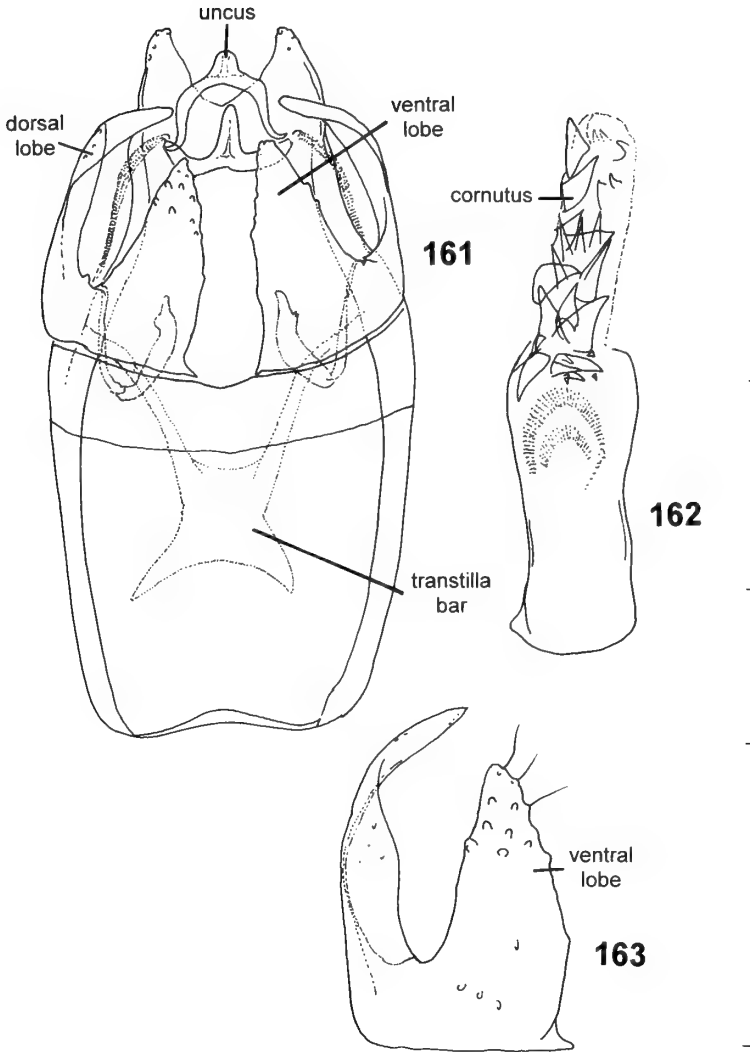
**Figs 152–156** Male genitalia of *Ectoedemia* species, Belize. 152, *species 29105* (29105 – BMNH), capsule; 153, same, aedeagus; 154, *fuscivittata*, holotype (29107 – BMNH), capsule; 155, same, aedeagus; 156, *fuscivittata*, paratype (AD0302 – VPU), aedeagus. Scale: 0.1 mm.



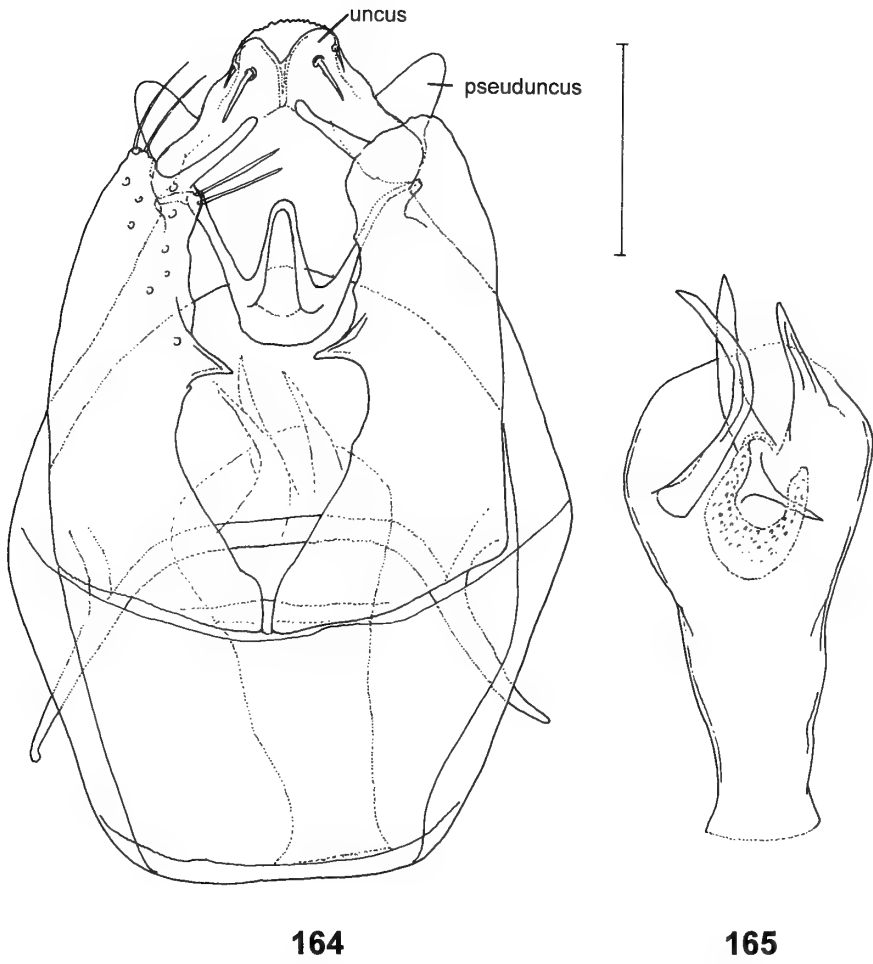
**Figs 157, 158** Male genitalia of *Fomoria molybditis*, holotype, Colombia (25651 – BMNH). 157, capsule; 158, aedeagus. Scale: 0.1 mm.



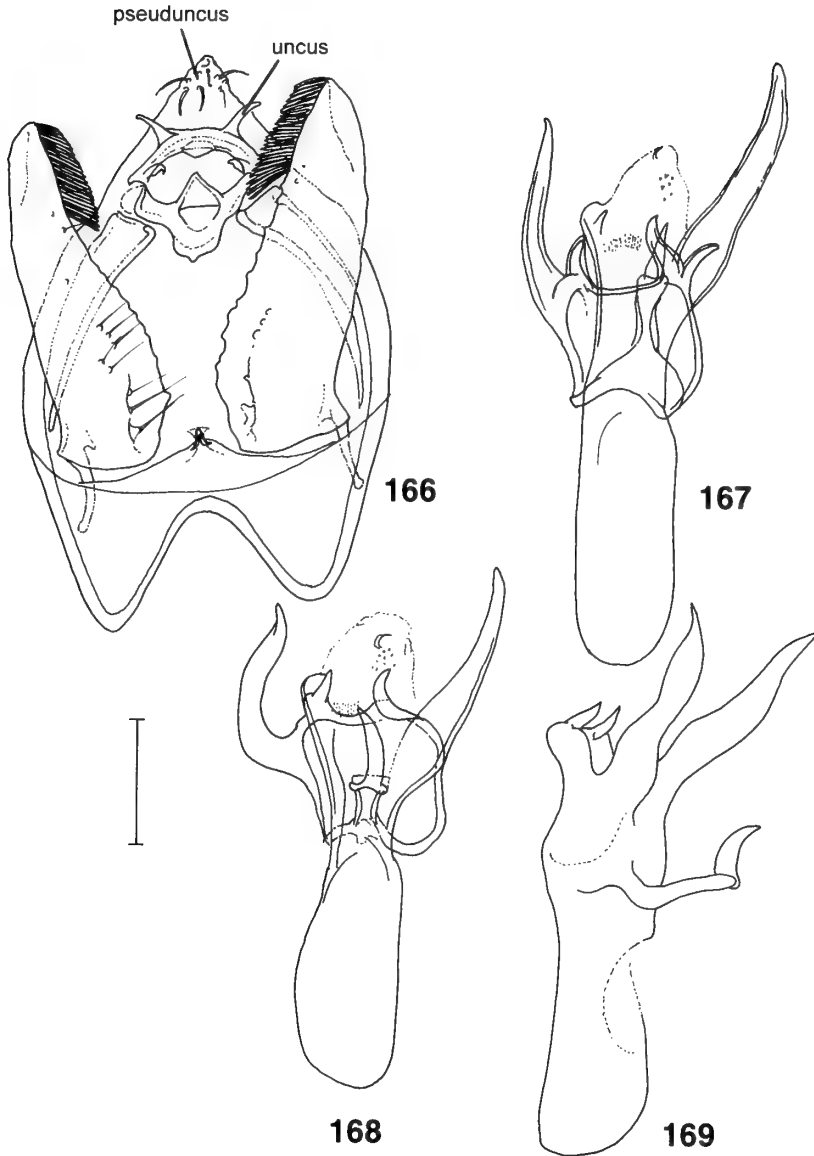
**Figs 159, 160** Male genitalia of *Fomoria diskusi*, holotype, Belize (28844 – BMNH). 159, capsule; 160, aedeagus. Scale: 0.1 mm.



**Figs 161–163** Male genitalia of *Fomoria species 29122*, Belize (29122 – BMNH). 161, capsule; 162, aedeagus with partially everted vesica; 163, valva. Scale: 0.1 mm.

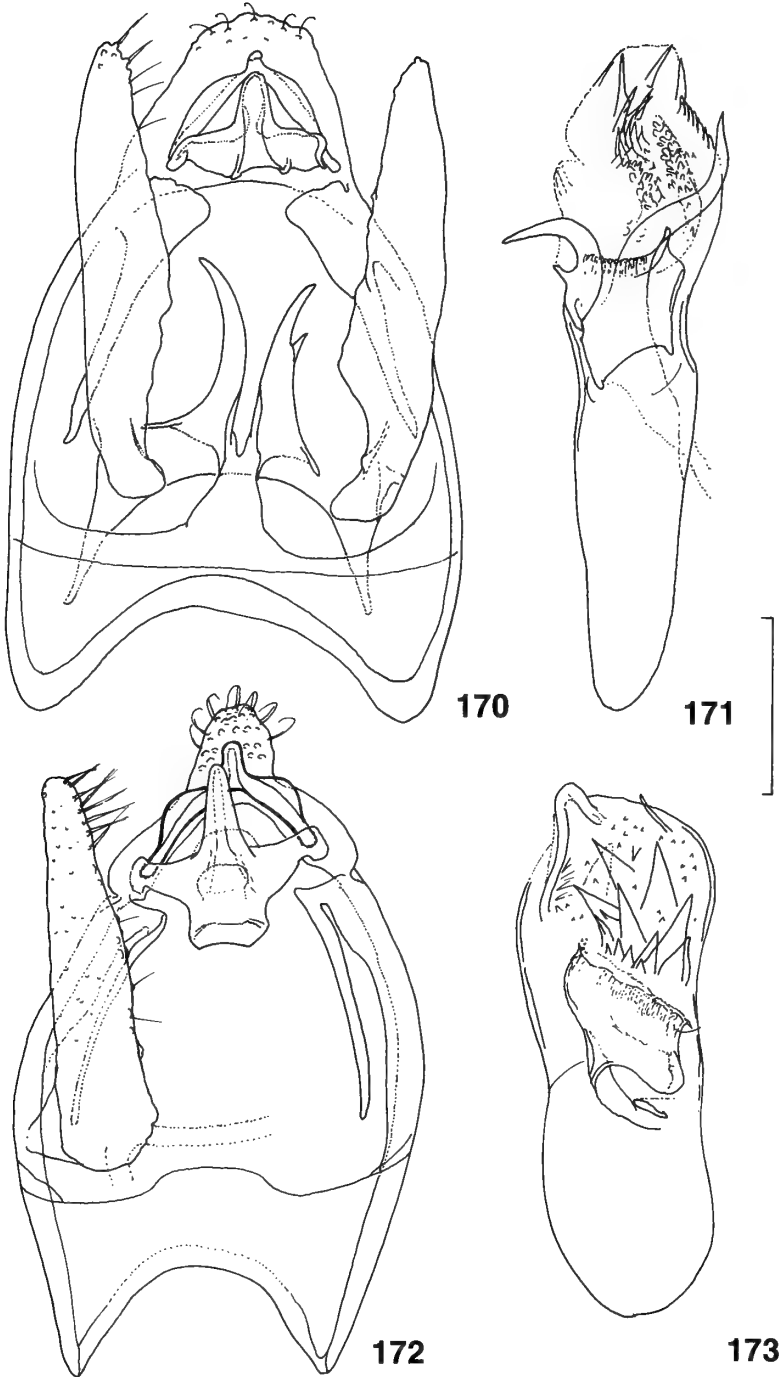


**Figs 164, 165** Male genitalia of *Fomoria latipennata*, holotype, Belize (28968 – BMNH). 164, capsule; 165, aedeagus.  
Scale: 0.1 mm.

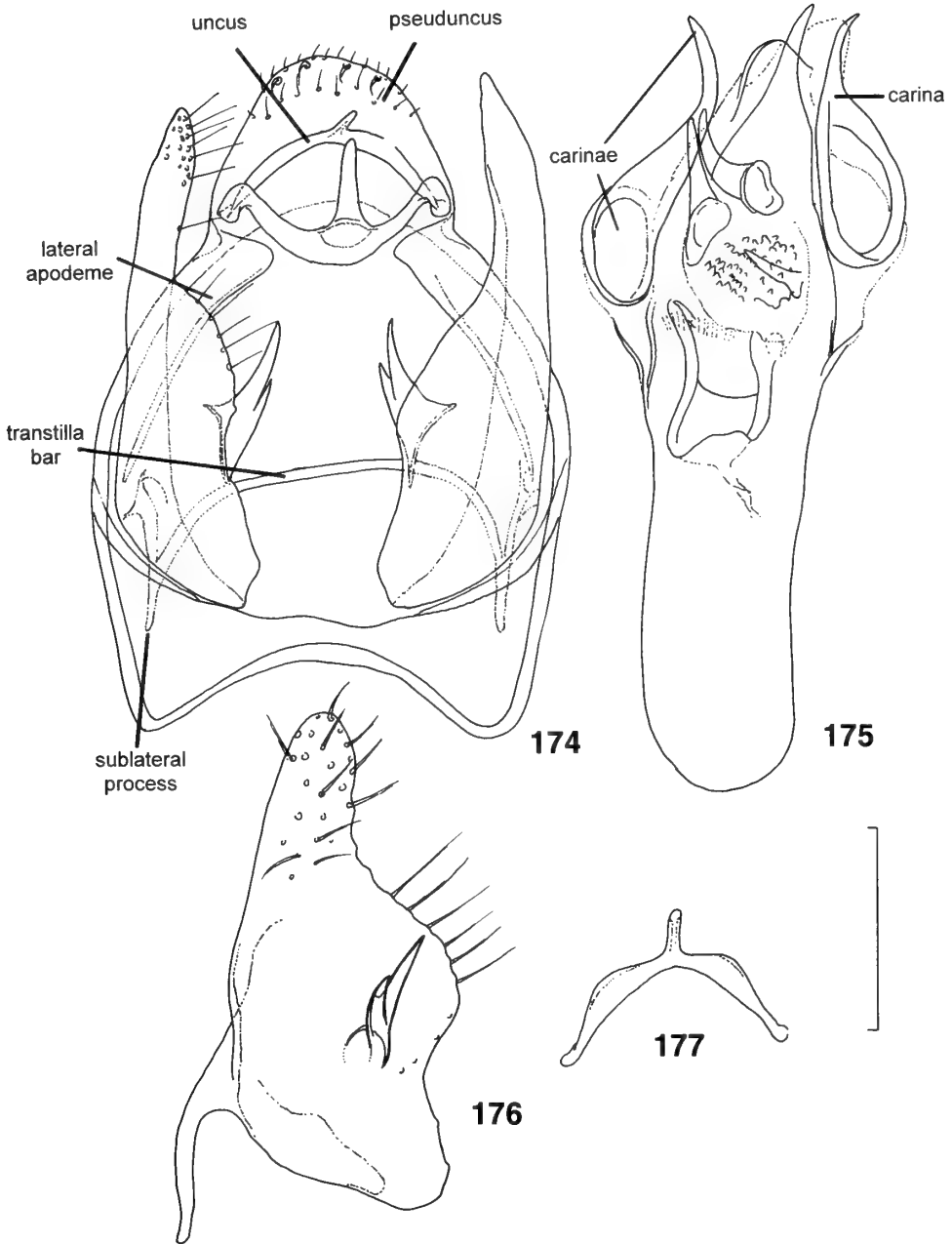


**Figs 166–169** Male genitalia of *Acalyptris bovicorneus*, Belize. 166, holotype (29115 – BMNH), capsule; 167, same, aedeagus; 168, paratype (AD0307 – VPU), aedeagus; 169, holotype (29115 – BMNH), aedeagus in lateral view. Scale: 0.1 mm.

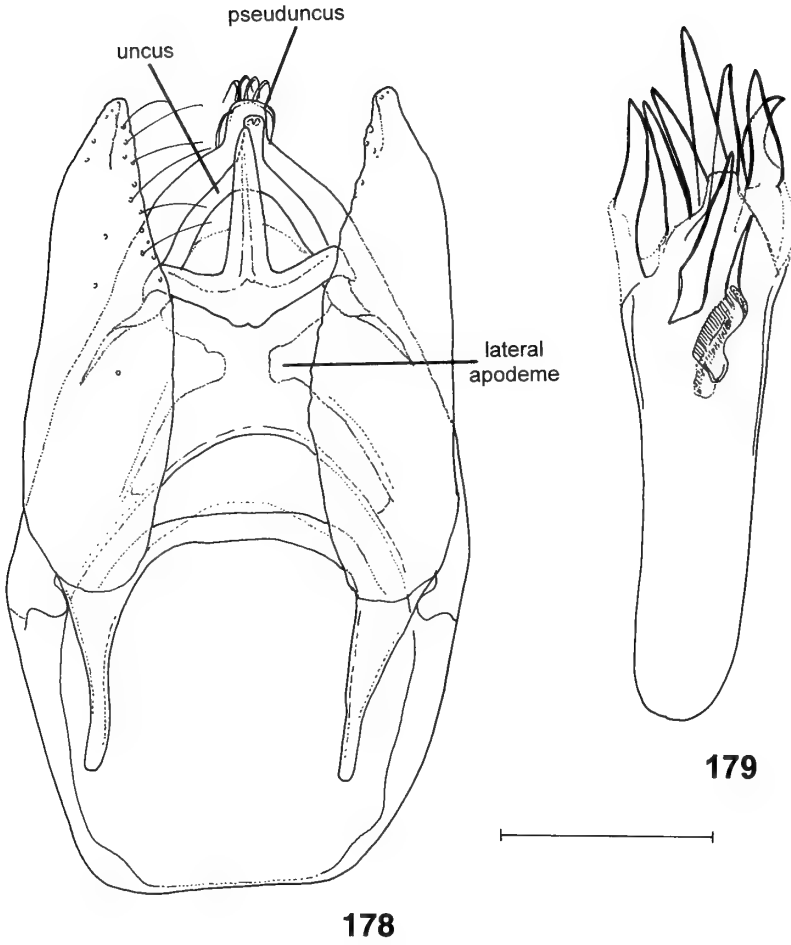




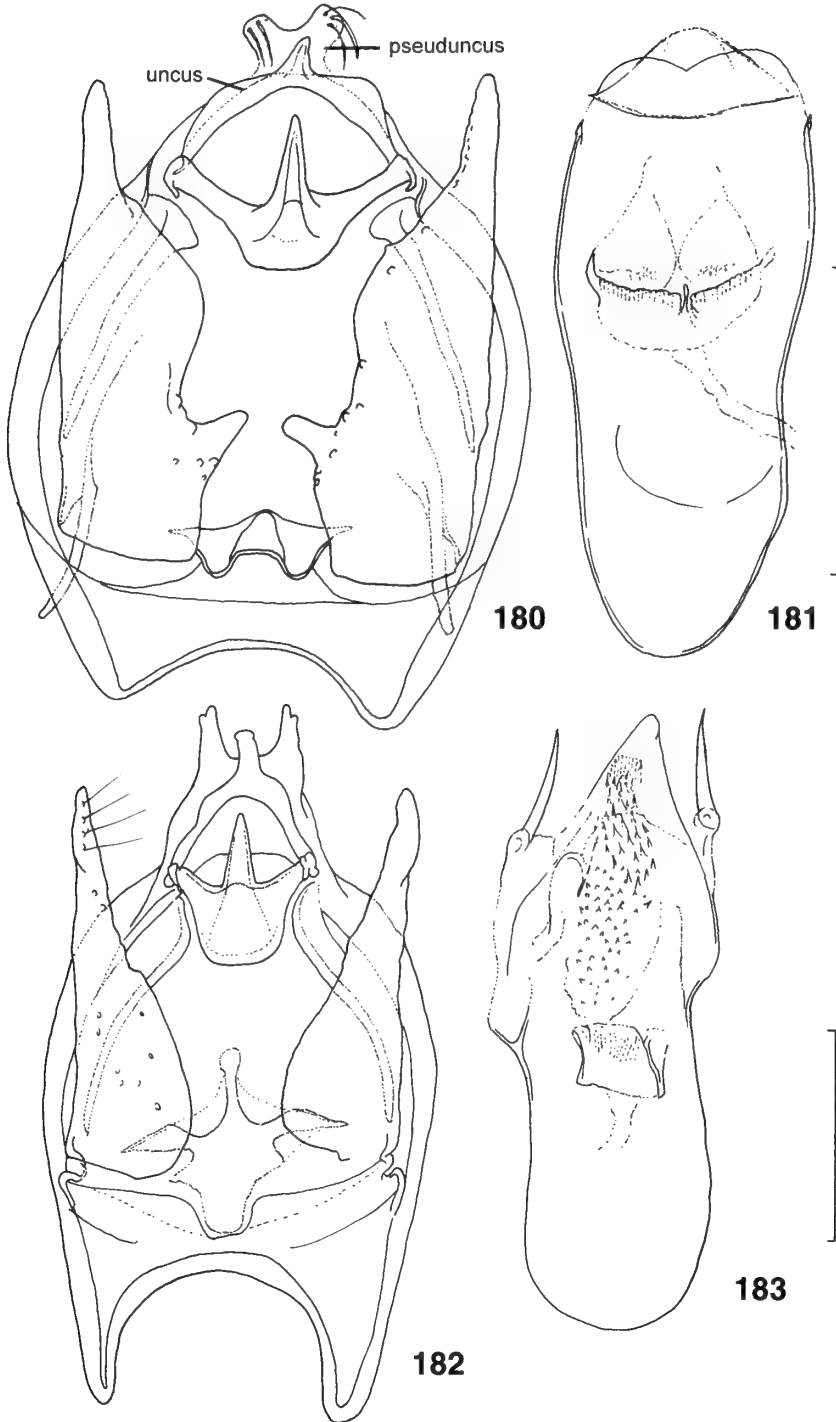
**Figs 170–173** Male genitalia of *Acalyptris* species, Belize. 170, *martinheringi*, holotype (29109 – BMNH), capsule; 171, same, aedeagus; 172, *hispidus*, holotype (29104 – BMNH), capsule; 173, same, aedeagus. Scale: 0.1 mm.



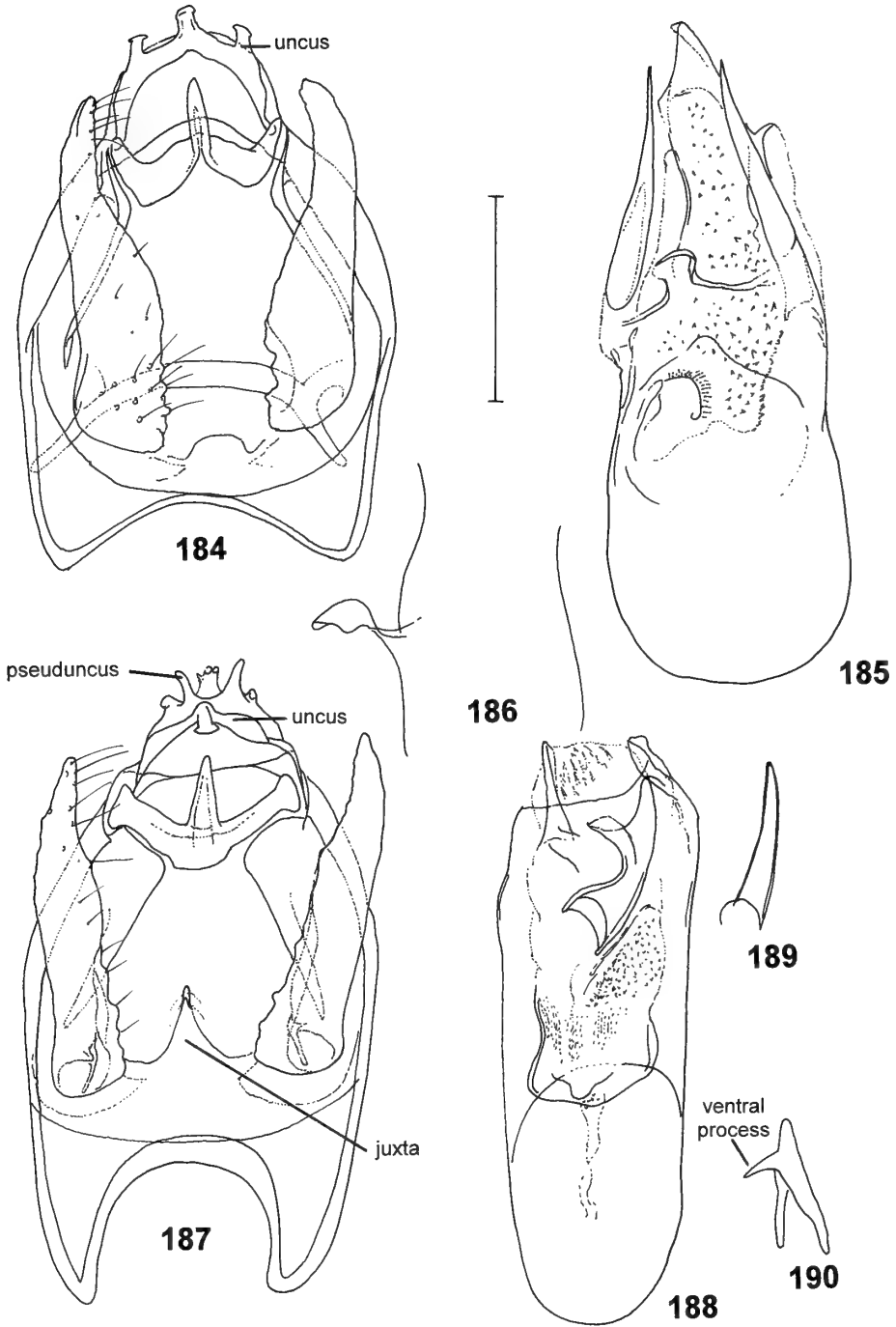
**Figs 174–177** Male genitalia of *Acalyptris fortis*, Belize. 174, holotype (29131 – BMNH), capsule; 175, same, aedeagus; 176, paratype (AD0311 – VPU), valva, slightly squashed; 177, paratype (29136 – BMNH), uncus. Scale: 0.1 mm.



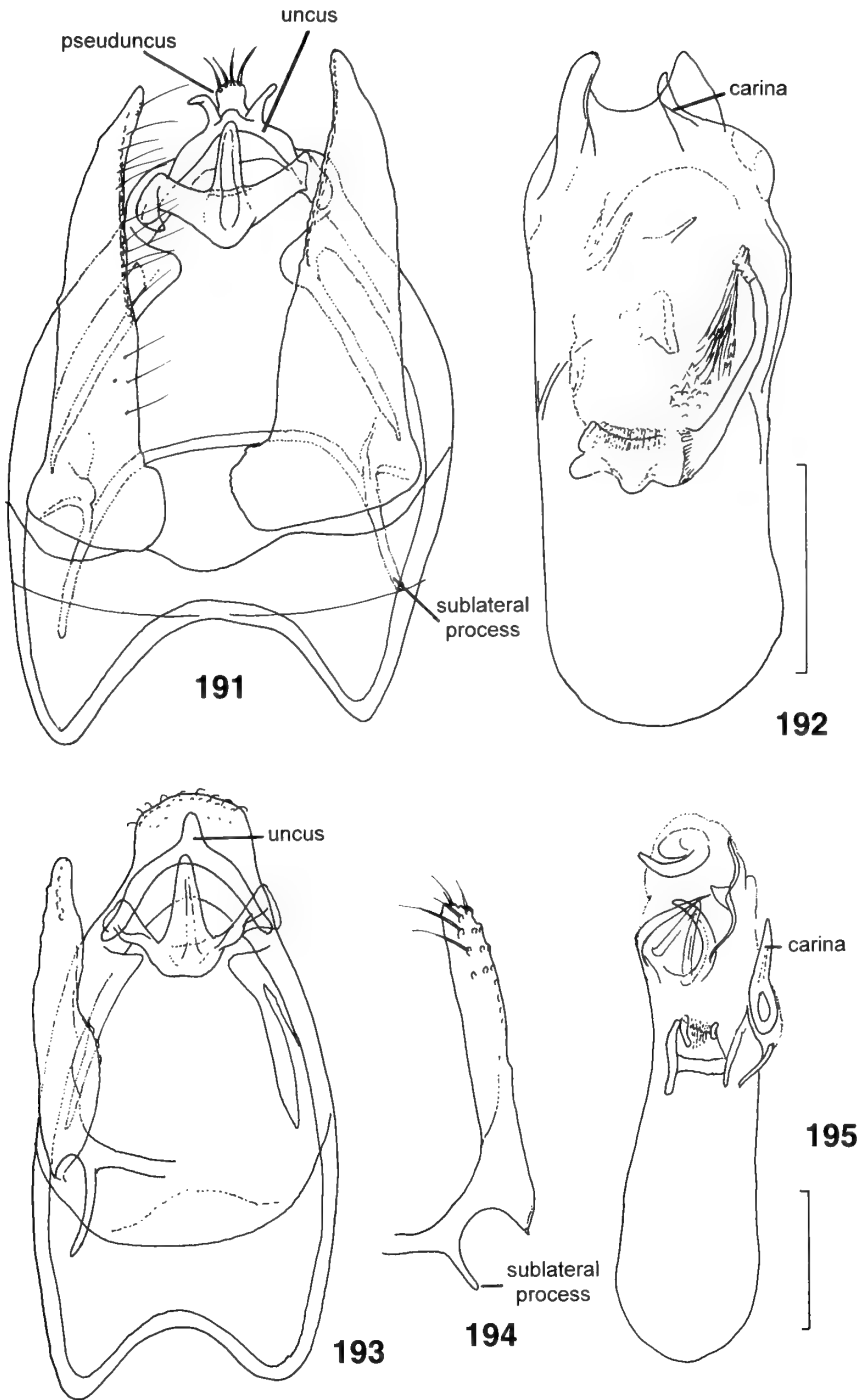
**Figs 178, 179** Male genitalia of *Acalyptris novenarius*, holotype, Belize (28970 – BMNH). 178, capsule; 179, aedeagus.  
Scale: 0.1 mm.



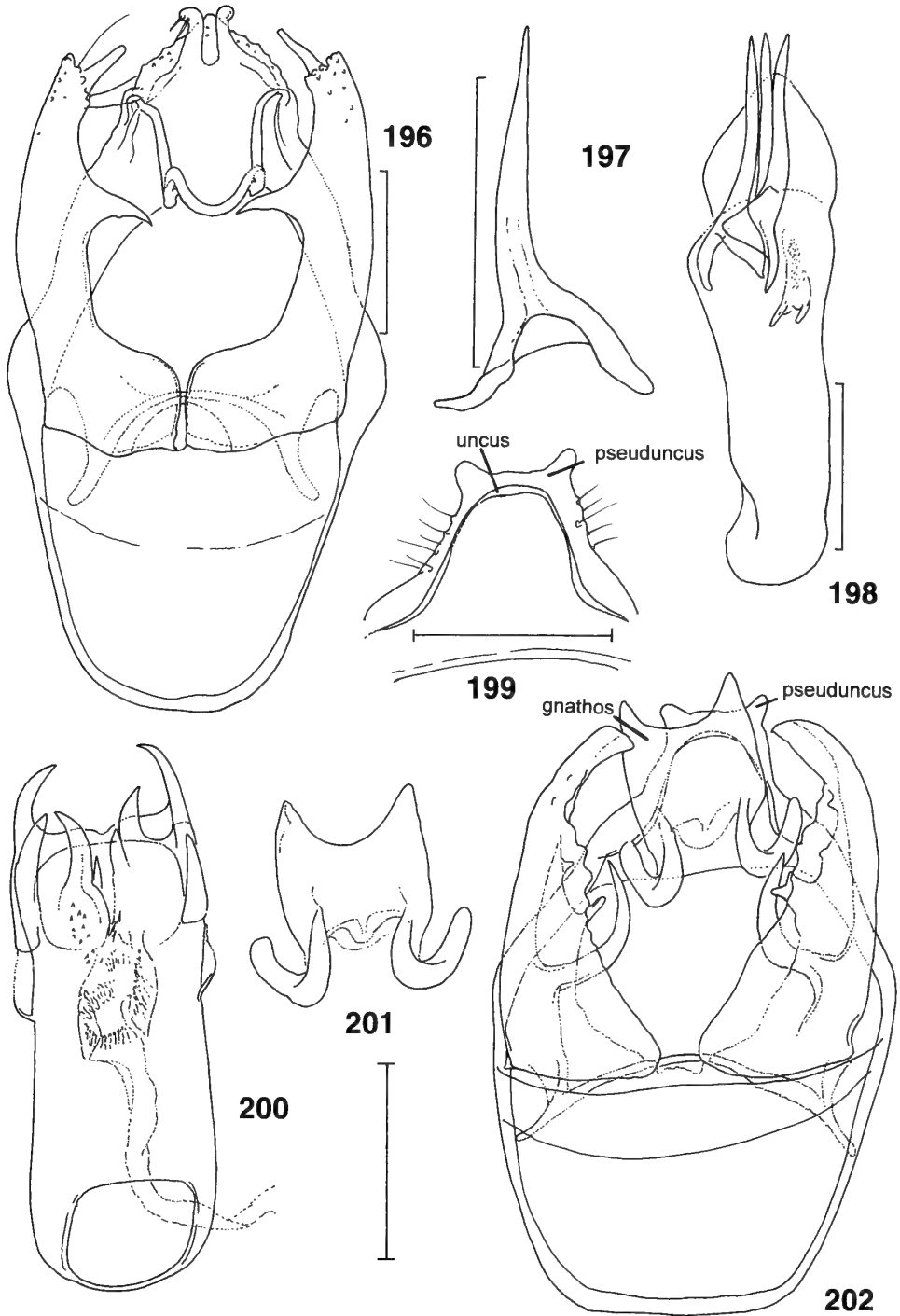
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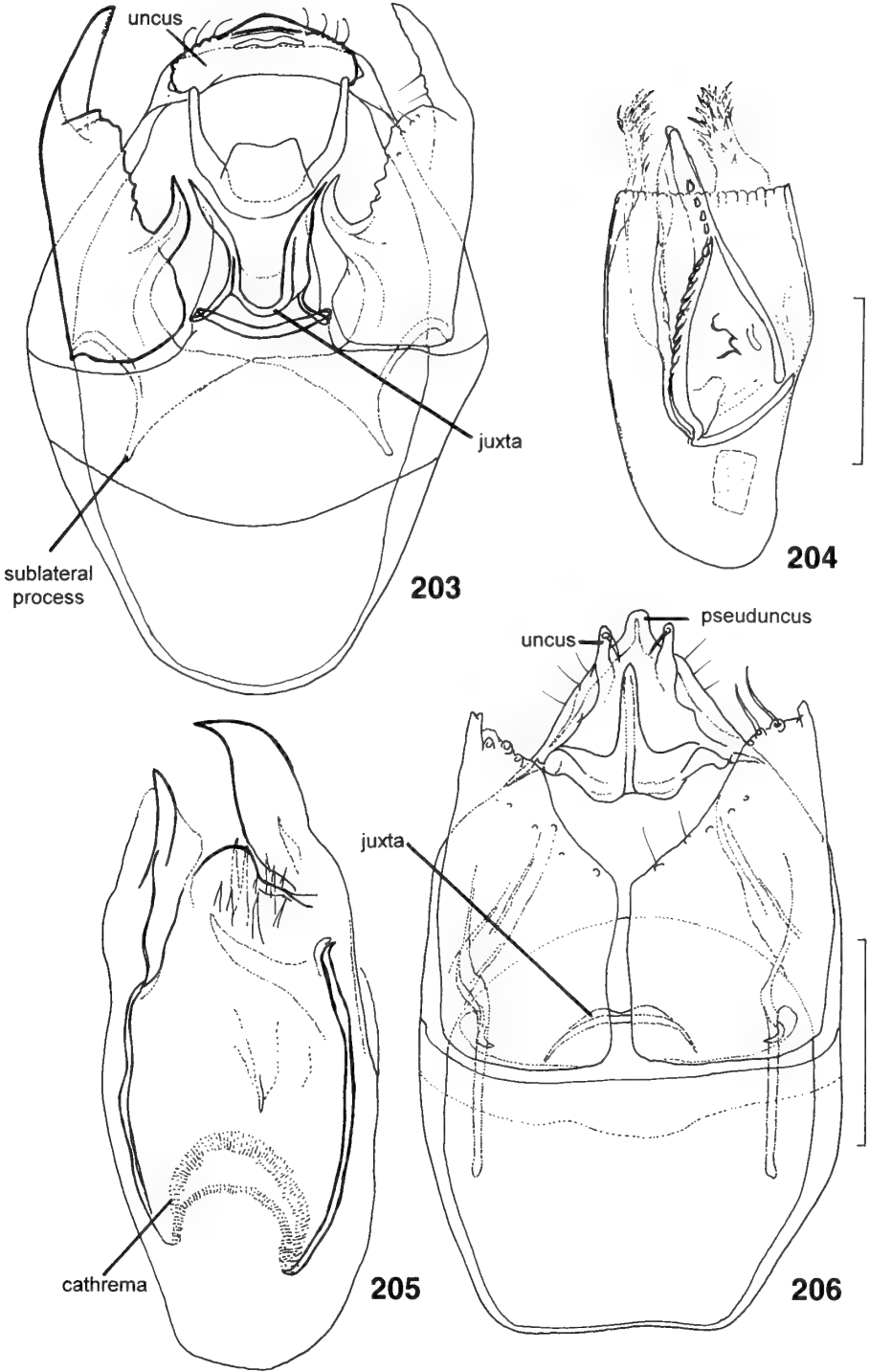
**Figs 184–190** Male genitalia of *Acalyptris* species, Belize. 184, *trifidus*, holotype (29127 BMNH), capsule; 185, same, aedeagus; 186, same, ventral projection of aedeagus in lateral view; 187, *unicornis*, holotype (29134 – BMNH), capsule; 188, same, aedeagus; 189, *cornutus* in lateral view – compare 188; 190; same, ventral component of uncus, ventrolateral view (dorsal component not shown – see 187). Scale: 0.1 mm.



**Figs 191–195** Male genitalia of *Acalyptris* species, Belize. 191, *laxibasis*, holotype (29128 – BMNH), capsule; 192, same, aedeagus; 193, *species 29135* (29135 – BMNH), capsule; 194, same, valva; 195, same, aedeagus. Scale: 0.1 mm.

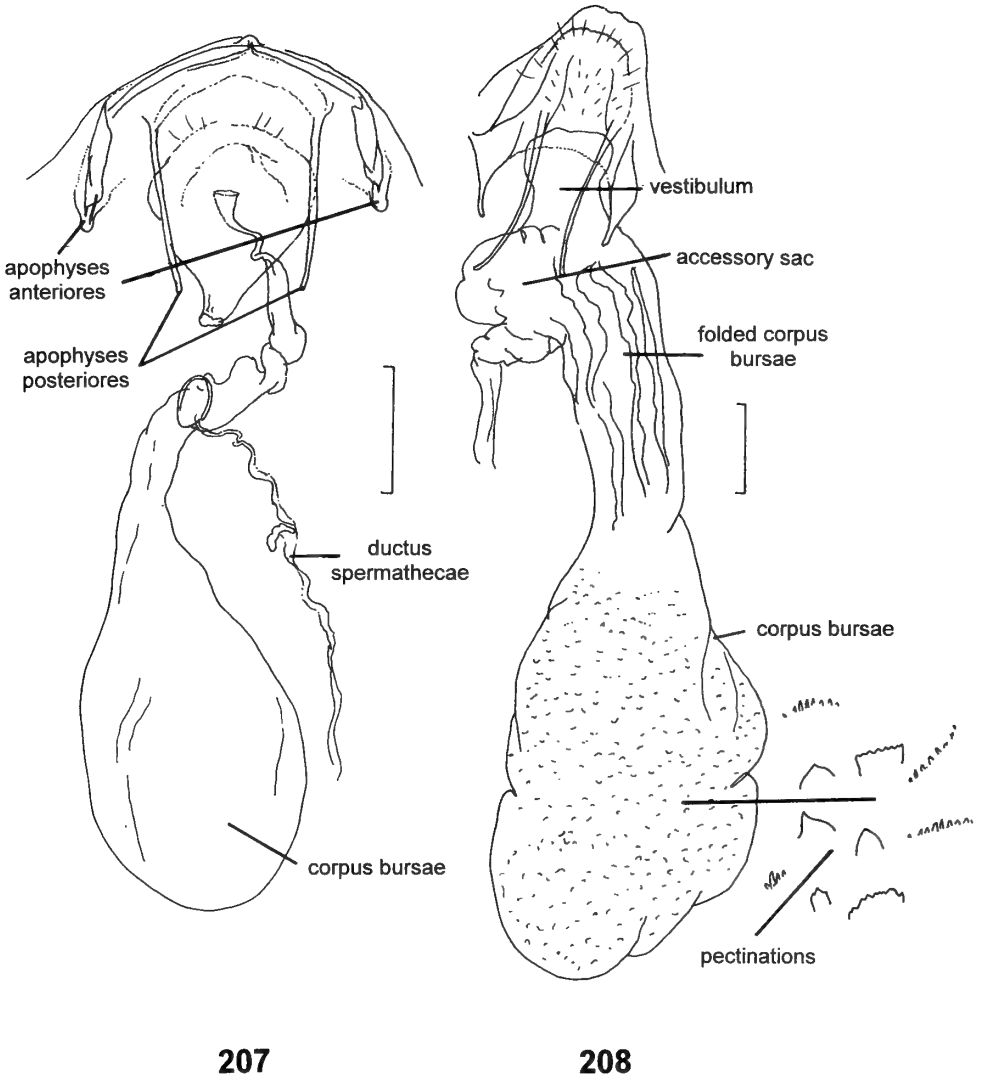


**Figs 196–202** Male genitalia of *Acalyptris* species, Belize. 196, *dividua*, holotype (29125 – BMNH), capsule; 197, same, paratype (AD0309 – VPU), cornutus; 198, same, holotype (29125 – BMNH), aedeagus; 199, *platygnathos*, holotype (29132 – BMNH), uncus and pseuduncus; 200, same, aedeagus; 201, same, gnathos; 202, same, capsule. Scale: 0.1 mm.

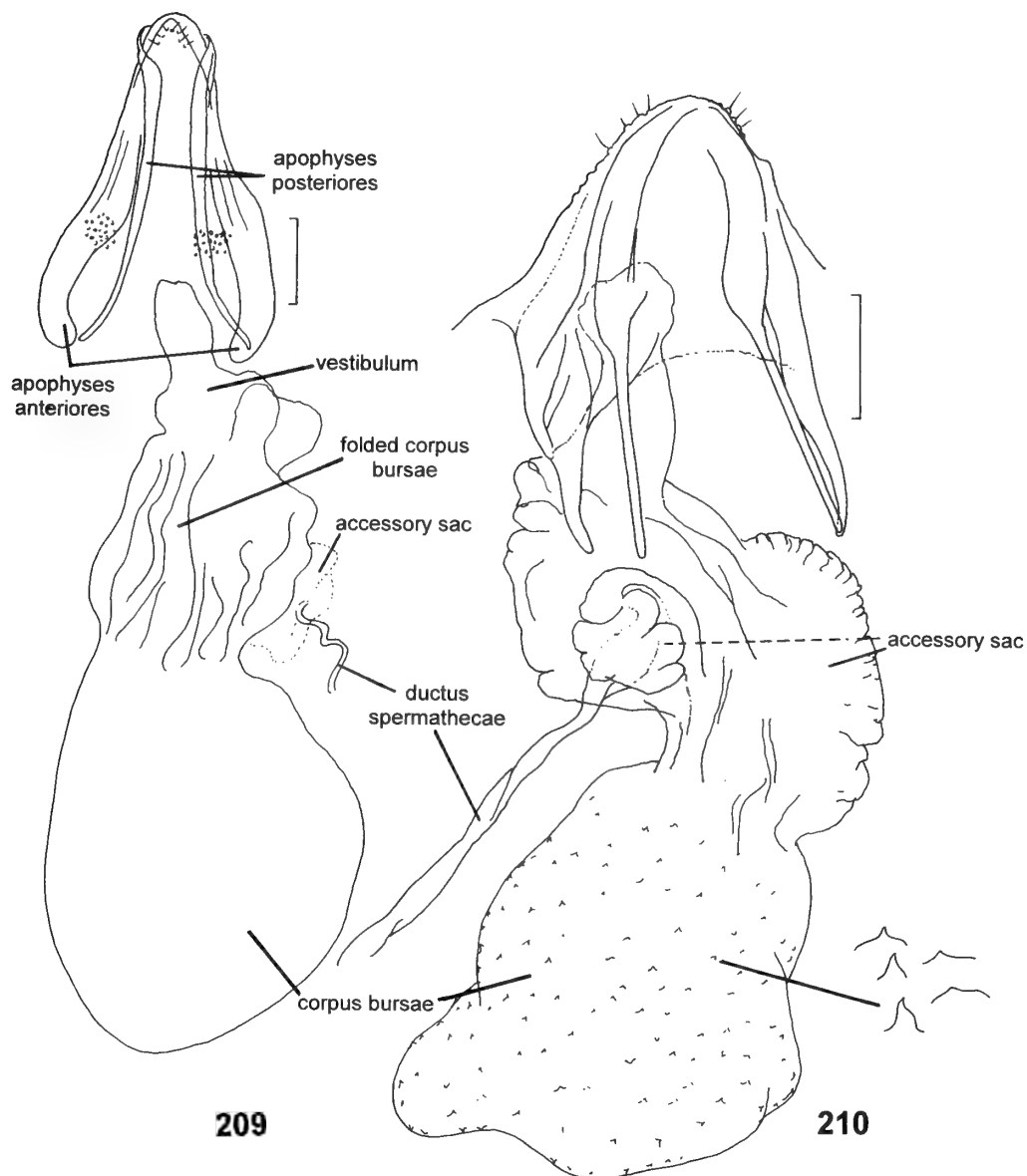


**Figs 203–206** Male genitalia of *Glaucolepis* species. 203, *aerifica*, lectotype, Peru (28965 – BMNH), capsule; 204, same, aedeagus; 205, *argentosa*, holotype, Belize (29106 – BMNH), aedeagus; 206, same, capsule. Scale: 0.1 mm.

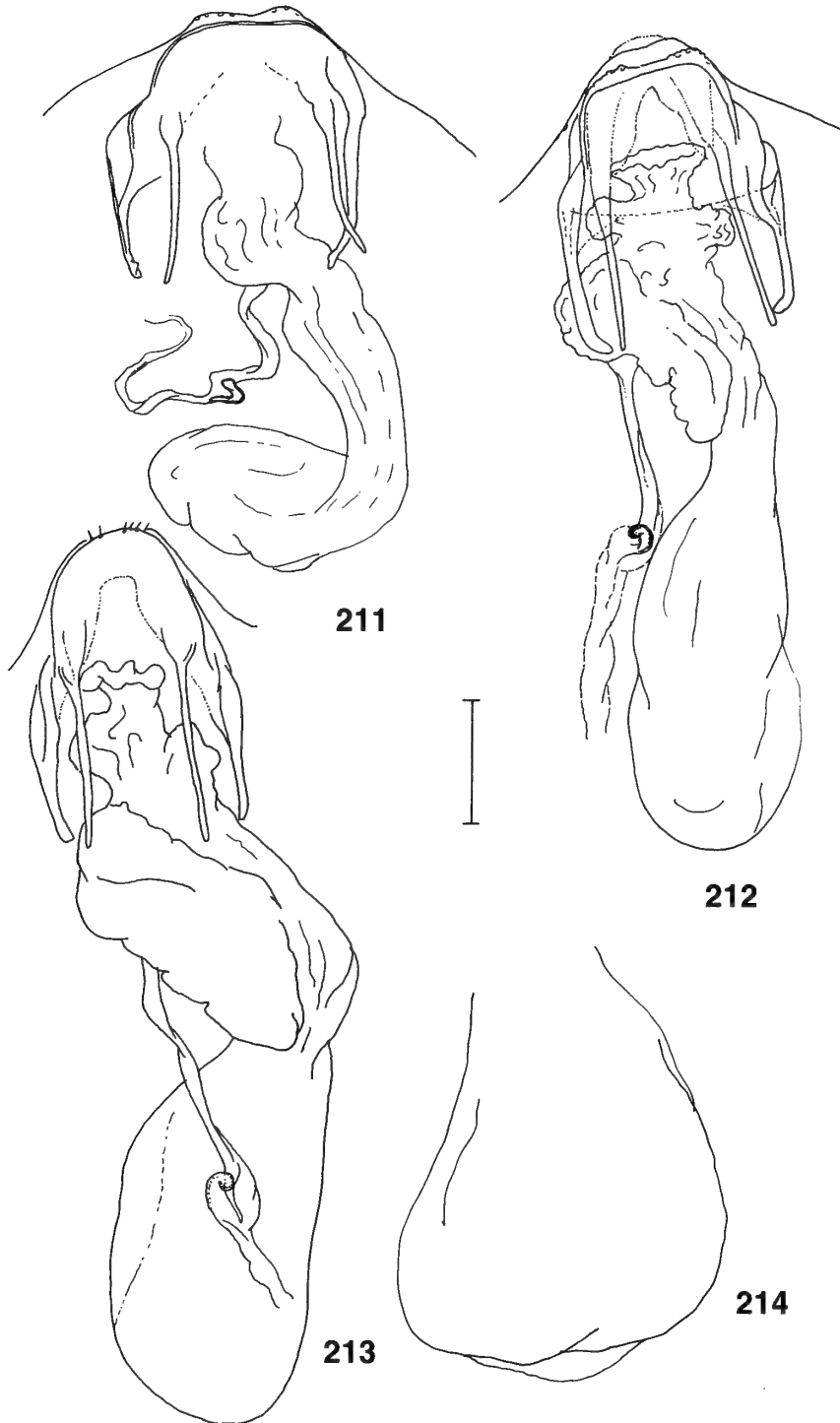




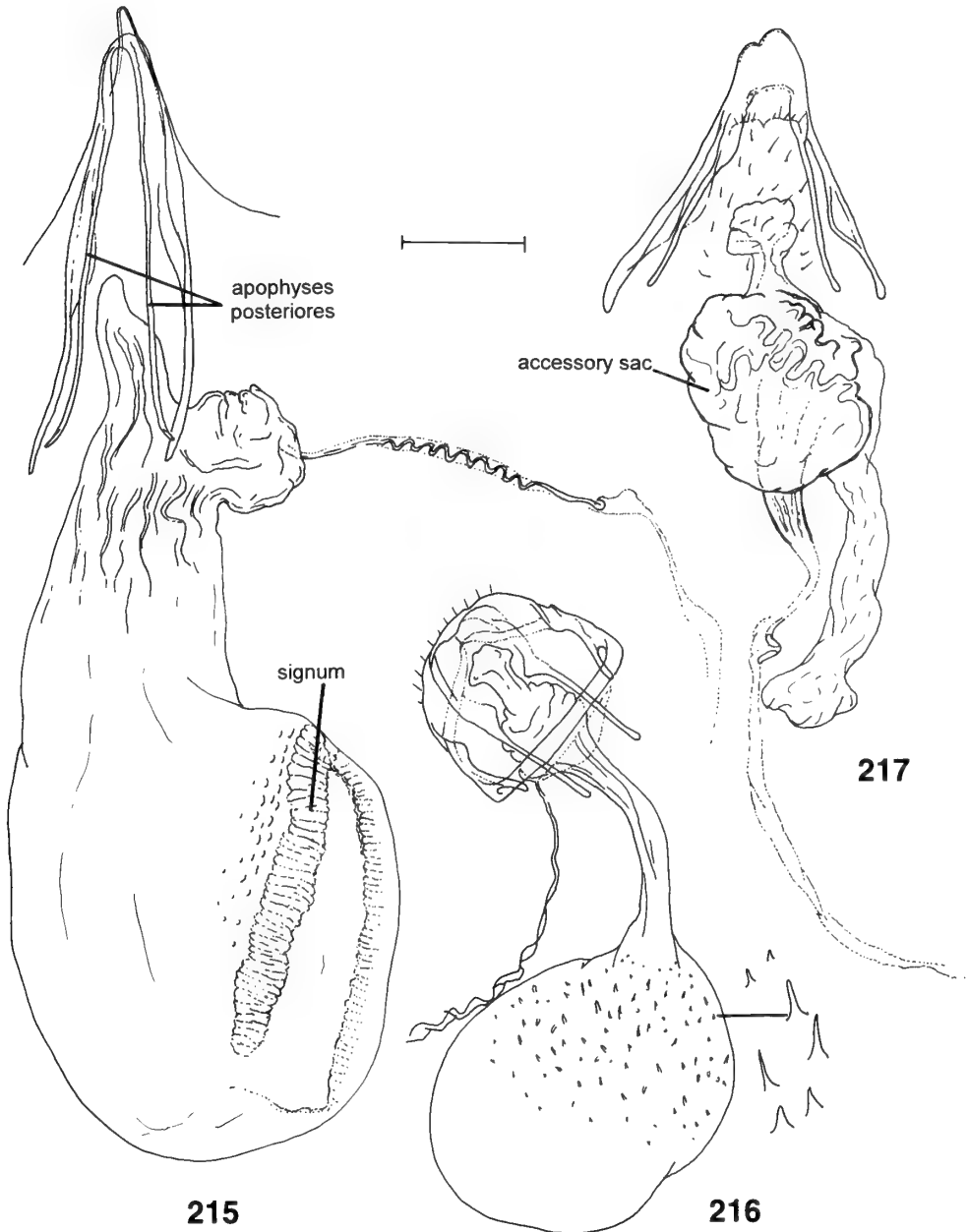
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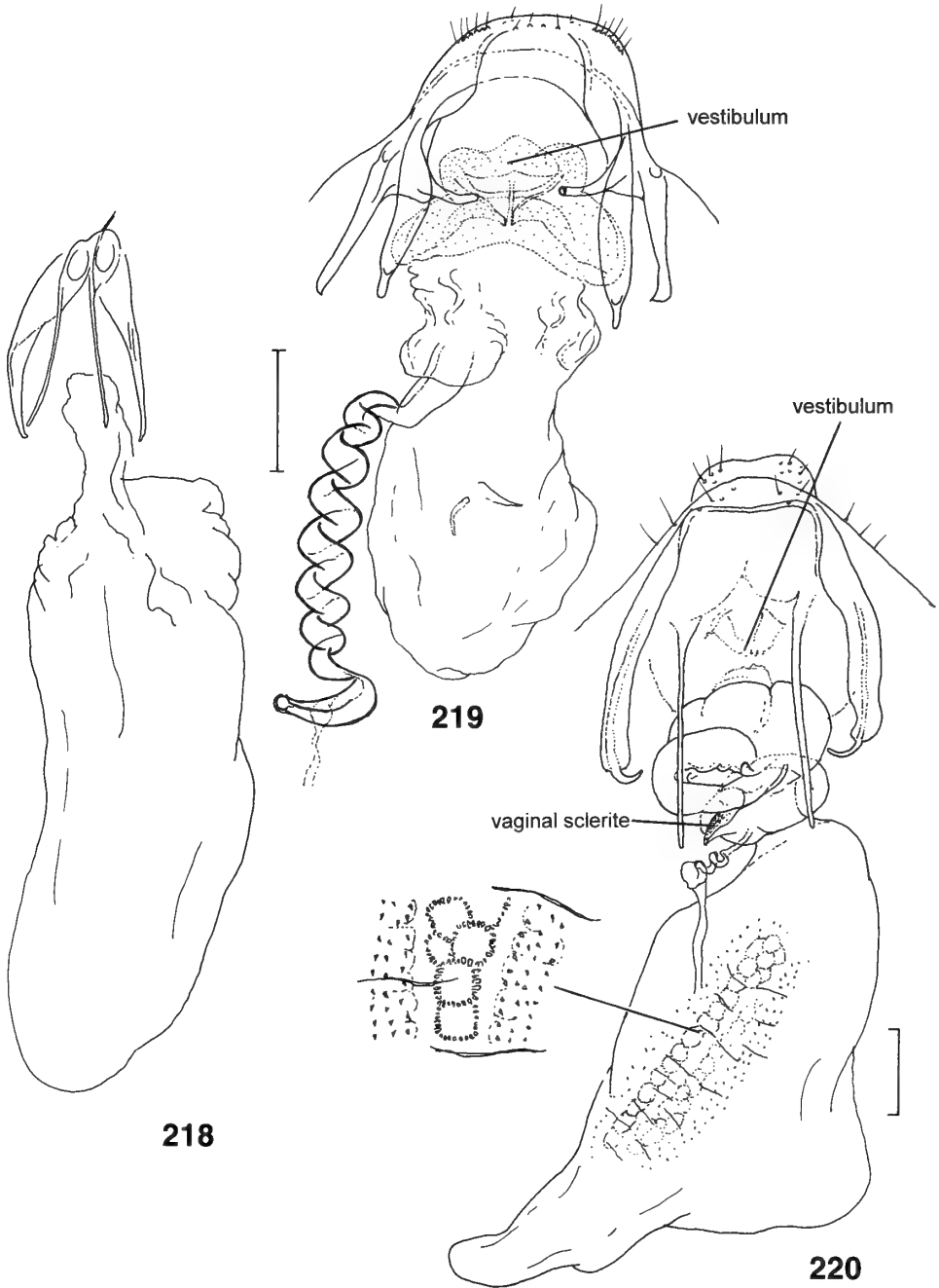
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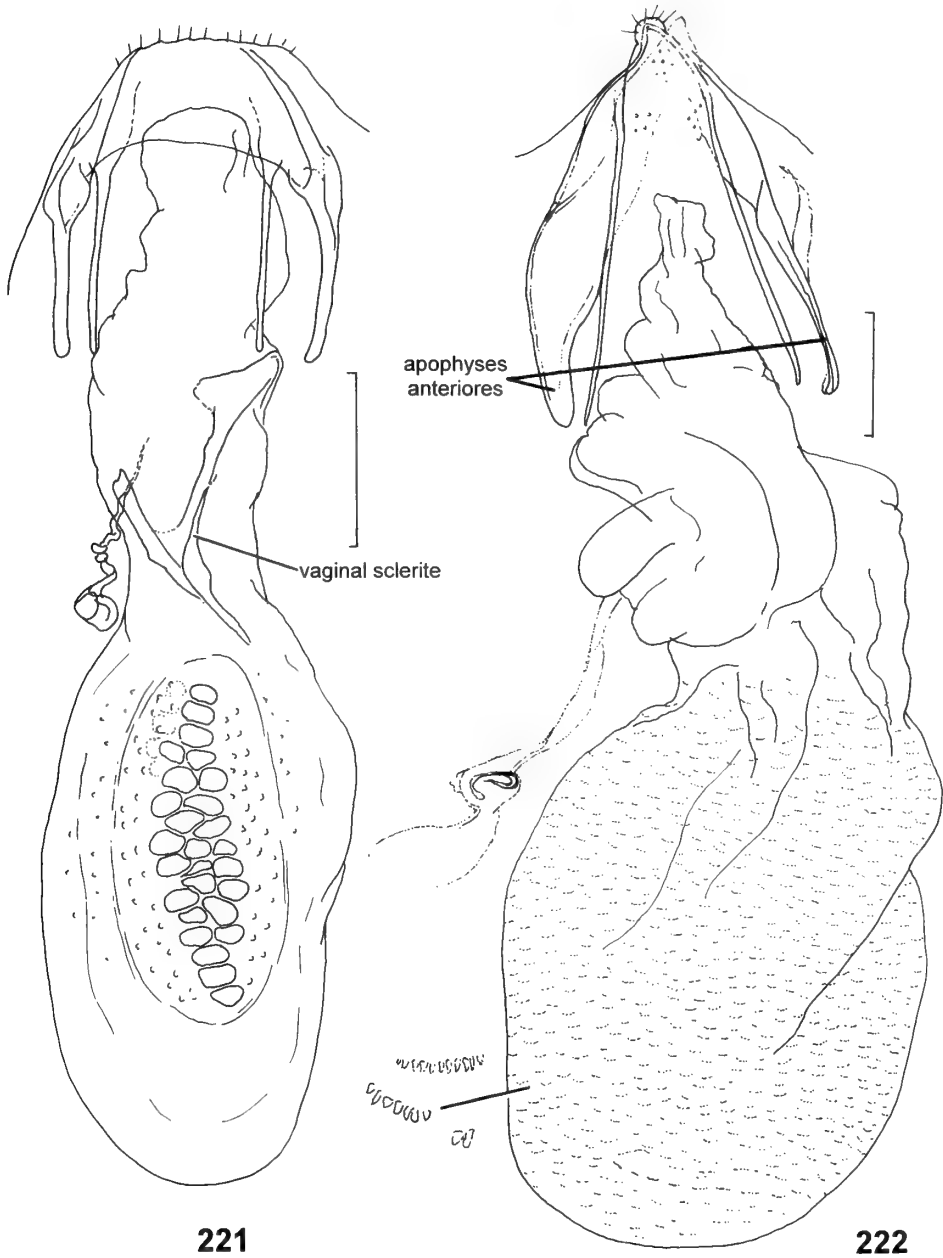
**Figs 211–214** Female genitalia of *Stigmella* species, Peru. 211, *epicosma*, paralectotype (28850 – BMNH); 212, *epicosma*, non-type (Diškus 186 – ZMUC); 213, *schoorli*, paratype (Diškus206 – ZMUC); 214, paratype (Diškus 204 – ZMUC), bursa. Scale: 0.1 mm.



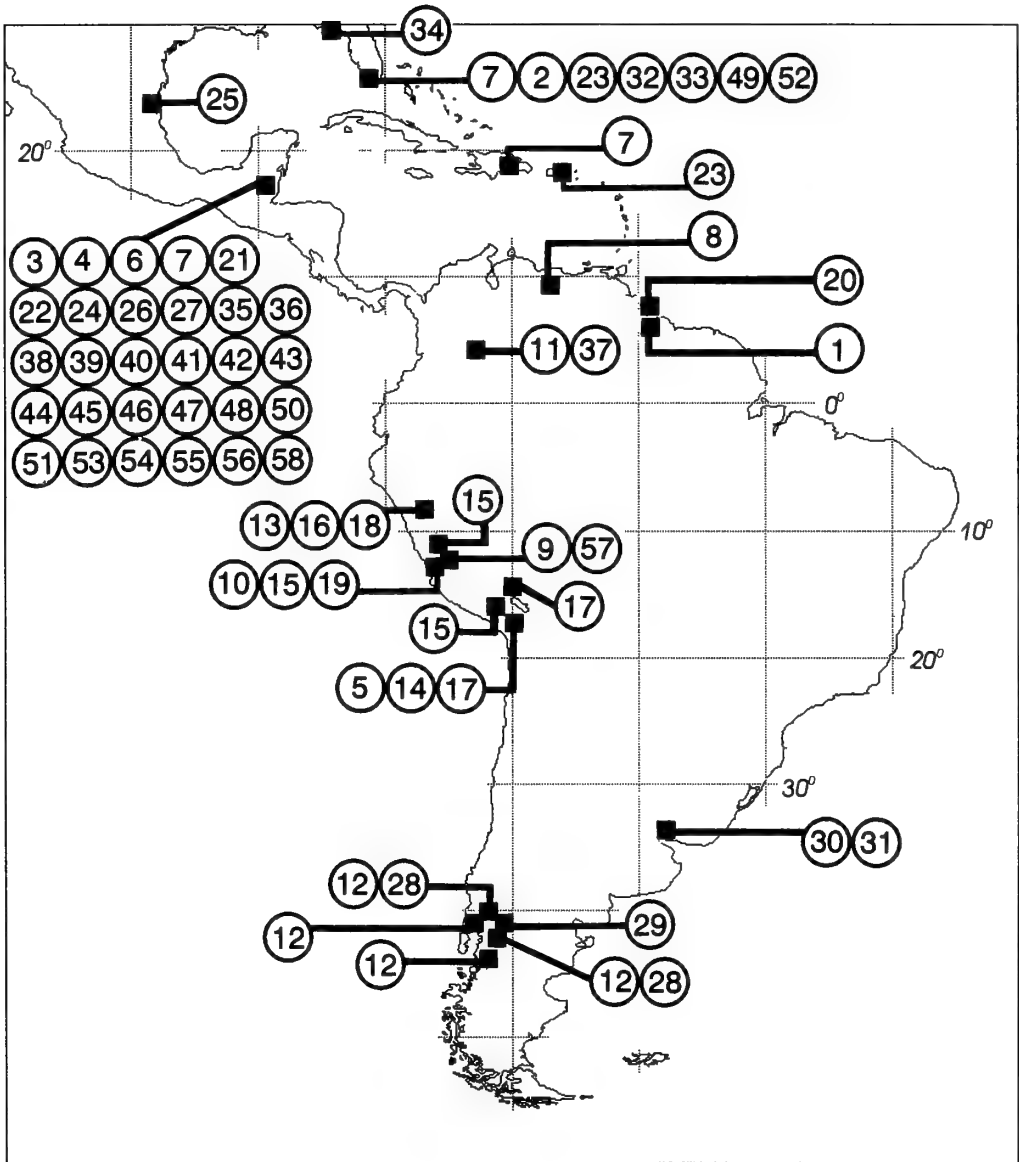
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**Figs 218–220** Female genitalia, paratypes, Belize. 218, *Stigmella pruinosa* (29126 – BMNH); 219, *Fomoria diskusi* (28846 – BMNH); 220, *Acalyptris bovicorneus* (29116 – BMNH). Scale: 0.1 mm.



**Figs 221, 222** Female genitalia. 221, *Acalyptris* species 29140, Belize (29140 – BMNH); 22, *Glaucolepis aerifica*, paralectotype, Peru (28966 – BMNH) [identity questionable – see text]. Scale: 0.1 mm.



**Fig. 223** Distribution map of Nepticulidae species recorded from the Neotropical Region: 1, *Enteucha cyanochlora*; 2, *E. gilvafascia*; 3, *E. hilli*; 4, *E. contracolorea*; 5, *E. terricula*; 6, *E. snaddonii*; 7, *Manoneura basidactyla*; 8, *M. trinaris*; 9, *Stigmella andina*; 10, *S. cuprata*; 11, *S. johannis*; 12, *S. rudis*; 13, *S. marmorea*; 14, *S. peruanica*; 15, *S. epicosma*; 16, *S. schoorli*; 17, *S. hamata*; 18, *S. imperatoria*; 19, *S. olyritis*; 20, *S. eurydesma*; 21, *S. albilamina*; 22, *S. fuscilamina*; 23, *S. gossypii*; 24, *S. kimae*; 25, *S. plumosetaella*; 26, *S. barbata*; 27, *S. pruinosa*; 28, *S. ovata*; 29, *S. hylomaga*; 30, *S. costalimai*; 31, *S. guitonae*; 32, *Ectoedemia reneella*; 33, *E. helenella*; 34, *E. mesoloba*; 35, *E. species 29105*; 36, *E. fuscivittata*; 37, *Fomoria molybditis*; 38, *F. diskusi*; 39, *F. species 29122*; 40, *F. latipennata*; 41, *Acalypttris bovicorneus*; 42, *A. martinheringi*; 43, *A. fortis*; 44, *A. hispidus*; 45, *A. novenarius*; 46, *A. lascuevella*; 47, *A. bifidus*; 48, *A. trifidus*; 49, *A. tenuijuxtus*; 50, *A. unicornis*; 51, *A. laxibasis*; 52, *A. bicornutus*; 53, *A. species 29135*; 54, *A. dividua*; 55, *A. platygnathos*; 56, *A. species 29140*; 57, *Glaucolepis aerifica*; 58, *G. argentosa*.

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