

Moths of the tribe Pseudoterpnini (Geometridae: Geometrinae): a review of the genera

LINDA M. PITKIN¹, HONGXIANG HAN² and SHAYLEEN JAMES^{1*}

¹*Department of Entomology, Natural History Museum, Cromwell Road, London SW75BD, UK*

²*Institute of Zoology, Chinese Academy of Sciences, Beijing, China*

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The classification of the genera of the widely distributed Old World tribe Pseudoterpnini is reviewed and 34 genera are recognized. Two new generic synonyms (*Sterictopsis* Warren and *Oxyphanes* Turner as synonyms of *Rhuma* Walker), and 21 new or reinstated combinations are established. Representative moths of all the genera are illustrated in colour (upper side and underside), and genitalia of all genera are illustrated in monochrome (162 figures). All the known species and subspecies of Pseudoterpnini are listed (321), together with their synonyms. The Pseudoterpnini and their characters are assessed, and many genera are newly assigned to the tribe. © 2007 Natural History Museum, London. Journal compilation © 2007 The Linnean Society of London, *Zoological Journal of the Linnean Society*, 2007, 150, 343–412.

ADDITIONAL KEYWORDS: Afrotropical Region – Australasian Region – China – Lepidoptera – Oriental Region – Palaearctic Region – taxonomy.

INTRODUCTION

Moths of the family Geometridae occur almost worldwide, although they are most diverse in the tropics, and they are one of the three most species-rich families of Lepidoptera, with about 21 000 described species. The caterpillars, known as loopers or inchworms from their looping gait resulting from a reduced number of abdominal prolegs, feed mainly on the leaves of a wide range of plants, particularly trees and shrubs. Although it seems likely to be significant, the extent of their environmental impact is not yet known because the life histories of the majority of these moths have not been investigated. Geometridae are generally secretive and cryptic insects, the moths sometimes green as the leaves they rest on, or brown, grey and other colours forming mottled bark-like patterns of flecks and wavy lines. Their resting postures enhance camouflage, with the moths spreading their wings flat against the underside of leaves, and the caterpillars often twig-like.

The family Geometridae has long been the focus of interest of dedicated researchers from leading insti-

tutions around the world, and they have made much progress towards a better understanding of geometrid taxonomy and systematics. The subfamily Geometrinae, with more than 2400 species in nearly 270 genera, has received major attention in recent decades in studies by Ferguson (1985, covering the North American representatives), Holloway (1996, Bornean), Pitkin (1996, Neotropical), McQuillan & Edwards (1996, Australian), Hausmann (2001, European) and Han (2005 (unpublished), Chinese representatives). Further work is in progress by Peter McQuillan and Cathy Young on a generic-level review of the Australian Geometrinae, based on adult and immature morphology and gene sequences.

Although regional, these works have included discussion of broader taxonomic context, but such is the global diversity of the Geometridae that investigations that shed light on some aspects often also highlight the need for further study. So, while global synthesis of the subfamily Geometrinae is a goal in sight for taxonomists, more building blocks towards that end are still required. This study, a review of all the genera of the Pseudoterpnini, aims to provide one such contribution.

*Corresponding author.

Moths of the tribe Pseudoterpnini (alternatively treated as subtribe Pseudoterpniti by Holloway, 1996) are widely distributed in the Old World, from western Europe to the western Pacific, in temperate, subtropical and tropical regions. The group is a conspicuous component of the Geometrinae, in comprising 34 genera and more than 300 species, and in the atypical appearance of the moths. With a wingspan ranging up to 74 mm, they are generally larger and also more robust than other more typical slender-bodied Geometrinae, and instead of the typical green geometrine colouring, their wings are of mixed shades of brown, grey, white and yellow, with strongly patterned undersides. These and other anomalous features discussed under 'Taxonomic characters of the Pseudoterpnini' make the Pseudoterpnini a fascinating group for study, and highly significant to the understanding of Geometrinae and Geometridae.

Our study sets out to provide an improved taxonomic framework at the genus level for the Pseudoterpnini. It will enable better assessment and understanding of the many species encompassed within the genera reviewed, and the wealth of data that all these taxonomic names represent. The study is designed to give a global overview of the group, bringing together the knowledge gained from regional studies (both published and in progress) and adding to it. In particular, our review builds on and complements research by Han & Xue (in prep.) on the Chinese Geometrinae, which those authors are preparing for a forthcoming volume of the *Fauna Sinica* series. The Pseudoterpnini are well represented in China, with 15 genera occurring there.

COMMENTS ON THE TAXONOMIC HISTORY OF THE PSEUDOTERPNIINI

Pseudoterpnini Warren, 1893 (as Pseudoterpninae). Holloway, 1996 (as Pseudoterpniti); Hausmann, 1996a, 2001 (as Pseudoterpnini). See also comment on availability of the name Pseudoterpnini by Hausmann, 1996b: 96.

Terpnini Inoue, 1961, based on *Terpna* Herrich-Schäffer [1854], a misspelling of *Terpne* Hübner, 1822 (which is a junior synonym of *Geometra* Linnaeus), but referring to *Terpne* auctorum (= *Pachyodes* Guenée). [Synonymized by Holloway 1996: 192; Hausmann, 1996b: 96.]

Archaebalbini Viidalepp, 1981 [originally as Archeobalbini, spelling emended by Hausmann, 1996a: 20. Synonymized by Holloway, 1996: 192.]

Pingasini Heppner & Inoue, 1992. [Unavailable, see comments by Holloway, [1994]: 8, 302, on similar unsubstantiated tribal names in Heppner & Inoue: Millionini and Obeidini. Effectively synonymized by

Holloway, 1996: 192, by inclusion of *Pingasa* in Pseudoterpniti.]

[Based mainly on The Forum Herbulot world list of family group names in Geometridae (Hausmann (ed.), website, updated 2006).]

The Pseudoterpnini were first named as subfamily Pseudoterpninae by Warren (1893) in a study of Indian Geometridae, and included the genera *Actenochroma*, *Dindica*, *Terpna* (see above) and *Sphagnodela* Warren (which is not included in Pseudoterpnini in the present study). The next major work was by Prout (1912a), who preferred to use informal groupings, but brought together most of the genera now known as Pseudoterpnini in his groups 1 and 2. These comprised: *Actenochroma*, *Aeolochroma*, *Herochroma*, *Crypsiphona*, *Cyneoterpna*, *Dindica*, *Epipristis*, *Heliomystis*, *Hypodoxa*, *Metallolophia*, *Mimandria*, *Orthocraspeda* (a homonym later replaced by *Orthorisma*), *Pingasa*, *Protophyta*, *Pseudoterpna*, *Rhuma*, *Sterictopsis* (treated in the present study as a synonym of *Rhuma* **syn. nov.**), and (under *Terpna*) *Absala*, *Calleremites*, *Dindicodes*, *Hypobapta*, *Lophophelma*, *Pachista*, *Pachyodes* and *Psilotagma*. Prout also included *Apodasmia* Turner, *Gnophosema* Prout, *Sphagnodela*, *Synclismus* Butler and *Xenochroma* Warren, none of which is included by us in Pseudoterpnini in the present study.

A number of genera occurring in Australia were grouped together as 'archaic types' of Geometridae by Goldfinch (1929), mainly following groups 1 and 2 of Prout (1912a): *Aeolochroma*, *Austroterpna*, *Crypsiphona*, *Cyneoterpna*, *Epipristis*, *Heliomystis*, *Hypobapta*, *Hypodoxa* (treated under *Pingasa*), *Paraterpna*, *Pingasa*, *Protophyta*, *Rhuma* and *Sterictopsis*. He also included *Oenochlora* Warren, which we do not include in Pseudoterpnini in the present study.

Inoue's (1961) treatment of Japanese Geometridae had a concept of Terpnini that was based on *Terpna*, and has subsequently been synonymized with Pseudoterpnini (see above); he included also *Dindica* and *Pingasa* (and *Agathia* Guenée – not included in Pseudoterpnini in the present study). Viidalepp (1981) included in Terpnini: *Aplasta*, *Holoterpna*, *Pseudoterpna* (in subgroup Pseudoterpnina) and *Agathia* (in subgroup Terpnina).

Several of Goldfinch's 'archaic types': *Aeolochroma*, *Austroterpna*, *Crypsiphona*, *Cyneoterpna*, *Heliomystis*, *Hypobapta*, *Sterictopsis*, and additionally *Lophothorax* and *Oxyphanes* (the last synonymized by us with *Rhuma* in the present study), were treated as 'Section A – the grey and brown genera' of Geometrinae by McFarland, 1988). We now formally assign them, and other genera in Australia cited above, *Hypodoxa*, *Paraterpna* and *Protophyta*, to Pseudoterpnini.

Heppner & Inoue's (1992) checklist of Taiwanese Geometridae termed the tribe Pingasini, without valid description, and included *Archaeobalbis* (currently a junior synonym of *Herochroma*), *Dindica*, *Pachyodes* and *Pingasa*. Holloway (1996) covered the Bornean members and used subtribe status, Pseudoterpniti, citing the genera *Actenochroma*, *Dindica*, *Epipristis*, *Herochroma*, *Lophophelma*, *Metallolophia*, *Orthorisma*, *Pachyodes*, *Pingasa*, *Pullichroma* and *Sunda-doxa*. His inclusion of *Pingasa* rendered Pingasini a synonym of Pseudoterpniti. Hausmann (1996a, b, 2001) covered the Middle Eastern and European members and reverted to use of tribal status, Pseudoterpnini, citing the genera *Aplasta*, *Holoterpna*, *Pingasa* and *Pseudoterpna*, with mention in the first of those works also of *Agathia*, and *Dooabia* Warren, which are not included in Pseudoterpnini in the present study.

Additional genera are newly included in Pseudoterpnini in the present study: *Crypsiphona*, *Cyneoterpna*, *Hypobapta*, *Hypodoxa*, *Metaterpna*, *Mictoschema*, *Paraterpna*, *Aeolochroma*, *Austroterpna*, *Heliomystis*, *Lophothorax*, *Protophyta* and *Rhuma*.

MATERIAL AND METHODS

This study has been based, where possible, on the examination of primary types, and also on extensive material in various collections, particularly those of the Natural History Museum, London, UK (NHM), the Institute of Zoology, Chinese Academy of Sciences, Beijing, China, and the Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany. We examined external features of most species in each genus, and a considerable range of genitalia preparations, which are indicated, for example, by '[male genitalia]', against the species name in the list under each genus. The terminology of the genitalia largely follows that of Klots (1956), and is much as has been used in Pitkin (1996: labelled in fig. 87; 2002: labelled in fig. 264). The illustrations of whole moths (upper side and underside), moth genitalia and abdomens were prepared from digital scans, and were subsequently edited in Adobe Photoshop. The whole moth scans were made by Phil Crabb of the NHM's Commercial & Business Image Resource, using a Nikon DX1 body mounted on a Sinar plate camera, with a Hasselblad 135-mm lens, and the genitalia and abdominal scans were made by Shayleen James using a Nikon Super Coolsan 4000 ED camera.

TAXONOMIC CHARACTERS OF THE PSEUDOTERPNIINI

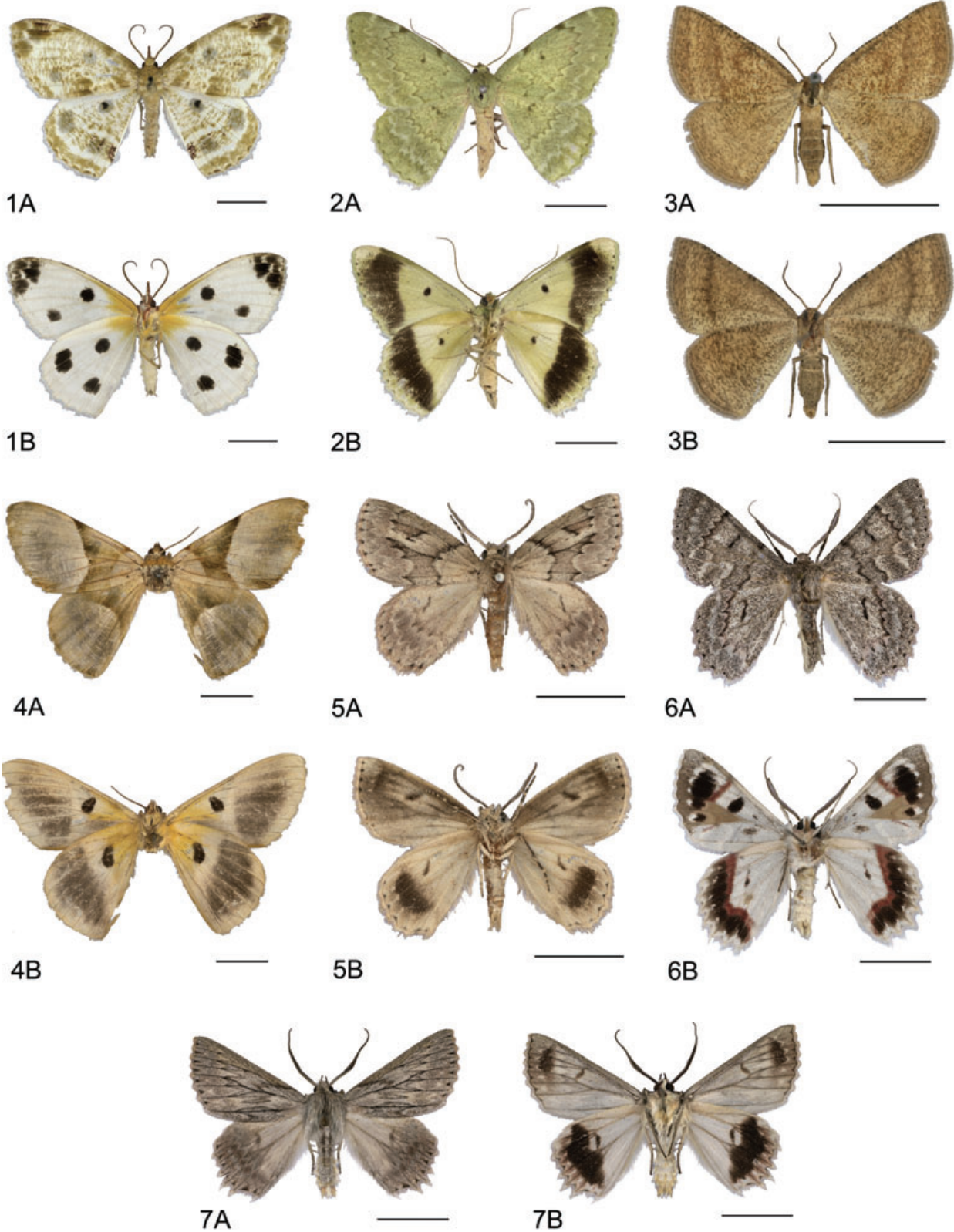
The Pseudoterpnini are atypical of Geometrinae in several respects, and some features give many of the moths a superficial resemblance to ennomines, partic-

ularly to those of the tribe Boarmiini as noted by Holloway (1996: 192). The majority of pseudoterpnine moths are larger and more robust than the 'typical' concept of Geometrinae as delicately built moths, and Pseudoterpnini never have the bright pure green colour that is obvious in many other Geometrinae (e.g. Geometrini and Nemoriini). Only a few Pseudoterpnini have a noticeable green hue, and that is usually dull or mottled. Unlike most Geometridae, the undersides of the wings are boldly patterned in most Pseudoterpnini and the discal spots are elongated or large. The hind wing shape is often characteristic of the tribe, with the costa short and the anal margin elongate. Below is a more detailed account of the characters, with those that we consider most significant numbered.

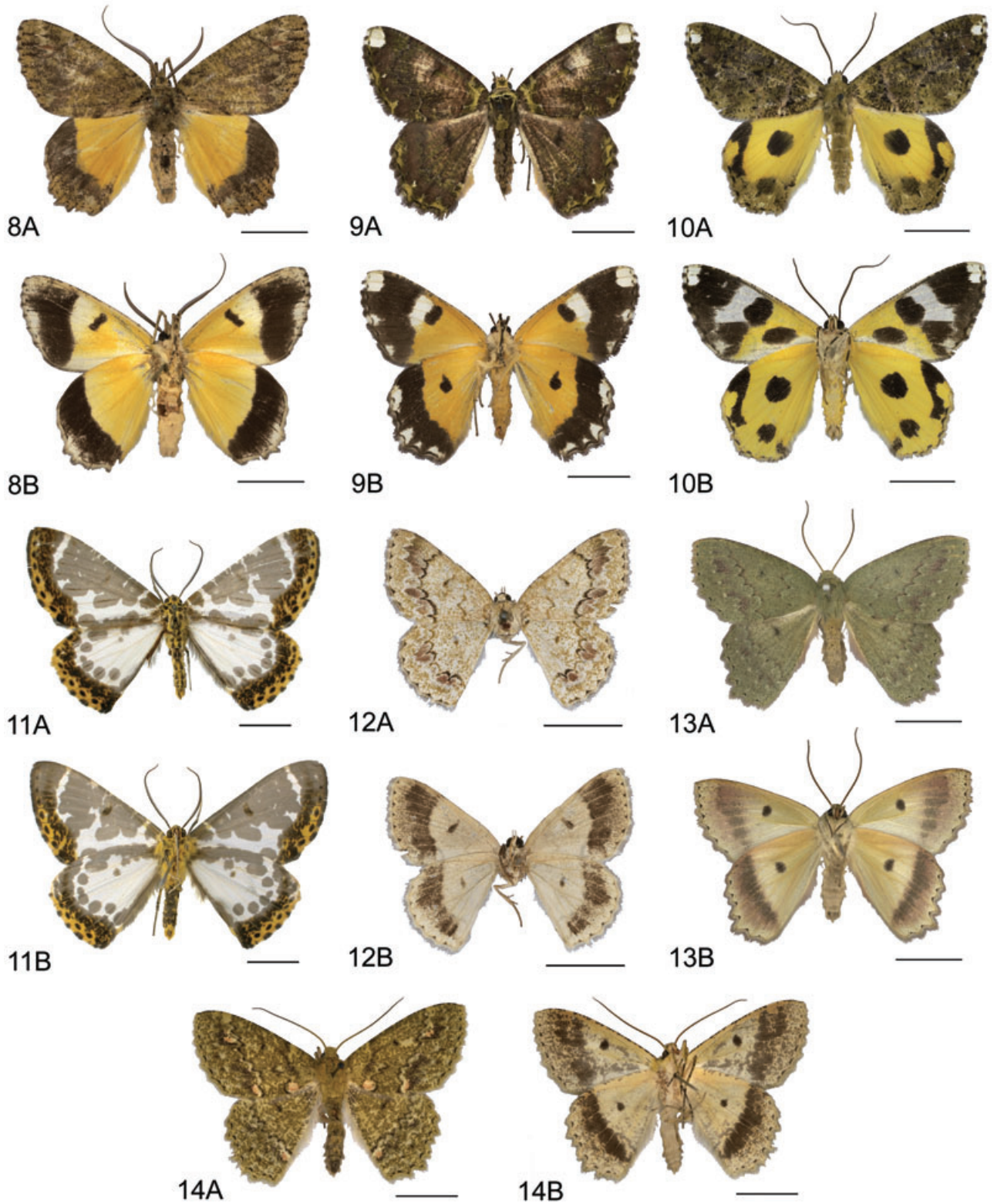
Adult moths

1. Fairly large with build robust, and with dense scale covering on the wings. This combination applies to most genera, and the largest, *Limbatochlamys*, has a wingspan extending up to 74 mm, but a few pseudoterpnine moths are small: notably *Aplasta*, with a wingspan of 20–29 mm or less (Hausmann, 2001: 115) – see discussions below and under that genus.
2. Wing pattern (upper side) not bright or pure green, instead often of mottled markings with an overall brown, grey, or olive-green hue, or sometimes with bold yellow or white patterns [e.g. *Dindica* (Fig. 8A) and many species of *Dindicodes* (Figs 10A, 11A)]. *Actenochroma* (Fig. 2A) has the greenest appearance in the Pseudoterpnini, but pale rather than bright green. N.B. Although the Pseudoterpnini do not usually appear obviously green, the one representative tested by Cook *et al.* (1994), *Pingasa venusta*, had the pigment geoverdin present in large quantities, which is the character regarded as definitive of the Geometrinae.
3. Wing pattern (underside) usually with strong markings, dark discal spots and bands, e.g. *Actenochroma* (Fig. 2B) and *Dindica* (Fig. 8B); often with large basal zone (from base of wing to postmedial line) differing in colour or tone from outer zone (from postmedial line outwards). Exceptions: a few genera: *Aplasta*, *Holoterpna*, *Mictoschema*, *Mimandria* and *Pseudoterpna*, have only faint underside markings. Most Geometridae other than Pseudoterpnini have underside markings fainter and paler than on the upper side.
4. Discal spot often elongated, forming a dash or comma, or large and round, and usually more pronounced on underside of wings, e.g. *Absala* (Fig. 1B), *Dindicodes* (Figs 9B, 10B) and *Hypobapta* (Fig. 16B). Discal spots are small and dot-like in most geometrines outside the Pseudoterpnini, but

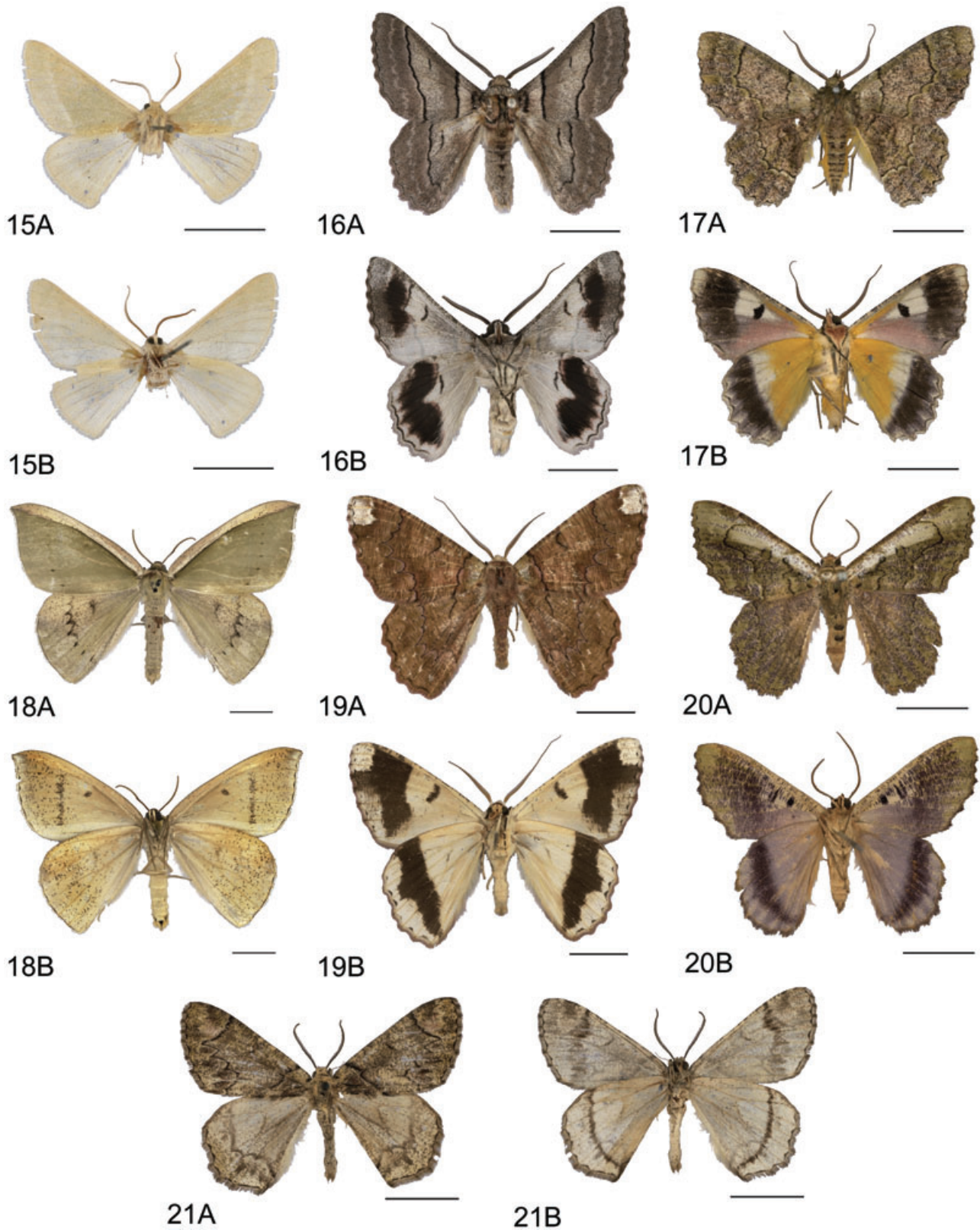
- they are occasionally elongated, e.g. in *Iotaphora* Warren (tribal placement unknown).
5. Frenulum usually normal, i.e. moderately well developed, and not reduced as in many other Geometrinae as noted by Holloway (1996; as Geometrini). Degree of development of the frenulum can be a variable character (as noted in Pitkin, 1996: 312), but the presence in the Pseudoterpnini of a normal, fairly strong, frenulum might be to some extent associated with robust build, as in a few less robust members of the group the frenulum is reduced or absent (absent in *Aplasta* and *Holoterpna*, reduced slightly to moderately in *Pseudoterpna*). The frenulum is absent also in *Mictoschema*, males of which are small but females larger and more robust. Outside the Pseudoterpnini, an example of fairly large and robust moths with a well-developed frenulum is the Neotropical nemoriine genus *Rhodochlora* Warren (Pitkin, 1996: 318). Expansion of the humeral lobe of the hind wing (associated with the frenular reduction of Geometrinae by Holloway, 1996) is moderate to strong in the Pseudoterpnini, e.g. strong in *Pullichroma*, *Pingasa* and *Mictoschema*.
 6. Hind wing with costa short and anal margin elongate, at least slightly so in the majority of genera and strong in some [e.g. *Metallolophia*, particularly *vitticosta* (Fig. 20), and *Mictoschema* (Fig. 22)], but not in *Aplasta* and *Pseudoterpna*, or in the group of genera placed with *Aeolochroma* in the current work (see genus *Aeolochroma* onwards), except sometimes *Aeolochroma* itself. Other features of pseudoterpnine wing shape: outer margin of fore wing convexly curved and hind wing rounded, hind wing usually with the apex rounded also; fore wing apex never strongly falcate as in some other Geometrinae (e.g. *Tanaorhinus* Butler), and slightly falcate only in *Limbatochlamys*, never strongly angled or with a tail, at the most only weakly angled (in *Austroterpna*).
 7. Thorax and abdomen often with dorsal crests (e.g. well developed in *Dindica*, *Pachyodes* and *Aeolochroma*), but not in various genera including, for example, *Actenochroma*, *Aplasta*, *Holoterpna* and *Protophyta*. Inoue (1961) cited developed crests as a character of Terpnini (which was his concept of Pseudoterpnini); he noted crests as absent in most other geometrine tribes, present but not strong in Hemitheini, and weak in Hemistolini [included in Hemitheini (as Hemitheiti) by Holloway (1996)]. However, his study was restricted to Old-World fauna, and Pitkin (1996: 322) noted that prominent crests are present in some members of the Neotropical tribe Lophochoristini [which was tentatively included in Rhomboristini (as Rhomboristiti) by Holloway (1996)].
 8. Pair of fields of needle-like scales on sternite 3 of the male abdomen more often absent than present (absent in 17 genera, present in eight genera, present or absent in nine other genera, see genera descriptions for details). Pseudoterpnini are unusual in the low incidence of this character that generally typifies the Geometrinae. However, Pitkin (1996) noted the absence of these paired fields in about one-third of Neotropical genera.
- Other characters of adult moths:* Antenna of male usually with basal half or more bipectinate (or sometimes simple filiform or occasionally fasciculate); in female commonly simple filiform, or occasionally serrate or lamellate, but bipectinate with short rami in *Lophophelma neonoma*, *Lophothorax*, *Mimandria*, *Pachista*, *Psilotagma pictaria*, and sometimes in *Holoterpna* and *Limbatochlamys*. Rami of antenna usually devoid of scales, but presence of scales observed in the following genera: *Mimandria*, *Holoterpna errata* (but not in other *Holoterpna* species), *Hypodoxa multicolor* and *H. regina* (but not in *H. emiliaria*), *Hypobapta* (basal few rami only), *Aeolochroma chioneschatia* (but not in other species), *Rhuma divergens* (basal few rami only, and not in other *Rhuma* species). These observations support the findings by Young (2006) that scaled rami occur in a fairly wide range of geometrine genera. Moths of Pseudoterpnini never have a white interantennal fillet as is sometimes present in various other Geometrinae [e.g. usual in Neotropical Geometrinae (Pitkin, 1996: 313)]. Frons often protruding slightly to strongly (e.g. strong in *Absala*); some genera with black band or large black area on frons, others without. Labial palpus with first and second segments rough-scaled, third segment often short in male.
- Wing pattern:* additional features – wing pattern occasionally sexually dimorphic (e.g. in *Aeolochroma*) but usually similar in both sexes. Antemedial and postmedial lines on wings dark, usually brown or black but sometimes grey-green; antemedial line usually present only on fore wing (but present also on hind wing of *Epipristis truncataria*); subbasal line, where present, only on fore wing; postmedial line of fore wing usually angled outward in upper half or sometimes curved, rarely almost straight. Terminal line usually strong and blackish, sometimes broken into dashes. Tufts of raised scales present on hind wing of a few genera (*Hypodoxa*, *Pingasa* and *Sundadoxia*), and occasionally on fore wing (*Herochroma* and *Hypodoxa*). Venation: fore wing with R_{2-5} stalked, with M_1 commonly close and or even connate, but only occasionally on a short stalk with R_{2-5} (sometimes in *Holoterpna* and *Rhuma*, occasionally in *Pseudoterpna*, and rarely an extremely short stalk in *Aeolochroma*) – this character is subject to variation within genera and



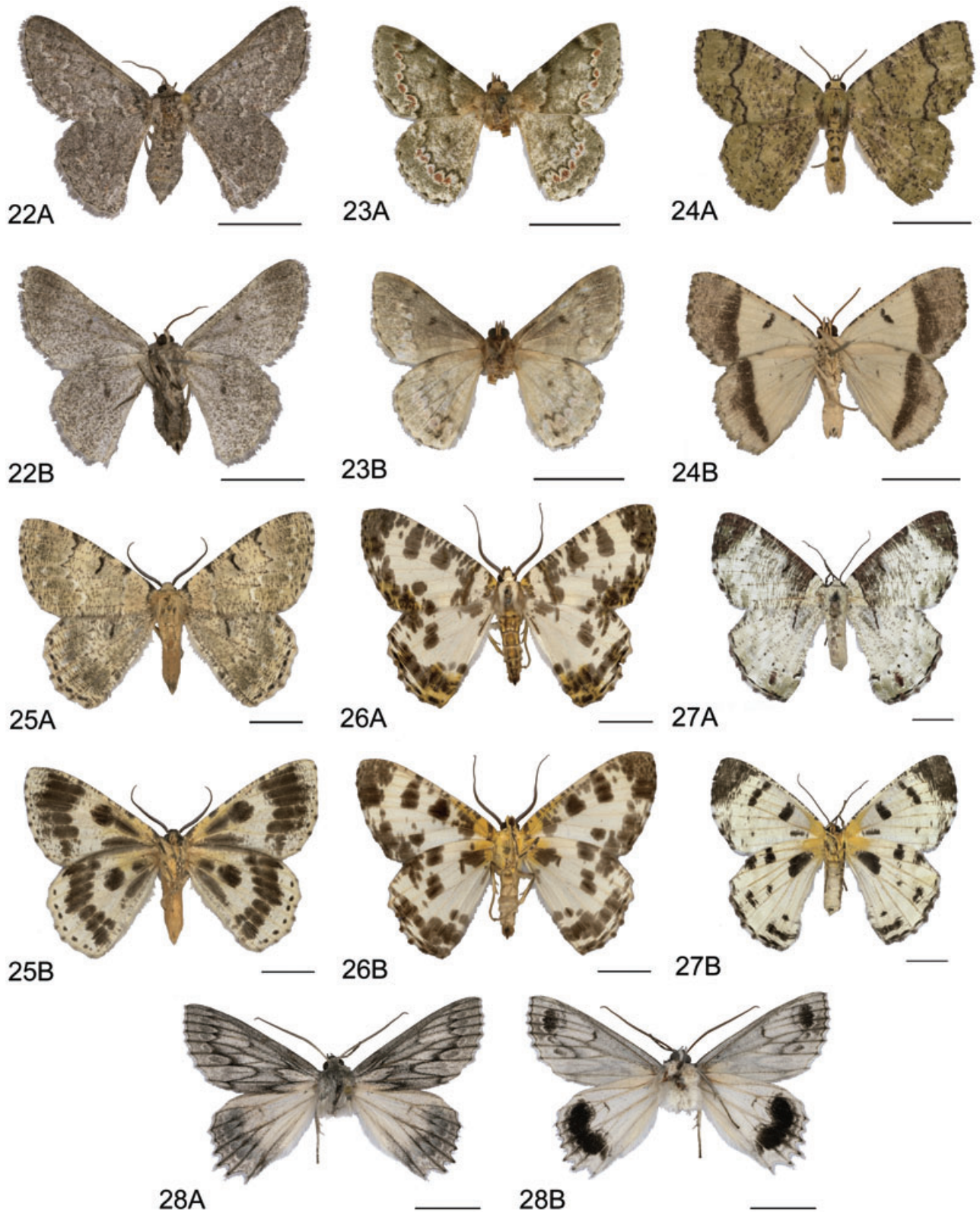
Figures 1–7. Pseudoterpni moths. A, upper side, B, underside. Scale bars = 10 mm. 1, *Absala dorcada*; 2, *Actenochroma muscicoloraria*; 3, *Aplasta ononaria*; 4, *Calleremites subornata*; 5, *Crypsiphona melanosema*; 6, *Crypsiphona ocultaria*; 7, *Cyneoterpna wilsoni*.



Figures 8–14. Pseudoterpnini moths. A, upper side, B, underside. Scale bars = 10 mm. 8, *Dindica polyphaenaria*; 9, *Dindicodes apicalis*; 10, *Dindicodes crocina*; 11, *Dindicodes ectoxantha*; 12, *Epipristis oxycyma*; 13, *Herochroma baba*; 14, *Herochroma ochreipicta*.



Figures 15–21. Pseudoterpnini moths. A, upper side, B, underside. Scale bars = 10 mm. 15, *Holoterpna diagrapharia*; 16, *Hypobapta percomptaria*; 17, *Hypodoxa emiliaria*; 18, *Limbatochlamys rosthorni*; 19, *Lophophelma vigens ruficoloraria*; 20, *Metallolophia vitticosta*; 21, *Metaterpna differens*.



Figures 22–28. Pseudoterpnini moths. A, upper side, B, underside. Scale bars = 10 mm. 22, *Mictoschema swierstrai*; 23, *Mimandria insularis*; 24, *Orthorisma netunaria*; 25, *Pachista superans*; 26, *Pachyodes amplificata*; 27, *Pachyodes haemataria*; 28, *Paraterpna harrisoni*.

even within species; veins M_3 and CuA_1 not stalked. Hind wing veins M_3 and CuA_1 separate or connate. $R_s + M_1$ of the hind-wing usually separate or connate, as in many Geometrinae, not stalked as usual in Holloway's (1996) broad concept of Hemitheini (given by him as Hemitheiti) and in Nearctic Geometrinae in general (Ferguson, 1985); $R_s + M_1$ are stalked in a minority of pseudoterpnines: *Aplasta*, *Calleremites*, *Dindica glaucescens*, *Metallolophia variegata*, *Austroterpna*, often in *Holoterpna* and *Rhuma*, and rarely with a very short stalk in *Pingasa (lahayei)*. A_3 of hind wing usually present in Pseudoterpnini but sometimes reduced, absent in *Aplasta*.

Hind tibia in male commonly somewhat dilated when a hair pencil is present and very strongly dilated in some species of *Herochroma*. Hind tibia usually with two pairs of spurs, but with only one in *Crypsiphona* and *Holoterpna*, and sometimes only one also in *Hypobapta* and *Mictoschema*. Male hind tibia commonly without a terminal extension, but present in: *Dindicodes* (occasionally), *Herochroma*, *Hypodoxa*, *Pingasa* (usually, a short extension), *Psilotagma*, *Aeolochroma* (occasionally) and *Rhuma*. Ferguson (1985) regarded the presence of this extension as common in Geometrinae and absent from other subfamilies. In the abdomen, the shape of the ansa of the tympanal organ shows more variation than that given by Cook & Scoble (1992) as a probable synapomorphy of the Geometrinae (other than the Dysphaniini): usually narrow just above base, broader medially and narrowing to apex. This state occurs in the majority of Pseudoterpnini, but exceptions (principally *Calleremites*, *Dindica*, *Hypobapta*, *Paraterpna* and *Psilotagma*) have the apex of the ansa broadened as in some Ennominae or some other geometrine subfamilies. Outside of Pseudoterpnini, Geometrinae known to have the apex of the ansa broadened include a few Neotropical examples in the Nemoriini: *Tachyphyle pretiosa* (Thierry-Mieg), *Phrudocentra janeira* (Schaus) and *Phrudocentra kinstonensis* (Butler) (Pitkin, 1996). In some Pseudoterpnini, notably certain Australian genera: *Heliomystis*, *Hypobapta*, *Protophyta* and *Rhuma*, the ansa is broad at the base and often tapering. This was remarked on by Young (2006), who noted similarity to the state given for the Oenochrominae *s.l.* by Cook & Scoble (1992).

Abdominal segment 8 commonly unmodified, but sternite 8 modified in males of some genera: *Absala*, *Calleremites*, *Crypsiphona*, *Cyneoterpna*, *Herochroma (flavibasalis-group)* and *Orthorisma* (sternite and tergite), and tergite 8 modified in *Paraterpna*.

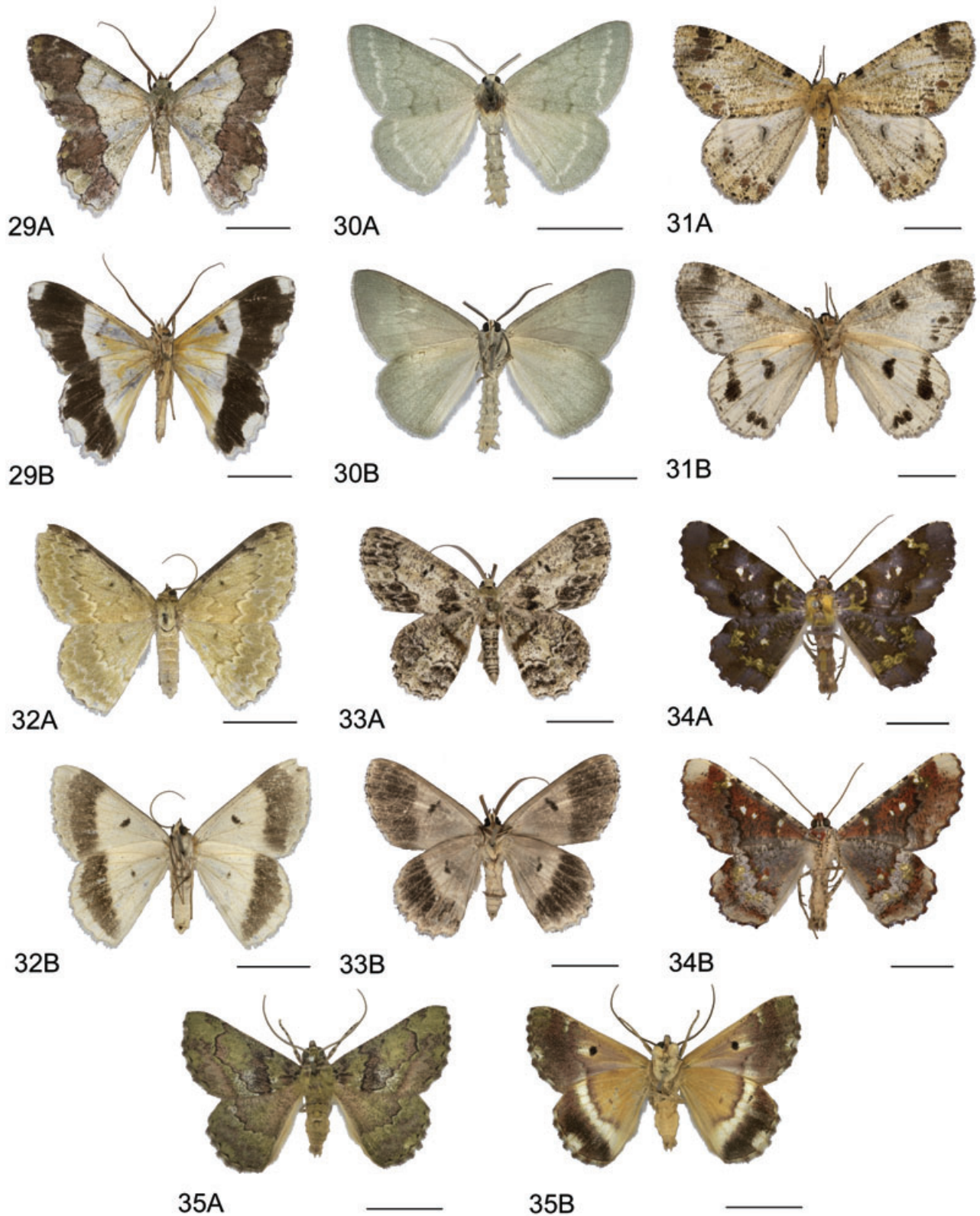
It is worth noting an additional information resource that illustrates moths of many Australian species, specimens in the Australian National Insect Collection (ANIC), CSIRO Entomology, Canberra: <http://www.ento.csiro.au/gallery/moths/Geometridae>.

Male genitalia

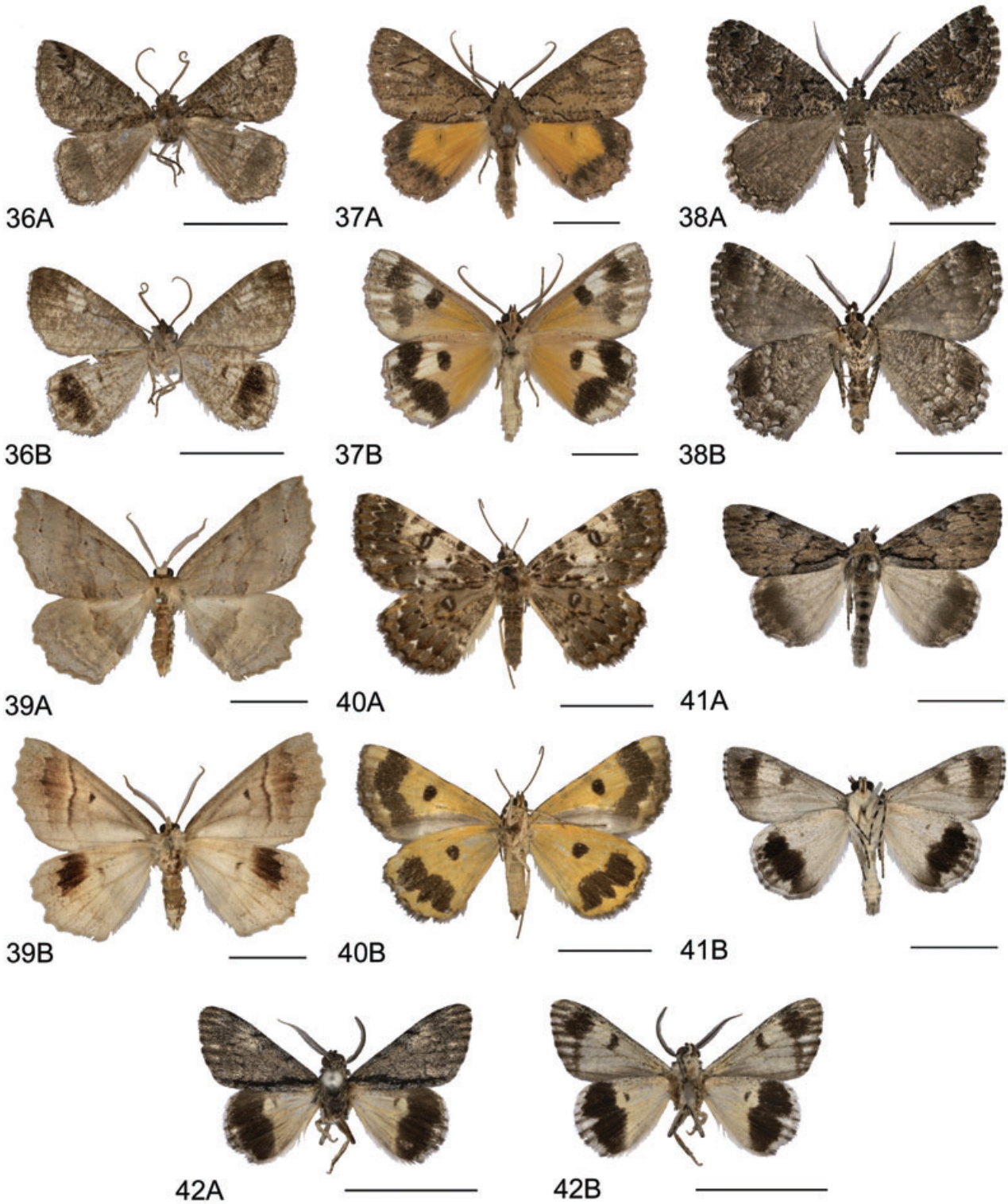
1. Socii and uncus modified in the majority of genera. Typically, the socii of Pseudoterpnini are strongly developed, large, and sclerotized, and the uncus is reduced to merely the basal component, or sometimes with a vestigial or short process. The socii and uncus base commonly form a single sclerotized structure, which is fused basally, bifid and fork-like distally and is referred to here as the socii/uncus complex (e.g. Figs 51, 53, 56–64). The derivation of the structures and demarcation between them is not entirely clear, as discussed by Holloway (1996: 192), but from our current study we consider the bifid distal part of the structure more likely to be equivalent to socii than to be a bifid uncus. In extreme cases (*Crypsiphona* and *Pullichroma*, Figs 55, 79), the socii appear to have replaced the uncus entirely. Towards the other end of the range, the uncus and socii are by degrees less modified: although still flanked by enlarged sclerotized socii, the uncus is moderately to well developed in *Herochroma elaearia* and *Metaterpna thyatiria*, and long and rod-like in *Actenochroma* and *Limbatochlamys*. *Psilotagma* and *Calleremites* have a rod-like uncus, but with weaker socii, especially in the latter genus. *Orthorisma* is modified differently from other members of the Pseudoterpnini in having strong enlargement of the uncus, with relatively small socii. Tendencies within the Geometrinae towards dominance of socii over uncus have been discussed by Holloway (1996), who noted this in Geometrini, Aracimini, Comibaenini and a few others, and by Pitkin (1996: 318), who noted several independently derived occurrences in Neotropical representatives: Synchronini, some Lophochoristini and a nemoriine: *Rhodochlora rufaria* Prout.

The group of genera placed with *Aeolochroma* in the current work (see genus *Aeolochroma* onwards) differs strongly from other Pseudoterpnini in that the socii are vestigial or absent (in *Aeolochroma*, *Austroterpna*, *Lophothorax*, *Protophyta* and *Rhuma*), and only weakly developed in *Heliomystis*; these genera all have a rod-like uncus (Figs 81–89). Such weak development of socii is unusual in the Geometrinae, but has been noted for several varied Neotropical genera by Pitkin (1996: 318), and was considered to be one of the characters of the tribe Dysphaniini by Holloway (1996: 185).

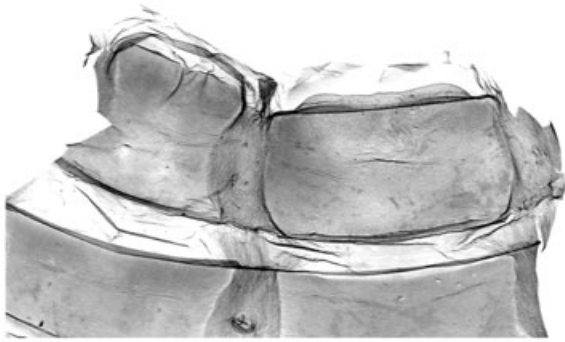
2. Valva often divided into two parts: costal lobe and sacculus [e.g. *Aeolochroma* (Fig. 82), *Dindica* and *Dindicodes* (Figs 57, 58), and *Pachyodes* (Fig. 73)]. The valva is often complex and highly variable; both divided and undivided states occur in some genera (e.g. *Herochroma* and *Lophophelma*), but the valva of several others is always undivided (e.g.



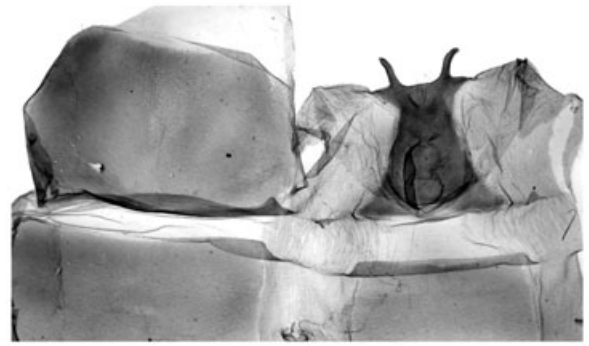
Figures 29–35. Pseudoterpnini moths. A, upper side, B, underside. Scale bars = 10 mm. 29, *Pingasa ruginaria ruginaria*; 30, *Pseudoterpna pruinata*; 31, *Psilotagma decorata*; 32, *Pullichroma pullicosta*; 33, *Sundadoxa multidentata*; 34, *Aeolochroma amethystina*; 35, *Aeolochroma turneri*.



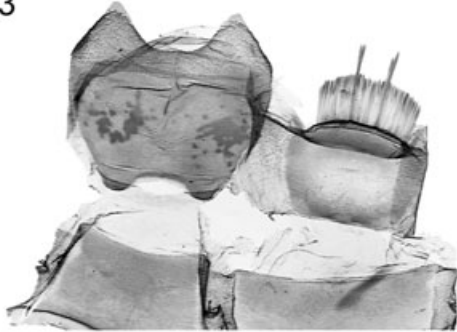
Figures 36–42. Pseudoterpnini moths. A, upper side, B, underside. Scale bars = 10 mm. 36, *Austroterpna idiographa*; 37, *Heliomystis electrica*; 38, *Lophothorax eremnopsis*; 39, *Protophyta castanea*; 40, *Rhuma subaurata*; 41, *Rhuma argyraspis*; 42, *Rhuma thiobapta*.



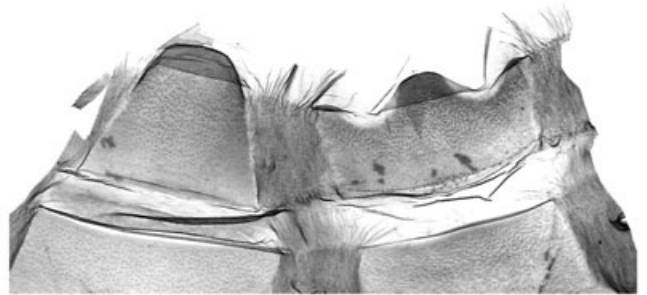
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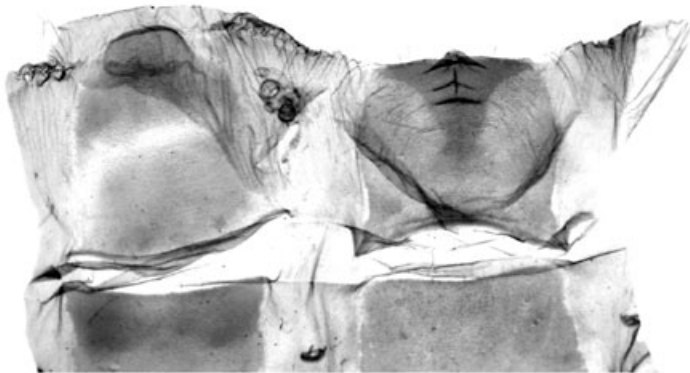
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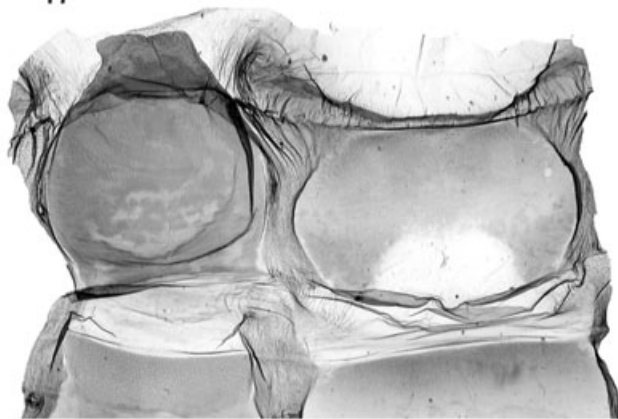
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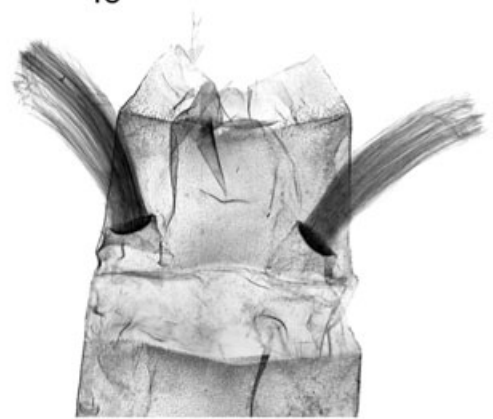
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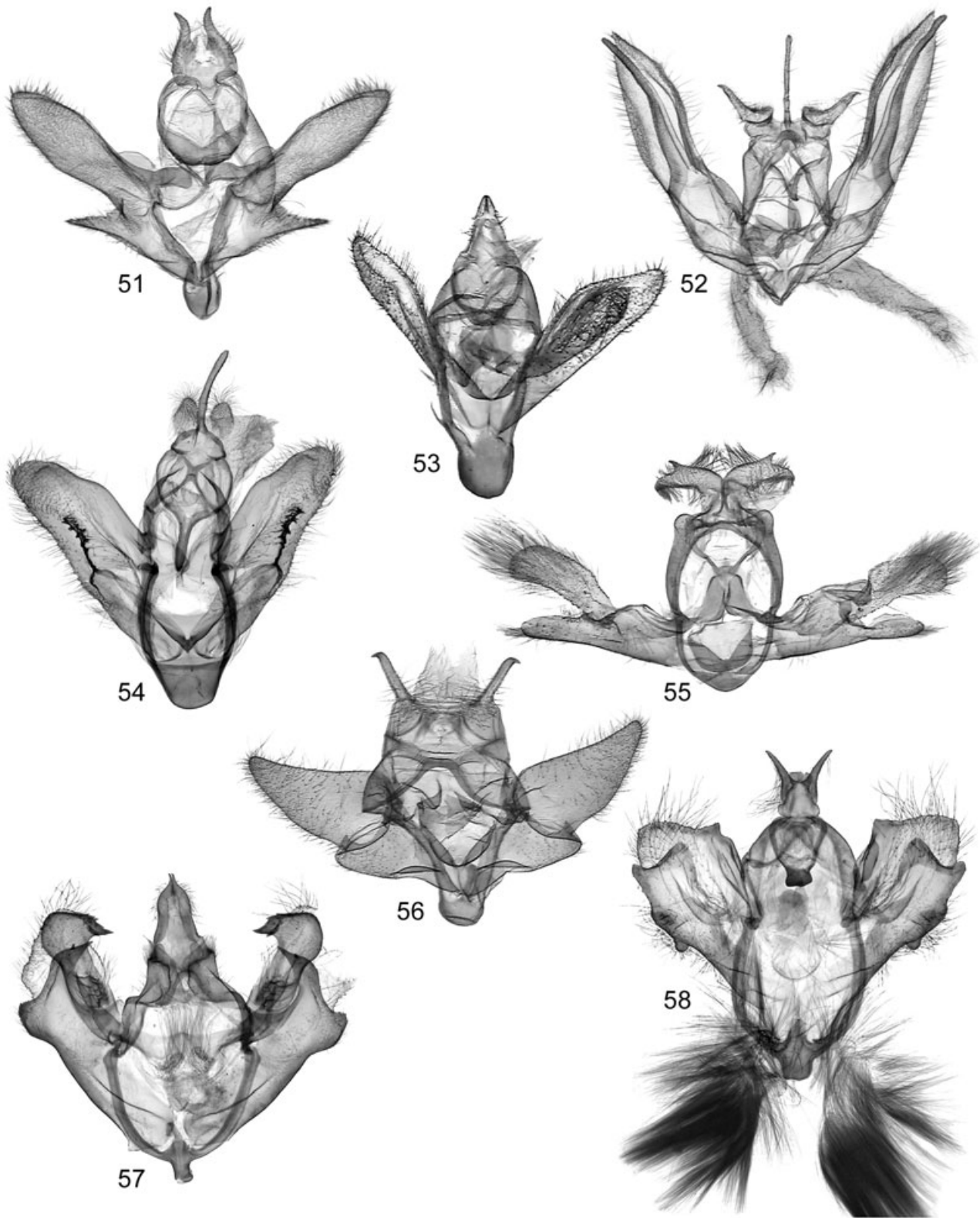


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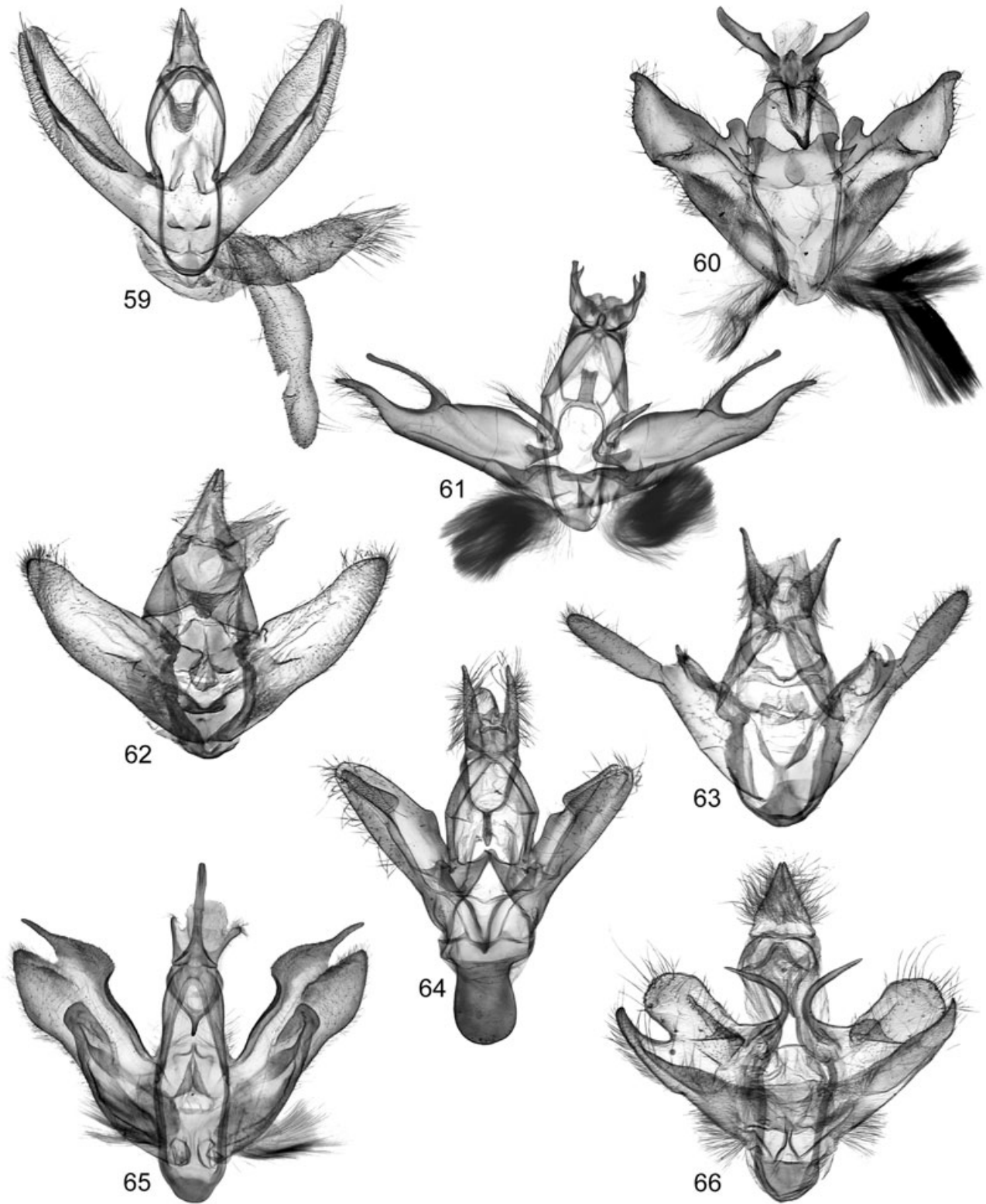


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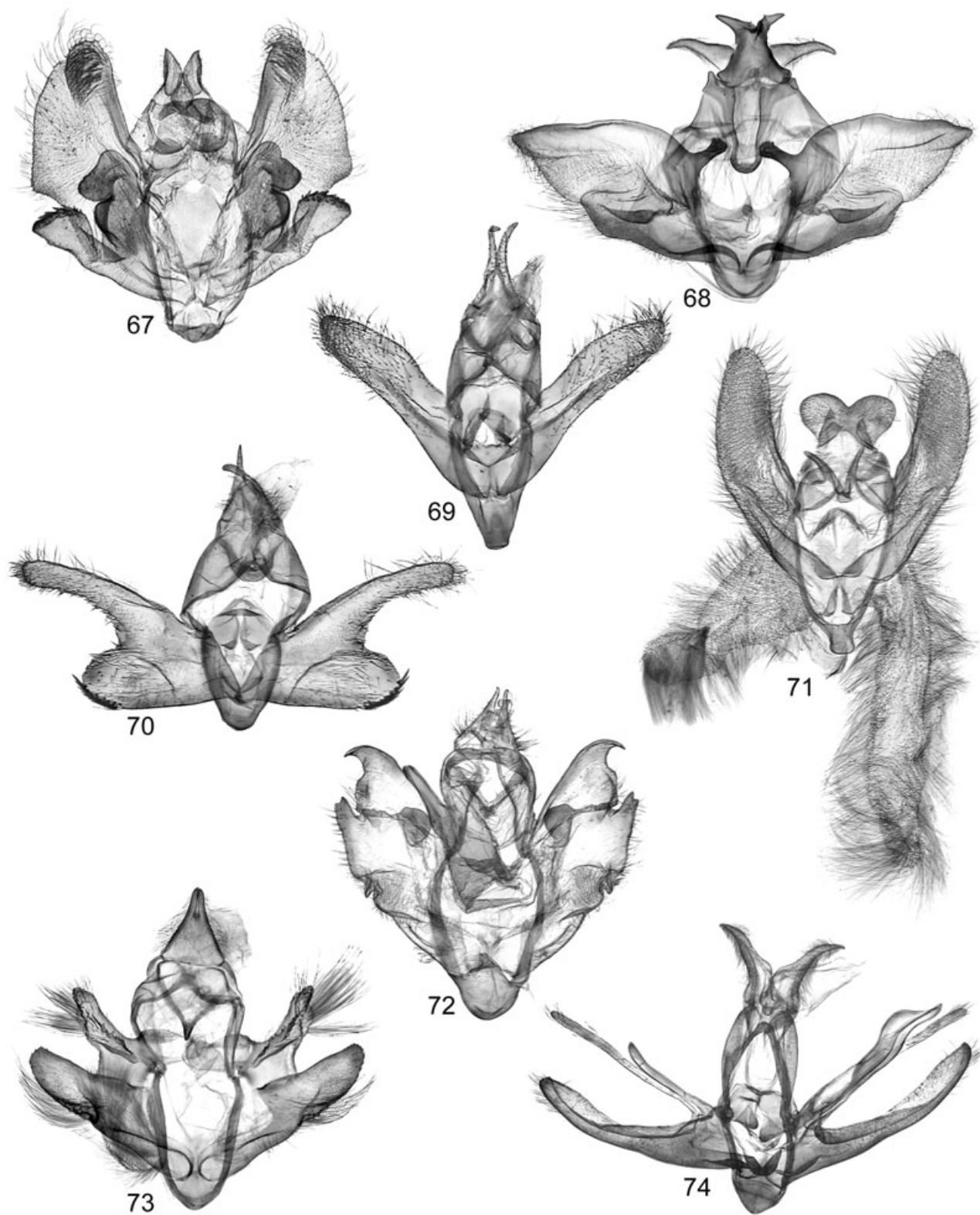
Figures 43–50. Male abdomen, segment A8. 43, *Absala dorcada*; 44, *Calleremites subornata*; 45, *Crypsiphona melanoosema*; 46, *Cyneoterpna wilsoni*; 47, *Herochroma mansfieldi*; 48, *Orthorisma netunaria*; 49, *Paraterpna harrisoni*; 50, *Aeolochroma acanthina*.



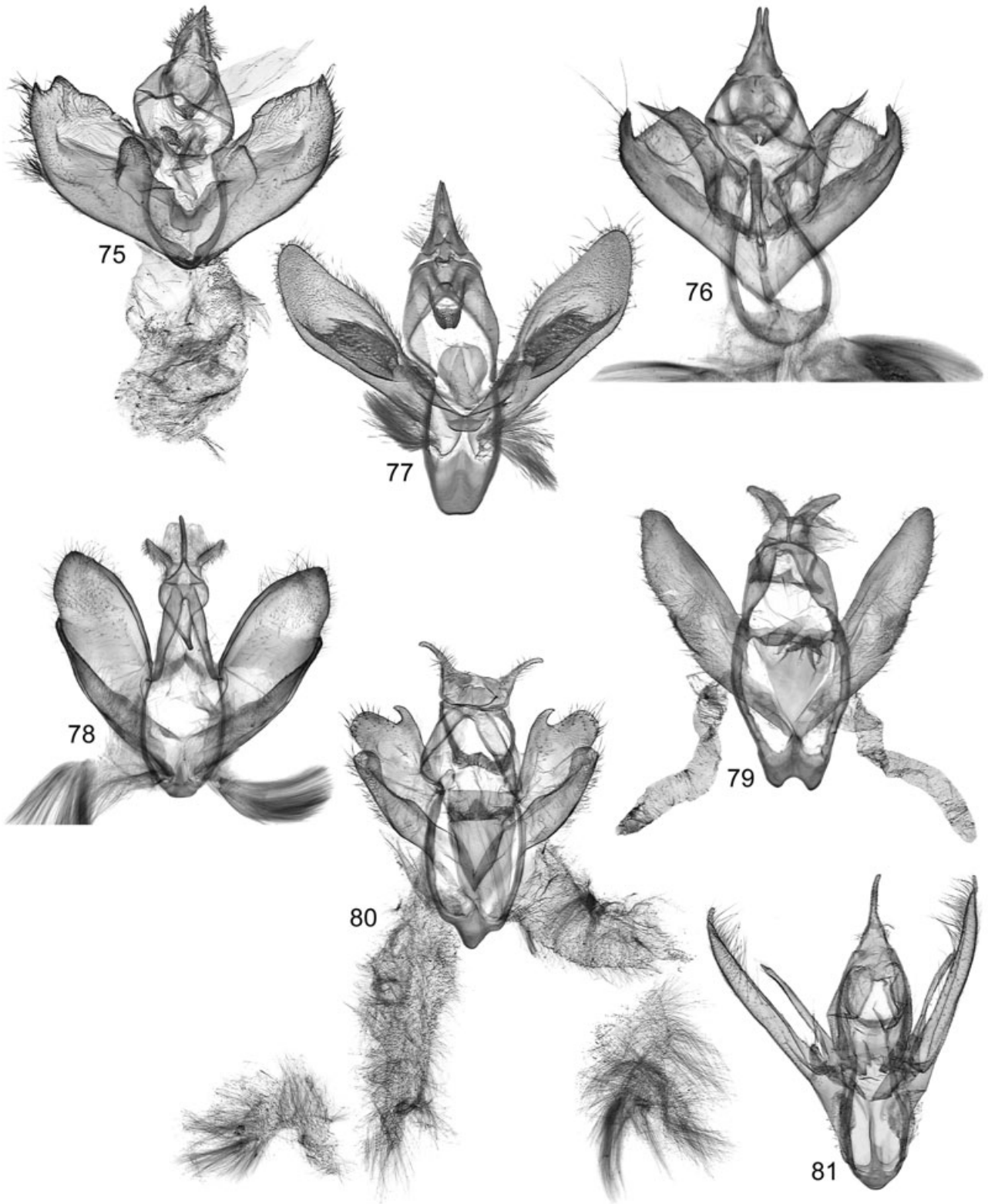
Figures 51–58. Male genitalia. 51, *Absala dorcada*; 52, *Actenochroma muscicoloraria*; 53, *Aplasta ononaria*; 54, *Callere-
mites subornata*; 55, *Crypsiphona melanosema*; 56, *Cyneoterpna wilsoni*; 57, *Dindica polyphaenaria*; 58, *Dindicodes
crocina*.



Figures 59–66. Male genitalia. 59, *Epipristis oxycyma*; 60, *Herochroma ochreipicta*; 61, *Herochroma mansfieldi*; 62, *Holoterpna diagrapharia*; 63, *Hypobapta percomptaria*; 64, *Hypodoxa emiliaria*; 65, *Limbatochlamys rosthorni*; 66, *Lophophelma ruficosta*.



Figures 67–74. Male genitalia. 67, *Metallolophia arenaria*; 68, *Metaterpna thyatiraria*; 69, *Mictoschema swierstrai*; 70, *Mimandria cataractae*; 71, *Orthorisma netunaria*; 72, *Pachista superans*; 73, *Pachyodes amplificata*; 74, *Paraterpna harrisoni*.



Figures 75–81. Male genitalia. 75, *Pingasa ruginaria communicans*; 76, *Pingasa ruginaria pacifica*; 77, *Pseudoterpna pruinata*; 78, *Psilotagma decorata*; 79, *Pullichroma pullicosta*; 80, *Sundadoxa multidentata*; 81, *Aeolochroma turneri*.

Aplasta, *Epipristis*, *Metaterpna*, *Pseudoterpna* and *Rhuma*). A divided valva is uncommon in the Geometrinae, and it is more often seen in the Ennominae (e.g. Macariini, Abraxini and Eutoeini). In the Pseudoterpnini, the lobes of the divided valva quite often overlap or lie close together (e.g. *Dindica* and *Dindicodes*), and less commonly diverge (e.g. *Absala*, Fig. 51, and *Mimandria cataractae*) as they usually do in the Ennomine tribes just mentioned.

Other characters of male genitalia: Socii/uncus complex, or uncus where present, finely setose dorsally; socii usually tapered, but shaped otherwise in minorities (e.g. *Crypsiphona* and *Herochroma*, Figs 55, 60, 61). The pair of socii prongs varies: sometimes close together as in *Lophophelma* (Fig. 66) or diverging as in *Hypobapta* (Fig. 63). Gnathos usually with a well-sclerotized median process or expanded region (in other Geometrinae the gnathos is sometimes similarly developed, sometimes weak). The gnathos of *Hypobapta* is less strongly developed, and it is absent in *Cyneoterpna*. A few Pseudoterpnini have the highly unusual character of the gnathos fused with the membrane of the diaphragma (*Crypsiphona*, *Paraterpna* and the *flavibasalis*-group of *Herochroma*). Coremata are present, situated basally to the valva, in about half of all pseudoterpnine genera. A cruciform vinculum in the region of the saccus, characteristic of Geometrinae (Holloway, 1996), is fairly infrequently distinct in Pseudoterpnini (e.g. in *Dindica* and *Dindicodes*, Figs 57, 58). Aedeagus: commonly tubular and not with sclerotization reduced to a ventral longitudinal strip as in most other Geometrinae, although sometimes extended posteriorly on one side with a process. Vesica of aedeagus with cornuti present in slightly less than one-third of genera, which is considerably more frequent than in other Geometrinae.

Female genitalia

Ovipositor valves oblique (and usually truncate), papillate and usually sclerotized. This is the normal state for Geometrinae (Pitkin, 1996: 319; Holloway, 1996; except Geometrini (given by him as Geometriti) *et al.*) and is present in Pseudoterpnini except in some species of *Rhuma*, and sometimes particularly strongly papillate, e.g. *Crypsiphona*, *Cyneoterpna* and *Metaterpna*. Sternite 8 usually weakly sclerotized, but occasionally more so, e.g. in *Dindicodes*. Apophyses anteriores usually much shorter than apophyses posteriores (e.g. Figs 152, 153), and only occasionally approaching length of apophyses posteriores (e.g. *Heliomystis*; Fig. 157). Region around ostium often lightly sclerotized, broad and wrinkled, and sometimes forming a shallow anterior pouch. Corpus bursae with or without a signum: signum absent in

approximately two-thirds of genera, and a bicornute signum (a character cited by Holloway, 1996) present only in *Actenochroma*, *Limbatochlamys* and sometimes in *Herochroma*.

Diagnosis and monophyly

Although there is no single defining character of the Pseudoterpnini, the majority of genera share a suite of characters, which are numbered above. Several genera differ significantly, but still possess some characters by which they are associated with the Pseudoterpnini, and by which we consider them to be best placed within this group. These anomalous genera are *Aplasta* and several others, and the group of genera placed with *Aeolochroma* in the current work.

Moths of *Aplasta*, *Holoterpna*, *Mictoschema*, *Mimandria* and the type genus itself, *Pseudoterpna*, are fairly small with plain undersides, and have either the frenulum or the proboscis (or both) reduced, i.e. normal for Geometrinae other than Pseudoterpnini. They are known only from the Palaearctic (mainly Europe and the Middle East) and/or Afrotropical Regions, and do not occur where the majority of Pseudoterpnini are found, in Palaearctic China, the Oriental Region and Australasian Regions. In the male genitalia they have the modified socii/reduced uncus structure that is typical of Pseudoterpnini, and, although that character is not confined to Pseudoterpnini, *Aplasta et al.* do not have features of other Geometrinae that share it [e.g. bright green colouring, angled wings, and (Geometrini *et al.*) ovipositor valves that are not oblique and papillate]. Hausmann (2001: 113) regarded *Aplasta* in particular as possibly primitive Pseudoterpnini, and that might be the case with all five genera named above.

We have placed *Aeolochroma* in our current assessment of the Pseudoterpnini because of the characters it shares with the tribe: typical robust build and wing pattern features, particularly the strongly marked underside; also the frenulum not reduced, and large crests present on the abdomen. However, the male genitalia are very different from those of most Pseudoterpnini in having a rod-like uncus and socii that are not enlarged but are modified in the opposite extreme: vestigial or absent. Several other genera with those genitalic characters are here associated with *Aeolochroma* and placed in Pseudoterpnini: *Austroterpna*, *Lophothorax*, *Protophyta* and *Rhuma*, and also *Heliomystis* (which has socii but only weakly developed). Their moths all have some degree of bold markings on the under side (Figs 34B–42B). All of these genera are restricted to the Australasian Region. Common (1990: 80) linked *Aeolochroma* and *Heliomystis* with other Australian genera here assigned to Pseudoterpnini: *Crypsiphona*, *Cyneoter-*

pna and *Hypobapta*, and postulated that they may have arisen from ancestral connections with *Pingasa*, a primarily oriental genus of Pseudoterpnini that extends into the Australasian Region.

Some characters of the Pseudoterpnini are present also, but generally exaggerated, in the Dysphaniini [treated as a sister tribe to the rest of the Geometrinae by Holloway (1996)]. These characters are: large and robust build, bold wing pattern, hind wing sometimes with costa short and anal margin elongate, and discal spots sometimes large. An additional character shared with Dysphaniini, not by typical Pseudoterpnini but by *Aeolochroma* and associated genera, is that the socii are vestigial. Pseudoterpnini do not have a fovea, although a fovea is present in Dysphaniini. Young (2006) considers that Dysphaniini share some features with robust oenochromines.

Although it might seem easier to define the Pseudoterpnini if the tribe were limited to the most typical genera, i.e. those that share the suite of characters numbered above, we consider that the tribe is most likely to be monophyletic by inclusion of all the genera treated in our study. Even the core of more typical genera exhibits a wide range of variation, particularly in genitalic characters, as is discussed above (e.g. in degree of modification of the uncus and socii). However, the tribe is more consistent in characters of robust build and wing pattern, which are shared by the vast majority of the Pseudoterpnini, including the *Aeolochroma* complex. The type genus itself, *Pseudoterpna*, and several apparently related genera, are anomalous in comparison with the rest of the tribe, but we consider that their shared characters discussed above (genitalic characters, absence of bright green colouring, wing shape) indicates the likely monophyly of these genera and the rest of the tribe.

Biological notes

The resting posture of moths is that typical of the majority of Geometridae: open planiform, i.e. with all wings outspread and held flat (McFarland, 1988: 224, 240). McFarland termed an extreme version of this, with the fore wings held strongly forwards and the hind wings extended strongly backwards, split planiform (the *Pingasa* posture). Some examples of this are seen in *Pingasa*, notably *P. cinerea* but also other species (<http://www.usyd.edu.au/macleay/larvae/geom/ciner.html>; <http://www-personal.une.edu.au/~dbritton/geometridae.htm>; Herbison-Evans & Crossley, website, updated, 2005: <http://www.usyd.edu.au/macleay/larvae/geom/geometridae.html>; http://freebsd.tspes.tpc.edu.tw/~afu/geometridae_040.htm; <http://orientalmoth100.netfirms.com/092-341.jpg>; <http://www.bjbug.com/special/friends/cheni/htmE/mo0007.htm>; <http://www21.ocn.ne.jp/~k-yanagi/>

2-Geo-Geometrinae.htm), and *Hypodoxa* (http://www.geocities.com/brisbane_moths/LopperMoth.htm).

Early stages of Australian representatives of moths of Pseudoterpnini are well documented in McFarland (1988) and Herbison-Evans & Crossley (website, updated 2005). Information on other members of Pseudoterpnini is patchy, but Hausmann (2001) and Patocka (1994; pupa) cover aspects of European ones. The mature larva, where known, generally has a dorsal notch on the head as in most Geometrinae, although this is very shallow in *Aplasta* (Hausmann, 2001: 114), and in some the head is so sharply pointed that a notch or groove is only apparent on close inspection, as in *Crypsiphona* (McFarland, 1988: figs 807–815). The larva is green (except in *Holoterpna*, and with brown markings in *Rhuma*), often sturdy, either plumply rounded, e.g. *Dindica* (Sugi, 1987: pl. 14, fig. 3) or somewhat flattened dorsoventrally, e.g. *Crypsiphona* and *Cyneoterpna* (McFarland, 1988); without dorsal projections as are common in various other Geometrinae. The typical resting posture is rigid and stick-like, angled away from the twig or leaf, and with the true legs often held tightly against the head, e.g. *Crypsiphona* (McFarland, 1988: figs 814, 815) and *Pachista* (Sugi, 1987: pl. 14, fig. 1).

Distribution and host plants

Moths of the tribe Pseudoterpnini are widely distributed in the Old World, from western Europe to the western Pacific, in four biogeographical regions: Oriental, Australasian, Palaearctic, and Afrotropical. The most widespread genus, *Pingasa* (and also the largest with 45 species), is distributed across all four regions, and *Epipristis* is in three regions: (Oriental, Palaearctic and Australasian), but the tribe in general is strongly represented in Asia, notably in China (15 genera), and in India and Indonesia (13 genera in each). Some genera (*Absala*, *Calleremites*, *Dindicodes*, *Limbatochlamys*, *Metaterpna* and *Psilotagma*) have a primarily mainland Asian distribution, others (*Actenochroma*, *Dindica*, *Herochroma*, *Lophophelma*, *Metallolophia* and *Pachyodes*) extend more or less throughout the oriental tropics, and a few (*Orthorisma*, *Pullichroma* and *Sundadoxia*) occur only in Sundaland. There are also strong Australian components, with a number of endemic genera richer in, or restricted to, the temperate part of Australia: *Crypsiphona*, *Cyneoterpna*, *Hypobapta* and *Paraterpna*, in the main group of pseudoterpnine genera, and *Austroterpna*, *Heliomystis*, *Lophothorax*, *Protophyta* and *Rhuma*, in the *Aeolochroma* complex. These are all small genera with between one and four species, but *Aeolochroma* itself (with 26 species) and *Hypodoxa* (a genus of 18 species in the main group of Pseudoterpninae) are more widespread and are richer in tropical

Australasia (from northern Australia to the Pacific, with a centre of richness in Papua New Guinea).

Several of the above genera extend to the Palaearctic Region, if only just, but a few genera are exclusively Palaearctic (*Aplasta*, *Pachista* and *Pseudoterpna*), or Palaearctic and Afrotropical (*Holoterpna*). The remaining genera are two that are exclusively Afrotropical (*Mictoschema* and *Mimandria*).

Most Pseudoterpnini have host plants (as far as known) of trees and woody shrubs, and to a lesser extent herbs. A wide range of hosts is known across the tribe, and the most widespread and speciose genus, *Pingasa*, is recorded from 20 plant families. However, some correlation of distribution patterns and host plants is apparent within the tribe, in that the Australian genera mainly use Myrtaceae (nine of the ten genera have at least one host record, seven of these genera are solely on Myrtaceae, and one other, *Aeolochroma*, is on Myrtaceae and Euphorbiaceae). Two of the three exclusively Palaearctic genera (*Aplasta* and *Pseudoterpna*) feed only on Leguminosae, although the third exclusively Palaearctic genus (*Pachista*) feeds on Magnoliaceae and Hippocastanaceae.

REVIEW OF GENERA

Genera and species are listed in alphabetical order in this study, except that in a few cases they are assigned to species groups, and the *Aeolochroma* complex of genera is treated separately (see genus *Aeolochroma* onwards). New and very recent taxonomic changes are indicated here, but otherwise synonyms of genera and species, and placements of species in genera, are as cited in the catalogue of *Geometrid Moths of the World* (Scoble, 1999). The status of currently valid subspecies has not been assessed here and is left unchanged, but it is likely that many subspecies will prove to be synonymous with the nominate subspecies. Unavailable names are not generally cited here. In addition to nomenclatural references to genera and their type species, citations of significant subsequent studies of the genera are given where appropriate. The distribution records given for each genus are based primarily on specimens we examined in the course of this work, or on type localities, with the addition of a small number of literature records. In addition to *The Times Comprehensive Atlas of the World* (Tenth edition, 1999, reprinted 2001), we were able to trace some obscure place names on various websites of the internet using the search engine Google™. We have assigned the distribution data to biogeographical regions based on the folding map in Wallace (1876), as used also in <http://www.nhm.ac.uk/research-curation/projects/bombus/regions.html>, except that we have used Weber's Line as the boundary between Oriental

and Australasian regions, as per Holloway & Jardine (1968). We have listed country names alphabetically within the regions.

ABSALA SWINHOE, 1893
(FIGS 1, 43, 51, 90, 127)

Absala Swinhoe, 1893: 149. Type species: *Absala dorcada* Swinhoe, 1893, by monotypy. Han, Li & Xue (2006). [Historical treatment of *Absala* as a subgenus of *Terpna*, by Prout (1912a, 1927) indicates its inclusion, here confirmed, in Pseudoterpnini (of which Terpnini is a synonym).]

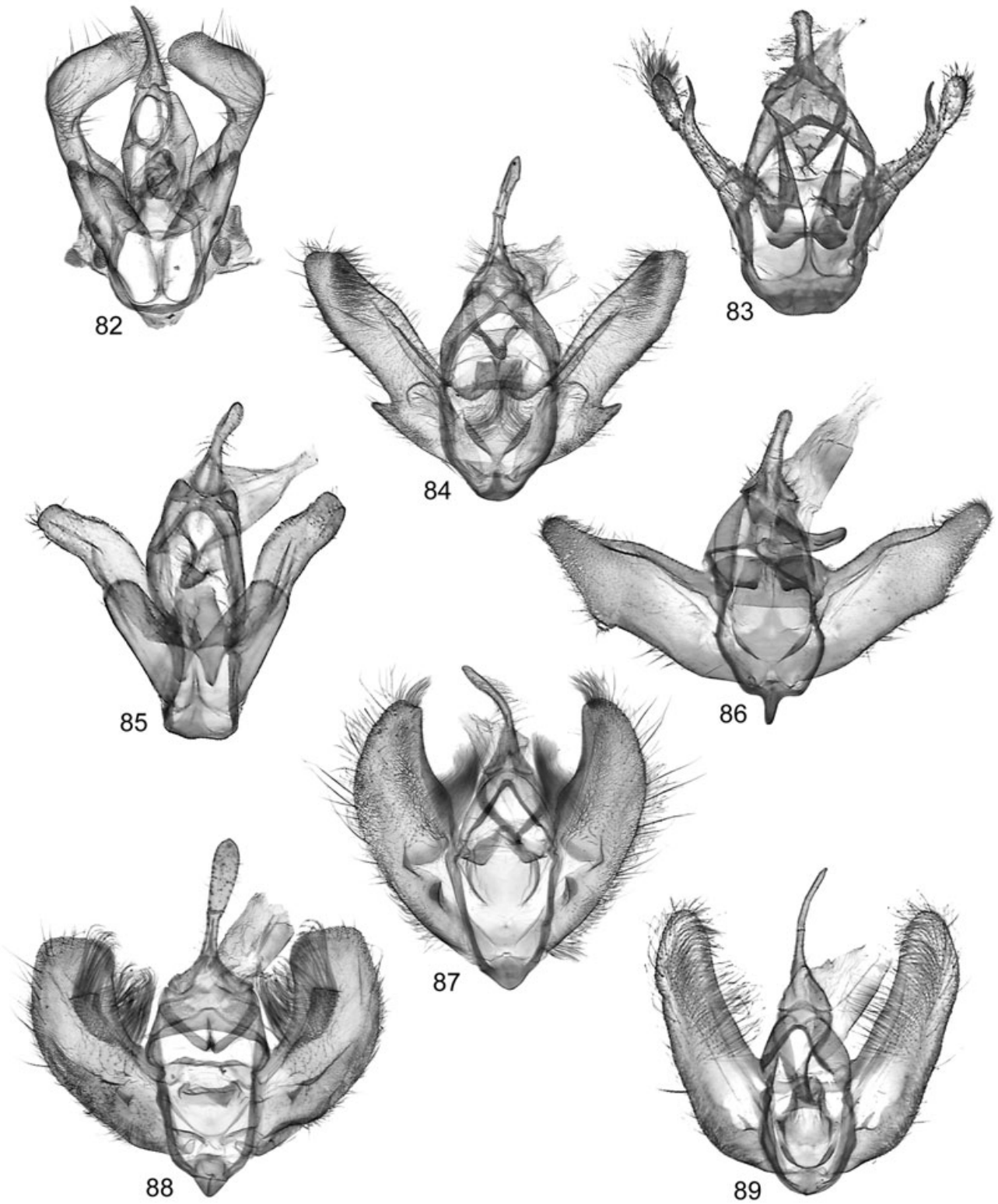
Adults (Figs 1, 43): Antenna bipectinate with short rami in male, simple filiform in female. Frons protruding strongly, rough-scaled. Labial palpus with third segment not elongate in female.

Wing pattern: whitish, diffused with olive-green striations. Fore wing with lines indistinct, with olive-green patch at wing base, apex, and mid dorsum; submarginal line white, distinctly wavy near costa and with red brown patch on inner side of line; discal spot small and olive-green. Hind wing with postmedial and submarginal lines white, bordered with olive; with red-brown patch between them at anal margin; discal spot black. Underside: wings white, bright yellow near base of wing; postmedial line marked merely by two large dark brown round spots, similar to discal spot; fore wing with dark brown patch at apex. Outer margin of wings slightly wavy; hind wing with costa of moderate length and anal margin slightly elongate.

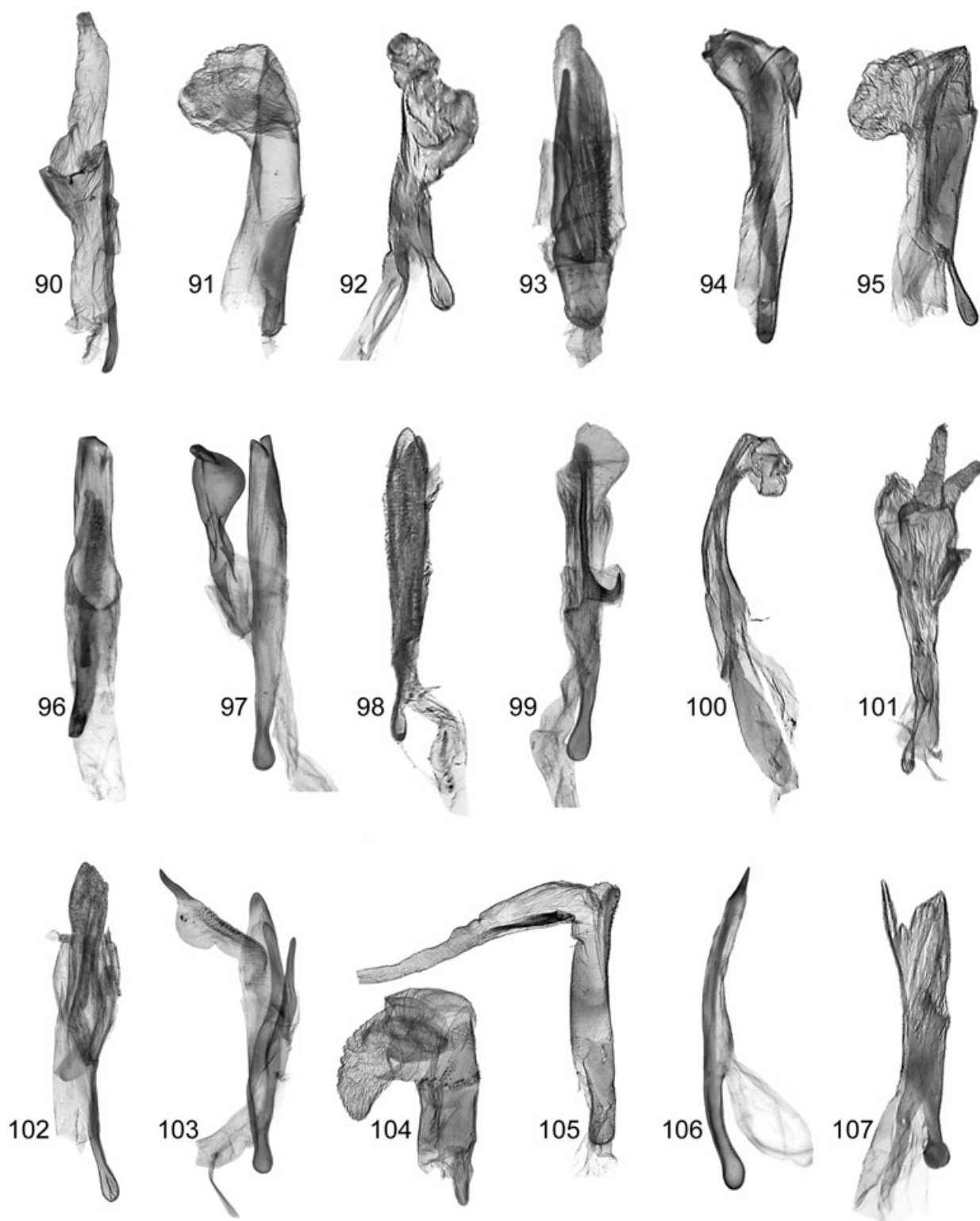
Hind tibia of male without hair-pencil. Thorax and abdomen with dorsal crests sometimes well developed. Sternite 3 of abdomen without setal patches; sternite 8 of male lightly sclerotized, with posterior margin projecting as a low flat broad rim.

Male genitalia (Figs 51, 90): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal one-third fused, prongs well separated and curved as S-shapes, pointing outwards at apex. Gnathos with very broad expanded median region, slightly bilobed and dentate at margin. Valva divided into two diverging parts, a large lightly sclerotized costal lobe, and smaller triangular sacculus (less than half length of costal lobe). Coremata absent. Transtilla with pair of arms not joined. Saccus distinctly developed, oval. Aedeagus slender, with a blunt sclerotized process towards posterior end; vesica without cornuti.

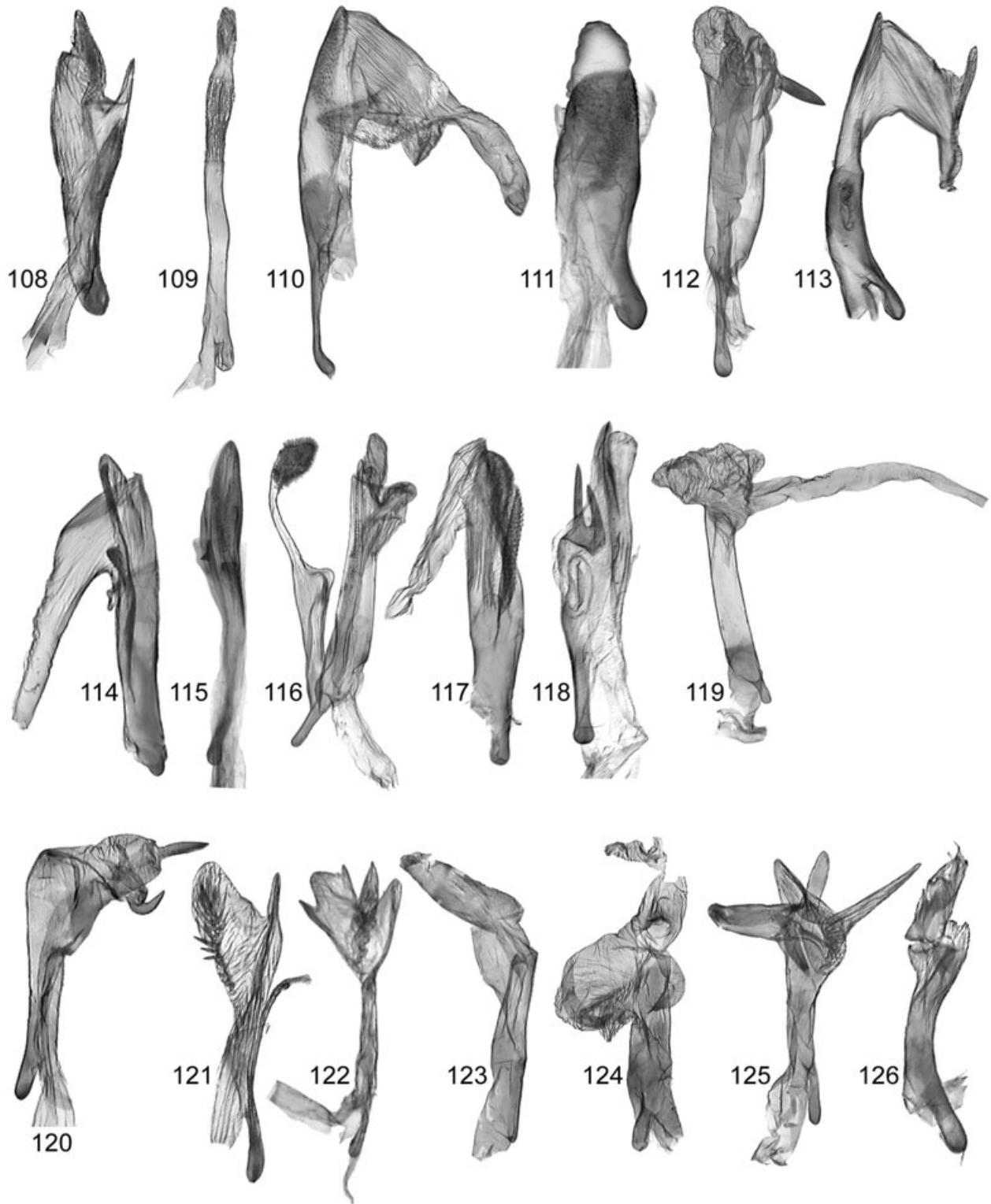
Female genitalia (Fig. 127): Apophyses anteriores shorter than apophyses posteriores. Very broad, wrinkled and sclerotized, region present around ostium, with pair of lateral lobes; lamella postvaginalis weakly defined and lightly wrinkled. Ductus bursae moderate in length, wrinkled, without antrum.



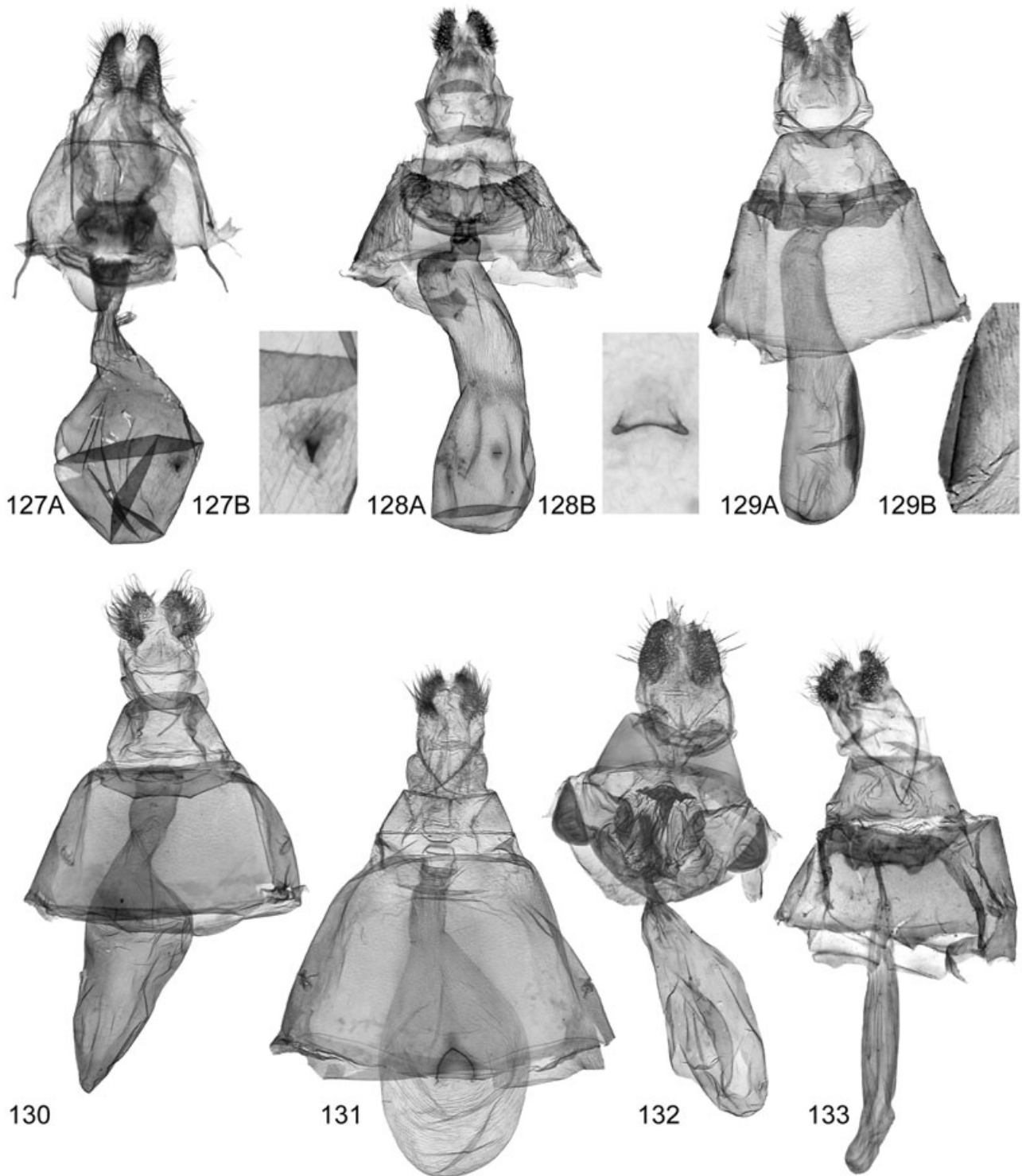
Figures 82–89. Male genitalia. 82, *Aeolochroma hypochromaria*; 83, *Austroterpna idiographa*; 84, *Heliomystis electrica*; 85, *Lophothorax eremnopsis*; 86, *Protophyta castanea*; 87, *Rhuma subaurata*; 88, *Rhuma argyraspis*; 89, *Rhuma thiobapta*.



Figures 90–107. Male genitalia (aedeagus). 90, *Absala dorcada*; 91, *Actenochroma muscicoloraria*; 92, *Aplasta ononaria*; 93, *Calleremites subornata*; 94, *Crypsiphona melanosema*; 95, *Cyneoterpna wilsoni*; 96, *Dindica polyphaenaria*; 97, *Dindicodes crocina*; 98, *Epipristis oxycyma*; 99, *Herochroma ochreipicta*; 100, *Holoterpna diagrapharia*; 101, *Hypobapta percomptaria*; 102, *Hypodoxa emiliaria*; 103, *Limbatochlamys rosthorni*; 104, *Lophophelma ruficosta*; 105, *Metallophilia arenaria*; 106, *Metaterpna thyatiraria*; 107, *Mictoschema swierstrai*.



Figures 108–126. Male genitalia (aedeagus). 108, *Mimandria cataractae*; 109, *Orthorisma netunaria*; 110, *Pachista superans*; 111, *Pachyodes amplificata*; 112, *Paraterpna harrisoni*; 113, *Pingasa javensis*; 114, *Pseudoterpna pruinata*; 115, *Psilotagma decorata*; 116, *Pulichroma pullicosta*; 117, *Sundadoxa multidentata*; 118, *Aeolochroma acanthina*; 119, *Aeolochroma turneri*; 120, *Austroterpna paratorna*; 121, *Heliomystis electrica*; 122, *Lophothorax eremnopsis*; 123, *Protophyta castanea*; 124, *Rhuma subaurata*; 125, *Rhuma argyraspis*; 126, *Rhuma thiobapta*.



Figures 127–133. Female genitalia. 127A, *Absala dorcada*; 127B, signum of *Absala dorcada*; 128A, *Actenochroma muscicoloraria*; 128B, signum of *Actenochroma muscicoloraria*; 129A, *Aplasta ononaria*; 129B, signum of *Aplasta ononaria*; 130, *Crypsiphona ocularia*; 131, *Cyneoterpna wilsoni*; 132, *Dindica olivacea*; 133, *Dindicodes leopardinata*.

Corpus bursae rounded, membranous; signum a small, rounded, lightly sclerotized patch with a tooth-like process.

Diagnosis: *Absala* is characterized by its wing pattern, particularly the underside, which is pure white with several very distinct large dark spots (three on the hind wing). *Dindicodes* sometimes also has three spots on the underside of the hind wing but the ground colour is yellow. The male genitalia of *Absala* are distinctive in having the prongs of the socii/uncus complex curved as S-shapes, in addition to being well separated. *Absala* is one of relatively few genera in the Pseudoterpnini that have sternite 8 of the male abdomen modified, its posterior margin projects uniquely as a low broad rim; *Absala* is also one of a minority of pseudoterpnine genera that have a signum in the female.

Distribution: *Oriental Region:* China; India; Thailand; Vietnam.

Species included

dorcada Swinhoe, 1893 (*Absala*) [male and female genitalia]

ACTENOCHROMA WARREN, 1893

(FIGS 2, 52, 91, 128)

Actenochroma Warren, 1893: 350. Type species: *Hypo-chroma muscicoloraria* Walker, [1863] 1862. [Placed in Pseudoterpnini (as Pseudoterpninae) by Warren, 1893.]

Adults (Fig. 2): Antenna simple filiform in both sexes. Frons protruding moderately. Labial palpus stout, moderate in length but with third segment fairly short.

Wing pattern: fairly uniformly palish green; with wavy antemedial and dentate postmedial lines darker green, each forming a dark green spot on costa of fore wing, postmedial line with whitish shading on outer side, postmedial line angled on fore wing; submarginal line faint whitish green; discal spot small and dark green. Underside: fore and hind wings with basal zone (to postmedial line) white or cream; outer zone with broad dark brown band; discal spot black-brown, fairly small and more of a dot than a dash. Outer margin of wings wavy; hind wing with costa short and anal margin elongate.

Hind tibia of male with hair-pencil. Thorax and abdomen without dorsal crests. Sternite 3 of male abdomen with a small weak median setal patch (pair of patches apparently merged).

Male genitalia (Figs 52, 91): Uncus well developed but very slender, long and rod-like. Socii sclerotized,

well separated and strongly diverging, tapered to narrow apex, base broadened on inner side into a short lobe with strong ventral ridge at margin. Gnathos with median process small, V-shaped and curved. Valva long and narrow, with pointed apex, mainly lightly sclerotized; not divided into separate costal lobe and sacculus, but with spinulose harpe strongly developed as a long narrow finger-like process, reaching apex of valva. Coremata long but weak. Transtilla weakly developed. Vinculum projecting anteriorly beyond valva but not forming a distinct saccus. Aedeagus short and moderately broad, smooth; vesica without cornuti.

Female genitalia (Fig. 128): Apophyses anteriores shorter than apophyses posteriores, but longer than in most other genera of Pseudoterpnini. Very broad, wrinkled and slightly sclerotized, region present around ostium; lamella postvaginalis weakly defined and lightly wrinkled. Ductus bursae short, with lightly sclerotized antrum, short collar-like with small ventral section unsclerotized. Corpus bursae long and lightly wrinkled; signum very small, with a tiny blunt tooth at each end.

Diagnosis: The fairly uniformly palish green wing colour of *Actenochroma* is distinctive, more of a true green than normally seen in the Pseudoterpnini. The genus is also characterized by its male genitalia, with the long narrow valva bearing a long spinulose harpe. *Actenochroma* is one of only a few pseudoterpnine genera to have enlarged sclerotized socii together with a long rod-like uncus (other genera are *Limbatochlamys* and *Psilotagma*, although the socii of the latter genus are less strongly developed). *Actenochroma* is one of only three pseudoterpnine genera that have a bicornute signum in the female, the others being *Limbatochlamys* and (some species) *Herochroma*.

Distribution: *Oriental Region:* Brunei; China; India; Indonesia (Kalimantan, Sumatra); Malaysia (West); Nepal.

Species included

muscicoloraria (Walker, [1863] 1862) (*Hypo-chroma*) [male and female genitalia]

sphagnata (Felder & Rogenhofer, 1875) (*Hypo-chroma*)

APLASTA HÜBNER [1823]

(FIGS 3, 53, 92, 129)

Aplasta Hübner, [1823] 1816: 304. Type species: *Phalaena ononaria* Fuessly, 1783. [Cited by Viidalepp (1981) in Terpnini sensu Inoue, 1961 (now a synonym of Pseudoterpnini); cited in Pseudoterpnini by Hausmann, 1996a, 2001.]

Adults (Fig. 3): Moths small (compare scale of Fig. 3 with Figs 1–2, 4–41). Antenna simple filiform or shortly ciliate to weakly serrate in both sexes. Frons usually not protruding significantly but sometimes protruding slightly, fairly smooth scaled, mid brown to dark olive brown, often contrasting distinctly (but occasionally only weakly) with white to straw coloured band above frons. Proboscis strongly reduced. Labial palpus with third segment very short in male, moderately short in female.

Wing pattern: straw coloured, pale, mid or dark brown, sometimes with grey tinge but usually orange-tinged or reddish, [occasionally greenish grey (Hausmann, 2001: 115)] finely mottled with short striations; without antemedial line, other lines represented by bands or fasciae, stronger brown but often diffuse: medial fascia (sometimes present on fore wing but indistinct or absent on hind wing), postmedial, and marginal band; discal spots indistinct or absent. Underside similar to upper side although fasciae sometimes slightly stronger. Outer margin of fore wing smooth, hind wing almost smooth or very slightly wavy; hind wing with costa of moderate length, anal margin not particularly elongate. Frenulum and retinaculum absent. Hind wing with veins Rs and M₁ on a stalk, A₃ absent.

Hind tibia of male without hair-pencil. Thorax and abdomen without dorsal crests; sternite 3 of abdomen without setal patches.

Male genitalia (Figs 53, 92). Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal two-thirds fused, prongs very close together, but occasionally diverging apically, tapered and usually curved dorsoventrally. Gnathos with median region broad and expanded, minutely spinulose. Valva not divided; valvae asymmetrical, left valva (in ventral view) simple and moderately slender, right valva with harpe present as a large spinose lobe. Coremata small. Transtilla weakly sclerotized, arched posteriorly. Sacculus strongly developed, U-shaped or rounded. Aedeagus with a well-sclerotized posterior extension; vesica with densely wrinkled region appearing somewhat sclerotized, but without distinct cornuti.

Female genitalia (Fig. 129): Apophyses anteriores very short, much shorter than apophyses posteriores. Broad wrinkled region present laterally and anteriorly to ostium, ostial opening with slight anterior lip, with tiny median notch; lamella postvaginalis not distinct. Ductus bursae not distinct from corpus bursae, other than antrum, which is extremely short, smoothly sclerotized and broadening towards ostium. Corpus bursae elongate and mainly membranous; signum large, elongate and longitudinally folded.

Diagnosis: Moths of *Aplasta* are unusually small for Pseudoterpnini, and plainer than most others of the

tribe, particularly on the underside. The genus has some similarities with other fairly small and atypical pseudoterpnines with plain undersides, and in which the frenulum is also absent and the proboscis reduced or absent (*Holoterpna* and *Mictoschema*), or the frenulum is reduced but the proboscis is normal (*Pseudoterpna*), or the proboscis is reduced but the frenulum is not (*Mimandria*). Only *Aplasta* and *Mimandria* have wings that are sometimes orange–red tinged (commonly in *Aplasta*), and the wings of *Aplasta* are plain above, not patterned as in *Mimandria*. The male genitalia of *Aplasta* are characteristic in having a spinose harpe on the right valva but not on the left valva, whereas *Pseudoterpna* has a similar harpe on both valvae. In the female the elongate folded signum is characteristic.

Biological notes: Host plants: Leguminosae (Fabaceae): *Ononis arvensis* L., *O. repens* L. and *O. spinosa* L. (for this and other information on biology, including further reputed hostplants, see Hausmann, 2001: 114–117). The bright green larva is short, stout and setose (Hausmann, 2001: text-fig.160; Porter, 1997: 26, pl. 9: B). Hausmann describes the larva as being atypical of Geometrinae in having only a shallow dorsal notch on the head, and lacking projections on segment T1.

Distribution: *Palearctic Region*: Armenia and Caucasus (Hausmann, 2001); Austria; Croatia; Cyprus; France (including Corsica); Germany; Great Britain (southern England); Greece (Hausmann, 1996a); Hungary? (Bihar, ‘Nagy Kagya’); Iran and Iraq (Hausmann, 2001); Israel (Hausmann, 1996a); Italy [including Sardinia, Sicily (Hausmann, 2001)]; Jordan (Hausmann, 1996b); Lebanon; Netherlands and Poland (Hausmann, 2001); Portugal; Romania; Spain (including Balearic Islands); Switzerland; Syria; Turkey; Yugoslavia.

Species included

ononaria (Fuessly, 1783) (*Phalaena Geomet[ra]*) [male and female genitalia]

tubellata (Villers, 1789) (*Phalaena Geomet[ra]*)

sudataria (Hübner, [1817]) (*Geometra*)

faecaturia (Hübner, [1819]) (*Geometra*) [synonymy cited by Hausmann, 2001]

ononata Bellier, 1861 (*Aplasta*) [unjustified emendation, cited by Hausmann, 2001]

ononaria spinosaria Dannehl, 1926 (*Aplasta*) [synonymy cited by Hausmann, 2001]

CALLEREMITES WARREN, 1894A

(FIGS 4, 44, 54, 93)

Calleremites Warren, 1894a: 384. Type species: *Calleremites subornata* Warren, 1894a, by original des-

Adults (Fig. 3): Moths small (compare scale of Fig. 3 with Figs 1–2, 4–41). Antenna simple filiform or shortly ciliate to weakly serrate in both sexes. Frons usually not protruding significantly but sometimes protruding slightly, fairly smooth scaled, mid brown to dark olive brown, often contrasting distinctly (but occasionally only weakly) with white to straw coloured band above frons. Proboscis strongly reduced. Labial palpus with third segment very short in male, moderately short in female.

Wing pattern: straw coloured, pale, mid or dark brown, sometimes with grey tinge but usually orange-tinged or reddish, [occasionally greenish grey (Hausmann, 2001: 115)] finely mottled with short striations; without antemedial line, other lines represented by bands or fasciae, stronger brown but often diffuse: medial fascia (sometimes present on fore wing but indistinct or absent on hind wing), postmedial, and marginal band; discal spots indistinct or absent. Underside similar to upper side although fasciae sometimes slightly stronger. Outer margin of fore wing smooth, hind wing almost smooth or very slightly wavy; hind wing with costa of moderate length, anal margin not particularly elongate. Frenulum and retinaculum absent. Hind wing with veins Rs and M₁ on a stalk, A₃ absent.

Hind tibia of male without hair-pencil. Thorax and abdomen without dorsal crests; sternite 3 of abdomen without setal patches.

Male genitalia (Figs 53, 92). Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal two-thirds fused, prongs very close together, but occasionally diverging apically, tapered and usually curved dorsoventrally. Gnathos with median region broad and expanded, minutely spinulose. Valva not divided; valvae asymmetrical, left valva (in ventral view) simple and moderately slender, right valva with harpe present as a large spinose lobe. Coremata small. Transtilla weakly sclerotized, arched posteriorly. Sacculus strongly developed, U-shaped or rounded. Aedeagus with a well-sclerotized posterior extension; vesica with densely wrinkled region appearing somewhat sclerotized, but without distinct cornuti.

Female genitalia (Fig. 129): Apophyses anteriores very short, much shorter than apophyses posteriores. Broad wrinkled region present laterally and anteriorly to ostium, ostial opening with slight anterior lip, with tiny median notch; lamella postvaginalis not distinct. Ductus bursae not distinct from corpus bursae, other than antrum, which is extremely short, smoothly sclerotized and broadening towards ostium. Corpus bursae elongate and mainly membranous; signum large, elongate and longitudinally folded.

Diagnosis: Moths of *Aplasta* are unusually small for Pseudoterpnini, and plainer than most others of the

tribe, particularly on the underside. The genus has some similarities with other fairly small and atypical pseudoterpnines with plain undersides, and in which the frenulum is also absent and the proboscis reduced or absent (*Holoterpna* and *Mictoschema*), or the frenulum is reduced but the proboscis is normal (*Pseudoterpna*), or the proboscis is reduced but the frenulum is not (*Mimandria*). Only *Aplasta* and *Mimandria* have wings that are sometimes orange–red tinged (commonly in *Aplasta*), and the wings of *Aplasta* are plain above, not patterned as in *Mimandria*. The male genitalia of *Aplasta* are characteristic in having a spinose harpe on the right valva but not on the left valva, whereas *Pseudoterpna* has a similar harpe on both valvae. In the female the elongate folded signum is characteristic.

Biological notes: Host plants: Leguminosae (Fabaceae): *Ononis arvensis* L., *O. repens* L. and *O. spinosa* L. (for this and other information on biology, including further reputed hostplants, see Hausmann, 2001: 114–117). The bright green larva is short, stout and setose (Hausmann, 2001: text-fig.160; Porter, 1997: 26, pl. 9: B). Hausmann describes the larva as being atypical of Geometrinae in having only a shallow dorsal notch on the head, and lacking projections on segment T1.

Distribution: *Palaeartic Region*: Armenia and Caucasus (Hausmann, 2001); Austria; Croatia; Cyprus; France (including Corsica); Germany; Great Britain (southern England); Greece (Hausmann, 1996a); Hungary? (Bihar, ‘Nagy Kagya’); Iran and Iraq (Hausmann, 2001); Israel (Hausmann, 1996a); Italy [including Sardinia, Sicily (Hausmann, 2001)]; Jordan (Hausmann, 1996b); Lebanon; Netherlands and Poland (Hausmann, 2001); Portugal; Romania; Spain (including Balearic Islands); Switzerland; Syria; Turkey; Yugoslavia.

Species included

ononaria (Fuessly, 1783) (*Phalaena Geomet[ra]*) [male and female genitalia]

rubellata (Villers, 1789) (*Phalaena Geomet[ra]*)

sudataria (Hübner, [1817]) (*Geometra*)

faecaturia (Hübner, [1819]) (*Geometra*) [synonymy cited by Hausmann, 2001]

ononata Bellier, 1861 (*Aplasta*) [unjustified emendation, cited by Hausmann, 2001]

ononaria spinosaria Dannehl, 1926 (*Aplasta*) [synonymy cited by Hausmann, 2001]

CALLEREMITES WARREN, 1894A

(FIGS 4, 44, 54, 93)

Calleremites Warren, 1894a: 384. Type species: *Calleremites subornata* Warren, 1894a, by original des-

ignation. Han, Li & Xue (2006). [Historical treatment of *Calleremites* as a subgenus of *Terpna*, by Prout (1912a, 1927) indicates its inclusion, here confirmed, in Pseudoterpnini (of which *Terpnini* is a synonym).]

Adults (Figs 4, 44): Only male known: antenna simple filiform. Frons protruding moderately. Labial palpus moderately long.

Wing pattern: Wing grey and olive-green, with fine striations particularly on hind wing. Brown antemedial line smooth, oblique and curved slightly outwards; brown postmedial line on fore wing, and similar line in middle of hind wing, smooth and curved inwards, demarcating dark olive area extending to antemedial line on fore wing and to base of hind wing. Underside: fore and hind wings with basal zone to postmedial line whitish, and yellow at base of wing; outer zone with a very broad grey-brown band. Discal spot large and dark brown with fine whitish central streak on underside of wings, but indistinct on upper side. Outer margin of wings almost smooth; hind wing with costa of moderate length and anal margin elongate. Veins R_s and M_1 of hind wing on short stalk.

Hind leg characters not known (legs missing or damaged in material examined). Abdomen without dorsal crests, and sternite 3 without setal patches; sternite 8 of male sclerotized medially, with a pair of widely spaced finger-like posterior processes. Cavus tympani with rake-like comb of fine spine-like projections at base of ansa.

Male genitalia (Figs 54, 93): Uncus strongly developed, a long rod, slightly curved and spatulate. Socii weakly sclerotized, short (less than half length of uncus), and oval. Gnathos with median process slender, finger-like. Valva not distinctly divided, but with slight development of costal lobe and sacculus; costal lobe protruding and with rounded apex, costa straight; sacculus forming a rounded lobe, much shorter than costal lobe; with strongly wrinkled dentate ridge distally, between costal lobe and sacculus. Coremata absent. Transtilla weakly sclerotized. Saccus protruding distinctly and rounded. Aedeagus short and broad, with one very long rod-like sclerotized posterior process flanked by a pair of shorter processes; vesica somewhat sclerotized, wrinkled and densely spinulose.

Female genitalia. Unknown.

Diagnosis: *Calleremites* can be recognized easily by its wing pattern, which has a dark olive area demarcated by curved antemedial and postmedial lines. The male genitalia are characterized by the rugose distal ridge between the costal lobe and sacculus, and the male abdomen by the modification of sternite 8.

Distribution: *Oriental Region*: China; India (Sikkim).

Species included

subornata Warren, 1894a (*Calleremites*) [male genitalia]

CRYPHSIPHONA MEYRICK, 1888

(FIGS 5, 6, 45, 55, 94, 130)

Crypsiphona Meyrick, 1888: 836 (key), 901. Type species: *Crypsiphona melanoosema* Meyrick 1888. [Treated in Section A of Geometrinae by McFarland (1988); here assigned to Pseudoterpnini.]

Adults (Figs 5, 6, 45): Antenna bipectinate in basal three-quarters or more in male, simple filiform in female. Frons not protruding significantly; with large well-defined black/brown area, or dark brown transverse line, or without distinct dark marking. Labial palpus with third segment tiny in both sexes, or sometimes moderate in length in female.

Wing pattern: whitish-grey or straw-coloured, with brown or grey speckles and other markings; antemedial line wavy, postmedial line dentate and angled, or lines broken and indistinct, or absent; discal spot forming a narrow dash or short line, sometimes indistinct (particularly on hind wing); whitish submarginal line broken and sometimes indistinct. Hind wing with pale basal zone and darker outer zone, but only weakly differentiated. Underside: fore and hind wings with large pale basal zone mainly white, white and straw-coloured, or cream, contrasting moderately to strongly with dark brown markings in outer zone (a band or large blotch on hind wing, smaller or occasionally absent on fore wing); dark discal spot on the fore wing varying from a small weak dot or dash to a well-defined larger blotch (the latter in proximity with two other dark spots); discal spot a weaker dot or dash on hind wing. Outer margin of wings slightly wavy; fore wing fairly elongate, hind wing with costa sometimes short, anal margin slightly, to fairly strongly, elongate.

Hind tibia without hair pencil; with only one pair of spurs. Thorax and tegulae with dense covering of long hair-like scales dorsally in *ocultaria*, but not in other species. Thorax and abdomen without dorsal crests; abdomen (of *ocultaria* only) with double row of dark markings. Sternite 3 of abdomen without setal patches; segment 8 of male sclerotized and modified posteriorly, sternite projecting as a pair of lobes, tergite with a regular and dense marginal fringe of narrow scales including two groups each of two or three longer scales.

Male genitalia (Figs 55, 94): Socii large and sclerotized, apparently replacing uncus entirely, not fused but pressed together from sub-basally to about midlength, apical halves diverging and curved outwards, and with bifid tip. Gnathos entirely fused with membrane of diaphragma; median region of gnathos

slightly expanded but without spinules, and fused with, or at least adjoining, posterior end of transtilla. Valva moderately narrow, with costa on each distinctly or slightly asymmetrical and forming irregular ridges and processes; distal half of valva (or slightly less) divided into two main lobes; posterior lobe (not a continuation of the costa) lightly sclerotized, with apex bluntly rounded and sometimes strongly spatulate, or tapered; anterior lobe more or less finger-like. Coremata absent. Transtilla arched posteriorly as a pair of large, lightly sclerotized, lobes. Juxta forming a large pouch with a V-shaped postero-ventral margin. Saccus small or large. Aedeagus with a spine-like process at its posterior end, pointing at least slightly anteriorly.

Female genitalia (Fig. 130): Ovipositor valves strongly papillate and setose. Apophyses anteriores very short, much shorter than apophyses posteriores. Lightly sclerotized region present around ostium, moderately to very broad, mainly smooth. Ductus bursae moderately long; without distinct antrum. Corpus bursae fairly small or moderately elongate, membranous; signum absent.

Diagnosis: Species of *Crypsiphona* are rather disparate in appearance, apart from sharing the character of reduction in hind tibial spurs, which does not occur widely in Geometrinae and is seen in Pseudoterpnini only in *Crypsiphona*, *Holoterpna*, *Hypobapta* and *Mictoschema*. One of the strongest definitive characters of *Crypsiphona* is the modified abdominal male segment 8, with unique configuration of the tergite's marginal fringe. In the male genitalia, the socii are unusual, and appear to have replaced the uncus entirely; the socii are pressed together sub-basally but not fused, and then flare outwards in the apical half, similar to those of *Paraterpna*, but the apices are bifid in *Crypsiphona* and not in *Paraterpna*. Another unusual character these two genera share is the gnathos fused with the membrane of the diaphragma; *Mimandria* and the *flavibasalis*-group of *Herochroma* also have the gnathos arms fused with the membrane of the diaphragma, but not the median projection of the gnathos.

Biological notes: Host plants: Myrtaceae: *Eucalyptus* spp., with particular reference to *E. odorata* Behr and *E. diversifolia* Bonpl. (McFarland, 1988: 257, for *C. oculataria*). McFarland (1988: 257–261) described and figured the early stages of *C. oculataria*: egg (fig. 806); larva (figs 807–815) pale maturing to dark green with tiny purplish speckles, and with a whitish-cream to reddish spiracular line, body somewhat flattened dorsoventrally and with a pointed head, resting posture of mature larva rigid and stick-like; pupa (figs 816–821). For further accounts, and photographs of larvae, see Herbison-Evans & Crossley (website, updated 2005), and Common (1990: pl. 26, fig. 14).

Distribution: Australasian Region: Australia (New South Wales, South Australia (McFarland, 1988), Tasmania, Western Australia).

Species included

- amaura* Meyrick 1888 (*Crypsiphona*) [male and female genitalia]
- melanosema* Meyrick 1888 (*Crypsiphona*) [male genitalia]
- ocultaria* (Donovan 1805) (*Phalaena*) [male and female genitalia]

CYNEOTERPNA PROUT, 1912A
(FIGS 7, 46, 56, 95, 131)

Cyneoterpna Prout, 1912a: 10 (key), 43. Type species: *Hypochroma wilsoni* Felder & Rogenhofer, 1875. [Replacement name for *Autanepsia* Turner.] [Treated in Section A of Geometrinae by McFarland (1988); here assigned to Pseudoterpnini.]

Autanepsia Turner, 1910: 563 (key), 629. Type species: *Hypochroma wilsoni* Felder & Rogenhofer, 1875. [Junior homonym of *Autanepsia* Turner, 1908 (Geometridae: Sterrhinae).]

Adults (Figs 7, 46): Antenna bipectinate in basal three-quarters or more in male, simple filiform in female. Frons not protruding significantly, but mainly rough-scaled, and with strongly protruding tuft of hair-like scales between the antennae; frons with a median transverse band that is dark brown or black, becoming whitish below, and with white above, towards the antennae. Labial palpus with third segment moderately long in both sexes.

Wing pattern: whitish grey mottled with dark brown, with distinct blackish lines on the veins of the fore wing. Fore wing with antemedial and postmedial lines strongly dentate, fine and sometimes diffuse, discal spot absent or indistinct; postmedial line slightly curved or almost straight; whitish submarginal line on fore and hind wings broken and indistinct; terminal line on fore and hind wings composed of well-defined blackish dots or streaks between the veins. Hind wing with pale basal zone and outer zone darker, but not strongly contrasting and sometimes diffuse; discal spot grey or brown, and comma-like, situated in basal zone just before outer zone. Underside: wings with large whitish or pale greyish brown zone, basal on hind wing, basal or diffuse posterior zone on fore wing, with dark brown band or blotch in outer zone (large on hind wing, smaller or absent on fore wing); dark discal spot comma-like on fore and hind wings. Outer margin of fore wing slightly, and hind wing distinctly, wavy; fore wing fairly elongate (particularly in *alpina*), hind wing with costa not particularly short but anal margin slightly elongate.

Thorax and tegulae (and head) with dense covering of long hair-like scales dorsally. Hind tibia without hair pencil. Abdomen without distinct dorsal crests but with a double row of dark markings; sternite 3 without setal patches; segment 8 of male with a lightly sclerotized lobe at posterior end of sternite and sometimes also tergite.

Male genitalia (Figs 56, 95): Uncus vestigial. Socii strongly developed and sclerotized, long and rod-like except for broad base, strongly separated and diverging, with extreme apex outwardly curved and pointed. Gnathos absent or extremely weak. Valva divided slightly and bisected by a transverse ridge; costal lobe tapered and much longer than sacculus, sacculus tapered or rounded. Coremata absent. Transtilla lightly sclerotized. Juxta forming a large pouch with a V-shaped postero-ventral margin. Saccus distinctly protruding and rounded. Aedeagus short and sometimes moderately broad; vesica without cornuti.

Female genitalia (Fig. 131): Ovipositor valves strongly papillate and setose. Apophyses anteriores very short, much shorter than apophyses posteriores. Lamella postvaginalis weakly defined, sometimes with area of light sclerotization; lamella antevaginalis forming a weak lip or projecting lobe to ostium. Ductus bursae short or moderately short, and not particularly narrow; without sclerotized antrum. Corpus bursae moderate-sized and membranous, pear-shaped or rounded; lightly-sclerotized signum present, either with a serrate ridge at rim except at anterior end, or with one tiny tooth-like process.

Diagnosis: The general greyish colour of the moths, with dark streaks mainly along the veins, is characteristic and only likely to cause confusion with the very similar *Paraterpna*. The male genitalia of *Cyneoterpna* and *Paraterpna* differ distinctly: in the former the gnathos is absent and the valva is composed of two lobes with a ridge between them, whereas the latter has a gnathos and the valva is composed of three lobes. Both genera are in the minority of pseudoterpnine genera that have a signum in the female.

Biological notes: Host plants (for *C. wilsoni*): Myrtaceae: *Eucalyptus dives* Schauer (Common, 1990: 372), and *E. odorata* Behr (McFarland, 1979: 37, 1988: 262 for captive larvae). McFarland (1988: 262–266) described and figured the early stages of *C. wilsoni*: egg (figs 828–831); larva (figs 832–844) somewhat flattened dorsoventrally and generally similar to *Crypsiphona*, but with the head capsule projecting as a flat ridge, sharply cornered and slightly bicornute; pupa (figs 845–847).

Distribution: *Australasian Region:* Australia [New South Wales, South Australia, Tasmania (McQuillan, 2004)].

Species included

alpina Goldfinch, 1929 (*Cyneoterpna*) [male and female genitalia]

wilsoni (Felder & Rogenhofer, 1875) (*Hypochroma*) [male and female genitalia]

DINDICA MOORE, 1888

(FIGS 8, 57, 96, 132)

Dindica Moore, 1888: 248. Type species: *Hypochroma basiflavata* Moore, 1868 (junior synonym of *Dindica polyphaenaria* (Guenée, [1858])). Inoue, 1990. [Placed in Pseudoterpnini (as Pseudoterpninae) by Warren, 1893.]

Perissolophia Warren, 1893: 350. Type species: *Perissolophia subrosea* Warren, 1893. [Synonymized by Prout, 1912a: 42.]

Adults (Fig. 8): Antenna of male bipectinate, sometimes only in basal half but often much more, occasionally all except tip; rami longer than in *Lophophelma*; antenna simple filiform in female. Frons with lower part protruding strongly and angular, scales of frons coarse. Labial palpus entirely rough-scaled, third segment in female slightly elongate.

Wing pattern: fore wing usually grey- or olive-green, diffused with black- or red-brown scales or speckles, and often with dark longitudinal lines on and between the veins; antemedial line dentate, distinct or indistinct; discal spot forming a narrow dash or short line; postmedial line distinct from costa to vein M_3 , then strongly angled, usually becoming broken or indistinct; white, dentate submarginal line often present from costa to M_3 . Hind wing usually with large pale basal zone to postmedial line (bright yellow, cream, whitish, pinkish, or grey), but occasionally basal zone only slightly paler than outer zone; with outer zone a brown or black band, sometimes mixed with olive, occasionally broken; hind wing seldom with discal spot. Underside: fore and hind wings usually with basal zone yellow or dull white, outer zone usually with blackish or brown band, often broad, but sometimes narrow or broken, or occasionally absent; merging with postmedial line or separate; fore wing with discal spot forming a short broad band, hind wing with discal spot slender or weak, or absent. Outer margin of wings slightly to moderately wavy, fore wing sometimes moderately elongate; hind wing with costa not particularly short, but anal margin often elongate. Veins R_s and M_1 of hind wing not usually stalked, but on a stalk in *glaucescens*.

Hind tibia of male sometimes with hair pencil. Thorax and abdomen with dorsal crests strongly developed, especially on thorax. Sternite 3 of male abdomen with or without a pair of setal patches. Cavus tympani

usually with rake-like comb of fine spine-like projections at base of ansa.

Male genitalia (Figs 57, 96): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal one-third to four-fifths (approximately) fused; prongs usually very close together but occasionally well separated, almost straight, sometimes forming a tiny point at apex. Gnathos with median region often very broad and expanded, with margin slightly or distinctly bilobed, or forming a narrow tongue- or V-shaped process, strongly or occasionally weakly spinose or spinulose. Tegumen sometimes with dentate-edged and setose lateral lobes or processes. Valva divided distally into well-sclerotized variously shaped costal lobe and sacculus; costal lobe usually setose distally, often with apical process or spines, costa sometimes strongly expanded; sacculus broad, overlapping costal lobe and approaching or occasionally reaching its apex, often expanded subapically, usually with spinose apical process or sometimes with apex divided. Coremata often strongly developed, but sometimes weak or absent. Transtilla with pair of arms, sometimes joined, weakly to well sclerotized. Saccus usually forming a small rounded process. Aedeagus moderately slender and sometimes short, often with a slender process arising medially and lying along the aedeagus.

Female genitalia (Fig. 132). Sternite 8 lightly to moderately sclerotized. Apophyses anteriores extremely short; very broad, complexly wrinkled and folded, sclerotized region present around ostium, forming shallow anterior pouch; lamella postvaginalis usually not clearly differentiated. Ductus bursae ranging from very short to long, often very narrow but sometimes moderately broad; sometimes lightly sclerotized but without distinct antrum. Corpus bursae small to large, usually membranous but occasionally wrinkled and weakly sclerotized posteriorly; signum absent.

Diagnosis: Moths of *Dindica* have a more strongly developed crest on the thorax than in other genera of Pseudoterpnini. The wing pattern of *Dindica* is nearly always distinctive, with the hind wing (very different from the fore wing) having a large pale basal zone and usually a dark outer band, and discal spot absent or weak. *Heliomystis* is strikingly similar except that the hind wing has a larger discal spot on the underside, and some species of *Rhuma* have a contrasting dark outer band, but these moths are smaller than those of *Dindica* (compare scale of Figs 8, 41, 42). The male genitalia of *Dindica* have complex and variable structures of the divided valva, but the broad sacculus overlapping the costal lobe is distinctive except from *Dindicodes*, which unlike *Dindica* has an aedeagus of two diverging parts.

Biological notes: The larva (Sugi, 1987: pl. 14, fig. 3, *D. virescens*, and Holloway, 1996: 213, *D. polyphaenaria*) is robust, leaf-green, with a fine, whitish lateral line and sometimes a yellow subdorsal one; sometimes also with a yellow line on the head. The resting posture is stick-like with the true legs held tightly against the head. (Holloway, 1996.) Host plants: Lauraceae: *Alseodaphne* (Robinson *et al.*, 2001), *Benzoin*, *Lindera*, *Litsea* and *Parabenzoin* (Holloway, 1996); also Lauraceae: *Cinnamomum*, and Styracaceae: *Styrax* (Scoble, 1999); Euphorbiaceae: *Aporusa* (Robinson *et al.*, 2001); Theaceae: *Camellia* (Robinson *et al.*, 2001).

Distribution: Palaearctic Region: China; Japan; North Korea (Inoue, 1990); [South] Korea (Shin, 1996); *Oriental Region:* Bhutan; China; India; Indonesia (Bali, Flores, Java, Sulawesi, Sumatra); Malaysia; Myanmar; Nepal; Philippines; Taiwan; Thailand; Vietnam.

Species included

- alapis* Prout, 1932 (*Dindica*) [male and female genitalia]
- discordia* Inoue, 1990 (*Dindica*) [male genitalia]
- glaucescens* Inoue, 1990 (*Dindica*) [male genitalia]
- hepatica* Inoue, 1990 (*Dindica*) [male genitalia]
- kishidai* Inoue, 1986 (*Dindica*) [male genitalia; female genitalia photograph, Inoue (1990: fig. 119)]
- limatula* Inoue, 1990 (*Dindica*) [male and female genitalia photographs, Inoue (1990: figs 107, 118)]
- marginata* Warren, 1894a (*Dindica*) [male genitalia; female genitalia photograph, Inoue (1990: fig. 111)]
- olivacea* Inoue, 1990 (*Dindica*) [male and female genitalia]
- owadai* Inoue, 1990 (*Dindica*) [male genitalia]
- pallens* Inoue, 1990 (*Dindica*) [male genitalia]
- para para* Swinhoe, 1891 (*Dindica*) [male and female genitalia]
- erythropunctura* Chu, 1981 (*Dindica*)
- para malayana* Inoue, 1990 (*Dindica*)
- polyphaenaria* (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]
- basiflavata* (Moore, 1868) (*Hypochroma*) [male genitalia]
- purpurata* Bastelberger, 1911 (*Dindica*) [male and female genitalia]
- semipallens* Inoue, 1990 (*Dindica*) [male genitalia]
- subrosea* (Warren, 1893) (*Perissolophia*) [male genitalia]
- subsimilis* (Warren, 1898) (*Perissolophia*)
- subvirens* Yazaki & Wang (2004) (*Dindica*) [male genitalia photograph, Yazaki & Wang (2004: fig. 13)]
- sundae* Prout, 1935b (*Dindica*) [species status given by Holloway (1996: 214)] [male and female genitalia]

taiwana Wileman, 1914 (*Dindica*) [male and female genitalia]
tienmuensis Chu, 1981 (*Dindica*) [male and female genitalia]
virescens (Butler, 1878) (*Bylazora*) [male genitalia; female genitalia photograph, Inoue (1990: fig. 116)]
koreana (Alphéraky, 1897) (*Pseudoterpna*)
virescens yuwanina Kawazoe & Ogata, [1963] (*Dindica*)
wilemani Prout, 1927 (*Dindica*) [male and female genitalia]
wytsmani Prout, 1927 (*Dindica*) **stat. rev.** [male genitalia]

DINDICODES PROUT, 1912A
 (FIGS 9–11, 58, 97, 133)

Dindicodes Prout, 1912a: 41. Type species: *Hypochroma crocina* Butler, 1880, by original designation. [Historical treatment of *Dindicodes* as a subgenus of *Terpna*, by Prout (1912a, 1927) indicates its inclusion, here confirmed, in *Pseudoterpni* (of which *Terpni* is a synonym).]

Adults (Figs 9–11): Antenna bipectinate with short rami in male, simple filiform in female. Frons protruding moderately to strongly. Labial palpus with third segment barely elongate in female.

Wing pattern: fore wing (*crocina*- and *apicalis*-groups) dark yellowish green diffused with black and reddish brown; antemedial line wavy or indistinct; postmedial line dentate and angled, but often indistinct or composed of small black spots on veins, angled outward in upper half; both lines sometimes with silver-grey shading on one side; submarginal line of most species composed of small pale speckles between veins; with or without white or pale spot at apex; discal spot forming a long and narrow dash. Hind wing (*crocina*-group): strong yellow, with large blackish discal spot; broad blackish terminal band broken, often composed only of large spots; most species (except *crocina*) with grey area spreading from wing base to discal spot and down towards anal angle. Hind wing (*apicalis*-group): similar to fore wing. Underside (*crocina*-group): fore wing yellow with dark brown or grey markings, grey area usually present at base or near dorsum, outer zone dark grey-brown overall or only at or near apex, dark postmedial line either broken but fairly distinct, or merely marked by one or two large spots; dark discal spot large; underside of hind wing similar to upper side. Underside (*apicalis*-group): fore and hind wings distinctly demarcated into two zones, large basal zone (to postmedial line) yellow and outer zone forming a dark broad band; discal spots small. Wing pattern (*costiflavens*-group): fore and hind wings, both upper side and underside, with broad

band at outer margin, yellow with blackish speckles and spots (*costiflavens* with similar band at costa of fore wing, but *ectoxantha* with very extensive grey costal area); other parts of wings white with some grey spots. Outer margin of wings only slightly wavy; hind wing with costa sometimes short and with anal margin slightly elongate.

Hind tibia of male sometimes with hair-pencil; occasionally with terminal extension (stout in *crocina*). Thorax with moderate-sized crests; abdomen with dorsal crests developed moderately to strongly. Sternite 3 of male abdomen with or without a pair of setal patches.

Male genitalia (Figs 58, 97): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal one-third to more than half fused, prongs varying from very close together to well separated, straight. Gnathos with median process often V-shaped but sometimes broadly rounded or truncate and flat, spinulose. Valva divided distally; costal lobe lightly sclerotized and with rounded apex, but costal margin sclerotized and sometimes well-protruding, sometimes with long basal spinulose process; sacculus usually overlapping costal lobe (but occasionally only slightly), and approaching or occasionally extending beyond its apex, variously shaped, with lower margin projecting slightly to strongly, sometimes forming a distinct process. Coremata often strongly developed, but sometimes weak or absent. Transtilla weakly developed. Anellus sometimes with large sclerotized plate covered with minute 'pimples' and situated posteriorly to juxta. Saccus forming rounded small protrusion. Aedeagus divided near middle into two strong, diverging parts, and with large area of tiny spinules on main branch.

Female genitalia (Fig. 133): Apophyses anteriores much shorter than apophyses posteriores. Sternite 8 well sclerotized; wrinkled on ventral side, mainly around weakly defined lamella postvaginalis; very broad region around ostium lightly and fairly smoothly sclerotized. Ductus bursae short and very slender; without sclerotized antrum. Corpus bursae very long and membranous; signum absent.

Diagnosis: *Dindicodes* has various wing patterns in different species-groups, but the main group (*crocina*-group) can be easily recognized by the yellow hind wing, which has several large spots. The *apicalis*-group is distinguished by having a large yellow basal zone on the underside, while the upper side is mainly greenish brown, with a white apical spot on the fore wing. The *costiflavens*-group is characterized by having similar wing pattern on upper side and underside. All the species-groups have similar genitalia, and a characteristic of *Dindicodes*, present in all males, is

that the aedeagus is well divided into two diverging parts from the middle. The aedeagus of a species of *Aeolochroma*, *saturataria*, is similar but does not have the tiny spinules that are present in *Dindicodes*.

Distribution: Palaearctic Region: China; *Oriental Region:* Bhutan; China; India; Myanmar; Nepal; Thailand; Vietnam.

Species included

crocina-group

crocina (Butler, 1880) (*Hypochroma*) [male and female genitalia]

albodavidaria (Xue, 1992) (*Pachyodes*) **comb. nov.** [formal publication of transfer by Han (2005, unpublished), from *Pachyodes*] [male genitalia]

davidaria (Poujade, 1895) (*Pachyodes*) **comb. rev.** [formal publication of transfer by Han (2005, unpublished), from *Pachyodes*] [male and female genitalia]

leopardinata (Moore, 1868) (*Hypochroma*) **comb. rev.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*'] [male and female genitalia]

euclidiaria (Oberthür, 1913) (*Hypochroma*) **comb. rev.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*'] [male genitalia]

moelleri (Warren, 1893) (*Dindica*) **comb. rev.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*'] [male genitalia]

apicalis-group

apicalis (Moore, 1888) (*Pingasa*) **comb. rev.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*'] [male genitalia]

apicalis hunana (Xue, 1992) (*Pachyodes*) **comb. nov.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*']

harutai harutai (Yazaki, 1992) (*Pachyodes*) **comb. nov.** [from '*Pachyodes*'] [male and female genitalia photographs, Yazaki (1992: figs 4, 5)]

harutai infuscatus (Yazaki, 1992) (*Pachyodes*) **comb. nov.** [from '*Pachyodes*']

costiflavens-group

costiflavens (Wehrli, 1933) (*Terpna*) **comb. nov.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*'] [male genitalia]

ectoxantha (Wehrli, 1933) (*Terpna*) **comb. nov.** [formal publication of transfer by Han (2005, unpublished), from '*Pachyodes*'] [male genitalia]

Species excluded

vigil (Prout, 1926b) (*Terpna*) [male genitalia]

This species has a similar wing pattern to that of the *crocina*-group, but the very different male genitalia, with well-developed rod-like uncus, and long, strong, diverging, socii, excludes *vigil* from *Dindicodes*, although its correct generic placement is unknown.

EPIPRISTIS MEYRICK, 1888

(FIGS 12, 59, 98, 134)

Epipristis Meyrick, 1888: 836 (key), 916. Type species: *Epipristis oxycyma* Meyrick, 1888. [Cited in Pseudoterpnini by Holloway, 1996.]

Terpnidia Butler, 1892: 131. Type species: *Hypochroma nelearia* Guenée, [1858]. [Synonymized by Prout, 1912a: 29.]

Pingarmia Sterneck, 1927: 147. Type species: *Pingarmia transiens* Sterneck, 1927. [Synonymized by Prout, 1934c: 6, by inclusion of *transiens* in *Epipristis*.]

Adults (Fig. 12): Moths small (compare scale of Fig. 12 with Figs 13, 14 of *Herochroma*). Antenna simple filiform in both sexes, or (*transiens*, male) bipectinate but with short rami. Frons protruding slightly, black and usually with smooth scales. Labial palpus with third segment slightly elongate in female.

Wing pattern: dull olive green, pale brown or grey, or straw-coloured; fore wing with dentate or wavy antemedial line, dentate postmedial line angled or curved, and white submarginal line; area outside postmedial line darker than basal zone (to postmedial line) of wing, usually forming band of diffuse whitish-edged spots (mingling with submarginal line and reddish brown or dull greyish green), especially in female; discal spot present on fore and hind wings as a dash, particularly on fore wing, but sometimes as a small spot. Underside: fore and hind wings with basal zone whitish or greyish, outer zone with broad or occasionally narrow black-brown band (absent in *transiens*), discal spot distinct and often forming a short dash. Outer margin of wings slightly wavy; hind wing rounded, with costa fairly short and anal margin fairly elongate.

Hind tibia usually without hair-pencil except in males of *transiens* and *nelearia*. Abdomen usually with distinct but not large dorsal crests, but these absent in *oxydonta*. Sternite 3 of male abdomen usually without a pair of setal patches (but weakly present in *nelearia*).

Male genitalia (Figs 59, 98): Genitalia not heavily sclerotized. Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half to two-thirds fused, prongs slender and tapered, very close together, almost straight. Gnathos with median process tongue-like and broad, with faint pimple-like markings. Valva not divided; narrow and usually long, with costal margin usually straight or slightly curved (but angled and with a process in *transiens*); with a longitudinal median ridge, usually narrow, bearing long slender spines (varying from one to many, usually forming a line) and usually also short dense setae (median ridge in *transiens* without spines or dense setae). Coremata membranous and indistinct but sometimes long. Transtilla with pair of arms project-

ing strongly posteriorly but often weakly sclerotized, separate or joined weakly (strongly developed in *transiens*). Saccus not usually a distinct process. Aedeagus usually weakly sclerotized posteriorly (*transiens* strongly); vesica with dense fine wrinkles.

Female genitalia (Fig. 134). Apophyses anteriores very short, much shorter than apophyses posteriores. Wrinkled and sclerotized region around ostium, and also wrinkled lamella postvaginalis, present or absent. Ductus bursae very short or moderately long, with or without lightly sclerotized antrum, or occasionally ductus bursae entirely sclerotized. Corpus bursae usually fairly small (but extremely long in *transiens*), usually with narrower anterior caecum (not in *transiens*), membranous; signum absent, but scobinate region sometimes present.

Diagnosis: *Epipristis* resembles *Mimandria* (an Afro-tropical genus), and to some extent *Herochroma*, in the wing pattern, usually having a lacy band of whitish-edged spots between the postmedial and submarginal lines. Moths of *Herochroma* are usually larger, and *Epipristis* differs from that genus and *Mimandria* in the male genitalia, having a fairly simple and undivided valva, and a longitudinal median ridge that is spinose or setose except in the somewhat atypical species *transiens*. *Pseudoterpna* also has a spinose or setose median ridge, but with the spines usually forming a patch, not a line as is usual in *Epipristis*. The vesica of the aedeagus of *Epipristis* has dense fine wrinkles, whereas in *Pseudoterpna* the wrinkles are not dense.

Distribution: *Palaeartic Region:* China; *Oriental Region:* Bhutan; Brunei; China; India; Indonesia (Bali, Java, Sulawesi, Sumatra); Malaysia; Myanmar; Philippines; Singapore; Sri Lanka; *Australasian Region:* Australia; Indonesia [N. Moluccas: Bacan (Holloway, 1996)]; Papua New Guinea.

Species included

minimaria (Guenée, [1858]) (*Hypochroma*) [male genitalia]

parvula (Walker, 1860) (*Hypochroma*)

nelearia nelearia (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]

nelearia accessa Prout, 1937 (*Epipristis*)

oxycyma Meyrick, 1888 (*Epipristis*) [male and female genitalia]

australis Goldfinch, 1929 (*Epipristis*)

oxydonta Prout, 1934b (*Epipristis*)

rufilunata rufilunata (Warren, 1903) (*Pingasa*)

nelearia viridans Prout, 1916b (*Epipristis*)

rufilunata antelucana Prout, 1927 (*Epipristis*)

storthophora Prout, 1937 (*Epipristis*) [male genitalia]

transiens (Sterneck, 1927) (*Pingarmia*) [male and female genitalia]

truncataria (Walker, 1861) (*Acidalia*) [male and female genitalia]

HEROCHROMA SWINHOE, 1893

(FIGS 13, 14, 47, 60, 61, 99, 135)

Herochroma Swinhoe, 1893: 148. Type species: *Herochroma baba* Swinhoe, 1893, by monotypy. Inoue, 1999; Han & Xue, 2003. [Cited in Pseudoterpni by Holloway, 1996.]

Chloroclydon Warren, 1894a: 464. Type species: *Scotopteryx usneata* Felder & Rogenhofer, 1875, by original designation. [Synonymized with *Archaeobalbis* by Prout, 1912a: 25, by inclusion of *usneata* in *Archaeobalbis*; *Archaeobalbis* synonymized with *Herochroma* by Holloway, 1996: 198.]

Archaeobalbis Prout, 1912a: 9 (key), 24. Type species: *Hypochroma viridaria* Moore, 1868, by original designation. [Synonymized by Holloway, 1996: 198.]

Neobalbis Prout, 1912a: 10 (key), 26. Type species: *Pseudoterpna elaearia* Hampson, 1903, by original designation. [Synonymized with *Archaeobalbis* by Inoue, 1992: 156; *Archaeobalbis* synonymized with *Herochroma* by Holloway, 1996: 198.]

Adults (Figs 13, 14, 47): Antenna of both sexes simple filiform. Frons protruding moderately, rough-scaled or smooth. Labial palpus with third segment slightly elongate in female.

Wing pattern: usually straw-coloured or grass-green diffused with grey- or red-brown. Antemedial line dentate or wavy, postmedial line dentate and on fore wing sometimes curved or occasionally angled; both lines black-brown, or mixed with red-brown, or dull green, distinct or indistinct; inner (basal) side of antemedial line usually with faint red- and black-brown blotch on each side of vein A, occasionally distinct; dark reddish-brown broken band or series of patches usually present between postmedial line and submarginal line, but absent or weak between veins M_3 and CuA_1 ; submarginal line composed of pale markings and sometimes dark spots between the veins, distinct or indistinct. Fore and hind wings with discal spots, occasionally dash-like. Underside: fore and hind wings with large pale basal zone (to postmedial line) and dark outer zone usually distinctly demarcated but occasionally concolorous, basal zone whitish or yellowish, sometimes diffused with red or grey-brown; outer zone usually with dark brownish or red-brown band, often broad but sometimes narrow; discal spot on fore wing dot-like or occasionally a broad dash, that on hind wing either dot-like or a narrow dash, or absent. Outer margin of fore wing wavy, hind wing strongly wavy to dentate; tufts of raised scales sometimes

present near base of the male fore wing. Hind wing with costa sometimes short, and anal margin elongate.

Hind tibia of male often strongly dilated, with well-developed hair-pencil, but sometimes dilated moderately or not at all; with long terminal extension. Abdomen often with pairs of small dorsal crests. Sternite 3 of male abdomen with, or occasionally without, a pair of setal patches; sternite 8 (of *flavibasalis*-group only) with distal sclerotization, more or less produced medially.

Male genitalia (Figs 60, 61, 99): Uncus usually very short but sometimes moderately well developed, broad to rod-like, sometimes bifurcate. Socii diverging strongly, sometimes even laterally directed; well sclerotized and always much larger than uncus, strong, rather club-like or sometimes narrow, often with a small lobe on inner margin. Gnathos with median process small and somewhat spinulose, usually V-shaped to tongue-shaped but occasionally truncate. Valva variously shaped: undivided, divided into separate costal lobe and sacculus, or divided more distally into two lobes; costa often expanded, sometimes with basal, terminal, or occasionally medial process; sacculus sometimes forming distal spine, or with other process. Coremata strongly developed or weak. Transtilla with one or two pairs of processes projecting posteriorly, varying in shape, pointed or blunt, often well developed but sometimes weak. Saccus usually not projecting, occasionally projecting distinctly. Aedeagus moderately slender, often with one to two processes arising medially and directed posteriorly; vesica with or without cornutus: a sclerotized lobe with wrinkled basal region. [Species of *flavibasalis*-group have a different type of genitalia: sclerotized bifid socii/uncus complex present (see p. 351 for discussion), fused only at base, consisting of vestigial uncus and large socii not diverging apically but with bi- or tri-furcate apex. Gnathos arms, but not median plate, fused with membrane of diaphragma; median region of gnathos expanded as a quadrate plate fused with or adjacent to posteriorly arched transtilla. Valva well divided distally into two slender setose lobes, and with another long slender setose process at base.]

Female genitalia (Fig. 135): Ovipositor valves sometimes strongly papillate and setose. Apophyses anteriores sometimes extremely short but more often of moderate length, always shorter than apophyses posteriores. Very broad sclerotized region present around ostium, slightly to strongly wrinkled and variously shaped, sometimes complex and sometimes forming a shallow anterior pouch; lamella postvaginalis distinct or indistinct; lamella antevaginalis forming a pair of blunt processes in some. Ductus bursae short to long, usually moderately broad, lightly to well sclerotized,

often wrinkled, sometimes with distinct antrum. Corpus bursae small to large, mainly membranous but sometimes sclerotized and wrinkled at posterior end; often with bicornute or linear signum, or signum absent.

Diagnosis: The wing pattern of *Herochroma* resembles that of *Epipristis* and *Mimandria* to some extent, in usually having a series of markings between the postmedial and submarginal lines, but not appearing as a lacy band, as is typical of those two genera; moths of *Herochroma* are usually larger (compare the scale of Figs 13, 14 with Figs 12, 23 of *Epipristis* and *Mimandria*). In the male genitalia, *Herochroma* is unusual in the Pseudoterpnini in having a short uncus together with large socii. The uncus is variable and occasionally similar to that of *Metaterpna*, but the gnathos differs in the two genera; in *Herochroma*, unlike *Metaterpna*, no basal lobe is present on the gnathos arms. The combination of well-diverging and often somewhat club-like socii, and a strongly modified transtilla, is characteristic of many species of *Herochroma*. The *flavibasalis*-group differs in several characters as described above, most notably in having the gnathos arms fused with the diaphragma. That occurs also in *Mimandria*, but in both genera the median projection of the gnathos is not fused with the diaphragma, whereas in *Crypsiphona* and *Paraterpna* the gnathos is entirely fused. The last two genera are very different from *Herochroma* in external appearance [see Figs 5, 6 (*Crypsiphona*), Fig. 28 (*Paraterpna*) and Fig. 14 (*Herochroma flavibasalis*-group)].

Biological notes: Host plant(s): Araliaceae: *Schefflera* (Robinson *et al.*, 2001, for *Herochroma* sp.).

Distribution: *Palaeartic Region:* Afghanistan (Inoue, 1999); Armenia? ('Armenien Agri Dagh'); China; Kazakhstan; Tajikistan; *Palaeartic/Oriental Region:* Pakistan; *Oriental Region:* Bhutan; China; India; Indonesia [Bali and Flores (Inoue, 1999), Java, Sulawesi, Sumatra]; Jammu and Kashmir, Malaysia; Myanmar; Nepal; Philippines; Sri Lanka; Taiwan (Inoue, 1999); Thailand; Vietnam.

Species included

baba-group

aethalia (Prout, 1927) (*Archaeobalbis*) [male and female genitalia photographs, Inoue (1999: figs 65, 91)]

baba Swinhoe, 1893 (*Herochroma*) [male and female genitalia]

baibarana (Matsumura, 1931) (*Dindica*) [male genitalia]

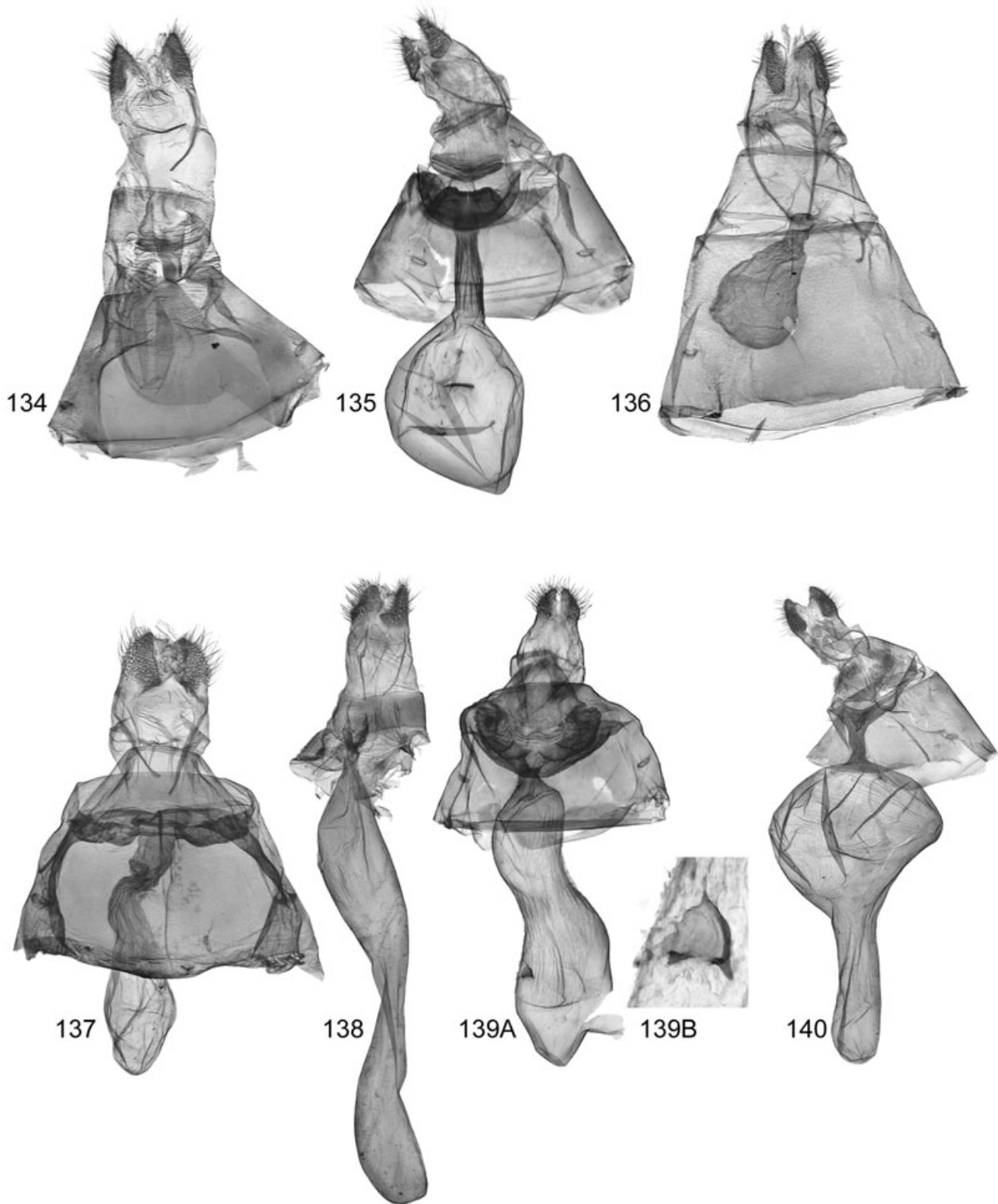
orientalis (Holloway, 1982) (*Archaeobalbis*) [synonymized by Inoue (1999: 90)]

- crassipunctata crassipunctata* (Alphéraky, 1888) (*Gnophos*) [male and female genitalia photographs, Inoue (1999: figs 76, 99)]
- sordida* (Wehrli, 1928) (*Archaeobalbis*) [synonymized by Inoue (1999: 97)]
- crassipunctata farinosa* (Warren, 1893) (*Actenochroma*) [status changed to subspecies by Inoue (1999: 99)] [male genitalia photograph, Inoue (1999: fig. 77)]
- cristata cristata* (Warren, 1894a) (*Actenochroma*) [male and female genitalia]
- subopalina* (Warren, 1894a) (*Actenochroma*) [male genitalia]
- cristata rubicunda* Inoue, 1999 (*Herochroma*)
- curvata* Han & Xue, 2003 (*Herochroma*) [male genitalia]
- elaearia* (Hampson, 1903) (*Pseudoterpna*) [male and female genitalia]
- holelaica* (Prout, 1935b) (*Archaeobalbis*) [male and female genitalia]
- nigrescentipalpis* (Prout, 1916a) (*Archaeobalbis*) [male genitalia]
- ochreipicta* (Swinhoe, 1905) (*Actenochroma*) [male and female genitalia]
- montana* (Bastelberger, 1911) (*Actenochroma*) [synonymized by Inoue (1999: 86)]
- pallensia* Han & Xue, 2003 (*Herochroma*) [male genitalia]
- perspicillata* Han & Xue, 2003 (*Herochroma*) [male genitalia]
- pseudocristata* Inoue, 1999 (*Herochroma*) [male genitalia photograph, Inoue (1999: fig. 81)]
- scoblei* (Inoue, 1992) (*Archaeobalbis*) [male genitalia photograph, Inoue (1999: fig. 74)]
- serrativaiva* (Holloway, 1982) (*Archaeobalbis*) [male genitalia]
- sinapiaria* (Poujade, 1895) (*Hypochroma*) [male and female genitalia]
- subspoliata* (Prout, 1916a) (*Archaeobalbis*) [status changed to species by Inoue (1999: 95)] [male and female genitalia]
- subtepens* (Walker, 1860) (*Hypochroma*) [male and female genitalia]
- subtepens formosicola* (Matsumura, 1931) (*Dindica*)
- subviridaria* (Yazaki, 1994) (*Archaeobalbis*) [male genitalia photograph, Inoue (1999: fig. 62)]
- supraviridaria* Inoue, 1999 (*Herochroma*) [male and female genitalia photographs, Inoue (1999: figs 61, 88)]
- urapteraria* (Walker, 1860) (*Hypochroma*) [male and female genitalia photographs, Inoue (1999: figs 64, 90)]
- urapteraria eudicheres* (Prout, 1916b) (*Archaeobalbis*) [synonymized by Inoue (1999: 83)]
- usneata* (Felder & Rogenhofer, 1875) (*Scotopteryx?*) [male and female genitalia photographs, Inoue (1999: figs 75, 98)]
- hypoglauca* (Hampson, 1895) (*Pseudoterpna*)
- viridaria viridaria* (Moore, 1868) (*Hypochroma*) [male and female genitalia]
- subochracea* (Warren, 1894a) (*Actenochroma*)
- viridaria peperata* (Herbulot, 1989) (*Archaeobalbis*) [status changed back to subspecies by Inoue (1999: 78)]
- xuthopletes* (Prout, 1934b) (*Archaeobalbis*) **stat. rev.** [male genitalia photograph, Inoue (1999). Inoue treated *xuthopletes* as a subspecies of *subspoliata*, but the genitalia of the holotype (male) of *xuthopletes* are distinctly different from those of the only male syntype of *subspoliata*.]
- yazakii* Inoue, 1999 (*Herochroma*) [male and female genitalia photographs, Inoue (1999: figs 60, 87)]
- flavibasalis*-group
- aeruginosa* Inoue, 1999 (*Herochroma*) [male genitalia photograph, Inoue (1999: fig. 85)]
- clariscripta* Holloway, 1996 (*Herochroma*) [male genitalia]
- flavibasalis* (Warren, 1894a) (*Actenochroma*) [male and female genitalia]
- bipunctata* (Thierry-Mieg, 1915) (*Neobalbis*) [male genitalia]
- hemiticheres* (Prout, 1935b) (*Neobalbis*) [male and female genitalia]
- thaiensis* (Inoue, 1992) (*Archaeobalbis*) [synonymized by Inoue (1999: 101)]
- mansfieldi* (Prout, 1939) (*Neobalbis*) [male and female genitalia]
- rosulata* Han & Xue, 2003 (*Herochroma*) [male and female genitalia]
- Species excluded*
- The following two species were transferred from *Hemistola* Warren (in the Hemitheini) to *Herochroma* (Scoble, 1999). This was an error: the species do not belong in *Herochroma*, and do not show any characters of *Pseudoterpnini*. Both species are here returned to *Hemistola* (**comb. rev.**).
- flavitincta* (Warren, 1897b) (*Hemistola?*)
- liliana* (Swinhoe, 1892) (*Thalassodes*)

HOLOTERPNA PÜNGELER, 1900
(FIGS 15, 62, 100, 136)

Holoterpna Püngeler, 1900: 296. Type species: *Holoterpna diagrapharia* Püngeler, 1900. [Cited in *Pseudoterpnini* by Hausmann, 1996a, 2001.]

Adults (Fig. 15): Antenna bipectinate in basal three-quarters or more in male, simple filiform or bipectinate in female. Frons either not protruding significantly or sometimes protruding slightly, smooth scaled, mainly brown and contrasting distinctly with



Figures 134–140. Female genitalia. 134, *Epipristis oxycyma*; 135, *Herochroma cristata cristata*; 136, *Holoterpna pruinosata*; 137, *Hypobapta percomptaria*; 138, *Hypodoxa emiliaria*; 139A, *Limbatochlamys pararosthorni*; 139B, signum of *Limbatochlamys pararosthorni*; 140, *Lophohelma vigens vigens*.

white above frons (but paler and not contrasting in *diagrapharia*). Proboscis absent or strongly reduced. Labial palpus with third segment very short in male, moderately long in female. Wing pattern: wings without strong markings, either plain and very pale olive-cream (hind wing sometimes slightly paler), with very faint, smoothly curved, postmedial line on fore wing darker or whitish, and with discal spot virtually absent, or (*errata*) wings finely mottled brown and whitish, with fine, dark brown, wavy antemedial line, dentate postmedial line, and short discal dash. Underside pale and plain, or at least plainer than upper side. Outer margin of wings almost smooth; hind wing with costa fairly short to moderately long, anal margin often fairly elongate. Frenulum and retinaculum absent. Venation variable: M_1 of fore wing sometimes on a short stalk with veins R_{2-5} , and R_s and M_1 of hind wing often on a stalk.

Hind tibia without hair pencil; with only one pair of spurs. Thorax and abdomen without dorsal crests; sternite 3 of abdomen without setal patches.

Male genitalia (Figs 62, 100): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal two-thirds or more fused, prongs very close together, [tapered and] slender and almost straight. Gnathos with median region expanded as a short, minutely spinulose, tongue. Valva not divided; with small mid-basal lobe, or occasionally simple and without processes. Coremata usually present but not strongly developed. Transtilla usually with pair of arms not joined by sclerotization; each arm adjoining posterior region of light sclerotization on anellus. Juxta forming a broad, slightly bilobed, pouch. Saccus projecting distinctly, rounded or subrectangular. Aedeagus simple and usually slender; vesica without cornuti and only weakly wrinkled.

Female genitalia (Fig. 136). Membrane between ovipositor valves sometimes modified (e.g. in *pruinosa*) with a sclerotized median ridge defining a pair of flat curved lobes, or not modified. Apophyses anteriores very short, much shorter than apophyses posteriores. Region around ostium mainly membranous and without conspicuous features other than ostial opening sometimes wrinkled, and lamella postvaginalis sometimes distinct and lightly sclerotized. Ductus bursae short, wrinkled and sclerotized at ostium and with small band of sclerotization near corpus bursae, or mainly membranous. Corpus bursae membranous and small to moderate sized, pear shaped or oval; signum absent.

Diagnosis: Moths of *Holoterpna* are fairly plain on the underside, like those of *Aplasta*, *Pseudoterpna*, *Mictoschema* and *Mimandria*. These genera share characters of loss or reduction of the proboscis and/or the

frenulum, but to varying degree, and the absence of a frenulum distinguishes *Holoterpna* from *Mimandria* and *Pseudoterpna*. [See also the discussion under *Aplasta*.] The male genitalia of *Holoterpna* are distinguished from those of most of the above genera in having the valvae almost simple, not divided as in *Mimandria*, or with a spinose harpe as in *Aplasta* and *Pseudoterpna*. The genitalia of *Mictoschema* are similar, but the gnathos has a larger, although weaker, median region that is not tongue-like and minutely spinulose as in *Holoterpna*.

Biological notes: Host plants: (for *H. pruinosa*): oliphagous on Umbelliferae; records on *Ferulago campestris* (Besser) Grecescu and *Foeniculum* spp. noted by Hausmann (2001: 119). The larva has been described as colourful, yellow with crimson/purple transverse strips, and without projections on the prothorax (T1) or the anal segment (Prout, 1935a).

Distribution: *Palaeartic Region:* Israel; Italy and Lebanon (Hausmann, 1996b); Macedonia, Turkey (Hausmann, 2001); Turkmenistan; *Afrotropical Region:* Namibia; Zimbabwe.

Species included

diagrapharia Püngeler, 1900 (*Holoterpna*) [male genitalia]

errata errata Prout, 1922a (*Holoterpna*?) [male genitalia]

errata segnis Prout, 1930a (*Holoterpna*)

pruinosa (Staudinger, 1898) (*Eucrostis*?) [male and female genitalia]

HYPOBAPTA PROUT, 1912A

(FIGS 16, 63, 101, 137)

Hypobapta Prout, 1912a: 41. Type species: *Hypochroma percomptaria* Guenée, [1858]. [Replacement name.] [Treated in Section A of Geometrinae by McFarland (1988); here assigned to Pseudoterpniini.]

Hypochroma Guenée, [1858]. Type species: *Hypochroma percomptaria* Guenée, [1858]. [Junior homonym of *Hypochroma* Herrich-Schäffer, [1855] 1850–1858 (Geometridae: Ennominae).]

Adults (Fig. 16): Antenna of male bipectinate in basal two-thirds or more, simple filiform to serrate in female. Frons not protruding significantly, usually rough-scaled. Labial palpus with third segment short to moderate length, usually slightly longer in female than in male.

Wing pattern: grey-brown with blackish fine speckles and other markings, and with diffuse, pale, somewhat whitish areas mainly basal to the postmedial line; antemedial line slightly wavy, postmedial line

dentate or almost smooth, sometimes slightly angled, both lines blackish and well marked, and sub-basal line also present (on fore wing only); discal spot forming a narrow line, often curved or wavy; whitish submarginal line wavy or dentate, distinct or indistinct. Underside: fore and hind wings with large pale basal zone white with dark brown speckles, and sometimes diffused with pink or brown, contrasting usually strongly with dark brown band (or on fore wing sometimes blotch) in outer zone; dark discal lines as on upper side. Outer margin of wings wavy; hind wing with costa sometimes fairly short, anal margin usually elongate.

Hind tibia without hair pencil; with one or two pairs of spurs. Thorax with large but low dorsal crest, abdomen with dorsal crests weak or absent. Sternite 3 of abdomen without setal patches.

Male genitalia (Figs 63, 101): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), fused only at base; prongs almost straight, well separated, and diverging; inner edge of each prong forming low rounded lobe at base. Gnathos with median region slightly broadened or otherwise differentiated, with or without spinules. Valva narrow, either divided (but with costal lobe much shorter than sacculus), or costa merely produced as a low irregular lobe (not making the valva distinctly divided); in either case, the costal lobe has a spine-like process (small to fairly large), and the sacculus or anterior part of the valva projects as a finger-like distal lobe. Coremata absent. Transtilla weakly sclerotized but sometimes large. Saccus small or little developed. Aedeagus broadening to posterior end, which has two (or occasionally three) wrinkled and sclerotized diverging lobes; vesica with or without caeca, but always with one or more cornuti: spines, spine-like process, or a sclerite.

Female genitalia (Fig. 137): Ovipositor valves sometimes strongly papillate and setose. Apophyses anteriores shorter than apophyses posteriores, but longer than in most other genera of Pseudoterpnini. Very broad, wrinkled and lightly sclerotized, region usually present around ostium. Ductus bursae to ostium slightly to very strongly swollen and usually lightly sclerotized. Corpus bursae moderate-sized and membranous; signum absent.

Diagnosis: The greyish colouring and strong blackish lines on the wings of *Hypobapta* are distinctive. In the male genitalia, the socii/uncus complex (with prongs well separated, diverging, and fairly straight) is similar to that of *Cyneoterpna* and some species of *Hypodoxa*. *Hypobapta* differs, however, in the simple finger-like anterior lobe of the valva, and the diverging posterior lobes of the aedeagus.

Biological notes: Host plants: Myrtaceae: *Eucalyptus* spp. (McFarland, 1988: 273, 278, for *H. diffundens* and *percomptaria*); McFarland (1979: 38–39) recorded *Eucalyptus odorata* Behr for *H. barnardi*, *diffundens* and *percomptaria*, and also *Eucalyptus leucoxydon* F. Muell. for *H. percomptaria*. McFarland (1988: 273–283) described and figured the early stages of *Hypobapta diffundens* and *percomptaria*: egg (figs 884, 913–916); larva (figs 885–891, 917–929) pale green, becoming whitish blue-green, with minute and sometimes faint purplish speckles, spiracular line cream, body flattened dorsoventrally, head strongly pointed when mature, with a medial groove; usual resting posture of larva rigid and straight, when mature often hanging downwards from the hostplant; pupa (figs 892–896, 930–935).

Distribution: Australasian Region: Australia (Queensland, South Australia, Tasmania, Victoria).

Species included

barnardi Goldfinch 1929 (*Hypobapta*) [male and female genitalia]

diffundens (Lucas 1891) (*Hypochroma*) [male and female genitalia]

eugramma (Lower 1892) (*Hypochroma*)

percomptaria (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]

xenomorpha (Lower, 1915) (*Pseudoterpna*)

HYPODOXA PROUT, 1912A

(FIGS 17, 64, 102, 138)

Hypodoxa Prout, 1912a: 10 (key), 33. Type species: *Hypochroma emiliaria* Guenée, [1858]. [Here assigned to Pseudoterpnini.]

Adults (Fig. 17): Antenna of male bipectinate in basal two-thirds or more, simple filiform in female. Frons protruding slightly or occasionally moderately, not strongly rough-scaled; occasionally with black transverse band or with lower part of frons black. Labial palpus with first and second segments rough-scaled, third segment very short to moderate length in male, fairly elongate in female.

Wing pattern: typically olive-green mottled with dark brown speckles and other markings, but sometimes mainly brown or greyish; with or without large areas of pale whitish grey or cream, occasionally predominantly pale; often pink-tinged, and often with yellow fringe along anal margin of hind wing (and also along sides of abdomen); fore wing with or without distinct pale basal zone (to postmedial line); antemedial line dentate or indistinct; discal spot either forming a small dash or a dot; postmedial line wavy or dentate, curved or angled, usually with paler outer edge; sub-

marginal line often whitish with dark edge but sometimes predominantly dark, wavy but sometimes indistinct; fore wing usually with two dark but diffuse patches at outer margin; hind wing sometimes with dark streak situated in from anal margin and tapering from outer margin towards base of wing. Underside: fore and hind wings usually with strongly demarcated dark outer zone or band, and pale basal zone (yellowish or whitish, often with pink tinge on fore wing); discal spot often distinct, usually stronger on fore wing, but sometimes indistinct or, on hind wing, absent. Outer margin of wings slightly wavy; hind wing rounded, with costa short and anal margin elongate, and with dark-edged hair brushes either as three tufts, or joined in a wavy, or occasionally almost straight, slanting line, but usually with tuft at anal margin of wing projecting more strongly, clearly basal to the discal spot (if discal spot is visible); tufts of raised scales usually also present, to varying degree, near base of fore wing.

Hind tibia of male with hair pencil and with short terminal extension. Thorax and abdomen with weak dorsal crests. Sternite 3 of male abdomen with a very weak pair of setal patches, widely spaced.

Male genitalia (Figs 64, 102): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal one-quarter to half fused, prongs moderately to strongly separated at base and diverging, parallel or converging. Gnathos quadrate to rounded, with narrow median process often spinulose, tongue-like or variously shaped. Valva not divided, typically with non-costal side folded over, and always with a ridge-like process on that side, distal and spinulose. Coremata absent. Transtilla arms not joined, well apart. Saccus very large, with rounded apex. Aedeagus with fine longitudinal ridges in posterior half, becoming wrinkled distally, merging with vesica; aedeagus often with median tongue-like process; vesica without cornuti.

Female genitalia (Fig. 138): Apophyses anteriores extremely to moderately short, always much shorter than apophyses posteriores. Very broad, densely wrinkled region often present around ostium, lightly sclerotized or almost membranous. Ductus bursae with or without longitudinal ridges, ductus often merging with corpus bursae. Corpus bursae mainly membranous, slender, moderately to greatly elongate; signum absent.

Diagnosis: Moths of *Hypodoxa*, *Sundadox*a and *Pingasa* all have brushes of hair-like scales on the hind wings. In *Hypodoxa* the brush is often composed of three tufts and even if they are joined, they do not form quite such a straight bar as in *Sundadox*a; in both those genera the brushes are situated more

basally (in relation to the discal spot) than in *Pingasa*. The male genitalia of *Hypodoxa* have two definitive characters: the distal, spinulose, ridge-like process on the valva, and the conspicuously large saccus.

Biological notes: Host plants: Myrtaceae: *Eucalyptus* and *Angophora* (Common, 1990: 372, for *H. bryophylla*); mainly *Eucalyptus ?polycarpa* F. Muell. but also *E. ?drepanophylla* F. Muell. (McFarland, 1979: 39, for *H. emiliaria*); *Leptospermum* (McFarland, 1988: 228, for *H. calliglauca*); *Melaleuca quinquenervia* (Cav.) Blake (Robinson *et al.*, website, 2005, for *H. erebusata*). McFarland (1979) noted that the larva of *emiliaria* bore a close superficial resemblance to that of *Crypsiphona oculitaria*. For an account of the early stages of *H. bryophylla*, with photographs, see Herbison-Evans & Crossley (website, updated 2005).

Distribution: *Australasian Region*: Australia; Indonesia (Irian Jaya, Moluccas); Papua New Guinea; Solomon Islands.

Species included

- bryophylla* (Goldfinch, 1929) (*Pingasa*)
calliglauca (Turner, 1926) (*Pingasa*)
conspurcata (Lucas, 1898) (*Hypochroma*)
myriosticta (Turner, 1904) (*Pseudoterpna*)
corrosa (Warren, 1907) (*Hypochroma*) [female genitalia]
deteriorata (Walker, 1860) (*Hypochroma*) [male and female genitalia]
nigraria (Felder & Rogenhofer, 1875) (*Boarmia*)
emiliaria emiliaria (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]
assidens (Lucas, 1901) (*Hypochroma*)
aurantiacea (Lucas, 1891) (*Hypochroma*)
subornata (Warren, 1896d) (*Hypochroma*)
talagi (Swinhoe, 1917) (*Pingasa*)
emiliaria aignanensis Prout, 1916b (*Hypodoxa*)
emiliaria basinigra (Warren, 1902a) (*Hypochroma*)
emiliaria fulgurea Prout, 1913 (*Hypodoxa*)
emiliaria purpurifera (Warren, 1899a) (*Hypochroma*)
emiliaria purpurissata (Lucas, 1901) (*Hypochroma*)
emiliaria subleprosa Prout, 1917a (*Hypodoxa*)
erebusata (Walker, 1860) (*Hypochroma*)
erebata (Meyrick, 1888) (*Hypochroma*)
horridata (Walker, [1863]) (*Hypochroma?*)
involuta Prout, 1933 (*Hypodoxa*) [male genitalia]
involuta perplexa Prout, 1933 (*Hypodoxa*)
leprosa leprosa (Warren, 1907) (*Hypochroma*)
leprosa incarnata Prout, 1913 (*Hypodoxa*)
lichenosa lichenosa (Warren, 1907) (*Hypochroma*)
lichenosa rufomixta Prout, 1913 (*Hypodoxa*)
multicolor (Warren, 1899a) (*Hypochroma*) [male genitalia]
multicolor circumsepta Prout, 1913 (*Hypodoxa*)

muscosaria (Guenée, [1858]) (*Hypochroma*)
ceptraria (Felder & Rogenhofer, 1875) (*Hypochroma*?)
squamata (Felder & Rogenhofer, 1875) (*Hypochroma*)
paroptila (Turner, 1906) (*Pseudoterpna*)
regina regina Prout, 1916a (*Hypodoxa*)
regina pallida Joicey & Talbot, 1917 (*Hypodoxa*)
ruptilinea Prout, 1913 (*Hypodoxa*)
viridicoma (Warren, 1899a) (*Hypochroma*)
viridicoma interrupta (Warren, 1902a) (*Hypochroma*)

LIMBATOCHLAMYS ROTHSCHILD, 1894
 (FIGS 18, 65, 103, 139)

Limbatochlamys Rothschild, 1894: 540. Type species: *Limbatochlamys rosthorni* Rothschild, 1894, by original designation. Han, Galsworthy & Xue, 2005. [Cited in Pseudoterpnini by Han, Galsworthy & Xue, 2005.]

Adults (Fig. 18): Moths large (compare scale of Fig. 18 with Figs 1–3, 5–17). Antenna in both sexes bipectinate with short rami (much shorter in female), or sometimes serrate in female. Frons protruding moderately, rough-scaled. Labial palpus short.

Wing pattern: fore wing mainly uniform olive-green, with straw-coloured costal band distinctly bordered by a black line at lower margin; hind wing with straw-coloured costal area, spreading downwards into large diffuse grey-green area, which runs from outer margin to anal angle and often across wing to base; costal band of fore wing and most areas of hind wing speckled with dark brown. Postmedial line of fore wing composed merely of a row of dots (sometimes indistinct) on veins, or a faint, slightly dentate line; postmedial line of hind wing dark brown, dentate. Discal spot faint on fore wing, forming a distinct or faint dash on hind wing, or absent. Underside: pale brown, with dark speckles (sparse or absent towards base); postmedial line usually present on fore wing but only occasionally on hind wing; with or without discal spot. Outer margin of wings almost smooth; fore wing with costa curved towards slightly falcate apex. Hind wing with costa of moderate length and with fairly elongate anal margin.

Hind tibia without hair pencil. Abdomen without dorsal crests, and sternite 3 without setal patches.

Male genitalia (Figs 65, 103): Uncus well developed, rod-like, long and slender. Socii sclerotized, very slender, slightly narrower than uncus, about half length of uncus. Gnathos with median process V-shaped, hook or finger-like. Valva long and often fairly narrow, divided apically (*rosthorni*) or not divided; with costa, harpe and sacculus region well sclerotized, other parts weakly sclerotized; costa often produced as apical spine-like process, spinulose or smooth; harpe not approaching apex of valva, with apex bluntly rounded or narrow and pointed, without spinules. Coremata

well developed. Transtilla weakly sclerotized, forming a pair of arms, more or less meeting medially. Saccus rounded and projecting moderately. Aedeagus moderately broad, with two sclerotized processes arising medially, variously shaped, one lying over other; vesica with pointed apical cornutus.

Female genitalia (Fig. 139). Apophyses anteriores very short to moderate length but much shorter than apophyses posteriors. Broad, wrinkled and heavily sclerotized, region present around ostium, merging with lamella postvaginalis. Ductus bursae short, moderately narrow, and without distinct antrum. Corpus bursae large or moderate-sized; mainly membranous but sometimes with lightly sclerotized area and with wrinkles; signum a well-developed subtriangular plate, with a tooth at each of the two anterior corners.

Diagnosis: *Limbatochlamys* is characterized by its fore wing pattern, uniformly olive-green except for the straw-coloured costal band, and also by the fore wing shape, slightly falcate at the apex. *Limbatochlamys* is one of only a few pseudoterpne genera to have male genitalia with both a long rod-like uncus and socii. Other genera are *Actenochroma*, which (unlike *Limbatochlamys*) has a spinulose harpe reaching the apex of the valva, and *Psilotagma*, which is sometimes similar to *Limbatochlamys* in having narrow socii, but differs in not having a harpe in the valva. *Limbatochlamys* is also one of only three pseudoterpne genera that have a bicornute signum in the female, the others being *Actenochroma* and (some species) *Herochroma*.

Distribution: *Palearctic Region:* China; *Oriental Region:* China.

Species included

rosthorni Rothschild, 1894 (*Limbatochlamys*) [male and female genitalia]
pararosthorni Han & Xue, 2005 (*Limbatochlamys*) [male and female genitalia]
parvisis Han & Xue, 2005 (*Limbatochlamys*) [male and female genitalia]

LOPHOPHELMA PROUT, 1912A
 (FIGS 19, 66, 104, 140)

Lophophelma Prout, 1912a: 40. Type species: *Hypochroma vigenis* Butler, 1880. [Cited in Pseudoterpnini by Holloway, 1996.]

Adults (Fig. 19): Antenna of male bipectinate in basal half to two-thirds, and simple filiform in female (female of *neonoma* bipectinate but with short rami). Frons protruding moderately to strongly, with blackish transverse band either median and diffuse or occa-

sionally broken, or at ventral margin and distinct. Labial palpus short, third segment slightly elongate in female.

Wing pattern: usually diffused grey- or red-brown, or grey-green, with black speckles and striations; fore wing usually with apical or subapical paler blotch (*rubroviridata* and *ruficosta* without such blotch); fore wing with distinct sub-basal line or occasionally a band, and distinct antemedial and postmedial lines, antemedial line slightly or strongly sinuate; fore and hind wings with postmedial line dentate, often strongly, postmedial line on fore wing angled outward at upper half; submarginal line composed of white spots (distinct or indistinct) between veins. Discal spot distinct and often forming a dash on upper side and underside of fore wing, on hind wing usually narrow but sometimes faint on upper side, and present or absent on underside. Underside: fore and hind wings with basal zone (to postmedial line) whitish, or yellowish but only at base of wing, and fore wing sometimes with pink in the lower part, outer zone with dark brown band, often broad but sometimes narrow or broken. Outer margin of wings wavy; hind wing rounded, with costa short and anal margin fairly strongly elongate.

Hind tibia of male with or without hair pencil. Abdomen with well-developed dorsal crests; sternite 3 of male with or without a pair of weak setal patches.

Male genitalia (Figs 66, 104): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half to three-quarters fused; prongs very close together, straight. Gnathos with median process usually V-shaped, or occasionally tongue-like, often narrow but sometimes broad, spinulose. Valva extremely variable in shape, often moderately short and undivided, or divided into separate costal lobe and sacculus, or divided more distally into two lobes; costa often with variously-shaped process at base; sacculus variable, but often with apex narrow, or tapered and pointed, and dentate or spinulose. Coremata weak to moderately well developed, or sometimes absent. Transtilla weakly sclerotized. Saccus (in *taiwana* only) slightly bifurcate with widely diverging lobes. Aedeagus short and moderately broad, usually with posterior part more sclerotized and with large area of spinules, but occasionally without spinules; occasionally with two posterior processes; vesica usually without cornuti but occasionally with a small cornutus.

Female genitalia (Fig. 140): Sternite 8 lightly to moderately sclerotized. Apophyses anteriores extremely short, much shorter than apophyses posteriores. Very broad, wrinkled and sclerotized region present around ostium; sometimes with rounded and wrinkled lamella postvaginalis. Ductus bursae without distinct antrum; ductus bursae very short, moderately sclero-

tized or almost membranous, fairly narrow but broader than in *Dindicodes*. Corpus bursae large, membranous, or lightly sclerotized and wrinkled at posterior end; signum absent.

Diagnosis: Moths of *Lophophelma* can usually be recognized by a combination of the following characters (not necessarily all present in each species): dark striations on fore and hind wings, postmedial line often well marked and strongly dentate, and hind wing elongate. Other genera that have striations on both fore and hind wings are *Pachista* and *Metallophilia*, but *Lophophelma* does not have the basal dark markings on the underside of the wings that are characteristic of *Pachista*, or the dark-ringed pale-centred discal spots of *Metallophilia*. The *apicalis*-group of *Dindicodes* also have striations on both wings, but they have a much larger yellow zone on the underside than the small yellow patch diffused from the base of the wing that occurs in some species of *Lophophelma*. In the male genitalia the valva is extremely variable, but the sacculus often terminates in a narrow or pointed process. This is by no means unique to *Lophophelma*, but when present it does distinguish the genus from *Pachyodes*, which resembles *Lophophelma* in some other respects – including a large spinulose area on the aedeagus. (Holloway (1996) considers the possibility that *Lophophelma* might be paraphyletic in relation to *Pachyodes*).

Distribution: *Palaeartic Region:* China; *Oriental Region:* Brunei; Bhutan; China; India; Indonesia (Java, Sulawesi, Sumatra, Sumbawa); Malaysia; Nepal; Philippines; Singapore; Sri Lanka; Taiwan; Thailand; Vietnam.

Species included

albapex (Inoue, 1988) (*Pachyodes*) **comb. nov.** [from '*Pachyodes*'] [male genitalia photograph, Inoue (1988: fig. 2:b)]

calaurops (Prout, 1912a) [*Terpna* (*Lophophelma*)] [male and female genitalia]

costistrigaria (Moore, 1868) (*Hypochroma*) **comb. rev.** [formal publication of transfer by Han (2005), from '*Pachyodes*'] [male genitalia]

erionoma erionoma (Swinhoe, 1893) (*Pachyodes*) [male genitalia]

furvirubens (Prout, 1934b) (*Terpna*) [male genitalia]
erionoma albicomitata (Prout, 1927) (*Terpna*) [male genitalia]

erionoma kiangsiensis (Chu, 1981) (*Terpna*)

erionoma subnubigosa (Prout, 1927) (*Terpna*) [male and female genitalia]

erionoma imitaria (Sterneck, 1928) (*Terpna*)

eucryphes (West, 1930) (*Terpna*)

eupines (West, 1930) (*Terpna*)

funebrosa funebrosa (Warren, 1896c) (*Terpna*) [male genitalia]

funebrosa tenuilinea (Warren, 1899a) (*Terpna*)

iterans iterans (Prout, 1926a) (*Terpna*) **comb. nov.** [formal publication of transfer by Han (2005), from 'Pachyodes'] [male genitalia]

iterans onerosus (Inoue, 1970) (*Terpna*) **comb. nov.** [formal publication of transfer by Han (2005), from 'Pachyodes']

loncheres (Prout, 1931b) (*Terpna*) [male genitalia]

luteipes luteipes (Felder & Rogenhofer, 1875) (*Pachyodes*) [male genitalia]

similis (Moore, 1888) (*Pingasa*)

luteipes enthusiasts (Prout, 1927) (*Terpna*) [male and female genitalia]

neonoma (Hampson, 1907) (*Pseudoterpna*) [male genitalia]

niveata (Debauche, 1941) (*Terpna*) [male genitalia]

obtecta (Debauche, 1941) (*Terpna*) [male genitalia]

pingbiana (Chu, 1981) (*Terpna*) **comb. nov.** [formal publication of transfer by Han (2005), from *Terpna*]

rubroviridata (Warren, 1898) (*Terpna*) [male genitalia]

ruficosta (Hampson, 1891) (*Pachyodes*) [male genitalia]

taiwana (Wileman, 1912) (*Pachyodes*) **comb. rev.** [formal publication of transfer by Han (2005), from 'Pachyodes'] [male genitalia]

varicoloraria (Moore, 1868) (*Hypochroma*) **comb. rev.** [formal publication of transfer by Han (2005), from 'Pachyodes'] [male genitalia]

vigens vigens (Butler, 1880) (*Hypochroma*) [male genitalia]

vigens ruficoloraria (Warren, 1897a) (*Terpna*) [female genitalia]

METALLOLOPHIA WARREN, 1895

(FIGS 20, 67, 105, 141)

Metallolophia Warren, 1895: 88. Type species: *Hypochroma vitticosta* Walker, 1860, by original designation. Han, Galsworthy & Xue, [2004]. [Cited in Pseudoterpnini by Holloway, 1996.]

Adults (Fig. 20): Antenna variable in male, bipectinate but with short rami, or simple filiform, or lamellate (e.g. in type species, *vitticosta*); simple filiform in female. Frons protruding slightly to moderately. Labial palpus short, strong, third segment minute in male, in female sometimes slightly elongate.

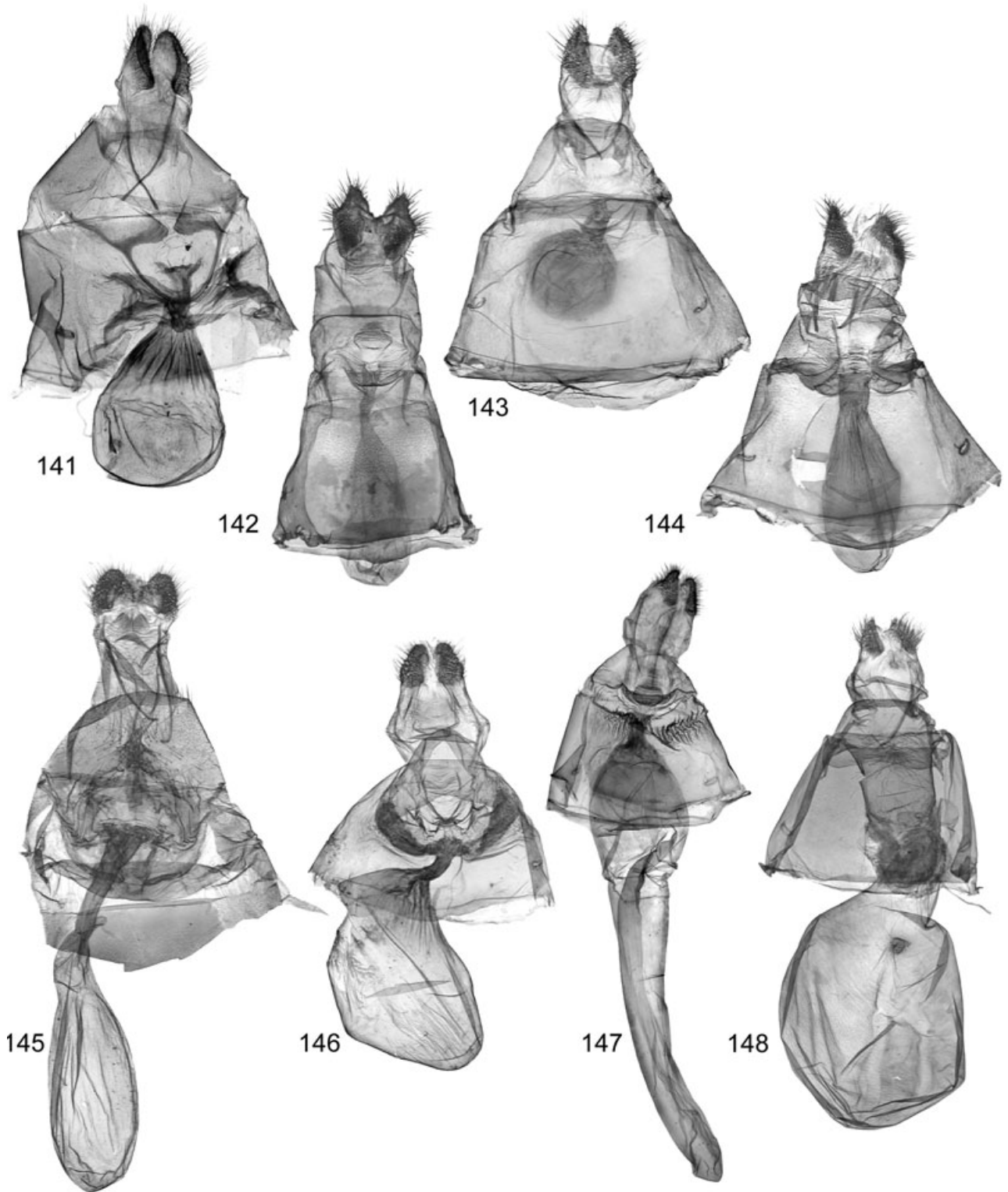
Wing pattern: wings with a degree of sheen; usually diffused greenish, brownish, and often with a tinge of purple; fore wing often with a broad, pale, diffuse or distinct, band or zone below costa. Antemedial and postmedial lines sinuous or dentate, postmedial distinct or indistinct, usually strongly angled or curved in

upper half of fore wing, or occasionally not angled; submarginal line usually indistinct. Fore and hind wings with discal spot, usually pale-centred and bounded by a dark line, often large on fore wing. Underside: fore and hind wings with basal zone (to postmedial line) often paler, purple-tinged, and with strong yellow spreading from base; outer zone usually a broad purplish or brown band, sometimes also with broad postmedial line; fore wing with large discal spot, pale-centred or not, and usually with a black or dark purple spot basal to discal spot, and a purplish streak below the basal spot; hind wing with discal spot large or small, pale-centred or solid, or absent. Outer margin of wings wavy or smooth; hind wing with costa occasionally short, anal margin slightly to distinctly elongate. Veins Rs and M₁ of hind wing not usually stalked but on a stalk in *variegata*.

Hind tibia of male with or without hair pencil. Abdomen with small to well-developed dorsal crests, sometimes 'metallic' and glossy. Sternite 3 of male abdomen often with but sometimes without a pair of setal patches, sometimes the two patches merging.

Male genitalia (Figs 67, 105): Uncus weakly developed, very short and rounded or subtriangular, hollow and open ventrally. Socii very large and stout, close together but diverging apically, tapered and forming a point at apex. Gnathos often with a pair of weakly sclerotized, usually well separated, median lobes or narrow processes, or merely slightly expanded at median region. Valva broad, sometimes appearing divided but with costal lobe much larger than sacculus; valva with well-sclerotized costa, sacculus, and basal lobe (a large lobe extending from base of valva often to mid-length of valva), but other areas of valva weakly sclerotized; costa expanded apically and with a dense patch of ramose-tipped setae; sacculus forming a strong process, narrow or club-shaped, spinose or spinulose (chiefly at apex); basal lobe of valva usually from well developed to weak or absent. Transtilla often weakly developed, with a pair of arms sometimes projecting posteriorly. Anellus often lightly sclerotized. Saccus often not projecting distinctly, but projecting and rounded in some species. Aedeagus moderately slender to moderately broad, with a sclerotized finger-like posterior process bearing a row of short spines; vesica with large cornutus, often slightly bifid at apex.

Female genitalia (Fig. 141). Anterior margin of sternite 8 usually extended ventrally as a narrow sclerotized ring, but occasionally weak or unmodified (this structure is possibly formed from modified apophyses anteriores, which are otherwise absent). Broad region around ostium often lightly to moderately sclerotized and wrinkled; lamella postvaginalis indistinct or



Figures 141–148. Female genitalia. 141, *Metallolophia devecisi*; 142, *Metaterpna differens*; 143, *Mictoschema swierstrai*; 144, *Mimandria insularis*; 145, *Orthorisma netunaria*; 146, *Pachista superans*; 147, *Pachyodes amplificata*; 148, *Paraterpna harrisoni*.

occasionally distinct. Ductus bursae short to moderate length, usually broad and sometimes very broad; without distinct antrum. Corpus bursae small to large, mainly membranous but sometimes lightly sclerotized and wrinkled at posterior end; signum absent.

Diagnosis: The usually pale-centred discal spots of *Metallolophia* are distinctive except that similar ones occur in some species of *Aeolochroma* and *Rhuma*. However, *Metallolophia* alone has the characteristic markings on the underside of the fore wing, of dark marks basal to a large discal spot. *Metallolophia* is unusual in the structure of the valva of the male genitalia, which has a ramose-tipped setal patch on the costa, and a large basal lobe. In the female genitalia, the narrow sclerotized ring usually extending from the anterior margin of sternite 8 (but not in the type species *vitticosta*) is also unique.

Distribution: *Palearctic Region:* China; *Oriental Region:* Brunei; China; India; Indonesia (Sumatra); Malaysia; Philippines; Thailand; Vietnam.

Species included

albescens Inoue, 1992 (*Metallolophia*) [male and female genitalia]

ostrumaria Xue, 1992 (*Metallolophia*) [synonymized by Han & Xue, [2004]]

arenaria (Leech, 1889) (*Pachyodes*) [male and female genitalia]

danielaria (Oberthür, 1913) (*Hypochroma*)

assamensis Orhant, 2000 (*Metallolophia*) [male genitalia]

cineracea Holloway, 1996 (*Metallolophia*) [male and female genitalia]

cuneataria Han & Xue, [2004] (*Metallolophia*) [male and female genitalia]

devecisi Herbulot, 1989 (*Metallolophia*) [male and female genitalia]

flavomaculata Han & Xue, [2004] (*Metallolophia*) [male genitalia]

inanelaria Han & Xue, [2004] (*Metallolophia*) [female genitalia]

medullosa Inoue, 1988 (*Metallolophia*) [male and female genitalia]

ocellata (Warren, 1897b) (*Terpna* (?)) [male genitalia]

opalina (Warren, 1893) (*Terpna*) [male and female genitalia]

purpurivenata Han & Xue, [2004] (*Metallolophia*) [male and female genitalia]

stueningi Han & Xue, [2004] (*Metallolophia*) [male genitalia]

subradiata (Warren, 1897c) (*Terpna*) [male and female genitalia]

variegata Holloway, 1996 (*Metallolophia*) [male genitalia]

vitticosta (Walker, 1860) (*Hypochroma*) [male and female genitalia]

METATERPNA YAZAKI, 1992

(FIGS 21, 68, 106, 142)

Metaterpna Yazaki, 1992: 8. Type species: *Terpna differens* Warren, 1909. Genus currently under study by HX. Han and D. Stünig. [Type species previously included in *Pachyodes*, which was cited in Pseudoterpnini by Holloway, 1996; *Metaterpna* is here formally assigned to Pseudoterpnini.]

Adults (Fig. 21): Antenna bipectinate with short rami in male, simple filiform in female. Frons protruding slightly to moderately, rough-scaled. Labial palpus with third segment of moderate length in male, longer in female.

Wing pattern: fore wing brown, sometimes olive-tinged; antemedial line pronounced, black and oblique; black postmedial line dentate and angled; with pinkish white or indistinct red brown subapical patch outside postmedial line (*thyatiraria* with another large whitish patch at anal angle); submarginal line indistinct. Hind wing with very large basal zone (to postmedial line) cream or greyish, outwards from postmedial line with diffuse darker band or olive and dark brown markings; postmedial line mainly smooth, lower half sometimes weak, with another dark brown line (dentate and entire or broken) situated along innerside. Discal spot on upper side and underside of wings forming a narrow dash, or sometimes absent on hind wing. Underside: generally somewhat fainter than upper side, except postmedial line often dark and distinct. Outer margin of wings wavy; hind wing with costa moderate in length and anal margin slightly elongate.

Hind tibia without hair-pencil. Dorsal crests moderately developed on thorax and strong on abdomen. Sternite 3 of abdomen without setal patches.

Male genitalia (Figs 68, 106): Uncus strongly developed and fairly stout, with apex slightly bifid or with a pair of diverging processes. Socii very large, tapered, sclerotized part situated posteriorly from base of uncus, reaching to level of apex of uncus or projecting beyond it, and strongly diverging. Gnathos with median region expanded, tongue-like and spinulose; lateral arms expanded and strongly developed, forming a short lobe near where the base adjoins the uncus. Valva not divided, broad but tapered apically; costa convexly curved and expanded, with process at base, small and blunt, or finger-like and spinulose; sacculus a rounded lobe, distinct or indistinct, with a curved ventral ridge forming a shallow pocket medially, and a wavy ridge at base, near lower margin. Coremata absent. Transtilla with a pair of lightly sclerotized

arms. Saccus projecting and rounded. Aedeagus slender, with long narrow pointed apical process.

Female genitalia (Fig. 142): Ovipositor valves strongly sclerotized, irregularly papillate and with a few ridges on inner margin. Apophyses anteriores much shorter than apophyses posteriores. Very broad, sclerotized and sometimes wrinkled, region present around ostium, sometimes forming a band; lamella postvaginalis well defined. Ductus bursae narrow and fairly long, without distinct antrum. Corpus bursae moderately small, membranous; signum absent.

Diagnosis: *Metaterpna* can usually be recognized by the wing pattern, in which the hind wing is paler than the fore wing, and has a distinct postmedial line. A similar postmedial line occurs occasionally in *Dindica* (e.g. *limatula*), but *Metaterpna* differs distinctly from *Dindica* in having the valva undivided in the male genitalia. *Metaterpna* is characterized by its genitalia, with basal lobes on the gnathos arms in the male. The combination of large socii and a bifid uncus is another distinctive character, except that it is seen also in some species of *Herochroma*. The ovipositor lobes of the female of *Metaterpna* are more strongly sclerotized and irregularly shaped than in other Pseudoterpnini.

Distribution: Palaearctic Region: China; *Oriental Region:* China; India; Nepal.

Species included

differens (Warren, 1909) (*Terpna*) [male and female genitalia]

thyatiraria (Oberthür, 1913) (*Hypochroma*) [male and female genitalia]

thyatiroides (Sterneck, 1928) (*Dindica*)

MICTOSCHEMA PROUT, 1922A

(FIGS 22, 69, 107, 143)

Mictoschema Prout, 1922a: 153. Type species: *Mictoschema swierstrai* Prout, 1922a. [Here assigned to Pseudoterpnini.]

Adults (Fig. 22): Antenna bipectinate to near apex in male, lamellate in female. Frons sometimes protruding slightly, blackish brown and smooth scaled. Proboscis absent. Labial palpus with third segment very short in male, sometimes slightly longer in female.

Wing pattern: mottled mid to dark grey-brown; fore wing with slightly wavy antemedial line, postmedial line irregularly dentate, lines occasionally faint; diffuse submarginal line cream coloured but often broken and indistinct; discal spot usually present on fore and hind wings, sometimes just a tiny dot. Underside of wings paler than upper side and lines absent or indistinct; usually with faint, diffuse, darker outer band, present at least apically on fore wing, and sometimes

on hind wing but usually very weak; discal spots more distinct than on upper side. Outer margin of wings very slightly wavy; hind wing with costa often fairly short, anal margin usually elongate. Frenulum and retinaculum absent.

Hind tibia without hair pencil; with either one or two pairs of spurs. Thorax and abdomen with dorsal crests. Sternite 3 of abdomen without setal patches.

Male genitalia (Figs 69, 107): Genitalia not heavily sclerotized. Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half fused, prongs slender and very close together, diverging slightly apically. Gnathos with median region expanded and large, but only lightly sclerotized and without spinules. Valva not divided, fairly narrow and more or less parallel-sided; with low ventral ridge running from base towards apex, but without processes and without costal band. Coremata absent. Transtilla arms very weakly sclerotized, very broad and forming a pair of shallow pouches anteriorly. Saccus projecting with a blunt or slightly rounded apex. Aedeagus fairly short and lightly sclerotized; vesica without obvious cornuti.

Female genitalia (Fig. 143): Genitalia largely unsclerotized. Apophyses anteriores very short, much shorter than apophyses posteriores. Some wrinkles present around ostium, but only weakly sclerotized. Ductus bursae very short, with lightly sclerotized antrum forming an incomplete collar. Corpus bursae very small and round; signum absent.

Diagnosis: Moths of *Mictoschema* are fairly plain on the underside, like those of *Aplasta*, *Holoterpna*, *Pseudoterpna* and *Mimandria*, but *Mictoschema* moths are more strongly mottled brown over the entire wing, compared with the others. These genera share characters of loss or reduction of the proboscis and/or the frenulum, but to varying degree, and the absence of both proboscis and frenulum distinguishes *Mictoschema* from *Mimandria* and *Pseudoterpna*. The male genitalia of *Mictoschema* are distinguished from those of most of the above genera in having the valvae almost simple, not divided as in *Mimandria*, or with a spinose harpe as in *Aplasta* and *Pseudoterpna*. The genitalia of *Mictoschema* are most similar to those of *Holoterpna*, except that the gnathos of the latter genus has a smaller, although stronger, median region that is tongue-like and minutely spinulose. [See also the discussion under *Aplasta*.]

Distribution: Afrotropical Region: Botswana; Namibia; South Africa; Zimbabwe.

Species included

swierstrai Prout, 1922a (*Mictoschema*) [male and female genitalia]

tuckeri Prout, 1925 (*Mictoschema*) [male genitalia]

MIMANDRIA WARREN, 1895

(FIGS 23, 70, 108, 144)

Mimandria Warren, 1895: 88. Type species: *Mimandria insularis* Swinhoe, 1904. [Cited in Pseudoterpnini by Hausmann, 1996a.]

Adults (Fig. 23): Moths small (compare scale of Fig. 23 with Figs 13, 14 of *Herochroma*). Antenna bipectinate usually almost to apex, in both sexes but sometimes with extremely short rami in female. Frons sometimes protruding slightly, black or dark brown and smooth scaled. Proboscis reduced. Labial palpus with third segment short in male, longer in female.

Wing pattern: straw-coloured, or greyish green or brown, mottled; fore wing with wavy antemedial line, postmedial line dentate and curved, submarginal line white but often indistinct and near postmedial line; row of small reddish brown spots with white edges outside postmedial line and mingling with submarginal line; discal spot present on fore and hind wings, often small or indistinct but moderate sized, on fore wing sometimes as a dash. Underside: mainly paler and plainer than upper side, postmedial line occasionally distinct but usually faint or absent, without row of spots; with or without darker but fairly weak, diffuse, and broken outer band; discal spots varying from fairly distinct to extremely faint. Outer margin of wings very slightly wavy or almost smooth; hind wing rounded, with costa of moderate length and anal margin fairly elongate.

Hind tibia usually without hair-pencil. Abdomen usually with low dorsal crests, often with a dark mark on either side of each; sternite 3 without setal patches.

Male genitalia (Figs 70, 108): Genitalia not heavily sclerotized. Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half to two-thirds fused, prongs slender, tapered and very close together. Gnathos arms, but not median projection, fused with membrane of diaphragma; median region expanded and flat, with tiny pimple-like ridges. Valva divided into long costal lobe, finger-like or tapered, and much shorter sacculus, rounded and with a distal row or group of spines; sacculus either rigidly folded over costal lobe of valva and fused basally with diaphragma (*insularis*), or diverging from costal lobe and not fused basally (*cataractae*); costal margin of valva slightly curved convexly. Coremata absent. Transtilla arms joined as a weakly sclerotized loop, projecting strongly posteriorly, and forming a pair of pouches anteriorly. Saccus projecting distinctly or sometimes only slightly. Aedeagus with posterior sclerotized tongue-like extension; vesica with one or more caeca, and with a patch of cornuti (spines, or wrinkled

and somewhat sclerotized region with minute pimple-like spinules.

Female genitalia (Fig. 144): Apophyses anteriores very short, much shorter than apophyses posteriores. Wrinkled region present around ostium (with lamella postvaginalis but not strongly defined), mainly membranous or sometimes partly sclerotized. Ductus bursae very short, with or without antrum lightly sclerotized and forming an incomplete collar. Corpus bursae fairly small or elongate, membranous; signum absent.

Diagnosis: *Mimandria* closely resembles *Epipristis*, and to some extent *Herochroma* (a genus of usually larger moths), in the wing pattern, having a lacy band of whitish-edged spots between the postmedial and submarginal lines. [N.B. *Mimandria* occurs only in the Afrotropical Region, and *Epipristis* and *Herochroma* do not occur there.] The underside of *Mimandria* is plainer though, and the proboscis is reduced, features in common with *Aplasta*, *Holoterpna*, *Mictoschema* and (with plain underside but proboscis not reduced) *Pseudoterpna*, none of which has a band of lacy markings on the upper side of the wings. [See also the discussion under *Aplasta*.] The male genitalia of *Mimandria* are distinguished from those of the above genera (except some species of *Herochroma*) in having the valva divided, and from *Herochroma* in having the socii very close together, not diverging. *Mimandria* and the *flavibasalis*-group of *Herochroma* are unusual in having the gnathos arms fused with the diaphragma, but not also the median projection of the gnathos as in *Crypsiphona* and *Paraterpna*.

Distribution: *Afrotropical Region*: Angola; Kenya; Madagascar; Mauritius; Namibia; Réunion; South Africa; Zimbabwe.

Species included

- cataractae cataractae* Prout, 1917b (*Mimandria*) [male and female genitalia]
- cataractae rhusiodocha* Prout, 1934a (*Mimandria*)
- diospyrata* (Boisduval, 1833) (*Geometra*)
- insularis* Swinhoe, 1904 (*Mimandria*) [male and female genitalia]
- kely* Viette, 1971 (*Mimandria*)
- recognita* (Saalmüller, 1891) (*Hypochroma*)

ORTHORISMA PROUT, 1912B

(FIGS 24, 48, 71, 109, 145)

Orthorisma Prout, 1912b: 181. Type species: *Hypochroma netunaria* Guenée, [1858]. [Replacement name.] [Cited in Pseudoterpnini by Holloway, 1996.] *Orthocraspeda* Prout, 1912a: 11 (key), 28. Type species: *Hypochroma netunaria* Guenée, [1858]. [Junior

homonym of *Orthocraspeda* Hampson, [1893] 1892 (Lepidoptera: Limacodidae).]

Adults (Figs 24, 48): Antenna simple filiform in both sexes but thick in male. Frons protruding slightly to moderately, dark brown or black and smooth-scaled, but with a white or cream line at lower edge and a band between the antennae. Labial palpus not rough-scaled; with third segment fairly elongate in female, shorter but not very short in male.

Wing pattern: ranging from pale brown to olive-green, with dark brown or black speckles and other markings; antemedial line wavy; postmedial line wavy or dentate, well defined, distinctly angled at vein M_3 and concave above angle, without whitish shading but with dark speckles forming a diffuse band on outer side (at least towards costa), these speckles sometimes forming a broken submarginal line; discal spot forming a comma-like dash or sometimes broken into two spots on the fore wing, and an indistinct dash or dot on the hind wing. Underside: fore and hind wings with basal zone (to postmedial line) whitish or cream; outer zone with dark brown band, shading paler to outer margin of fore wing, and with more distinct pale area at margin of hind wing; discal spot black-brown, a dash (usually moderate-sized) on the fore wing, a very faint dash or dot on the hind wing. Outer margin of wings slightly wavy to almost smooth; hind wing rounded, with costa fairly short and anal margin slightly to moderately elongate.

Hind tibia of male with hair-pencil. Abdomen with dorsal crests. Sternite 3 of abdomen without setal patches; segment 8 of male with sclerotized processes at posterior end: large processes on tergite, smaller medial process on sternite.

Male genitalia (Figs 71, 109): Uncus large, broader than long and bilobed; socii sclerotized but not strongly developed. Gnathos with large, strongly bilobed, median process, minutely spinulose in part. Valva moderately long and narrow, simple, not divided, and without processes other than some low basal ridges and furrows. Coremata long. Transtilla a lightly sclerotized band produced as a pair of pouch-like projections anteriorly. Saccus protruding, squarish or slightly rounded. Aedeagus slender, without a posterior projection; vesica with cornuti, a large region of tiny spinules.

Female genitalia (Fig. 145): Apophyses anteriores absent. Sternite 8 forming medial pair of setose sclerotized lobes, well posterior to very broad complex region present around ostium; the latter region with sclerotized ridges and lobes, including a pair of setose lobes flanking ostium. Ductus bursae long and slender, with ridges and wrinkles. Corpus bursae membranous and fairly slender; signum absent.

Diagnosis: Moths of *Orthorisma* can be recognized by their distinctive postmedial line on the fore wing: well defined, angled and concave above the angle. More distinctive characters are the broad bilobed uncus of the male genitalia, and the large processes on the male abdominal tergite 8.

Distribution: Oriental Region: Brunei; Malaysia (Sabah, Sarawak); Indonesia (Kalimantan, Natuna Islands, Sumatra (Holloway, 1996)).

Species included

netunaria (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]

crassistriga (Warren 1896d) (*Terpna*)

unicolor (Warren 1899a) (*Actenochroma*)

PACHISTA PROUT, 1912A

(FIGS 25, 72, 110, 146)

Pachista Prout, 1912a: 40. Type species: *Hypochroma superans* Butler, 1878. Han, Li & Xue (2006). [Historical treatment of *Pachista* as a subgenus of *Terpna*, by Prout (1912a, 1927) indicates its inclusion, here confirmed, in Pseudoterpnini (of which *Terpnini* is a synonym).]

Adults (Fig. 25): Moths: male moderately large but female larger. Antenna bipectinate in both sexes, rami shorter in female than in male. Frons protruding strongly. Labial palpus with third segment barely elongate in female.

Wing pattern: grey-brown with fine dark striations; fore wing with black sub-basal line, wavy antemedial line and postmedial line black towards costa, where each forms a black spot, but lines mostly fainter elsewhere on wings, postmedial line with white shading on outer side, postmedial line dentate, angled on fore wing, submarginal line white, dentate but not very distinct; discal spot forming a long black dash. Underside: wings with large basal zone (to postmedial line) mainly whitish but with dull yellow spreading diffusely from base; outer zone with a dark brown band, wavy at inner margin (i.e. at postmedial line); wings with large blackish discal spot, and with a smaller blackish spot basal from discal spot and a blackish streak below basal spot. Outer margin of wings slightly wavy; hind wing with costa short and anal margin elongate.

Hind tibia without hair-pencil. Abdomen with dorsal crests usually prominent; sternite 3 without setal patches.

Male genitalia (Figs 72, 110): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal two-thirds fused, prongs close together, almost straight. Gnathos with median process tongue-like, spinulose. Valva broad and well sclerotized, slightly

divided for a short length distally, with median ridge between costal lobe and sacculus forming a large rounded sclerite; costal apex curved outwards, sacculus with irregularly dentate apex, and with rugose-edged setose median area. Coremata small and weak. Transtilla weakly developed. Saccus protruding and rounded. Aedeagus long and with posterior part broader, well-sclerotized and with a large area of spinules, vesica with a large wrinkled plate-like cornutus.

Female genitalia (Fig. 146): Ovipositor valves strongly papillate and setose. Apophyses anteriores absent. Very broad, wrinkled and sclerotized, region present around ostium. Ductus bursae very short and narrow; without distinct antrum. Corpus bursae large and broad, membranous; signum absent.

Diagnosis: *Pachista* is one of only a few genera in the Pseudoterpnini with the antennae bipectinate in the female [the others are *Limbatochlamys*, *Lophothorax*, *Mimandria*, *Holoterpna* (sometimes), and *Lophophelma* and *Psilotagma* (one species each)], whereas in other genera they are usually simple filiform. *Pachista* is distinctive in having two dark markings, in addition to the large discal spot and outer band, on the underside of both fore and hind wings. That character is shared with a few members of *Metallolophia*, but *Metallolophia* can usually be distinguished by pale-centred discal spots on the upper surface of the wings. A unique character is present in the valva of the male genitalia: the large rounded sclerite formed from the ridge between the costal lobe and the sacculus.

Biological notes: Host plants: Magnoliaceae: *Magnolia* spp. (Sugi, 1987: 271) and Hippocastanaceae: *Aesculus* (Inoue, 1961: 90). The larva is white-tinged green, fairly short, stout, but sometimes appearing slightly flattened along the lateral ridge (a white line), and with a projecting pointed head; it is figured, in a rigid resting posture, by Sugi (1987: pl. 14, fig. 1), and <http://aoki2.si.gunmau.ac.jp/youtyuu/HTMLs/ooyashaku.html>.

Distribution: *Palaeartic Region:* China; Japan; Korea (Shin, 1996).

Species included

superans (Butler, 1878) (*Hypochroma*) [male and female genitalia]
shirakiana (Matsumura, 1931) (*Pingasa*)

PACHYODES GUENÉE, [1858]
 (FIGS 26, 27, 73, 111, 147)

Pachyodes Guenée, [1858]: 282. Type species: *Pachyodes almaria* Guenée, [1858] (junior synonym of

Pachyodes haemataria (Herrich-Schäffer, [1854])). [Previously included in *Terpna*, by Prout (1912a, 1927); *Pachyodes* cited in Pseudoterpnini (of which Terpnini is a synonym) by Holloway, 1996.]

Archaeopseustes Warren, 1894a: 380. Type species: *Abraxas amplificata* Walker, 1862. [Synonymized by Warren: 1894b: 681.]

Adults (Figs 26, 27): Moths large (compare scale of Figs 26, 27 with Figs 13, 14 of *Herochroma*). Antenna bipectinate in male, simple filiform in female. Frons protruding strongly, with distinct broad black transverse median band complete or occasionally broken. Labial palpus short, sometimes third segment slightly elongate in female.

Wing pattern: usually dull white, diffused with grey-green; fore wing with costa diffused with longitudinal, purple-red tinged, brown striations, extending downwards in the region between antemedial line and discal spot, then tapering off gradually; apex with purple-red tinged brown patch, occasionally with similarly coloured patch extending from base of hind wing to discal spot. Antemedial line not strongly wavy, postmedial line (angled or curved, white with black dots at veins) and submarginal line (white) wavy or dentate; fore wing with sub-basal line in addition to other lines. Hind wing with longitudinal purple-brown or black bar near outer margin, between veins CuA₁ and CuA₂, at border of grey-green patch at anal angle. Underside: wing base strong yellow; fore and hind wings usually with large black discal spot; area between yellow base and discal spot usually with brown or blackish markings (except in *pratti*); outer zone of wings (outside postmedial line) occasionally a blackish band but usually composed of separate spots. [A few species (*amplificata* and *leucomelanaria*) with somewhat different wing pattern: wings (above) dull white diffused with grey-brown striations and blotches; outer margin of wings diffused with strong yellow, particularly at anal angle of hind wing.] Outer margin of fore wing barely wavy, hind wing margin not much rounded, sometimes oblique; hind wing with costa not particularly short but with anal margin elongate.

Hind tibia of male sometimes with hair-pencil and terminal tuft. Abdomen with well-developed dorsal crests. Sternite 3 of male abdomen with a pair of setal patches [character not visible in the damaged abdomen examined of *pratti*].

Male genitalia (Figs 73, 111): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal two-thirds fused, prongs very close together, straight and forming a tiny point at apex. Gnathos with narrow median process, pointed tongue- or V-shaped, spinulose. Valva well sclerotized, well divided into two large lobes (costal lobe and sacculus), of similar length or the costal lobe a little shorter, not very

narrow, without distal processes (merely with a series of tiny teeth around the margin of the sacculus); costal lobe with blunt or rounded apex and with a low process or ridge across lower half, irregularly wrinkled; sacculus broader, with rounded apex. Coremata well developed. Transtilla with pair of arms not joined, bulbous and weakly sclerotized. Saccus protruding distinctly, with rounded apex. Aedeagus short and posteriorly broad; more sclerotized posteriorly and with large area of spinules; vesica without cornuti.

Female genitalia (Fig. 147): Apophyses anteriores extremely short, much shorter than apophyses posteriores. Very broad, wrinkled and sclerotized, region present around ostium; lamella postvaginalis often rounded, occasionally weakly defined. Ductus bursae moderately to very short; without distinct antrum. Corpus bursae large, broad or elongate, membranous; signum absent.

Diagnosis: Moths of *Pachyodes* are usually easily recognized by the longitudinal reddish-brown striations on the fore wing (but not on the hind wing), and often also by the longitudinal bar between CuA₁ and CuA₂ on the hind wing. The valva of the male genitalia is characteristic throughout the genus in being well divided into two large lobes of similar length, or the costal lobe a little shorter, and which are neither very narrow nor have distal processes.

Distribution: Palaearctic Region: China; *Oriental Region:* Brunei; China; India; Indonesia (Kalimantan, Sumatra); Malaysia (Peninsular, Sarawak); Nepal; Philippines; Thailand; Vietnam.

Species included

amplificata (Walker, 1862) (*Abraxas*) [male and female genitalia]

abraxas (Oberthür, 1913) (*Hypochroma*)

haemataria (Herrich-Schäffer, [1854]) (*Terpna*) [male and female genitalia]

almaria Guenée, [1858] (*Pachyodes*)

leucomelanaria Poujade, 1895 (*Pachyodes*)

ornataria Moore, 1888 (*Pachyodes*) [placed in '*Pachyodes*' in Scoble (1999)] [male genitalia]

pratti (Prout, 1927) (*Terpna*) [male genitalia and female genitalia]

subtrita subtrita (Prout, 1914) (*Terpna*) [male genitalia]

subtrita simplicior (Joannis, 1929) (*Terpna*)

PARATERPNA GOLDFINCH, 1929

(FIGS 28, 49, 74, 112, 148)

Paraterpna Goldfinch, 1929: 401. Type species:

Paraterpna harrisoni Goldfinch, 1929. [Here assigned to *Pseudoterpnini*.]

Adults (Figs 28, 49): Antenna of male bipectinate in basal three-quarters or more, with short rami; simple filiform in female. Frons not protruding significantly but densely scaled, frons with a median transverse band that is dark greyish brown, whitish below and white above. Labial palpus with third segment fairly short in male, slightly longer in female.

Wing pattern: white mottled with grey and brown, with grey-brown lines on veins, distinct on fore wing and fainter or incomplete on hind wing; antemedial and postmedial lines strongly dentate; postmedial line distinct and strongly sinuous on fore wing, but weak on hind wing; whitish submarginal line on fore and hind wings broken and indistinct. Hind wing with pale basal zone and diffusely darker outer zone; discal spot indistinct on fore wing but present as a faint grey or brown line in pale basal zone on hind wing. Underside: wings with very large whitish or pale greyish brown zone, with blackish brown band or blotch in outer zone (large band strongly contrasting on hind wing, smaller blotch on fore wing); dark discal spot present as a dash on fore and hind wings. Outer margin of wings wavy, particularly hind wing; fore wing elongate; hind wing with costa and anal margin fairly long.

Thorax and tegulae with dense covering of long hair-like scales dorsally. Hind tibia of male with hair pencil. Abdomen with black dorsal markings in a longitudinal line; sternite 3 of male with a pair of widely spaced setal patches; segment 8 of male with a truncate sclerotized lobe at posterior end of tergite.

Male genitalia (Figs 74, 112): Uncus vestigial. Socii very strongly developed, large and sclerotized, densely setose, pressed together from sub-basally to near mid-length, apical halves tapered and pointed, diverging and slightly curved outwards. Gnathos a long U-shape, entirely fused with membrane of diaphragma and with posterior end of transtilla. Valva divided from near base, forming three moderately to extremely long and narrow lobes; costal lobes asymmetrical. Coremata absent. Transtilla arched posteriorly and with a pair of pouches. Juxta with V-shaped postero-ventral margin. Saccus protruding distinctly. Aedeagus moderately broad, with a few posterior ridges, and with a large posterior spine pointing slightly towards anterior end.

Female genitalia (Fig. 148). Ovipositor valves strongly papillate and setose. Apophyses anteriores very short, much shorter than apophyses posteriores. Antrum moderately sclerotized and smooth, large and very broad, with ostial opening approximately as broad as sternite 8. Sternite 7 with medio-posterior field of spine-like setae. Corpus bursae pear-shaped and membranous; signum present as a small, minutely spinulose, patch.

Diagnosis: The general greyish colour of the moths, with dark streaks mainly along the veins, is characteristic and only likely to cause confusion with the very similar *Cyneoterpna*. The male genitalia differ distinctly: in *Paraterpna* the gnathos is well developed and the valva is composed of three lobes, whereas in *Cyneoterpna* the gnathos is absent and the valva is composed of two lobes with a ridge between them. *Paraterpna* shares some highly unusual characters with another genus, *Crypsiphona*, (although the external features of the moths differ – compare Fig. 28 of *Paraterpna* with Figs 5, 6 of *Crypsiphona*): both genera have the gnathos entirely fused with the membrane of the diaphragma. [*Mimandria* and the *flavibasalis*-group of *Herochroma* also have the gnathos arms fused with the membrane of the diaphragma, but not the median projection of the gnathos.] *Paraterpna* and *Crypsiphona* have similar socii also, which are pressed together sub-basally but not fused, and then flare outwards in the apical half (bifid in *Crypsiphona* but not in *Paraterpna*), while the uncus base is vestigial or entirely absent. In the female genitalia *Paraterpna* has a distinctively large broad antrum, and the genus is one of a minority of Pseudoterpnini that have a signum in the female.

Biological notes: Host plant(s): Myrtaceae: *Leptospermum* (McFarland, 1988: 228).

Distribution: Australasian Region: Australia (New South Wales).

Species included

harrisoni Goldfinch, 1929 (*Paraterpna*) [male and female genitalia]

PINGASA MOORE, [1887]
(FIGS 29, 75, 76, 113, 149)

Pingasa Moore, [1887] 1884–7: 419. Type species: *Hypochroma ruginaria* Guenée, [1858]. [In Terpnini sensu Inoue, 1961 (= Pseudoterpnini).]

Skorpisthes Lucas, 1900: 143. Type species: *Skorpisthes undascripta* Lucas, 1900 (junior synonym of *Pingasa cinerea* Warren). [Synonymized by Prout, 1912a: 30.]

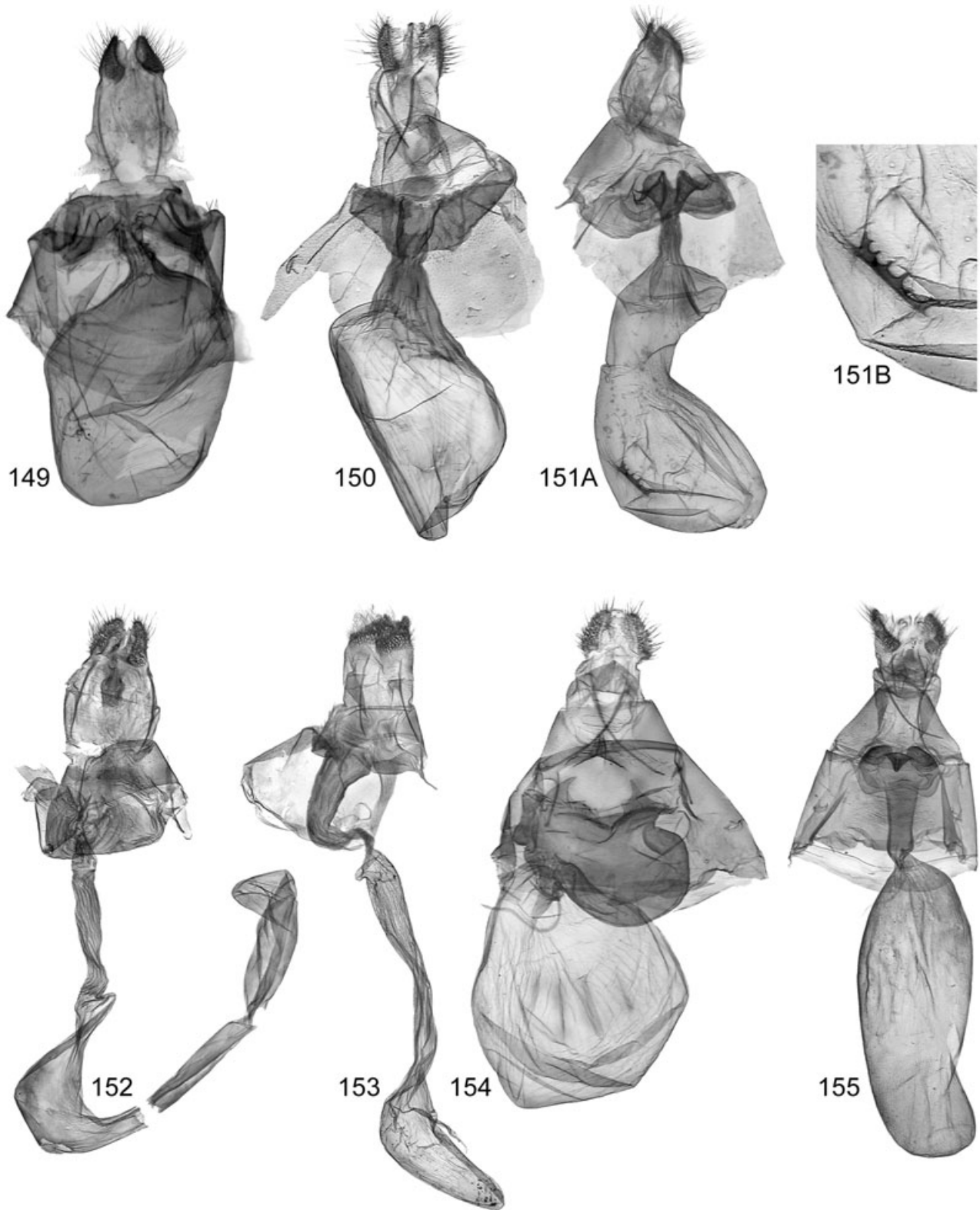
Adults (Fig. 29): Antenna bipectinate with short rami in male (proximal rami a little shorter than outer rami), simple filiform in female. Frons protruding moderately, with broad or narrow black transverse band varying (usually distinct but occasionally diffuse or absent, commonly in upper half of frons, but sometimes median or occasionally spread over all except upper margin of frons); frons usually smooth-scaled, seldom rough. Labial palpus with third segment

smooth, often moderate in length in male but occasionally tiny, elongate in female.

Wing pattern: fore wing with distinct wavy or dentate antemedial line; fore and hind wings with post-medial line usually curved or sometimes angled, irregularly dentate, or smooth but with spikes extended along veins, and with distinct or indistinct, dentate or wavy, pale submarginal line. Postmedial line divides fore and hind wings into two zones: basal zone usually pale, from white to grey-brown, and outer zone usually darker, varying from pale or dark grey, or grey-green, to pinkish or reddish brown; in those species that have outer zone much darker than basal zone, white or pale patches are usually present at middle of outer wing margin; occasionally area from antemedial line to base of fore wing similar in colour to outer zone. Underside: fore and hind wings with basal zone white, except often yellow near base of wing, seldom diffused with grey-brown; fore wing usually with discal spot distinct and often forming a dash, and hind wing with or without discal spot; outer zone various, usually with distinct band, dark brown or purplish, commonly broad but sometimes narrow or broken (especially on hind wing), or occasionally without band. Outer margin of wings slightly to moderately wavy; hind wing with costa short and anal margin elongate. Hind wing with hair brushes: one situated on the basal edge of the discal spot, and the other between the lower margin of the cell and the hind margin (hair brushes absent in *lahayei* and *multispurcata*).

Hind tibia of male with short terminal extension in most species, and with hair-pencil. Abdomen with medium-sized or small dorsal crests. Sternite 3 of male abdomen usually with a pair of setal patches, sometimes joined together by sparse setae in the middle.

Male genitalia (Figs 75, 76, 113): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half to four-fifths (approximately) fused; prongs straight and very close together. Gnathos with pair of narrow median processes, or median region expanded (occasionally very broad) and slightly to moderately bilobed, spinulose. Valvae extremely variable in shape and sometimes asymmetrical; often divided distally into costal lobe and sacculus, with sacculus approaching or often extending beyond apex of costal lobe, but valva undivided in a few species; a few species with a spinose lobe ventrally near base, or with other process. Coremata well developed or weak. Transtilla usually weakly developed but occasionally with pair of arms projecting strongly posteriorly. Anellus sometimes forming posterior plate, rarely strongly sclerotized. Juxta slightly to well sclerotized, and often with separate or weakly-joined sclerotized



Figures 149–155. Female genitalia. 149, *Pingasa pseudoterpnaria pseudoterpnaria*; 150, *Pseudoterpna pruinata*; 151A, *Psilotagma decorata*; 151B, signum of *Psilotagma decorata*; 152, *Pullichroma pullicosta*; 153, *Sundadoxa multidentata*; 154, *Aeolochroma hypochromaria*; 155, *Aeolochroma turneri*.

process situated posteriorly to it; this posterior process long and often spinulose. Saccus often not projecting distinctly but sometimes projecting and rounded. Aedeagus moderately short, sometimes with a sclerotized process (usually finger-like, arising medially and lying along the aedeagus, but occasionally a more distal tooth-like process); vesica usually with cornutus, often a strong spine or blade, but sometimes shaped otherwise or occasionally absent.

Female genitalia (Fig. 149): Apophyses anteriores short, often extremely so, and much shorter than apophyses posteriores. Moderately to very broad, slightly wrinkled, sclerotized region present around ostium, sometimes merging with lamella postvaginalis, which is usually weakly defined. Ductus bursae narrow or broad, usually short but occasionally long and membranous; without distinct antrum but entire ductus bursae often lightly to well sclerotized. Corpus bursae moderately large or occasionally small, membranous or sometimes sclerotized at posterior end, signum absent.

Diagnosis: Those species that have a well-marked dark outer band on the wings are easily recognized as *Pingasa*, but the presence of a pair of hair brushes on each hind wing is a more definitive character for the genus. *Sundadoxa* has a single hair brush and *Hypodoxa* usually has three or one, but in both those genera the hair brush is situated more basally (in relation to the discal spot) than in *Pingasa*. The male genitalia of *Pingasa* are variable, but the pair of narrow median processes on the gnathos of many species is distinctive, and, when present, the posterior process of the juxta is too.

Biological notes: Host plants: [based on Holloway, 1996: 207 (summary of records), plate 12 (larva of *ruginaria*), Robinson *et al.*, 2001, Robinson *et al.*, website, 2005, and Scoble, 1999; plus a record on *Rhodomyrtus*, with images of larvae, pupae and moths at <http://www.ccs-hk.org/DM/butterfly/Geometrid/Pingasa-chloroides.html>].

Anacardiaceae: *Anacardium*, *Buchanania*, *Euroschinus*, *Rhus*, *Schinus*, *Sclerocarya*

Aquifoliaceae: *Ilex*

Apocinaceae: *Carissa*

Araliaceae: *Cussonia*

Combretaceae: *Terminalia*

Compositae: *Gerbera*

Dipterocarpaceae: *Shorea*

Ericaceae: *Erica*

Hamamelidaceae: *Liquidambar*

Lauraceae: *Cinnamomum*, *Litsea*,

Leguminosae: *Cajanus*, *Crotalaria*, *Dalbergia*, *Lespedeza*, *Xylia*

Myrsinaceae: *Maesa*

Myrtaceae: *Eugenia*, *Psidium*, *Rhodomyrtus*

Pinaceae: *Pinus*

Rhamnaceae: *Ziziphus*

Rubiaceae: *Mussaenda*, *Wendlandia*

Rutaceae: *Flindersia*

Sapindaceae: *Dimocarpus*, *Lepisanthes*, *Litchi*, *Nephelium*

Sterculiaceae: *Sterculia*, *Triplochiton*

Ulmaceae: *Trema*

The unusual resting position of *Pingasa* moths is referred to on p. 360.

Distribution: *Palaeartic Region:* Algeria; China; Iran; Iraq (Hausmann, 1996b); Japan; Morocco; Turkmenistan; *Afrotropical Region:* Burundi; Cameroon; Comoros; Côte d'Ivoire; Ethiopia; Equatorial Guinea; Ghana; Kenya; Libya; Madagascar; Malawi; Mauritius; Nigeria (Hausmann, 1996a); Réunion; Rwanda; São Tomé & Príncipe; Saudi Arabia; Sierra Leone; South Africa; Tanzania; The Gambia; Uganda; Zaire; Zimbabwe; *Oriental Region:* Bhutan; Brunei; Cambodia; China; India (including Andaman Islands); Indonesia (Bali, Java, Kalimantan, Lombok, Mentawai Archipelago, Sulawesi, Sumatra, Sumbawa); Malaysia; Nepal; Philippines; Sabah; Sri Lanka; Taiwan; Thailand; Vietnam; *Australasian Region:* Australia; Indonesia (Irian Jaya, Moluccas); Papua New Guinea; Solomon Island.

Species included

abyssiniaria abyssiniaria (Guenée, [1858]) (*Hypochroma*)

abyssiniaria rufata Fletcher, 1956 (*Pingasa*) [male and female genitalia]

aigneri aigneri Prout, 1930b (*Pingasa*) [male genitalia photograph, Yazaki (1995: fig. 572)]

aigneri pallida Yazaki, 1995 (*Pingasa*) [male genitalia photograph, Yazaki (1995: fig. 573)]

alba alba Swinhoe, 1891 (*Pingasa*)

alba albida (Oberthür, 1913) (*Hypochroma*)

alba brunnescens Prout, 1913 (*Pingasa*) [male genitalia]

angulifera Warren, 1896b (*Pingasa*)

atrascripta Warren, 1899a (*Pingasa*)

munita (Lucas, 1901) (*Hypochroma*)

aravensis Prout, 1916a (*Pingasa*)

atropa Prout, 1935b (*Pingasa*)

blanda (Pagenstecher, 1900) (*Pseudoterpna*)

acutangula Warren, 1903 (*Pingasa*)

chlora chlora (Stoll, 1782) (*Phal[aena] Pyralis*) [male genitalia]

chloraria (Guenée, [1858]) (*Hypochroma*)

ecchloraria (Hübner, [1823]) (*Pseudoterpna*)

latifascia Warren, 1894a (*Pingasa*)

paulinaria (Pagenstecher, 1885) (*Hypochroma*)

- chlora candidaria* Warren, 1894a (*Pingasa*) [male genitalia]
chlora subdentata Warren, 1894a (*Pingasa*) [male genitalia]
chlora sublimbata (Butler, 1882) (*Hypochroma*) [male genitalia]
chloroides Galsworthy, 1998 (*Pingasa*) [male and female genitalia]
cinerea Warren, 1894a (*Pingasa*)
singularis (Kershaw, 1897) (*Pseudoterpna*)
undascripta (Lucas, 1900) (*Skorpiesthes*)
cornivalva Wiltshire, 1982 (*Pingasa*)
crenaria (Guenée, [1858]) (*Hypochroma*) [male genitalia]
distenta (Walker, 1860) (*Hypochroma*)
leucostigmata (Nietner, 1861) (*Boarmia*)
decristata Warren, 1902b (*Pingasa*)
dispensata dispensata (Walker, 1860) (*Hypochroma*)
dispensata celata (Walker, 1866) (*Hypochroma*)
dispensata delotypa Prout, 1935c (*Pingasa*)
distensaria distensaria (Walker, 1860) (*Hypochroma*?)
distensaria respondens (Walker, 1860) (*Hypochroma*) [male and female genitalia]
elutriata Prout, 1916b (*Pingasa*)
floridivenis Prout, 1920 (*Pingasa*)
grandidieri (Butler, 1879) (*Hypochroma*)
eugrapharia (Mabille, 1880) (*Hypochroma*)
griveaudi griveaudi Herbulot, 1966 (*Pingasa*)
griveaudi vinosa Herbulot, 1985 (*Pingasa*)
herbuloti Viette, 1971 (*Pingasa*)
hypoleucaria hypoleucaria (Guenée, 1862) (*Hypochroma*)
borbonisaria (Oberthür, 1913) (*Hypochroma*)
hypoleucaria rhodozona Joannis, 1932 (*Pingasa*)
hypoxantha hypoxantha Prout, 1916c (*Pingasa*)
hypoxantha holochroa Prout, 1916c (*Pingasa*)
javensis Warren, 1894a (*Pingasa*) [male genitalia]
chlora lombokensis Prout, 1927 (*Pingasa*)
lahayei lahayei (Oberthür, 1887) (*Hypochroma*)
lahayei austrina Prout, 1917b (*Pingasa*) [male genitalia]
lariaria (Walker, 1860) (*Hypochroma*) [male genitalia]
irrorataria (Moore, 1868) (*Hypochroma*)
manilensis Prout, 1916b (*Pingasa*) [male genitalia]
meekei Warren, 1907 (*Pingasa*)
multispurcata Prout, 1913 (*Pingasa*)
murphyi Herbulot, 1994 (*Pingasa*)
nobilis nobilis Prout, 1913 (*Pingasa*)
nobilis furvifrons Prout, 1927 (*Pingasa*)
pallidata (Joannis, 1913) (*Hypochroma*)
pauciflavata Prout, 1927 (*Pingasa*)
porphyrochrostes Prout, 1922b (*Pingasa*) [male genitalia]
pseudoterpnaria pseudoterpnaria (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]
pryeri (Bulter, 1878) (*Hypochroma*)
pseudoterpnaria gracilis Prout, 1916a (*Pingasa*) [male genitalia]
pseudoterpnaria tephrosiaria (Guenée, [1858]) (*Hypochroma*)
rhadamaria rhadamaria (Guenée, [1858]) (*Hypochroma*)
rhadamaria alterata (Walker, 1860) (*Hypochroma*)
rhadamaria attenuans (Walker, 1860) (*Hypochroma*)
rhadamaria signifrontaria (Mabille, 1893) (*Hypochroma*)
rhadamaria victoria Prout, 1913 (*Pingasa*)
rubicunda Warren, 1894a (*Pingasa*) [male genitalia]
rubimontana Holloway & Sommerer, 1984 (*Pingasa*) [male genitalia]
rufofasciata Moore, 1888 (*Pingasa*) [male and female genitalia]
ruginaria ruginaria (Guenée, [1858]) (*Hypochroma*) [male and female genitalia]
nyctemerata (Walker, 1860) (*Hypochroma*)
perfectaria (Walker, 1860) (*Hypochroma*)
ruginaria andamanica Prout, 1916b (*Pingasa*)
ruginaria communicans (Walker, 1860) (*Hypochroma*) [male genitalia] [appears to be not conspecific with *ruginaria ruginaria* but this needs to be confirmed]
ruginaria commutata (Walker, 1860) (*Hypochroma*)
batiaria (Plötz, 1880) (*Hypochroma*)
ruginaria interrupta Warren, 1901 (*Pingasa*)
ruginaria pacifica Inoue, 1964 (*Pingasa*) [male and female genitalia]
secreta Inoue, 1986 (*Pingasa*) [male and female genitalia photographs, Inoue (1986, figs 4, 5)]
subpurpurea Warren, 1897a (*Pingasa*) [male genitalia]
subviridis Warren, 1896c (*Pingasa*) [male and female genitalia]
tapungkanana (Strand, 1910) (*Pseudoterpna*) [male genitalia]
ultrata Herbulot, 1966 (*Pingasa*)
venusta Warren, 1894a (*Pingasa*) [male genitalia]

PSEUDOTERPNA HÜBNER, [1823] 1816
(FIGS 30, 77, 114, 150)

Pseudoterpna Hübner, [1823] 1816: 285. Type species: *Geometra cythisaria* [Denis & Schiffermüller], 1775 [junior synonym of *Pseudoterpna pruinata* (Hufnagel)].

Adults (Fig. 30): Antenna bipectinate with short rami in male, simple filiform in female. Frons protruding slightly to moderately, with rough scales. Labial palpus with third segment short in both sexes.

Wing pattern: grey-brown, or pale to moderately dark grey-green. Antemedial and postmedial lines brown or dark green, antemedial line dentate or

wavy; postmedial line (on upper side and underside) dentate and on fore wing slightly angled or occasionally straight, distinct or, particularly on underside, faint; submarginal line white, dentate or slightly wavy; discal spot brown or dark green, forming a narrow dash on both upper side and underside of fore wing, sometimes faint or on hind wing even absent. Underside rather plain, without strong markings; grey-brown or greenish, often slightly paler than upper side. [One species, *simplex*, without any lines or other markings on upper side and underside]. Outer margin of wings slightly wavy or smooth; hind wing with costa fairly long, apex often protruding beyond anal angle of fore wing. Frenulum slightly to moderately reduced. Vein M_1 of fore wing occasionally on a short stalk with veins R_{2-5} , but more often not stalked.

Hind tibia of male often with hair-pencil, occasionally with terminal tuft. Abdomen usually with weakly to moderately developed dorsal crests, occasionally without; sternite 3 of male with or without a pair of setal patches.

Male genitalia (Figs 77, 114). Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half to two-thirds fused, prongs tapered and usually narrow, very close together or somewhat diverging apically, almost straight. Gnathos with median region expanded, spinulose [sometimes with long terminal spines (Hausmann, 2001)], and slightly indented at apex. Valva not divided, narrow to moderate in width, with smooth outline and rounded apex; with median ridge or lobe (harpe) usually large, often longer than broad, spinose, or with one spine and a patch of setae. Coremata small or moderately well developed. Transtilla with large lightly-sclerotized posterior projection. Saccus projecting distinctly, large and rounded or occasionally subrectangular. Aedeagus with narrow elongate sclerotized area, often with small dentate process near middle, and occasionally another at posterior end; vesica sometimes with fine, not dense, wrinkles.

Female genitalia (Fig. 150): Apophyses anteriores much shorter than apophyses posteriores. Very broad, wrinkled region present around ostium but only weakly sclerotized; with weakly-sclerotized and sometimes poorly defined, rounded lamella postvaginalis. Ductus bursae short to moderately long, moderately broad, sclerotized and wrinkled or ridged towards corpus bursae; with distinct, well-sclerotized, antrum extending to ostium. Corpus bursae small to fairly large, membranous; signum absent.

Diagnosis: Moths of *Pseudoterpna* are not particularly distinctive, except that they are unusually plain on the underside of the wings compared with most

other Pseudoterpni. The genitalia have better definitive features. Males of *Pseudoterpna* have a simple and undivided valva with a spinose or setose median ridge (harpe), which is similar to that of *Epipristis*, but the spines usually form a patch in *Pseudoterpna* and never a line as is usual in *Epipristis*. The valvae of *Pseudoterpna* also resemble those of *Aplasta*, except that the latter genus has a harpe on only one valva. Another feature in which *Pseudoterpna* differs is that the vesica of the aedeagus does not have dense wrinkles as in *Aplasta* and *Epipristis*. [See also the discussion under *Aplasta*.]

Biological notes: Host plants: Leguminosae (Fabaceae): *Adenocarpus*, *Calycotome*, *Chamaecytisus*, *Cytisus*, *Genista*, *Lygos* (*Retama*), *Spartium*, *Ulex* [for this and other information on biology, including further reputed host plants, see Hausmann, 2001: 122–134; text-figs 105, 106 (egg of *Pseudoterpna coronillaria flamignii*)]. The larva (of *P. pruinata*) is strong green with a dark dorsal line, and with a conspicuous white to pink-tinged spiracular line along each side; the projection of the head is cleft. The resting posture of the larva is rigid and stick-like. For further accounts, and photographs of larvae, see Carter (1982: 118), Porter (1997: 26, pl. 9: C), Silvonen (website, 2002), and Thompson & Nelson (website, 2003).

Distribution: Palaearctic Region: Algeria; Austria; Belarus (Hausmann, 2001); Bosnia-Herzegovina; Bulgaria (Hausmann, 2001); Caucasus and Transcaucasus (Hausmann, 2001); Croatia; Cyprus; Denmark (Hausmann, 2001); France (including Corsica); Germany; Gibraltar; Great Britain (England); Greece (including Crete) (Hausmann, 2001); Hungary; Ireland; Israel; Italy [including Sardinia (Hausmann, 2001), and Sicily]; Jordan (Hausmann, 2001); Lebanon; Lithuania (Hausmann, 2001); Morocco; Portugal; Russia; Siberia (Hausmann, 2001); Slovakia; Spain; Sweden (Hausmann, 2001); Switzerland; Syria; Tunisia; Turkey; Ukraine (Hausmann, 2001). A record from China (Staudinger, 1901: 261) is unconfirmed.

Species included

- coronillaria coronillaria* (Hübner, [1817]) (*Geometra*) [male genitalia line drawing, Hausmann (2001)]
- coronillaria algerica* Wehrli, 1930 (*Pseudoterpna*)
- coronillaria axillaria* Guenée, [1858] (*Pseudoterpna*) [male genitalia line drawing, Hausmann (1996a)]
- coronillaria cinerascens* (Zeller, 1847) (*Geom[etra]*) [male genitalia line drawing, Hausmann (1996a)]
- coronillaria flamignii* Hausmann, 1997 (*Pseudoterpna*) [male and female genitalia line drawings, Hausmann (2001)]

coronillaria halperini Hausmann, 1996a (*Pseudoterpna*) [male genitalia line drawing, Hausmann, 1996a]
corsicaria (Rambur, 1833) (*Hemithea*) [male and female genitalia line drawings, Hausmann (2001)]
corsicaria ramburaria Oberthür, 1916 (*Pseudoterpna*)
lesuraria Lucas, 1933 (*Pseudoterpna*) [male genitalia]
pruinata (Hufnagel, 1767) (*Phalaena*) [male and female genitalia]
agrestaria (Duponchel, 1829) (*Hemithea*) [cited as a synonym by Hausmann, 2001]
atropunctaria (Walker, [1863]) (*Aspilates*) [treated as a synonym by Hausmann, 2001]
pruinata f. *candidata* Stauder, 1920 (*Pseudoterpna*)
cythisaria ([Denis & Schiffermüller], 1775) (*Geometra*)
genistaria (Villers, 1789) (*Phal[aena]* *Geom[etra]*)
pruinata var. *holsatica* (Wagner, 1922) (*Aspilates*) [synonymized by Hausmann, 2001]
pruinata nigrolineata Schwingenschuss, 1918 (*Pseudoterpna*)
prasinaria (Fabricius, 1775) (*Phalaena*)
pruinaria (Rottemburg, 1777) (*Phalaena*) [cited as an unjustified emendation by Hausmann, 2001]
pruinata var. *virollata* Krulikovski, 1908 (*Pseudoterpna*) [synonymized by Hausmann, 2001]
viridisparata (Roquette, 1857) (*Ph[alaena]* *Geom[etra]*)
rectistrigaria Wiltshire, 1948 (*Pseudoterpna*) [male and female genitalia]
simplex Alphéraky, 1892 (*Pseudoterpna*)

PSILOTAGMA WARREN, 1894B
 (FIGS 31, 78, 115, 151)

Psilotagma Warren, 1894b: 678. Type species: *Psilotagma decorata* Warren, 1894b. [Historical treatment of *Psilotagma* as a subgenus of *Terpna*, by Prout (1912a, 1927) indicates its inclusion, here confirmed, in *Pseudoterpnini* (of which *Terpnini* is a synonym).]

Adults (Fig. 31): Antenna in both sexes either simple filiform (*decorata*) or bipectinate but with very short rami (*pictaria*). Frons protruding moderately, with middle part blackish brown. Labial palpus with third segment short in both sexes.

Wing pattern: Fore wing pale to mid brown or olive-brown, with distinct and strongly contrasting dark brown subapical patch at costa, and small, more diffuse, patches at and above anal angle, just outside postmedial line; antemedial line indistinct or sometimes almost absent, except for a dark brown patch on costa; postmedial line distinct between costa and vein M_3 , then strongly angled and continuing broken or indistinct, situated well towards submarginal line, which is white, dentate and usually indistinct. Hind wing with similar colour but paler, often whitish; post-

medial line indistinct, with dark brown patches outside. Discal spot on both fore and hind wings narrow and bent. Underside: fore and hind wing whitish; strong dark brown discal spots large and nearly round or crescent-shaped, with dark brown patches just outside indistinct postmedial line as on upper side. Fore wing slightly narrower than in other genera of *Pseudoterpnini*; outer margin of fore and hind wings slightly wavy; hind wing with costa moderate in length, and anal margin slightly elongate.

Hind tibia of male with hair-pencil (*decorata*) or without (*pictaria*); often with short terminal extension. Abdomen with fairly well developed dorsal crests. Sternite 3 of male abdomen with (*decorata*) or without (*pictaria*) a pair of setal patches.

Male genitalia (Figs 78, 115): Uncus well developed, long, slender and rod-like; socii lightly sclerotized, slightly broader than uncus, short or long, but always shorter than uncus. Gnathos almost V-shaped, with median process spinulose. Valva moderately long, not divided into separate costal lobe and sacculus; costal and sacculus regions sclerotized; costa convexly curved, sometimes sinuous, with or without a tiny apical process; sacculus forming a long low ridge, sometimes folded over and with dentate margin. Coremata well developed or weak. Transtilla forming a pair of sclerotized arms, projecting posteriorly. Saccus slightly projecting. Aedeagus with a pair of sclerotized processes arising medially, smooth or spinulose, rounded or pointed; vesica with or without spine-like cornutus.

Female genitalia (Fig. 151): Apophyses anteriores shorter than apophyses posteriores. Surroundings of ostium sclerotized and minutely spinulose, particularly on a lateral pair of lobes, which are large and strongly developed in *decorata*, each lobe extending as a large and broadly rounded anterior pouch, but weakly developed in *pictaria* and limited to low lobes at opening of ostium, without an anterior pouch; lamella postvaginalis weakly defined and with some transverse wrinkles. Ductus bursae moderately long. Corpus bursae elongate, with bulbous anterior end particularly in *pictaria*, and curved and very large in *decorata*; narrow signum present in *decorata*, with several spine-like processes, but signum absent in *pictaria*.

Diagnosis: The fore wing pattern of *Psilotagma*, with the strong dark subapical patch, is characteristic. That patch is usually larger than in *Absala*, the latter genus being clearly distinguished by having three very distinct large round spots on the white underside of the hind wing, compared with more broken and diffuse markings on the underside of *Psilotagma*. *Psilotagma* is one of a minority of genera in the *Pseudoterpnini* that have uncus and socii structure unmodified, i.e. the uncus is well developed and rod-like as in *Lim-*

batochlamys, but the valva, without a harpe and with the sacculus forming a long low ridge, is characteristic of *Psilotagma*. *Psilotagma* is also one of a minority of pseudoterpni genera that have a signum in the female (in *decorata* only). The two species, *decorata* and *pictaria*, share characters of the moth (external) and of the male genitalia, but the female genitalia differ considerably – although both species have a lateral pair of spinulose lobes at the ostial opening, they are very different in degree of development.

Distribution: Palaearctic Region: China. Oriental Region: Bhutan; China; India; Nepal.

Species included

decorata Warren, 1894b (*Psilotagma*) [male and female genitalia]

dorsocristata (Poujade, 1895) (*Terpna*)

pictaria Moore, 1888 (*Pachyodes*) **comb. nov.** [from '*Pachyodes*'] [male and female genitalia]

PULLICHROMA HOLLOWAY, 1996

(FIGS 32, 79, 116, 152)

Pullichroma Holloway, 1996: 202. Type species: *Actenochroma pullicosta* Prout, 1931a. [Placed in Pseudoterpni by Holloway, 1996.]

Adults (Fig. 32): Antenna fasciculate in male, simple filiform in female. Frons protruding slightly. Labial palpus with first and second segments shorter than in *Actenochroma*; third segment short in male, moderately long in female.

Wing pattern: fairly uniformly straw-coloured with only a faint trace of olive-green; with well-defined dark brown costa; antemedial line wavy but often indistinct, postmedial line dentate, fine, and with whitish shading on outer side, postmedial line slightly curved on fore wing and sometimes slightly angled near costa; submarginal line faint and whitish; discal spot small. Underside: fore and hind wings with basal zone (to postmedial line) white or cream; outer zone with broad dark brown band; discal spot black-brown, small or moderate-sized, a dot or a very short dash, weaker or absent on the hind wing. Outer margin of wings no more than weakly wavy; hind wing slightly or distinctly rounded; hind wing with costa fairly short and anal margin slightly elongate.

Hind tibia without hair-pencil. Thorax and abdomen without dorsal crests. Sternite 3 of abdomen without setal patches.

Male genitalia (Figs 79, 116): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), but with socii apparently replacing uncus entirely, basal half fused but with the margins of the pair of prongs distinct, prongs diverging and curved outwards. Gna-

thos approximately quadrate, median region with pair of lobes far apart. Valva not divided; moderately narrow, with costal margin slightly convexly curved or almost straight; mainly only lightly sclerotized but with raised spinulose patch, situated ventrally at middle of lower margin of valva. Coremata long but very delicate. Transtilla lightly sclerotized, with pair of arms meeting. Saccus bilobed, with median indentation. Aedeagus with long slender process arising near base, ie. anterior end (with spinulose apex in the sole member of the genus, *pullicosta*); vesica without cornuti.

Female genitalia (Fig. 152): Apophyses anteriores short, much shorter than apophyses posteriores. Broad, lightly sclerotized and concentrically wrinkled, region present around ostium, without differentiated lamella postvaginalis. Ductus bursae very long, with longitudinal weak ridges and covered with minute pimple-like spinules; antrum forming an incomplete collar. Corpus bursae membranous and very elongate, strongly bent towards posterior end; signum absent.

Diagnosis: Moths of *Pullichroma* are somewhat similar to those of *Actenochroma* in their fairly plain and pale colouring, but they are straw-coloured, not green as in *Actenochroma*. The male genitalia of *Pullichroma* and *Actenochroma* are not alike, and the socii structure of *Pullichroma* resembles that of *Crypsiphona*, replacing the uncus as a pair of prongs, although fused basally, not merely pressed together as in *Crypsiphona*, and not bifid apically as in *Crypsiphona*. *Pullichroma* has a character of the aedeagus unique in Pseudoterpni, the long process arising from near the base, not medially as in some other genera, e.g. *Dindica* and *Dindicodes*.

Distribution: Oriental Region: Brunei; Indonesia (Sulawesi (Holloway, 1996), Sumatra); Philippines.

Species included

pullicosta (Prout, 1931a) (*Actenochroma*) [male and female genitalia]

SUNDADOXA HOLLOWAY, 1996

(FIGS 33, 80, 117, 153)

Sundadoxa Holloway, 1996: 201. Type species: *Hypodoxa multidentata* Prout, 1916a. [Placed in Pseudoterpni by Holloway, 1996.]

Adults (Fig. 33): Antenna of male bipectinate in basal two-thirds, simple filiform in female. Frons protruding moderately, rough-scaled. Labial palpus all rough-scaled, third segment fairly elongate in both sexes.

Wing pattern: large areas of pale whitish grey or cream, with dark speckles and often suffused with

olive-green, and mid to dark brown or grey mottled patches; fore wing with pale basal zone (to postmedial line) and outer zone (from postmedial line outwards) usually darker; antemedial line dentate or indistinct; discal spot sometimes forming a small dash, on fore wing usually with a smaller spot on basal side towards costa; postmedial line wavy and curved, usually with whitish outer edge; white submarginal line wavy but sometimes indistinct. Underside: fore and hind wings with basal zone varying from whitish to mid brown or grey, but paler than dark outer zone, not speckled, outer margin whitish, particularly on hind wing towards anal angle; discal spot distinct and forming a dash. Outer margin of wings slightly wavy; hind wing rounded, with costa short and anal margin elongate, and with a conspicuous hair brush forming a dark, slanting, straight line, basal to the discal spot; raised scales near the base of the fore wing, if present at all, only weak, and only in males.

Hind tibia of male with hair pencil. Thorax and abdomen with dorsal crests weak or occasionally strong. Sternite 3 of male abdomen with a very weak pair of setal patches joined together.

Male genitalia (Figs 80, 117): Sclerotized bifid socii/uncus complex present (see p. 351 for discussion), with basal half fused, rod-like prongs strongly separated and curved outwards. Gnathos approximately quadrate, with broad median region very finely spinulose. Valva divided for a short length distally; costal lobe broad and rounded, with hook-like extension of the costal margin; sacculus a moderately broad, slightly spatulate, lobe, not extending as far as the costal lobe. Coremata very long and delicate. Transtilla only formed of arm bases, not joined; pair of patches of setae present in anellus. Saccus distinctly protruding, cruciform to diamond-shaped. Aedeagus broad, with short, smoothly sclerotized, anterior part; posterior part somewhat longer and lightly sclerotized, with longitudinal wrinkles and striations and with more rigid, folded spinulose region; vesica without cornuti.

Female genitalia (Fig. 153): Apophyses anteriores much shorter than apophyses posteriores. Very broad, finely wrinkled and lightly sclerotized, region present around ostium, with lateral patches of dense hair-scales. Ductus bursae broad towards ostium, with sclerotized wrinkles and ridges, and with a region of extremely minute and inconspicuous pimple-like spinules. Corpus bursae membranous, slender and very elongate; signum absent.

Diagnosis: Moths of *Sundadoxa*, *Hypodoxa* and *Pingasa* all have hair brushes on the hind wings, but in *Sundadoxa*, unlike the other genera, the brushes form a single straight bar. These genera differ in characters of the male genitalia: for example the presence of core-

mata in *Sundadoxa* but not in *Hypodoxa*, and the former genus has a much smaller saccus than the latter. *Sundadoxa* does not have narrow median processes on the gnathos, as are present in *Hypodoxa* and often in *Pingasa*. The widely diverging rod-like prongs of the socii/uncus complex of *Sundadoxa* resemble those of *Cyneoterpna*, but *Sundadoxa* differs from that genus in having a fairly well-developed gnathos, a process on the costal margin of the valva, and coremata.

Distribution: *Oriental Region:* Brunei; Indonesia [Sumatra (Holloway, 1996)]; Malaysia (Peninsular, Sarawak).

Species included

multidentata (Prout, 1916a) (*Hypodoxa*) [male and female genitalia]

The following genera have the uncus unmodified (i.e. moderately long and rod-like) and socii vestigial or absent (or fused with the anal tube and not strongly developed).

AEOLOCHROMA PROUT, 1912A

(FIGS 34, 35, 50, 81, 82, 118, 119, 154, 155)

Aeolochroma Prout, 1912a: 11 (key), 35. Type species: *Hypochroma turneri* Lucas, 1890. [Treated in Section A of Geometrinae by McFarland (1988); here assigned to *Pseudoterpnini*.]

Adults (Figs 34, 35, 50): Antenna in male bipectinate, fasciculate, or occasionally weakly ciliate; simple filiform in female. Frons protruding slightly to strongly, with dark transverse band, usually broad, in lower half or middle. Labial palpus often broad and short, third segment usually tiny in both sexes.

Wing pattern (sexually dimorphic in several species): overall pale to dark; varying mixtures of olive green (usually conspicuous), dark brown, and grey patches, with darker lines and other markings; occasionally mainly grey, brown or straw-coloured; fore wing sometimes with a broad, pale, diffuse band below costa, occasionally with white patches near costa or apex. Antemedial line wavy or dentate, postmedial line dentate and on fore wing irregularly curved, these lines dark and distinct, submarginal line also dark but commonly broken and sometimes indistinct. Fore wing and hind wings with discal spot, often a small, inconspicuous, dot or short dash, but sometimes moderately large and with pale centre bounded by a dark line. Underside (group 1: males and some females): fore and hind wings with basal zone (to postmedial line) dull yellow/orange, postmedial line varying from dark and distinct to extremely faint, with narrow white, or occasionally pale yellow, band on outer side of line; outer zone mainly dark brown, with white or occasion-

ally yellow spot at midpoint of outer margin of each wing; this pattern is particularly distinct on the hind wing and sometimes ill-defined on the fore wing, better defined in some species than in others. Underside (others): fore and hind wings with basal zone (to post-medial line) usually pale but occasionally dark, outer zone with a dark band or scattered markings. Underside (general): whitish patch sometimes present at apex of fore wing; discal spots small to moderately large, smaller and occasionally absent on the hind wing. Outer margin of wings usually slightly wavy; hind wing with costa occasionally short, anal margin slightly to moderately elongate.

Hind tibia of male usually with hair pencil but occasionally without; occasionally with short terminal extension. Thorax with fairly prominent, and abdomen with large, dorsal crests. Sternite 3 of male abdomen with pair of setal patches present, or weak or absent; segment 8 of male often with lateral pair of coremata.

Male genitalia (Figs 81, 82, 118, 119): Uncus usually somewhat curved and tapering from broader base to a slender rod. Gnathos usually U-shaped; median process barely present to well developed, varying (tongue, plate, hook-like or occasionally a pair of processes) but always smooth and without spinules. Pair of valvae usually fused antero-ventrally; valva long or of moderate length, often narrow; divided to varying degree into long costal lobe and very much shorter sacculus; costal lobe often also strongly divided, sometimes and/or with a narrow basal process, costa sometimes irregularly shaped or with processes, and valvae occasionally asymmetrical; minute process usually present towards base of sacculus in those species that have coremata in the abdomen. Coremata of genitalia present in majority of species and sometimes long. Transtilla usually weak and often indistinct. Saccus usually projecting little, but projecting distinctly in several species (e.g. *albifusaria*). Aedeagus broad to slender, often fairly short, but occasionally long (e.g. *quadrilinea*); sometimes with a sclerotized process that arises medially and is often bifurcate; vesica usually without cornuti.

Female genitalia (Figs 154, 155): Apophyses anteriores much shorter than apophyses posteriores. Ostial opening usually sclerotized, and (in species of group 1) incorporating a triangular structure; lamella postvaginalis usually indistinct, lamella antevaginalis usually large, sclerotized, and medially excised. Ductus bursae short to long, sometimes with weak sclerotization forming an incomplete collar. Corpus bursae membranous, rounded to elongate; signa usually absent, but present in *hypochromaria* as a transverse row of four longitudinal ridges, lightly sclerotized and appearing faint.

Diagnosis: *Aeolochroma* is a large and variable genus. Approximately half of the species have distinctive underside markings (in males at least), and are here referred to as group 1. These moths have a yellowish basal zone, a narrow whitish band on the outer side of the postmedial line, and a dark outer zone with a white or yellow spot at the midpoint of the outer margin of each wing. The majority of *Aeolochroma* species for which we have examined male genitalia have two characters present (usually correlated): the coremata in the abdomen and the minute process on the sacculus.

Biological notes: Host plants: Myrtaceae: *Leptospermum flavescens* Sm. (McFarland, 1988: 228, for *A. metarhodata* and *mnitaria*), *Melaleuca leucadendra* (L.) L. and *M. quinquenervia* (Cav.) Blake (Robinson *et al.*, website, 2005, for *A. quadrilinea*); Euphorbiaceae: *Beyeria leschenaultii* var. *latifolia* (McFarland, 1988: 293, for *A. sp.*). McFarland (1988: 293–299) described and figured the early stages of *Aeolochroma* sp.: egg (figs 999–1002); larva (figs 1003–1018) pale green, usually becoming dark green with minute purplish speckles dorsally and whitish-cream ventrally, with bright green subspiracular and midventral lines, and a diffuse cream spiracular line, body somewhat flattened dorsoventrally and with a roundly bilobed head; resting posture of mature larva sometimes rigid and straight, sometimes curved; pupa (figs 816–821).

Distribution: *Australasian Region:* Australia; Indonesia (Irian Jaya, Moluccas); New Caledonia; Papua New Guinea.

Species included

Group 1 (see remarks above)

albifusaria albifusaria (Walker, 1866) (*Boarmia*) [male and female genitalia]

discolor (Warren, 1896d) (*Actenochroma*)

albifusaria suffusa Prout, 1927 (*Aeolochroma*)

bakeri Prout, 1913 (*Aeolochroma*)

intima Prout, 1913 (*Aeolochroma*)

languida (Warren, 1898) (*Actenochroma*) [male genitalia]

rufivaria (Warren, 1907) (*Hypochroma*)

modesta (Warren, 1903) (*Hypochroma*) [intermediate]

prasina prasina (Warren, 1896b) (*Actenochroma*?) [male and female genitalia]

prasina angustifascia Prout, 1916a (*Aeolochroma*)

prasina defasciata Prout, 1916a (*Aeolochroma*)

prasina louisa Prout, 1927 (*Aeolochroma*)

prasina spadiocampa Prout, 1917b (*Aeolochroma*)

saturataria (Walker, 1866) (*Hypochroma*) [male genitalia]

caesia (Warren, 1896b) (*Actenochroma*?)

perfulvata (Warren, 1899b) (*Hypochroma*)

turneri (Lucas, 1890) (*Hypochroma*) [male and female genitalia]
venia Prout, 1924 (*Aeolochroma*)
viridimedia viridimedia Prout, 1916a (*Aeolochroma*) [male genitalia]
viridimedia recta Prout, 1929 (*Aeolochroma*)

Other species examined

acanthina (Meyrick, 1888) (*Hypochroma*) [male genitalia]
amethystina (Warren, 1907) (*Actenochroma*) [male genitalia]
chioneschatia Prout, 1924 (*Aeolochroma*) [male and female genitalia]
hypochromaria hypochromaria (Guenée, [1858]) (*Cleora?*) [male and female genitalia]
bryophanes (Turner, 1904) (*Pseudoterpna*)
hypochromaria caledonica Holloway, 1979 (*Aeolochroma*) [male genitalia]
melaleuca (Goldfinch, 1929) (*Terpna*)
metarhodata (Walker, [1863]) (*Scotosia*) [male genitalia]
mniaria (Goldfinch, 1929) (*Terpna*) [male genitalia]
purpurissa (Warren, 1906) (*Hypochroma*)
quadrilinea (Lucas, 1892) (*Hypochroma*) [male genitalia]
ochrea (Warren, 1896d) (*Actenochroma*)
subrubella (Warren, 1903) (*Hypochroma*)
subrubescens (Warren, 1896a) (*Hypochroma*)
unitaria (Walker, 1860) (*Tephrosia*) [male genitalia]
viridicata (Lucas, 1890) (*Hypochroma*)

Species not examined

rhodochlora (Goldfinch, 1929) (*Terpna*)
olivia (Goldfinch, 1943) (*Terpna*)
pammiges (Turner, 1941) (*Terpna*)

AUSTROTERPNA GOLDFINCH, 1929
 (FIGS 36, 83, 120, 156)

Austroterpna Goldfinch, 1929: 385. Type species: *Austroterpna idiographa* Goldfinch, 1929. [Treated in Section A of Geometrinae by McFarland (1988); here assigned to Pseudoterpnini.]

Adults (Fig. 36): Antenna in male bipectinate (with fairly short rami) from base to four-fifths or more, simple filiform in female. Frons not protruding significantly. Labial palpus rough-scaled, with third segment short in both sexes, particularly in male.

Wing pattern: fore wing grey to brown, mottled with dark brown or blackish short striations and dots, and also pale flecks, giving an overall brownish grey appearance except for some darker lines and other markings, and with a dark dentate streak slanting

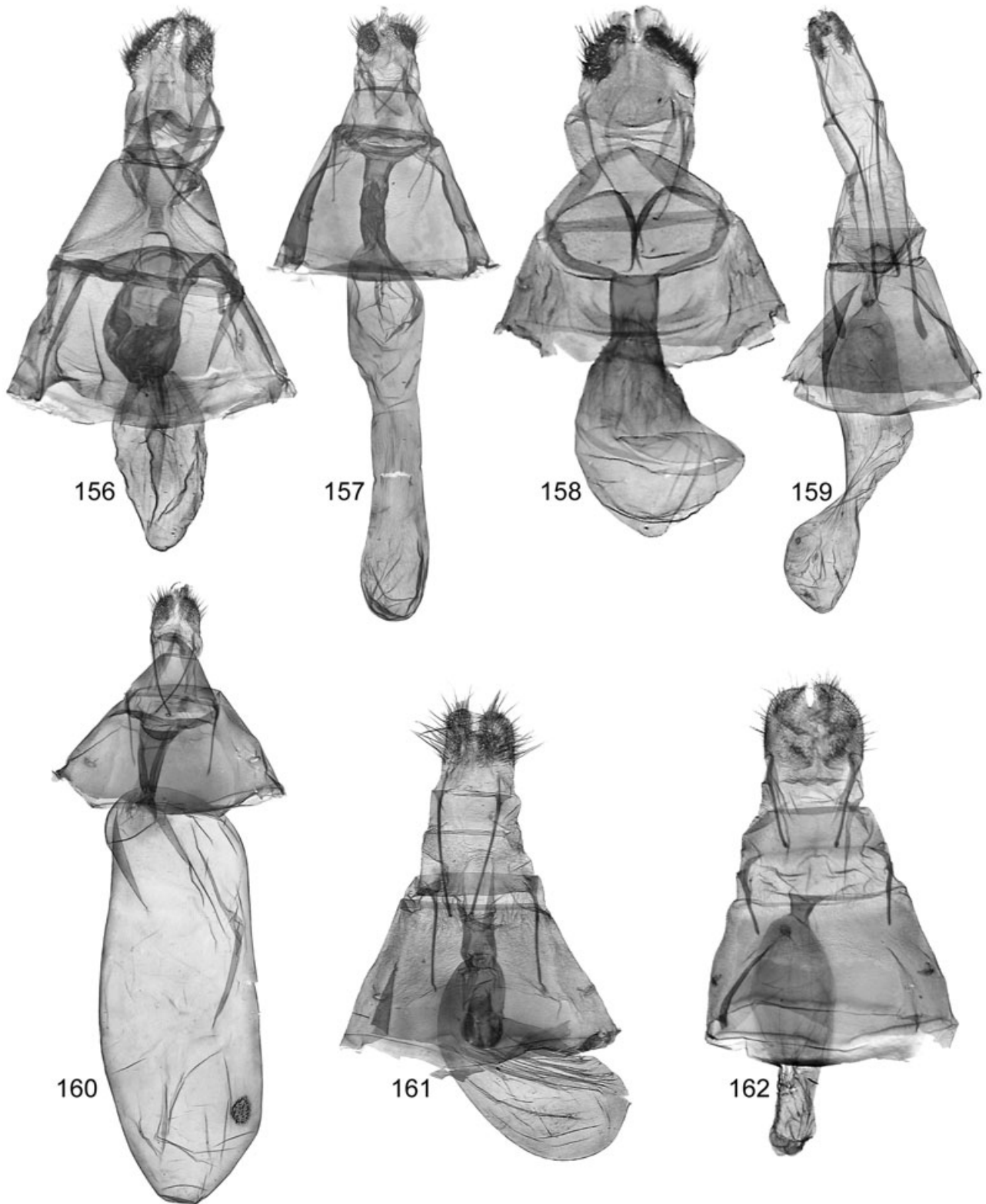
subapically from costa to postmedial line, a slightly paler area between this and narrow discal dash; postmedial line dentate and strongly angled at vein CuA₂, antemedial line often almost straight but sometimes wavy; sometimes with a dark streak above anal vein from base of wing to antemedial line. Hind wing grey or greyish brown, with basal zone pale and occasionally whitish but contrasting only slightly to moderately with darker outer zone; discal spot shorter and fainter than on fore wing. Underside: fore wing with large pale basal zone and smaller dark outer zone varying from distinctly contrasting to only very diffuse and faint; discal spot or dash strong to weak; hind wing similar to upper side but with stronger dark and pale contrasting markings, outer zone dark except pale at outer margin of wing. Outer margin of wings very slightly wavy, almost smooth; hind wing with costa and anal margin of moderate length, outer margin usually weakly angled at vein CuA₁. Veins Rs and M₁ of hind wing on a stalk.

Hind tibia of male without hair pencil. Thorax with a strong dorsal crest but abdomen without crests; sternite 3 without setal patches.

Male genitalia (Figs 83, 120): Uncus rod-like, short and slightly curved. Gnathos approximately V-shaped, with arms broadened towards median process, which is also V-shaped and has a small posterior tooth. Pair of valvae fused antero-ventrally; valva deeply divided into a long, very narrow, costal lobe, and a shorter lobe that is also very narrow but tapered and pointed, with another less conspicuous lobe in between the two, much shorter, broad-based and tapered; costal lobe divided distally into a pointed, sinuous, spine-like process and a bulbous, oval, membranous lobe. Coremata absent. Transtilla forming a pair of lightly sclerotized adjoining lobes, each with a pouch. Juxta forming a pair of shallow pouches anteriorly. Saccus not differentiated from vinculum. Aedeagus moderately slender anteriorly but often broader posteriorly; vesica with two strong spines, one on a caecum.

Female genitalia (Fig. 156): Apophyses anteriores short and broadened, much shorter than apophyses posteriores. Lamella postvaginalis very smoothly sclerotized, forming a raised tongue-shaped lobe; lamella antevaginalis projecting as a subrectangular plate; both lamellae strongly defined. Ductus bursae large, bulbous, and wrinkled, with large strongly sclerotized antrum forming an incomplete collar. Corpus bursae small, barely larger than ductus bursae; membranous, oval, tapering anteriorly; signum absent.

Diagnosis: Moths of *Austroterpna* resemble some of those of *Rhuma*, particularly if a dark streak is present above the anal vein of the fore wing. The male genitalia are very different: *Austroterpna* is



Figures 156–162. Female genitalia. 156, *Austroterpna idiographa*; 157, *Heliomystis electrica*; 158, *Lophothorax eremnopis*; 159, *Protophyta castanea*; 160, *Rhuma subaurata*; 161, *Rhuma argyraspis*; 162, *Rhuma thiobapta*.

characterized by the complex valva, with three main lobes of which the costal lobe is divided distally as described above, whereas the valva is undivided in *Rhuma*.

Biological notes: Host plants: Mimosaceae: *Acacia rivalis* JM Black (McFarland, 1988: 252, for *Austroterpna paratorna*); *Acacia neriifolia* A. Cunn. ex Benth. (McFarland, 1988: 228, for *Austroterpna idiographa*). McFarland (1988: 249–256) described and figured the early stages of *Austroterpna*: egg (fig. 759, *idiographa*); larva green, with a whitish spiracular line or more heavily marked with dark reddish-purple, head tapered and with an apical notch (figs 760–766, 781–792, both species); pupa (figs 767–770, 793–796, both species).

Distribution: Australasian Region: Australia (New South Wales, South Australia).

Species included

idiographa Goldfinch, 1929 (*Austroterpna*) [male and female genitalia]

paratorna (Meyrick, 1888) (*Hypochroma*) [male and female genitalia]

HELIOMYSTIS MEYRICK, 1888

(FIGS 37, 84, 121, 157)

Heliomystis Meyrick, 1888: 835 (key), 900. Type species: *Heliomystis electrica* Meyrick, 1888. [Treated in Section A of Geometrinae by McFarland (1988); here assigned to Pseudoterpnini.]

Adults (Fig. 37): Antenna bipectinate in male, simple filiform in female. Frons not protruding significantly. Labial palpus with third segment short in male, longer in female.

Wing pattern: fore wing mottled shades of brown with black speckles and lines, lines usually stronger in female and diffuse whitish patches present, particularly on inner side of postmedial line; antemedial line dentate, postmedial line straight and slanting from costa to vein M_3 , then sharply angled and dentate, area between the two lines occasionally very dark (McFarland (1988: Fig. 249; white submarginal line broken and diffuse. Hind wing with large basal zone, usually bright, orange-yellow, to dark, diffuse postmedial line; basal zone contrasting strongly with mid to dark brown outer zone. Fore and hind wings with discal spot, a dash. Underside: fore and hind wings usually with large basal zone yellow or yellowish, spreading from base to greater or lesser extent, blackish discal spots large and oval, and white patch present between discal spot and outer zone; outer zone with broad dark brown or blackish band (more pronounced on hind wing), and with paler region of brown and white from outside this band to the wing margin.

Outer margin of wings slightly wavy; fore wing moderately elongate, hind wing with costa not short and anal margin slightly elongate.

Hind tibia of male with hair pencil. Thorax and abdomen with dorsal crests strongly developed, especially on thorax. Sternite 3 of male abdomen with a pair of widely spaced setal patches.

Male genitalia (Figs 84, 121): Uncus slender and rod-like. Socii clearly developed but completely fused with anal tube. Gnathos approximately V-shaped, with short tongue-like, spinulose, median process. Valva of moderate length and fairly narrow; slightly divided, but with tapered sacculus very small in relation to main part of valva (i.e. costal lobe); costal lobe approximately parallel-sided and with ridge just in from costa. Coremata absent. Transtilla forming a pair of adjoining lobes, large and lightly sclerotized. Juxta with lateral tufts of long hair-like setae. Saccus projecting slightly. Aedeagus slender, with a long sclerotized process arising between anterior end and midpoint, and projecting posteriorly; vesica with numerous spine-like cornuti.

Female genitalia (Fig. 157): Apophyses anteriores fairly long, of similar length to apophyses posteriores. Lamella postvaginalis weakly defined, lightly sclerotized, with transverse wrinkles and minute 'pimples'; lamella antevaginalis similar but more distinctly sclerotized, and broader. Ductus bursae moderately long and wrinkled, with smooth sclerotized antrum. Corpus bursae membranous and elongate; signum absent.

Diagnosis: The large orange–yellow area of the hind wing of *Heliomystis* (very different from the fore wing) is distinctive, except for a strong resemblance to some species of *Dindica*. *Heliomystis* is readily distinguished by the large discal spot on the underside of the hind wing, whereas the discal spot is absent or weak in *Dindica* (compare Figs 8B, 37B). The genitalia are very different: in the male, *Heliomystis* has a rod-like uncus, and socii that are not strongly developed and are unique in the Pseudoterpnini in being fused with the anal tube, whereas *Dindica* has a well-sclerotized bifid socii/uncus complex; *Heliomystis* does not have the sacculus overlapping the costal lobe as in *Dindica*, and the female genitalia do not have such extensive, complexly wrinkled, and sclerotized, ostial surrounds as in *Dindica*.

Biological notes: Host plants: Myrtaceae: *Eucalyptus dives* Schauer (Common, 1990: 371), and *E. obliqua* L'Herit. (McFarland, 1979: 37, 1988: 267, for captive larvae, which thrived on that plant species but not on others offered). McFarland (1988: 249, 252) described and figured the early stages of *Heliomystis*: egg (figs 858–861); larva (figs 862–871) green, often darker ventrally or sometimes dorsally, with a whitish

spiracular line, head tapered and almost pointed, with a medial groove, typical resting posture of mature larva straight or slightly curved, with thoracic legs held together and projecting from the body like a thorn from a stick; pupa (figs 872–875).

Distribution: Australasian Region: Australia [New South Wales, Queensland, South and Western Australia (McFarland, 1988), Tasmania (McQuillan, 2004), Victoria].

Species included

electrica Meyrick, 1888 (*Heliomyristis*) [male and female genitalia]

LOPHOTHORAX TURNER, 1939

(FIGS 38, 85, 122, 158)

Lophothorax Turner, 1939: 134. Type species: *Lophothorax alamphodes* Turner, 1939. [Treated in Section A of Geometrinae by McFarland (1988); here assigned to Pseudoterpnini.]

Adults (Fig. 38): Antenna of male bipectinate from base to near apex. Antenna of female also bipectinate but with rami shorter, approximately half the size of those of the male (Vanna Rangsi, pers. comm.). Frons not protruding significantly. Labial palpus very rough-scaled, with third segment short.

Wing pattern: overall mottled brown, slightly greyish, dark on fore wing and paler on hind wing; with short striations, more pronounced near margins and stronger on fore wing; fore wing with some blackish speckles, and dentate antemedial and postmedial lines; postmedial line irregularly curved, and strongly angled at vein CuA₂; fore wing also with small cream dashes and diffuse patches; discal spot blackish, forming an irregular dentate line, sometimes shaped like an M turned sideways (as in McFarland, 1988: figs 937, 938); hind wing fairly plain, postmedial line and discal dash usually faint. Underside dappled with more pale (whitish) markings than upper side, fore and hind wings with diffuse darker brown blotches (one fairly large, towards costa, and one smaller, below) situated outside postmedial line; narrow whitish band immediately on outer side of postmedial line, broken by brown veins; hind wing not plain as on upper side, and fore and hind wings generally similar, but markings somewhat fainter on lower half of fore wing; discal spots on fore and hind wings forming short dashes. Outer margin of wings wavy; hind wing with costa and anal margin of moderate length.

Hind tibia of male without hair pencil. Abdomen without dorsal crests; sternite 3 without setal patches.

Male genitalia (Figs 85, 122): Uncus rod-like, of moderate length, apical half curved and somewhat hood-

shaped. Gnathos with broad arms and with tongue-like median process, without spinules. Pair of valvae fused antero-ventrally; valva divided into a long, moderately narrow, costal lobe, and a short sacculus (both lobes blunt or bluntly rounded in the sole species: *eremnopis*). Coremata absent. Transtilla forming a pair of long pouches anteriorly; juxta without obvious features. Saccus not projecting anteriorly from vinculum. Aedeagus slender, with a long and very narrow sclerotized posterior process; vesica with a large wrinkled sclerite.

Female genitalia (Fig. 158): Sternite 8 forming medial pair of large sclerotized lobes. Apophyses anteriores absent or extremely short. Lamella postvaginalis not distinct, ostial opening with very slight anterior lip, lamella antevaginalis forming a broad subrectangular plate, lightly sclerotized and largely smooth. Ductus bursae short and moderately broad, sclerotized, smooth posteriorly but wrinkled towards where it joins with corpus bursae. Corpus bursae wrinkled posteriorly and smoothly membranous anteriorly, pear-shaped; signum absent.

Diagnosis: Moths of *Lophothorax* are rather similar to those of *Austroterpna*: fairly small and brownish, but without a distinct darker outer zone on the hind wing (upper side) as is present to varying degree in *Austroterpna*. The M-like marking on the fore wing of *Lophothorax* is often distinctive. *Lophothorax* is one of only a few genera in the Pseudoterpnini with the antennae bipectinate in the female [the others are *Limbatochlamys*, *Mimandria*, *Pachista*, *Holoterpna* (sometimes), and *Lophophelma* and *Psilotagma* (one species each)], whereas in other genera they are usually simple filiform. The male genitalia of *Lophothorax* are like those of *Aeolochroma* and *Austroterpna* in having the pair of valvae fused antero-ventrally and each valva divided, but the valva of *Lophothorax* is simply divided into two lobes, not three or more as in *Austroterpna*, and *Lophothorax* does not have the apomorphies present in the majority of species of *Aeolochroma* (coremata in the abdomen and a minute process on the sacculus).

Biological notes: Host plant(s): Sapindaceae: *Dodonaea bursariifolia* F.Muell. (McFarland, 1979: 36–37, 1988: 284.) McFarland (1988: 284–285) described and figured early stages of *Lophothorax*: larva (figs 942–955) green, slightly darker dorsally, sometimes with a broken whitish line that is barely subspiracular; larva firm and plump when fully grown, resting posture varying from rigid and fairly straight to arched, twisted or curved; pupa (figs 956–958). Several of McFarland's larvae were parasitized, some by an unidentified wasp and two by a tachinid fly (*Ethylla* sp.).

Distribution: Australasian Region: Australia (South and Western Australia).

Species included

eremnopis (Turner, 1922) (*Crypsiphona*) [male genitalia]

alamphodes Turner, 1939 (*Lophothorax*)

PROTOPHYTA TURNER, 1910

(FIGS 39, 86, 123, 159)

Protophyta Turner, 1910: 564 (key), 648. Type species: *Pseudoterpna castanea* Lower, 1898. [Here assigned to Pseudoterpnini.]

Adults (Fig. 39). Antenna of male bipectinate from base to near apex, simple filiform in female. Frons protruding slightly. Labial palpus with third segment moderately long in male, shorter in female.

Wing pattern: fore and hind wings overall fairly pale brown, with several brown transverse slanting wavy lines and grey or brown fasciae, usually faint in male but forming more distinct and contrasting bands in female, and female generally greyer; discal spot tiny or sometimes absent on fore wing, absent on hind wing. Underside: fore wing with large pale, almost whitish brown, basal zone up to transverse postmedial line, and in outer zone a darker brown band, sometimes very diffuse and faint, on inner side of submarginal line; hind wing mainly pale whitish brown, but with dark brown blotch on inner side of submarginal line from costa to vein M_2 ; discal spots small. Outer margin of wings wavy, and hind wing usually with a slightly larger emargination between veins M_1 and M_3 ; hind wing with costa and anal margin of moderate length.

Hind tibia of male without hair pencil. Abdomen without dorsal crests; sternite 3 without setal patches.

Male genitalia (Figs 86, 123): Uncus tapering from base but mainly rod-like. Gnathos with a large median tongue, with minute 'pimples' ventrally. Valva not divided, moderately narrow and tapered apically, with sclerotized costal band well defined by a low ridge along inner side but without other processes. Coremata absent. Transtilla with pair of broad sclerotized arms, each with a shallow anterior pouch. Juxta large and smooth. Saccus projecting strongly, narrow and finger-like. Aedeagus with small sclerite in vesica, near where it arises from aedeagus, and a more distal sclerotized patch.

Female genitalia (Fig. 159): Genitalia large and elongate. Ovipositor valves only weakly papillate but with strong spine-like setae. Apophyses anteriores long, but less than half length of very elongate apophyses posteriores. Lamella postvaginalis well defined, smoothly sclerotized, and with long narrow lateral extensions. Region around ostium wrinkled but largely membranous, except for sclerotized ventral rim of ostium. Duc-

tus bursae and corpus bursae membranous, corpus bursae long; tiny signum present towards anterior end, round and rugose with short projections.

Diagnosis: The pattern of fasciae on the wings of *Protophyta* is fairly distinctive. In the male genitalia, the valva is more simple and plain than others in this group of genera that have the socii vestigial or absent; the valva is not divided as in *Aeolochroma*, *Austroterpna*, *Heliomystis* and *Lophothorax*, and it does not have the field of hair-like setae, the small process towards the base of the valva and the curved ridge extending from it that are present in *Rhuma*. *Protophyta* females have unusually long apophyses posteriores (for Pseudoterpnini) and the genus is one of a minority of Pseudoterpnini that have a signum. *Protophyta benigna* (not examined here) was described as is similar to *castanea* but larger and more distinctly marked (Turner, 1939).

Distribution: Australasian Region: Australia (South and Western Australia).

Species included

benigna Turner, 1939 (*Protophyta*)

castanea Lower, 1898 (*Pseudoterpna*) [male genitalia]

RHUMA WALKER, 1860

(FIGS 40–42, 87–89, 124–126, 160–162)

Rhuma Walker, 1860: 312, 483. Type species: *Rhuma subaurata* Walker, 1860. [Here assigned to Pseudoterpnini.]

Sterictopsis Warren 1898: 257. Type species: *Sterictopsis inconsequens* Warren, 1898 [junior synonym of *Sterictopsis argyraspis* (Lower)]. [Treated in Section A of Geometrinae by McFarland (1988).] **Syn. nov.**

Oxyphanes Turner, 1936: 27. Type species: *Oxyphanes thiobapta* Turner, 1936. [McFarland (1988: 289) suspected a close relationship with *Sterictopsis*.] **Syn. nov.**

Adults (Fig. 40–42): Antenna in male bipectinate from base to three-quarters or more, or (*subaurata*) finely fasciculate, weakly ciliate or simple filiform in female. Frons usually not protruding significantly but occasionally protruding moderately. Labial palpus with third segment short in both sexes, particularly in male. Labial palpus with third segment short to very short in both sexes, particularly in male.

Wing pattern: fore wing grey to brown mottled with white or cream and flecks of dark or blackish brown, giving an overall brownish grey appearance except for some darker lines and other markings, or (*subaurata*) with strong pattern of mainly cream medial region contrasting with mainly brown inner and outer regions, and with dark spots and other markings;

sometimes with dark spots or small blotches where lines and discal spot meet costa, and some species (*argyraspis* and *thiobapta*) with a dark line from base to halfway or more along anal vein; postmedial line faint or broken, dentate and angled, other lines indistinct or broken, except antemedial line distinct in *argyraspis*; discal spot indistinct or distinct, sometimes a dark ring around a pale centre. Hind wing with large pale basal zone, cream or whitish lightly flecked with brown, contrasting with dark brown or greyish outer zone, or (*subaurata*) hind wing mainly brown, with dark spots, and a few white spots, representing broken lines; discal spot varying from very weak and small or absent to fairly large and diffuse or a dark wing with pale centre. Underside: fore wing with very large cream or (*subaurata*) yellow basal zone, contrasting with smaller outer zone, which is dark brown either with whitish dashes between veins to outer margin or with yellow margin; hind wing similar to upper side but sometimes with stronger markings, or (*subaurata*) similar to underside of fore wing; discal spot or dash usually moderately large on fore wing but sometimes small or indistinct on hind wing. Outer margin of wings slightly wavy or smoothly curved; fore wing longer than hind wing, in which costa is fairly short but anal margin not particularly elongate. Frenulum not usually reduced, but cited as reduced for an undescribed species of *Sterictopsis* by Young (2006). Vein M_1 of fore wing sometimes on a short stalk with veins R_{2-5} , but often not stalked; veins R_s and M_1 of hind wing usually on a stalk, but separate in *subaurata*.

Hind tibia of male with hair pencil and with short to long terminal extension. Abdomen and sometimes thorax with large or small dorsal crests; sternite 3 of male abdomen with a pair of setal patches (large and merged in *subaurata*).

Male genitalia (Figs 87–89, 124–126): Genitalia of species formerly in *Sterictopsis* and *Oxyphanes* not heavily sclerotized. Uncus tapering from base (often broad) to rod, curved and very slender, or spatulate apically. Gnathos V-shaped, with a pointed median process, usually either serrate or with a few spinules or near apex. Valva not divided, either moderately broad and with fairly truncate apex or more elongate and tapered, often curved, particularly outer (non-costal) margin; costa with (*subaurata*) or without a weak lobe; valva with ventral field of long hair-like setae extending well away from distal end of valva, often pronounced; valva with a small ventral finger- or plate-like process (or harpe) towards base, with a low ridge extending posteriorly from it, curved and usually sinuous, usually forming a shallow pouch. Coremata absent. Transtilla often lightly sclerotized, with arms joined either as a simple band or arched and forming

a pair of pouches anteriorly. Juxta smooth and lightly sclerotized, with a postero-lateral pair of sclerites. Saccus tapered and projecting weakly or distinctly. Aedeagus usually with posterior tongue or finger-like process or extension; vesica with one or sometimes two sclerotized processes or plates, or occasionally without obvious cornuti.

Female genitalia (Figs 160–162): Ovipositor valves often modified: only lightly sclerotized and weakly papillate (species formerly in *Sterictopsis* and *Oxyphanes*), not truncated or appearing as oblique as in other Pseudoterpnini (species formerly in *Sterictopsis*), or ovipositor valves joined postero-dorsally by small smooth V-shaped sclerite, and valves more curved than usual in Pseudoterpnini (species formerly in *Oxyphanes*). Apophyses anteriores either fairly long or moderately short, but always shorter than apophyses posteriores. Lamella postvaginalis weakly defined, with several transverse wrinkles, or membranous and not defined. With (*subaurata*) very broad, weakly wrinkled, region present around ostium; lamella antevaginalis forming a sclerotized, semicircular plate, projecting lip-like from ostium; other species without this. Ductus bursae very short to moderately long, usually somewhat sclerotized. Corpus bursae membranous, variously shaped, occasionally narrower anteriorly, fairly small to very large and long; small signum present towards anterior end, oval and rugose with short spinules (*subaurata*), or signum absent.

Diagnosis: Moths of *Rhuma* often resemble those of *Austroterpna*, particularly if a dark streak is present above the anal vein of the fore wing, although *R. subaurata* is patterned differently (see above). The male genitalia are very different: the valva is undivided in *Rhuma* but divided in *Austroterpna*. *Rhuma* is characterized by the valva with a ventral field of long hair-like setae (extending well away from the distal end of valva, unlike in *Heliomystis*), and with a small process towards the base of the valva and a curved ridge extending from it, and also by the postero-lateral sclerites extending from the juxta. These characters are shared by *Rhuma* and the former genera *Sterictopsis* and *Oxyphanes*, which are consequently synonymized here.

Biological notes: Host plants: Myrtaceae: *Eucalyptus* spp. including *odorata* Behr (McFarland, 1979: 39, 1988: 288, for *argyraspis*). McFarland (1988: 288–292) described and figured the early stages of *argyraspis*: egg (fig. 964–966); larva (figs 967–983) instars except first yellowish olive-green, shading to pinkish or reddish brown laterally and ventrally, and maturing with brown dorsal markings, head bilobed, resting posture of larva rigid, straight and stick-like; pupa (figs 984–

986). Early stages and host plants of other species unknown.

Distribution: Australasian Region: Australia [New South Wales, Queensland, South Australia, Tasmania (McQuillan, 2004)].

Species included

argyraspis (Lower, 1893) (*Pseudoterpna*) [male and female genitalia]

inconsequens (Warren, 1898) (*Sterictopsis*)

divergens (Goldfinch, 1929) (*Sterictopsis*) [male genitalia]

subaurata Walker, 1860 (*Rhuma*) [male and female genitalia]

thiobapta Turner, 1936 (*Oxyphanes*) [male and female genitalia]

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REFERENCES

- Alphéraky S. 1888.** Neue Lepidopteren. *Stettiner Entomologische Zeitung* **49**: 66–69.
- Alphéraky S. 1892.** Lépidoptères rapportés de la Chine et de la Mongolie par G.N. Potanine (Suite). II. Heterocera. In: Romanoff NM, *Mémoires sur les Lépidoptères / rédigés par N. M. Romanoff St Petersburg* **6**: 1–81, plates 1–3.
- Alphéraky S. 1897.** Lépidoptères de l'Amour et de la Corée. In: Romanoff NM, *Mémoires sur les Lépidoptères / rédigés par N. M. Romanoff St Petersburg* **9**: 151–184.
- Bastelberger MJ. 1911.** Neubeschreibungen von Geometriden aus dem Hochgebirge von Formosa. *Internationale Entomologische Zeitschrift* **4**: 241–242, 248–249.
- Bellier M. 1861.** Observations sur la faune entomologique de la Sicile. *Annales de la Société Entomologique de France* **8**: 667–713.
- Boisduval JBAD de. 1833.** Mémoire sur les Lépidoptères de Madagascar. *Bourbon et Maurice Nouvelles Annales du Museum National d'Histoire Naturelle* **2**: 149–270, pls 1–7, [8].
- Butler AG. 1878.** Descriptions of new species of Heterocera from Japan. Part III. Geometridae. *Annals and Magazine of Natural History* **5** (1): 392–407, 440–452.
- Butler AG. 1879.** On a Collection of Lepidoptera from Madagascar. *Cistula Entomologica* **2** (21): 389–394.
- Butler AG. 1880.** Descriptions of new species of Asiatic Lepidoptera Heterocera. *Annals and Magazine of Natural History* **5** (6): 119–129.
- Butler AG. 1882.** Descriptions of new species of Lepidoptera, chiefly from Duke-of-York Island and New Britain. (Continued). *Annals and Magazine of Natural History* **5** (10): 226–238.
- Butler AG. 1892.** On a collection of Lepidoptera from Sandakan, N.E. Borneo. *Proceedings of the Zoological Society of London* **1892**: 120–133, pl.6.
- Carter D. 1982.** *Butterflies and moths in Britain and Europe*. London: Heinemann.
- Chu HF. 1981.** Geometridae. *Iconographia heterocerorum Sinicorum* **1**, 112–131, pls 29–37. Beijing: Science Press.
- Common IFB. 1990.** *Moths of Australia*. Melbourne: Melbourne University Press.
- Cook MA, Harwood LM, Scoble MJ, McGavin GC. 1994.** The chemistry and systematic importance of the green wing pigment in emerald moths (Lepidoptera; Geometridae, Geometrinae). *Biochemical Systematics and Ecology* **22**: 43–51.
- Cook MA, Scoble MJ. 1992.** Tympanal organs of geometrid moths: a review of their morphology, function, and systematic importance. *Systematic Entomology* **17**: 219–232.
- Dannehl F. 1926.** Beiträge zur Lepidopteren-Fauna Südtirols. *Entomologische Zeitschrift, Frankfurt A M* **40** (17): 393–408.
- Debauche H. 1941.** Geometridae de Célèbes (Lepidoptera Heterocera). *Mémoires du Musée Royal d'Histoire Naturelle de Belgique* **2** (22): 1–46, plates 1–2.
- Denis M, Schiffermüller I. 1775.** *Ankündigung systematischen Werkes von den Schmetterlingen der Wienergegend*. 3pls. Wien.
- Donovan E. 1805.** *An epitome of the natural history of the insects of New Holland, New Zealand, New Guinea, Otaheite, and other islands in the Indian, Southern, and Pacific Oceans &c. 41 pls*. London.
- Duponchel PAJ. 1829.** In: Godart JB, *Histoire Naturelle des Lépidoptères, ou, Papillons de France* **7** (2): [1]–507, pls 133–170.
- Fabricius JC. 1775.** *Systema Entomologiae, sistens Insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus &c*, pp. 1–832. Flensburgi et Lipsiae.

- Felder R, Rogenhofer AF. 1875.** *Reise der österreichischen Fregatte Novara um die Erde (Zool.)* 2 (Abt. 2) (5): pls 121–140. Wien.
- Ferguson DC. 1985.** Geometroidea, Geometridae (Part): Subfamily Geometrinae. In: Dominick RB, et al. *The Moths of America North of Mexico (Lepidoptera)* 18 (1): xxi + 131 pp, pls 1–4.
- Fletcher DS. 1956.** New species of African Geometridae. Part I, II. *Proceedings of the Royal Entomological Society of London (B)* 25 (1/2): 19–34, 35–42, 6 plates.
- Fuessly JC. 1783.** *Archiv der Insectengeschichte* 3: pls 13–18. Zürich: Winterthur.
- Galsworthy AC. 1998.** A new species of *Pingasa* (Lepidoptera, Geometridae, Geometrinae) from Hong Kong. *Trans. Lep Soc. Japan* 49 (2): 104–106, figs 1, 2.
- Goldfinch GM. 1929.** Revision of Australian Geometridae (Lepidoptera). Containing a revision of the archaic types of the family, with notes and descriptions of new species. *Proceedings of the Linnean Society of New South Wales* 54: 379–407, plates 14–16.
- Goldfinch GM. 1943.** *Terpna olivia* sp. n. N.S. Wales. *Records of the Australian Museum* 21 (3): 179.
- Guenée A. 1858.** (dated 1857). Uranides et Phalénites 1. In: Boisduval M, Guenée A, eds. *Histoire Naturelle des Insectes, Species Général des Lépidoptères* 9: [i]–lvi, 1–514; 10: 1–584; Atlas; pls 1–22.
- Guenée A. 1862.** (dated 1863). Lépidoptères. Maillard L, *Notes sur l'Île de la Réunion (Bourbon) (Annexe G)*: 1–72.
- Hampson GF. 1891.** *Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part VIII. The Lepidoptera Heterocera of the Nilgiri district:* iv + 144 pp., pls 139–156. London.
- Hampson GF. 1893.** 1892. Family Limacodidae. *The Fauna of British India, including Ceylon and Burma. Moths* 1: 371–402.
- Hampson GF. 1895.** Descriptions of new Heterocera from India. *Transactions of the Entomological Society of London* 1895 (2): 277–315.
- Hampson GF. 1903.** The moths of India. Supplementary paper to the volumes in 'The Fauna of British India'. Series II, part VIII. *Journal of the Bombay Natural History Society* 14: 639–659.
- Hampson G. 1907.** The moths of India. Supplementary paper to the volumes in 'The Fauna of British India'. Series III, part IX. *Journal of the Bombay Natural History Society* 18: 27–53, pl. E.
- Han HX. 2005.** (Unpublished). A study on the systematics of Geometrinae from China (Lepidoptera: Geometridae). xii + 471 pp., figs 24–833 + pls 1–15. PhD dissertation. Beijing: The Chinese Academy of Sciences.
- Han HX, Galsworthy A, Xue DY. [2004]** (dated 2005). A revision of the genus *Metallophya* Warren (Lepidoptera, Geometridae, Geometrinae). *Journal of Natural History* 39: 165–195, figs 1–80.
- Han HX, Galsworthy A, Xue DY. 2005.** A taxonomic revision of *Limbatochlamys* Rothschild, 1894 with comments on its tribal placement in Geometrinae (Lepidoptera: Geometridae). *Zoological Studies* 44: 191–199.
- Han HX, Li HM, Xue DY. 2006.** A taxonomic study of three genera newly recorded from China (Lepidoptera: Geometridae: Geometrinae). *Acta Entomologica Sinica* 49 (3): 484–490.
- Han HX, Xue DY. 2003.** In: Han HX, Xue DY, Li HM, A study on the genus *Herochroma* Swinhoe in China, with descriptions of four new species (Lepidoptera: Geometridae, Geometrinae). *Acta Entomologica Sinica* 46 (5): 629–639.
- Han HX, Xue DY. 2004.** (dated 2005). In: Han HX, Galsworthy A, Xue DY, A revision of the genus *Metallophya* Warren (Lepidoptera, Geometridae, Geometrinae). *Journal of Natural History* 39 (2): 165–195, figs 1–80.
- Han HX, Xue DY. 2005.** Han HX, Galsworthy A, Xue DY, A taxonomic revision of *Limbatochlamys* Rothschild, 1894 with comments on its tribal placement in Geometrinae (Lepidoptera: Geometridae). *Zoological Studies* 44 (2): 191–199.
- Hausmann A. 1996a.** The morphology of the geometrid moths of the Levant and neighbouring countries. Part I: Orthostixinae and Geometrinae. *Nota Lepidopterologica* 19 (1/2): 3–90.
- Hausmann A. 1996b.** Systematic list of the geometrid moths of the Levant and neighbouring countries. Part I: Orthostixinae and Geometrinae. *Nota Lepidopterologica* 19 (1/2): 91–106.
- Hausmann A. 1997.** Zur Nomenklatur der europäischen Unterarten von *Pseudoterpna coronillaria* (Hübner (1817) (Lepidoptera: Geometridae, Geometrinae). *Nachrichten des Entomologischen Vereins Apollo. Frankfurt am Main. Entomologischer Verein Apollo N F* 18 (2/3): 223–225.
- Hausmann A. 2001.** Introduction. Archiearinae, Orthostixinae, Desmobathrinae, Alsophilinae, Geometrinae. In: Hausmann A, ed. *The Geometrid Moths of Europe* 1: 1–282. Stenstrup: Apollo Books.
- Hausmann A (ed.) . updated 2006.** <http://www.herbuloth.de>.
- Heppner JB, Inoue H. 1992.** *Lepidoptera of Taiwan. Volume 1, part 2: Checklist.* Gainesville, Florida: Association for Tropical Lepidoptera and Scientific Publishers.
- Herbison-Evans D, Crossley S. updated 2005.** (website). Geometridae of Australia – loopers, measuring worms, span worms, inch worms, twig caterpillars, arches, emeralds. Geometroidea. <http://www.usyd.edu.au/macleay/larvae/geom/geometridae.html>.
- Herbulot C. 1966.** Description de quatre nouveaux Geometridae des Comores. *Bulletin de la Société Entomologique de France* 70 (9/10): 285–287.
- Herbulot C. 1985.** Sur quelques Geometridae des Comores (Lepidoptera). *Nouvelle Revue d'Entomologie (N.S.)* 2 (1): 45–49, 7 figs.
- Herbulot C. 1989.** Nouveaux Geometridae de Malaisie (Lepidoptera). *Lambillionea* 88 (11–12): 171–172.
- Herbulot C. 1994.** Un nouvel *Pingasa* du Malawi (Lepidoptera Geometridae). *Bulletin de la Société Entomologique de Mulhouse* 1994: 12–13.
- Herrich-Schäffer GAW. [1854, 1855]** (1850–1858). *Sammlung neuer oder wenig aussereuropäischer Schmetterlinge* 1: 84 pp., figs 1–551. Regensburg.
- Holloway JD. 1979.** *A survey of the Lepidoptera, biogeography*

- and ecology of New Caledonia. *Series Entomologica* **15**: pp. 1–588. The Hague: Dr W. Junk.
- Holloway JD. 1982.** Taxonomic Appendix. Barlow HS. *An introduction to the moths of South East Asia*, pp. 174–271. Kuala Lumpur: published by the author.
- Holloway JD. 1994.** dated 1993. The Moths of Borneo: Family Geometridae, Subfamily Ennominae. *Malayan Nature Journal* **47**: 1–309.
- Holloway JD. 1996.** The Moths of Borneo: Family Geometridae, Subfamilies Oenochrominae, Desmobiathrinae and Geometrinae. *The Malayan Nature Journal* **49** (3/4): 147–326, 427 figures, 12 colour plates.
- Holloway JD, Jardine N. 1968.** Two approaches to zoogeography: a study based on the distribution of butterflies, birds and bats in the Indo-Australian area. *Proceedings of the Linnean Society of London* **179**: 153–188.
- Holloway JD, Sommerer MD. 1984.** Spolia Sumatrensis: three new Geometrinae. *Heterocera Sumatrana* **2**: 20–25.
- Hübner J. [1817, 1819] ([1799-1831]).** *Sammlung europäischer Schmetterlinge* **5** Geometrae (1): pls 1–113. Augsburg.
- Hübner J. 1822.** *Systematisch-alphabetisches Verzeichniss aller bisher bey den Fürbildungen zur Sammlung Europäischer Schmetterlinge angegebenen Gattungsbennennungen: mit Vormerkung auch Augsbürgischer Gattungen.* vi, 81 pp. Augsburg.
- Hübner J. [1823] (1816-[1825]).** *Verzeichniss bekannter Schmetterlinge* [sic]. 431 pp. Augsburg.
- Hufnagel. 1767.** Fortsetzung der Tabelle von den Nachtvögeln, welche die 3te Art derselben, nemlich die Spannenmesser (Phalaenas Geometras Linnaei) enthält. Berlinisches Magazin, oder gesammelte Schriften und Nachrichten für die Liebhaber der Arzneywissenschaft, Naturgeschichte und der angenehmen. *Wissenschaften überhaupt* **4** (5): 504–527.
- Inoue H. 1961.** Lepidoptera: Geometridae. *Insecta Japonica* **1** (4): pls 1–7.
- Inoue H. 1964.** Some new subspecies of the Geometridae from the Ryukyu archipelago and Formosa (Lepidoptera). *Kontyû* **32** (2): 335–340, 1 pl., 6 figs.
- Inoue H. 1970.** Some new species and subspecies of the Geometridae from Taiwan (Lepidoptera). *Bulletin/Faculty of Domestic Sciences of Otsuma Women's University* **6**: 1–5, pl. 1–3.
- Inoue H. 1986.** Further new and unrecorded species of the Geometridae from Taiwan with some synonymic notes (Lepidoptera). *Bulletin/Faculty of Domestic Sciences of Otsuma Women's University* **22**: 211–267, 67 figs.
- Inoue H. 1988.** Five new species of the Geometridae from southeast Asia (Lepidoptera). *Tinea* **12** (11): 97–104, 9 figs.
- Inoue H. 1990.** A revision of the genus *Dindica* Moore (Lepidoptera: Geometridae). *Bulletin/Faculty of Domestic Sciences of Otsuma Women's University* **26**: 121–161, 123 figs.
- Inoue H. 1992.** Twenty-four new species, one new subspecies and two new genera of the Geometridae (Lepidoptera) from East Asia. *Bulletin/Faculty of Domestic Sciences of Otsuma Women's University* **28**: 149–188.
- Inoue H. 1999.** Revision of the genus *Herochroma* Swinhoe (Geometridae, Geometrinae). *Tinea* **16** (2): 76–105.
- Joannis J de. 1913.** Heterocera. 122–147. Andreini A, Materiali per lo studio della fauna Eritrea raccolti nel 1901–03 dal Dott. A. Andreini tenente medico principalmente nelle regioni circostanti ad Adi-Ugri ed ad Adi-Caiè. Lépidoptères. *Bullettino della Societa Entomologica Italiana* **44**: 115–147.
- Joannis J de. 1929.** Lépidoptères Hétérocères du Tonkin. *Annales de la Société Entomologique de France* **98** (4): 361–552.
- Joannis J de. 1932.** Lépidoptères Hétérocères des Mascareignes. *Société Entomologique de France: Livre du Centenaire 1932*: 427–456, pl. 23.
- Joicey JJ, Talbot G. 1917.** New Heterocera from Dutch New Guinea. *Annals and Magazine of Natural History* **8**, **20**: 50–87, pl. 4, fig. 1.
- Kawazoe A, Ogata M. 1963.** A list of the moths from the Amami Islands (1). *Tyô to Ga (Transactions of the Lepidopterological Society of Japan)* **13** (1): 13–27.
- Kershaw JA. 1897.** Description of a new Victorian moth. *Victorian Naturalist Melbourne* **14** (7): 10.
- Klots AB. 1956.** Lepidoptera. In: Tuxen SL, ed. *Taxonomist's glossary of genitalia in insects*. Copenhagen: Ejnar Munksgaard, 97–111.
- Krulikowski L. 1908.** Einige neue Varietäten und Aberrationen der Lepidopteren des östlichen Russlands (Gouvern. Wiatka und Kasan.). *Societas Entomologica* **23**: 11–12.
- Leech JH. 1889.** On a Collection of Lepidoptera from Kiukiang. *Transactions of the Entomological Society of London* **1889** (1): 99–148, plates 7–9.
- Lower OB. 1892.** Descriptions of new South Australian Lepidoptera. *Transactions and Proceedings and Report of the Royal Society of South Australia* **15** (1): 5–17.
- Lower OB. 1893.** New Australian Lepidoptera. *Transactions and Proceedings and Report of the Royal Society of South Australia* **17** (1): 146–184.
- Lower OB. 1898.** New Australian Lepidoptera: with a note on *Deilephila livornica*, Esp. *Proceedings of the Linnean Society of New South Wales* **23**: 42–55.
- Lower OB. 1915.** Descriptions of new Australian Lepidoptera. *Proceedings of the Linnean Society of New South Wales* **40**: 474–485.
- Lucas TP. 1890.** On Queensland and other Australian Macrolpidoptera, with localities, and descriptions of new species. *Proceedings of the Linnean Society of New South Wales* **2** (4): 1065–1099.
- Lucas TP. 1891.** On Queensland and other Australian Lepidoptera, with descriptions of new species. *Proceedings of the Linnean Society of New South Wales* **2** (6): 277–306.
- Lucas TP. 1892.** On 34 new species of Australian Lepidoptera, with additional localities &c. *Proceedings of the Royal Society of Queensland* **8**: 68–94.
- Lucas TP. 1898.** Descriptions of Queensland Lepidoptera. *Proceedings of the Royal Society of Queensland* **13**: 59–86.
- Lucas TP. 1900.** New species of Queensland Lepidoptera. *Proceedings of the Royal Society of Queensland* **15**: 143–161.
- Lucas TP. 1901.** Queensland Lepidoptera. *Proceedings of the Royal Society of Queensland* **16**: 73–95.
- Lucas D. 1933.** Lépidoptères nouveaux de la France Occiden-

- tale et de l'Afrique du Nord. *Bulletin de la Société Entomologique de France* **38** (13): 195–200.
- Mabille P. 1880.** (1879–1880). Recensement des Lépidoptères hétérocères observés jusqu'à ce jour à Madagascar. *Annales de la Société Entomologique de France* **5** (9): 291–348.
- Mabille P. 1893.** Description de Lépidoptères nouveaux. *Annales de la Société Entomologique de Belgique* **37**: 50–65.
- Matsumura SM. 1931.** *6000 illustrated Insects of Japan-Empire.* (x), ii, iii, 23, 1497 + 191, 2. 10 plates. Tokyo.
- McFarland N. 1979.** Annotated list of larval foodplant records for 280 species of Australian moths. *Journal of the Lepidopterists' Society* **33** (Suppl.): 1–72.
- McFarland N. 1988.** *Portraits of South Australian geometrid moths.* iv + 400 pp. Lawrence, Kansas: Allen Press.
- McQuillan PB. 2004.** An overview of the Tasmanian geometrid moth fauna (Lepidoptera: Geometridae) and its conservation status. *Journal of Insect Conservation* **8**: 209–220.
- McQuillan PB, Edwards ED. 1996.** Geometridae. In: **Nielsen ES, Edwards ED, Rangsi TV.** *Checklist of the Lepidoptera of Australia. Monographs on Australian Lepidoptera, Vol. 4.* Melbourne: CSIRO, pp. 200–228
- Meyrick E. 1888.** Revision of Australian Lepidoptera. II. *Proceedings of the Linnean Society of New South Wales* **2** (2): 835–928.
- Moore F. 1868.** On the Lepidopterous Insects of Bengal. (Tribe Geometres *et al.*). *Proceedings of the Zoological Society of London* **1867** (3): 612–686, plates 32–33.
- Moore F. [1887] 1884–7.** *The Lepidoptera of Ceylon* **3**: 1–578, pls 144–215. London: Reeve.
- Moore F. 1888.** Heterocera continued (Pyalidae, Crambidae, Geometridae, Tortricidae, Tineidae). In: Hewitson WC, Moore F. *Descriptions of new Indian lepidopterous insects from the collection of the late Mr. W.S. Atkinson, M.A., F.L.S. &c.* Part 3: 199–299, pls 7–8. Bengal.
- Nietner J. 1861.** *Observations on the enemies of the Coffee Tree in Ceylon.* Colombo.
- Oberthür C. 1887.** M. Charles Oberthür communiqué des descriptions de Lépidoptères algériens nouveaux. *Bulletin de la Société Entomologique de France* **1887**: lvii–lix.
- Oberthür C. 1913.** Suite de la révision des Phalénites décrites par A. Guenée dans le *Species général. Études de Lépidoptérologie comparée* **7**: 237–331, plates.
- Oberthür C. 1916.** Révision iconographique des espèces de Phalénites (Geometra, Linné). *Études de Lépidoptérologie comparée* **12**: 67–176, figs 3198–3459.
- Orhant G. 2000.** Nouveaux Geometridae Est-Asiatiques (Lepidoptera Geometridae. Geometrinae & Ennominae). *Bulletin de la Société Entomologique de Mulhouse* **2000**: 1–9, figs 1–28.
- Pagenstecher A. 1885.** Beiträge zur Lepidopteren-Fauna des malayischen Archipels. (II.) Heterocera der Insel Nias (bei Sumatra). *Jahrbücher des Nassauischen Vereins für Naturkunde. Wiesbaden* **38**: 1–71, 2 pls.
- Pagenstecher A. 1900.** Der Lepidopterenfauna des Bismarck-Archipels. Mit Berücksichtigung der tiergeographischen und biologischen Verhältnisse, systematisch dargestellt. II. Die Nachtfalter. *Zoologica, Stuttgart* **12** (29): 1–268, 2 plates.
- Patocka J. 1994.** Die Puppen der Spanner Mitteleuropas (Lepidoptera, Geometridae): Charakteristik und Bestimmungstabelle der Gattungen. *Tijdschrift voor Entomologie* **137** (1): 27–56.
- Pitkin LM. 1996.** Neotropical Emerald moths: a review of the genera (Lepidoptera: Geometridae, Geometrinae). *Zoological Journal of the Linnean Society* **118**: 309–440.
- Pitkin LM. 2002.** Neotropical ennomine moths: a review of the genera (Lepidoptera: Geometridae). *Zoological Journal of the Linnean Society* **135**: 121–401.
- Plötz C. 1880.** Verzeichniss der vom Prof. Dr. Royal. Buchholz in West-Africa gesammelten Schmetterlinge. (Schluss.). *Stettiner Entomologische Zeitung* **41** (7–9): 298–307.
- Porter J. 1997.** *The colour identification guide to caterpillars of the British Isles: Macrolepidoptera.* xii, 275 pp. London: Viking.
- Poujade GA. 1895.** Nouvelles espèces de Phalaenidae recueillies à Moupin par l'Abbé A. David. *Bulletin du Muséum d'Histoire Naturelle Paris* **1** (2): 55–59.
- Prout LB. 1912a.** Lepidoptera Heterocera, Fam. Geometridae, subfam. Hemitheinae. In: Wytsman P. *Genera Insectorum* **129**: 1–274, pls 1–5. Bruxelles: Verteneuil & Desmet.
- Prout LB. 1912b.** Notes and Observations. A new generic name in the Hemitheinae. *Entomologist* **45**: 181.
- Prout LB. 1913.** Contributions to a knowledge of the sub-families Oenochrominae and Hemitheinae of Geometridae. *Novitates Zoologicae* **20**: 388–442.
- Prout LB. 1914.** H. Sauter's Formosa-Ausbeute. Geometridae (Lep.). *Entomologische Mitteilungen* **3** (7/8): 236–249, 259–273.
- Prout LB. 1916a.** New genera and species of Indo-Australian Geometridae. *Novitates Zoologicae* **23**: 1–77.
- Prout LB. 1916b.** New Indo-Australian Geometridae. *Novitates Zoologicae* **23**: 191–209.
- Prout LB. 1916c.** New African Geometrae. *Novitates Zoologicae* **23**: 272–286.
- Prout LB. 1917a.** On new and insufficiently known Indo-Australian Geometridae. *Novitates Zoologicae* **24**: 293–317.
- Prout LB. 1917b.** New Geometridae in the Joicey collection. *Annals and Magazine of Natural History* **8**, 20: 108–128, pl. vii.
- Prout LB. 1920.** New moths in the Joicey Collection. *Annals and Magazine of Natural History* **9** (5): 286–293.
- Prout LB. 1922a.** New South African Heterocera. Geometridae. Prout LB, Prout AE. *Annals of the Transvaal Museum* **8** (3): 149–183, pl. 1.
- Prout LB. 1922b.** New Geometridae from Central Ceram. Collected by C., F. & J. Pratt. *Bulletin of the Hill Museum, Witley, Surrey* **1** (2): 279–299.
- Prout LB. 1924.** New Geometridae from Dutch New Guinea and Mefor Island. *Bulletin of the Hill Museum, Witley, Surrey* **1** (3): 456–476, plates 23–24.
- Prout LB. 1925.** New species of Geometridae (Lepidoptera) in the collections of the South African Museum. *Annals of the South African Museum* **19**: 579–600, pls 16, 17, fig. 11.
- Prout LB. 1926a.** New Geometridae. *Novitates Zoologicae* **33**: 1–32.

- Prout LB. 1926b.** On a collection of moths of the family Geometridae from Upper Burma made by Captain A.E. Swann. Part 1. *Journal of the Bombay Natural History Society* **31** (129–146): 1 pl.
- Prout LB. 1927** (1920–1941). Die indoaustralischen Spinner. In: Seitz A, ed. *Die Gross-Schmetterlinge der Erde* **12**, pp. 1–356, pls 1–41, 50. Stuttgart: Verlag A. Kernen.
- Prout LB. 1929.** New Geometridae from Buru. *Bulletin of the Hill Museum, Witley, Surrey* **3** (1): 23–42.
- Prout LB. 1930a** (1929–1938). The African Geometrae. In: Seitz A, ed. *The Macrolepidoptera of the World* **16**, pp. 1–164, pls 1–16. Stuttgart: Verlag A. Kernen.
- Prout LB. 1930b.** On the Japanese Geometridae of the Aigner Collection. *Novitates Zoologicae* **35**: 289–337.
- Prout LB. 1931a.** Geometrid descriptions and notes. *Novitates Zoologicae* **36**: 151–180.
- Prout LB. 1931b.** New Geometridae from the Indo-Australian region. *Novitates Zoologicae* **37**: 18–34.
- Prout LB. 1932.** On the Geometridae of Mount Kinabalu. *Journal of the Federated Malay States Museums* **17** (1): 39–111, plates 9–11.
- Prout LB. 1933.** New Geometridae (Lep.) from Buru. *Stylops* **2** (2): 25–27.
- Prout LB. 1934a.** New species and subspecies of Geometridae. *Novitates Zoologicae* **39**: 99–136.
- Prout LB. 1934b.** (1920–41). The Indoaustralian Geometridae. In: Seitz A, ed. *The Macrolepidoptera of the World* **12**, pp. 1–356, pls 1–41, 50. Stuttgart: Verlag A. Kernen.
- Prout LB. 1934c, 1935a.** (1934–38). The Palaearctic Geometrae. 3. Subfam. Hemitheinae. In: Seitz A, ed. *The Macrolepidoptera of the World*: **4** (Suppl.), pp. 1–253, pls, pp. 1–31. Stuttgart: Verlag A. Kernen.
- Prout LB. 1935b.** New Geometridae from East Java. *Novitates Zoologicae* **39**: 221–238.
- Prout LB. 1935c.** (1929–38). The African Geometrae. In: Seitz A, ed. *The Macrolepidoptera of the World*: **16**, pp. 1–164, pls 1–16. Stuttgart: Verlag A. Kernen.
- Prout LB. 1937.** New and little-known Bali Geometridae in the Tring Museum. *Novitates Zoologicae* **40**: 177–189.
- Prout LB. 1939.** *Neobalbis mansfieldi*, sp.n. (Lep. Geometridae). *Entomologist* **72**: 208.
- Püngeler R. 1900.** Neue Macrolepidopteren aus Central-Asien. *Deutsche Entomologische Zeitschrift, Iris* **12**: 288–299, plates 8–9.
- Rambur [JP]. 1833.** Suite du Catalogue des Lépidoptères de l'Île de Corse. *Annales de la Société Entomologique de France* **2**: 5–59, plates 1–2.
- Robinson GS, Ackery PR, Kitching IJ, Beccaloni GW, Hernández LM. 2001.** *Hostplants of the moth and butterfly caterpillars of the Oriental Region*. Kuala Lumpur: Southdene Sdn Bhd.
- Robinson GS, Ackery PR, Kitching IJ, Beccaloni GW, Hernández LM. 2005.** (website). HOSTS – a database of the world's Lepidopteran hostplants. <http://www.nhm.ac.uk/research-curation/projects/hostplants/>.
- Roquette L. 1857.** Lepidopterologische Beobachtungen. *Allgemeine Deutsche Naturhistorische Zeitung* **3**: 296–312.
- Rothschild W. 1894.** Some new species of Lepidoptera. *Novitates Zoologicae* **1**: 535–540.
- Rottemburg SU von. 1777.** Anmerkungen zu den hufnagelischen Tabellen der Schmetterlinge. *Naturforscher* **11**: 63–91.
- Saalmüller M. 1891.** In: von Heyden L. *Lepidopteren von Madagascar: neue und wenig bekannte Arten zumeist aus der Sammlung der Senckenberg'schen naturforschenden Gesellschaft zu Frankfurt am main. unter Berücksichtigung der gesammten Lepidopteren-Fauna Madagascars* **2**: [247]–531, pls 7–14.
- Schwingenschuss L. 1918.** Herr L. Schwingenschuss berichtet unter Vorweisung von Belegstücken über nachstehende Falteraberrationen. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* **68** (6–8): 150–155.
- Scoble MJ, ed. 1999.** *Geometrid moths of the world: a catalogue (Lepidoptera, Geometridae)*. xxv + 1016 pp. (2 volumes). Collingwood: CSIRO Publishing.
- Shin YH. 1996.** *Synonymic list and distribution of the Geometridae of Korea (Lepidoptera)*. Korea: Center for Insect Systematics.
- Silvonen K. 2002.** (website). <http://kimmos.freeshell.org/lnel/g5/psepruin.htm>. In: Larvae of North-European Lepidoptera <http://kimmos.freeshell.org/lnel/species.htm>.
- Stauder H. 1920.** Neue mediterrane Geometridae. *Internationale Entomologische Zeitschrift* **14** (5): 34–39.
- Staudinger O. 1898.** Neue Lepidopteren aus Palaestina. *Deutsche Entomologische Zeitschrift, Iris* **10**: 271–319.
- Staudinger O. 1901.** In: **Staudinger O, Rebel H.** *Catalog der Lepidopteren Des Palaearctischen Faunengebietes* I. Theil: Famil. Papilionidae-Hepialidae: 260–334. Berlin: Royal Friedländer & Sohn.
- Sterneck J. 1927.** Die Schmetterlinge der Stötznerschen Ausbeute. Geometridae, Spinner. *Deutsche Entomologische Zeitschrift, Iris* **41**: 9–32, figs 1–7; 147–171, figs 1–7.
- Sterneck J. 1928.** Die Schmetterlinge der Stötznerschen Ausbeute. Geometridae, Spinner. *Deutsche Entomologische Zeitschrift, Iris* **42**: 131–244, plates 2–5.
- Stoll C. [1780–1782].** In: Cramer P. *De uitlandsche Kapellen* **4**: 29 + 252 pp., pls 289–400. Amsterdam & Utrecht.
- Strand E. 1910.** Schmetterlinge aus Zentral- und West-Sumatra, gesammelt von Herrn Dr. Max Moszkowski. *Deutsche Entomologische Zeitschrift, Iris* **24** (10): 190–208.
- Sugi S, ed. 1987.** *Larvae of larger moths in Japan*. Tokyo: Kodansha.
- Swinhoe C. 1891.** New species of Heterocera from the Khasia Hills. Part I. *Transactions of the Entomological Society of London* **1891** (4): 473–495, pl. 19.
- Swinhoe C. 1892.** New species of Heterocera from the Khasia Hills. Part II. *Transactions of the Entomological Society of London* **1892**: 1–20, pl. 1.
- Swinhoe C. 1893.** On new Geometers. *Annals and Magazine of Natural History* **6** (12): 147–157.
- Swinhoe C. 1904.** On the Geometridae of Tropical Africa in the National Collection. *Transactions of the Entomological Society of London* **1904** (3): 497–590.
- Swinhoe C. 1905.** New species of eastern Heterocera in the

- National Collection. *Annals and Magazine of Natural History* 7 (15): 166.
- Swinhoe C. 1917.** New species of indo-malayan Lepidoptera. *Annals and Magazine of Natural History* 8 (19): 409–416.
- Thierry-Mieg P. 1915.** Descriptions de Lépidoptères nouveaux. *Miscellanea Entomologica* 22: 37–48.
- Thompson RS, Nelson B. 2003.** (website). <http://www.habitas.org.uk/moths/larva.asp?item=5738>. In: *The Butterflies and Moths of Northern Ireland* <http://www.habitas.org.uk/moths/>.
- Turner AJ. 1904.** New Australian Lepidoptera, with synonymic and other notes. *Transactions and Proceedings and Report of the Royal Society of South Australia* 28: 212–247.
- Turner AJ. 1906.** New Australian Lepidoptera, with synonymic and other notes. *Transactions and Proceedings and Report of the Royal Society of South Australia* 30: 118–142.
- Turner AJ. 1908.** Revision of Australian Lepidoptera, IV. *Proceedings of the Linnean Society of New South Wales* 32 (4): 631–700.
- Turner AJ. 1910.** Revision of Australian Lepidoptera, V. *Proceedings of the Linnean Society of New South Wales* 35 (3): 555–653.
- Turner AJ. 1922.** Australian Lepidoptera of the group Geometrites. *Transactions and Proceedings of the Royal Society of South Australia* 46: 225–294.
- Turner AJ. 1926.** Studies in Australian Lepidoptera. *Transactions and Proceedings of the Royal Society of South Australia* 50: 120–155.
- Turner AJ. 1936.** New Australian Lepidoptera. *Proceedings of the Royal Society of Queensland* 47: 25–50.
- Turner AJ. 1939.** New Australian Lepidoptera. *Proceedings of the Royal Society of Queensland* 50: 133–152.
- Turner AJ. 1941.** New species of Lepidoptera from the Barnard Collection. *Memoirs of the Queensland Museum* 12 (1): 40–52.
- Viette P. 1971.** Nouveaux Geometridae Geometrinae de Madagascar [Lep.]. *Bulletin Mensuel de la Société Linnéenne de Lyon* 40 (3): 69–80, figs 1–19.
- Viidalepp J. 1981.** (On the suprageneric systematics of subfamily Geometrinae (Lepidoptera, Geometridae). In Russian. *Trudy vses. ent. Obshch (Horae Societas Entomologica Unionis Sovieticae)* 63: 90–95.
- Villers DC. 1789.** *Caroli Linnæi Entomologia, faunae Suecicae descriptionibus aucta; DD. Scopoli, Geoffroy, de Geer, Fabricii, Schrank & c., speciebus vel in systemate non enumeratis, vel nuperrime detectis, vel speciebus Galliae Australis locupletata, generum specierumque rariorum iconibus ornata* 2. Lugduni: sumptibus Piestre et Delamolliere.
- Wagner F. 1922.** Vorläufige Beschreibung einiger bemerkenswerter neuer Lepidopteren-Formen meiner Sammlung. *Internationale Entomologische Zeitschrift* 16 (5): 39–40.
- Walker F. 1860, 1861, 1862, [1863], 1866.** *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum*. 1860, part 21: 277–498; 1861, part 23: 757–1020; 1862, part 24: 1021–1280; [1863], part 26: 1479–1796; 1866, part 35: 1535–2040. London: [British Museum].
- Wallace AR. 1876.** *The geographical distribution of animals, with a study of the relations of living and extinct faunas as elucidating the past changes of the Earth's surface*, Vol. 1. (of 2). London: Macmillan.
- Warren W. 1893.** On new genera and species of moths of the family Geometridae from India, in the collection of H.J. Elwes. *Proceedings of the Zoological Society of London* 1893 (2): 341–434, plates 30–32.
- Warren W. 1894a.** New genera and species of Geometridae. *Novitates Zoologicae* 1: 366–466.
- Warren W. 1894b.** New species and genera of Indian Geometridae. *Novitates Zoologicae* 1: 678–682.
- Warren W. 1895.** New species and genera of Geometridae in the Tring Museum. *Novitates Zoologicae* 2: 82–159.
- Warren W. 1896a.** New Geometridae in the Tring Museum. *Novitates Zoologicae* 3: 99–148.
- Warren W. 1896b.** New species of Drepanulidae, Uraniidae, Epiplemidae, and Geometridae from the Papuan region, collected by Mr. Alvert S. Meek. *Novitates Zoologicae* 3: 272–306.
- Warren W. 1896c.** New Indian Epiplemidae and Geometridae. *Novitates Zoologicae* 3: 307–321.
- Warren W. 1896d.** New species of Drepanulidae, Thyrididae, Uraniidae, Epiplemidae, and Geometridae in the Tring Museum. *Novitates Zoologicae* 3: 335–419.
- Warren W. 1897a.** New genera and species of Moths from the Old-World Regions in the Tring Museum. *Novitates Zoologicae* 4: 12–130.
- Warren W. 1897b.** New genera and species of Drepanulidae, Thyrididae, Epiplemidae, Uraniidae and Geometridae in the Tring Museum. *Novitates Zoologicae* 4: 195–262, pl.5.
- Warren W. 1897c.** New genera and species of Moths from the Old-World Regions in the Tring Museum. *Novitates Zoologicae* 4: 378–402.
- Warren W. 1898.** New species and genera of the families Drepanulidae, Thyrididae, Uraniidae, Epiplemidae, and Geometridae from the Old-World Regions. *Novitates Zoologicae* 5: 221–258.
- Warren W. 1899a.** New species and genera of the families Drepanulidae, Thyrididae, Uraniidae Epiplemidae, and Geometridae from the Old-World Regions. *Novitates Zoologicae* 6: 1–66.
- Warren W. 1899b.** New Drepanulidae, Thyrididae, Epiplemidae, Uraniidae, and Geometridae. From the Oriental and Palaearctic Regions. *Novitates Zoologicae* 6: 313–359.
- Warren W. 1901.** Drepanulidae, Thyrididae, Epiplemidae, and Geometridae from the Aethiopian Region. *Novitates Zoologicae* 8: 202–217.
- Warren W. 1902a.** Drepanulidae, Thyrididae, Uraniidae, Epiplemidae, and Geometridae from the Oriental Region. *Novitates Zoologicae* 9: 340–372.
- Warren W. 1902b.** New African Drepanulidae, Thyrididae, Epiplemidae, and Geometridae in the Tring Museum. *Novitates Zoologicae* 9: 487–536.
- Warren W. 1903.** New Uraniidae, Drepanulidae and Geometridae from British New Guinea. *Novitates Zoologicae* 10: 343–414.
- Warren W. 1906.** New Drepanulidae, Thyrididae, Uraniidae,

- and Geometridae, from British New Guinea. *Novitates Zoologicae* **13**: 61–161.
- Warren W. 1907.** New Drepanulidae, Thyrididae, Uraniidae and Geometridae from British New Guinea. *Novitates Zoologicae* **14**: 97–186.
- Warren W. 1909.** New species of Thyrididae, Uraniidae and Geometridae from the Oriental Region. *Novitates Zoologicae* **16**: 123–128.
- Wehrli E. 1928.** Neue Psepheniden und Geometriden (Lep.). *Internationale Entomologische Zeitschrift* **21** (46): 454–457.
- Wehrli E. 1930.** Ueber einige nordafrikanische Geometriden (Lepid. Heterocera). *Internationale Entomologische Zeitschrift* **23** (37/38): 429–438.
- Wehrli E. 1933.** Neue Terpna-, Calleulype- und Obeidia-Arten und -Rassen aus meiner Sammlung (Lep. Hes.). *Internationale Entomologische Zeitschrift* **27** (4): 37–40.
- West R.J. 1930.** Descriptions of New Species of Japanese, Formosan and Philippine Geometridae. *Novitates Zoologicae* **35**: 254–269.
- Wileman A.E. 1912.** New species of Lepidoptera from Formosa. *Entomologist* **45**: 258–260.
- Wileman A.E. 1914.** New species of Geometridae from Formosa. *Entomologist* **47**: 201–203, 290–293, 319–323.
- Wiltshire E.P. 1982.** In: Wittmer W, Büttiker W, eds. *Fauna of Saudi Arabia* **4**: 1–531. Basle: Pro Entomologia. Jeddah: Meteorology and Environmental Protection Administration.
- Wiltshire E.P. 1948.** Middle East Lepidoptera, IX: Two new forms or species and thirty-five new records from Cyprus. *Entomologist's Record and Journal of Variation* **60**: 79–87.
- Xue D.Y. 1992.** Geometridae. In: Liu YQ, ed. *Iconography of forest insects in Hunan China*. Changsha: Hunan Science and Technology Press, 807–904.
- Yazaki K. 1992.** Geometridae. Haruta T, Moths of Nepal. Part 1. *Tinea* **13** (Suppl. 2): 5–46, figs–33, plates 2–12.
- Yazaki K. 1994.** Geometridae. Haruta T, Moths of Nepal. Part 3. *Tinea* **14** (Suppl. 1): 5–40, text–figs 331–383, plates 66–72.
- Yazaki K. 1995.** Geometridae. Haruta T, Moths of Nepal. Part 4. *Tinea* **14** (Suppl. 2): 2–27, figs 537–585, plates 97–101.
- Yazaki K, Wang M. 2004.** In: Yazaki K, Wang M, Huang GH. Notes on geometrid moths (Lepidoptera, Geometridae) from Nanling Mts, S. China (II). *Tinea* **18** (1): 56–64, figs 1–23.
- Young C.J. 2006.** Molecular relationships of the Australian Ennominae (Lepidoptera: Geometridae) and implications for the phylogeny of the Geometridae from molecular and morphological data. *Zootaxa* **1264**: 1–147.
- Zeller P.C. 1847.** Verzeichniss der vom Professor Dr. Loew in der Türkei und Asien gesammelten Lepidoptera. IX. *Isis von Oken* **1847** (1): 3–39.