

Reprint from

110

Entomologica scandinavica

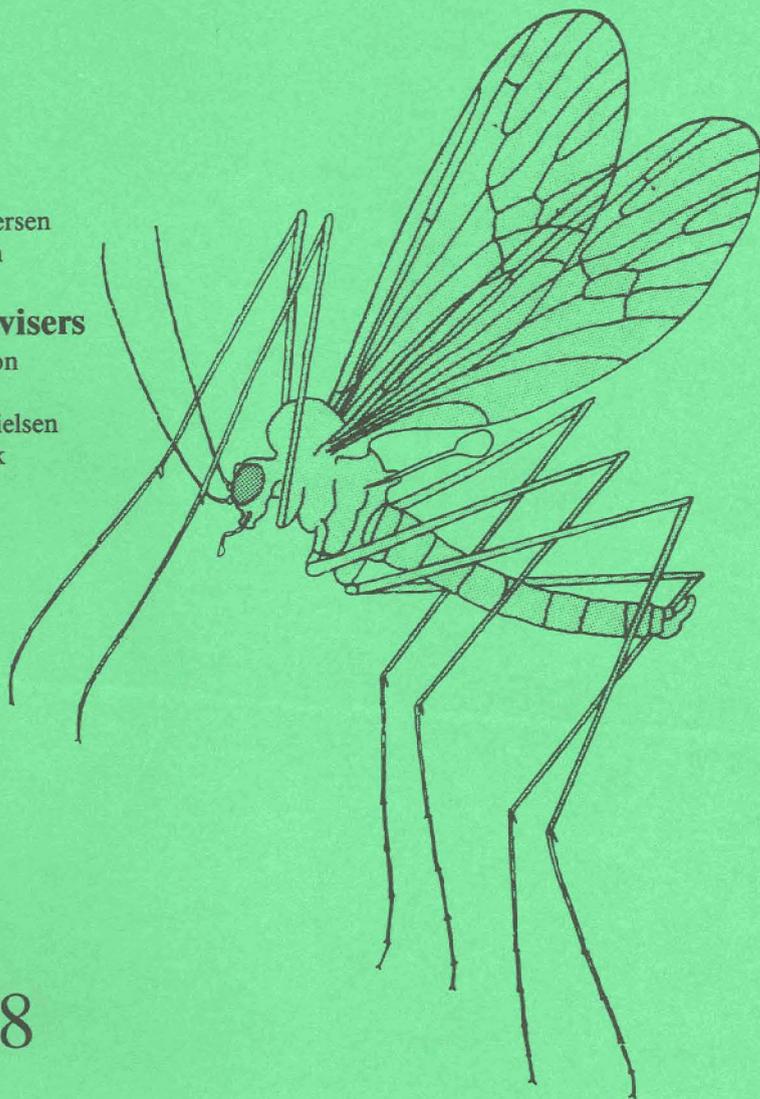
An International Journal of Systematic Entomology

Editors

Nils Møller Andersen
Verner Michelsen

Editorial advisers

Gary A. P. Gibson
Jyrki Muona
Ebbe Schmidt Nielsen
Norman Platnick



Vol. 28

Australian Nepticulidae (Lepidoptera): redescription of the named species

ROBERT J. B. HOARE, ROLAND JOHANSSON,
ERIK J. VAN NIEUKERKEN and EBBE S. NIELSEN

Ent. scand.



Hoare, R. J. B., Johansson, R., Nieukerken, E. J. van & Nielsen, E. S.: Australian Nepticulidae (Lepidoptera): redescription of the named species. *Ent. scand.* 28: 1-26. Copenhagen, Denmark. March 1997. ISSN 0013-8711.

The named Australian species of Nepticulidae are redescribed and illustrated. The genitalia of all but one species are described and illustrated, in most cases for the first time. Of the 16 species treated, 13 belong to the probably endemic genus *Pectinivalva* Scoble: *P. caenodora* (Meyrick), *P. chalcitis* (Meyrick), *P. commoni* Scoble, *P. endocapna* (Meyrick), *P. gilva* (Meyrick), *P. melanotis* (Meyrick), *P. anazona* (Meyrick), *P. funeralis* (Meyrick), *P. libera* (Meyrick), *P. planetis* (Meyrick), *P. primigena* (Meyrick), *P. trepida* (Meyrick) and *P. warburtonensis* (Wilson). The remaining three are referable to the worldwide genus *Stigmella* Schrank: *S. leucargyra* (Meyrick), *S. phyllanthina* (Meyrick) and *S. symmora* (Meyrick). *Pectinivalva* is provisionally split into two informal species groups (the 'commoni' group and the 'funeralis' group), and a diagnosis is provided for these. Brief details of biology are given where known.

R. J. B. Hoare, Division of Entomology, CSIRO, GPO Box 1700, Canberra, ACT 2601, Australia, or: Division of Botany and Zoology, Australian National University, Canberra, ACT 0200, Australia.

R. Johansson, Seminarievägen 47B, S-352 38 Växjö, Sweden.

E. J. van Nieukerken, Nationaal Natuurhistorisch Museum, Postbus 9517, 2300 RA Leiden, The Netherlands.

E. S. Nielsen, Division of Entomology, CSIRO, GPO Box 1700, Canberra, ACT 2601, Australia.

Introduction

The Nepticulidae is a family of very small moths, found on all continents except Antarctica. The larvae of most species are leaf-miners, but some mine in bark or buds, or in the winged seeds of Aceraceae. There are probably well over 1000 species world-wide, 700 of which have been described (van Nieukerken, unpublished database). Only the northern European fauna can be considered well known (Johansson et al. 1990), but revisions are available of all or part of the recognised fauna of the following regions: Western Palearctic (Johansson 1971, van Nieukerken 1983, 1985, 1986a, 1990), Canada (Wilkinson & Scoble 1979), the USA (Wilkinson 1979, 1981; Wilkinson & Newton 1981; Newton & Wilkinson

1982), Japan (Kemperman & Wilkinson 1985), eastern Europe, central and (northern) east Asia (Puplesis 1994), South Africa (Scoble 1978a, 1978b, 1980a, 1980b, 1983) and New Zealand (Donner & Wilkinson 1989).

The Australian nepticulids have received little attention, and, although the fauna is now estimated to include over 400 species, only the 16 species dealt with here have been named. However, the fauna is of considerable interest and importance to the understanding of the family. The subfamily Pectinivalvinae, with the single included genus *Pectinivalva*, was erected by Scoble (1983) to accommodate a monophyletic group of Australian nepticulids which retain some primitive morphological features. This subfamily has not been

found outside Australia, and may well be endemic. The only other subfamily, Nepticulinae, is also well represented in this country.

The first Australian nepticulids were described by Meyrick (1906). He named 14 species, all of which he placed in the genus *Nepticula* Heyden, now a junior synonym of *Stigmella* Schrank (Wilkinson 1978). Eleven of these are here shown to belong to *Pectinivalva* Scoble; the remaining three are true *Stigmella*. Wilson (1939) named a single species (again in *Nepticula*) on the basis of a few poorly preserved specimens from Western Australia; this too belongs in *Pectinivalva*. Finally, Scoble (1983) named one species of *Pectinivalva* to validate his new subfamily.

A detailed phylogenetic study of the Australian Nepticulidae is now being undertaken by Hoare. Because of the great size of the fauna and limitations of time, this study will not result in a complete taxonomic revision of the group in Australia, and such a revision is still some way in the future. The current paper is intended to be the first in a series of more circumscribed accounts of Australian nepticulids, and is considered to be the logical first step towards tackling the taxonomy of this large group. Meyrick's descriptions are accurate, but inadequate for the recognition of species many of which have closely similar relatives that he had not seen. Study of the genitalia is usually essential for certain identification. Therefore, with the exception of *Pectinivalva commoni* (genitalia illustrated by Scoble (1983)) and *P. gilva* (abdomen lost), the genitalia of all named species are described and illustrated here for the first time, and the adults of all named species are illustrated

for the first time. The generic assignments applied here were adopted in Nielsen (1996).

Materials and methods

The project was initiated and planned by Nielsen. The type specimens of species described by Meyrick and housed in the BMNH were examined and dissected by van Nieuwerkerken. Colour illustrations of the adults and line drawings of the genitalia and wing venation were prepared by Johansson, and copies were sent to Hoare who examined and dissected specimens in the ANIC in the search for additional material. This resulted in the discovery of the 'missing sex' of only one species (the female of *Pectinivalva caenodora*), specimens of which were sent to Johansson for illustration.

It should be noted that the condition of many of the type specimens is relatively poor, and that the illustrations of adults are therefore inevitably somewhat 'idealized'. In addition, the colour of specimens which are more than one hundred years old is bound to have faded, and no attempt has been made to reconstruct the original coloration.

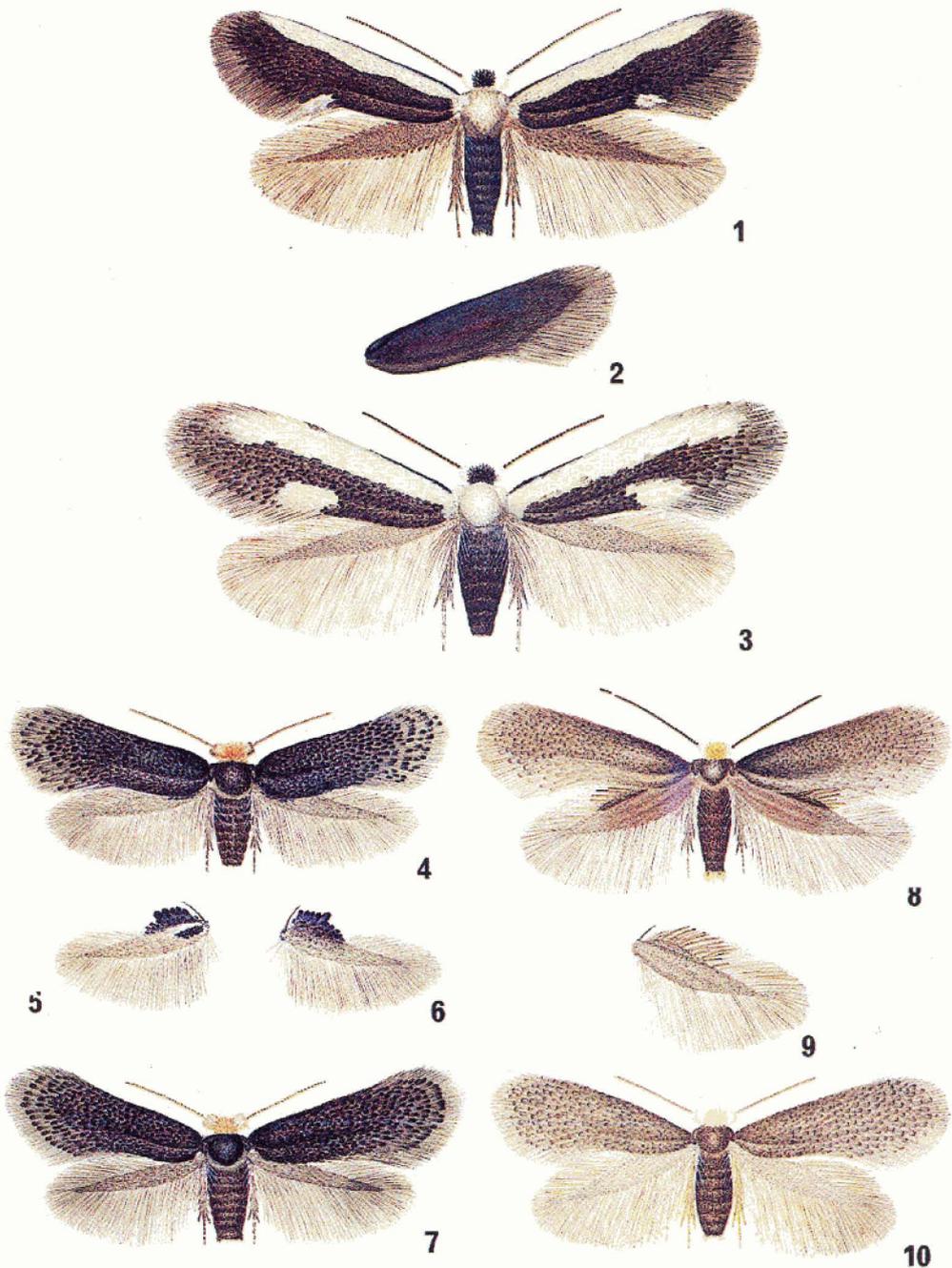
The terminology used in the redescriptions follows that of van Nieuwerkerken (1986b). Dissecting techniques were as described in van Nieuwerkerken (1985).

The following acronyms have been used for institutions mentioned in the text:

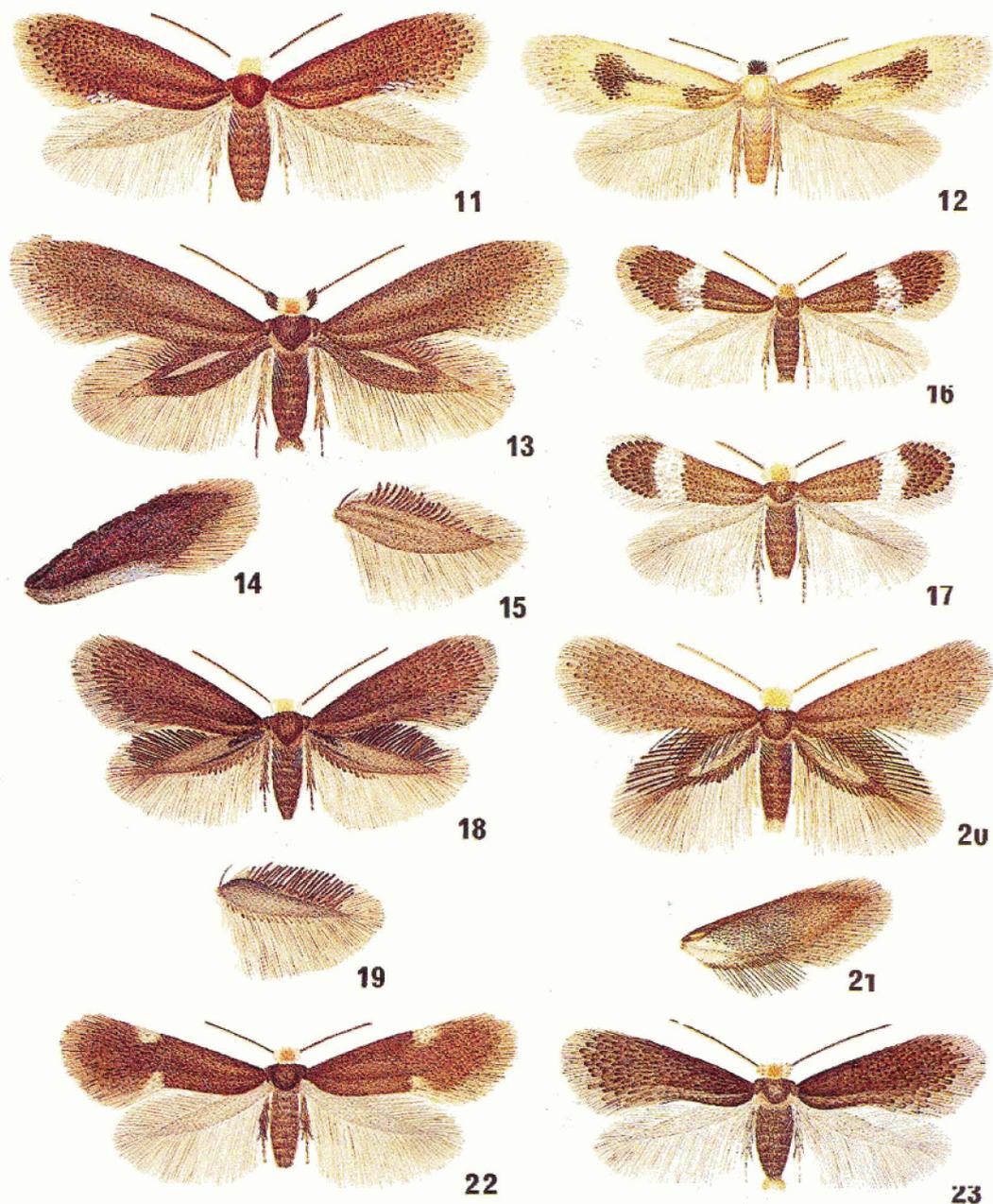
- ANIC Australian National Insect Collection, CSIRO, Canberra, Australia.
 BMNH The Natural History Museum, London, UK (statutory name: British Museum (Natural History)).

Table 1. Diagnosis of the informal species-groups of *Pectinivalva* Scoble.

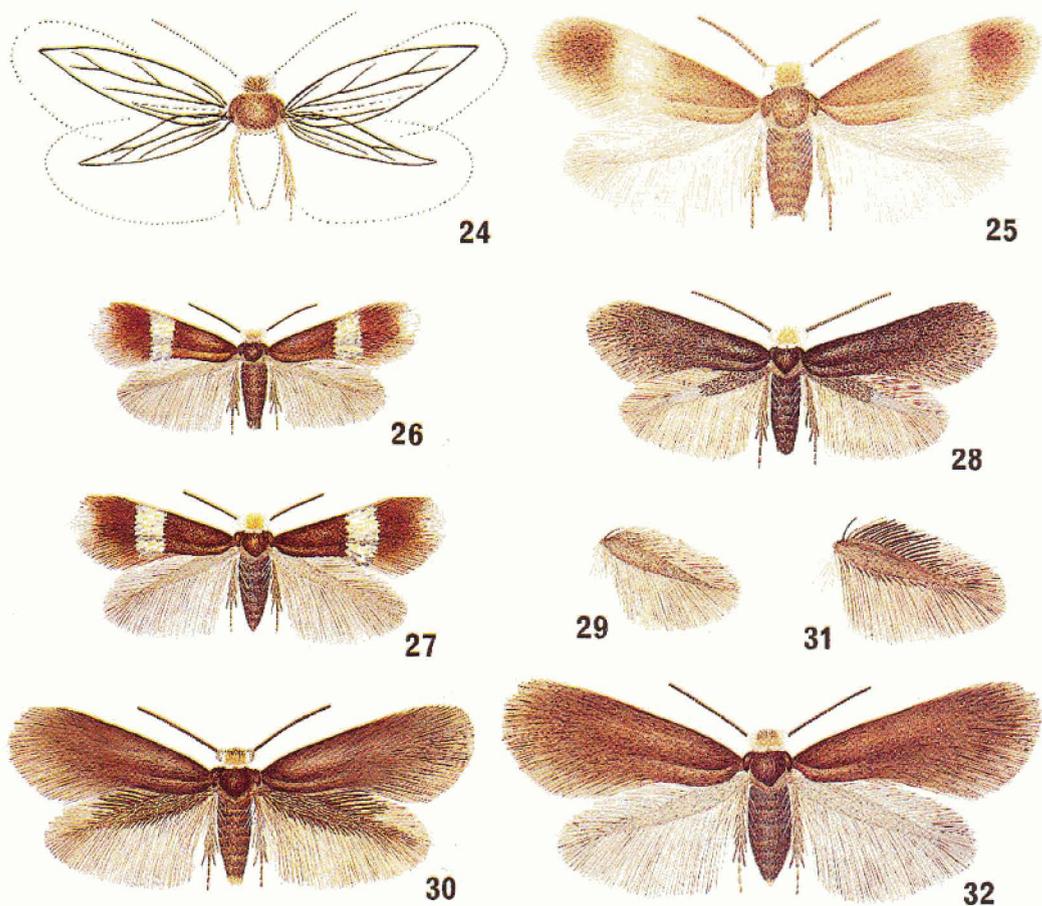
	<i>P. commoni</i> group	<i>P. funeralis</i> group
Forewing venation: R ₂₊₃ R ₄ and R ₅	Present Separate	Absent Fused
Male genitalia: Valva	Rounded at tip	± square or triangular
Pectinifer elements	Long, narrow, parallel	Short, broad and tooth-like, or reduced or absent
Uncus	Hood-like, undivided, setae often arising from dorsal lobes	Divided at tip, setae arising directly from dorsal surface
Female genitalia: Vestibulum	Lateral sclerotizations weak or absent	Lateral sclerotizations strongly developed
Signum	A single broad toothed 'band' with lacunae	Two concentric very narrow 'fence-like' bands
Known host-plants	<i>Eucalyptus</i> spp.	<i>Eucalyptus</i> and other Myrtaceae



Figs 1-10. *Pectinivalva* spp., adults (wingspan in parentheses). (1-3) *P. caenodora*: (1) ♂ holotype, Sydney, N.S.W., 8.x.1884 (6.4 mm); (2) ♂, forewing underside; (3) ♀, 5 mi S of Forster, N.S.W., 3.ix.1967 (6.5 mm). (4-7) *P. commoni*. (4) ♂ holotype, 17 mi SE of Braidwood, N.S.W., emg. 27.i.1958, *Eucalyptus* ?*delegatensis* (5.3 mm); (5) ♂, hindwing upperside; (6) ♂, hindwing underside; (7) ♀ paratype, same data as ♂, emg. 7.ii.1958 (5.3 mm). (8-10) *P. endocapna*: (8) ♂ lectotype, Albany, W.A., 3.xii.1886 (5.6 mm); (9) ♂, hindwing underside; (10) ♀ paralectotype, Albany, W.A., 6.xii.1886 (5.5 mm).



Figs 11-23. *Pectinivalva* spp., adults (wingspan in parentheses). (11) *P. chalcitis*, ♀ holotype, Albany, W.A., 3.xii.1886 (5.5 mm). (12) *P. gilva*, ♀ holotype, Sydney, N.S.W., 6.xii.1879 (5.7 mm). (13-15) *P. melanotis*: (13) ♂ holotype, Sydney, N.S.W., 5.ix.1881 (6.6 mm); (14) ♂, forewing underside; (15) ♂, hindwing underside. (16) *P. anazona*, ♀ holotype, Brisbane, Qld, 21.ix.1879 (4 mm). (17) *P. primigena*, ♀ holotype, Sydney, N.S.W., 20.viii.1878 (4.3 mm). (18, 19) *P. funeralis*: (18) ♂ holotype, Sydney, N.S.W., 2.iii.1879 (5.2 mm); (19) ♂, hindwing underside. (20, 21) *P. libera*: (20) ♂ holotype, Sydney, N.S.W., 8.iii.1878 (5 mm); (21) ♂, forewing underside. (22) *P. planetis*, ♀ holotype, Sydney, N.S.W., 6.xii.1879 (5.5 mm). (23) *P. trepida*, ♂ lectotype, Gisborne, Vic., 11.iii.1900 (4.8 mm).



Figs 24-32. *Pectinivalva* spp. and *Stigmella* spp., adults (wingspan in parentheses). (24, 25) *P. warburtonensis*: (24) ♂ lectotype, [Warburton Ranges, W.A., viii.1935] (5.5 mm); (25) ♀ paralectotype, [same data as ♂] (5.5 mm). (26, 27) *S. leucargyra*: (26) ♂ lectotype, Sydney, N.S.W., emg. 3.ix.1884, *Correa reflexa* (3.7 mm); (27) ♀ paralectotype, same data as ♂ (4.2 mm). (28, 29) *S. phyllanthina*: (28) ♂ lectotype, Sydney, N.S.W., emg. 1.ii.1878, *Glochidion ferdinandi* (4.6 mm); (29) ♂, hindwing underside. (30-32) *S. symmora*: (30) ♂ lectotype, Adelaide, S.A., 18.x.1882 (5.2 mm); (31) ♂, hindwing underside; (32) ♀ paralectotype, same data as ♂ (6 mm).

Redescriptions

Genus *Pectinivalva* Scoble

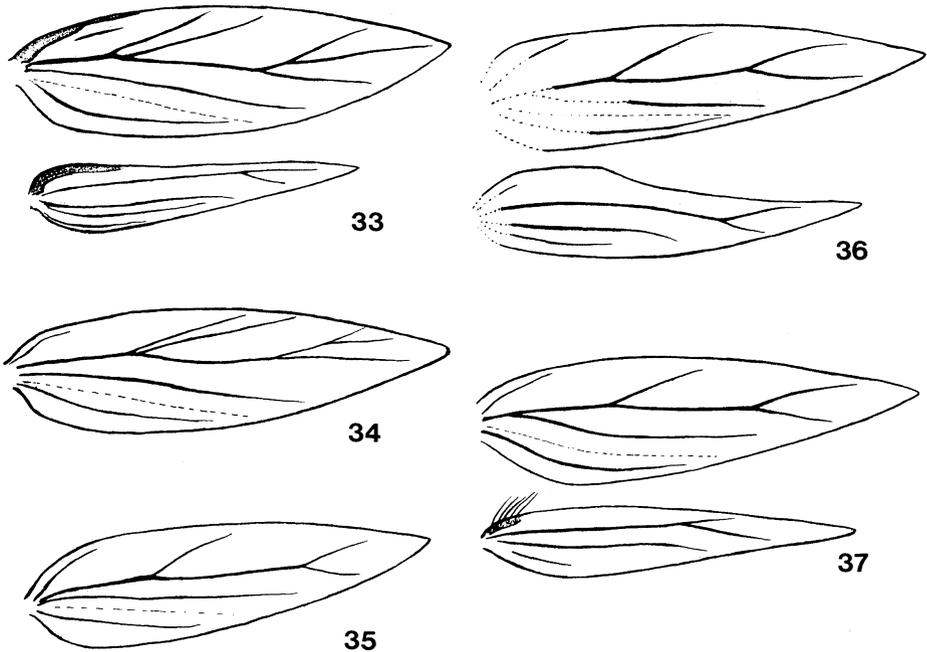
Pectinivalva Scoble, 1983: 12. Type species: *P. commo-ni* Scoble, by original designation.

Scoble (1983) described the morphology of *Pectinivalva* in some detail; a few additional points will be made here. The genus is currently under study by Hoare, and a full redescription will await the results of this work.

Pectinivalva may be divided into two groups on the basis of the male and female genitalia (Table

1). All described species fall clearly into one or other of these groups, here referred to as the 'commoni' and 'funeralis' groups, and a generic or sub-generic distinction may be justified. However, as undescribed species which show possibly intermediate combinations of characters are currently being investigated, it would be premature to erect a formal distinction and risk rendering one genus or subgenus paraphyletic. Characters common to both groups, and which Scoble (1983) did not treat in detail, are summarized below.

Head vestiture. The 'collar' (i.e. the 2 tufts of



Figs 33-37. Wing venation of *Pectinivalva* spp. (33) *P. communi* ♀. (34) *P. caenodora* ♀, forewing. (35) *P. anazona* ♀, forewing. (36, 37) *P. warburtonensis*: (36) ♂; (37) ♀.

scales arising from the back of the head) consists of piliform scales, as in most genera of Nepticulidae (apart from *Stigmella* Schrank and *Enteucha* Meyrick). However, two undescribed species (one belonging to each group) have collars consisting of lamellate scales.

Antenna. The sensillum vesiculocladum in the few species examined is 5-branched (see van Nieukerken & Dop 1987).

Forelegs. The tibia of the foreleg is thickened above with black scales in the males of a number of species from both groups (as noted by Meyrick (1906) for *P. funeralis*).

Hindwing. The males of many species in both groups have a more or less elongate pocket-like fold in the hindwing in the region of vein Rs+M. The fold itself is usually devoid of scales, at least centrally, but is surrounded by androconial scales. The shape of the fold and the colour and arrangement of the androconia are highly diagnostic at species level.

Male genitalia: aedeagus. In most nepticulids the base of the ejaculatory duct is surrounded by a striate thickening, known as the cathrema. In *Pectinivalva*, a true cathrema appears to be absent

(Scoble 1983), but two or three interconnected cornuti are usually clearly visible in this position, and form a smooth structure which may be homologous (van Nieukerken 1986b).

Female genitalia: vestibulum. The sclerotized band mentioned by Scoble (1983) is probably present in all species, but may be obscured in strongly stained slide preparations. It is usually associated with the apices of 2 lateral sclerites, which resemble a third pair of apophyses, and are often connected posteriorly to the anterior apophyses. The development of these lateral sclerites varies considerably; in species of the 'communi' group they may be absent. Signum. Scoble did not mention the signum in his description of *Pectinivalva*, but it is almost invariably present and of characteristic shape (see Table 1 and Figs 74-78, 80, 82, 84).

A description of the early stages and biology of *Pectinivalva* is outside the scope of the present paper. More than 30 species have now been reared; all of these are leaf-miners of Myrtaceae, and most of their hosts belong to the subfamily Leptospermoideae.

The *Pectinivalva comuni* group*Pectinivalva caenodora* (Meyrick)

(Figs 1-3, 34, 38-40, 74)

Nepticula caenodora Meyrick, 1906: 58.*Pectinivalva caenodora*; Nielsen 1996: 16.

Type material. – Holotype ♂, New South Wales: Sydney, 8.x.1884, E. Meyrick. Genitalia slide 25635 (BMNH).

Other material examined. – New South Wales: 5 mi S of Forster, 1♀, 3.ix.1967, I.F.B.Common (ANIC); Minton Falls, 6 km N of Rosebank, 1♂, 2♀, 19.xi.1976, I.F.B.Common and E.D.Edwards. Genitalia slides 10143, 10144 (ANIC).

Redescription. – Male (Figs 1, 2). Wingspan 6.4 mm. Head: frontal tuft black; collar inconspicuous, comprising a few black hair-scales; eyecaps yellowish white; antennae grey-brown, 38 segments. Thorax yellowish white. Forewing coarsely scaled, dark brown, with a broad yellowish white costal band from base to apex; basal ½ of costa edged black; at tornus a small yellowish white spot; terminal cilia dark grey-brown with distinct cilia-line. Hindwing covered with coarse dark brown scales; a row of short, dark brown androconial scales along basal ¾ of costa and dorsum; cilia grey-brown. Underside: forewing (Fig. 2) almost black with blue and purplish lustre; hindwing dark grey-brown. Abdomen almost black with black anal tufts, underside with pale scaling.

Female (Figs 3, 34). Wingspan 5.8-6.5 mm. Head: as in male, except antennae shorter, 28-30 segments. Forewing slightly paler than in male with broader and straighter costal band; tornal spot much larger and cilia line less distinct. Underside dark grey-brown. Hindwing: both sides grey-brown with paler cilia. Abdomen: upperside fuscous, underside yellowish; tip very broad, without anal tufts. Venation as in Fig. 34.

Male genitalia (Figs 38-40). Capsule 305 µm long, broadly triangular. Vinculum anteriorly concave. Tegumen (Fig. 39) consisting of narrow well-sclerotized band and, posteriorly, another broader band resembling tegumen in other Nepticulidae. Uncus hood-shaped, pointed, with 2 setose lateral flaps connected to base of upper-side. Gnathos with broad cordate central element. Valva 175 µm long, very loosely fused to vinculum; apex strongly expanded with pectinifer comprising 45-50 elements. A slender weakly sclerotized bar, hingeing with apex of aedeagus, loosely connected to base of each valva. Transtilla absent.

Aedeagus (Fig. 40) 510 µm, with long spine connected to tip of aedeagal tube. Vesica with 2 long, curved terminal spines and 3 long interconnected basal spines, also numerous smaller spines throughout its length.

Female genitalia (Fig. 74). Total length 800 µm. S8 broad and blunt, with 5 setae on each side. T8 with 6-7 setae along margin of each side. Vestibulum funnel-shaped; lateral sclerites weak, not connected to apophyses. Ductus spermathecae with ca. 4 poorly defined convolutions. Bursa with dense cover of elongate, scale-like pectinations; towards signum decreasing in size and changing form to short subtriangular 'scales'. Bottom of bursa with strongly sclerotized elongate signum, consisting of interconnected rows of teeth interspersed with lacunae.

Condition of type material. – Head, thorax and right wings well preserved; left forewing worn, cilia and tornal spot lost.

Remarks. – Host-plant and early stages unknown. Two similar species with male genitalia very close to those of *P. caenodora* have been reared from juvenile foliage of *Eucalyptus pilularis* and an unidentified *Eucalyptus* species. The larvae of both species are green and make large characteristic trumpet-shaped blotch mines with the frass scattered in arcs. It is likely that *P. caenodora* has a similar biology. Both of the undescribed species lack the yellowish tornal spot of *P. caenodora*; in one the costal streak is absent; and in the other it only extends half way along the costa.

Pectinivalva chalcitis (Meyrick)

(Figs 11, 75)

Nepticula chalcitis Meyrick, 1906: 60.*Pectinivalva chalcitis*; Nielsen 1996: 16.

Type material. – Holotype ♀, Western Australia: Albany, 3.xii.1886, E. Meyrick. Genitalia slide 25643 (BMNH).

Redescription. – Male. Unknown.

Female (Fig. 11). Wingspan 5.5 mm. Head: frontal tuft pale yellow; collar invisible (worn); eyecaps white; antennae brown, 30 segments. Thorax and forewing bronze brown, weakly shining; at tornus a few whitish scales; cilia grey-brown (reconstructed following Meyrick's description). Hindwing grey with paler cilia. Underside: forewing similar to upperside but slightly paler; hindwing grey. Venation similar to that of *P. comuni* (Fig. 33). Abdomen fuscous.

Female genitalia (Fig. 75). Total length ca. 850 μm . S8 broad and blunt. T8 with ca. 5 setae on either side. Anal papillae with 13-14 setae on each side. Vestibulum with lateral sclerites not connected to apophyses. Ductus spermathecae with $3\frac{1}{2}$ convolutions. Bursa almost globular, densely covered with square, scale-like pectinations; anterior part with strongly sclerotized toothed signum and small black pigment spots.

Condition of type material. – Tips of both forewings worn and most of the cilia lost.

Remarks. – Host-plant and early stages unknown. No additional material known.

Pectinivalva commoni Scoble

(Figs 4-7, 33, 41, 42, 76)

Pectinivalva commoni Scoble, 1983:13.

Type material. – Holotype σ , New South Wales: 17 mi SE of Braidwood, emerged 27.i.1958, I.F.B. Common. Genitalia slide 11526 (ANIC). Paratypes: 3 ϕ , same data as holotype, emerged 7.ii. and 22.ii.1958. Genitalia slides 11499, 11527, 11577 (ANIC).

Redescription. – Male (Figs 4-6). Wingspan 5.3 mm. Head: Frontal tuft orange; collar white; eyecaps white, edged posteriorly with blackish brown; antennae pale grey, 52 segments. Thorax fuscous. Forewing fuscous, with mottled appearance caused by shining pale purplish grey bases of the scales; distal 3 rows of scales with more of bases showing, making wing-tip appear lighter; cilia grey. Hindwing (Fig. 5) lanceolate, pale brownish grey; a small oval area of blackish androconial scales in middle at base; cilia pale grey. Underside: forewing brown with a purplish tinge; hindwing (Fig. 6) grey with row of long blackish brown lamellate scales along costa at base, and second row of shorter scales beneath these. Abdomen fuscous.

Female (Figs 7, 33). Wingspan 5.3-5.6 mm. Head: as in male, but antennae shorter, 23 segments. Thorax and forewing as in male. Hindwing with piliform instead of lamellate scales along costa, and without androconial scales. Venation as in Fig. 33.

Male genitalia (Figs 41, 42). Capsule 340 μm long, roughly rectangular. Vinculum with slight anterior excavation. Tegumen band-like. Uncus hood-shaped, blunt, with 4 curved setae on each side. Gnathos with central element pointed, broadest at mid-length. Valva 250 μm , elongate,

loosely fused to vinculum; tip rounded with pectinifer comprising ca. 30 elements. Short sublateral processes present. Transtilla absent. Aedeagus (Fig. 42) 455 μm , without carinate processes. Vesica with 2 or 3 interconnected spines at base, 3 prominent apical spines and numerous short spine-like cornuti.

Female genitalia (Fig. 76). Total length 760 μm . S8 broad and blunt. Anal papillae with ca. 15 setae each. T8 with a few setae on each side. Apophyses posteriores distinctly longer than anteriores. Vestibulum funnel-shaped with weak lateral sclerites. Ductus spermathecae with 3 convolutions, strongly widening towards vesicle. Anterior $\frac{1}{2}$ of bursa with dense cover of weak, scale-like pectinations; bottom with well-sclerotized toothed signum.

Condition of type material. – All four specimens in very good condition.

Remarks. – The host-plant is a species of *Euca-lyptus*, tentatively identified as *E. delegatensis* (= *gigantea*). The larval mines were collected on 24 September (form of mine not recorded), and adults emerged during the following February. Only the type series of four specimens is known.

Pectinivalva endocapna (Meyrick)

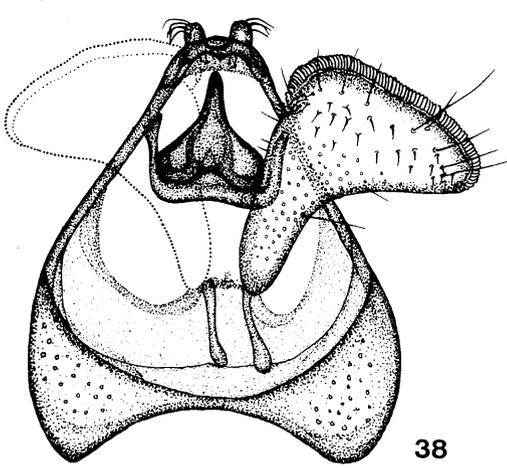
(Figs 8-10, 43, 44, 77)

Nepticula endocapna Meyrick, 1906: 60.

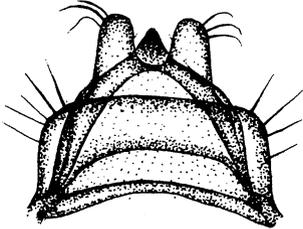
Pectinivalva endocapna; Nielsen 1996: 16.

Type material. – Lectotype (here designated) σ , Western Australia: Albany, 3.xii.1886, E. Meyrick. Genitalia slide 25636 (BMNH). Paralectotypes: 6 σ , 3 ϕ , same data as lectotype, 2-6.xii.1886. Genitalia slide 25637 (BMNH).

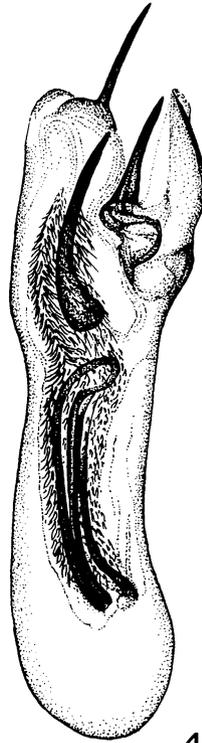
Redescription. – Male (Figs 8, 9). Wingspan 4.7-5.7 mm. Head: frontal tuft yellow; collar inconspicuous, consisting of a few white hair-scales; eyecaps white; antennae grey-brown, 30-33 segments. Thorax and forewing pale grey-brown, coarsely scaled, with base of costa darker; dorsum paler, yellowish grey. Cilia yellowish grey, irrorated with dark-tipped scales. Hindwing broad, grey-brown with purplish lustre except for distal $\frac{1}{4}$; basal $\frac{2}{3}$ with longitudinal fold near costa; along dorsal side of fold a row of short, dark brown androconial scales; costal side whitish; 10-15 long grey-brown scales inserted in fold. Cilia grey. Underside: forewing slightly darker than upperside with faint purplish lustre; hindwing



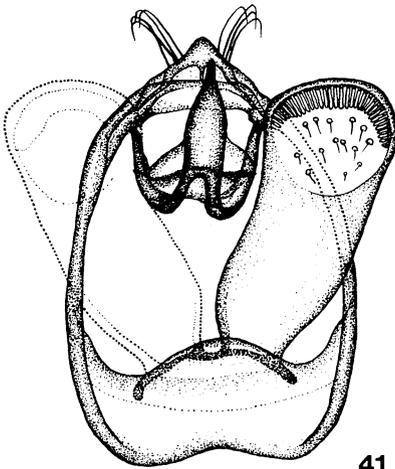
38



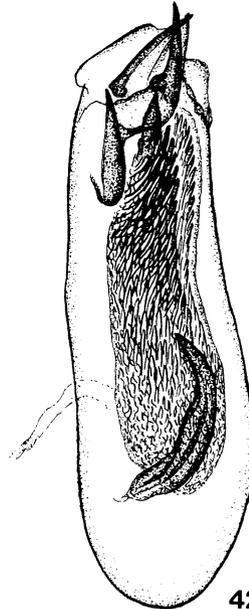
39



40

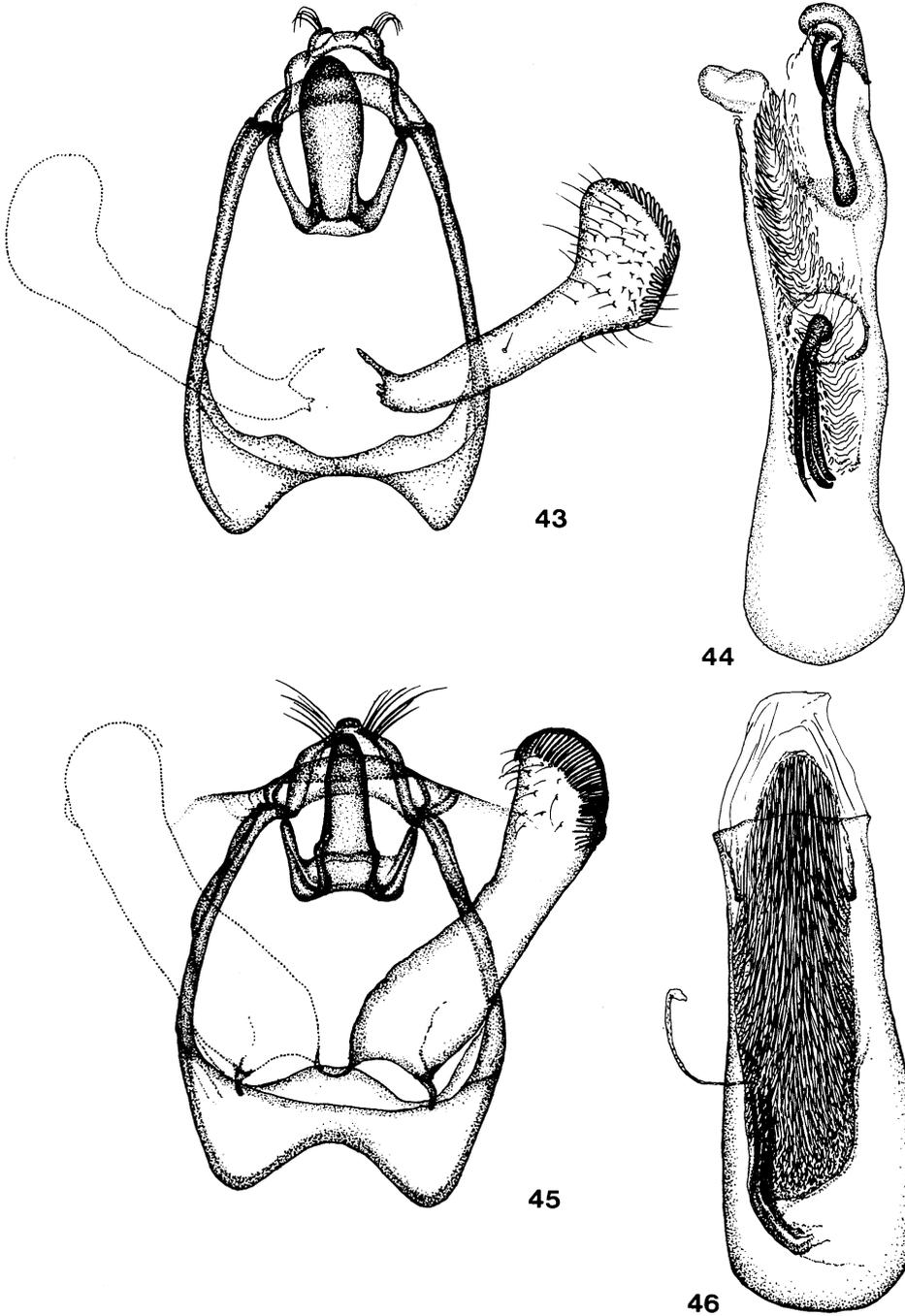


41

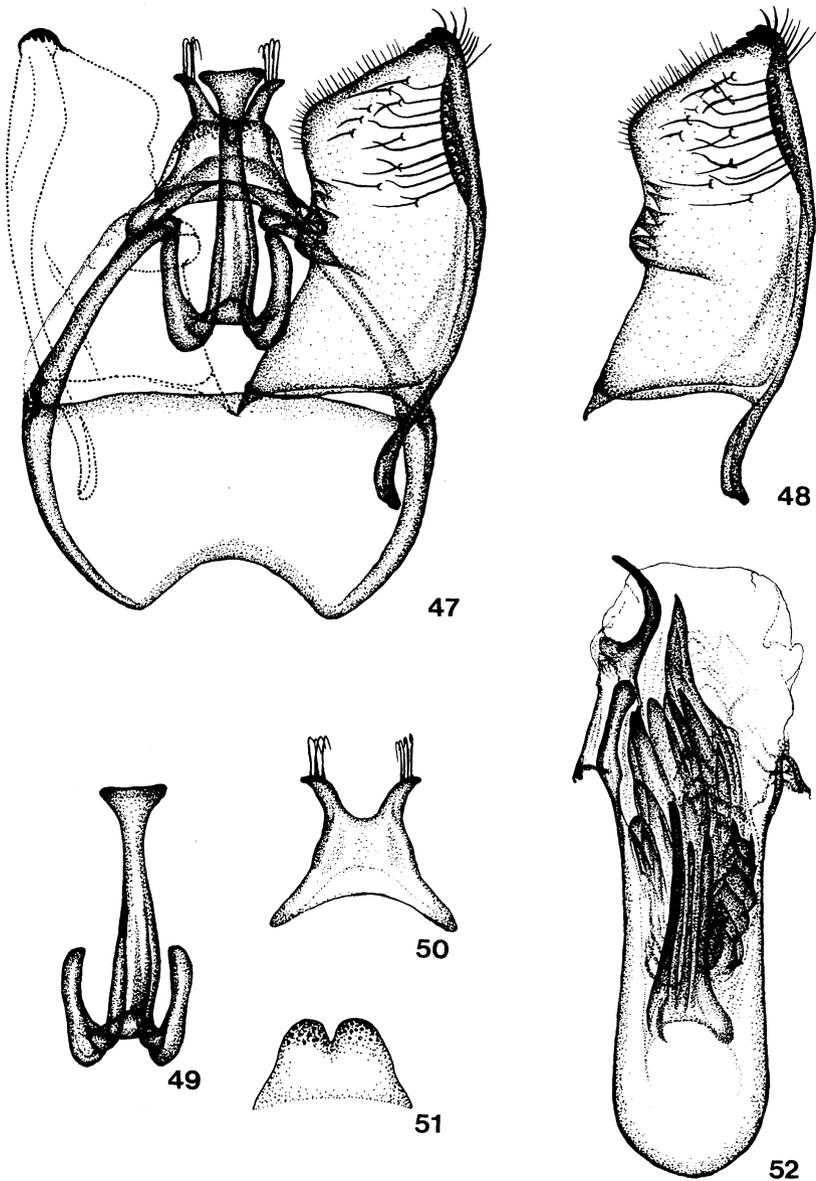


42

Figs 38-42. Male genitalia of *Pectinivalva* spp. (38-40) *P. caenodora*: (38) genital capsule (BMNH 25635); (39) tegumen and uncus (ANIC 10143); (40) aedeagus, ventro-lateral view (BMNH 25635). (41, 42) *P. commoni* (ANIC 11526): (41) genital capsule; (42) aedeagus, ventral view.



Figs 43-46. Male genitalia of *Pectinivalva* spp. (43, 44) *P. endocapna* (BMNH 25636): (43) genital capsule (valvae spread to show inner surface); (44) aedeagus, ventral view. (45, 46) *P. melanotis* (BMNH 25637): (45) genital capsule; (46) aedeagus, ventral view.



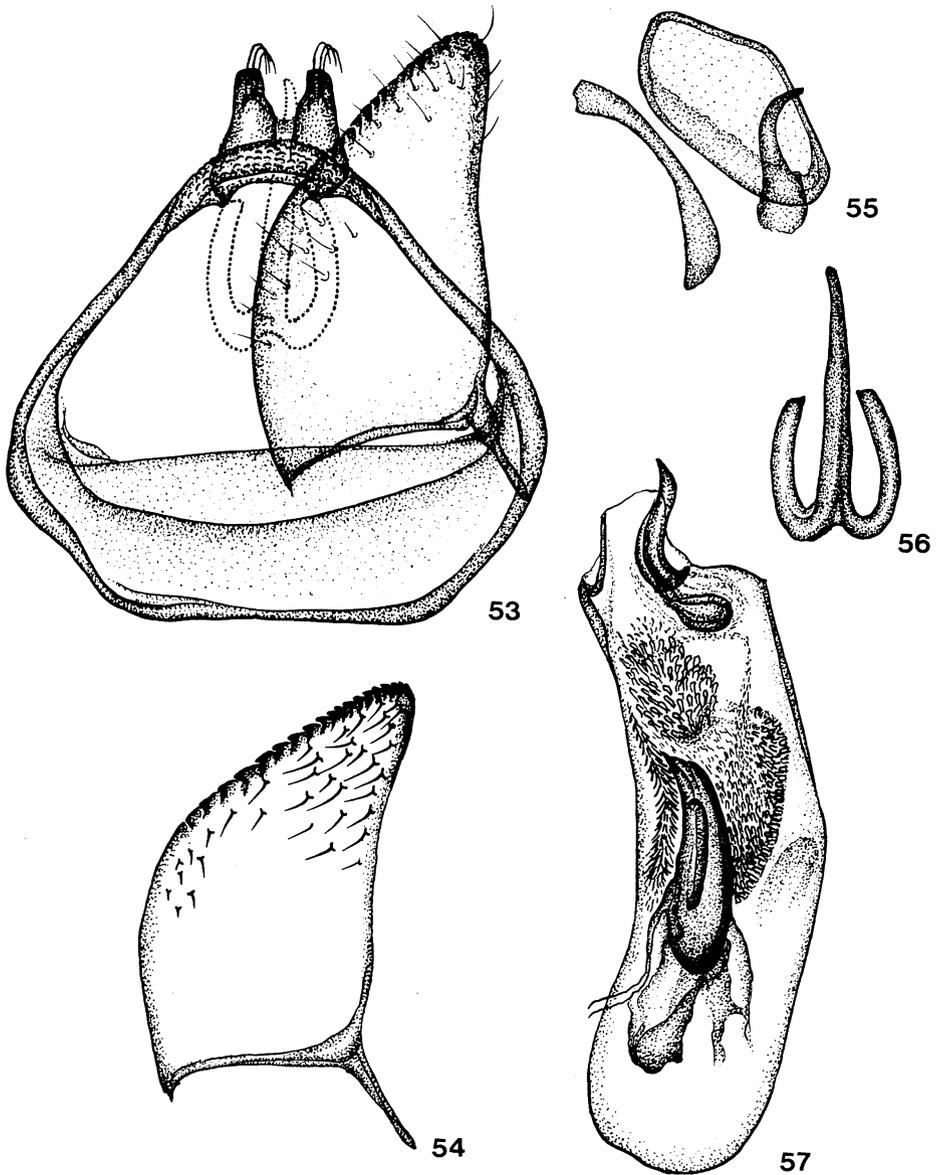
Figs 47-52. Male genitalia of *Pectinivalvafuneralis* (BMNH 24114): (47) genital capsule; (48) right valva; (49) gnathos; (50) uncus; (51) tegumen; (52) aedeagus, ventral view.

(Fig. 9) similar to upperside but paler. Venation similar to that of *P.commoni* (Fig. 33). Abdomen dark brown with small, pale yellowish anal tufts.

Female (Fig. 10). Wingspan ca. 5.5 mm. Head: frontal tuft pale yellow; collar inconspicuous, white; eyecaps white; antennae yellowish grey,

23-27 segments. Thorax and both sides of forewing yellowish grey, slightly paler than in male. Hindwing narrower than in male; both sides pale grey with concolorous cilia.

Male genitalia (Figs 43, 44). Capsule 310 µm long, elongate in shape. Vinculum narrow, anteri-

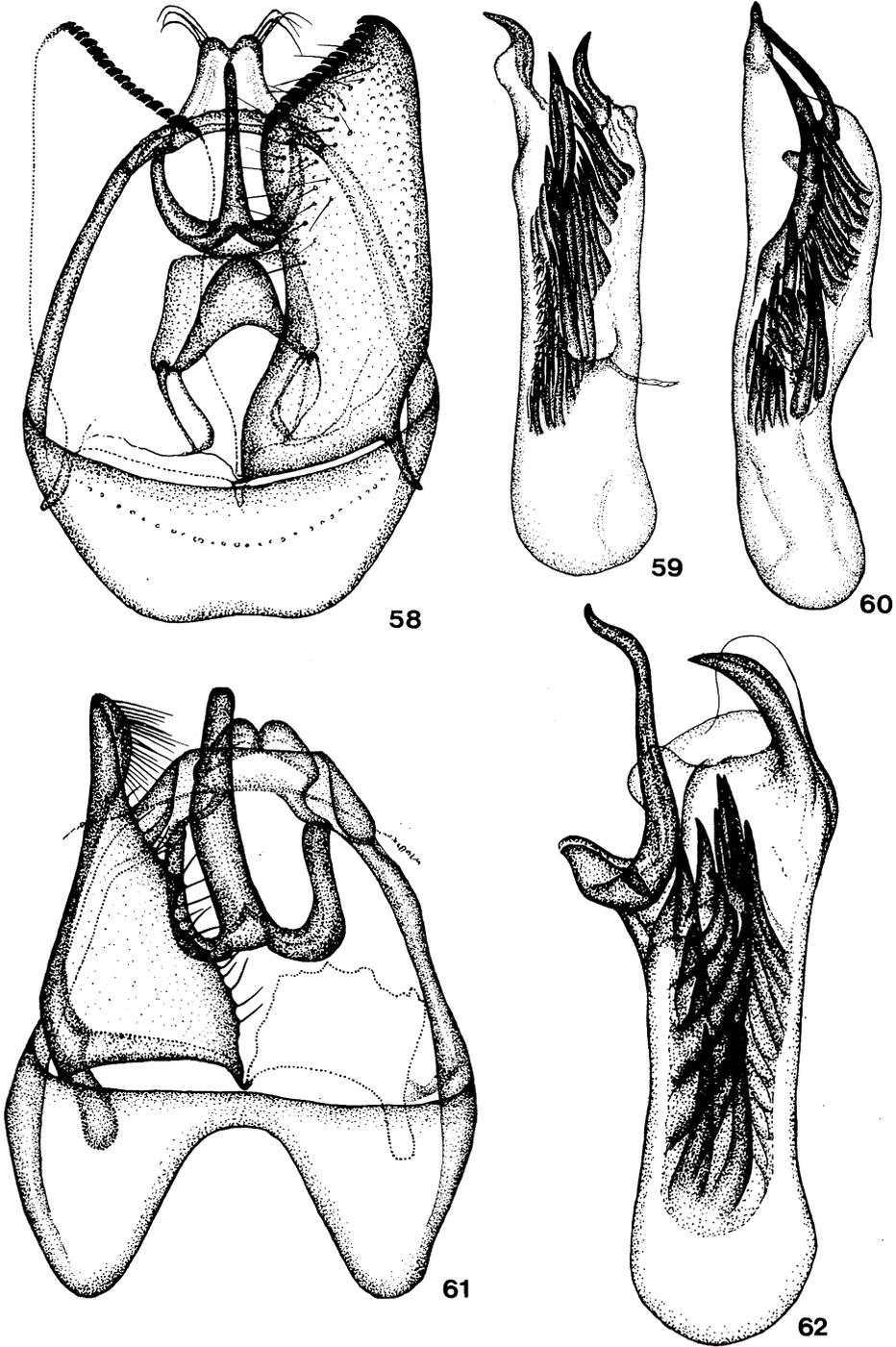


Figs 53-57. Male genitalia of *Pectinivalva libera* (BMNH 24112): (53) genital capsule; (54) right valva; (55) juxta; (56) gnathos; (57) aedeagus, ventral view.

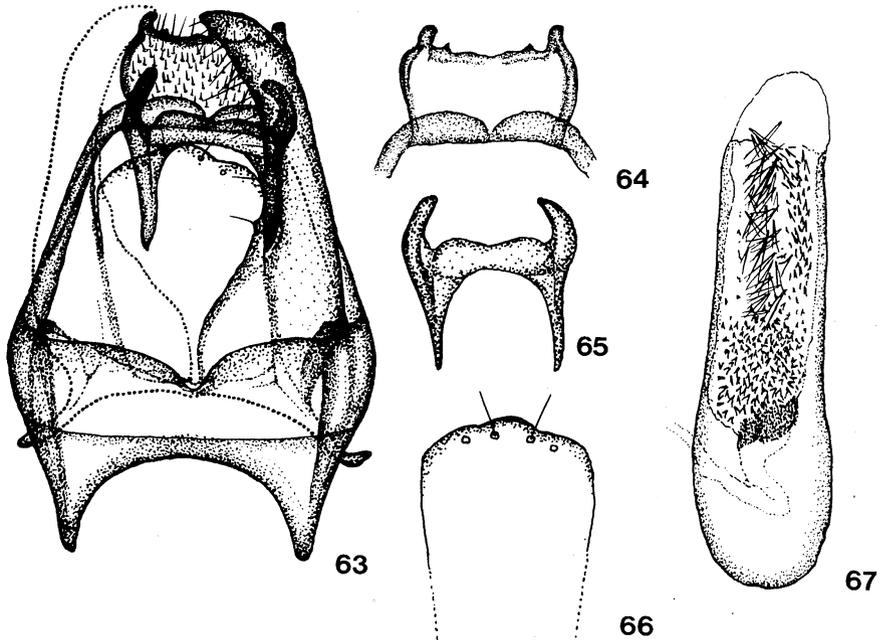
only concave. Tegumen band-like. Uncus broadly hood-shaped with blunt tip; 2 small setose flaps connected to either side of uncus upperside. Gnathos with broadly spatulate central element. Valva 205 μm , narrow, loosely connected to vinculum, terminally widened, with pectinifer comprising 25-30 elements. Sublateral processes strongly

reduced. Transtilla absent. Aedeagus (Fig. 44) 400 μm , with short spine at tip of aedeagal tube. Vesica with 1 long distal cornutus and 3 long interconnected basal cornuti; throughout its length with numerous small spines and fold-like structures resembling fingerprints.

Female genitalia (Fig. 77). Total length ca. 800



Figs 58-62. Male genitalia of *Pectinivalva* spp. (58-60) *P. trepida* (BMNH 25641): (58) genital capsule; (59) aedeagus, ventral view; (60) aedeagus, lateral view. (61, 62) *P. warburtonensis* (ANIC 11520): (61) genital capsule; (62) aedeagus, ventral view.



Figs 63-67. Male genitalia of *Stigmella leucargyra* (BMNH 25640): (63) genital capsule; (64) uncus; (65) gnathos; (66) juxta; (67) aedeagus, ventral view.

μm . S8 very broad, with 9-10 long setae on each side; anal papillae with numerous very small setae. T8 with 6-8 setae on each side. Apophyses posteriores slightly longer than anteriores. Vestibulum very broad with weak lateral sclerites. Ductus spermathecae with $2\frac{1}{2}$ convolutions, vesicle distinct. Bursa constricted anterior to ductus spermathecae, conical; posterior $\frac{1}{2}$ with dense cover of scale-like pectinations; anterior $\frac{1}{2}$ with strongly sclerotized toothed signum, the lacunae circular.

Condition of type material. – Lectotype and one other specimen in relatively good condition, the rest more or less worn.

Remarks. – The host-plant and early stages are unknown, but Meyrick stated that the species was common on a fence at Albany under a row of *Eucalyptus*, and suspected that this was the host-plant. No material other than the type series is known. The female from York, included by Meyrick in the type series, belongs to an undescribed species of *Stigmella* Schrank.

Pectinivalva gilva (Meyrick)

(Fig. 12)

Nepticula gilva Meyrick, 1906: 59.

Pectinivalva gilva; Nielsen 1996:16.

Type material. – Holotype ♀, New South Wales: Sydney, 6.xii.1879, E. Meyrick (BMNH).

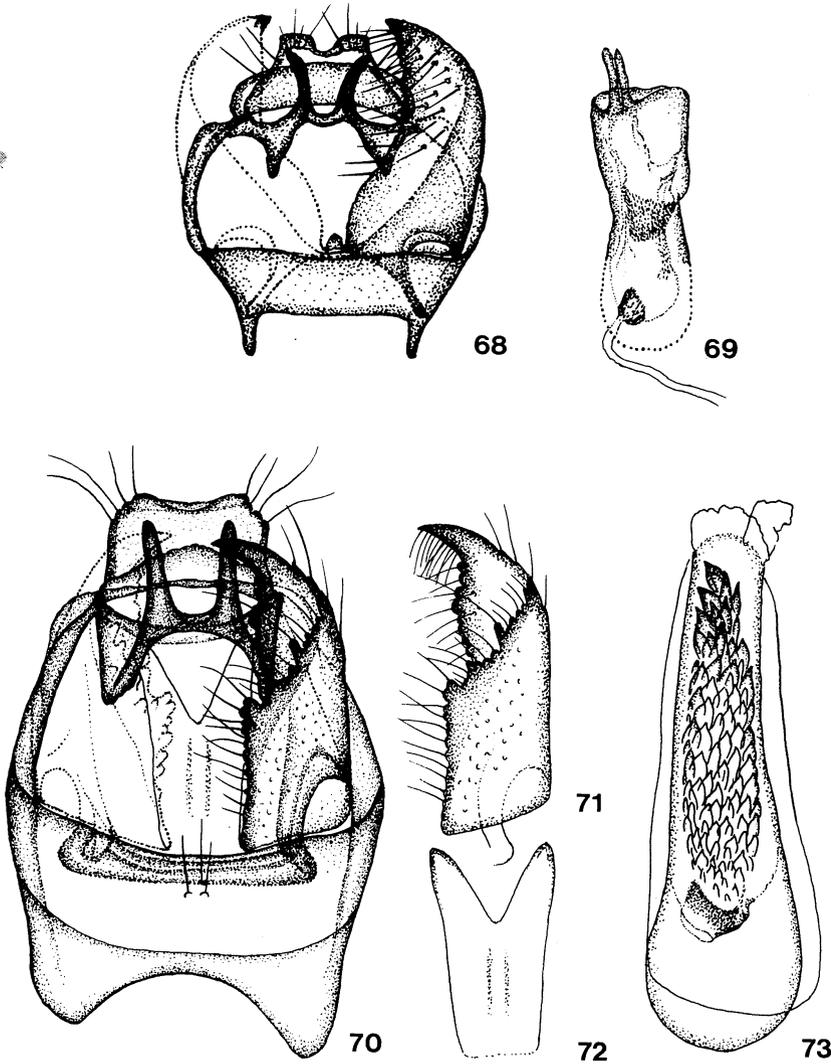
Redescription. – Male. Unknown.

Female (Fig. 12). Wingspan 5.7 mm. Head: frontal tuft black; collar worn (damaged by thick pin); eyecaps whitishochreous; antennae grey, (incomplete). Thorax and forewing whitishochreous; a fuscous patch on dorsum at $\frac{1}{4}$ reaching $\frac{1}{2}$ way across wing, irrorated with dark fuscous; a similar patch at tornus reaching nearly to costa and extended basad towards disc above middle; cilia pale greyish ochreous. Hindwings bronzy grey; cilia pale greyish ochreous. Underside pale brown. Abdomen broad with blunt, truncate tip, yellowish-brown.

Female genitalia. Not known (abdomen lost).

Condition of type material. – Both antennae are incomplete, and the abdomen was lost during the preparation of a genitalia slide; otherwise in good condition.

Remarks. – Host-plant and early stages unknown. No material other than the holotype is known, but



Figs 68-73. Male genitalia of *Stigmella* spp. (68, 69) *S. phyllanthina* (BMNH 24116): (68) genital capsule; (69) aedeagus, ventral view. (70-73) *S. symmora* (BMNH 25639): (70) genital capsule; (71) right valva; (72) juxta; (73) aedeagus, ventral view.

one or two species with a broadly similar wing pattern are represented in the ANIC. These belong to the 'commoni' group of *Pectinivalva*. This supports the assignment of *P. gilva* to this group.

***Pectinivalva melanotis* (Meyrick)**

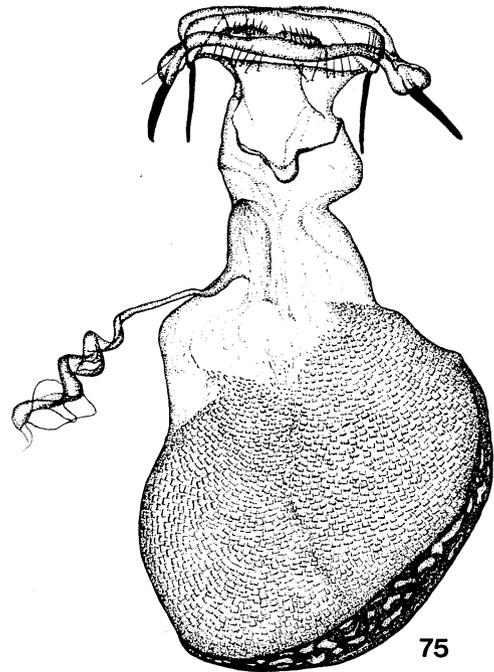
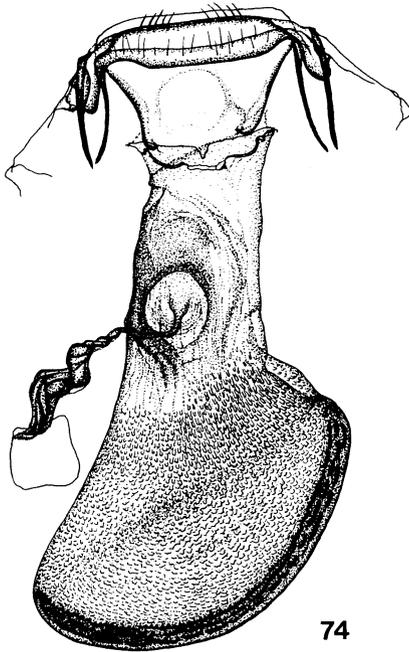
(Figs 13-15, 45, 46)

Nepticula melanotis Meyrick, 1906: 59.
Pectinivalva melanotis; Nielsen 1996: 16.

Type material. – Holotype ♂, New South Wales: Sydney, 5.ix.1881, E. Meyrick. Genitalia slide 24115 (BMNH).

Other material examined. – New South Wales: Cordaux Dam, 1♂, 13.ix.1972, V.J. Robinson. Genitalia slide 11233 (ANIC).

Redescription. – Male (Figs 13-15). Wingspan 5-6.6 mm. Head: frontal tuft orange; collar pale yellow; eyecaps pale yellow with large dark brown



Figs 74, 75. Female genitalia of *Pectinivalva* spp. (74) *P. caenodora* (ANIC 10144). (75) *P. chalcitis* (BMNH 25643).

scale-flap above; antennae grey-brown, 34 segments. Thorax, forewing and cilia dark grey-brown, densely irrorated with fine dark-tipped scales. Hindwing broad, dark purplish brown except for distal $\frac{1}{2}$; from base to $\frac{2}{3}$ a longitudinal furrow with short yellowish scales; cilia dark grey. Underside: forewing (Fig. 14) almost black with purplish lustre; dorsal $\frac{1}{4}$ paler, bluish grey; hindwing (Fig. 15) dark grey with a row of dark grey androconial scales inserted near costa. Abdomen dark grey-brown with large dark grey-brown anal tufts.

Female. Unknown.

Male genitalia (Figs 45, 46). Capsule 420 μm long, elongate. Vinculum with distinct anterior emargination. Tegumen band-like. Uncus broadly hood-shaped with blunt tip; 6-7 setae inserted on each side of uncus upperside. Gnathos with long, blunt central element. Valva 285 μm long, narrow, distally slightly widened with pectinifer comprising ca. 35 long, thin elements; small sublateral processes present. Transtilla absent. Aedeagus (Fig. 46) 475 μm , cylindrical; vesica with 3 long

interconnected cornuti and several hundred thin spines.

Condition of type material. – A perfectly set specimen in very good condition.

Remarks. – Host-plant and early stages unknown.

The *Pectinivalva funeralis* group

Pectinivalva anazona (Meyrick)

(Figs 16, 35, 78, 79)

Nepticula anazona Meyrick, 1906: 58.

Pectinivalva anazona; Nielsen 1996: 16.

Type material. – Holotype ♀, Queensland: Brisbane, 21.ix.1879, E. Meyrick. Genitalia slide 25642 (BMNH).

Redescription. – Male. Unknown.

Female (Figs 16, 35). Wingspan 4 mm. Head: frontal tuft ochreous; collar inconspicuous, consisting of a few whitish hair-scales; eyecaps yellowish white; antennae pale brown, 16 segments. Thorax and forewing grey-brown, weakly shining,



76



77

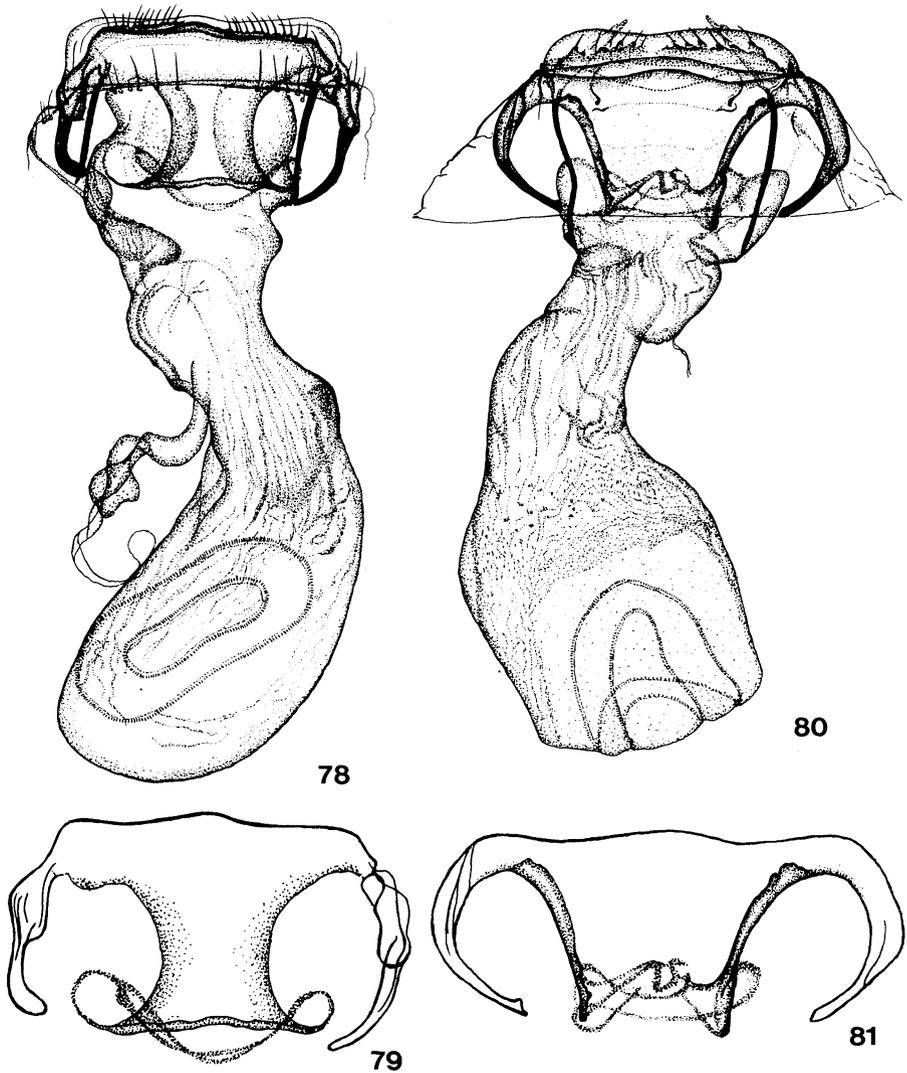
Figs 76, 77. Female genitalia of *Pectinivalva* spp. (76) *P. communi* (ANIC 11499). (77) *P. endocapna* (BMNH 25638).

distal $\frac{1}{2}$ slightly darker, coarsely scaled; fascia silvery white, slightly postmedial, broad at dorsum, distinctly narrower towards costa; cilia pale grey-brown. Venation as in Fig. 35. Hindwings and cilia pale grey. Underside grey, fascia shining through. Abdomen (after Meyrick) dark bronze grey.

Female genitalia (Figs 78, 79). Total length ca. 750 μm . S8 very broad, anal papillae with 12 setae each. T8 with 5-6 setae on either side. Vestibular sclerotizations (Fig. 79) connected to anterior apophyses. Ductus spermathecae with 2 indistinct convolutions; bursa with tiny pectinations, and in anterior $\frac{1}{2}$ with large signum consisting of 2 concentric ovals of minute spine-like parallel lines.

Condition of type material. – The specimen is in rather poor condition; the forewings are slightly worn and most of the cilia are lost (cilia and abdomen reconstructed in Fig. 16).

Remarks. – Meyrick thought that the host-plant was likely to be *Lophostemon confertus* (= *Tristania conferta*) (Myrtaceae) because the holotype was beaten from this plant. At least three species of *Pectinivalva* have now been reared from *Lophostemon* spp. and the closely related *Tristaniopsis*. Whilst all of these species are similar to *P. anazona* in possessing a shining transverse fascia (unusual for *Pectinivalva*), they differ in that the bursa lacks a signum and is covered with strong pectinations. On the basis of the loss of the signum, these species are considered to form a monophyletic group, to which *P. anazona* does not belong. Therefore on balance, it is considered unlikely that *Lophostemon* is the host-plant of *P. anazona*. No additional material of this species has been found, and the photograph reproduced in Common (1970: fig. 36.14E) and in Nielsen & Common (1991: fig. 41.26A) represents an undescribed species of *Pectinivalva*.



Figs 78-81. Female genitalia of *Pectinivalva* spp. (78, 79) *P. anazona* (BMNH 25642): (78) complete genitalia; (79) anterior apophyses and sclerotizations of vestibulum. (80, 81) *P. planetis* (BMNH 25637): (80) complete genitalia; (81) anterior apophyses and sclerotizations of vestibulum.

***Pectinivalva funeralis* (Meyrick)**

(Figs 18, 19, 47-52)

Nepticula funeralis Meyrick, 1906: 59-60.

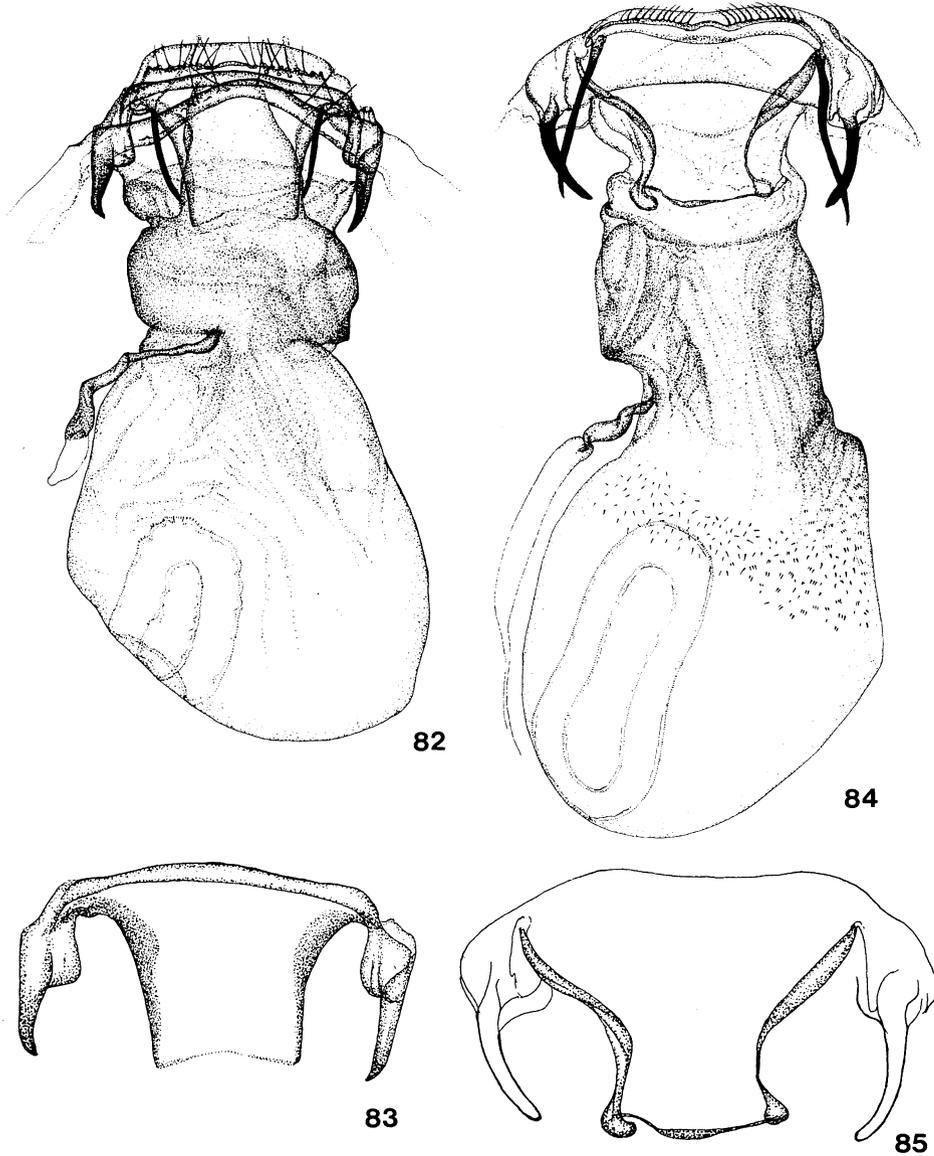
Pectinivalva funeralis; Nielsen 1996: 16.

Type material. – Holotype ♂, New South Wales: Sydney, 2.iii.1879, E. Meyrick. Genitalia slide 24114 (BMNH).

Other material examined. – New South Wales: Como

West, 1♂, 14.i.1974, L. Willan and V. J. Robinson. Genitalia slide 10230 (ANIC).

Redescription. – Male (Figs 18, 19). Wingspan 5-5.2 mm. Head: frontal tuft pale yellow; collar whitish; eyecaps white, or laterally black-edged; antennae dark brown, 36 segments. Thorax and forewing unicolorous dark brown; dorsum with fringe of long narrow blackish androconial scales;



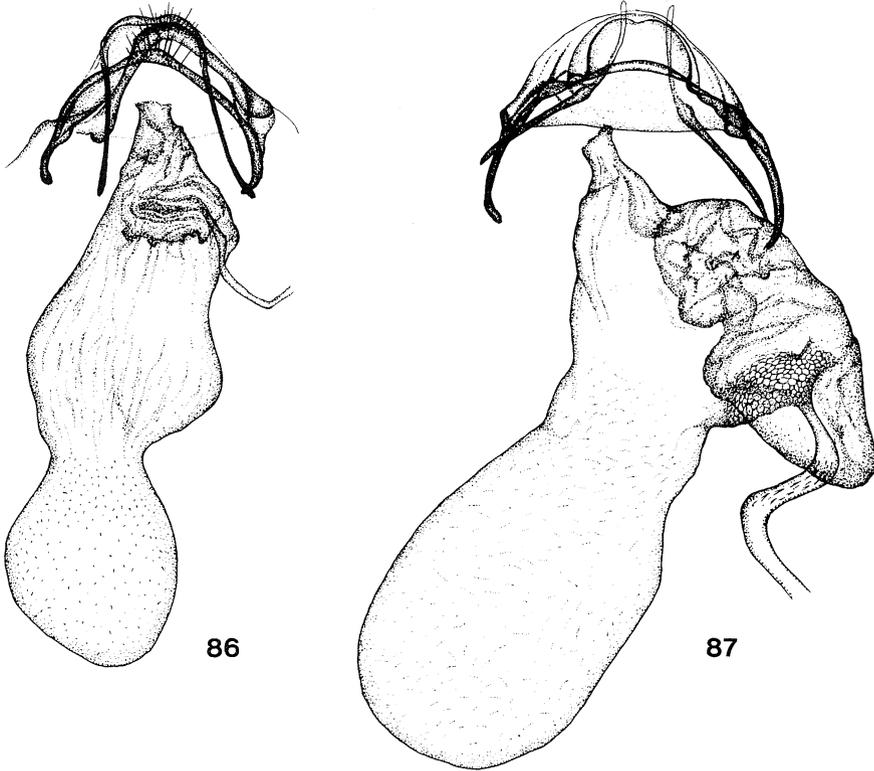
Figs 82-85. Female genitalia of *Pectinivalva* spp. (82, 83) *P. primigena* (BMNH 25649): (82) complete genitalia; (83) anterior apophyses and sclerotizations of vestibulum. (84, 85) *P. warburtonensis* (ANIC 11498): (84) complete genitalia, (85) anterior apophyses and sclerotizations of vestibulum.

cilia grey-brown. Fore-tibia short and thickened above with black scales. Hindwing broad, dark grey-brown; elongate patch of bluish black scales at base, and similar row of scales along vein A; costa with double row of dark brown androconial scales, one short and one full length of cilia; along inner 1/2 of dorsum short grey-brown scales

in cilia; cilia grey-brown. Underside: forewing dark grey-brown, basal 1/2 of costa darker, almost black; hindwing (Fig. 19) dark grey, base of costa darker, bluish grey. Venation similar to that of *P. anazona* (Fig. 35). Abdomen brown.

Female. Unknown.

Male genitalia (Figs 47-52). Capsule 380 µm



Figs 86, 87. Female genitalia of *Stigmella* spp. (86) *S. leucargyra* (BMNH 25645). (87) *S. symmora* (BMNH 25644).

long. Vinculum relatively broad, rounded, with small anterior excavation. Tegumen (Fig. 51) broad with medial emargination. Uncus (Fig. 50) bilobed with horn-like lateral processes. Gnathos (Fig. 49) with long central element, terminally widened. Valva (Fig. 48) 310 μ m long, roughly rectangular with inner lobe in middle; at inner margin of lobe 5-6 triangular teeth; apex of valva with 6-7 small teeth. Well-sclerotized sublateral processes present. Transtilla absent. Aedeagus (Fig. 52) 490 μ m, with single horn-like carina, and ca. 20 larger and 10 smaller leaf-shaped cornuti; some larger cornuti at base, surrounding ejaculatory duct.

Condition of type material. – The forewings are worn and most of the cilia are lost. Head, thorax and hindwings in relatively good condition.

Remarks. – Host-plant and early stages unknown.

Pectinivalva libera (Meyrick)

(Figs 20, 21, 53-57)

Nepticula libera Meyrick, 1906: 61.
Pectinivalva libera; Nielsen 1996: 16.

Type material. – Holotype σ , New South Wales: Sydney, 8.iii.1878, E. Meyrick. Genitalia slide 24112 (BMNH).

Redescription. – Male (Figs 20, 21). Wingspan 5 mm. Head: frontal tuft yellow; collar yellowish white; eyecaps yellowish white; antennae yellowish grey, 38 segments. Thorax, forewing and cilia unicolorous grey-brown, irrorated with dark-tipped scales. Hindwing very broad at base, clearly cuspidate towards tip; grey with darker, grey-brown tip and margins; from base to $\frac{3}{4}$ a longitudinal furrow devoid of scales; costa with 2 rows of broad, fuscous androconial scales, one full length of cilia, one $\frac{1}{2}$ cilia length; dorsum with

single row of androconial scales reaching approximately $\frac{1}{4}$ length of cilia. Underside: forewing (Fig. 21) fuscous, with conspicuous yellow spot near costa at base; costal fold dark brown with a few orange scales near base; dorsum with row of long black hair-scales inserted near margin; hindwing grey-brown. Abdomen dark fuscous with yellowish white anal tufts.

Female. Unknown.

Male genitalia (Figs 53-57). Capsule 330 μm long, broadly triangular; vinculum without anterior emargination. Tegumen band-like with numerous small granules. Uncus distinctly bilobed, with 3 curved setae on each lobe. Gnathos (Fig. 56) with long, narrow central element. Valva (Fig. 54) 250 μm x 140 μm , roughly triangular with ca. 20 small triangular teeth along distal $\frac{1}{2}$ of inner margin; slender sublateral processes present. Transtilla absent. Juxta as in Fig. 55 (probably incomplete). Aedeagus (Fig. 57) 425 μm , with single, horn-like carina connected to aedeagal tube. Vesica with 1 large broad cornutus, distally split into 3 points; an irregular chitinous structure centrally; distal $\frac{1}{2}$ with numerous small spines.

Condition of type material. – The forewings are worn and most of the cilia are lost.

Remarks. – Host-plant and early stages unknown. Only the holotype of *P. libera* is known. The genitalia and the position and form of the androconial scales indicate a close relationship to *P. funeralis*. Another closely related, undescribed species, which differs from *P. libera* in having a transtilla in the male genitalia, has been reared from leaf-mines on *Angophora costata* (Myrtaceae) at Toowoomba, Queensland.

Pectinivalva planetis (Meyrick)

(Figs 22, 80, 81)

Nepticula planetis Meyrick, 1906: 58.
Pectinivalva planetis; Nielsen 1996: 16.

Type material. – Holotype ♀, New South Wales: Sydney, 6.xii.1879, E. Meyrick. Genitalia slide 25637 (BMNH).

Redescription. – Male. Unknown.

Female (Fig. 22). Wingspan 5.5 mm. Head: frontal tuft orange; collar pale yellow; eyecaps white; antennae brown, 24 segments. Thorax and forewing grey-brown with slightly paler cilia; on tornus and costa $\frac{3}{5}$ from base 2 small indistinct pale yellowish spots. Hindwing pale grey with

concolorous cilia. Underside: forewing unicolorous grey-brown; hindwing pale grey. Abdomen dark grey.

Female genitalia (Figs 80, 81). Total length ca. 680 μm . S8 very broad and blunt. Anal papillae distinct, with 6 setae each. Apophyses posteriores longer than anteriores. Vestibulum wide; lateral sclerotizations (Fig. 81) distinct, connected to anterior apophyses. Ductus spermathecae with 2 poorly defined convolutions. Signum of 2 concentric bands as in *P. anazona*.

Condition of type material. – Left forewing lost, otherwise in relatively good condition.

Remarks. – Host-plant and early stages unknown. *P. planetis* is only known from the holotype.

Pectinivalva primigena (Meyrick)

(Figs 17, 82, 83)

Nepticula primigena Meyrick, 1906: 58.
Pectinivalva primigena; Nielsen 1996: 16.

Type material. – Holotype ♀, New South Wales: Sydney, 20.viii.1878, E. Meyrick. Genitalia slide 25649 (BMNH).

Redescription. – Male. Unknown.

Female (Fig. 17). Wingspan 4.3 mm. Head: frontal tuft yellow; collar not visible; eyecaps yellowish white; antennae brown, 19 segments. Thorax and proximal part of forewing weakly shining, grey-brown, irrorated with fine, dark-tipped scales; at $\frac{2}{3}$ a broad dull whitish fascia; distal part coarsely scaled, dark grey, with distinct cilia-line; terminal cilia white. Hindwing narrow, grey with slightly paler cilia. Underside: forewing unicolorous grey-brown; hindwing grey. Abdomen dark grey-brown.

Female genitalia (Figs 82, 83). Total length ca. 610 μm . S8 very broad and blunt. Anal papillae distinct, with 11 setae each. Apophyses posteriores shorter than anteriores. Vestibulum broad and folded; lateral sclerotizations (Fig. 83) distinct, interconnected anteriorly, and connected to anterior apophyses. Ductus spermathecae with 1½ poorly defined convolutions. Signum (175 μm) of 2 concentric bands as in *P. anazona*; some indistinct sclerotizations between these bands.

Condition of type material. – Head and wings well preserved; thorax and abdomen glued to pin.

Remarks. – Host-plant and early stages unknown.

Meyrick beat the single known specimen from *Banksia serrata* (Proteaceae) and thought this was probably the host-plant. He also stated that he found nepticulid larvae on this plant, but failed to rear them. Moore (1966) illustrated vacated mines on *Banksia serrata* and *B. integrifolia*, which he believed belonged to nepticulids. However, search in a number of localities in NSW during 1995 has failed to reveal any unequivocal sign of nepticulids on *Banksia* or any other genus of Proteaceae. Vacated mines on *Banksia serrata*, identical to those illustrated by Moore, have been found in two localities, but they are considered unlikely to belong to Nepticulidae as the commencement of the linear mine is uncharacteristically broad, and the egg appears to be injected into the leaf tissues, and is not visible on the surface. Moreover, no *Pectinivalva* has yet been reared from any family of plants other than Myrtaceae. References in the literature to nepticulids feeding on Proteaceae (e.g. van Nieuwerkerken 1986b: 37; Powell 1980) are all based on the statements of Meyrick and Moore and should be treated with the greatest caution.

Pectinivalva trepida (Meyrick)

(Figs 23, 58-60)

Nepticula trepida Meyrick, 1906: 61.

Pectinivalva trepida; Nielsen 1996: 16.

Type material. – Lectotype (here designated) ♂, Victoria: Gisborne, 11.iii.1900, G. Lyell. Genitalia slide 25641 (BMNH). Paralectotypes: 2♂, same data as lectotype. Genitalia slide 24111 (BMNH).

Redescription. – Male (Fig. 23). Wingspan 4.5-4.8 mm. Head: frontal tuft ochreous; collar not visible (worn); eyecaps pale yellowish, some scales tipped with brown; antennae grey, 45-47 segments. Thorax and forewing unicolorous dark grey-brown, coarsely scaled; cilia grey-brown, irrorated with dark grey scales. Hindwing and cilia pale grey, without androconial scales. Under-side: forewing unicolorous dark grey-brown; hindwing pale grey. Abdomen fuscous with dull yellowish anal tufts.

Female. Unknown.

Male genitalia (Figs 58-60). Capsule 365 µm long. Vinculum anteriorly rounded without distinct emargination. Tegumen narrow. Uncus bilobed with 7 curved setae at tip of each lobe. Gnathos lateral arms and central element long and narrow. Valva 280 µm long (x 125 µm), roughly rectangular; posterior margin with ca. 16 triangu-

lar teeth; short sublateral processes present. Transtilla absent. Juxta joined to valvae and aedeagus, with ventral lobe between valvae and 2 dorso-caudal lobes. Aedeagus (Figs 59, 60) 440 µm, with 1 horn-like carinate process; vesica with 3 long curved cornuti and ca. 30 smaller ones.

Condition of type material. – Lectotype and one other specimen with relatively well preserved head and wings, the third specimen worn.

Remarks. – Host-plant and early stages unknown. No additional material known.

Pectinivalva warburtonensis (Wilson)

(Figs 24, 25, 36, 37, 61, 62, 84, 85)

Nepticula warburtonensis Wilson, 1939: 238.

Pectinivalva warburtonensis; Nielsen 1996: 16.

Type material. – Lectotype (here designated) ♂, [Western Australia: Warburton Ranges, viii.1935]. Genitalia slide 11520 (ANIC). Paralectotype: 1♀, [same data as lectotype]. Genitalia slide 11498 (ANIC).

Redescription. – Male (Figs 24, 36). Wingspan 5.5 mm. Head: frontal tuft grey; antennae lost. Thorax grey-brown. Rest of pattern not discernible (see below). Venation as in Fig. 36.

Female (Figs 25, 37). Wingspan 5.5 mm. Head: frontal tuft ochreous; eyecaps white; antennae grey-brown, 17 segments. Thorax pale grey-brown. Forewing pale grey-brown with a broad diffuse whitish fascia at $\frac{2}{3}$; distal part of forewing slightly darker than proximal part. Cilia pale grey-brown. Hindwing and cilia pale yellowish grey. Abdomen grey-brown with very broad tip and small grey-brown anal tufts. Venation as in Fig. 37.

Male genitalia (Figs 61, 62). Capsule 390 µm long. Vinculum with deep anterior emargination. Tegumen broad and band-shaped. Uncus small, bilobed. Gnathos with long lateral arms and very long central element. Valva 275 µm, triangular, inner margin without teeth (setae only); short, broad sublateral processes present. Transtilla absent. Aedeagus (Fig. 62): ca. 390 µm, with 2 long carinate processes of unequal length and shape. Vesica with ca. 20 strong cornuti.

Female genitalia (Figs 84, 85). Total length ca. 820 µm. S8 very broad with 10-11 setae on each side. Apophyses posteriores longer than anteriores. Vestibulum broad, with weak lateral sclerites connected to base of apophyses anteriores (Fig. 85). Ductus spermathecae with 2 convolutions.

Bursa with posterior band of small denticles arranged singly or in groups of 2 or 3; signum large, with 2 concentric oval bands as in *P. anazona*.

Condition of type material. – Both specimens in poor condition, glued to a coverslip; the male with the upperside down, so that most of its scales have been lost.

Remarks. – Host-plant and early stages unknown. *P. warburtonensis* was collected on the University of Adelaide Anthropological Expedition to the Warburton Ranges in August, 1935. Other specimens of microlepidoptera taken on this expedition are present in the ANIC, and those that are labelled were collected by a Dr Hackett; he presumably also collected the type specimens of *P. warburtonensis*. In his original description, Wilson mentioned four specimens, and designated a 'type' (i.e. holotype), and two paratypes. The fourth specimen, he stated, was used for dissection. He did not give the sex of the holotype. Only two specimens, a male and a female, glued to the same coverslip, remain; the other two were probably lost prior to the transference of Wilson's collection from Adelaide to the ANIC. The remaining specimens are unlabelled, but a separate piece of paper pinned next to them indicates that they are the 'type specimens' of *Nepticula warburtonensis*. The male is here designated lectotype, and the female paralectotype.

Genus *Stigmella* Schrank

Stigmella Schrank, 1802: 169. Type species: *Phalaena (Tinea) anomalella* Goeze, 1783: 168, by subsequent designation (Walsingham 1907: 1008).

Nepticula von Heyden, 1843: 208. Type-species: *Tinea aurella* Fabricius, 1775: 666, by subsequent designation (Tutt 1899: 184). Synonymized by Walsingham 1907: 1008.

Dysnepticula Börner, in Brohmer 1925: 370. Type species: *Phalaena (Tinea) anomalella* Goeze, 1783: 168, by original designation (junior objective synonym).

Astigmella Puplesis, 1984: 111. Type-species: *Astigmella dissona* Puplesis, 1984: 112, by original designation. Synonymized by van Nieukerken 1986a.

The morphology of *Stigmella* has been most recently summarized by van Nieukerken (1986b). Superficially, members of this genus can almost always be distinguished from *Pectinivalva* by the presence of lamellate scales in the collar; in the females the abdominal tip is markedly more pointed (broad and 'square' in *Pectinivalva*). In

the forewing venation, 1+2A is thickened in *Stigmella*, but not in *Pectinivalva*; in the hindwing *Pectinivalva* has the trunk of Rs+M deflected towards the costa (Scoble 1983). The male and female genitalia of the two genera are very distinct; in particular the gnathos has paired posterior processes in all known Australian *Stigmella* species (only a single process in *Pectinivalva*), and females of *Stigmella* lack either of the two characteristic types of signum found in *Pectinivalva*.

The few, unnamed Australian species of *Acalypttris* Meyrick also have lamellate collars, and might therefore be confused with species of *Stigmella*. However, the undivided central element of the gnathos in the male, and the paired reticulate signa in the female genitalia readily distinguish *Acalypttris* species.

Stigmella has traditionally been divided into informal species-groups on the basis of genitalic and host-plant characters (see especially Johanson 1971; Emmet 1976; Newton & Wilkinson 1982; Kemperman & Wilkinson 1985; van Nieukerken 1986a and Puplesis 1994). None of the three species treated here fit clearly within a previously defined group, and the relationships of the Australian species are currently under review.

Stigmella leucargyra (Meyrick)

(Figs 26, 27, 63-67, 86)

Nepticula leucargyra Meyrick, 1906: 57-58.

Stigmella leucargyra; Nielsen 1996: 16.

Type material. – Lectotype (here designated) ♂, New South Wales: Sydney, emerged 3.ix.1884, E.Meyrick. Genitalia slide 25640 (BMNH). Paralectotypes: 4♀, same data as lectotype. Genitalia slide 25645 (BMNH).

Redescription. – Male (Fig. 26). Wingspan 3.7 mm. Head: frontal tuft pale ochreous; collar metallic grey; eyecaps shining white; antennae dark brown, 25 segments. Thorax and forewing shining bronze with purplish lustre; shining silver transverse fascia at $\frac{2}{3}$ from wing base; terminal cilia almost white, at tornus darker, brownish. Hindwing narrow, without androconial scales, grey; cilia grey. Underside: forewing dark brown; hindwing grey. Abdomen fuscous.

Female (Fig. 27). Wingspan 4-4.2 mm. Head: frontal tuft yellow; collar white; eyecaps white; antennae brown, 22-23 segments. Thorax and wings as in male. Abdomen fuscous, pointed, with slightly protruding ovipositor.

Male genitalia (Figs 63-67). Capsule 265 μm long. Vinculum with deep anterior emargination and pointed lateral corners. Tegumen narrow, bilobed. Uncus (Fig. 64) square, covered with small setae; posterior margin with 2 short lateral processes on each side. Gnathos (Fig. 65) with widely separated posterior processes; anterior processes distinctly longer than posterior ones. Valva 190 μm , triangular, slender, without inner lobe. Transtilla narrow in middle; sublateral processes long and curved. Juxta as in Fig. 66. Aedeagus (Fig. 67) 240 μm , vesica with distinct cathrema and numerous small cornuti of two types: very small and triangular or slightly longer and needle-like.

Female genitalia (Fig. 86). Total length 640 μm . S8 and T8 with medial posterior groups of small setae. Accessory sac small, without reticulate field; ductus spermathecae without internal spines, not convoluted. Corpus bursae constricted in middle, anterior $\frac{1}{2}$ with minute spines.

Condition of type material. – All specimens in good condition.

Remarks. – The host-plant is *Correa reflexa* (= *speciosa*) (Rutaceae). Meyrick stated that he found the larvae during July and August, the moths emerging in early September. He described the larva as bright green with a blackish head, and making an irregular contorted gallery in the leaf. In a related, undescribed species, feeding on *Correa lawrenciana* var. *cordifolia*, the mine begins as a brownish spot, and the larva mines outwards from this in concentric semicircles, doubling back when it approaches the edge of the leaf.

Meyrick stated that he found similar larvae on *Phebalium dentatum* (also Rutaceae), and considered that these were probably conspecific. In view of the fact that other species of *Correa* are mined by other *Stigmella* spp., it is unlikely that these *Phebalium* mines belonged to *S. leucargyra*.

No specimens other than the type material are known. The photograph in Common (1990: fig. 16.10) represents a closely related, but undescribed species of *Stigmella*.

Stigmella phyllanthina (Meyrick)

(Figs 28, 29, 68, 69)

Nepticula phyllanthina Meyrick, 1906: 60.
Stigmella phyllanthina; Common 1990: 156.

Type material. – Lectotype (here designated) σ , New South Wales: Sydney, emerged 1.ii.1878, E. Meyrick. Genitalia slide 24116 (BMNH). Paralectotypes: 2 σ , same data as lectotype. Genitalia slide 24113 (BMNH).

Other material examined. – New South Wales: Sydney, Botanical Gardens, 1 σ , emerged 27.ix.1957, K.M. Moore (ANIC).

Redescription. – Male (Figs 28, 29). Wingspan 3.8-4.6 mm. Head: frontal tuft yellow; collar white; eyecaps white; antennae brown, 26-29 segments. Thorax and forewing dark grey-brown with faint purplish lustre; cilia grey-brown, irrorated with fine dark-tipped scales. Hindwing grey, basal $\frac{1}{2}$ with fuscous androconial scales; at middle of costa a few grey androconial scales, approximately $\frac{1}{2}$ length of cilia; cilia grey-brown. Under-side: forewing unicolorous fuscous; hindwing (Fig. 29) dark fuscous. Abdomen concolorous with forewing, without anal tufts.

Female. Unknown.

Male genitalia (Figs 68, 69). Capsule 195 μm long. Vinculum with square anterior emargination and small, narrow lateral corners. Tegumen broad, band-like. Uncus broad with thickened sides and distinct emargination in posterior margin. Gnathos with triangular lateral arms; transverse bar narrow; horns well separated at base and slightly diverging. Valva 145 μm (x 85 μm), roughly triangular, inner margin slightly concave; tip of valva strongly sclerotized. Transtilla narrow with long narrow sublateral processes. A small triangular juxta at base of valvae. Aedeagus (Fig. 69) 135 μm , with 2 finger-like carinate processes. Vesica with small cathrema and medial field of extremely small spines.

Condition of type material. – All three specimens in more or less poor condition; the lectotype has the head, right antenna and right pair of wings relatively well preserved, and complete genitalia.

Remarks. – The host-plant is *Glochidion ferdinandi* (= *Phyllanthus ferdinandi*) (Euphorbiaceae). Meyrick described the mine as a long broad sinuate gallery and stated that the cocoon was white. This species appears to belong to a complex of very closely related taxa of uncertain status. Specimens reared from the same host-plant, from mines fitting Meyrick's description, in southern coastal NSW, lack the dark androconial scales on the male hindwing but have genitalia indistinguishable from those of *S. phyllanthina*. Two or three additional, closely similar, but prob-

ably separate, species have been reared from other species of *Glochidion* in northern Queensland.

Stigmella symmora (Meyrick)

(Figs 30-32, 70-73, 87)

Nepticula symmora Meyrick, 1906: 59.

Stigmella symmora; Nielsen 1996: 16.

Type material. – Lectotype (here designated) ♂, South Australia: Adelaide, 18.x.1882, E. Meyrick. Genitalia slide 25639 (BMNH). Paralectotypes: 2♂, 4♀, 6 unsexed, same data as lectotype. Genitalia slide 25644 (BMNH).

Redescription. – Male (Figs 30, 31). Wingspan 5.2-5.7 mm. Head: frontal tuft fuscous on frons, ochreous on vertex; collar yellowish white; eyecaps shining white, edged lead-grey; antennae dark brown, 28-29 segments. Thorax and forewing unicolorous fuscous with faint purplish lustre; cilia slightly lighter. Hindwing covered with slender, fuscous androconial scales; a row of short androconial scales along dorsum, and a row of longer ones, almost full length of cilia, along costa; cilia grey-brown. Underside: forewing brownish black; hindwing (Fig. 31) dark grey-brown with lighter cilia. Abdomen fuscous with small yellowish anal tufts.

Female (Fig. 32). Wingspan 5-6 mm. Head: frontal tuft grey-brown on frons, pale ochreous on vertex; collar yellowish white; eyecap white (not edged grey); antennae dark brown, 21-23 segments. Thorax and forewing dark grey-brown, weakly shining (slightly paler than in male). Hindwing grey; cilia grey. Underside: forewing dark grey-brown; hindwing grey. Abdomen fuscous, pointed, with slightly protruding ovipositor.

Male genitalia (Figs 70-73). Capsule 315 µm long. Vinculum with distinct anterior emargination. Tegumen distinctly broader in middle. Uncus almost square with slightly concave posterior margin. Gnathos large with triangular lateral arms and long, widely separated and almost parallel posterior processes. Valva (Fig. 71) 185 µm, with small dorsal lobe; inner lobe with long papillae on inner margin. Transtilla broad, well-sclerotized and without sublateral processes (corners rounded). Juxta (Fig. 72) large, weakly sclerotized. Aedeagus (Fig. 73) 440 µm, surrounded by wide manica without spines; vesica with distinct cathrema and numerous (at least 75) leaf-shaped cornuti.

Female genitalia (Fig. 87). Total length 800

µm. Apophyses without setose anal papillae. T8 with 3 bands of scales. Accessory sac large; distinct reticulate field at base of ductus spermathecae; ductus spermathecae with fine internal spines. Corpus bursae large with evenly distributed, fine pectinations.

Condition of type material. – The lectotype and a few of the other specimens are in relatively good condition, the rest are worn.

Remarks. – Meyrick found this species flying around *Dodonaea viscosa* (Sapindaceae), and thought this was certain to be the host-plant. Specimens reared from bright green larvae making linear mines in *D. viscosa* at Canberra, A.C.T., are externally extremely similar to *S. symmora*, and the male genitalia appear to be identical. However, the male lacks androconial scales on the hindwing. It is probable that these specimens represent a very closely related species.

Meyrick thought that his type series consisted entirely of females; however, in fact he collected at least three males. In *Stigmella*, the male genitalia are usually not or hardly visible externally on dried specimens, whereas in other nepticulid genera the valvae are often more or less exposed, making determination of sex without dissection easy.

Acknowledgements

We thank Michael Shaffer, Kevin Tuck, Gaden Robinson and Malcolm Scoble of the Department of Entomology, Natural History Museum, London, for their patient and generous support for this project involving four authors in three countries. Roland Johansson received funding from the E.M. Hering Memorial Foundation for a visit to the BMNH in 1995. Dr Klaus Sattler (BMNH) and Dr Penny Gullan, Department of Botany and Zoology, Australian National University, Canberra, provided helpful comments on a draft manuscript.

References

- Börner, C. 1925. 22 Ordn. Lepidoptera, Schmetterlinge. Pp. 358-387 in Brohmer (Ed.): Fauna von Deutschland, 3., verbesserte Auflage.
- Common, I. F. B. 1970. Lepidoptera. Pp. 765-866 in CSIRO: The Insects of Australia. xii + 1029 pp. Melbourne.
- 1990. Moths of Australia. vi + 535 pp. Melbourne.
- Donner, J. H. & Wilkinson, C. 1989. Nepticulidae (Insecta: Lepidoptera). *Fauna of New Zealand* 16, 88 pp.
- Emmet, A. M. 1976. Nepticulidae. Pp. 171-267 in

- Heath (Ed.): The moths and butterflies of Great Britain and Ireland. Vol. 1. 343 pp. London.
- Fabricius, J. C. 1775. *Systema entomologiae*, etc. 832 pp. Flensburgi & Lipsiae.
- Goeze, J. A. E. 1783. *Entomologische Beiträge zu des Ritter Linne Zwölften Ausgabe des Natursystems*. xx + 178 pp. Leipzig.
- Heyden, C. von. 1843. [No title]. P. 208 in: *Amtlicher Bericht der Versammlung der Naturforscher zu Mainz*.
- Johansson, R. 1971. Notes on the Nepticulidae (Lepidoptera). I. A revision of the *Nepticula ruficapitella* group. *Entomologica scandinavica* 2: 241-262.
- Johansson, R., Nielsen, E. S., Nieuwerkerken, E. J. van & Gustafsson, B. 1990. The Nepticulidae and Opostegidae (Lepidoptera) of North West Europe. *Fauna entomologica scandinavica* 23, 739 pp.
- Kemperman, T. C. M. & Wilkinson, C. 1985. Japanese species of the genus *Stigmella* (Nepticulidae: Lepidoptera). *Insecta matsumurana* (n.s.) 32, 107 pp.
- Meyrick, E. 1906. Descriptions of Australian Tineina. *Transactions of the Royal Society of South Australia* 30: 33-66.
- Moore, K. M. 1966. Observations on some Australian forest insects. *Australian Zoologist* 13: 303-349.
- Newton, P. J. & Wilkinson, C. 1982. A taxonomic revision of the North American species of *Stigmella* (Lepidoptera: Nepticulidae). *Systematic Entomology* 7: 367-463.
- Nielsen, E. S. 1996. Nepticulidae. P. 27 in Nielsen et al. (Eds): Checklist of the Lepidoptera of Australia. *Monographs on Australian Lepidoptera*. Vol. 4. 529 pp. and CD-ROM. Melbourne.
- Nielsen, E. S. & Common, I. F. B. 1991. Lepidoptera. Pp. 817-915 in Naumann et al. (Eds): *The Insects of Australia*. 2nd ed. Vol. 2. Melbourne.
- Nieuwerkerken, E. J. van. 1983. The Cistaceae-feeding Nepticulidae (Lepidoptera) of the western Palaearctic region. *Systematic Entomology* 8: 453-478.
- 1985. A taxonomic revision of the Western Palaearctic species of the subgenera *Zimmermannia* Hering and *Ectoedemia* Busck s.str. (Lepidoptera, Nepticulidae), with notes on their phylogeny. *Tijdschrift voor Entomologie* 128: 1-164.
- 1986a. A provisional phylogenetic check-list of the Western Palaearctic Nepticulidae, with data on host-plants (Lepidoptera). *Entomologica scandinavica* 17: 1-27.
- 1986b. Systematics and phylogeny of Holarctic genera of Nepticulidae (Lepidoptera, Heteroneura: Monotrysia). *Zoologische Verhandlungen* 236: 1-93.
- 1990. The *Trifurcula subnitidella* group (Lepidoptera: Nepticulidae); taxonomy, distribution and biology. *Tijdschrift voor Entomologie* 133: 205-238.
- Nieuwerkerken, E. J. van & Dop, H. 1987. Antennal sensory structures in Nepticulidae (Lepidoptera) and their phylogenetic implications. *Zeitschrift für zoologische Systematik und Evolutionsforschung* 25: 104-187.
- Powell, J. A. 1980. Evolution of larval food preferences in Microlepidoptera. *Annual Review of Entomology* 25: 133-159.
- Puplesis, R. K. 1994. The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts. 299 pp. + plates. Leiden.
- Scoble, M. J. 1978a. Nepticulidae of southern Africa: the genus *Ectoedemia* Busck. *Journal of the Entomological Society of Southern Africa* 41: 81-86.
- 1978b. Nepticulidae of southern Africa: a taxonomic revision of the genus *Stigmella* Schrank (Lepidoptera: Monotrysia). *Annals of the Transvaal Museum* 31: 87-129.
- 1980a. *Trifurcula* Zeller: a critical analysis of the genus, cladistic relationships and descriptions of two new species from South Africa (Lepidoptera: Nepticulidae). *Journal of the Entomological Society of Southern Africa* 43: 139-150.
- 1980b. The genus *Niepelitia* Strand: taxonomy, and comments on structure and relationships (Lepidoptera: Nepticulidae). *Annals of the Transvaal Museum* 32: 197-229.
- 1983. A revised cladistic classification of the Nepticulidae (Lepidoptera) with descriptions of new taxa mainly from South Africa. *Transvaal Museum Monograph* 2, xi + 105 pp. Pretoria.
- Tutt, J. W. 1899. *Natural history of the British Lepidoptera*. A textbook for students and collectors. Vol. 1. iv + 560 pp. London, Berlin.
- Walsingham, Lord. 1907. Microlepidoptera of Tenerife. *Proceedings of the Zoological Society of London*, 1907: 911-1034.
- Wilkinson, C. 1978. On the *Stigmella-Nepticula* controversy (Lepidoptera). *Tijdschrift voor Entomologie* 121: 13-22.
- 1979. A taxonomic study of the micro-lepidopteran genera *Microcalyptis* Braun and *Fomoria* Beirne occurring in the United States of America (Lepidoptera, Nepticulidae). *Ibidem* 122: 59-90.
- 1981. A supplement to the genus *Ectoedemia* Busck (Nepticulidae: Lepidoptera) in North America, dealing with some difficult species and also some new ones. *Ibidem* 124: 93-110.
- Wilkinson, C. & Newton, P.J. 1981. The microlepidopteran genus *Ectoedemia* Busck (Nepticulidae) in North America. *Ibidem* 124: 27-92.
- Wilkinson, C. & Scoble, M.J. 1979. The Nepticulidae (Lepidoptera) of Canada. *Memoirs of the Entomological Society of Canada* 107, 118 pp.
- Wilson, J.O. 1939. A new species of the family Nepticulidae (Lepidoptera). *Transactions of the Royal Society of South Australia* 63: 238-239.

Revised manuscript accepted January 1997.