

Revision of the genus *Helastia* sensu stricto with description of a new genus (Lepidoptera: Geometridae: Larentiinae)

R. C. CRAW

Entomology Division
Department of Scientific and Industrial Research
Private Bag, Auckland, New Zealand

Abstract *Helastia* Guenée, 1868 is redefined and redescribed. New Zealand species previously placed in that genus but not congeneric with the type species are reassigned to either the available genera *Epyaxa* Meyrick, 1883, *Asaphodes* Meyrick, 1885 and *Xanthorhoe* Hübner, [1825] or placed in a newly described genus, *Gingidiobora*. Six Australian species placed in *Xanthorhoe* are shown to be congeneric with three New Zealand species, previously placed in *Helastia* and here transferred to *Epyaxa*.

Eight new species are described in *Helastia*: *Helastia alba* n. sp.; *H. angusta* n. sp.; *H. christinae* n. sp.; *H. cryptica* n. sp.; *H. mutabilis* n. sp.; *H. ohauensis* n. sp.; *H. salmoni* n. sp.; *H. scissa* n. sp. The following new combinations and synonymies are proposed: *Asaphodes chlorocapna* (Meyrick, 1925) n. comb.; *A. citroena* (Clark, 1934) n. comb.; *A. glaciata* (Hudson, 1925) n. comb.; *A. ida* (Clark, 1926) n. comb.; *Epyaxa agelasta* (Turner, 1904) n. comb.; *E. centroneura* (Meyrick, 1890) n. comb.; *E. epia* (Turner, 1922) n. comb.; *E. hyperythra* (Lower, 1892) n. comb.; *E. lucidata* (Walker, 1862) n. comb.; *E. sodaliata* (Walker, 1862) n. comb.; *E. subidaria* (Guenée, 1857) n. comb.; *E. venipunctata* (Walker, 1863) n. comb.; *Gingidiobora nebulosa* (Philpott, 1917) n. comb.; *G. subobscurata* (Walker, 1862) n. comb.; *Helastia clandestina* (Philpott, 1921) n. comb.; *H. corcularia* (Guenée, 1868) n. comb. (= *Larentia infantaria* Guenée, 1868 n. syn.); *H. expolita* (Philpott, 1917) n. comb.; *H. siris* (Hawthorne, 1897) n. comb.; *H. triphragma* (Meyrick, 1883) n. comb.

Keywords Lepidoptera; Geometridae; Larentiinae; revision; *Helastia*; *Epyaxa*; *Xanthorhoe*

INTRODUCTION

Guenée (1868) erected the genus *Helastia* for a species of larentiine moth *eupitheciaria* he was describing from specimens collected by R. W. Fereday in Canterbury. Meyrick (1883, 1884) treated this species as a synonym of *Larentia cineraria* (Doubleday, 1843) and the genus disappeared from the systematic literature for almost 90 years until resurrected by Dugdale (1971).

The classification of the New Zealand larentiine fauna has followed the last revision by Meyrick (1917) until Dugdale (1971) made numerous generic reassignments. Meyrick's placement of species was largely in genera of convenience and he was followed by Hudson (1928). Basically Meyrick's systematic treatment involved placing nocturnal species with bipectinated male antennae in *Xanthorhoe* Hübner, [1825] and those with ciliated male antennae in *Hydriomena* Hübner, 1825; brightly coloured diurnal species were placed in *Notoreas* Meyrick, 1885, *Lythria* Hübner, [1823] and *Dasyuris* Guenée, 1868. In earlier studies Meyrick (1883, 1884, 1885) had described endemic Larentiine genera such as *Epyaxa* Meyrick, 1883; *Cephalissa* Meyrick, 1883 and *Asaphodes* Meyrick, 1885; in some cases (e.g., *Epyaxa*, *Cephalissa*) sinking these as synonyms of *Xanthorhoe* and *Hydriomena* or retaining them for small groups of species as with *Asaphodes* in the later 1917 revision. Prout (1912) and Turner (1922) proposed a different classification to Meyrick's for this group of New Zealand larentiines, splitting Meyrick's concept of *Xanthorhoe* into two generic groups, *Xanthorhoe* and *Larentia* Treitschke, 1825. Prout (1939) continued these innovations but they were not accepted by New Zealand workers nor were they used in New Zealand collections.

Dugdale (1971) reviewed many New Zealand larentiine taxa in an attempt to remove "zoogeographically inept generic names from the New Zealand fauna". Most of the New Zealand species placed by Meyrick in *Xanthorhoe* were reassigned to the available and resurrected endemic genera *Asaphodes* and *Helastia* whereas *Homodotis* Meyrick, 1885 was reinstated for two species placed by Meyrick (1917) in *Asaphodes*. No statement can be made on the generic affinities of *Helastia* until the Southern Hemisphere and Oriental larentiine fauna have been revised.

Many of the species included in *Helastia* by Dugdale (1971) were originally poorly defined and described and have never been subject to critical revision. Series of these species in New Zealand collections are quite confused. The genus also includes some of the commonest and most frequently encountered moths in the New Zealand fauna. There are also a number of undescribed species in New Zealand collections. The aim of this revision was to clarify species limits and synonymy, and to describe the undescribed species. As the study progressed it became apparent that *Helastia* as defined by Dugdale (1971) was not a natural group. A new concept of *Helastia* is proposed. Species not congeneric with the type species of *Helastia* are either reassigned to available genera or placed in a newly described genus.

METHODS, CONVENTIONS, REPOSITORIES, AND TERMINOLOGY

Over 1500 specimens were examined in the course of this study. Specimens are deposited in a number of collections and these are referred to in the text by the abbreviations proposed by Watt (1979). Material examined is listed in detail only for those species represented by less than 10 specimens. Broad species distributions are indicated by the two-letter area codes proposed by Crosby et al. (1976).

Key construction was facilitated by using the DELTA system and KEY programme of Dallwitz (1984). Terminology of morphological features follows that proposed by McGuffin (1958) for larvae, McGuffin (1977) for wing patterns and venation, and Dugdale (1971), Klots (1970), Sibatani et al. (1954), Okagaki et al. (1955), and Ogata et al. (1956) for male and female genitalia.

Abbreviations:

r.f.l. = right forewing length.

[1863], [AK] = date or information determined from external evidences.

CRITERIA FOR WEIGHTING CHARACTERS

Generic and specific classification of New Zealand larentiines was based mainly on male antennal and wing venation characters until Dugdale's (1964, 1971) studies of male and female genitalia. Commenting on the classification of the Geometridae in general, Ferguson (1969: 9) noted that "Earlier authors from Packard to Prout tended to over-emphasise the value of venation in geometrid classification because without knowledge of the genitalia they were hard pressed to find tangible characters".

Sotavalta (1964), in a study of 39 arctiid species, found great variation in wing venation characters, concluding that "the wing venation is not a sufficiently reliable criterion for generic assignments and in most cases not even for specific characteristics within Arctiinae" (p. 41). Sotavalta agreed with Warren (1947) who recommended abandoning wing venation as a source of taxonomic characters. Extensive intra-specific variation in wing venation characters has been noted in Geometridae (Ferguson 1969) and Satyridae (Davenport 1941).

Strict application of the venational character diagnostic for the tribe Xanthorhoimi (Forbes 1948; i.e., "middle discocellular of hindwing straight and much shorter than lower") would respectively exclude and include the congeneric species *Helastia cinerearia* (Doubleday) and *H. semisignata* (Walker) from the tribe. This difficulty has already arisen with respect to these two species through Prout's (1912) reinstatement of the genus *Larentia* Treitschke to include the species of *Xanthorhoe* in which vein M_2 of the hindwing originates from below the centre of the angled discocellular. As Meyrick (1917) pointed out, Prout's proposal would place in separate genera such obviously closely related species as *Helastia semisignata*, *H. cinerearia*, and *H. plumbea* (Philpott).

There is extensive convergence and parallelism in the wing patterns and coloration of larentiine moths. Many New Zealand species have wing patterns and coloration extremely similar to unrelated Palaearctic species. For instance some of the New Zealand *Helastia* species are very similar externally to species of the unrelated Northern Hemisphere *Perizoma* Hübner, [1825] (D. S. Fletcher, pers. comm.). Conversely, congeneric species can often differ greatly in wing coloration and pattern.

There are numerous instances in the Larentiinae of what appear to be natural genera with a wide variety of male antennal types. A New Zealand example is *Pasiphila* Meyrick 1883 where the males of different species have varied antennal types (Dugdale 1971).

Despite their disadvantages for formal systematic work wing pattern, coloration, and male antennal characters are easily observed and generally require no special preparation. If used with caution they can be valuable guides to identification and I have tried to emphasise these characters in the identification keys wherever possible. For formal systematic conclusions concerning generic and specific limits the emphasis has been placed mainly on male and female genitalia characters. Some larentiine workers base their descriptions of new genera solely on male genitalia characters since they claim that the use of other morphological characters gives incoherent results (e.g., Herbulot 1951).

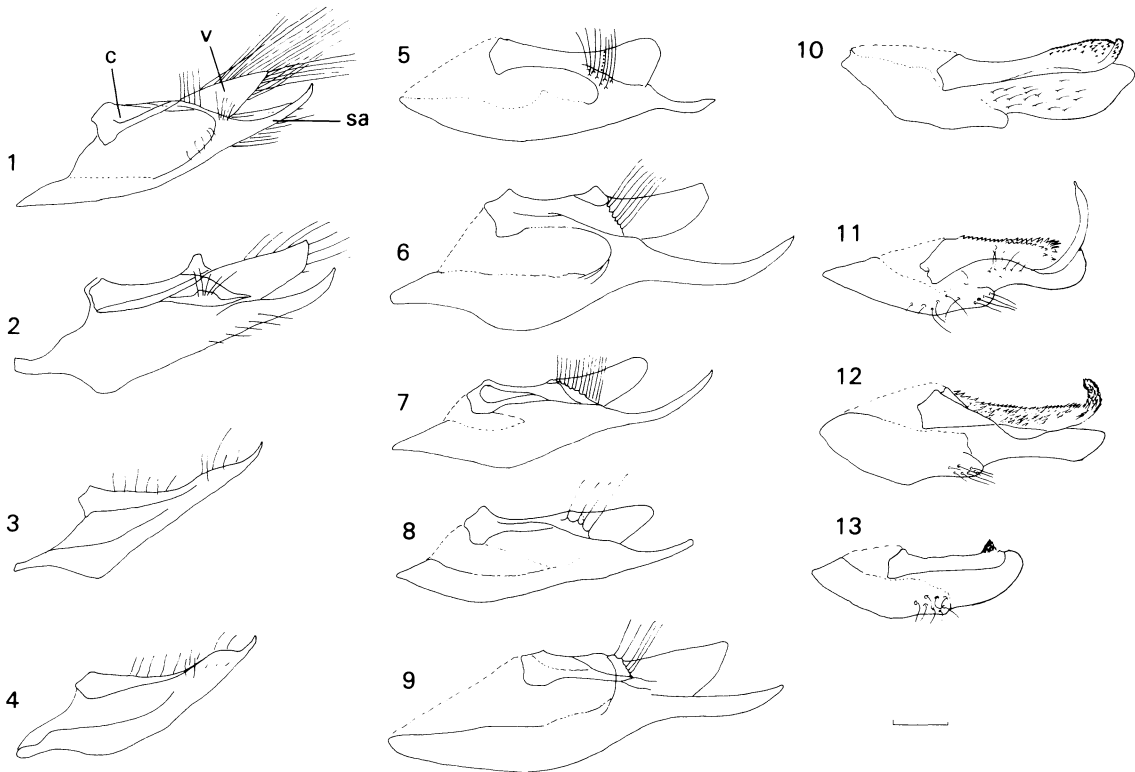


Fig. 1–13 Male genitalia, right valva, internal face. Abbreviations: c = costa; sa = sacculus free arm; v = valvula. Scale line = 0.25 mm.

1 *Epyaxa rosearia*; 2 *E. subidaria*; 3 *E. sodaliata*; 4 *E. lucidata*; 5 *E. venipunctata*; 6 *E. centroneura*; 7 *E. hyperythra*; 8 *E. agelasta*; 9 *E. epia*; 10 *Xanthorhoe semifissata*; 11 *X. lophogramma*; 12 *X. orophylla*; 13 *X. bulbulata*.

SYSTEMATICS

Helastia Guenée

Guenée 1868: 94.; Meyrick, 1917: 258 (as synonym of *Xanthorhoe*); Dugdale, 1971: 101; Fletcher, 1979: 96.

Type species. *Helastia eupitheciaria* Guenée, 1868: 95, by original monotypy.

Description. EXTERNAL. Small (r.f.l. < 10 mm) to large (r.f.l. > 15 mm) sized nocturnal larentiine moths. Male antennae bipectinated or ciliated, if bipectinated pectinations basal on segment and confluent basally; female antennae ciliated. No sexual dimorphism in wing pattern and coloration. Male seventh and eighth abdominal segments markedly reduced with pair of spiracled coremata (eversible lobes) on seventh segment.

MALE GENITALIA. Valva divided into three distinct regions: (1) smooth, heavily sclerotised costa confined to basal half of dorsoproximal margin of

valva, sometimes produced as a free arm; ventral part of costa distinctly divided into two arms, one articulating with appendix angulare of tegumen (tegumenal arm), the other articulating with dorsal median margin of sacculus (valvular arm); (2) heavily sclerotised sacculus with distal free elongation forming a scobinate to spinulose process; (3) membranous rounded valvula. Dorsal manica pad spinose, spines large. Ventral manica pad as a heavily sclerotised median thorn or spine. Juxta with distinct calcar always extending below ventral margin of valva (in lateral view).

FEMALE GENITALIA. Seventh sternite large with distinct lodix. Lamella antevaginalis U to V-shaped band of varying thickness or distinct median plate. Ductus bursae longer than wide. Corpus bursae elongate pouch shape to globose when expanded. Ductus seminalis arising on corpus bursae near junction with ductus bursae.

Remarks. *Helastia* as here defined is now restricted to those New Zealand larentiine species with the following diagnostic combination of male

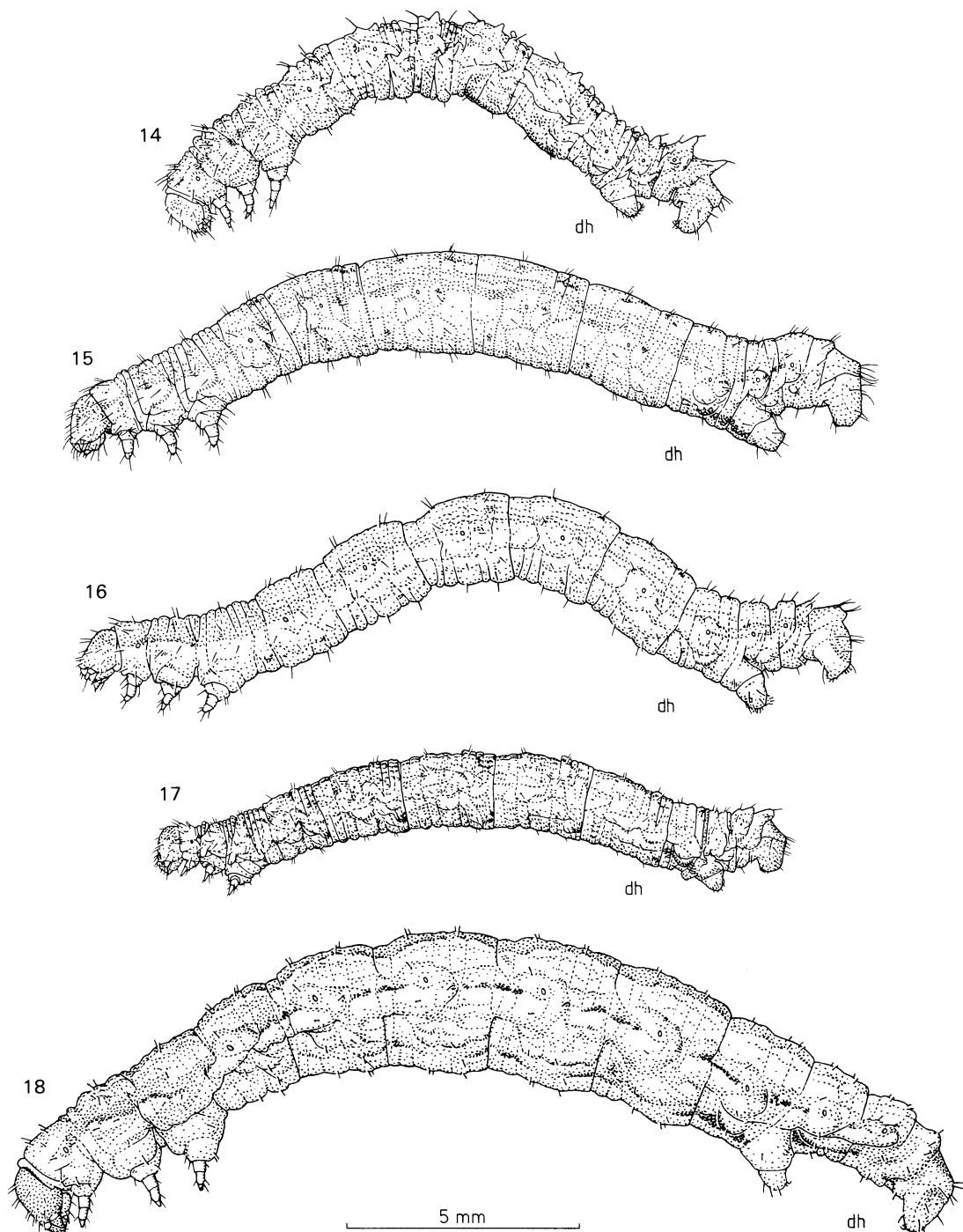
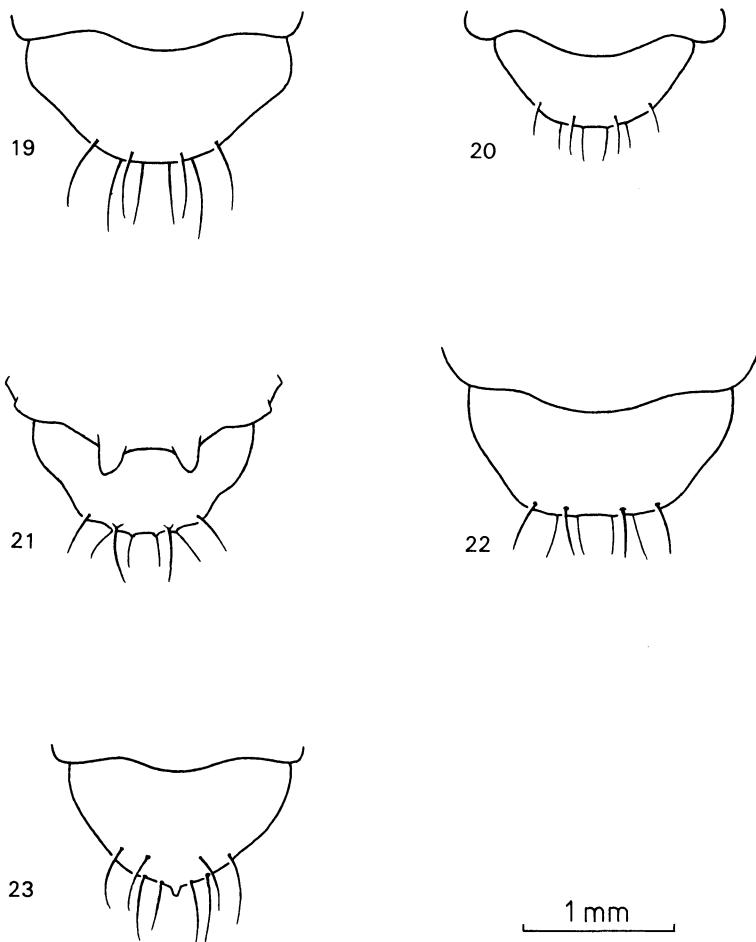


Fig. 14–18 Final instar larvae, habitus, lateral view. Scale line = 5 mm.
14 *Helastia semisignata*; 15 *Epyaxa rosearia*; 16 *Xanthorhoe semifissata*; 17 *Homodotis megaspilata*; 18 *Asaphodes clarata*.

Fig. 19–23 Final instar larvae, anal shield, dorsal view. Scale line = 1 mm.

19 *E. rosearia*; 20 *H. megaspilata*; 21 *Helastia semisignata*; 22 *Asaphodes clarata*; 23 *Xanthorhoe semifissata*.



and female genitalic characters: (1) the distal free elongation of the sacculus as a scobinate to spinulose process; (2) the seventh sternite of the female with a lodix; and (3) the ductus bursae longer than wide. No other group of New Zealand larentiine species shares this unique combination of characters although *Paranotoreas ferox* (Butler, 1877) has a scobinate sacculus free arm. This species is distinguished from *Helastia* species by the very broad expanded ductus bursae characteristic of *Paranotoreas* Craw, 1986 (Craw 1986).

The *rosearia/semifissata* species group placed in *Helastia* by Dugdale (1971) do not share the above unique combination of characters, but do not themselves form a single genus. Three of these species (*Cidaria rosearia* Doubleday 1843; *Larentia lucidata* Walker, 1862; *Panagra venipunctata* Walker, 1863) are congeneric with a group of six Australian species previously placed in *Xanthor-*

hoe. The generic name *Epyaxa* Meyrick, 1883 is available for these species. *Epyaxa* species are distinguished from *Helastia* by their possession of a reduced elongate valvula and a smooth, spine like sacculus free arm in the male genitalia (Fig. 1–9). As well they are distinguished by the male antennal pectinations having their bases hidden by the preceding segment apex and they are sexually dimorphic in wing coloration and pattern.

The *semifissata* species group differs from *Epyaxa* and *Helastia* in male valva structure by possessing a well developed scobinate or spinulose costa with no ventral arms and a reduced sacculus (Fig. 10–13). They resemble *Epyaxa* in male antennae structure and the presence of sexual dimorphism in wing pattern and coloration. Congeneric with the *semifissata* species group is *Xanthorhoe frigida* Howes, 1946, which was not examined by Dugdale (1971). The combination of a reduced sacculus with a well

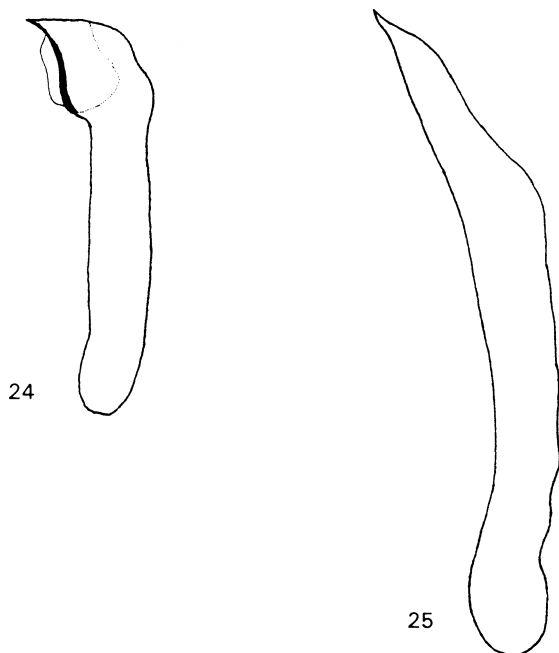


Fig. 24–25 Male genitalia, aedeagus, ventrolateral view. Scale line = 0.2 mm.
24 *Helastia christinae*; 25 *H. farinata*.

developed costa in the male genitalia brings this species group much closer to the Northern Hemisphere *Xanthorhoe* species (as illustrated by Hegvik 1977) than any other species group in the New Zealand larentiine fauna. Although they possibly may eventually prove to constitute a distinct endemic genus, I am retaining them in *Xanthorhoe* for the present.

Of the three other valid species placed in *Helastia* by Dugdale (1971), two belong to a new genus described below. The third, *Xanthorhoe chlorocapna* Meyrick, 1925, resembles species of *Asaphodes* (as defined by Dugdale) in male genitalic characters as do three species originally described in *Xanthorhae* (*X. citroena* Clarke, 1934; *X. glaciata* Hudson, 1925; *X. ida* Clarke, 1926) and not examined by Dugdale (1971). Three species placed in *Hydriomena* by Meyrick (1917) and Hudson (1928) because their males possess ciliated antennae are here transferred to *Helastia* on male and female genitalia characters.

What little is known of the larvae supports this new concept of *Helastia*. Known larvae of *Helastia* sensu stricto are dorsally tuberculate, the tubercles on the rear abdominal segments being particularly conspicuous (Fig. 14). In contrast larvae of *Epyaxa rosearia* (Fig. 15), *Xanthorhoe semifis-*

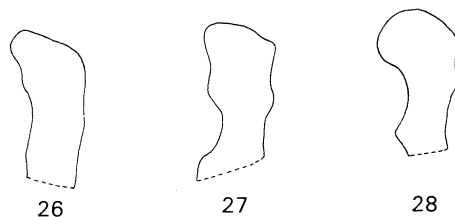


Fig. 26–28 Male genitalia, sacculus free arm apex, dorsal view. Scale line = 0.2 mm.
26–27 *H. mutabilis*; 28 *H. alba*.

sata (Fig. 16), *Homodotis megaspilata* (Fig. 17), and *Asaphodes clarata* (Fig. 18) are smooth, non-tuberculate and quite distinct in overall habitus from *Helastia*. Larvae of all these genera have anal shields much broader than long with setae SD₁, L₁, D₁, and D₂ close together and confined to the apical third of the shield (Fig. 19–23). They share this feature with other larvae of New Zealand larentiines belonging to the tribe Xanthorhoini (Craw 1986).

CHECKLIST OF TAXA

New Zealand

Asaphodes chlorocapna (Meyrick, 1925) (*Xanthorhoe*) n. comb.

A. citroena (Clarke, 1934) (*Xanthorhoe*) n. comb.

A. glaciata (Hudson, 1925) (*Xanthorhoe*) n. comb.

A. ida (Clarke, 1926) (*Xanthorhoe*) n. comb.

Epyaxa lucidata (Walker, 1862) (*Larentia*) n. comb.

= *robustaria* Walker, 1862 (*Coremia*)

= *plurimata* Walker, 1862 (*Coremia*)

= *officiosa* Meyrick, 1910 (*Hydriomena*)

= *pratica* Meyrick, 1911 (*Xanthorhoe*)

E. rosearia (Doubleday, 1843) (*Cidaria*)

= *subductata* Walker, 1862 (*Larentia*)

= *ardularia* Guenée, 1868 (*Coremia*)

= *inamaenaria* Guenée, 1868 (*Coremia*)

= *homalocyma* Meyrick, 1902 (*Xanthorhoe*)

E. venipunctata (Walker, 1863) (*Panagra*) n. comb.

= *psamathodes* Meyrick, 1883 (*Larentia*)

Gingidiobora nebulosa (Philpott, 1917) (*Xanthorhoe*) n. comb.

G. subobscurata (Walker, 1862) (*Scotosia*) n. comb.

= *ascotata* Felder & Rogenhofer, 1875 (*Cidaria*)

= *petropola* Meyrick, 1883 (*Larentia*)

Helastia alba n. sp.

H. angusta n. sp.

H. cinerearia (Doubleday, 1843) (*Cidaria*)

= *infusata* Walker, 1862 (*Larentia*)

= *invexata* Walker, 1862 (*Larentia*)

= *inopterata* Walker, 1862 (*Larentia*)

= *diffusaria* Walker, 1862 (*Larentia*)

- = *eupitheciaria* Guenée, 1868
- = *adonata* Felder & Rogenhofer, 1875 (*Cidaria*)
- H. christinae* n. sp.
- H. clandestina* (Philpott, 1921) (*Xanthorhoe*) n. comb.
- H. corcularia* (Guenée, 1868) (*Larentia*) sp. rev., n. comb.
- = *infantaria* Guenée, 1868 (*Larentia*) n. syn.
- H. cryptica* n. sp.
- H. cymozeugta* (Meyrick, 1913) (*Xanthorhoe*)
- = *maoriaria* Hudson, 1939 (*Xanthorhoe*)
- H. expolita* (Philpott, 1917) (*Hydriomena*) n. comb.
- H. farinata* (Warren, 1896) (*Xanthorhoe*)
- H. mutabilis* n. sp.
- H. ohauensis* n. sp.
- H. plumbea* (Philpott, 1915) (*Xanthorhoe*)
- H. salmoni* n. sp.
- H. scissa* n. sp.
- H. semisignata* (Walker, 1862) (*Larentia*)
- = *punctilineata* (Walker, 1862) (*Larentia*)
- = *dissociata* Walker, 1862 (*Cidaria*)
- = *similisata* Walker [1862] (*Cidaria*)
- H. siris* (Hawthorne, 1897) (*Asaphodes*) n. comb.
- H. triphragma* (Meyrick, 1883) (*Cidaria*) n. comb.
- Xanthorhoe bulbulata* (Guenée, 1868) (*Cidaria*)
- X. figida* Howes, 1946
- X. lophogramma* Meyrick, 1897
- X. orophylla* (Meyrick, 1883) (*Epyaxa*)
- X. orophylloides* Hudson, 1909
- = *subantarctica* Salmon, 1956
- X. semifissata* (Walker, 1862) (*Coremia*)
- = *ypsilonaria* (Guenée, 1868) (*Coremia*)
- = *delicatulata* (Guenée, 1868) (*Cidaria*).

Australia

- Epyaxa agelasta* (Turner, 1903), (*Xanthorhoe*) n. comb.
- E. centroneura* (Meyrick, 1890) (*Xanthorhoe*) n. comb.
- E. epia* (Turner, 1922) (*Xanthorhoe*) n. comb.
- E. hyperythra* (Lower, 1892) (*Xanthorhoe*) n. comb.
- E. sodaliata* (Walker, 1862) (*Cidaria*) n. comb.
- E. subidaria* (Guenée, 1857) (*Coremia*) n. comb.

KEY TO THE GENERA GINGIDIOBORA AND HELASTIA

- 1. Underside fore- and hindwings with distinctive white transverse median band; underside forewing apex with distinct white patch; male genitalia with sacculus produced as a smooth free arm; female seventh sternite membranous without a lodix *Gingidiobora*

Underside fore- and hindwings without distinctive white transverse median band; underside forewing apex without distinct white patch, male genitalia with sacculus produced as a scobinate to spinulose process, female seventh sternite with a lodix *Helastia*

KEY TO THE SPECIES OF HELASTIA

Males

- 1. Forewing triangular 2
- Forewing falcate 13
- 2(1). Upperside forewing discal spot black, grey or brown 3
- Upperside forewing discal spot reddish-ochreous *H. plumbea*
- 3(2). Costa of valva produced as long free arm (Fig. 50–55, 57, 59–66) 4
- Costa of valva not produced as long free arm (Fig. 49, 58) 12
- 4(3). Sacculus of valva free arm extending well beyond outer margin of valvula (Fig. 57, 66) 5
- Sacculus of valva free arm not extending well beyond outer margin of valvula (Fig. 50–55, 59–65) 6
- 5(4). Upperside forewing greyish green with light to dark grey and yellowish ochreous wavy transverse lines; sacculus free arm slightly curved and upturned; aedeagus apex bulbous, with ventral median carina (Fig. 24); South Island only *H. christinae*
- Upperside forewing slate grey with slightly darker, faint wavy transverse lines; sacculus free arm curved upwards sharply at right angles to plane of sacculus base; aedeagus apex not bulbous (Fig. 25); North Island only *H. farinata*
- 6(4). Free arm of costa projecting beyond outer margin of valvula much further than free arm of sacculus (Fig. 59–63, 65) 7
- Free arm of costa not projecting beyond outer margin of valvula much further than free arm of sacculus (Fig. 50–55, 64) 10
- 7(6). Calcar on juxta elongate and distinctly capitate 8
- Calcar on juxta short and broad 9
- 8(7). Upperside forewing coloration brown to grey-brown; sacculus free arm broadly rectangular with rounded apex; North Island only *H. semisignata*

- Upperside forewing coloration light to dark slate grey; sacculus free arm narrowly rectangular with squared blunt apex; South, Stewart, and Chatham Islands only *H. corcularia*
- 9(7). Upperside forewing coloration whitish grey with conspicuous wavy brown transverse lines; ventral manica pad a long thorn *H. salmoni*
Upperside forewing coloration dark brown with obscure wavy transverse lines; ventral manica pad a short thorn .. *H. scissa*
- 10(6). Aedeagus apex bulbous, with a ventral median carina 11
Aedeagus apex not bulbous, with a ventral median carina *H. ohauensis*
- 11(10). Upperside forewing brownish white to grey; sacculus free arm apex obliquely angled to squared (Fig. 26, 27) *H. mutabilis*
Upperside forewing dull white to whitish grey; sacculus free arm apex rounded (Fig. 28) *H. alba*
- 12(3). Forewing small to medium size (< 15 mm r.f.l.); upperside forewing postmedial line with strongly developed costal and median projections; sacculus free arm sculpturing spinulose *H. cinerearia*
Forewing large size (> 15 mm r.f.l.); upperside forewing postmedial line without strongly developed costal and median projections; sacculus free arm sculpturing scobinate; South Island only *H. clandestina*
- 13(1). Antennae bipectinated; costa of valva produced as long free arm; aedeagus apex bulbous, with median carina 14
Antennae ciliated; costa of valva not produced as long free arm; aedeagus apex not bulbous, without median carina 15
- 14(13). Sacculus free arm extending well beyond outer margin of valvula, surface sculpturing large and spinulose (Fig. 68) *H. cymozeucta*
Sacculus free arm not extending well beyond outer margin of valvula, surface sculpturing small and toothed (Fig. 67) *H. cryptica*
- 15(13). Upperside forewing with apical streak; upperside forewing postmedial line with median projection double toothed 16
Upperside forewing without apical streak; upperside forewing postmedial line with median projection single toothed 17
- 16(15). Upperside forewing basal line broadly rounded *H. angusta*
Upperside forewing basal line angulate with distinct median projection *H. expolita*
- 17(15). Forewing small size (< 10.6 mm r.f.l.); ventral manica pad a laterally flattened spine; Wellington, Stephens Island, and Chatham Islands *H. siris*
Forewing medium size (> 11 mm r.f.l.); ventral manica pad a dorsoventrally flattened spine; South Island only *H. triphragma*
- Females**
1. Forewing triangular 2
Forewing falcate 11
- 2(1). Forewing discal spot black, grey or brown 3
Forewing discal spot reddish-ochreous *H. plumbea*
- 3(2). Lodix a single flat plate 4
Lodix a single plate heavily sculptured (Fig. 98); North Island only .. *H. farinata*
- 4(3). Lamella antevaginalis a U to V-shaped band of varying width 5
Lamella antevaginalis a distinct median plate 9
- 5(4). Forewing small to medium size (< 15 mm r.f.l.); cervix bursae present (Fig. 90–92, 94) 6
Forewing large size (> 15 mm r.f.l.); cervix bursae absent (Fig. 95) *H. clandestina*
- 6(5). Ductus bursae scobinate 7
Ductus bursae smooth (Fig. 90) *H. cinerearia*
- 7(6). Cervix bursae not longitudinally sulcate (Fig. 92, 94) 8
Cervix bursae longitudinally sulcate (Fig. 91) *H. alba*
- 8(7). Cervix bursae with an extensively developed lateral sclerite *H. mutabilis*
Cervix bursae without an extensively developed lateral sclerite *H. christinae*
- 9(4). Papillae anales normal (i.e., unmodified); apophyses posteriores without process (Fig. 105) 10
Papillae anales modified, with dorsal, median, laterally flattened plate; apophyses posteriores with process (Fig. 104) *H. scissa*

- 10(9). Upperside forewing coloration brown to grey-brown; lamella antevaginalis plate with lateral margins pointed (Fig. 97); North Island only *H. semisignata*
Upperside forewing coloration light to dark slate grey; lamella antevaginalis plate with lateral margins rounded; (Fig. 96) South Island, Stewart Island, and Chatham Islands *H. corcularia*
- 11(1). Upperside forewing postmedial line with medial projection single toothed 12
Upperside forewing postmedial line with medial projection double toothed 13
- 12(11). Forewing small size (< 10.6 mm r.f.l.); lodix a pair of small (0.25 mm long) lateral concave plates (Fig. 103); Wellington, Stephens Island, and Chatham Islands *H. siris*
Forewing medium size (> 11 mm r.f.l.); lodix a pair of large (0.4 mm long) lateral concave plates (Fig. 102); South Island *H. triphragma*
- 13(11). Upperside forewing with apical streak 14
Upperside forewing without apical streak 15
- 14(13). Upperside forewing basal line angulate with distinct median projection *H. expolita*
Upperside forewing basal line broadly rounded *H. angusta*
- 15(13). Lodix a median unsculptured plate, not developed laterally (Fig. 99) *H. cryptica*
Lodix an extensively developed sculptured plate, extensively developed laterally (Fig. 100) *H. cymozeucta*

Helastia cinerearia (Doubleday), 1843

Doubleday, 1843 in Dieffenbach, 1843: 286 (*Cidaria?*); Meyrick, 1883: 528 (*Larentia*); Meyrick, 1884: 83 (*Larentia*); Hudson, 1898: 67, pl. VIII, fig. 2 (*Xanthorhoe*); Prout, 1912: 52 (*Larentia*); Meyrick, 1917: 259 (*Xanthorhoe*); Hudson, 1928: 112, pl. XI, fig. 41 (*Xanthorhoe*); Prout, 1939: 265 (*Larentia*); Dugdale, 1971: 101 (*Helastia*).

adonata Felder & Rogenhofer, 1875: pl. CXXXI, fig. 31 (*Cidaria*)

diffusaria Walker, 1862: 1201 (*Larentia*)

eupitheciaria Guenée, 1868: 95 (*Helastia*)

infusata Walker, 1862: 1199 (*Larentia*)

inopterata Walker, 1862: 1201 (*Larentia*)

invexata Walker, 1862: 1199 (*Larentia*)

Description. EXTERNAL (Fig. 29). Small to medium sized (r.f.l. 8.5–11.5 mm) triangular forewing. Upperside forewing coloration and pattern mottled grey to brown with wavy transverse lines on a whitish grey background; postmedial line with strongly developed costal and median projections. Male antennae bipectinated.

MALE GENITALIA (Fig. 49, 71). Costa of valva flat plate; ventral arms distinctly asymmetrical, tegumenal arm narrow, valvular arm very broad. Sacculus free arm only projecting slightly beyond outer margin of valvula, surface sculpturing spinulose. Aedeagus short, stout, curved. Ventral manica pad thorn like. Calcar oblong, slightly narrowed at base.

FEMALE GENITALIA (Fig. 90). Seventh sternite with reduced lodix consisting of thin band. Lamella antevaginalis broadly and shallowly U-shaped. Lamella postvaginalis a plate with median groove, laterally with thin sclerotised band fusing with apophyses anteriores. Ductus bursae ribbon-like (i.e., dorso-ventrally flattened), smooth, sclerotised. Corpus bursae globose with conspicuous sclerotised, smooth cervix bursae.

Type data. **Lectotype**, male of *cinerearia* selected by D. S. Fletcher, here designated: [Auckland], Sinclair, BMNH 42–55; BMNH genitalia slide G10292.

Holotype, male of *adonata*: [Auckland or Wai-kato?] Hochstetter, BMNH 1939–1 (Rothschild bequest); abdomen missing. **Holotype**, female of *diffusaria*: [Auckland] Bolton, BMNH 54–4; head and abdomen missing. **Lectotype**, male of *eupitheciaria*, selected by D. S. Fletcher, here designated: Canterbury, Fereday, BMNH 1927–3 (Ex. Musaeo Ach. Guenée: Ex. Oberthur Coll.); BMNH genitalia slide G10302. **Holotype**, female of *infusata*: [Auckland], Sinclair, BMNH 47–104; BMNH genitalia slide G. 10293. **Lectotype**, male of *inopterata* selected by D. S. Fletcher, here designated: as for *cinerearia*. **Lectotype**, male of *invexata* selected by D. S. Fletcher, here designated: [Auckland], Bolton, BMNH 54–4; BMNH genitalia slide G. 10294 (all BMNH).

Two specimens of this species collected by Dr Andrew Sinclair were in the British Museum collections at the time of Doubleday's original description of *Cidaria cinerearia*. These two specimens, along with several others, were redescribed as *Larentia inopterata* by Francis Walker, who later realised his mistake and synonymised *inopterata* with *cinerearia* (Walker, [1863]: 1703). Consequently the selected lectotype of *inopterata* is the same specimen as that selected as the lectotype of *cinerearia*.

Material examined. 150♂♂, 90♀♀ (NZAC).

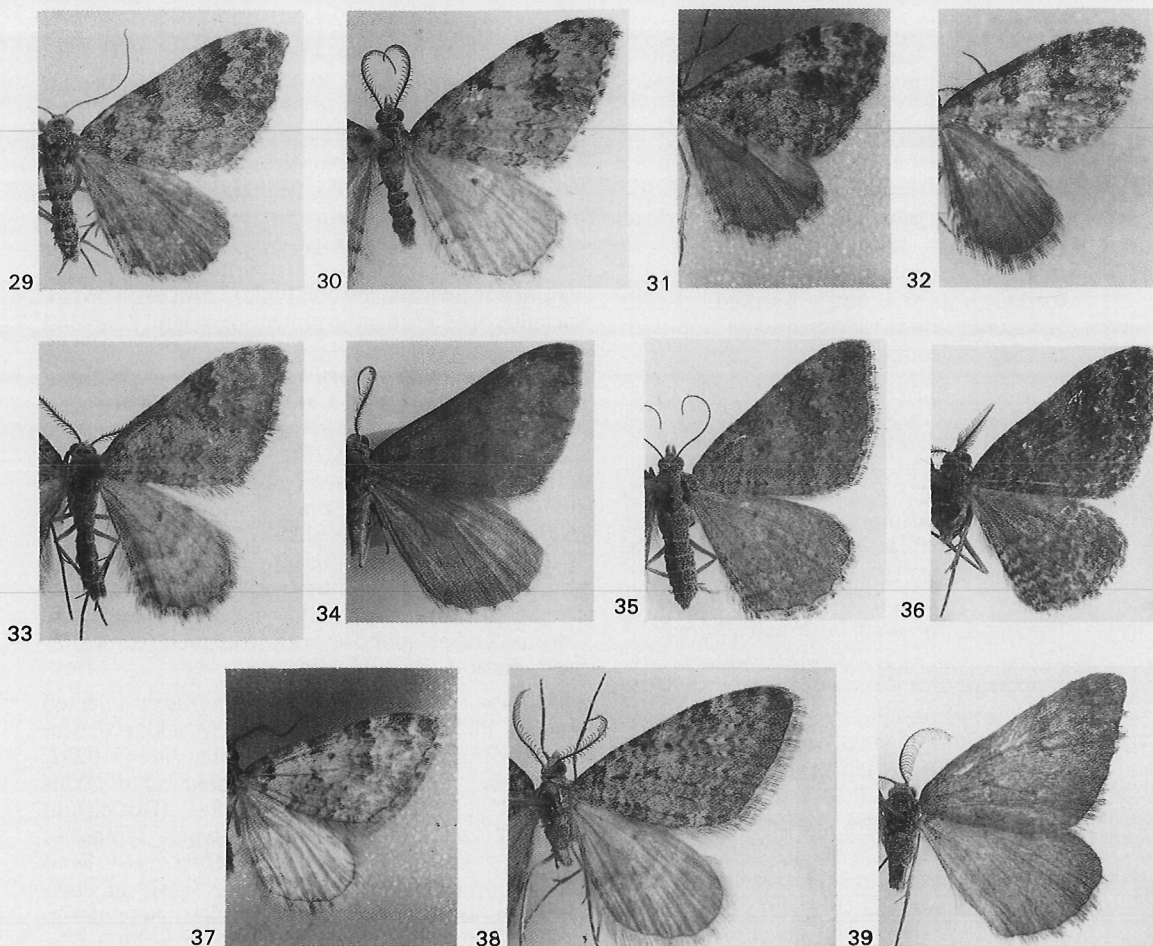


Fig. 29-39 Habitus, upperside right wings.

29 *Helastia cinerearia*; 30 *H. alba*; 31 *H. mutabilis*; 32 *H. plumbea*; 33 *H. christinae*; 34 *H. clandestina*; 35 *H. corcularia*; 36 *H. semisignata*; 37 *H. salmoni*; 38 *H. ohauensis*; 39 *H. scissa*.

Distribution. North Island: ND, AK, CL (including Mercury Islands), WO, BP, TO, TK, RI, HB, WN; South Island: NN, SD, MB, KA, NC, MC, SC, MK, WD, DN, CO, OL, FD, SL, SI; Chatham Islands.

Habitat. This species is virtually ubiquitous throughout the three main islands and is also found on the Chathams and small offshore islands. It occupies a wide variety of habitats from urban backyards through various forest types to subalpine fell fields.

Remarks. Although often confused in New Zealand collections with *H. alba*, *H. christinae*, and *H. mutabilis*, and even at one stage considered the

same species as *H. semisignata* (Meyrick 1884) this species is immediately distinguishable by the absence of a spine-like free arm on the costa in the male genitalia and the combination of the reduced lodix and smooth ductus bursae in the female genitalia.

***Helastia alba* n. sp.**

Description. EXTERNAL (Fig. 30). Small to medium sized (r.f.l. 9-12.5 mm) triangular forewing. Upperside forewing coloration and pattern dull

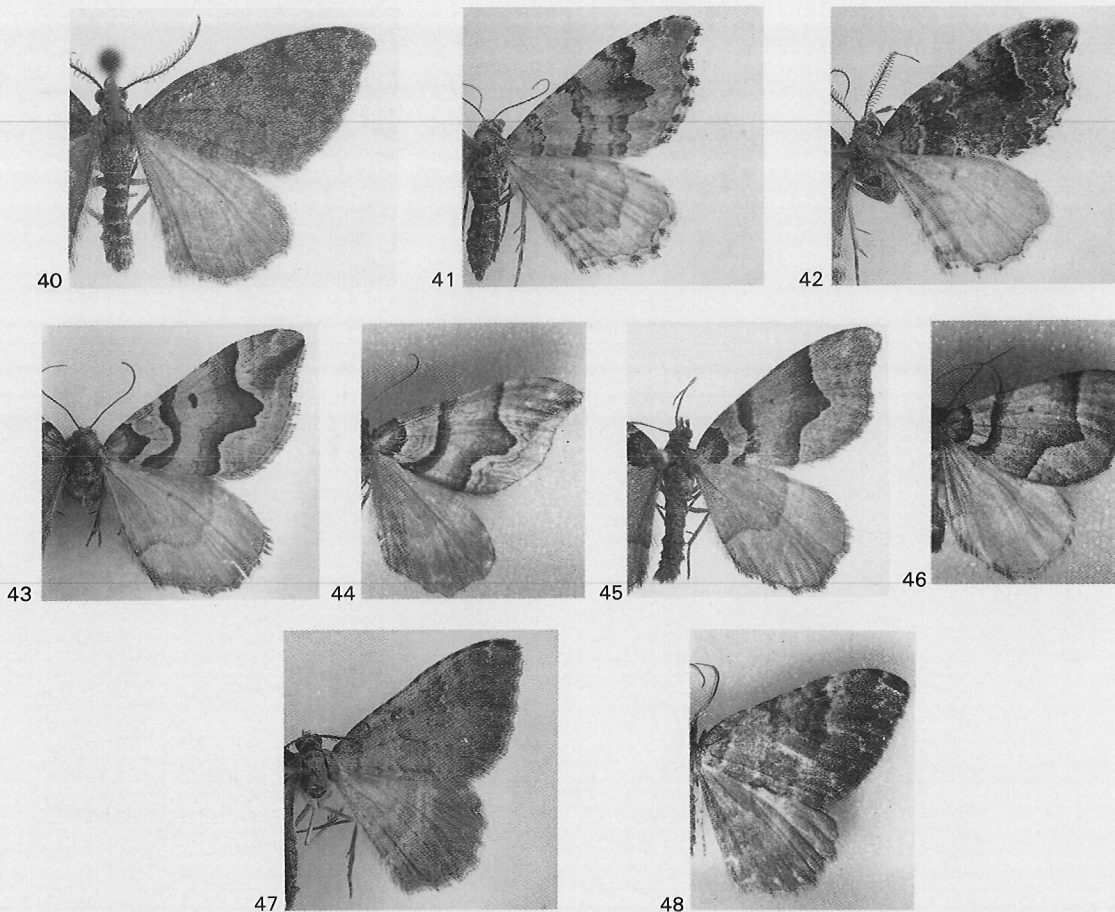


Fig. 40–48 Habitus, upperside right wings. 40 *H. farinata*; 41 *H. cryptica*; 42 *H. cymozeugta*; 43 *H. expolita*; 44 *H. angusta*; 45 *H. triphragma*; 46 *H. siris*; 47 *Gingidiobora subobscurata*; 48 *G. nebulosa*.

whitish to whitish grey with dark brown to brownish ochreous wavy transverse lines. Male antennae bipectinated.

MALE GENITALIA (Fig. 28, 50–52, 72). Costa of valva produced as free spine-like arm not projecting far beyond apical and outer margin of valvula and apex of sacculus free arm. Sacculus free arm not projecting far beyond outer margin of valvula, apex rounded, scobinate. Aedeagus long, thin, curved; apex bulbous with a ventral median carina. Ventral manica pad long, thick heavily sclerotised spine. Calcar short, elongate, apex rounded.

FEMALE GENITALIA (Fig. 91). Lodix a large, flat kidney shaped plate. Ductus bursae short, scobinate. Corpus bursae orbicular. Cervix bursae minutely scobinate with ventral median longitudinal

sulcus (i.e., groove), laterally and dorsally extended as a sclerite.

Type data. **Holotype**, male “Queenstown [OL]. 18/12[19] 13” (NZAC). **Paratypes**: 7 ♂♂, 3 ♀♀ designated as follows (all NZAC): 1 ♂, 1 ♀, same data as holotype; 6 ♂♂, 1 ♀, Queenstown, various dates, Pasco Collection, ex. Southland Museum; 1 ♀, “Ben Lomond, 20/12[19]13”.

Material examined. Holotype, Paratypes; 57 ♂♂, 42 ♀♀ (NZAC).

Distribution. South Island only: NN, BR, NC, MC, MK, OL, FD, SL.

Habitat. Chiefly associated with montane to sub-alpine *Nothofagus* forests but occasionally found at

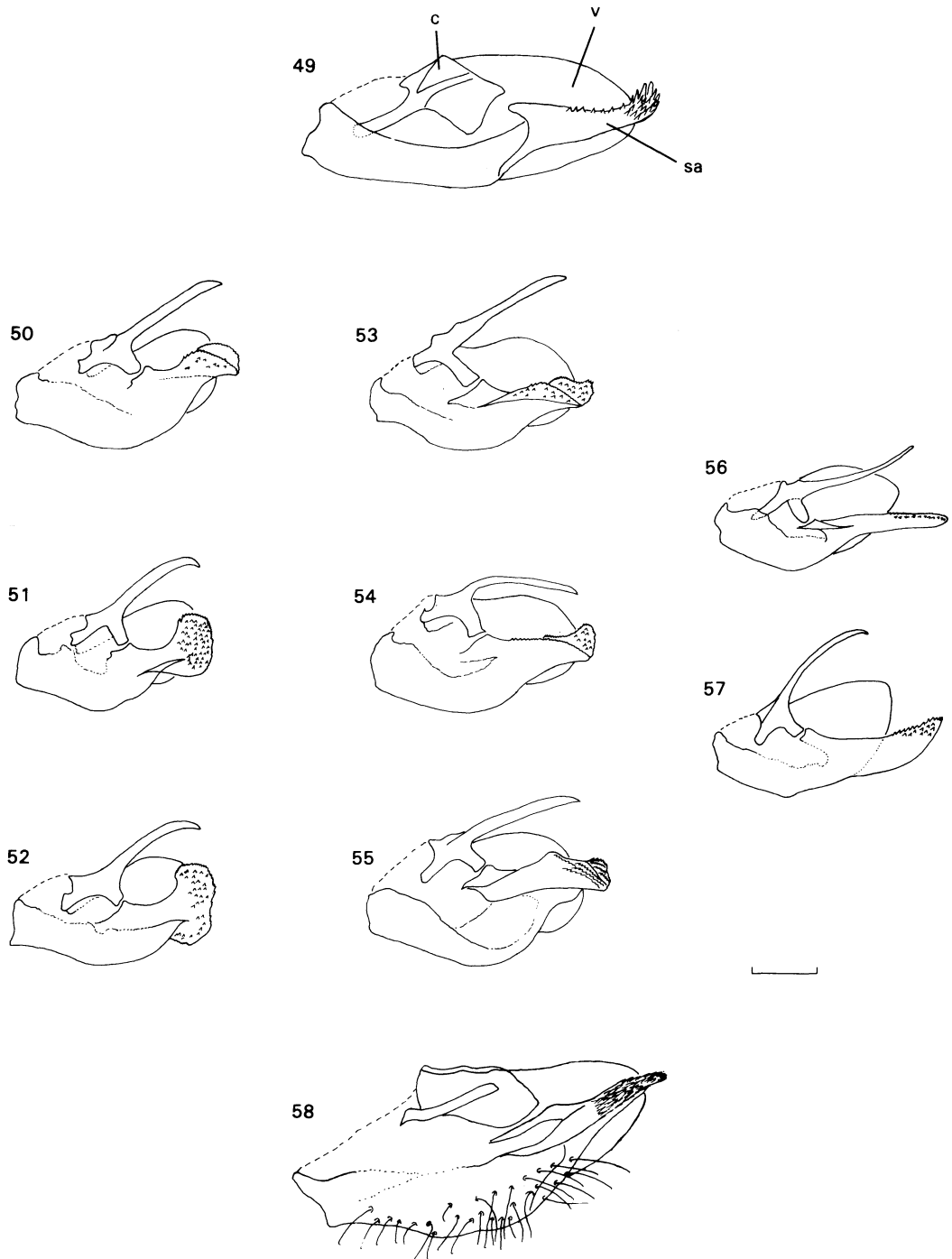


Fig. 49–58 Male genitalia, right valva, internal face. Scale line = 0.25 mm, except for fig. 49 where = 0.125 mm. 49 *H. cinerearia*; 50 *H. alba*, South end Victoria Range [BR]; 51 Ashley Gorge [NC]; 52 *H. alba*, River Jordan, Paradise [OL]; 53 *H. mutabilis*, Oturere Stream [TO]; 54 *H. mutabilis*, Riwaka [NN]; 55 *H. mutabilis*, Ashley Gorge [NC]; 56 *H. plumbea*; 57 *H. christinae*; 58 *H. clandestina*.

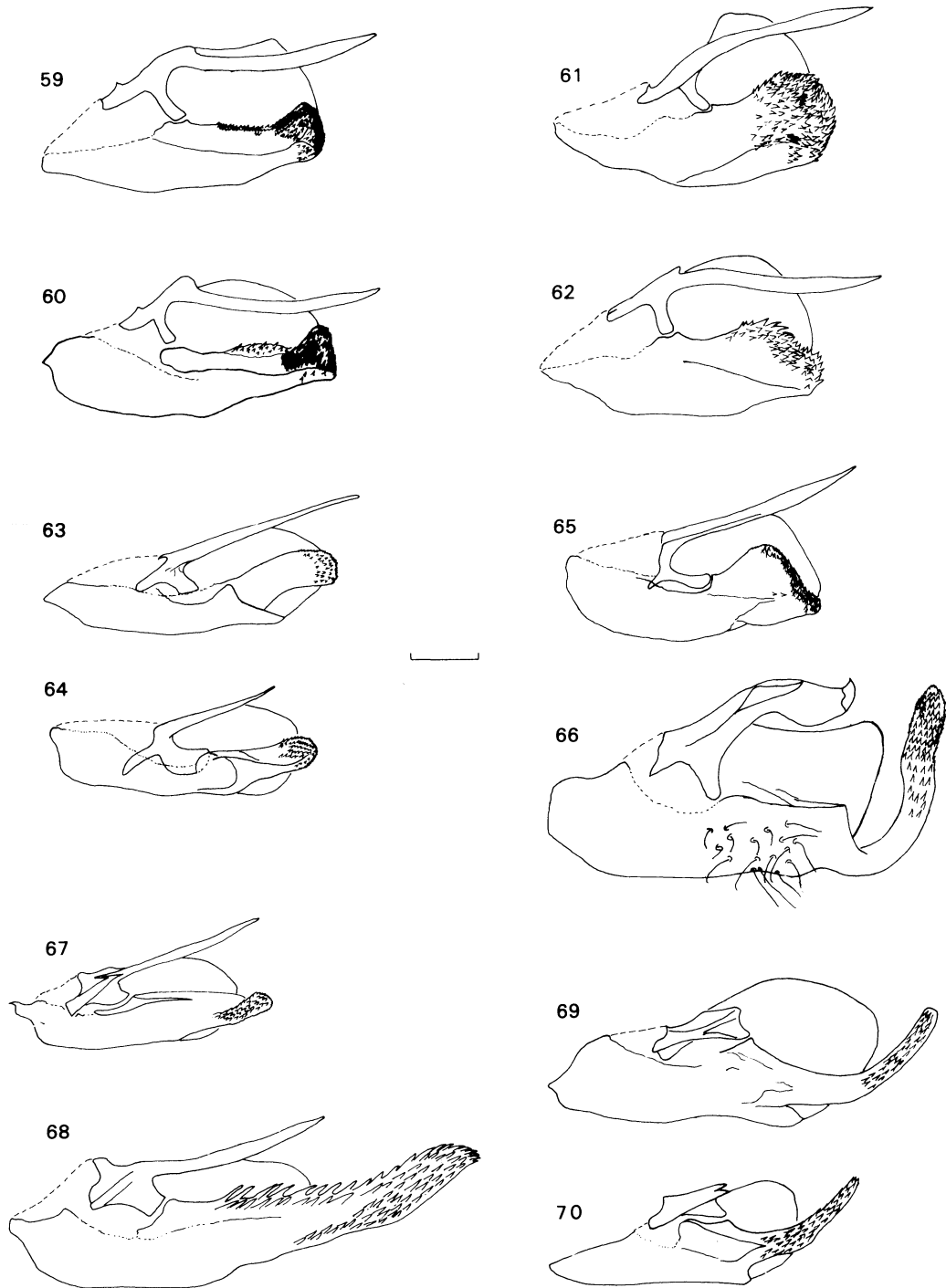


Fig. 59–70 Male genitalia, right valva, internal face. Scale line = 0.25 mm
 59 *H. corcularia*, Riwaka [NN]; 60 *H. corcularia*, Waikawa [SL]; 61 *H. semisignata*, Orongorongo Valley [WN]; 62 *H. semisignata*, Waipoua State Forest [ND]; 63 *H. salmoni*; 64 *H. ohauensis*; 65 *H. scissa*; 66 *H. farinata*; 67 *H. cryptica*; 68 *H. cymozeucta*; 69 *H. expolita*; 70 *H. triphragma*.

lower altitudes in association with podocarp-broadleaf forests.

Remarks. This species and *H. mutabilis* have been confused in the literature and New Zealand collections with *H. cinerearia* (e.g., Hudson 1928). Some authors have distinguished the two species as a separate species *eupitheciaria* either closely related to *H. cinerearia* (e.g., Meyrick 1919; Prout 1939) or to *H. semisignata* and *H. plumbea* (Philpott 1928). D. S. Fletcher (pers. comm.) has kindly examined the male genitalia of the lectotype of *H. eupitheciaria* and it is clear that this specimen is conspecific with *H. cinerearia*. I have also examined a colour slide of this lectotype specimen and it is undoubtedly *H. cinerearia* and not conspecific with most of the specimens sometimes distinguished in New Zealand collections as *eupitheciaria*. These specimens collectively represent two undescribed species which are here described as *H. alba* and *H. mutabilis*. Specimens of these two species are also placed in many collections under *cinerearia* too.

H. alba and *H. mutabilis* can be easily distinguished from *H. cinerearia* by the presence of a free spine-like arm on the costa in the male genitalia, and by the large kidney shaped lodix and short, scobinate ductus bursae in the female genitalia. Distinguishing features separating *H. alba* from *H. mutabilis* are the sacculus free arm with a rounded apex in *alba* versus a squared to obliquely angled apex in *mutabilis* in the male genitalia (Fig. 26–28), and the groove on the cervix bursae in the female genitalia of *alba* and its absence in *mutabilis*.

Helastia mutabilis n. sp.

Description. EXTERNAL (Fig. 31). Small to medium sized (9.5–13.1 mm) triangular forewing. Upperside forewing coloration brownish white to grey with brown to dark brown wavy transverse lines. Male antennae bipectinated.

MALE GENITALIA (Fig. 26–27, 53–55, 73–74). As in *alba* except sacculus free arm more elongate with apex squared to obliquely angled.

FEMALE GENITALIA (Fig. 92). As in *alba* but ductus bursae slightly longer and cervix bursae appearing broad in ventral view due to absence of longitudinal sulcus.

Type data. **Holotype**, male: “Riwaka [NN] 15/11/1928, A. Philpott (NZAC). **Paratypes**, 11 ♂♂, “Nelson, N.Z., various dates, A. Philpott” (NZAC).

Material examined. Holotype, Paratypes, 41 ♂♂, 20 ♀♀ (AMNZ, CMNZ, NMNZ, NZAC).

Distribution. North Island: AK, TO, GB, RI, HB, WN; South Island: NN, SD, BR, KA, NC, MC, DN.

Habitat. As for *alba* but more frequent at lower altitudes.

Remarks. See *alba*.

Helastia plumbea (Philpott, 1915)

Philpott, 1915: 194 (*Xanthorhoe*); Meyrick, 1917: 259 (*Xanthorhoe*); Hudson, 1928: 113 (*Xanthorhoe*); Philpott, 1928: 484, fig. 5, male genitalia (*Xanthorhoe*); Prout, 1939: 251, as synonym of *infantaria* Guenée (*Xanthorhoe*); Dugdale, 1971: 101 (*Helastia*).

Description. EXTERNAL (Fig. 32). Small to medium sized (r.f.l. 9.5–12.5 mm) triangular forewing. Upperside forewing bluish grey with darker wavy transverse lines; veins dotted with black and white spots. Discal spot reddish-ochreous. Male antennae bipectinated.

MALE GENITALIA (Fig. 56, 75). Costa of valva produced as long, free spine-like arm, extending well beyond apical margin of valvula. Sacculus free arm elongate, extending well beyond apical margin of valvula, apex with sharp scobinations. Aedeagus long, thin, curved; apex bulbous with ventral median carina. Ventral manica pad short thorn. Calcar short, elongate.

FEMALE GENITALIA (Fig. 93). Lodix a large single flat kidney shaped plate. Lamella antevaginalis a distinct kidney shaped median plate with short lateral processes. Lamella postvaginalis smooth sclerotised plate laterally fused to lamella antevaginalis. Upper half ductus bursae membranous, lower half lightly sclerotised, scobinate. Corpus bursae membranous pouch.

Type data. **Holotype**, male “Queenstown [OL] 18/12/1913; *Xanthorhoe plumbea* Philpott, **Holotype** ♂” (NZAC). **Paratype** male, same data as holotype (NZAC).

Material examined. Holotype, paratype; 108 ♂♂, 53 ♀♀ (AMNZ, CMNZ, NMNZ, NZAC).

Distribution. North Island: TO; South Island: NN, BR, MB, NC, WD, MK, DN, CO, OL, FD.

Habitat. Montane to subalpine, chiefly along stream and river banks.

Remarks. Easily distinguished from other *Helastia* species externally by the combination of the upperside forewing bluish grey coloration with the reddish ochreous discal spot.

Description. EXTERNAL (Fig. 33). Small to medium sized (r.f.l. 9–12 mm) triangular forewing. Upperside forewing greyish green with light to dark grey and yellowish-ochreous wavy transverse lines; conspicuous transverse greyish white median band with black to brown discal spot. Male antennae bipectinated.

MALE GENITALIA (Fig. 24, 57, 76). Costa of valva produced as free spine-like arm. Sacculus free arm extending well beyond apical margin of valvula, slightly curved and upturned, scobination short. Aedeagus long, thin, curved; apex bulbous with ventral median carina. Ventral manica pad a long median spine. Calcar short, apex expanded and rounded.

FEMALE GENITALIA (Fig. 94). Lodix a large, flat kidney shaped plate. Lamella antevaginalis broadly V-shaped. Lamella postvaginalis lightly sclerotised extending laterally as a sclerotised band fusing with apophyses anteriores. Ductus bursae short, scobinate, upper two thirds sclerotised, third to corpus bursae membranous. Corpus bursae elongate; cervix bursae scobinate, not extended laterally and dorsally as a smooth sclerite.

Type data. **Holotype**, male “Roaring Meg Creek, Kawarau Gorge, CO; 20 Nov. 1974, J. S. Dugdale” (NZAC). **Paratypes**, 7 ♂♂, 14 ♀♀, same locality as holotype, various dates (NZAC).

Material examined. Holotype, paratypes; 11 ♂♂, 10 ♀♀ (AMNZ, NZAC).

Distribution. South Island only: DN, CO, OL. Six specimens (4 in NZAC, 1 in AMNZ, 1 in CMNZ), from other areas of the South Island have been provisionally referred to this species but the populations to which they belong require further study.

Habitat. Lowland to subalpine; generally besides stream and river banks.

Remarks. Liable to be confused with *H. alba*, *H. mutabilis* and *H. plumbea* but easily distinguished from all three by the conspicuous transverse greyish white median band on the upperside forewing, by the shape of the sacculus free arm in the male genitalia and by the presence of a scobinate cervix bursae without a smooth lateral/dorsal sclerite in the female genitalia.

Etymology. Patronym honouring Christine Patrick.

***Helastia clandestina* (Philpott, 1921) n. comb.**

Philpott, 1921: 338 (*Xanthorhoe*); Hudson, 1928: 113, pl. 12, fig. 38 (*Xanthorhoe*); Prout, 1939: 250 (*Xanthorhoe*).

Description. EXTERNAL (Fig. 34). Large sized (r.f.l. 15.5–17.5 mm) triangular forewing. As described by Philpott (1921) but the upperside forewing base colour more slaty grey (as noted by Hudson 1928) rather than bluish grey as in the original description. Male antennae bipectinated.

MALE GENITALIA (Fig. 58, 77). Costa of valva a flat plate; ventral arms distinctly asymmetrical, tegumenal arm narrow, valvular arm very broad. Sacculus free arm only projecting slightly beyond apical margin of valvula, scobinate. Ventral manica pad a thorn. Calcar broader than long, dorsoventrally flattened, densely covered with long hairs. **FEMALE GENITALIA** (Fig. 95). Lodix a flat kidney shaped plate not extending to lateral margins of sternite. Lamella antevaginalis laterally a sclerotised band, medially deeply U-shaped and thickened with a median slit. Lamella postvaginalis a sclerotised plate. Ductus bursae broad, membranous. Corpus bursae globose when expanded, small relative to overall size.

Type data. **Holotype**, male: “Arthur’s Pass, Feb. 1920, ESG [E. S. Gourlay], *Xanthorhoe clandestina* Phil. **Holotype** ♂” (CMNZ).

Material examined. Holotype ♂; 1 ♂, 2 ♀♀, same data as holotype (AMNZ, CMNZ); 1 ♂ Rough Creek, Arthur’s Pass, Feb. 1973, P. Leaf (NZAC); 1 ♂ junction Bealey-Waimakariri Rivers, 8 March, 1972, A. C. Harris (NZAC).

Distribution. South Island only: NC.

Habitat. An extremely rarely collected species known only from a couple of localities in the vicinity of the type locality, Arthur’s Pass. A. C. Harris (pers. comm.) stated that the specimen he collected was flying over stones in the riverbed.

***Helastia corcularia* (Guenée, 1868)**

sp. rev., n. comb.

Guenée, 1868: 61 (*Larentia*)
infantaria Guenée, 1868: 62 (*Larentia*). n. syn.

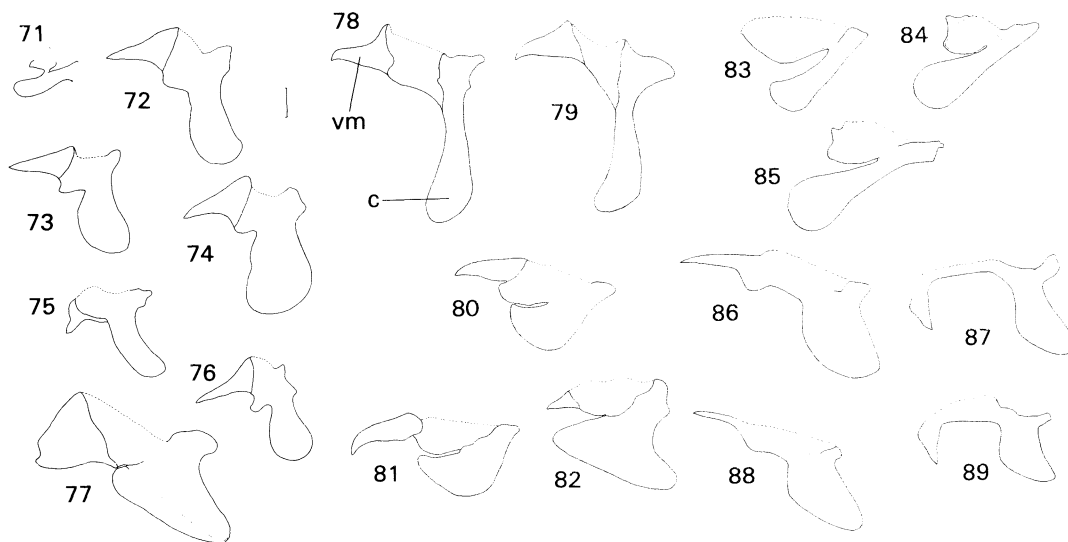


Fig. 71–89 Male genitalia, calcar and ventral manica pad, lateral view. Abbreviations: c = calcar; vm = ventral manica pad. Scale line = 0.1 mm.

71 *H. cinerearia*; 72 *H. alba*; 73 *H. mutabilis*, Oturere Stream [TO]; 74 *H. mutabilis*, Ashley Gorge [NC]; 75 *H. plumbea*; 76 *H. christinae*; 77 *H. clandestina*; 78 *H. corcularia*; 79 *H. semisignata*; 80 *H. salmoni*; 81 *H. ohauensis*; 82 *H. scissa*; 83 *H. farinata*; 84 *H. cryptica*; 85 *H. cymozeugta*; 86 *H. expolita*; 87 *H. angusta*; 88 *H. triphragma*; 89 *H. siris*.

Description. EXTERNAL (Fig. 35). Medium sized (r.f.l. 10.9–14.7 mm) triangular forewing. Upper side forewing coloration and pattern light to dark slate grey with slightly darker wavy transverse lines, veins dotted with black and white spots. Male antennae bipectinated.

MALE GENITALIA (Fig. 59–60, 78) Costa of valva produced as long, free spine-like arm, ventral surface of arm with a single row of minute spines; ventral arms symmetrical. Sacculus free arm narrowly rectangular with squared blunt apex, not extending far beyond apical margin of valvula, scobinations small relative to *semisignata*. Aedeagus long, thin; apex bulbous with ventral median carina. Ventral manica pad acuminate thorn. Calcar long, capitate.

FEMALE GENITALIA (Fig. 96, 105). Lodix a large, flat kidney shaped plate. Lamella antevaginalis heavily sclerotised and expanded median plate, lateral margins rounded. Upper half ductus bursae sclerotised, lower half membranous. Corpus bursae elongate ovate when expanded.

Type data. **Lectotype**, female of *corcularia* selected by D. S. Fletcher, here designated: [Canterbury, Fereday], Ex. Musaeo Ach. Guenée; Ex. Oberthur coll. Brit. Mus. 1927–3; BMNH genitalia slide G10142 (BMNH). **Holotype**, female of *infantaria* [Canterbury, Fereday], Typicum specimen; Ex. Musaeo Ach. Guenée; Ex. Oberthur Coll. Brit. Mus. 1927–3; BMNH genitalia slide G10296 (BMNH).

Butler (1879: 394) appears to be the first author to have synonymised *H. corcularia* with the species *H. semisignata* and he was followed in this by all subsequent authors. The species *H. plumbea* was regarded as a junior subjective synonym of *infantaria* by Prout (1939: 251) but the *infantaria* holotype is clearly not conspecific with *plumbea*. D. S. Fletcher (pers. comm.) comments that the holotype of *infantaria* appears to be “a small example of *Larentia corcularia* Guenée” because “the genitalia match perfectly”. Prout (1939) was obviously misled by the size of the specimen. I have examined a colour slide of the *infantaria* holotype and the specimen is conspecific with *corcularia*.

Material examined. 234 ♂♂, 197 ♀♀ (AMNZ, CMNZ, NZAC).

Distribution. South Island: NN, SD, MB, KA, BR, NC, MC, SC, WD, MK, DN, CO, OL, FD, SL, SI; Chatham Islands.

Habitat. Almost ubiquitous, occupying a wide variety of habitats similar to those of *H. cinerearia*.

Remarks. Previously placed under the specific name *semisignata* in New Zealand collections this species is easily distinguished from that by the shape of the sacculus free arm apex and the size of the scobinations in the male genitalia and by the rounded lateral margins of the lamella antevaginalis median plate in the female genitalia.

***Helastia semisignata* (Walker, 1862)**

Walker, 1862: 1200 (*Larentia*); Butler, 1877: 304 (*Larentia*); Prout, 1912: 52 (*Xanthorhoe*); Meyrick, 1917: 259 (*Xanthorhoe*); Hudson, 1928: 113 (*Xanthorhoe*); Prout, 1939: 250 (*Xanthorhoe*); Dugdale, 1971: 101 (*Helastia*).

dissociata Walker, 1862 [1863]: 1734 (*Cidaria*).
punctilineata Walker, 1862: 1202 (*Larentia*); Prout, 1912: 52 (*Xanthorhoe*, as synonym of *semisignata*).

similisata Walker, 1862 [1863]: 1735 (*Cidaria*); Butler, 1877: 394 (as *semilisata* [sic], as synonym of *semisignata*).

Description. EXTERNAL (Fig. 36). Medium sized (r.f.l. 10.8–14.5 mm) triangular forewing. Forewing coloration and pattern brown to grey-brown with darker, wavy transverse lines; veins dotted with black and white spots. Male antennae bipectinated. MALE GENITALIA (Fig. 61–62, 79). As in *corcularia* but sacculus free arm broadly rectangular with rounded apex; scobinations increasing gradually in size from inner to outer dorsal margin, the largest conspicuously larger than those in *corcularia*. FEMALE GENITALIA (Fig. 97). As in *corcularia* but lamella antevaginalis median plate with distinct lateral processes.

Type data. **Holotype**, male of *Larentia semisignata*: New Zealand [AK], 45–61 [presented by Dr A. Sinclair, R.N.]. *Larentia semisignata*: BMNH genitalia slide G10138 (BMNH). **Lectotype**, male of *Larentia punctilineata* selected by D. S. Fletcher, here designated: New Zealand [AK], 54–4 [presented by Col. Bolton]: *Larentia punctilineata*, BMNH genitalia slide G10140 (BMNH). **Holotype**, female of *dissociata*: [AK], 45–61 [presented by Dr A. Sinclair, R.N.]; BMNH genitalia slide G10141. **Holotype**, male of *Cidaria similisata*: New Zealand [AK], 54–4 [presented by Col. Bolton]: *Cidaria similisata*: BMNH genitalia slide G10139 (BMNH).

Material examined. 115 ♂♂, 129 ♀♀ (AMNZ, NZAC).

Distribution. North Island only: ND, AK, BP, TO, GB, TK, HB, RI, WN.

Habitat. Almost ubiquitous occupying a wide variety of habitats.

Remarks. See under *corcularia*.

***Helastia salmoni* n. sp.**

Descriptions. EXTERNAL (Fig. 37). Medium sized (r.f.l. 12.7–13.2 mm) triangular forewing. Upperside forewing whitish-grey with wavy brown transverse lines. Male antennae bipectinated.

MALE GENITALIA (Fig. 63, 80). Costa of valva produced as long, thin, free, spine-like arm extending well beyond apical margin of valvula and apex of sacculus free arm; ventral arms distinctly asymmetrical. Sacculus free arm elongate, just extending beyond apical margin of valvula, apex rounded. Aedeagus long, stout, slightly curved; apex not bulbous with a ventral median carina. Ventral manica pad a laterally flattened thorn. Calcar short, broad, apex rounded.

Type data. **Holotype**, male, “Homer Tunnel, 27/1[19]46, J. T. Salmon” (NMNZ); **Paratype**, male, “Gertrude, Otago, 4700–5200 ft., 18/1[19]63”, [J. S. Dugdale], (NZAC).

Material examined. Holotype ♂, paratype ♂.

Distribution. South Island only: FD.

Habitat. Subalpine.

Remarks. Distinguished externally from *corcularia* by the whitish grey coloration of the upper side forewing as opposed to the slate grey coloration of that species. In the male genitalia a number of characters serve to separate this taxon from *corcularia* of which the shape of the calcar and sacculus free arm are the most obvious (cf. Fig. 59, 60, 63, 78, 80). Closest to *H. ohauensis* but distinct from that species by the much longer free arm of the costa (cf. Fig. 63, 64).

Etymology. Patronym honouring Dr J. T. Salmon, Taupo for his contribution to New Zealand lepidopterology.

***Helastia ohauensis* n. sp.**

Description. EXTERNAL (Fig. 38). Medium sized (r.f.l. 13 mm) triangular forewing; fore- and hindwings more elongate than in *corcularia* with the forewing apex and hindwing termen more rounded than in that species. Upperside forewing coloration and pattern light slaty brownish grey with darker and lighter wavy transverse lines. Male antennae bipectinated.

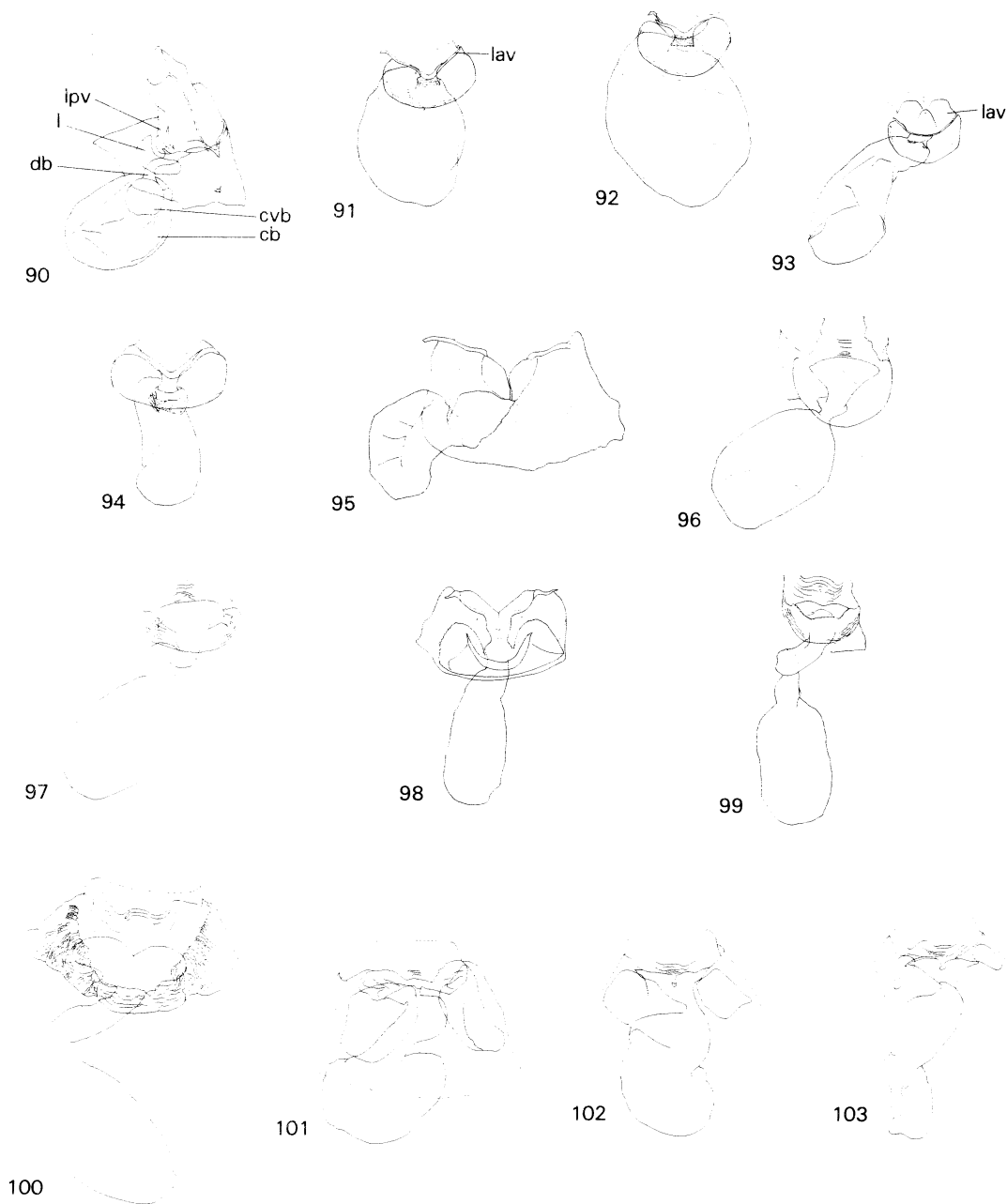


Fig. 90–103 Female genitalia, ventral view. Abbreviations: cb = corpus bursae; cvb = cervix bursae; db = ductus bursae; l = lodix; lav = lamella antevaginalis; lpv = lamella postvaginalis. Scale line = 0.2 mm.
 90 *H. cinerearia* (ventrolateral view); 91 *H. alba*; 92 *H. mutabilis*; 93 *H. plumbea*; 94 *H. christinae*; 95 *H. clandestina*; 96 *H. corcularia*; 97 *H. semisignata*; 98 *H. farinata*; 99 *H. cryptica*; 100 *H. cymozeucta*; 101 *H. expolita*; 102 *H. triphragma*; 103 *H. siris*.

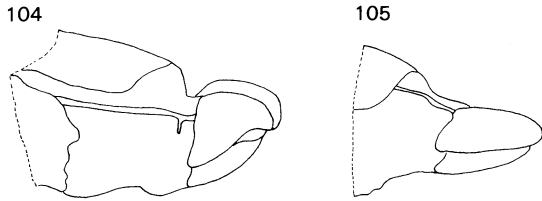


Fig. 104–105 Female genitalia, papillae anales, ventro-lateral view. Scale line = 0.2 mm.
104 *H. scissa*; 105 *H. corcularia*.

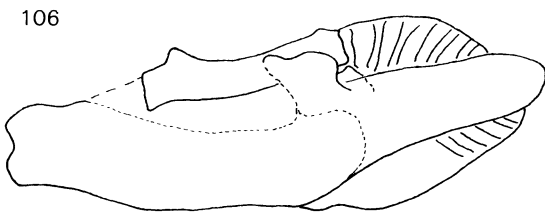


Fig. 106 *Gingidiobora subobscurata*, male genitalia, right valva, internal face. Scale line = 0.2 mm.

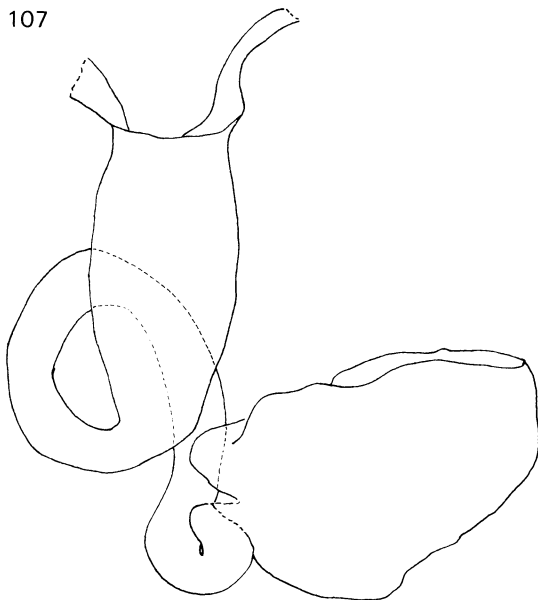


Fig. 107 *G. subobscurata*, female genitalia. Scale line = 0.2 mm.

MALE GENITALIA (Fig. 64, 81). Costa of valva produced as free, short, spine-like arm not extending beyond apical margin of valvula; ventral arms distinctly asymmetrical, valvular arm much broader than tegumenal arm and rounded. Sacculus free arm elongate, not extending far beyond apical margin of valvula, apex rounded. Aedeagus long, stout, basally bulbous; apex not bulbous with a ventral median carina. Ventral manica pad a long thorn. Calcar short, broad.

Type data. **Holotype**, male. "Freehold Ra., Lake Ohau, 4000 ft., 32/12[19]36, S. Lindsay (CMNZ).

Material examined. Holotype male.

Distribution. South Island only. MK.

Habitat. Subalpine.

Remarks. See under *H. salmoni*.

Helastia scissa n. sp.

Description. **EXTERNAL** (Fig. 39). Medium sized (r.f.l. 11.5–12.7 mm) triangular forewing. Upper-side forewing coloration and pattern dark brown with obscure wavy transverse lines. Male antennae bipectinated.

MALE GENITALIA (Fig. 65, 82). Costa of valva produced as free, long, spine-like arm extending well beyond apical margin of valvula and apex of sacculus free arm; ventral arms distinctly asymmetrical, valvular arm thin and much longer than tegumenal arm. Sacculus free arm thick, short, hardly extending beyond apical margin of valvula; apex obliquely angled. Aedeagus long, thin. Ventral manica pad a short spine. Calcar short, broad securiform.

FEMALE GENITALIA (Fig. 104). Papillae anales fused dorsally with a median smooth, sclerotised, dorsally projecting, laterally flattened plate. Posterior apophyses with a short, ventrally directed process at right angles to main apophyses and just anterior to their junction with papillae anales. Lodix a single flat plate with lateral shallow depressions between lodix and lamella antevaginalis. Lamella antevaginalis distinct median plate. Ductus bursae sclerotised.

Type data. **Holotype**, male. "Slopes, Mt Tarn-dale, Nelson Province, 13/2[19]66, J. S. D. [J. S. Dugdale]". **Paratype** male and female same data as holotype (all NZAC).

Material examined. Holotype male, Paratype male and female.

Distribution. South Island only: MB.

Remarks. The combination of the broad securiform (axe headed) calcar and distinctly asymmetrical ventral arms of the costa in the male genitalia with the modified papillae anales (hence the name) and apophyses posteriores in the female genitalia distinguish this species from *H. corcularia* and *H. semisignata*. From *H. salmoni* and *H. ohauensis* this species is distinguished by the securiform calcar, the size of the ventral manica pad and the obliquely angled apex of the sacculus free arm.

Helastia farinata (Warren, 1896)

Warren, 1896: 388 (*Xanthorhoe*); Prout, 1912: 52 (*Larentia*); Meyrick, 1917: 259 (*Xanthorhoe*); Hudson, 1928: 113 (*Xanthorhoe*); Prout, 1939: 265 (*Larentia*); Dugdale, 1971: 101 (*Helastia*).

Description. EXTERNAL (Fig. 40). Medium sized (r.f.l. 10–12.5 mm), triangular forewing. Upperside forewing slate grey with slightly darker, faint wavy transverse lines. Male antennae bipectinated.

MALE GENITALIA (Fig. 25, 66, 83). Costa of valva extended as long, broad, laterally flattened, free arm; apical margins of arm bordered by short, sharp spines and a median, inward directed process. Sacculus free arm long, projecting well beyond apical margin of valvula, curved upwards sharply at right angles to plane of sacculus base so that apex is in line with free arm of costa and dorsal margin of valvula; heavily scobinate. Aedeagus long and thin especially at apex which is a narrow, acuminate tube. Ventral manica pad extremely reduced, largely membranous except for a very thin medial sclerotised strip. Calcar short, apex broadly rounded. FEMALE GENITALIA (Fig. 98): Lodix extensively developed, a heavily sculptured plate raised well above plane of sternite seven. Lamella antevaginalis and postvaginalis fused, heavily sclerotised, deeply V-shaped. Ductus bursae short with a sclerotised collar. Corpus bursae elongate pouch.

Type data. Lectotype, male of *farinata*, selected by D. S. Fletcher, here designated: "Wellington, New Zealand, Rothschild Bequest, BM 1939-1", BMNH genitalia slide G10145; labelled "*Xanthorhoe farinata* Warr. Type ♂" (BMNH).

Warren described the species from two male specimens. Only one of these syntypes remains in BMNH and this has been selected and designated as the lectotype.

Material examined. 12 ♂♂, 11 ♀♀ (NMNZ, NZAC).

Distribution. North Island only: BP, TK, GB, HB, WN.

Habitat. Most frequently found in shaded damp forest gullies.

Remarks. A distinctive species which is apparently a North Island endemic. Hudson (1939: 409) records the species from Awapiri, Marlborough in the South Island. Under *Xanthorhoe farinata* in the NMNZ collection a faded female specimen of *Dichromodes sphaeriata* Felder & Rogenhofer, 1875 was found labelled "Awapiri, 8/12/1918". It is probable that this is the specimen upon which Hudson's record is based.

Helastia cryptica n. sp.

Description. EXTERNAL (Fig. 41). Medium sized (r.f.l. 10.4–13 mm) falcate forewing. Upperside fore- and hindwing coloration and pattern very variable ranging from reddish, green and brown to creamy white and blackish brown with wavy transverse black and white lines. Postmedial line with distinct median double toothed projection. Male antennae bipectinated.

MALE GENITALIA (Fig. 67, 84). Costa of valva produced as long, free, spine-like arm, not extending further beyond apical margin of valvula than sacculus free arm apex; ventral arms short, broad. Sacculus free arm not extended far beyond apical margin of valvula; apex with short, sharp scobinations. Aedeagus long, thin; apex bulbous with ventral median carina. Ventral manica pad reduced, largely membranous except for a very thin medial sclerotised strip with a minute thorn. Calcar elongate ovate, short.

FEMALE GENITALIA (Fig. 99). Lodix a median unsculptured plate. Lamella antevaginalis distinct convex, longitudinally elongate plate; shallowly emarginate on ostiolar margin. Lamella postvaginalis lightly sclerotised with a median depression. Ductus bursae long, expanded at ostium; upper half sclerotised, lower half membranous. Corpus bursae elongate pouch extending to fourth abdominal segment.

Type date. Holotype, male: "River Jordan, Paradise, 10/1/1978, R. C. Crow" (NZAC). **Paratypes** designated as follows: 1 ♀ Cragieburn Stm, Cragieburn Ra., 1000 m. 11/1/1978, R. C. Crow (NZAC); 1 ♂, Spreydon, 14/12/1974, S. Lindsay (CMNZ); 1 ♂ Freehold Range, Lake Ohau, 4000 ft., 31/12/1975, S. Lindsay (CMNZ); 2 ♀♀ Hermitage, 13/1/1973, G. W. Gibbs (NZAC); 2 ♂♂ Obelisk, 1/1/1974, G. Howes Collection (NMNZ); 1 ♂ Paradise 1/1/1970, Fenwick Coll. (NMNZ).

Material examined. Holotype male, 6 ♂♂, 3 ♀♀ Paratypes; 34 ♂♂, 21 ♀♀ (CMNZ, NMNZ, NZAC).

Distribution. South Island only: MC, SC, WD, MK, DN, CO, OL, FD.

Habitat. A lowland to subalpine forest and scrub species though also found in highly modified areas.

Remarks. This species and the following one *H. cymozeucta* were both first collected in the 1870s and 1880s but were confused with *Asaphodes obarata* (Felder & Rogenhofer 1875) (as *Larentia obarata*) by Meyrick (1884) and Hudson (1898) as noted by Prout (1939: 249). The species *H. cryptica* is quite distinct in male (sacculus free arm short, not extending much beyond apical margin of valvula; scobinations small) and female (lodix unsculptured plate) genitalic characters from *cymozeucta* though impossible to distinguish externally.

Helastia cymozeucta (Meyrick, 1913)

Meyrick, 1913: 25 (*Xanthorhoe*); Meyrick, 1917: 260 (*Xanthorhoe*); Hudson, 1928: 118, pl. 15, fig. 9, 10 (*Xanthorhoe*); Prout, 1939: 249 (*Xanthorhoe*); Dugdale, 1971: 101 (*Helastia*); *maoriaria* Hudson, 1939: 410, pl. LVI, fig. 22 (*Xanthorhoe*); Dugdale, 1971: 101 (as synonym of *cymozeucta*, *Helastia*).

Description. EXTERNAL (Fig. 42). As in *cryptica*. MALE GENITALIA (Fig. 68, 85). As in *cryptica* except sacculus free arm extending well beyond apical margin of valvula and heavily spinulose. FEMALE GENITALIA (Fig. 100): Lodix large, heavily sculptured forming a high ridge and extensively developed laterally. Deep pockets formed laterally between seventh and eighth sternites by lateral development of lodix. Lamella antevaginalis distinct median plate, broadly emarginate on ostiolar margin. Lamella postvaginalis sclerotised, with median depression. Ductus bursae long, thin; upper half sclerotised, lower half membranous. Corpus bursae elongate pouch extending to third to fourth abdominal segment.

Type data. Lectotype, male of *cymozeucta*, selected by D. S. Fletcher, here designated: "Ohakune, G. V. Hudson, Meyrick Coll. BM 1938-20", BMNH genitalia slide G10299 (BMNH). Lectotype, male of *maoriaria* selected by R. C. Craw, here designated: "Wainuiomata, Dec. 28, 1919, G. V. Hudson", Hudson Collection register number 948B (NMNZ).

Material examined. Lectotype ♂ *maoriaria*; 37 ♂♂, 19 ♀♀ (CMNZ, NMNZ, NZAC, C. J. Green private collection, Auckland).

Distribution. North Island: AK, WO, GB, TO, WN; South Island: NN, BR, WD.

Habitat. As in *cryptica*.

Remarks. See under *cryptica*.

Helastia expolita (Philpott, 1917) n. comb.

Philpott, 1917: 240 (*Hydriomena*); Hudson, 1928: 98, pl. 12, fig. 42 (*Hydriomena*); Prout, 1939: 291 (*Euphyia*).

Description. EXTERNAL (Fig. 43). Medium sized (r.f.l. 13–14.5 mm) broadly falcate forewing. Upperside forewing purplish-grey with dark oblique apical streak. Postmedial line with strong developed double toothed median projection; basal line angulate with distinct median projection. Male antennae ciliated.

MALE GENITALIA (Fig. 69, 86). Costa of valva a flattened plate with very broad Y-shaped symmetrical ventral arms; dorsal margin of costa with short, deciduous spines. Sacculus free arm curved, upturned; extending well beyond apical margin of valvula; weakly scobinate at apex and on dorsal surface. Aedeagus curved, long, thin without bulbous apex. Ventral manica pad long, thick dorsoventrally flattened spine. Calcar short, stout, broad, rounded.

FEMALE GENITALIA (Fig. 101). Lodix pair of large, lateral concave plates. Lamella antevaginalis a rugose band, expanded laterally. Ductus bursae sclerotised. Corpus bursae globose when expanded.

Type data. Holotype, male: "Broken River, Canterbury, J. H. Lewis" (NZAC); Paratype-male, same data as holotype, (NZAC).

Material examined. Holotype male, paratype male; 3 ♂♂ Otago, Lewis Collection (NMNZ); 1 ♀ Mt. Gray [sic], 14/11/[19]23, Lindsay Collection (CMNZ); 1 ♂ Jack's Pass, 20/11/[19]32, S. Lindsay (CMNZ); 1 ♂ Cupola Basin, Dec. [19]67, J. Pearson (NZAC).

Distribution. South Island only: BR, MB, NC, MC.

Habitat. Montane to subalpine.

Remarks. Easily distinguished externally from *H. angusta*, *H. siris* and *H. triphragma* by the upper side forewing with a median angular projection on the basal line. The three specimens labelled "Otago, Lewis Collection" (NMNZ) are probably from Broken River, Canterbury and part of the original series collected by J. H. Lewis. One of these specimens is from the Hudson Collection (Register number 902a) with the entry "Broken River? ex. Coll. Lewis". Philpott's original description mentions that "seven or eight examples were taken". As only the holotype and one paratype are present in NZAC

it is reasonable to assume that these other specimens are from the original series taken by Lewis and mislabelled Otago.

***Helastia angusta* n. sp.**

Description. EXTERNAL (Fig. 44). Medium sized (r.f.l. 13.5–14.1 mm) narrowly falcate forewing. Upperside forewing coloured whitish purplish brown with darker transverse basal, antemedial and postmedial lines; oblique purplish brown apical streak. Postmedial line with distinct double toothed median projection; basal line evenly curved, no angular projection. Male antennae ciliated.

MALE GENITALIA (Fig. 87). Costa a flattened plate, dorsal margin with spines in holotype, spines absent in paratype but may be deciduous as in *expolita*: ventral arms asymmetrical, tegumenal arm much narrower than broadly rounded valvular arm. Sacculus free arm extending well beyond apical margin of valvula, long and curved upwards sharply at right angles to main plane of sacculus base so that apex is in a line above dorsal margin of costa and valvula; heavily scobinate. Aedeagus long, thin. Ventral manica pad a short, thick laterally flattened spine. Calcar short, stout, broad but smaller than in *expolita*.

Type data. Holotype, male: "Lake Moke, Otago, 5/12/[19]63, J. S. D. [J. S. Dugdale]", (NZAC).

Paratype, ♀, same data as holotype, abdomen missing (NZAC); **Paratype**, ♂ Humboldt [Mountains], 25/12/[19]11, Fenwick Collection (AMNZ).

Material examined. Holotype male, paratype male and female.

Distribution. South Island only: OL.

Habitat. Montane to subalpine.

Remarks. Only known from the Lake Wakatipu region at present. Easily distinguished externally from *expolita* by the more narrowed forewing with the upperside basal line evenly rounded. The male genitalia are quite distinct from those of *expolita* with the most conspicuous differences being the longer and more sharply upturned sacculus free arm and the laterally flattened ventral manica pad in *angusta*.

***Helastia triphragma* (Meyrick, 1883) n. comb.**

Meyrick, 1883: 528 (*Cidaria*); Meyrick, 1884: 74 (*Cidaria*); Hudson, 1898: 49 (*Hydriomena*); Hudson, 1928: 98, pl. 12, fig. 40 (*Hydriomena*); Prout, 139: 291 (*Euphyia*).

Description. EXTERNAL (Fig. 45). Medium sized (r.f.l. 11.3–12.7 mm) falcate forewing. Upperside forewing coloration purplish grey; upperside hindwing very variable purplish grey to pale ochreous. Upperside forewing without apical streak; postmedial line with strongly developed single toothed median projection; basal line evenly curved. Male antennae ciliated.

MALE GENITALIA (Fig. 70, 88). Costa of valva a flattened plate. Sacculus free arm narrow, curved, upturned, extending well beyond apical margin of valvula; heavily scobinate dorsally and ventrally over whole free arm. Aedeagus long, thin, curved. Ventral manica pad a long, thick dorsoventrally flattened spine. Calcar short, stout, broad, obliquely directed. FEMALE GENITALIA (Fig. 102): Lodix a pair of large lateral concave plates. Lamella antevaginalis narrow median plate with deep narrow median slit. Ductus bursae sclerotised, ribbon like. Corpus bursae with upper third nearest junction with ductus heavily sclerotised, remaining two thirds membranous; globose when expanded.

Type data. Lectotype, male selected by J. S. Dugdale, here designated: "Blenheim New Zealand, W. Skellon/81, Meyrick Coll. B.M. 1938–290" (BMNH).

Material examined. 61 ♂♂, 31 ♀♀ (AMNZ, CMNZ, NMNZ, NZAC).

Distribution. South Island only: MB, MC, DN, CO, OL.

Habitat. Coastal, lowland and montane scrub.

Remarks. Easily distinguished from all the other *Helastia* species with falcate forewings (except *H. siris*) by the single toothed median projection on the postmedial line. The larger size of the forewing, the dorsoventrally flattened ventral manica pad and the large lodix plates separate the species from the closely related *H. siris*.

***Helastia siris* (Hawthorne, 1897)**

sp. rev., no comb.

Hawthorne, 1897: 283 (*Asaphodes*); Meyrick, 1917: 255 (as synonym of *Hydriomena triphragma*).

Description. EXTERNAL (Fig. 46). Small sized (r.f.l. 9.5–10.6 mm) falcate forewing; otherwise as in *triphragma*.

MALE GENITALIA (Fig. 89). Ventral manica pad a laterally flattened ventrally projecting spine. Calcar short, elongate. Otherwise as in *triphragma*.

FEMALE GENITALIA (Fig. 103). Lodix a pair of small lateral concave plates. Lamella antevaginalis a semicircular median plate with shallow median slit. Otherwise as in *triphragma*.

Type data. Holotype, female: Hudson Coll. Register number 525C, "Wellington exact loc. uncertain (ex. coll. Hawth.)" (NMNZ).

Material examined. Holotype female; 7 ♂♂, 2 ♀♀ (CMNZ, NMNZ, NZAC).

Distribution. North Island: WN; South Island: SD (Stephen's Island); Chatham Islands.

Habitat. Coastal.

Remarks. Distinguished from *triphragma* by the small size of the forewing, the laterally flattened ventral manica pad and the small lodix plates.

Gingidiobora n. gen.

Type species. *Scotosia subobscurata* Walker, 1862: 1358.

Description. EXTERNAL (Fig. 47, 48). Large (r.f.l. 15–21 mm) nocturnal larentiine moths. Male antennae bipectinated. Male seventh and eighth abdominal segments reduced with eversible coremata on seventh segment.

MALE GENITALIA (Fig. 106). Uncus long, thin decurved. Valva divided into distinct costa, sacculus and valvula. Costa rectangular, elongate plate. Sacculus produced as a smooth free arm. Valvula membranous, rugose. Aedeagus long, thin curved. Dorsal manica pad scobinate to spinulose. Ventral manica pad a broad plane sclerite. Juxta with elongate calcar and fused with base of labides.

FEMALE GENITALIA (Fig. 107): Seventh sternite membranous without a lodix. Lamella antevaginalis thin sclerotised band shallowly to deeply U-shaped. Ductus bursae very long and heavily sclerotised; first third a dorsoventrally flattened broad tube, remaining two thirds to junction with corpus bursae a narrow cylindrical tube reflexed around first third. Corpus bursae membranous, globose when expanded. Ductus seminalis arising midway on corpus bursae.

Etymology. From *Gingidium* the larval foodplant and borós, chewing. Gender feminine.

INCLUDED SPECIES

Gingidiobora subobscurata
(Walker, 1862) n. comb.

G. nebulosa (Philpott, 1917) n. comb.

Remarks. The combination of the structure of the male valva, in particular the smooth sacculus free arm and rugose valvula, and the distinctive female genitalia with the very long reflexed ductus bursae

and the absence of a lodix on the seventh sternite distinguishes this genus from *Helastia* sensu stricto, *Epyaxa* and the New Zealand species of *Xanthorhoe*. The larvae of *Gingidiobora* are also distinct from those of *Helastia* being green and smooth. They feed at night on the apiaceous herb *Gingidium montanum* J. R. & G. Forster, 1776 (Hudson, 1939, 1950 for *G. subobscurata*; Craw, personal observation and rearing for *G. nebulosa*).

ACKNOWLEDGMENTS

This study could not have been completed without the assistance of D. S. Fletcher (BMNH) who very kindly examined types. Thanks are due to J. S. Dugdale and G. W. Gibbs for continued help and comments. G. Kuschel kindly commented on formation of names. Special thanks are due to Brian and Christine Patrick for a constant supply of specimens of both adults and larvae, and to D. W. Helmore for his fine illustrations of larvae. R. G. Ordish (NMNZ), A. Savill (CMNZ), and K. Wise (AMNZ) readily loaned specimens in their charge. Specimens of Australian species were made available by I. F. B. Common and E. B. Schmidt-Nielsen (CSIRO) and P. McQuillan (Dept of Agriculture, Tasmania).

Part of this study was undertaken at the Zoology Dept., Victoria University of Wellington, and was partially supported by a New Zealand Postgraduate Research Scholarship from the University Grants Committee and grants from the Internal Research Committee, Victoria University of Wellington.

REFERENCES

- Butler, A. G. 1977: On two collections of Heterocerous Lepidoptera from New Zealand, with descriptions of new Genera and Species. *Proceedings of the Zoological Society of London*, 1877: 379–407.
- Craw, R. C. 1986: Review of the genus *Notoreas* (sensu auctorum) (Lepidoptera: Geometridae: Larentinae). *New Zealand journal of zoology* 13: 131–140.
- Crosby, T. K.; Dugdale, J. S.; Watt, J. C. 1976: Recording specimen localities in New Zealand: an arbitrary system of areas and codes defined. *New Zealand journal of zoology* 3: 69 + map.
- Dallwitz, M. J. 1984: User's guide to the DELTA system: a general system for coding taxonomic descriptions. *CSIRO division of entomology report no. 13*. (2nd Edition).
- Davenport, D. 1941: The butterflies of the Satyrid genus *Coenonympha*. *Bulletin of the Museum of Comparative Zoology* 87(4): 138 p., 10 pls.
- Doubleday, E. 1843: List of the annulose animals hitherto recorded as found in New Zealand, with the descriptions of some new species. *Lepidoptera In: Dieffenbach, E. ed., Travels in New Zealand with contributions to the geography, geology, botany and natural history of that country*. Vol. 2. London, John Murray. pp. 283–289.

- Dugdale, J. S. 1964: Insects of Campbell Island. Appendix: Lepidoptera: Geometridae. *Pacific insects monograph* 7: 607–623.
- 1971: Entomology of the Aucklands and other islands south of New Zealand: Lepidoptera, excluding non-crambine Pyralidae. *Pacific insects monograph* 27: 55–172.
- Felder, C.; Felder, R.; Rogenhofer, A. F. 1864–1867 [1875]: Reise der osterreichischen Fregatte Novara um die Erde (Zoologischer Theil) Band 2 (Abtheilung). Heft 5. Wien.
- Ferguson, D. C. 1969: A revision of the moths of the subfamily Geometrinae of America, north of Mexico (Insecta, Lepidoptera). *Peabody Museum of Natural History, Yale University Bulletin* 29.
- Fletcher, D. S. 1979: The generic names of moths of the world Volume 3. Geometroidea. In: Nye, I. W. B. ed., London, Trustees of the British Museum (Natural History).
- Forbes, W. T. M. 1948: Lepidoptera of New York and neighbouring states, pt. 2. *Cornell University agricultural experiment station memoir no. 274*.
- Guenée, A. 1868: New species, &c., of heterocerous Lepidoptera from Canterbury, New Zealand collected by Mr R. W. Fereday. *Entomologist's monthly magazine* 5: 61–65; 92–95.
- Hawthorne, E. F. 1897: Descriptions of two new species of Lepidoptera. *Transactions and proceedings of the New Zealand Institute* 29: 282–283.
- Hegvik, H. 1977: Genitalier hos slekten *Xanthorhoe* Hb. (Lep. Geometridae). *Saertrykk av atalanta norvegica* 3: 24–31.
- Herbulot, C. 1951: Diagnoses de nouveaux genres de Geometridae Larentiinae. *Revue Française de Lépidoptérologie* 13: 25–26.
- Hübner, J. [1825]. *Verzeichniss Bekannter Schemetlinge* 21: 327.
- Hudson, G. V. 1898: New Zealand moths and butterflies (Macrolepidoptera). London, West, Newman & Co.
- 1928: The butterflies and moths of New Zealand. Wellington, Ferguson & Osborn Ltd.
- 1939: A supplement to the butterflies and moths of New Zealand. Wellington, Ferguson & Osborn Ltd.
- 1950: Fragments of New Zealand entomology. Wellington, Ferguson & Osborn Ltd.
- Klots, A. B. 1970: Lepidoptera. In: Tuxen, S. L. ed., Taxonomist's glossary of genitalia in insects. 2nd edition. Copenhagen, Munksgaard, pp. 115–130.
- McGuffin, W. C. 1958: Larvae of the Nearctic Larentiinae (Lepidoptera: Geometridae). *Canadian entomologist supplement* 8.
- 1977: Guide to the Geometridae of Canada (Lepidoptera). II. Subfamily Ennominae. 2. *Memiors of the Entomological Society of Canada* no. 101.
- Meyrick, E. 1883: Monograph of New Zealand Geometrina. *New Zealand journal of science* 1: 526–531.
- 1884: A monograph on the New Zealand Geometrina. *Transactions and proceedings of the New Zealand Institute* 16: 49–113.
- 1885: Notes on the nomenclature of the New Zealand Geometrina. *New Zealand journal of science* 2: 589.
- 1913: Descriptions of New Zealand Lepidoptera. *Transactions and proceedings of the New Zealand Institute* 45: 22–29.
- 1917: Revision of New Zealand Notodontina. *Transactions and proceedings of the New Zealand Institute* 49: 248–273.
- 1919: Descriptions of New Zealand Lepidoptera. *Transactions and proceedings of the New Zealand Institute* 51: 349–354.
- Ogata, M.; Okada, Y.; Okagaki, H.; Sibatani, A. 1957: Male genitalia of Lepidoptera: morphology and nomenclature. III. appendages pertaining to the tenth somite. *Annals of the Entomological Society of America* 50: 237–244.
- Okagaki, H.; Sibatani, A.; Ogata, M.; Okada, Y. 1955: Male genitalia of Lepidoptera: morphology and nomenclature. II. Morphological significance of sacculus and furca. *Annals of the Entomological Society of America* 48: 438–442.
- Philpott, A. 1917: Descriptions of new species of Lepidoptera. *Transactions and proceedings of the New Zealand Institute* 47: 192–201.
- 1921: Notes and descriptions of New Zealand Lepidoptera. *Transactions and proceedings of the New Zealand Institute* 49: 239–245.
- 1928: Notes and descriptions of New Zealand Lepidoptera. *Transactions and proceedings of the New Zealand Institute* 59: 481–490.
- Prout, L. B. 1912: Notes on the nomenclature of the New Zealand Geometridae; with description of a new species. *Proceedings of the New Zealand Institute* 44: 52–54.
- 1939: The Indoaustralian Geometridae. In: The Seitz Macrolepidoptera of the World, Vol. 12. Stuggart, J. Lehmann.
- Sibatani, A.; Ogata, M.; Okada, Y.; Okagaki, H. 1954: Male genitalia of Lepidoptera: morphology and nomenclature. 1. Divisions of the valvae in Ropalocera, Phalaenidae (= Noctuidae) and Geometridae. *Annals of the Entomological Society of America* 47: 93–106.
- Sotavalta, O. 1964: Studies on the variation of the wing venation of certain tiger moths. *Annals of the Academy of Science Fennica (A) IV (Biol.)* 74: 1–41.
- Turner, A. J. 1922: Australian Lepidoptera of the group Geometrites. *Transactions of the Royal Society of South Australia* 46: 225–294.
- Walker, F. 1862: List of the specimens of Lepidopterous insects in the collection of the British Museum. Geometrites. Parts 24 (pp. 1021–1280) and 25 (pp. 1281–1477). London, British Museum.
- 1862 [1863]: List of the specimens of Lepidopterous insects in the collection of the British Museum. Geometrites. Part 26 (pp. 1479–1796). London, British Museum.

- Warren, B. C. S. 1947: Some principles of classification in Lepidoptera, with special reference to the butterflies. *Entomologist* 80: 208–217, 235–241, 262–268, 280–282.
- Warren W. 1896: New species of Drepanulidae, Thyrididae, Uranidae, Epiplemidæ and Geometridæ in the Tring Museum. *Novitates Zoologicae* 3: 335–419.
- Watt, J. C. 1979: Abbreviations for entomological collections. *New Zealand journal of zoology* 6: 519–520.