INSECTA MATSUMURANA

NEW SERIES 32 : 1-107 OCTOBER 1985

JAPANESE SPECIES OF THE GENUS STIGMELLA (NEPTICULIDAE : LEPIDOPTERA)

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with biological data provided by
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Abstract

KEMPERMAN, TH.C.M. and WILKINSON, C. [with biological data provided by KUROKO, H. and KUMATA, T.]. 1985. Japanese species of the genus *Stigmella* (Nepticulidae : Lepidoptera). *Ins. matsum. n. s.* 32 : 1-107, 241 figs. (46 pls.).

A revision of the Japanese species of leaf-mining microlepidoptera in the family Nepticulidae is in progress for the first time. This publication comprises the genus *Stigmella* Schrank. Descriptions, diagnoses and bibliographies are given for 40 species, 37 of which are new. As far as possible the taxa have been compared with the known species from the western Palaearctic and Nearctic regions. The genus in Japan has been divided into 10 species-groups. The information given on biology and life-histories has been collated from rearing records, label data and herbaria. Pre-existing types have been examined and 37 holotypes have been designated.

The genitalia of the adults demonstrate major diagnostic features and were essential in providing identification keys. The proposed groups were defined mainly on these structures. Wherever possible the host-plant associations are given and the mining habits of the larvae are discussed.

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Contents

INTRODUCTION

To the casual observer the adult moths of Nepticulidae are minute, brownish and non-descriptive, some species having a white fascia, others not. Under the microscope, however, they often flash with brilliant metallic colours of copper, gold, purple and silver, competing favourably with the iridescent blues and greens of some morpho butterflies. The family is characterized by the white eye-caps—plumes of shining scales on the scape occluding the eyes. The hindwings of males often have specialised black scales associated with olfactory responses.

Often one's first introduction to the family is the observation of tunnels or mines in the leaves of trees and bushes. They are made by the apodous, prognathous larvae, which complete their juvenile existence between the upper and lower layers of epidermis of leaves. Sectioning the leaves reveals that the larvae consistently tunnel in the same layer of the leaf at a given stage in the life-cycle. When full grown they usually leave the mine by biting an exit hole and dropping to the ground. Occasionally the shape of the cut is characteristic. A silken cocoon containing a pupa is made usually amongst debris on the ground.

The larva and the host plant have had a long time to adapt, since we have fossil leaves containing mines going back more than 175 million years. Indeed it seems that leafminers similar to those of today can be identified in Miocene deposits. Miners may be found not only on trees but also on herbaceous plants, some species tunnelling in fruits and bark. The mining habit is not confined to the family Nepticulidae nor even to the Lepidoptera, for the Diptera, Coleoptera and Hymenoptera also contain mining families.

The family has a wide distribution and the genus *Stigmella* occurs on all continents except Antarctica. It is the only genus known to occur in New Zealand. There is considerable similarity in the Holarctic species, the same groups occurring in the USA, Western Europe, USSR and Japan. Thus not only is the leaf mining habit old, but the distribution is presumably also. Conspecificity in these regions also occurs which is not thought to be due to recent introductions. In South Africa the same genera occur as in the Palaeartic, but the species are less closely related to those from elsewhere in the Nothern Hemisphere. Of the regions so far studied Australia contains the most disparate, although it must be added that those from South America have been little studied to date. Primitive characters such as a pectinifer occur in the males of certain Australian Nepticulidae which also lack a cathrema. The former character forms a link with the Opostegidae and Incurvarioidea, whilst the nepticulids expanded scape is also a common feature with the Opostegidae. However a different form of pectinifer has been found in species of the eastern Palaearctic and it is hoped to discover if the feature is more widespread amongst the Chinese Nepticulidae now being collected for study.

The Nepticulidae are regarded as primitive but highly specialised Lepidoptera in the suborder Monotrysia. They are more advanced than the Eriocraniidae but seem to represent a basic stock of an aphyletic line of leaf-miners leading to such major groups as the Gracillariidae.

Variation in venation gave rise to the recognition of the different genera. Later the major genitalia characters supported these divisions and finer characteristics are usually reliable at species level, although instances occur where populations with

quite different externals and or life cycles exhibit inseparable genitalia, both male and female. No major changes for the genus *Stigmella* or its species groups are recommended here ; they conform very well to those established for the western Palaearctic region. However in Japan 10 groups are recognised, few species could not be easily placed in groups but have been nominally assigned to existing groups. Two females representing new species have not been so placed. Thirty-seven species are described as new, and three were previously described, one by Stainton —*S. betulicola*—, one by Matsumura—*S. gimmonella*— and one by Kuroko—*S. castanopsiella.*

Much of the taxonomic history of the genus *Stigmella* and its synonym *Nepticula* has already been discussed (Wilkinson 1978 : 13-22). From a nomenclatorial point of view there has been much discussion regarding the correct name for the genus. *Stigmella* is the older name but there have been attempts to reject it (Wilkinson, l. c.).

The original description of *Stigmella* is rather inadequate, but with the subsequent designation of the type-species by Walsingham (1907 : 1008) the name *Stigmella* is validated for this genus of leaf-mining microlepidoptera. However it is recommended that the name Nepticulidae be adopted as the family-group name since it has priority.

Species of Nepticulidae have been known in Europe since the 18th century. For example *anomalella* Goeze (1783) was described in all stages of its life cycle even earlier by Degeer in 1752, predating Linnaeus' 10th edition of the Systema Naturae. However the separate identity of the genus was not recognised until the turn of the century when *Stigmella* was described by Schrank (1802 : 169). Since then, in Europe, species have been described and assigned to the genus regularly by entomologists from many countries. The second half of the 19th century saw the awakening of interest in North American Nepticulidae, starting with Clemens (1862a, b) who described fifteen species from the mine and hostplant. In New Zealand and South Africa interest began early this century, but studies in Japan are more recent. Before this revision was undertaken only five species of Nepticulidae had been described, two belonging to *Stigmella.* Thus this work owes everything to the carefully and excellently reared material of Dr. H. Kuroko and Dr. T. Kumata.

Methods

Species have been assigned to species-groups which correspond well with those used in Europe by Johansson (1971) and Schoorl et al. (1985) and in North America by Wilkinson & Scoble (1979) and Newton & Wilkinson (1982). Each taxon is treated separately and described under headings which are consistent throughout, namely Description, Diagnosis, Biology, Type locality, Type material examined, Other material examined, Derivatio nominis.

The Description provides all the salient features for each species whilst the Diagnosis is differential and explains how each species can be distinguished from those with which it is likely to be confused. The external features were described with the aid of a binocular microscope with high intensity front illumination filtered to correspond with natural daylight. Colours of particular descriminatory value are those of the head tufts, eye-caps of the scape, antennae, collar and forewings.

Instead of the usual alar expanse, the forewing length has been measured in mm from wingbase to apex. This is given separately for males and females when there is a recognisable difference. In almost all species the thorax, abdomen and forewings have reflections, the colour and intensity of which varies with the angle of incident light. The description gives the basic ground colour, as well as the dominating reflections and iridescence. Venation has been checked and in all cases found typical of the genus. Unique specimens were rendered temporarily transparent by means of toluene.

For each taxon, when known, the male and female genitalia have been described in full. Their morphology is used extensively to provide not only diagnostic characters but also indications of relationship. Schematic figures are provided (Figs. 1-4) to indicate the terminology used for the various genital structures.

The genitalia were prepared as described by Schoorl et al. (l.c.) and were examined with the aid of a high power Zeiss binocular microscope with phase and interference contrast and camera lucida facilities. The use of phase contrast was particularly useful for examining attachment membranes and obviated the need for heavy staining.

Under Biology details of the foodplant, egg, larva, mine and cocoon are given. This information comes from preserved specimens, data labels or has been supplied by Dr. Kuroko and Dr. Kumata.

The Type locality and Type material examined have been cited in full for each taxon as recommended by the International Code. All other specimens and host-plant material are also listed together with collector's name and depository. Illustrations are provided for all species treated in this revision. External features are in the form of black ink line drawings as are also the male genitalia. The external features of the holotype have normally been illustrated and in cases where this is not so '(not H.T.)' appears in the legend. The male capsule, aedeagus and valvae have been figured separately and drawn by means of a drawing-tube extension to the microscope. The outer surface of the valvae is illustrated and where possible, the inner surface is indicated. The female genitalia are shown by means of photographs —several being used to demonstrate the important diagnostic features. All genitalia figures are marked with a scale line, the length which it represents being given in the legend.

Depository. All primary types collected by H. Kuroko are deposited in the collection of Entomology Lab., College of Agriculture, University of Osaka Prefecture, Japan. Those collected by S. Matsumura, T. Kumata and S. Nakamura are deposited in Entomological Institute, Faculty of Agriculture, Hokkaidô University, Japan.

Generic synonyms and selected references

Stigmella Schrank, 1802 : 169. Type species by subsequent designation (Walsingham, 1907 ; 1008), *Phalaena (Tinea) anomalella* Goeze, 1783 : 168 = *Tinea rosella* Schrank, 1802 : 139.

Stigmella Schrank ; Oken, 1815 : 655, 677.

Stigmella Schrank ; Walsingham, 1907 : 1008.

Stigmella Schrank ; Grossbeck, 1917 : 145.

Stigmella Schrank ; Hampson, 1918 : 387.

Stigmella Schrank ; Fletcher, 1929 : 210.

Stigmella Schrank ; Gerasimov, 1937 : 89.

Stigmella Schrank ; McDunnough, 1939 : 107.

Stigmella Heyden *sensu* Beirne, 1945 : 197. Incorrect author given by Beirne. Incor-

rectly synonymized with *Nepticula* Heyden by Borkowski, 1972 : 702.

Stigmella Schrank ; Klimesch, 1948 : 49.

Stigmella Schrank ; Borkowski, 1969 : 96.

Stigmella Schrank ; Emmet in Heath, 1976 : 213.

Stigmella Schrank ; Wilkinson, 1978 : 13 (detailed taxonomic history of the nomenclature and more complete bibliography).

Stigmella Schrank ; Wilkinson and Scoble, 1979 : 12.

Stigmella Schrank ; Newton and Wilkinson, 1982 : 367.

Nepticula Heyden, 1843 : 208. Type species by subsequent designation (Tutt, 1899 : 184), *Tinea aurella* Fabricius, 1775 : 166 (syn. by Walsingham, 1907 : 1008).

Nepticula Heyden ; Zeller, 1848 : 301.

Nepticula Heyden ; Stainton. 1854a : 295.

Nepticula Heyden ; Herrich-Schäffer, 1855 : 69.

Nepticula Heyden ; Heinemann, 1862 : 237.

Nepticula Heyden ; Wocke in Staudinger & Wocke, 1871 : 209.

Nepticula Heyden ; Snellen, 1882 : 967.

Nepticula Heyden ; Smith, 1891 : 110.

Nepticula Heyden ; Meyrick, 1895 : 710.

Nepticula Heyden ; Tutt, 1899 : 184.

Nepticula Heyden ; Dyar, 1903 : 545.

Nepticula Heyden ; Spuler, 1910 : 472.

Nepticula Heyden ; Busck, 1913 : 103.

Nepticula Heyden ; Braun, 1917 : 162.

Nepticula Heyden ; Petersen, 1930 : 1.

Nepticula Heyden *sensu* Beirne, 1945 : 201.

Nepticula Heyden ; Klimesch, 1951 : 4.

Nepticula Heyden ; Johansson, 1971 : 241.

Nepticula Heyden ; Borkowski, 1972 : 690.

Microsetia Stephens *sensu* Kirby, 1897 : 313. Type species by subsequent incorrect designation by Kirby, *Nepticula microtheriella* Stainton, 1854a : 302 (syn. by Tutt 1899 : 184).

Johanssonia Borkowski, 1972 : 702. Type species by original designation and monotypy, *Nepticula acetosae* Stainton, 1854a : 303 (syn. by Karlsholt and Nielsen, 1976 : 17, 81, but kept as separate subgenus).

GENERIC DESCRIPTION

Adult : ♂, ♀.

Head : palps extending just beyond labrum, usually pale grey or white, sometimes dark brown to black ; antennae approximately half the length of the forewings, grey, white, brown to black ; tufts on front of head usually ochreous, sometimes white or brown, vertex more frequently concolorous than different ; scape usually whitish, sometimes fuscous distally or totally brown, in some species there is sexual dimorphism ; collar usually whitish, sometimes brown often strongly iridescent.

Thorax : usually fuscous, rarely whitish, uniform in colour and iridescent. Forewing, media coalescing with radius at base and anastomosing to a point beyond middle of the wing ; cubitus arising separately, reaching middle of the wing ; R4 coincident with R5 ; anal vein not reaching cubitus. Elongate and ovate in shape, ground colour of dorsal surface generally fuscous and uniform in colour, sometimes pale with each scale darker at the tip ; fringe pale grey or brown, usually iridescent and with diffuse margin at apex, rarely well defined by apical wing scales ; markings sometimes absent but usually with a fascia or patches. Hindwing, media single branched. Narrow and lanceolate, half to two-thirds width of forewing ; pale grey or brown. Legs, proximal pair of spurs of hind-tibiae always above the middle.

Abdomen : generally concolorous with thorax, iridescent metallic grey beneath.

Genitalia : ♂. Tegumen strap-like, either articulating or fusing with dorsal arms of vinculum ; uncus usually bilobed, articulating with tegumen and vinculum laterally, and marginally sclerotised ; gnathos U-shaped, M-shaped or W-shaped with dorso-lateral arms arising from transverse ventral plate, sometimes the medial

arms are fused to form a central process; vinculum usually U-shaped, rarely ring-shaped, anteriorly bilobed to varying degrees; valves usually quadrate and frequently bifurcate distally to form a style; transtillae either U-shaped or W-shaped, horizontal bar sometimes interrupted, juxta if present weakly sclerotised; aedeagus simple in form with interspecific variation in length; vesica usually adorned with cornuti of variable size orientated in a ridge and with a cathrema, a plate of minute spiculae, rarely with anellar spines or plates.

♀. Apophyses usually shorter than ductus bursae, ductus with accessory sac sometimes denticulate; bursa copulatrix large and variously pectinate; signum usually absent, but if present, normally weakly sclerotised and comprising ridge-like plates.

Larva. Exclusively leaf miners, usually forming linear tracts, occasionally terminating in blotches.

KEYS TO JAPANESE SPECIES-GROUPS

Both keys are based exclusively on genitalia characters as none can be identified from external features alone. If preparation of the genitalia is impossible then species should first be eliminated on the basis of food plant. Those remaining may possibly be then differentiated by external characters.

Key to males:

1a Gnathos with one medial projection on basal sclerite. ..... *caesurifasciella*-group
1b Gnathos with two medial or lateral projections. 2
2a Vesica with numerous cornuti and/or spines of various length. 3
2b Vesica with few cornuti and/or spines. 8
3a Cornuti very small, more or less equal in size. 4
3b Cornuti of various length but always with some very long and slender spines. .. 5
4a Posterior arms of gnathos short to nodulous. ..... *oxyacanthella*-group
4b Posterior arms of gnathos very long. ..... *ultima*-group
5a Gnathos with two medial projections. ..... *aurella*-group
5b Gnathos with two lateral or sublateral projections 6
6a Aedeagus less than three times as long as broad. 7
6b Aedeagus three or more times as long as broad.
..... *suberivora*-group or *ruficapitella*-group (see both groups)
7a Horizontal bar of transtilla interrupted. ..... *ulmivora*-group
7b Horizontal bar of transtilla not interrupted. ..... *malella*-group
8a Valves with very broad, prominent style and cuiller small, almost absent.
..... *betulicola*-group
8b Valves with slender style and tall cuiller. ..... *salicis*-group

Key to females:

1a Bursa copulatrix with signa. 2
1b Bursa copulatrix without signa. 5
2a Signum band-shaped, long, passing almost entirely around bursa copulatrix, terminalia extended to form pointed ovipositor ..... *salicis*-group
2b Signum not a circum-bursal band, terminalia not so extended. 3
3a Signum broad short band consisting of small plates with one (exceptionally more) short spinule. ..... *ulmivora*-group
3b Signum not a broad band, spines not on little plates. 4
4a Signa comprising of long, slender spicules, eighth tergite terminally sharp-pointed.

ultima-group

4b Signa comprising of short mountain chain-like series of short spines, eighth tergite blunt. *betulicola*-group

5a Anterior and posterior apophyses more or less of equal length. 7

5b Anterior apophyses much shorter than posterior apophyses. 6

6a Accessory sac prominent, heavily folded, ductus spermathecae uncoiled. *suberivora*-group

6b Accessory sac very small, unfolded, ductus spermathecae with some slight coiling. *ulmivora*-group

7a Terminalia blunt or medially concave. *oxyacanthella*-group

7b Terminalia more or less round. 8

8a Accessory sac small. *S. egonokii* or *S. boehmeriae**

8b Accessory sac large and prominent. 9

9a Proximal 1/3 of bursa copulatrix longitudinally folded. *caesurifasciella*-group or *suberivora*-group

9b Bursa copulatrix longitudinally hardly or not folded. 10

10a Bursa copulatrix with sclerotizations, ductus spermathecae without spicules. *ruficapitella*-group

10b Bursa copulatrix without sclerotizations, ductus spermathecae normally with spicules. *aurella*-group

Betulicola species-group

betulicola-group *sensu* Johansson, 1971 : 245.
betulicola-group *sensu* Emmet, 1976 : 259.
betulicola-group *sensu* Schoorl et Wilkinson, 1985 in press.
corylifoliella-group *sensu* Wilkinson and Scoble, 1979 : 50.
corylifoliella-group *sensu* Newton and Wilkinson, 1982 : 431-432.
luteella-group *sensu* Puplesis, 1984b : 583.

Stigmella oplismeniella is tentatively placed in this group on the basis of the shape of the signa in the female genitalia and the valves and gnathos in the male genitalia, however some unique features shown by the genitalia suggest that it could be placed in a group of its own.

This group contains the following Japanese species : *S. betulicola* (Stainton), *S. cathepostis, S. conchyliata, S. populnea, S. titivillitia.*

Puplesis (1984b) places the European species *S. alnetella* (Stainton), *S. glutinosae* (Stainton), *S. luteella* (Stainton), and *S. nivenburgensis* (Preissecker), and also the recently discovered Primoryan species *S. sakhalinella* Puplesis in the *luteella*-group. All of these species show most of the typical *betulicola*-group characteristics. Schoorl et al. place the European species in the *betulicola*-group, recently revised by them. The *luteella*-group sensu Puplesis is therefore synonymized with the *betulicola*-group.

Key to this group :

1a Male with ventral plate of vinculum anteriorly bilobed. 2

1b Male with ventral plate of vinculum anteriorly unlobed, very long, straight or only slightly concave, uncus long, lateral lobes broad, tapering towards top, almost twice as high as middle part of uncus. *cathepostis*

2a Ventral plate of vinculum short, thus anterio-lateral lobes short. 3

2b Ventral plate of vinculum very long, median convexity deep, up to upper part of ventral

* Distinguish on external characters (see "species not placed in a species-group").

plate, anterio-lateral lobes thus very long and broad. ..... *oplismeniella*

3a Ventral arms of transtilla reduced or wanting ; female genitalia with minute signa, 1/7 length of bursa copulatrix. ..... *titivillitia*

3b Ventral arms of transtilla developed ; female genitalia with signa larger than 1/7 length of bursa copulatrix. 4

4a Female signa large, 1/4 length of bursa copulatrix. 5

4b Female signa larger, as much as 3/5 length of bursa copulatrix. 6

5a Anterior and posterior apophyses of equal length. ..... *betulicola*

5b Posterior apophyses 1/3 longer than anterior apophyses. ..... *populnea*

6a Signa on bursa narrow, consisting of few spines, margin of 8th tergite caudally with bow-like structures (Fig. 124). ..... *oplismeniella*

6b Signa on bursa copulatrix broad, consisting of many spines, margin of 8th tergite caudally without bow-like structures. ..... *conchyliata*

Stigmella betulicola (Stainton)

Nepticula betulicola Stainton, 1856 : 42 ; Frey, 1856 : 387 ; Stainton, 1859 : 436 ; Borkowski, 1975 : 526.

Stigmella betulicola (Stainton) ; Beirne, 1945 : 198 ; Klimesch, 1948 : 54-57 ; Hering, 1957 : 184 ; Emmet, 1976 : 259.

Nepticula betulicolella Doubleday, 1859 : 36 (unjustified emendation).

DESCRIPTION. Figs. 5, 39, 40, 41, 117, 213.

Adult. ♂, ♀.

Head : frontal tuft cream to light fuscous ; scape and collar cream ; antenna brown, with ♂ ca. 19 segments, ♀ unknown.

Thorax : brown with bronze reflections mixed with silver. Forewing, (length ca. 1.6-1.8 mm) light brown background ; proximal to costal-sub-basal/anal postmedial line brown with a dark basal streak, though this dark colour is not always present and the whole proximal part is light brown mixed with some grey ; distally background becomes darker, terminally dark brown with bronze reflections ; rest of wing with silver to light bronze reflections ; sometimes greyish buff postmedial fascia is distinguishable but never clearly demarcated.

Abdomen : as thorax or somewhat lighter.

Genitalia : ♂. Tegumen posteriorly weakly rounded, papillate, anterior margins convex ; uncus long, rectangular except for anterior margin, row of dorsal papillae, interrupted medially ; gnathos broad with very long posterior arms, but not extending as far as uncus, long lateral arms and short anterior arms, basal sclerite somewhat thickened medially ; vinculum short, anteriorly bilobed, both upper and lower parts of ventral plate small ; valves long, reaching beyond uncus, style prominent, cuiller short, steep sloping ; horizontal bar of transtilla interrupted, ventral arm nodulous ; aedeagus robust, vesica with two pairs of solid cornuti posteriorly, a large plate anteriorly with small sharp spinules and with short broad-based spines.

♀. Apophyses equal ; accessory sac small ; bursa copulatrix conical shaped, and accessory sac unfolded, without minute spinules ; signa moderately large, oval-shaped with short broad-based spines.

DIAGNOSIS. *S. betulicola* differs from other Japanese *betulicola*-group members here described, by the shape of the cornuti on the vesica, the transtilla which has ventral processes, and the shortness of the vinculum when compared with *S. titivil-*

litia and *S. cathepostis*. The signa on the bursa copulatrix are larger than those of *S. titivillitia* and smaller and more oval than of *S. conchyliata*.

DISCUSSION. Our material of this species is in poor condition, some 10 specimens having been stored together in one capsule. After separation we found nine males and one female. Unfortunately the genitalia of the female were damaged, but the description is reliable. This species is also known from North East China on *Betula platyphylla* (Nieukerken, pers. comm.) and probably shows a continuing distribution from Japan through Siberia to Europe.

According to Schoorl & Wilkinson (1985) *S. corylifoliella* (Clemens) of North America is better regarded as conspecific with *betulicola* although the spectrum of host plants differs from that of the Palaearctic. Considering also its presence in Japan a complete Holarctic distribution is implied.

BIOLOGY.

Food plants. *Betula platyphylla* Sukatschev var. *japonica* (Miq.) Hara.

Mine. Linear, slender, restricted by mid-rib or lateral vein. Early part of mine very slender, filled with dark brown grains of frass, usually in loose "intestinally" coiled form. Later the mine runs along veins and becomes gradually broader ; pale green to whitish green, with a longitudinal dark brown frass line in centre, sometimes disseminated. Length of mine 36-38 mm.

Life history. Larva occurs in mid August, adult in September, next larva in late September and then it will hibernate in a cocoon. Perhaps bivoltine at Minodo-guchi.

MATERIAL EXAMINED. ♂ : "Honshu, Minodo-guchi, Nagano Pref., Sept. 1974, H. Kuroko", "Larva collected in Mid. Aug. 1974", "Host : *Betula platyphylla* Sukatchev var. *japonica* Hara", slide VU no. 0432 ; 6 ♂ : same data, slides VU no. 0700, VU no. 0721, VU no. 0722, 3 no slides ; ♀ : same data, slide VU no. 0735.

Stigmella cathepostis Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 6, 42, 43, 44, 214.

Adult. ♂ (♀ unknown).

Head : frontal tuft buff to yellow ; scape cream ; collar concolorous ; antenna light with ca. 23 segments.

Thorax : as distal part of forewing. Forewing, (length ca. 1.6 mm) brown background ; proximally brown to fuscous with moderate silver iridescence ; post-medial fascia weak, broadest centrally, buff, with slight silver reflections ; distally deep brown to ochreous lustre with some blue and purple. Hindwing, light greyish brown with some bronze reflections.

Abdomen : unknown.

Genitalia : ♂. Tegumen very slight but broad, both margins straight, uncus large, bilobed, lobes ungulate ; gnathos on both sides a long horn-like posterior arm as well as a stout lateral arm ; ventral arms short, thin tapering to filamentous ; vinculum trapezium-shaped with weakly rounded base, lateral lobes absent ; valves long reaching just beyond uncus (apically), style broad, cuiller very low, dorso-lateral margin articulates with broad based, short processes with a vinculum-tegumen joint ; horizontal bar of transtilla interrupted, lateral arms long ; aedeagus short with two sets of prominent palmate cornuti posteriorly, medially two plates with minute

spicules; opening of ductus ejaculatorius at same height; conical structure present distal to aedeagus.

DIAGNOSIS. The shape of the vinculum discriminates *S. cathepostis* from the rest of the Japanese *betulicola*-group cited here. Not only is the absence of lobes on the anterior margin of the vinculum a key factor but also the considerable length of the ventral plate. The female genitalia differ from those of *S. longisacca* Newton & Wilkinson (1982) by the shape of the uncus and gnathos. Furthermore the hairs on the valves of *cathepostis* are more concentrated toward the top of the style.

DISCUSSION. The forms of the valves and aedeagus leave little doubt that *S. cathepostis* belongs to the *betulicola*-group. However the shape of the vinculum suggests a rather unusual status within this group. *S. discidia* Schoorl & Wilkinson (in press) has a different shape and the anterior margin of the vinculum seems to be somewhat bilobed. A conical structure of uncertain origin lies distal to the aedeagus. It may form part of the vesica or anellus.

BIOLOGY.

Food plants. *Carpinus tschonoskii* Maxim.

Egg. Laid on upper surface of leaf, between lateral veins; 0.2×0.13 mm, elliptical.

Mine. Linear, nearly full depth, restricted by mid-rib and lateral veins, early part of mine very slender, later becomes gradually broader, and runs along veins; whitish green to whitish brown, with a dark brown frass-line in centre. Length of mine 30-45 mm.

Larva. Head width ca. 0.3 mm, body length ca. 2.5 mm; pale yellow, head capsule pale yellow brown.

Life history. Larva appears from late May to late June, from mid to late August, and from late September to mid October, and then hibernates. May be trivoltine at Hikosan.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "(Kyushu), Hikosan,—Buzen—, 30-VII-1954, H. Kuroko", "Host: *Carpinus tschonoskii* Maxim.", slide VU no. 0783; paratype ♂: "(Kyushu), Hikosan,—Buzen—, 31-VII-1954, H. Kuroko", "Host: *Carpinus tschonoskii* Maxim.", slide VU no. 0431.

DERIVATIO NOMINIS. Cathetus (L.) (from kathetos (Gr.))=a perpendicular line; postis (L.)=doorpost, refering to the vinculum connecting the valves.

Stigmella conchyliata Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 7, 118, 119.

Adult. ♀ (♂ unknown).

Head: frontal tuft orange; scape buff; collar central scales buff, marginal scales pale translucent; antenna brown with ca. 24 segments.

Thorax: dark background with bronze iridescence. Forewing, see *S. vittata* which *S. conchyliata* resembles except for the details described below, (length ca. 2.2 mm) proximal half dark greyish brown, distal half dark brown; both parts prominent mixed with purple, blue and bronze, terminally with greater intensity; post-medial fascia white with bronze reflections. Hindwing, greyish brown.

Abdomen: as thorax.

Genitalia: ♀. Anterior and posterior apophyses equally long, ductus bursae as long as apophyses, with many small convolutions; accessory sac small, simple; ductus spermathecae with two slight twists at the base; bursa copulatrix long, slender and covered with minute spicules which become pectinate around the edge of the signa; signa length ca. 3/5 of bursa, comprising rows of mountain-like denticules, but lacking other sclerotizations.

DIAGNOSIS. This species can be diagnosed from *S. titivillitia* and *S. vittata* by the prominent purple forewing reflections and white fascia with bronze reflections which are replaced by silver in *S. titivillitia*. Furthermore these species differ in lengths of apophyses and measurements of the signa.

DISCUSSION. See introduction to the species-group.

BIOLOGY.

Food plants. *Alnus* spec.

Cocoon. Known from holotype, fixed on leaf fragment, buff to ochreous, 2.6× 1.5 mm.

TYPE LOCALITY. Ebino-Kogen, Miyazaki Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Ebino-Kogen, Miyazaki Pref.", "30-IV-1965, H. Kuroko", "Host: *Alnus* sp.", slide VU no. 0697.

DERIVATIO NOMINIS. Conchyliatus (L.)=of a purple colour, clothed in purple.

Stigmella oplismeniella Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 8, 81, 82, 83, 122, 123, 124, 212.

Adult. ♂, ♀.

Head: frontal tuft orange; scape cream; collar cream; antenna dark brown with purple reflections, ♂ ca. 27 and ♀ ca. 22 segments.

Thorax: sepia to black with brown and metallic purple iridescence. Forewing, (length ♂ ca. 1.8 mm; ♀ ca. 2.0-2.2 mm) concolorous with thorax but also with cupreous reflections; postmedial fascia white with silverish lustre; terminal cilia also concolorous, purple reflections all over quite prominent. Hindwing, dark greyish brown.

Abdomen: as thorax.

Genitalia: ♂. Tegumen narrow, arcuate, total length covered with scales; uncus long, posterior side medially straight, anteriorly following same margin as from tegumen, laterally with stout well-sclerotized processes; gnathos broad, basal sclerite narrow, posterior arms long, lateral arms short, running from basal sclerite to medially from posterior arms, anterior arms very long and stout; valves long with prominent style reaching as far as uncus, cuiller almost absent; transtilla with disrupted horizontal bar, however both parts connected with membranous bridge, lateral arms long, ventral arms completely absent; small juxta present; vinculum with very reduced upper part of ventral plate, only inconspicuously developed near region of juxta, lower part of ventral plate long but with narrow very deep median convexity thus anterio-lateral lobes prominent and broad; aedeagus tall without manica, vesica with row of stout cornuti tapering in length but not in breadth from posterior opening to cathrema, ductus ejaculatorius covered with spiculae over total length.

♀. Posterior apophyses somewhat longer than anterior apophyses; form of

margins of 8th tergite see fig. 124 ; ductus bursae short with complex folds, accessory sac small ; bursa copulatrix small, narrow with few scallop-like pectinations and large signa with stout spines, signa ca. half length of bursa.

DIAGNOSIS. Shape of ♂ genitalia makes this species easily distinguished from other *Stigmella* spp., as do the shape of the 8th tergite and the signa in ♀ genitalia.

BIOLOGY.

Food plants. *Oplismenus undulatifolius* (Arduino) Roem. & Schult.

Egg. Laid on the lower (sometimes upper) surface of the leaf. Size 0.28×0.20 mm, elliptical.

Mine. Linear, full depth, usually runs longitudinally along leaf margin and then doubles back three or four times, semi-transparent, pale green to pale brown, with a longitudinal black frass-line in centre, later frass-line more disseminated, sometimes in zigzag arcs. Length of mine 118-164 mm.

Larva. Head width 0.3 mm, body length 2.3-3.1 mm. ; head capsule brown, body bright yellow, on ventral side with eight pairs of tubercles. Larva escapes from the lower surface of the mine.

Cocoon. Ovate or elliptical, flattened ; pale ochreous brown, without lustre, 2.5-2.7×1.0-1.3 mm.

Life history. The first adult appears from mid May to early June ; larva from mid September to late October, then spins a cocoon. May be univoltine at Hikosan.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "(Kyushu), Hikosan, (Buzen), 14-V-1957, H. Kuroko", "Host : *Oplismenus undulatifolius*", slide VU no. 0787 ; 2 ♀ paratypes : "Kyushu, Hikosan, —Buzen—, 3-VI-1957 & 18-V-1957, H. Kuroko", slides VU no. 0683 & VU no. 0684.

ADDITIONAL MATERIAL. In Ent. Lab., University of Osaka Pref. 1 ♂ : "Kyushu, Hikosan, (Buzen), 13-V-1955, H. Kuroko", "Host : *Oplismenus undulatifolius*" ; 1 ♀ : "Kyushu, Hikosan, (Buzen), 14-V-1957, H. Kuroko", "Host : *Oplismenus undulatifolius*".

DERIVATIO NOMINIS. Named after host-plant.

Stigmella populnea Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 9, 113, 114, 115, 116.

Adult. ♀ (♂ unknown).

Head : frontal tuft orange ; scape cream ; collar cream ; antenna buff with ca. 18 segments.

Thorax : dark brown background with slight bronze iridescence. Forewing, (length ca. 2.4 mm) background dark greyish brown with bronze reflections, basally black-brown with concolorous lustre ; reflections on proximal half near fascia mixed with cupper ; postmedial fascia greyish white with slight purple reflections ; terminal cilia concolorous. Hindwing, as normal, light greyish brown.

Abdomen : as thorax.

Genitalia : ♀. Posterior apophyses longer than anterior apophyses ; ductus bursae of same length as apophyses ; accessory sac small ; bursa copulatrix long with two signa ; signa ca. 1/4 of the bursa length, covered with minute spicules, shark-teeth shaped, single, paired or in small groups ; also small pectinations con-

centrated between ductus and signa.

DIAGNOSIS. Differs from *S. tranocrossa* by having a dark forewing base, a more distal postmedial fascia, reflecting silver instead of white and purple on the distal parts, and the bronze lustre is more prominent.

BIOLOGY.

Food plants. *Populus nigra* L.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Sapporo, Hokkaido, 17-VII-1957, T. Kumata", "Host, *Populus nigra*", "In capsule broken leg and antenna, Th. K., 820525", slide VU no. 0694; paratype ♀: "Apoi-dake, Hidaka Mts., Hokkaido, Japonia", "28-VII-1973, T. Kumata", host unknown, slide VU no. 0716.

DERIVATIO NOMINIS: Populneus (L.)=of poplar.

Stigmella titivillitia Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 10, 45, 46, 47, 120, 121.

Adult. ♂, ♀.

Head: frontal tuft orange to ochreous; scape cream; collar brown with bronze reflections; antenna brown, ♂ with ca. 29 segments, ♀ with ca. 21 segments.

Thorax: dark brown background with bronze reflections. Forewing, (length ♂ ca. 1.8 mm, ♀ ca. 2.2 mm) background proximal half greyish brown, distal half dark brown; medially with cupreous reflections, rest bronze; distal part reflects brown but also with purple lustre; curved postmedial fascia white with silver and some blue-green reflections, broadening towards costa. Hindwing, buff, ♂ without androconical scales.

Abdomen: as thorax.

Genitalia: ♂. Tegumen bi-laterally symmetrical, posterior margin papillate, anterior margin convex; uncus rectangular, not as broad as tegumen, row of papillae on centre, posterior margin almost straight, anterior margin bilobed; gnathos large with very prominent but thin arcuate posterior arms, rather long lateral arms and stout anterior processes of equal length, basal sclerite with median thickening; vinculum short with two slight anterio-lateral lobes, upper part of the ventral plate short; valves very high, narrow with style reaching beyond uncus, cuiller low with sigmoid declivity; horizontal bar of transtilla interrupted, lateral arms long, ventral arms inconspicuous; aedeagus club-shaped, vesica caudally with two groups rather prominent cornuti, anterior two plates with minute spines flanked by two groups of also prominent cornuti.

♀. Posterior apophyses 1/3 longer than anterior apophyses; bursa copulatrix medially broad with signa which are very small and measure only 1/7 of bursa length, tall spines on signa.

DIAGNOSIS. This species can be distinguished from *S. conchyliata* by the absence of prominent purple reflections on the forewing, having apophyses of unequal length and a much smaller signum on a stouter bursa copulatrix.

DISCUSSION. *S. titivillitia* varies in the breadth of its fascia, but the fascia is always broader costally.

BIOLOGY.

Food plants. *Alnus japonica* (Thunb.) Steud. and *Alnus hirsuta* Turcz.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Sapporo, 3-VII-1967", "Hokkaido, T. Kumata", "Host, *Alnus hirsuta*", slide VU no. 0699; paratypes 3 ♀: "Host, *Alnus japonica*", "Sapporo, Hokkaido, 21-VII-1958, T. Kumata", slides VU no. 0666, VU no. 669, VU no. 0728; paratype ♀: "Sapporo, emerg. 23-VII-1956, T. Harada", "Host, *Alnus japonica* Steud., Det. T. Kumata, 1957", slide VU no. 0698; paratype ♂: "Host, *Alnus japonica*", "Sapporo, Hokkaido, 21-VII-1958, T. Kumata", no slide since abdomen was missing.

ADDITIONAL MATERIAL. In Ent. Inst., Hokkaido University. 2 ♀: "Sapporo, 4-VIII-1957", "Hokkaido, T. Kumata", "Host, *Alnus hirsuta*", no slides; 1 ♀: "Sapporo, Hokkaido, 26-VII-1958, T. Kumata", "Host, *Alnus japonica*", no slide.

DERIVATIO NOMINIS. Titivillitium (L.)=very small trifle, bagatelle, refers to the inconspicuousness of this species.

REMARKS. We noticed some teleutospores in the opening of the ductus bursae, possibly the same or similar to those in *S. tranocrossa*.

Malella species-group

malella-group *sensu* Johansson, 1971: 245.
malella-group *sensu* Emmet, 1976: 249.

The larvae of the western Palaearctic species of this group, except *S. malella*, feed on *Rhamnus* as does the one Japanese species. *S. kurotsubarai* fits well in this group as shown by male genitalia. It seems likely that more *Rhamnus*-feeding Nepticulidae species will be found in future as this is a well known host plant in other regions. As this group has rather heterogenous genitalia characters, it is uncertain to which species within this group *S. kurotsubarai* is most closely related. However, affinity with *S. rhamnophila* (Amsel, 1934) is clear from the shape of uncus, gnathos and valves.

Stigmella kurotsubarai Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 26, 72, 73, 74.

Adult. ♂ (♀ unknown).

Head: orange to ochreous frontal tuft; scape cream; collar cream; antenna brown background with cream/bronze lustre, ca. 26 segments.

Thorax: brown to sepia with light bronze and violet reflections. Forewing, (length ca. 2 mm) speckled appearance because cream coloured scales are darker distally; overall colour buff, with silverish to light bronze iridescence mixed with some violet. Hindwing, as light as forewing but more greyish brown.

Abdomen: colours as thorax.

Genitalia: ♂. Tegumen band-shaped, caudal margin papillate, uncus long with submedially two processes consisting of 3 small lobes, gnathos with two long posterior processes, lateral and anterior processes united but separately visible; valves with prominent style and low but broad cuiller, horizontal bar of transtilla firm, lateral arm short, triangular; ventral plate of vinculum with small upper part and very small lower part, anterio-lateral lobes small, pointed; aedeagus without manica, vesica of medium length, cathrema medially situated, entire vesica covered

with small cornuti except at both ends where they are long, ductus ejaculatorius initially with numerous inconspicuous spinules.

DIAGNOSIS. This species is diagnosed from other Japanese *Stigmella* spp. by the shape of uncus and gnathos.

DISCUSSION. With respect to the food choice and genitalia this species belongs to the European *malella*-group. The group feeds wholly on *Rhamnus* except for *malella* itself.

BIOLOGY.

Food plants. *Rhamnus davurica* Pall. var. *nipponica* Makino.

TYPE LOCALITY. Tateshina, Nagano Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Larva was collected on 6-IX-1965", "Honshu, Tateshina, Nagano Pref.", "3-VII-1966, H. Kuroko", "Host: *Rhamnus davurica*", slide VU no. 0782.

ADDITIONAL MATERIAL. In Ent. Lab., University of Osaka Pref. 1 ♀: "Nobeyama, Nagano Pref., 30-VI-1964, H. Kuroko", "Larva was collected on 4-IX-1963", "Host: *Rhamnus davurica*"; 1 ♂: "Nobeyama, Nagano Pref., 7-V-1964, H. Kuroko", "Host: *Rhamnus davurica*".

DERIVATIO NOMINIS. After the Japanese name of the host-plant.

Ulmivora species-group

ulmivora-group *sensu* Johansson, 1971: 244.
ulmivora-group *sensu* Emmet, 1976: 235.
ulmivora-group *sensu* Puplesis, 1984b: 583.

The two Japanese species belonging to this group are closely related to each other. They feed on *Ulmus* and have unique external colours. The most striking difference between them is the presence or absence of the signum on the female bursa copulatrix. The male genitalia of *S. nakamurai* are related to those of *S. viscerella* (Stainton) from Europe.

Key to the females:

1a Bursa copulatrix with signum of patelloid spines, terminal cilia of forewing as dark as forewing, terminalia broad. ..... *nireae*

1b Bursa copulatrix without signum, terminal cilia of forewing light, terminalia narrow. ..... *nakamurai*

Stigmella nakamurai Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 16, 54, 55, 56, 125, 126, 127, 128, 216, 217, 218.

Adult. ♂, ♀.

Head: frontal tuft orange; scape cream; antenna light brown with ♂ ca. 25 and ♀ ca. 18 segments.

Thorax: dark brown to sepia with bronze, green and purple brown reflections. Forewing, (length ♂ ca. 1.76-2 mm, ♀ ca. 1.68 mm) same colours as thorax, ♀ seems to have a somewhat lighter over all colour but still dark; terminal cilia cream, with silverish bronze reflections. Hindwing, male as dark as forewing, female moderate greyish brown.

Abdomen: greyish brown, ventrally cream with silverish lustre.

Genitalia: ♂. Tegumen slightly bowed, posterior margin medially with some short papillae; uncus long, bilobed, lobes more heavily sclerotized than other parts, blunt; gnathos very long, two very long, stout, pointed submedial processes, basal sclerite as long as length of lobes, anterior arms short, pointed, lateral arms short, broad; valves with style reaching beyond uncus, cuiller prominent, circular, both with long hairs from which the tips are turned inwards, and sclerotizations on inner side of valve at height of vinculum/tegumen/uncus articulation, with a sharp long spine; transtilla with long lateral arms, ventral arms almost absent, horizontal bar disjointed, both parts connected by a very thin membranous bridge; vinculum short, broad, upper part of ventral plate long, lower part very short as well as anterio-lateral lobes which are sharp; membranous quadrate juxta present, broad and long; aedeagus short without manica, vesica with several groups of stout cornuti posteriorly, cathrema medially situated, band of small spines between cathrema and posterior cornuti; two opposing triangular structures lying posterior to the aedeagus near gnathos.

♀. Posterior apophyses longer than anterior apophyses; ductus bursae as long as posterior apophyses; accessory sac small and simple; ductus spermathecae with few convolutions; bursa copulatrix long, tuberous and densely covered with scallop-like pectinations, no signum.

DIAGNOSIS. *S. nakamurai* differs from *S. nireae* in having cream terminal cilia and having no signa on the bursa copulatrix. It is diagnosed from *S. palionisi* Puplesis by the distribution of cornuti on the vesica and by the shape of the uncus. Also the transtilla of *palionisi* is smaller than that of *nakamurai*.

DISCUSSION. From the male genitalia and externals we can place this species in the *ulmivora*-group. Its close relationship to *S. viscerella* (Stainton) is clear from the genitalia.

BIOLOGY.

Food plants. *Ulmus davidiana* Planch. var. *japonica* (Rehd.) Nakai.

Egg. On upper-side of leaf, often on vein.

Mine. Occurring on leaf upper-side, linear, usually dark brown in old mines, and filled with coiled or dispersed frass except on extreme margins of mine. First half of mine much contorted, with convolutions contiguous; second half of mine less contorted, often sinuous or nearly straight. This mine is at once distinguished from those of *S. gimmonella* and *S. nireae* by the more widely coiled and dispersed frass throughout its length, and the egg is laid on the upper-side of leaf.

Cocoon. Known from holotype and paratypes, light brown, 2.3-2.6×1.3-1.6 mm.

Life history. Unknown, but mines with larvae were collected in summer from end July to mid August, and adults emerged in August. This may suggest that *S. nakamurai* is univoltine. However it needs further investigation.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Hokkaido, Sapporo, EM. 3-VIII-1981, S. Nakamura", "Host, 0242 *Ulmus davidiana* v. *japonica*", slide VU no. 0791; paratypes 3 ♂: "Hokkaido, Sapporo, EM. 2-VIII-1981; 10-VIII-1981; 20-VIII-1981, S. Nakamura", "Host, respec. 0220, 0332, 0360 *Ulmus davidiana* v. *japonica*", slides VU no. 0795, VU no. 0794, VU no. 0790; paratype ♀: "Hokkaido, Sapporo,

EM. 18-VIII-1981, S. Nakamura", "Host, 0356 *Ulmus davidiana* v. *japonica*", slide VU no. 0789.

OTHER MATERIAL EXAMINED. 2 ex. with same data as holotype except for em.: 5 & 6-VIII-1981, no slides.

ADDITIONAL MATERIAL. In Ent. Inst., Hokkaido University. 1 ♀: "Nopporo, Hokkaido, Japonia", "26-V-1978, T. Kumata", "Host, 1761 *Ulmus davidiana* v. *japonica*", slide S. Nakamura no. SN-29; 14 ♂ and 15 ♀: "Hokkaido, Sapporo, EM. 2-25-VIII-1981, S. Nakamura", "Host, *Ulmus davidiana* v. *japonica*", no slides; 9 ♂: "Hokkaido, Sapporo, EM. 1-21-VIII-1981, S. Nakamura", "Host, *Ulmus davidiana* v. *japonica*", slides S. Nakamura nos. SN-6, 10, 14, 15, 18, 19, 24, 25 and 26; 5 ♀: "Hokkaido, Sapporo, EM. 3-21-VIII-1981, S. Nakamura", "Host, *Ulmus davidiana* v. *japonica*", slides S. Nakamura nos. SN-10, 11, 12, 17, 18.

DERIVATIO NOMINIS. After S. Nakamura who collected the material.

Stigmella nireae Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (16), 129, 130, 131, 219.

Adult. ♀ (♂ unknown).

Head: frontal tuft orange; scape cream; collar cream; antenna sepia with violet/bronze lustre, ca. 18 segments.

Thorax: sepia to black with mixture of reflections, primarily silver, also bronze, green, brown and purple. Forewing, (length ca. 2.48 mm) concolorous with thorax, with same reflections, but silverish lustre dominant, also violet present; terminal cilia dark greyish brown to sepia with somewhat more bronze lustre. Hindwing, dark greyish brown.

Abdomen: as thorax, but ventrally somewhat lighter.

Genitalia: ♀. Posterior apophyses almost three times as long as anterior apophyses; length of ductus bursae equal to posterior apophyses; accessory sac small with few convolutions; bursa copulatrix large, tuberous with signum consisting of a broad band with short spicules with large pear-shaped flat base-plate, each base-plate normally with one spine, exceptionally more; rest of bursa covered with comb-like pectinations, laterally from signa these pectinations become less abundant and significantly more simple.

DIAGNOSIS. This species differs clearly from *S. nakamurai* by its sepia to black overall colour, lacking lighter terminal cilia and by the signum on the bursa copulatrix. The terminalia of *S. nireae* are shorter, broader and less prominent than those of *S. nakamurai*.

DISCUSSION. From the externals and the overall shape of the female genitalia *S. nireae* is closely related to *S. nakamurai*. Both feed in their larval stage on *Ulmus*. *S. nireae* is placed with *S. nakamurai* in the *ulmivora*-group. The possession of a signum on the bursa copulatrix is not a characteristic of the *ulmivora*-group.

BIOLOGY.

Food plants. *Ulmus davidiana* Planch. var. *japonica* (Rehd.) Nakai.

Egg. On lower-side of leaf, near leaf-margin.

Mine. A very long gallery seen more clearly from leaf upper-side than from lowerside, very narrow throughout, much contorted, irregular in one mine examined, frass thin, linear and occupying less than 1/5 width of track except first 1 cm, in

which frass occupies almost whole width of track. This mine is rather difficult to distinguish from that of *S. gimmonella*, which sometimes also has thin and linear frass. However, the much longer mine seems to serve in separating this species from *S. gimmonella*.

Cocoon. Known from holotype, ochreous to brown, 2.6×2.1 mm.

TYPE LOCALITY. Nopporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Hokkaido, Nopporo, EM. 15-VI-1981, S. Nakamura", "Host, 0051 *Ulmus davidiana* v. *japonica*", slide "S. Nakamura, Genitalia on slide, No. SN-30".

DERIVATIO NOMINIS. Nire (Jap.)= *Ulmus*.

Ultima species-group

ultima-group *sensu* Puplesis, 1984a: 116.
aceris-group *sensu* Schoorl, Nieukerken & Wilkinson, 1985: 99.

Schoorl et al. (1985: l.c.) separated *S. aceris* (Frey) from the *oxyacanthella*-group to which it was previously assigned by Johansson (1971: 245). Males of the *ultima*-group are especially characterised by the broad gnathos with long slender posterior arms and the tall, rectangular uncus which is particularly thickened medially and at the posterior margins. Females can be easily distinguished from the *oxyacanthella*-group by the presence of signa comprising small spines on the bursa copulatrix, the pointed posterior process on the posterior margin of the 8th tergite (see fig. 141), and the broad and blunt anterior apophyses.

The male genitalia of *S. japonica* particularly resemble those of the North American species *S. gossypii* (Forbes & Leonard), however small differences in the gnathos, valves and aedeagus separate them. Newton and Wilkinson (1982: 393) were unable to include *S. gossypii* in the American *prunifoliella*-group because of differences in the male genitalia, but we find *prunifoliella*-group male structures mostly correspond with the *ultima*-group. Nevertheless we maintain their separate identities on the grounds of significant differences in the female structures. The *prunifoliella*-group lacks the pectinate striations on the bursa copulatrix.

In addition to *S. ultima*, Puplesis (1984a: l.c.) adds three Primoryan species to this group, *S. tegmentosella* Puplesis, *S. monella* Puplesis and *S. kozlovi* Puplesis, whose male and female genitalia compare well with those of the rest of the group. The Japanese species were originally described in the *aceris*-group following Schoorl et al. (1985: 99-100). However owing to its delay in publication the name of *ultima* Puplesis (1984a) predates it. We have compared illustrations of the male genitalia of the Primoryan species and our slides of female paratypes of *ultima* and *kozlovi* (slide nos. VU 0796 and VU 0797 respectively) with those of the Japanese species and find that their similarities warrant their inclusion together in this species-group. *S. bumbegerensis* Puplesis (1984c: 509) is a new Mongolian species, and its discovery encourages one to speculate on a continuous Holarctic distribution for this species-group.

Key to this group:

1a Frontal tuft black, signa on female genitalia 1/8-1/10 length of bursa copulatrix. ..... *japonica*

1b Frontal tuft buff to orange, signa on female genitalia 1/4 length of bursa copulatrix. ..... *orientalis*

Stigmella japonica Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 13, 51, 52, 53, 132, 133, 134, 135, 136, 137, 223, 224.

Adult. ♂, ♀.

Head: frontal tuft black; scape ♂ cream with darker hind margin, ♀ cream; collar cream; antenna brown, with ♂ ca. 22-23 and ♀ ca. 16-17 segments.

Thorax: dark greyish brown, with bronze iridescence mixed with purple and blue-green. Forewing, (length ♂ ca. 1.6-1.9 mm, ♀ ca. (1.9-) 2-2.1 mm) colour as thorax, silver-bronze iridescence rather intensive blue and green reflections at some angles; terminal cilia concolorous; males generally lighter than females. Hindwing, greyish brown.

Abdomen: as thorax, less intense.

Genitalia: ♂. Tegumen ribbon-shaped, caudal margin with minute crenellations; uncus with sclerotizations, remainder membranous, caudo-lateral edges with short weak-curved processes; gnathos with vertical, broad lateral arms, posterior arms prominent; vinculum with long, sharp lateral processes on the anterior margin, upper part of ventral plate much longer than lower; large valves with blunt style, a shorter process with one tooth, inner side of cuiller heavily papillate; aedeagus with two large bands with numerous small cornuti.

♀. Anterior apophyses shorter than posterior, anterior processes of anterior apophyses long and slender; caudal margin of 8th tergite pointed; ductus bursae longer than apophyses; accessory sac bulbous though small; ductus spermathecae with one slight spiral at the basis; signa on bursa copulatrix broader than long, length ca. 1/8-1/10 of bursa, with prominent spines.

DIAGNOSIS. The signa of *S. japonica* are less developed than those of *S. orientalis*. *S. japonica* also differs from *S. orientalis* in having a black or brown-black frontal tuft and a darker background colour with more purple reflections.

DISCUSSION. See introduction to this species-group.

Differences with the male genitalia of the above mentioned Primoryan *tegmentosella* and *kozlovi* from *Acer tegmentosum* and *Betula davurica* respectively are the longer arms of the gnathos and the heavy pustules on the cuiller-edges in the males of *S. japonica*. The signa on the bursa copulatrix of *kozlovi* and *japonica* are more or less equal sized. The length of the signum in *ultima* is intermediate between *japonica* and *orientalis*. *S. japonica* differs from the Mongolian *S. bumbegerensis* Puplesis by its much smaller valves and transtilla bars.

BIOLOGY.

Food plants. *Acer mono* Maxim. and *A. crataegifolium* Sieb. et Zucc.

Egg. On upper-side of leaf, usually beside large veins.

Mine. Basically a linear-blotch, starting as a thin and much contorted gallery, gradually becoming broader towards 2/3 length of mine, after which it abruptly widens into a large blotch. Frass in first 5 mm of mine broken-linear, sometimes deposited as a minute mass within each leaf-areola; the next 15 mm of mine with frass neatly coiled and occupying almost whole width of track; then frass in remaining linear part of mine changes into a dispersed and wide line occupying about

half the width of track ; blotchy part of mine with frass scattered irregularly in its central area.

Cocoon. Known from ♂ and ♀ paratypes, buff to brown, 1.81×1.19 mm.

Life history. Voltinism unknown, but this species probably passes through at least 2 generations a year in Hokkaido. In fact, the holotype and a paratype emerged at end June from larvae collected at early June, and some paratypes emerged at mid September from larvae collected at end August. Hibernation stage unknown ; according to the breeding records mentioned above, however, occurrence of the adult in mid September seems to be too late to have another generation within the same year in Hokkaido.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Misumai, Sapporo, Hokkaido", "22-VI-1974 em., T. Kumata", "Host, 1274 *Acer mono*", slide VU no. 0667 ; paratypes 2 ♂ : "Kyushu, Hikosan, (Buzen), 12-VII-1955, H. Kuroko", "Host : *Acer crataegifolium*", slides VU no. 0657, VU no. 0778 ; paratype 1 ♂ ; "Hokkaido, Ikeda, 15-VII-1958, H. Kuroko", abdomen missing ; paratypes 2 ♀ : "Moiwa, Sapporo, Hokkaido, Japonia", "em. 8 & 16-IX-1975, T. Kumata", "Host, 1496 *Acer mono*", slide VU no. 0668, one no slide ; paratype ♀ : "Nopporo, 15-IX-1964", "Hokkaido, T. Kumata", "Host, *Acer mono*", no slide ; paratype ♀ : "Misumai, Sapporo, Hokkaido", "21-VI-1974 em., T. Kumata", "Host, 1274 *Acer mono*", no slide ; paratype ♀ : "Moiwa, 29-IX-1964", "Hokkaido, T. Kumata", "Host, *Acer mono*", slide VU no. 0436.

ADDITIONAL MATERIAL : In Ent. Inst. Hokkaido University. 1 ♀ : "Misumai, Sapporo, Hokkaido", "22-VI-1974 em., T. Kumata", "Host, 1274 *Acer mono*", no slide ; 1 ♀ : "Moiwa, Sapporo, Hokkaido", "11-IX-1975, T. Kumata", "Host, 1496 *Acer mono*", no slide ; 1 ♀ : "Moiwa, Sapporo, 4-IX-1966", "Hokkaido, T. Kumata", "Host, *Acer mono*, em. 4-IX", no slide ; 2 ♀ : "Sapporo, Hokkaido, 23-VI-1956, T. Kumata, emerg. 6 and 10-VII-1956", "Host, 72 *Acer mono*", no slides.

DERIVATIO NOMINIS. Named after country of original discovery.

Stigmella orientalis Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 15, 138, 139, 140, 141, 142.

Adult. ♀ (♂ unknown).

Head : frontal tuft buff to orange ; scape cream ; collar cream ; antenna greyish brown as forewing, with ca. 18-19 segments.

Thorax : background light brown with slight bronze iridescence. Forewing, (length ca. 2.3 mm) as thorax with bronze iridescence with some purple, blue and fuscous reflections ; small anal reflections on the proximal half, sometimes silverish instead of bronze.

Abdomen : as thorax.

Genitalia : ♀. Posterior apophyses longer than anterior ; anterior processes of anterior apophyses not as narrow as usual but short, triangular ; caudal margin of tergite 8 pointed ; ductus bursae longer than apophyses ; accessory sac small, bulbous ; ductus spermathecae uncoiled ; bursa copulatrix with two elliptical signa, length ca. 1/4 of bursa, covered with spines.

DIAGNOSIS. This species differs from *S. japonica* in the significantly larger

signa on the bursa copulatrix as well as in the shape of the ends of the anterior apophyses.

DISCUSSION. See introduction to this *ultima* species-group. The signa on the bursa copulatrix are much bigger than those of other known *ultima*-group females.

BIOLOGY.

Food plants. *Acer* spec.

Cocoon. Known from holotype and paratype, cream, length ca. 2.38×1.62 mm.

TYPE LOCALITY. Kosugidani, Yakushima, Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀ : "(Kyushu), Yakushima, Kosugidani, 11-XI-1959, H. Kuroko", slide VU no. 0730 ; paratype ♀ : same data as holotype except for date : 9-XI-1957, slide VU no. 0430.

DERIVATIO NOMINIS. Orientalis (L.)=from the east.

Oxyacanthella species-group

oxyacanthella-group *sensu* Johansson, 1971 : 245.
oxyacanthella-group *sensu* Emmet, 1976 : 252, *partim.*
oxyacanthella-group *sensu* Puplesis, 1984b : 583, *partim.*
oxyacanthella-group *sensu* Schoorl, Nieukerken & Wilkinson, 1985 : 68.
crataegifoliella-group *sensu* Wilkinson & Scoble, 1979 : 30, *partim.*
crataegifoliella-group *sensu* Newton & Wilkinson, 1982 : 375, 376, *partim.*
prunifoliella-group *sensu* Newton & Wilkinson, 1982 : 385, *partim.*
bifasciella-group *sensu* Wilkinson & Scoble, 1979 : 59, *partim.*

The European species of the group were recently revised by Schoorl et al. (1985). In Japan this group consists of the following species : *S. alaurulenta*, *S. chaenomelae*, *S. honshui*, *S. sorbivora* and *S. zumii*. These species resemble very closely the European representatives in characteristic features.

American species which correspond with the *oxyacanthella*-group are to be found divided between North American groups *crataegifoliella* and *prunifoliella*. Parts of these groups are therefore synonymized here. Some of the males of these American species possess characters comparable with the *ultima*-group but since the females are decidedly *oxyacanthella*-group, precedence has been given to them.

S. nostrata Puplesis and *S. aurora* Puplesis from Primorye (USSR) belong to this group but are different from the known Japanese species. Postmedial fasciae are not known among these species. Although not both sexes are known for all Japanese species, the following keys have been compiled.

Key to known males :

1a Style of valves in genitalia reaching far beyond uncus. ..... *sorbivora*
1b Style of valves in genitalia reaching as far as or slightly further than uncus. 2
2a Ventral arms of transtilla present, uncus and gnathos narrow. 3
2b Ventral arms of transtilla wanting, uncus and gnathos broad, cuiller round. .. *honshui*
3a Aedeagus short, uncus low, cuiller sharp but low. ..... *chaenomelae*
3b Aedeagus long, uncus high, cuiller high, almost rectangular, anterio-lateral lobes very sharp. ..... *zumii*

Key to known females :

1a Narrow ending of anterior apophyses almost as long as those of posterior apophyses. ..... *alaurulenta*

1b Narrow ending of anterior apophyses much shorter than those of posterior apophyses. 2
2a Terminalia narrow, prolonged, bilobed ..... *zumii*
2b Terminalia broad, straight, much less prolonged ..... *chaenomelae*

Stigmella alaurulenta Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 11, 145, 146.

Adult. ♀ (♂ unknown).

Head: frontal tuft orange; scape cream with golden iridescence; collar brown, bronze reflections; antenna brown with ca. 22 segments.

Thorax: black-brown background with slight golden reflections. Forewing, (length ca. 2.0 mm) as thorax, but with frontal scales have a light blue-green appearance and metallic colours are absent; no further markings. Hindwing, light greyish brown.

Abdomen: as thorax.

Genitalia: ♀. Anterior and posterior apophyses of same length; caudal margins of anal segments straight or very weakly rounded; bursa copulatrix thin, almost entirely covered with minute pectinations.

DIAGNOSIS. *S. alaurulenta* differs from *S. honshui* by its brown collar and the very prominent golden iridescence on the forewing; furthermore *S. honshui* has less antennal segments. Narrow part of anterior apophyses of *S. alaurulenta* is longer than that of *S. chaenomelae*.

DISCUSSION. See at *S. honshui*.

BIOLOGY.

Food plants. *Malus sieboldii* (Regel.) Rehd.

Life history. Adult specimen used for description emerged in mid May from larva collected at end of September of the preceding year; thus the hibernation might be in prepupal stage within cocoon. The voltinism is not known exactly, but likely to be bivoltine or more.

TYPE LOCALITY. Otaki, Nagano Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Otaki, Kiso, Nagano-ken, Honsyu, Japonia", "12-V-1976 em., T. Kumata", "Host, 1552 *Malus sieboldii*", slide VU no. 0702.

DERIVATIO NOMINIS. Ala (L.)=wing; aurulenta (L.)=made of gold.

Stigmella chaenomelae Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 14, 57, 58, 59, 143, 144.

Adult. ♂, ♀.

Head: frontal tuft orange to ochreous; scape buff; collar as scape; antenna dark brown with ♂ ca. 23 segments, ♀ unknown.

Thorax: dark greyish brown with bronze lustre. Forewing, (length ca. 1.72 mm) background colour of both sexes dark brown to sepia, structural colours ♂ bronze mixed with some purple and green when also frontally lit, ♀ cupreous mixed with red and purple and also green with additional frontal light; terminal cilia instead of anal cilia concolorous especially with respect to the iridescence—this

phenomenon is clear in both sexes—, anal cilia coloured as hindwing. Hindwing, light greyish brown.

Abdomen: as thorax.

Genitalia: ♂. Tegumen laterally broad, posteriorly rounded; uncus laterally with papillae, medially rounded, with long ventrally directed lobes which articulate with posterior arms of gnathos; gnathos same width as uncus, posteriorly short lateral and ventral arms fused to dorsally directed plate; vinculum with long upper part of ventral plate, lower part short, lateral lobes of anterior margin short and sharp; valves large, style very prominent, reaching far beyond uncus or tegumen, cuiller triangular, margins with many spines, one of which is very robust and pointing in same direction as style; ventral arms of transtilla short; aedeagus with an area of numerous minute cornuti, in one long distinct part of which they are arranged in three longitudinal rows, these cornuti somewhat bigger.

♀. Apophyses of equal length, caudal margins of anal structures almost straight; ductus bursae of same length as apophyses; accessory sac bulbous, ductus spermathecae without convolutions; bursa copulatrix thin with inconspicuous scallop-like pectinations.

DIAGNOSIS. This species differs from *S. alaurulenta* and *S. honshui* by the prominent reflections on the terminal cilia of the forewing; moreover the reflections are cupreous on ♀ forewing; background colours in *S. chaenomelae* much darker than in *S. desperatella* (Frey) and with less purple mixture than in *S. oxyacanthella*; uncus, gnathos, which is narrow, and aedeagus separate this species from the other Japanese *oxyacanthella*-group members.

BIOLOGY.

Food plants. *Chaenomeles japonica* (Thunb.) Lindl.

TYPE LOCALITY. Mt. Takao (probably), Tokyo, Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: no label on locality, but it is supposed to be Mt. Takao, Tokyo, "B967, VI. 26. 1938, A. Kawada", slide VU no. 0703; paratype ♀: same locality as holotype, "B967, VI. 23. 1938, A. Kawada", slide VU no. 0704.

DERIVATIO NOMINIS. After the host-plant *Chaenomeles japonica.*

Stigmella honshui Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 12, 60, 61, 62.

Adult. ♂, ♀ (?).

Head: frontal tuft orange; scape cream with silverish-white iridescence; collar cream; antenna dark brown with ♂ ca. 22 and ♀ ca. 17 segments.

Thorax: dark greyish brown background with light bronze and purple lustre. Forewing, (length ♂ ca. 2.32-2.4 mm) broad, dark brown with silverish and bronze reflections mixed with purple, violet and blue. Hindwing, light greyish brown with cream reflections.

Abdomen: as thorax.

Genitalia: ♂. Tegumen with unpapillated posterior margin, laterally with some small papillae; uncus laterally lobed, basal sclerite narrow; gnathos laterally with short blunt arms, lateral and anterior arms united to dorsally directed plate; vinculum with long upper part of ventral plate, lower part very short, anteriorly with

short, sharp lobes; valves with styles reaching as far as lateral lobes of gnathos, cuiller rounded, papillated; transtilla with long lateral arms and very short rectangular ventral arms; aedeagus long, straight, vesica with band of various shaped, mostly tiny cornuti.

DIAGNOSIS. *S. honshui* differs from *S. alaurulenta* by the cream collar, and other reflections on the forewings, also the number of antenna-segments differs in both species. *S. honshui* can be discriminated from *S. zumii* by genitalia features. Differs from *S. sorbivora* by its shorter style and basal sclerite from the uncus; furthermore by the transtilla of a different shape. *S. chaenomelae* differs from *S. honshui* in shape of tegumen, valves and aedeagus.

DISCUSSION. From one specimen (probably female) the abdomen has been lost, so no details are known about female genitalia.

BIOLOGY.

Food plants. *Malus pumila* Mill.

TYPE LOCALITY. Nagano, Nagano Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Honshu, Nagano, 3-IV-1955, Sekiya", "Host: *Malus pumila*", slide VU no. 0784.

OTHER MATERIAL EXAMINED. One presumably ♀: "same locality as holotype, 1-VI-1955", "Host: *M. pumila* Mill.", no slide.

DERIVATIO NOMINIS. After Honshu, where this species is first found.

Stigmella sorbivora Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (11), 63, 64, 65, 222.

Adult. ♂ (♀ unknown).

Head: frontal tuft orange; scape pale buff; collar light brown with scale-centres somewhat darker, concolorous with antenna; antenna brown with ca. 20 segments.

Thorax: pale brown, silver reflecting. Forewing, (length ca. 2 mm) brown background with bright reflections, silver, golden, some purple and green; terminal cilia long; no postmedial fascia. Hindwing, as forewing but paler.

Abdomen: as thorax.

Genitalia: ♂. Posterior margin of tegumen papillated; uncus laterally lobed, sclerotizations in centre of lobes thin, basal sclerite of uncus very broad, posteriorly rounded; gnathos laterally with short, blunt posterior arms, anterior arms ventrally united with lateral arms to broad dorsally directed plates; vinculum with long upper part of ventral plate, lower part very short, anteriorly with short, sharp lobes; valves with long style reaching far beyond uncus, cuiller round, papillated; transtilla with long lateral arms and sharp pointed short ventral arms; aedeagus long, straight, vesica with band of various shaped, most tiny cornuti, ductus ejaculatorius with some long spicules.

DIAGNOSIS. Externally without good discriminatory features for separating this species from others without a postmedial fascia; the genitalia however provide sufficient diagnostic features.

DISCUSSION. Two cocoons were mounted with the holotype, in one we found an almost fully developed pupa. Sex and head details could not be determined but the other characters agreed well with the holotype. *S. sorbivora* is placed in the

oxyacanthella-group on the basis of the genitalia.

BIOLOGY.

Host plants. *Sorbus japonica* Hedl.

Cocoon. Known from holotype, fuscous to dark brown, 2.4×1.7 mm.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Kyushu, Hikosan, (Buzen), 21-IV-1955, H. Kuroko", "Host : *Sorbus japonica* Hedl.", slide VU no. 0690.

DERIVATIO NOMINIS. The name refers to the larval stages feeding on *Sorbus*.

Stigmella zumii Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (11), 48, 49, 50, 147, 148, 149, 150, 151, 240.

Adult. ♂, ♀.

Head : frontal tuft orange ; scape cream ; collar buff ; antenna dark greyish brown with golden reflections, ♂ ca. 27 and ♀ ca. 19 segments.

Thorax : sepia with golden refections mixed with purple and green. Forewing, (length ♂ ca. 2 mm, ♀ ca. 2 mm) same colour as thorax but with more prominent golden lustre and a more important green fraction in the accompanying colours, also with brown. Hindwing, light greyish brown.

Abdomen : as thorax.

Genitalia : ♂. Tegumen broad, posterior margin with some small papillae, medially narrow ; uncus broad, simple ; gnathos with posterior and anterior processes of equal length, lateral arms short, posterior arms originating somewhat subterminally ; valve with style reaching uncus and prominent cuiller, posterior margin of cuiller rectangular ; transtilla with long lateral arms, no ventral arms and almost straight horizontal bar ; median convexity of vinculum reaching upper part of ventral plate, anterio-lateral lobes small, sharp ; aedeagus without manica, vesica with long band of cornuti.

♀. Genitalia not significantly differing from other *Malus*-feeding species except for scale pattern on 8th tergite, and somewhat bilobed caudal margin of 8th tergite.

DIAGNOSIS. This species is hard to separate on externals but the genitalia show good features, as does the pattern of scales on the last ventral tergite (see fig. 147). See also diagnosis of *S. alaurulenta*.

DISCUSSION. On basis of the shape of the uncus *S. zumii* could be placed in the *ultima*-group. However the shape of the gnathos and the female genitalia indicate greater similarities with the *oxyacanthella*-group.

BIOLOGY.

Food plants. *Malus sieboldii* (Regel.) Rehd.

TYPE LOCALITY. Tateshina-kogen, Nagano Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Larva was collected on 2-X-1969", "Honshu, Tateshina-kogen, Nagano Pref.", "7-IV-1970 (reared under 20℃), H. Kuroko", "Host : *Malus sieboldii*", slide VU no. 0777 ; paratypes ♂, 2 ♀ : same data as holotype, slides VU no. 0776, VU no. 0775, VU no. 0781.

ADDITIONAL MATERIAL. In Ent. Lab., University of Osaka Pref. 2 ♂, 10 ♀ : "Tateshina-kogen, Nagano Pref., 7-IV-1970 (reared under 20℃), H. Kuroko", "Larvae were collected on 2-X-1969", "Host : *Malus sieboldii*".

DERIVATIO NOMINIS. Zumi (Jap.)= *Malus sieboldii.*

Salicis species-group

salicis-group *sensu* Johansson, 1971 : 244.
salicis-group *sensu* Emmet, 1976 : 288.
rosaefoliella-group *sensu* Wilkinson & Scoble, 1979 : 14, *partim.*
fuscotibiella-group *sensu* Newton & Wilkinson, 1982 : 408.

Japanese species belonging to this well known Holartic group are particularly characterized by the shape of the aedeagus and the configuration of the cornuti on the vesica. Also peculiar is the prolonged ovipositor of the females of this group.

The North American *rosaefoliella*-group (Wilkinson & Scoble, 1979 : l.c.) originally contained species of which the females could have had signa on the bursa and fed on Salicaceae or lacked a bursa and fed on Rosaceae. The first subgroup were subsequently placed in the *fuscotibiella*-group. As this group is similar in all respects to the European *salicis*-group, they are here synonymized.

Key to this group :

1a Cuiller of valves of male genitalia extending as far as style, posterior arms submedial, anterio-lateral lobes of lower part of ventral plate blunt. ..... *tranocrossa*
1b Cuiller of valves not extending as far as style, style finger-like, very prominent, anterio-lateral lobes of ventral plate sharp, narrow. ..... *vittata*

Stigmella tranocrossa Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 31, 66, 67, 68, 220, 221.

Adult. ♂ (♀ unknown).

Head : frontal tuft orange ; scape cream ; collar cream ; antenna brown with ca. 26 segments.

Thorax : background dark brown with slight bronze reflections mixed with some purple. Forewing, (length ca. 2 mm) general background as thorax with same reflections ; medial fascia cream with white reflections, basic region with irregular cream patch, lustre as fascia ; terminal cilia concolorous to somewhat darker. Hindwing, light greyish brown.

Abdomen : as thorax.

Genitalia : ♂. Tegumen posteriorly rounded, anteriorly straight ; uncus medially joined by two prominent processes near its connection with vinculum and several others of less importance on the caudal margin ; gnathos medially bilobed, lobes long, slender ; vinculum with two anterior lobes very broad and rounded, upper part of ventral plate small ; valves high and slight, style long, cuiller triangular, almost as high as style, with sharp-spined margins ; horizontal bar of transtilla short ; aedeagus long, vesica with several stout cornuti, placed together, and a few long, slight cornuti on the same place.

DIAGNOSIS. *S. tranocrossa* differs from *S. populnea* in having fascia more medially situated on the forewing ; further this species lacks purple reflections on distal part of forewing as well as on light terminal cilia ; the spotted proximal forewing and the basal patch distinguish *S. tranocrossa* from *S. vittata* as do the differences in the genitalia, especially the valves, gnathos and aedeagus.

BIOLOGY.

Food plants. *Populus nigra* L. "Italica".

Egg. So far as examined, unvariably on leaf lower-side away from large veins.

Mine. On leaf upper-side, starting as a very narrow gallery, usually running along vein for some distance, with frass very thin and broken-linear ; then widening in later part, convolutions often so contorted as to form false blotch, with frass wider than that in early gallery, but remains in linear state. The mine of *S. tranocrossa* is very similar to that of *S. vittata*, but can be distinguished from the latter by the egg which is deposited away from large veins, and by the early mine having very thin, broken-linear frass which occupies about 1/4 width of track.

Life history. Incompletely known, but collecting data suggest that *S. tranocrossa* is at least bivoltine. The adults occur in July in first generation and in September to October in second generation. Hibernating stage is unknown.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Sapporo, 3-VII-1957", "Hokkaido, T. Kumata", "Host, *Populus nigra*", slide VU no. 0696 ; paratype ♂ : "Sapporo, Hokkaido, 22-IX-1958, T. Kumata", "Host, *Populus nigra*", slide VU no. 0695.

DERIVATIO NOMINIS. Tranos (Gr.)=clear, distinct ; krossos (Gr.)=fringe.

Stigmella vittata Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 32, 69, 70, 71, 152, 153, 154, 155, 156, 157, 225, 226, 227, 228.

Adult. ♂, ♀.

Head : frontal tuft cream to orange ; scape cream ; collar cream to buff ; antenna dark brown with ♂ ca. 24-27 segments and ♀ ca. 21 segments.

Thorax : dark greyish brown with bronze iridescence. Forewing, (length ♂ ca. 1.52-1.92 mm, ♀ ca. 2.48 mm) background proximal half greyish brown, distal half darker ; structural colours proximally bronze mixed with purple and blue, distally with less bronze but more blue ; postmedial fascia greyish-white, with silver/bronze iridescence mixed with some green ; terminal cilia as distal part of wing or occasionally somewhat lighter but not cream or buff.

Abdomen : as thorax, ♀ with blunt elongation caudally.

Genitalia : ♂. Tegumen membranous, rounded at pseuduncus ; uncus gradually tapering, bilobed, with lobes papillate ; gnathos comprising a pair of medial, horn-like processes arising from stout base, lateral arms rather short, on anterior margin two very short, dorsally pointing processes ; vinculum posteriorly not interrupted by tegumen, anteriorly bilobed, lobes moderately sharp ; valves broad, apically bilobed, thus style and cuiller equally developed ; horizontal bar of transtilla very short, lateral arms long ; aedeagus straight, vesica with a number of spine-like cornuti.

♀. Posterior apophyses longer than anterior apophyses ; whole anal region inculding 8th sternite and tergite elongated, so forming a stout ovipositor ; ductus bursae shorter than apophyses ; accessory sac with many broad and rounded folds as has the base of bursa copulatrix ; bursa copulatrix elongate, covered with minute pectinations and a band-shaped signum, consisting of scale-like pectinations.

DIAGNOSIS. This species differs from *S. salicis* (Stainton) by having a prominent bronze and purple lustre ; the terminal cilia of *salicis* are cream instead of dark

as in *S. vittata* ; in addition the forewing fascia is never interrupted as is often seen in *S. salicis* ; the differences between *S. vittata* and *S. zelleriella* (Snellen) are numerous, of which the most important are the shape of the fascia in *zelleriella*, which is more or less expanded into a blotch, and the absence of prominent metallic iridescence. *S. obliquella* (Heinemann) which most resembles *salicis* differs in the same characteristics and has, in addition, a more speckled appearance. *S. vittata* differs from *S. tranocrossa* by the lighter terminal cilia and the irregular cream patch on the forewing base.

DISCUSSION. Judging from the genitalia, *S. vittata* belongs to the *salicis*-group. However it seems to be the only known Japanese *Salix*-feeding *Stigmella* which does not have cream terminal cilia. Two female specimens (paratypes, Kyushu) belong to this species, although they are much larger.

BIOLOGY.

Food plants. *Salix* spp., inculding *Salix gracilistyla* Miq. (Salicaceae).

Egg. Laid on the lower surface of the leaf of host plant, always along the mid-rib or lateral vein, 0.22×0.15 mm.

Mine. False blotch mine occurring on leaf upper-side whilst egg on lowerside. Starting as thin linear gallery, often following a vein at least for a short distance, with frass linear and occupying almost whole mine-cavity ; widening later, much contorted, usually following a margin of the previous gallery ; thus the mine often restricted to a small area and forming a false blotch. Frass usually narrow-linear throughout, and as much contorted as gallery. Often several mines occur on the same leaf. Exits by semi-circular slit at terminal end of mine.

Larva. Head width ca. 0.32 mm, body length ca. 3.0 mm ; deep yellow, with pale brown head capsule, plate of prothorax lightly darkened.

Cocoon. (2.6-) 3.0-3.2×1.7-1.8 mm, thickness 1.0 mm, elliptical to ovate, flattened, thin but tough ; pale yellowish brown, honey buff, to pale brown, without lustre. Placed in soil interstices.

Life history. The first adult emerged in early May, larva from early to late June, larva from mid to late August, adult in early September, larva early to mid October, spins in late October and hibernates in larval stage. These data suggest that the species is bi- and/or trivoltine at Hikosan.

TYPE LOCALITY. Kii-Oshima, Wakayama Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Kii-Osima, em. 11-VI-1964", "Honsyu, T. Kumata", "Host, 684 *Salix* sp.", slide VU no. 0437 ; paratypes 3 ♂ : same data as holotype except for em.-dates : 11-VI-1964, slide VU no. 0729, 11-VI-1964 and 8-VI-1964, no slides ; paratype ♂ : "Host : *Salix* sp., larva was collected on 5-XI-1966", "Mt. Myoko", "Wakayama Pref.", "15-IV-1967, H. Kuroko", slide VU no. 0680 ; paratypes 2 ♀ : "Kii-Osima, em. 8-VI-1964", "Honsyu, T. Kumata", "Host, 684 *Salix* sp.", slide VU no. 0656, no slide ; paratype ♀ : "Kii-Osima, em. 11-XI-1964", "Honsyu, T. Kumata", "Host, 684 *Salix* sp.", no slide ; paratype ♀ : "Kyushu, Hikosan, (Buzen), 4-IX-1955, H. Kuroko", "Host : *Salix gracilistyla*", slide VU no. 0780 ; paratype ♀ : "Kyushu, Hikosan, (Buzen), 10-V-1955, H. Kuroko", slide VU no. 0679.

ADDITIONAL MATERIAL. In Ent. Inst., Hokkaido University. 1 ♀ : "Kii-Osima, em. 9-VI-1964", "Honsyu, T. Kumata", "Host, 684 *Salix* sp.", right wings on slide, T. Kumata no. Npt-9 ; 3 ♂ : "Kii-Osima, em. 9, 11 & 11-VI-1964", "Honsyu, T.

Kumata", "Host, 684 *Salix* sp.", no slides; 7 ♀ : "Kii-Osima, em. 8 & 11-VI-1964", "Honsyu, T. Kumata", "Host, 684 *Salix* sp.", no slides.

In Ent. Lab., University of Osaka Pref. 2 ♀ : "Kyushu, Hikosan, (Buzen), 12-V-1955, H. Kuroko", "Host : *Salix gracilistyla*"; 1 ♂ : "Kyushu, Hikosan, (Buzen), 4-IX-1955, H. Kuroko", "Host : *Salix gracilistyla*".

DERIVATIO NOMINIS. Vittata (L.)=band, ribbon.

Aurella species-group

aurella-group *sensu* Johansson, 1971 : 243.
aurella-group *sensu* Puplesis, 1984b : 583.
aurella-group *sensu* Emmet, 1976 : 214.
marginicolella-group *sensu* Johansson, 1971 : 243.
marginicolella-group *sensu* Emmet, 1976 : 224, *partim*.
marginicolella-group *sensu* Puplesis, 1984b : 583.

In Japan this group consists of the following species : *S. acrochaetia*, *S. alikurokoi*, *S. gimmonella*, *S. ichigoiella*, *S. sesplicata*, *S. spiculifera* and the provisionally added species *S.* spec. a.

S. acrochaetia, *S. gimmonella* and *S.* spec. a. differ from the other group-members by lacking features such as the large, thick and folded accessory sac and the thin bursa copulatrix. Nevertheless, greater affinity with other groups is unlikely, although the male genitalia of *S. gimmonella* indicate similiarities to the *suberivora*- and *ruficapitella*-groups. Also because of the distinct prominent terminal patch *S.* spec. a. is believed to belong to the *aurella*-group.

S. gimmonella also has similarities with the *marginicolella*-group *sensu* Johansson into which it could have been placed. However we doubt that this group has a separate identity from the *aurella*-group and should probably be synonymized with it.

Key to the Japanese *aurella*-group members :

1a Male. 8
1b Female. 2
2a Without terminal patch on forewing or at most with some white scales, but never prominent. 3
2b With prominent terminal patch on forewing. 5
3a Anterior apophyses with numerous little spines caudally. 4
3b Anterior apophyses without these spines, but only the normal hairs, also lacking the finger-like very narrow distal half. ..... *ichigoiella*
4a Anterior apophyses with distal half finger-like and narrow, posterior apophyses ending thickened. ..... *gimmonella*
4b Anterior apophyses as in *gimmonella*, posterior apophyses ending not thickened. ..... *acrochaetia*
5a Terminalia of female genitalia of normal broadness, anterior apophyses with usual narrow spiny ending. 6
5b Terminalia of female genitalia very broad, anterior apophyses with short blunt ending. ..... spec. a
6a Ductus spermathecae covered with short spiculae. 7
6b Ductus spermathecae without prominent spiculae, apex of posterior apophyses thickened. ..... *alikurokoi*
7a Apophyses of equal length. ..... *spiculifera*
7b Apophyses of unequal length. ..... *sesplicata*

8a Lower part of vinculum of same length or longer than upper part, aedeagus long and slender, medially constricted. ..... *gimmonella*

8b Lower part of vinculum very short, aedeagus extremely narrow in comparison with its length, medially not especially constricted. ..... *alikurokoi*

Stigmella acrochaetia Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 19, 165, 166.

Adult. ♀ (♂ unknown).

Head: frontal tuft yellow to orange; scape cream; collar prominent, cream; antenna dark brown with ca. 24 segments.

Thorax: dark brown with cupreous iridescence. Forewing, (length ca. 2.8-3.0 mm) proximally dark greyish brown, becoming fuscous towards medial position; distally concolorous; post medial fascia narrow, although anally somewhat broader, white with silver reflections; dark proximal and distal parts with prominent cupreous lustre mixed with some red; terminal as well as costal and anal cilia coloured as hindwing with buff reflections, sharp border between dark terminal scales and light cilia. Hindwing, greyish brown, light.

Abdomen: as thorax.

Genitalia: ♀. Dorsal side of outer membrane caudally with numerous little spines, anterior margin of anterior apophyses situated well forward, posterior and anterior apophyses of equal length, posterior apophyses with a slender tuft; ductus bursae shorter than apophyses; accessory sac long, heavily folded; ductus spermathecae thin, covered basally with numerous minute spiculae; colliculum with opposing sigmoid thickenings; bursa copulatrix thin without pectinations or signa.

DIAGNOSIS. Differs from other Japanese *aurella*-group members by its prominent cupreous reflections and light, sharply demarcated terminal cilia; it shares with *S. gimmonella* the shape of the anterior apophyses and the small spines on the dorsal side of the terminal segment, as well as the characteristic tuft on the apex of the posterior apophyses, but it lacks the subterminal thickening of the posterior apophyses.

DISCUSSION. This species, unfortunately known from only one female specimen, is clearly distinguishable from other species described here. Its affinities are rather doubtful. With respect to the external features the terminal cilia place it in the *hemargyrella*-group but the genitalia clearly refer it to the *aurella*-group, where we have provisionally placed it.

BIOLOGY. Unknown.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Sapporo, 25-V-1961", "Hokkaido, N. Okabe, (Coll. Kumata)", slide VU no. 0712.

DERIVATIO NOMINIS. Akros (Gr.)=tip, top, at the end; chaite (Gr.)=hair, refers to the tuft on the apex of the posterior apophyses in the female genitalia.

Stigmella alikurokoi Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 18, 78, 79, 80, 159, 160, 161, 162, 163, 164, 215.

Adult. ♂, ♀.

Head: frontal tuft orange to brown; scape white; collar brown with bronze reflections; antenna brown with ♂ 26-28 segments and ♀ 23-25 segments.

Thorax: brown background with reflections. Forewing, (length ♂ 1.70-2.15 mm, ♀ ca. 1.70-2.35 mm) over all background colour greyish brown; proximal half basally bronze to gold, medial region somewhat darker with cupreous lustre mixed with bronze and red; postmedial fascia white with silver to light iridescence mixed with purple and blue; fascia anally broader than costally; subterminal region with patch concolorous with postmedial fascia; dark distal parts as medial region; terminal cilia covered by row of fox-red scales. Hindwing, buff.

Abdomen: as thorax.

Genitalia: ♂. Tegumen posteriorly rounded, uncus medially bilobed, gnathos with posteriorly directed central process which bifurcates in its terminal third, lateral arms ear-shaped; vinculum anteriorly bilobed, often lobes of unequal length, lower part of ventral plate very short; aedeagus with manica, vesica posteriorly with two small groups of little spines, anteriorly with an almost circular group of stout horn-like cornuti.

♀. Posterior apophyses longer than anterior; latter ending of canal in posterior apophyses with thickening; endings of anterior apophyses pointed and long; accessory sac as complex as that of *S. ichigoiella*; ductus spermathecae without spiculae; bursa copulatrix very thin, with minute pectinations.

DIAGNOSIS. This species differs from *S. ichigoiella* in having a prominent white patch and more intense colours; the shape of the posterior apophysis ending as well as the unequal length of posterior and anterior apophyses distinguish *S. alikurokoi* from *S. ichigoiella* and *S. spiculifera*; the latter can also be discriminated from *S. alikurokoi* by the presence of numerous spiculae on the ductus spermathecae; in comparison with a *Stigmella* species reared from *Agrimonia* in Nepal, the ground colour is lighter, the purple reflections in *S. alikurokoi* are less prominent; the darker distal forewing parts in *S. alikurokoi* are fox-brown instead of dark brown in the species from *Agrimonia*; differences from *S. auromarginella* (Richardson, 1890) are the cupreous colours on the median region of the forewing and the subterminal position of the white patch instead of terminal as in *S. auromarginella*; the latter has in addition much more purple in the reflections and lacks the fox-red scales covering the basal half of the buff terminal cilia. The only other Japanese species with a thickening in the posterior apophyses-ending is *S. gimmonella*, which also belongs to the *aurella*-group, and is diagnosed from *S. alikurokoi* by the differing length of the apophyses and the far more numerous spines on the dorsal side of the outer membrane, and as far as the external features are concerned the terminal forewing-patch is wanting in *S. gimmonella*.

DISCUSSION. The *Rubus*-feeding *Stigmella* species are quite homogenous. *S. alikurokoi* belongs as do the other known Japanese *Rubus*-miners to the *aurella*-group.

BIOLOGY.

Food plants. *Rubus buergeri* Miq., *Rubus phoenicolasius* Maxim. and *Rubus palmatus* Thunb. var. *coptophyllus* (A. Gray) O. Kuntze.

Egg. Laid on the upper surface of the leaf, beside vein, 0.27×0.21 mm.

Mine. Linear, long and slender, on upper surface of leaf, sometimes runs along leaf margin and mid rib; greenish brown to brown with a dark brown central line

of frass ; length of mines, 77-100 mm.

Larva. Head width ca. 0.38 mm, body length ca. 3.5 mm ; yellow with lustre, head capsule pale blackish brown.

Cocoon. Elliptical, flattened ; dark brown to brown, placed between grains of soil, 2.0-2.5×1.2-1.6 mm.

Life history. There are three generations or more in a year at Hikosan.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Kyushu, Hikosan, (Buzen), 3-VII-1954, H. Kuroko", "no, 197", "slide no 146, (H.K.) ♂", "Host : *Rubus buergeri* Miq." ; paratype ♂ : "Kozagawa, Wakayama-k., em. 1-VI-1964", "Honsyu, T. Kumata", "Host, 644 *Rubus palmatus* var. *coptophyllus*", slide VU no. 0658 ; paratypes 2 ♀ : "Kozagawa, Wakayama-k., em. 1-VI-1964", "Honsyu, T. Kumata", "Host, 644 *Rubus palmatus* var. *coptophyllus*", slide VU no. 0659, no slide ; paratype ♀ : "Kyushu, Hikosan, (Buzen), 3-VII-1954, H.Kuroko", slide VU no. 0671 ; paratypes 2 ♀ : "Kyushu, Hikosan, (Buzen), 17-VII-1955, H. Kuroko", "Host : *Rubus palmatus*", slides VU no. 0670 and 0786 ; paratype ♀ : "Kyushu, Hikosan, -Buzen-, 30-IV-1960, H. Kuroko", slide VU no. 0720 ; paratype ♀ : "Kyushu, Hikosan, (Buzen), 15-VII-1955, H. Kuroko", "Host : *Rubus phoenicolatius* Maxim. (misspelling for *phoenicolasius*)", abdomen lost.

ADDITIONAL MATERIAL. In Ent. Inst., Hokkaido University. 1 ♂ : "Kozagawa, Wakayama-k., 14-20-V-1964", "Honsyu, T. Kumata", "Host, 644 *Rubus palmatus* v. *coptophyllus*", right wings on slide, T. Kumata no. Npt-5.

DERIVATIO NOMINIS. Ali- from alius (L.)=another. This species originally had the manuscript name *kurokoi* after Hiroshi Kuroko, our Japanese entomologist colleague, Prof. at the University of Osaka Pref. and one of the two main collectors of the material studied in the present article. But this name had to be changed on the publication of Puplesis (1984b) where he used it for a Russian species.

Stigmella gimmonella (Matsumura, 1931)

Nepticula gimmonella Matsumura, 1931 : 1114.
Stigmella gimmonella (Matsumura) ; Kuroko, 1982 : 448.

DESCRIPTION. Figs. 22, 75, 76, 77, 168, 169, 170, 171, 172, 233, 234, 235.

Adult. ♂, ♀.

Head : frontal tuft yellow ; scape white ; collar white ; antenna with ♂ ca. 36 and ♀ ca. 24 segments.

Thorax : dark brown to sepia with slight bronze and purple reflections. Forewing, (length ♂ ca. 2-2.5 mm, ♀ ca. 2.5 mm) background colour with iridescence concolorous with thorax except for basal part which has somewhat more anthracite-like appearance ; post medial fascia cream, anally broader than costally with silver reflections ; terminal cilia cream to pale greyish. Hindwing, light greyish brown.

Abdomen : as forewing base with more silver reflections ; terminal tergites brown to ochreous.

Genitalia : ♂. Tegumen membranous, broad ; uncus with two medial processes, slightly bilobed ; gnathos with lateral and anterior arms united and two submedial posterior arms ; valves with long style and long blunt process on cuiller as long as style, crossing with inner blades with sharp spine ; vinculum long, slender,

with long anterio-lateral lobes; aedeagus with spiculate manica, vesica medially constricted with full length band of stout cornuti, in anterior direction decreasing in size.

♀. Dorsal side of outer membrane caudally with numerous little spines; apophyses of equal length, posterior apophyses subterminally with round thickened cavity; accessory sac large, with complex folds; bursa copulatrix very thin without spicules or signa.

DIAGNOSIS. *S. gimmonella* shares many female genitalia characters with *S. acrochaetia*, but the latter species lacks the typical thickened posterior apophygeal endings not uncommon among the Japanese *aurella*-group members. These thickened cavities appear to be less terminally situated than in *S. alikurokoi*. *S. gimmonella* can be distinguished from *S. nireae* by its forewing fascia and much longer vinculum. Also other genital differences can be seen by comparison of the figures. Differs from *S. alikurokoi* in having lighter externals and different shaped male genitalia (see figs. 78-80).

DISCUSSION. Our adults reared from *Ulmus* agree well with the type of *S. gimmonella* although there is some notable variation in the shape of the vinculum especially with respect to the length of the lower part and the shape of the anterio-lateral lobes. Also the relative length of the vesica as compared with the manica seems to be less constant than for other species. Apart from species where the host plant is unknown, *S. gimmonella* is the only one within the *aurella*-group that does not feed on *Rubus*. One specimen collected in Teine, Hokkaido, is unfortunately in a bad condition, but is smaller than all the others. It was reared from *Ulmus davidiana* Planch. var. *japonica* (Rehd.) Nakai. The genitalia however do not differ.

S. gimmonella is closely related to *S. continuella* (Stainton) and *S. marginicolella* (Stainton) judging from both male and female genitalia characteristics. The two latter species were placed in the *marginicolella*-group by Johansson (1971 : 243). We prefer to consider them as one group.

BIOLOGY.

Food plants. *Ulmus laciniata* (Trautv.) Mayr. and *U. davidiana* Planch. var. *japonica* (Rehd.) Nakai.

Egg. On lower-side of leaf, mostly near veins or leaf-margins.

Cocoon. Light brown, ca. 2.5×1.8 mm.

Mine. Although the egg is deposited on lowerside of leaf, the mine always occurs upon upper-side. A linear gallery sinuous, sometimes partly following leaf-margin or a vein, very thin throughout, and less than 2 mm even in the broadest part. First 1/3 of mine with frass occupying about 2/3 width of gallery and leaving very thin clear margins; frass on second 1/3 of mine linear similarly to the preceding, but a little broader, occupying the central part of track up to 1/2 width; the remaining 1/3 of mine with frass becoming sparse, and arranged in a line, which is narrower than the preceding in most mines. In a few mines, the frass is very thin and linear thoughout its length.

Life history. Not exactly known, but likely to be bivoltine; in the first generation, larvae occur at end June to July and adults at end July to August; in second generation, larvae in September to mid October, adults the next spring from May to June. Hibernation seems to take place in pupal or prepupal stage within cocoon on

the ground.

TYPE LOCALITY. Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ (examined by C.W. in Japan, in 1980): "6/14, 1891, Sapporo", but originally mentioned as "collected in the beginning of April", slide no. 231, H. Kuroko.

OTHER MATERIAL EXAMINED. 3 ♂, 3 ♀: "Nopporo, Hokkaido, Japonia", "22-V-1978, T. Kumata", "Host, 1767 *Ulmus laciniata*", slides: "T. Kumata No. Npt-12 (♂), T. Kumata No. Npt-13 (♀), T. Kumata No. Npt-14 (♀)", VU no. 0793; 1 ♂: "Teine, Hokkaido, 4-VIII-1957, T. Kumata", "Host, *Ulmus davidiana* var. *japonica*", slide VU no. 0792.

ADDITIONAL MATERIAL: In Ent. Inst., Hokkaido University. 2 ♀: "Hokkaido, Sapporo, EM. 3 and 11-VIII-1981, S. Nakamura", "Host, 0197 and 0255 *Ulmus davidiana* var. *japonica*", no slides; 1 ♀: "Hokkaido, Sapporo, EM. 15-VIII-1980, S. Nakamura", "Host, 0020 *Ulmus davidiana* var. *japonica*", no slides; 2 ♂: "Hokkaido, Sapporo, EM. 20-VII-1981, S. Nakamura", "Host, 0066 and 0073 *Ulmus davidiana* var. *japonica*", slides S. Nakamura nos. SN-5 and 20; 1 ♀: "Hokkaido, Nopporo, EM. 4-VIII-1981, S. Nakamura", "Host, 0195 *Ulmus davidiana* var. *japonica*", slide S. Nakamura no. SN-21; 3 ♀: "Hokkaido, Sapporo, EM. 21, 22 and 23-VII-1981, S. Nakamura", "Host, 0064, 0092 and 0092 *Ulmus davidiana* var. *japonica*", slides S. Nakamura nos. SN-22, 23 and 27.

Stigmella ichigoiella Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 17, 173, 174, 175, 176.

Adult. ♀ (♂ unknown).

Head: frontal tuft buff to ochreous; scape cream; collar bronze; antenna light greyish brown with ca. 27 segments.

Thorax: background brown with bronze reflections. Forewing, (length ca. 2.5 mm) background proximal half greyish brown, distal half dark brown; proximally with cupreous and golden reflections mixed with purple and red; distally with cupreous and red lustre; postmedial fascia white with silver and blue/green iridescence; terminal patch absent or at most consisting of one or two obscure white scales.

Abdomen: as thorax.

Genitalia: ♀. Apophyses of equal length, anterior ending of canal in posterior apophyses without thickening, anterior apophyses rather blunt; ductus bursae shorter than apophyses; accessory sac very prominent, corrugated; ductus spermathecae without spiculae; bursa copulatrix large, very thin, hardly visible, covered with minute scallop-like pectinations.

DIAGNOSIS. *S. ichigoiella* differs from *S. alikurokoi* in lacking the prominent terminal patch of *S. alikurokoi*; furthermore by being over all paler; the difference between these species is also seen in the length of apophyses, the unthickened posterior apophygeal endings and the rather blunt anterior apophyses; the ductus spermathecae without spiculae discriminates this species from *S. spiculifera* in addition to the apophygeal endings and the lighter colour, as well as the minute or non-existent terminal patch which is prominent in *S. spiculifera*; *S. ichigoiella* can be separated from *S. acrochaetia* by the numerous spicules on the dorsal side of the blunt

end of the anterior apophyses and the slender tufts on ends of the posterior apophyses in the latter species.

BIOLOGY.

Food plants. *Rubus buergeri* Miq.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀ : "Kyushu, Hikosan, (Buzen), 14-IV-1954, H. Kuroko", "Host : *Rubus buergeri* Miq.", slide VU no. 0672.

DERIVATIO NOMINIS. Ichigo (Jap.)=blackberry=*Rubus* spec.

Stigmella sesplicata Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 38, 205, 206.

Adult. ♀ (♂ unknown).

Head : frontal tuft orange to ochreous ; scape white to buff ; collar brown with golden iridescence ; antenna brown with ca. 15-18 segments.

Thorax : dark brown ground colour with golden lustre mixed with cupreous, purple and green. Forewing, (length ca. 1.8 mm) proximal half same colour as thorax ; mixture of reflections contains somewhat more purple ; distal half darker coloured without golden and cupreous iridescence but with brown and red reflections ; postmedial fascia white with brilliant silver and blue-green iridescence ; there is no darker region between fascia and lighter proximal half ; terminal patch concolorous with fascia, size varies from a few to many scales and shape is more or less reniform. Hindwing, greyish brown, lacking androconial scales.

Abdomen : brown background with moderate silver and bronze reflections.

Genitalia : ♀. Anterior apophyses length 2/3 of posterior apophyses ; accessory sac voluminous, proximal half entirely covered with very minute spicules ; ductus spermathecae thick, uncoiled, minute spiculae partly inverted ; bursa copulatrix very prominent, completely covered with inconspicuous pectinate structures ; bursa wall very thin, posterior 1/4 of bursa with folds.

DIAGNOSIS. *S. sesplicata* differs from *S. oa* by the different shape of the forewing terminal patch, the absence of an anal connection between fascia and terminal patch, and apical projections on the anterior apophyses less extended.

DISCUSSION. See *S. zelkoviella*. On the basis of its similarity with *S. lediella* (Schleich) and the presence of a terminal patch on the forewing, this species is placed in the *aurella*-group. However from bursa characteristics it could well be assigned to the *suberivora*-group.

BIOLOGY.

Food plants. *Rhododendron* spec.

TYPE LOCALITY. Mikazuki-yama, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀ : "Mikazuki-y., Hukuoka-k., 30-VI-1957", "Kyusyu, T. Kumata", "Host, 239 *Rhododendron* sp.", slide VU no. 0685 ; paratypes 2 ♀ : same data as holotype except for date, 29-VI-1957, slide VU no. 0686 and no slide.

ADDITIONAL MATERIAL. In Ent. Inst. Hokkaido University. 1 ♀ : "Mikazuki-y., Hukuoka-k., 30-VI-1957", "Kyusyu, T. Kumata", "Host, 239 *Rhododendron* sp.", no slide.

DERIVATIO NOMINIS. Semis (L.)=half ; plicata (L.)=with folds, referring to the

folds on the base of the bursa copulatrix.

Stigmella spiculifera Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 20, 177, 178, 179, 180, 181, 182.

Adult. ♀ (♂ unknown).

Head: frontal tuft orange; scape cream; collar cream; antenna brown, with ca. 27 segments.

Thorax: dark brown with red and purple reflections. Forewing, (length ca. 2.5 mm) ground colour dark brown with slight differences in shade attributable to varying reflections; proximal iridescence purple, red and cupreous and distal dark brown with some purple; postmedial fascia and terminal patch white, silver reflecting; cilia coloured as hindwing or somewhat darker, there is no dark brown row of scales between terminal patch and cilia; white/silver scales anally between terminal patch and submedial fascia, it therefore appears that the two former regions are linked by an interrupted band. Hindwing, greyish brown.

Abdomen: as thorax.

Genitalia: ♀. Apophyses almost of equal length, posterior apophyses without thickening anteriorly; ductus bursae short; accessory sac with complex folds; ductus spermathecae coiled with prominent spiculae; bursa copulatrix thin, covered with pectinations.

DIAGNOSIS. This species differs from *S. alikurokoi* in the absence of a row of dark scales between the terminal patch and terminal cilia, darker over all colour and some white/silver scales on the anal side of the distal half. The absence of prominent blue/purple in forewing as well as a broader terminal patch separates this species from *S. auromarginella* (Richardson, 1890); numerous stout spiculae distinguish *S. spiculifera* from other members of the *aurella*-group treated in the present article.

BIOLOGY.

Food plants. *Rubus hirsutus* Thunb. and *R. palmatus* Thunb.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Kyushu, Hikosan, (Buzen), 30-VI-1954, H. Kuroko", slide VU no. 0673; paratype ♀: "Kyushu, Hikosan, (Buzen), 13-V-1957, H. Kuroko", "Host: *Rubus palmatus*", slide VU no. 0785.

DERIVATIO NOMINIS. Spiculum (L.)=point; -fera, suffix from fero (L.)=carry.

Stigmella spec. a

DESCRIPTION. Figs. 21, 167.

Adult. ♀ (♂ unknown).

Head: frontal tuft black; scape black with brown tinge and cream base; collar black; antenna black with ca. 20 segments.

Thorax: black with silver iridescence. Forewing, (length ca. 2.2 mm) background dark brown to sepia or black, iridescence silver with some bronze, green, blue and violet reflections; postmedial fascia white with silver lustre, terminal patch concolorous with additional blue; terminal cilia not lighter. Hindwing, light greyish brown.

Abdomen: as forewing background.

Genitalia: ♀. Apophygeal base very broad, anterior apophyses also apically broad thus without long processes, posterior apophyses longer than anterior apophyses; ductus bursae shorter than apophyses, covered with some very minute pectinations; accessory sac short, thin; bursa copulatrix unknown.

DIAGNOSIS. This species is diagnosed from other Japanese *aurella*-group members by the dark forewing colours and extremely broad terminalia of the female genitalia.

DISCUSSION. Since there is nothing known about the bursa copulatrix it is premature to describe this species here, although it is doubtless a new species. We have placed this specimen in the *aurella*-group on the basis of its forewing patterns.

BIOLOGY. Unknown.

MATERIAL EXAMINED. ♀: "Nati, Wakayama, 18-V-1967", "Honsyu, T. Kumata", slide VU no. 0715.

Caesurifasciella species-group

This new group is characterized by the male and female genitalia, for in male genitalia the uncus is inverted y-shaped with a short medial, posteriorly directed process, and broad lateral lobes; the gnathos is laterally broad with horizontal blades curved posteriorly and one large medial projection; aedeagus with manica and numerous cornuti. Female genitalia with distal half of bursa copulatrix narrow with numerous folds over length of this part; proximal half tuberous with many minute pectinations.

The female genitalia of the group are similar to those of the Japanese *suberivora*-group members *S. sesplicata*, *S. oa*, *S. kurii* and *S. chrysopterella*. The male genitalia, on the other hand, make incorporation within that group unsatisfactory. There are similarities with certain members of the European *lapponica*-group such as *S. lapponica* (Wocke, 1862) and *S. confusella* (Wood, 1894) especially concerning the gnathos, but the shape of the uncus is very different, and the transtilla and the presence of a manica on the aedeagus with numerous cornuti indicate only superficial affinities.

Key to the *caesurifasciella*-group members:

1a Postmedial forewing patches do not meet, terminal cilia concolorous with distal half. ..... *caesurifasciella*

1b Postmedial forewing patches meet to form fascia, terminal cilia lighter than distal half. ..... *egregilustrata*

Stigmella caesurifasciella Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 34, 84, 85, 183, 184, 185, 186, 187.

Adult. ♂, ♀.

Head: frontal tuft ♂ cream to white, ♀ orange; scape cream; collar silverish cream as scape or somewhat darker; antenna silver reflections on brown ground colour, ♂ ca. 23 segments, ♀ ca. 16 segments.

Thorax: background greyish brown with structural silver very prominent. Forewing ♂, as ♀, except for length (ca. 1.7 mm) and the distal half of the forewing,

on which the two white patches are not as clear as those on wings of ♀, the entire upper half seems to be more speckled; ♀, (length ca. 1.6-1.8 mm) background of proximal half greyish brown with strong silver reflections; distal half dark brown with a slight red tint when frontal light is used, with also cupreous, gold, green and purple more to the front; distally two cream-white post medial patches, one costal and one anal, costal more distal than anal; both patches have silver iridescence; terminal cilia concolorous; costal and anal cilia lighter. Hindwing, light greyish brown with glossy silver reflections.

Abdomen: greyish brown mixed with buff in the background, also silverish with frontal lighting.

Genitalia: ♂. Generally as *S. egregilustrata*, but with a more band-shaped tegumen; lateral lobes of uncus narrower; gnathos with round horizontal plate-shaped lateral arms; horizontal bar of transtilla short.

♀. Ductus bursae as long as apophyses; accessory sac bulbous; ductus spermathecae with 2 to 3 convolutions; distal half of bursa copulatrix narrow with numerous folds, proximal half tuberous, densely covered with minute pectinations.

DIAGNOSIS. Unlike *S. egregilustrata* this species has postmedial patches on forewing which do not meet. It lacks differences in shape of valves, transtilla and tegumen.

DISCUSSION. Male genitalia hardly differ from those of *egregilustrata* but external characters are sufficient to separate these species. Aedeagus damaged; not figured. Manica absent.

BIOLOGY.

Food plants. *Quercus acuta* Thunb.

Cocoon. Known from ♀ paratype, dark brown, ca 2.1×1.3 mm.

TYPE LOCALITY. Nara Park, Nara Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Nara Park, Nara Pref.", "1.VII. 1965, H. Kuroko", "Host: *Quercus acuta* Thunb.", slide VU no. 0675; paratype ♀: "Nara Park, Nara Pref.", "1.VII.1965, H. Kuroko", slide VU no. 0725; paratype ♂: same data, slide VU no. 0674.

DERIVATIO NOMINIS. Caesurus (L.)=interruption.

Stigmella egregilustrata Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 36, 86, 87, 88.

Adult. ♂ (♀ unknown).

Head: except for orange frontal tuft all head scales cream with bronze iridescence; hind-margin of scape somewhat darker, as is not unusual with males; antenna with ca. 24 segments.

Thorax: greyish brown background with bronze, green and purple structural colours. Forewing, (length ca. 2.1 mm) proximal half greyish brown, distal part dark brown with golden reflections mixed with red, purple and green; postmedial region with two white silver patches which could meet and in the holotype are separated only by one darker scale; anal area very broad, runs from a postmedial to subterminal position, with costally directed curve in the brown subterminal region; terminal cilia ivory with brilliant silver reflections. Hindwing, greyish brown.

Abdomen: as thorax.

Genitalia: ♂. Tegumen posteriorly as well as anteriorly more or less elliptical; uncus inverted y-shaped, with a short medial, posteriorly directed process, lateral lobes broad; gnathos with broad horizontal lateral arms with moderately sharp margins, one stout and ventrally directed medial projection; vinculum anteriorly bilobed (these anterio-lateral lobes in holotype asymmetrical), median convexity of anterior margin reaching upper part of ventral plate; valve with long style, cuiller very short, heavily papillated; transtilla with long horizontal bar; aedeagus with manica from which the posterior end is entirely covered with minute spicules, often arising in linear groups, cornuti cover the whole vesica, spines of various shapes.

DIAGNOSIS. This species differs from *S. caesurifasciella* by the more prominent white postmedial patches on forewing, which do not normally meet in the latter species; *S. caesurifasciella* also lacks the subterminal curve on the forewing; the apical region is generally rounder in *S. egregilustrata*; the ♂ genitalia are very much the same as those of *S. caesurifasciella* but differ in the occurrence of a manica and the length of the horizontal transtilla bar; furthermore the lateral arms of the gnathos are less rounded.

DISCUSSION. This species has a certain resemblance to *S. caesurifasciella* but is larger overall. Moreover the iridescence is brighter such that distally the forewing is reminiscent of a peacock's tail.

BIOLOGY.

Food plants. *Quercus glauca* Thunb.

Cocoon. Known from holotype, rust coloured, ca. 2.5×1.5 mm.

TYPE LOCALITY. Ogori, Mii-Gun, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Kyushu, Ogori, 19-VII-1957, I. Tateishi", "Host: *Quercus glauca* Thunb.", slide VU no. 0711.

DERIVATIO NOMINIS. Egregius (L.)=distinguished; lustratus (L.)=light up.

Ruficapitella species-group

ruficapitella-group *sensu* Johansson, 1971: 245, *partim.*
ruficapitella-group *sensu* Puplesis, 1984b: 583, *partim.*
atricapitella-group *sensu* Emmet, 1976: 239, *partim.*
quercipulchella-group *sensu* Newton & Wilkinson 1982: 445, *partim.*

The following species can be placed in the *ruficapitella*-group with the European species: *S. castanopsiella, S. fumida, S. pulla, S. quericifaga, S. valvaurigemmata* and *S. zelkoviella.*

S. fumida, S. pulla, S. valvaurigemmata and *S. zelkoviella* have been placed in this group because of similarities of the male genitalia. There are no female genitalia known of these species so they may belong to the *suberivora*-group which have similar male genitalia. In the absence of females *S. valvaurigemmata* and *S. zelkoviella* have characteristics which lead to problems of placement in a species group. Arbitrarily they are placed in the *ruficapitella*-group. It seems that the division of species into groups purely on the basis of the male genitalia can lead to unsatisfactory results and so favours the fuller use of female genitalia and for discussions on relationships.

Key to the Japanese members of this group:

1a Male. 2
1b Female. 7
2a Gnathos and uncus broad with basal sclerites long, narrow and lateral posterior arms prominent. 5
2b Gnathos and uncus narrow, basal sclerite very small; posterior arms submedial. 3
3a Valves with ear-like, pustulated proliferations on cuiller. ..... *valvaurigemmata*
3b Valves without ear-like proliferation on cuiller. 4
4a Manica long, length of coiled vesica twice aedeagus. ..... *castanopsiella*
4b Manica small, vesica as long as aedeagus. ..... *zelkoviella*
5a Hindwing with many androconial scales reaching beyond forewing. ..... *fumida*
5b Hindwing without androconial scales. 6
6a Ventral arms of transtilla long, vesica longer than aedeagus. ..... *pulla*
6b Ventral arms of transtilla short, vesica as long as aedeagus. ..... *quercifaga*
7a Bursa copulatrix compact with small rectangular chitination, ductus spermathecae convoluted. ..... *quercifaga*
7b Bursa copulatrix compact with large sclerotization taking part of whole bursa. ..... *castanopsiella*

Stigmella castanopsiella (Kuroko)

Nepticula castanopsiella Kuroko, 1978: 1; Kino, 1981: 43.
Stigmella castanopsiella (Kuroko); Kuroko, 1982: 448; Puplesis, 1984b: 583.

DESCRIPTION. Figs. 27, 95, 96, 97, 192, 239.

Adult. ♂, ♀.

Head: frontal tuft orange; scape ♂ cream with darker margins, ♀ cream; collar dark brown; antenna greyish brown with ♂ ca. 32 and ♀ ca. 30 segments.

Thorax: dark brown with slight bronze reflections mixed with red. Forewing, (length ♂ ca. 2.3-2.7 mm, ♀ ca. 2.7-3.0 mm) proximal half dark greyish brown with bronze lustre mixed with light purple; white post median fascia anally broader than costally and with silverish to very light bronze reflections, medially and distally from fascia dark brown with some brown and red iridescence, dark brown forewing scales always darker at apex, giving distal part of wing a dotted appearance; subterminal scales become longer terminally, so that basal halves of pale silver reflecting terminal cilia are covered by darker parts of these scales, making the wing terminally fasciate. Hindwing, light greyish brown.

Abdomen: as thorax but paler.

Genitalia: ♂. Tegumen posteriorly weakly bilobed; uncus bilobed with papillate outer margins; gnathos prominent, subterminally with two stout posterior, long anterior and broad lateral arms; vinculum anteriorly bilobed, lobes prominent; valves with style of moderate length and pointed triangular cuiller of same length; ventral arms of transtilla rather long; aedeagus with long, anteriorly bulbous manica; vesica with numerous anteriorly directed spinous cornuti, convoluted, twice as long as aedeagus.

♀. Apophyses approximately of equal length; ductus bursae shorter than apophyses; accessory sac rather small, thin and folded; bursa copulatrix crescent-shaped, curved upwardly, along the whole posterior side of the bursa a heavy sclerotized signum having spines irregularly on anterior margin and with double wavy longitudinal line in middle.

DIAGNOSIS. This species differs from those in the Japanese *suberivora*-group by the heavy sclerotizations on the bursa, the male genitalia and the large size of the adult.

BIOLOGY.

Food plants. *Castanopsis cuspidata* Schotky var. *sieboldii* Nakai.

Egg. Laid on upper surface of the leaf, along mid-rib (sometimes along lateral vein). Size 0.5×0.3 mm, oval.

Mine. Linear, upper surface, for the first half (22-25 mm) of its length runs in a straight narrow line along mid-rib towards base of leaf. The second half (25-30 mm) made by the last (4th) instar larva becomes broader linear and leaves the mid-rib. The colour of narrow linear portion is reddish brown to whitish brown, filled with brownish grains of frass. The broad linear portion is yellowish brown, containing a narrow dark greenish mass of frass.

Larva. Head width ca. 0.45 mm, body length 4-5 mm ; head black, body deep yellow to reddish yellow, ganglia and malpighian tubes pale dark brown.

Cocoon. Oval, flattened, 2.6-3.3×1.5-2.1 mm. Just after spinning the cocoon is whitish, but gradually changes to yellow, then brownish after a few days. It is spun between particles of soil or dead leaves on the ground.

Life history. The adult deposits its eggs from late May to late June, which remain through the summer and the larvae hatch in October and mature in March of the following year. Pupation takes place from March to April and the adult appears from late April to mid June. This species appears to be univoltine. See also Hisai (1972, 1973, 1974) and Kino (1981) about recent ecological and life-history studies on this species.

TYPE LOCALITY. Minoo Park, Osaka Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Paratypes 3 ♂ : "Larvae were collected on 11.III. '75", "Minoo Park, Osaka Pref., 19.IV.1975, H. Kuroko", "Paratype, *Nepticula castanopsiella*, ♂, H. Kuroko", slides VU no. 0734, VU no. 0660, no slide ; paratypes 3 ♀ : "Larvae were collected on 21.I.1973", "Tokyo, National Park for Nature Study, Minato-Ku, 7.V.1973, N. Hisai", "Paratype, *Nepticula castanopsiella,* ♀, H. Kuroko", slide VU no. 0661, 2 no slides.

OTHER MATERIAL EXAMINED. 1 ♀ : "Kyushu, Nishi Koen, Fukuoka City, 23-V-1957, Koji Yano", slide VU no. 0719.

Stigmella fumida Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 23, 24, 98, 99, 100.

Adult. ♂ (♀ unknown).

Head : frontal tuft black : scape buff with black hind-margin ; collar dark sepia ; antenna sepia with ca. 25 segments.

Thorax : colour as forewing. Forewing, (length ca. 2.7-2.8 mm) background brown-black with bronze iridescence mixed with green and purple ; terminal reflections lighter. Hindwing, dark with androconial scales both in a tuft and on the whole costal side, also with two rows of scent-scales.

Abdomen : as thorax.

Genitalia : ♂. Tegumen flat elliptical ; uncus broad with caudally short blunt process on the lateral lobes ; gnathos with prominent posterior arms ; vinculum

anteriorly bilobed ; valves with stout style and almost rectangular cuiller ; aedeagus with manica half length of aedeagus, vesica with several clusters of cornuti of various shapes.

DIAGNOSIS. *S. fumida* differs from *S. kumatai* in the black frontal tuft and dark collar, and in the absence of membranous patches in the uncus. *S. fumida* has different shaped manica and cornuti from the related *S. kumatai* in which the cornuti are generally longer. *S. pulla* differs in the gnathos and less prominent anterio-ventral edges of the valves.

BIOLOGY.

Food plants. *Quercus acutissima* Carruth.

Life history. The adult specimen used for the original description emerged in May from a larva collected in October the preceding year. This means that hibernation occurs in the prepupal or pupal stage within the cocoon. The voltinism is unknown.

TYPE LOCALITY. Kamitsushima, Tsushima, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Kamitusima, Tusima, Japonia", "em. 27-V-1980, T. Kumata leg.", "Host, 2134 *Quercus acutissima*", slide VU no. 0691.

DERIVATIO NOMINIS. Fumidus (L.)=smoky, smoke coloured.

Stigmella pulla Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (25), 104, 105, 106, 230, 231, 232.

Adult. ♂ (♀ unknown).

Head : Frontal tuft basally yellow, upper part darker ; scape largely cream ; collar brown ; antenna cream-buff with more than usual reflections, with 34-35 segments.

Thorax : brown with bronze reflections. Forewing, (length ca. 2.7-2.8 mm) uniform brown as thorax, bronze reflections mixed with green ; terminal cilia without prominent purple lustre ; no markings. Hindwing, greyish brown, no iridescence.

Abdomen : as thorax with silver iridescence ; two prominent buff anal tufts on last tergite.

Genitalia : ♂. Tegumen band-shaped ; uncus with two lateral posterio-ventrally directed processes ; gnathos with thin basal sclerite, long posterior arms, and lateral arms half as long as posterior arms ; vinculum anteriorly weakly bilobed ; valves ventrally touching each other with short style, cuiller nearly rectangular, valves have dorsally from style very short process ; ventral arms of transtilla prominent, horizontal bar straight ; aedeagus long pyriform ; vesica with two bands of cornuti decreasing in size anteriorly, one with only large cornuti at the posterior and one part lacks them all together, vesica with one marked coil.

DIAGNOSIS. *S. pulla* differs from *S. kumatai* by its entirely cream scape and collar ; furthermore the antennae are white instead of black and the average number of segments differs ; other discriminative characters can be found in the shape of the uncus, the thinner gnathos, the shape of the aedeagus and the absence of a manica. *S. pulla* has a more greyish colour than *S. kurii* and is less reflective. *S. pulla* resembles the Primoryan *S. omelkoi* Puplesis but differs in shape of valves, vinculum, uncus and gnathos. The two last structures are considerably more slender in *S.*

pulla.

BIOLOGY.

Food plants. *Quercus mongolica* Fischer var. *grosseserrata* (Bl.) Rehd. & Wils.

Egg. On upper-side of leaf, usually in disc detached from large veins.

Mines. Narrowly linear throughout, but becoming gradually wider terminally, sinuous, and sometimes running along lateral vein or leaf-margin. In first half, mine with thin linear frass occupying about 1/3 width of track ; in dried condition linear frass sometimes disrupted into short lengths. In second half of mine frass dispersed, or rarely coiled, occupying less than 1/3 width of track. In a few mines frass is thin linear throughout length.

Cocoon. Known from holotype, dark red-brown, ca. 2.8×2.0 mm.

Life history. Not well known, possibly bivoltine or more, because mines with larvae were collected in July and again in September in Hokkaido. When full-grown, the larvae leave the mines through a semicircular slit and spin cocoon in soil or amongst fallen leaves on the ground. Hibernation takes place on prepupal stage within cocoon.

TYPE LOCALITY. Moiwa, Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂ : "Moiwa, Sapporo, 8-V-1967", "Hokkaido, T. Kumata leg.", "Host, *Quercus mongolica* var. *grosseserrata*", slide no VU 0727.

ADDITIONAL MATERIAL : In Ent. Inst., Hokkaido University. 1 ♀ : "Moiwa, Sapporo, 8-V-1967", "Hokkaido, T. Kumata", "Host, 790 *Quercus mongolica* var. *grosseserrata*", right wings on slide, T. Kumata no. Npt-6.

DERIVATIO NOMINIS. Pulla (L.)=dark, blackish.

Stigmella quercifaga Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (25), 101, 102, 103, 193, 194, 195, 196, 197.

Adult. ♂, ♀.

Head : frontal tuft orange to buff ; scape cream ; collar cream ; antenna brown with ♂ ca. 30 segments and ♀ ca. 20 segments.

Thorax : dark background with bronze and silver reflections mixed with green and purple. Forewing, (length ♂ ca. 2.1 mm, ♀ ca. 2.0 mm) same as thorax, without any markings. Hindwing, without androconial scales ; colour greyish brown.

Abdomen : as thorax.

Genitalia : ♂. Tegumen broad, band-shaped ; uncus with prominent lateral arms as well posteriorly directed horn-like processes ; posterior arms of gnathos long and slender ; vinculum anteriorly bilobed, upper part of ventral plate relatively short ; valves with large style and high, rounded cuiller ; ventral arms of transtilla rather short ; aedeagus without manica, vesica with various cornuti, one group half way down vesica consisting of remarkable rigid spines.

♀. Posterior apophyses somewhat longer than anterior apophyses ; accessory sac rather long and slender, containing a rod-like structure ; bursa copulatrix large without signa, but at its base covered with numerous minute patelloid spines, bursa carries a chitinous rectangular plate, the margins curled anteriorly ; ductus spermathecae with ca. 9 convolutions.

DIAGNOSIS. Green less prominent than in *S. pulla* ; antenna only 29-30 seg-

ments vs. 34-35 in *S. pulla*; differs from *S. kumatai* in that it lacks purple reflecting terminal region of the forewing as well as by differing head colours; the shapes of tegumen, uncus, gnathos and vesica distinguish this species from *S. fumida*.

DISCUSSION. The chitinous rectangular plate in the bursa copulatrix places this species rather apart from the *suberivora*-group members, however the male genitalia could justify its presence among them. The convoluted ductus spermathecae can be characteristic for both *suberivora*- and *ruficapitella*-groups, as are the pectinations on the base of the bursa. It remains uncertain to which group this species belongs but on the basis of the female genitalia it has been placed in the *ruficapitella*-group.

BIOLOGY.

Food plants. *Quercus acutissima* Carruth. and *Quercus serrata* Thunb.

Cocoon. Brown, known from paratypes, 2.3-2.5×1.6 mm.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Kyushu, Hikosan, (Buzen), 10-VII-1955, H. Kuroko", "Host: *Quercus acutissima* Carruth.", slide VU no. 0663; paratype ♂: "larva was collected on 21-V-1975, same locality as holotype, 3-VI-1975, H. Kuroko", slide VU no. 0705; paratypes 2 ♀: "Kyushu, Hikosan, (Buzen), 12-VII-1955, H. Kuroko", slides VU no. 0726, VU no. 0788; paratype ♂: "Kyushu, Hikosan, (Buzen), 7-I-1955, H. Kuroko", *Quercus serrata* Thunb.", slide VU no. 0706.

DERIVATIO NOMINIS. *Quercus* (L.)=oak; phagein (Gr.)=to eat.

Stigmella valvaurigemmata Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 30, 89, 90, 91.

Adult. ♂ (♀ unknown).

Head: frontal tuft greyish brown; scape-base cream, margins dark brown; collar dark brown; antenna concolorous with ca. 24 segments.

Thorax: greyish brown with bronze reflections. Forewing, (length ca. 1.9 mm) proximally greyish brown with bronze reflections, medially dark brown with cupreous reflections mixed with red, distal parts concolorous; post medial fascia white-grey, silver reflecting with green and purple, anally somewhat broader; terminal cilia as hindwing, anal cilia rather short, concolorous. Hindwing, light greyish brown.

Abdomen: as thorax.

Genitalia: ♂. Tegumen band-shaped; uncus high, bilobed, with weak scalariform lateral margins; gnathos with very short basal sclerite, stout posterior arms close together, lateral arms broad, short, vertical; vinculum anteriorly broadened, bilobed, lobes prominent; valve with moderately long, thick style, cuiller ventrally with ear-like process, the latter with very stout papillae, one of which is apically bilobed; transtilla with short lateral arms, long ventral arms and an uninterrupted horizontal bar; aedeagus with spiculate manica, on vesica long band with posteriorly prominent cornuti gradually diminishing in size.

DIAGNOSIS. This species differs from *S. caesurifasciella* by the uninterrupted straight postmedial fascia, the larger and brown frontal tuft, further by the ear-like processes on the valves; the huge papillae on these processes distinguish *S. valvaurigemmata* from *S. clisiotophora* as do the shape of the uncus, gnathos and the presence of a manica as well as the general shape and colours of the adult. *S. kurokoi*

Puplesis, from southern Primorye, USSR, has some striking resemblance with *S. valvaurigemmata* as far as the general morphology and the presence of special characters are concerned. Nevertheless, they differ in the form of the ear-shaped structures on the cuiller, which are much longer and narrower in *valvaurigemmata*, and in the shape of the uncus. The style of *S. kurokoi* is narrower. It is remarkable that the ear-shaped structures on the cuiller of *S. kurokoi* are more or less equal to those of *S. clisiotophora*, although the general morphology is similar to above described species. *S. clisiotophora* does not appear to be related to *S. kurokoi* when considering the over all shape of both species.

DISCUSSION. This species and *S. clisiotophora* are the only known Japanese species with ear-like processes on the ventral side of the cuiller. Both feed on *Quercus* in their larval stage. The fundamental differences in the shape of the male genitalia especially with regard to the gnathos, uncus and the presence of a manica suggest a rather limited relationship between these species. The ear-like valve processes, however, are so similar in position and general structure that they probably do not have separate origins. We believe that this is an example of homology and stresses the close relationship between the *ruficapitella*-group and the *suberivora*-group.

BIOLOGY.

Food plants. *Quercus* spec.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Kyushu, Hikosan, (Buzen), 31-VII-1954, H. Kuroko", slide VU no. 0713.

DERIVATIO NOMINIS. Valva (L.)=valve; auris (L.)=ear; gemmata (L.)=with buds papillate.

Stigmella zelkoviella Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 28, 92, 93, 94.

Adult. ♂ (♀ unknown).

Head: frontal tuft orange, basally ochreous; scape cream with darker hind-margin; antenna dark with ca. 21 segments; collar buff.

Thorax: background colour brown. Forewing, (length ca. 2.48 mm) brown background with broad silver postmedial fascia narrower at costal margin; distal half of wing dark brown; upper half lighter; basal half of terminal cilia yellow, upper half silverish white; proximal to terminal cilia with one row of normal scales of which apices are purple-brown in contrast with the lighter base, this gives the appearance of a small extra fascia; the proximal half of the wing has a light bronze iridescence with a violet lustre; the brown distal parts reflect brown and purple. Hindwing, greyish brown.

Abdomen: probably the same colour as thorax.

Genitalia: ♂. Tegumen strap-shaped; articulations with vinculum hardly visible; uncus bilobed with wide ear-like lobes; gnathos bilobed and M-shaped, lateral arms long, blade-shaped, somewhat anteriorly directed; vinculum with sharp anterio-lateral lobes; valves with moderately long narrow style, cuiller round, base of valve ventrally sharp edged; aedeagus long, with short manica, vesica with long, broad cornuti, tiny spicules and series of simple triangular spines.

DIAGNOSIS. *S. zelkoviella* differs from other members of the *ruficapitella*-group by its relatively small manica and long aedeagus, further by the size of the cornuti; the shape of uncus, gnathos and lobes of the vinculum can be also used for discrimination.

BIOLOGY.

Food plants. *Zelkova serrata* (Thunb.) Makino.

Egg. Laid on the lower surface of the leaf, along the vein. Size 0.3×0.2 mm, elliptical.

Mine. Linear, slender; highly contorted, pale brown, including brown granular frass in a longitudinal belt which in first half of mine occupies almost all width, but in last half of mine it becomes 1/3-1/6 width of mine. Length of mine, ca. 70 mm.

Cocoon. Size ca. 3.0×1.75 mm, thickness ca. 0.8 mm, elliptical, swollen in central part; dark brown tinged with red, without lustre, thin but tough. Constructed between grains of soil.

Life history. The first reared adult emerged at the end of April. In late August and mid October larvae were found. The last generation of the larvae hibernated within the cocoon. These facts may suggest that this species is bivoltine or trivoltine at Hikosan.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "(Kyushu), Hikosan, (Buzen), 22-IV-1955, H. Kuroko", "Host: *Zelkova serrata* Makino", slide VU no. 0710.

DERIVATIO NOMINIS: After *Zelkova serrata*, the hostplant of this species.

Suberivora species-group

This species-group consists of the following species as far as the Japanese fauna is concerned: *S. chrysopterella, S. clisiotophora, S. kumatai, S. kurii* and *S. oa*. The known male genitalia of most species fit well into the large *ruficapitella*-group. However the over all shape of the female genitalia definitely separates them from the European group of mainly *Quercus*-feeders. Distinguishing features such as the absence of sclerotizations on the bursa copulatrix, the folded posterior half of the bursa and the tuberous anterior half, are the general characteristics of this group which are shared with *S. suberivora* (Stainton, 1869), a species formerly placed in the *ruficapitella*-group.

Since a great many of the *suberivora*-group species have a terminal patch, and a postmedial fascia, as well as similarity in general shape of male and female genitalia, their affinity with the *aurella*-group should be recognised. Spiculae on the ductus spermathecae of *S. oa* and on those of most of the *aurella*-group members indicate the same relationship, as does the occurrence of a manica in both groups.

Key to Japanese members:

1a Male. 2
1b Female. 3
2a Cuiller with ear-like processes, posterior arms of gnathos short, basal sclerite long and very narrow. ..... *clisiotophora*
2b Cuiller without ear-like processes, posterior arms of gnathos very tall, juxta present. ..... *kumatai*
3a Forewing without postmedial fascia or terminal patch. 4

3b Forewing with postmedial fascia and sometimes terminal patch. 6
4a Convolutions in ductus spermathecae more than 10, accessory sac very prominent but rather slender. 5
4b Convolutions in ductus spermathecae less than 10, accessory sac very prominent, bulbous. ..... *kumatai.*
5a Convolutions in ductus spermathecae with straight outer sides ..... *kurii*
5b Convolutions in ductus spermathecae with curving outer sides. ..... *chrysopterella*
6a Forewing with noticeable terminal patch. ..... *oa*
6b Forewing without terminal patch. ..... *clisiotophora*

Stigmella chrysopterella Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (25), 203, 204.

Adult. ♀ (♂ unknown).

Head: fronal tuft orange to ochreous; scape cream; antenna greyish brown with ca. 26 segments.

Thorax: dark background with bronze golden reflections, slightly mixed with green and purple. Forewing, (length ca. 2.5 mm) as thorax. Hindwing, without androconial scales, light greyish brown.

Abdomen: as thorax.

Genitalia: ♀. Apophyses of equal length; ductus spermathecae with ca. 11 convolutions; accessory sac large, with transverse folds; bursa copulatrix large, internally without any structures except some longitudinal folds at the base, very lightly covered with minute pectinations.

DIAGNOSIS. *S. chrysopterella* differs from *S. kurii* not only in hostplant preference, but also in the shape of the convolutions of the ductus spermathecae and the colour of the frontal tuft which is orange instead of black.

BIOLOGY.

Food Plants. *Quercus acutissima* Carruth.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "(Kyushu), Hikosan, (Buzen), 23-V-1955, H. Kuroko", slide VU no. 0724.

DERIVATIO NOMINIS. Chrysos (Gr.)=golden; pteron (Gr.)=wing.

Stigmella clisiotophora Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 35, 110, 111, 112, 200, 229.

Adult. ♂, ♀.

Head: frontal tuft ♂ orange, ♀ orange and ochreous; scape ♂ whitish cream in front, darkening through brown to black posteriorly, ♀ ochreous with darker hind margin; antenna dark brown with ♂ ca. 27 and ♀ 19 segments.

Thorax: dark brown as is also forewing background. Forewing, (length ♂ ca. 2.35 mm, ♀ ca. 2.15 mm) proximal half somewhat lighter than distal part with a slight silverish reflection mixed with some blue and purple; distal half browny iridescence with purple; post medial fascia white with strong silverish reflection. Hindwing, ♂ rather dark greyish brown, ♀ lighter, but costal colour same as proximal half of forewing, ♂ both anal and costal sides with androconial scales, those on anal side band- or ribbon-shaped.

Abdomen: as thorax.

Genitalia: ♂. Tegumen a very broad band: uncus also very broad, bilobed but with each lobe ending in a posteriorly directed process; basal sclerite of gnathos approximately 5 times broader than length of lateral and posterior arms; vinculum anteriorly bilobed, median concavity reaching upper part of ventral plate; juxta present; valves with long styles, on ventral side cuiller with triangular ventroposteriorly directed, ear-shaped process, with few papillations; dorsally from style arises somewhat shorter "substyle"; transtilla broad; aedeagus anteriorly broader than posteriorly, no manica; cornuti on vesica posteriorly large, becoming gradually smaller in anterior direction.

♀. Apophyses of equal length; bursa copulatrix with complex corrugated fold, no clear signa; posterior part of ductus spermathecae with extremely minute dots, ca. 4 convolutions.

DIAGNOSIS. *S. clisiotophora* differs from *S. valvaurigemmata* in having less complex ear-like structures on the ventral side of the valves and also differs in the shape of the gnathos, uncus, anterior parts of the vinculum and the absence of a manica.

DISCUSSION. The shape of the female genitalia allows *S. clisiotophora* to be placed in the *suberivora*-group instead of the *ruficapitella*-group to which *S. valvaurigemmata* belongs (see discussion *S. valvaurigemmata*). *S. kurokoi* Puplesis, 1984, from southern Primorye, USSR, also has ear-like structures on the cuiller. The general morphology of the male genitalia however does not resemble *S. clisiotophora*; differences in gnathos, uncus, vinculum and aedeagus are evident —compare with *S. valvaurigemmata* to which species *S. kurokoi* has close affinity especially in general morphology.

BIOLOGY.

Food plants. *Quercus variabilis* Bl.

Egg. On upper-side of leaf, slightly away from lateral vein.

Mine. A sinuous and linear gallery gradually becoming wider terminally, begins following a vein then turns toward disc of leaf, and crosses lateral vein, but not its own early mine. First half of mine filled by frass almost across whole width without clear margins; the second half with broad dispersed frass leaving thin clear margins, the frass usually occupies about 3/4 width of gallery. This mine is similar to that of *S. kumatai*, but can be distinguished by broader frass occupying almost whole width of mine in first half and about 3/4 width in second half.

Life history. Voltinism unknown. Living larvae were collected in mid October and adults emerged in June of the next year. Therefore, this species has at least two generations a year in southern Japan, and hibernates in prepupal or pupal stage within cocoon. At terminal end of empty mines is a semicircular slit through which the larva has left for pupating.

TYPE LOCALITY. Izuhara, Tsushima, Japan.

TYPE MATERIAL EXAMINED. Holotype ♂: "Izuhara, Tusima, Japonia", "em. 2-VI-1980, T. Kumata leg.", "Host, 2070 *Quercus variabilis*", slide VU no. 0692; paratype ♀: "Izuhara, Tusima, Japonia", "em. 3-VI-1980, T. Kumata leg.", "Host, 2070 *Quercus variabilis*", slide VU no. 0693.

DERIVATIO NOMINIS. Klisias (Gr.)=folding door, valve; otos (Gr.)=ear; phero (Gr.)=carry.

Stigmella kumatai Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 25, 107, 108, 109, 188, 189, 190, 191, 236, 237.

Adult, ♂, ♀.

Head: frontal tuft orange and ochreous, ♀ also yellow; scape ♂ cream with dark hind margin, ♀ entirely white cream; collar dark brown; antenna black with ♂ 29-31 segments, ♀ 24-25 segments.

Thorax: dark brown background, structural bronze mixed with green. Forewing, (length ♂ ca. 2.35 mm, ♀ ca. 2.40 mm) as thorax except for terminal cilia which reflect prominently purple; no further markings. Hindwing, greyish brown; ♂ with some blue green reflections on marginal scales, ♀ almost without lustre; ♂ with androconial scales on costal side in a distinct tuft as well as on the whole side, ♀ without.

Abdomen: as thorax but with less iridescence.

Genitalia: ♂. Tegumen broad with a blunt edged posterior margin; uncus bilobed with at both sides a membranous patch under the lobes; gnathos stout, posterior arms as long as basal sclerite; vinculum anteriorly rather weakly bilobed; valves with style barely reaching uncus, small valves do not touch each other ventrally; manica somewhat larger than aedeagus with little internal spicules, the density of which decreases in frontal direction; vesica almost completely covered with cornuti of various shapes.

♀. Anterior apophyses as long as posterior apophyses; ductus bursae of same length as apophyses; accessory sac very large (in fact 2/3 bursa length) with numerous longitudinal folds, basally covered with tiny pectinations; ductus spermathecae with ca. 7 coils; posterior 2/3 of bursa copulatrix slender with many striae, anterior relatively small and tuberous, crumpled appearance without visible denticulations.

DIAGNOSIS. This species resembles *S. pulla* but differs from it by having black instead of cream antennae with less segments; forewing of *S. kumatai* with structural purple, which is lacking on *S. pulla*; abdominal colour of *S. kumatai* not so silver as *S. pulla*. In the latter the male has an entirely cream scape instead of dark hind margins as in *S. kumatai*. Collar colour of *S. kumatai* is brown whereas in *S. pulla* it is cream. Male hindwing with costal androconial scales, especially in a tuft. Membranous patches in the uncus separate *S. kumatai* from other *suberivora*-group members known from Japan, as does the manica which is larger than the aedeagus.

DISCUSSION. Based on the female genitalia this species belongs to the *suberivora*-group but the shape of the manica which is larger than the aedeagus is aberrant. This is also confirmed by the typical membranous patches in the sclerotizations of the uncus. So far only one other known Japanese species has this feature: *S. sorbivora*, which seems to belong to the *oxyacanthella*-group.

BIOLOGY.

Food plants. *Quercus mongolica* Fischer var. *grosseserrata* (Bl.) Rehd. & Wils. and *Quercus serrata* Thunb.

Egg. Always on upper-side of leaf, beside a large vein.

Mine. A sinuous linear mine starting as a very thin gallery with linear frass occupying 1/4 to 1/3 width of track, suddenly becomes wider, no more than 5 mm at

widest part, with coiled or dispersed frass very thick and occupying nearly 1/2 width of gallery. Linear part of frass not broken in dried condition of mine. This mine is distinct from that of *S. pulla*, which attacks the same plant in the same season, by the thicker frass in the second half of the *kumatai* mine.

Life history. Incompletely known, but likely to be bivoltine. Larvae occurring in late June and July, and probably also in the autumn from September to early October. Adults emerged in July in first generation, and probably in May to early June of the next year in second generation. When full-grown, larvae leaving the mine through a semi-circular slit.

TYPE LOCALITY. Moiwa, Sapporo, Hokkaido, Japan.

TYPE MATERIAL EXAMINED. Holopype ♂ : "Moiwa, Sapporo, Hokkaido, Japonia", "8-VII-1977, T. Kumata", "Host, 1712 *Quercus mongolica* v. *grosseserrata* (Bl.) Rehd. & Wils.", slide VU no. 0651 ; paratypes 2 ♂ : same data as holotype except for emerg.-dates, 9-VII-1977, slide VU no. 0650, and 11-VII-1977, slide VU no. 0733, host no. 1713 ; paratypes 4 ♀ : same data as holotype except for emerg.-dates, 2-8-VII-1977, slides VU no. 0664 and VU no. 0665, 11-VII-1977, no slide, 13-VII-1977, no slide ; paratype ♀ : "Sapporo, Hokkaido, leg. T. Kumata, 23-VI-1956, emerg. 13-VII-1956", "Host, 78 *Quercus serrata* Thunb., det. T. Kumata, 1956", slide VU no. 0707.

ADDITIONAL MATERIAL. In Ent. Inst., Hokkaido University. 2 ♂ : "Moiwa, Sapporo, Hokkaido, Japonia", "8-VII-1977, T. Kumata", "Host, 1712 *Quercus mongolica* var. *grosseserrata*", slide T. Kumata no. Npt-15 and no slide ; 2 ♂ : "Moiwa, Sapporo, Hokkaido, Japonia", "9 and 13-VII-1977", "Host, 1713 *Quercus mongolica* var. *grosseserrata*", no slide ; 3 ♀ : "Moiwa, Sapporo, Hokkaido, Japonia", "9, 11 and 11-VII-1977, T. Kumata", "Host, 1713 *Quercus mongolica* var. *grosseserrata*", slide T. Kumata no. Npt-11, and two no slides.

DERIVATIO NOMINIS. Named after Dr. Tosio Kumata, our colleague from Hokkaido University, one of the two principal collectors of material treated in this study.

Stigmella kurii Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. (25), 201, 202.

Adult. ♀ (♂ unknown).

Head : frontal tuft black ; scape cream to buff ; collar as scape ; antenna dark greyish brown with bronze reflections, ca. 21 segments.

Thorax : dark brown, bronze reflections mixed with green. Forewing, (length ca. 2.56 mm) as thorax but also with purple component in mixture of reflections ; no further markings. Hindwing, light greyish brown.

Abdomen : as thorax but somewhat lighter.

Genitalia : ♀. Posterior apophyses somewhat shorter than anterior apophyses ; ductus bursae short ; accessory sac with complex folds ; ductus spermathecae long with many convolutions ; bursa copulatrix with short folded base, bursa itself tuberous, very thin and almost naked, thus with very few small scallop-like pectinations.

DIAGNOSIS. The externals are hardly separable from other *Quecus*-feeding unicolorous species such as *S. chrysopterella*, *S. quercifaga*, *S. pulla* and *S. fumida*,

although differences in frontal tuft-colours and reflection-mixtures occur. Separation has to be made on the genitalia, in this case on the female genitalia (♂ unknown). Form of the convolutions of the ductus spermathecae as well as the apophygeal morphology give good discriminative features.

BIOLOGY.

Food plants. *Castanea crenata* Sieb. & Zucc.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀ : "Kyushu, Hikosan, (Buzen), 19-VII-1955, H. Kuroko", "Host : *Castanea crenata*", slide VU no. 0773.

DERIVATIO NOMINIS. Kuri (Jap.)=*Castanea*.

Stigmella oa Kemperman et Wilkinson spec. nov.

DESCRIPTON. Figs. 33, 207, 208.

Adult. ♀ (♂ unknown).

Head : frontal tuft orange ; scape cream ; collar dark brown ; antenna with ca. 26 segments.

Thorax : dark brown with some red and bronze reflections. Forewing, (length ca. 2.7 mm) proximally dark brown to black, medially with bronze and red-purple lustre, distally less reflecting, cupreous, brown and some purple ; post medial fascia greyish white, continues anally to terminal patch, all with silver-green reflections, this white-silver pattern cup-shaped ; proximal half of terminal cilia dark greyish brown, distal half lighter. Hindwing, dark greyish brown.

Abdomen : as thorax.

Genitalia : ♀. Apophyses almost equally long ; ductus bursae shorter than apophyses, accessory sac stout with many folds like the base of the bursa copulatrix from which the folded part is approximately as long as the total accessory sac ; ductus spermathecae densely covered with spines, uncoiled, anterior part of bursa tuberous, covered with numerous scallop-like pectinations.

DIAGNOSIS. Differs from *S. egregilustrata* in the shape of the post medial fascia which is not constricted ; terminal patch is a real patch connected to the fascia by a curved, dorsally directed line from anal proliferations of the postmedial fascia ; furthermore in its dark over all colour, size and less brilliant iridescence. The spiculated but uncoiled ductus spermathecae separates *S. oa* from *S. quercifaga*, *S. chrysopterella*, *S. caesurifasciella*, *S. clisiotophora* and *S. sesplicata* ; the latter species from *Rhododendron* most resembles *S. oa* in genitalia, but differs in external features such as colour pattern, connection between postmedial fascia and smaller sized terminal patch.

DISCUSSION. This species is easy to distinguish from other known Holarctic species. Unfortunately there is no information about host plants, but its over all resemblance to other known Japanese *Quercus*-feeding species as well as its similarity to *S. sesplicata* leads us to place it in the *suberivora*-group. The fact that many species in this group possess a terminal patch, postmedial fascia, at least in two cases an anal connection or proliferation and spiculae on the ductus spermathecae of *S. oa* as well as on several members of the *aurella*-group points to the similarity between these two groups. As very few Japanese *aurella*-group species have those structures one can speculate that spiculae on the ductus are a plesiomorphic

European character, and after that loss the *ruficapitella/suberivora*-group complex evolved from the *aurella*-group.

BIOLOGY. Unknown.

TYPE LOCALITY. Kimitoge, Wakayama Pref., Honshu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Kimitoge, Wakayama, Honshu, Japan, 23-V-1971, M. Owada et F. Komai", slide VU no. 0714.

DERIVATIO NOMINIS. Oa (Gr.)=hem, border, which refers to the line of white scales between the post medial fascia and the terminal patch. It also refers to the dark proximal half of the terminal cilia which forms the separation between the light terminal patch and the concolorous cilia ending.

Species not placed in a group

Neither of the following species have been incorporated into a group because only one female specimen is available for each. Their similarities with known species-groups are not striking enough.

Stigmella egonokii Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 37, 198, 199, 241.

Adult. ♀ (♂ unknown).

Head: frontal tuft orange; scape cream; collar cream; antenna entirely dark brown dorsally, and cream to greyish brown ventrally with ca. 20 segments.

Thorax: dark greyish brown with bronze, purple and green iridescence. Forewing, (length ca. 2.2 mm) proximal half concolorous with thorax, but also with a greyish silver lustre when lit from the side; distal half dark brown with brown and yellow to golden reflections mixed with some purple and green; postmedial fascia white with silverish lustre mixed with blue, on distal edge medially constricted; terminal cilia light greyish brown with slight silver lustre. Hindwing, concolorous with terminal cilia.

Abdomen: as thorax with a lighter appearance.

Genitalia: ♀. Anterior apophyses somewhat longer than posterior apophyses; ductus bursae short; accessory sac voluminous, with small comb-like pectinations; base of ductus spermathecae densely covered with smaller but identically shaped pectinations; bursa copulatrix long, tuberous covered with numerous pectinations, these decreasing in number towards distal end, basally also mixed with slightly but significantly longer spinules.

DIAGNOSIS. *S. egonokii* can ce distinguished from other Japanese *Stigmella* species by the externals, especially the antenna colour, and the position where the pectinations on the bursa copulatrix are concentrated.

DISCUSSION. Unfortunately Klimesch did not describe the genitalia of *S. styraciçolella* (Klimesch, 1978) (only females known). We are therefore uncertain how close these species are.

BIOLOGY.

Food plants. *Styrax japonica* Sieb. & Zucc.

Egg. Laid on the upper surface of the leaf, along a vein, 0.25×0.20 mm, elliptical.

Mine. Linear, slender, upper surface, sometimes restricted by mid-rib of lateral vein. Pale greenish brown to pale brown, filled with greenish brown to dark brown grains of frass. Length of mine ca. 60 mm.

Larva. Head width 0.3 mm, body length 2.5 mm; yellow tinged with light brown, transparent, with lustre, head capsule pale yellowish brown, plate on prothorax and ganglia through ventral skin obscure, malpighian tubes slightly brownish through skin.

Cocoon. Elliptical or ovate, fibrous on surface; red-brown, sometimes pale brown, 2.4×1.6 mm.

Life history. The adult of the first generation appears at the end of April, second generation larvae appear in late June, the third generation larvae in late September to late October. Hibernation in cocoon. These data suggest that the species has two or three generations per year at Hikosan.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "Kyushu, Hikosan, (Buzen), 24-IV-1955, H. Kuroko", "Host: *Styrax japonica*", slide VU no. 0774.

DERIVATIO NOMINIS. Ego-no-ki (Jap.)=*Styrax*.

Stigmella boehmeriae Kemperman et Wilkinson spec. nov.

DESCRIPTION. Figs. 29, 209, 210, 211, 238.

Adult. ♀ (♂ unknown).

Head: frontal tuft orange to brown; scape cream; collar light greyish brown as thorax; antenna dark brown with ca. 20 segments.

Thorax: greyish brown with slight silverish reflections. Forewing, (length ca. 1.7-1.9 mm) basal part of proximal half light brown with bronze reflections mixed with blue-green and purple; submedially cream with strong silver reflections mixed with blue-green and purple; medially dark brown to sepia background with cupreous, red and brown reflections; postmedial fascia as submedial region; subterminally concolorous with medial part; terminal cilia light greyish brown with some silver reflections. Hindwing, greyish brown.

Abdomen: as thorax.

Genitalia: ♀. Posterior and anterior apophyses equally long, rather slender; accessory sac separate from ductus spermathecae, proximally thin, distally bulbous; ductus spermathecae with few convolutions and basally with small spines; bursa copulatrix proximally with folds, distally bulbous with numerous scallop-shaped pectinations.

DIAGNOSIS. The forewing colour pattern makes this species easy to separate from other known Japanese *Stigmella*-species. Furthermore it is the only Japanese *Stigmella* having female genitalia with a separate accessory sac and ductus spermathecae (cf. *S. pomella*, *S. pygmaeella* from European *pomella*-group).

DISCUSSION. The separated accessory sac and ductus spermathecae make comparison possible with other groups, although some of the characteristics indicate association with the *ruficapitella*- and the *suberivora*-groups.

BIOLOGY.

Food plants. *Boehmeria nipononivea* Koidz. and *Boehmeria spicata* (Thunb.) Thunb.

Egg. Laid on the upper surface of the leaf of host plant.

Mine. Linear, slender, usually made on distal part of leaf, sometimes on apical serrations; pale brown with a compact blackish central frass-line. Mine is visible from lower surface of the leaf. Length of mine 25-48 mm.

Larva. Head width ca. 0.3 mm, body length 2.25-2.5 mm; pale yellow, gut yellow through skin, head capsule pale brown, surface of body wholly covered with minute hairs.

Cocoon. Size 2.1-2.3×1.1 mm, thickness 0.7 mm; elliptical to ovate, rather flattened; light brown to coral pink, fibrous on surface. Spun in space between particles of soil.

Life history. Adult of the first generation emerged in the middle of April, next larvae from late June to early July, adults in late July, larvae in mid August, adults in late August, larvae from mid to late September; larvae of last generation spinning cocoons in October and hibernating within the cocoons. These data suggest that the species has four generations or more per year at Hikosan.

TYPE LOCALITY. Hikosan, Fukuoka Pref., Kyushu, Japan.

TYPE MATERIAL EXAMINED. Holotype ♀: "(Kyushu), Hikosan, (Buzen), 15-IV-1958, H. Kuroko", slide VU no. 0738; paratypes 2 ♀: "(Kyushu), Hikosan, (Buzen), 11-IV-1958, H. Kuroko", "Host *Boehmeria spicata*", slide VU no. 0779, second specimen no slide; paratype ♀: "(Kyushu), Hikosan, (Buzen), 25-VII-1954, H. Kuroko", "no. 145", slide VU no. 0739.

ADDITIONAL MATERIAL. In Ent. Lab., University of Osaka Pref. 2 ♀: "Kyushu, Hikosan, (Buzen), 26-VII-1954, H. Kuroko", "Host: *Boehmeria spicata*"; 1 ♀: "Kyushu, Hikosan, (Buzen), 14-IV-1958, H. Kuroko", "Host: *Boehmeria niponoivea*".

DERIVATIO NOMINIS. After *Boehmeria* as hostplant.

STIGMELLA SPECIES-GROUPS IN JAPAN

Betulicola-group
1. *betulicola* (Stainton)
2. *cathepostis* sp. nov.
3. *conchyliata* sp. nov.
4. *oplismeniella* sp. nov.
5. *populnea* sp. nov.
6. *titivillitia* sp. nov.

Malella-group
7. *kurotsubarai* sp. nov.

Ulmivora-group
8. *nakamurai* sp. nov.
9. *nireae* sp. nov.

Ultima-group
10. *japonica* sp. nov.
11. *orientalis* sp. nov.

Oxyacanthella-group
12. *alaurulenta* sp. nov.
13. *chaenomelae* sp. nov.
14. *honshui* sp. nov.
15. *sorbivora* sp. nov.
16. *zumii* sp. nov.

Salicis-group
17. *tranocrossa* sp. nov.
18. *vittata* sp. nov.

Aurella-group
19. *acrochaetia* sp. nov.
20. *alikurokoi* sp. nov.
21. *gimmonella* (Matsumura)
22. *ichigoiella* sp. nov.
23. *sesplicata* sp. nov.
24. *spiculifera* sp. nov.
25. spec. a

Caesurifasciella-group
26. *caesurifasciella* sp. nov.
27. *egregilustrata* sp. nov.

Ruficapitella-group
28. *castanopsiella* (Kuroko)
29. *fumida* sp. nov.
30. *pulla* sp. nov.
31. *quercifaga* sp. nov.
32. *valvaurigemmata* sp. nov.
33. *zelkoviella* sp. nov.

Suberivora-group

34. *chrysopterella* sp. nov.
35. *clisiotophora* sp. nov.
36. *kumatai* sp. nov.
37. *kurii* sp. nov.
38. *oa* sp. nov.

Group unassigned

39. *egonokii* sp. nov.
40. *boehmeriae* sp. nov.

List of food plants for Japanese Stigmella species

I. Food plant—*Stigmella* species

Aceraceae	
Acer	*S. japonica*
	S. orientalis
Betulaceae	
Alnus	*S. conchyliata*
	S. titivillitia
Betula	*S. betulicola*
Carpinus	*S. cathepostis*
Ericaceae	
Rhododendron	*S. sesplicata*
Fagaceae	
Castanea	*S. kurii*
Castanopsis	*S. castanopsiella*
Quercus	*S. caesurifasciella*
	S. chrysopterella
	S. clisiotophora
	S. egregilustrata
	S. fumida
	S. kumatai
	S. pulla
	S. quercifaga
	S. valvaurigemmata
Gramineae	
Oplismenus	*S. oplismeniella*
Rhamnaceae	
Rhamnus	*S. kurotsubarai*
Rosaceae	
Chaenomeles	*S. chaenomelae*
Malus	*S. alaurulenta*
	S. honshui
	S. zumii
Rubus	*S. alikurokoi*
	S. ichigoiella
	S. spiculifera
Sorbus	*S. sorbivora*
Salicaceae	
Populus	*S. populnea*
	S. tranocrossa
Salix	*S. vittata*
Styracaceae	
Styrax	*S. egonokii*
Ulmaceae	
Ulmus	*S. gimmonella*
	S. nakamurai
	S. nireae
Zelkova	*S. zelkoviella*
Urticaceae	
Boehmeria	*S. boehmeriae*
Hostplant unknown	
	S. acrochaetia
	S. oa
	S. spec. a

II. *Stigmella* species and their food plants.

S. acrochaetia	Unknown.
S. alaurulenta	*Malus sieboldii* (Rosaceae).
S. alikurokoi	*Rubus buergeri* (Rosaceae).
	Rubus palmatus var. *coptophyllus* (Rosaceae).
	Rubus phoenicolasius (Rosaceae).
S. boehmeriae	*Boehmeria spicata* (Urticaceae).
	Boehmeria nipononivea (Urticaceae).
S. caesurifasciella	*Quercus acuta* (Fagaceae).
S. castanopsiella	*Castanopsis cuspidata* (Fagaceae).
S. cathepostis	*Carpinus tschonoskii* (Betulaceae).
S. chaenomelae	*Chaenomeles japonica* (Rosaceae).
S. chrysopterella	*Quercus acutissima* (Fagaceae).
S. clisiotophora	*Quercus variabilis* (Fagaceae).
S. conchyliata	*Alnus* sp. (Betulaceae).
S. egonokii	*Styrax japonica* (Styracaceae).
S. egregilustrata	*Quercus glauca* (Fagaceae).

S. fumida ..... *Quercus acutissima* (Fagaceae).
S. gimmonella ..... *Ulmus davidiana* var. *japonica* (Ulmaceae).
Ulmus laciniata (Ulmaceae).
S. honshui ..... *Malus pumila* (Rosaceae).
S. ichigoiella ..... *Rubus buergeri* (Rosaceae).
S. japonica ..... *Acer crataegifolium* (Aceraceae).
Acer mono (Aceraceae).
S. kumatai ..... *Quercus mongolica* var. *grosseserrata* (Fagaceae).
Quercus serrata (Fagaceae).
S. kurii ..... *Castanea crenata* (Fagaceae).
S. kurotsubarai ..... *Rhamnus davurica* var. *nipponica* (Rhamnaceae).
S. nakamurai ..... *Ulmus davidiana* var. *japonica* (Ulmaceae).
S. nireae ..... *Ulmus davidiana* var. *japonica* (Ulmaceae).
S. oa ..... Unknown.
S. oplismeniella ..... *Oplismenus undulatifolius* (Gramineae).
S. orientalis ..... *Acer* spec. (Aceraceae).
S. populnea ..... *Populus nigra* cv. Italica (Salicaceae).
S. pulla ..... *Quercus mongolica* var. *grosseserrata* (Fagaceae).
S. quercifaga ..... *Quercus serrata* (Fagaceae).
Quercus acutissima (Fagaceae).
S. sesplicata ..... *Rhododendron* sp. (Ericaceae).
S. sorbivora ..... *Sorbus japonica* (Rosaceae).
S. species a ..... Unknown.
S. spiculifera ..... *Rubus hirsutus* (Rosaceae).
Rubus palmatus (Rosaceae).
S. titivillitia ..... *Alnus hirsuta* (Betulaceae).
Alnus japonica (Betulaceae).
S. tranocrossa ..... *Populus nigra* cv. Italica (Salicaceae).
S. valvaurigemmata ..... *Quercus* species (Fagaceae).
S. vittata ..... *Salix gracilistyla* (Salicaceae).
Salix species (Salicaceae).
S. zelkoviella ..... *Zelkova serrata* (Ulmaceae).
S. zumii ..... *Malus sieboldii* (Rosaceae).

ACKNOWLEDGEMENTS

The senior authors wish to acknowledge the generous loan of material and the continued support of Dr. H. Kuroko and Dr. T. Kumata throughout the work. C.W. also thanks Dr. Kuroko and his family for their generous hospitality during his visit to Osaka.

Drs. E.J. van Nieukerken and Drs. J.W. (Pim) Schoorl are thanked for their helpful discussions and the former for his critical comments on the manuscript. Dr. A. Puplesis is recognised for the gift and loan of material and assistance which enabled us to distinguish between Russian and Japanese species.

On the technical side we are most indebted to R. (Daisy) van Beusekom-Kloos for making the genitalia preparations and line drawings of the external features, and to T. Feijen for the development and processing of the plates.

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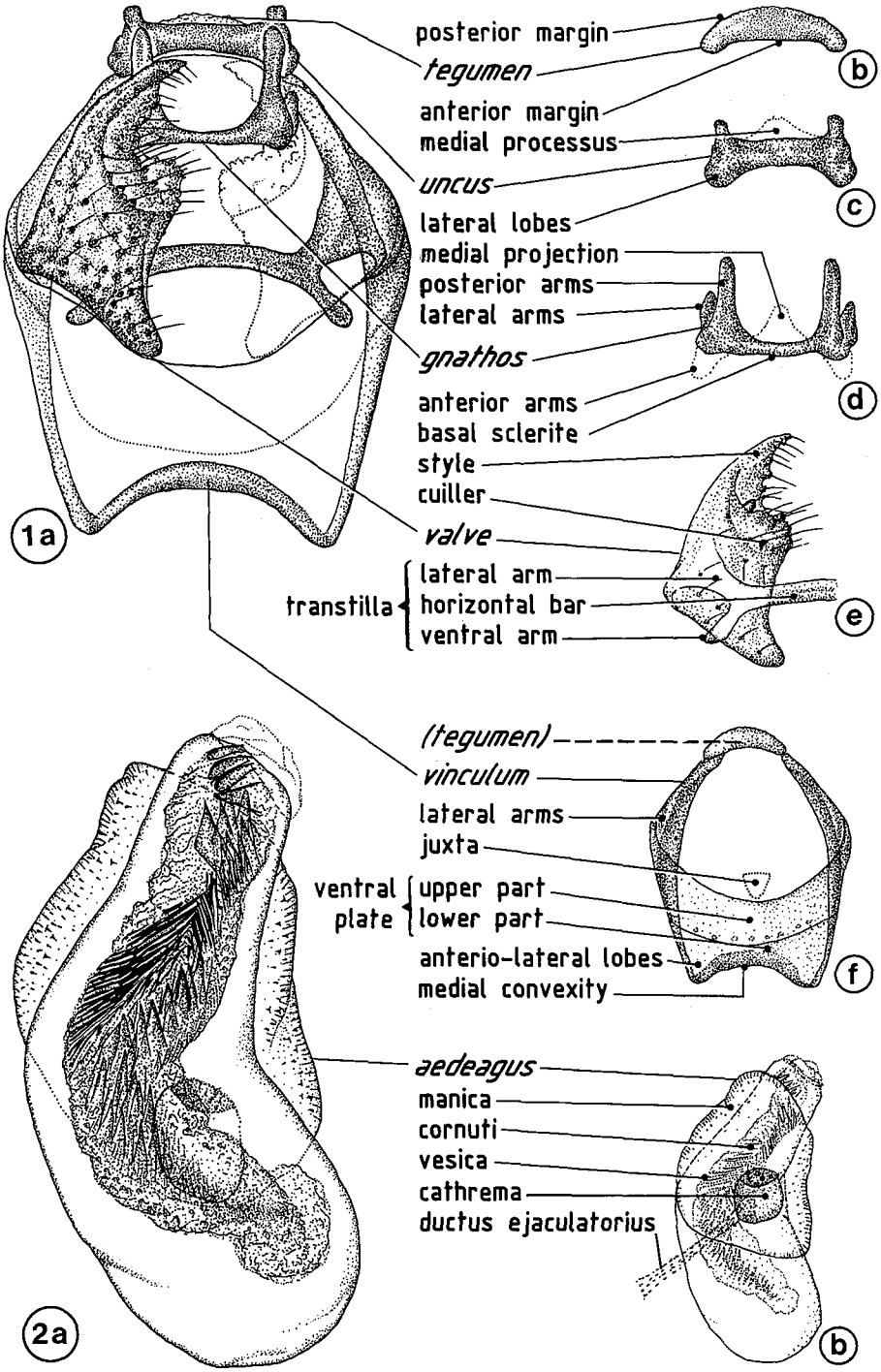
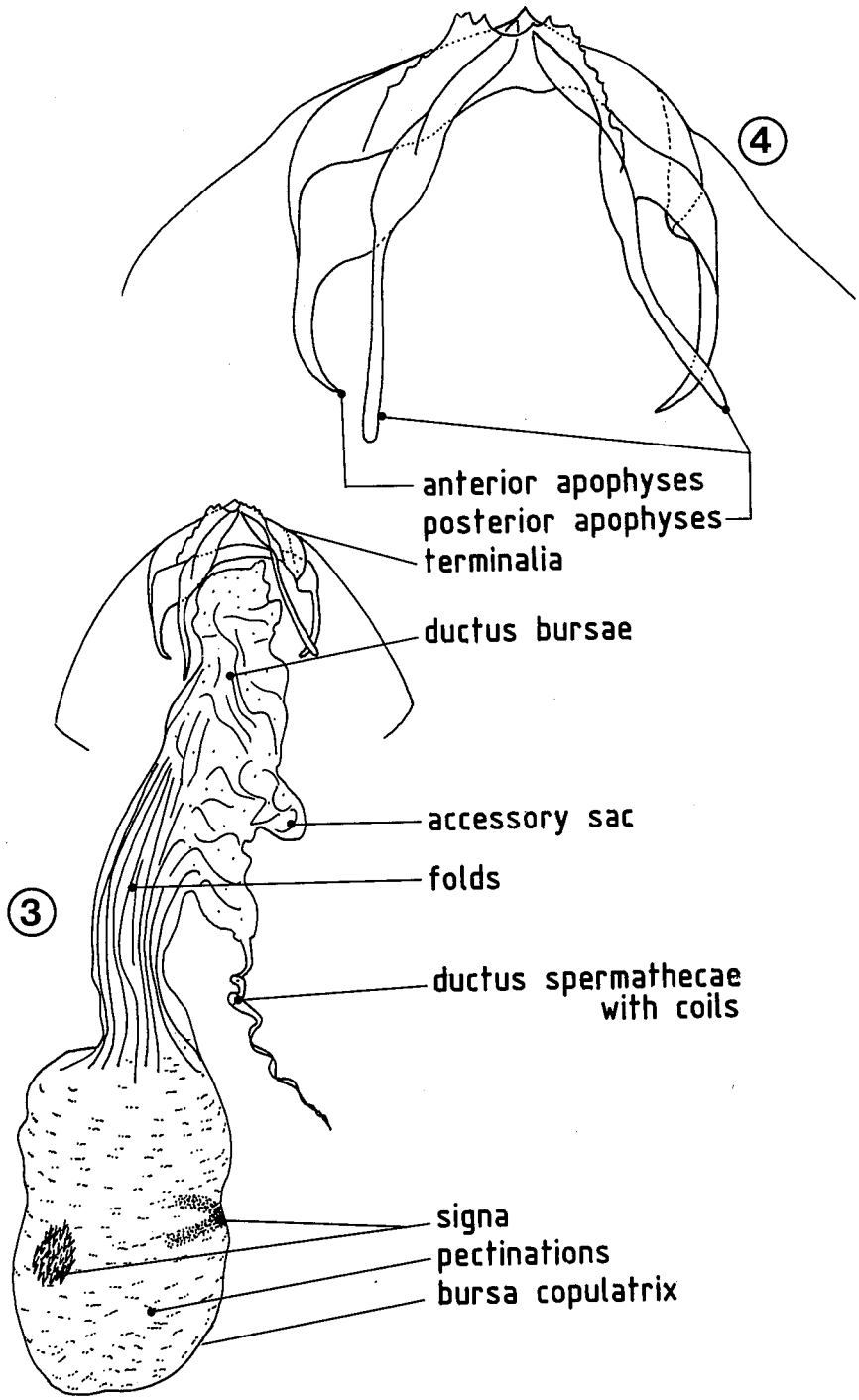
INDEX

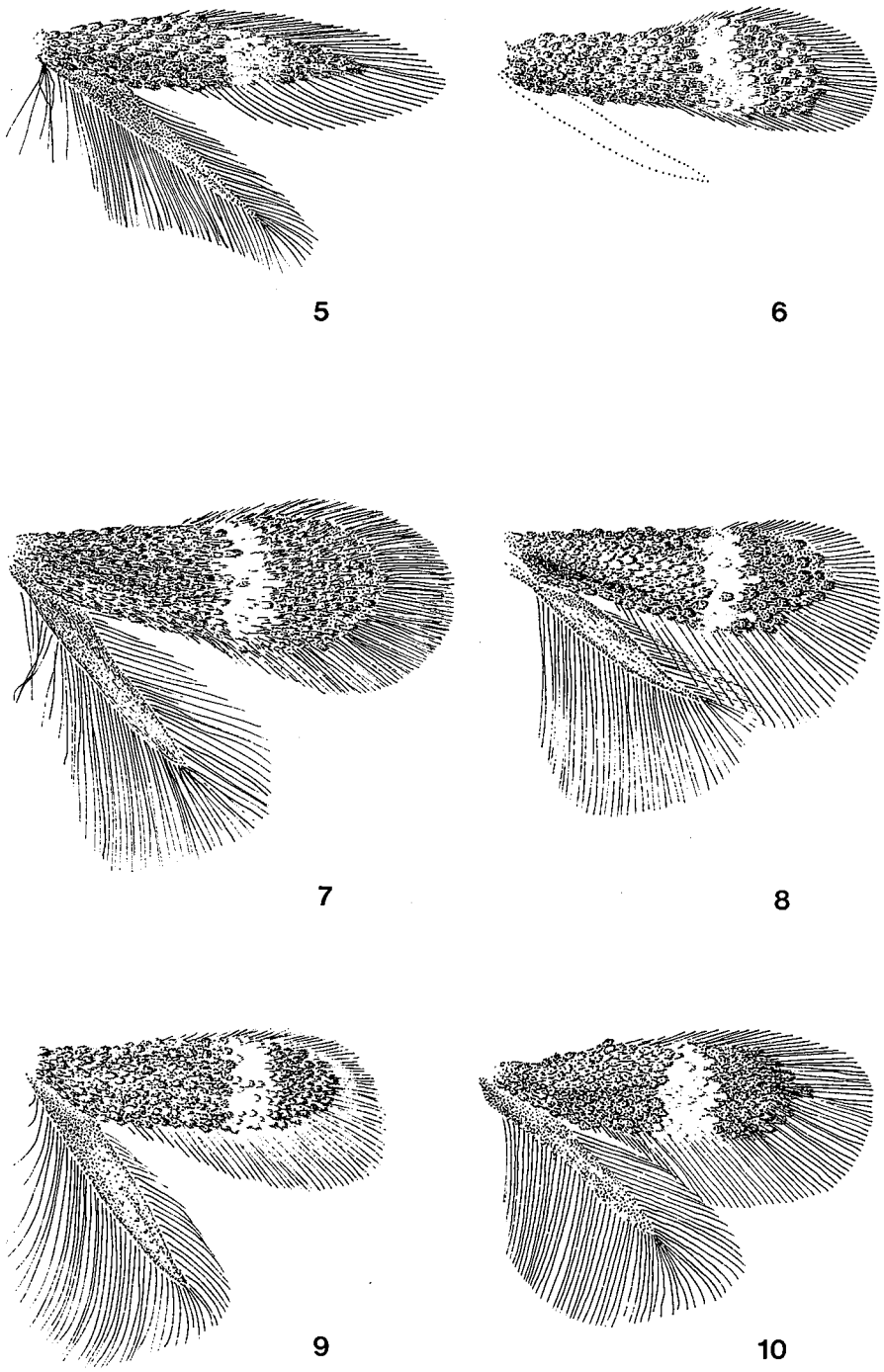
In the following index to specific names those given in italics are Japanese species. Italicised numbers refer to the pages where they are described. Other references are normally limited to the first mention of the species in each species-group.



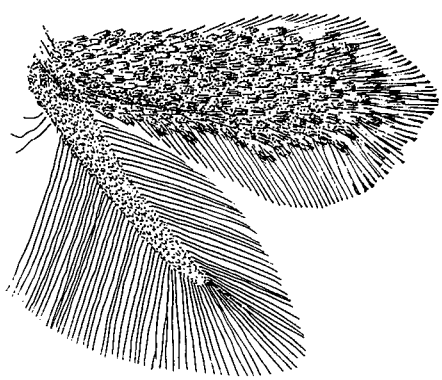
Figs. 1-2. Schematic drawing of ♂ genitalia of a *Stigmella* (cf. *S. fumida*). 1a, general view capsule; b, tegumen; c, uncus; d, gnathos; e, valve; f, vinculum; 2a, general view aedeagus; b, idem.



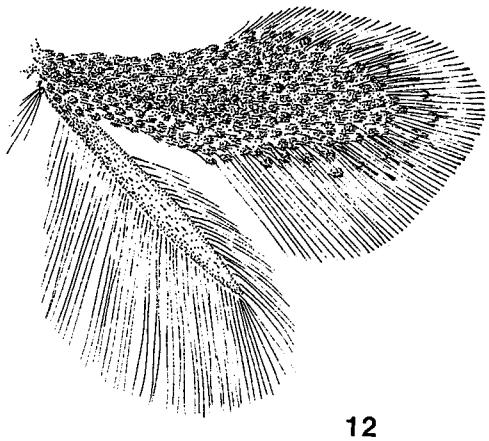
Figs. 3-4. Schematic drawing of ♀ genitalia of *Stigmella*. 3, general view with fictive arrangement of structures; 4, detail of terminalia.



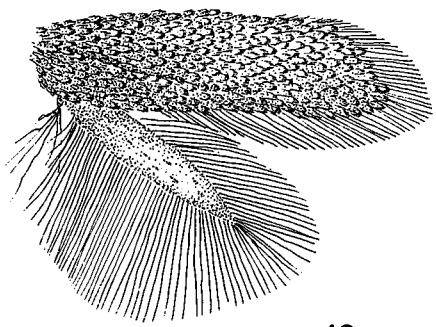
Figs. 5-10. External features of *Stigmella* spp.: 5, *betulicola* (not HT); 6, *cathepostis*; 7, *conchyliata*; 8, *oplismeniella*; 9, *populnea*; 10, *titivillitia*.



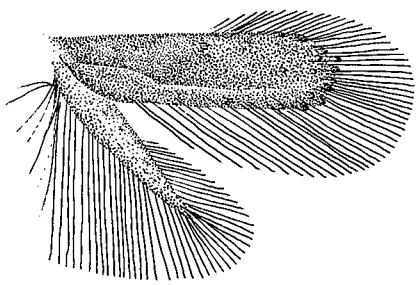
11



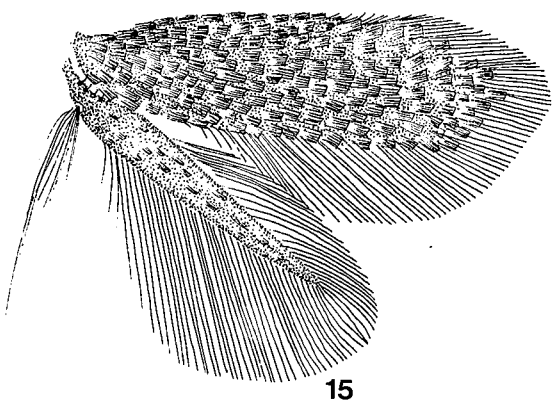
12



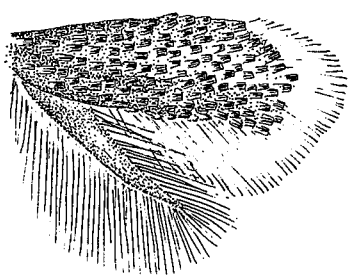
13



14

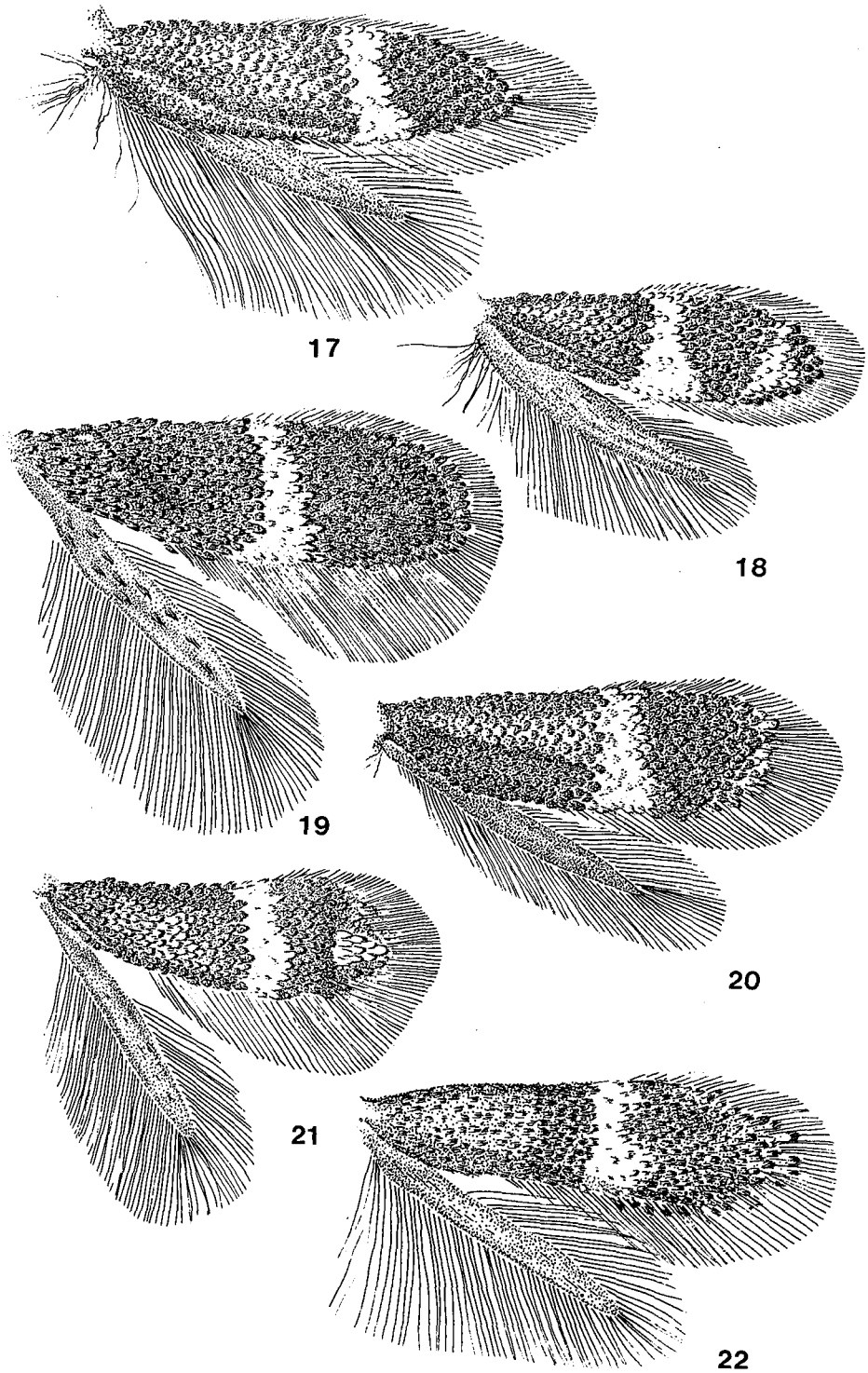


15

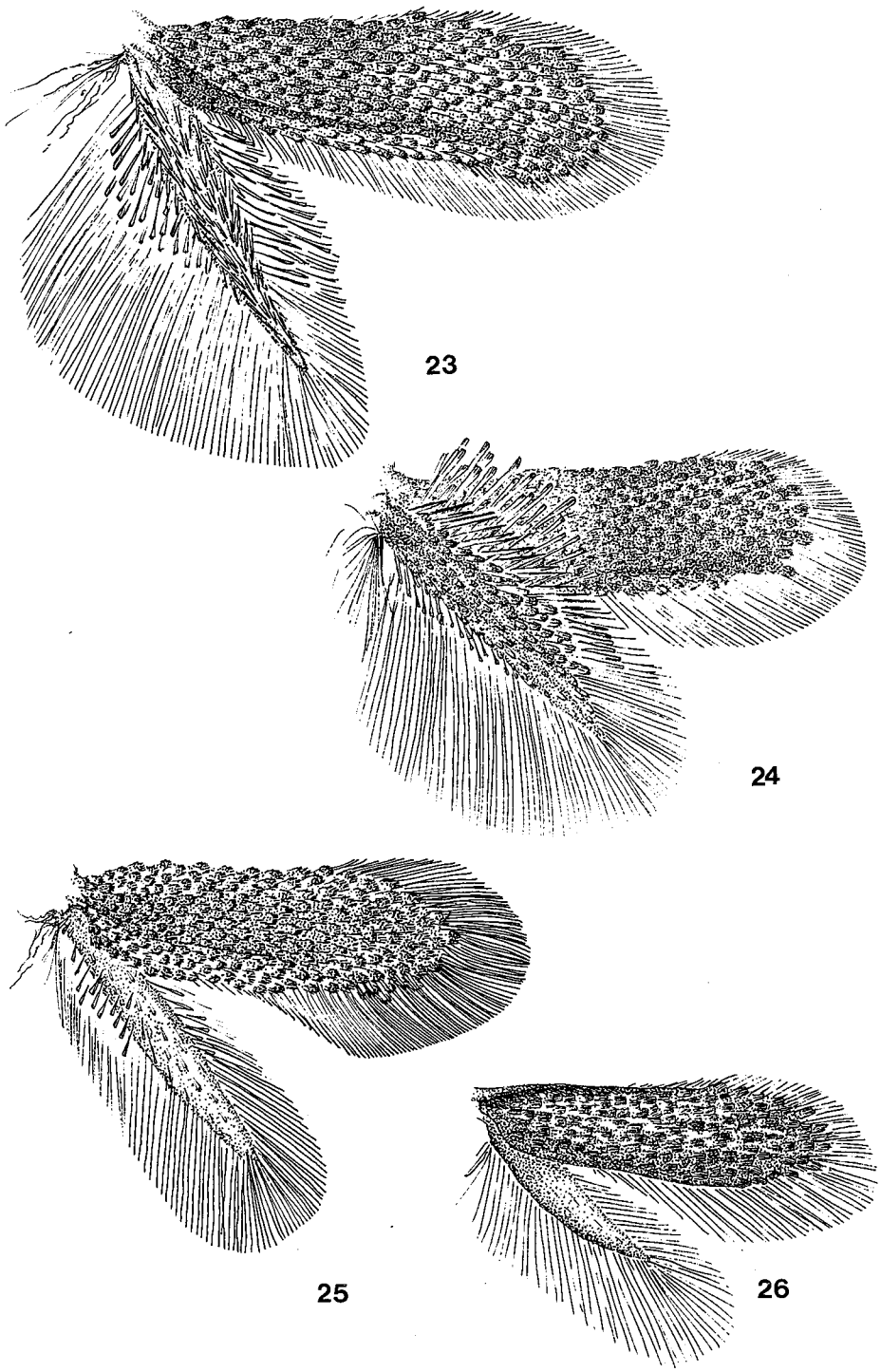


16

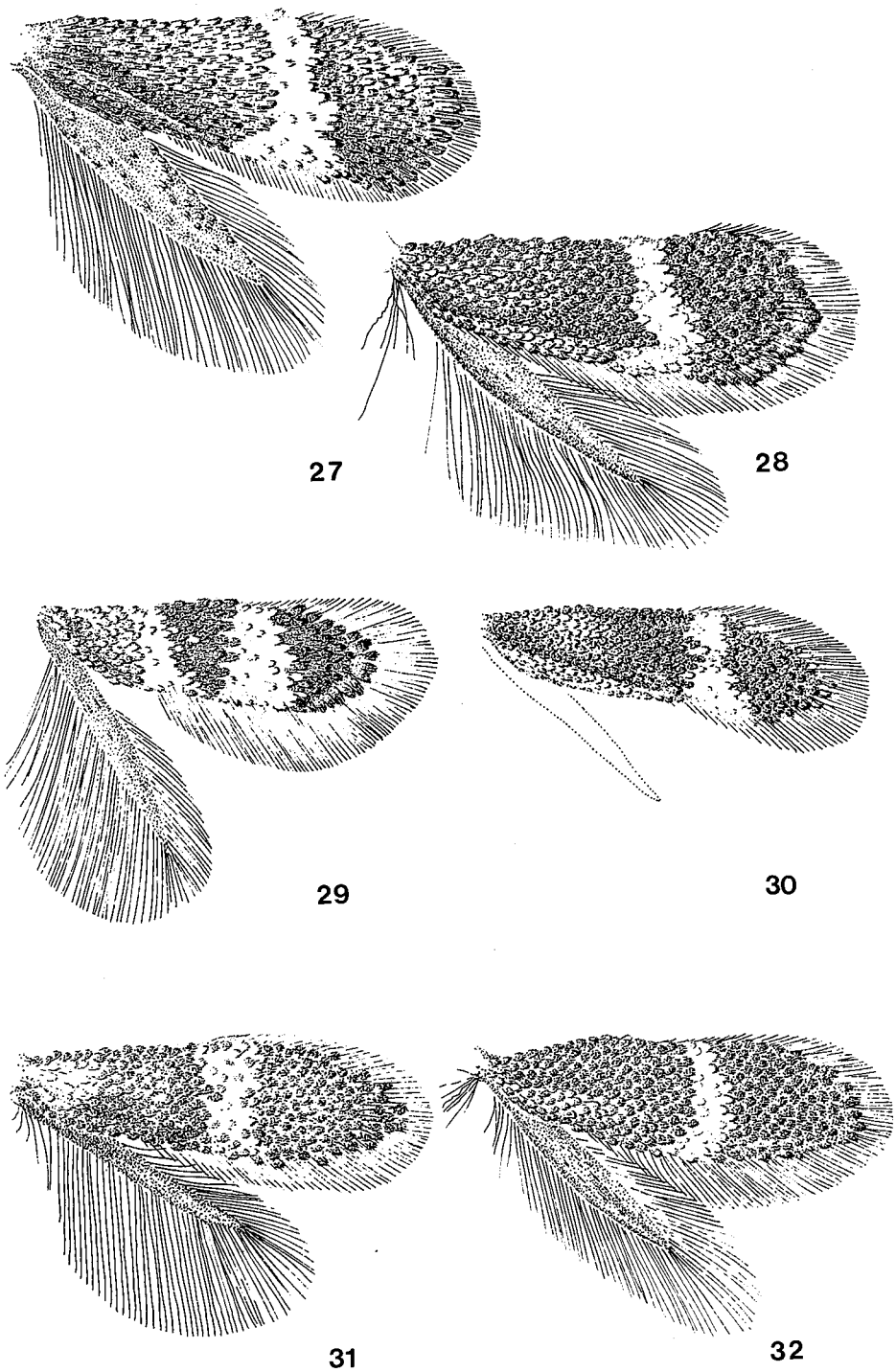
Figs. 11-16. External features of *Stigmella* spp.: 11, *alaurulenta*; 12, *honshui*; 13, *japonica*: 14, *chaenomelae*; 15, *orientalis*; 16, *nakamurai*.



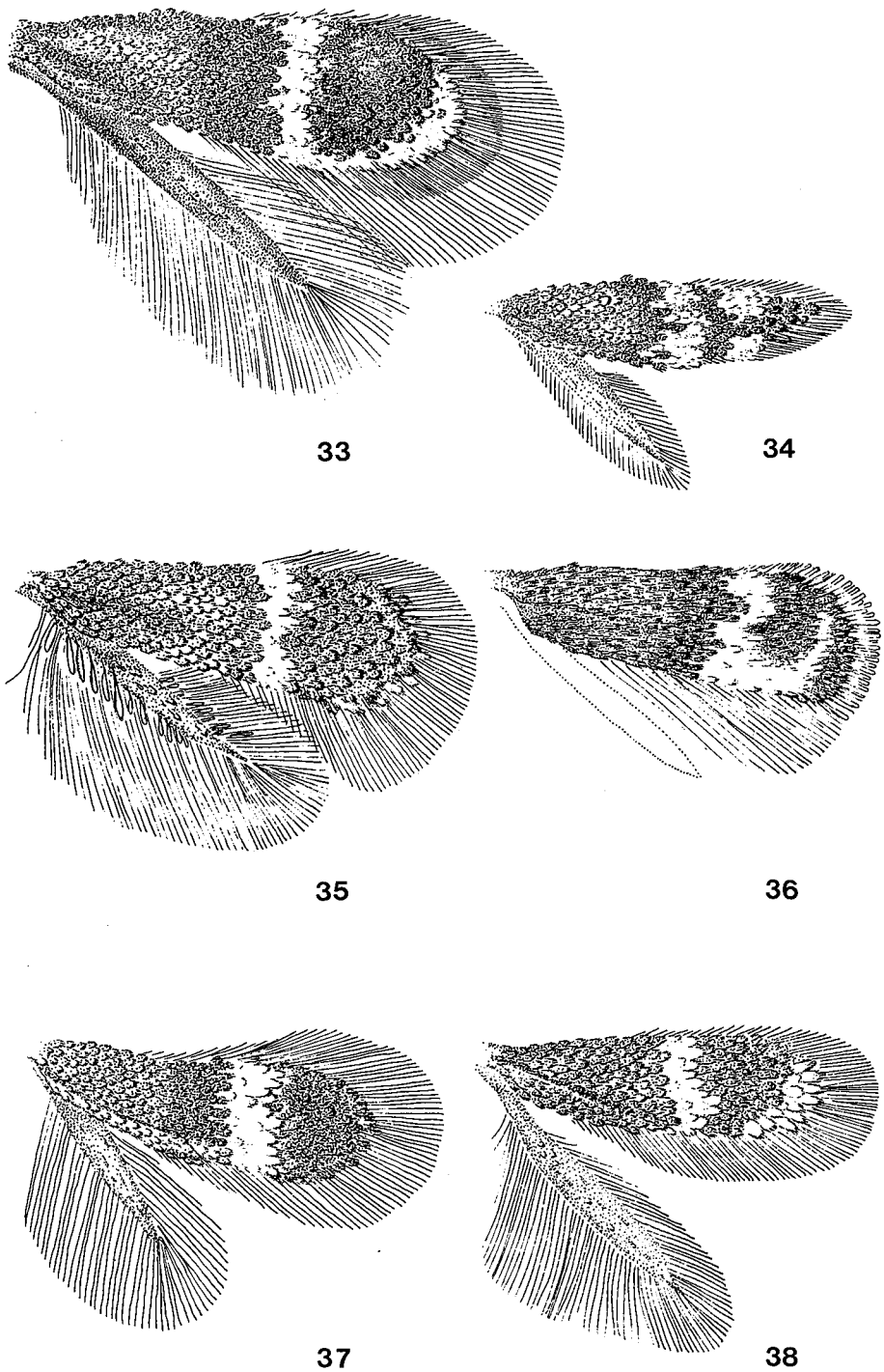
Figs. 17-22. External features of *Stigmella* spp.: 17, *ichigoiella*; 18, *alikurokoi*; 19, *acrochaetia*; 20, *spiculifera*; 21, spec. a; 22, *gimmonella* (not HT).



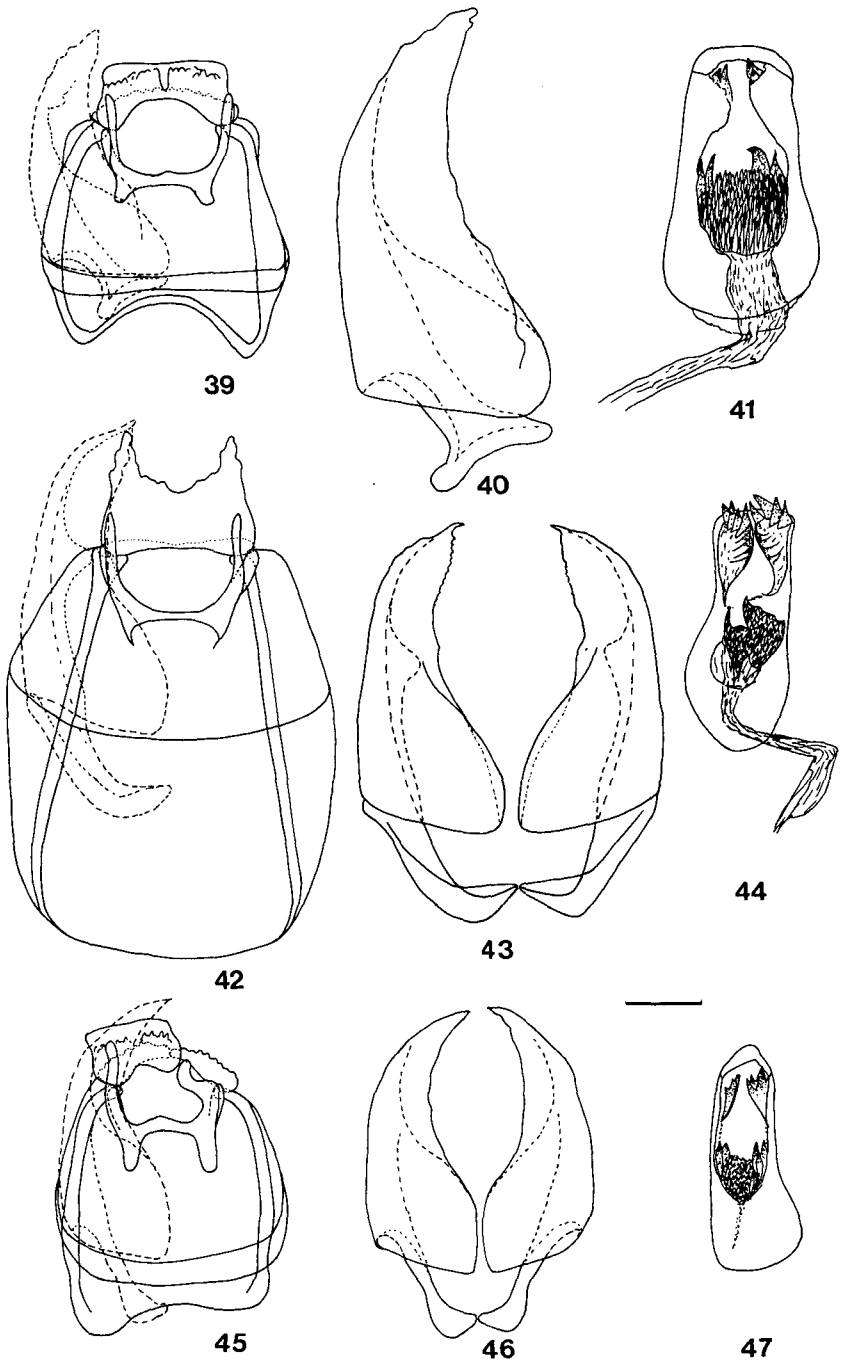
Figs. 23-26. External features of *Stigmella* spp.: 23, *fumida*, dorsal side; 24, *fumida*, ventral side; 25, *kumatai*; 26, *kurotsubarai*.



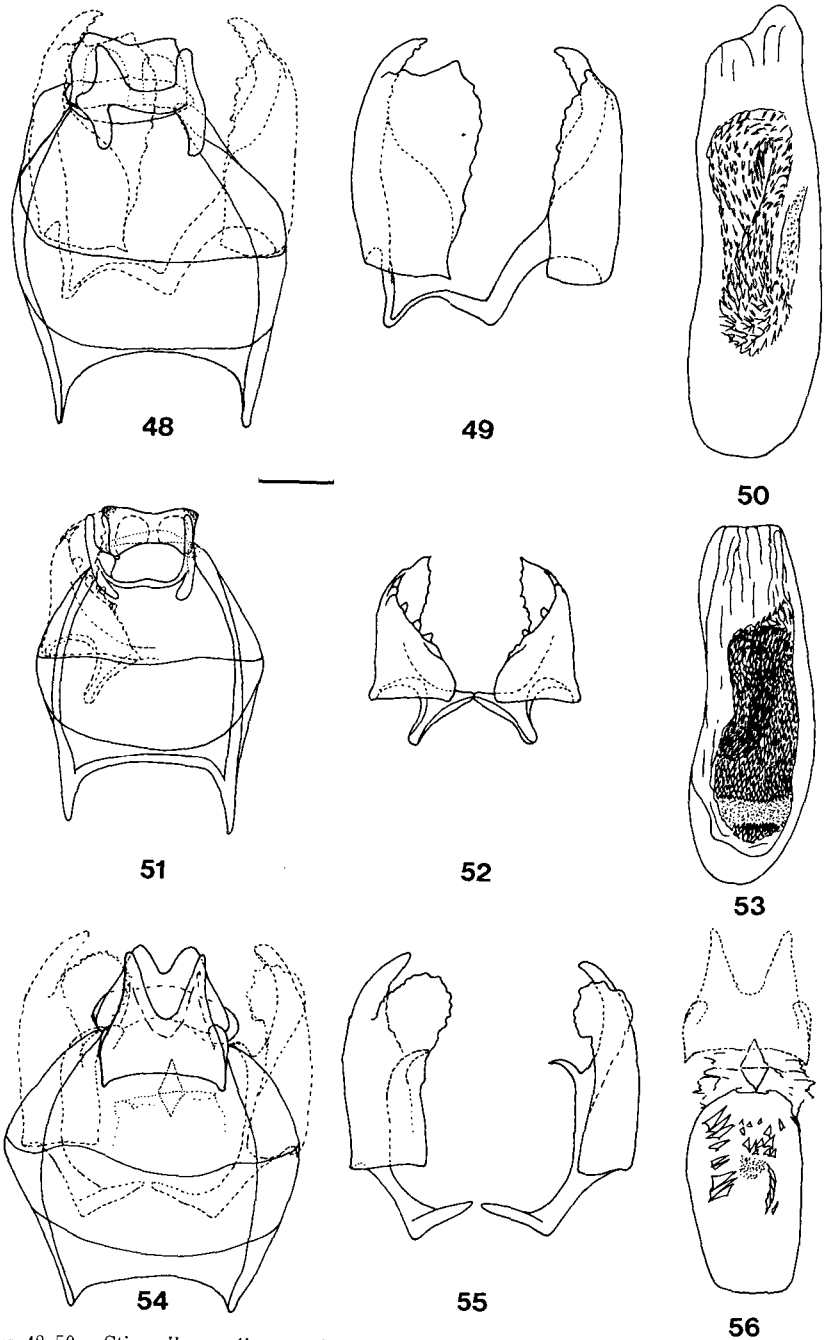
Figs. 27-32. External features of *Stigmella* spp.: 27, *castanopsiella*; 28, *zelkoviella*; 29, *boehmeriae*; 30, *valvaurigemmata*; 31, *tranocrossa*; 32, *vittata*.



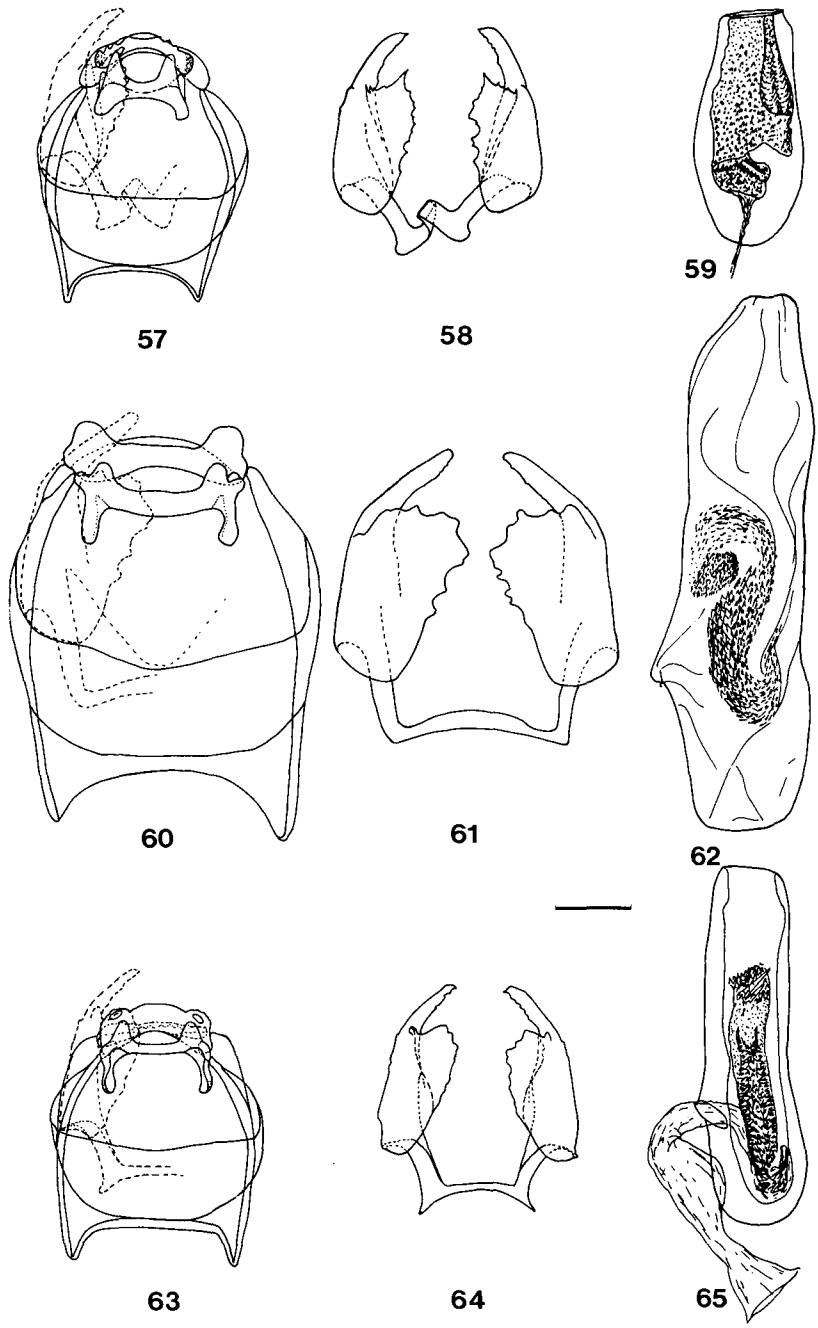
Figs. 33-38. External features of *Stigmella* spp.: 33, *oa*; 34, *caesurifasciella*; 35, *clisiotophora*; 36, *egregilustrata*; 37, *egonokii*; 38, *sesplicata*.



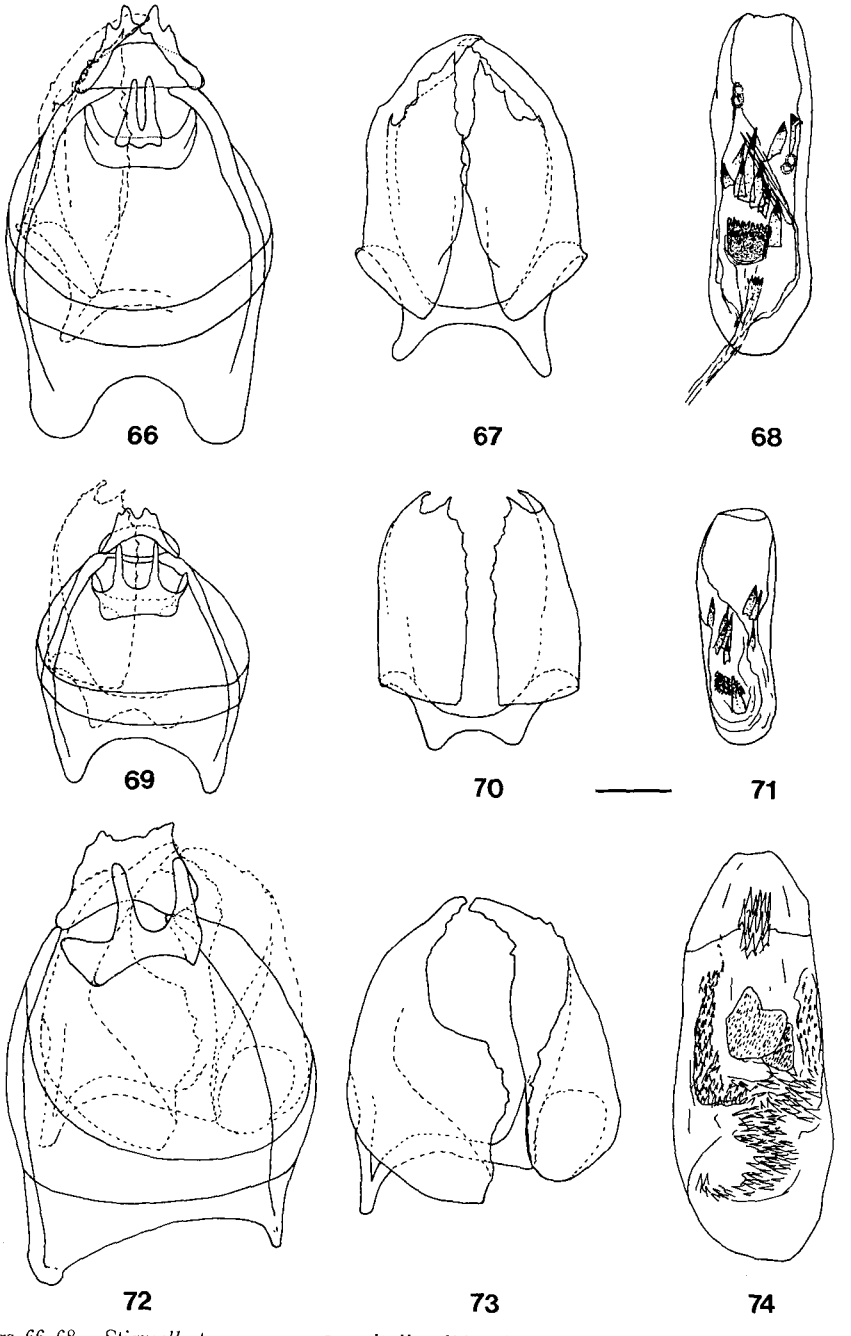
Figs. 39-41. *Stigmella betulicola*, ♂ genitalia, slide VU no. 0432 (not HT). 39, capsule, scale : 53.8 μm ; 40, valve, scale : 34.3 μm ; 41, aedeagus, scale : 31.6 μm.
Figs. 42-44. *Stigmella cathepostis*, ♂ genitalia, slide VU no. 0431 (not HT). 42, capsule, scale : 55.7 μm ; 43, valves, scale : 55.7 μm ; 44, aedeagus, scale : 51.8 μm.
Figs. 45-47. *Stigmella titivillitia*, ♂ genitalia, slide VU no. 0699. 45, capsule, scale : 55.5 μm ; 46, valves, scale : 55.5 μm ; 47, aedeagus, scale : 55.5 μm.



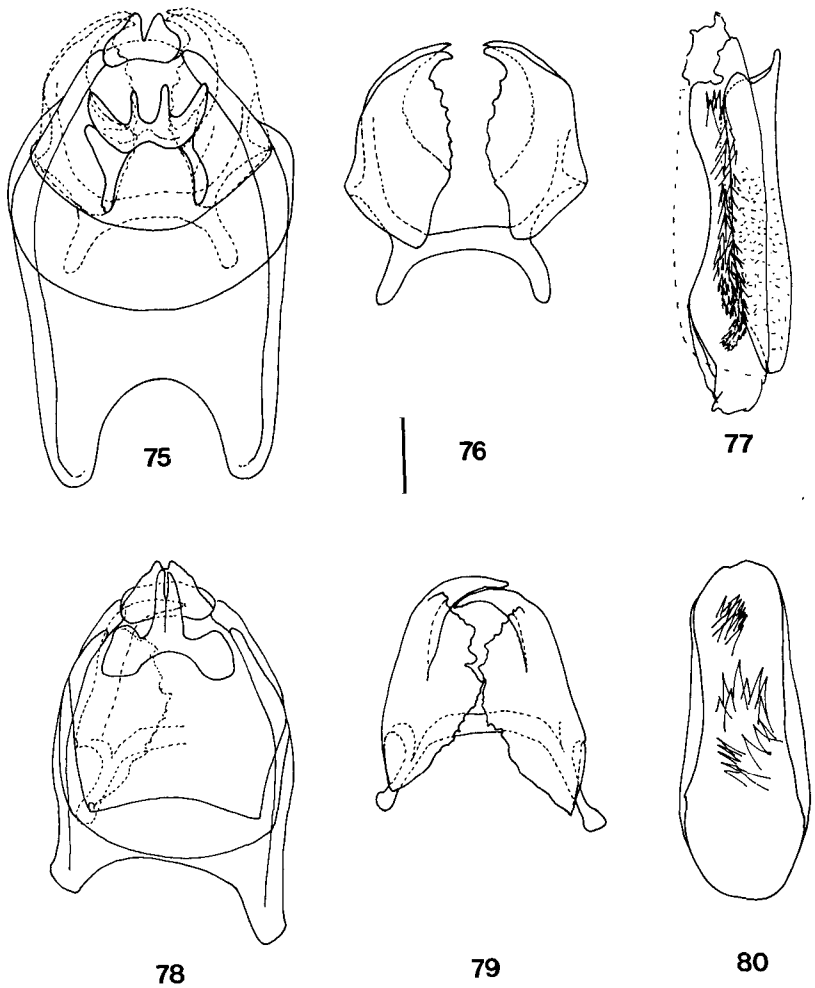
Figs. 48-50. *Stigmella zumii*, ♂ genitalia, slide VU no. 0775. 48, capsule, scale : 44.6 μm ; 49, valves, scale : 44.6 μm ; 44, aedeagus, scale : 44.6 μm.
Figs. 51-53. *Stigmella japonica*, ♂ genitalia, slide VU no. 0667. 52, capsule, scale : 67.7 μm ; 52, valves, scale : 67.7 μm ; 53, aedeagus, scale : 67.7 μm.
Figs. 54-56. *Stigmella nakamurai*, ♂ genitalia, slide VU no. 0791. 54, capsule, scale : 49.8 μm ; 55, valves, scale : 49.8 μm ; 56, aedeagus, scale : 49.8 μm.



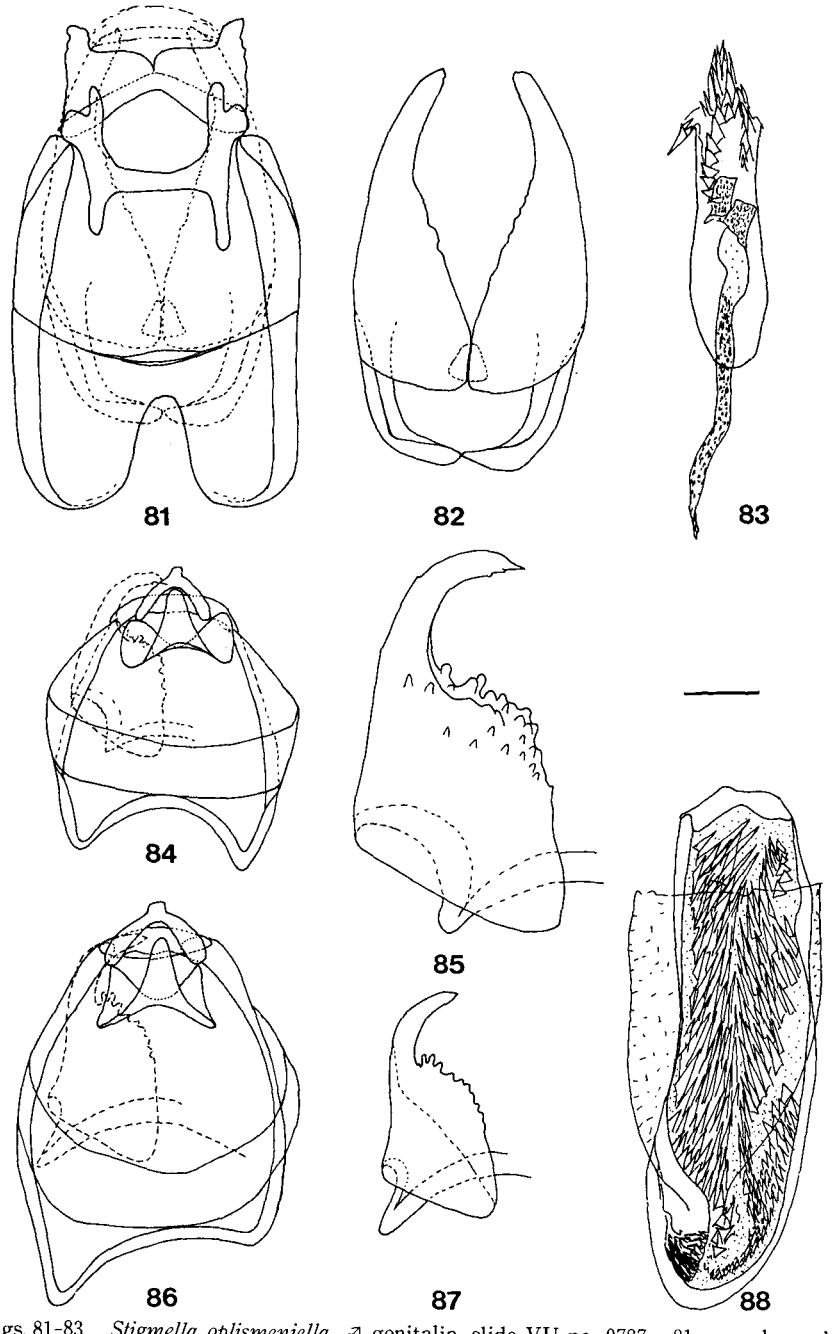
Figs. 57-59. *Stigmella chaenomelae*, ♂ genitalia, slide VU no. 0703. 57, capsule, scale: 54.1 μm; 58, valves, scale: 54.1 μm; 59, aedeagus, scale; 54.1 μm.
Figs. 60-62. *Stigmella honshui*, ♂ genitalia, slide VU no. 0784. 60, capsule, scale: 45.3 μm; 61, valves, scale: 45.3 μm; 62, aedeagus, scale: 45.3 μm.
Figs. 63-65. *Stigmella sorbivora*, ♂ genitalia, slide VU no. 0690. 63, capsule, scale: 56.2 μm; 64, valves, scale: 56,2 μm; aedeagus, scale: 56.2 μm.



Figs. 66-68. *Stigmella tranocrossa*, ♂ genitalia, slide VU no. 0696. 66, capsule, scale : 55.3 μm ; 67, valves, scale : 55.3 μm ; 68, aedeagus, scale : 55.3 μm.
Figs. 69-71. *Stigmella vittata*, ♂ genitalia, slide VU no. 0437. 69, capsule, scale : 69.1 μm ; 70, valves, scale : 69.1 μm ; 71, aedeagus, scale : 69.1 μm.
Figs. 72-74. *Stigmella kurotsubarai*, ♂ genitalia, slide VU no. 0782. 72, capsule, scale : 44.7 μm ; 73, valves, scale : 44.7 μm ; 74, aedeagus, scale : 44.7 μm.



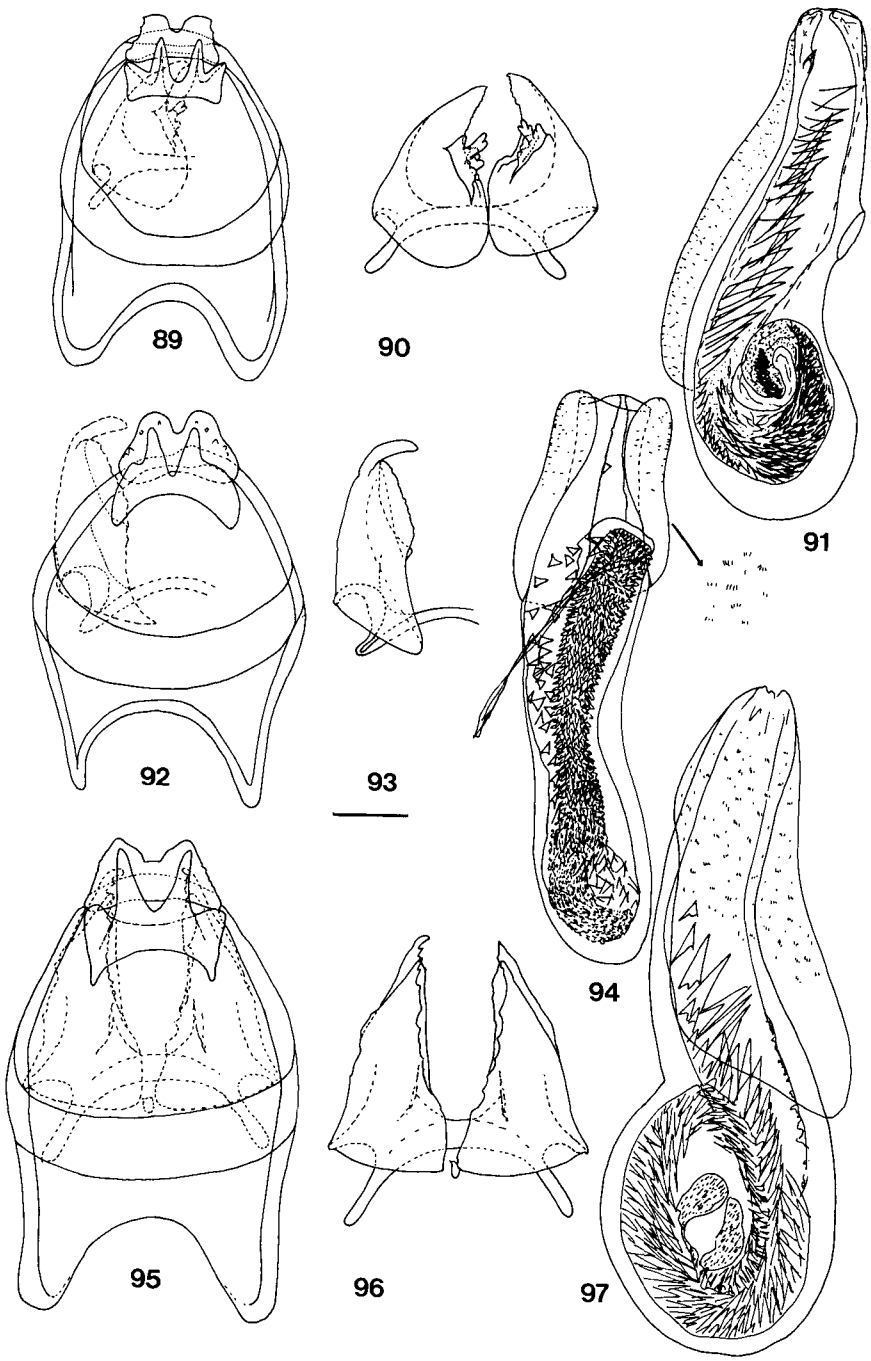
Figs. 75-77. *Stigmella gimmonella*, ♂ genitalia, slide VU no. 0792 (not HT). 75, capsule, scale: 45.2 μm; 76, valves, scale: 45.2 μm; 77, aedeagus, scale: 45.2 μm.
Figs. 78-80. *Stigmella alikurokoi*, ♂ genitalia, slide VU no. 0658 (not HT). 78, capsule, scale: 50.4 μm; 79, valves, scale: 50.4 μm; 80, aedeagus, scale: 50.4 μm.



Figs. 81-83. *Stigmella oplismeniella*, ♂ genitalia, slide VU no. 0787. 81, capsule, scale : 63.2 μm ; 82, valves, scale : 63.2 μm ; 83, aedeagus, scale : 63.2 μm.

Figs. 84-85. *Stigmella caesurifasciella*, ♂ genitalia, slide VU no. 0674 (not HT). 84, capsule, scale : 68.5 μm ; 85, valve, scale : 32.9 μm.

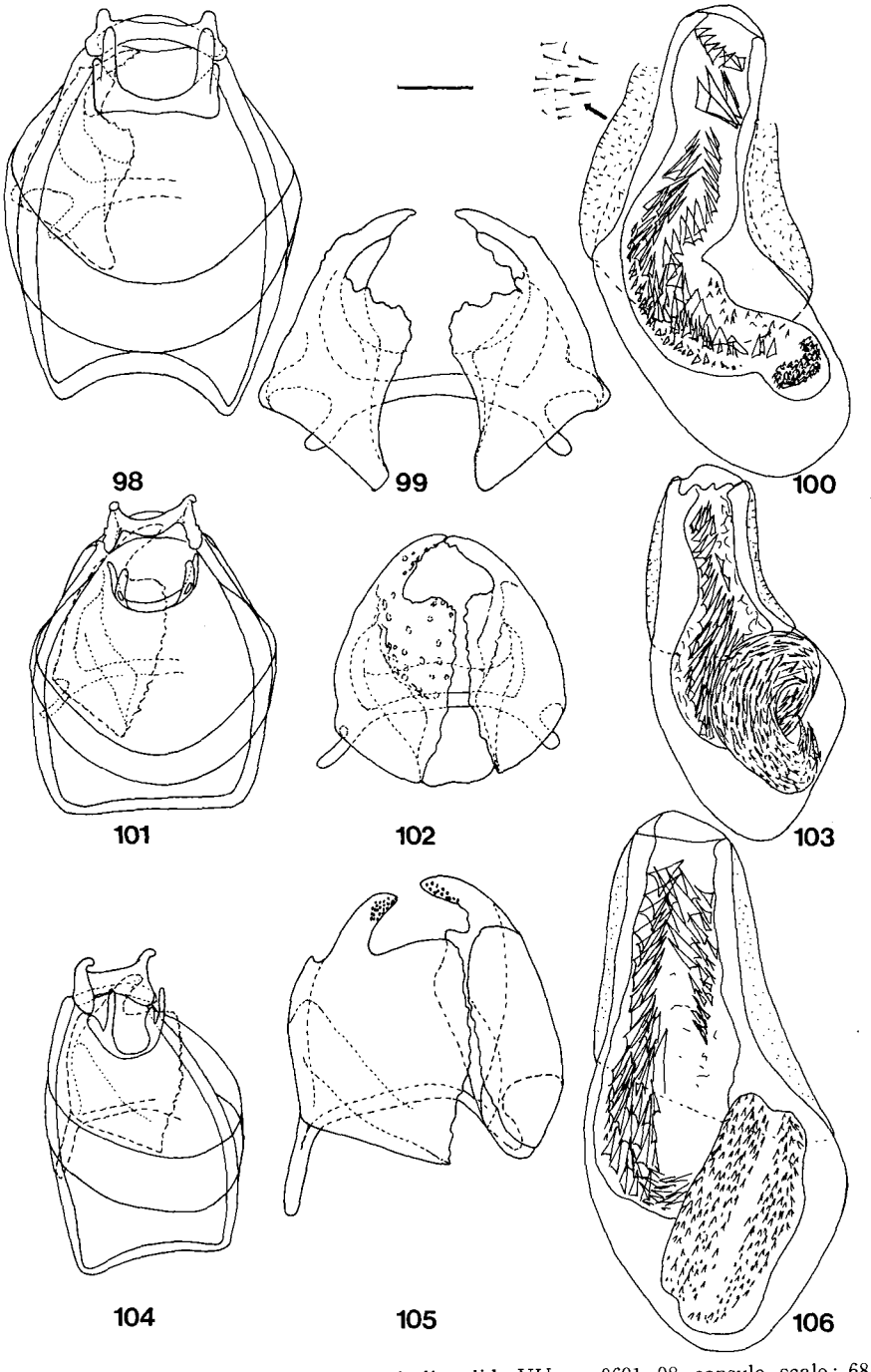
Figs. 86-88. *Stigmella egregilustrata*, ♂ genitalia, slide VU no. 0711. 86, capsule, scale : 53.9 μm ; 87, valve, scale : 53.9 μm ; 88, aedeagus, scale : 53.9 μm.



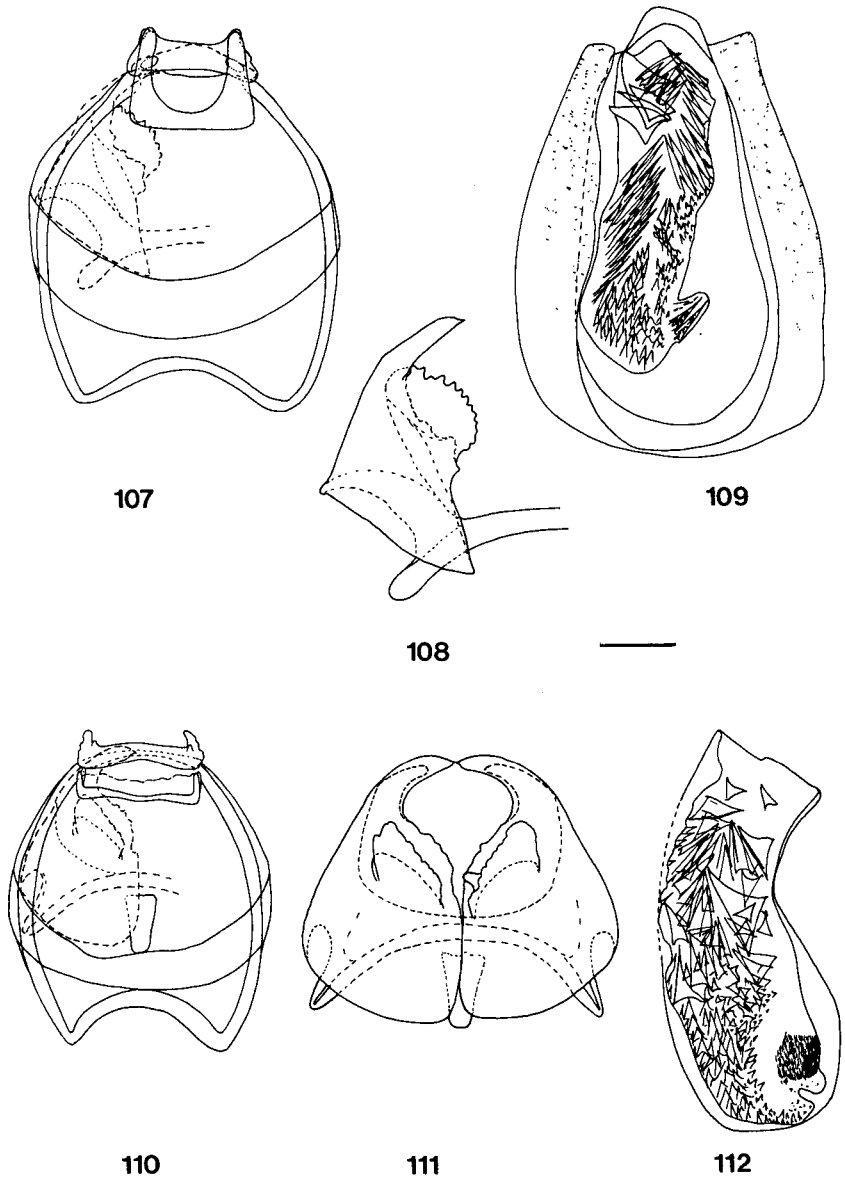
Figs. 89-91. *Stigmella valvaurigemmata*, ♂ genitalia, slide VU no. 0713. 89, capsule, scale : 68.8 μm ; 90, valves, scale : 54.4 μm ; 91, aedeagus, scale : 68.8 μm.

Figs. 92-94. *Stigmella zelkoviella*, ♂ genitalia, slide VU no. 0710. 92, capsule, scale : 55.9 μm ; 93, valve, scale : 55.9 μm ; 94, aedeagus, scale : 66.6 μm.

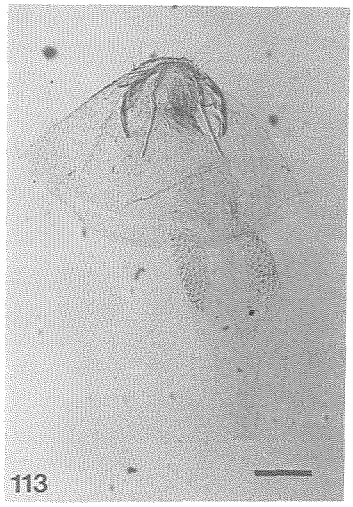
Figs. 95-97. *Stigmella castanopsiella*, ♂ genitalia, slide VU no. 0734 (not HT). 95, capsule, scale : 62.2 μm ; 96, valves, scale : 62.2 μm ; 97, aedeagus, scale : 62.2 μm.

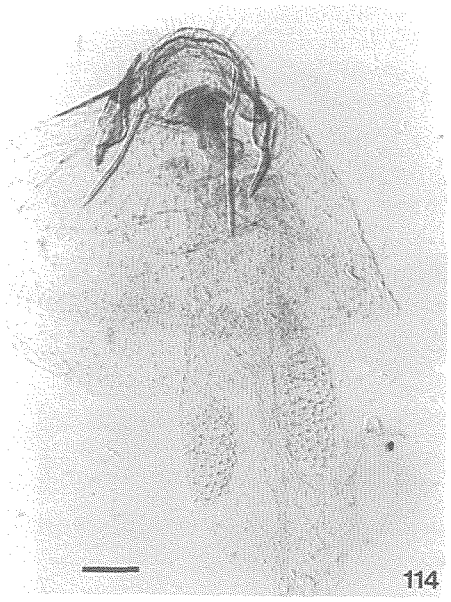


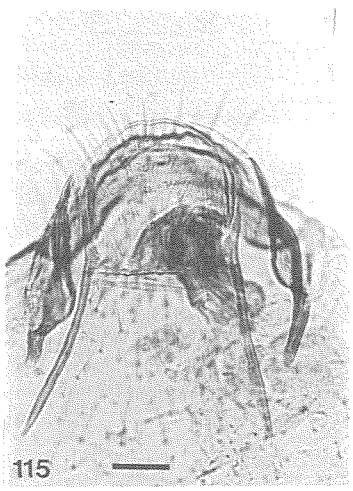
Figs. 98-100. *Stigmella fumida*, ♂ genitalia, slide VU no. 0691. 98, capsule, scale: 68.8 μm; 99, valves, scale: 55.2 μm; 100, aedeagus, scale: 66.4 μm.
Figs. 101-103. *Stigmella quercifaga*, ♂ genitalia, slide VU no. 0705. 101, capsule, scale: 66.1 μm; 102, valves, scale: 63.9 μm; 103, aedeagus, scale: 68.1 μm.
Figs. 104-106. *Stigmella pulla*, ♂ genitalia, slide VU no. 0727. 104, capsule, scale: 84.0 μm; 105, valves, scale: 54.5 μm; 106, aedeagus, scale: 54.9 μm.

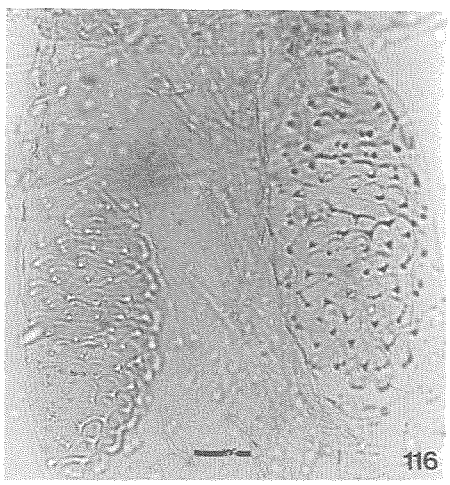


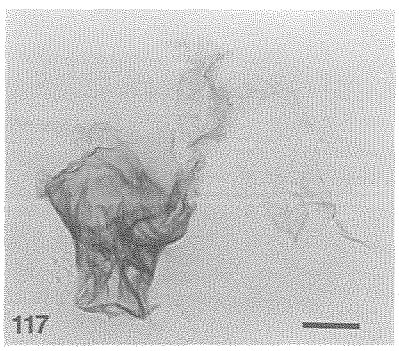
Figs. 107-109. *Stigmella kumatai*, ♂ genitalia, slide VU no. 0733. 107, capsule, scale : 64. 7 μm ; 108, valve, scale : 53.2 μm ; 109, aedeagus, scale : 68.0 μm.
Figs. 110-112. *Stigmella clisiotophora*, ♂ genitalia, slide VU no. 0692. 110, capsule, scale : 71.2 μm ; 111, valves, scale : 51.4 μm ; 112, aedeagus, scale : 67.5 μm.





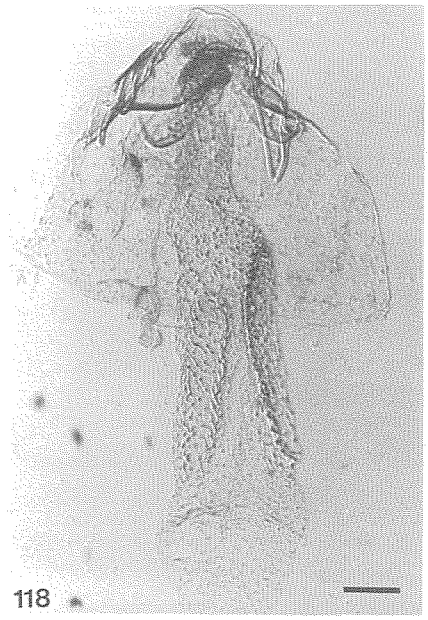


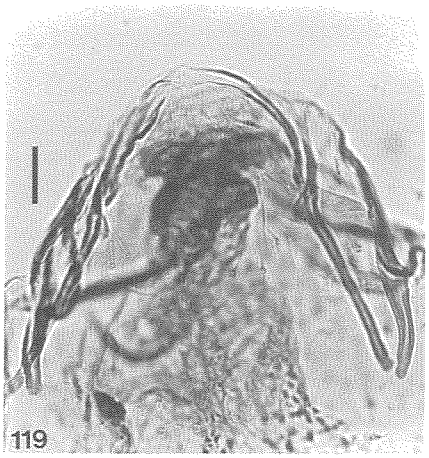


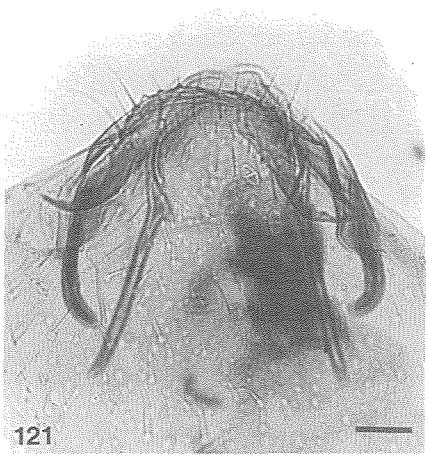


Figs. 113-116. *Stigmella populnea*, ♀ genitalia. 113, holotype, slide VU no. 0694, scale: 113.4 μm; 114, paratype, slide VU no. 0716, scale: 66.8 μm; 115, idem, detail of terminalia, scale: 41.1 μm; 116, idem, detail of signa on bursa copulatrix, scale: 25.6 μm.

Fig. 117. *Stigmella betulicola*, parts of ♀ genitalia, slide VU. no. 0735, showing ductus bursae, accessory sac and rest of bursa copulatrix, scale: 25.4 μm.

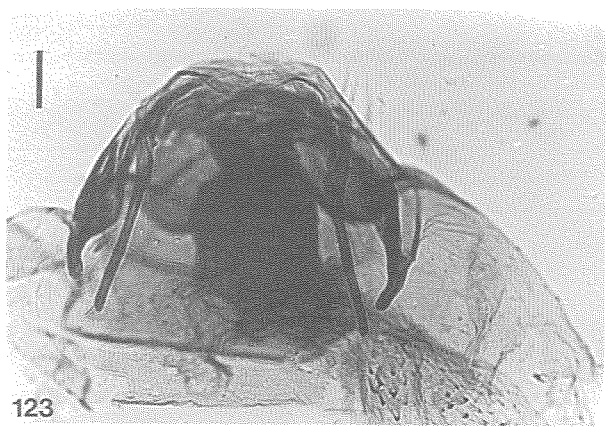


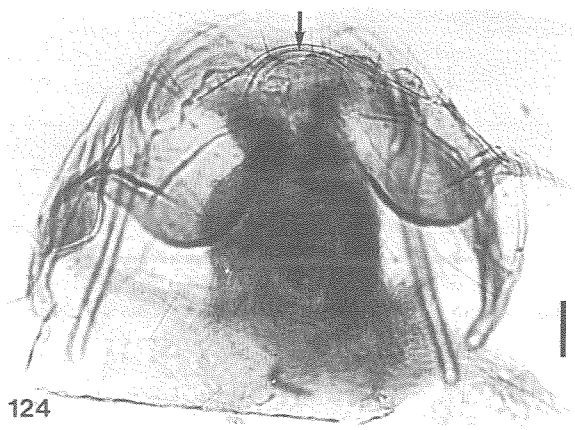




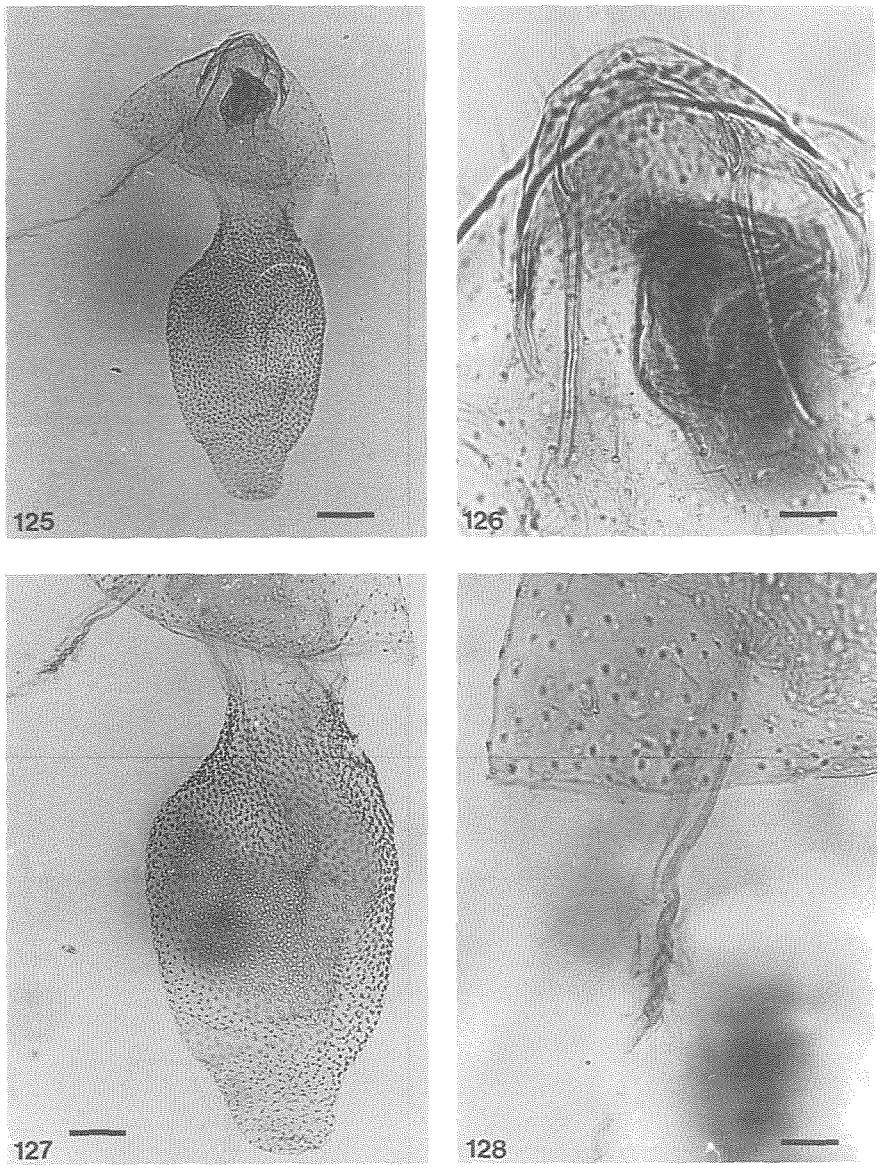
Figs. 118-119. *Stigmella conchiliata*, ♀ genitalia. 118, holotype, slide VU no. 0697, scale: 71.7 μm ; 119, idem, detail of terminalia, scale: 35.7 μm.

Figs. 120-121. *Stigmella titivillitia*, ♀ genitalia. 120, paratype, slide VU no. 0728, scale: 71.9 μm ; 121, idem, detail of terminalia, scale: 34.8 μm.

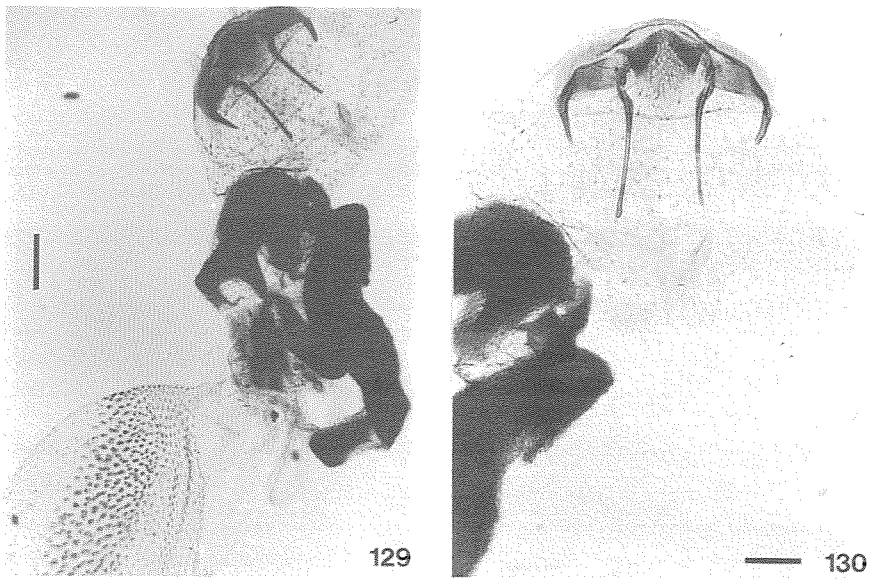


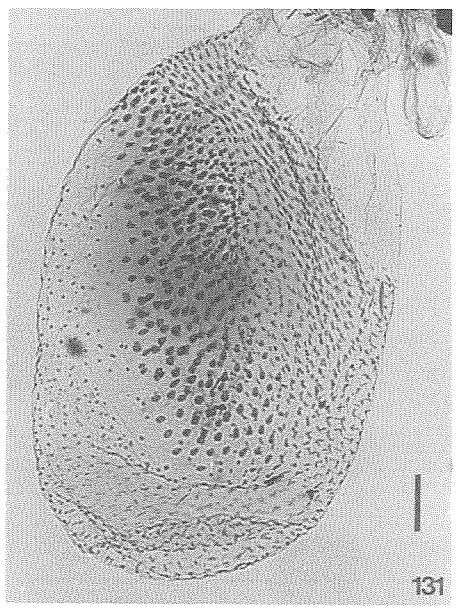


Figs. 122-124. *Stigmella oplismeniella*, ♀ genitalia. 122, paratype, slide VU no. 0684, scale : 91 μm ; 123, idem, detail of terminalia, scale : 44.4 μm ; 124, idem, arrow indicates bow-like sclerotisations on 8th tergite, scale : 31.2 μm.

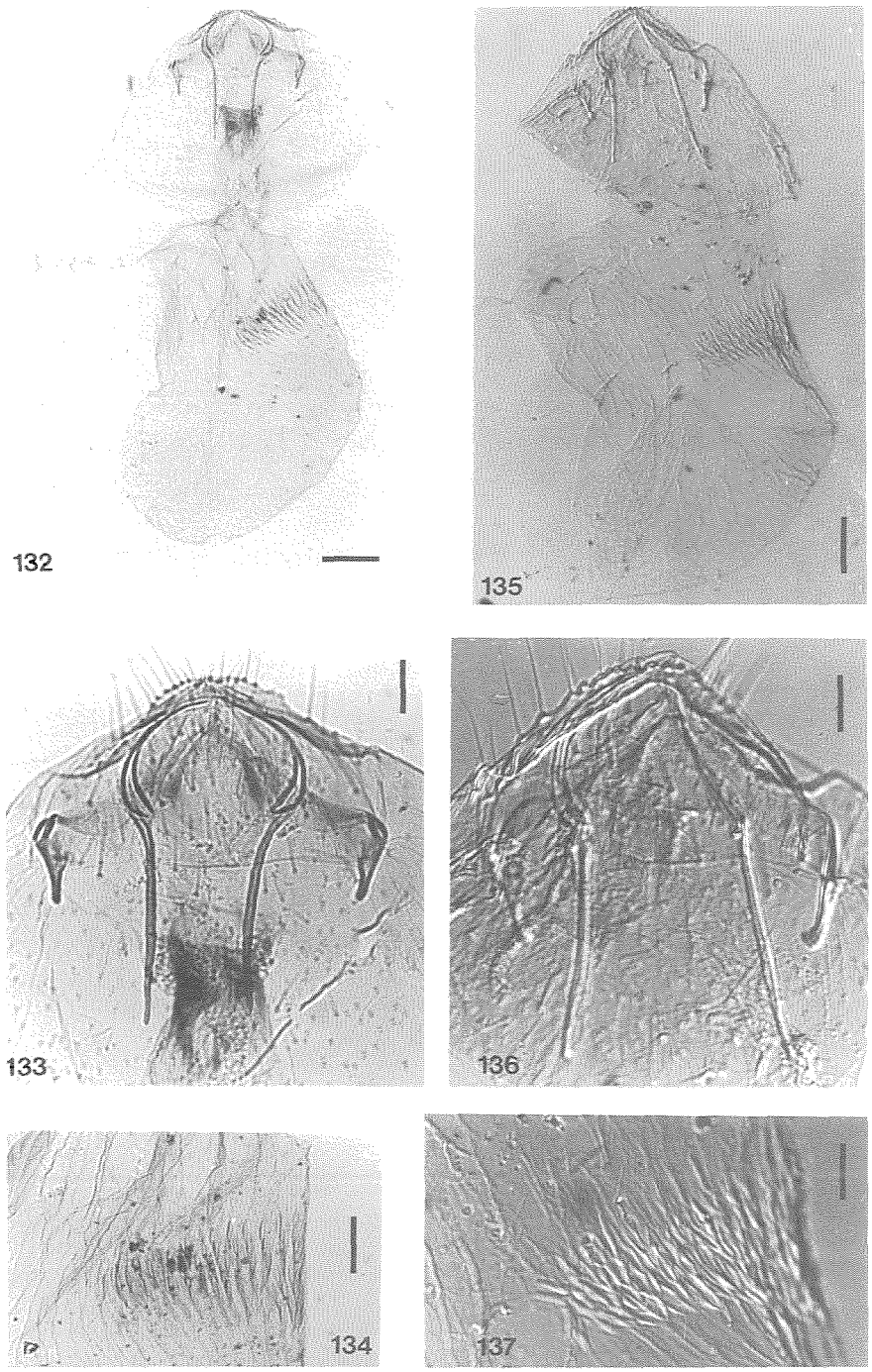


Figs. 125-128. *Stigmella nakamurai*, ♀ genitalia. 15, paratype, slide VU no. 0789, scale : 107 μm ; 126, idem, detail of apophyses, scale : 26.3 μm ; 127, idem, detail of bursa copulatrix, scale : 64 μm ; 128, idem, detail of coiled ductus spermathecae, scale : 24.3 μm.

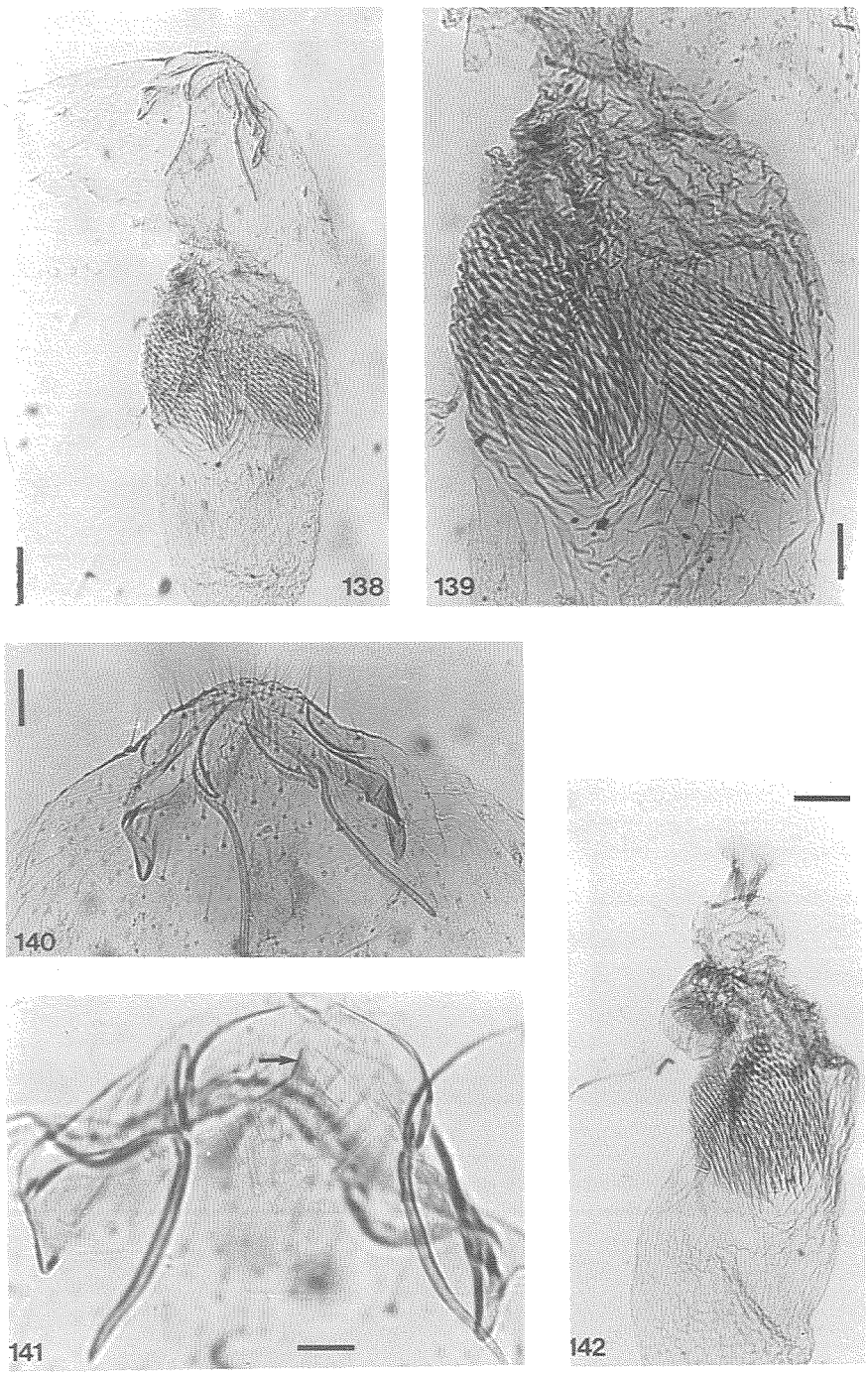




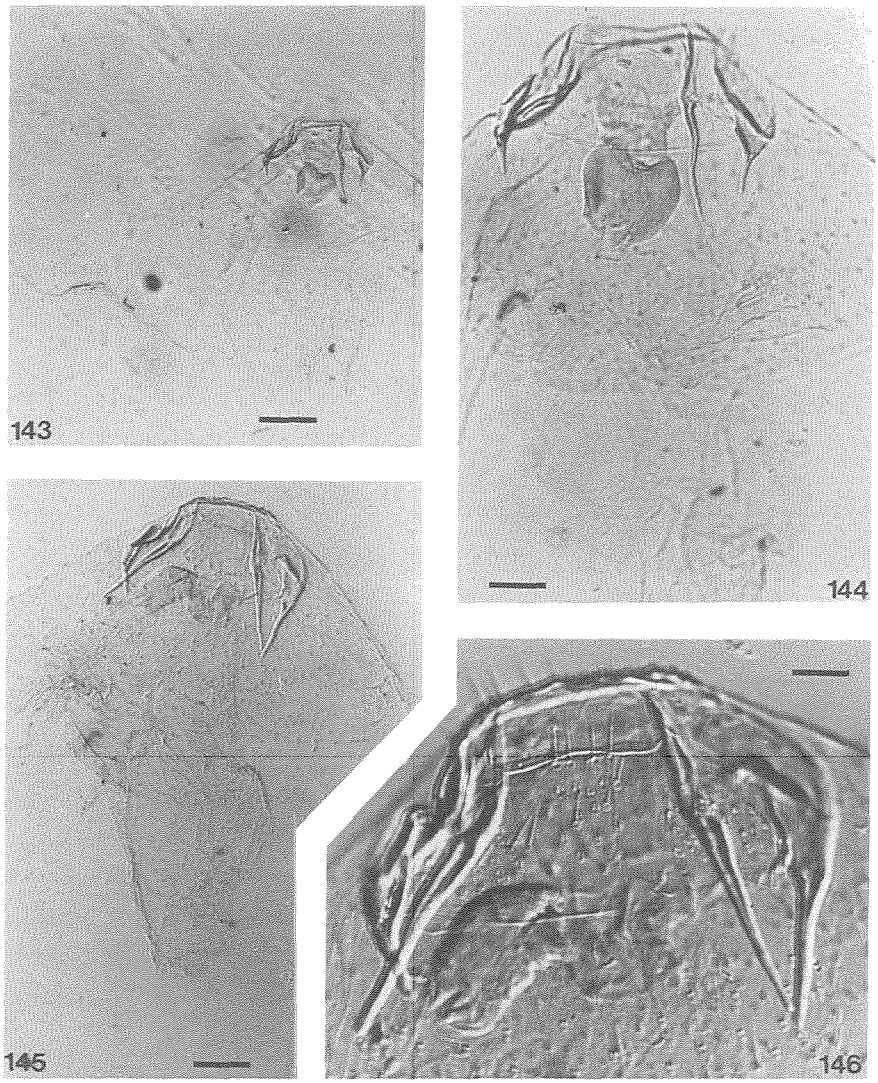
Figs. 129-131. *Stigmella nireae*, ♀ genitalia. 129, holotype, slide no. SN-30 (Nakamura), scale: 106 μm; 130, idem, detail of terminalia, scale: 67.8 μm; 131, idem, detail of bursa copulatrix, note signum with single spines on large base plates, scale: 65.9 μm.



Figs. 132-137. *Stigmella japonica*, ♀ genitalia. 132, paratype, slide VU no. 0436, scale: 84.6 μm; 133, idem, detail of terminalia, scale: 33.2 μm; 134, idem, detail of signum on bursa copulatrix, scale: 42.3 μm; 135, paratype, idem, slide VU no. 0668, scale: 66.7 μm; 136, idem, detail of ductus spermathecae, scale: 16.2 μm; 137, idem, detail of bursa copulatrix, scale: 7.7 μm.

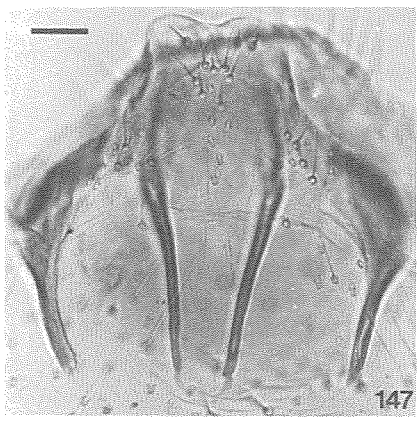


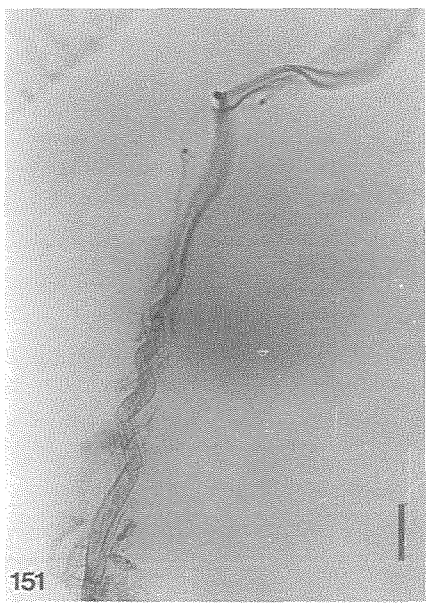
Figs. 138-142. *Stigmella orientalis*, ♀ genitalia. 138, paratype, slide VU no. 0430, scale: 85.3 μm; 139, idem, detail of signa, scale: 41.5 μm; 140, idem, detail of terminalia, scale: 41.5 μm; 141, holotype, slide VU no. 0730, detail of terminalia, note pointed caudal margin of 8th tergite (arrow), scale: 26 μm; 142, idem, detail of bursa copulatrix with signa, ductus bursae and accessory sac with ductus spermathecae, scale: 58 μm.

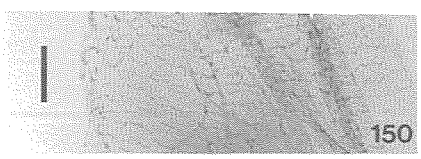


Figs. 143-144. *Stigmella chaenomelae*, ♀ genitalia. 143, paratype, slide VU no. 0704, scale : 106 μm ; 144, idem, detail of terminalia, scale : 43.1 μm.

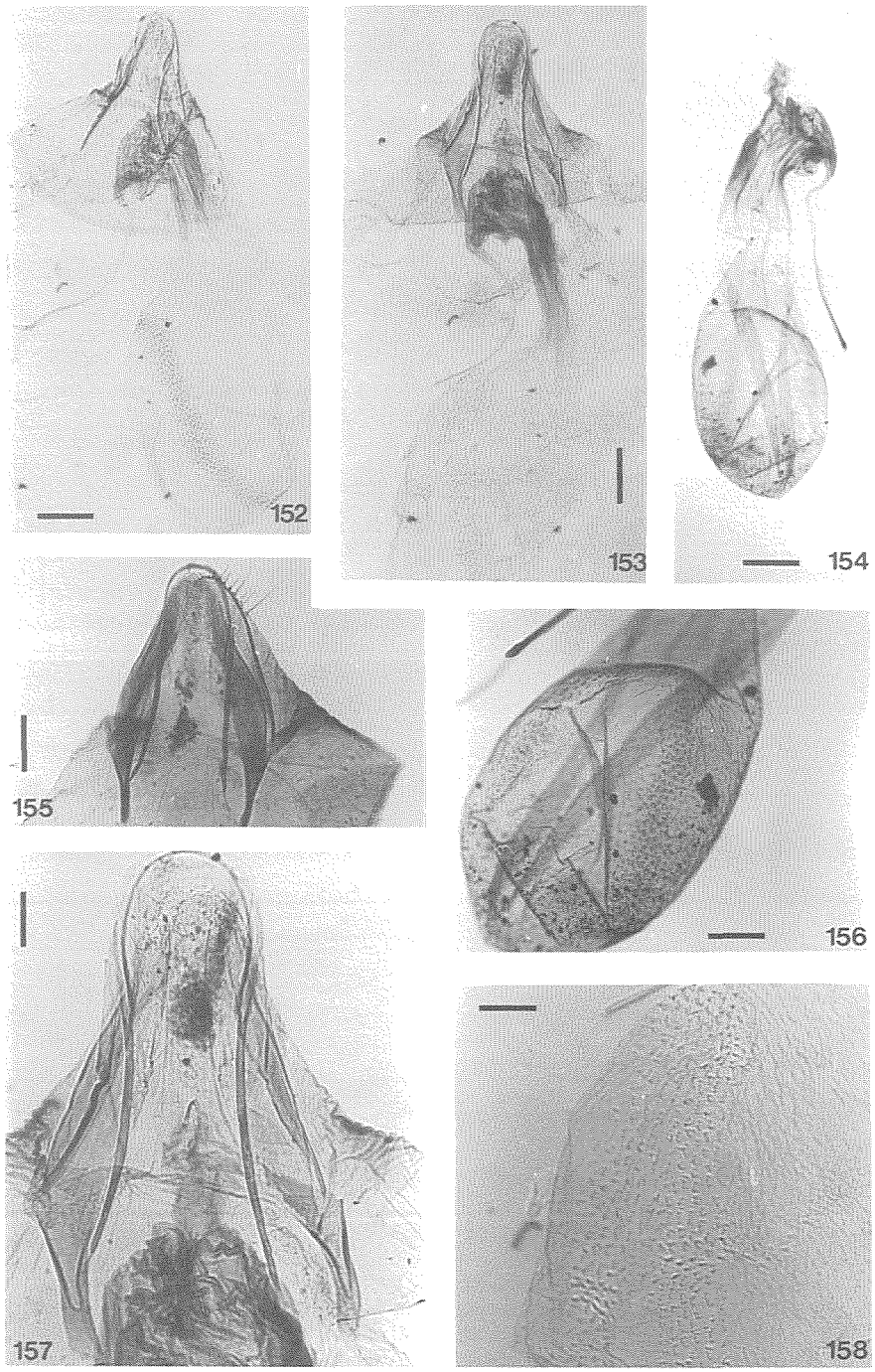
Figs. 145-146. *Stigmella alaurulenta*, ♀ genitalia. 145, holotype, slide VU no. 0702, scale : 68.2 μm ; 146, idem, detail of terminalia, scale : 25.9 μm.



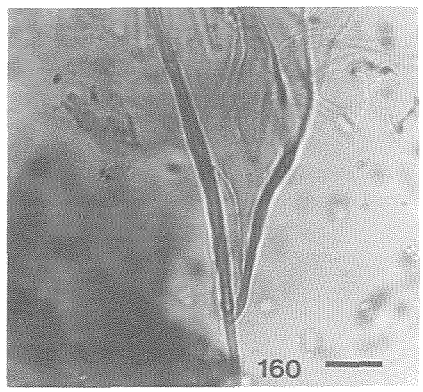


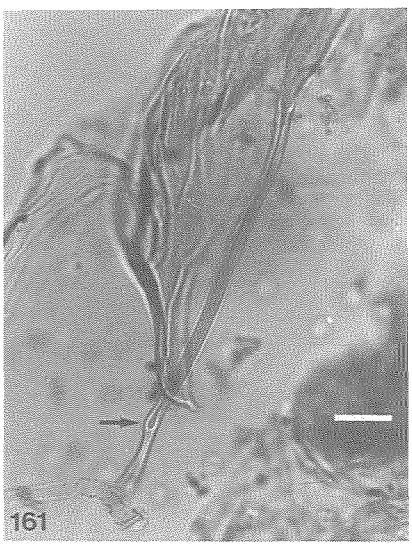


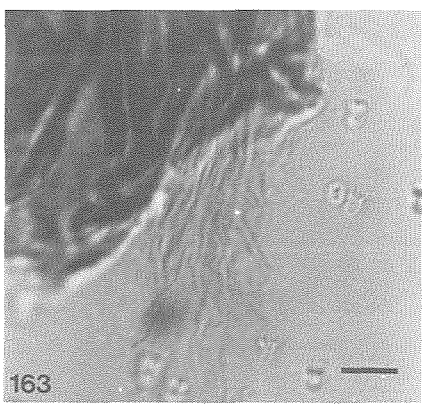
Figs. 147-151. *Stigmella zumii*, ♀ genitalia. 147, paratype, slide VU no. 0781, scale: 23 μm, detail of terminalia; 148, idem, detail of bursa copulatrix and accessory sac, scale: 66.9 μm; 149, paratype, idem, slide VU no. 0777, scale: 68.4 μm; 150, idem, detail of bursa copulatrix with scallop-like pectinations, scale: 36.1 μm; 151, idem, detail of ductus spermathecae, scale: 22.9 μm.

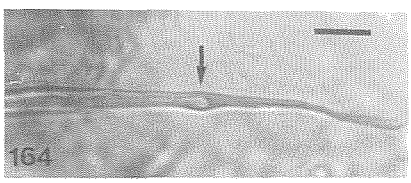


Figs. 152-158. *Stigmella vittata*, ♀ genitalia. 152, paratype, slide VU no. 0656, scale : 103.7 μm ; 153, paratype, slide VU no. 0679, scale : 107.7 μm ; 154, paratype, idem, slide VU no. 0780, scale : 115.3 μm ; 155, idem, detail of terminalia, scale : 67.6 μm ; 156, idem, detail of signa on bursa copulatrix, scale : 66.0 μm ; 157, as 153, detail of terminalia, scale : 41.3 μm ; 158, as 153, detail of signa on bursa copluatrix, scale : 40.5 μm.

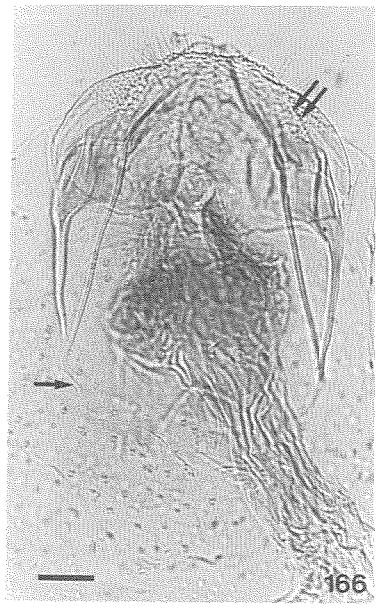






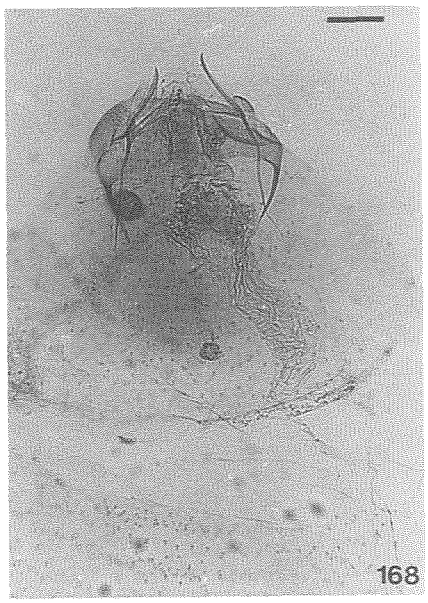


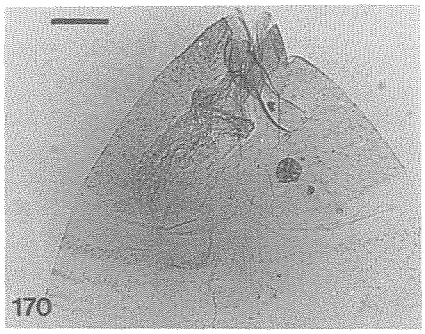
Figs. 159-164. *Stigmella alikurokoi*, ♀ genitalia. 159, slide VU no. 0786, general view, scale: 68 μm; 160, idem, detail of apophyses, scale: 18.5 μm; 161, idem, detail of posterior apophyses with thickened ending (arrow), scale: 18.5 μm; 162, paratype, slide VU no. 0659, scale: 41.2 μm; 163, idem, detail of ductus spermathecae, scale: 10.2 μm; 164, idem, detail of posterior apophyses with thickened ending (arrow), scale: 10.8 μm.

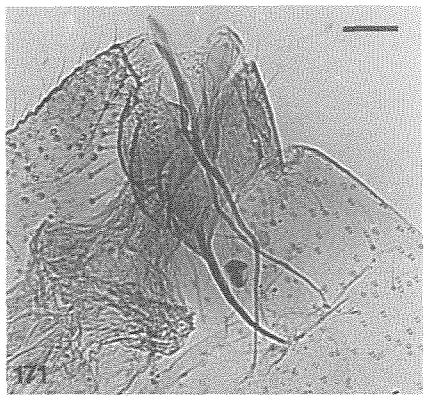


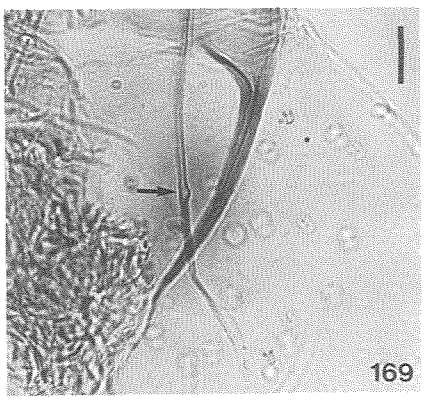
Figs. 165-166. *Stigmella acrochaetia*, ♀ genitalia. 165, holotype, slide VU no. 0712, scale : 66.8 μm ; 166, idem, detail of terminalia, note numerous spines caudally on dorsal side of outer membrane (double arrow) and tuft on apophyses endings (arrow), scale : 37 μm.

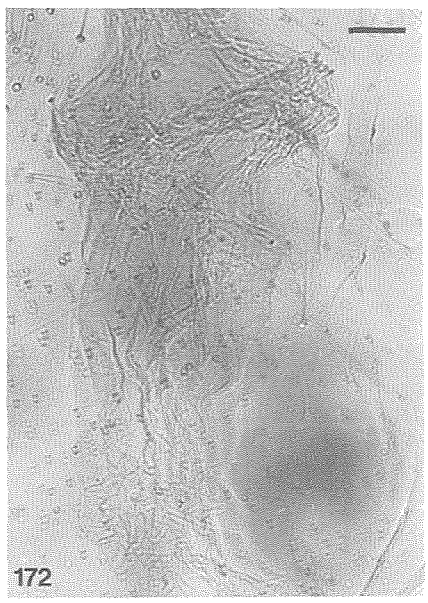
Fig. 167. *Stigmella* spec. a, ♀ genitalia, slide VU no. 0715, scale : 36.2 μm.



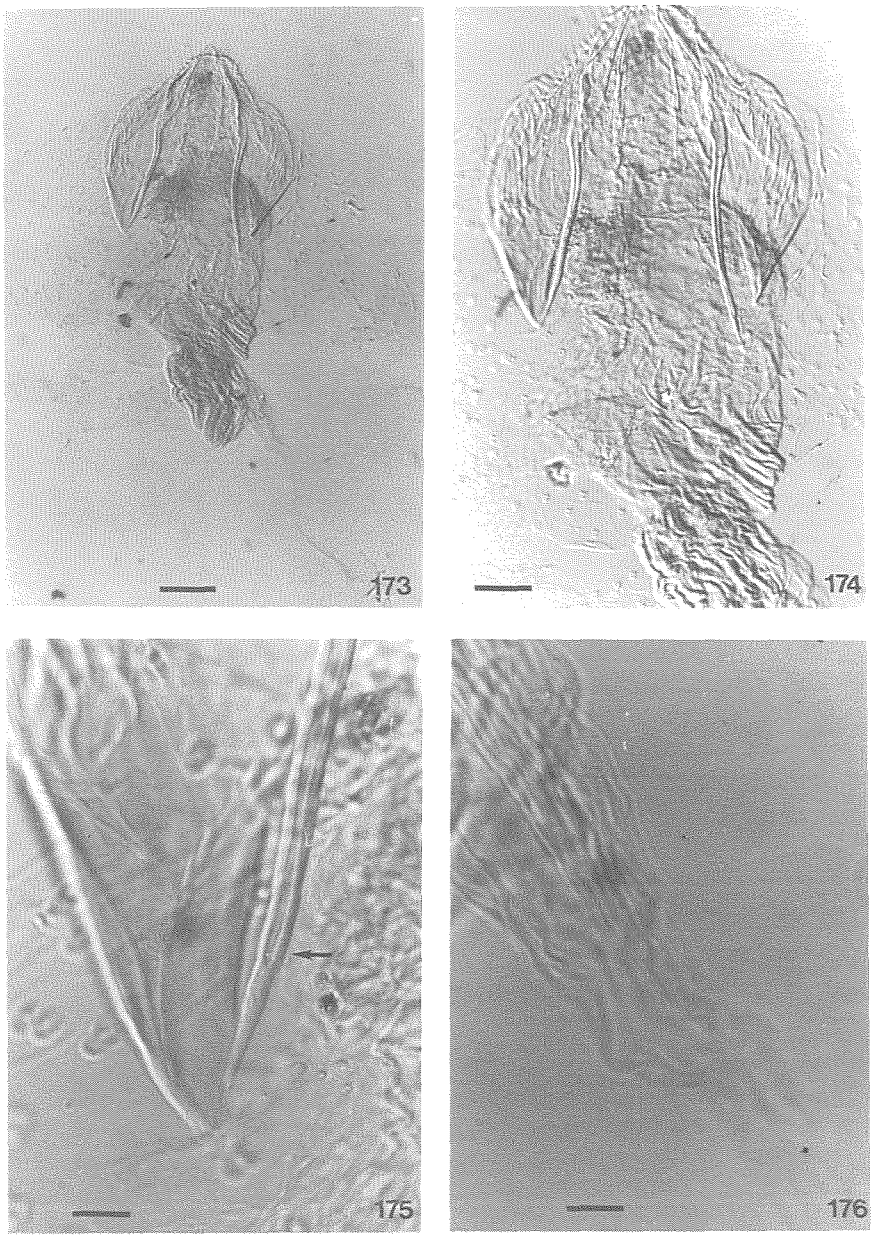




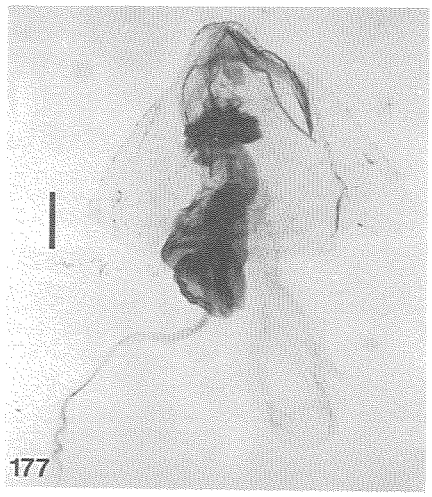


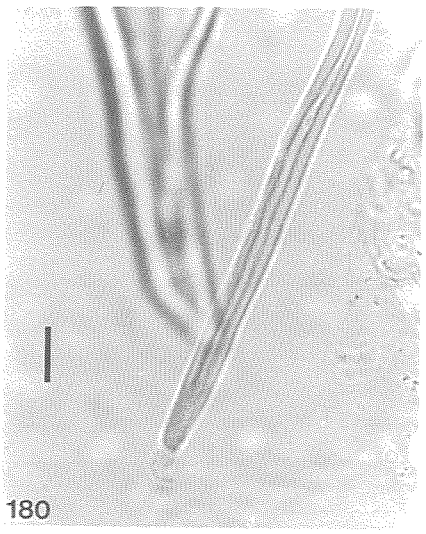


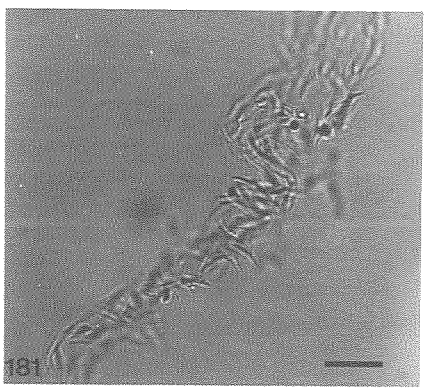
Figs. 168-172. *Stigmella gimnonella*, ♀ genitalia. 168, paratype, slide no. Npt-12 (Kumata), scale : 58.8 μm ; 169, idem, detail of apophyses, arrow indicates thickened cavity at ending posterior apophyses, scale : 14.5 μm ; 170, paratype, slide no. Npt-14 (Kumata), scale : 92.19 μm, lateral view ; 171, idem, detail of terminalia, scale : 35.8 μm ; 172, idem, detail of bursa copulatrix, scale : 23 μm.

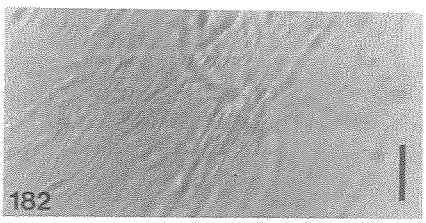


Figs. 173-176. *Stigmella ichigoiella*, ♀ genitalia. 173, holotype, slide VU no. 0672, scale : 71.3 μm ; 174, idem, detail of terminalia, scale 42.6 μm ; 175, idem, detail of apophyses, note unexpanded cavity in end of posterior apophyses (arrow), scale : 11.2 μm ; 176, idem, detail of ductus spermathecae without spiculae, scale : 12.3 μm.

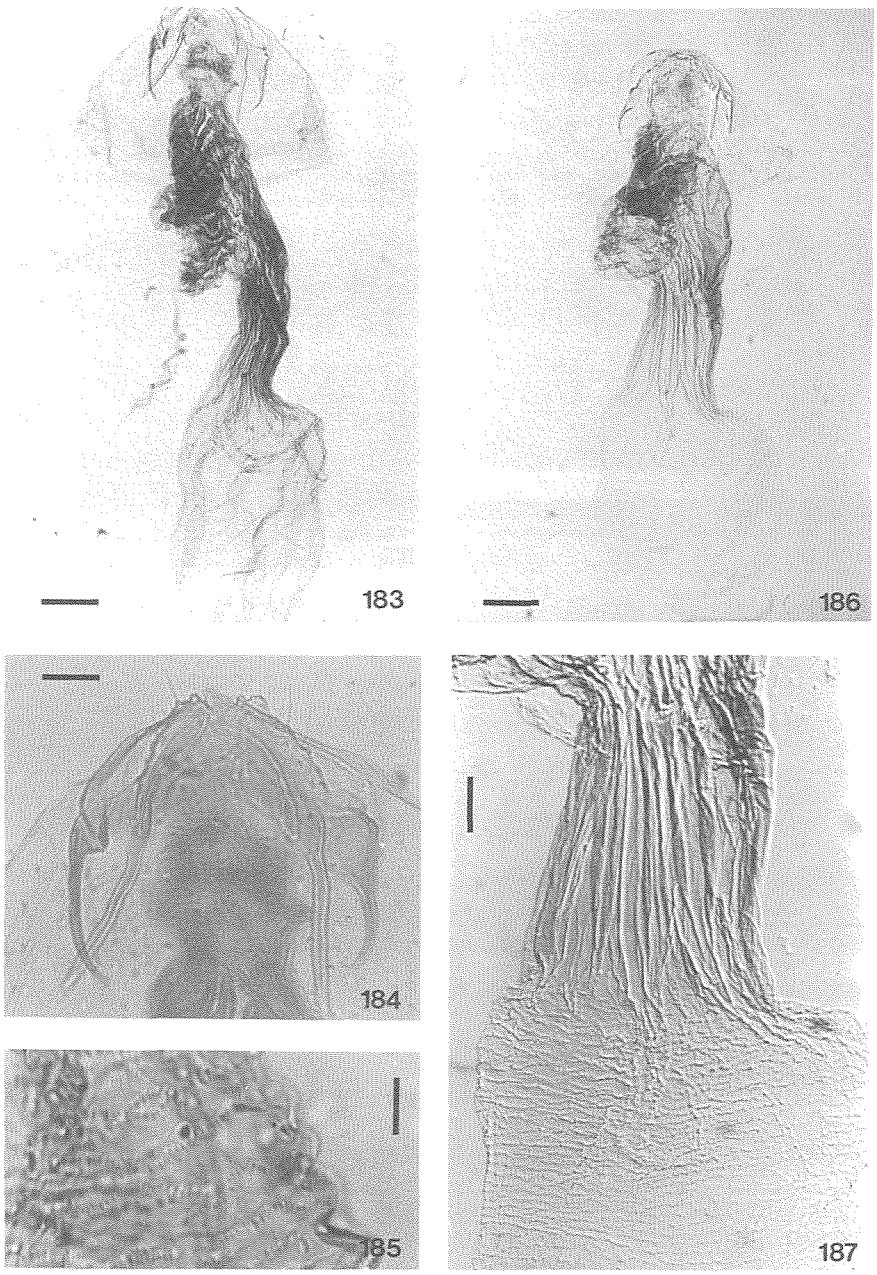




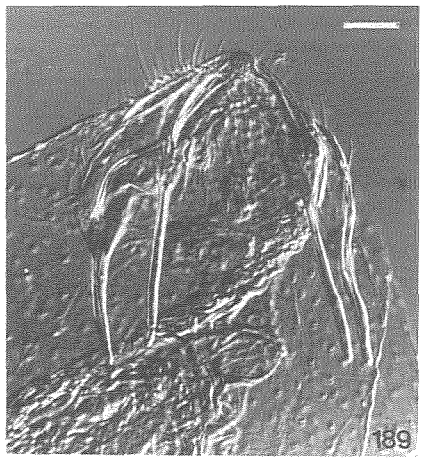


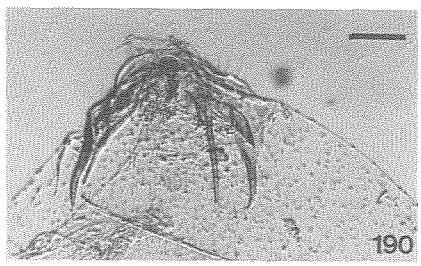


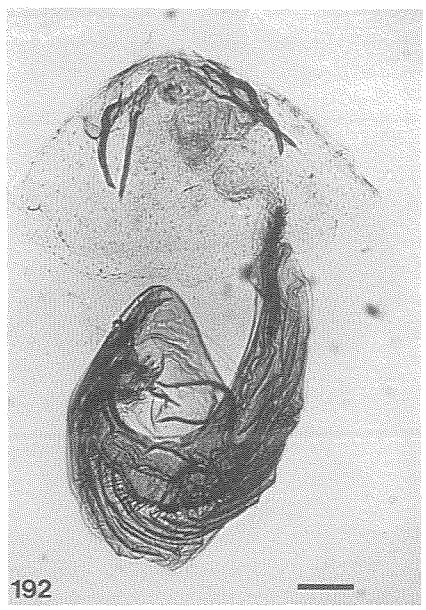
Figs. 177-182. *Stigmella spiculifera*, ♀ genitalia. 177, paratype, slide VU no. 0785, scale: 105.0 μm; 178, idem, detail of bursa copulatrix and ductus spermathecae, scale: 39.8 μm; 179, holotype, slide VU no. 0673, scale: 42.3 μm; 180, idem, detail of apophysis ending, scale: 12.7 μm; 181, idem, detail of ductus spermathecae, scale: 16.2 μm; 182, idem, detail of bursa copulatrix, scale: 7.7 μm.

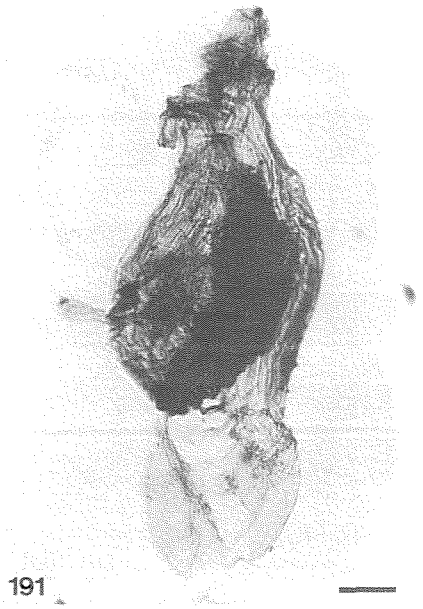


Figs. 183-187. *Stigmella caesurifasciella*, ♀ genitalia. 183, paratype, slide VU no. 0725, scale: 90.5 μm; 184, idem, detail of terminalia, scale: 34.9 μm; 185, idem, detail of bursa copulatrix, note comb-like pectinations, scale: 10.1 μm; 186, holotype, slide VU no. 0675, scale: 112.7 μm; 187, idem, detail of proximal part of bursa copulatrix, scale: 44.6 μm.



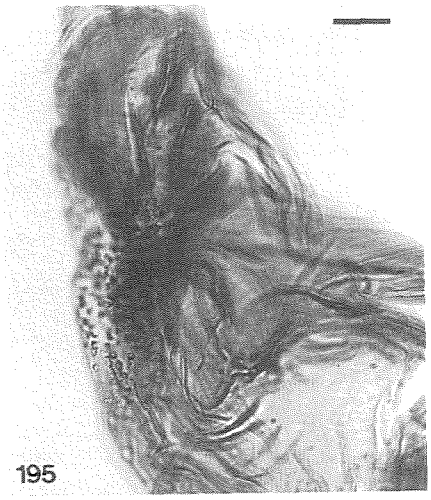


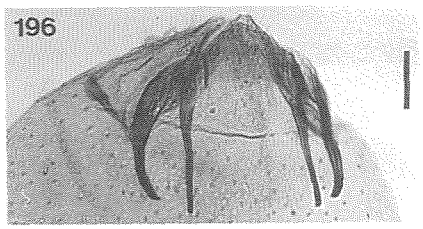


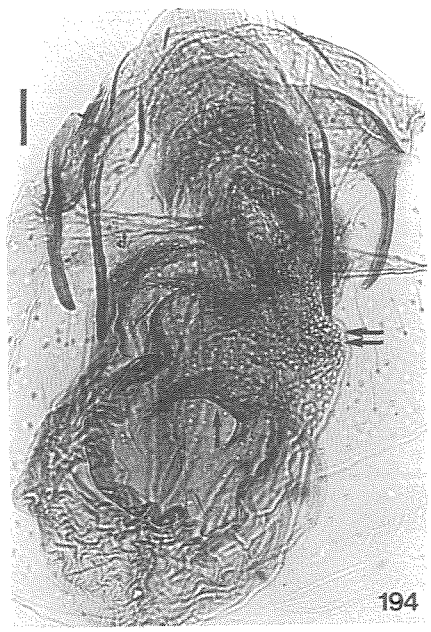


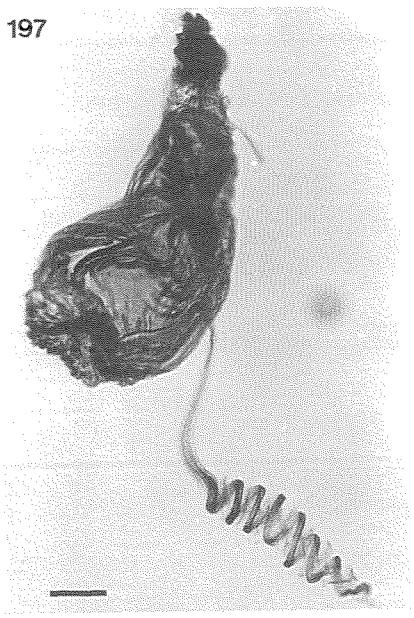
Figs. 188-191. *Stigmella kumatai*, ♀ genitalia. 188, paratype, slide VU no. 0665, scale: 93.1 μm; 189, idem, detail of terminalia, scale: 38.5 μm; 190, paratype, idem, slide VU no. 0707, detail of terminalia, scale: 71.5 μm; 191, idem, detail of rest of genitalia, scale: 71.1 μm.

Fig. 192. *Stigmella castanopsiella* ♀ genitalia, slide VU no. 0719, scale: 107.2 μm.

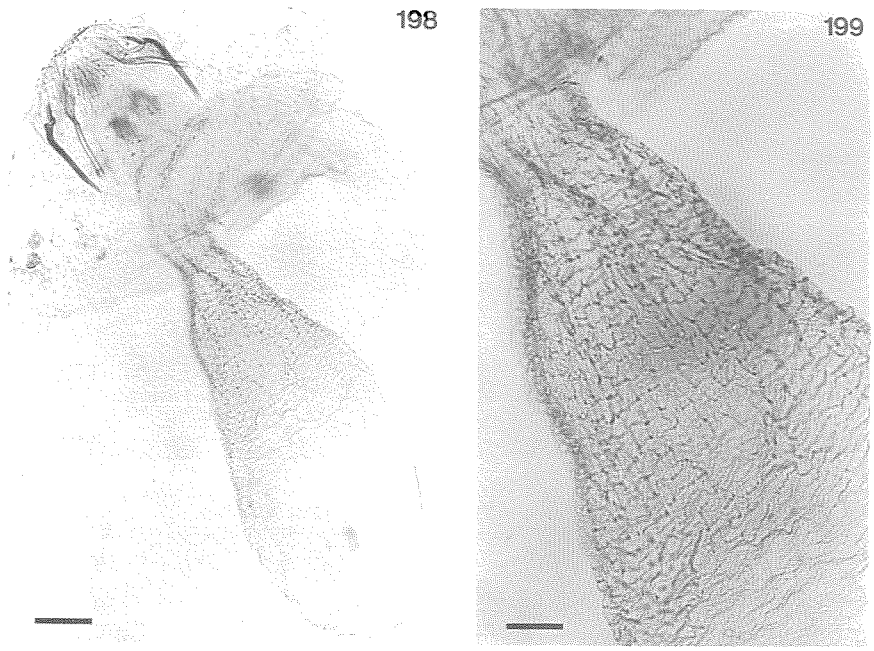


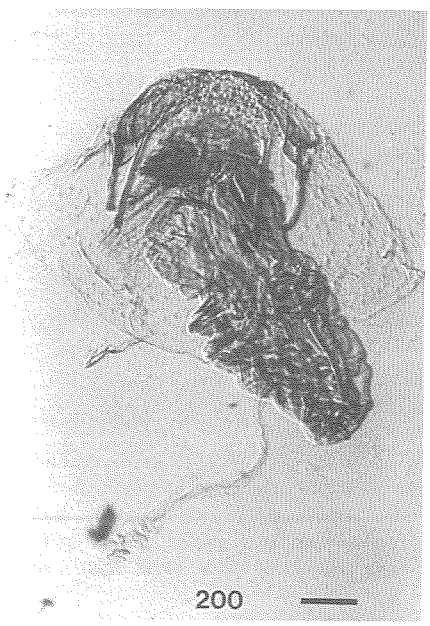




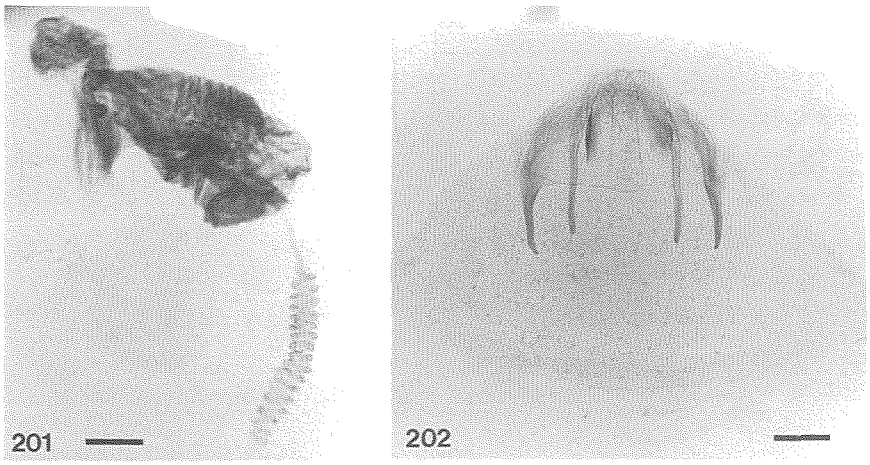


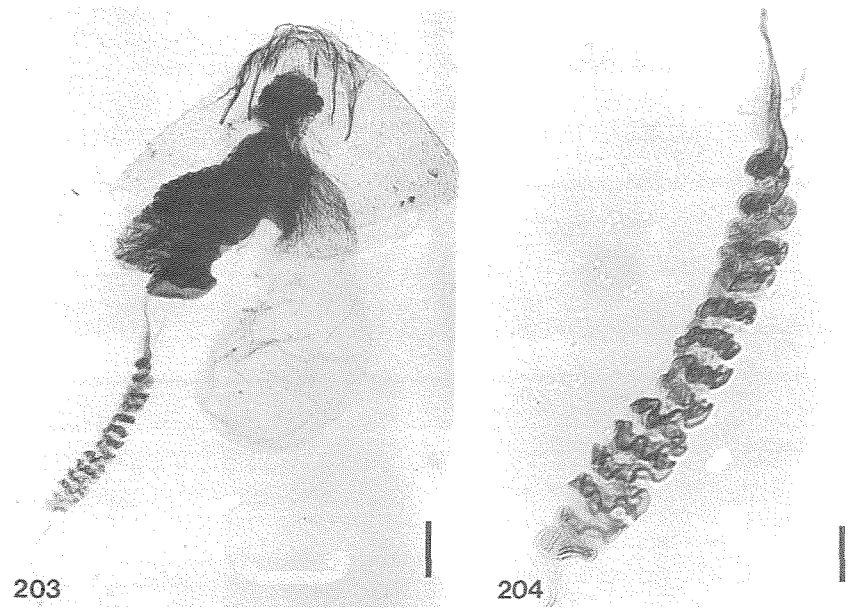
Figs. 193-197. *Stigmella quercifaga*, ♀ genitalia. 193, paratype, slide VU no. 0726, scale : 71.2 μm ; 194, paratype, idem, slide VU no. 0706, note chitinous rectangular plate (arrow) and patelloid spines (dubble arrow), scale : 38.4 μm ; 195, paratype, idem, slide VU no. 0788, detail of spines on bursa copulatrix, scale : 25.8 μm ; 196, idem, detail of terminalia, scale : 57.1 μm ; 197, idem, detail of ductus bursae, bursa copulatrix and coiled ductus spermathecae, scale : 58.9 μm.



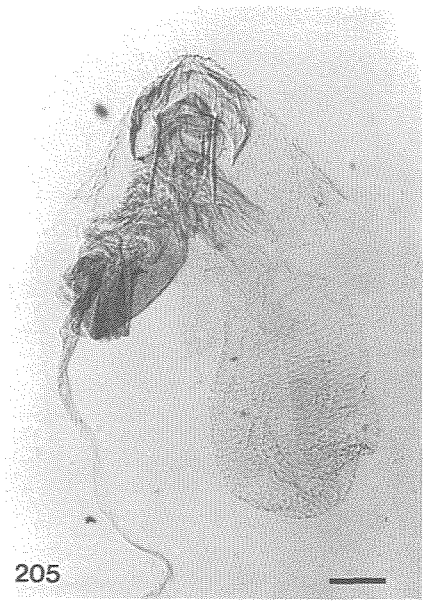


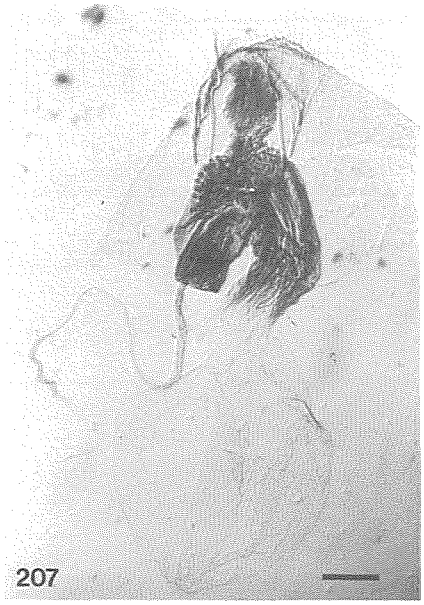
Figs. 198-199. *Stigmella egonokii*, ♀ genitalia. 198, paratype, slide VU no. 0774, scale: 73.3 μm; 199, idem, detail of proximal part of bursa copulatrix, scale: 26.4 μm.
Fig. 200. *Stigmella clisiotophora*, ♀ genitalia, paratype, slide VU no. 0693, scale: 72.7 μm.

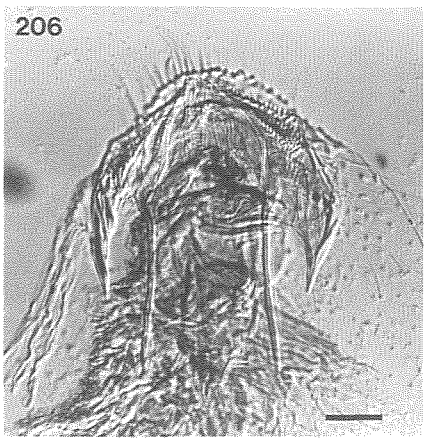


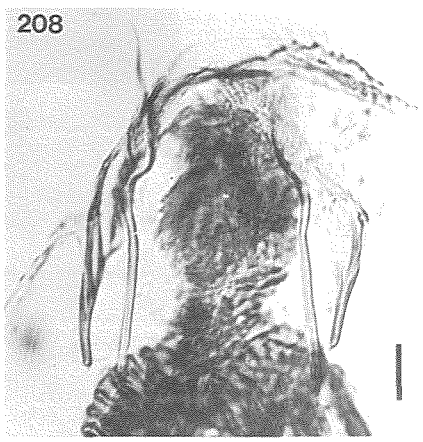


Figs. 201-202. *Stigmella kurii*, ♀ genitalia. 201, holotype, slide VU no. 0773, scale : 110.8 μm, note very thin bursa copulatrix ; 202, idem detail of terminalia, scale : 61.3 μm.
Figs. 203-204. *Stigmella chrysopterella*, ♀ genitalia. 203, holotype, slide VU no. 0724, scale : 113.1 μm ; 204, idem, detail of coiled ductus spermathecae (note differences between this convolutions and those of *S. kurii* in 201), scale : 43.1 μm.



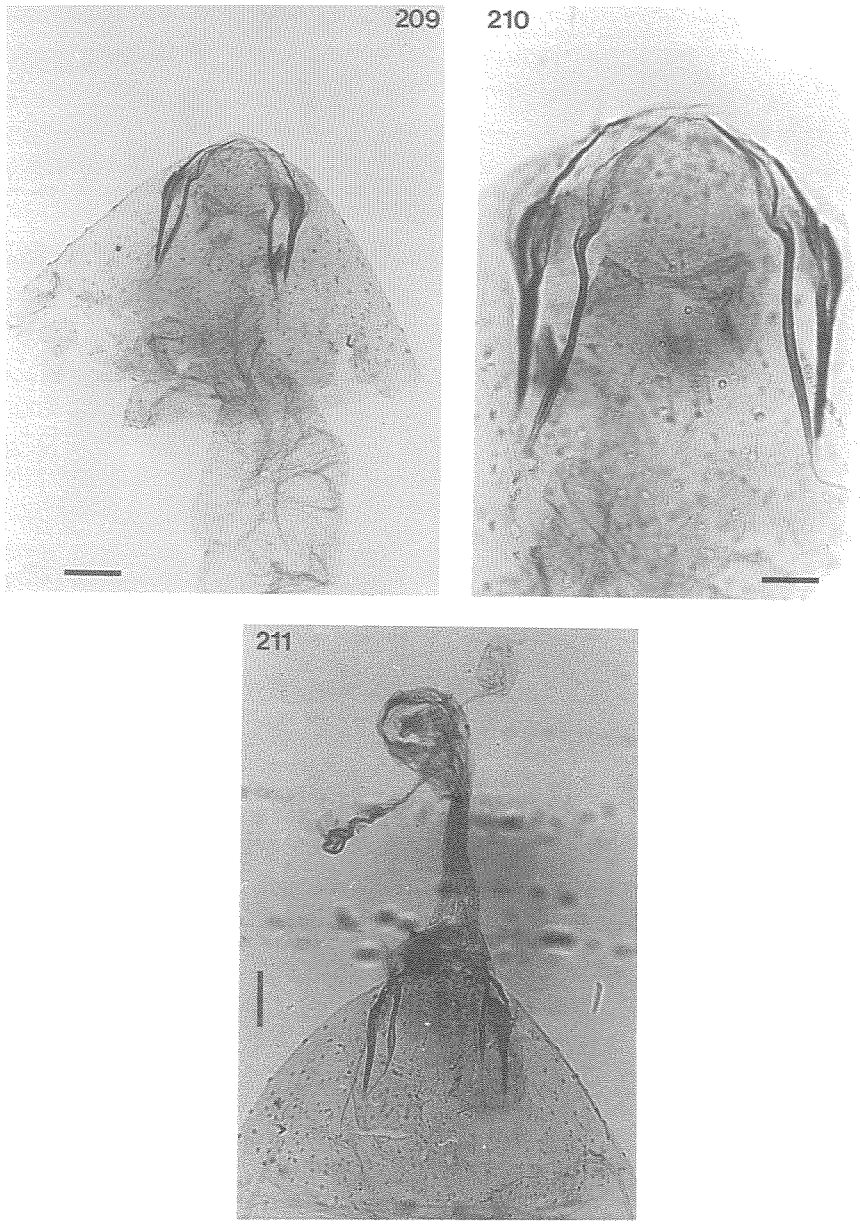




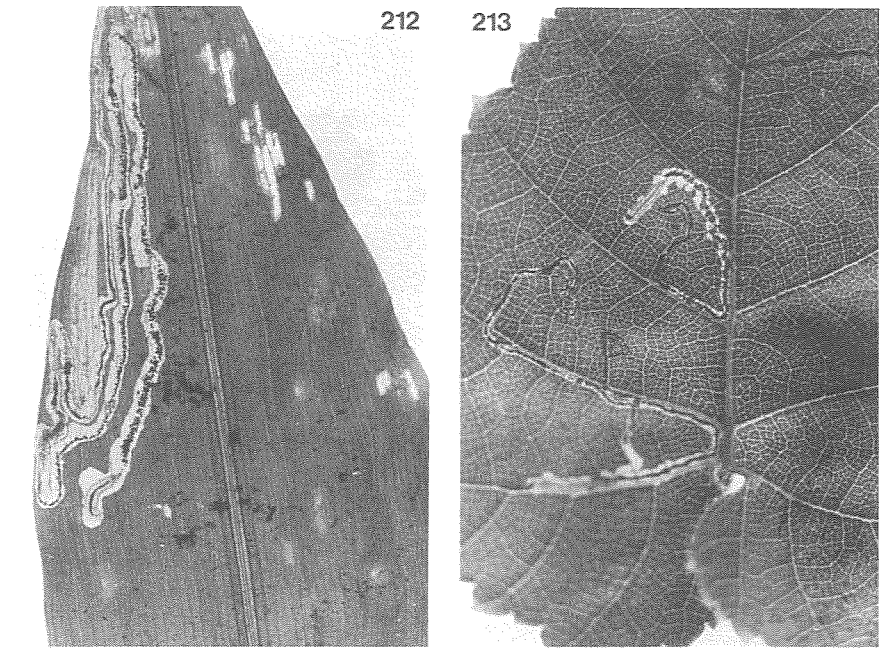


Figs. 205-206. *Stigmella sesplicata*, ♀ genitalia. 205, holotype, slide VU no. 0685, scale: 90.2 μm; 206, idem, detail of terminalia, scale: 37.5 μm.

Figs. 207-208. *Stigmella oa*, ♀ genitalia. 207, holotype, slide VU no. 0714, scale: 103.9 μm; 208, idem, detail of terminalia, scale: 35.6 μm.



Figs. 209-211. *Stigmella boehmeriae*, ♀ genitalia. 209, paratype, slide VU no. 0779, scale : 67 μm ; 210, idem, detail of terminalia, scale : 29.7 μm ; 211, holotype, idem, slide VU no. 0738, note separate accessory sac and ductus spermathecae, scale : 67 μm.



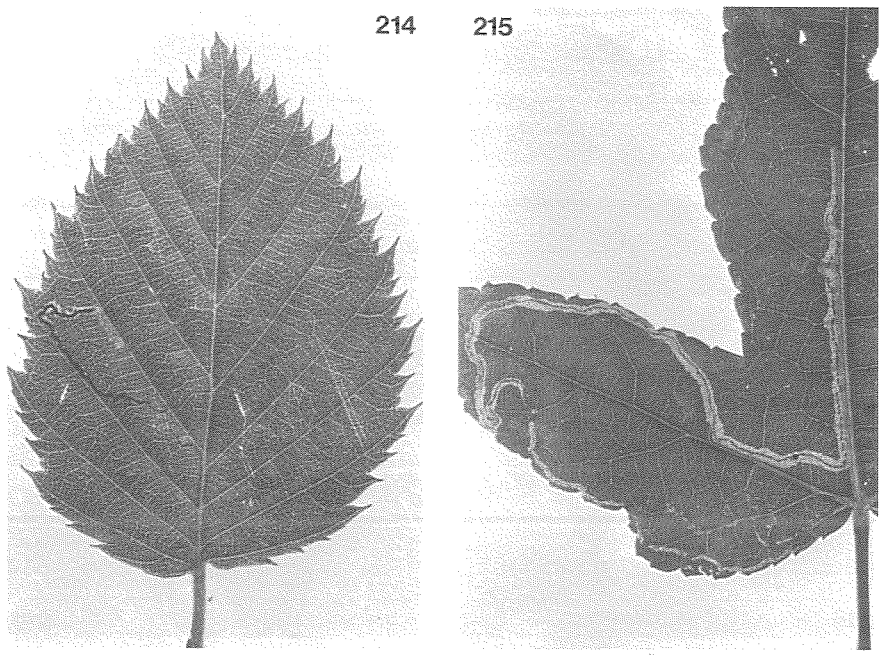
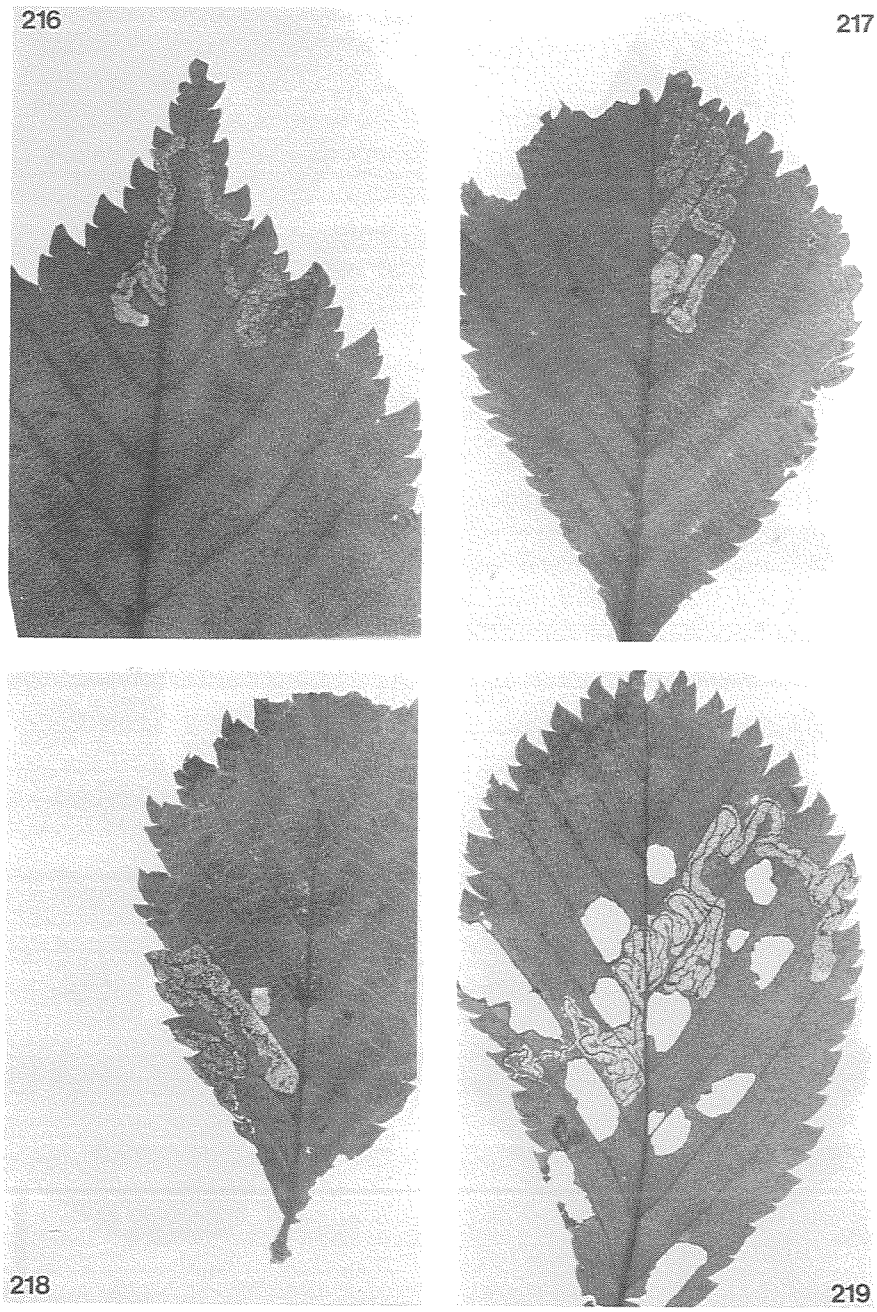
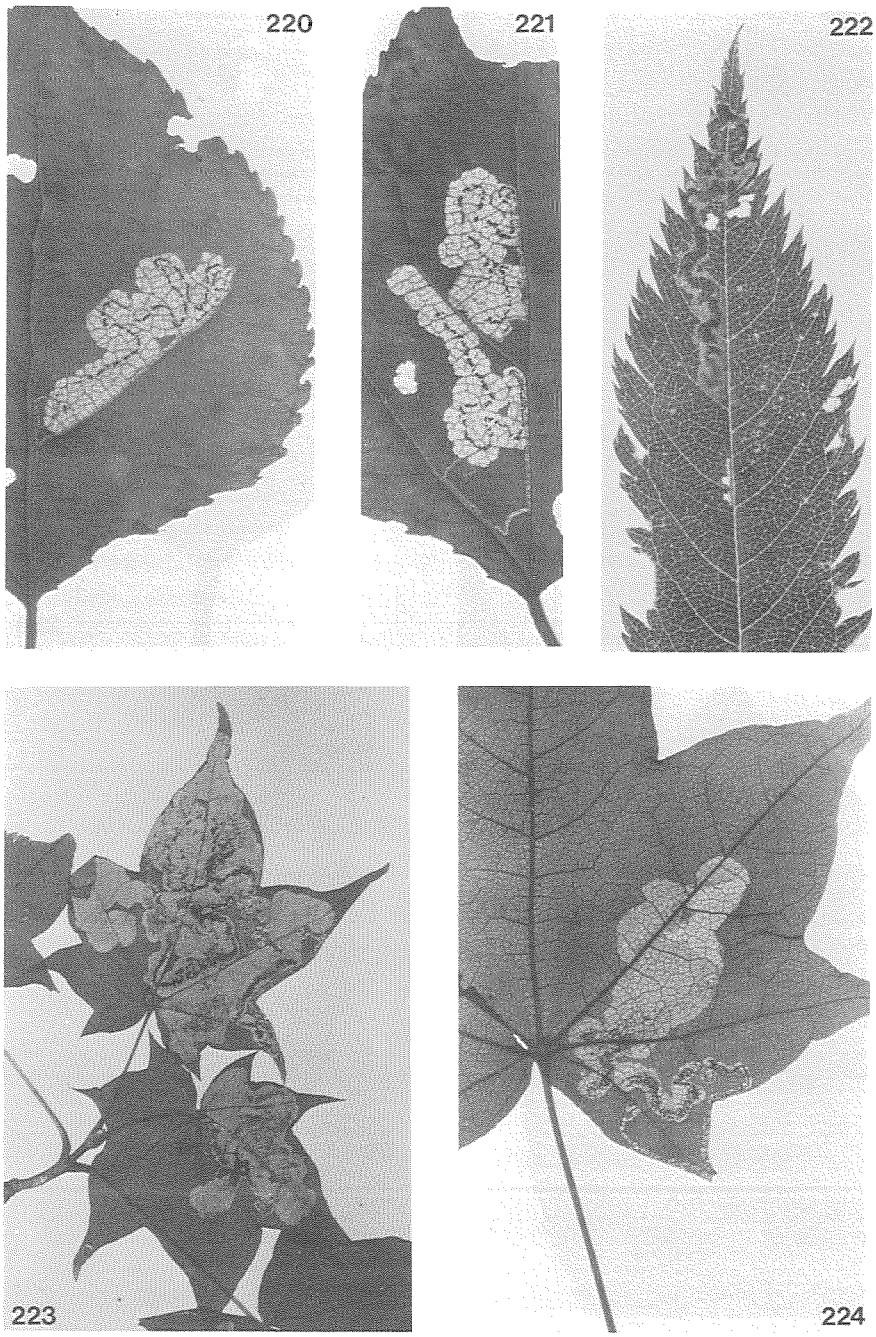


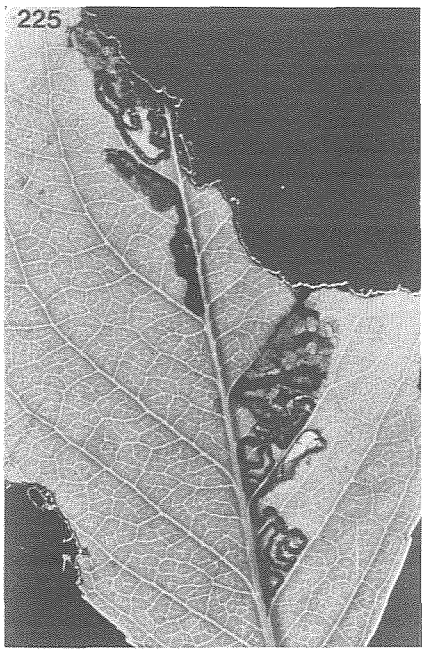
Fig. 212. *Stigmella oplismeniella* on *Oplismenus undulatifolius*.
Fig. 213. *Stigmella betulicola* on *Betula platyphylla* (Minodo-guchi, Nagano Pref., 24-IX-1980).
Fig. 214. *Stigmella cathepostis* on *Carpinus tschonoskii*.
Fig. 215. *Stigmella alikurokoi* on *Rubus palmatus*.

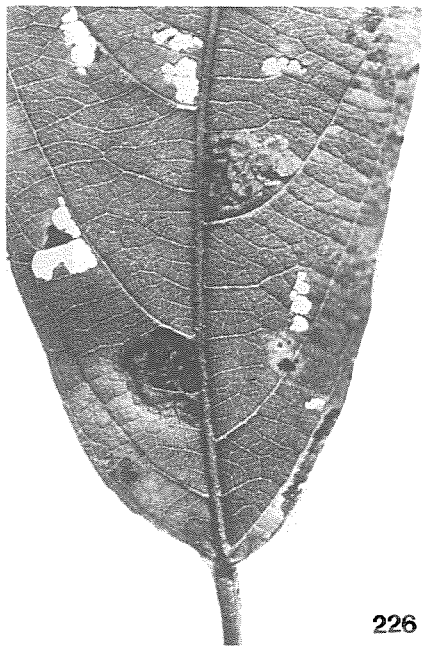


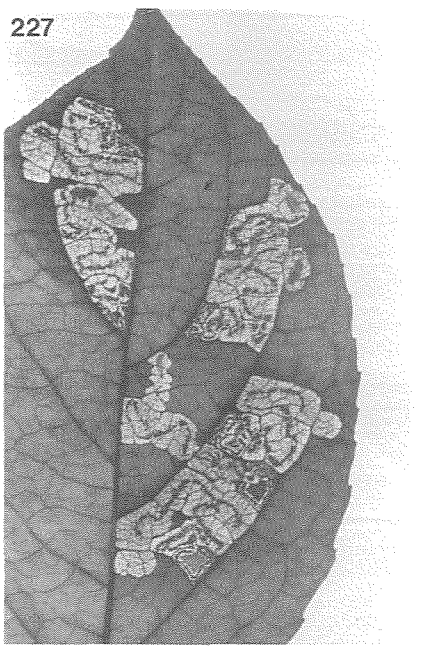
Figs. 216-218. *Stigmella nakamurai* on *Ulmus davidiana* v. *japonica* (Sapporo, Hokkaido 23, 24-VII, 14-VIII-1981).
Fig. 219. *Stigmella nireae* on *Ulmus davidiana* v. *japonica* (Nopporo, Hokkaido, 6-IX-1980).



Figs. 220-221. *Stigmella tranocrossa* on *Populus nigra* "ITALICA" (Sapporo, Hokkaido, 18-VII-1954).
Fig. 222. *Stigmella sorbivora* on *Sorbus japonica*.
Figs. 223-224. *Stigmella japonica* on *Acer mono* (Moiwa, Sapporo, Hokkaido, 25-VIII-1975).







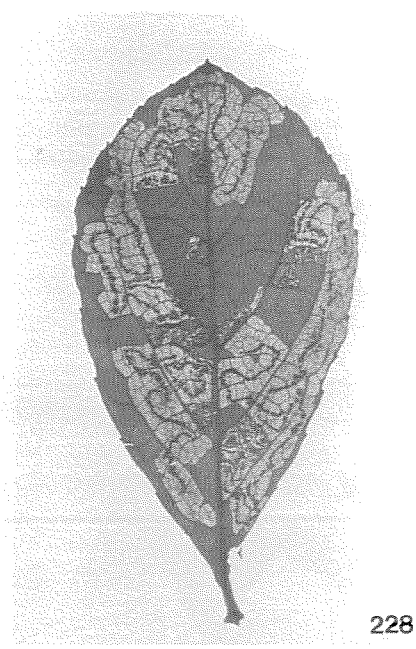


Fig. 225. *Stigmella vittata* on *Salix gracilistyla* (Hikosan, 10-VII-1955).
Fig. 226. *Stigmella vittata* on *Salix* spec. (Ichirino, Ishikawa Pref., 9-X-1982).
Figs. 227-228. *Stigmella vittata* on *Salix* spec. (Kii-Osima, Wakayama-ken, Honsyu, 24-V-1964).

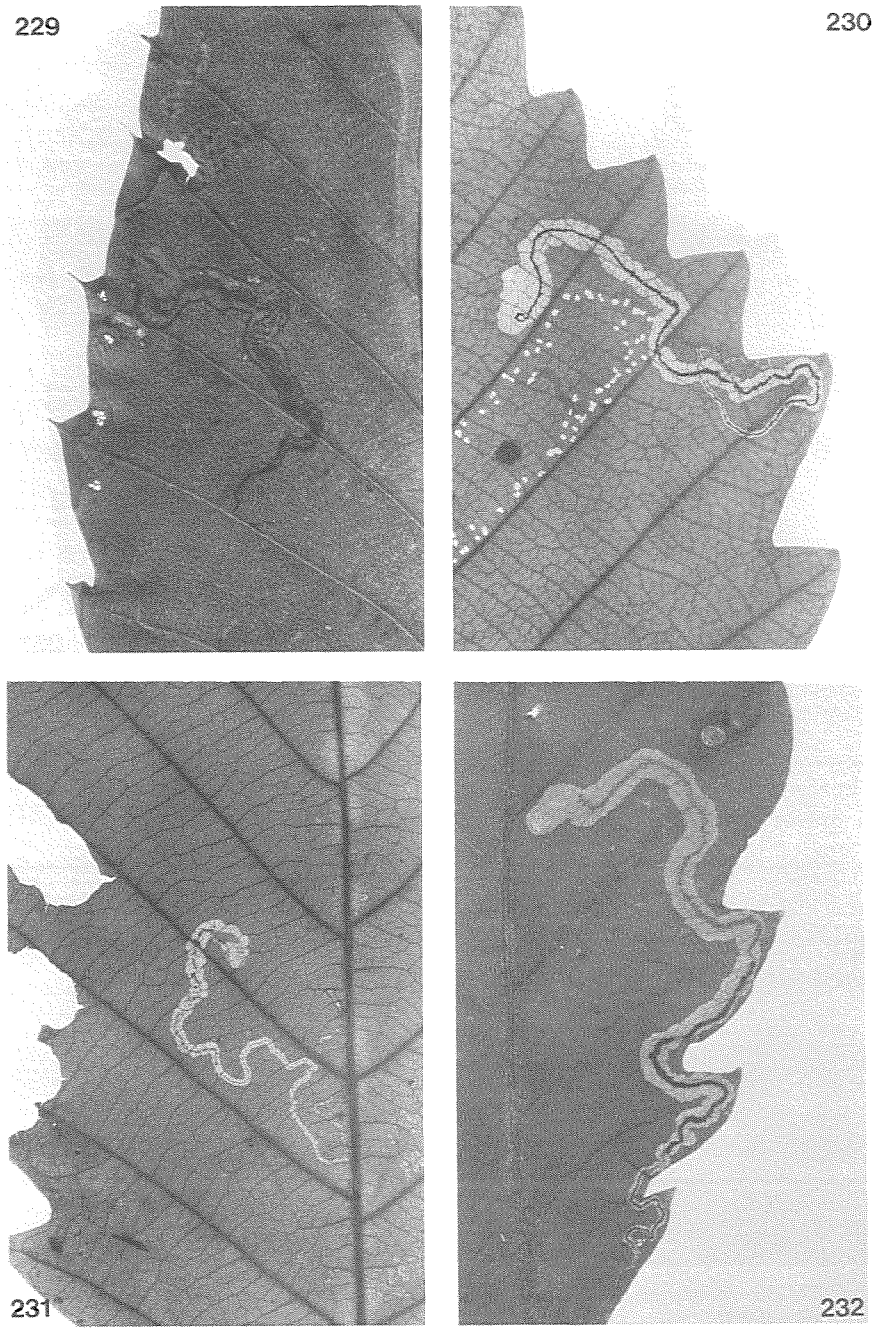
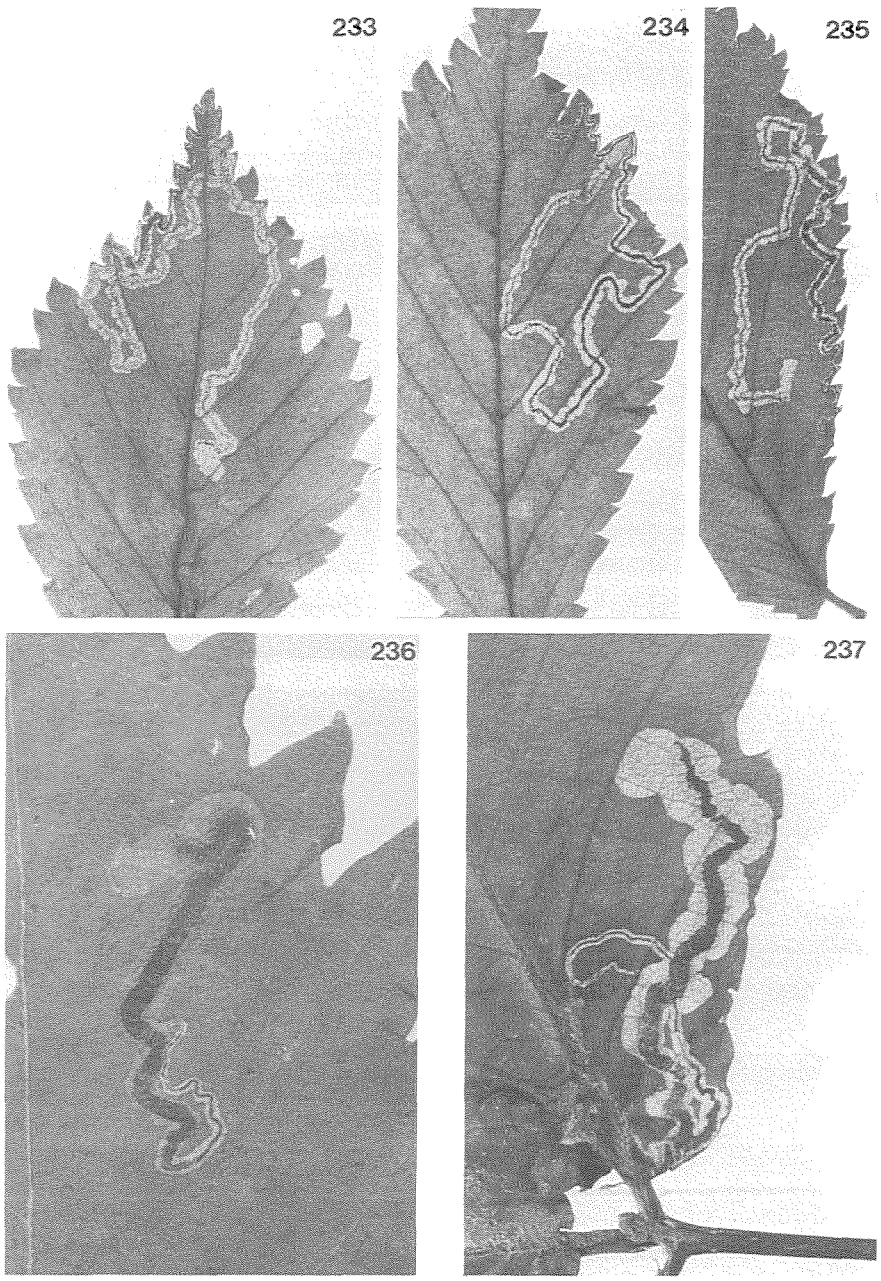
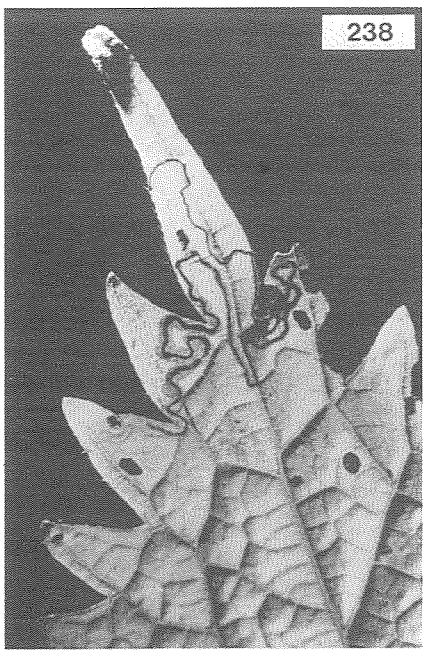


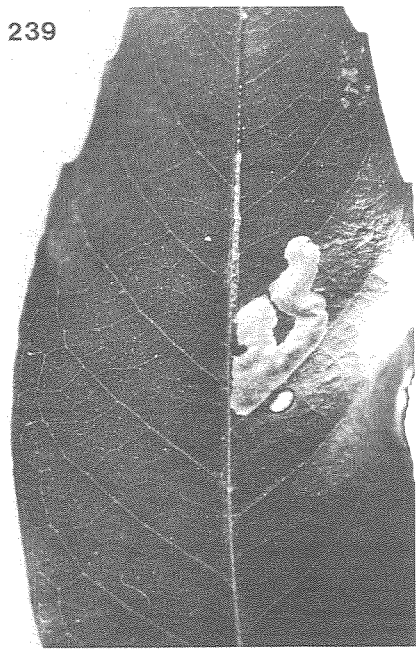
Fig. 229. *Stigmella clisiotophora* on *Quercus variabilis* (Tutu, Tusima, Kyusyu, 15-X-1979).
Figs. 230-232. *Stigmella pulla* on *Quercus mongolica* var. *grosseserrata* (resp.: Teine, Hokkaido, 9-VII-1956; Moiwa, Sapporo, Hokkaido, 21-IX-1966; Sapporo, Hokkaido, 25-VII-1956).

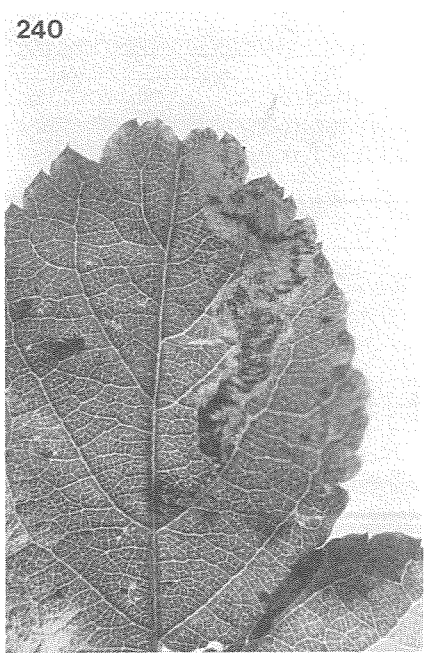


Figs. 233-235. *Stigmella gimmonella* on *Ulmus davidiana* var. *japonica* (Sapporo, Hokkaido, 9-VII-1981).

Figs. 236-237. *Stigmella kumatai* on *Quercus mongolica* var. *grosseserrata* (resp.: Moiwa, Sapporo, Hokkaido, 24-VI-1977; Sapporo, Hokkaido, 23-VI-1956).







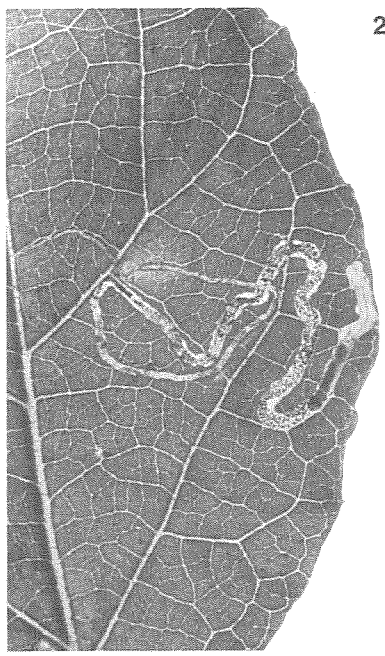


Fig. 238. *Stigmella boehmeriae* on *Boehmeria spicata* (Hikosan, 10-VII-1958).
Fig. 239. *Stigmella castanopsiella* on *Castanopsis cuspidata*.
Fig. 240. *Stigmella zumii* on *Malus sieboldii* (Minodo-guchi, Nagano Pref., 24-X-1980).
Fig. 241. *Stigmella egonokii* on *Styrax japonica*.