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NEPTICULIDAE (LEPIDOPTERA) IN CHINA, 1. INTRODUCTION AND *STIGMELLA* SCHRANK FEEDING ON FAGACEAE

Nieukerken, E. J. van & Y. Liu, 2000. Nepticulidae (Lepidoptera) in China, 1. Introduction and *Stigmella* Schrank feeding on Fagaceae. – Tijdschrift voor Entomologie 143: 145-181, figs. 1-98, table 1. [ISSN 0040-7496]. Published 1 December 2000.
The *Stigmella* species feeding on Fagaceae collected in China in 1984 are described and all known East Asian species are reviewed. In total 13 species are recognized: 12 are tentatively grouped in the *ruficapitella*-group and one in the *caesurifasciella*-group. The *ruficapitella*-group includes here also the *castanopsiella*-group and the *suberivora*-group. *Stigmella kao, S. circumargentea, S. vandrieli* and *S. lithocarpella* are described as new species from Yunnan and *S. fumida* Kemperman & Wilkinson is also reported from Yunnan. From Heilongjiang four species are reported: *S. omelkoi* Puplesis, *S. fervida* Puplesis (on basis of mines only), *S. dentatae* Puplesis and *S. aladina* Puplesis. Three new synonyms are proposed: *S. quercifaga* Kemperman & Wilkinson with *S. aladina* Puplesis, *S. kurii* Kemperman & Wilkinson with *S. chrysopterella* Kemperman & Wilkinson and *S. egregilustrata* Kemperman & Wilkinson with *S. caesurifasciella* Kemperman & Wilkinson. *S. chrysopterella* is tentatively regarded as the female of *S. fumida.* The collecting localities in China are briefly described and illustrated.
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Key-words. – Nepticulidae; *Stigmella;* Fagaceae; *Quercus; Cyclobalanopsis; Castanopsis; Lithocarpus;* Yunnan; Heilongjiang; East-Palaearctic; hostplant relationships; leafminers

Chinese abstract: see page 178.

Nepticulidae, a family of very small Microlepidoptera with mostly leafmining larvae, were hitherto almost unknown from the territories of the People's Republic of China. Only one species has been recorded: *Sinopticula sinica* Yang (Yang 1989). Nieukerken & Puplesis (1991) recombined this species with *Trifurcula* (*Glaucolepis*) Braun.

In contrast to Europe, where Nepticulidae have extensively been studied (e.g. Johansson et al. 1990), the eastern Palaearctic region has long been neglected, with only three species described by Matsumura (1931) from Japan. Only since the early eighties, have studies started on the faunas of the far east region of the former Soviet Union, Primorskij Kraj (summarised by Puplesis 1994) and Japan (Kemperman et al. 1985, Kumata & Nakatani 1995). Inevitably, the closeness of Japan and the Primory'e Region, together with difficulties in understanding Puplesis' earlier studies in Russian have caused some synonyms. Most of the names concerned have been formally synonymized by Puplesis (1994), some are synonymized here.

Nepticulidae from the Oriental region have hardly been studied. Meyrick described some 30 species, mostly from India, which are in the course of revision by the first author. Overlap of Chinese and Indian lowland faunas is probably negligible, but there may be some similarity in the faunas of the unstudied Assam region and other mountainous border areas. There is one possible case of a Meyrick species, which we found in China. From other adjacent parts of the Oriental region we are aware of some material in collections from Thailand, Taiwan and Nepal (in fact more Palaearctic), but none of these has been described so far.

The study of Chinese Nepticulidae started with collecting during general surveys of Microlepidoptera in China by the second author. During an intensive co-operation between the former Department of Animal Systematics of the Free University, Amsterdam, the Netherlands and the Zoological Institute of the Academia Sinica in Beijing, a collecting expedition in

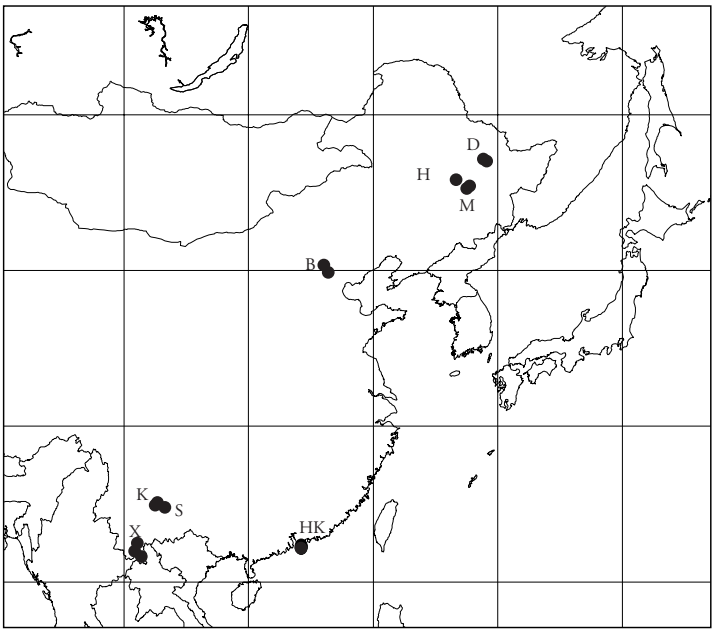

Fig. 1.
Map showing collecting stations in China. – B = Beijing, D = Dailing, H = Harbin, HK = Hongkong, K = Kunming, M = Maoershan, S = Shilin, X = Xishuanbanna region.

China was organised in 1984. Closing down of the Amsterdam department prevented a continuation of this collecting effort. The results of the 1984 trip, to the provinces of Heilongjiang and Yunnan, including some collecting around Beijing, are the basis of this and future papers, thereby providing a first inventory of Chinese Nepticulidae.

Undoubtedly the Chinese nepticulid fauna is much richer than the c. 50-60 species we collected, since we visited only a relatively small part of the country, whereas there are many much richer areas not studied by us. Also, we only collected in autumn, and missed many of the earlier species, of which we frequently found the vacated mines. Further, since we concentrated on collecting leafmines, we probably missed species which have a more secretive life history, and are often better collected at light. Extensive collecting in many parts of China is needed to get even a rough idea of the richness of the Chinese fauna of Nepticulidae. We estimate that there will be more than 300 species in this huge country.

This paper is the first to treat the species of which we reared adults. Many of these are new, but also a considerable number belong to previously described species from the neighbouring Primory'e region, Japan and some even from Europe. Those species of which we only collected mines and/or larvae, will be treated as well, when we were able to identify the mines with some certainty. This applies mostly to species collected in Northeast China. All the other unidentified mines which are attributable to Nepticulidae will be mentioned briefly, as a guide for future collecting, and because they provide interesting additional hostplant records.

In this paper we will treat the species of the genus *Stigmella* reared from hosts belonging to the Fagaceae (oaks). They are tentatively treated as belonging to the *Stigmella ruficapitella* group. Because the majority of known Eastern Palaearctic species of this group have been found during our trip and the others are expected to occur in China as well, we review all the Eastern Palaearctic species.

Material and methods

This paper is mainly based on material collected in China during the 1984 expedition. Holotypes and half of the material is deposited in the Zoological Institute of the Academia Sinica in Beijing, the remaining material in the National Museum of Natural History, Leiden, The Netherlands

Other material from China was not considered; the number of Nepticulidae from China in other collections is very low. Even the large Höhne collection of Chinese Lepidoptera in the Alexander Koenig museum in Bonn only contains a negligible number, some three specimens in poor condition.

For comparison with the neighbouring region, much material from Japan and the Primory'e region was studied, including types. The following abbreviations for depositories are used:

EIHU Entomological Institute, Hokkaido University, Japan
ELUO Entomological Laboratories, University of Osaka, Japan
RMNH National Museum of Natural History Naturalis, Leiden, Netherlands (formerly Rijksmuseum van Natuurlijke Historie)
ZIAB Zoological Institute, Academia Sinica, Beijing, China
ZIAN Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia

The material was collected as larvae in leafmines during the autumn of 1984. The collectors were always E. J. van Nieukerken and J. van Driel, they are not repeated in the material lists, except in the case of holotypes. The EvN numbers used on labels and material lists are composed of 3 parts (e.g. 22-2-1): station number (see below), hostplant number and rearing lot. A letter code in the collection indicates the destination of the material collected: K for material collected as larva and reared, H for empty mines and L for larvae which are kept in alcohol. When numbers of larvae are given in the material lists they refer to the number of larvae collected and subsequently reared. Since no detailed descriptions of larvae are provided here, we do not list the larval alcohol material.

Larvae were collected and kept in the field in plastic bags with some soil or moss for pupation. Leaves were removed after the larvae left their mines and dried for the collection. Breedings from Heilongjiang were kept cool in the laboratory in Beijing during our trip to Yunnan in October 1984. Breedings from Yunnan were regularly checked for emerging moths, especially those from Xishuanbanna. Most mines and larvae were studied and briefly described during the collection trip, using a stereo-microscope.

Rearing of larvae was carried out in the laboratory in Amsterdam. The material from the bags, soil with cocoons, was transferred to closed glass jam jars. Species from the provinces of Heilongjiang and Beijing, with harsh winters, were given a cold treatment and kept out of doors until March 1985. Species from Yunnan partly emerged in the laboratory in November and December; the remaining part received a short cold treatment at about 4°C before being brought back at room temperature. Species from southern Yunnan (Xishuanbanna) were kept at temperatures above 20°C until emergence.

Emerged moths were spread and later stage-mounted. Larvae are stored in ethanol 70% and leafmines stored dry in pergamine or mylar envelopes. Samples of hostplants are kept as herbarium specimens in RMNH.

Genitalia preparations were made following the methods described by Nieukerken et al. (1990).

Photographs of genitalia were made with a Carl Zeiss microcamera attached to a Carl Zeiss Axioskop, some with the AxioCam digital camera, using Carl Zeiss AxioVision 2.0.5.3 software and the module Extended Focus. Photographs of adults with the same microcamera on a Carl Zeiss SV11 Stereomicroscope. Photographs of leafmines were prepared with a Canon reflex camera on a stand and simulated dark-field illumination. Drawings of genitalia were prepared with the aid of a drawing tube attached to the Axioskop.

SEM-micrographs were taken with a Jeol JSM 840A scanning electronic microscope. Specimens were parts of dry collection specimens mounted on stubs and coated with palladium.

Hostplant names follow the Flora of China (Flora of China 2000, Wu & Raven 1999), authorities are mentioned in the hostplant-list and for other species the first time they are mentioned in the text.

Description of sampled areas

The 1984 collection trip was held from 6 September to 31 October. The main areas visited were in the provinces Heilongjiang and Yunnan, with a little collecting in and near Beijing. The various areas are described here; a list of stations is given as an appendix. The localities are shown on the map in fig. 1.

Heilongjiang

This is the northernmost province of China, with an extreme continental climate; severe cold and dry winters, moderate wet summers. The vegetation ranges from a Siberian taiga in the north towards a very rich mixed hardwood forest zone in the south, similar to that of the Jilin province (Wang 1961). Although the central plain around Harbin is completely deforested, large areas of almost pure forest exist in the mountain ranges near the Russian border. Visited localities were Dailing in the extreme South of the lesser Hinggang range (Xiao Hinggang Ling) and Maoershan, approximately 80 km east of Harbin.

The nepticulid fauna of Heilongjiang reminded us very much of the European fauna; the hostplant genera are all represented as hostplants in Europe as well. Yet only few species are probably the same as in Europe, with the obvious exception of probably all species feeding on *Betula* and *E. argyropeza* (Zeller). The continuous distribution of *Betula* and *Populus tremula-davidiana,* probably throughout the glaciations, could be an explanation for this pattern. The fauna is very similar to that of the nearby Primory'e region in Russia, and most species have been described from there by Puplesis.

Judging from Wang (1961) the forests visited by us are an impoverished version of the very rich forests which occur in the China-Korea border area (Changbai Shan range) in Jilin province.

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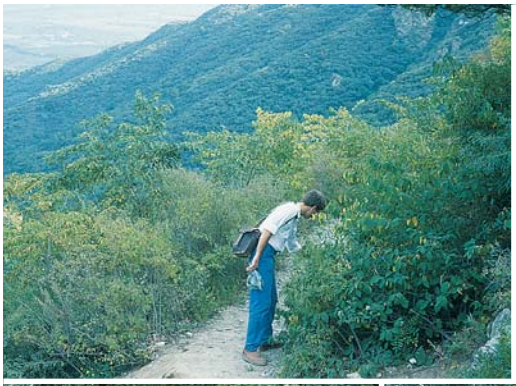
Figs. 2-7. Collecting localities in Harbin province. – 2, Undergrowth in primary mixed forest, Dailing, Liangshui Linchang (13 September 1984, station 7); 3, Steep south exposed hill with *Quercus mongolica* stand, Dailing, Dachinchuan Linchang (15 September 1984, station 9); 4, Forest road in mixed forest with dominance of *Betula*, Dailing, Dachinchuan Linchang (16 September 1984, station 11); 5, Swamp with *Sanguisorba parviflora* and *Filipendula palmata*, Dailing, Dachinchuan Linchang (17 September 1984, station 12); 6, *Rosa acicularis* with abundant mines of *Ectoedemia picturata* Puplesis, same locality as 5; 7, Mixed hardwood forest on mount Maoershan (25 September 1984, station 14).



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Figs. 8-13.
Collecting localities in Beijing (8, 9) and Yunnan province. – 8, Deciduous shrub on hills, Beijing, Xiangshan (1 October 1984, station 18); 9, Autumn view of deciduous woods and shrub on hills with red *Cotinus coggygria*, Beijing, Wofosi (27 October 1984, station 18); 10, Evergreen cupuliferous forest, Kunming, Qiongzhu Si (Bamboo temple) (4 October 1984, station 22); 11, Mixed *Pinus yunnanensis*, *Keteleeria* and oak forest, with abundant *S. vandrieli* on *Cyclobalanopsis glaucoides* (here in undergrowth) and *Stigmella* sp. on *Myrsine africana*, Anning, Yunnan (20 October 1984, station 35); 12, Fringes of broad-leaved evergreen rainforest, Menglung (12 October 1984, station 31); 13, Broad-leaved evergreen rainforest along river, Menglung (13 October 1984, station 31).

Dailing (figs. 2-6)

A small town in a river-valley in hilly country ranging from 300-800 m. The forests are vast, and partly primary, partly secondary but still in a good condition. Pure timber stands are rare. The original forest combines species from the montane coniferous forest: *Pinus koraensis* Sieb. et Zucc., *Abies nephrolepis* (Trautv.) Maxim. and *Picea* spp. and species from the mixed hardwood forest: *Tilia amurensis* Rupr., *T. mandshurica* Rupr., *Betula platyphylla* Suk, *B. costata* Trautv., *Fraxinus mandshurica* Rupr., *Phellodendron amurense* Rupr., with frequently *Corylus* groves in the undergrowth. *Quercus mongolica* Fisch. forms pure stands on steep south exposed hills (fig. 3), often with *Rhododendron dahuricum* L. growing at the top of the hill.

In Dailing 34 species of Nepticulidae were observed, with a particularly rich fauna on *Quercus mongolica:* 7 species, including the following species treated in this paper: *S. fervida, S. omelkoi, S. aladina* and *S. dentatae*. The most abundant species were *Ectoedemia picturata* Puplesis on *Rosa acicularis* (fig. 6) and *E. pilosae* Puplesis on *Agrimonia, Stigmella vittata* Kemperman & Wilkinson on *Salix raddeana* Lacksch. ex Nasarow and the oak miners. Surprisingly few specimens were found on the abundant *Alnus, Betula* and *Corylus* trees.

Some species can here be collected in large numbers a few weeks prior to the time of our visit, as indicated by the abundant empty mines of *Stigmella* cf. *ultima* Puplesis on *Acer mono* Maxim., *Stigmella* spp. on *Tilia* and *S. palmatae* Puplesis on *Filipendula palmata* (Pall.) Maxim (fig. 5).

Maoershan (fig. 7)

This town is situated in a more cultivated area than Dailing, with the forest concentrated on the (often steep) hills, with an altitude of 200-800 m. The forests are mainly mixed hardwood (broad-leaved) with usually as dominants: *Tilia* spp., *Quercus mongolica, Acer mono, Ulmus* spp., *Betula* spp. and *Populus davidiana* Dode. Coniferous trees only occur here in artificial plantations. The fauna is similar to that of Dailing, but slightly richer. We were here too late for more species than in Dailing, so probably more species can be collected here in early September. The most abundant species here were the *Quercus*-miners, including the four *Stigmella* species, and *Stigmella lediella* (Schleich) on *Rhododendron dahuricum.* Also of interest here is the *Ulmus* fauna with four species at least. The *Betula* fauna here was as disappointing as in Dailing. In total we found 36 species in Maoershan.

Harbin

Even in the middle of this heavily polluted town we found many larvae of *Stigmella nireae* Kemperman & Wilkinson on *Ulmus*. In the botanical garden we found commonly two European species, which might be introductions, viz. *Ectoedemia hannoverella* (Glitz) on *Populus* and *S. microtheriella* (Stainton) on *Corylus.*

Beijing area (figs. 8, 9)

Considering our short and superficial collecting in Beijing, we can conclude that even this densely populated area has a rich nepticulid fauna of which we collected 19 species. Some species are the same as in Heilongjiang, especially those from *Ulmus,* but several are different. The studied habitats are, apart from park areas, dry shrubby hills with *Cotinus coggygria* Scop. var. *pubescens* (fig. 9), *Zizyphus jujuba* Mill. var. *spinosus, Prunus* spp., *Spiraea* spp., *Ulmus* spp. and *Koelreuteria paniculata* Lasan.

The hostplant spectrum is comparable to that in Europe, with some notable exceptions, such as *Koelreuteria* and *Grewia.*

Yunnan, Kunming area (figs. 10, 11)

Kunming is a large town, situated on a high plateau, about 1,900-2,000 m elevation, with some mountain ridges up to 2,400 m nearby. The area is very heavily cultivated due to the high population density, and as a consequence the original vegetation is largely destroyed. The original forest type is the evergreen cupuliferous forest (Wang 1961), with many species of Fagaceae, but this is replaced over vast areas by an open *Pinus yunnanensis* Franch. forest, locally with stands of the conifer *Keteleeria evelyniana* Mast. and the oaks *Quercus variabilis* Bl., *Q. acutissima* Carr. and *Cyclobalanopsis glaucoides* Schottky (fig. 11). Only very locally, on steep hills and particularly near temples, remnants of a much richer forest type are found, the evergreen cupuliferous forest, rich in Fagaceae. Two localities are noticeable in this respect: near the bamboo temple (station 22, fig. 10), with six species of Fagaceae *(Castanopsis orthocantha* Franch., *Lithocarpus dealbatus* (Hook f. et Thoms.) Rehd., *L. mairei* (Schottky) Rehd., *Cyclobalanopsis glaucoides, C. glauca* (Thunb.) Oersted and *Q. acutissima)* and Xishan (western hills, station 23) with at least five oaks. Many species of trees are very local and we failed to find any *Ulmus, Carpinus* or *Acer,* although they are listed in local catalogues. The fauna here was extremely interesting and rich, with a high proportion of *Stigmella* species. Hostplants show a distinct Palaearctic pattern with many Fagaceae, Betulaceae, Salicaceae and Rosaceae but striking differences are *Myrsine africana* L. (Myrsinaceae) and *Reinwardtia indica* Dumort (Linaceae). The high proportion of Ericaceae in the hostplant record is similar to the situation in Japan. Due to the climate, collecting can probably take place all year round with different results; on some plants we only found large numbers of empty mines. The total number of 47 species collected in this area leads us to

the expectation that the fauna in undisturbed parts of the same vegetation type (as can be found in remote parts of Yunnan), must be extremely rich.

South Yunnan (Xishuanbanna) (figs. 12, 13)

In this region two main types of climax vegetation can be recognized: the evergreen cupuliferous forest, mainly above 1500 m, and the evergreen broad-leaved rainforest, similar to the tropical rainforest (Wang 1961). We were not able to collect in the first type - which must be very rich here - although we passed vast areas of this forest around Simao. In Jinghong we collected in secondary bamboo-groves only. In Menglung we collected in and at the fringes of the tropical rainforest (figs. 12, 13), but the time was really too short to get a good picture. Still we found mines on 48 species of hostplants, representing somewhere between 35 and 45 species of Nepticulidae, but numbers were very low, and larvae rarely present. Collecting in tropical forests needs a very different approach from that in temperate regions, and is much more practicable for somebody working in the area.

Taxonomic part

Stigmella Schrank

Stigmella: Kemperman et al. 1985: 5, Van Nieukerken 1986b: 55, Johansson & Nielsen 1990: 139, Puplesis 1994: 57.
Nepticula Heyden: Johansson 1971: 241.

For descriptions and diagnoses of the genus we refer to the citations above. *Stigmella* is a huge genus with a global distribution, and currently about 350 named species. Because of its size, the genus has been divided into species-groups, which are often defined on a few genitalic characters. Many of these groups may represent monophyletic entities, but a phylogenetic analysis has yet to be carried out. On a global basis the division of the genus is unsatisfactory, and shows a partly reticulate pattern. Still, in the Palaearctic the division started by Johansson (1971), and refined by Johansson & Nielsen (1990) and Puplesis (1984b, 1985), is workable, and most species collected in China can be attributed to one of these groups.

Stigmella ruficapitella group

Nepticula ruficapitella group: Johansson 1971: 241
Nepticula atricapitella group: Emmet 1976: 239
Stigmella ruficapitella group: Puplesis 1984b: 583, 1985: 150, Kemperman et al. 1985: 40, van Nieukerken 1986a: 13, Johansson et al. 1990: 224, Puplesis 1994: 155.
Stigmella suberivora group: Kemperman et al. 1985: 47.
Stigmella castanopsiella group: Puplesis 1984b: 583, 1985: 150, 1994: 164.

This group was erected for the European species of *Stigmella* feeding on *Quercus*, by Johansson (1971), who also included *S. tristis*, feeding on *Betula*. Johansson & Nielsen (1990) enlarged the group for a few non-*Quercus* feeders, such as *S. hemargyrella* (Kollar) (on *Fagus*), *S. speciosa* (Frey) (on *Acer*) and *S. lonicerarum* (Frey), which were previously placed in the *hemargyrella*-group (Johansson 1971, van Nieukerken 1986a). Puplesis (1994) removed these non-*Quercus* feeders again to the *hemargyrella*-group. Kemperman et al. (1985) split the *ruficapitella*-group into a *suberivora*- and *ruficapitella*-group on the basis of the accessory sac of the female. Such a division is not tenable, since the status of *S. suberivora* (bursa not reduced, accessory sac without spines) is the plesiomorphic condition and the *suberivora*-group therefore probably paraphyletic. Puplesis (1984b, 1985, 1994) did not recognize the *suberivora*-group, but removed the Fagaceae-feeders *S. castanopsiella* Kuroko and *S. kurokoi* Puplesis and erected for these the *castanopsiella*-group. This group, together with the new species *vandrieli* and *lithocarpella*, most likely constitutes a monophyletic entity, but exclusion from the *ruficapitella* group would probably render the remainder paraphyletic. Thus, until a thorough phylogenetic analysis has been carried out, we keep the group here in the wide sense.

Excluded species

Two species, included by Kemperman et al. (1985) in the *ruficapitella* or *suberivora* groups are here transferred to other groups: *S. zelkoviella* Kemperman & Wilkinson, 1985 is removed to the *marginicolella*-group and *S. oa* Kemperman & Wilkinson, 1985 is related to, if not synonymous with *S. lediella* Schleich.

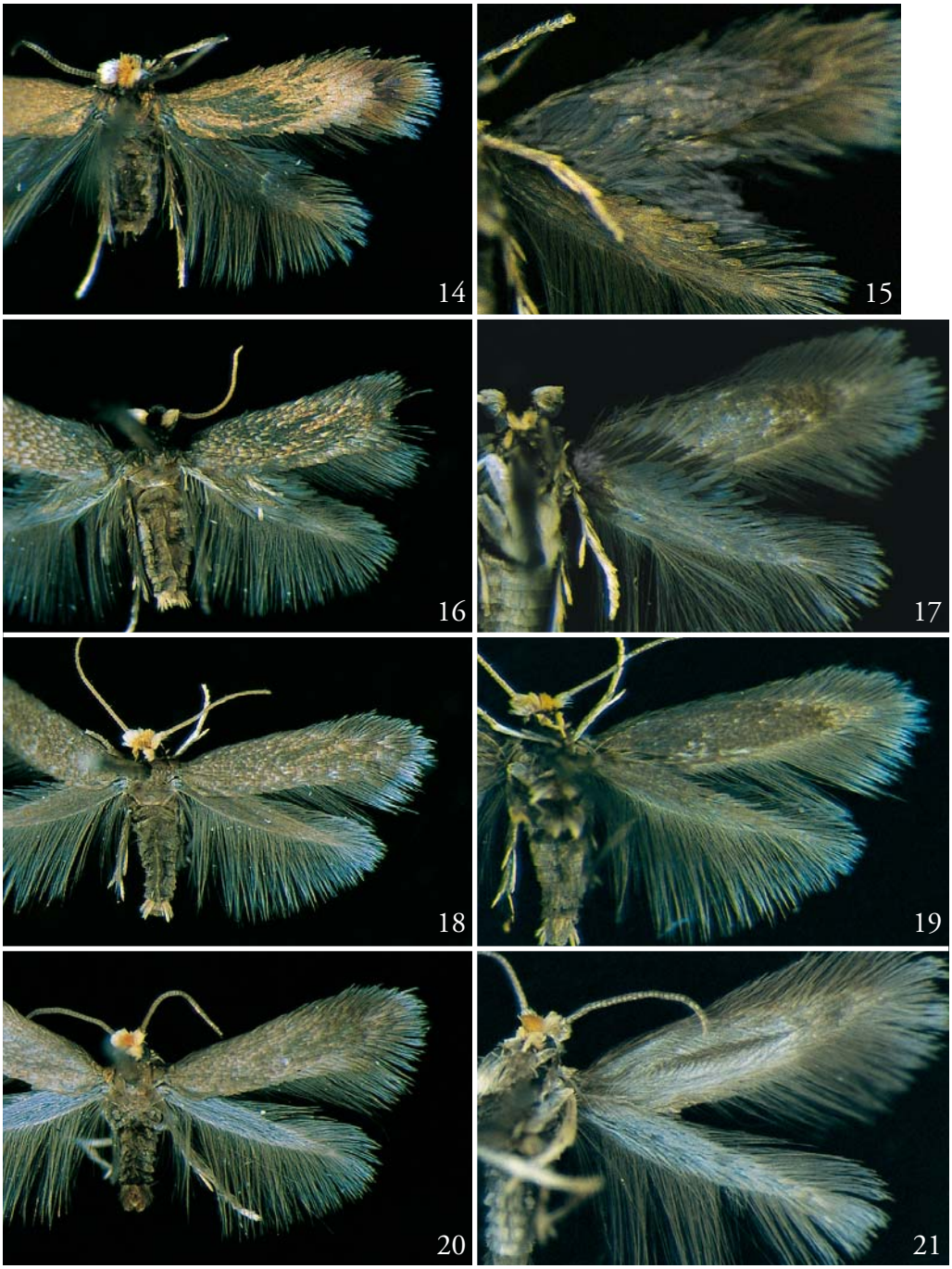
The *caesurifasciella*-group as recognized by Kemperman et al. (1985) is the only other group comprising Fagaceae-feeders. Despite some similarity, we keep this group separate, because of the uncommon condition of gnathos and uncus.

Description

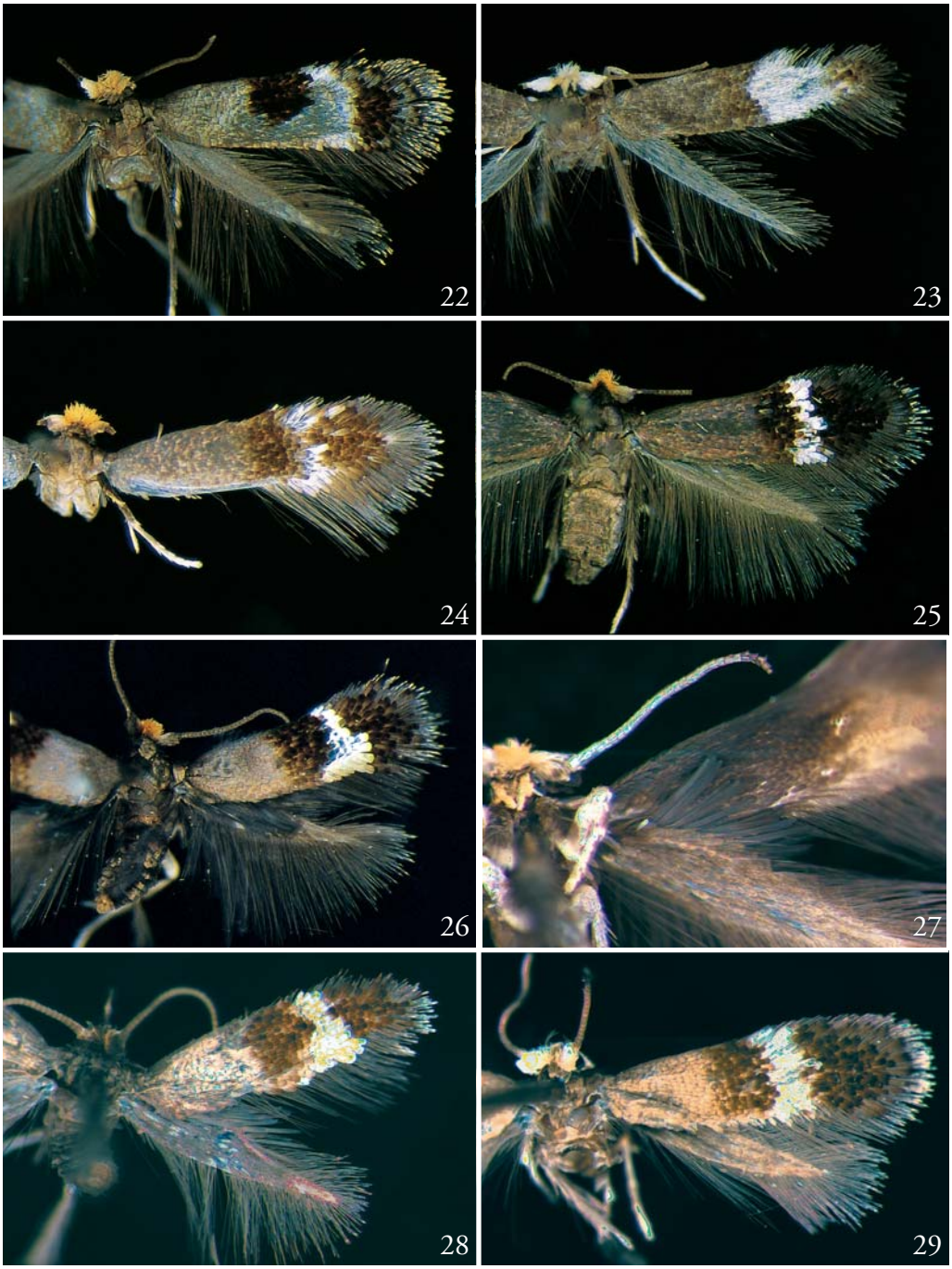
Adults uniform brown, often with shining wingtips, or wings with metallic fascia and bright shining colours. Scape in several species with dark edge. Males often with extensive androconial scales on hindwing, often long spatulate scales extending into fringe. Males usually with long and distinct abdominal tufts, often inserted on well sclerotised plates.

Male genitalia with bilobed uncus, and bilobed gnathos, rarely with anterior processes. Aedeagus usually with large and spinose manica; vesica with large number of distinct and often large cornuti; some species with coiled vesica in a bulbous basal part.

Female genitalia with usually well developed accessory sac, in many species with additional sclerotizations, often in the form of many spines, at cost of a



Figs. 14-21. *Stigmella* species, the unicolorous species, males, dorsal habitus and wing underside, showing androconial scales. – 14, 15, *S. omelkoi*, ♂ paratype, Primory'e; 16, 17, *S. fumida*, ♂, 36-6-1, Kunming; 18, 19, *S. dentatae*, ♂, 14-6-2, Maoershan mount; 20, 21, *S. aladina*, ♂, 14-6-2, mount Maoershan.



Figs. 22-29. *Stigmella* species, the fasciate species, dorsal habitus and wing underside, showing androconial scales (27). – 22, *S. circumargentea*, ♀, holotype; 23, *S. lithocarpella*, ♂, holotype; 24, *S. kao*, ♂ holotype; 25, *S. kao*, ♀ paratype; 26, 27, *S. vandrieli*, ♂ holotype and paratype (27); 28, *S. kurokoi*, Japan, Hokkaido; 29, *S. fervida*, paratype, Primory'e.

Table 1. Systematic list of hostplants. The hostplants are listed alphabetically by hostplant genus and species. The nepticulid species are given in taxonomic order per host.

Fagaceae	
Castanea crenata Sieb. & Zuc.	*S. chrysopterella* (=*fumida*?)
Castanopsis cuspidata (Thunb.) Schottky	*S. castanopsiella*
Castanopsis delavayi Franch.	*S.* sp. 1
Castanopsis indica (Roxb.) DC.	*S.* sp. 2
Castanopsis orthocantha Franch.	*S. kao*, *S.* sp. 1
Cyclobalanopsis acuta (Thunb.) Oersted	*S. caesurifasciella*
Cyclobalanopsis glauca (Thunb.) Oersted (syn. *Quercus glauca* Thunb.)	*S. caesurifasciella*
Cyclobalanopsis glaucoides Schottky (syn. *Quercus glauca* ssp. *schottkyana* Thunb.)	*S. vandrieli*
Lithocarpus dealbatus (Hook. f. et Thoms.) Rehd.	*S. circumargentea*, *S. lithocarpella*
Lithocarpus mairei (Schottky) Rehd.	*S.* cf. *circumargentea*
Quercus sp.	*S. kurokoi*
Quercus acutissima Carr.	*S. fumida, S. aladina*
Quercus dentata Thunb.	*S. dentatae, S. kurokoi*
Quercus mongolica Fisch.	*S. fervida, S. omelkoi, S. dentatae, S. aladina*
Quercus serrata Thunb. ex Murray	*S. omelkoi, S. aladina*
Quercus variabilis Bl.	*S. fumida, S. clisiotophora*

very reduced flimsy bursa. Ductus spermathecae often clearly coiled, in *castanopsiella* subgroup possibly partly fused with accessory sac. Tergum VIII often with longitudinal depressions.

Biology

Leafminers of almost exclusively Fagaceae: *Quercus*, *Cyclobalanopsis*, *Castanea*, *Castanopsis*, *Lithocarpus* and *Fagus*. Few species on other hosts: *Betula*, *Lonicera,* and *Acer*.

Checklist

***Stigmella ruficapitella*-group**

1. fervida Puplesis, 1984
2. omelkoi Puplesis, 1984
   kumatai Kemperman & Wilkinson, 1985
3. fumida Kemperman & Wilkinson, 1985
   ?*chrysopterella* Kemperman & Wilkinson, 1985 **?syn. n.**
   ?*kurii* Kemperman & Wilkinson, 1985 **syn. n.**
4. dentatae Puplesis, 1984
   pulla Kemperman & Wilkinson, 1985
5. aladina Puplesis, 1984
   quercifaga Kemperman & Wilkinson, 1985 **syn. n.**
6. clisiotophora Kemperman & Wilkinson, 1985
7. circumargentea Nieukerken & Liu, **sp. n.**
8. kao Nieukerken & Liu, **sp. n.**
9. castanopsiella (Kuroko, 1978)
10. kurokoi Puplesis, 1984
    valvaurigemmata Kemperman & Wilkinson, 1985
11. vandrieli Nieukerken & Liu, **sp. n.**
12. lithocarpella Nieukerken & Liu, **sp. n.**

***S. caesurifasciella*-group**

13. caesurifasciella Kemperman & Wilkinson, 1985
    egregilustrata Kemperman & Wilkinson, 1985 **syn. n.**

A list of hostplants and the *Stigmella* species feeding on them is given in table 1.

Key to East-Palaearctic species

1. Forewings more or less uniformly brownish or bronze, without distinct pale markings.....2
– Forewings with white or metallic fascia or distinct spots 6
2. Males 3
– Females [can only be identified by their genitalia]
3. Hindwing with distinct spatulate androconial scales, extending into fringe; forewing more or less shining bronze; scape usually with dark edge 4
– Hindwing without distinct spatulate androconial scales, at most small brown scales; forewing not metallic; scape uniformly pale 5
4. Frontal tuft pale yellow or orange; androconial scales brown .....*S. omelkoi*
– Frontal tuft black; androconial scales pale, almost white .....*S. fumida*
5. Anal tufts yellowish; hindwing upperside with brown lamellar scales; forewing underside dark brown.....*S. dentatae*
– Anal tufts grey-brown; hindwing upperside grey; underside of forewing with hairlike androconiae in fish-bone pattern, enclosing long hair-pencil, arising from hindwing .....*S. aladina*
6. Forewing with single postmedial metallic fascia, no other pattern but basal area sometimes paler than posterior part of wing and metallic.....9
– Forewing with two fasciae, or fascia joined to other pale area, or distal third almost completely white 7

7. Distal third of forewing almost completely white, not metallic, only small patch with brown scales at tip ..... *S. lithocarpella*
– Distal third of forewing not completely white, pattern more complicated 8
8. Forewing almost completely silver metallic with brown costal and distal patches. *S. circumargentea*
– Forewing with postmedial fascia and a second fascia or two spots at wing tip, sometimes joined with fascia along dorsum ..... *S. caesurifasciella*
9. Males 10
– Females..... [Difficult or impossible to separate without study of genitalia]
10. Hindwing with distinct spatulate androconial scales along edges; scape distinctly edged grey or fuscous 11
– Hindwing without androconial scales, or these very inconspicuous; scape edged or not 14
11. Androconial scales along hindwing costa almost as long as hindwing wide 12
– Androconial scales much shorter, not so distinct. 13
12. Frontal tuft orange; androconial scales dark brown; vesica with more than 2 coils *S. vandrieli*
– Frontal tuft grey-brown to black; androconial scales paler; vesica with one complete coil .... *S. kurokoi*
13. Valva with squarish, protruding inner lobe, without papillate lobe; aedeagus with small cornuti only; manica present ..... *S. kao*
– Valva triangular, inner lobe not prominent, but with ear-shaped papillate lobe; aedeagus with many cornuti of different sizes; manica absent .... *S. clisiotophora*
14. Scape completely yellowish white ..... *S. fervida*
– Scape edged with grey ..... *S. castanopsiella*

Stigmella fervida Puplesis
(figs. 29, 34, 35, 76, 77, 88, 89)

Stigmella fervida Puplesis 1984b: 593, 1985: 162. Holotype ♂, RSFR: Primor'ye, 20 km E of Ussuriysk, Gornotayezhnoye, 3.vii.1982, R. Puplesis (ZIAN) [examined]

Diagnosis

A fasciate species, recognized from the other fasciate species by the unedged scape, the absence of androconiae and the relatively dark wingbase. Female genitalia resemble those of *S. omelkoi*, but T8 very wide and short, bursa covered with pectinations and ductus spermathecae with fewer convolutions.

Description

Male (fig. 29). – Forewing length 2.1-2.6 mm (2.04 ±0.73, n=9), wingspan 4.2-5.4 mm. Head: frontal tuft pale yellow to orange; collar brown; scape silvery white, not edged, flagellum brown. Antennae with 31-34 segments (31.13±3.09, n=8). Thorax and forewings brown, forewing basal ⅓ shining brown-bronze, at ⅔ a silvery metallic fascia, slightly wider at dorsum, cilia-line distinct, terminal cilia silver; underside forewings dark brown. Hindwing brown on both sides. Abdomen brown, anal tufts hardly visible.

Female. – Forewing length 2.1 mm (n=1), wingspan 4.6 mm. Antenna with 24 segments (n=1). Underside forewing and hindwings grey. Abdominal tip blunt.

Male genitalia (figs. 76, 77). – Capsule length 245 µm (n=2). Vinculum anteriorly slightly concave. Uncus with widely separated hooklike processes, truncate, but inwards hooked tips, slightly arched inbetween. Gnathos with long posterior processes, in middle less sclerotized. Valva length 150-155 µm (n=2), with strongly inwards curved distal process of more than ⅓ valva length, inner margin rectangular; sublateral processes long. Aedeagus 315-320 µm long (n=2), short and wide; vesica with many cornuti of same size, one big cornutus at phallotrema; manica present, but inconspicuous and without spines.

Female genitalia (fig. 34, 35). – T8 very wide and short, no distinct furrows or rims, with about 16 setae centrally, c. 4 laterally. Anterior apophyses short. Total length bursa c. 1200 µm (n=1), basal part of ductus and accessory sac heavily folded; bursa thin, covered with small pectinations; accessory sac covered with strong pectinations. Ductus spermathecae with about 3 convolutions.

Biology

Hostplant. – *Quercus mongolica*, a deciduous oak.

Leafmines (figs. 88, 89). – Egg on leaf-upperside, between veins, sometimes close to margin. Early mine an extremely contorted gallery, doubling back several times, closely following earlier track, so that early mine forms a brown dot; this is further enhanced because the leaf around the mine stains pale brown; the frass in this part is brown, dispersed or coiled, often filling mine completely. Later the mine widens, but continues to double back, only in its final part it may follow a looser course; frass coiled or dispersed, black, filling about half the gallery width. Mine rarely crossing a vein.

Larva. – Yellow, with pale head; ganglia not visible. Feeding dorsum upwards.

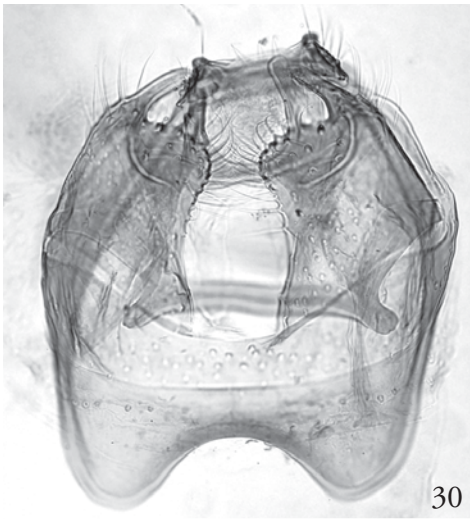
Life history. – Bivoltine, larvae found in June-July and September. Adults fly in June-July, spring generation not yet known.

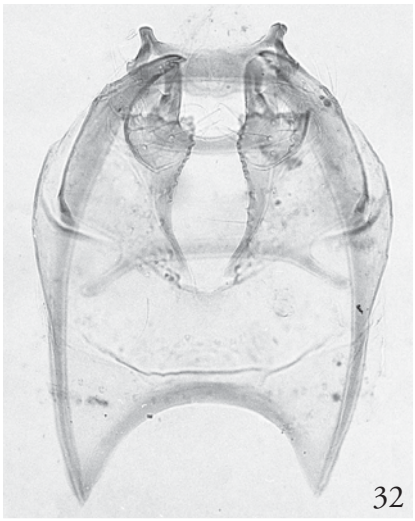
Distribution

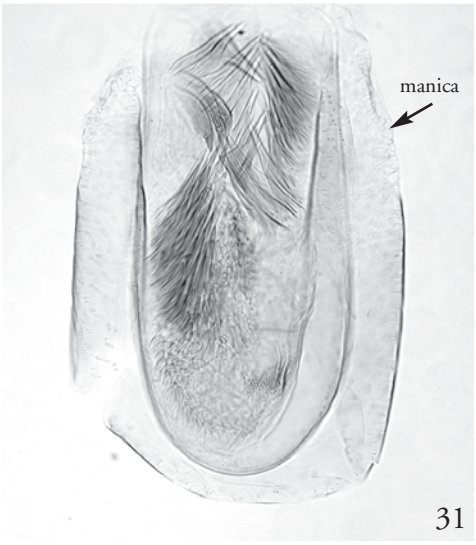
Primorskiy Kray and Heilongjiang.

Remarks

Although we failed to rear any adults, we are fairly







Figs. 30-33. Male genitalia, ventral view, capsule above, aedeagus below. – 30, 31, *Stigmella omelkoi,* Primory'e, slide EvN 2940; 32, *S. fumida¸* Shilin, 24-4-1, slide B 218; 33, *S. fumida¸* SW Kunming, 36-5-2, B 210.

certain that the Chinese material belongs to *S. fervida:* the very characteristic mines and larvae fit Puplesis' (1994) description very well. The mines are very similar to those of an as yet unnamed European species (Johansson & van Nieukerken in preparation).

Material examined. – CHINA (Heilongjiang): EvN no 9-1-1, 6 km E of Dailing, Dachinchuan Linchang, East Hill, 15.ix.1984, leafmines and 11 larvae; EvN no 10-1-1, 6 km E of Dailing, Dachinchuan Linchang, South Hill, 16.ix.1984, 10 larvae; EvN no 12-8-1, 5 km E of Dailing, Dachinchuan Linchang, Yinchun garden, 17.ix.1984, 14 larvae; EvN no 14-6-1, Maoershan mount, 5 km NE Maoershan, 21.ix.1984, 3 larvae; EvN no 16-8-1, Laoshan, 5 km E Maoershan, 26.ix.1984, 2 larvae [rearing in all cases failed]. – RUSSIA: 1♂, paratype, Primory'e, 20 km E Ussurijsk, 6.vii.1982, R. Puplesis (RMNH); 10♂, 2♀ Primory'e, 20 km E Ussurijsk, GTS, 2.vii-4.viii.1982, R. Puplesis (RMNH).

Stigmella omelkoi Puplesis
(figs. 14, 15, 30, 31, 36, 37, 80, 81, 90)

Stigmella omelkoi Puplesis 1984b: 593, 1985: 161. Holotype ♂, RSFR: Primor'ye, 20 km E of Ussuriysk, Gornotayezhnoye, ex l. 4.iii.1983, larvae 8.ix.1982, R. Puplesis (ZIAN) [examined]

Stigmella kumatai Kemperman & Wilkinson, 1985: 50. Holotype ♂, JAPAN: Hokkaido, Moiwa, Sapporo, 8.vii.1977, *Quercus mongolica*, T. Kumata, Genitalia slide VU 0651 (EIHU) [not examined] (Synonymized by Puplesis 1994: 163).

Stigmella omelkoi; Puplesis 1994: 163.

Diagnosis

Male recognized by a combination of a pale orange frontal tuft, edged scape, unicolorous wings and long spatulate androconiae in hindwing-fringe. *S. fumida* is similar, but has a black frontal tuft and paler androconiae. *S. omelkoi* resembles the European *S. suberivora*. Female difficult to separate from other unicolorous species, but more metallic bronze. Male genitalia with characteristic broad manica, which envelopes the aedeagus completely; in other species only the caudal half. Female genitalia similar to those of *S. fervida*, but *omelkoi* with more convolutions in ductus spermathecae and narrower T8.

Description

Male (figs. 14, 15). – Forewing length 2.3-2.6 mm (2.47±0.09, n=8), wingspan 4.7-5.6 mm. Head: frontal tuft pale orange; collar dark fuscous; scape silvery white, posterior edge fuscous, flagellum fuscous. Antennae with 31-32 segments (31.6±0.6, n=5). Thorax and forewings shining bronze brown, wingtip purplish; underside forewings dark brown, without androconial scales. Hindwing pale brown, covered with fuscous lamellar androconial scales; long lamellar androconial scales extending in fringe over ¼ to ⅓ of fringe length; costal androconiae longer than dorsal ones (figs. 80, 81). Abdomen brown, anal tufts pale brown.

Female. – Forewing length 2.2-2.5 mm (2.33 ± 0.08, n=9), wingspan 4.7-5.3 mm. Antennae with 22-25 segments (23.2±1.3, n=5). Scape not edged, completely silvery white. Hindwing and underside of wings grey. Abdominal tip blunt.

Male genitalia (figs. 30, 31). – Capsule length 270-300 µm (n=3). Vinculum anteriorly bilobed. Uncus with widely separated short horns, these with less sclerotized 'windows' in middle. Gnathos with widely separated posterior processes. Valva length 185-200 µm (n=3), with pointed distal process of less than ¼ valva length, inner margin with prominent lobe; sublateral processes short. Aedeagus 350-385 µm long (n=3); vesica with distally about 7-9 large conical cornuti, and two lateral groups of needle-shaped cornuti, ± 50 in total; basally with small blunt or pectinate cornuti; manica large and conspicuous, enveloping aedeagus completely.

Female genitalia (figs. 35, 36). – T8 laterally with longitudinal bare furrows, demarcated by sclerotized rims, posterior margin rounded; centrally with 15-23 setae, on lateral patches 5-6 setae each. Bursa well visible, total length 900-1000 µm (n=2), walls thin, without pectinations. Accessory sac heavily folded, with some pectinations. Ductus spermathecae with 7-7½ convolutions.

Biology

Hostplant. – *Quercus mongolica* (including var. *grosseserrata* in Japan), *Q. serrata* (in Japan).

Leafmines (fig. 90). – Egg on leaf-upperside, usually against a vein. Mine a long sinuous gallery, first with linear or narrow dispersed black frass; in last instar with green coiled frass, filling about ½ mine width; mine much wider. Mine easily separated from sympatric *S. aladina* and *dentatae*, which have linear frass throughout and the egg on leaf-underside.

Larva. – Yellow, no field notes made.

Life history. – Bivoltine, larvae found in June-July and late August-September. Adults fly in May-June (indoors rearing March) and July to early September.

Distribution

Japan: Hokkaido, Primorskiy Kray and China: Heilongjiang.

Material examined. – 18♂, 16♀, leafmines. – CHINA (Heilongjiang): 1♂, EvN no 14-6-3, Maoershan mount, 5 km NE Maoershan, 21.ix.1984, from 4 larvae, e.l. 22.iii.1985, *Quercus mongolica* (ZIAB). – RUSSIA: 1♂, paratype, Primory'e, 20 km E Ussurijsk, 26.vii.1982, R. Puplesis (RMNH); 16♂, 16♀ Primory'e, 20 km E Ussurijsk, GTS, 7.vii-13.viii, 1-4.ix.1982, R. Puplesis (RMNH).

Stigmella fumida Kemperman & Wilkinson
(figs. 16, 17, 32, 33, 93)

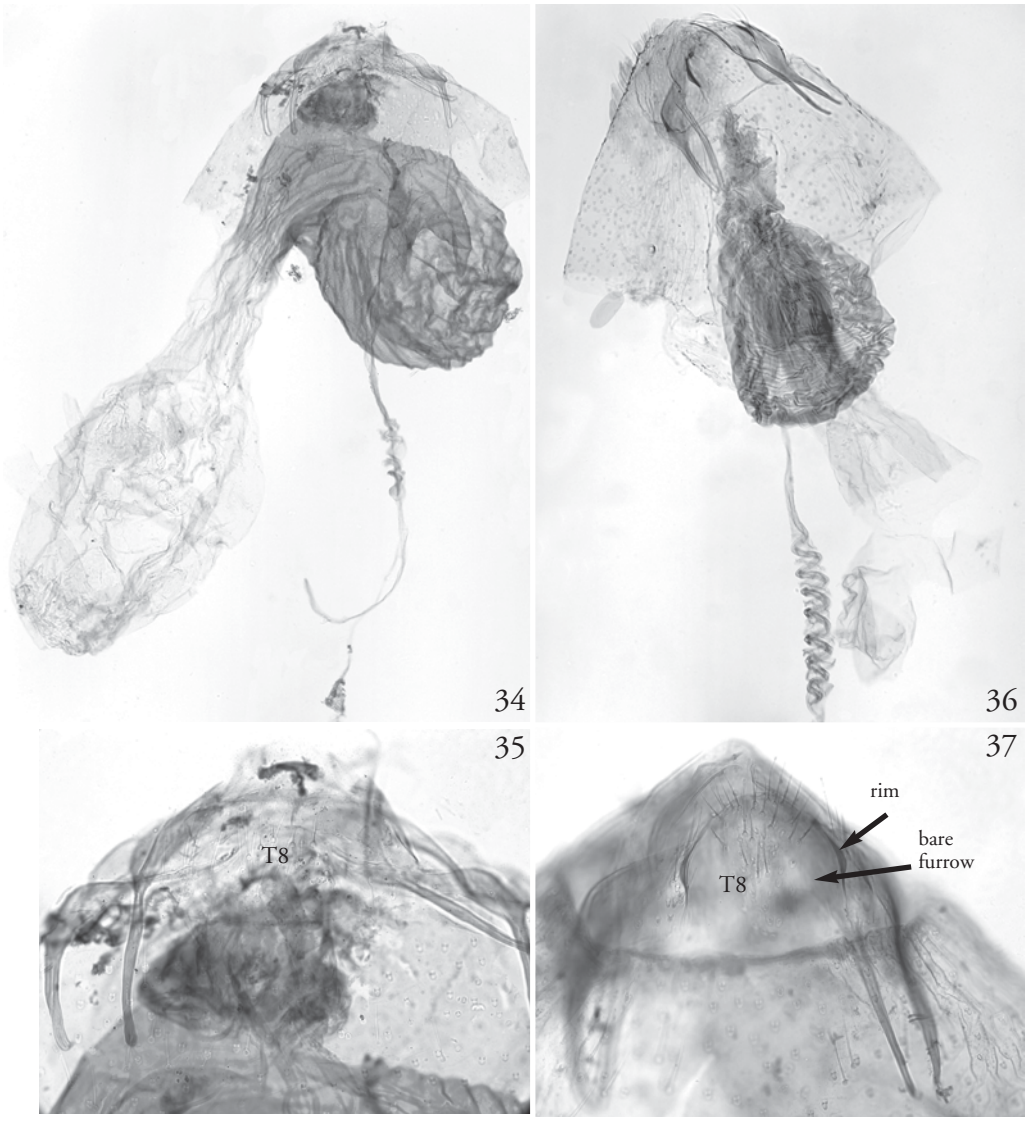
Stigmella fumida Kemperman & Wilkinson 1985: 42. Holotype ♂, JAPAN: Tsushima, Kamitsushima, em. 27.v.1980, T. Kumata slide VU 0691(EIHU) [examined]
[possible new synonyms:]

Stigmella chrysopterella Kemperman & Wilkinson, 1985: 48. Holotype ♀, JAPAN: Kyushu, Hikosan, Buzen, 23.v.1955, H. Kuroko, *Quercus acutissima*, slide VU 0724 (ELUO) [not examined]

Stigmella kurii Kemperman & Wilkinson, 1985: 51. Holotype ♀, JAPAN: Kyushu, Hikosan, Buzen, 19.vii.1955, H. Kuroko, *Castanea crenata*, slide VU 0773 (ELUO) [not examined] **syn. n. of *chrysopterella***

Diagnosis

Male most similar to *omelkoi*, but separated by black frontal tuft and paler androconial scales. Female (if *chrysopterella* indeed is the female) difficult to separate from other unicolorous species, but usually



Figs. 34-37. Female genitalia, dorsal view and detail of abdominal tip with T8 (35, 37). – 34, 35, *Stigmella fervida*, Primory'e, slide EvN 2945; 36, 37 *S. omelkoi*, Primory'e, slides EvN 2931 and 2932.

frontal tuft darker. Female genitalia characterized by ductus spermathecae with 15 convolutions.

Description

Male (figs. 16, 17). – Forewing length 2.3-2.7 mm (2.47±0.17, n=4), wingspan 5.2-6.1 mm. Head: frontal tuft black, palpi contrasting white; collar dark fuscous; scape yellowish white cream, posteriorly edged with brown, flagellum brown. Antennae with 25-29 segments (n=4).

Forewings and thorax shining fuscous, underside pale brown. Hindwings grey, covered with cream androconial scales, extending about ⅓ into fringe, along costal edge white and brown spatulate androconial scales as long as hindwing width. Abdomen with anal tufts, colour not noted.

Female. – Unknown (but see remarks).

Male genitalia (figs. 32, 33). – Capsule length 290

µm (n=2). Vinculum anteriorly bilobed. Uncus with widely separated short horns, these with less sclerotized 'windows' in middle. Gnathos with widely separated posterior processes. Valva length 190-200 µm (n=2), with pointed distal process of about ⅓ valval length, inner margin with prominent pointed lobe. Aedeagus 505-540 µm (n=2), 200 µm wide at basis; slightly asymmetric; vesica with long cornuti arranged in two rows, pointing towards each other, in total about 65 long cornuti, distally 5 large triangular cornuti and basally smaller pointed and pectinate cornuti. Manica small, not very conspicuous.

Biology

Hostplants. – *Quercus acutissima, Q. variabilis*, two common deciduous oaks, widespread in degraded forest areas. Possibly also on *Castanea crenata* (see remarks).

Leafmines (fig. 93). – Egg on leaf-upperside (n=6), or underside (n=1), usually on or against a vein. Mine a sinuous gallery throughout, first with narrow brown linear frass, filling ⅓ of mine, sometimes filling it completely; in final instar frass broadly dispersed, or coiled, black; occasionally narrower.

Larva. – Yellowish white with pale brown head and narrow black tergites on metathorax and abdominal segments 1-8.

Life history. – Insufficiently known, larvae found in October, adults reared from February-May, one adult collected in July (Korea). Probably at least bivoltine.

Distribution

Japan: Tsushima, possibly Kyushu (*chrysopterella*), North Korea, China: Yunnan. Probably widespread in sino-japanese zone.

Remarks

Unfortunately we did not rear females, which remain undescribed. It is, however, very likely that *S. chrysopterella* Kemperman & Wilkinson, described from a single female from *Quercus acutissima*, is in fact the female of *fumida*. *S. omelkoi* and *S. fumida* are rather similar as males, and so are the females of *omelkoi* and *chrysopterella*. More reared material is needed before any formal synonymising with *fumida* is justified.

However, we do synonymize here *S. kurii* Kemperman & Wilkinson with *chrysopterella,* which was described from the same locality, also from a single female, but reared from *Castanea*. The slight differences between *chrysopterella* and *kurii* mentioned by their authors do not warrant specific status. The photographs of the female genitalia are almost identical in all details, including the 15 convolutions of the ductus spermathecae (Kemperman & Wilkinson incorrectly state 11). The cited difference in shape of the coils is probably caused by a preparation artefact. Also the reported difference in head colour can easily occur within one species. Moreover, in Europe all species feeding on *Castanea* feed also on *Quercus*.

Material examined. – 5♂, leafmines. – CHINA (Yunnan): 1♂, EvN no 24-4-1, Shilin (Stone forest), Lunan county, 6.x.1984, from 1 larva, e.l. 25.ii.1985; 2♂, EvN no 36-5-1/2, 18 km SW Kunming, along road to Anning, 23.x.1984, from 3 larvae, e.l. 20.ii.1985-4.iii.1985; 1♂, EvN no 36-6-1, 18 km SW Kunming, along road to Anning, 23.x.1984, from 2 larvae, e.l. 21.ii.1985; leafmines, EvN no 22-17-1, Kunming, Qiongzhu Si (Bamboo temple), 5.x.1984, empty mines. – NORTH KOREA: 1♂, Mt. Pektusan before Sam-zi-yan hotel, lake-shore, 20.vii.1977. No. 383, light-trap, Pely & Draskovits (RMNH).

Stigmella dentatae Puplesis
(figs. 18, 19, 38, 39, 42, 44, 45, 86, 87, 91)

Stigmella dentatae Puplesis 1984a: 114, 1984c: 99. Holotype ♂, RSFR: Primor'ye, 20 km E of Ussuriysk, Gornotayezhnoye, 29.v.1983, R. Puplesis (ZIAN) [examined]
Stigmella pulla Kemperman & Wilkinson, 1985: 43. Holotype ♂: JAPAN, Hokkaido: Moiwa, Sapporo, 8.v.1967, *Quercus mongolica* var. *grosseserrata*, T. Kumata (EIHU) (Synonymized by Puplesis 1994: 161) [not examined]
Stigmella dentatae; Puplesis 1994: 162.

Diagnosis

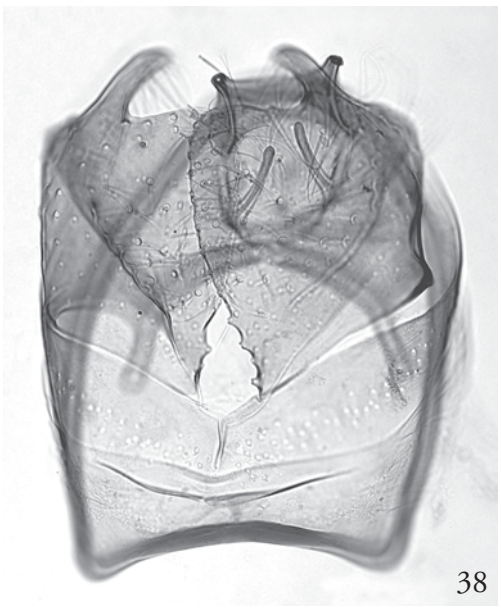
A uniform brown species, male distinguished from *omelkoi* and *aladina* by the lack of their conspicuous androconial scales, *dentatae* has only some androconial scales along hindwing costa and brown hindwings; the yellow abdominal tufts separate it also from *aladina*, which has grey tufts. Male genitalia characterized by basally broadened aedeagus and coiled vesica Females only separated by genitalia: accessory sac folded, with one bend and covered with many spines.

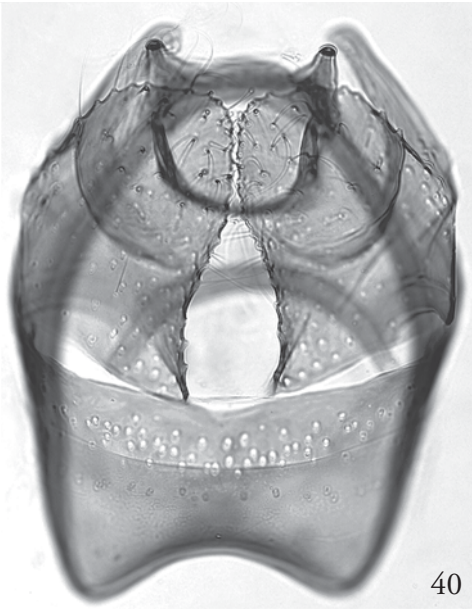
Description

Male (figs. 18, 19). – Forewing length 2.3-2.8 mm (2.55±0.18, n=6), wingspan 5.3-6.4 mm. Head: frontal tuft yellowish orange; collar and scape cream, flagellum grey brown. Antennae with 32-37 segments (n=4). Thorax and forewings uniform brown, cilia similar, their tips greyish; underside brown, without androconial scales (fig. 86). Hindwing disk with brown scales, cilia grey; underside brown, costal edge with pale brown spatulate androconial scales (fig. 87). Abdomen grey-brown, large yellow anal tufts.

Female. – Forewing length 2.5 mm (2.42±0.09, n=4), wingspan 5.1-5.7 mm. Antennae with 24-25 segments (n=3). Hindwing pale grey, fringe normal. Abdominal tip blunt.

Male genitalia (figs. 38, 39, 41). – Capsule length 265-300 µm (n=4). Vinculum anteriorly concave. Uncus with widely separated horns. Gnathos with widely separated long posterior processes. Valva length 190-215 µm (n=4), with pointed distal process





Figs. 39-41. Male genitalia, ventral view, above capsule, below aedeagus. – 38, 39, *Stigmella dentatae*, Primory'e, slide EvN 2952, aedeagal wall partly broken; 40, 41, *Stigmella aladina*, Primory'e, slide EvN 2956.

Fig. 42. *Stigmella dentatae,* Primory'e, slide EvN 2950, aedeagus with partly everted vesic.

of less than ¼ valva length, inner margin with rounded lobe. Aedeagus 370-415 µm long (n=4), 185-220 µm wide at bulbous base, asymmetrically widened at right side; vesica with one coil basally, basal part with many minute cornuti, distal part with ± 70 large cornuti. Manica spinose, distinct.

Female genitalia (fig. 44, 45). – T8 rounded, with two longitudinal bare furrows, a group of 6-8 setae centrally. Bursa present, but flimsy, usually lost during preparation; accessory sac folded, with one bend; covered with many spines of different sizes, partly joined in groups; the spines concentrated on right side. Ductus spermathecae long, a long straight part followed by 4 convolutions.

Biology

Hostplant. – *Quercus mongolica* (including var. *grosseserrata* in Japan), *Q. dentata* (Primorskiy Kray).

Leafmines (fig. 91). – Egg on leaf-underside, in single positively identified mine away from a vein. In the mixed series with *S. aladina* eggs are found on veins or away from them. Mine a long narrow linear gallery with linear black frass throughout, not different from *S. aladina*. These mines are also very similar to those of the European *S. roborella* (Johansson).

Larva. – Pale yellow, head pale brown, ganglia invisible. Feeds dorsum upwards.

Life history. – Bivoltine, larvae found in July and September-November; adults fly in May (indoors rearing March-April) and July-September.

Distribution

Japan: Hokkaido, Primorskiy Kray, Heilongjiang.

Material examined. – 126♂, 4♀ – CHINA (Heilongjiang): 1♂, EvN no 10-1-2-6, 6 km E of Dailing, Dachinchuan Linchang, South Hill, 16.ix.1984, from 21 larvae, 26.iii.1985-1.iv.1985 (ZIAB); 1♂, EvN no 12-8-2, 5 km E of Dailing, Dachinchuan Linchang, Yinchun garden, 17.ix.1984, from 21 larvae, e.l. 26.iii.1985-28.iii.1985 (ZIAB); 4♂, EvN no 14-6-2, Maoershan mount, 5 km NE Maoershan, 21.ix.1984, from 51 larvae, e.l. 23.iii.1985-29.iii.1985 (ZIAB, RMNH); 1♂, EvN no 16-8-2, Laoshan, 5 km E Maoershan, 26.ix.1984, from 15 larvae, e.l. 28.iii.1985 (ZIAB). – RUSSIA: 109♂, 3♀ (including 1 paratype), Primory'e, 20 km E Ussuryisk, Gornotaezhnoye, 7.vii-1.ix.1982, 31.vii.1983, R. Puplesis (RMNH); 10♂, Primory'e, 10 km S. Slavyanki Ryazanovka, 25-27.vii.1983, R. Puplesis (RMNH). – Leafmines: many, in mixed series with *S. aladina*, except the mine 10-1-2-6 from which a male *dentatae* emerged.

Stigmella aladina Puplesis
(figs. 20, 21, 40, 41, 43, 46-48, 82-85, 92)

Stigmella aladina Puplesis 1984a: 115, 1984c: 100. Holotype ♂, RSFR: Primor'ye, vicinity of Spassk-Dal'niy, ex l. 4.viii.1983, larvae 18.vii.1983, R. Puplesis (ZIAN) [examined]

Stigmella quercifaga Kemperman & Wilkinson, 1985: 44. Holotype ♂, Japan, Kyushu, Hikosan, Buzen, 10.vii.1955, *Quercus acutissima*, H. Kuroko, Genitalia slide VU 663 (ELUO) [examined] **Syn. n.**

Stigmella aladina; Puplesis 1994: 162.

Diagnosis

Male resembles *dentatae*, but can be distinguished easily by the grey-brown anal tufts in contrast to the yellow tufts in *dentatae*; moreover *aladina* has a complex of androconiae on forewing-underside in a fishbone pattern enclosing a hair-pencil. Females can only be separated from *dentatae* and *omelkoi* by genitalia: the plate in accessory sac is characteristic.

Description

Male (figs. 20, 21). – Forewing length 2.1-2.4 mm

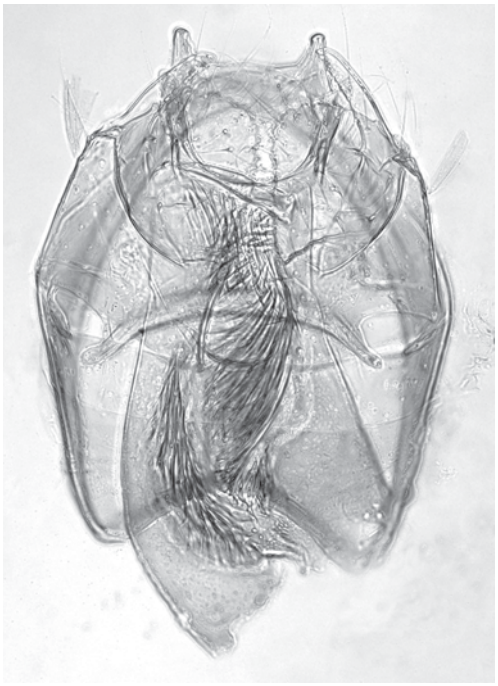


Fig. 43. *Stigmella aladina*, male genitalia. Holotype of *S. quercifaga* Kemperman & Wilkinson, slide VU 663.

(2.29±0.15, n=9), wingspan 4.6-5.7 mm. Head: frontal tuft yellowish orange; collar and scape cream, flagellum brown. Antennae with 30-32 segments (31.38±1.19, n=8). Thorax and forewings brown, with leaden grey to bronze gloss, slightly purple towards tip; underside forewings with a long oval patch of androconial scales arranged obliquely in a fish-bone like pattern of two rows, meeting in midline; in midline a row of lamellar scales (figs. 82-85). Hindwing upperside grey, along costa first costal bristles normal, brown, a second group silvery white and very much lengthened, forming a hair-pencil, fitting in the groove formed by the fish-bone pattern on forewing underside (figs. 82, 83). Abdomen grey-brown, anal tufts long, dark grey.

Female. – Forewing length 2.1-2.6 mm (2.26 ±0.16, n=10), wingspan 4.7-5.6 mm. Antennae with 23-26 segments (25±1.2, n=4). Underside forewing and hindwing grey, no special scales. Abdomen blunt.

Male genitalia (figs. 40, 41, 43). – Capsule length 255-305 µm (276.7±18.5, n=6). Vinculum anteriorly concave. Uncus with widely separated horns, slightly curved at tip. Gnathos with widely separated long posterior processes. Valva length 195-220 µm (206.7 ±11.4, n=6), with rather long pointed distal process of more than ⅓ valva length, inner margin with prominent lobe. Aedeagus 280-310 µm long (296.7±6.1, n=6), 150-165 µm wide, hardly longer than capsule; vesica with very large cornutus at phallotrema, as long as aedeagal width; further with four different groups of cornuti. Spinose manica present, not very distinct.

Female genitalia (fig. 46-48). – T8 slightly pointed, with 12-22 setae. Bursa present, but flimsy, usually lost during preparation; accessory sac folded, basally with large chitinous plate and a group of blunt, very small spines. Ductus spermathecae long, a long straight part followed by 7-8 distinct convolutions.

Biology

Hostplant. – *Quercus mongolica*, in Japan on *Q. serrata* and *Q. acutissima*.

Leafmines (fig. 92). – Egg on leaf-underside, in single positively identified mine on a vein. In the mixed series with *S. dentatae* eggs are found on veins or away from them. Mine a long narrow linear gallery with linear black frass throughout, not different from *S. dentatae*. These mines are also very similar to those of the European *S. roborella* (Johansson).

Larva. – Pale yellow, head pale brown, ganglia invisible. Feeds dorsum upwards.

Life history. – Bivoltine, larvae found in July and September, in Japan, Kyushu already in May. Adults fly in July-August, spring generation only known from reared specimens (March-April).

Distribution

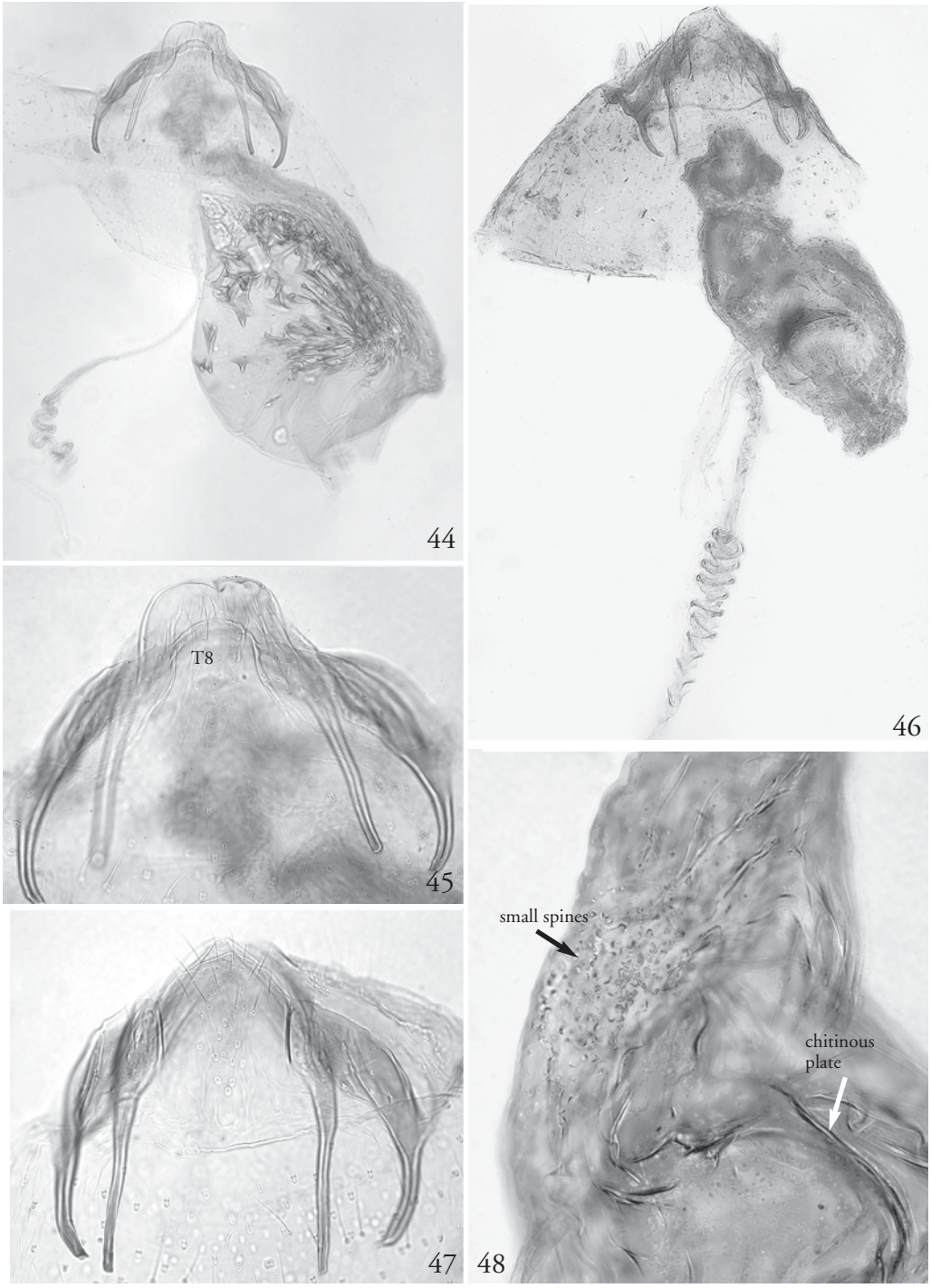
Japan: Kyushu, Primorskiy Kray and Heilongjiang.

Remarks

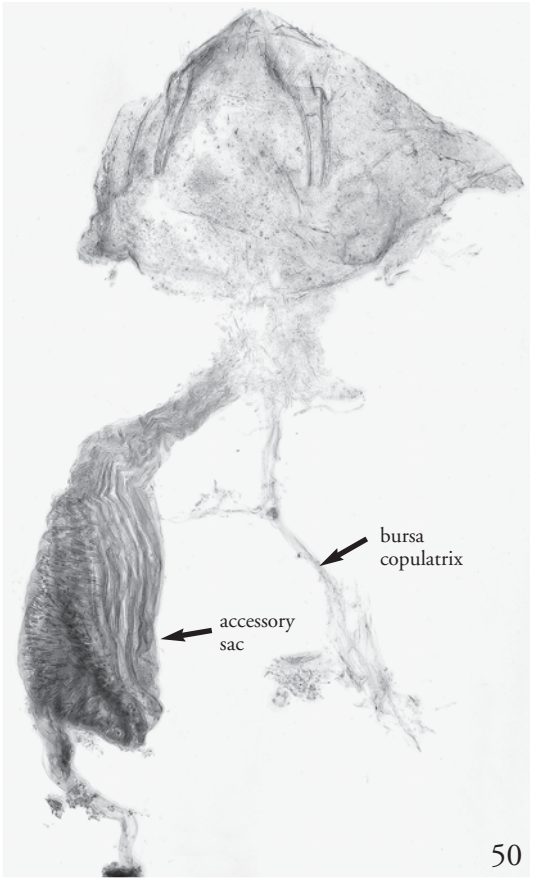
Examination of the holotype and a female paratype of *quercifaga* confirmed the suspected synonymy. The aedeagus as illustrated in fig. 103 of Kemperman & Wilkinson (1985) does not resemble that of the holotype (fig. 43) at all: it shows a non-existent coil and lacks the large cornutus; it more closely resembles *dentatae*. Probably drawings have been inadvertently swapped.

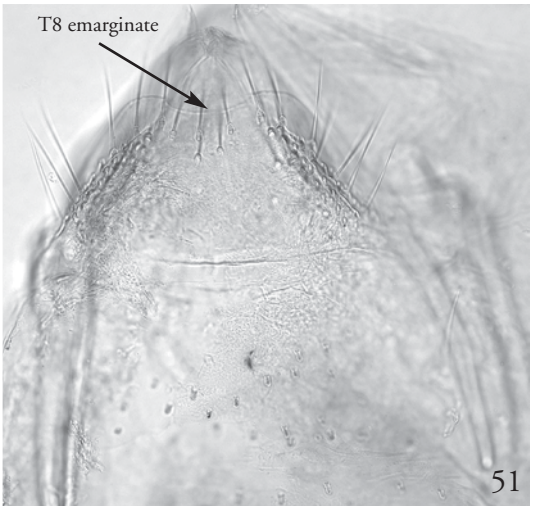
The characteristic androconial scales of this species were overlooked both by Puplesis (1984a, 1994) and by Kemperman & Wilkinson (1985). The pattern of these scales is very remininiscent of similar scales in the European *S. rolandi* van Nieukerken (van Nieukerken 1990), which belongs to a completely different group of species. The female genitalia closely resemble those of the European *Stigmella svenssoni* (Johansson) (see Johansson & Nielsen 1990).

It is not unlikely that some of the vacated mines on *Quercus acutissima*, collected by us in Yunnan, belong to this species, which occurs on this oak in Japan. However, since in Heilongjiang this species was usually reared together with *S. dentatae* from similar mines, data of vacated mines cannot be further considered.



Figs. 44-48. Female genitalia, dorsal view and detail of abdominal tip with T8 (45, 47) and detail of accessory sac (48). – 44, 45, *Stigmella dentatae*, Primory'e, slide EvN 2939; 46, *S. aladina*, Primory'e, slide EvN 2865; 47, 48, idem, paratype *quercifaga,* Kyushu, slide VU 0788.





Figs. 49-51. *Stigmella circumargentea*, female genitalia, dorsal view and detail of abdominal tip. – 49, holotype, slide A091; 50, 51, paratype, slide EvN 2867.

Material examined. – 44♂, 12♀ – CHINA (Heilongjiang): 1♂, EvN no 10-1-2-11, 6 km E of Dailing, Dachinchuan Linchang, South Hill, 16.ix.1984, from 21 larvae, e.l. 26.iii.1985-1.iv.1985 (ZIAB); 1♂, EvN no 12-8-2, 5 km E of Dailing, Dachinchuan Linchang, Yinchun garden, 17. ix.1984, from 21 larvae, e.l. 26.iii.1985-28.iii.1985 (ZIAB); 4 ♂, 3 ♀, EvN no 14-6-2, Maoershan mount, 5 km NE Maoershan, 21.ix.1984, from 51 larvae, e.l. 23.iii.1985-29.iii. 1985 (ZIAB, RMNH). – Japan: 1♂, 1♀ (holotype and paratype of *quercifaga*), Kyushu, Hikosan, Buzen, 10-12.vii. 1955, *Quercus acutissima*, H. Kuroko (ELUO). – RUSSIA: 37♂, 8♀ (incl. 1 paratype), Primory'e, 20 km E Ussuryisk, 1982-1983, R. Puplesis (RMNH). – Leafmines: many, in mixed series with *S. dentatae*, except the mine 10-1-2-11 from which a male *aladina* emerged.

Stigmella clisiotophora Kemperman & Wilkinson

Stigmella clisiotophora Kemperman & Wilkinson, 1985: 48. Holotype ♂: JAPAN, Tsushima: Izuhara, em. 2.vi.1980, *Quercus variabilis*, T. Kumata (EIHU) [not examined].

Diagnosis

A fasciate species with edged scape and short androconial scales, resembling *S. kao*. Male genitalia characterized by relatively short aedeagus and valva with papillate ear-like lobe. See further original description.

Biology

On *Quercus variabilis*, mine rather similar to that of *fumida* on the same host. It is possible that mines of *S. clisiotophora* were amongst the many empty mines we found on *Q. variabilis* and *Q. acutissima* in Yunnan.

Distribution

Only known from the small island of Tsushima in Japan. Likely to occur in China as well.

Stigmella circumargentea van Nieukerken & Liu **sp. n.** (figs. 22, 49-51, 94)

Type material. – Holotype ♀ CHINA (Yunnan), Kunming, Qiongzhu Si (Bamboo temple), 25.08N-102.37E, 5-18 OCT 1984, 2100 m, van Nieukerken & van Driel, Evergreen cupuliferous forest on northern slope, *Lithocarpus dealbatus* (Hook. f. et Thoms.) Rehd., e.l. 17-20 NOV 1984, EvN no 22-2-2, Genitalia slide A091 (ZIAB). – Paratype ♀ data as holotype, but e.l. 22.xi, Genitalia slide EvN 2867 (RMNH). The types were reared from 2 larvae. – Further material: 47 leaves with empty mines.

Etymology. – *circumargentea:* an adjective, from circum (Latin) =around and argenteus (Latin) = silver, describing the large extension of the silver forewing colour around a small brown patch.

Diagnosis

Easily recognized by the colour pattern of the forewing, being almost completely metallic leaden to silver, with the exception of brown dorsal and terminal patches. Female genitalia characterized by emarginate T8 and large group of spines at left side of accessory sac. *S. lithocarpella*, which occurs on the same host and locality is very different externally and also makes completely different leafmines, almost resembling *Ectoedemia*-mines.

Description

Male unknown.

Female (fig. 22). – Forewing length 2.8 mm (n=2), wingspan 6.2 mm. Head: frontal tuft pale yellowish white to pale orange; collar grey; scape white; flagellum brown. Antennae with 22 segments (n=1).

Thorax and forewing shining metallic leaden, with a coppery gloss, more silvery in apical part (fascia); at ½ a blackish brown patch along costa, enclosed by the junction of fascia and basal patch; fascia followed by dark brown patch; terminal scales silvery with brown tips, which form a cilia line; terminal cilia silvery white. Hindwing grey.

Male genitalia unknown.

Female genitalia (fig. 49-51). – T8 with emarginate posterior margin; middle area with about 6 setae, otherwise bare; two lateral scaly patches with each 10-13 setae. Bursa flimsy, hardly visible; accessory sac total length c. 800 µm, with narrow ductus and heavily, longitudinally folded walls; at left side covered with numerous (more than 250) spines. Ductus spermathecae originating in distal part of accessory sac, hardly convoluted.

Biology

Hostplant. – *Lithocarpus dealbatus*, an evergreen cupuliferous tree with entire, coriaceous leaves. Mines collected on leaves with a total length of 40-125 mm. Mines on *L. mairei* (same locality) probably belong also to this species.

Leafmines (fig. 94). – Egg deposited on leaf upperside, between the margin and midrib. Mine starts as a long gallery, varying from sinuous to almost straight, with linear to dispersed frass, filling early mine, later frass ⅓ width of mine. Total mine length c. 4-6 cm.

Larva. – Yellow, headcapsule brown. Feeds with dorsum upwards.

Life history. – Larvae found in October, adults reared in November.

Distribution

Yunnan.

Remarks

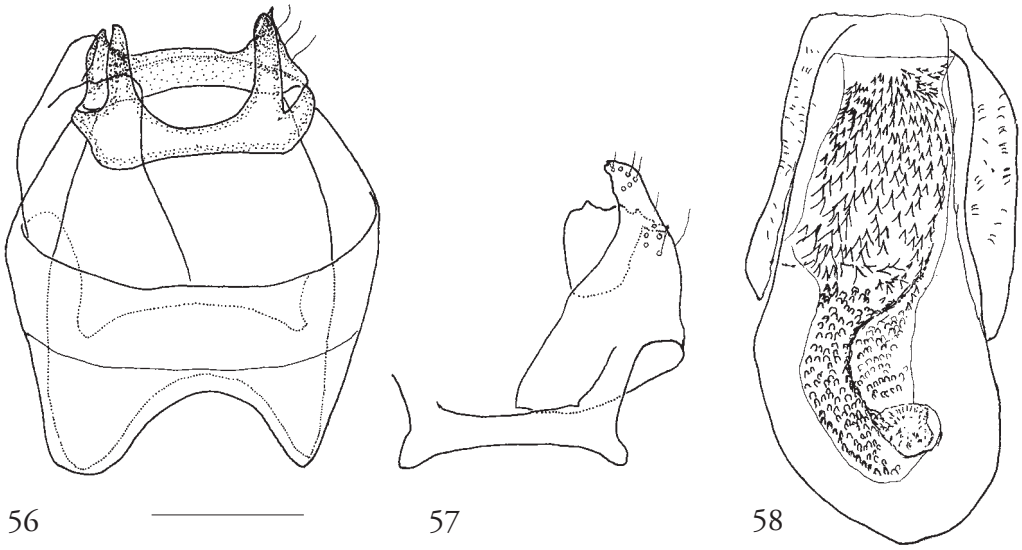
Although it is in general better not to describe

Figs. 52-55.
Stigmella kao, holotype, male genitalia, ventral view. – 52, Capsule; 53-55, aedeagus, with enlarged details.

Nepticulidae on the basis of the female sex only, we have done so here because this species is well defined both externally, in genitalia, and in its biology. On the basis of the female genitalia we suppose that this species belongs to the *ruficapitella*-group sensu stricto and not in the *castanopsiella* subgroup.

Stigmella kao van Nieukerken & Liu **sp. n.**
(figs. 24, 25, 52-61, 95)

Type material. – Holotype ♂: CHINA (Yunnan), Kunming, Qiongzhu Si (Bamboo temple), 25.08N-102.37E, 5-18 OCT 1984, 2100 m, van Nieukerken & van Driel, Evergreen cupuliferous forest on northern slope, *Castanopsis orthocantha* Franch., e.l. 9-16 NOV 1984 (10-12), EvN no 22-5-2, Genitalia slide A080 (ZIAB) [metathorax and hindwings on separate micropin, antennae lost]. – Paratypes, 3♂, 5♀, same data, reared from 18 larvae, Genitalia slides ♂: A109, A136, ♀: A081, EvN 2864 (ZIAB, RMNH). – Further material: leaves with 61 mines, 15 collected with larvae.



Figs. 56-58. *Stigmella kao*, holotype, male genitalia, ventral view, scale 100 µm. – 45, capsule, ventral view; 46, valva, dorsal view; 47, aedeagus, ventral view.

Etymology. – *kao*, a noun in apposition, from Kao = Chinese name for the genus *Castanopsis*, the host-plant of this species.

Diagnosis

Externally resembling the other fasciate species with edged scape (*vandrieli, kurokoi, clisiotophora, castanopsiella*), but male with short androconiae only and frontal tuft pale orange; possibly not to be distinguished externally from *S. clisiotophora*. Male genitalia rather aberrant within the oak miners: aedeagus short, with many short and similar cornuti only; female genitalia without accessory sac and lacking all sclerotizations.

Description

Male (fig. 24). – Forewing length 2.8-3.0 mm (n=3), wingspan 6.0-6.7 mm. Head: frontal tuft pale orange; collar lead-grey; scape silvery white, posteriorly and distally narrowly edged grey; flagellum grey-brown. Antennae with 30 segments (n=1).

Thorax shining lead-grey. Forewings basal half with purple gloss, followed by dark brown band, a shining silvery fascia at ⅔, constricted in middle or usually broken; wingtip dark brown, with distinct cilia-line, terminal cilia silvery; underside brown. Hindwing on upperside with pale brown indistinct small androconial scales. Underside grey-brown, with patch of slightly darker scales. Abdomen not examined.

Female (fig. 25). – Forewing length 2.8-2.9 mm (n=3), wingspan 6.1-6.3 mm. Antennae all broken. Similar to male, hindwing grey.

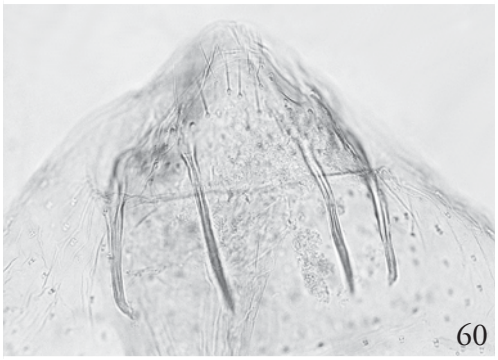
Male genitalia (figs. 52-58). – Capsule length 210-245 µm (n=3). Tegumen band-shaped, narrow. Vinculum with narrow anterior excavation. Uncus wide, with 2 pointed lobes wide apart. Gnathos with posterior processes widely separated, pointed; no anterior processes. Valva length 160-165 µm (n=2), approximately triangular, with prominent squarish inner lobe, slightly protruding posteriorly and a pointed distal process; transtilla with short sublateral processes. Aedeagus 325-355 µm long (n=3), 140-150 µm wide, comparatively short, cylindrical; vesica in distal half covered with relatively small triangular cornuti and in basal half with very small truncate, partly pectinate cornuti. Manica spinose, covering basal half of aedeagus.

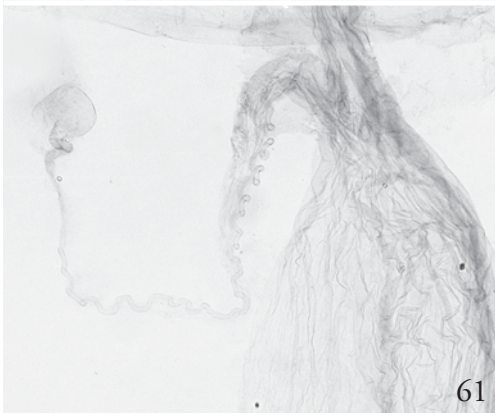
Female genitalia (figs. 59-61). – T 8 rounded, with about 7 setae on either side, no furrows or rims; apophyses narrow, equal in length. Bursa total length 465-470 µm (n=2), narrow and elongate, with longitudinal folds, anteriorly wrinkled; completely without spines or pectinations. Accessory sac absent, ductus spermathecae with narrow convolutions, c. 13-15.

Biology

Hostplant. – *Castanopsis orthocantha*, an evergreen cupuliferous tree with slightly serrate, coriaceous leaves. Mines collected on leaves with a total length of 45-95 mm.

Leafmines (figs. 95). – Egg on leaf upperside, always along midrib, 5-35 mm away from petiole. Mine starting as a linear mine along midrib towards tip for 21-38 mm, occasionally in last part following





a lateral vein; then suddenly turning back and becoming an elongated blotch of 11-24 mm long, 4-7 mm wide. Frass almost filling gallery, in blotch in two lateral lines. Total length of mine 37-59 mm (n=14). Mine resembling that of some *Ectoedemia* species, such as *E. intimella* (Zeller) in Europe.

Larva. – Greenish white, with black trapezoid tergites on metathorax and abdominal segments 1-8. Head pale brown. Feeds dorsum upwards.

Life history. – Larvae found in October, adults reared in November.

Distribution

Yunnan.

Remarks

This species is tentatively placed in the *ruficapitella*-group, although both male and genitalia are aberrant, as is the leafmine. We cannot place it in another group on the present basis, and prefer to await further cladistic analysis.

Stigmella castanopsiella (Kuroko)

Nepticula castanopsiella Kuroko, 1978: 1. Holotype ♂, JAPAN: Honshu, Osaka Pref., Minoo Park, 19.iv.1975, H. Kuroko, reared from *Castanopsis cuspidata* var. *sieboldii*. (ELUO).

Nepticula castanopsiella; Kino 1981: 43-56 [ecology].

Stigmella castanopsiella; Inoue et al. 1982: 448; Kemperman et al. 1985: 41.

Diagnosis

A fasciate species without conspicuous androconial scales. Distinguished from *S. fervida* by edged scape and paler metallic forewing base. The other fasciate species, *S. vandrieli*, *S. kurokoi, S. kao* and *S. clisiotophora* have distinct androconiae. Male genitalia with coiled vesica as in *kurokoi¸ lithocarpella* and *vandrieli*, but capsule and valvae more slender than these species. Female genitalia with very characteristic spinose coiled sclerotization, see further the cited descriptions.

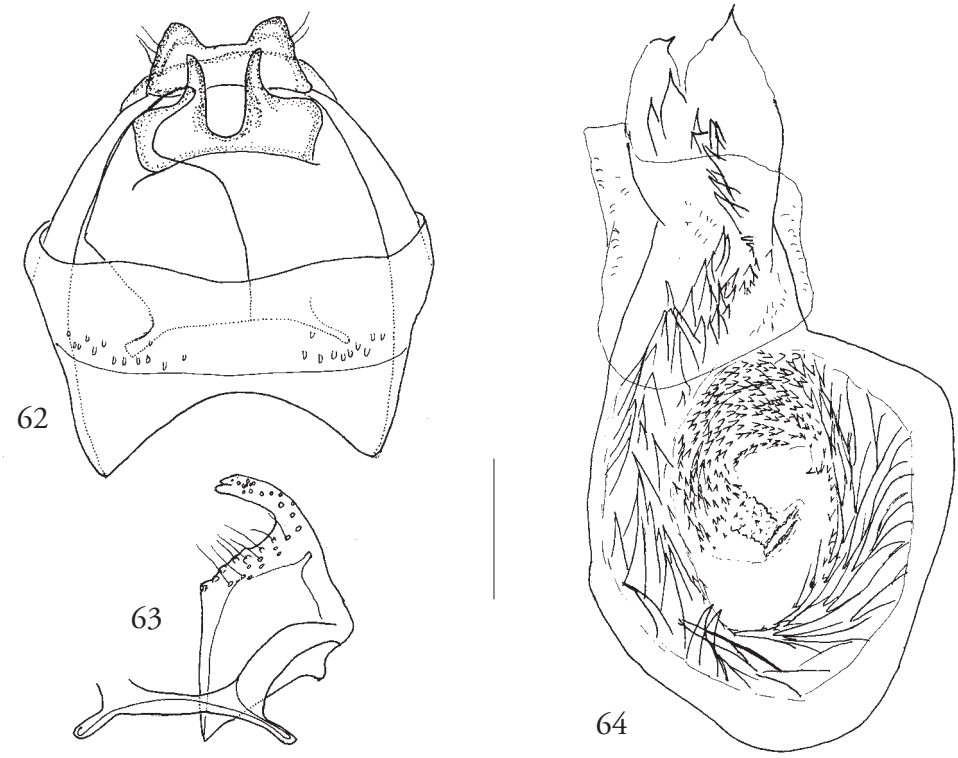
Biology

On *Castanopsis cuspidata*, very common in some Japanese towns.

Distribution

Japan, Honshu and Kyushu. To be expected in China.

Figs. 59-61. *Stigmella kao*, female genitalia and details of abdominal tip and ductus spermathecae. – 59, 60, paratype, slide EvN2864; 61, paratype, slide A081 (44).



Figs. 62-64. *Stigmella lithocarpella*, holotype, male genitalia, scale 100 µm. – 62, Capsule, ventral view; 63, valva, dorsal view; 64, aedeagus, dorsal view.

Stigmella kurokoi Puplesis
(figs. 28, 78, 79)

Stigmella kurokoi Puplesis, 1984b: 594, 1985: 162. Holotype ♂, RSFR: Primor'ye, 20 km E of Ussuriysk, Gornotayezhnoye, 10.viii.1982, R. Puplesis (ZIAN) [examined]
Stigmella valvaurigemmata Kemperman & Wilkinson, 1985: 45. Holotype ♂, JAPAN: Kyushu, Hikosan, Buzen, 31.vii.1954, H. Kuroko, *Quercus* spec., slide VU 0713 (ELUO) (Synonymized by Puplesis 1994: 161) [not examined]
Stigmella kurokoi; Puplesis 1994: 164.

Diagnosis

The only fasciate species of this group with a dark frontal tuft (fig. 28). Further recognized by long spatulate androconiae. Male genitalia with basal bulbous part and vesica with one complete coil (figs. 78, 79). Distinguished from *castanopsiella* and *lithocarpella* by the papillate lobes on the valvae. Female as yet unknown. See further cited descriptions.

Biology

Reared from a *Quercus* species (Kemperman et al. 1985), and here reported from *Quercus dentata*, mine linear (according to label data), otherwise unknown.

Distribution

Japan, Kyushu and Hokkaido (new record, see material), Primorskiy Kray. To be expected in China.

Material examined. – 6♂. – JAPAN: 2♂, Hokkaido, Tshikari-coast, em. 5+8.viii.1992, host *Quercus dentata*, linear miner, Y. Sakamaki (EIHU). – RUSSIA: 1♂, paratype, Primory'e, 20 km E Ussurijsk, 3.viii.1982, R. Puplesis (RMNH); 3♂ Primory'e, 20 km E Ussurijsk, GTS, 13.viii-20.viii.1982, R. Puplesis (RMNH).

Stigmella lithocarpella van Nieukerken & Liu **sp. n.**
(figs. 23, 62-66, 96)

Type material. – Holotype ♂, CHINA (Yunnan), Kunming, Qiongzhu Si (Bamboo temple), 25.08N-

Figs. 65-68.
Male genitalia, ventral view (66 dorsal), above capsule, below aedeagus. – 65, 66, *Stigmella lithocarpella*, holotype; 67, 68, *S. vandrieli*, paratype, slide A068.

102.37E, 5-18 OCT 1984, 2100 m, van Nieukerken & van Driel; Evergreen cupuliferous forest on northern slope, *Lithocarpus dealbatus* (Hook. f. et Thoms.) Rehd., e.l. 28 NOV 1984, EvN no 22-2-1 [reared from 4 larvae]; Genitalia slide B 227 (ZIAB). – Further material: 11 leaves with 13 leafmines.

Etymology. – *lithocarpella*, a noun in apposition. Named after the hostplant genus *Lithocarpus*, followed by the ending -ella, commonly used, especially in the 19th century, to indicate small micromoths.

Diagnosis

Easily recognized by the very wide fascia and pale frontal tuft. Male genitalia with the characteristic bulbous and coiled aedeagus of *castanopsiella* subgroup, fewer coils than in *vandrieli*, but similar to *kurokoi*; separated from that species by wider and shorter valvae without papillate lobes.

Description

Male (fig. 23). – Forewing length 2.7 mm (n=1), wingspan 6.1 mm. Antennae broken. Head: frontal

tuft pale yellow, almost white; collar and scape white, flagellum grey-brown.

Thorax brown. Forewings basal half brown, followed by a very wide silvery fascia, width ⅓ of wing-length; wingtip again brown, cilia-line absent; underside brown. Hindwings grey, costa with narrow, slightly spatulate scales. Abdomen not examined.

Female unknown.

Male genitalia (figs. 62-66). – Capsule length 245 µm (n=1). Vinculum anteriorly slightly bilobed. Uncus bilobed, notch equal to width of individual lobes. Gnathos with posterior processes relatively close, deeply incised between. Valva length 180 µm (n=1), with pointed, slightly bifurcate distal process of about ⅓ valva length; inner margin straight in basal half; transtilla short, sublateral processes more than half length. Aedeagus 465 µm long (n=1), basally bulbous, 255 µm wide, almost twice as long as capsule; vesica coiled, with about one complete coil, covered with numerous cornuti: in basal ¼ inside coil with small cornuti, more distal more than 80 larger cornuti; some big cornuti at phallotrema; manica conspicuous, enveloping only part of distal half of aedeagus.

Female genitalia unknown.

Biology

Hostplant. – *Lithocarpus dealbatus*, an evergreen cupuliferous tree with entire, coriaceous leaves. Mines collected on leaves with a total length of 60-85 mm.

Leafmines (fig. 96). – Egg deposited on leaf upperside, close to margin, frequently near tip; often 2-3 eggs are laid together. Mine starts as a much contorted gallery, filled with black frass; later becoming an elongated blotch with black frass deposited in lateral lines; in the blotch the upper parenchyma is not eaten completely.

Larva. – Greenish yellow with brown headcapsule; it feeds with dorsum upwards.

Life history. – Larvae found in October, adult reared in November.

Distribution

Yunnan.

Remarks

Description on the basis of a single specimen is warranted here, because we have a complete, well recognizable life history and a species which is very characteristic both externally and in male genitalia.

Stigmella vandrieli van Nieukerken & Liu **sp. n.**
(figs. 26, 27, 67-75, 97, 98)

Type material. – Holotype ♂, CHINA (Yunnan): Anning, 24.55N-102.29E, 20 OCT 1984, 1900 m, van Nieukerken & van Driel, Mixed *Pinus yunnanensis, Keteleeria,* oak forest *Quercus glauca* ssp. *schottkyana* Thunb., e.l. 13-30 NOV 1984 [24-26.xi], EvN no 35-5-3, Genitalia slide EvN 2862 (ZIAB). – Paratypes: 3♂, 2♀, data as holotype, reared from 10 larvae, Genitalia slides ♂: A068, A089, ♀: A090, EvN 2863 (ZIAB, RMNH). – Additional material: 3♂ [wings only, rest lost], Kunming, Gidian Si (Golden temple), 04.x.1984, e.l. 24.x.1984, EvN 21-3-1 (ZIAB).

Etymology. – *vandrieli*, a noun in genitive case. Named after Hans van Driel in honour of his contribution to collecting in China.

Diagnosis

A fasciate species with very distinct androconial scales and edged scape, only to be confused with *S. kurokoi*, which has a dark frontal tuft in contrast to the orange one in *vandrieli*. Male genitalia characterized by vesica with more than two complete coils. Female only separated from other fasciate species (*kao, kurokoi, castanopsiella, clisiotophora*) by the complicated genitalia.

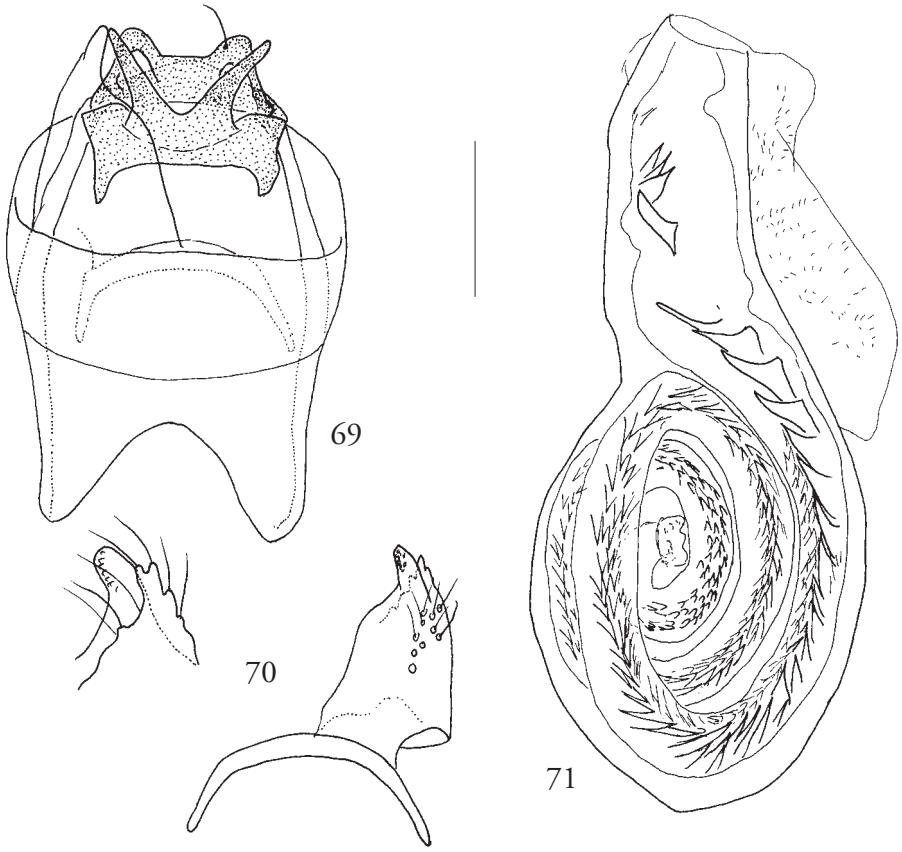
Description

Male (figs. 26, 27). – Forewing length 2.0-2.3 mm (n=3), wingspan 4.9-5.0 mm. Head: frontal tuft orange; collar lead-grey; scape silvery white, posteriorly and distally edged with lead-grey to black; flagellum grey-brown. Antennae with 30-31 segments (n=3).

Thorax shining lead-grey. Forewings basal third shining lead-grey, followed by dark brown band of ¼ wing-length, a shining silvery fascia at ⅔, constricted in middle or broken, dorsally enlarged; wingtip dark brown, with distinct cilia-line, terminal cilia silvery grey; underside dark brown with blue green gloss. Hindwing costa with long spatulate, dark brown androconial scales (fig. 27); these almost as long as hindwing width. Upperside of hindwing with dark brown lamellar scales, slightly extending into dorsal fringe, about 1/5 cilia length. Underside grey-brown. Abdomen brown-grey, ventrally grey; anal tufts absent.

Female. – Forewing length 2.2-2.4 mm (n=2), wingspan 5.4-5.6 mm. Antennae with 22 segments (n=1). Very similar to male, but forewing underside grey-brown with blue-green gloss, hindwing grey, without special scales.

Male genitalia (figs. 67-71). – Capsule length 205-230 µm (n=3). Tegumen slightly arched. Vinculum narrow, with deep anterior excavation. Uncus bilobed, notch equal to width of individual lobes. Gnathos with posterior processes basally close, diverging posteriorly, pointed; anteriorly with small anterior processes. Valva length 130-140 µm (n=3), almost triangular; with short distal process and a more ventral setose lobe; transtilla wide, sublateral processes about half its length. Aedeagus 475-500 µm long (n=3), basally bulbous, 210-215



Figs. 69-71. *Stigmella vandrieli*, paratype, slide A068, male genitalia, scale 100 µm. – 69, capsule, ventral view; 70, valva, dorsal view, with enlarged detail in ventral view; 71, aedeagus, ventral view.

µm wide, more than twice as long as capsule; vesica coiled, with 2.5 to 3 complete coils, with a narrow band of numerous pointed cornuti: small in basal part, larger ones near tip; manica conspicuous, enveloping only part of distal half of aedeagus.

Female genitalia (figs. 72-75). – T8 rounded, with a group of scales and 4-5 setae centrally and a pair of lateral setose lobes. All apophyses relatively long and narrow. Bursa complex, structure not completely understood, c. 1050-1110 µm long. Ductus bursae long (more than half bursa length) and narrow, with a complete coil in middle, leading towards a globular sac, which is either the bursa or accessory sac; from the ductus a sclerotized spinose structure runs into the sac and makes 2 turns and ends spirally. It appears as if the ductus spermathecae is part of this structure. The whole structure seems to fit the male coiled vesica perfectly, a fit hitherto unparalleled in nepticulid genitalia.

Biology

Hostplant. – *Cyclobalanopsis glaucoides (=Quercus* (*Cyclobalanopsis*) *glauca* ssp. *schottkyana)*, an evergreen cupuliferous tree with serrate, coriaceous leaves. Mines collected on leaves with a total length of 50-125 mm.

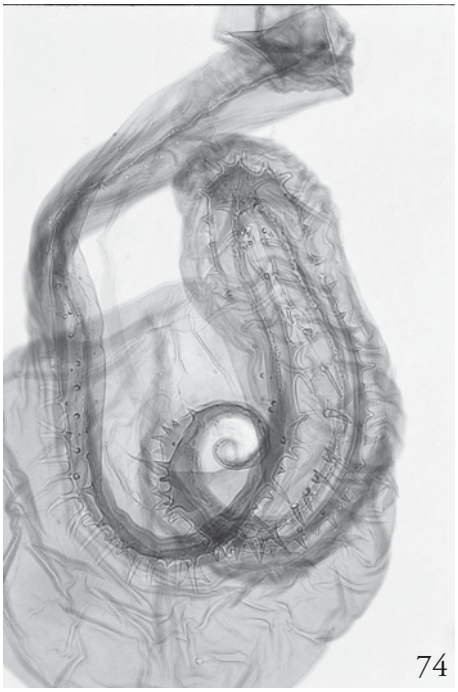
Leafmines (fig. 97, 98). – Egg on leaf upperside, position variable, but not infrequently on a lateral vein. Mine a much contorted gallery, first filled with black frass, later with dispersed black frass, leaving narrow clear margins.

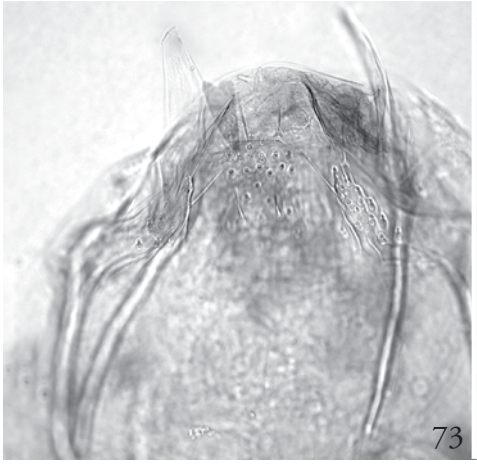
Larva. – Pale greyish white in mine, pale yellow outside; head pale, with dark brown caudal extensions and eye spots; ganglia not visible in mine, but distinct outside; feeds with dorsum upwards.

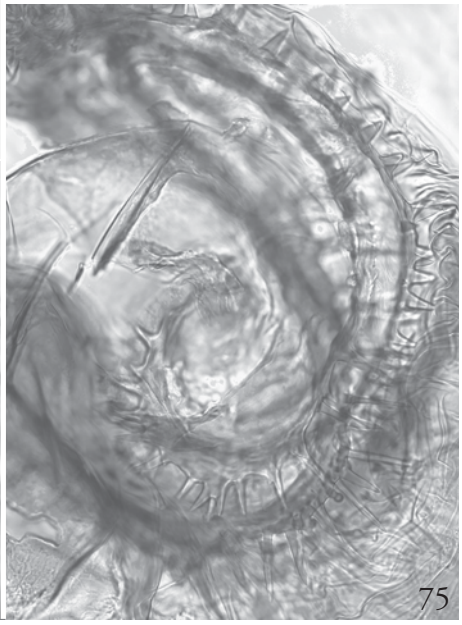
Life history. – Larvae found in October, adults reared in October-November.

Distribution

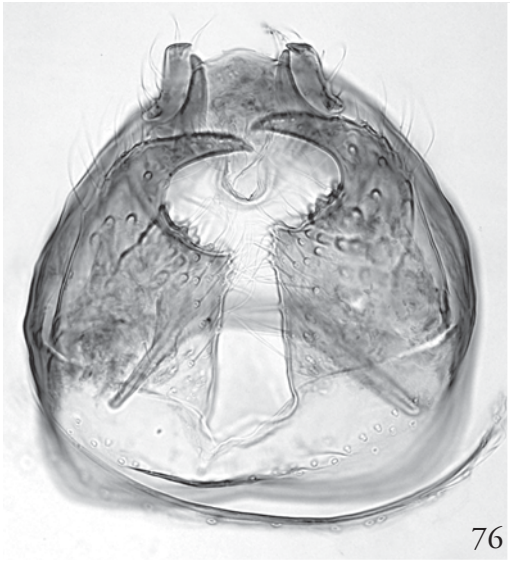
Yunnan.

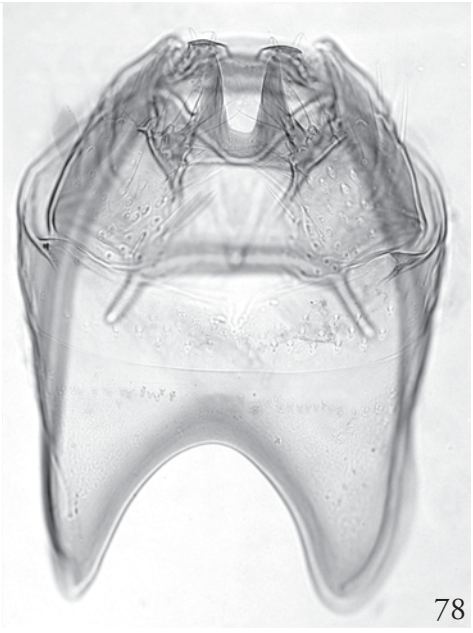






Figs. 72-75. *Stigmella vandrieli*, parataypes, female genitalia, dorsal view. – 72, overview, slide EvN 2863; 73, detail of abdominal tip, slide EvN 2863; 74, 75, details of accessory sac, slides A090 and EvN 2863.





Figs. 76-79. Male genitalia, ventral view, above capsule, below aedeagus. – 76, 77, *Stigmella fervida*, Primory'e, slide EvN 2943; 78, 79, *Stigmella kurokoi*, Primory'e, slide EvN 2942.

Stigmella caesurifasciella Kemperman & Wilkinson

Stigmella caesurifasciella Kemperman & Wilkinson, 1985: 38. Holotype ♀, JAPAN, Honshu, Nara Park, Nara pref., i.vii.1965, host *Quercus acuta* Thunb., H. Kuroko, slide VU no. 0675 (ELUO). [not examined]

Stigmella egregilustrata Kemperman & Wilkinson, 1985: 39. Holotype ♀, JAPAN, Kyushu, Ogori, 19.vii.1957, host *Quercus glauca* Thunb., I. Tateishi, slide VU no. 0711 (ELUO). [not examined] **Syn. n.**

Diagnosis

Characterized by fascia in combination with a terminal patch or (broken) fascia of silver metallic scales. Male genitalia very different from other oak-feeding species: uncus and gnathos both with single central projection only, very similar to *Stigmella lapponica* group. Female genitalia with pectinate bursa and folded accessory sac. See further original descriptions.

Biology

On *Cyclobalanopsis glauca* and *acuta*. Leafmines not described.

Distribution

Japan: Honshu and Kyushu. To be expected in China.

Remarks

S. egregilustrata is here synonymized with *caesurifasciella* because the two show hardly any difference. Kemperman et al. (1985) mention a missing manica in *caesurifasciella* in contrast with *egregilustrata*, but the aedeagus is reported to be damaged, so we assume that in that process the manica got lost.

Unidentified species

In this paragraph we describe the mines and larvae which we could not rear, but which probably belong to *Stigmella* species.

Together with *S. fumida* we found mines on *Quercus acutissima* and *Q. variabilis* with narrower frass, which may belong to another species (such as *S. aladina*), but they could also be *fumida.* Similarly we found some variation in *Stigmella* mines on *Cyclobalanopsis glaucoides*, which could point to a second species next to *S. vandrieli* or intraspecific variation. Such mines are not further described.

Stigmella species 1

Hostplants. – *Castanopsis delavayi* Franch., *C. orthocantha* Franch.

Leafmine. – Egg on leaf-upperside, rarely underside (2 examples), sometimes on a vein, often not. Mine a sinuous gallery, first filled with black frass, later black frass leaving narrow clear margins to margins of about ½ mine width.

Larva. – Pale yellow, head brown, posterior lobes dark brown. Prothoracic tergite black. Feeds dorsum upwards.

Distribution. – Yunnan.

Remarks. – The mines and larvae on both *Castanopsis*-species resemble each other so much, that they probably belong to one *Stigmella* species. The mines also resemble those of *S. vandrieli*, but the larva is clearly different.

Material examined. – EvN no 23- 6-1, 14 km SW Kunming, Xishan, 22.x.1984, 2 larvae (rearing failed), 25 empty mines, *Castanopsis delavayi*; EvN no 22- 5-1, Kunming, Qiongzhu Si (Bamboo temple), 05.x.1984, 6 larvae (rearing failed), 26 empty mines, *Castanopsis orthocantha.*

Stigmella species 2

Hostplant. – *Castanopsis indica* (Roxb.) DC.

Leafmine. – Egg on leaf upperside, on a vein. Mine an angular gallery, sometimes following veins; early mine with thick black or brown frass, leaving narrow clear margins, later coiled black frass filling about half mine width.

Larva. – Not found.

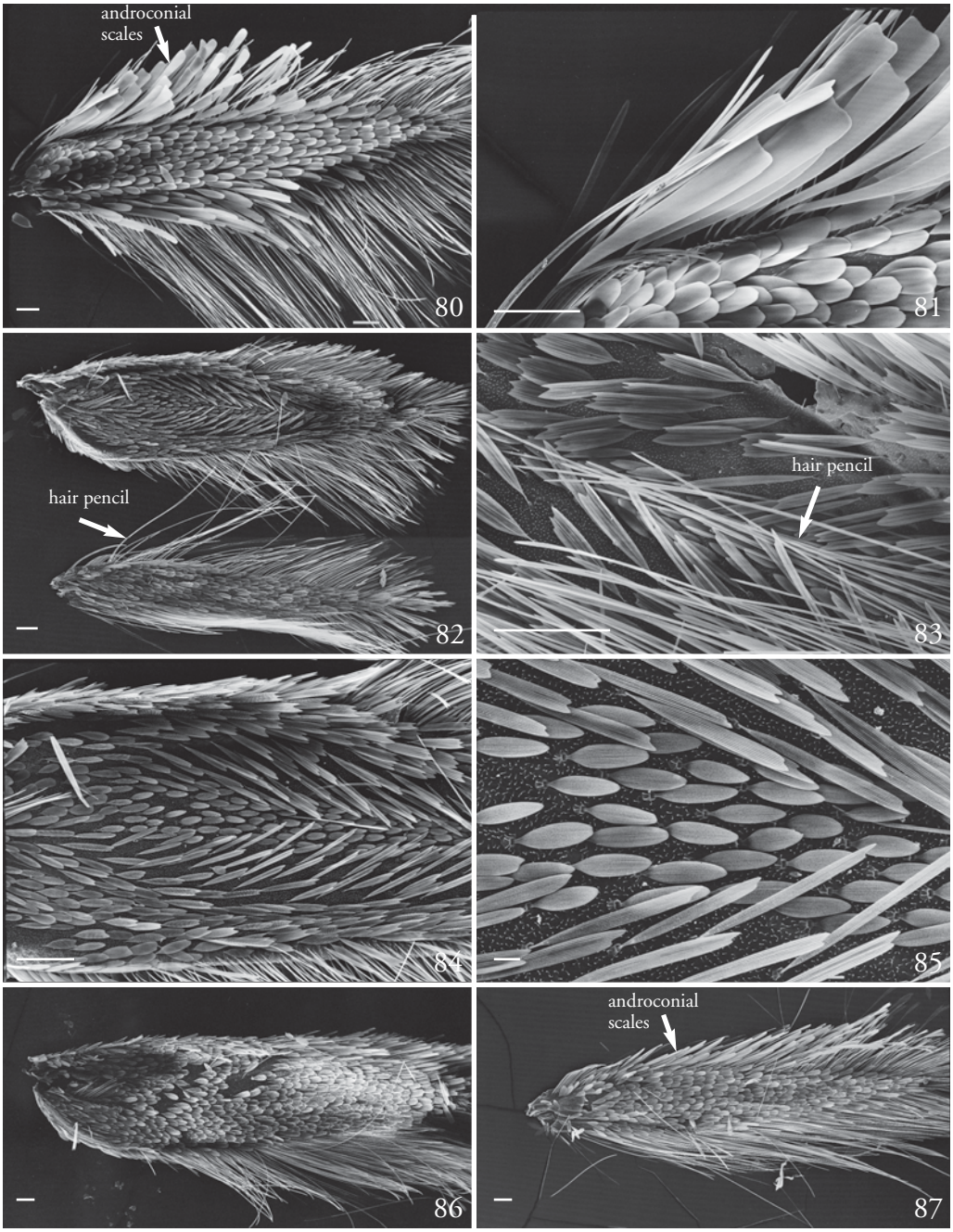
Distribution. – Southern Yunnan: Xishuanbanna.

Material examined. – EvN no 31- 1-1, Menglung, 60 km NW Mengla, 12.x.1984, 2 empty mines; EvN no 32-16-1, Menglung, 60 km NW Mengla, 13.x.1984; 1 empty mine.

Hostplant relationships and biogeography

In this paper we record only nine species from China and four species from neighbouring countries, to be expected in China. When looking at the diversity of the hostplant family, this must be a huge underestimate of the real diversity of fagaceous feeding *Stigmella:* there are seven genera and 291 native species (163 endemic) of Fagaceae in China (Wu & Raven 1999). Although many of these species are closely related, and possibly harbour often the same nepticulids, we may assume at least a diversity of three times as much as is known at present.

The fauna of deciduous *Quercus* is probably best known with five widespread *Stigmella* species. Compared with the European situation this is still a rather sparse representation: in Europe eleven species are associated with the few species of European deciduous oaks. In China the deciduous oaks are usually widespread in the northern part of the country and in secondary habitats in the south. These species also harbour widespread Nepticulidae, of which *S. fumida* has the largest known distribution at present. Also



Figs. 80-87. *Stigmella* species, scanning micrographs of male wings with androconial scales. – 80, 81, *S. omelkoi,* hindwing upperside with spatulate androconial scales in fringe; 82-85, *S. aladina*, forewing and hindwing undersides, with fishbone pattern scales on forewing and hair-pencil on hindwing fitting in groove on forewing underside (83), various details; 86, 87, *S. dentatae*, forewing underside without special scales (85) and hindwing upperside with small spatulate scales in dorsal fringe. All material from Primor'e. – Scales 100 µm, 10 µm in fig. 84.

these species have probably more than one host each, as is known in a number of cases. The species associated with deciduous oaks have overall the closest relationships with European species: the majority are uniformly coloured, and also in androconiae and genitalia there are striking resemblances with European counterparts. Although a phylogenetic analysis has yet to be made, we may already see the similarities between *S. fervida* and an as yet unnamed European species (Johansson & Nieukerken in prep.), between *S. omelkoi* and *S. suberivora* (Stainton), *S. aladina* and *S. svenssoni* (Johansson) and *S. dentatae* and *S. eberhardi* (Johansson).

In contrast to these similarities, the southern provinces harbour a completely different fauna. This is the realm of the evergreen broad-leaved forests which harbour the large majority of Chinese oaks with the large genera *Lithocarpus* (123 species of which 69 endemic), *Castanopsis* (58 species, 30 endemic) and *Cyclobalanopsis* (69 species, 43 endemic). The four new species described here from these hosts form only the tip of an iceberg of diversity. Interestingly they are all fasciate species or show other intricate colour patterns, quite different from the unicolorous species of the North and of Europe. They are also in their genitalia rather different and it is questionable whether they really fall within one monophyletic group. Further sampling will reveal whether this is overall true and will enable us to make a phylogenetic analysis. We expect that these species will have a smaller distribution than those of the deciduous oaks, although it is possible that some have a wider host range.

Up till now we have no records of Nepticulidae in China from the small genera *Fagus*, *Castanea* or *Formanodendron*.

On the hosts on which we found *Stigmella* species we also collected several *Ectoedemia* species. They will be the subject of a future paper.

Acknowledgements

The authors are much indebted to Prof. Dr C. Wilkinson for his initiatives, which lead to the co-operation and finally this paper. We would further extend our gratitude to J. W. (Hans) van Driel (Ravenswaard, the Netherlands), who together with the first author, took part in the collecting trip in 1984, and made an important contribution through his hard work during and after this expedition.

Numerous people in China made the expedition a success. We would like to thank in particular Bai Jiuwei (Zoological institute Beijing), and Zhang Ke (interpreter, Beijing) who both took part in the whole expedition, and made it a most successful and pleasant trip. Not less pleasant was the company of those who accompanied us during part of the trip: Fang Sanyan, Sun Jianghua, Bao Wenlong (all Harbin), Long Yongchen (Kunming), Shan Fang (Kunming). The Chinese authorities, especially the Department of Foreign Affairs and the directors of the organizing institutes (Zoological Institute, Beijing; Northeast Forestry Institute, Harbin; Kunming Institute of Zoology) are acknowledged for smoothing the ways for our trip.

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中国微蛾科 (鳞翅目): 导言与山毛榉科上的微蛾属研究

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主要内容介绍微蛾科 (Nepticulidae) 在古北区和东洋区的研究现状及1984年在中国东北黑龙江省和西南云南省部分地区一个多月的国际合作调查采集结果。发现在山毛榉科(Fagaceae) 植物上有微蛾属*(Stigmella)* 13种，其中有4新种和3新同物异名。

Appendix

List of collecting stations

Station 1. China (Beijing): Beijing, Haidian, Friendship Hotel, 39.55 N – 116.26 E, 50 m, 7 September 1984. Park. Leg. E. J. van Nieukerken & J. W. van Driel.
Station 2. China (Beijing): Beijing, Yiheyuan, Kunming Lake, 39.57 N – 116.20 E, 50 m, 8-10 September 1984. Park, lake shores. Leg. E. J. van Nieukerken & J. W. van Driel.
Station 3. China (Beijing): Badaling, 40 km NNE Beijing, Great Wall, 40.23 N – 116.01 E, 9 September 1984. Calcareous hills with thorny scrub. Leg. E. J. van Nieukerken & J. W. van Driel.
Station 4. China (Heilongjiang): Harbin, city, 45.50 N – 126.40 E, 11, 19 September 1984. Trees in town. Leg. E. J. van Nieukerken & J. W. van Driel.
Station 5. China (Heilongjiang): Harbin, city, 45.50 N – 126.40 E, 12 September 1984. Tree nursery. Leg. E. J. van Nieukerken & J. W. van Driel.
Station 6. China (Heilongjiang): Dailing, 25 km WSW of Nancha, 47.01 N – 129.02 E, 300 m, 13-18 September 1984. Planted forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 7. China (Heilongjiang): 22 km NW of Dailing, Liangshui Linchang, 47.09 N – 128.50 E, 400 m, 13 September 1984. Mixed primary coniferous-hardwood forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 8. China (Heilongjiang): 16 km NW of Dailing, Bishui Linchang, 47.08 N – 128.56 E, 400 m, 14 September 1984. Mixed coniferous-hardwood forest along river. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 9. China (Heilongjiang): 6 km E of Dailing, Dachinchuan Linchang, East Hill, 47.01 N – 129.07 E, 300-350 m, 15 September 1984. Steep south exposed hill with *Quercus mongolica* stand. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 10. China (Heilongjiang): 6 km E of Dailing, Dachinchuan Linchang, South Hill, 47.00 N – 129.06 E, 300 m, 16 September 1984. Steep south exposed hill with *Quercus mongolica* stand. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 11. China (Heilongjiang): 6 km SE of Dailing, Dachinchuan Linchang, 47.00 N – 129.07 E, 300 m, 16 September 1984. Mixed forest with dominance of *Betula*. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 12. China (Heilongjiang): 5 km E of Dailing, Dachinchuan Linchang, Yinchun garden, 47.01 N – 129.06 E, 300 m, 17 September 1984. Swamp and mixed hardwood forest with dominance of *Quercus*. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 13. China (Heilongjiang): Maoershan experimental forestry farm, 1 km N of village, 45.16 N – 127.31 E, 300 m, 20-27 September 1984. Cultivated area with shrub and plantations. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 14. China (Heilongjiang): Maoershan mount, 5 km NE Maoershan, 45.17 N – 127.34 E, 350-800 m, 21-25 September 1984. Mixed hardwood forest with dominance of *Quercus mongolica*. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 15. China (Heilongjiang): 18 km NE Maoershan: Laoyenling res. station, 45.24 N – 127.44 E, 400-450 m, 23 September 1984. Mixed hardwood forest with dominance of *Quercus* and swamps. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 16. China (Heilongjiang): Laoshan, 5 km E Maoershan, 45.16 N – 127.35 E, 350-580 m, 26 September 1984. Mixed hardwood forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 17. China (Heilongjiang): Harbin, Botanical Garden, 45.50 N – 126.40 E, 28 September 1984. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 18. China (Beijing): Beijing, Xiangshan, Wofosi and botanical garden, 39.59 N – 116.12 E, 100-500 m, 1, 27 October 1984. Hills with deciduous shrub and low trees. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 19. China (Yunnan): Kunming city, 25.04 N – 102.41 E, 1900 m, 3-7 October 1984. In town. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 20. China (Yunnan): Kunming, botanical garden, 25.08 N – 102.41 E, 2000 m, 4 October 1984. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 21. China (Yunnan): Kunming, Gidian Si (Golden temple), 25.06 N – 102.45 E, 2000 m, 4 October 1984. Open mixed *Keteleeria*, *Pinus*, oak forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 22. China (Yunnan): Kunming, Qiongzhu Si (Bamboo temple), 25.08 N – 102.37 E, 2100 m, 5, 18, 21 October 1984. Evergreen cupuliferous forest on northern slope. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 23. China (Yunnan): 14 km SW Kunming, Xishan, 24.59 N – 102.37 E, 2300 m, 5 October 1984. Open *Pinus*-oak forest and shrub. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 24. China (Yunnan): Shilin (Stone forest), Lunan county, 24.46 N – 103.17 E, 1800 m, 6-7 October 1984. Cultivated and seminatural vegetation between rocks. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 25. China (Yunnan): W. of Yiliang, 24.53 N – 103.07 E, 1900 m, 7 October 1984. Steep hills with degenerated *Pinus yunnanensis* forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 26. China (Yunnan): Puwen, 40 km SSW Simao, along road to Jinghong, 22.31 N – 101.06 E, 1200 m, 9 October 1984. Roadside forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 27. China (Yunnan): Mengyang, 20 km NE Jinghong, along road to Simao, 22.01 N – 100.54 E, 900 m, 9 October 1984. Roadside forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 28. China (Yunnan): Jinghong, hills E of Lancang Jiang river, 21.58 N – 100.50 E, 650-800 m, 9-10 October 1984. Secondary bamboo groves. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 29. China (Yunnan): Jinghong, riverbanks of Lancang Jiang river, 21.58 N – 100.49 E, 600 m, 11 October 1984. cultivated area. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 30. China (Yunnan): 8 km W of Jinghong, 21.59 N – 100.45 E, 600 m, 11 October 1984. cultivated area. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 31. China (Yunnan): Menglung, 60 km NW Mengla, 21.38 N – 101.23 E, 600 m, 12-13 October 1984. Fringes of broad-leaved evergreen rainforest, cultivated area. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 32. China (Yunnan): Menglung, 60 km NW Mengla, 21.38 N – 101.23 E, 760-800 m, 13 October 1984. Broadleaved evergreen rainforest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 33. China (Yunnan): 20 km SSW Simao, along road Simao-Jinghong, 22.37 N – 101.05 E, 1200 m, 15 October 1984. Roadside forest. Leg. E. J. van Nieukerken & J. W. van Driel.

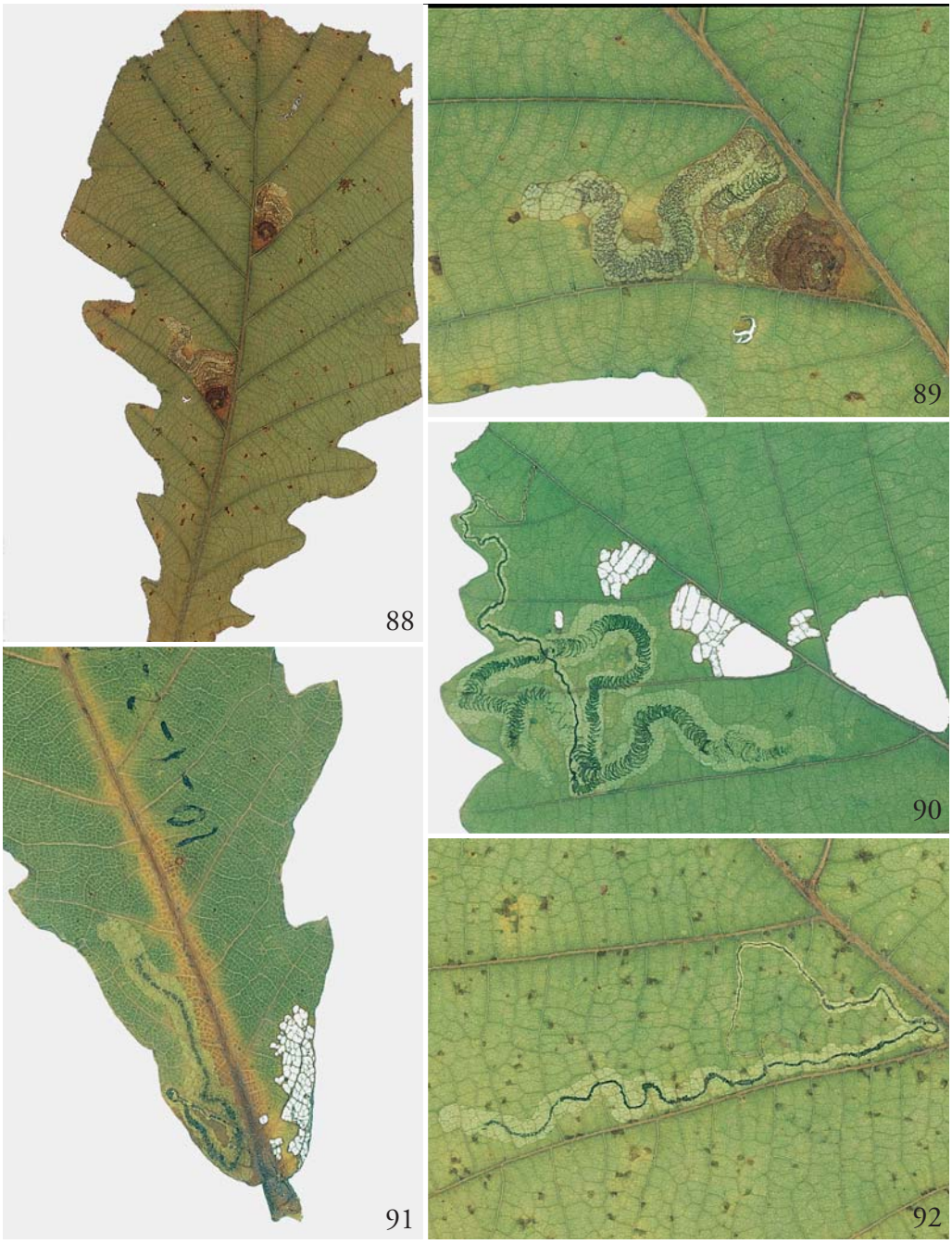
Station 34. China (Yunnan): 11 km N Kunming, Botanical Institute, 25.08 N – 102.41 E, 2000 m, 19 October 1984. Open *Quercus variabilis* stand. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 35. China (Yunnan): Anning, 24.55 N – 102.29 E, 1900 m, 20 October 1984. Mixed *Pinus yunnanensis*, *Keteleeria*, oak forest. Leg. E. J. van Nieukerken & J. W. van Driel.

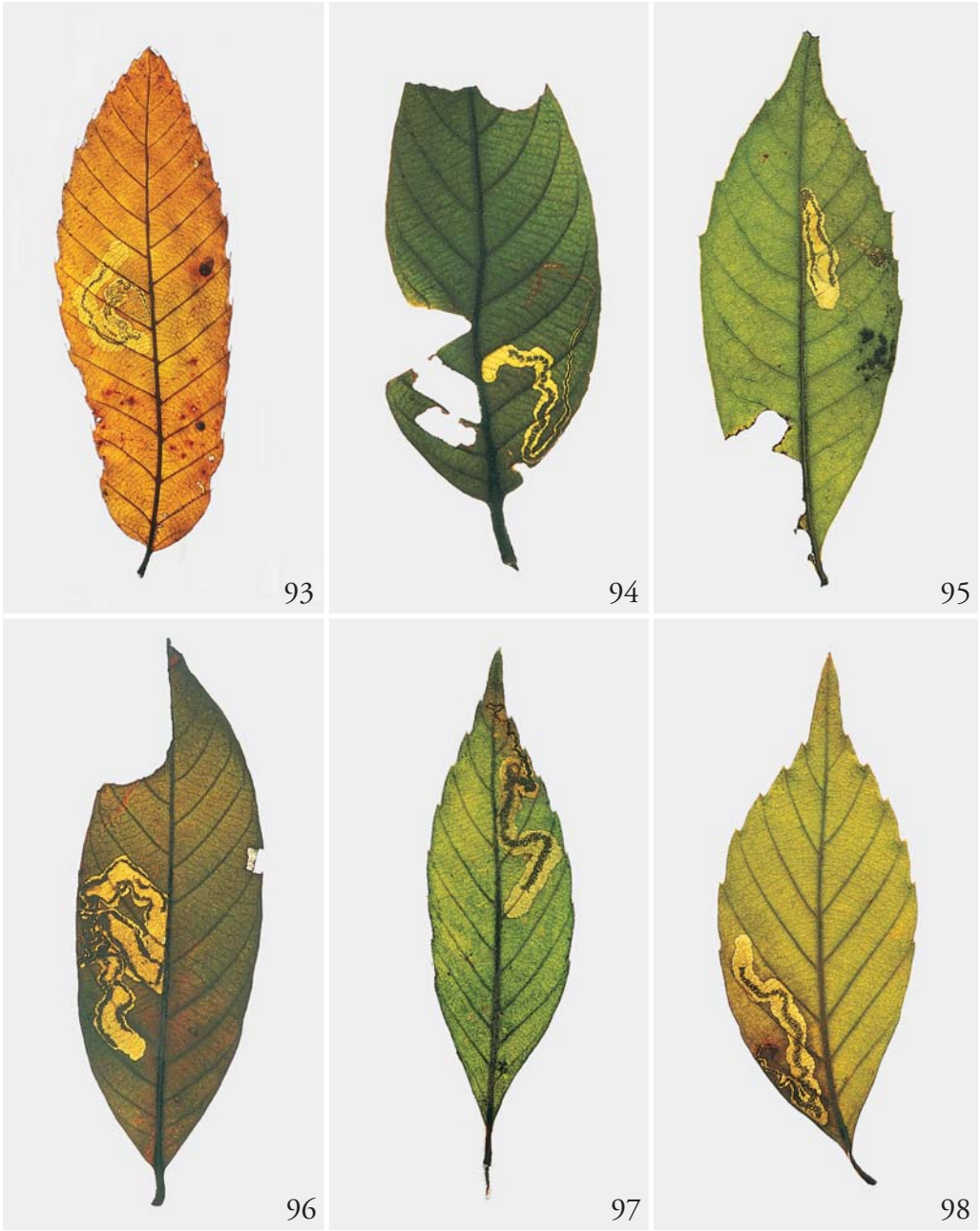
Station 36. China (Yunnan): 18 km SW Kunming, along road to Anning, 24.57 N – 102.31 E, 1900 m, 23 October 1984. Open *Quercus-Pinus* forest. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 37. Hong Kong, Victoria, 22.16 N – 114.13 E, 31 October 1984. In town. Leg. E. J. van Nieukerken & J. W. van Driel.

Station 38. Hong Kong, Victoria Peak, 22.16 N – 114.13 E, 500 m, 31 October 1984. Evergreen broad-leaved shrub on hillsides. Leg. E. J. van Nieukerken & J. W. van Driel.



Figs. 88-92. Leafmines of *Stigmella* species on *Quercus mongolica*, from Heilongjiang. – 88, 89, *S. fervida*, 9-1-1, Dailing; 90, *S. omelkoi*, 14-6-3, Maoershan mount; 91, *S. dentatae*, 10-1-2-6, Dailing; 92, *S. aladina*, 10-1-2-11, Dailing.



Figs. 93-98. Leafmines of *Stigmella* species from Yunnan. – 93, *S. fumida* on *Quercus acutissima,* 36-5-1, SW Kunming; 94, *S. circumargentea* on *Lithocarpus dealbatus*, 22-2-2, Kunming, mine from type-series; 95, *S. kao* on *Castanopsis orthocantha*, 22-5-2, Kunming, mines from type-series; 96, *S. lithocarpella* on *Lithocarpus dealbatus*, 22-2-1, Kunming, mine from type-series; 97, 98, *S. vandrieli* on *Cyclobalanopsis glaucoides*, 35-5-3, Anning, mines from type-series.

BOOK REVIEW

E. J. Weeda, J. H. J. Schaminée & L. van Duuren, 2000. Atlas van Plantengemeenschappen in Nederland. Deel 1, Wateren, moerassen en natte heiden. – KNNV Uitgeverij, Utrecht. 334 pp. illustrated in full colour. [ISBN 90-5011-132-7]. Price NLG 79.90 excl. p&p. [Atlas of plant communities in the Netherlands, vol. 1, vegetations of waters, marshes and wet heathland, In Dutch].

More than other zoologists, entomologists are depending on botanical information both for finding good localities and for the description of the habitat of the insects they study. This is especially true for specialised herbivore insects. The reviewer, for instance, starts preparing his field work by study of flora's and descriptions of vegetation (as can be seen in the pages before this review). Although we have nowadays a fair amount of flora atlases, as far as I know, atlases with detailed distribution data for plant communities have not been published before.

In the Netherlands the production of such an atlas has now started as a new four volume series. The Netherlands already belong to the few countries with an enormous amount of detailed published information on its biota, with atlases for all vertebrates, several groups of plants and invertebrates, and now is adding a series of detailed 5 km square dot maps for the plant communities.

The book will be published in 4 volumes, each treating a group of plant communities, similar to those treated in volumes 2-5 of the recent series on the Vegetation of The Netherlands. Volume 1 starts with a relatively short general introduction, mostly on methods and sources (a thorough introduction to study of plant communities has been given in volume 1 of 'De Vegetatie van Nederland'). Then follows an introduction into the plant communities of the Dutch wetlands and further detailed descriptions of all communities, grouped in vegetation classes. The classes receive a rather detailed treatment of ecology, botanical composition and distribution, amply illustrated with colour photographs of vegetations. Each association (community) is treated on 2 pages with two maps for the periods before 1975 and since 1975. The dots are given for 5 km squares. The data are partly based on detailed field relevés, partly on estimates which were calculated from the presence of the characteristic combination of species. The list of species used for these estimates is always presented with the map.

The book is well designed and a pleasure to handle. The photographs are of good quality and show also some extra's such as (former) economic activities in some plant communities (collection of seagrass, peat digging). Also one insect is depicted: a copulating pair of the Silver-studded Blue *Plebeius argus*, as a typical species for heathland. The text contains a lot of interesting detail on the occurrence of the communities.

In all a very nice book for all nature lovers and certainly also for entomologists working in the Netherlands, this volume in particular for those interested in aquatic insects. Still, it is a pity that there is not even a small abstract or explanation in English for foreign users who cannot read Dutch.

[Erik J. van Nieukerken]