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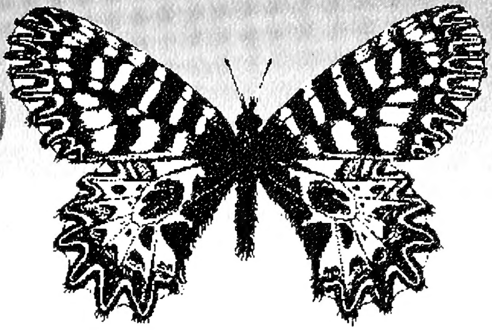

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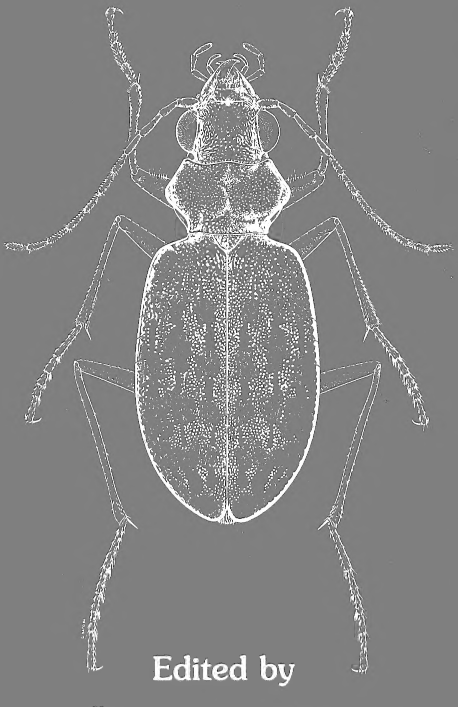

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Much of the content is due to the author's own research since his first visited West Africa in 1967, but especially following a structured research programme between 1993 and 2002, involving more than 15 study visits to West Africa. When asked how long his field research programme would last, the authors answered: "When I have walked the distance from London to Lagos inside West African rainforests in good condition". This milestone was reached in 2002 - here is the result.

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In *The Geometrid Moths of Europe* volume 2 on Sterrhinae, the third volume in the series to be published, a number of difficult genera such as *Cyclophora*, *Scopula* and *Idaea* are covered. Especially *Idaea* with more than 100 species occuring in Europe, has caused a lot of problems to identify, but based on the many specimens illustrated on the 24 colour plate, the species of this genus can be identified much easier now. Apart from its largest species, the genus *Idaea* is illustrated in 1.5 times natural size. The remaining Sterrhinae are in natural size on the colour plates. On additional black and white photos for species which are difficult to identify, their differential characters are pointed out with arrows. As in the previously published volumes 1 and 4, a map with the European distribution is given, and with dots for verified specimens. Finally there are line drawings of male and female genitalia of all species and also this volume contains a systematic catalogue of the European species and including those of the neighbouring regions such as North Africa, Macaronesia, Turkey, and the Middle East. Three new species and three new subspecies are described in this volume that sets new standards in the study of European Sterrhinae.

Vol. 4 on Perizomini and Eupitheciini has now been published and a number of very fine review has been written about it in various entomological and lepidopterological journals. Already now there is no doubt, that this volume will mean a new era in the study of the European species of these groups. All the Eupithecia species are illustrated in 1.5 times natural size on the colour plates. A total of 151 species are dealt with in the volume of which 133 are Eupitheciini. One new species is described and a number of species are recorded from Europe for the first time.

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Contents

Professor Dalibor Povolný
13 November 1924 – 6th of November 2004

Professor Dr. Ing. Dalibor Povolný, Dr. Sc., Dr. h.c., our good friend and colleague, acknowledged lepidopterist and dipterist world-wide, lost his struggle against a grave disease on the 6th of November 2004, only a week before his 80th birthday.

Dalibor Povolný was born on 13 November 1924 in Třebíč, a small town in western Moravia, in the family of a teacher. Ever since his boyhood he was taught to love Nature. He was strongly influenced in that direction by his father and by Antonín Růžička, entomologist and Dalibor's schoolmaster. Immediately after the end of World War II, Dalibor Povolný enrolled at the Faculty of Agronomy of the University of Agriculture in Brno. Already during his university studies he worked as an assistant at the Institute of Applied Entomology under the leadership of Professor Miller. At the same time, his other love – singing – brought him to the study of operatic singing at the Brno conservatory, and he had close contacts with the cultural activities in Brno. Dalibor Povolný started to work at the Entomological Laboratory of the Czechoslovak Academy of Sciences after having finished his military service in 1953. Shortly

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thereafter he entered the newly established Parasitological Institute in which, together with Dr. Rozsypal and Dr. Gregor, he founded a working team that concentrated on the study of synanthropic flies, gadflies, and pupiparous Diptera. In 1961, Dalibor Povolný qualified as a university lecturer in zoology at the University of Agriculture in Brno, and in 1968 he was appointed professor of zoology at that University. In 1962 he became the head of the Institute of Zoology of the Faculty of Agronomy. In 1965–1969 he also lectured in parasitology at the Nangrahar University in Afghanistan, at the same time developing intense research on insects and mammals. In 1971, for political reasons, he was stripped of all his academic functions, was forbidden to lecture and publish, and was moved to a detached workplace at Lednice in southern Moravia. There he devoted all his time to continued extensive investigations. Unfortunately, it was not until 1989 that he could present his results in their full extent to the scientific public. In 1990 and 1991 he was vice-chancellor of the University of Agriculture in Brno. In 1991 he was pensioned, but this brought no change to his life habits. He continued to work in the Institute of Zoology and Apiculture at the Mendel University of Agriculture and Silviculture, and his working activity seemed to grow, as if he tried to catch up with all that he had missed.

The scope of Professor Povolný's scientific knowledge was considerable, but the study of Lepidoptera and Diptera was always the centre of his interests. He and František Gregor, his lifelong friend, were among the first in the Czech Republic to engage in serious scientific studies on Microlepidoptera. Their joint efforts yielded a number of papers on mining species, especially of the genus *Phyllonorycter,* and a comprehensive paper on Moravian burnet moths. In the early 1950s, Povolný started to specialise himself in the study of moths of the family Gelechiidae, and very soon he became a foremost specialist of this insect group. For example, he worked on a voluminous material of South American gelechiids and studied the Californian species of this group. The scientific results obtained by Professor Povolný are admirable. Let us just mention the mere fact that he described over 250 taxons as new to science.

At the turn of the 1950s, Dalibor Povolný was charged with the task of studying synanthropic and parasitic Diptera. Although being rather compelled to do it, Povolný took to the job with his characteristic enthusiasm and he soon assumed the leadership of a productive team. Among other involvements, the team was invited to co-operate in the monumental work on "Flies and Disease", edited by Professor Greenberg and published in the USA in 1971. In 1997, Povolný's many years' study of the central European flesh flies yielded an extensive monograph published in Munich, Germany, that is widely used throughout Europe. Povolný worked on flesh flies intensively, particularly during the past decade. Every year he travelled to various parts of central Europe and the Mediterranean region to study them. His last trip in June 2004 was to his beloved Sicily. Already suffering from considerable health problems and pains, he still worked hard in the field. He was fully aware of his impaired health, yet he never ceased persuading himself that it might yet improve so that he would be able to complete his unfinished projects.

Povolný's interest did not concentrate only on flies, butterflies, and moths. He also devoted much of his time to a number of theoretical as well as practical problems in ecology, domestication, evolution, and forensic entomology, to name a few. He was an enthusiastic popularizer of zoology and entomology in the broadcasting media and popular magazines, and he gave many lectures to the general public and to scientific audiences both at home and abroad. He was regularly invited to give lectures several times each year and he always tried to oblige. He participated in a large number of international congresses and symposiums, some of them organised by himself. He was a member of numerous national and international scientific societies. His publishing activity was incredible. He is the author of some 350 original scientific papers, a number of comprehensive monographs, and hundreds of other articles and communications. His work in this field was highly appreciated.

Professor Povolný was an ardent scientist and, like most scientists, he did dislike being disturbed when working. Nevertheless, he was always very obliging and ready to help in any way possible. To save time, he would run rather than walk along the University's corridors. His memory was excellent, and his ability to clearly and rapidly formulate his ideas in a discussion was amazing. However, he often stuck to his opinions without compromise, which got him involved in a number of problems. Sometimes it was difficult, or even impossible to convince him that he was mistaken.

Povolný was not one of those tedious scientists. His sense of humour was known to everybody. He never ruined the good mood of a party, he was an excellent storyteller, and he never spoilt a joke. That is why he was often the centre of attention, even at scientific meetings, and at times a discussion on a serious scientific topic would often take quite a different direction... Professor Povolný could perfectly mimic the voices of his friends and, above all, those of the colleagues with whom he disagreed in ideology or expert opinions. And in matters he considered important he could fight like a Kilkenny cat.

Dalibor loved art and, above all, music. He was an excellent operatic tenor, and he could not forget about it even during his scientific work. He would sing when examining specimens in his lab and during field work. His sonorous voice would resound at considerable distances so that one would first hear an aria and then only glimpse a man sweeping his entomological net. Loaded with an incredible amount of energy, Dalibor was an unforgettable personality that seemed to be indestructible…

ZDENĚK LAŠTŮVKA

Nota lepid. 27 (2/3): 103–124

Multivariate analysis of male genital structures in the *Hipparchia semele-muelleri-delattini* complex (Nymphalidae, Satyrinae) from the Balkans: how many taxa?

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Abstract. Two closely related *Hipparchia* taxa, *Hipparchia delattini* Kudrna, 1975 and *H. semele muelleri* Kudrna, 1975 have been described from the Balkans based on differences in male genital structure, compared to each other and to another nominal European taxon (*H. semele* Linnaeus, 1758). Subsequently, Kudrna (1977) synonymised both *H. delattini* and *H. muelleri* with *H. volgensis* (Mazochin-Porshnjakov, 1952). Application of multivariate statistical techniques on male genital data indicates a cline in several aspects of genital morphology linking these three taxa across Europe. Although clusters are repeatedly found that correspond with the three taxa, it is not possible to ascribe every individual specimen to one of the three *Hipparchia* taxa. *Hipparchia muelleri* is shown to occupy an intermediate position between *H. semele* and *H. delattini*. Generally, *H. delattini* is present in an area covering part of northern Greece and the central Balkans. *H. semele* is present in western Europe, the Balkans and down the western side of Greece. However, individual specimens that classify to *H. delattini* in the current analyses may occur much further west, where historically only *H. semele* has been, and there appears to be a correlation between putative taxa and altitude with *H. delattini* occurring at higher altitudes. It is suggested that genetic differentiation between these taxa has been maintained and enhanced during glacial-interglacial cycles. The results of this study are discussed in relation to other morphological characters and biogeography and require further testing with molecular data.

Key words. Lepidoptera, Nymphalidae, Satyrinae, *Hipparchia semele*, *Hipparchia delattini*, *Hipparchia muelleri*, *Hipparchia volgensis*, genitalia, Balkans, biometrics, numerical taxonomy.

Introduction

Kudrna (1975), through comparison of male genital structures in a relatively small number of specimens, described two *Hipparchia* taxa from Greece and the Balkans, namely *Hipparchia muelleri* (type locality: Mt. Chelmos, southern Greece) and *H. delattini* (type locality: Pristina, Kosovo), differentiating them from each other and from *H. semele* (Linnaeus, 1758; type locality: Sweden). Later, Kudrna (1977) synonymised both *H. delattini* and *H. muelleri* with *H. volgensis* (Mazochin-Porshnjakov, 1952). According to Kudrna (1977), the *H. semele* male valve has a prominent terminal dorsal process, which is triangular in shape, and a well-pronounced distal termination, while in *H. delattini* the dorsal process is poorly pronounced. *H. muelleri* has a valve dorsal process that is intermediate between *H. semele* and *H. delattini* (Kudrna 1975; Coutsis 1983).

In a study to test the validity of these nominal taxa (Wakeham-Dawson et al. 2003), discriminant function analysis (DFA) was used to compare *Hipparchia* specimens captured in Greece and the Balkans against specimens of nominal taxa from type localities (topotypes). This analysis indicated the presence of specimens consistent with one or other of the topotypical concepts of *H. semele*, *H. muelleri* and *H. delattini* in the area. We did not incorporate topotypical *H. semele* material from Sweden, but our sample of this species included specimens from southern England, Spain, France and various localities to the north of the Balkans from Italy to Romania. However, in the same study, cluster analysis of a sample of these data without preconceptions of the validity of the taxa cast doubt on the presence of three taxa (Wakeham-Dawson et al. 2003). The cluster analysis indicated two main groups: a Balkan cluster (incorporating the majority of the nominal *H. muelleri* and *H. delattini* specimens of the DFA analysis) and an extra-Balkan cluster (incorporating mainly nominal *H. semele* specimens of the DFA analysis). There was some, albeit limited, overlap between the clusters that could be the result of errors in measurement, or represent hybrids, or a continuum between the two clusters, which might become more apparent with additional data.

The results were thus inconclusive. To test these hypotheses further, and supplied with additional data from the second author that extended through areas of the Balkans not represented in the first analysis, the current paper returns to the question: is it possible to recognise more than one discrete taxon in the Balkan area? Such issues in taxonomy require several distinct approaches: (i) the investigation of dimensionality and relationships in and among variables and the placement of individuals and putative taxa within axes describing these dimensions; (ii) the degree to which putative taxa can be discriminated within the space described by the variables; (iii) an exploration of natural clusters (putative taxa) using information on the specimens representing them. This latter approach makes no prior assumptions about the allegiance of individuals and works either by determining whether a fixed number of clusters exist or by allowing numbers of clusters (taxa) to be generated by the data.

Preliminary analysis by the second author of an initial data set including 91 specimens and using Lorkovic's total and partial transitions method (see Sijarić 1980) failed to show a clear separation between Balkan specimens subjectively classified as *H. delattini* and *H. semele*, when uncus length was plotted against valve length. It should be noted that the current study does not include specimens of the more distantly related Balkan species *Hipparchia senthes* (Fruhstorfer, 1908) (see Olivier & Coutsis 1997; Wakeham-Dawson et al. 2003).

Methods

Sources of data and measurements. The genitalia data used in the current study are taken from 82 male butterfly specimens captured in the Balkans and other areas in Europe (see Appendix). These include measurements from 20 specimens in the second author's collection added to the data set used for B_K analysis in Wakeham-Dawson et al. (2003), as well as further specimens from the northern Balkans included in that analysis but not clustered. Of these, 54 specimens have been identified by subjective comparison of genitalia (see Kudrna 1977; Jakšić 1998) and capture locality in relation to type locality for the nominal taxa; a further 28 specimens are not assigned to a taxon. The first author made all the measurements using the methods described in Wakeham-Dawson (1998) (see Fig. 1). Diagonal length (DL) is divided by valve length (VL1) to produce a unitless ratio D, which measures overall proportion (shape) of the genitalia independently of size variation between individuals in a taxon. Similarly, valve length (VL1) is divided by valve breadth (VB2) to produce a ratio $V1$, representing overall valve shape. Posterior valve length (VL2) is divided by posterior valve breadth (VB1) to produce a ratio $V2$, representing valve shape at the posterior end of the valve. Uncus length (UL) is divided by uncus breadth (UB) to produce a ratio U, representing uncus shape. Brachium length (BL) is divided by brachium breadth (BB) to produce a ratio B, representing brachium shape. Tegumen length (TL) is divided by tegumen breadth (TB) to give a ratio T, representing tegumen shape, and phallus length (PL) is divided by phallus breadth (PB) to give a ratio P. This provides 20 variables (13 measurements and 7 ratios) for analysis.

Statistical analysis. We first investigated the dimensionality and relationships among the genitalia variables using principal components analysis (PCA). This also allows the examination of specimens, and the taxa to which they putatively belong, in a reduced space accounting for key amounts of the variance, typically the first two dimensions. We entered key geographical variables (latitude, longitude and altitude) as supplementary to the analysis allowing trends in variables and taxa to be determined.

Second, we determined the degree to which the *Hipparchia* specimens can be discriminated and classified to taxa by using discriminant function analysis (DFA). DFA, like PCA, also produces linear combinations of the original variables, but DFA constructs these new variables (discriminant functions) to maximize differences between groups allocated a priori to analysis. To be completely effective as a technique the groups need to be allocated on different criteria (variables) from those used in the DFA. We have not been able to apply such rigour here. But, a number of the individuals ($N = 54$) were previously allocated to taxa on the basis of geography and visual inspection of the genitalia, as indicated above, independently of this analysis. DFA is particularly useful in the current case for identifying significant discriminatory variables and for classifying specimens without labels. For DFA, variables were first selected as being significant discriminators by applying ANOVA. We have chosen non-metric multidimensional scaling (NMMS) based on Mahalanobis's distance (D^2) for the placement of individuals in the multidimensional discriminant space; this allows distances on all discriminant axes to be adequately portrayed instead of their placement on just the first two discriminant axes. DFA produces Mahalanobis's D^2 between taxa and groups. The closer a particular specimen's discriminant score is to a particular taxon's mean location (centroid) in the discriminant space (measured by Mahalanobis's D^2) compared to the mean location of other taxa, the more likely it is that it belongs to that taxon. Similarly, the closer a taxon (represented by group centroids) is to another in discriminant space, the more similar the two are morphologically. Wilks's lambda (λ) measures the discriminatory power of the model. Its value ranges from 0 (perfect discriminatory power) to 1 (no discriminatory power). The

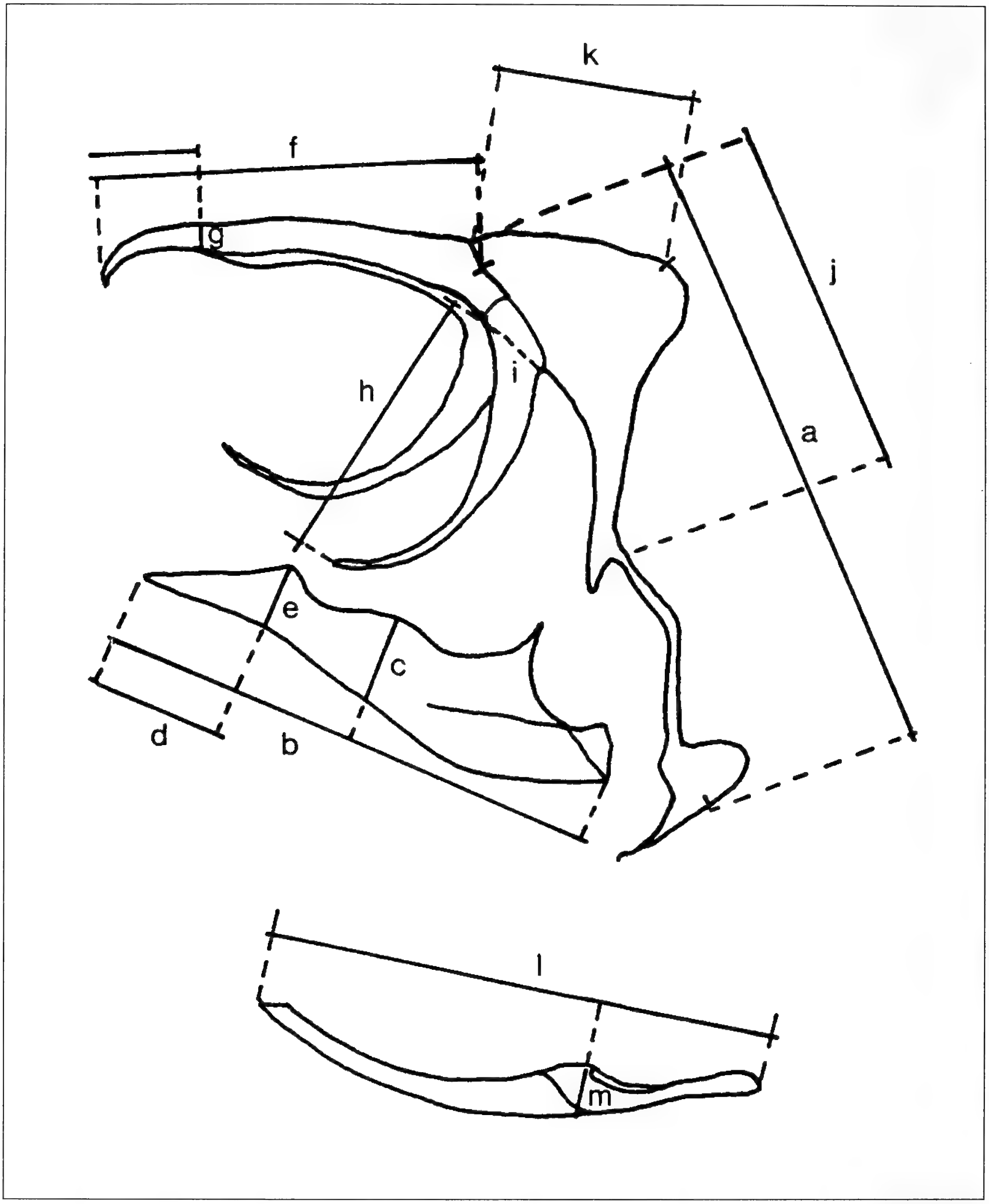

Fig. 1. Diagram of male genitalia, including measurements made on male genitalia, of *Hipparchia* butterflies. Terminology based on Higgins 1975. a = diagonal length (DL), measured from dorsal junction of tegumen and uncus to base of saccus (the line running at the same angle as the vinculum); b = valve length (VL1); c = valve breadth (VB2), measured across the widest part of the central valve process and at 90° to the line b; d = posterior valve length (VL2), measured from valve apex to line e; e = posterior valve breadth (VB1), measured across the widest part of the terminal valve process and at 90° to the line b; f = uncus length (UL), measured from uncus apex to mid-point between junction of tegumen and uncus; g = uncus breadth (UB), measured at 0.5 mm from uncus apex and at 90° to line f; h = brachium length (BL), measured from apex of brachium to dorsal junction of tegumen and brachium; i = brachium breadth (BB), measured across junction of tegumen and brachium; j = tegumen length (TL), measured from dorsal junction of tegumen and uncus to junction of apex angularis and vinculum, at same angle as line a; k = tegumen breadth (TB); l = phallus length (PL); m = phallus breadth (PB).

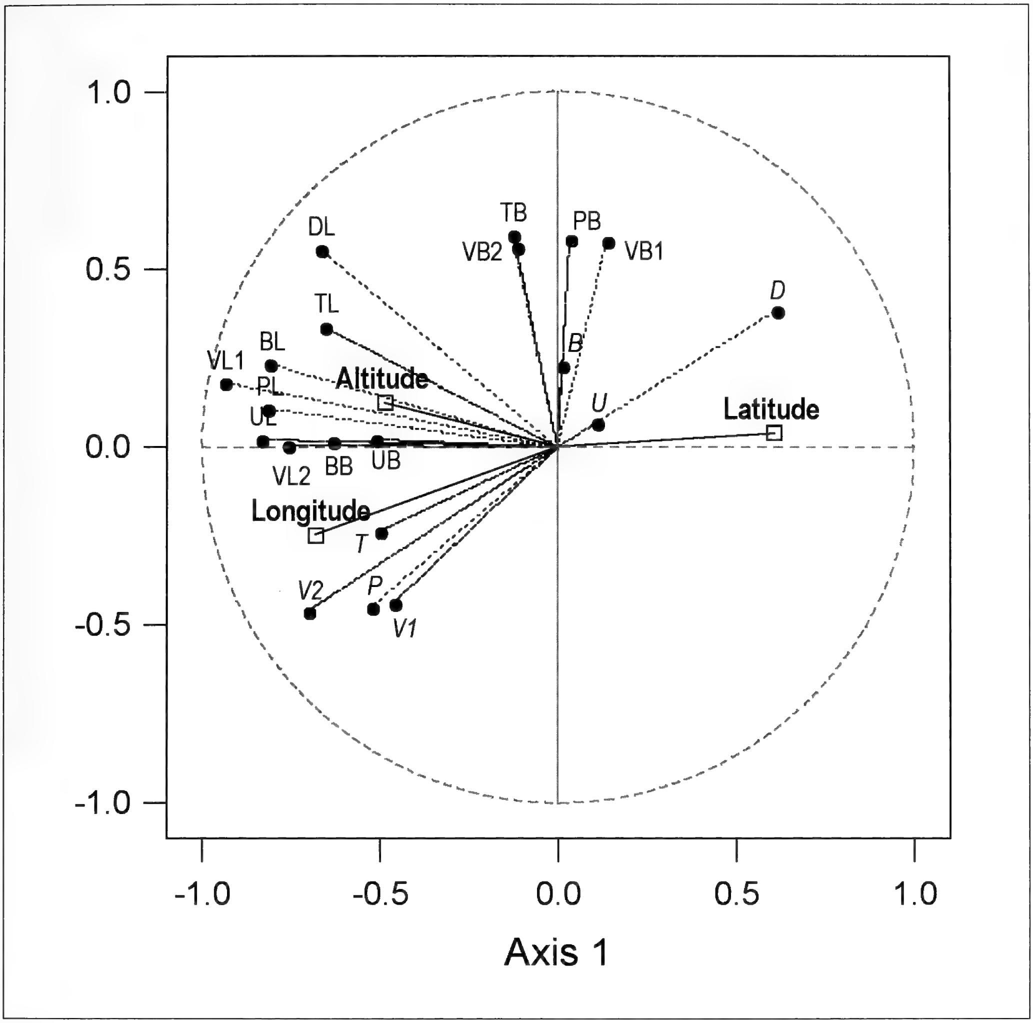

Fig. 2. Principal components analysis of 20 genitalia variables (13 measurements and 7 ratios) in *Hipparchia* (N = 82). Geographical variables (latitude, longitude and altitude) were entered as supplementary to the analysis. See Tables 2 and 3 for eigenvalues and loadings for axes.

success of DFA is determined by the percentage of specimens classified correctly as predicted, which itself requires prior assumptions of the validity of the taxa involved and of material that can be referred definitely to them.

Third, we subjected the data on the 82 specimens for the 20 variables to k-means clustering (Legendre & Legendre 1998). This technique starts with *k* random clusters and then moves objects between those clusters with the goal to (i) minimize variability within clusters and (ii) maximize variability between clusters. The technique is related to ANOVA, and the success of the operation is determined from the F statistics associated with each dimension (variable). It is a suitable technique for situations when a certain number of groups is suspected to exist and allows the testing of *a priori*

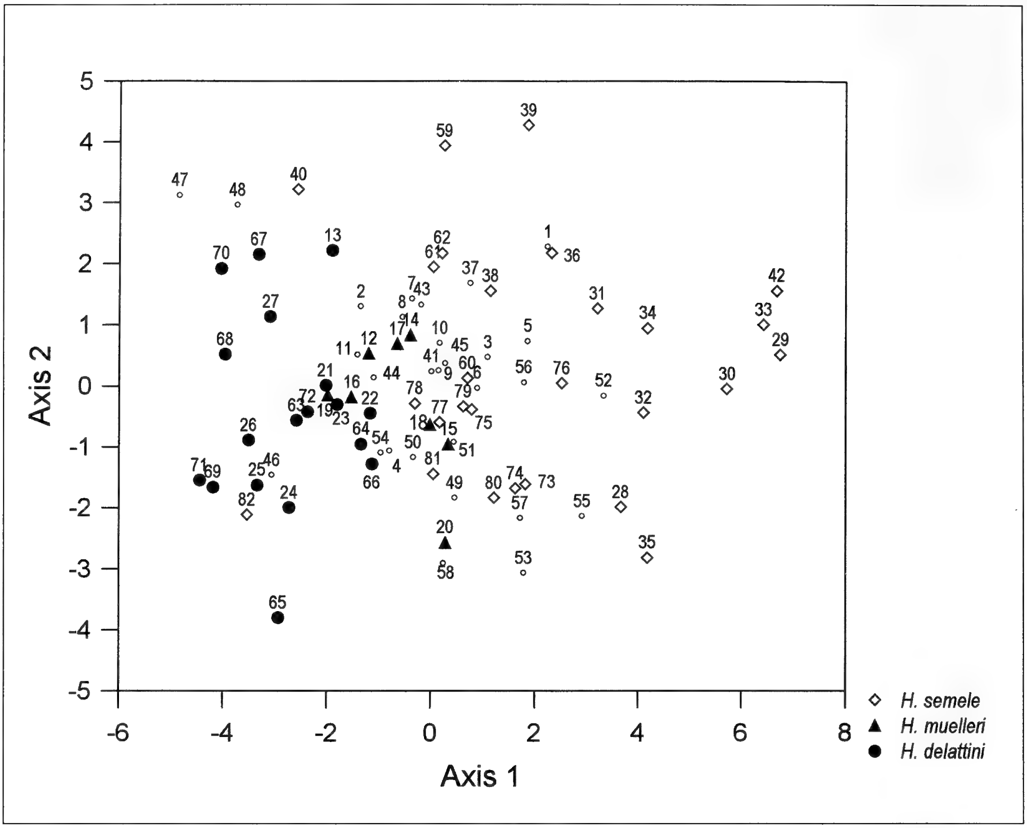

Fig. 3. Placement of *Hipparchia* specimens (N = 82) in the first two axes of a principal components analysis for 20 genitalia variables (see Fig. 2 and Tables 2 and 3). Undesignated specimens prior to analysis indicated by small dots.

classifications. Here, we tested for 3 groups as three putative taxa occur but also discuss results for a 2*k* solution. The approach we used is to 'seed' the analysis with three 'types' for *H. semele* (awd281 (case 30) from Eastbourne, Sussex, UK), *H. muelleri* (awd127 (case 12) from Mount Chelmos, S. Greece) and *H. delattini* (pj117 [kos-5/6293] (case 65) from Pristina, Serbia), the latter two coming from the type localities and chosen independently of the DFA.

Fourth, non-hierarchic (permitting clusters to overlap) B_k clustering procedure of Jardine & Sibson (1968) is used to explore clustering structure in data sets, using association coefficients (Euclidean distance measures) derived from all variables. This method is independent of *a priori* classifications or hypotheses of the number of groups expected. B_k clustering is used to build up linkage diagrams from low to progressively greater distance levels and assessing them for clustering structure. In B_k clustering, as values of k increase, the number of links required below a certain distance level for an operational taxonomic unit (OTU) to join a cluster is equal to k, but k-1 OTUs can also fall into an overlap between clusters under certain circumstances

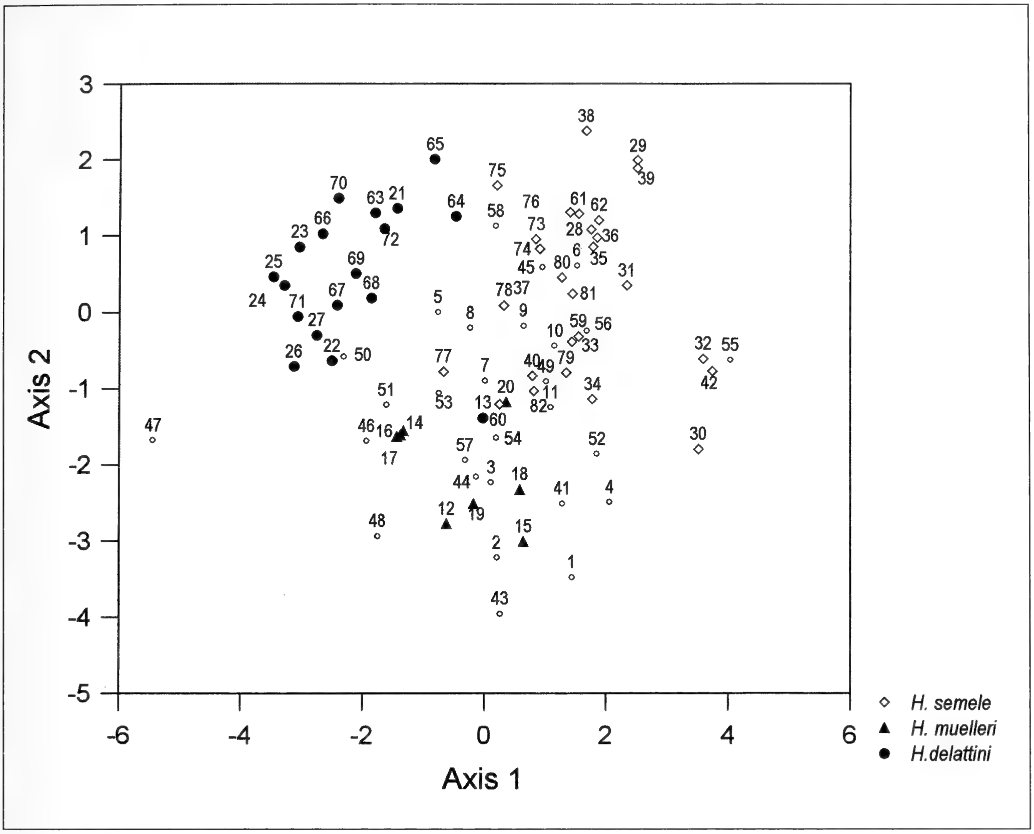

Fig. 4. Non metric multidimensional scaling plot (2 dimensions) of Mahalanobis's D^2 distances for the 82 *Hipparchia* specimens based on 20 variables (measurements and ratios). Kruskal stress and coefficient of alienation < 1%. See Appendix for specimen locality data and text for explanation. Undesignated specimens prior to analysis indicated by small dots.

without those clusters being thereby united. Single linkage is the first in the sequence, with k=1 and therefore no overlap, and represents the only situation where a hierarchic classification is derived. In the approach of assessing linkage diagrams under B_k rules, the clusters forming as one moves from a low to a high dissimilarity (distance) level are examined for the extent of linkage amongst their component OTUs in relation to linkages with other clusters. In the situation of discriminating taxa, evidence is sought for strong within-cluster linkage and of only limited between-cluster linkage and few OTUs in cluster overlap.

The method has been applied also in biogeographic and ecological analyses to explore commonality of distribution patterns and associations of species across samples (e.g. Holloway 1977, 1979; Davis et al. 2001). It offers a more sensitive method of recapturing information on clustering structure in data than other approaches such as averaging methods which are usually favoured because the results produced appear more clear-cut, but sometimes unjustifiably so because of their tendency to break chaining in the data structure rather than identify where it occurs.

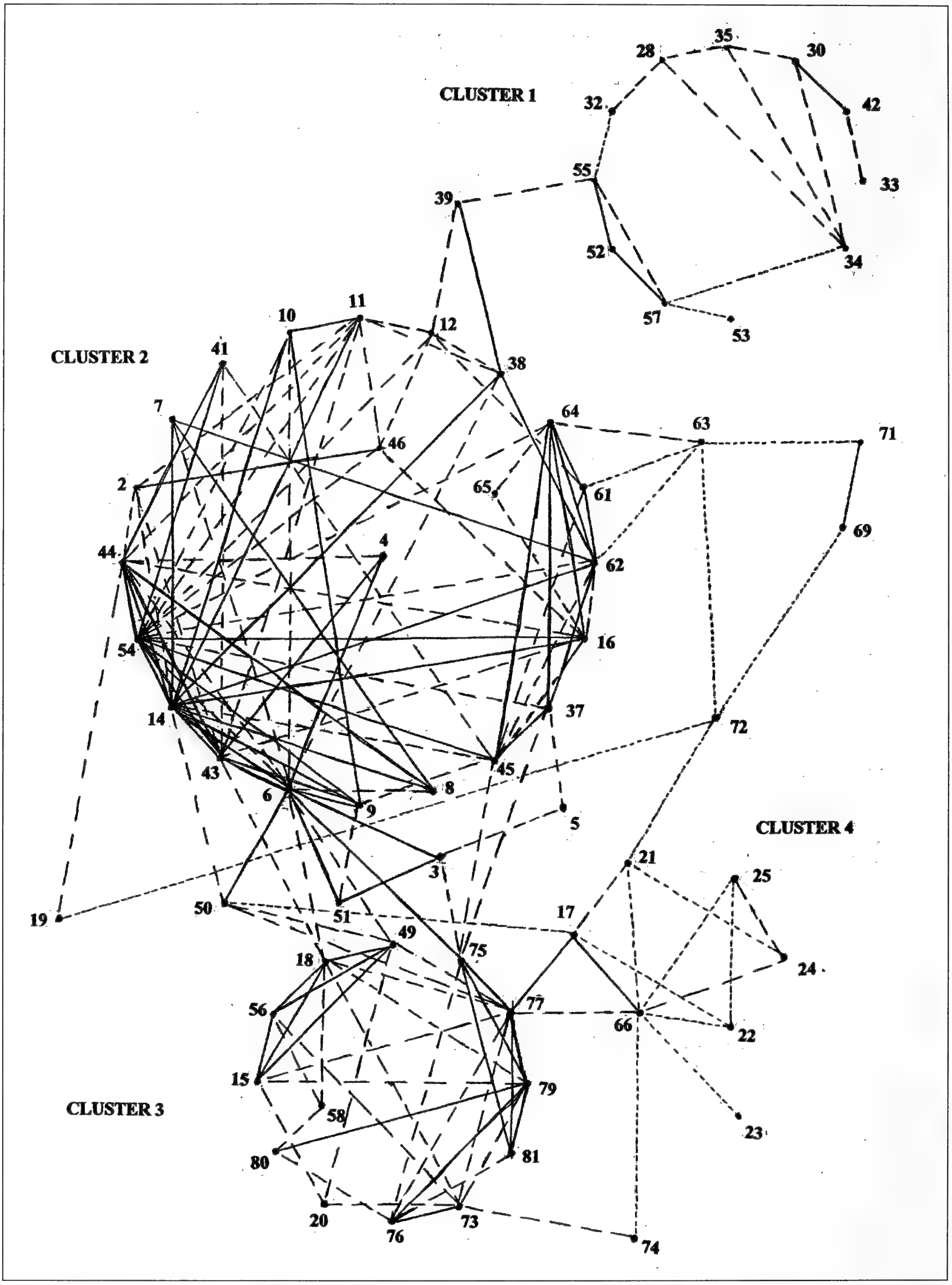

Fig. 5. Linkage diagram showing the links clustering 64 of the 82 specimens to a dissimilarity level of 0.40, although for clarity, only links to 0.35 are shown for Clusters 2 and 3. The additional links to 0.40 are predominantly within each of these two clusters, though 75 and 77 (two links) and 18 (seven links) in Cluster 3 show further affinity to Cluster 2 and could also be considered intermediate. Links to 0.30 are shown as solid lines, those to 0.35 as broken lines, and those to 0.40 outside clusters 2 and 3 as lines of small dashes. 18 of the next 22 links for Cluster 1 (except OTU 53) are interior to the cluster, supporting its distinctiveness and homogeneity.

Tab. 1. Measurements (mm) (means ± standard errors) of male genitalia in three *Hipparchia* taxa from six geographical localities. N = number of specimens.

Taxon & Locality	***H. semele*** **(UK) N=9**		***H. semele*** **(France/ Spain) N=9**		***H. muelleri*** **(S. Greece) N=8**		***H. delattini*** **(Kosovo) N=7**		***H. delattini*** **(N. Greece) N=8**	
Variable	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
DL	3.24	0.03	3.76	0.08	3.48	0.07	3.75	0.07	3.58	0.05
VL1	2.47	0.05	2.99	0.06	3.01	0.04	3.19	0.06	3.14	0.03
VL2	0.54	0.02	0.63	0.02	0.71	0.02	0.74	0.03	0.74	0.02
VB1	0.46	0.02	0.48	0.02	0.47	0.02	0.42	0.03	0.42	0.02
VB2	0.51	0.02	0.51	0.01	0.51	0.01	0.47	0.03	0.58	0.01
UL	1.76	0.02	2.13	0.05	2.22	0.05	2.50	0.05	2.53	0.06
UB	0.16	0.01	0.15	0.01	0.23	0.01	0.20	0.01	0.23	0.01
BL	1.33	0.04	1.71	0.04	1.61	0.05	1.95	0.05	1.82	0.05
BB	0.26	0.01	0.31	0.02	0.35	0.01	0.38	0.02	0.34	0.01
TL	1.91	0.05	2.28	0.06	2.08	0.06	2.36	0.07	2.13	0.05
TB	1.28	0.03	1.43	0.02	1.24	0.03	1.34	0.04	1.24	0.04
PL	2.77	0.07	3.24	0.07	3.30	0.03	3.33	0.07	3.43	0.05
PB	0.29	0.02	0.34	0.01	0.31	0.01	0.29	0.01	0.30	0.01

All procedures, but the B_k cluster analysis, have been carried out in STATISTICA version 5.5 (Statsoft 1999). It was unnecessary to normalise the variables. Variables have been standardised for the PCA, DFA and k-means clustering and analysis has been carried on all 20 measurements and the seven ratios separately for the three (*H. semele*, *H. muelleri* and *H. delattini*) and two taxa (*H. semele* and *H. delattini*).

Results

Summary statistics are provided in Table 1 for geographical units with adequate samples rather than the taxa as these concepts of taxa may prove to be unsupported.
Principal components analysis. Table 2 and 3 record the eigenvalues and loadings for the 20 variables. The first two axes accounted for 47% of the variance; the distribution of variables and specimens in the axes are provided in Figs 2 and 3. Axis 1 primarily distinguished the majority of variables from *D*, the ratio of diagonal length (DL) to valve length (VL1). All but three variables (UB, *U* and *B*) have their highest loadings on the first two axes. Latitude increases in the same direction as *D*, whereas the majority of other variables are related to increasing longitude and altitude (Fig. 2). Latitude correlates significantly with 13 of the genitalia variables, longitude with 14 and altitude with 10 variables at $P < 0.05$ (11, 12 and 5 respectively with Bonferroni correction at $P < 0.0025$). The distribution of putative taxa correspond with this pattern; a clear gradient is established from *H. semele* through *H. muelleri* to *H. delattini*, the latter increasingly located in the direction of higher values (increased size) for most genitalia variables and with increasing longitude and altitude (Fig. 3).
Principal components of the 7 ratios produced much the same results (not tabulated). The first two axes accounted for 53% of the variance. All variables had their highest loadings on the first two axes. Axis 1 separated *V1*, *V2*, *T* and *P* (loadings –0.60 to

Tab. 2. Eigenvalues and extracted variables for the first 10 components of a principal components analysis on 20 genitalia variables (13 measurements and 7 ratios).

Component extracted	Eigenvalue	% Total variance	% Cumulative variance
1	6.715	33.58	33.58
2	2.727	13.63	47.21
3	2.394	11.97	59.18
4	1.769	8.85	68.03
5	1.308	6.54	74.57
6	1.213	6.07	80.64
7	1.065	5.32	85.96
8	0.976	4.88	90.84
9	0.518	2.59	93.43
10	0.470	2.35	95.78

Tab 3. Loadings for the first six axes of a principal components analysis of 20 genitalia variables (13 measurements and 7 ratios) in *Hipparchia* specimens (* supplementary to analysis. *Hipparchia* specimens include all 82 individuals in the study).

Variable	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
DL	-0.672	0.555	0.109	-0.219	-0.049	0.252
VL1	-0.941	0.180	-0.033	0.032	-0.065	-0.032
VL2	-0.760	0.002	-0.154	0.159	0.059	-0.161
VB1	0.137	0.576	-0.274	0.131	0.111	0.258
VB2	-0.117	0.558	-0.496	0.478	0.162	-0.065
UL	-0.837	0.022	0.095	0.211	0.139	-0.204
UB	-0.515	0.020	-0.687	-0.026	-0.219	0.012
BL	-0.812	0.232	0.184	0.079	0.023	-0.031
BB	-0.637	0.017	-0.172	-0.394	0.593	-0.040
TL	-0.656	0.339	0.311	-0.228	-0.042	0.380
TB	-0.132	0.594	0.548	0.116	0.184	-0.060
PL	-0.818	0.106	0.027	0.045	-0.175	-0.065
PB	0.030	0.581	-0.090	-0.518	-0.316	-0.491
D	0.609	0.381	0.163	-0.274	0.036	0.349
V1	-0.461	-0.441	0.443	-0.439	-0.199	0.062
V2	-0.706	-0.463	0.095	0.018	-0.075	-0.322
U	0.106	0.064	0.804	0.095	0.294	-0.172
B	0.008	0.229	0.393	0.533	-0.678	0.045
T	-0.504	-0.241	-0.209	-0.316	-0.228	0.425
P	-0.524	-0.450	0.096	0.496	0.171	0.416
*Latitude	0.607	0.038	0.297	0.134	0.050	0.071
*Longitude	-0.682	-0.247	-0.398	0.037	0.052	-0.064
*Altitude	-0.488	0.123	0.100	0.194	-0.032	-0.162

–0.83) from *D* (+0.76), and axis 2 distinguished variables *U* and *B* (+0.70 and +0.77) from the remainder (<0.20). Longitude, altitude and latitude are again polarised on Axis 1, with longitude (-0.66) and altitude (-0.34) relating to *V1*, *V2*, *T* and *P* and latitude (+0.50) to *D*. The distribution of taxa is similar to that from PCA on all variables, but *a priori* designated *H. muelleri* are offset from *H. semele* and *H. delattini* – a distribution reappearing in the NMMS plot of Mahalanobis's D^2 distances (Fig. 4) – rather than sandwiched between them, and linking up more with variable *T* rather than *V1*, *V2* and *P*.

Discriminant function analysis. ANOVA identified 17 of the 20 variables that significantly distinguished *a priori* labelled *Hipparchia* to the three taxa ($F_{(3,50)} = 2.82$ to 22.70, $P = 0.048$ to < 0.00001), 13 variables at $P < 0.0025$ (Bonferroni correction); the exceptions were VB2, TB and *V1*. Stepwise DFA of the 54 specimens that had been labelled (the others had not been assigned to a taxon prior to the classification; see Wakeham-Dawson et al. 2003) selected six variables (UB, UL, VB1, BB, BL and PL) that contributed to the discrimination. This results in 94% correct classification of specimens (Wilks's lambda = 0.136, $F_{(12,90)} = 12.81$, $P < 0.001$), with only three specimens being incorrectly classified. The parameters for variables are given in Table 4, the distances in Table 5 (lower diagonal) and the classification matrix in Table 6. An NMMS plot of Mahalanobis's D^2 distances between labelled specimens, including those not labelled, shows three clusters, each overlapping to a degree but with '*semele*' and '*delattini*' separated more than '*muelleri*' and '*semele*' (Fig. 4). The predicted classification of individuals not previously tagged is given in the Appendix together with a marker for those misclassified. Specimens classified as *H. delattini* are restricted to the Balkans but those determined to be *H. semele* occur as far east as 23°E and down the west side of the Balkans.

Stepwise discriminant function analysis for the three taxa based only on the seven ratios selected three variables that contributed to the discrimination of *a priori* designated individuals (*V2*, *U*, *B*). Significant discrimination was achieved (Wilks's lambda: 0.32, $F_{(6,98)}=12.443$, $P < 0.00001$) with 85.2% correct classification of designated individuals. *H. muelleri* was intermediate in distance between *H. semele* and *H. delattini* with all Mahalanobis's D^2 distances being significant (see Table 5, upper diagonal).

Further DFA for just two taxa (*H. semele* and *H. delattini*) based on the seven ratios selected three variables (*V2*, *V1*, *T*) that discriminated between individuals. Significant discrimination was achieved (Wilks's lambda = 0.35, $F_{(3,42)} = 25.52$, $P < .00001$) with 93.48% correct classification. *H. muelleri* specimens were regarded as unclassified prior to the analysis. Mahalanobis's D^2 between the two groups is = 7.65, $F_{(3,42)} = 25.40$, $P < 0.00001$. Individuals classified as *H. delattini* occurred as far west as 14°E and those classified as *H. semele* occurred as far east as 23°E. An interesting outcome is that of the collection of eight *H. muelleri* specimens from the same locality (22°E, 38°N), six were classified as *H. semele* (cases 12, 14–17, 19) and two as *H. delattini* (cases 18, 20).

K-means clustering. This technique resolved three main clusters based on three type individuals, group 1 *H. semele* (n = 15), group 2 *H. muelleri* (n = 42) and group 3

Tab. 4. Parameters for variables entered into stepwise (forward) discriminant function analysis of 54 specimens designated a priori to three *Hipparchia* taxa (Wilks's Lambda: 0.13632. $F_{(12,90)}=12.813$ $P < .00001$).

Variable	Wilks' lambda	Partial lambda	$F_{(2,45)}$ to remove	P level
VB1	0.190	0.718	8.82	0.0006
UL	0.167	0.817	5.04	0.0106
UB	0.235	0.579	16.35	0.0000
BL	0.177	0.769	6.75	0.0027
BB	0.166	0.821	4.90	0.0119
PL	0.162	0.841	4.25	0.0204

Tab. 5. Mahalanobis's D^2 between taxa for the 54 designated *Hipparchia* specimens (Lower triangle based on all genitalia variables; for comparison, the upper triangle is based on 7 ratio variables).

Taxa	*H. semele*	*H. muelleri*	*H. delattini*
H. semele	0.00	4.67	6.20
H. muelleri	10.27	0.00	4.27
H. delattini	14.70	10.25	0.00

Tab. 6. Classification matrix from discriminant function analysis of 54 specimens designated *a priori* to three *Hipparchia* taxa (Rows: observed classifications; columns: predicted classifications).

Group identity	Percent Correct	*H. semele*	*H. muelleri*	*H. delattini*
H. semele	92.86	26	2	0
H. muelleri	100.00	0	8	0
H. delattini	94.44	0	1	17
Total	94.44	26	11	17

H. delattini (n = 25). The distances between the groups and the accompanying ANOVA results are given in Tables 7 and 8. In phenetic (Euclidean) distances, group 2 is intermediate to groups 1 and 3, mirroring the PCA and DFA results. Fifteen variables have significant F values at $P < 0.05$; this number is still 14 with a Bonferroni correction. Nearly 65% of individuals were correctly assigned to the presumptive taxa. However this figure varied considerably among taxa, respectively 42.9% for *H. semele*, 75.0% for *H. muelleri* and 94.4% for *H. delattini* (Table 9). *H. semele*

Tab. 7. *K*-means clustering for three groups, Analysis of Variance

Variable	**Between SS**	**Within SS**	$F_{(2,79)}$	**P**
DL	28.564	52.436	21.517	<0.00001
VL1	53.195	27.805	75.571	<0.00001
VL2	35.114	45.886	30.227	<0.00001
VB1	4.737	76.263	2.454	0.093
VB2	6.434	74.566	3.408	0.038
UL	51.421	29.579	68.669	<0.00001
UB	17.968	63.032	11.260	0.00005
BL	45.110	35.890	49.648	<0.00001
BB	28.991	52.009	22.018	<0.00001
TL	27.136	53.864	19.899	<0.00001
TB	1.693	79.307	0.843	0.434
PL	45.402	35.598	50.378	<0.00001
PB	1.949	79.051	0.974	0.382
D	23.194	57.806	15.849	<0.00001
V1	12.340	68.660	7.099	0.0015
V2	39.150	41.850	36.952	<0.00001
U	0.940	80.060	0.464	0.631
B	1.227	79.773	0.608	0.547
T	19.601	61.399	12.610	0.00002
P	27.071	53.929	19.828	<0.00001

Tab. 8. *K*-means clustering for three groups, Euclidean distances between clusters (Distances below diagonal; squared distances above diagonal).

Groups	**No. 1 (*H. semele*)**	**No. 2 (*H. muelleri*)**	**No. 3 (*H. delattini*)**
No. 1 (*H. semele*)	0.000	0.760	2.366
No. 2 (*H. muelleri*)	0.872	0.000	0.539
No. 3 (*H. delattini*)	1.538	0.734	0.000

tended to be misclassified to *H. muelleri*, *H. muelleri* to *H. delattini* and *H. delattini* to *H. muelleri*. The groups were significantly different for geography and altitude with group number corresponding to the seeding by *H. semele*, *H. muelleri* and *H. delattini* respectively; specimens classified to *H. semele* occur to the north and west, and at the lower altitudes, those classified to *H. delattini* occur to the south and east, and at higher altitudes and specimens classified to *H. muelleri* occur at intermediate altitudes and geographical locations (Table 10). Even so, there is substantial geographical

Tab. 9. Summary (means and standard errors) for geographical variables of clusters from *k*-means clustering (ANOVA on normalized data; latitude: $F_{(2, 79)} = 19.23$, $P < 0.00001$; longitude: $F_{(2, 79)} = 29.84$, $P < 0.00001$; altitude: $F_{(2, 79)} = 11.79$, $P < 0.00003$).

Groups	**No. 1 (*H. semele*)**	**No. 2 (*H. muelleri*)**	**No. 3 (*H. delattini*)**	**Total**	**% correct classification**
*H. semele**	12	14	2	28	42.9
H. muelleri *	0	6	2	8	75.0
H. delattini *	0	1	17	18	94.4
Total	12	21	21	54	64.8

Tab. 10. Summary (means and standard errors) for geographical variables of clusters from *k*-means clustering (ANOVA on normalized data; latitude: $F_{(2, 79)} = 19.23$, $P < 0.00001$; longitude: $F_{(2, 79)} = 29.84$, $P < 0.00001$; altitude: $F_{(2, 79)} = 11.79$, $P < 0.00003$).

CLUSTER	**Latitude**		**Longitude**		**Altitude**	
	Mean	**SE**	**Mean**	**SE**	**Mean**	**SE**
No. 1 (*H. semele*)	47.83	1.12	4.83	1.96	453.33	163.55
No. 2 (*H. muelleri*)	42.88	0.51	15.70	1.01	683.33	80.43
No. 3 (*H. delattini*)	41.59	0.39	20.53	0.82	1102.00	97.83
All groups	43.39	0.42	15.18	0.89	768.90	63.84

Tab. 11. The geographic distribution of the *Hipparchia* specimens in each B_k cluster (see text for explanation).

Area	**1**	**2**	**Intermediate 2/3**	**3**	**4**	**Loose outlying cluster 5**	**Outliers**
Southern England (9)	7	0	1	0	0	0	1
Spain to French Alps (9)	0	7	1	0	0	1	0
Hungary, Romania (5)	0	5	0	0	0	0	0
Bavaria, Austria, Slovenia (10)	0	0	1	8	0	0	1
Croatia (Istria, Dalmatia [Croatia]) (10)	1	4	3	2	0	0	0
Serbia (10)	0	3	0	0	1	4	2
Corfu & Albania (5)	2	2	0	0	1	0	0
N.W. Greece (Epiros) (6)	0	4	1	1	0	0	0
N. Greece (Naoussa) (8)	0	1	0	0	6	1	0
S. Greece (Mt. Chelmos) (8)	0	4	0	3	1	0	0
Greece (Kevi) (2)	0	0	0	0	0	1	1
Total (82)	10	30	7	14	9	7	5

overlap based on all 82 specimens with *H. delattini* designated specimens being found as far west as 2° East and *H. semele* designated specimens being found as far east as 22° East.

Running *k*-means clustering for two groups, seeded with the *H. semele* and *H. delattini* specimens, rather than three is highly instructive. Sixteen variables provide significant group differentiation at $P < 0.05$ and 14 variables at $P < 0.0025$. There is 91.3% correct classification of *H. semele* and *H. delattini*, the two taxa used to seed the two groups. All *H. delattini* are correctly classified and all but four of the 24 *H. semele*. The eight *H. muelleri* are allocated to group 2 (*H. delattini*). In the $k = 2$ solution, there is as much geographical overlap of all 82 specimens as in the $k = 3$ means clustering solution, despite the fact that they again differ for longitude, altitude and latitude (t test; $t_{(80)}$: latitude 6.14, longitude –6.60, altitude -4.90; all $P < 0.00001$). Group 1 (seeded with *H. semele*) occur eastwards to 20°E and Group 2 (seeded with *H. delattini*) occur west to 2°E.

B_k analysis. This produces four main clusters, and a number of clusters that are not so well defined (Fig. 5). Cluster 1 includes nominal *H. semele* specimens from southern England and three from the Balkans. These specimens are: awd279 (28), awd281 (30), awd283 (32), awd284 (33), awd285 (34), awd286 (35), awd287 (42), bmnh13377 (52), bmnh13374 (55), and bmnh29808 (57). See Appendix for capture locations. Numbers in parenthesis are those allocated to each specimen during cluster analysis and used in Figs 3 & 4. Cluster 2 largely contains Balkan specimens, including most of the *H. muelleri* topotypes and some unidentified specimens. These specimens are: bmnh29865 (2), bmnh29867 (4), bmnh29872 (6), bmnh29869 (7), bmnh29874 (8), bmnh29875 (9), bmnh29871 (10), bmnh29868 (11), awd127 (12), awd382 (14), awd386 (16), awd316 (37), awd288 (38), and awd289 (39). Cluster 2 has some peripheral specimens; these are: bmnh11994 (1), awd247 (13), awd392 (19), awd427 (59), awd428 (60), and pj115 (63). Cluster 2 links through intermediates with Cluster 3; this includes *H. muelleri* topotypes and nominal *H. semele* specimens. These are specimens: awd383 (15), awd391 (18), awd393 (20), jdh60 (49), bmnh29807 (56), bmnh29809 (58), pj61 (73), pj62 (74), pj63 (75), pj64 (76), pj65 (77), pj67 (79), pj68 (80), pj70 (81). Specimens: bmnh29866 (3), bmnh29870 (5), awd282 (31), awd315 (36), jdh 59 (50), bmnh13378 (51), and pj66 (78) are those intermediate between Clusters 2 and 3. Cluster 4 contains nominal *H. delattini* specimens from North Greece and an *H. delattini* topotype from Pristina, Kosovo. These are specimens: awd387 (17), awd394 (21), awd396 (22), awd398 (23), awd399 (24), awd400 (25), and pj118 (66). Specimens: awd401 (26) and bmnh13375 (53) are peripheral to Cluster 4. An additional loose cluster (Cluster 5) contains a mix of specimens that includes *H. delattini* topotypes from Pristina, Kosovo. These are specimens: pj121 (69), pj123 (71), pj124 (72), awd402 (27), awd292 (40), awd356 (48), and pj122 (70). Specimens: awd280 (29), awd355 (47), pj119 (67), pj120 (68), and pj71 (82) are extreme outliers. These clusters show some geographical segregation, although the sample size for each geographic region in Table 11 is small.

A DFA (based on the genitalia measurements and shape ratios) of the specimens identified in the five main B_k clusters confirms the integrity of these clusters by showing segregation of the clusters (Wilks's lambda = 0.008, $F_{(32,185)} = 15.45$, $p < 0.001$) and 95% correct classification of specimens within clusters (variables UL, DL, PL, *U*, BL, TB, BB and *B* retained in the stepwise forward entry analysis). However, there is some overlap between clusters, especially if only ratios are used in a DFA (Wilks's lambda = 0.387, $F_{(12,145)} = 5.25$, $p < 0.001$; 55% correct classification of specimens within clusters; ratios *D*, *U* and *T* retained in the stepwise forward entry analysis), so size is an important factor in segregating specimens. PCA and DFA on the clusters failed to identify just which variables might be used to distinguish individuals to groups as Clusters 1 and 2 did not separate neatly from Clusters 3 and 4. However, PCA suggests that *H. semele* specimens from southern England (Cluster 1) are largely distinct from the three southern European *H. semele* (also included in Cluster 1) because of genital shape differences as well as size difference.

When B_k clusters are presented visually (Fig. 5), the nominal *H. semele* specimens from southern Europe are grouped into Clusters 2 & 3 with the nominal *H. muelleri* specimens. The nominal *H. semele* specimens from southern England (Cluster 1) are segregated to one side of Cluster 2 and nominal *H. delattini* specimens (Cluster 4) from North Greece and Kosovo are segregated to the other side.

Discussion

This study was generated by questions concerning the number of *Hipparchia* taxa in the Balkans, particularly on the existence of one or two *Hipparchia* species closely related to *H. semele*. A number of findings emerge. First, clusters for the three taxa, *H. semele*, *H. muelleri* and *H. delattini*, are repeatedly found in all analyses based on genital morphology; in the PCA, DFA, NMMS of Mahalanobis's D^2 distances, the *k*-means clustering and the B_k clustering. Second, even so, the clusters merge and are not so distinct that every individual can be categorised unequivocally to one of the *three* taxa, certainly not on individual genital morphology and with even less success for genital ratio variables which control for differences in absolute size. Overlap occurs for the putative taxa in PCA, the NMMS plot of Mahalanobis's D^2 distances and B_k clustering and incorrect classification occurs in DFA and *k*-means clustering. Third, from the highly significant associations of genital morphology with longitude, latitude and altitude, there is a strong suggestion of a gradient (cline) in genital morphology. In this, *H. muelleri* largely adopts an intermediate position between *H. semele* and *H. delattini*, but not exactly an intermediate position for all genital attributes as evident in the PCA of ratio data. Just whether *H. muelleri* is more closely associated with *H. semele* or *H. delattini* depends on the analysis being applied and which variables are used. For example, DFA on two groups for ratios links *H. muelleri* more with *H. semele*, but *k*-means clustering for $k = 2$ on ratios allocates *H. muelleri* to *H. delattini*.

Fourth, despite the apparent cline for many variables in genital morphology, classification (DFA, *k*-means clustering) reveals a geographical overlap of taxa, regardless of whether two or three groups are considered. The overlap is greater for *k*-means clustering than for DFA; the reason for this is that, in the absence of distinct morphological boundaries between the taxa being considered, *k*-means clustering has shifted the morphological boundary between them into *H. semele*; that is, more *a priori* designated *H. semele* are misclassified than *H. delattini* and the latter has grown in number and geographical range (expanding westwards) at the expense of the former. A more conservative picture is provided by DFA on two groups for ratios. This shows that *H. delattini* extends no further west than 14°E but that *H. semele* extends eastwards to 23°E. It is a more reliable picture since complications associated with *H. muelleri* are removed and genital comparisons are based on ratios, not purely on size aspects on genital morphology.

Arising, then, from this analysis is the possibility of two *Hipparchia* taxa present in the Balkan study area, a finding greatly in need of confirmation from more extensive sampling and DNA markers. Broadly, these are *H. semele* and *H. delattini* (which includes *H. muelleri*-like forms). Kudrna (1975) originally described *H. muelleri* as a subspecies of *H. semele*; on the whole, we find *H. muelleri* to be closer to *H. delattini* than to *H. semele* in male genital morphological space. The two species may have broader distributions (geographical ranges) than previously considered. *H. delattini*, which is probably conspecific with Russian *H. volgensis* (see Kudrna, 1977), appears to be largely confined to the Balkans and Northern Greece. *H. semele* is present in western Europe, but also into the Balkans. The complexity of some clusters (clusters 2 and 3) in B_k clustering may point towards hybridisation between the two taxa.

The suggested relationship between taxa and altitude accords with the findings of Pamperis (1997), who recorded *H. muelleri* at low to intermediate altitudes and *H. delattini* (synonymised with *H. volgensis*) at intermediate to higher altitudes in Greece. However, it should be noted that the validity of Pamperis' wing-pattern based method of taxa identification has been questioned by Wakeham-Dawson & Kudrna (2000).

The two apparent taxa of the current study may be the product of speciation during isolation in ice-age refugia; other species conform to this east versus west European pattern (see Dennis et al. 1991; Dennis 1993; Hewitt 1999, 2000; Schmitt & Seitz 2001a, b). This model would describe the different taxa evolving in western (*H. semele*) and eastern (*H. delattini* or *H. volgensis*) regions at Mediterranean latitudes and recolonising northern areas in Europe and coming into contact following each glacial stage. Subsequent glacial advances tend to erase populations north of the Alps in which case genetic differentiation is maintained and enhanced during glacial-interglacial cycles (Dennis et al. 1991). Examples of similar 'cryptic' taxa are provided by sibling species groups of *Maniola jurtina* (Linnaeus, 1758) (Thomson 1987), *Pontia daplidice* (Linnaeus, 1758) and *P. edusa* (Fabricius, 1777) (Geiger et al. 1988) and *Leptidea reali* Reissinger, 1989 and *L. sinapis* (Linnaeus, 1758) (Mazel 2001), the last of which comprises components that extensively overlap in geographical range. The two taxa hypothesis produced by the current study is supported by a study of female genitalia (Coutsis 1983), which shows a clear disjunction in morphology between *H. semele* and *H. delattini*. Coutsis (1983) groups *H. muelleri* with *H. delattini* based on female genital morphology, corresponding with the closer relationship found here for *H. muelleri* and *H. delattini* than that for *H. muelleri* and *H. semele* based on male genital attributes. No significant difference was found in the morphology of *H. muelleri* and *H. delattini* androconia (Wakeham-Dawson 1998). Even so, in all analyses of male genitalia, there is failure to discriminate absolutely between the three taxa investigated here, and *H. muelleri* emerges as being approximately equidistant from *H. delattini* and *H. semele* in phenetic distances.

The issue arises that variation in male genitalia may not be a reliable taxonomic characteristic. Any structure that is not critical during copulation will probably not be under powerful sexual selection and so will not be a reliable indicator of reproductive isolation between taxa. If this is the case, genital shape may be neutral to selection and subject only to random processes, or to pleiotropic effects. In another satyrine butterfly, *Maniola jurtina* Linnaeus, 1785, there is an absence of an apparent relationship between valve shape and either mating success or strength of the male-female bond (Goulson 1993). However, both valve shape and uncus are much larger in species with a sphragis (e.g., *Heteronympha penelope* Waterhouse (Lepidoptera: Satyridae), and this may be an adaptation to sphragis removal during mating (Orr 2002).

Specimens, which are as yet unmeasured, from Bulgaria, appear to exhibit two clear forms of male genitalia (valve shape) that associate more definitely with *H. semele* or *H. delattini* (S. Abadijev, loan material) than do most specimens from the Balkans. The next stage in this research is: (1) to test the two-taxa (*semele* and *volgensis*) hypothesis with further specimens from across Europe including the Balkans and eastwards into Bulgaria and Russia, and (2) to assess the morphological data against molecular data.

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Appendix. Label data of the 82 *Hipparchia* specimens included in the current study. Sp. no. = specimen number; Case no. = cluster number used in cluster diagrams and Figs 3 & 4. Taxon: ? (specimens of uncertain taxonomic attribution) determined by discriminant function analysis; classification noted as 's' *semele*, 'm' *muelleri* or 'd' *delattini*. The three individuals misclassified and their reclassification are indicated by appropriate letter. Specimens deposited at The Natural History Museum, London (BMNH), the collection of A. Wakeham-Dawson (AWD), the collection of P. Jakšić (PJ), the collection of J. D. Holloway (JDH), and the Booth Museum, Brighton (BMB).

sp. no. (Case no.)	Taxon	Country	Location	Notes
bmnh11994 (1)	? m	Italy	Gorizia, La Logua	BMNH
awd127 (12)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1300 m, 15.vii.1995, AWD
bmnh13374 (55)	? s	N. Greece	Corfu	BMNH
bmnh13375 (53)	? m	N. Greece	Corfu	BMNH
bmnh13376 (54)	? m	N. Greece	Corfu	BMNH
bmnh13377 (52)	? s	Albania	Tepelenë	16.vi.1933, leg. A.H.G Alston & N.Y. Sandwith, BM 1932-383, BMNH
bmnh13378 (51)	? m	Croatia	Perkovic	12.vi.(19)08, H. Stauder, Fruhstorfer, Coll., BM 1987 285, BMNH
awd247 (13)	delattini m	Macedonia	Séli, Náoussa	1500-1600 m, 21.vi.1996, AWD
awd279 (28)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd280 (29)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd281 (30)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd282 (31)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd283 (32)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd284 (33)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd285 (34)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd286 (35)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd287 (42)	semele	England	Eastbourne, Sussex	200 m, 4.viii.1996, AWD
awd288 (38)	semele	France	Mount Canigou, E. Pyrenees	2200 m, 28.vii.1993, AWD
awd289 (39)	semele	France	Les Arcs, Alps	2600 m, 1.viii.1993, AWD
awd292 (40)	semele	France	Prades, E. Pyrenees	1000 m, 17.vii.1990, AWD
bmnh29807 (56)	? s	Croatia	Knin	July (19)08, Fruhstorfer, Coll., BM 1987-285, BMNH
bmnh29808 (57)	? m	Croatia	Dernis	10.vi.(19)08, H. Stauder, Fruhstorfer, Coll., BM 1987-285, BMNH
bmnh29809 (58)	? s	Croatia	Perkovic	12.vi.(19)08, H. Stauder, Fruhstorfer, Coll., BM 1987-285, BMNH
bmnh29865 (2)	? m	Italy	Venezia Giulia, Costa Trieste	13.vii.1926, BMNH
bmnh29866 (3)	? m	Italy	Littorale austr.	H. Stauder, 17.vi.1912, BMNH
bmnh29867 (4)	? m	Croatia	St Kriz	12.vii.1912, BMNH
bmnh29868 (11)	? s	Romania	Biharfüred, Bihar Mts	800-1200 m, K. Jordan, 20.vii.1911, BMNH
bmnh29869 (7)	? m	Romania	Herkulesbad	W. R. & E. H., 25.vii.1907, BMNH
bmnh29870 (5)	? d	Croatia	Senjska drega	17.vii.1912, BMNH
bmnh29871 (10)	? s	Hungary	Szovata, Maros-Torda c.	27.vii.1910, BMNH
bmnh29872 (6)	? s	Croatia	Zengg	1913, BMNH
bmnh29874 (8)	? s	Romania	Herkulesbad	21.vii.1907, BMNH
bmnh29875 (9)	? s	Romania	Herkulesbad	W. R. & E. H., 25.vii.1907, BMNH
awd315 (36)	semele	Spain	Albaraccin	1000 m, 20-23.vi.1995, AWD
awd316 (37)	semele	Spain	Albaraccin	1000 m, 20-23.vi.1995, AWD

sp. no. (Case no.)	**Taxon**	**Country**	**Location**	**Notes**
awd355 (47)	? d	N. Greece	Kevi	22.vi.1981, P.W. Cribb Coll. (Acc. no. 094732) BMB
awd356 (48)	? m	N. Greece	Kevi	22.vi.1981, P.W. Cribb Coll. (Acc. no. 094733) BMB
awd382 (14)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd383 (15)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd386 (16)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1300 m, 13.vi.1997, AWD
awd387 (17)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd391 (18)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1300 m, 13.vi.1997, AWD
awd392 (19)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd393 (20)	muelleri	S. Greece	Mount Chelmos, Pelopónnisos	1350-1600 m, 14.vi.1997, AWD
awd394 (21)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd396 (22)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd398 (23)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd399 (24)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd400 (25)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd401 (26)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd402 (27)	delattini	N. Greece	Séli, Náoussa, Macedonia	1500-1600 m, 25-26.vi.1997, AWD
awd427 (59)	semele	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
awd428 (60)	semele m	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
awd429 (61)	semele	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
awd430 (62)	semele	France	Lozère	W.G. & S.M. Tremewan, 1000 m, 15.vii.1998, AWD
cfu350 (41)	? m	Greece	Corfu	Ex coll. D & S. Howell, AWD
jdh20 (46)	? m	N.W. Greece	4 km w. of Spartos (e. of Vonitsa)	26.viii.1963, JDH
jdh23 (43)	? m	N. Greece	Dodoni, sw. of Konitsa	JDH
jdh24 (44)	? m	N. Greece	Aristi, SW. of Konitsa	13.vi.1977, JDH
jdh51 (45)	? s	N. Greece	Mesovounion, between Konitsa and Ioánnina	June 1984, JDH
jdh59 (50)	? d	N. Greece	Ioánnina	open hillside, June 1984, JDH
jdh60 (49)	? s	N. Greece	Ioánnina	open hillside, June 1984, JDH
pj61 [BDR-365] (73)	semele	Germany	Bavaria, Fohrenheide Gebiet	15.7.1973, H. Weigel, PJ
pj62 [BDR-363] (74)	semele	Germany	Bavaria mer., Eching	28.7.1951, P. Hotler, PJ
pj63 [BDR-364] (75)	semele	Germany	Bavaria mer., Eching	28.7.1951, P. Hotler, PJ
pj64 [BDR-362] (76)	semele	Germany	Bavaria mer., Eching	28.7.1951, P. Hotler, PJ

sp. no. (Case no.)	Taxon	Country	Location	Notes
pj65 [AUS-1274] (77)	semele m	Austria	Marchfeld, Oberweiden	date?, O. Wagner, PJ
pj66 [slov-412] (78)	semele	Slovenia	Slavnik	500m, 29.7.1976, B. Mihljevic, PJ
pj67 [slov-432] (79)	semele	Slovenia	Postojna	9.8.1931, M. Hafner, PJ
pj68 [slov-430] (80)	semele	Slovenia	Sorsko polje	9.8.1931, M. Hafner, PJ
pj70 [slov-422] (81)	semele	Slovenia	Opatija	25.6.1948, S. Michieli, PJ
pj71 [slov-428] (82)	semele	Slovenia	Ankaran	20-30.6.1959, S. Michieli, PJ
pj115 [kos-6/7277] (63)	delattini	Serbia	Pristina, Grmija	700 m, 25.6.1979, P. Jaksic, PJ
pj116 [kos-2249] (64)	delattini	Serbia	Prizen	950 m, 22.8.1994, P. Jaksic, PJ
pj117 [kos-5/6293] (65)	delattini	Serbia	Pristina, Grmija	700 m, 19.9.1979, P. Jaksic, PJ
pj118 [kos-6/7709] (66)	delattini	Serbia	Pristina, Grmija	700 m, 9.9.1979, P. Jaksic, PJ
pj119 [kos-6/7340] (67)	delattini	Serbia	Pristina, Grmija	700 m, 6.7.1979, P. Jaksic, PJ
pj120 [kos-6/7341] (68)	delattini	Serbia	Pristina, Grmija	700 m, 6.7.1979, P. Jaksic, PJ
pj121 [kos-1185] (69)	delattini	Serbia	Sar-planina, Piribeg	1700m, 3-4.8.1987, P. Jaksic, PJ
pj122 [kos-439 b] (70)	delattini	Serbia	Pristina, Grmija	700 m, 15.6.1979, P. Jaksic, PJ
pj123 [kos-5637] (71)	delattini	Serbia	Pristina, Grmija	700 m, 5.9.1976, P. Jaksic, PJ
pj124 [kos-1189] (72)	delattini	Serbia	Kopaonik, Sipacine	1200 m, 19.7.1985, P. Jaksic, PJ

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Nepticulidae from the Volga and Ural region

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Abstract. The Nepticulidae of the Russian provinces (oblasts) Ul'yanovsk, Samara, Saratov, Volgograd, Astrakhan and Chelyabinsk and the Kalmyk Republic are listed. We record 60 species, including two only previously recorded, 28 species only on the basis of leafmines (indicated with an *). Seventeen species are recorded as new for Russia. Eleven of these are reported on the basis of adults: *Stigmella glutinosae* (Stainton, 1858), *S. ulmiphaga* (Preissecker, 1942), *S. thuringiaca* (Petry, 1904), *S. rolandi* Van Nieukerken, 1990, *S. hybnerella* (Hübner, 1813), *Trifurcula* (*Trifurcula*) *subnitidella* (Duponchel, 1843), *T.* (*T.*) *silviae* Van Nieukerken, 1990, *T.* (*T.*) *beirnei* Puplesis, 1984, *T.* (*T.*) *chamaecytisi* Z. & A. Laštůvka, 1994, *Ectoedemia* (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 and *Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944). Six species are reported on the basis of mines only: *Stigmella freyella* (Heyden, 1858), *S. nivenburgensis* (Preissecker, 1942), *S. paradoxa* (Frey, 1858), *S. perpygmaeella* (Doubleday, 1859), *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) and *E. spinosella* (Joannis, 1908). *Astigmella dissona* Puplesis, 1984 is synonymised with *Stigmella naturnella* (Klimesch, 1936), here recorded for European Russia for the first time, bridging the gap between Far East Russia and Europe. *S. juryi* Puplesis, 1991 is synonymised with *S. paradoxa* (Frey, 1858). *S. zelleriella* (Snellen, 1875) is found in a stream valley in steppe area, probably associated with *Salix triandra*, a different host in habitat that differs widely from other occurrences. *S. obliquella* (Heinemann, 1862) is for the first time recorded from European Russia. A few new records outside this area are cited under distribution, including *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855) recorded from Magadan in the Far East.

Zusammenfassung. Es wird ein Verzeichnis der Nepticulidae der Russischen Provinzen (Oblasten) Uljanowsk, Samara, Saratow, Wolgograd, Astrachan und Tscheljabinsk sowie aus der Kalmykkischen Republik gegeben. Insgesamt sind 60 Arten (inklusive zwei in früherer Zeit angegebene) enthalten, wovon 28 nur durch Blattminen belegt sind (in der Zusammenstellung mit dem Symbol * markiert). Siebzehn Arten sind neu für Russland, davon wurden elf als Imagines gefunden: *Stigmella glutinosae* (Stainton, 1858), *S. ulmiphaga* (Preissecker, 1942), *S. thuringiaca* (Petry, 1904), *S. rolandi* Van Nieukerken, 1990, *S. hybnerella* (Hübner, 1813), *Trifurcula* (*Trifurcula*) *subnitidella* (Duponchel, 1843), *T.* (*T.*) *silviae* Van Nieukerken, 1990, *T.* (*T.*) *beirnei* Puplesis, 1984, *T.* (*T.*) *chamaecytisi* Z. & A. Laštůvka, 1994, *Ectoedemia* (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 und *Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944). Von sechs Arten wurden nur Blattminen gefunden: *Stigmella freyella* (Heyden, 1858), *S. nivenburgensis* (Preissecker, 1942), *S. paradoxa* (Frey, 1858), *S. perpygmaeella* (Doubleday, 1859), *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) und *E. spinosella* (Joannis, 1908). *Astigmella dissona* Puplesis, 1984 wird synonymisiert mit *Stigmella naturnella* (Klimesch, 1936). Diese Art wird hier zum ersten Mal aus dem europäischen Teil Russlands gemeldet, wodurch die große Verbreitungslücke zwischen Mitteleuropa und dem Fernen Osten geschlossen wird. *S. juryi* Puplesis, 1991 wird synonymisiert mit *S. paradoxa* (Frey, 1858). *S. zelleriella* (Snellen, 1875) wurde in einem Bachtal im Steppenbereich gefunden und ist dort wahrscheinlich trophisch mit *Salix triandra* assoziiert, lebt hier also im Vergleich zu den anderen bekannten Vorkommen an einer anderen Futterpflanze und in einem sehr verschiedenartigen Habitat. Auch *S. obliquella* (Heinemann, 1862) wird hier zum ersten Mal aus dem europäischen Teil Russlands gemeldet. Die Verbreitungsangaben enthalten auch einige Neumeldungen außerhalb dieses Gebietes, darunter *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855) aus Magadan im Fernen Osten.

Резюме. Приведен список молей-малюток Ульяновской, Самарской, Саратовской, Волгоградской, Астраханской, Челябинской областей и Республики Калмыкия. Из 60 отмеченных видов лишь 2 были приведены предшествующими исследованиями; 28 видов приведены на основании характерных листовых мин (отмечены в тексте статьи звездочкой *). 17 видов приведены как новые для фауны России, 11 из них отмечены на имагинальной фазе (*Stigmella glutinosae* (Stainton, 1858), *S. ulmiphaga* (Preissecker, 1942), *S. thuringiaca* (Petry, 1904), *S. rolandi* Van Nieukerken, 1990, *S. hybnerella* (Hübner, 1813), *Trifurcula* (*Trifurcula*) *subnitidella* (Duponchel, 1843), *T.* (*T.*) *silviae* Van Nieukerken, 1990, *T.* (*T.*) *beirnei* Puplesis, 1984, *T.* (*T.*) *chamaecytisi* Z. & A. Laštůvka, 1994, *Ectoedemia* (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 и *Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944)); 6 видов – только на основании мин: *Stigmella freyella*

(Heyden, 1858), *S. nivenburgensis* (Preissecker, 1942), *S. paradoxa* (Frey, 1858), *S. perpygmaeella* (Doubleday, 1859), *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857) и *E. spinosella* (Joannis, 1908). *Astigmella dissona* Puplesis, 1984 синонимизируется с *Stigmella naturnella* (Klimesch, 1936), впервые отмечаемой для Европейской России и закрывающей таким образом ранее существовавший пробел в распространении вида между Западной Европой и Дальним Востоком России. *S. juryi* Puplesis, 1991 синонимизируется с *S. paradoxa* (Frey, 1858). *S. zelleriella* (Snellen, 1875) обнаружена на берегу ручья в глинистой степи, где, вероятно, связана с *Salix triandra*, новым для нее кормовым растением в данном биотопе, резко отличном от известных. Также впервые для Европейской России приводится вид *S. obliquella* (Heinemann, 1862). Несколько новых находок за пределами изучаемого региона обсуждаются в данных по распространению: *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855) отмечается из-под Магадана.

Key words. Russia, faunistics, new records, new synonymy, *Stigmella*, *Ectoedemia*, *Bohemannia*, *Trifurcula*.

Ключевые слова. Россия, фаунистика, новые находки, новая синонимия, *Stigmella*, *Ectoedemia*, *Bohemannia*, *Trifurcula*.

Introduction

The leafmining moth family Nepticulidae is relatively poorly known from large parts of Russia. Previous research has concentrated on the fauna of the far eastern Primorskiy Kray, the former Soviet republics of Central Asia and the Crimea in Ukraine (Puplesis 1994). In his book Puplesis lists many species from the European part of Russia, but gives very few pertinent records. Also in the earlier faunal treatment of the larvae (Gerasimov 1952) no detailed records were given, and for many species the only indication of distribution is ‘European part of the Soviet Union’. Such records could also have been referring to Ukraine, Byelorussia or the Baltic republics. Hence, the occurrence in Russia is often not clear.

There is a number of faunistic papers which deal with some species of Nepticulidae from a few provinces (regions) in the European part of Russia, the northwest being comparatively well investigated: Murmansk (Kozlov & Jalava 1994; Kozlov et al. 2000), Karelia (Kutenkova 1986, 1989) and a checklist for Leningrad (Jürivete et al. 2000). In the west, Nepticulidae are recorded from Smolensk, Bryansk (Skala 1944) and Kaluga (Shmytova 2001, 2002). Other scattered records can be found in some ecological studies (Kozlov 1996; Kozlov & Koricheva 1990, 1991). A few mines have also been reported from the Caucasus and Black Sea Coast (Utech 1962).

For the lower and middle Volga region, there are very few published records for Nepticulidae. Surprisingly no species were listed by Eversmann (1844). Another well know 19th century lepidopterist working in this area, Hugo Christoph, did not publish any nepticulid record, but he collected a few specimens near Sarepta (Volgograd), which are now in the Natural History Museum in London; they have been studied by the senior author and are listed here. A few species were recorded from the upper Volga reaches in Tatarstan (Kazan district) (Krulikowsky 1908). Further Puplesis recorded *Stigmella kazakhstanica* Puplesis, 1991 from Astrakhan (Puplesis et al. 1991) (but see below under *S. ulmiphaga*), *Trifurcula* cf. *puplesisi* Van Nieukerken, 1990 was recorded from Sarepta (Krasnoarmeysk) (van Nieukerken 1990) and *T. pallidella* (Duponchel, 1843) from the Saratov region (Puplesis 1994). More recently, Sachkov et al. (1997) list several miners from the Zhiguli Nature reserve in the Samara region and Anikin (2001) lists three species from the Volga region, including the already cited *T. pallidella* and *S. kazakhstanica.*

The junior authors and several colleagues extensively collected Lepidoptera in the Volga and Ural region, results of which have partly been published by Anikin et al. (1993). Adult Nepticulidae and many mines were collected in the Ul'yanovsk and Samara provinces, middle Volga, but a few adults have also been collected in Saratov, Volgograd and Astrakhan in the lower Volga valley and mines were also collected in the Kalmyk republic. We also include the record of just two specimens taken in the southern Ural (Cheliabinsk) during recent Russian-Finnish expeditions (Ahola et al. 1997; Nupponen et al. 2000).

During all these studies, 30 species of Nepticulidae were collected as adults and in addition the mines of 28 other identifiable species were found (plus mines of some species recorded as adults as well). With the previously recorded (uncertain) *S. kazakhstanica* and *T. puplesisi*, the total is 60 species of Nepticulidae. Although this is in all probability only a small portion of the actual fauna of the region (estimated to be at least 100 species), we publish these records here, since they provide interesting biogeographical data. At least 17 species are new for Russia, and for a few others these comprise the first published detailed records for Russia. For many species these records show an enormous eastward extension of the known distribution. The few records of species in the *Stigmella ruficapitella* group have also been given by van Nieukerken & Johansson (2003).

Material and methods

Adults were mainly collected at light, mostly using a small generator with different types of lamps, or by sweeping vegetation at dusk. Leafmines were picked in the field and dried immediately; all attempts to rear the larvae were unsuccessful.

All specimens were identified or checked by the senior author. The adults are in the collection of V. V. Zolotuhin, but duplicates are stored in the National Museum of Natural History Naturalis, Leiden (RMNH). The majority of dried leafmines is kept in RMNH, with a reference collection kept by V. V. Zolotuhin.

Genitalia preparations were made partly in glycerine, partly in Euparal, following conventional procedures. Photographs of genitalia and of leafmines were taken with a Zeiss AxioCam digital camera attached to a Zeiss Axioskop H (genitalia slides) or a Zeiss Stemi SV 11 under dark field illumination (leafmines), using Carl Zeiss AxioVision 3.0.6 software. All photographs of genitalia show specimens embedded in Euparal, prepared by the senior author, and are annotated with 'EvN' numbers.

The described distribution of Nepticulidae over European countries follows van Nieukerken (2004), unless otherwise stated. Plant names follow the Flora Europaea (Tutin et al. 1964–1993; Flora Europaea website 2004).

Identification of leafmines. Since leafmines are not the organism itself, but only a trace, some authors prefer not to use records which are based on leafmines only, partly stimulated by the presence of many misidentifications in literature. However, in many cases leafmines show good diagnostic characters, certainly in combination with hostplant identity. By omitting such data, one would loose valuable information on the distribution of species. However, the presence on the basis of leafmines alone needs to be treated with caution: for several hostplants it is clear that the mines are not always different enough to allow safe identification. This is especially the case with *Stigmella* mines on *Quercus* (see van Nieukerken & Johansson 2003), on rosaceous herbs, *Rosa*, *Rubus* and *Pyrus*. Also some mines on *Ulmus* can be problematic. We have not attempted to name such mines with any certainty, but list them at the end of the paper. Even for some of the named mines, we would prefer confirmation by reared adults. Species which we only record on the basis of leafmines, are marked with an asterisk (*) before the name.

Collection localities. Under each species we list the records alphabetically by province and a short locality name. The full details of the localities are given here, the bold printed locality name is used as short name throughout the paper. The localities are shown in the map (fig. 1). For the transliteration of the Cyrillic we follow the BSI system, the same as used by Times (2000). We give the province (oblast) and district (rayon) names in English as noun (e.g. ‘Ul’yanovsk’), not in the Russian adjectival form (e.g. ‘Ul’yanovskaya Oblast’), but we provide below Cyrillic names in the adjectival forms for all localities. For the collector names we use abbreviations, see below.

Astrakhan: [Астраханская область]

1. Akhtubinsk distr., 10 km NNE pgt N. Baskunchak, near lake Karasuk, 48°11’N, 46°54’E [Ахтубинск, Баскунчак, оз. Карасук]
2. Akhtubinsk distr., Bogdo Bolshaja, Surikovskaya b., 47°59’N, 46°48’E [Ахтубинск, Богдо, Суриковская б.]

Chelyabinsk: [Челябинская область]

3. S. Ural: Arkaim reserve, near Amurskiy village, 52°39’N, 59°34’E [Заповедник Аркаим, пос. Амурский] (see Nupponen et al. 2000)

Kalmyk Republic: [Республика Калмыкия]

4. Elista City Park, 46°19’N, 44°16’E [Элиста, городской парк]
5. Yashalta, 20 km SW, 160 km W Elista, oak forests, 46°20’N, 42°18’E [Яшалта]

Samara: [Самарская область]

6. Samarskaya Luka area, Zhiguli State Nature Reserve, Bakhilova Polyana, 53°24’N, 49°40’E [Жигулевский заповедник, Бахилова Поляна]
7. Samarskaya Luka area, Zhiguli State Nature Reserve, mixed forest on rocky slope, 53°25’N, 49°40’E [Жигулевский заповедник]

Saratov: [Саратовская областъ]

8. Saratov city, 51°34’N, 45°59’E [Саратов]

Ul'yanovsk: [Ульяновская область]

9. Aksakovo, Mayna distr., 60 km SWS Ul'yanovsk, 54°09'N, 47°31'E
[с. Аксаково, Майнский район]
10. Akulovka, Nikolaevka distr., 150 km SWS Ul'yanovsk, limestone steppe, 53°06'N, 47°29'E [Акуловка, Николаевский р-н]
11. Arskoe outskirts, Ul'yanovsk distr., 15 km W of Ul'yanovsk, meadow near mixed forest, 54°16'N, 48°08'E [с. Арское, Ульяновский р-н]
12. Baryshskaya Sloboda, Surskoe distr., 85 km WNW Ul'yanovsk, 54°34'N, 46°48'E [Барышская Слобода, Сурский р-н]
13. Beketovka, Veshkayma distr., 100 km W Ul'yanovsk, Steppe, 54°06'N, 46°52'E [Бекетовка, Вешкаймский р-н]
14. Glotovka, Inza distr., 120 km W from Ul'yanovsk, humid mixed forest, 53°57'N, 46°43'E [Глотовка, Инзенский р-н]
15. Kalinovka, Radishchevo distr., ca. 150 km S of Ul'yanovsk, orchards, 52°58'N, 48°19'E [Калиновка, Радищевский р-н]
16. Karamzina outskirts, Ul'yanovsk distr., 10 km SWS Ul'yanovsk, mixed forest near by water, 54°14'N, 48°22'E [пос. Карамзина, Ульяновский р-н]
17. Kryazh (=Kryachok), Barysh distr., 53°47'N, 47°25'E
[оз. Кряж, Барышский р-н]
18. Mar'evka, Novospasskoe distr., 120 km S Ul'yanovsk, grass steppe, 53°08'N, 48°09'E [с. Марьевка, Новоспасский р-н]
19. Ryabina railway station, Povolzhye, Radishchevo distr., 160 km S Ul'yanovsk, orchards and oak forest edge 52°53'N, 48°15'E
[ж/д ст. Рябина, Радищевский р-н]
20. Shikovka, Povolzhye, Pavlovka distr., 200 km S Ul'yanovsk, 52°44'N, 47°27'E
[с. Шиковка, Павловский р-н]
21. Srednikovo, Radishchevo distr., 140 km S Ul'yanovsk, steppe, 52°56'N, 48°06'E [Средниково, Радищевский р-н]
22. Staraya Mayna, Staraya Mayna distr., 10 km NE, 54°37'N, 49°05'E
[р.п. Старая Майна, Старомайнский р-н]
23. Surulovka, Novospasskoe distr., steppe, 53°06'N, 47°46'E [Суруловка, Новоспасский р-н]
24. Tsemzavod outskirts, Sengiley distr., 20 km S Ul'yanovsk, mixed forest 54°02'N, 48°21'E [пос. Цемзавод, Сенгилеевский р-н]
25. Ul'yanovsk North, park Pobedy, 54°22'N, 48°25'E [Ульяновск, парк Победы]
26. Ul'yanovsk city, valley of Sviyaga river 54°18'N, 48°20'E [Ульяновск, пойма р. Свияги]
27. Ul'yanovsk, Vinnovka city park, 54°16'N, 48°20'E [Ульяновск, парк Винновская роща]
28. Tushna, Sengiley distr., ca 40 km S of Ul'yanovsk, mixed forest, 53°50'N, 48°22'E [р.п. Тушна Сенгилеевского р-на]
29. Vasil'evka, Novospasskoe distr., 130 km S Ul'yanovsk, 53°05'N, 48°07'E
[Васильевка, Новоспасский р-н]

30. Vjazovka, Radishchevo distr., 160 km S Ul'yanovsk, 52°53'N, 48°26'E [Вязовка, Радищевский р-н]
31. Vjazovka, 6 km S, Radishchevo distr., 166 km S Ul'yanovsk, 52°51'N, 48°21'E [6 км Ю с. Вязовка, Радищевский р-н]
32. Yulovo, Inza distr., mixed forest, 53°58'N, 46°32'E [Юлово, Инзенский р-н]

Volgograd: [Волгоградская область]

33. Chapurnikovskaya balka, Krasnoarmeysk (= Sarepta) distr., 48°29'N, 44°30'E [Чапурниковская балка, Красноармейский р-н]
34. Krasnoarmeysk (= Sarepta), 48°31'N, 44°29'E [Красноармейск]
35. Tumak outskirts, Sredneakhtub distr., 48°39'N, 44°41'E [Тумак, Сред. Ахтуба]

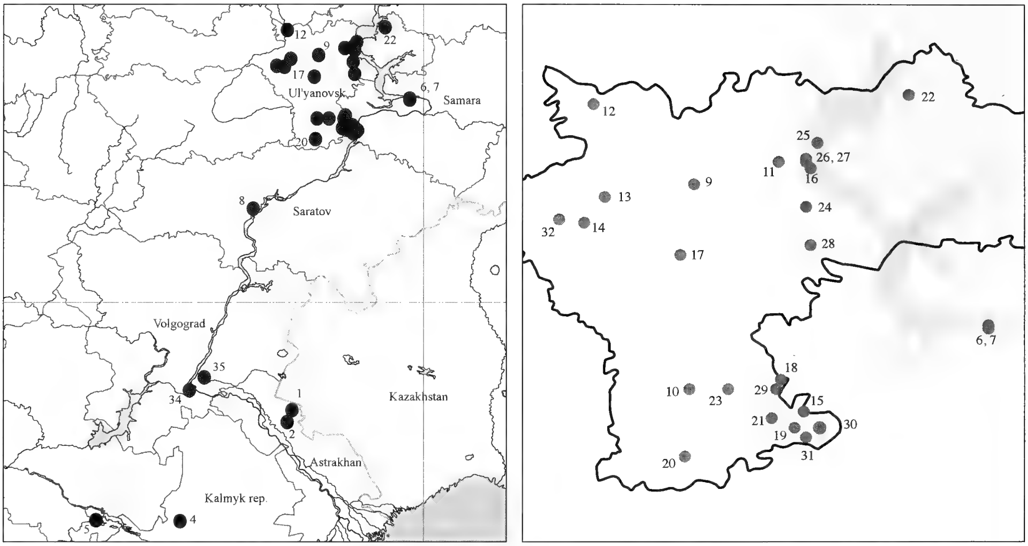


Fig. 1. Maps of the Volga region, showing the collection localities, see text for numbers; **Fig. 1.a.** Ul'yanovsk province.

Collectors. AV: V.V. Anikin. IA: A.Ju. Isajev. IV: V.B. Isajeva. JJ: J. Junnilainen. KD: D.A. Komarov. KA: A. Kovalev. MA: A.V. Mistchenko. NS: S.V. Nedoshivina. NK: K. Nupponen. RS: S.M. Rybakov. SS: S.A. Sachkov. SU: students of the Ul'yanovsk State pedagogical university. ZV: V.V. Zolotuhin.

Description of the region. The region is large and extends from the fringes of the Taiga in the north (ca. 54°20'N) to an extensive steppe zone in the southern parts (ca. 46°20'N). A more detailed description was given by Anikin et al. (1993). We describe a few localities were Nepticulidae were collected in more detail.

Parks in Ul'yanovsk City

Vinnovka forest-park and park Pobedy. – These are two very large forest-parks, which form recreation zones within the city. The Pobedy Park (fig. 2) consists of mixed forest remnants, with a dominance of *Betula pendula*, *Acer platanoides*, *Quercus*

Figs. 2–5. Some habitats where Nepticulidae were collected. **2.** Pobedy Park, Ul'yanovsk, in early spring, with flowering *Anemone*. **3.** Vinnovka park, Ul'yanovsk, with stream. **4.** Srednikovo, showing the grassy slopes and *Quercus robur* in foreground. **5.** Vjazovka: valley forest in background, steppe on foregound.

robur, *Populus tremula*, *Tilia cordata* and *Pinus sylvestris*. Smaller trees and shrubs are represented by *Sorbus aucuparia*, *Rhamnus cathartica*, *Euonymus verrucosus*, *Rosa* spp. and in open places the small shrubs *Chamaecytisus ruthenicus* and *Genista tinctoria*. The Vinnovka Park (fig. 3) is the remnant of a 19th century recreation area with orchards and forest. This park is situated in a deep ravine on the right banks of the Volga, with small sandy hills and numerous brooks. This condition results in an unusual mixture of xerophytic and hydrophytic plants. Most of the studied mines were collected in this park. The dominant trees are *Quercus robur*, *Alnus glutinosa*, *Acer platanoides*, *Tilia cordata*, *Corylus avellana*, *Ulmus* spp. and *Prunus spinosa*. Closer to the water grow different *Salix* spp., mainly *S. alba*, *S. triandra* and *S. caprea*. The open slopes in this park are completely covered with *Fragaria moschata, F. vesca* and other herbaceous Rosaceae. A rich fauna of Nepticulidae was found here, mostly as mines: *Stigmella naturnella, S. tiliae, S. aceris, S. malella, S. catharticella, S. paradoxa, S. salicis, S. lemniscella, S. lonicerarum, Ectoedemia atricollis, E. arcuatella, E. albifasciella, E. subbimaculella, E. spinosella* and all the *Populus* miners.

Forest biotopes

Aksakovo. – A small humid, deciduous forest within 2 km from the village, with a dominance of *Betula pubescens*, *B. pendula*, *Alnus glutinosa*, *Populus tremula* and *Salix* spp. There has only once been collected here, at light on 9 May, before budding of the trees. The collected Nepticulidae are the early flying species *Stigmella lapponica, S. magdalenae* and *S. sorbi*.

Forest-steppe biotopes

Srednikovo (fig. 4). – Mixed forest (*Pinus sylvestris*, *Populus tremula*, *Quercus robur*, *Prunus spinosa*, *Prunus fruticosa*, *Prunus padus*, *Rhamnus cathartica*) on limestone hills with a great diversity of rare plants on the open grassy slopes (*Hedysarum grandiflorum*, many species of *Astragalus*, *Globularia*, *Gypsophyla*, *Centaurea ruthenica*, *C. sumensis*, *Paeonia tenuifolia*). Here we collected the species feeding on *Chamaecytisus*: *Trifurcula pallidella* and *T. chamaecytisi*, but also *Stigmella glutinosae*.

Surulovka. – Similar vegetation, but on sandy steppe with a dominance of *Chamaecytisus*, *Genista*, *Fragaria* on open places. The Nepticulidae collected here, however, live on oaks: *Ectoedemia liebwerdella, E. longicaudella* and *E. albifasciella*.

Zhiguli. – The Zhiguli State nature Reserve is a hilly area (up to 382 m) on an Peninsula in a Volga Bend close to Samara, with ancient rocks of Permian age. These consist of dolomites and limestone covered with forests and small pockets with steppe. The dominant trees are *Quercus robur*, *Tilia cordata*, *Betula pendula*, *Pinus sylvestris*, *Acer platanoides*, *Populus tremula* with some *Ulmus glabra* and other *Acer* spp. and in the under storey *Lonicera xylosteum*, *L. tatarica*, *Viburnum opulus*, *Sambucus nigra*, *Rosa* spp., *Crataegus ambigua* (= *volgensis*), *Corylus avellana*, *Euonymus verrucosus* and *Rubus* spp. The shrubs *Caragana frutex* and *Spiraea crenata* are typical for the limestone steppes and *Caragana arborescens* grows in artificial plantations at lower altitudes. The herb flora is very rich, with a dominance of different Rosaceae, Poaceae, Fabaceae, as well as endemic and sub-endemic Caryophyllaceae and Ranunculaceae. Some leafminers of this reserve have previously been reported (Sachkov et al. 1997) and the Nepticulidae fauna is rich and comprises *S. naturnella*, *S. microtheriella*, S. *paradoxa*, *S. oxyacanthella*, *S. hybnerella*, *S. floslactella*, *S. trimaculella*, *S. lemniscella*, *S. lonicerarum*, *S. basiguttella*, *Trifurcula beirnei* and *Ectoedemia* (*Zimmermannia*) *liebwerdella*.

Steppe biotopes

Beketovka. – Sandy and limestone hills with a dominance of herbaceous Rosaceae and Fabaceae. The collecting site is situated in an *Elaeagnus* plantation near the water. Nepticulidae collected here are *Stigmella thuringiaca*, *S. aceris* and *Trifurcula silviae*.

Mar'evka. – A steppe on salty clay, with *Limonium* and various Asteraceae. One collecting locality is situated in the middle of the steppe under the only *Salix triandra*/*alba* trees on a bank of a stream with *Phragmitis australis*. The collected Nepticulidae feed on *Salix* and *Populus*: *Stigmella zelleriella, S. obliquella, S. trimaculella* and *Ectoedemia hannoverella* and thus were probably all collected near this stream.

Vjazovka and 6 km S Vjazovka (fig. 5). – These very interesting localities are situated on the right bank of Volga in the so-called 'bayrachnyj les', valley-forest with a dominance of *Acer tataricum*, *Quercus robur*, *Rhamnus cathartica*, *Euonymus verrucosus*, *Prunus spinosa* and some *Prunus tenella*, *Caragana frutescens*, *Sorbus* *aucuparia* and the vine *Aristolochia clematitis*. On the top of the slopes one finds a very hot clay- and salt-steppe, with a dominance of Chenopodiaceae (*Kochia*), a small shrubby *Artemisia* (*A. lerchiana*), *Atraphaxis spinosa*, *Ferula caspica*, *Allium* spp., *Tulipa* and some rare Fabaceae. In ravines grows a very rich vegetation with a dominance of mesophytic Fabaceae, *Fragaria, Peucedanum ruthenicum* and Poaceae. The Nepticulidae here are *Stigmella rolandi*, *S. hybnerella, S. plagicolella, S. roborella, S. samiatella* and *Ectoedemia liebwerdella.*

Volgograd area
Chapurnikovskaya balka. – This site has a very rich flora, with both forest and steppe vegetations. On the slopes of the gullies one finds a deciduous forest amidst the sub-zone of southern, desert-steppes. The dominant tree species are *Quercus robur*, *Ulmus* spp., *Alnus glutinosa*, *Salix* spp., *Populus nigra* and *P. tremula.* In addition there are plantations of *Pinus sylvestris*, *Robinia pseudoacacia* and *Caragana arborescens.* The steppe grassland is very rich, with a dominance of *Stipa* spp. and various other grasses, *Artemisia* spp., *Euphorbia* spp. and different Fabaceae. The nepticulid fauna comprises *Stigmella aceris*, *S. ulmiphaga, S. rolandi, S. obliquella, S. samiatella* and *Ectoedemia caradjai.*

Plantations in Kalmyk Republic. – The city park of Elista, and the oak forest SW of Yashalta are artificial plantations in a region of desert or semi-desert. There is no doubt that most or all species of Nepticulidae here on trees were introduced with their hosts, such as *Stigmella viscerella* and *Ectoedemia spinosella.*

SPECIES TREATMENTS

Stigmella naturnella (Klimesch, 1936) New for European Russia

Astigmella dissona Puplesis, 1984 **syn. nov.**

Material. Samara: 1♂, Zhiguli, Bakhilova Polyana, 14.v.1992, SS. – Ul'yanovsk: 13♂, Pobedy, 19.iv.1995, under trunks of birch (*Betula* sp.), IV; 80 mines, some with larvae, Ul'yanovsk, Vinnovka, *Betula*, 9, 21, 30.ix.2002, MA, SU.

Remarks. By study of the holotypes of *S. naturnella* and *S. dissona* it has become clear that they are actually one species. The characters mentioned by Puplesis (1994) do not hold when more material is concerned, see fig. 24–26 for the male genitalia. The leaf-mines (fig. 8–10) of this species are best recognized by the absence of most diagnostic characters of other *Betula* miners. They resemble a short mine of *S. confusella* (Wood & Walsingham, 1894), or *S. luteella*, but the latter usually feeds partly in underside parenchyma, resulting in a greenish mine, and starts with a short contorted part.

The finding of *S. naturnella* in this part of Russia bridges the enormous distributional gap between central Europe, where it has been found in Italy, Austria, Czech Republic, Slovakia, Hungary and Russia: Primory'e. We assume that it has a continuous distribution with its host *Betula* throughout Siberia. A similar distribution is assumed for other species feeding on birch, currently known from Europe and the Far East: *S. betulicola*, *S. luteella*, S. *sakhalinella* Puplesis, 1984, *S. continuella* and *Ectoedemia occultella*. Whereas *S. naturnella* is usually a rare species in central Europe, it seems here to be the commonest *Betula* miner.

Stigmella lapponica (Wocke, 1862)

Material. Ul'yanovsk: 1♂, Aksakovo, 9–10.v.1996, in forest, ZV; 1♀, Yulovo, 30.iv.1994, IV; 1 mine, Ul'yanovsk, *Betula*, 9.ix.2002, SU; 2 mines with larvae, Vinnovka, *Betula*, vii–viii.2002, MA.

Remarks. A widespread species feeding on *Betula*, previously known from northern Russia, Murmansk, Karelia and Leningrad (Jürivete et al. 2000; Kozlov & Jalava 1994; Kutenkova 1989) but expected to occur all over Russia. It has also been recorded from Siberia: Chita (Kulishenko 1987) and Novosibirsk (Puplesis 1994). Leafmines are characteristic (fig. 6), even more so than the adults, which may be confused with *S. confusella*.

* *Stigmella freyella* (Heyden, 1858) New for Russia

Material. Ul'yanovsk: 5 mines, Tsemzavod, *Calystegia sepium*, mid vii.2003, MA.

Remarks. *S. freyella* is widespread in the more southern half of Europe, including the Crimea, Ukraine (Gerasimov 1952) and goes north to the Netherlands, Germany, Poland and Latvia. The leafmines are characteristic (fig. 11) and cannot be confused with anything else.

* *Stigmella tiliae* (Frey, 1856)

Material. Ul'yanovsk: 3 mines, *Tilia*, Ul'yanovsk, 9.ix.2002, SU; 10 mines, Vinnovka, *Tilia cordata*, vii–viii.2002, MA.

Remarks. Previously recorded from Tatarstan (Krulikowsky 1908) (marked with a question mark), Samara (Sachkov et al. 1997) and Krasnodar (Puplesis 1994); also in all neighbouring states. *S. tiliae* occurs probably everywhere with *Tilia*.

* *Stigmella betulicola* (Stainton, 1856)

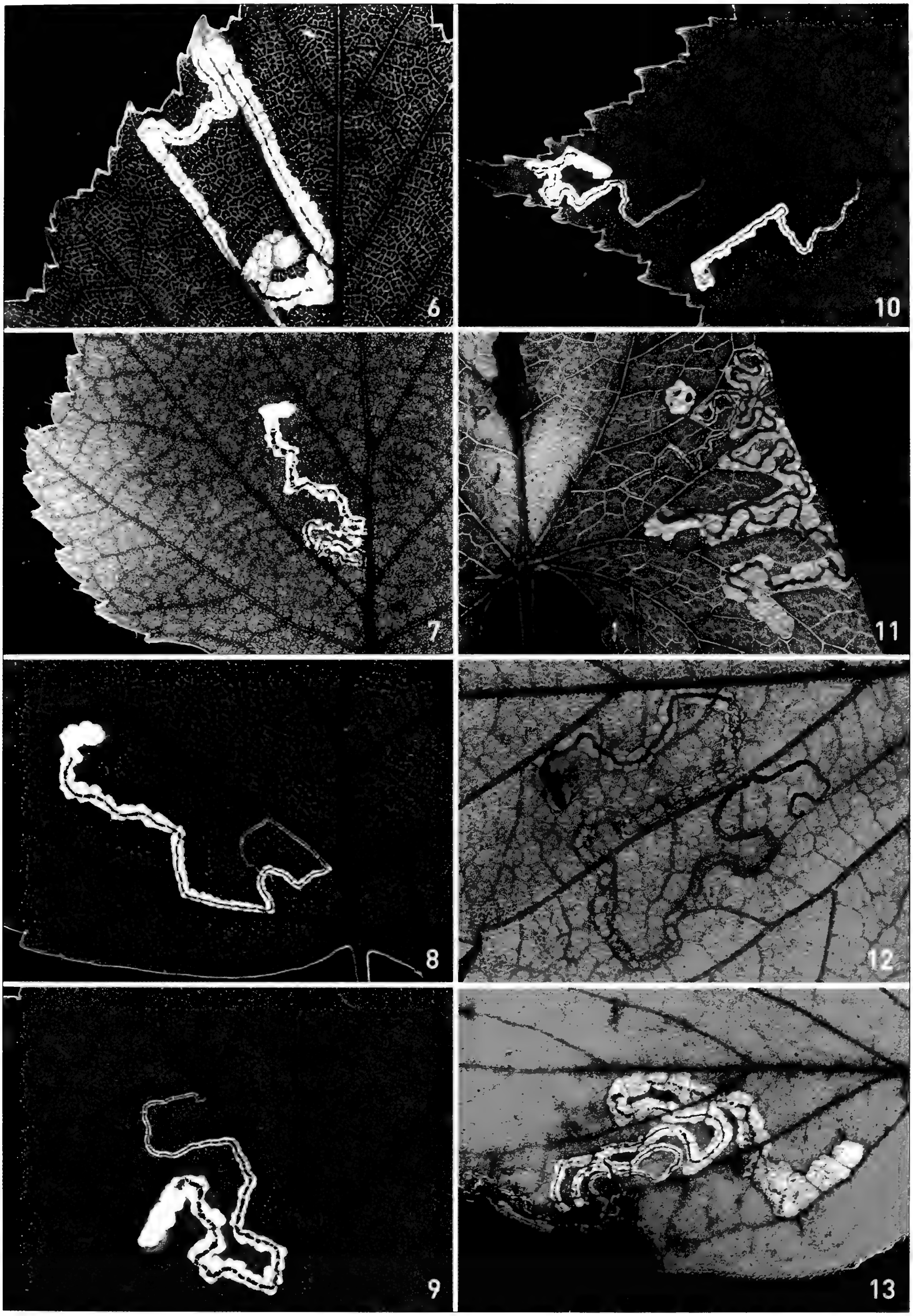
Material. Ul'yanovsk: 1 mine, Vinnovka, 21.ix.2002, MA.

Remarks. A widespread species, occurring throughout Europe to the far north and also in Japan and China (Kemperman et al. 1985; Nieukerken & Liu 2000). In Russia recorded from Murmansk, Karelia, Leningrad, Smolensk, Samara and Tatarstan (Jürivete et al. 2000; Kozlov & Jalava 1994; Krulikowsky 1908; Kutenkova 1989; Sachkov et al. 1997; Skala 1944). The mines are usually well identifiable, but since we only got a single mine here, confirmation is required. It feeds on *Betula*, and often occurs gregariously (more mines on one leaf) on seedlings and saplings of birch.

* *Stigmella nivenburgensis* (Preissecker, 1942) New for Russia

Material. Ul'yanovsk: 5 mines, Vinnovka, 21.ix.2002, *Salix cf triandra*, leg. MA.

Remarks. *S. nivenburgensis* occurs scattered in Central and East Europe, closest in Lithuania and Poland, and is also reported from Turkmenistan (Puplesis 1994). It is the only species in the *S. betulicola* species group feeding on *Salix*. The mines are narrow and straight (fig. 14), very different from those of the *S. salicis* group.



Figs. 6–13. Leafmines of *Stigmella* (all, except fig. 11, from Ul'yanovsk: Vinnovka). **6.** *S. lapponica* on *Betula*. **7.** *S. luteella* on *Betula*. **8–10.** *S. naturnella* on *Betula*. **11.** *S. freyella* on *Calystegia sepium* (Tsemzavod). **12.** *S. aceris* on *Acer tataricum*. **13.** *S. lonicerarum* on *Lonicera xylosteum*.

* *Stigmella luteella* (Stainton, 1857)

Material. Ul'yanovsk: 9 mines, Ul'yanovsk, Vinnovka, *Betula pendula*, 9–30.ix.2002, MA, SU.

Remarks. *S. luteella* is known from Karelia (Kutenkova 1989), and according to (Puplesis 1994) it occurs throughout Russia to Sakhalin. Leafmines are usually rather characteristic (fig. 7), being often partly in the lower mesenchym only, which makes the mine appear green from above. Some mines, however, may be difficult to separate from those of *S. betulicola* or *S. naturnella* (see above).

Stigmella glutinosae (Stainton, 1858) New for Russia

Material. Ul'yanovsk: 1♂, Srednikovo, 6.vi.1998, ZV (EvN3485); 4 mines, Vinnovka, 21.ix.2002, *Alnus glutinosa,* leg. MA (fig. 27).

Remarks. *S. glutinosae* is widespread throughout Europe and occurs in all neighbouring states, but no pertinent records for Russia could be found. Gerasimov (1952) recorded it from the northern and central parts of the European part of the Soviet Union, but the latter at that time also included the Baltic republics and the Ukraine, from where the species is also known. The leafmines can easily be confused with those of *S. alnetella* (Stainton, 1856), although the mines recorded here have the wider frass line which is more characteristic for *S. glutinosae*. However, on the basis of mines alone the species would not have been recorded.

Stigmella microtheriella (Stainton, 1854)

Material. Samara: 1♀, Samara, 8.vi.1998. – Ul'yanovsk: 1 mine, Vinnovka, 15.vii–15.viii.2001, MA; 4 mines, Ul'yanovsk, 9.ix.2002, SU; 4 mines, Vinnovka, vii–viii.2002, MA. All mines on *Corylus avellana.*

Remarks. *S. microtheriella* feeds on *Carpinus, Corylus* and *Ostrya*, and is the only known parthenogenetic *Stigmella*-species. It is widespread and abundant throughout Europe. Puplesis (1994) listed it as Russian, without detailed localities, and it has recently been cited from Zhiguli, Samara (Sachkov et al. 1997).

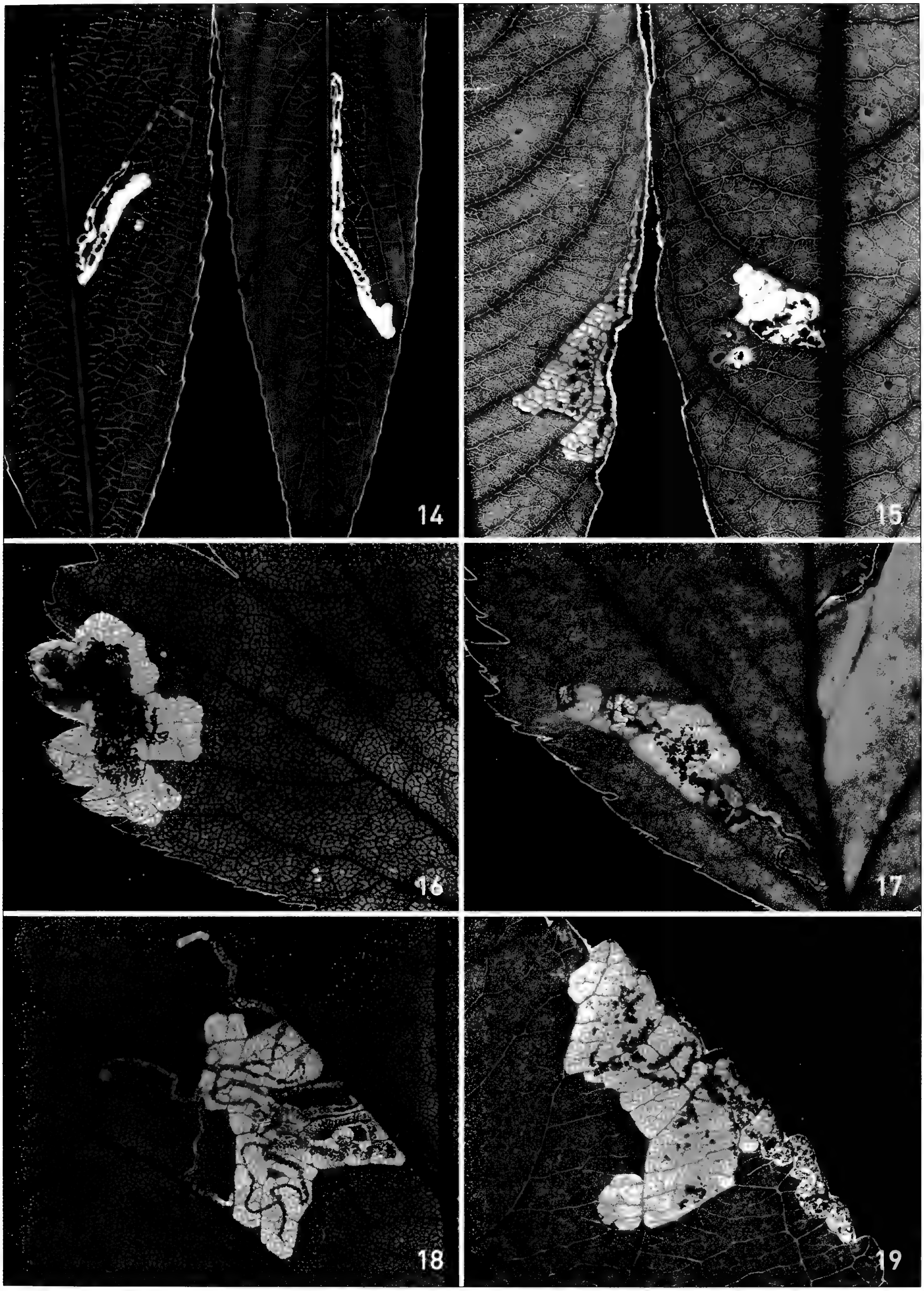
* *Stigmella prunetorum* (Stainton, 1855)

Material. Ul'yanovsk: 14 mines, Vinnovka, *Prunus domestica/P. spinosa*, 21.–30.ix.2002, MA; 7 mines, Vinnovka, *Prunus cerasus,* vii–viii.2002, MA.

Remarks. No detailed records from Russia have been published, although Puplesis (1994) records it from southern Russia. This record refers to adults from Belgorod (Borisovka) (R. Puplesiś, pers. comm.). The mines are very characteristic (fig. 20) and easy to separate from sympatric *S. plagicolella* and *Ectoedemia spinosella.*

Stigmella aceris (Frey, 1857)

Material. Ul'yanovsk: 1♂, Beketovka, 11.–13.vii.1998, Steppe, IV & IA; 2♂, 2♀, Pobeda 20.x.2002, under bark of Pinus, IA, KA; 4 mines, Ul'yanovsk city, *Acer platanoides*, 9.ix.2002, SU, 7 mines, Vinnovka, *Acer platanoides*, 15.vii.–15.viii.2001, vii.–viii.2002, MA; 18 mines, Vinnovka, *Acer tataricum,* vii.–viii.2002, MA. – Volgograd: 2 ♀, Chapurnikovskaya balka, 21.viii.1999, KD.



Figs. 14–19. Leafmines of *Stigmella* (all, except fig. 17, from Ul'yanovsk: Vinnovka). **14.** *S. nivenburgensis* on *Salix cf triandra*. **15.** *S. obliquella* on *Salix cf triandra*. **16.** *S. paradoxa* on *Crataegus* sp. **17.** *S. hybnerella* on *Crataegus ambigua* (Samara: Zhiguli). **18.** *S. perpygmaeella* on *Crataegus* sp. **19.** *E. atricollis* on *Malus domestica*.

Remarks. This species is common in Southern and Eastern Europe, feeding on *Acer campestre*, *A. platanoides* and *A. tataricum* (mines, fig. 12). From Russia previously recorded from 'southern Russia' (Puplesis 1994), which refers to Belgorod (1♂, 1♀ in ZIN: Borisovka, 1985, leg. Krivochatskij), and recently from Samara (Sachkov et al. 1997). Male and female genitalia are illustrated in figs. 28 and 47. The finding of adults as late as 20 October, under the bark of *Pinus*, indicates the possibility of hibernating adults, which was hitherto an unknown phenomenon in European Nepticulidae. However, they also may just be surviving stragglers from the summer generation.

* *Stigmella malella* (Stainton, 1854)

Material. Ul'yanovsk: 4 mines, Arbuzovka, 30.viii.2002, ZV; 15 mines, Ul'yanovsk city, 9.ix.2002, SU; 54 mines, Ul'yanovsk, Vinnovka, 9.–30.ix.2002, MA, SU. All on *Malus domestica*.

Remarks. This common pest of apple (*Malus*) has been reported from Stavropol, southern Ural (Puplesis 1994) and Krasnodar (Kozlov & Koricheva 1989, 1991). Chagelishvili (1972) reports it as a pest in Georgia, from Russia we do not know any report as pest. Leafmines may be confused with those of *S. desperatella*, which has green larvae in contrast to the yellow ones in *S. malella*. *S. desperatella* is not yet known from Russia, but appears to be common in the Caucasus (Puplesis 1994). Because of this the Georgian records need to be viewed with caution (R. Puplesis, pers. comm.).

* *Stigmella catharticella* (Stainton, 1853)

Material. Ul'yanovsk: 5 mines, Vinnovka, *Rhamnus cathartica*, 15.vii.–15.viii.2001; 2 mines, 21.–30.ix.2002, MA.

Remarks. A widespread European species, previously recorded from Russia without detail (eastern Europe, including southern Ural (Puplesis 1994). The mines are very characteristic and cannot be confused with those of the Central European *S. rhamnella* (Herrich-Schäffer, 1860), which feeds on the same host.

* *Stigmella viscerella* (Stainton, 1853)

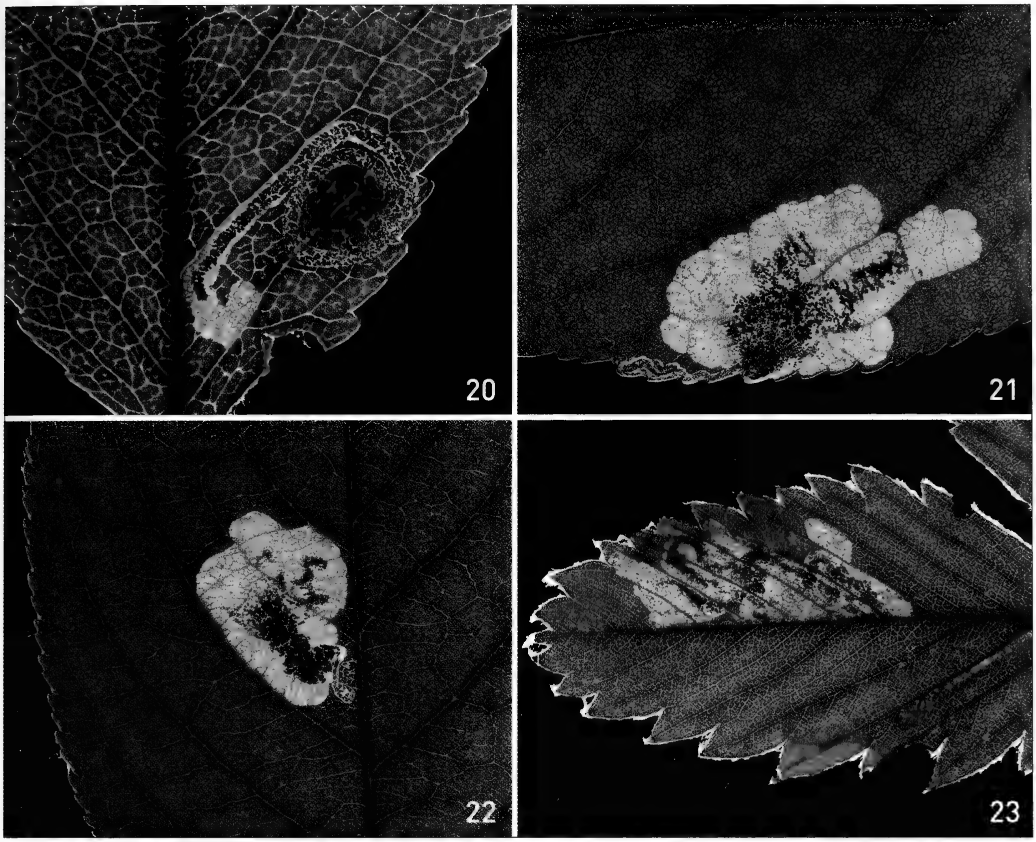
Material. Kalmyk Republic: mines, Ulmus sp., Elista, 26.ix.2000, ZV.

Remarks. A widespread European species, particularly in southern Europe. There is only one previous Russian record, of leafmines from Samara (Sachkov et al. 1997). The mines are very characteristic, but occasionally individual mines of *S. lemniscella* may resemble those of *viscerella*. However, in this case the large sample of similar mines and the absence of 'normal' *S. lemniscella* mines indicate that they are indeed *viscerella*.

Stigmella ulmiphaga (Preissecker, 1942) New for Russia

Material. Astrakhan: 1 ♂, Karasuk, 31.v.1999, KD. – Volgograd: 1 ♂, Chapurnikovskaya balka, 21.viii.1999, KD (fig. 29).

Remarks. *Stigmella ulmiphaga* occurs scattered in South-East Europe from Austria to Greece, and is also known from Turkmenistan, where it is common (Puplesis 1994) and sometimes abundant (R. Puplesis pers. comm.).



Figs. 20–23. Leafmines of Nepticulidae (all from Ul'yanovsk: Vinnovka). **20.** *Stigmella prunetorum* on *Prunus spinosa*. **21–22.** *Ectoedemia spinosella* on *Prunus sp*. **23.** *E. arcuatella* on *Fragaria moschata*.

Unidentified mines on *Ulmus* from Elisha and Ul'yanovsk could either belong to this species, to *S. ulmivora* (Fologne, 1860) or to *S. kazakhstanica* Puplesis, 1991, which all make very similar mines. Sachkov (1996) recorded *S. ulmivora* from Samara, but these mines could also belong to *S. ulmiphaga*, although we think that the occurrence of *S. ulmivora* in the mesophytic forests of Samara and Ul'yanovsk is very likely.

Stigmella kazakhstanica Puplesis, 1991

Remarks. Previously reported on the basis of empty mines in Astrakhan (Puplesis et al. 1991), and is further known from nearby Kazakhstan and Turkmenistan (Diškus & Puplesis 2003). These mines actually could also have belonged to *S. ulmiphaga*, which makes similar mines.

Stigmella thuringiaca (Petry, 1904) New for Russia

Material. Ul'yanovsk: 5♂, Beketovka, 11.–13.vii.1998, steppe, IV & IA; 2♂, Vasil'evka, 9.–10.vi.1998, 17.–19.vii.1999, IA & IV.

Remarks. *S. thuringiaca* has a wide distribution in Southern and Central Europe, from Spain in the West, to Germany and Poland in the North. The nearest previously known occurrence was in the Crimea, Ukraine (Puplesis 1994). The larva feeds on a number of herbaceous Rosaceae, such as *Potentilla* spp., *Fragaria* spp., *Sanguisorba minor, Agrimonia* and *Filipendula* spp., often on dry grassland biotopes. The steppe habitat in this area fits this picture. Mines are difficult to separate from other Rosaceae feeders: on *Potentilla* they can be confused with *S. tormentillella* (Herrich-Schäffer, 1860), on *Filipendula* with *S. filipendulae* (Wocke, 1871), and on *Sanguisorba* with *S. poterii* (Stainton, 1857), *S. rolandi*, *S. anomalella* (Goeze, 1783) and *S. centifoliella* (Zeller, 1848).

***Stigmella rolandi* Van Nieukerken, 1990** New for Russia

Material. Ul'yanovsk: 3♂, Vjazovka 6 km S, 5.–6.viii.1998, ZV. – Volgograd: 1♂, 2♀, Chapurnikovskaya balka, 21.viii.1999, KD (figs. 30–31).

Remarks. *S. rolandi* is widespread in southern Europe, north to Germany and east to Ukraine, and also in the Tyan Shan mountains in Kazakhstan (Puplesis et al. 1992). It feeds on *Rosa* and *Sanguisorba*.

*** *Stigmella paradoxa* (Frey, 1858)** New for Russia

Stigmella juryi Puplesis, 1991: 125. **syn. nov.**

Material. Samara: 3 mines, Zhiguli, *Crataegus ambigua*, 5.x.2003, ZV. – Ul'yanovsk: 9 mines, Vinnovka, *Crataegus* sp., vii.–viii.2002, MA.

Remarks. *Stigmella juryi* was described from the Crimea and Turkmenistan on the basis of adults collected at light. Later A. Diškus discovered that *S. juryi* makes similar mines on *Crataegus* as *S. paradoxa* (R. Puplesis & A. Diškus, pers. comm.). By comparing a series of Western European *S. paradoxa* and paratypes of *S. juryi* (in RMNH), it appeared that the difference given by Puplesis (1991), large anterior processes of gnathos in *S. juryi* does not hold: these processes are similar in many specimens of *S. paradoxa*, and are variable as well; moreover, also the way of mounting the genitalia influences the appearance of these processes. On suggestion of R. Puplesis (in litt.) we therefore synonymise *S. juryi* here.

Although *S. paradoxa* is widespread in Europe, it is usually one of the rarer species feeding on *Crataegus*. It has not been recorded from Russia before, the closest occurrence is in Ukraine (Crimea) and Moldova; it also occurs commonly in Turkmenistan (paratypes of *S. juryi*), and recently it has also been recorded from Iran (Laštůvka & Huemer 2002). The mines are unmistakeable (fig. 16), the rather similar mines of *Leucoptera malifoliella* (O.-G. Costa, 1836) differ by the concentric circles of frass and by the shape of the egg-scale which is a rounded cap-like structure in Nepticulidae, but has a flat surface and vertical sides in *Leucoptera*.

***Stigmella magdalenae* (Klimesch, 1950)**

Material. Ul'yanovsk: 11♂, 8♀, Aksakovo, 9.–10.v.1996, ZV; 6 mines, *Sorbus aucuparia*, 10 km NE Staraya Mayna, 15.vi.–1.vii.2001, MA; many mines, Tushna, *Sorbus aucuparia*, 1.ix.2002, leg. ZV; 9 mines, Vinnovka, *Sorbus aucuparia*, vii.–viii. 2002, MA.

Remarks. This species is particularly common in northern parts of Europe, but more to the south confined to the mountains. In Russia it was known from Leningrad

(Kozlov 1996). *Sorbus aucuparia* is the best known host, but it also occurs on other *Sorbus* spp., *Cotoneaster, Malus* and *Amelanchier* (Johansson & Nielsen 1990). Leafmines can usually be separated from those of *S. nylandriella* by the much smaller size and the usually narrower frass. Also, mines of *S. magdalenae* often occupy only a small portion of the leaflet, whereas those of *S. nylandriella* usually run throughout a leaflet.

* *Stigmella nylandriella* (Tengstrôm, 1848)

Material. Ul'yanovsk: 1 mine, *Sorbus aucuparia*, Staraya Mayna, 15.vi.–1.vii.2001, MA; 4 mines, Tushna, *Sorbus aucuparia*, 1.ix.2002, ZV.

Remarks. *S. nylandriella* is widespread in Europe on *Sorbus aucuparia*, with a wider distribution than *S. magdalenae*. In Russia it has been recorded from Bryansk, Murmansk, Karelia, Leningrad and Voronezh (Jürivete et al. 2000; Kozlov 1996; Kozlov & Koricheva 1990, 1991; Kozlov & Jalava 1994; Kutenkova 1989; Skala 1944), although it is possible that some of these records are misidentifications of *S. magdalenae*. The mines recorded here look like a normal *S. nylandriella* mine, so most likely belong indeed to this species. However, confirmation by adults would be welcome.

* *Stigmella oxyacanthella* (Stainton, 1854)

Material. Samara: 1 mines, Zhiguli, *Malus*, 5.x.2003, ZV. – Ul'yanovsk: 2 mines, Vinnovka, *Pyrus communis*, 21.ix.2002, MA.

Remarks. *S. oxyacanthella* is a widespread European species, feeding on a number of Rosaceous trees. Mines are usually easy to recognize, but there is some doubt for those on *Pyrus*, where several rather similar species occur (see below). The mine on *Malus* almost certainly is *S. oxyacanthella*, but a reared adult is still needed for a final confirmation. In Russia it was hitherto only recorded from Leningrad (Kozlov 1996).

Stigmella hybnerella (Hübner, 1813) New for Russia

Material. Samara: 5 mines, Zhiguli, *Crataegus ambigua*, 5.x.2003, ZV. – Ul'yanovsk: 1♀, Vjazovka, 6 km S, 5.–6.viii.1998, steppe, ZV [gen. lost]

Remarks. *Stigmella hybnerella* is a very common and widespread *Crataegus* feeding species, occurring from Europe eastwards to Turkmenistan. It is therefore surprising that no previous records for Russia exist. Puplesis (1994) reports the species from the Baltic States, Ukraine, Azerbaijan and Turkmenistan. The mine is easily recognizable (fig. 17).

* *Stigmella floslactella* (Haworth, 1828)

Material. Samara: 4 mines, Zhiguli, 5.x.2003, ZV. – Ul'yanovsk: 4 mines, Vinnovka, *Corylus avellana*, vii.–viii.2002, MA.

Remarks. A widespread European species, previously recorded as leafmines from Bryansk (Skala 1944) and Samara (Sachkov et al. 1997). The mines are separated from those of *S. microtheriella* by the larger size, the more sinuous course and the wide frass. With larvae it is even easier: those of *floslactella* feed with the dorsum upwards, and have a dark headcapsule and prothoracic plate, whereas *S. microtheriella* feeds with venter upwards and has a pale head and prothorax.

* *Stigmella salicis* (Stainton, 1854)

Material. Ul'yanovsk: 16 mines, pos. Karamzina, *Salix caprea*, mid vii.2003, MA; 4 mines, Vinnovka, *Salix caprea* and *Salix* sp., vii.–viii.2002, MA.

Remarks. This is one of the most widespread and commonest Nepticulidae in Europe, in Russia known from Smolensk, Karelia, Murmansk and Samara (Kozlov & Jalava 1994; Kutenkova 1989; Sachkov et al. 1997; Skala 1944). The earlier report from the Tyan-Shan is incorrect: these specimens have later been described as *Stigmella johanssoni* Puplesis & Diškus, 1996 (Puplesis 1994; Puplesis & Diškus 1996). *S. salicis* feeds on the 'sallow-type' of *Salix*: *S. caprea, S. cinerea* and *S. aurita* and a few others. However, it is possible that *S. vimineticola* (Frey, 1856) has a wider host-range and distribution than previously thought (see Aarvik et al. 2001), so that there is a slight possibility that leafmines could be confused.

Stigmella zelleriella (Snellen, 1875)

Material. Ul'yanovsk: 3♂, Mar'evka, 20.–23.vii.1999, IA & IV.

Remarks. *S. zelleriella* occurs in coastal dunes along the North Sea and the Baltic Sea on *Salix repens*, and on the other hand in northern Europe in mountain tundra on *Salix lapponum* (Johansson & Nielsen 1990). In Russia one specimen has been recorded from Murmansk: Kola Peninsula, in a peat bog (Kozlov & Jalava 1994), close to its occurrence in Fennoscandia, and it is also recorded from Leningrad (Jürivete et al. 2000), probably along the Baltic Sea. The present record is far apart from any previous one, suggesting its more widespread occurrence in Russia. This locality is actually rather atypical, in a river-valley forest with tall *Salix* species (most likely *S. triandra*) and without any of the known hosts. We assume therefore that *S. zelleriella* feeds here on *S. triandra*, a previously unknown host.

Stigmella obliquella (Heinemann, 1862) New for European Russia

Material. Ul'yanovsk: 3♂, 2♀, Mar'evka, 21.–23.vii.1999, Steppe, IA & IV; 1♂, 1♀, Vasil'evka, 9.–10.vi.1998, ZV; 1 mine, *Salix* cf. *triandra*, Vinnovka, 21.ix.2002, MA; 22 mines, Vinnovka, narrow-leaved *Salix*, vii.–viii.2002; 7 mines, Sviyaga, mid vii.2003, MA. – Volgograd: 1 ♂, Chapurnikovskaya balka, 21.viii.1999, KD.

Remarks. This species is widespread in Europe, feeding on narrow leaved *Salix*-species, such as *Salix alba*, and is also found in eastern Asia, Primory'e (Puplesis & Diškus 2003) and China (Van Nieukerken unpublished). There are no previously published records from the European part of Russia (Puplesis 1994: probably in western part of Russia), but the senior author observed mines, most likely of this species, in St. Petersburg (Vasiljevskiy Ostrov), 19.x.1985, on *Salix fragilis*. The records here show that it is common in the Volga valley from north to south. Because *S. zelleriella* now appears also to be able to feed on the same narrow-leaved *Salix* species, there is still some doubt about the identification of the leafmines (fig. 15). Male genitalia are illustrated in fig. 34.

Stigmella trimaculella (Haworth, 1828)

Material. Samara: 1 mine, Zhiguli, *Populus nigra*, 5.x.2003, ZV. – Ul'yanovsk: 1♀, Mar'evka, 21.–23.vii.1999, IA & IV; many mines, Vinnovka, *Populus nigra* and *balsamifera*, 15.vii.–15.viii.2001, vii.–21.ix.2002, MA.

Remarks. This widespread *Populus*-miner was previously recorded from Tatarstan (Krulikowsky 1908), southern Ural (Puplesis 1994) and mines from the North Ossetian ASSR (Utech 1962). It occurs also in the Leningrad region and Siberia: Novosibirsk (R. Puplesis, pers. comm.).

* *Stigmella assimilella* (Zeller, 1848)

Material. Ul'yanovsk: 1 mine, Kalinovka, end viii.2002, RS; 2 mines, Vinnovka, vii.–viii.2002, MA; 1 mine, Sviyaga, mid-vii.2003, MA, all on *Populus tremula*.

Remarks. *S. assimilella* is nowhere very common, but widespread with its host *Populus tremula*, and in Russia previously reported from Samara and Kaluga (Sachkov et al. 1997; Shmytova 2002) and also extends to the southern Ural and Primorskiy Kray (Puplesis 1994).

Stigmella sorbi (Stainton, 1861)

Material. Ul'yanovsk: 1♀, Yulovo, 1994, IV; 2♂, Aksakovo, 9.–10.v.1996, ZV; 1♂, 1♀, Ul'yanovsk region without exact data, summer 2001, IV; 3 mines, *Malus domestica*, Vinnovka, 2001, MA; 29 mines (some with larvae), Vinnovka, *Sorbus aucuparia*, vii.–viii.2002, MA.

Remarks. A very common boreal species, previously cited from Murmansk, Karelia, Leningrad, Kaluga and Tatarstan (Kozlov 1996; Kozlov & Koricheva 1991; Kozlov & Jalava 1994; Krulikowsky 1908; Kutenkova 1989; Shmytova 2001, 2002), and also known from Siberia: Chita (Kulishenko 1987). Common on mountain ash (*Sorbus aucuparia*), but also on *Malus, Cotoneaster* and sometimes other Rosaceae.

Stigmella plagicolella (Stainton, 1854)

Material. Kalmyk Republic: 3 mines, *Prunus spinosa* and *P. domestica*, Elista, 26.ix.2000, ZV. – Ul'yanovsk: 1♀, Vjazovka, 15.–16.vii.1999, IA & IV; 4 mines, Ul'yanovsk, *Prunus spinosa*, 9.ix.2002 SU; 8 mines, Vinnovka, *Prunus* sp., vii.–viii, 21.ix.2002, MA.

Remarks. This very widespread and common European species was previously recorded from Leningrad (Jürivete et al. 2000) and also occurs in the Caucasus (Puplesis 1994).

* *Stigmella lemniscella* (Zeller, 1839)

Material. Samara: 2 mines, Zhiguli, 5.x.2003, ZV. – Ul'yanovsk: 1 mines, Ul'yanovsk, *Ulmus*, 9.ix.2002 SU; 27 mines, Vinnovka, *Ulmus*, vii.–viii.2002, MA.

Remarks. Widespread throughout Europe. Previously reported from mines in Bryansk (Skala 1944), and Samara (Sachkov et al. 1997); according to Puplesis (1994) also in southern Russia, referring to material from Belgorod (Borisovka, 2 ♂, viii.1985, Krivochatskij, ZIN).

* *Stigmella continuella* (Stainton, 1856)

Material. Ul'yanovsk: 1 mine, *Betula*, Vinnovka, 21.ix.2002, MA.

Remarks. A widespread but usually rare species on *Betula*, previously only cited from Karelia (Kutenkova 1989) and Primorskiy Kray (Puplesis 1994). Mines very characteristic.

Stigmella aeneofasciella (Herrich-Schäffer, 1855)

Material. Ul'yanovsk: 1♀, Ryabina, 31.v.1993, ZV; 5 mines, Arskoe, *Agrimonia eupatoria*, 20.viii.2003, MA; 5 mines, Vinnovka, *A. eupatoria*, vii.–viii.2002, MA.

Remarks. Known from Karelia and Murmansk (Kozlov & Jalava 1994; Kutenkova 1986). *Stigmella aeneofasciella* is widespread in Europe, and also known from most neighbouring countries. It is most commonly found on *Agrimonia*, but can also be found on *Potentilla* and *Fragaria*.

* *Stigmella perpygmaeella* (Doubleday, 1859) New for Russia

Material. Ul'yanovsk: 2 mines, Vinnovka, *Crataegus* sp., vii.–viii.2002, MA.

Remarks. This widespread *Crataegus* miner has not previously been recorded from Russia, although it is common in the neighbouring countries. Mines (fig. 18) can usually be identified, but confusion with *S. crataegella* (Klimesch, 1936) is still possible. Confirmation by adults is therefore needed.

* *Stigmella incognitella* (Herrich-Schäffer, 1855)

Material. Ul'yanovsk: 1 mine, Kalinovka, *Malus*, late viii.2002, RS.

Remarks. *S. incognitella* is widespread, but overall rarer than *S. malella* on the same host. Previously only recorded from Leningrad (Jürivete et al. 2000).

* *Stigmella lonicerarum* (Frey, 1856)

Material. Ul'yanovsk: 4 mines, Vinnovka, *Lonicera xylosteum*, 30.ix.2002, MA.

Remarks. *S. lonicerarum* occurs in most Central European countries, and goes northwards to Sweden, Finland and Estonia. There is one previous record from Russia and the Volga region, also based on leafmines: Samara, Zhiguli reserve (Sachkov et al. 1997). Leafmines (fig. 13) are easy to separate from the common Agromyzidae mines on the same host.

* *Stigmella basiguttella* (Heinemann, 1862)

Material. Kalmyk Republic: 2 mines, *Quercus robur*, Yashalta, 25.ix.2000, ZV. – Samara: 2 mines, Zhiguli, *Quercus robur*, 5.x.2003, ZV. – Ul'yanovsk: 3 mines, Vinnovka, *Quercus robur*, vii.–viii+21.ix.2002, MA.

Remarks. Previously reported from Smolensk, Belgorod, the Kalmyk republic (van Nieukerken & Johansson 2003; Skala 1944), and Samara (Sachkov et al. 1997). The Ul'yanovsk records appear on the map in van Nieukerken & Johansson (2003), but were inadvertently not listed in the material. This is the only European *Quercus* mining *Stigmella* species of which mines can be identified with certainty.

Stigmella samiatella (Zeller, 1839)

Material. Ul'yanovsk: 1♂, Shikovka, 20.vii.1993, ZV; 1♂, Vjazovka, 6 km S, 29.v.–3.vi.2000, ZV. – Volgograd: 2♀, Chapurnikovskaya balka, 25.vii + 21.viii.1999, KD; 1 ♂, Tumak, 22.vii.1997, KD.

Remarks. Apart from these provinces also recorded from Belgorod and Kaluga (van Nieukerken & Johansson 2003; Shmytova 2001, 2002).

Stigmella roborella (Johansson, 1971)

Material. Ul'yanovsk: 1♂, Vjazovka, 15.–16.vii.1999, IA & IV

Remarks. Only known in Russia from Ul'yanovsk and Kaliningrad (van Nieukerken & Johansson 2003; Puplesis 1994). Leafmines can not be identified with certainty. Some mines collected in Kalmyk Republic, Elista, could belong to this species, but other species are still possible.

Trifurcula (*Trifurcula*) *puplesisi* Van Nieukerken, 1990

Remarks. One male from Sarepta (Volgograd) collected by Christoph was attributed with some doubt to this species (van Nieukerken 1990). We did not find it again.

Trifurcula (*Trifurcula*) *subnitidella* (Duponchel, 1843) New for Russia

Material. Cheliabinsk: 1♀, Arkaim 9.vii.1997, NK & JJ (coll. Junnilainen).

Remarks. Widespread throughout Europe, previously recorded from Ukraine (Crimea) and Estonia (van Nieukerken 1990, 2004). The record in the Urals extends the distribution far to the East. The hostplant, *Lotus*, in which it makes stem-mines, is widely distributed all over Russia. The single female (fig. 48) corresponds well in all details with material from Western Europe.

Trifurcula (*Trifurcula*) *silviae* Van Nieukerken, 1990 New for Russia

Material. Ul'yanovsk: 2♂, Beketovka, 11.–13.vii.1998, IV & IA (fig. 35).

Remarks. *T. silviae* was originally described from a number of localities in the French Alps, but later also found in very disjunct localities in Spain and Latvia (van Nieukerken et al. 1996). Recently it was also found in Austria and the Czech republic (Liška et al. 2002, A. & Z. Laštůvka, pers. comm.). In Latvia the species was reared from *Onobrychis arenaria*, a plant also known from the Ul'yanovsk area. The present record sheds another light on the isolation of the Latvian occurrence: it is not unlikely that *T. silviae* actually is rather widespread on steppe habitats in Eastern Europe, of which the Latvian is a northernmost, albeit rather isolated, example.

Trifurcula (*Trifurcula*) *beirnei* Puplesis, 1984 New for Russia

Material. Samara: 1♀, Zhiguli, Bakhilova Polyana, 22.viii.1996, S. Sachkov (fig. 49).

Remarks. *T. beirnei* is known from a relatively small number of records from southern England, Denmark, Germany, Austria, Poland, Czech Republic, Slovakia and Hungary (Laštůvka & Laštůvka 1997; van Nieukerken 1996, 2004; van Nieukerken &

Johansson 1986). Although larvae are unknown, the species seems to be associated with *Genista*-species: *G. tinctoria, G. germanica* and *G. pilosa.* Of these, *Genista tinctoria* is common in the Volga area.

Trifurcula (*Trifurcula*) *pallidella* (Duponchel, 1843)

Material. Ul'yanovsk: 1♂, Srednikovo, 19.vi.1994, ZV (figs. 39–40).

Remarks. *T. pallidella* is known from Central and Southeastern Europe. In Russia previously recorded from Saratov (Puplesis 1994) and also known from western Ukraine. The caterpillars make spindle shaped galls in stems of *Chamaecytisus* species (in some modern works regarded as *Cytisus* section *Tubocytisus*) and *Lembotropis* (Laštůvka & Laštůvka 1997). In the Ul'yanovsk region the only species of this group is *Chamaecytisus ruthenicus*, which we assume to be the host.

Trifurcula (*Trifurcula*) *chamaecytisi* Z. & A. Laštůvka, 1994 New for Russia

Material. Cheliabinsk: 1♂, Arkaim, 8.vii.1997, NK & JJ (coll. Junnilainen). – Ul'yanovsk: 2♂, Srednikovo, 10.–20.vii.1996, ZV; 2♂, same locality, 8.vi.1998, ZV; 1♂, Krjazh, 4.–10.vii.1998, IA & IV.

Remarks. *T. chamaecytisi* was only recently recognized as a species different from the very similar *T. immundella* (Zeller, 1839) (Laštůvka & Laštůvka 1994) and is known from Central eastern Europe (Austria, Czech and Slovak republics, Hungary), associated with various species of *Chamaecytisus*. The extension to the Volga and Ural regions conforms well with the distribution of this group of brooms, mapped together as '*Cytisus hirsutus*' (Sokolov et al. 1986), but usually considered as a group of species, of which *Chamaecytisus ruthenicus* occurs in the Ul'yanovsk region and in Arkaim (J. Junnilainen pers. comm.). Other *Trifurcula* species from the *immundella* species complex are not expected to occur in Russia, because the hosts are absent. For male genitalia see figs. 36–38.

* *Bohemannia pulverosella* (Stainton, 1849)

Material. Ul'yanovsk: 1 mine, Ul'yanovsk, *Malus*, 9.ix.2002 SU; 3 mines, Vinnovka, *Malus*, vii.–viii.2002, MA.

Remarks. Known from Leningrad (Puplesis 1994). Widespread throughout Europe. The mine may resemble that of *Ectoedemia atricollis*, see Van Nieukerken & Johansson (1990) for differences. *B. pulverosella* has usually ended feeding by mid-August, whereas *E. atricollis* larvae are usually not found before late August. The mine cited here from September was clearly an old mine.

* *Ectoedemia* (*Etainia*) *sericopeza* (Zeller, 1839)

Material. Ul'yanovsk: 3 mines in fruits of *Acer platanoides*, Vinnovka, 15.vii.–15.viii.2001, MA.

Remarks. *E.* (*E.*) *sericopeza* is a widespread species, the commonest of the subgenus, and has also been introduced in North America. In Russia it was known from Kaluga (Shmytova 2002) and Leningrad (Jürivete et al. 2000; Puplesis 1994). It feeds in the fruits of *Acer platanoides*, and the winter generation feed in shoots, petioles and buds.

* *Ectoedemia* (*Fomoria*) *weaveri* (Stainton, 1855)

Material. Ul'yanovsk: 3 mines with young larvae, Glotovka, *Vaccinium vitis-idaea,* 6.x.2002, NS.

Remarks. *Ectoedemia* (*Fomoria*) *weaveri* is a boreal species with a transpalaearctic distribution. It was previously cited from Murmansk in European Russia (Kozlov & Jalava 1994), and it occurs throughout to the Baikal, Chita and Yakutia regions in eastern Siberia (Bidzilya et al. 1998; Puplesis 1994). To this we can add Magadan even farther east and north in Siberia (Magadan, Upper Kolyna r., 500–1250m, 62°N – 149°40E, vii.1987, K. Mikkola, 7♂, Zoological Museum in Helsinki). Recently it was also recorded from Japan, Hokkaido (Kumata & Nakatani 1995).
E. weaveri feeds only on *Vaccinium vitis-idaea*, throughout winter, in the northernmost part of its distribution often during two years (van Nieukerken & Johansson 1990).

Ectoedemia (*Zimmermannia*) *liebwerdella* Zimmermann, 1940 New for Russia

Material. Samara: 1♂, Zhiguli, Bakhilova Polyana, 6.vii.1995, SS. – Ul'yanovsk: 2♂, Surulovka, 1.–3.vii.1997, IA & IV; 1♂, 6 km S Vjazovka, 5.–6.viii.1998, ZV.

Remarks. *Ectoedemia liebwerdella* occurs locally in Central and Southern Europe. It was originally described as a barkminer of *Fagus*, but many specimens have since been found in *Quercus* forests far away from *Fagus*, as is the situation here. These specimens we cannot separate from typical *E. liebwerdella*, although they usually are smaller. They differ from the closely related *E. atrifrontella* (Stainton, 1851) by the dark thorax and the larger humeral lobe and hairpencil of the hindwing. Male genitalia see figs. 41–42.

Ectoedemia (*Zimmermannia*) *longicaudella* Klimesch, 1953

Material. Ul'yanovsk: 2♂, Akulovka, 24.vii.1999, IA & IV; 1♂, Surulovka, 1.–3.vii.1997, IA & IV; 1♂, Vasil'evka, 17.–19.vii.1999, IA & IV

Remarks. *Ectoedemia longicaudella* is another barkminer of *Quercus*, and of the three European species it is the commonest and most widespread. It was known from Belgorod (Puplesis 1994) and Kaluga (Shmytova 2002). Male genitalia see figs. 43–44.

Ectoedemia (*Ectoedemia*) *hannoverella* (Glitz, 1872)

Material. Astrakhan: 1 ♂, Bogdo, 1997.05.09, KD. – Ul'yanovsk: 1♀, Mar'evka, 21.–23.vii.1999, IA & IV; 1♂, Vasil'evka, 9.–10.vi.1998, ZV; 1♂, Ul'yanovsk city, 20.vi.1990, ZV; 10 mines with larvae, Vinnovka, *Populus nigra*, 21.ix.2002, MA.

Remarks. According to Puplesis (1994) distributed from central Europe to southern Siberia (Novosibirsk), but no further detail known. Therefore these are the first detailed records for European Russia. Widespread in Central Europe. Male genitalia see figs. 45–46.

* *Ectoedemia* (*Ectoedemia*) *turbidella* (Zeller, 1848)

Material. Ul'yanovsk: 14 mines with larvae, Vinnovka, *Populus alba*, 21.ix.2002, MA

Remarks. *E. turbidella* is widespread in Europe, in Russia only previously recorded from Leningrad (Jürivete et al. 2000). EvN found also mines in St Petersburg (19.x.1985).

***Ectoedemia* (*Ectoedemia*) *argyropeza* (Zeller, 1839)**

Material. Saratov: 3♀, Saratov, 6.v.1990, AV. – Ul'yanovsk: 5 mines + larvae, Vinnovka, *Populus tremula*, 30.ix.2002, MA. – Volgograd: 2♀, Sarepta, 19th century, Christoph (BMNH).

Remarks. A widespread Holarctic species, found in Russia abundantly in Leningrad, Moscow, Kaluga, Tatarstan and Kalinigrad (Jürivete et al. 2000; Krulikowsky 1908; Puplesis 1994; Shmytova 2002; Speiser 1903). *E. argyropeza* is parthenogenetic, males are extremely rare (Bond & van Nieukerken 1987). It occurs with *Populus tremula*, probably throughout Siberia, although up to now it is only recorded from Northeast China (van Nieukerken & Liu 2000).

***Ectoedemia* (*Ectoedemia*) *caradjai* (Groschke, 1944)** New for Russia

Material. Volgograd: 2♀, Chapurnikovskaya balka, 21.viii.1999, KD (figs 50–51).

Remarks. A more southern species, common in southern and central Europe, north to Austria, southern Moravia (Czech Republic) and Ukraine. The mines were first discovered by Hering (1932) in Moldova, but his description was not available, because it was based on the 'work of an animal' after 1930 (International Commission on Zoological Nomenclature 1999). Feeds on several *Quercus* species.

***Ectoedemia* (*Ectoedemia*) *albifasciella* (Heinemann, 1871)**

Material. Ul'yanovsk: 1♂, Surulovka, 1.–3.vii.1997, IA & IV; 28 mines, Vinnovka, *Quercus robur,* 21.ix.2002+undated, MA. – Volgograd: 1♂, Sarepta, 22.v.1859, Christoph (BMNH).

Remarks. This miner of *Quercus* is widespread and often very abundant throughout Europe, but rarer in south. Previously recorded from Russia in Smolensk and Kaluga (Shmytova 2002; Skala 1944). Strictly spoken, males cannot be identified with certainty from *E. contorta* Van Nieukerken, 1985 or *E. pubescivora* (Weber, 1937). We, however, regard *E. albifasciella* as the most likely candidate for these localities. Mines of this species occur usually much earlier than the following species (August–September).

*** *Ectoedemia* (*Ectoedemia*) *subbimaculella* (Haworth, 1828)**

Material. Ul'yanovsk: 3 mines, Vinnovka, *Quercus robur,* 2002, MA.

Remarks. A similar distribution as the previous species, and often as abundant or even more. From Russia also recorded from Smolensk and Kaluga (Shmytova 2002; Skala 1944). The leafmines of *E. subbimaculella* are very characteristic by the slit on the underside; they occur much later than *E. albifasciella*, and are often found in green islands in fallen leaves, as was also here the case.

*** *Ectoedemia* (*Ectoedemia*) *atricollis* (Stainton, 1857)** New for Russia

Material. Ul'yanovsk: 28 mines, Vinnovka, *Malus domestica* + *Pyrus communis*, vii.–viii, 21.ix.2002, MA.

Remarks. A widespread European species, also occurring in Tajikistan, but probably as an introduction (Puplesis 1994). Not previously recorded from Russia. This is an oligophagous species, feeding on a number of tree genera in Rosaceae (*Crataegus, Malus, Pyrus, Prunus* etc.) and on *Staphylaea* (Staphylaeaceae). Leafmine see fig. 19.

* *Ectoedemia* (*Ectoedemia*) *arcuatella* (Herrich-Schäffer, 1855)

Material. Ul'yanovsk: 34 mines, Vinnovka, *Fragaria moschata*, vii.–viii, 21.ix.2002, MA.

Remarks. This widespread European species has once been recorded as leafmines from Russia: Smolensk (Skala 1944). According to Puplesis (1994) possibly also in Tyan-Shan'. The mines on *Fragaria* are very characteristic (fig. 23), and cannot be confused with anything else.

Ectoedemia (*Ectoedemia*) *angulifasciella* complex

Material. Ul'yanovsk: 1♂, Ryabina, 22.vi.1994, ZV.

Remarks. This male is in poor condition, and the colour of the head can no longer be determined. The specimen can belong to either *E. arcuatella*, *E. rubivora* (Wocke, 1860) or *E. atricollis*.

* *Ectoedemia* (*Ectoedemia*) *spinosella* (Joannis, 1908) – New for Russia

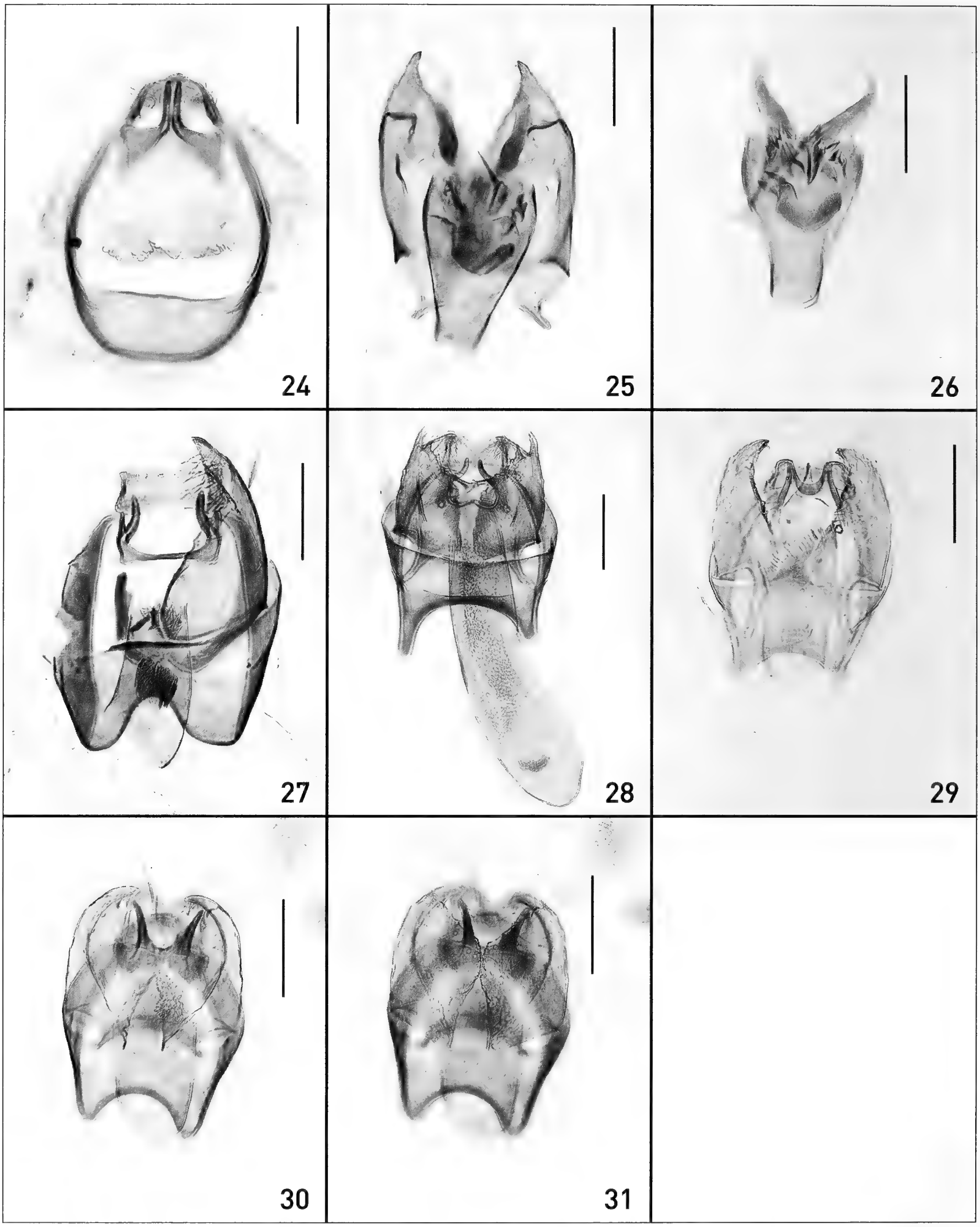
Material. Kalmyk Republic: mines, *Prunus* sp., Elista, 26.ix.2000, ZV. – Ul'yanovsk: 2 mines, Ul'yanovsk, *Prunus spinosa*, 9.ix.2002 SU; 32 mines, Vinnovka, *Prunus domestica* + *spinosa*, vii.–viii, 21.ix.2002, MA.

Remarks. *E. spinosella* is a more southern European species, reaching in the North to the southern part of Britain, The Netherlands, mid Germany and Poland. Gerasimov (1952) recorded it also from the Crimea, the Caucasus and European Part of the Soviet Union, but these records were not cited by Puplesis (1994); in the light of the present findings, they should be regarded as probably correct. Also common in western Turkmenistan (Puplesis et al. 1996). The mines are characteristic (figs. 21–22), and although they may sometimes be confused with *E. mahalebella* (Klimesch, 1936), the latter has never been found on *Prunus spinosa*. Still, confirmation by adults remains desirable.

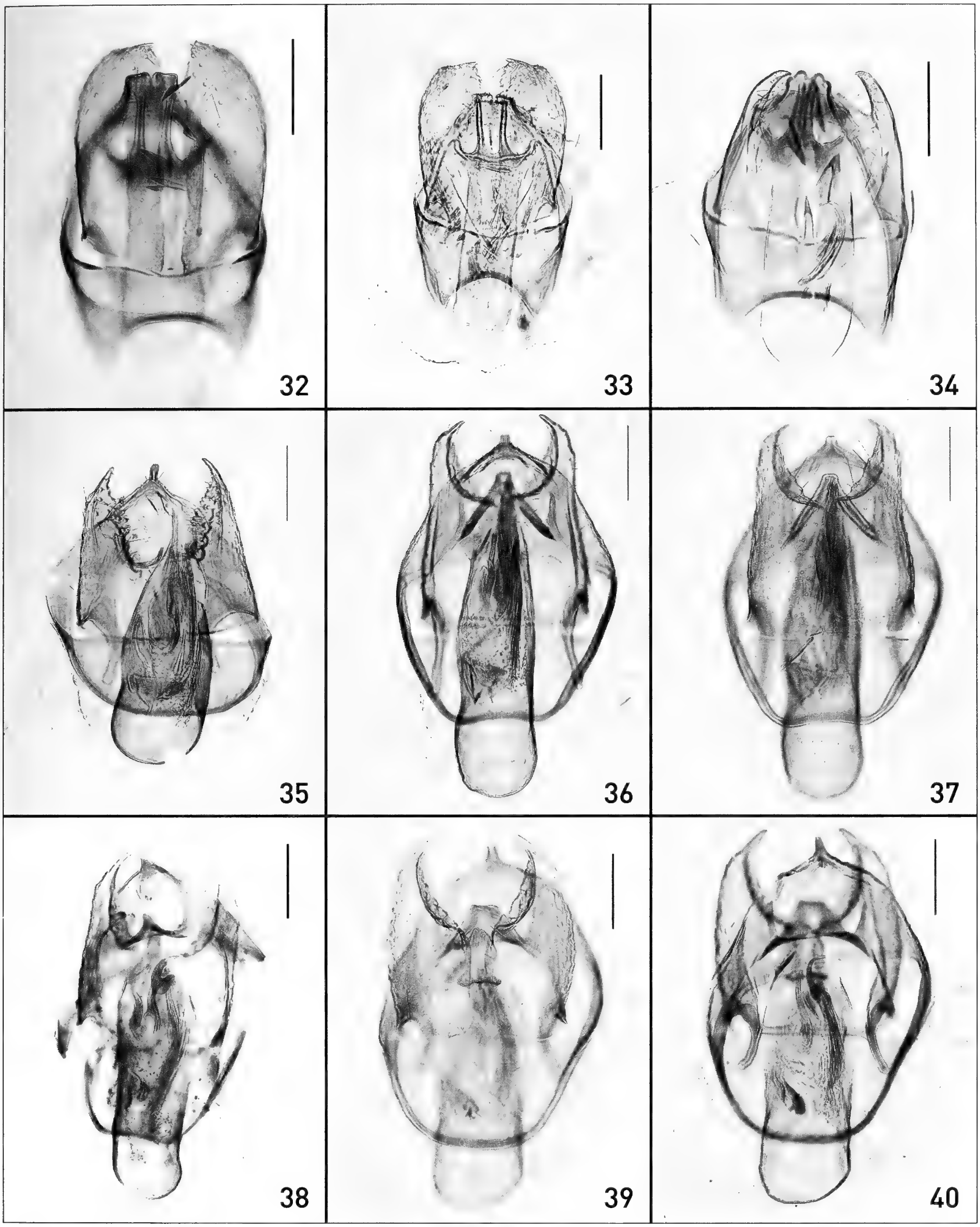
Ectoedemia (*Ectoedemia*) *occultella* (Linnaeus, 1767)

Material. Ul'yanovsk: 1♂, Baryshskaya Sloboda, 10.–12.vii.1997, *Sphagnum* peat bog, IA & IV.

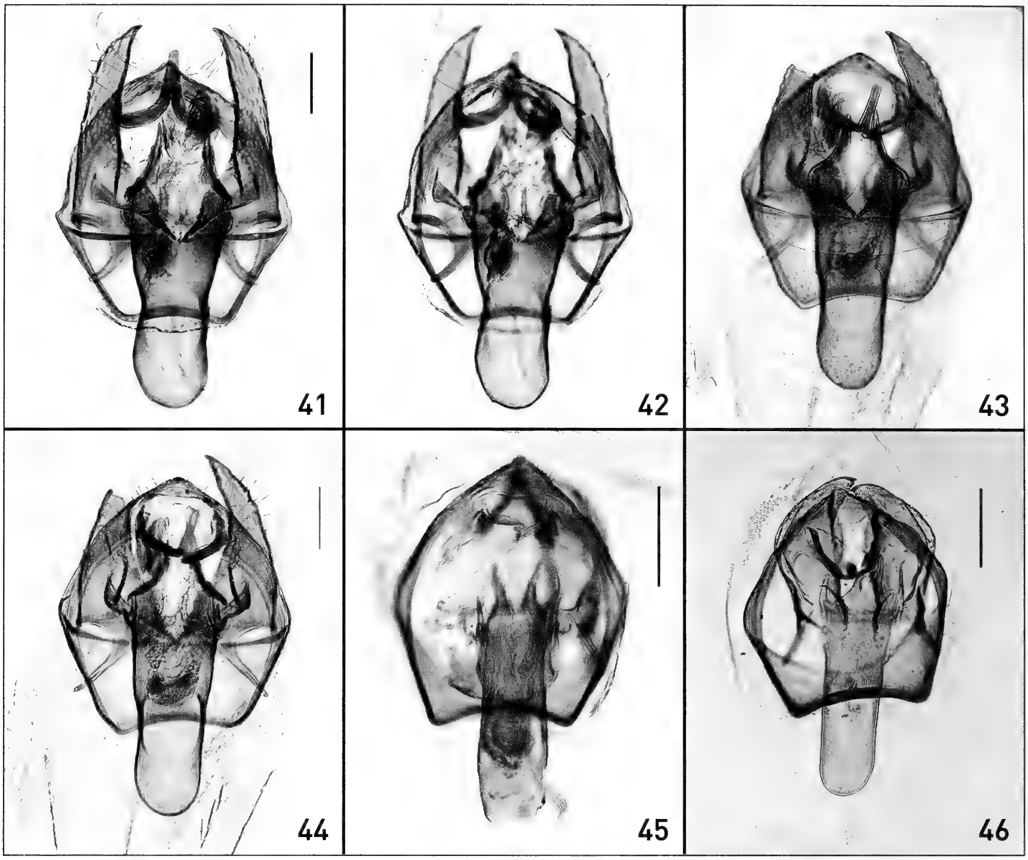
Remarks. *E. occultella* is one of the few Holarctic Nepticulidae species, throughout Europe, but also in Japan and North America (van Nieukerken 1985; Puplesis 1994). In Russia recorded from Murmansk, Karelia, Leningrad, Samara and Tatarstan (Jürivete et al. 2000; Kozlov & Jalava 1994; Krulikowsky 1908; Kutenkova 1989; Sachkov et al. 1997) and also as far east as Sakhalin (Puplesis 1994). It feeds normally on *Betula*, although it has occasionally been found on *Salix pentandra* in Finland. Very similar mines on Rosaceae in Nepal and Japan may also belong to this species.



Figs. 24–31. Male genitalia of Nepticulidae. **24–26.** *Stigmella naturnella*, Ul'yanovsk: Pobedy (EvN3302); Samara: Zhiguli (3303; fig. 26). **27.** *S. glutinosae*, Srednikovo (EvN3485). **28.** *S. aceris*, Ul'yanovsk: Pobedy (EvN3491). **29.** *S. ulmiphaga*, Chapurnikovskaya balka (EvN3329). **30–31.** *S. rolandi*, Chapurnikovskaya balka (EvN3332) (scale bars 100μm).



Figs. 32–40. Male genitalia of Nepticulidae. **32–33.** *Stigmella zelleriella*, Mar'evka (EvN3301, EvN3492). **34.** *S. obliquella*, Vasil'evka (EvN2997). **35.** *Trifurcula* (*Trifurcula*) *silviae*, Beketovka (EvN3294). **36–38.** *T.* (*T.*) *chamaecytisi*, Srednikovo (EvN3293) and Arkaim Reserve (EvN3400; fig. 38, **39–40.** *T.* (*T.*) *pallidella*, Srednikovo (EvN3300) (scale bars 100μm).



Figs. 41–46. Male genitalia of Nepticulidae. **41–42.** *Ectoedemia* (*Zimmermannia*) *liebwerdella*, Surulovka (EvN3313). **43–44.** *E.* (*Z.*) *longicaudella*, Akulovka (EvN3295). **45–46.** *Ectoedemia* (*E.*) *hannoverella*, Vasilev'ka (EvN3310) and Bogdo (EvN3339) (scale bars 100μm).

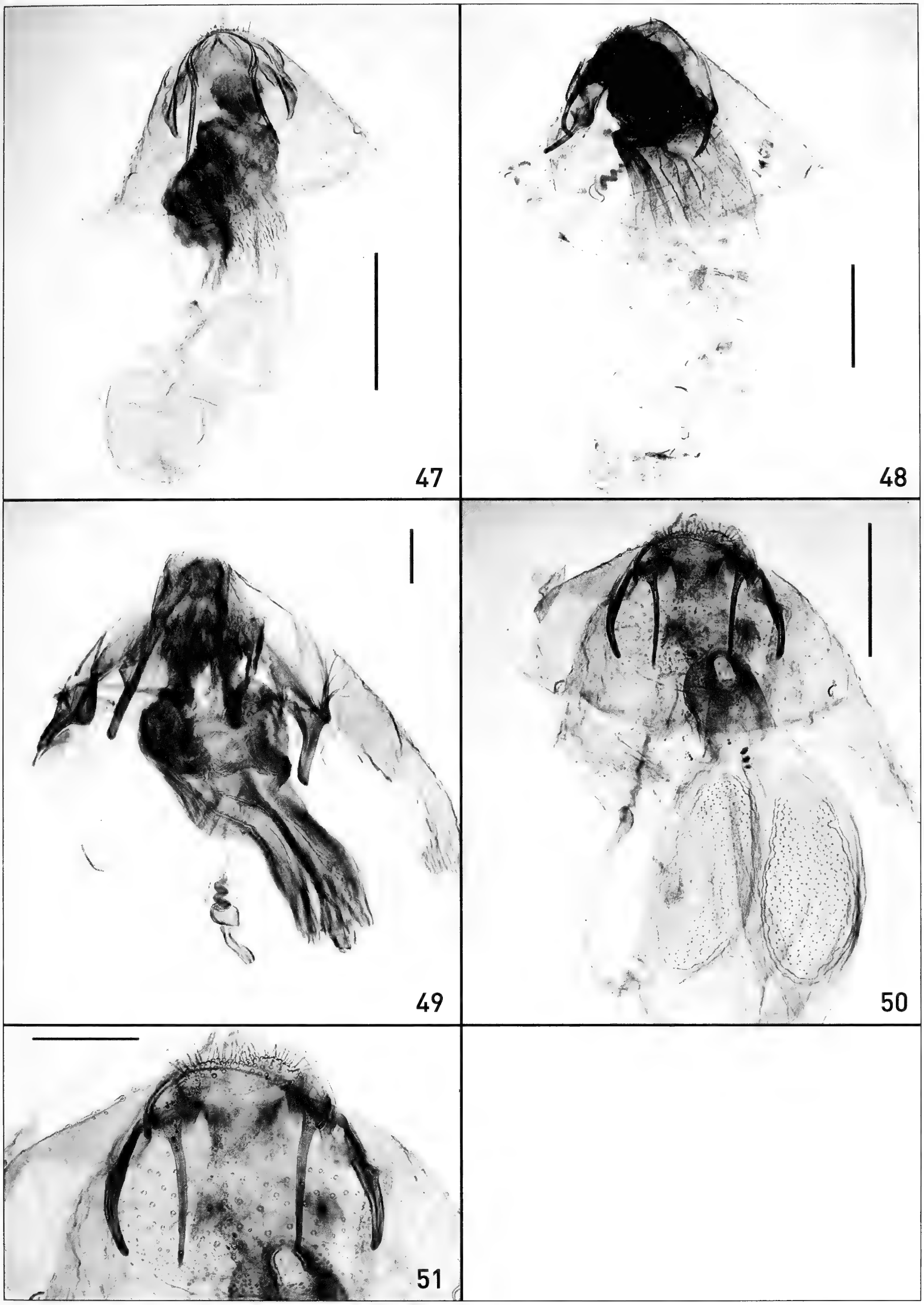
Doubtful records

We list here some leafmines, which we cannot identify with certainty, but which provide an insight in the total fauna.

Pyrus. – Kalmyk Republic: mines, *Pyrus communis*, Elista, 26.ix.2000, ZV. – Ul'yanovsk: 2 mines, Arbuzovka, 30.viii.2002, ZV; many mines, Vinnovka, vii.–viii.2002, MA.

The mines in Ul'yanovsk can be split more or less into two groups, which could belong to *Stigmella desperatella* (Frey, 1856) and *S. pyri* (Glitz, 1865); the material from the Kalmyk Republic resembles more *S. minusculella* (Herrich-Schäffer, 1855), but the mines cannot be identified with any certainty.

Puplesis (1994) records *S. minusculella* from southern Russia, based on material from Belgorod (R. Puplesis, pers. comm.), but the other two species have not yet been recorded from Russia, although *S. desperatella* is common in the Caucasus.



Figs. 47–51. Female genitalia of Nepticulidae. **47.** *Stigmella aceris*, Chapurnikovskaya balka (EvN3335). **48.** *Trifurcula* (*Trifurcula*) *subnitidella*, Arkaim Reserve (EvN3402). **49.** *T.* (*T.*) *beirnei*, Bakhilova Polyana (EvN3322). **50–51.** *Ectoedemia* (*E.*) *caradjai*, Chapurnikovskaya balka (EvN3337) (scale bars 200 μm for figs. 47, 48, 50, 100μm for figs. 49, 51).

Filipendula vulgaris. – Ul'yanovsk: 5 mines, Arskoe, 20.viii.2003, MA.
Leafmines in *Filipendula vulgaris* are normally not identifiable, and they could belong to either *S. thuringiaca* or *S. filipendulae* (Wocke, 1871). The latter is not yet known from Russia.
Rosa. – Ul'yanovsk: 7 mines, Tsemzavod, mid vii.2003, MA.
Stigmella mines on *Rosa* are usually undistinguishable, and could belong to either *S. anomalella* (Goeze, 1783) or *S. centifoliella* (Zeller, 1848). *S. rolandi* also feeds on *Rosa*, but has probably slightly different mines. *S. anomalella* is the most likely candidate here, it is reported from Leningrad and Samara (Puplesis 1994; Sachkov et al. 1997), and occurs further east in Tyan-Shan' and Primorskiy Kray (Puplesis 1994).

Rubus. – Ul'yanovsk: 1 mine, Ul'yanovsk city, 9.ix.2002, SU; 5 mines, Vinnovka, vii.–viii.2002, MA.
Mines of *Stigmella splendidissimella* (Herrich-Schäffer, 1855) and *S. aurella* (Fabricius, 1775) are very hard to distinguish, we therefore cannot attribute these mines with certainty to any of the species, although in view of the distribution the first seems the more likely candidate.

Ulmus. – Ul'yanovsk: 3 mines, Ul'yanovsk city, 9.ix.2002, SU.
We think that these mines belong most likely to *S. ulmivora* (Fologne, 1860), but since mines of *S. ulmiphaga* and *S. kazakhstanica* cannot be distinguished, we do not put any final identification to these mines. Similar mines from Samara have been reported as *S. ulmivora* (Sachkov et al. 1997).

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Peter Huemer 2004. Die Tagfalter Südtirols. – Veröffentlichungen des Naturmuseums Südtirols 2: 232 pp. – Hardcover (ISBN 3-85256-280-5). 44,40 €. (in German)

The butterflies of South Tyrol in northern Italy are now treated in the book "Die Tagfalter Südtirols" by Peter Huemer. South Tyrol, situated in the eastern Alps, comprises an area of just 7,400 km^2, but altitudes extends from 210 m to 3902 m providing extreme different habitats. Still until the 1970s, South Tyrol was famous as a paradise for Lepidoptera, but since that time man occupied much more land, especially for settlement and apple plantations. However, the impact of these changes on the composition of the butterfly species communities was not well known yet. For three years, Peter Huemer studied the relevant faunistic literature from the very beginning in the late 18th century to the beginning of the third millennium. Further, he studied south tyrolian butterflies in several institutional and private insect collections and went out himself to look for rarely recorded species, visiting localities where certain butterfly species occurred formerly or investigated areas from which butterflies have rarely been recorded. After all, the butterfly fauna of South Tyrol comprises 185 species (after elimination of doubtful records). The book starts with a general chapter, giving an introduction into geography, geology, climate, and vegetation of South Tyrol, methods used and a summary of the main results, e.g., occurrence of butterflies at different altitudes, ecological adaptation of the species and threats. The main chapter treats the species. For every species, information is given for identification, general distribution, regional occurrence, habitat, phenology, larval food plants, life history, and threats including recommendations for conservation. Records from South Tyrol are shown on relief maps and are distinguished between those made either before or after 1980. The book is completed by a list of references cited, a systematic index of the taxa, an alphabetic index of the scientific names and an alphabetic index of the German names.

The book is printed in colour throughout. More than 100 butterfly species are figured by colour photos taken from living specimens in nature, plus images from immatures and butterfly habitats. The text is written concisely and full of information. Among others, the reader will learn about *Libythea celtis* (Laicharting, 1782), which is the first lepidopterous species originally described from South Tyrol. At the beginning of the 20th century, it was still that common that it was mentioned as a pest, but it is regarded as endangered today. Its larval food plant, *Celtis australis*, naturally growths in the same areas which are especially suitable for apple. The displacement of natural stands of *Celtis australis* by apple orchards and the use of pesticides are therefore regarded as the main threats for the decline of *Libythea celtis*. Indeed, a summary of the main threats for the butterflies of South Tyrol lists agricultural management including the use of pesticides, intensive forestry, and urban settlement. Fortunately, the highest number of butterfly species can be found between 1000–1500 m altitude, an area which is not in favour for these activities by man and this holds much more true for alpine species. A revised version of the regional red data book of the 185 butterfly species lists 11 species as regionally extinct, 8 are critically endangered, 8 are endangered, 10 are vulnerable, 46 are nearly threatened, 70 are least concern, and for 25 species the data are deficient.

"Die Tagfalter Südtirols" by Peter Huemer is a basic tool for all who are interested in the butterflies from South Tyrol and their conservation. It is scientific and popular. The book has a high potential to fascinate South Tyrolians and especially young people for their native butterflies. They will find all necessary information in this lovely made book to start studying these creatures in nature. And this is what sustainable conservation of butterflies needs today: beginners.

MATTHIAS NUSS

Trifurcula pallidella (Duponchel, 1843) (Nepticulidae): distribution, biology and immature stages, particularly in Poland

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Abstract. *Trifurcula pallidella* (Duponchel, 1843) is recorded for the first time from 30 localities in south-eastern Poland. The biology is described and illustrated in detail for the first time: the larva makes spindle shaped galls in stems of *Chamaecytisus* spp., *Lembotropis nigricans*, and *Cytisus procumbens*. In Poland it is usually found on dry grassland or edges of woodland on calcareous soils. The larva, pupa and galls are described and illustrated. The distribution is revised and mapped on the basis of material and literature: its occurrence in Germany: Bavaria, Italy mainland and Sicily is confirmed, and new records are given for Corsica and Crete. It is widespread from Southeast Poland southwards throughout the Balkans and eastwards to the Volga, in the West to Regensburg in Germany, southern Switzerland, western Italy and Corsica. It is believed to use a different host in Mediterranean localities, possibly *Calicotome*. All known hosts and *Calicotome* belong to the monophyletic *Cytisus* group of recent molecular studies.

Zusammenfassung. *Trifurcula pallidella* (Duponchel, 1843) wird erstmals aus 30 Fundorten in Südostpolen gemeldet. Die Biologie wird zum ersten Mal detailliert beschrieben und abgebildet: die Raupe macht spindelförmige Galle im Stengel von *Chamaecytisus* spp., *Lembotropis nigricans*, und *Cytisus procumbens*. In Polen wird die Art meistens in Trockenrasen oder an Waldränder auf Kalkuntergrund gefunden. Die Raupe, Pupe und Galle werden beschrieben und abgebildet. Die Gesamtverbreitung wird auf Grund von Material und Literatur revidiert und auf einer Karte abgebildet: das Vorkommen in Deutschland: Bayern, auf dem Italienischen Festland und Sizilien wird bestätigt, und die Art wird von Korsika und Kreta neu nachgewiesen. *T. pallidella* ist weit verbreitet, von Südostpolen bis über die Balkanhalbinsel im Süden und nach Osten bis zur Wolga, im Westen bis Regensburg in Deutschland, die Südschweiz, Westitalien und Korsika. Es wird angenommen dass *T. pallidella* im Mittelmeerraum andere Futterpflanzen nutzt, wahrscheinlich *Calicotome*. Alle bekannten Futterpflanzen und *Calicotome* gehören zur monophyletische *Cytisus*-Gruppe die auch in rezenten molekularen Studien anerkannt wird.

Key words. *Trifurcula,* distribution maps, hostplants, galls, *Cytisus, Lembotropis, Chamaecytisus, Calicotome*, Fabaceae, Genisteae, Braconidae, *Mirax*.

Introduction

The genus *Trifurcula* Zeller, 1848 includes at least 36 named species in Europe (van Nieukerken 1996), particularly in the Mediterranean region, where also many unnamed species are known. More to the north the number of species is quickly decreasing, still sixteen species are found in the Czech Republic, eleven in Germany, seven in Denmark and five in Sweden. Only six species have been cited from Poland, which probably is an underestimate of the real number. The subgenus *Trifurcula* s. s. comprises a group of rather uniform moths, of which the larvae make stem-mines on Fabaceae (=Leguminosae). Two species groups are recognised: the *T. subnitidella* group which feeds on plants belonging to various Fabaceae tribes (i.e. *Lotus,*

Figs. 1-4. Habitats of *Trifurcula pallidella*. **1**–**2**. Poland, Podlasie: Stare Stulno, May 2003, grassland on a sand dune, hostplant *Chamaecytisus ruthenicus*. **3**. Poland, Lublin Upland: Brzeźno reserve, May 2003, calciphilous community at the margin of a marsh, hostplant *C. ruthenicus*. **4**. Slovakia, Plešivec, Slovenský Kras: Hôrka, October 1992, a dry calcareous hill with grassland, hostplant *C. hirsutus* (not visible on photograph). Photos M. Sielezniew (**1**–**3**), E.J. van Nieukerken (**4**).

Dorycnium, Coronilla), but not on brooms (tribe Genisteae), and the *T. pallidella* group, which is specialised on brooms.

The type species of *Trifurcula*, *T. pallidella* (Duponchel, 1843) is one of the largest species in the genus and one of the oldest known. Taxonomy and distribution were discussed by van Nieukerken & Johansson (1986), especially in relation to *T. beirnei* Puplesis, 1984, which previously had often been misidentified as *T. pallidella*. At that time the biology was unknown, although it was presumed that *T. pallidella* is associated with *Lembotropis nigricans* (L.) Griseb.

Shortly after that, the larvae were discovered by the senior author during a joint excursion with Aleš and Zdeněk Laštůvka. The larvae make galls in *Lembotropis nigricans* and *Chamaecytisus* spp. and later galls were also found in *Cytisus procumbens* (Waldst. & Kit. ex Willd.) Sprengel (=*Corothamnus procumbens*). The gall is shown and briefly described by A. & Z. Laštůvka (1997). The two Polish authors have found adults and galls of *Trifurcula pallidella* in several places in Poland since 1998. On the basis of these records the species was listed as occurring in Poland by Buszko & Nowacki (2000). We here report the Polish records in particular and provide details on the biology, immature stages and distribution in Poland and in Europe, where many new data have become available since 1986.

Material and methods

The first two Polish males of *T. pallidella* were found amongst material collected at light in xerothermic habitats in south-east Poland in 1998. In late autumn (20 October) of the same year, several empty galls were found in stems of *Lembotropis nigricans* and *Chamaecytisus ruthenicus* (Fischer ex Wołoszczak) A. Klásková in steppe vegetation in Machnów. The distribution of the host plants (Zając & Zając 2001) suggested that the species may have a wider range in Poland. Therefore we started detailed field investigations in 2001-2002 in order to test this hypothesis. A number of localities where the hostplants were expected were selected; these had similar biotic conditions as those mentioned above. Most of these sites are located in existing or planned nature reserves. We visited these sites from mid-September to mid-October: the period when the galls with larvae were expected. Some live material was also sent to the senior author, who reared a couple of specimens as well.

The senior author collected *T. pallidella* in the Czech and Slovak Republics in 1992 in collaboration with A. and Z. Laštůvka on localities were adults had been found previously. Other material studied was found during study of many museum and private collections since 1986, and some data were received from A. and Z. Laštůvka. He also re-examined all known literature citations.

Galls were collected by cutting parts of the stem of the hostplant. The stems were placed in plastic containers lined with tissue. Most larvae easily prepared cocoons on the tissue, after which the stems were removed and dried. Adults and parasites emerged after a winter diapause in an outhouse.

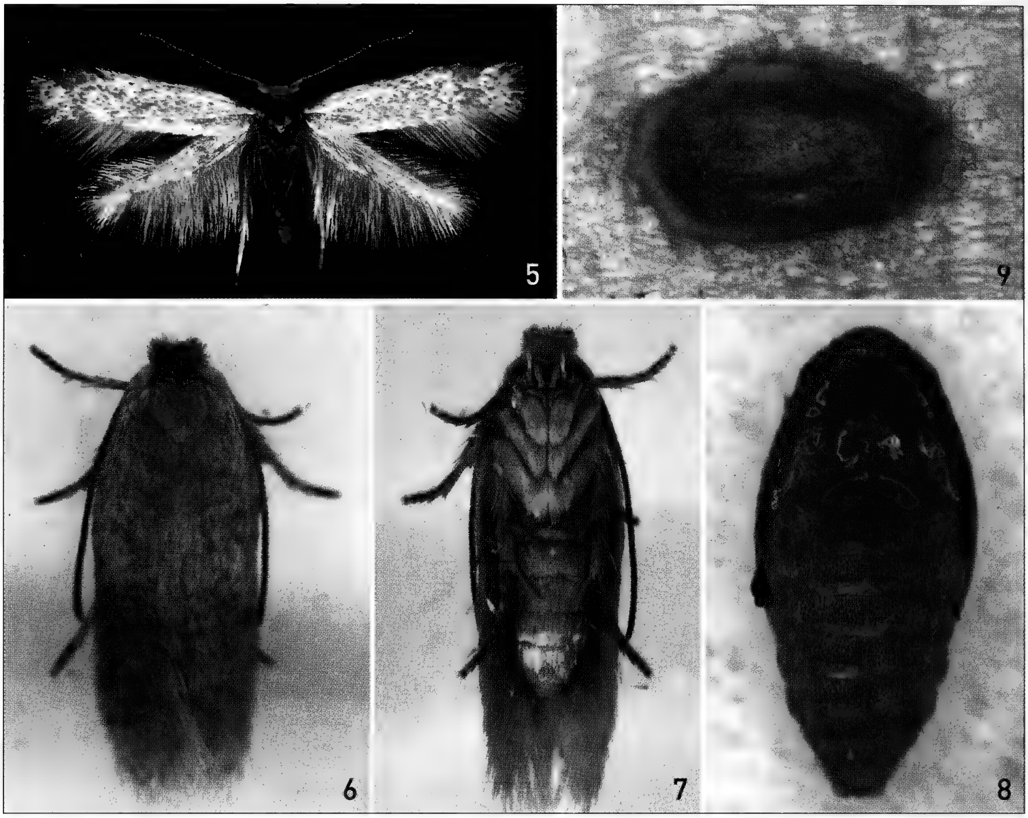
Larvae and pupal skins were examined after macerating in KOH and mounted on slides with euparal, after dehydration with ethanol and staining with chlorazol black and haemaluin. Galls were studied by simply cutting them with razor blades.

Morphological terms of larvae follow Gustafsson (1981), except for the naming of setae on the mesothorax, which follows Hoare (2000), in exchanging resp. the names of D1 and D2 and SV1 and SV2. Homologisation of setae, however, remains problematical. For this reason the ventral group of setae is not labelled in Fig. 21.

Photographs of preparations of immature stages and genitalia were taken with a Zeiss AxioCam digital camera attached to a Zeiss Axioskop H, those of live insects and galls by EvN with the same camera on Zeiss Stemi SV 11, using Carl Zeiss AxioVision 3.0.6 software. Galls were photographed by KP with a Canon D10 digital camera, with a standard lens. The adult moth was photographed with an Olympus DP10 digital camera attached to the stereo-microscope Olympus S260.

The European distribution map was prepared with Dmap 7.0 (Morton 2000). In Tab. 1 and 2 we give summarized locality data, all details of these, dates and UTM coordinates with an accuracy of 10 square kilometres are given in an excel sheet on the website of the senior author (http://www.naturalis.nl/nieukerken) and on the website of the journal (http://www.soceurlep.org/council-main.htm). When coordinates were not available from the source, we obtained most from NIMA (2004).

Depositories of collections are abbreviated according to Evenhuis & Samuelson (2004). For the hostplant names we follow Heywood & Ball (1968). Although since then there



Figs. 5–9. *Trifurcula pallidella.* **5.** Male, Poland: Stawska Góra res. **6–7.** Live female, Poland, Góry Pieprzowe res., emerged in Leiden. **8.** Live pupa, dorsal view, Poland, Stawska Góra res. **9.** Cocoon on tissue, Góry Pieprzowe res. Photos: J. Chobotow (**5**), E.J. van Nieukerken (**6–9**).

has been much discussion on the generic limits within the *Cytisus* group and the Genisteae in general, no consensus has been reached, and there is not another easy single source except the ILDIS database (ILDIS 2003), which uses a somewhat inconsistent nomenclature. The genera *Lembotropis* and *Chamaecytisus* as used here are often (but not always in the same paper) regarded as sections of *Cytisus* (resp. sect. *Lembotropis* and *Tubocytisus*), and the section *Corothamnus* in *Cytisus* (for *C. procumbens*) is in some publications raised to genus. In recent molecular studies, cited below, a large *Cytisus* seems to be paraphyletic, but also the genus *Chamaecytisus* as currently understood appears as polyphyletic (for a revision of this taxon see Cristofolini 1991).

RESULTS

Trifurcula pallidella (Duponchel)

Oecophora pallidella Duponchel, [1843]: 339, pl. 78. Lectotype selected by van Nieukerken & Johansson 1986.
Trifurcula pallidella; Zeller 1848: 332.
Trifurcula incognitella Toll 1936: 409.
Trifurcula pallidella; van Nieukerken & Johansson 1986: 271.

Diagnosis. Wingspan 7.5–9 mm. Head: frontal tuft from almost white, yellowish orange to brown ferruginous, collar white to straw, occasionally with a few darker scales. Scape straw to ferruginous orange, flagellum grey-ochreous indistinctly ringed, 42–50 segments. Thorax and forewings uniformly coloured, covered with two types of scales: white and ferruginous-tipped scales, sometimes with golden gloss. The ferruginous-tipped scales usually becoming more abundant towards apex. The general impression of the wing colour varies from white to ochreous, depending on abundance of scale type. Hindwing grey with straw cilia. Abdomen grey dorsally, straw ventrally.

Similar species. Of the species with which it can be found together, *Trifurcula pallidella* resembles *T. beirnei* most; this can in many cases be differentiated by the different flying period: *T. pallidella* occurs from May to early (mid) July, *T. beirnei* usually in August to September. However, there are a few earlier records of *T. beirnei*, thus July specimens need to be checked carefully. *T. beirnei* is on average larger (8–11 mm) than *T. pallidella*, and has three types of scales (white, yellow and dark tipped). The characteristic gnathos and large curved valvae of *T. beirnei* can often be seen without dissection.

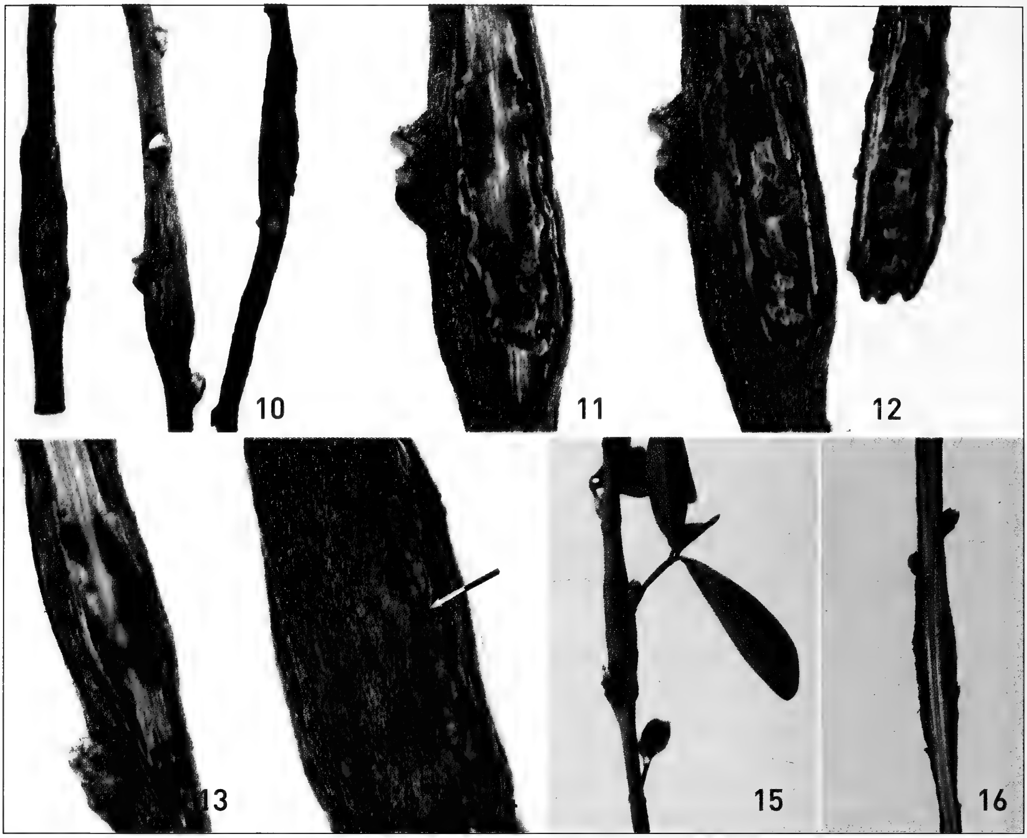
Most other species likely to confuse with *T. pallidella* belong to the *T. immundella* complex of species, and of these *T. immundella* (Zeller, 1839) and *T. chamaecytisi* Z. & A. Laštůvka, 1994 resemble *T. pallidella* most, but larger and worn specimens of the other species may also be confused. Most of these species, except *T. immundella*, feed on the same hosts as *pallidella*, and can therefore be found in the same localities. These species are on average somewhat smaller (6–8.5 mm, sometimes even smaller), and apart from *T. chamaecytisi*, they are darker when fresh. In collections *T. pallidella* was often confused with the much smaller (5–7 mm) *T. serotinella* Herrich-Schäffer, 1855. The male genitalia offer the best characters, for descriptions and illustrations we refer to van Nieukerken & Johansson (1986), but we also illustrate here the male genitalia (Fig. 17).

Life history

Hostplants. With certainty galls are now recorded from *Chamaecytisus albus* (Hacq.) Rothm., *C. austriacus* (L.) Link, *C. hirsutus* (L.) Link, *C. ratisbonensis* (Schaeffer) Rothm., *C. ruthenicus* (Fischer ex Wołoszczak) A. Klásková, *Cytisus procumbens* (Waldst. & Kit. ex Willd.) Sprengel (in section *Corothamnus*) and *Lembotropis nigricans* (L.) Griseb.

Galls. The galls with full-grown larvae were found from 9 September to early November. Galls occurred at different heights in the stem, both in older shoots and younger shoots of the same year. Occasionally two or three galls were found in the same stem. Old galls remain visible and can still be found in the next spring, at least until June (see Tab. 1 and 2).

The egg is deposited on the stem where later the gall forms, usually difficult to see. The larva first bores into the parenchyma and then feeds in a spiral gallery around the stem, successively moving upwards, also partly boring in the central woody part of the stem (Figs. 10–16). The stem is thickened more or less considerably by the larval



Figs. 10–16. *Trifurcula pallidella*, biology, galls and details, **10–14.** *Chamaecytisus ruthenicus*, Korhynie (11: Osłowo), **10.** Three galls. **11–13.** Various sections. **14.** Exit hole, indicated by arrow. **15–16.** Galls in *Lembotropis nigricans,* Stawska Góra res. Photos E.J. van Nieukerken (**10–14**), K. Pałka. (**15, 16**).

activity. The diameter of the galls varies from 3.2–6.0 mm (depending on stem thickness) and the length from 13-26 mm (n=20). The frass is deposited in the gallery (Figs. 11–13), in a similar fashion as in stem-mines of related *Trifurcula* species, almost filling the gallery.

The full fed larva quits the gall through a slit in its upper part, usually close to a stem bud (Fig. 14). The pupation takes place in a typical Nepticulidae cocoon (Fig. 9). Cocoon length is 2.7–3.7 mm (mean 3.3 mm, n=20), width 1.8–2.5 mm (mean 2.1 mm, n=20). Its colour is pale brown to ferruginous brown. In captivity the cocoons were attached to the walls of the rearing tubes, to the surface of a stem or on pieces of paper tissue. After hibernation in outdoor temperature, the adults emerged from the middle of May to early June.

Voltinism. The moths fly in central Europe from 9 May to 19 July, most in May and June, in southern Greece and Crete they fly from 9 April to 17 May, but also 10 June in northern Greece. The species is clearly univoltine.

Parasites. We reared several parasites of the family Braconidae, all belonging to *Mirax rufilabris* Haliday, 1833 (det. C. van Achterberg, Leiden). They emerged in the

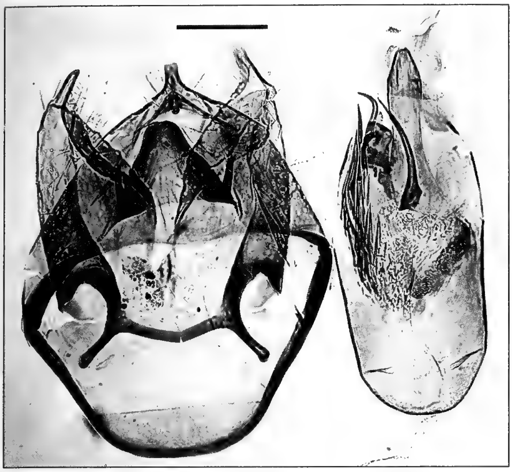


Fig. 17. *Trifurcula pallidella*, male genitalia, Germany: Kelheim, slide EJ7919. Scale 100μm.

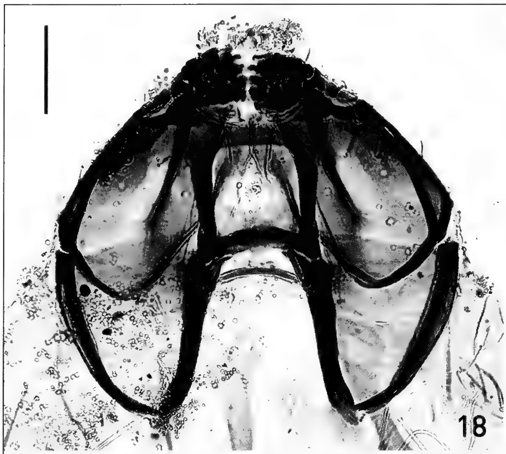
laboratory between 9 April and 13 June 2003. We also reared just one specimen of Eulophidae, probably *Chrysocharis* sp. (5 June 2003). All these were reared out of the cocoons and thus both species are koinobionts. *Mirax rufilabris* has been recorded from many Nepticulidae species, including *Trifurcula immundella* (Shaw & Askew 1976), but it is now understood that *Mirax* forms a complex of several species with a narrower host range, of which a revision is in preparation (C. van Achterberg, pers. comm.). The type locality of *M. rufilabris* is Ireland, probably near Dublin. Haliday renamed it later *M. spartii*, an indication that he reared it from broom and thus from the only nepticulid known to feed on broom in Ireland: *T. immundella* (see Emmet 1976). According to C. van Achterberg, the 'real' *M. rufilabris* was up to now only known from *Trifurcula immundella*, and *T. pallidella* thus comprises a new host record. We may therefore assume that *M. rufilabris* is specialised on *Trifurcula* species that feed in the stem of brooms (see Tab. 1).

The rate of parasitism was high: from the material collected in autumn 2002 we reared 57 specimens of *Mirax*, one of *Chrysocharis* and only thirteen adults of *T. pallidella*.

Remarks. The galls were discovered by the senior author during joint field work with Aleš and Zdeněk Laštůvka in Vranovice, Moravia, 5 October 1992. In this locality adults were previously frequently caught around *Chamaecytisus ratisbonensis*. After failing to localise any stem-mines, he opened some spindle-shaped galls, and found to his surprise nepticulid larvae in it. Later several adults were reared from galls of various localities. These galls had also been noted and described before by Baudyš (1925) and Černik (1942), who found them in various localities in Moravia and Slovakia (Tab. 2). The larva was identified as 'unknown Microlepidopteron', and also cited in the handbook by Buhr (1964: 422) under *Cytisus* as number 2225. The galls are probably not induced by the egg-laying activity of the adult, but by the feeding larva; since it seems that the larva is not depending on tissue formed in the gall (but this needs to be checked more carefully). This type of thickening should not be called a gall according to some authors.

Description of immature stages

Larva (Figs. 18–21). Mature larvae about 6–8 mm long, extremely slender, yellow when fresh. Body almost completely smooth, small spines (microtrichia) absent. Headcapsule 400–480 μm long, 440–515 μm wide (n=2), much wider than long. Labrum with 2 pairs of setae; mandibula with 4 strong cusps; labial palpus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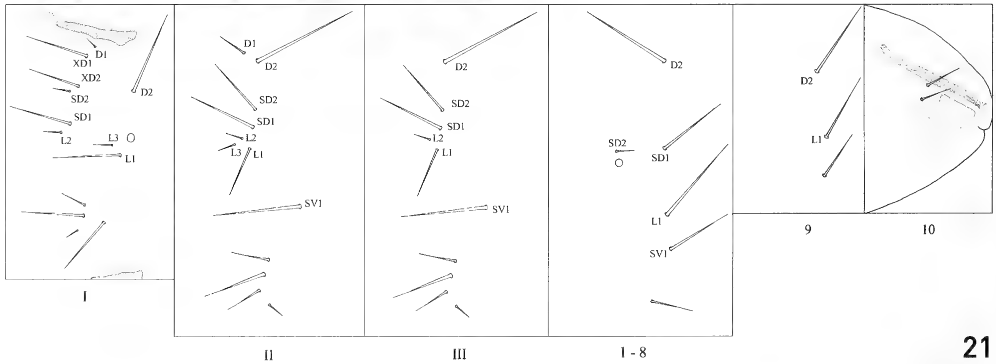

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Figs. 18–21. *Trifurcula pallidella*, larva, Stawska Góra res. **18.** Headcapsule, dorsal; scale 100µm. **19.** Headcapsule and prothorax, ventral; scale 200 µm. **20.** Detail of mouthparts, with labial palps; scale 50µm. **21.** Setal map, drawn by A. Mazurkiewicz & K. Pałka. Photos E.J. van Nieukerken.

with 3 segments and long terminal seta, second segment much longer than segment 1 or 3. Prothorax with pair of slender tergites and single indistinct sternite plus two small sternites anterolateral to the medial one; with the full complement of 13 pairs of setae. Mesothorax with 12 pairs of setae (D1 present, 4 pairs of setae ventral to SV1), metathorax with 10 pairs (D1 and L3 absent). Abdominal segments 1-8 with 6 pairs, A9 with 3 pairs and A10 with 2 pairs. Distribution of setae illustrated in setal map (Fig. 21). Paired ventral ambulatory calli present on T2–3 and A1–7. Anal rods in A10 posteriorly bifid, forming an angle of almost 180°.

The larva differs from other described *Trifurcula* (s. str.) (Gustafsson 1981; Gustafsson & van Nieukerken 1990) by the large headcapsule, which is wider than long, the complete absence of microtrichia, the presence of D1 (named D2 by Gustafsson) on the mesothorax and the labial palpus which has a very long segment 2, but otherwise confirms with the generic description. Only *Trifurcula (Glaucolepis) headleyella* (Stainton, 1854) and *T. (T.) subnitidella* (Duponchel, 1843) have also 12 setal pairs on the mesothorax, the other studied Nepticulidae have only 11 (Gustafsson 1981; Gustafsson & van Nieukerken 1990; Hoare 2000). No setal map of a species of *Trifurcula* (s. str.) had been published previously.

Pupa (Figs. 8, 22–24). Pupal exuviae examined. Frons protruding slightly into conical projection, eyecaps large, at eclosion torn from frons. Abdominal tergites 2–8 covered with many spines, in about 3 to 5 rows per segment, but not arranged in distinct rows. Cremaster with two small hooks.

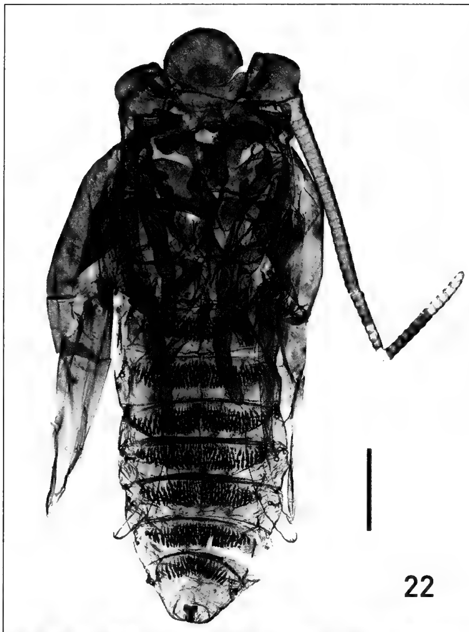
Distribution

Localities in Poland (Fig. 25). As a result of our studies, *T. pallidella* was found in 30 localities in south-east and east Poland. They are listed in Tab. 1 and presented on a map (Fig. 25).

The species reaches in Poland its northern distribution limits. The locality Grzybowce is the northernmost locality of this species in central Europe, but the Russian record in Ul'yanovsk Oblast is just a little further to the North.

European distribution (Fig. 26). In Tab. 2 we present all more or less reliable literature records and material seen by EvN or identified by colleagues sorted by country and locality. Since the previous revision of this species (van Nieukerken & Johansson 1986), many more data have become known, from which it appears that the previous suggestion that 'literature records can not be used at all' was too rigid. It is clear that the name *T. pallidella* was incorrectly used for *T. beirnei* in Great Britain, Denmark and parts of Germany and Poland. We have now also established that all previous records from France, Portugal and Spain are incorrect (van Nieukerken *et al.* 2004a, 2005): they are misidentifications for a number of pale *Trifurcula* species including *T. immundella*. From the overlapping part of the distributions of *T. pallidella* and *T. beirnei*, the records from Austria: Stelzing (Zeller in Krause 1871), Germany: Altenburg (Krause 1871; Borkowski 1975) and Poland: Sobótka (Zobten) (Wocke 1874; Puplesis 1984) definitely apply to *T. beirnei*. Two of the four localities on the Monte Baldo (Burmann & Huemer 1998), namely those in higher altitudes, refer to an unnamed species that is associated with *Genista radiata* (L.) Scop. (= *Cytisanthus radiatus*) (P. Huemer, *in litt.*) Other sources are reconsidered here in Tab. 2.

Many of the records presented in Tab. 2 are corroborated by either original material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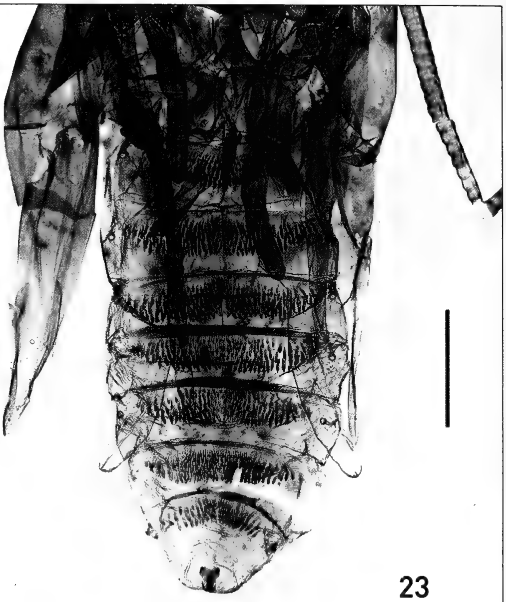
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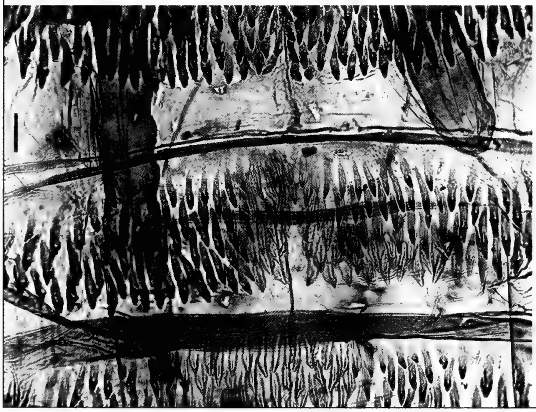
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Figs. 22–24. *Trifurcula pallidella*, pupal skin, dorsal view, Korhynie. Scales 500μm, 50μm (**24**). Photos: E.J. van Nieukerken.

or later findings. Others which have not been corroborated, are quite likely to be correct, but confirmation is still required (Italy: Pisa, Croatia, Macedonia, Rumania): they are all within the area where the known hosts occur and where the occurrence of *T. pallidella* is likely. Most problematic are records at the margin of the distribution area. The occurrence in Germany: Regensburg was previously doubted, and Segerer (1997) wrote: 'unüberprüfbare Angabe'. However, the occurrence in Germany is here corroborated by three specimens from three localities in Bavaria, including Regensburg (see Fig. 17). The record from Baden-Württemberg (Wörz 1958) has still to be rejected; it is a curious misidentification: upon checking, the specimen (coll. SMNS) appears to be a worn female of *Stigmella floslactella* (Haworth, 1828).

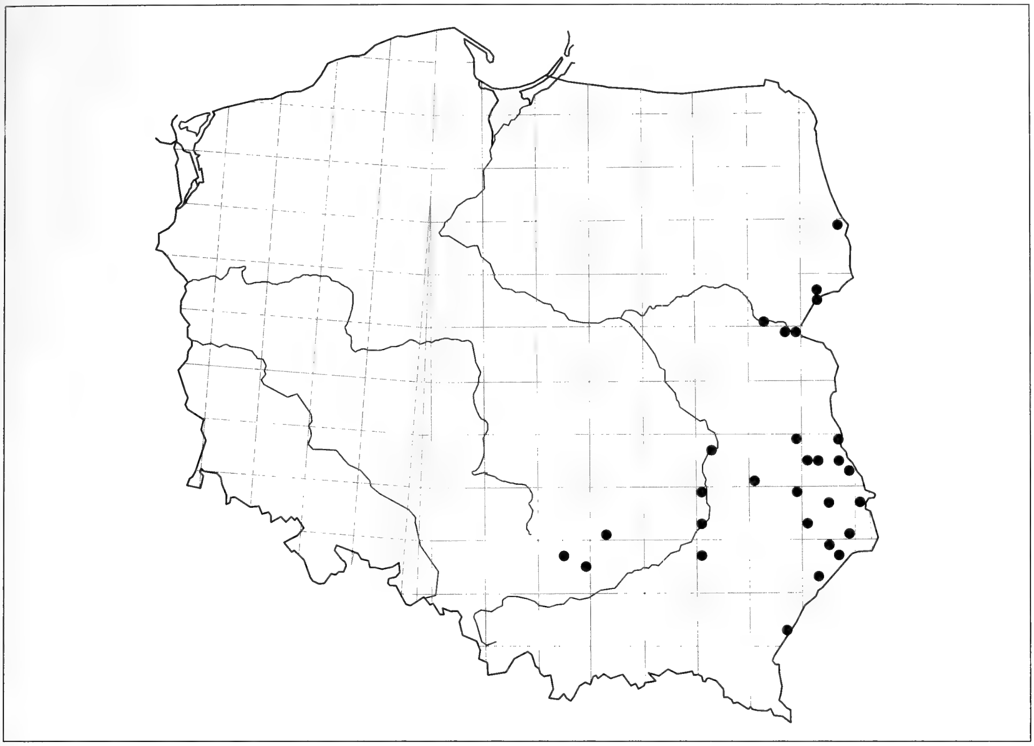

Fig. 25. Distribution of *Trifurcula pallidella* in Poland on 10km squares of the UTM grid.

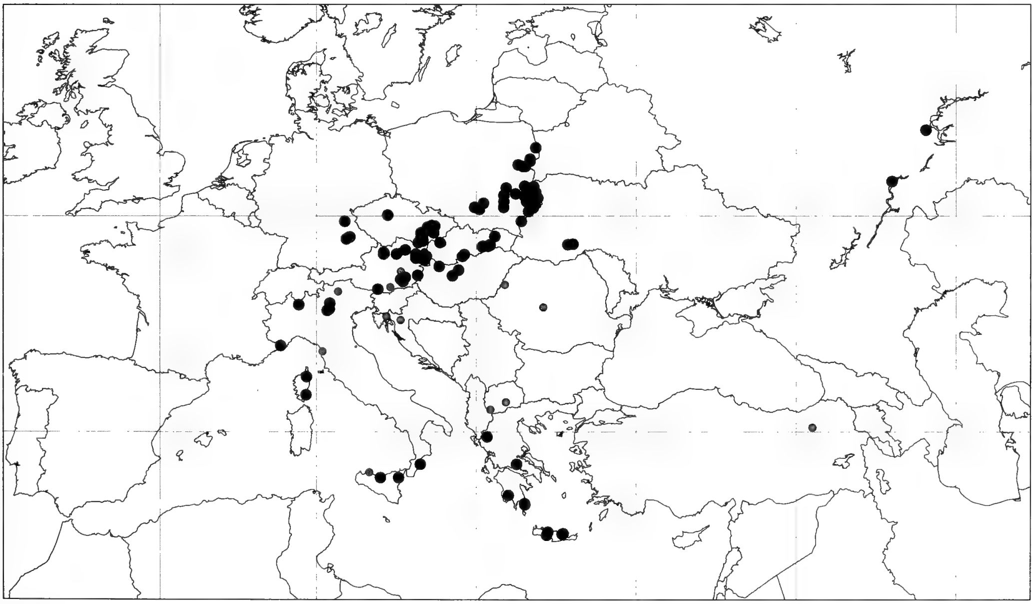

Fig. 26. Distribution of *Trifurcula pallidella*. Small grey circles: unconfirmed but not rejected literature records, large black circles: records confirmed by material, or reliable literature records. Grey shading gives the combined distribution of the hosts *Lembotropis nigricans* and *Chamaecytisus* spp. of the series *Tubocytisus* s. str. (Cristofolini 1991).

Tab. 1. Localities of *Trifurcula pallidella* in Poland and rearing results. UTM coordinates given as 10km squares, all in zone 34U. Hostplants: *Ca* = *Chamaecytisus albus*, *Cra.* = *C. ratisbonensis*, *Cru* = *C. ruthenicus*, *Ln*= *Lembotropis nigricans*. Other abbreviations: Chr. = *Chrysocharis* sp. (parasite), M = *Mirax rufilabris* (parasite), * = material sent to and reared in Leiden (in coll. RMNH). All material collected by A. Mazurkiewicz and / or K. Pałka.

Region	**Locality**	**UTM**	**Habitat**	**Host**	**Stage**	**Date**	**reared**
Lublin Upland	Brzeźno village	FB96	xerothermic rail-way embankment	*Cru*	old galls	8.v.2004	
	Brzeźno res.	FB87	edge of calcareous peat-bog	*Cru*	larvae	5.x.2002	3♂, 3♀, 5 M
					old galls	28.v.2004	
	Czumów	GB03	grassland on loess	*Cru.*	galls	15.x.2001	
	Gródek	GB03	grassland on loess	*Ca*	galls	11.xi.2004	
	Podzamcze res.	FB05	grassland on limestone rocks	*Cru*, *LN*	galls	7.x.2001	
				Cru	larvae	5.x.2002	2♀, 1 M
					1♂, 1♀	24-28.v.2004	
	Rogów res.	FB73	grassland on limestone rocks		1♂,1♀	25.v.2004	
	Skarpa Dobrska res.	EB68	grassland on loess		1♂	12.vi.1997	
				Cru, *LN*	galls	7.x.2001	
	Skarpa Dobużańska res.	FB90	grassland on loess	*Cru*	galls	15.x.2001	
	Stawska Góra res.	FB67	grassland on limestone rocks	*LN*	larvae	6.x.2001	2♂, 2♀
					larvae	3.x.2002	1♂, 21 M*
					larvae	10.x.2002	2♂, 5 M
	Tarnogóra	FB44	grassland on loess	*Cru*	galls	8.x.2000	
	Zalesie Kraszeńskie	FB57	xerothermic rail-way emb.	*Cru*	old galls	13.v.2004	
Małopolska Upland	Biała Góra res.	DA28	grassland on limestone rocks	*Cru*	galls	3.xi.2001	
	Biedrzychów	EB54	grassland on loess	*LN*	galls	2.x.2001	
	Góry Pieprzowe res.	EB51	grassland on loess		1♂	29.v.1995	
					2♂	2.vi.2001	
				Cru	larvae	3.x.2002	1♂, 1♀, 1 Chr, 6 M*
	Pińczów	DB60	grassland on gypsum	*LN*	galls	4.xi.2001	
					galls	10.x.2004	
	Wały res.	DA47	grassland on limestone rocks	*Cru*	galls	3.xi.2001	
Podlasie	Ciesacin res.	FB49	neutral grassland on sand on the edge of peat-bog	*Cru*	old galls	9.v.2004	
	Dobrowoda	FD62	grassland on gravel	*Cra*	galls	2.x.2002	*
	Drohiczyn	FD10	grassland on gravel	*Cru*	galls	2.x.2002	*
	Grzybowce	FD89	grassland on gravel	*Cru*	galls	9.x.2004	
	Mielnik – Przedmieście	FC49	grassland on gravel	*Cru*	galls	7.x.2001	
	Osłowo	FC39	grassland on gravel	*Cru*	galls	2.x.2002	9 M*
	Stare Stulno	FB89	neutral grassland on sand	*Cru*	galls	6.x.2001	
	Witowo, in Białowieża Primeval Forest	FD63	grassland on gravel	*Cru*	galls	2.x.2002	*
	Zagórze	FC39	grassland on gravel	*Cru*	galls	7.x.2001	
Roztocze	Biała Góra	FA79	grassland on limestone rocks	*Cru*, *LN*	galls	15.x.2001	
	Kąty II	FB51	grassland on limestone rocks	*Cru*, *LN*	galls	8.x.2000	
	Korhynie	FA88	grassland on limestone rocks	*Cru*, *LN*	galls	14.x.2001	
					galls	3.x.2002	4 M*
	Machnów	FA88	grassland on limestone rocks	*Cru*, *LN*	galls	20.x.1998	
					galls	25.ix.2004	
	Radruż	FA66	grassland on limestone rocks	*Cru*	larva	24.ix.2004	
Sandomierz Lowland	Nowa Dęba	EA58	neutral grassland on sand		1♂	3.vi.1998	
				Cru	galls	2.x.2001	
Przemyśl Hills	Złota Góra	FA31	grassland on gravel	*Cru*	galls	1.x.2001	

Tab. 2. Records of *Trifurcula pallidella*, except for Poland. The countries are indicated by their ISO codes, and some provinces abbreviated. Hostplants: *Ca* = *Chamaecytisus austriacus*, *Ch* = *C. hirsutus*, *Cr* = *C. ratisbonensis*, *Ln*= *Lembotropis nigricans*. Abbreviations: AZL = A. & Z. Laštůvka, EvN = E. van Nieukerken. Collection codons follow Evenhuis & Samuelson (2004). Reliability: ! after collectioncodon: material seen by EvN; ? not impossible, fits in distribution and biology, but confirmation required, ?? questionable (but not completely rejected). The remaining literature references are either reliable (genitalia check, recent authors, galls or circumstantial evidence) or at least likely records.

Key to sources: 1. Anikin 2001, 2. Baudyš 1925, 3. Baudyš 1931, 4. Baudyš 1947, 5. Burmann & Huemer 1998, 6. Caradja 1899, 7. Caradja 1901, 8. Černik 1942, 9. Curó 1883, 10. Czekelius 1924, 11. Hartig 1964, 12. Hauder 1912, 13. Hauder 1924, 14. Herrich-Schäffer 1847-1855, 15. Hrubý 1964, 16. Issekutz 1972, 17. Kasy 1985, 18. Klimesch 1949, 19. Klimesch 1961, 20. Klimesch 1968, 21. Klimesch 1990, 22. Laštůvka 1994, 23. Z. & A. Laštůvka 1994, 24. A. & Z. Laštůvka in litt., 25. Mann 1862, 26. Mann 1866, 27. Mann 1869, 28. Mann 1885, 29. Mariani 1938, 30. Mariani 1943, 31. Müller-Rutz 1922, 32. Nickerl 1908, 33. van Nieukerken & Johansson 1986, 34. van Nieukerken et al. 2004, 35. Pável & Uhryk 1896, 36. Prohaska & Hoffmann 1929, 37. Pröse & Segerer 1999, 38. Puplesis 1994, 39. Rebel 1899, 40. Schmid 1886, 41. Skala 1933, 42. Szőcs 1965, 43. Tokár et al. 1999, 44. Toll 1936, 45. Toll 1938, 46. Vorbrodt 1932, 47. Zeller 1850, 48. Zimmermann 1944b, 49. Zimmermann 1944a.

Country, Locality		**collector**	**stage, host**	**Source**
AT: BU	Bruck an der Leitha, Spitalberg	Preissecker	1♂	19, 49, NMW!
	Rechnitz, Donatikapella	Koschabek	1♂	16, 19
	Schieferberg, Leithagebirge	Kasy	1♂	33, NMW!
AT: KÄ	Villach	Preissecker	1♀	NHMB!
AT: NÖ	Fürbachwiesen, Gramatneusiedl	Kasy	4♂	17, 33, NMW!, RMNH!
	Hundsheimer Berg	Kasy	1♂	33, NMW!
	Jauerling	Preissecker		49
	Mödling [Goldene Stiege]		1♂	HNHM!
	Oberweiden	Preissecker		49
	Ostrong [Klimesch Haide]	Preissecker	1♂	21, 49, NMW!
	Pfaffstätten		1♀	HNHM!
	Stein a. D., Goldburg	Preissecker	1♂	49, NMW!
	Ysper	Preissecker	1♂	49, NMW!
AT: OÖ	Berg (Alpenvorland)	Wolfschläger		12, 21, 41
	Bergham	Wolfschläger		13, 41
	Diessenleiten	Hauder		13, 21, 41
	Ebelsberg (Alpenvorland)	Klimesch	[1♀!]	21, ZSM!
	Koglerau, Waldblösse	Knitschke	1♂	12, 21, 41, NMW!
	Linz, Linz kgl. [Koglerau]	Hauder	3♂	NHMB!, ZFMK!
	Linz-Uhrfahrwänd	Klimesch	[1♂!]	18, 21, ZSM!
AT: ST	Bruck a. Mur	Klimesch		19
	Graz; Graz, Plabutsch		9♂	33, 36, HNHM!, NHMB!, NHRS!, NMW!
	Premstätten	Prohaska	1♂	36, HNHM!
	Weiz	Knitschke	2♂	NMW!
AT: WI	Wien	Mann	4♂	14, 33, MNHN (LT)!, BMNH!
	Laaerberger Remisen	Mann		28, 49
	Mauer	Mann	1♀	19, 28, 49, NMW!
	Rodaun	Mann		19, 28, 49
	Tivoli	Mann		28, 49
	Wien, Dornbach		1♂	NMW!
CH	Ticino: Maroggia	Krüger	1♂	31, 46, NHMB!
CZ:Boh	Praha (Prag-Krtsch)	Nickerl		23, 32, 48

Country, Locality		**collector**	**stage, host**	**Source**
CZ:Mor.	Brno		gall, *Ln*	2
	Bulhary	AZL	larvae, *Ca*	22, 23
	Čelechovice na Hané	AZL		23, AZL!
	Dětkovice	AZL	15♂	23, RMNH!
	Dolní Dunajovice	AZL	larvae, *Ca*	23
	Hrušovany nad Jevišovkou	AZL	larvae, *Ca*	23
	Kvasice, Kvasická skála rock	Zavřel	gall, *Cr*	4
	Mikulov, Stráně u Sedlece	Picbauer, AZL	gall, *Ca*	4, 22,
	Mikulov, Pavlovské vrchy, Stolová h.	EvN	gall *Ca*	RMNH!
	Myslejovice	AZL	1♂	23, AZL!
	Olomouc, Neboteiner Berg	Černik	*Cr, Ln*	8
	Pouzdřany	Picbauer	gall, *Ln*	2
	Tuřany		gall, *Ln*	2
	Vicov	AZL	1♂	23
	Vranovice	AZL, EvN	7♂, 2♀, e.l. *Cr*	23, RMNH!
DE: BA	Grafenwöhr	Klimesch	1♂	ZSM!
	Kelheim Donau: Auf der Brand	E. Jäckh	1♂	USNM!
	Regensburg [Tegernheimerberge]		1♂	14, 37, 40, ETHZ!
FR– 2A	St. Lucia di Porto Vecchio	Liška	1♂	24
FR- 2B	15 km S. Bastia	Karsholt	1♂	24, ZMUC
GR–CR	Irakleio: Potamies	Johansson	2♂	RMNH!, Johansson!
	Irakleio: Stalis, Chersonisos	Bengtsson	2♂	Bengtsson!
	Rethymno: Plakias	Johansson	1♂	Johansson!
	Rethymno	Johansson	1§	Johansson!
GR	Fthiotis: Delfoi	Selling	1♂, 1♀	ZMUC!
	Ioannina: Asprángeli	AZL	2♂	24
	Lakonia: 5 km S Monemvasia	Skule,Christ.	1♂, 1♀	33, ZMUC!
	Lakonia: 7 km SW Monemvasia	Skule	1♂	33, ZMUC!
	Messinia: Messini	Horak	1♂	33, ZMUC!
HR	Josipdol			35?
	Rijeka (Fiume) (Istria)			30, 35?
	Dalmatia [no detail]			27?
HU	Budakeszi, Hársbokorhegy			42
	Nadap	Gozmany	1♂	42, HNHM!
	Nyír, Kecskemét	Klimesch	1♂	ZSM!
IT	Bolzano	Hedemann		11, 30, 39
	Bolzano: Renon: Collalbo	Hartig	1♂	11
	Catanzaro: Sta Catarina dello Ionio	AZL	1♀	24
	Imperia: Pieve d.T., Monesi	Liška	2♂	24
	Pisa	Mann		9, 14, 30, 47
	Trento: Pietramurata nei boschi	Jäckh	1♂	photograph in RMNH! [USNM]
	Verona: Mte Baldo, Ferrara + Pai	Burmann		5
IT-SIC	Messina: Francavilla di Sicilia	AZL	1♀	24
	Palermo: Castelbuono	AZL	1♂	24
	Palermitano (Sicilia)	Mann		9, 30
	Palermo: Vallecorta			29
	Palermo: San Martino delle Scale	Klimesch	3♂, 1♀	ZSM!
MK	Drenovo-Kav.	Klimesch		20
RO	Sibiu (as Hermannstadt)	Prall		10?
	Tulcea (as Tultscha)	Mann		6, 7?, 26
RU	Saratov	Anikin		1, 38
	Ul'yanovsk: Srednikovo, Povolzhye	Zolotuhin	1♂	34, coll. Zolotuhin!
SI	Carniola	Mann		9?
SK	Čebovce	AZL	2♂	23, AZL!
	Kočovce (Kocsócz)			15, 23?, 35
	Nové Mesto nad Váhom	Patočka		15, 23
	Plešivec	AZL, Patočka	1♂, *Ch*	23, 43
	Plešivec, Slov. Kras.: Hôrka	EvN	2♂, 2♀ e.l., *Ch*	RMNH!
	Velký Šariš, Prešov	Suza	gall, *Ca*	3
	Zádiel, Slovensky Kras	AZL, EvN	3♂, 1♀, el *Ln*	23, AZL!, RMNH!
TR	Bursa (Brussa)	Mann		25??
UA	Borshchiv area, S: Babuchow	Toll		44, 45
	Zalishchyky area: Obizowa	Toll		44, 45

The old record from Turkey (Mann 1862) is questionable: in Turkey occurs also a large pale species of *Trifurcula (Glaucolepis)*, which could easily be confused, but the occurrence of *T. pallidella* in Turkey is also to be expected.

The record of *T. pallidella* in September by Schmid (1886) is probably a misidentification for *T. beirnei*, likewise the August record from Macedonia (Klimesch 1968) is not accepted, but in both cases earlier records in the same area are considered as possibly correct *pallidella*. The record from 'Alpi Marittimi' (Mariani 1943) may refer to the incorrect record from the French department Alpes Maritimes (Cannes), but the recent record from Mónesi in the Alpi Marittimi very close to the French border also confirms its occurrence here in Italy. This also makes it more likely that real *T. pallidella* can after all be found in the French Department Alpes Maritimes.

In summary, *T. pallidella* is distributed from Southeast Germany (Bayern), east into Bohemia, Moravia, Slovakia, adjacent SE Poland, much of Austria, both along the Danube and East and South of the Alps, extending through the Balkans (with very few verified records) to southern Greece (Peloponnesus) and Crete, eastwards through Ukraine and Russia to the Volga, and one questionable record from Turkey. To the West it occurs in northern Italy almost reaching France, just extending into Switzerland (Ticino), and throughout Italy to Sicily and Corsica.

Habitats. In Poland and Slovakia the species was found in warm and dry grasslands or open woodland, often on calcareous soils, but also on sand or gravel (Figs. 1, 2, 4, Tab. 1). In one case (Brzeźno reserve, Fig. 3) it was found in a relatively wet habitat on the edge of a calcareous bog. Elsewhere in Europe it occurs in a variety of habitats, although usually on relatively warm places: often sunny slopes in river valleys, such as that of the Danube in Germany, Austria and Hungary. The hosts are frequently associated with *Quercus pubescens* woodland. The localities in Corsica, Greece and Crete are Mediterranean shrubland (garrigue, maquis or phrygana), often close to the sea. The altitudinal range is from sea level to 1000 m, with one record at 1600 m in Italy (Imperia, Monesi, Alpi Marittimi).

In 2001 and 2002 the species was extremely abundant in Poland, and larvae could be found in large numbers in most places. In contrast to that, in October 2004 almost no larvae or galls could be found in several of the same localities. Most localities in Central Europe are in Nature reserves, and the species may be vulnerable to increasing pressure by agricultural development and manure.

Discussion

Distribution and hostplant relationships. *Trifurcula pallidella* occurs commonly in many parts of the distribution area of its presumed hosts and is much more common than previously assumed (van Nieukerken & Johansson 1986). However, it has as yet not been found in the more western part of the distribution area of species of *Chamaecytisus*, e.g. France, parts of Germany and Spain. On the other hand, the distribution of *T. pallidella* cannot be explained completely by the distribution of the known hosts in the southern part of its range: no species of *Lembotropis, Chamaecytisus* or *Cytisus* sect. *Corothamnus* are known from Corsica or Sicily, and the relatively common occurrence of *T. pallidella* in southern Greece and Crete, contrasts with the sparse occurrence of just a few species of *Chamaecytisus*. In fact in this part of Greece and Crete only three species of brooms are frequent: *Calicotome villosa* (Poiret) Link, *Spartium junceum* L. and *Genista acanthoclada* DC. (Turland *et al.* 1993, EvN, personal observation in Peloponnesus).

Recent studies on the molecular phylogeny of the Genisteae (Cubas *et al.* 2002) support at least two large monophyletic clades: a *Genista* group and a *Cytisus* group. Käss & Wink (1995; 1997) find support for a division of the *Cytisus* groups in two clades using rbcL sequences and Neighbour Joining, in which *Chamaecytisus* is polyphyletic and dispersed over both clades, but all hostplants of *T. pallidella* in the analysis, group together with *Cytisus multiflorus*, *C. arboreus* and *Calicotome villosa*. However, in the ITS sequence and in MP analyses of both genes (Käss & Wink 1997), a monophyletic *Cytisus* group including *Calicotome* is supported. These authors therefore suggest to synonymise the genera *Lembotropis, Chamaecytisus* and *Calicotome* with *Cytisus.* Combining these results with the previous observations leads to the hypothesis that in the Mediterranean region *Calicotome* is a very likely alternative hostplant for *T. pallidella*, and that *T. pallidella* is specialised on a number of species (but not all) within the *Cytisus* clade.

There is an interesting parallel with the *Trifurcula immundella* species complex: this is a group of very closely related species, which feed on about the same hosts as *T. pallidella*, but the species in this complex are almost strictly monophagous: each feeds on only one or a few related hosts: *T. immundella* feeds on *Cytisus scoparius* (L.) Link, *T. moravica* Z. & A. Laštůvka, 1994 on *Lembotropis nigricans, T. corothamni* Z. & A. Laštůvka, 1994 on *C. procumbens*, *T. chamaecytisi* on *Chamaecytisus* and *T. calycotomella* A. & Z. & Laštůvka, 1997 on *Calicotome* spp. (Z. & A. Laštůvka 1994): all feeding on the *Cytisus* group and these species – apart from *T. immundella* – have combined the same host range as *T. pallidella.*

Galling. *Trifurcula pallidella* is the only species of the genus causing galls, the other species of the subgenus *Trifurcula* exclusively making stem-mines (van Nieukerken 1990; Z. & A. Laštůvka 1994; A. & Z. Laštůvka 1997), and most representatives of the other subgenera (*Levarchama* and *Glaucolepis*) make leafmines, a few *Glaucolepis* also stem-mines. The galls of *T. pallidella* in a way resemble the stem-mines, but the larva seems to feed in deeper tissue than is usual for *Trifurcula* (s. str.) species. It places *T. pallidella* in a rather isolated position in the genus, and also morphologically it is not very close to any other species. There is no apparent explanation why this species changed the stemmining habit into galling: on the same hostplants stem-mining species also occur as discussed above, so the plant itself cannot be the reason. The larva does not show special adaptations to the galling habit, it is only larger than most other Nepticulidae larvae, and the mandibular cusps are relatively strongly developed.

Galling has originated several times independently in the Nepticulidae: there are at least three other examples. The North American type species of the genus *Ectoedemia* (which means as much as an external swelling), *Ectoedemia populella* Busck, 1907 is causing globular galls in the petiole of *Populus* (Busck 1907). Related species in the *populella* species group also cause thickened petioles by their feeding habit, but these are not considered real galls. Most likely *E. populella* evolved from a petiole mining species. *Ectoedemia (Zimmermannia) castaneae* Busck, 1913, another North-American species, makes galls on bark of *Castanea* (Busck 1913), and probably evolved from barkmining species. Further *Ectoedemia (Fomoria) nigrifasciata* (Walsingham, 1908) from the Canary Islands makes a combined gall and mine in the Apocynaceae *Periploca laevigata* Ait. (Klimesch 1972); its closest relatives are leafmining on *Euphorbia.*

For two species of *Trifurcula* the larval way of feeding is still unknown: *T. beirnei* and *T. squamatella* Stainton, 1849. Both are relatively large species (the largest in the genus), associated with resp. *Genista* species and *Cytisus scoparius.* It is well worth considering the possibility that they are also gall makers, when searching for their larvae.

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Lomaspilis bithynica Wehrli, 1954 stat. rev., a distinct species new for Europe (Geometridae)

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Abstract. *Lomaspilis bithynica* Wehrli, 1954 formerly treated as a subspecies of *L. opis* (Butler, 1878) is recognized as a distinct species after an examination of the holotype and additional material. A differential diagnosis is given to distinguish the species from the other two Palaearctic members of genus *Lomaspilis* Hübner, [1825]. The external and genital features of the three species are figured. *L. bithynica* has been recorded from the Turkish provinces of Bolu, Trabzon, Çankiri, Erzurum, Erzincan, Artvin, Rize, and Kars. It is recorded here for the first time from Europe based on specimens collected recently in central Greece. Data on bionomics are also given.

Zusammenfassung. *Lomaspilis bithynica* Wehrli, 1954 stat. rev., die früher als Unterart von *L. opis* (Butler, 1878) galt, wird nach Untersuchung des Holotypus und weiteren Materials in den Artstatus erhoben. Eine detaillierte Diagnose gestattet es, die Art von den beiden anderen palaearktischen Arten der Gattung *Lomaspilis* Hübner, [1825] zu unterscheiden. Ihre äußeren Unterscheidungsmerkmale sowie die der Genitalapparaturen werden abgebildet. Nach unserer Kenntnis wurde *L. bithynica* in den türkischen Provinzen Bolu, Trabzon, Cankiri, Erzurum, Erzincan, Artvin, Rize und Kars gefunden. Die Art wurde neuerdings auch in Zentral-Griechenland nachgewiesen, was einen Erstnachweis für Europa darstellt. Erstmalig werden auch Daten zur Lebensweise von *L. bithynica* publiziert.

Key words. Lepidoptera, Geometridae, *Lomaspilis*, *bithynica*, Turkey, Greece, Europe, species status, morphology, distribution, host plant.

Introduction

Scoble (1999) lists only two species in the genus *Lomaspilis* Hübner, [1825]: *L. marginata* (Linnaeus, 1758) and *L. opis* (Butler, 1878), the latter represented by four subspecies: the nominotypical *L. o. opis* from Japan, *L. o. amurensis* (Hedemann, 1881) from the Amur region, *L. o. nigrita* Heydemann, 1938 from Finland, and *L. o. bithynica* Riemis, 1992 from north-eastern Turkey (Prov. Erzurum). Viidalepp (1996) lists *L. amurensis* (Hedemann, 1881) as a subspecies of *marginata*.

L. opis bithynica Riemis, 1992 had been described as form "*bithynica*" of *Lomaspilis marginata* by Wehrli (in Seitz 1954). According to article 10.2 of the International Code of Zoological Nomenclature (1999), a form name is available if validly published before 1961. Because Wehrli's (1954) publication is valid, he correctly made *Lomaspilis opis bithynica* (cf. ICZN article 45.6) an available name in writing: "...Eine merkwürdige Form, vielleicht zu subsp. *opis* Btlr. ... gehörig, oder besondere Art oder Rasse, – form. *bithynica n.* (22 e) erhielt ich von Boli, Kleinasien (E. Pfeiffer) leider nur in einem ♀ Exemplar...". Riemis (1992) was not justified to redescribe this taxon as a new subspecies. Thus, *L. opis bithynica* Riemis, 1992 must be listed as a junior primary homonym of *L. opis bithynica* Wehrli, 1954.

During several trips to north and north-eastern Turkey, the senior author found several specimens of *L. bithynica* looking identical to those figured by Wehrli (1954) and

Riemis (1992). The first attempt to breed specimens of this *L. bithynica* population ex ovo on *Betula* spp., which are the only known host plants of *opis* (Skou 1984), was not successful. No larva fed on this plant and all died. In another experiment, *Salix* sp. and *Populus tremula* were additionally offered because *Salix* and *Populus* species are known to be the typical host plants of *L. marginata*, while *Quercus, Fagus, Betula*, and *Corylus* are also mentioned in the literature as occasional host plants (Bergmann 1955; Ebert et al. 2003). It was found that larvae of *L. bithynica* feed only on *Populus tremula*. These results were confirmed by other entomologists (T. Drechsel, B. Müller). *P. tremula* was common at all sites where *L. bithynica* was found. Consequently, we hypothesized that *L. bithynica* would not be a subspecies of *L. opis* Butler.
Comparative studies were done to answer this hypothesis. After detailed analysis of both male and female genitalia, we found that *L. opis bithynica* was not conspecific with *L. opis* or *L. marginata*. Consequently, we consider *L. bithynica* as a good species: *Lomaspilis bithynica* Wehrli, 1954 stat. rev. The key to solve this taxonomic problem was to apply the method of vesica eversion as improved by Sihvonen (2001). We also compared our material with the holotype of *L. bithynica* (Figs. 7–8) described and figured by Wehrli (1954) and the holotype of *L. opis bithynica* of Riemis (1992). East Palaearctic subspecies or forms of *L. opis* and *L. marginata* were not included in our studies.

Abbreviations

ZFMK	Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn
ZMA	Zoological Museum Amsterdam
ZSM	Zoologische Staatssammlung, Munich

Material. *L. bithynica* Wehrli, 1954: Holotype ♀ with labels: 'Asia min.[or] s. | Bithynia | Boli <sic> 11.–20.vi.[19]34 | 800 m | E. Pfeiffer - München leg.' (on white paper printed in black); '*bithynica* Wehrli *Lomaspilis* Hb. | Holo ♀ Type (on red paper handwritten and printed in black), ZFMK. – *L. opis bithynica* Riemis, 1992: Holotype ♂ with labels: 'TURKIYE St.1703 <?> | Erzurum Rd.[Road] Erzu- | rum-Ispir, 10 km SW | Ovacik, 2300 m | 2.vii.1991 | W.De Prins, D. v. d. | Poorten, A.Riemis' (on white paper printed in black); 'HOLOTYPE | Lomaspilis | opis bithynica | det. A. Riemis, 1992' (on red paper printed in black), ZMA. – **Turkey**: 2♂, Prov. Erzurum, Kaçkar Daği, Yaylalar, alt. ca. 1900 m., 4./5.vii.1983, M.-C. et F. Aulombard et J. Plante leg., ZSM; 22♂, 8♀, Dog. Karadeniz Dağlari: Korga Daği, Umg. Köprüköy bei Ispir, 1600–2000 m, 3.–8.vi.2000, Gelbrecht, Drechsel, Busse & Schwabe leg., (7♂, 8♀, ex ovo cult., emerged: 20.iv.2001–12.v.2001 and 7.x.2001 and iv.2002), coll. Gelbrecht et coll. Malkiewicz; 2♂, 1♀, same locality, 1600 m, 23.vii.2001, leg. et coll. Löbel; 1♂, same locality, 1600 m, 22.vi.2002, Gelbrecht & Schwabe leg., coll. Gelbrecht; 2 ex., same locality, 1600 m, 06., 24.vi.2003, leg. et coll. Müller; 1 ex., 9 km S Ispir im Tal des Çoruh, 1840 m, 23.vi.2001, leg. et coll. Ochse; 1♂, Kuzgun-Brj., Stausee, 2280 m, 22.vi.2003, leg. et coll. Müller. 1♂, Prov. Kars, Arastal, 15 km E Karakurt, 1400 m, 23.vii.1992, leg. et coll. Petersen; 1♂, Sarikames, 2000 m, 4.vi.2000, leg. et coll. Petersen. 1 ex., Prov. Artvin, Kaçkar Daği, ca. 1800 m, Yaylalar Umg., 17.vii.1995, leg. & coll. Noack; 2 ex., Kaçkar Daği / Bilek Daği, 7 km N Aksu, 1600 m, 16.vii.2001 leg. et coll. Ochse. Prov. Rize: 1♂, 1♀, Umg. Çamlik, 1500 m, 8.vi.2003, leg. et coll. Müller. 2♂, Prov. Trabzon, Ovit Daği, 5 km N Hotel Genesis b. Dereköy, 1200–1300 m, 29.v.2000, leg. Gelbrecht, Drechsel, Busse & Schwabe, coll. Gelbrecht. 1♀, Prov. Çankiri, Ilgaz Umgebung, 1400 m, 10.vi.–14.vi.1991, leg. et coll. Löbel; 1♀, Ilgaz Umgebung, 960 m, 16.vi.1992, leg. et coll. Petersen. **Greece**: 2♀, Aliakmon River, Ag.[ios] Georgios Grevena 600 m, 6.vi.1992, Müller et Kotitsa leg., ZSM.
L. opis nigrita: 3♂, 5♀, **Poland**, Mikaszówka, P.[uszcza] Augustowska, 1.–10.vii.1997, Malkiewicz leg.; 2♂, Gruszki, Puszcza Augustowska, 13.vi.1992, Kokot leg.; 1♂, Rygol, Puszcza Augustowska, 16.vi.1992, Kokot leg.; 1♂, Grudki, Puszcza Białowieska, 6.vi.2000, Kokot leg.; 2♂, 2♀, Puszcza Borecka, 1.–13.06.1994, Buszko leg.; 3♂, 2♀, Mostki, gm.[ina] Staszów, 6.vi.1990, Pałka leg.; all specimens in coll. Malkiewicz.

L. marginata: 3♂, 3♀, **Poland**, Szklarska Poręba G.[órna], 10.v.1990, 15.vi.1991, 20.vii.1991; 2♂, 2♀, Karpacz-Stanica, 22.vi.1990, 5.vi.1993; 1♂, Wrocław 14.vi.[19]84; 1♀, Czarny Dunajec, 15.vii.1993; all specimens leg. et coll. Malkiewicz; 1♂ Polska, Toruń, 10.v.1994, J. Buszko leg.; 1♂ Polska, DV25, Tatra Mts., 1100 m., Dolina Jaworzynka, 7.vii.2001, J. Buszko leg.; 1♀ Polska, Bory Stobrawskie, Dobrodzień, 11.v.1991, leg. A. Guziak; 1♀ Polska, distr. Żary, Pietrzyków, 11.v.1998, A. Kokot leg.

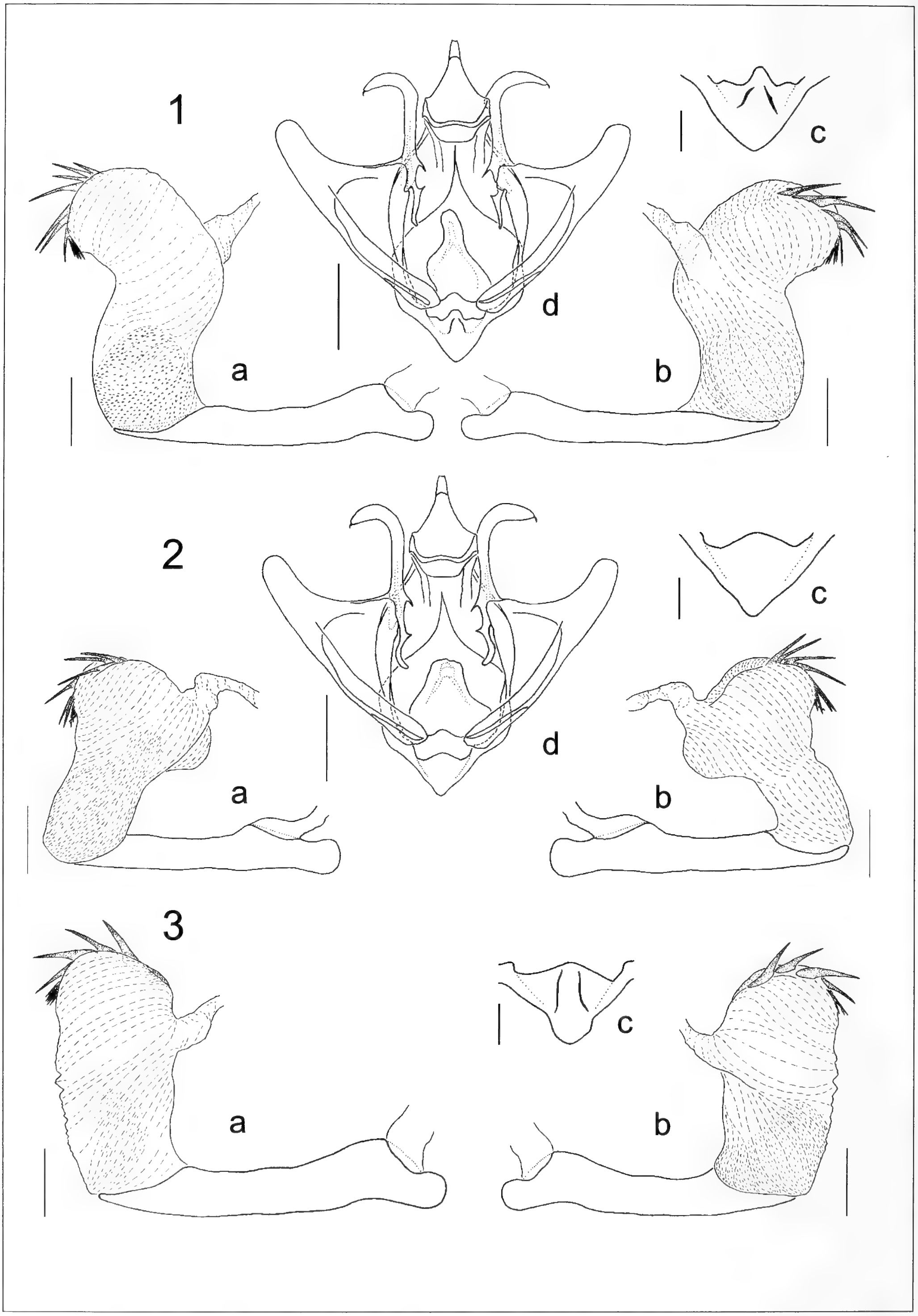
Lomaspilis bithynica Wehrli, 1954

Diagnosis. External features. Forewing length: male 14.0–15.0 mm (average 14.5), female 11.5–13.0 mm (average 12.3) (most females were bred). Forewing of *L. opis nigrita* males approximately 2 mm shorter (12.5 mm), whereas *L. marginata* males about 1.2 mm shorter (13.3 mm). Females of all three species similar in forewing length. Pattern of fore- and hindwings generally as in other two *Lomaspilis* species; differences expressed in shades and shapes of spots. Basal and median spots black with bluish suffusion. Terminal band pure black. Ground colour white, apart from costa (in bred females sometimes yellowish). Basal spot trapezoid, slightly concave between Cu and An veins, not oval as in *L. opis* and not as elongate as in *L. marginata.* Black medial band distal at M2 and CuA2 with two deep constrictions; at CuA2 often interrupted (Figs. 13–15). In *L. opis*, the medial band is broader, the concave constrictions are not so deeply, but mostly it is interrupted at CuA2. Terminal black band medial concavity deepest and more angled on both fore- and hindwing. Shape and continuity of medial band of both wings and width of medial concavity in terminal black band variable. *L. opis* wing pattern with similar variability, but medial band rarely continuous. Most important variation found in *L. marginata,* for which medial band can be reduced to one costal spot on forewings and nothing on hindwings.

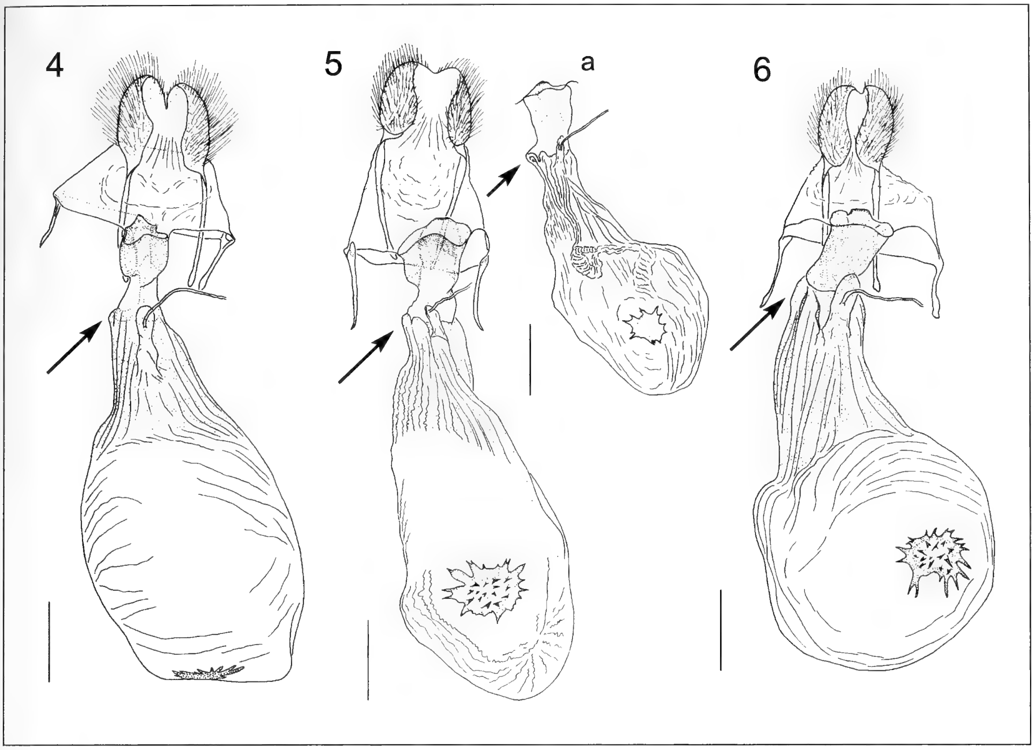
Male genitalia (Figs. 1–3). (*L. bithynica*: n=5; *L. opis nigrita*: n=10; *L. marginata*: n=6). Valva of *L. bithynica* distally slightly narrower than in *L. opis*, but almost uniform in shape in the three species. Basal process of costa hook-shaped, more sinuate and longer than that of *L. opis* and *L. marginata.* Medial part of costa curved abruptly, curved regularly in other two species. Saccus triangular without distinct pair of wrinkles in middle, but present in the two other species (Figs. 1c, 3c). Width of tip of costa variable in all species. Vesica pear-shaped: anteriorly narrow, medially becoming wider, posteriorly twice anterior width; anterior part covered with minute spines at one side; posterior end with one row of cornuti, attached opposite to ductus ejaculatorius; at base of ductus ejaculatorius, vesica forming a small globular diverticulum. The latter is absent in the other species in which the vesica is more simply built: elongate, cylindrical in *L. marginata* (Fig. 3) and kidney-shaped in *L. opis* (Fig. 1). Number, shape, and distribution of cornuti variable and not diagnostic (8–12 for *L. bithynica*, 12–15 for *L. opis*, 8–14 for *L. marginata*).

Female genitalia (Figs. 4–6). (*L. bithynica*: n=6 from Greece and Turkey; *L. opis nigrita*: n=9; *L. marginata*: n=6). Antrum cup-shaped, more strongly sclerotized posteriorly. Ostium comparatively wider than in *L. opis.* Colliculum large, strongly sclerotized; it is narrower in *L. opis* and only weakly developed in *L. marginata.*

Bursa copulatrix pear-shaped in *L. opis* and *L. marginata*, but in *L. marginata* more spherical anteriorly. In *L. bithynica* bag-shaped, highly dependent on maturation stage.



Figs. 1–3. Male genitalia of *Lomaspilis* spp. **1.** *L. opis nigrita* from Poland. **2.** *L. bithynica* stat. rev. from Turkey. **3.** *L. marginata* from Poland. **a, b.** Aedeagus with everted vesica (viewed from both sides). **c.** Saccus enlarged. **d.** General view with aedeagus removed (scale bar 0.5 mm).

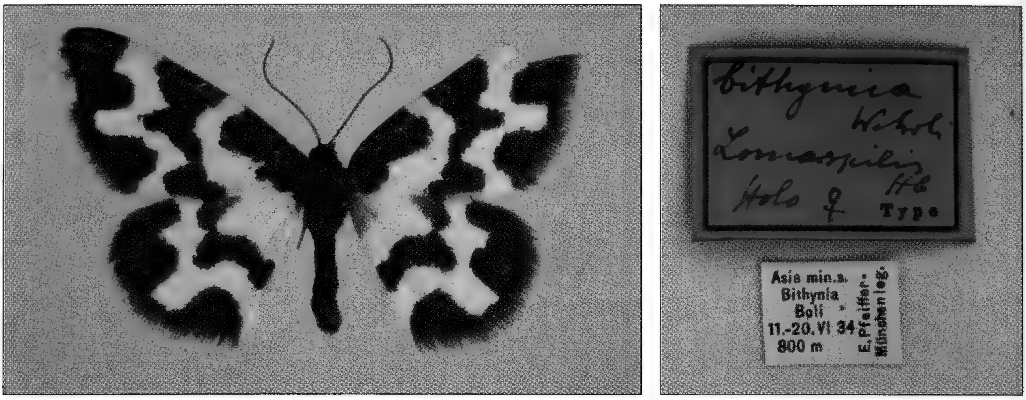


Figs. 4–6. Female genitalia of *Lomaspilis* spp., ventral view. **4.** *L. opis nigrita* from Poland. **5.** *L. bithynica* stat. rev. from Greece, Aliakmon River; **5a**. Bursa copulatrix of virgin female, not expanded from Turkey, Korga Daği, above Köprüköy near Ispir. **6**. *L. marginata* from Poland, Karkonosze Mts. (scale bars 0.5 mm).

Shape of asteroid signum strongly variable in all species; localized on ventral side of bursa in *L. bithynica* and *L. marginata*, but at bottom of bursa in *L. opis*.

Distribution. *L. bithynica* is known from many sites in northern and north-eastern Turkey and from one locality in Greece (Prov. Nomos Grevenon). This is the first record of this species for Europe. According to Ebert (pers. comm.) no specimens of the genus *Lomaspilis* are known from Iran. The distribution of *L. bithynica* is strongly isolated from that of *L. opis* which ranges from eastern Poland, eastern Slovakia and Finland through Russia and the East Palaearctic region (Malkiewicz & Sosiński 2000, Müller 1996, Skou 1984, Viidalepp 1996). *L. marginata* is a common species throughout most regions of Europe and its range extends to eastern Asia, southward to northern Turkey and the Caucasus.

Life history. Habitats of *L. bithynica* are deciduous forests with *Populus tremula*, the only known host plant, in mountains at an altitude of 600 m above sea-level in Greece and between 800–2,300 m a.s.l. in Turkey. This univoltine species flies from the end of May until the end of July. Under breeding conditions a few specimens of a second generation emerged in September and at the beginning of October. Adults were collected at light but also sometimes during the day like other *Lomaspilis* species.

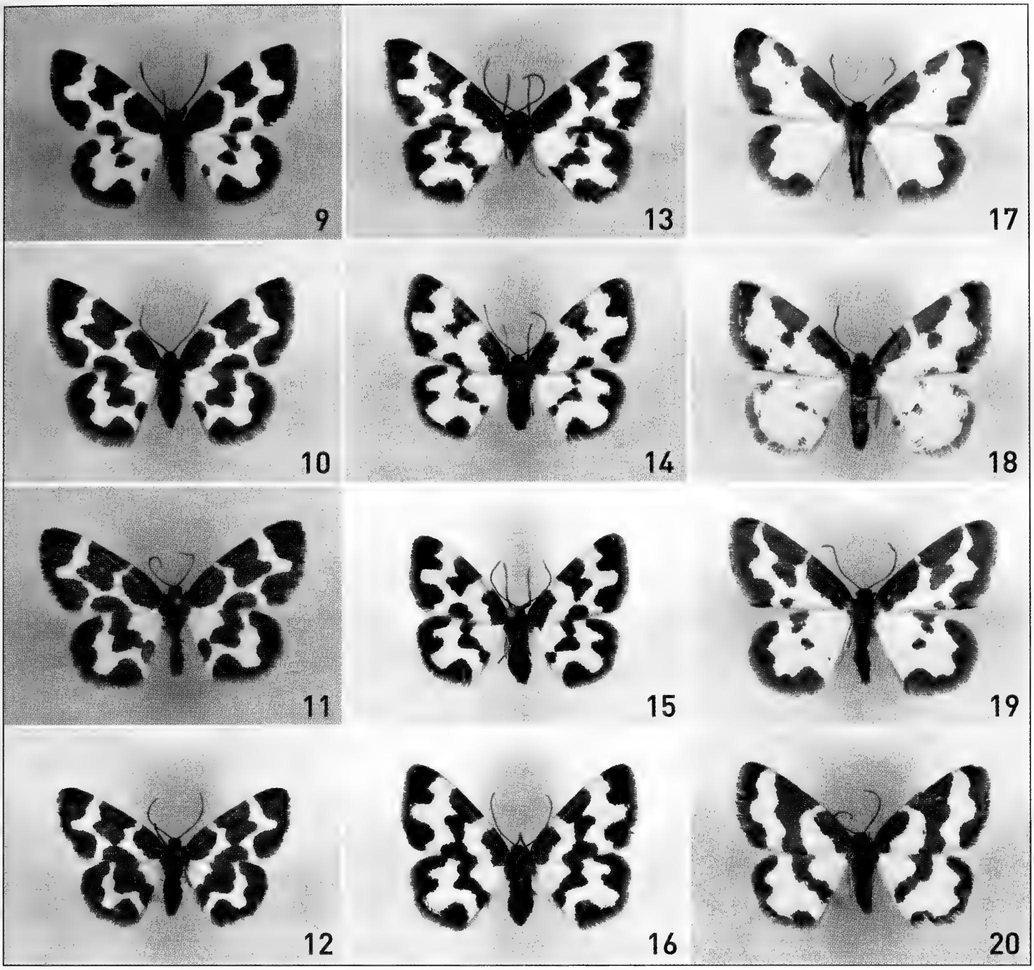


Figs. 7–8. Holotype of *Lomaspilis bithynica*, female (ZFMK).**7.** Specimen. **8.** Labels.

Discussion. Most authors of previous studies on the morphology and taxonomy of the genus *Lomaspilis* emphasized the poor or non-existent value of the male and female genitalia for determination at the species level (Wehrli 1954; Buszko & Bengtsson 1991; Riemis 1992). However, Heydemann (1936) recognized about 10 diagnostic characters in both sexes. According to our analysis only three of these are more or less useful: the shape of the saccus (and arrangement of wrinkles) in males, the shape of the bursa, and width of the ostium bursae in females. The other features listed by Heydemann are not suitable, particularly regarding the male's uncus, shape of the valva, the number and shape of the cornuti, and the shape of the signum in females. The last especially, repeated and illustrated by Riemis (1992), can be misleading because of wide intraspecific variability. The only reliable male character we could find is the form of the vesica. Another doubtful character regarded as diagnostic is the black colour of the dots and bands on the wings as well as on the head, thorax, and abdomen. In *L. bithynica* the black markings are not more black than those of *L. opis nigrita*, and both species are not always distinctive from *L. marginata* by the intensity of its black markings. There are some examples of *L. marginata* specimens that are more black than brown in collections and in the literature (Buszko & Bengtsson 1991). On the contrary, the pure white ground colour of the wings in *L. bithynica* seems to be diagnostic, at least for males.

Acknowledgements

The authors gratefully acknowledge Dr. D. Stüning, ZFMK, Bonn, for finding and taking a photograph of the holotype of *L. bithynica*, Dr. W. Hogenes, ZMA, Amsterdam, for the loan of type material, G. Ebert for information on the genus *Lomaspilis* in Iran, Dr. M. Nuss, Museum für Tierkunde Dresden, and Dr. W. Mey, Naturkundemuseum Berlin, for helpful comments on nomenclatural problems, Dr. A. Hausmann, München, for borrowing material from ZSM, Prof. J. Buszko, Torun and A. Kokot, Wrocław, for access to their collections, and T. Drechsel, Neubrandenburg, Dr. H. Löbel, Sondershausen, Dr. B. Müller, Berlin, D. Noack, Wildau, Dr. M. Ochse, Bad Dürkheim, M. Petersen, Darmstadt, for information on new records of *L. bithynica* and breeding experiments. We also thank two anonymous reviewers for improvement of the manuscript.



Figs. 9–20. Variability of wing pattern elements of *Lomaspilis* spp. **9–12.** *L. opis nigrita* from Poland: **9.** Male, Puszcza Borecka; **10–12.** Females, Mikaszówka, Płaska, Puszcza Augustowska. **13–16.** *L. bithynica* stat. rev. from Turkey: **13.** Male, **14–16.** Females, Korga Daği, above Köprüköy near Ispir. **17–20.** *L. marginata* from Poland: **17.** Male, Toruń; **18.** Female, Dobrodzień; **19.** male, Tatra Mts., Dolina Jaworzynka; **20.** Female, Pietrzyków.

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Leucoptera lathyrifoliella (Stainton, 1866) and *L. orobi* (Stainton, 1870): two distinct species (Lyonetiidae)

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Abstract. *Leucoptera lathyrifoliella* (Stainton, 1866) and *L. orobi* (Stainton, 1870) are considered distinct species on the basis of constant differences in the morphology of both male and female genitalia. No support was found for literature statements of differences in external appearance between the species. Likewise, the presumed differences in their host plants appear uncertain or erroneous, since both species exploit several host plant species in the plant genera *Vicia* and *Lathyrus*.

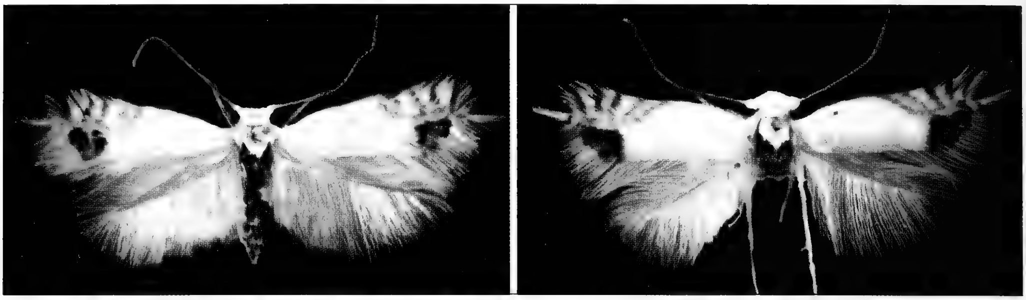
Key words. Lyonetiidae, *Leucoptera lathyrifoliella*, orobi, distinct species.

Introduction

Species of the genus *Leucoptera* Hübner, [1825] (Lyonetiidae) are very small moths with typically silky white or grey forewing ground colour and distinctive eye-spots at apex of the wing. The taxonomy of the West-Palaearctic species of the genus was recently revised by Mey (1994), who recognised twenty species to occur in the area.

Among the species, some uncertainty has occurred in the taxonomic status of *L. lathyrifoliella* (Stainton, 1866) and *L. orobi* (Stainton, 1870). Pierce & Metcalfe (1935) and Buszko (1981) illustrate the genitalia of these species. Their pictures, well in agreement with each other, display obvious differences between them. However, Mey (1994) considered them conspecific and accordingly synonymised *L. orobi* with *L lathyrifoliella*. Baraniak (1996) reports *L. lathyrifoliella* (including *L. orobi*) to occur in western, central and northern Europe. In Finland, both *L. lathyrifoliella* and *L. orobi* have been reported to occur. However, *L. orobi* was excluded from, e.g., the Finnish checklist (Varis et al. 1995) following Mey (1994). According to the literature, these species are identifiable by their wing pattern as well, and they are reported to have different host plants. *Lathyrus linifolius* (= *L. montanus*) is reported to be the host plant of *L. orobi*. The record of *L. tuberosus* as another host plant is considered a confusion due to plant nomenclature (Emmet 1985). *Lathyrus sylvestris* and *L. pannonicus* are listed as host plants of *L. lathyrifoliella* (Emmet 1985, 1988; Mey 1994).

The separation of these supposed taxa seems not possible using external appearance of adults. The wing pattern of both species varies more than mentioned in the literature, and differences suggested in the literature (e.g. hindwing fringe, cf. Emmet 1985) could not be verified after examination of over 50 specimens of both species. Moreover, both species have proven to exploit several host plants. Therefore, the host plant cannot be used as identification guide either. Yet, structures in both male and female genitalia possess features that constantly differ between the taxa *L. lathyrifoliella* and *L. orobi*. After examination of the genitalia of a considerable number of individuals



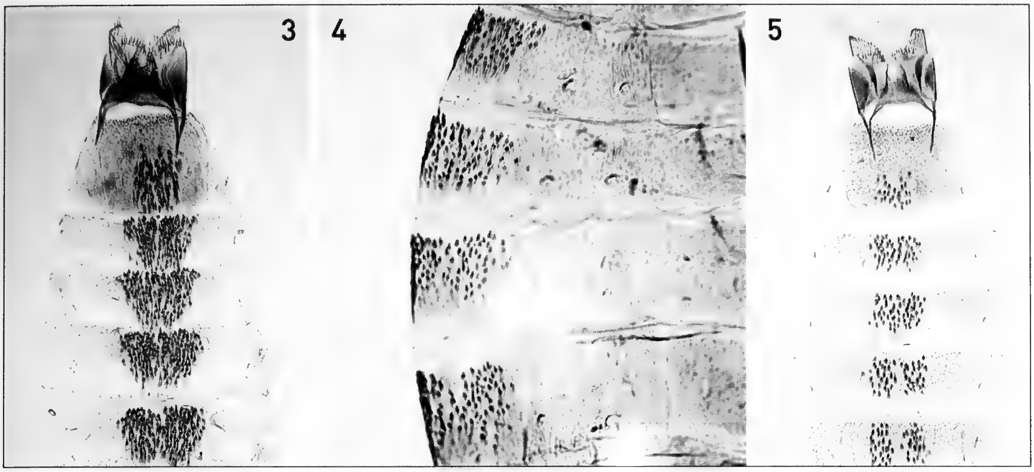
Figs. 1–2. Adults of *Leucoptera*. **1.** *L. orobi*. **2.** *L. lathyrifoliella*.

we suggest that *L. lathyrifoliella* and *L. orobi* are indeed distinct species, in agreement with Pierce & Metcalfe (1935) and Buszko (1981). In this paper we revise the taxonomy of *L. lathyrifoliella* and *L. orobi*, largely based on Finnish material. We provide diagnoses and illustrate the differentiating characters for these species.

The terminology follows Mey (1994). Material for the study was obtained from the following collections: BMNH (The Natural History Museum, London, U.K., K. Tuck), MNHB (Museum für Naturkunde, Humboldt-Universität Berlin, Germany, W. Mey.), MZH (Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland, L. Kaila), NMS (National Museum of Scotland, Edinburgh, Scotland, K. P. Bland) and the following private collections: Jari Junnilainen (Vantaa, Finland), Marko & Tomi Mutanen (Oulu, Finland), Kari Nupponen (Espoo, Finland) and Kari Vaalamo (Espoo, Finland).

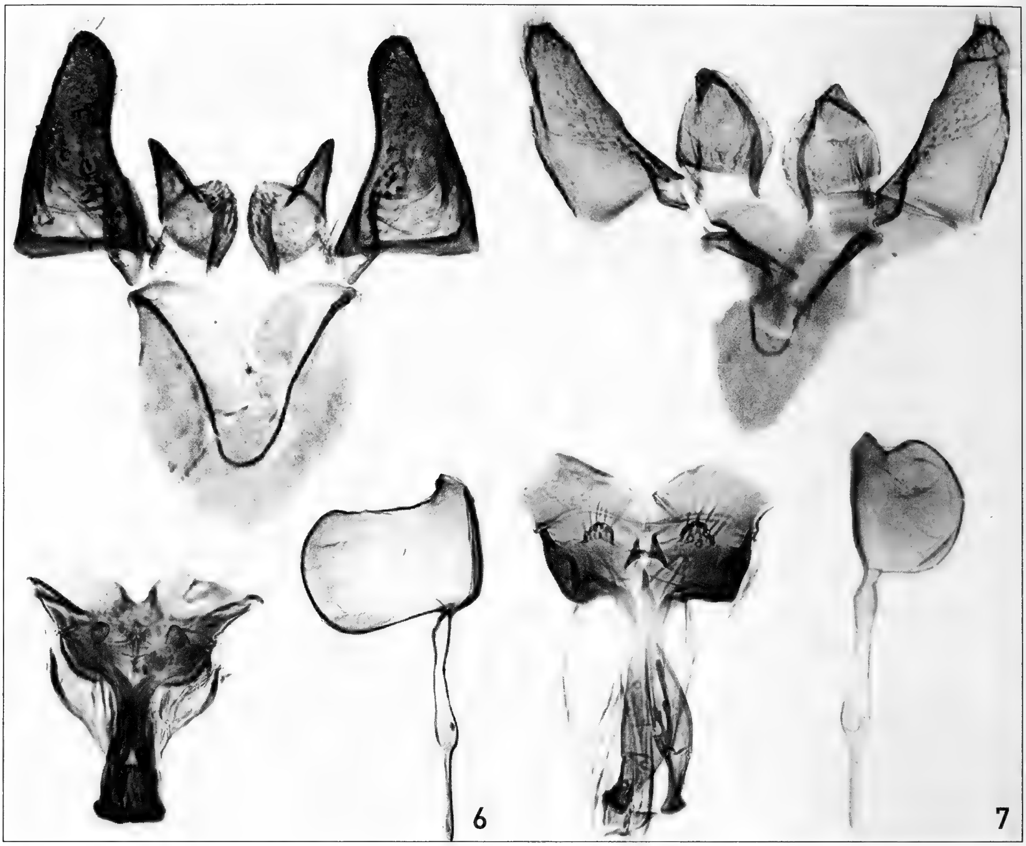
Leucoptera orobi (Stainton, 1870) Figs. 1, 3, 4, 6, 8, 9

Material. Lectotype ♀ slide of *Cemiostoma orobi* Stainton labelled: *Cemiostoma / orobi* STAINTON / lectotype / Scarboro / Mey 13/02 III. 02; BMNH Microlep. / 30226 / Euparal. BMNH, here designated. **Estonia:** Kogula, 20.vi.1994 1♀ J. Junnilainen leg. (slide BW 4891); Paldiski 2.vi.2000 1♂ J. Junnilainen leg. (slide BW 4292); **Finland:** Al: Kökar, Hamnö, 27.vi.1948 1♀ A. Nordman leg. (slide BW 4863), e. p. 1948 2♂ A. Nordman leg. (slides BW 4854, 4855); Kökar 666:15 24.vi.1991 1♂ J. Junnilainen leg. (slide BW 4890); EK: Virolahti 671:53 28.vi.1999 1♂ J.-P. Kaitila leg. (slide BW 4913); EH: Hattula 677:35, 9.vi.1988 1♂ Nupponen leg. (slide BW 4851); Somero 672:30 6.vi.2000 2♂, 1♀ T. Mutanen leg. (slides BW 4833, 4834 (♀), BW 4841 (♂)); 5.vi.2000, 1♂, 1♀ T. Mutanen leg. (slides BW 4835 (♀), BW 4840 (♂)), 13.vi.2000 1♀ T. Mutanen leg. (slide BW 4836); ES: Imatra 678:59, 14.vi.1998 1♂, 2♀ M. Mutanen leg., slides BW 4837 (♂), BW 4838 (♀) BW 4839 (♀); Imatra 678:59, 10–12.vi.2000 1♂, 3♀ B. Wikström leg. (slides BW 4843 (♀), BW 4844 (♀), BW 4845 (♀), BW 4846 (♂)); Joutseno 667:58 4.vi.1989 1♂ T. & K. Nupponen leg. (slide BW 4366), 10.vi.2000 1♂ B. Wikström leg. (slide BW 4818); **Latvia:** Skaune 18.v.1998 1♂ J. Junnilainen leg. (slide BW 4893); **United Kingdom:** Ballyvaghan Clare, 5.vi.1971 1♂ E. C. Pelham-Clinton leg., E.C.P-C.No. 27438 (ex larva *Lathyrus*), NMSZ 1989.035, (slide BW 4856, Coll. NMS); Ventnor, Isle of Wight 5.vi.1971 1♂ E. C. Pelham-Clinton leg., E.C.P-C.No.27439, ex larva *Lathyrus sylvestris*, leg. 1968, slide BW 4857; Aviemore, Inv. 24.vi.1969 1♀ E. C. Pelham-Clinton leg., E.C.P-C.No.25949, (ex larva *Lathyrus*), slide BW 4858, Coll. NMS.



Figs. 3–5. Abdomina of *Leucoptera*, showing the seta vestiture of terga. **3.** *L. orobi.* **4.** Lectotype of *L. orobi.* **5.** *L. lathyrifoliella*.

Diagnosis. For habitus see Fig. 1. Abdominal terga densely covered by stout setae (Fig. 3). Male genitalia (Fig. 6). Valva rounded at base, forming an acute-tipped extension apically, evenly tapered. Pleurallobus basally dilated, distolaterally with equally long triangular lobe. Phallotheca basally with large dilation (bulbus ejaculatorius), about 1.5 times broader than long. The semicircular nodose extension of gnathos and tegumen typical to *L. lathyrifoliella* vestigial.
Female genitalia (Fig. 8). Sternum 8 broad triangular, ostium bursae about half the width of sternum 8 since sternum 8 surrounds it by broadly sclerotised wall.
Life history. Emmet (1985) reports *Lathyrus linifolius* to be the host plant of *L. orobi.* In Finland it has also been found in sites where no *Lathyrus* grows, only *Vicia cracca* and *V. sepium* present as possible host plants. However, to our knowledge it has never been reared from either of these plant species. According to Emmet (1988) *L. orobi* has two generations in England. The first brood hatches from hibernated pupae during May, and the second brood flies during July. According to Emmet (1985) *L. orobi* occasionally develops a scarce second brood during July although a majority of pupae have a diapause and hibernate two or even more times. Collecting experience in Finland seems to support the view that *L. orobi* is single-brooded in Finland, the flying period from early to late June. No records from July are available.
Distribution. Finland, Estonia, Ireland, Latvia, U. K. (Scotland).
Remarks. The lectotype specimen possesses the diagnostic features of *L. orobi*, i. e. the shape of ostium bursae (Fig. 6) and the dense seta vestiture in abdominal terga (cf. Fig. 5). The latter character is, however, somewhat variable and should not alone be used in species identification.



Figs. 6–7. Male genitalia of *Leucoptera* (for each fig., top: valvae, vinculum, pleurallobus; bottom left: gnathos and tegumen; bottom right: aedeagus). **6.** *L. orobi*. **7.** *L. lathyrifoliella*.

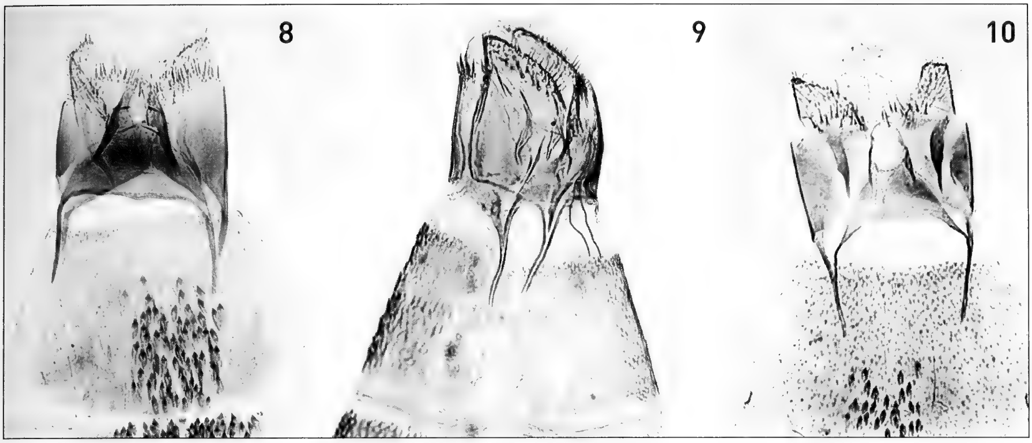
Leucoptera lathyrifoliella (Stainton, 1866) Figs. 2, 5, 7, 10

Material. **England**: Three syntypes and one pin without specimen: South Devon, Teignemouth, *Lathyrus*, e.l. 30.7.1861, Coll. Jordan. BMNH; South Devon, Branscombe, 1♀ 2.vi.1982 J. Langmaid leg. & Coll., 1♂, 2♀ e.l. ex *Lathyrus pratensis*, larvae 9.viii.1987, emg. 7.–12.v.1988 J. Langmaid leg. & Coll. **Finland:** V: Pargas (no date) 1♂, 2♀ A. Nordman leg. (slides BW 3239, 4847 (♀), 4860 (♂)) (ZMH); Turku 670:23.vi.1998 1♂, 1♀ e. l., T. Mutanen leg. (slides BW 4830 (♀), BW 4831 (♂)), vi.2000 2♀ e. l., T. Mutanen leg. (slides BW 4832, 4861); 20.vii.1992 1♂, 2♀ T. & K. Nupponen leg. (slides BW 4848, 4849 (♀), 4850 (♂); Vihti, Nummela, 669:35 1♂ e.l. 1995 B. Wikström leg. (slide BW 4885); U: Inkoo 666:32 10.vi.1996 1♂ B. Wikström leg. (slide BW 4842), 1.vi.1993 1♂ B. Wikström leg. (slide BW 3988). **Germany**: Kyffhäuser 2♂, ex *Latyhrus sylvaticus* (Zool. Mus. Berlin).

Diagnosis. For habitus see Fig. 2. Abdominal terga usually sparsely covered by stout setae (cf. Fig. 8 and remarks below).

Male genitalia (Fig. 7). Valva evenly tapered to acute tip. Pleurallobus broadest medially, apically gradually tapered. Bulbus ejaculatorius about as broad as long. Gnathos and tegumen with nodose semicircular extension.

Female genitalia (Fig. 10). Sternum 8 anteriorly broad, lateroposteriorly inward curved, thus being posteriorly narrow cylindrical. Ostium bursae as broad as the posterior part of sternum 8, insignificantly surrounded by sclerotisation.



Figs. 8–10. Female genitalia of *Leucoptera*. **8.** *L. orobi*. **9.** *L. orobi* (lectotype). **10.** *L. lathyrifoliella*.

Life history. Emmet (1985) reports *L. lathyrifoliella* from *Lathyrus sylvestris*. John Langmaid (personal communication) has reared this species from *Lathyrus pratensis*. In Finland it has been reared from both *Lathyrus sylvestris* and *Lathyrus linifolius*. In Finland it has also been found in sites where no *Lathyrus* grows, only *Vicia cracca* and *V. sepium* present as possible host plants. However, to our knowledge it has never been reared from either of these plant species. *L. lathyrifoliella* has two generations in Finland as in England. The first generation flies from late May to mid-June, and the second generation during July.

Distribution. Finland, Germany, U. K. (England).

Remarks. The type series of *L. lathyrifoliella*, preserved in BMNH, does not contain any specimens with abdomen left. There are no slides available, either. We base our opinion on the identity of the name *L. lathyrifoliella* on recent samples collected in close vicinity of the type locality. These specimens, both the male and females examined, share all the genital features of *L. lathyrifoliella* of authors. However, the abdominal seta vestiture is quite dense, like on specimens of *L. orobi*. This indicates that this character may be more variable than otherwise observed.

Acknowledgements

We are deeply indebted to the following persons for loan of material: K. P. Bland, Jari Junnilainen, John Langmaid, Wolfram Mey, Marko & Tomi Mutanen, K. Nupponen, K. R. Tuck (The Natural History Museum, London) and Kari Vaalamo. Wolfram Mey and two anonymous referees are also thanked for their valuable comments

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On the identity of *Epinotia berolinensis* (Amsel, 1932) (Tortricidae: Olethreutinae)

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Abstract. After studying the female holotype of *Epiblema berolinensis* Amsel, 1932, the name was found to be a synonym of *Rhopobota stagnana* ([Denis & Schiffermüller], 1775).

Zusammenfassung. Der Name *Epiblema berolinensis* Amsel, 1932 syn. n. wird nach Untersuchung des weiblichen Holotyps als Synonym von *Rhopobota stagnana* ([Denis & Schiffermüller], 1775) erkannt.

Key words. Lepidoptera, Tortricidae, Olethreutinae, *Epinotia*, *Rhopobota*, synonymie

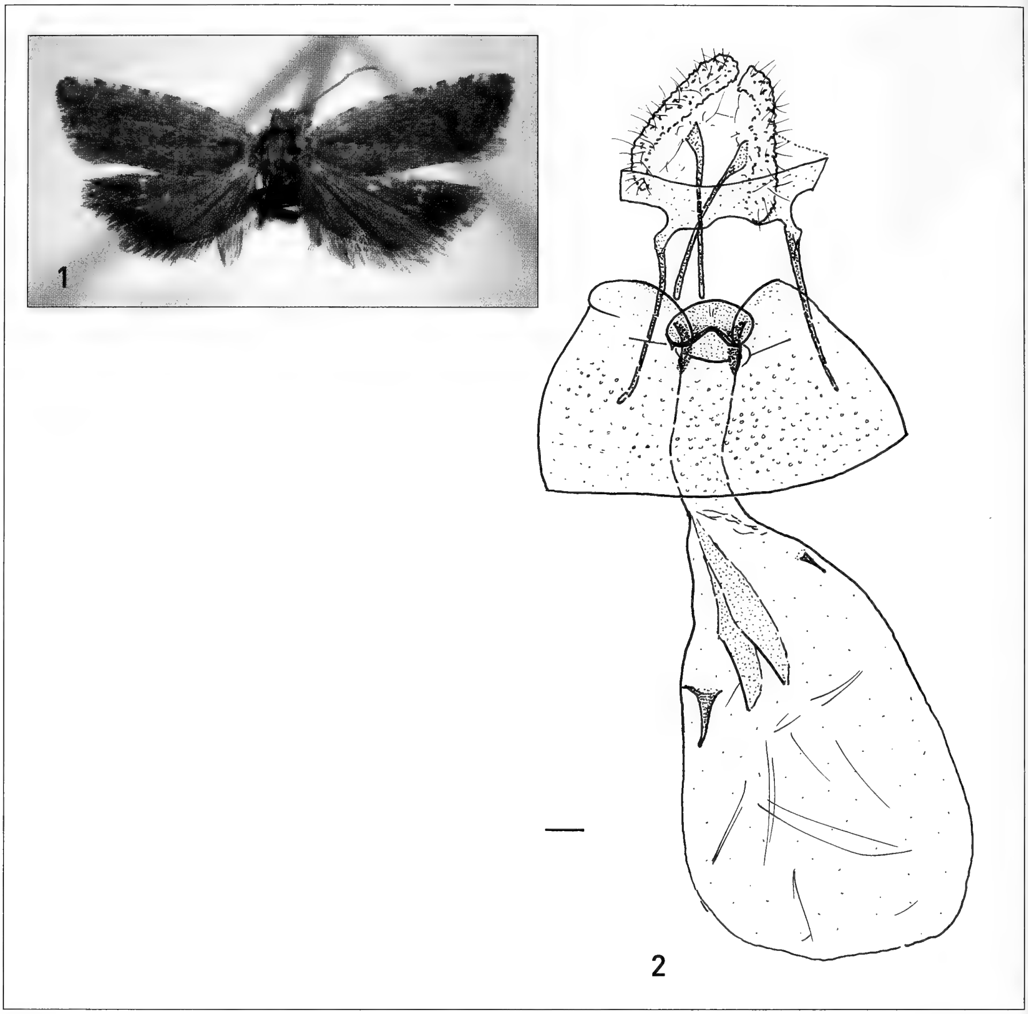
In the spring of 2004 I had the possibility to carry out some studies on the Tortricidae of the Staatliches Museum für Naturkunde, Karlsruhe. By chance I found the holotype of *Epiblema berolinensis* Amsel, 1932 (Fig. 1). Amsel (1932: 18–19) described this species on the basis of one female from Berlin–Lichterfelde captured on July 18th, 1928. He compared it with *Epinotia nemorivaga* (Tengström, 1848) (then placed in *Epiblema*), but pointed out that *E. berolinensis* has an isolated position within the genus *Epiblema* Hübner, [1825].

Razowski (2001, 2003) mentioned this species as *Epinotia berolinensis* (Amsel, 1932). Because the holotype was considered to be lost for a long time the status of the species could not be verified (Razowski 1999, 2003).

After dissecting the genitalia it was found that *E. berolinensis* is actually the same as *Rhopobota stagnana* ([Denis & Schiffermüller], 1775) under which name it is here synonymized (*Epiblema berolinensis* Amsel, 1932 **syn. n.**). The female genitalia (Fig. 2) show the characteristic slender sclerite of the posterior part of the corpus bursae, the laterally extended sterigma, and the broad shape of the subgenital sternite. The forewings of the type specimen of *E. berolinensis* are very poorly marked and the grey ground-color is dusted with light yellow scales. That is the reason why at first glance this holotype resembles *Epinotia sordidana* (Hübner, 1824). However, upon closer examination the characteristic pattern of *Rhopobota stagnana* ([Denis & Schiffermüller], 1775) is recognizable and *E. berolinensis* just represents a yellowish, poor patterned aberration of *R. stagnana*. The latter is not common in the counties of Berlin and Brandenburg (Blackstein 2002), but was already mentioned by Amsel (1930) for Berlin-Lichterfelde.

Acknowledgements

I wish to thank Dr. R. Trusch, Staatliches Museum für Naturkunde Karlsruhe (LNK) for the loan of the specimen and his support during my visit in Karlsruhe as well as Mrs. Ch. Hebig and Dr. M. Nuß, Staatliches Museum für Tierkunde Dresden, for providing literature and for arranging the photo.



Figs. 1–2. Holotype of *Epiblema berolinensis* Amsel, 1932 from [Germany], Berlin-Lichterfelde, 18.vii.1928, H. Amsel leg. (prep. Karisch 1780), SMNK. **1.** Habitus. **2.** Female genitalia (scale 0.1 mm).

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What is *Cossus sareptensis* Rothschild, 1912 (Cossidae)?

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Abstract. A new combination, *Holcocerus sareptensis* (Rothschild, 1912) **comb. n.,** is proposed and a redescription is given for this rare and little-known species of Cossidaefrom the Volga region in Russia.

Key words. *Cossus sareptensis*, *Holcocerus*, Volga region, Russia.

Presently, Cossidae still remain one of the less studied families of Macroheterocera. For instance, the recently published catalogue of the Lepidoptera of Europe, which included Cossidae (de Freina 1996), missed the little-known *Cossus sareptensis* Rothschild, 1912, considered below.

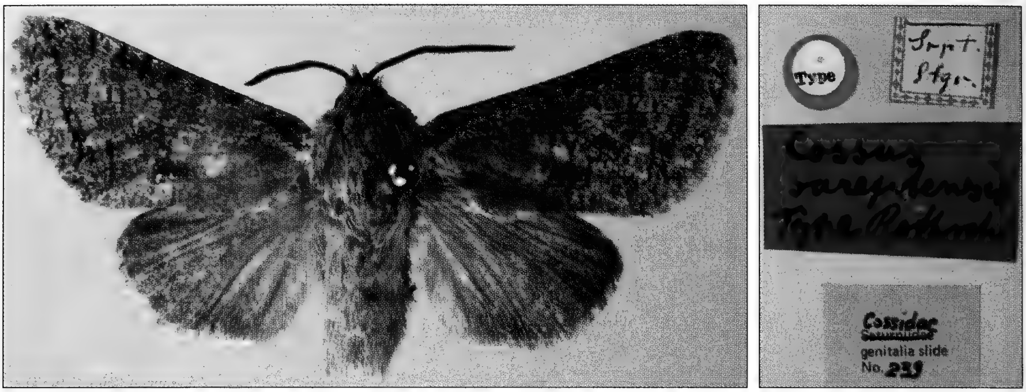
Cossus sareptensis was described by Rothschild (1912: 451) based on a single male. The type locality was given as "Sarepta" (now Krasnoarmeisk, Volgograd Province, Russia). This species, described within the genus *Cossus* Fabricius, 1793, was mentioned by subsequent authors (Daniel 1956: 278, pl. 10 fig. 3; Zagulyaev 1973: 184; Anikin, Sachkov & Zolotuhin 2000: 275) in the original combination although these authors did not examine the holotype; only F. Daniel had a black-and-white photograph. Through the courtesy of the Trustee Council of The Natural History Museum (British Museum [Natural History]) I was provided with a high quality scan of the holotype, its genitalia slide, and the labels. The exterior, genitalia (the uncus shape, the structure of the transtilla processes, the specific round tubercle on the valva), and the antennal structure (with no pectinate processes on segments) (Daniel 1959) provide evidence that the species belongs in fact to the genus *Holcocerus* Staudinger, 1884 (type species: *Cossus* (*Holcocerus*) *nobilis* Staudinger, 1884, by original designation). Therefore, a new combination is proposed. Taking into account the lack of information concerning this species, a redescription is provided.

Holcocerus sareptensis (Rothschild, 1912) comb. n. (Figs. 1–3)

Cossus sareptensis Rothschild, 1912: 451; Daniel, 1956: 278, Taf. X: 3; Zagulyaev, 1973: 184; Anikin, Sachkov & Zolotuhin, 2000: 275.

Material. Holotype P (by monotypy): a well-preserved specimen with the abdomen's distal end cut off and the following labels: (1) handwritten on white paper in a blue box in Indian ink "Srpt.[Sarepta] | Stgr.[Staudinger]"; (2) handwritten on red paper in Indian ink "*Cossus* | *sareptensis* | Type, Rothsch.[ild]"; (3) printed round label with red margin "Type"; (4) typed on blue paper "Cossidae | genitalia slide | No. 239" (The Natural History Museum, London).

Redescription. Wing expanse 31 mm, forewing length 13 mm. Antenna not pectinate, its segments without processes. Forewing upperside ground-color light-brown; pattern lighter in middle and with narrow wavy lines becoming more distinct closer to outer margin; fringe ochre-colored, darker at vein apices. Hindwing upperside grey without pattern; fringe ochre-colored.



Figs. 1–2. Holotype of *Holcocerus sareptensis* (Rothschild, 1912). **1.** Specimen. **2.** Labels.

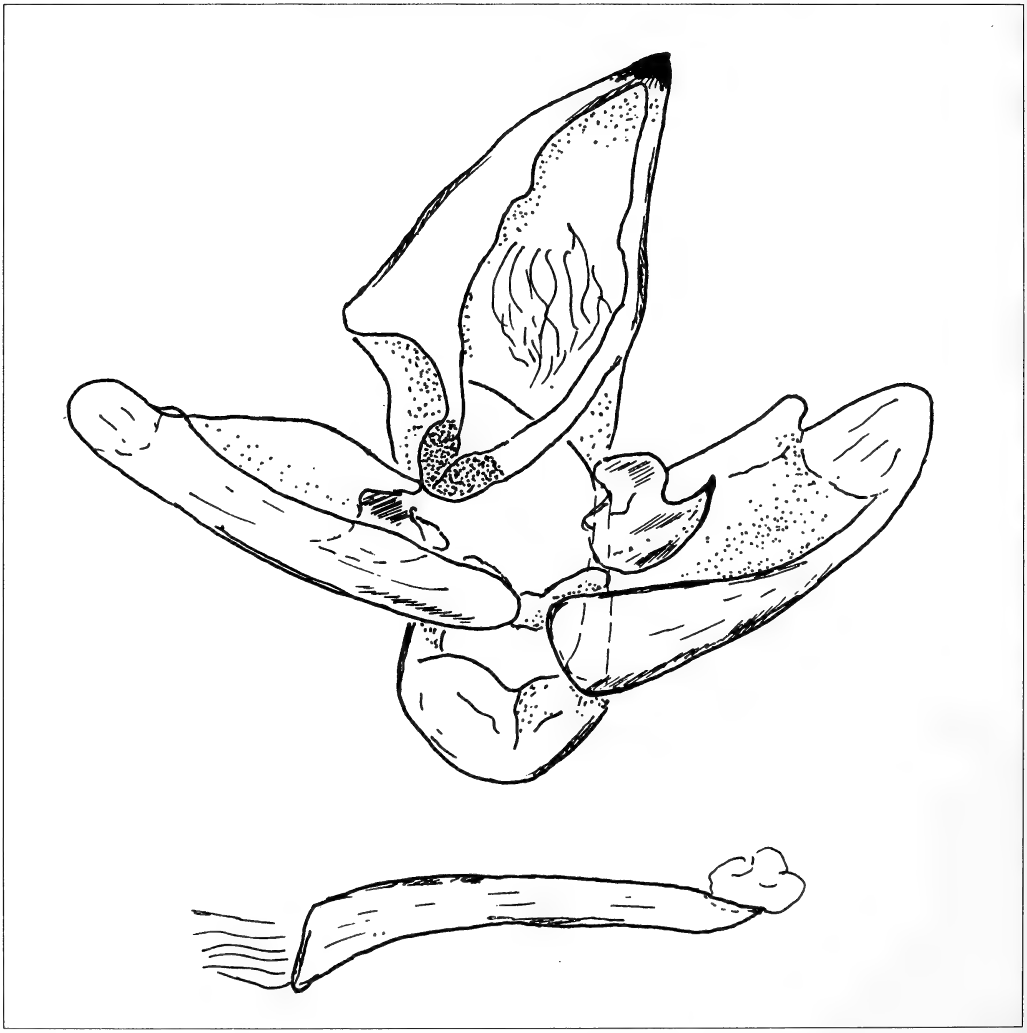


Fig. 3. *Holcocerus sareptensis* (Rothschild, 1912), holotype, genitalia, frontal projection

Male genitalia. Uncus blunt, angular, short, thickly sclerotized at apex. Gnathos arms long. Gnathos blade-like, formed by two merged halves. Valva characteristic of genus *Holcocerus*, sclerotized with membranous apex, wide with a round tubercle on dorsal margin. Arms of transtilla hook-shaped (with curved distal ends) well sclerotized. Saccus round. Aedeagus curved. Vesica without cornuti.

Female. Unknown.

Distribution. Known only from the type locality, Krasnoarmeisk in the Volgograd Province, Russia.

Remarks. This is quite a peculiar species quite well differing from other known representatives of the genus by a reduced wing pattern and a wide uncus. Externally, it is most similar to the Central Asian *Holcocerus campicola* (Eversmann, 1854).

Acknowledgements

The kind help of Mr. Geoff Martin (The Natural History Museum, London), curator of the Moths collection, made this study possible. The images are published with permission of the Council of Trustees of this museum.

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Hermann Hacker & Heinz Peks (eds.) 2004. Esperiana. Buchreihe zur Entomologie. Vol. 10 [incl. one extra sheet with corrigenda and addenda for volumes 8 and 9]. – Delta Druck und Verlag Schwanfeld: 784 pp. – Hardcover (ISBN: 3-9802644-9-1). 199 €. (in English)

The book series Esperiana, of which the first volume became published in 1990, predominantly deals with the taxonomy and faunistic of Palaearctic Noctuidae and insects from Yemen. Now, the tenth volume of the series has been published, containing three works on Noctuidae. The majority of this volume, altogether 683 pages and 27 colour-plates, is occupied by a comprehensive revision of the genus *Caradrina* Ochsenheimer, 1816 (Noctuidae: Amphipyrinae: Caradrini) by Hermann Hacker. Two other papers are dealing with a first record of *Caradrina suscianja* from Italy (two pages written by Stoyan Beshkov, Andrea Grassi & Alberto Zilli) and the *Eublemma*-species from Yemen (26 pages and two colour-plates written by Michael Fibiger & Hermann Hacker). The entire volume is completed by an alphabetic index of the scientific names.

The *Caradrina*-revision gives diagnoses and autapomorphies for the *Caradrina*-genus group, comprising beside *Caradrina* the genera *Hoplodrina* Boursin, 1937, *Stenodrina* Boursin, 1937, and *Stygiodrina* Boursin, 1937. Diagnoses and autapomorphies are also given for the eight subgenera of *Caradrina*, of which four are newly described. 33 species and 11 subspecies are described as new, the status of 12 species-group-names is changed, 21 species group names are regarded as new synonyms, and 26 species are transferred to other genera. Altogether, *Caradrina* now comprises 155 species. Most of them occur in the Palaearctic region, a few are known from the Nearctic and Afrotropical regions. For each species, historical descriptions are cited with full text, the examined material is listed and a diagnosis of external and genitalia characters including variability and possibilities for misidentifications are given. The distribution of each species is explained in detail and supported by a distribution map. Finally, reference is made to life-history data. The entire revision concludes with the numerous colour-figures of the moths and high quality black and white photographs of the genitalia slides. Text and figures of the revision enable the reader to identify the taxa dependably. Outstanding are the explanations on male genitalia characters and their terminology, the quality of the many genitalia figures as well as the colour figures of the moths specimens and their labels.

Although the author writes much about the phylogeny of the taxa treated and that 'the results were scored and documented in matrices', no details are presented. Indeed, nothing is stated which program has been used, a character matrix and a tree are absent. It remains questionable for the reader, why the results of this huge work are not shown and thus all the statements on the phylogeny can not be verified. The English text contains several vague wordings and the distribution maps do not show the precise dots of available records given in the material chapters. However, despite of these three critical points, the revision is well done and illustrated and follows the normal standards for a revision. All taxonomic information given can be verified and the results allow to identify the superficial very similar species of *Caradrina*.

Matthias Nuss

Nota lepid. **27** (2/3): 199–216

Discovery of the genus *Epimarptis* Meyrick, 1914 (Gelechioidea: Coleophoridae s. l.) in Japan, with the description of a new species

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Abstract. *Epimarptis hiranoi* sp. n. is described on the basis of specimens collected at several localities in Honshû, Japan. The following characters are illustrated: the habitus, head appendages, wing locking system and venation, thoracic and abdominal skeletons, abdominal vestiture, and genitalia. *E. hiranoi* is the fourth member of the genus *Epimarptis* Meyrick, 1914 and the first representative discovered in regions other than South Asia. It can be distinguished from congeneric species in the colouration of the forewing. In the thoracic skeletons, the new species has several characters not found in other genera of Coleophoridae s. l..

Key words. *Epimarptis hiranoi* sp. n., Japan, head appendages, thoracic skeletons, genitalia, *Epimarptis*, Coleophoridae s. l..

Introduction

Meyrick (1914) established the genus *Epimarptis* to describe the type species, *Epimarptis philocoma* Meyrick, 1914. Up until now the genus had been represented by three species (Meyrick 1914, 1917, 1931, 1936): *E. philocoma* was recorded from Bombay, India, *E. septicodes* Meyrick, 1917 from Maskeliya, the Democratic Socialist Republic of Sri Lanka, and *E. isoloxa* Meyrick, 1931 from Assam, India. Most of the generic characters of *Epimarptis* given in the original description are typical of the members of superfamily Gelechioidea where the genus is currently placed. Excluding the characters typical of gelechioids, the generic characters given in the original description are as follows: antennae in male near the base with a notch covered by an oblique tooth beneath it; pecten absent; in forewing venation M1 stalked with stem of R4+5, R5 reaching termen instead of costa; in hindwing venation Rs and M1 stalked, M2 absent. The presence or absence of a pecten sometimes varies within a genus. Smaller-sized gelechioids generally have the forewing M1 stalked with the stem of R4+5 and the hindwing with less than three M-veins. According to Meyrick (1931), *E. isoloxa* has the same wing venation as the type species. On the other hand, Meyrick (1917) stated that *E. septicodes* is different from the type species in having the forewing with CuA1 absent and M1 separated from the stem of R4+5. Consequently, among the generic characters in the original description, the effective diagnostic characters of *Epimarptis* are restricted to the male antennal notch covered by a tooth and the forewing with R5 reaching the termen.

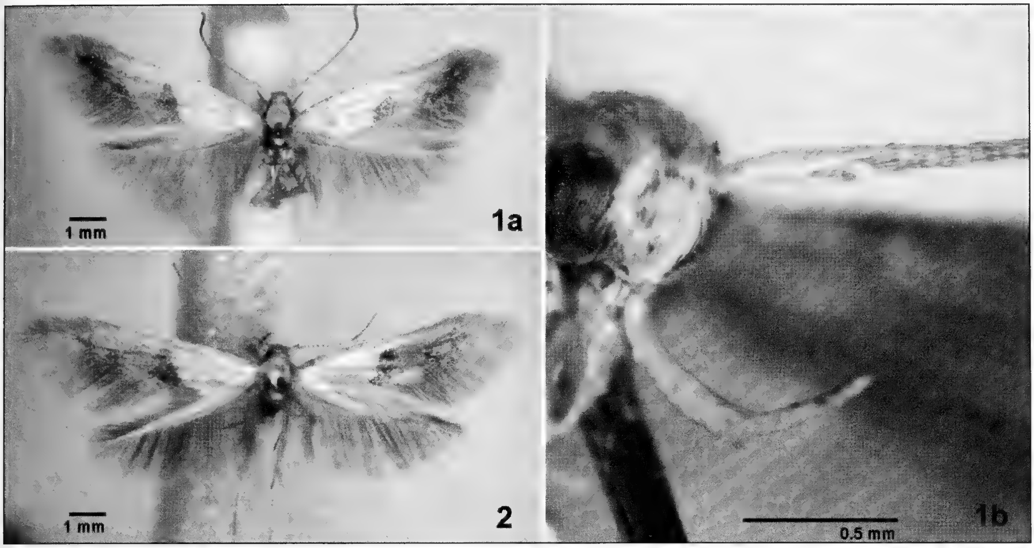
When establishing the genus *Epimarptis*, Meyrick (1914) proposed the family Epimarptidae for this genus alone, stating “Probably it is a development of the Oecophoridae.” Later, however, Meyrick (1917) transferred the genus to the Epermeniidae and maintained this idea in subsequent papers (Meyrick 1931, 1936).

Current limits of the superfamily Gelechioidea were generally accepted in the late 1960's, and since the late 1970's, rearrangements of the gelechioid family-group taxa have been attempted repeatedly. Minet (1986) was the first author to include *Epimarptis* in the superfamily. Later authors, when taking the genus into account, regarded it as forming solely the family Epimarptidae (Minet 1990; Sinev 1992) or the subfamily Epimarptinae of the family Batrachedridae (Hodges 1998). Kaila (2004) implemented a cladistic analysis of 143 gelechioid taxa using 193 morphological characters in order to estimate phylogenetic relationships within Gelechioidea. He stated that *Epimarptis* would fall in his expanded Coleophoridae comprising *Coelopoeta* Walsingham, 1907, *Stathmopoda* Herrich-Schäffer, 1853, and Batrachedrinae of Hodges (1998) in addition to Coleophoridae in the traditional sense, while abundant missing entries for *Epimarptis* prevented him from including the genus in his final analysis.

In spite of many recent studies on the taxonomic system within Gelechioidea, little morphological information is available for *Epimarptis* in the literature. The genitalia have never even been described and there are no available illustrations except for the figures of the moth and hindwing venation of the type species given by Hodges (1998). In the higher classification of the microlepidoptera, the head appendages and thoracic skeletons often offer some phylogenetic evidence, but these characters have not yet been examined in *Epimarptis*. *Epimarptis* is currently accepted as the type genus of a nominal family-group taxon, and current lack of information must be improved in order to obtain a more reliable hypothesis of its relationships within Gelechioidea.

On recent examination of some personal and institutional collections in Japan I found several Japanese specimens apparently referable to *Epimarptis*. These specimens have the male antennae with a notch near the base and the forewing with vein R5 reaching the termen. In addition, they agree with the original description of *E. philocoma* in many aspects of wing markings and also with a moth photo of the species in Hodges (1998). By courtesy of Mr K. Tuck and H. Taylor of The Natural History Museum, London (BMNH), I was able to compare my Japanese specimens with images of *Epimarptis* specimens in the BMNH, i.e. moth images of the type specimens of all described species and genitalia images of one male and two female non-type specimens of *E. philocoma*. Then I concluded that the Japanese specimens represented an *Epimarptis* species distinct from all described ones. Discovery of *Epimarptis* in Japan had not been expected because the genus has never been recorded even in Southeast Asia. The Southeast Asian fauna is generally much more similar to that of South Asia than to that of Japan.

In the present paper, I describe the Japanese *Epimarptis* species as the fourth member of the genus. For a better understanding of the genus and also of the Gelechioidea as a whole, I give illustrations not only of the habitus and genitalia, but also of some other characters that are usually neglected in species descriptions. A discussion is given on the morphology of the Japanese species mainly from the viewpoint of comparing it with that of some other genera placed in Coleophoridae by Kaila (2004).



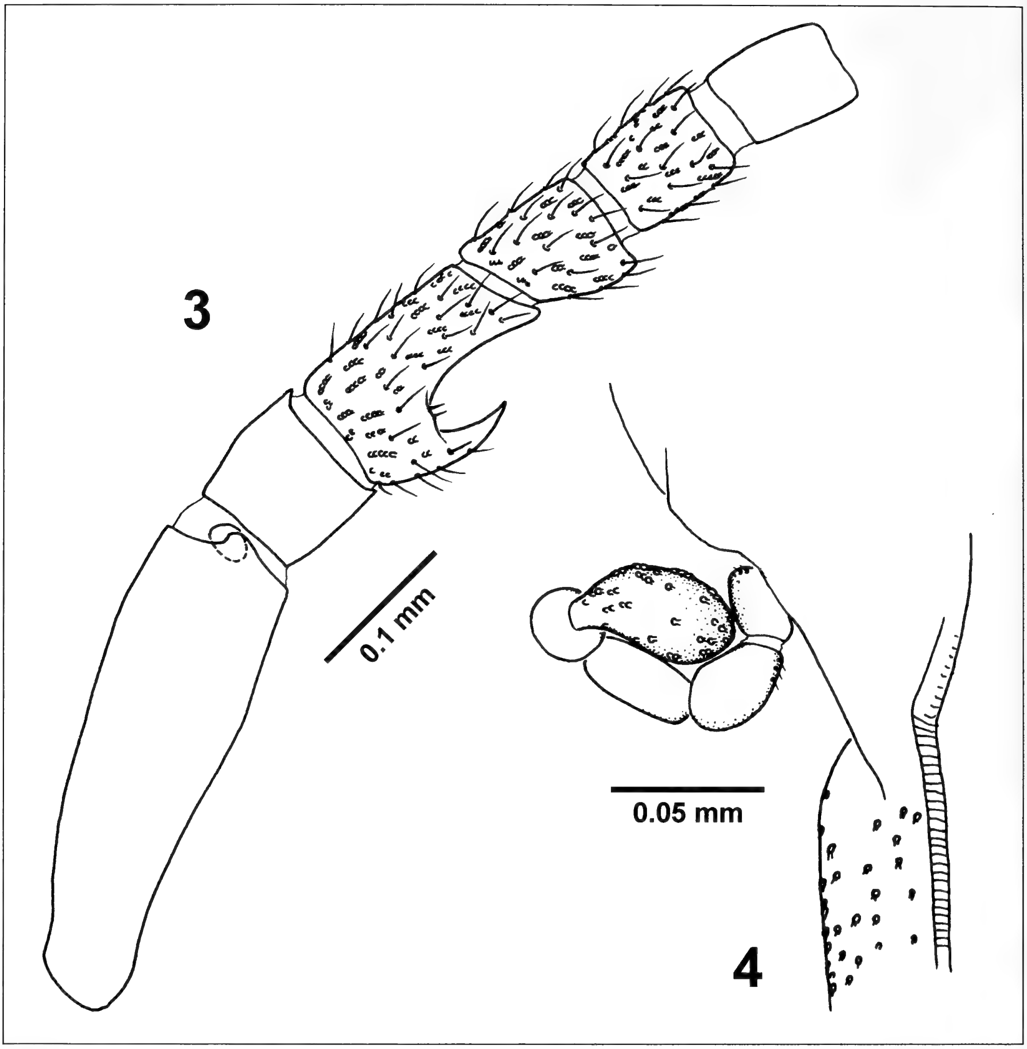
Figs. 1–2. Moths of *Epimarptis hiranoi* sp. n. **1.** Holotype (a: Whole moth, with abdomen removed for dissection. b: Antennal notch). **2.** ♀ paratype from Inekoki.

Epimarptis hiranoi sp. n. (Figs. 1–20)

Material. All specimens collected in Honshû, Japan. Holotype: ♂, 'Japan; Honsyû <underlined> | Kamasawa[-onsen] <35°30'N, 138°06'E> | Oosika Vill.[age] | Nagano Pref.[ecture] | 24,vi,2001 | K. Sugisima leg.', '♂ genitalia | slide no. 0910 | K. Sugisima, 2001', deposited in Entomological Laboratory, Osaka Prefecture University, Sakai-si, Ôsaka-hu, JAPAN (OPU). — Paratypes: 1♂, 'Fujihara-Dam <36°48'N, 139°03'E> | Minakami Machi | Gunma Pref. | 12.VI.1999 | U. Jinbo <leg.>'; 1♂, 'Ikezawa <36°24'N, 137°57'E> | Ikusaka mura | Nagano-ken | 29.VII.1995 | N. Hirano leg.'; 1♀, 'Ookuchizawa <36°17'N, 137°57'E>, Toyo- | shina T. Nagano | pref. 13 JUL 1979 | N. HIRANO leg.'; 1♂, 'Ohkuchizawa <36°17'N, 137°57'E>, To- | yoshina Nagano | pref. 10 VI 1983 | N. HIRANO leg.'; 1♂, 'Japan; Honsyû <underlined> | Ookuti-zawa <36°17'N, 137°57'E> |Toyosina Town | 19,vii,2003 | K. Sugisima leg.'; 1♀, 'Shimashima valley <36°11'N, 137°46'E> | Nagano pref. | 9 VII 1981 | N. HIRANO leg.'; 1♀, 'Shimashima valley <36°11'N, 137°46'E> | Nagano pref. | 26 VI 1982 |N. HIRANO leg.'; 1♂, 'Shimashima-dani <36°11'N, 137°46'E> | Azumi-mura | Nagano-ken | 19.VI.1987 | N. HIRANO [leg.]'; 1♂1♀, 'Inekoki <36°09'N, 137°46'E> | Azumi-mura | Nagano-ken | 9.VII.1988 | N. HIRANO [leg.]'; 1♂, ' [Kiso]Hukusima <Kawanisi> <36°50'N, 137°41'E> | Nagano-ken | Honsyu | Japonia', '8/VII | 1975 | T. KUMATA [leg.]'; 1♀, 'JAPAN | HONSYU, NAGANO: | Kamasawa[-onsen] <35°30'N, 138°06'E> | (Osika-mura) | 30.VI.2001 | T. SAITO [leg.]'; 1♂1♀ (1♀ whole insect mounted on slide 1737 of K. Sugisima), '13-JUL-1996 | JAPAN Aichi-pre. <underlined> | Asahi-highland <35°13'N, 137°24'E> | Asahi-cho | T. Mano leg.'; 2♂ (1♂ whole insect mounted on slide 0614 of K. Sugisima), '5-JUL-1997 | JAPAN Aichi-pre. <underlined> | Asahi-highland <35°13'N, 137°24'E> | Asahi-cho | T. Mano leg.'; 1♂, 'JAPAN: Mie-pre. <underlined> | Hijiki [34°42'N, 136°11'E] [alt.] 250 m | Ueno-city | 27-VI-1997 | T. Mano leg.'; 1♂, 'Yase | Kyoto[-city] | 26.vi.1952 | A. Mutuura [leg.]'; 1♂, 'Japan; Honsyû <underlined> | Tyôzya-hara <34°41'N, 132°11'E> | Geihoku-tyô | 10,vii,2001 | Ohshima-Issei leg. (Paratypes deposited in OPU, SEHU (Systematic Entomology, Hokkaido University, Sapporo, Japan), and BMNH (The Natural History Museum, London)). – 2♂2♀, Ôkuchi-zawa, Toyoshina, Nagano Pref. (in personal collection of N. Hirano).

Description. Male (Fig. 1) and female (Fig. 2) with no differences in size and coloration. Forewing length 5.3–6.0 mm (holotype 5.7 mm).

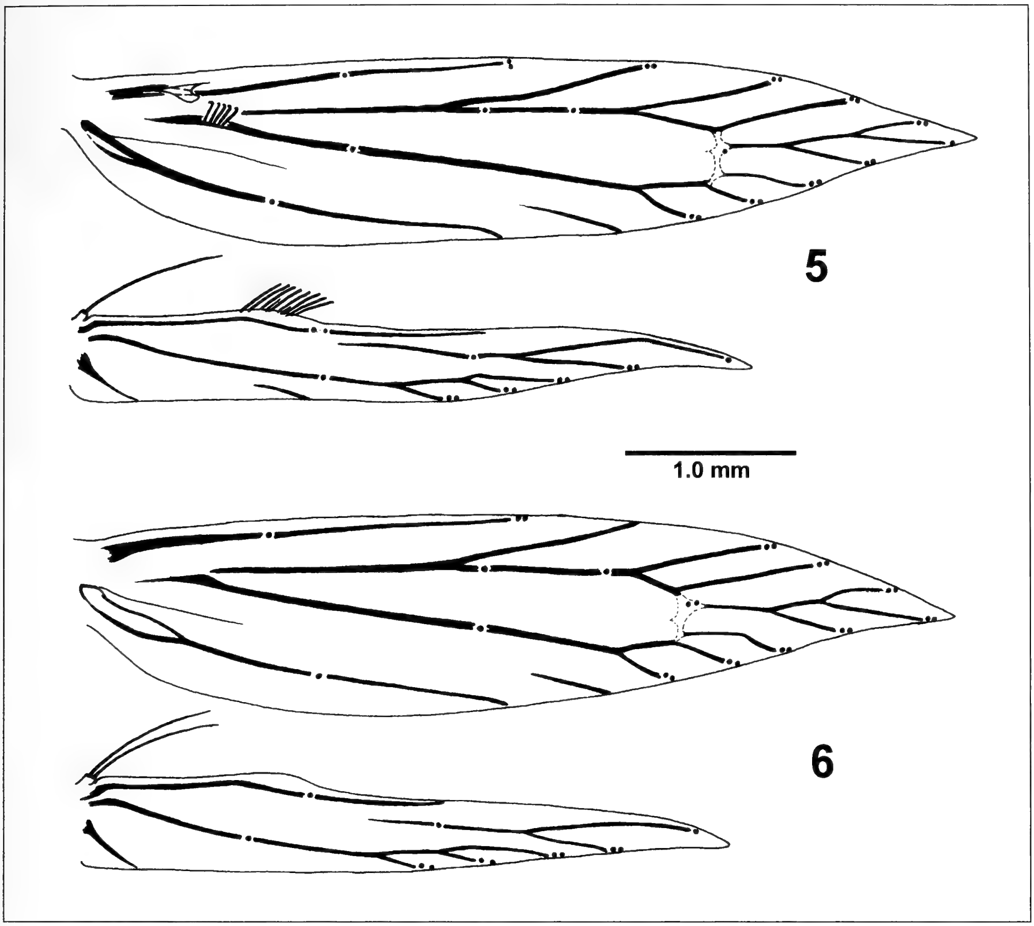
Head yellowish with a row of dark brownish scales above dorsal margin of eye. Antenna 4/5 as long as forewing; basal notch and covering tooth of male due to modification of third segment (Figs. 1b, 3); coloration yellow-ochreous, scape paler,



Figs. 3–4. Head appendages of *Epimarptis hiranoi* sp. n. (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima). **3.** Basal segments of antenna. **4.** Maxillary palpus.

flagellum annulated with dark brownish except on apical flagellomeres. Labial palpus yellowish, medially paler, densely mottled with dark brownish scales on third segment and often also at apex of second segment dorsally. Proboscis well developed, scale on basal 3/4; maxillary palpus (Fig. 4) composed of five segments, second and third segments cylindrical, fourth spherical, fifth bullet-shaped. Thorax yellowish, mottled with dark brownish scales on cephalic partof tegula. Legs pale ochreous, densely mottled with dark brownish scales on outer surface of fore tibiae, sparsely elsewhere; hind tibia dorsally ornamented with long soft hair-like scales. Abdomen pale ochreous dorsally, ivory ventrally.

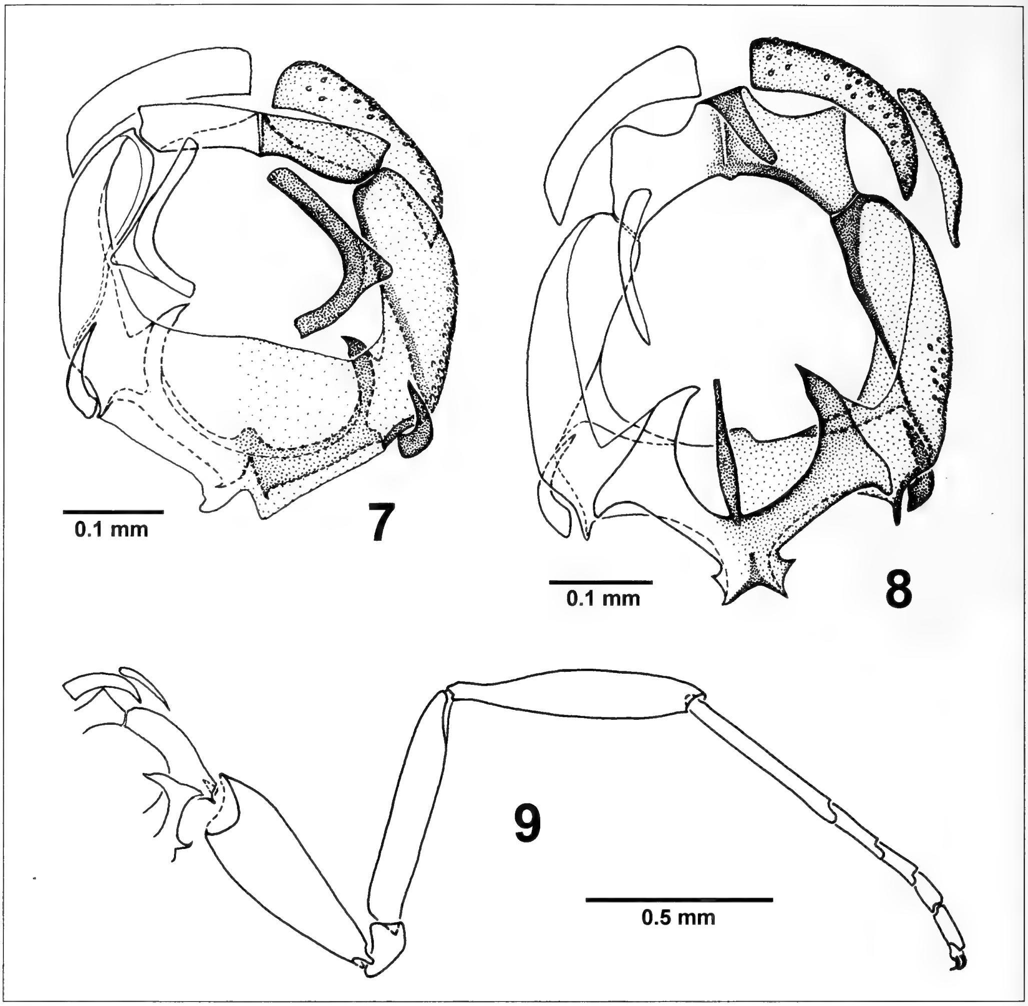
Forewing moderately lustrous, yellowish from base to 2/5, where a dark brownish triangular patch extends outwards obliquely from hind margin just beyond R-stem,



Figs. 5–6. Wing venation of *Epimarptis hiranoi* sp. n.; dots indicate positions of campaniform sensillae. **5.** ♂ paratype from Inekoki, slide no. 0580 of K. Sugisima. **6.** ♀ paratype from Shimashima-dani, wing-locking scales omitted, slide no. 0583 of K. Sugisima.

thence wing becoming orange-brownish to brownish near termen; another dark brownish triangular patch present around tornus, half as wide as first one; with another dark brownish patch of variable size and shape near apex of wing; each dark brownish patch almost unicolourous, with no gradation; costa thinly edged with dark brownish scales; cilia orange brownish, darker around tornus.

Wing structures (Figs. 5, 6). Forewing elongate lanceolate, 1/4–1/5 as wide as long, widest around 1/3, apically pointed; Sc reaching costal margin slightly beyond middle; cell almost closed around 1/8 because CuA-stem closely approaching R-stem, rudimentary between base of R3 and base of CuA1; R1 and R2 twice to three times as distant from each other as R2 and R3 are; M1 stalked with stem of R4+5; one of M2 or M3 absent (or M2 and M3 fused); CuP recognised as vein distally, as fold basally; anal vein bifurcate basally. Hindwing half as wide as forewing, linear-lanceolate, widest beyond 1/3; costal margin slightly projecting beyond 1/3; Sc+R1 nearly parallel to costa, ending at 2/3; Rs very weak in basal half, one branch arising caudally



Figs. 7–9. Denuded prothorax of *Epimarptis hiranoi* sp. n. **7.** Cephalic view of prothorax (♀ paratype from Asahi highland, slide no. 1737 of K. Sugisima); parapatagia omitted. **8.** Caudal view of prothorax (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima). **9.** Foreleg (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima).

from Rs, three branches arising from CuA-stem. Subcostal element of retinaculum in male arising from stalk of Sc; caudal element composed of a row of stout hooked scales along CuA-stem; frenulum with two acanthae in female; supplementary wing-locking system as a group of elongate scales around hind margin of forewing and a group of long needle-like scales arising from projection of costal margin of hindwing. Thorax (Figs. 7–12). Preepisternum without a membranous window in its lateral projection (Fig. 7). Parapatagium as a distinct pad-like sclerite, with sockets (Fig. 8). Fore tibia without epiphysis (Fig. 9). Cephalic margin of metascutellum round and totally margined by its internal folding (Figs. 10, 11a). Caudal margin of metathorax with a medial ridge (Fig. 11a). Caudal suture of inner sclerite of metacoxa present (Figs. 10, 12a). Intercoxal lamella forming a simple keel (Fig. 11b). Margin of infra-

Fig. 10. Denuded metathorax of *Epimarptis hiranoi* sp. n. in dorsal view (♀ paratype from Asahi highland, slide no. 1737 of K. Sugisima).

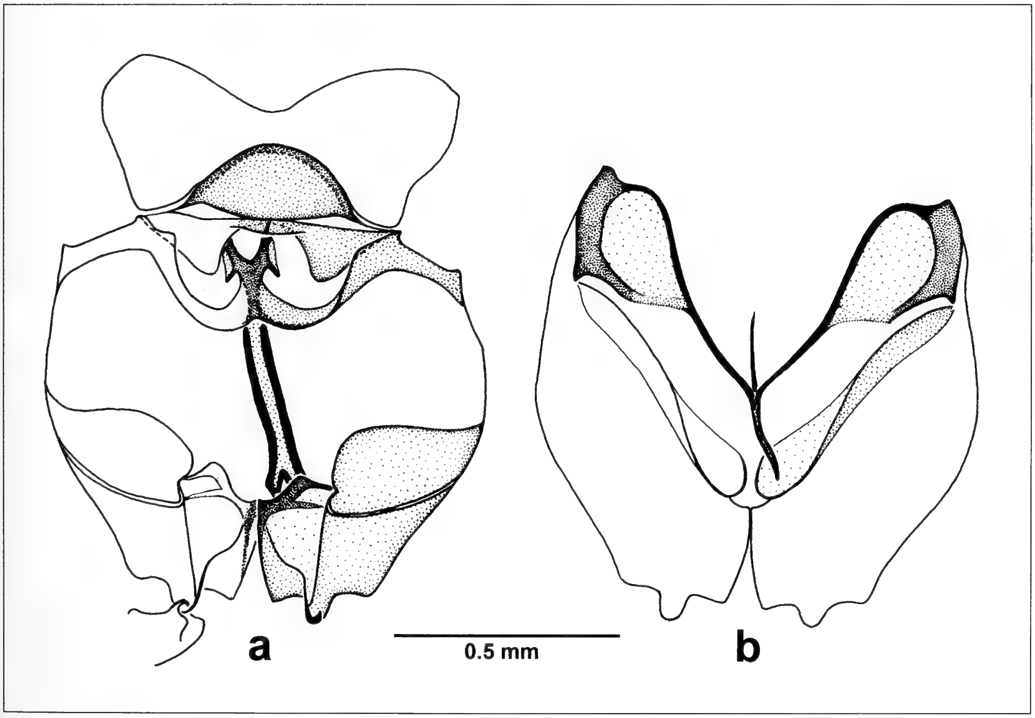


Fig. 11. Metathoracic skeleton of *Epimarptis hiranoi* sp. n. in caudal view (♂ paratype from Asahi highland, slide no. 0614 of K. Sugisima). a: Structures of dorsal half. b: Structures of ventral half.

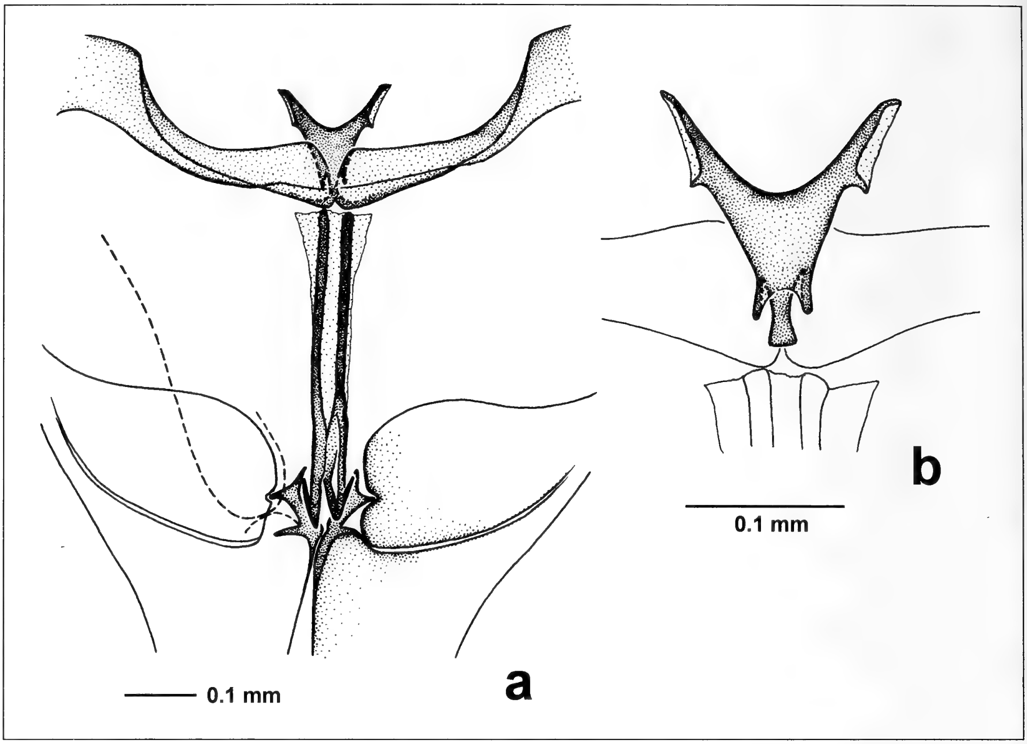
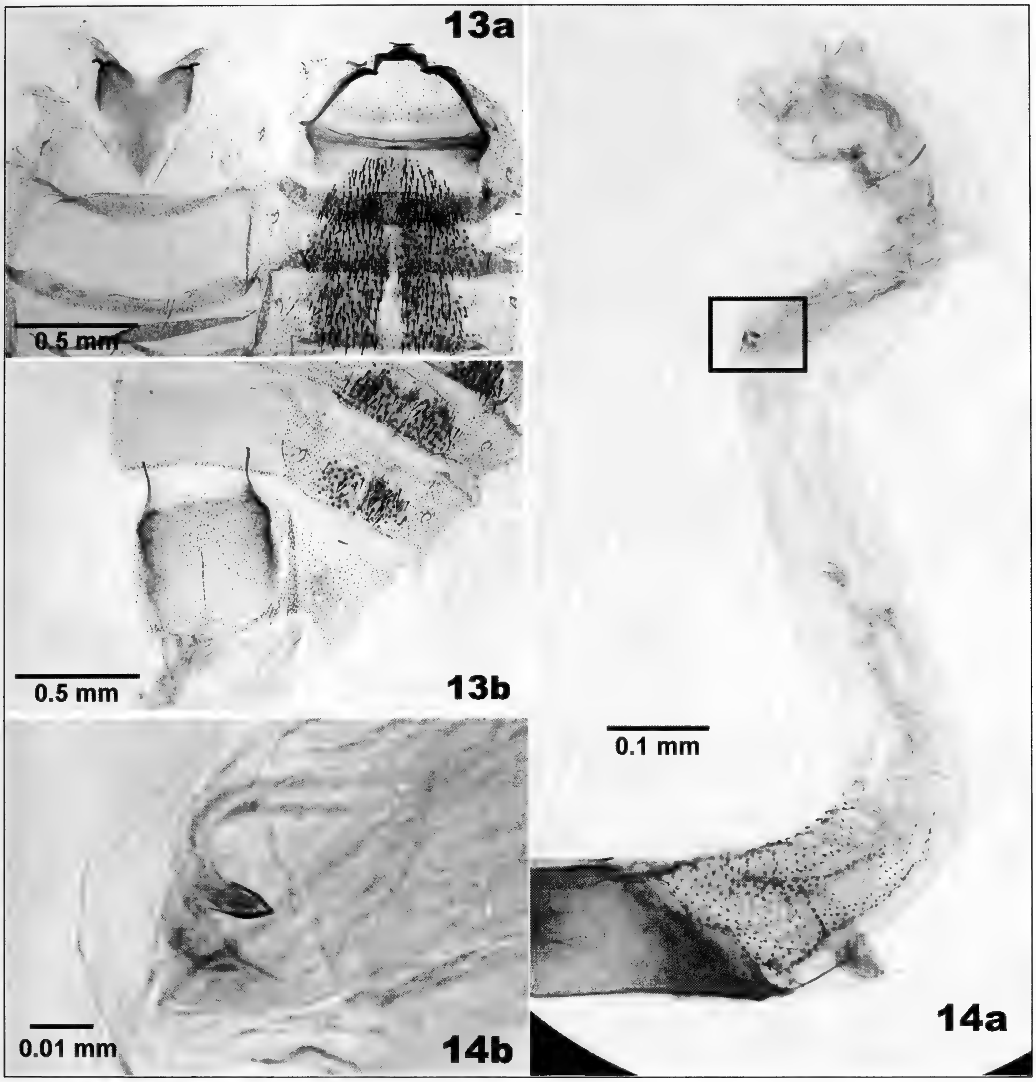


Fig. 12. Metathoracic furca in dorsal view (♀ paratype from Asahi highland, slide no. 1737 of K. Sugisima). a: Whole furcal structures and articulation with coxa. b: Furcal apophysis.

episternum strongly sclerotised, except for less sclerotised medial half of caudal part (Fig. 11b). Apophysis of metafurca (Fig. 12b) bluntly Y-shaped, cephalically bifurcate; each cephalic branch pointing toward cephalo-ventral and dorso-caudal corners; a pair of small projections directed dorso-caudally near caudal end of apophysis; secondary arm of furca and its lamina forming chiasma (Figs. 10, 11a, 12a); stem of furca composed of pair of longitudinal stout bars and less sclerotised lamina supported by these bars, with a relatively weak part around caudal 1/5 (Figs. 10, 12a).

Abdomen (Fig. 13). Abdominal supporting system of same structure in both sexes: ventral element composed of heavily sclerotised sub-pentagonal area with pair of short apodemes arising from cephalic corners and indistinct venulae forming margins. Second to seventh tergites each ornamented with pair of patches of spine-like scales.

♂ genitalia (Figs. 14–17) and associated structures (Fig. 13b). Eighth sternite (Fig. 13b) sclerotised more strongly than third to seventh sternites, with pair of apophyses arising sublaterally on cephalic margin. Uncus down-curved, abruptly narrowed near base and slightly tapering towards acute apex, with pair of setae present before apex. Gnathos (Figs. 15, 16b) articulated with tegumen, evenly tapering towards apex, strongly sclerotised along caudal margin, moderately so elsewhere; apex with a short point extending towards head. Tegumen tapering towards uncus, strongly sclerotised along margins of round cephalo-lateral corners. Inner



Figs. 13–14. Male abdomen and vesica of *Epimarptis hiranoi* sp. n. **13.** Abdominal segments of holotype (a: Cephalic four segments, showing structures of abdominal base and arrangement of 'spines' on tergites. b: Caudal two segments, showing modified eighth sternite). **14.** Vesica, paratype from Ookutizawa, slide no. 1295 of K. Sugisima (a: Whole vesica, largest cornutus surrounded by a square. b: Magnified view of squared area in Fig. 14a).

surface of valva (Fig. 16b) divided by a suture into equally long caudal and cephalic areas; caudal area sclerotised strongly along margin and weakly so elsewhere, with short setae scattered sparsely; cephalic area sclerotised moderately, with caudal margin medially projecting and forming strongly sclerotised club-shaped rod apically bearing one short seta. Outer surface of valva (Fig. 17) sclerotised strongly along dorso-cephalic margin near joint with tegumen and weakly to moderately so elsewhere, with dense group of very long hairs on cephalic part, with huge scales sparsely scattered on remaining part. Juxta (Figs. 15a, 16c) sub-triangular, on caudal margin

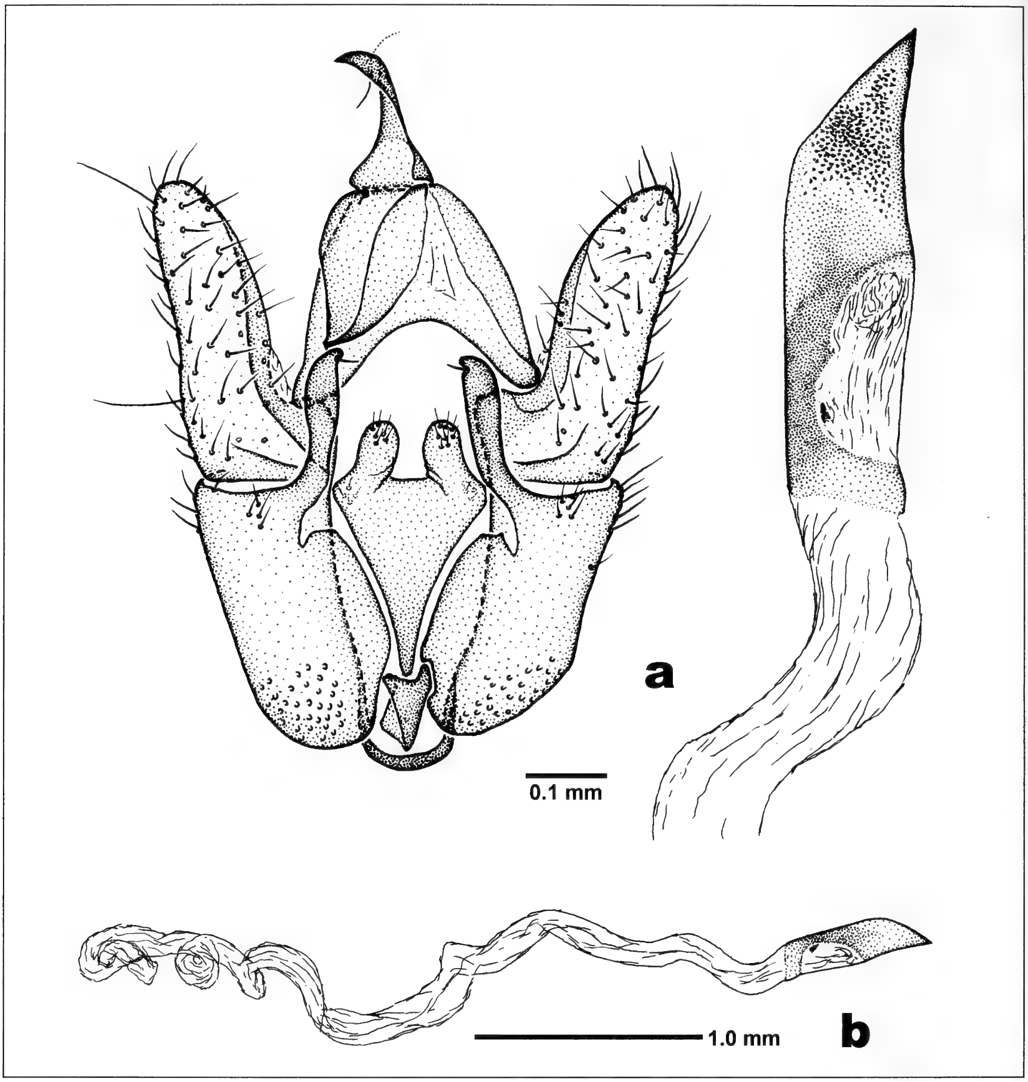


Fig. 15. ♂ genitalia of holotype of *Epimarptis hiranoi* sp. n. situated in standard position (a: Whole genitalia with ductus ejaculatorius omitted. b: Whole aedeagus).

with pair of thumb-shaped projections separated by distance equal to their basal width and apically adorned with six to ten setae; with dorsally concave pouch-like sclerite connected with cephalo-ventral corner of juxta. Diaphragma with group of a few setae dorsad from lateral corners of juxta. Vinculum narrow, U-shaped, with dorsal ends fused with dorso-cephalic margin of outer surface of valva. Aedeagus obliquely truncate apically, membranous on dorsal side and on ventro-cephalic area (Fig. 15a); ductus ejaculatorius very long (Fig. 15b); vesica (Fig. 14) over three times as long as aedeagus, lined with group of numerous minute spines near caudal opening of aedeagus and bearing thorn-like sclerite (considerably reduced in some individuals) distant from the opening.

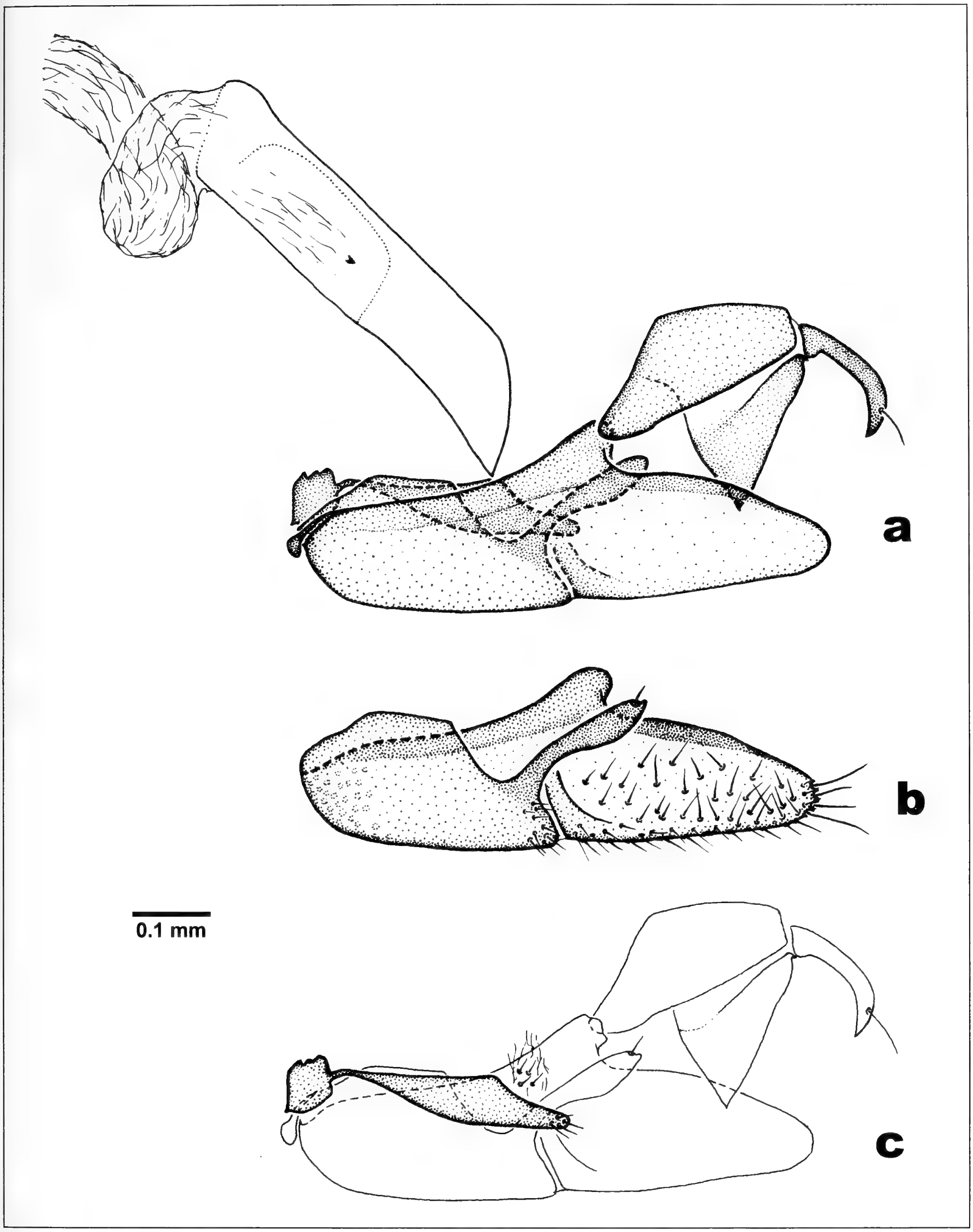


Fig. 16. ♂ genitalia of *Epimarptis hiranoi* sp. n. in lateral view (paratype from Fujihara-dam). a: Whole genitalia. b: Right valva viewed from left side. c: Juxta and setae on diaphragma.

♀ genitalia (Figs. 18–20). Papillae anales weakly sclerotised, ornamented with setae except on dorsal surface. Apophyses of equal length; apophysis anterioris composed of two branches apically fused, one branch derived from tergite, other from sternite (Fig. 20a). Eighth tergite (Figs. 19b, 20) sclerotised moderately, with several

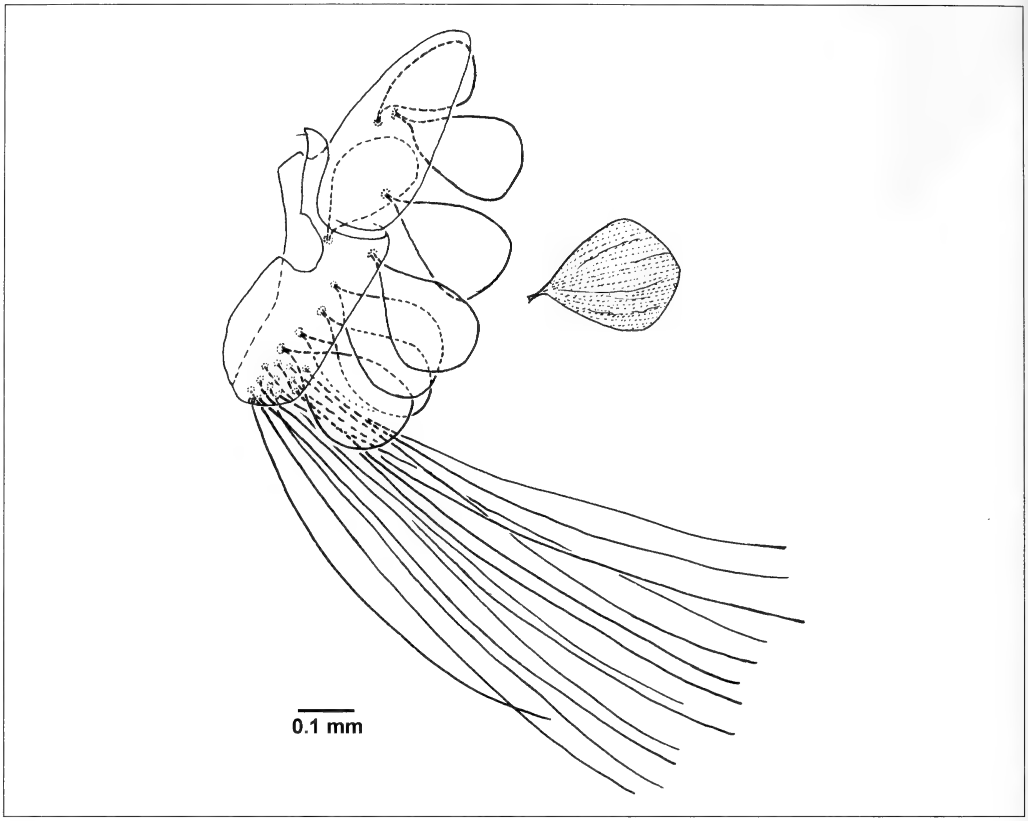


Fig. 17. Vestiture on the outer surface of right valva; diagram based on slides 0534 (paratype from Ohkuchi-zawa) and 1295 (paratype from Ookuti-zawa) of K. Sugisima.

setae of variable lengths along caudal margin; eighth sternite (Figs. 19a, 20) sclerotised strongly, finely spined, finely wrinkled, protruding over ninth sternite, with a pair of groups of setae of various lengths. Antrum a concavity from caudal part of seventh sternite to cephalic part of eighth sternite, weakly sclerotised except for caudal part; caudal wall strongly sclerotised, with paired indentations ventrally covered by cephalic part of eighth sternite, which gives the impression that the eighth sternite in ventral view has a round M-shaped rim near its cephalic margin (compare Figs. 19a and 20b). Colliculum (Figs. 19a, 20a) short, becoming wider cephalically, sclerotised moderately. Ductus bursae (Fig. 18) considerably long, nearly 20 times as long as apophyses posteriores, somewhat becoming wider near corpus bursae. Ductus seminalis (Figs. 19a, 20a) branching off from ductus bursae just cephalically from colliculum; corpus bursae (Fig. 18) ellipsoidal, with signum a keel-like plate.

Diagnosis. *Epimarptis hiranoi* sp. n. has three congeneric species as mentioned in the introduction. Both in size and colouration, *E. hiranoi* is most similar to *E. philocoma*, the type species. In the type species, the triangular dark patch at 2/5 of the forewing is dark brownish inwards and gradually becomes purplish outwards, while the corresponding marking of the new species does not have such a gradation. The new species

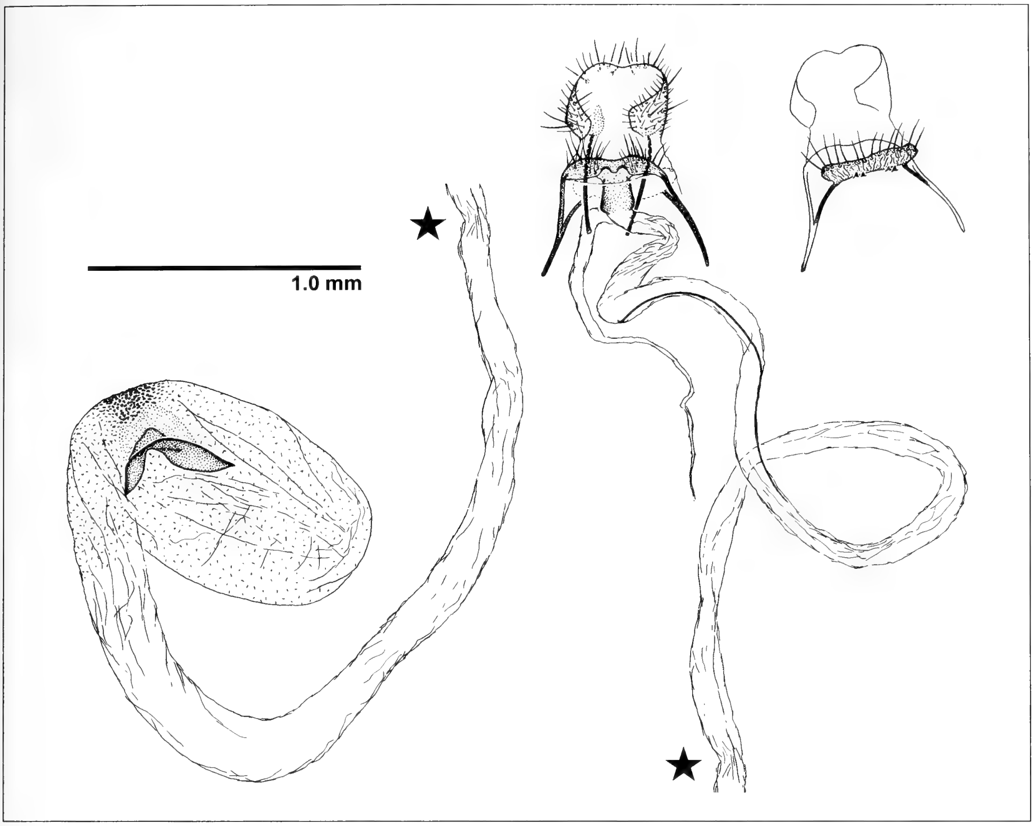


Fig. 18. ♀ genitalia of *Epimarptis hiranoi* sp. n. in standard position (paratype from Kamasawa, slide no. 0911 of K. Sugisima). Stars indicate the same position.

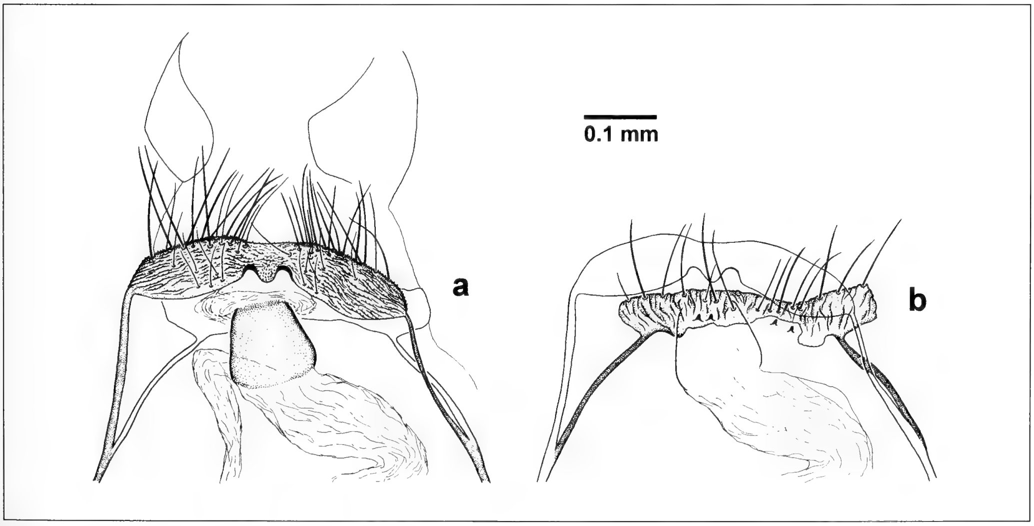


Fig. 19. ♀ genitalia of *Epimarptis hiranoi* sp. n., structures of area around eighth segment (paratype from Kamasawa, slide no. 0911 of K. Sugisima). **a:** Eighth sternite, antrum, and ductus seminalis. **b:** Eighth tergite.

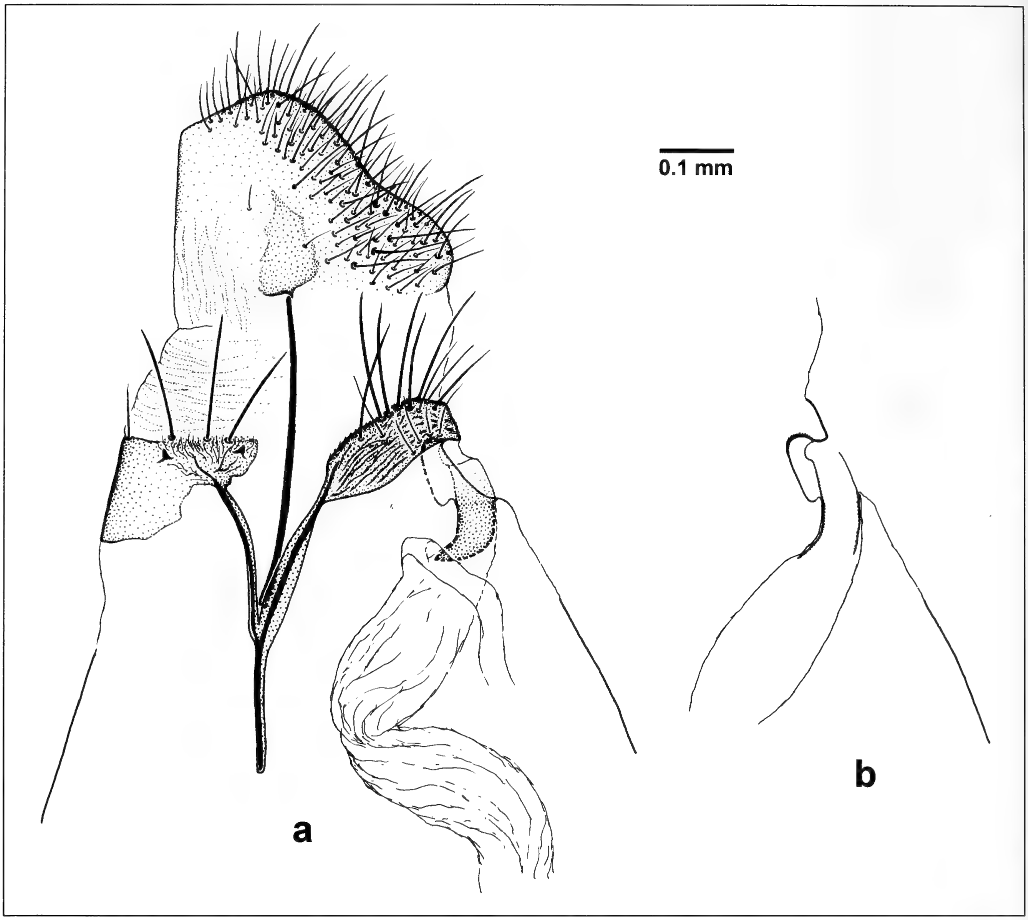


Fig. 20. ♀ genitalia of *Epimarptis hiranoi* sp. n. in lateral view (paratype from Inekoki, slide no. 0944 of K. Sugisima). a: Caudal part. b: Section along median line around ostium.

has only two M-veins in the forewing while the type species has three. In addition, there are some differences in their male genitalia. In the new species, the caudal area of the inner surface of the valva is as long as the cephalic area, the caudal projections of the juxta are separated by a length equal to the width of their bases, and the largest cornutus is at most a small conical sclerite. In the type species, the caudal area of the inner surface of the valva is 1.5 times as long as the cephalic area, the caudal projections of the juxta are closer to each other than in the new species, and the largest cornutus is C-shaped and much larger than in the new species. *E. hiranoi* can be separated from the other two congeneric species more easily. *E. septicodes* has dark brownish forewings and a greyish body, thus appearing much darker than the new species. *E. isoloxa* is 15–16 mm in wingspan and at a glance much larger than the new species. In colouration, the orange brownish area of the forewings is less distinct in *E. isoloxa* than in the new species.

Derivatio nominis. The specific name honours Mr Nagao Hirano, who provided many specimens and helped me in collecting others.

Life history. The immature stages are unknown. All moths were collected at light traps from mid June until late July. At Ôkuchi-zawa, Toyoshina, Nagano Pref., a total of 4♂, 3♀ were collected, and the collection dates range from June 10 to July 19, with a presumed peak in the second quarter of July.

Distribution. Japan, Honshû.

Discussion

Based on a fairly thorough cladistic analysis within Gelechioidea, Kaila (2004) suggested that Coleophoridae should be expanded to include *Coelopoeta*, *Stathmopoda*, those genera formerly placed in Batrachedrinae of Hodges (1998) and the traditional coleophorids which mainly comprise *Coleophora* Hübner, 1822. The monophyly of his expanded Coleophoridae is supported by four characters: epinotum without median ridge; male retinaculum directly from Rs; hindwing without stem of M1 + M2 in cell; and hindwing costa with long stout scales. These characters are more or less homoplastic when Gelechioidea as a whole are considered, and only the two hindwing characters are present in *Epimarptis hiranoi*. Nevertheless, according to Kaila (2004), *Epimarptis* constantly fell in his Coleophoridae clade. In his analysis, *Epimarptis* shows numerous missing entries. Thus a comparison of important morphological features for *Epimarptis* and other coleophorid genera, including the observations of the present study may provide some light on the phylogenetic position of *Epimarptis*. This comparison is presented below. It takes into account information on the morphology of the following genera of the expanded Coleophoridae: *Batrachedra* Herrich-Schäffer, 1853, *Coelopoeta*, *Coleophora*, *Goniodoma* Zeller, 1849, *Homaledra* Busck, 1900, *Idioglossa* Walsingham, 1881, and *Stathmopoda* Herrich-Schäffer, 1853. Information on other coleophorid genera was obtained from Kaila (2004) and Sugisima and Arita (2000).

In *E. hiranoi*, the notch and covering tooth of the male antenna are present on the ventral side and are due to a modification of the third segment (Figs. 1b, 3). In the other coleophorid genera, similar structures are known in *Idioglossa*. However, the structures of *Idioglossa* are due to a modification of the fourth or fifth segment. The male antennal notch and covering tooth in *Epimarptis* and *Idioglossa* can be homoplastic. Minet (1990) regarded the antennal notch in *Epimarptis* as being related to that of some Blastobasidae, but the notch in the latter taxa is on the dorsal side and is not likely to be homologous with that of *Epimarptis*.

The maxillary palpus of *E. hiranoi* (Fig. 4) is five-segmented while this organ has not been examined in other *Epimarptis* species. The five-segmented maxillary palpus has not been reported in any other gelechioids. The ancestral condition of the maxillary palpus in Gelechioidea is considered to be four-segmented, and the five-segmented condition is probably a reversal. In the other coleophorid genera studied here, it is composed of four or fewer segments.

In wing venation *E. hiranoi* (Figs. 5, 6) is different from other coleophorid genera. In the forewing of *E. hiranoi*, the Radial vein has five branches and R5 reaches the termen. *Batrachedra*, *Coleophora*, and *Homaledra* lack R5. In other coleophorid genera the Radial vein has five branches and R5 reaches the costa. The forewing cell of *E. hiranoi* is almost closed basally; this character is rare in Gelechioidea and can be a generic diagnostic feature. The hindwing venation of *E. hiranoi* is the same as that of *E. philocoma* (see Hodges 1998: fig. 9.6N). Without any apparent analysis Hodges (1998) considered that the caudal branch of Rs in *E. philocoma* is a fused vein M1+2 and three branches arising from the CuA-stem as M3, CuA1, and CuA2. However, it seems to be impossible to discriminate the fusion of M1 and M2 from the loss of one of the three M-branches unless the ancestral condition is determined. In *Batrachedra* and *Homaledra* M1 and M2 are stalked and their common stem arises from Rs. In *Coelopoeta*, all three M-branches are present, with M2 and M3 stalked; this venation seems hardly related to that of *Epimarptis*. In *Coleophora*, two M-veins are recognised as in *Epimarptis*, but the posterior one is neither stalked with Rs nor with the CuA-stem. In *Idioglossa*, the branching pattern of the veins is the same as in *E. hiranoi*, but Rs reaches the termen instead of the costa. The hindwing of *Stathmopoda* has all veins, with M1 stalked with Rs, and with M2 and M3 arising from the CuA-stem.

The fore leg of *E. hiranoi* (Fig. 9) lacks the epiphysis on the tibia. The absence of epiphysis is sometimes observed in *Coleophora*, where the epiphysis tends to be vestigial. In other coleophorid genera, the epiphysis is well-developed.

In *E. hiranoi*, the cephalic margin of the metascutellum (Figs. 10, 11a) is evenly rounded and lacks distinct corners. In addition, the margin of the infraepisternum (Fig. 11b) has a weakly sclerotised part medio-caudally. In other coleophorid genera, the metascutellum has distinct cephalo-lateral corners and the infraepisternum is strongly sclerotised along the entire margin.

The ventral element of the abdominal supporting system of *E. hiranoi* (Fig. 13a) is composed of a strongly sclerotised sub-pentagonal area, a pair of short apodemes, and a pair of indistinct venulae. *Coelopoeta*, *Idioglossa*, *Stathmopoda*, and the traditional coleophorids are similar to *E. hiranoi*, but they have no or little-developed apodemes. *Batrachedra* and *Homaledra* are sexually dimorphic: in addition to the strongly sclerotised area, the male has distinct venulae while the female has long pointed apodemes and distinct venulae.

The male of *E. hiranoi* has the eighth sternite strongly sclerotised with a pair of apophyses (Fig. 13b). The same condition is observed in *Batrachedra* and *Idioglossa* (Sugisima & Arita 2000; Sugisima, unpubl.). According to L. Kaila (pers. commn), the apophyses of the male eighth sternite of *Homaledra* are not so distinct, and other coleophorid genera have a non-specialized eighth sternite.

In *E. hiranoi*, the second to seventh abdominal tergites have a pair of patches of spine-like scales (Fig. 13) and the male genitalia have the gnathos articulated with the tegumen (Figs. 15a, 16a); these are the defining characters of Batrachedridae of Hodges (1998). However, these character states need further examination. The spine-like scales are arranged in paired patches in the traditional coleophorid genera as well as in the Batrachedridae of Hodges (1998). On the other hand, Kaila (2004) coded the spine-like scales of *Homaledra*, which was placed in Batrachedridae by Hodges (1998), as being arranged in a single patch. Moreover, *Stathmopoda haematosema* Meyrick, 1933 has the patch of spine-like scales arranged in an upside down paired "T" (Sugisima, unpubl.). This species appears to have the gnathos articulated with the tegumen rather than fused with it. These characters in *S. haematosema* show that the arrangement of spine-like scales and the articulation of the gnathos can be homoplastic in the clade of expanded Coleophoridae.

In the female genitalia of *E. hiranoi* (Figs. 18–20) the apophyses anteriores are composed of two apically fused branches, one arising from the eighth tergite and the other from the eighth sternite. The same structure is observed also in *Batrachedra* and *Homaledra*. Other coleophorid genera, except for *Idioglossa*, have the apophyses anteriores arising from the eighth tergite. In general, the apophyses anteriores originate from the eighth tergite. On the other hand, that structure in *Idioglossa* arises from the eighth sternite and it seems reasonable to consider that this condition is due to a loss of the tergite-branch from the condition observed in *Epimarptis*.

Based on the above observations the characters of *Epimarptis* show a rather mosaic pattern and it seems impossible to make any conclusions about its position within the coleophorid clade. The eighth sternite of the male abdomen and the apophyses anteriores of the female genitalia may suggest close affinities between *Epimarptis* and the Batrachedridae of Hodges (1998). The same affinities could be supported by the spine-like scales and the articulation of the gnathos, but these conditions may be homoplastic. In contrast, the absence of the epiphysis on the fore tibia suggests affinities between *Epimarptis* and the traditional coleophorids rather than the Batrachedridae of Hodges (1998). The characters of the wing venation and thoracic skeleton do not support any particular affinities, or even contradict the view that *Epimarptis* belongs to the Coleophoridae clade. In order to settle this contradiction, as stated by Kaila (2004: 321), it would be desirable to add more taxa and to reduce the number of missing entries into the analysis, especially with regard to the immature stages. As far as the present knowledge is concerned, *Epimarptis* seems to be rather uniform in morphology. Further discovery of undescribed species of *Epimarptis* is desired because they may possess intermediate characters between described *Epimarptis* species and some other gelechioids.

As mentioned in the introduction, there are no records of *Epimarptis* from Southeast Asia. It is not appropriate to regard a lack of research in this region as an explanation for this disjunction in distribution. Several expeditions for collecting micromoths, mainly by European and Japanese institutes, have been to Southeast Asia during recent decades. Judging from the habits of *E. hiranoi*, moths of *Epimarptis* are likely to be collected at light-traps. A more conceivable reason is that a shortage of information on the genus has kept many *Epimarptis* specimens remaining to be recognised in museum collections. This paper will hopefully lead to the discovery of many specimens of the genus in various micromoth collections from Southeast Asia.

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The *Elachista juliensis* complex revisited (Elachistidae)

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Abstract. The taxonomy of the *Elachista juliensis* complex is revised on the basis of extensive samples, including ex ovo series. Four species are considered to be valid: 1. *Elachista juliensis* Frey, 1870, (= *E. freyi* Staudinger, 1870 **syn. rev.**, *E. klimeschi* (Traugott-Olsen, 1994) **syn. rev.**, *E. ingeborgae* (Traugott-Olsen, 1994) **syn. n.**), 2. *Elachista occidentalis* Frey, 1882 (= *E. buvati* (Traugott-Olsen, 1994) **syn. n.**, *E. ruthae* (Traugott-Olsen, 1994) **syn. n.**), 3. *Elachista zonulae* Sruoga, 1990, and 4. *Elachista ribentella* **sp. n.** *E. juliensis* is distributed in Central Europe and seems confined to *Carex humilis*. *E. occidentalis* is widespread throughout Europe. It feeds on *Carex digitata* and *C. ericetorum*. *E. zonulae* is recorded from the Alps, Tatra Mts., Tian Shan Mts. in Kazakhstan, Kyrgyzstan and Tajikistan, and Altai Mts. in Siberia. It has been reared from *Carex sempervirens*. *E. ribentella* is recorded from Japan and the Russian Far East. Its host plant is *Carex blepharicarpa*.

Key words. Elachistidae, Elachistinae, *Elachista*, taxonomy, synonymy, *Elachista ribentella*, new species, Palaearctic

Introduction

The Elachistinae (Gelechioidea: Elachistidae) comprises numerous small-sized moths characterised by the leaf-mining larval mode of life. The adults are notoriously difficult to identify due to their generally uniform genital morphology. This, in addition to the scarcity of material available for many species, has lead to uncertain species concepts based on vague character evidence. Numerous papers dealing with the taxonomy of European *Elachista* Treitschke, 1833 species have been published during the last decades. These papers are often dedicated to descriptions of single species, not always accompanied with adequate reference to other related or similar species. Many species complexes still await critical treatment with all constituent taxa simultaneously presented.

In this paper the species complex containing *Elachista juliensis* Frey, 1870 and its close allies is revised. These taxa are considered to belong to the genus *Elachista* following the generic revision by Kaila (1999). This complex has caused problems in identification for a long time. Spuler ([1903]–1910) confused the species *Elachista serricornis* Stainton, 1854 and *Elachista freyi* Staudinger, 1870. In subsequent literature the former species was often called *E. mitterbergeri* Rebel, 1906 and the latter *E. serricornis*. This error still persists in the literature as confusion of the host plant records of these taxa in Traugott-Olsen & Schmidt Nielsen (1977), repeated by Parenti and Varalda (1994), but see Buhl et al. (1991). Parenti (1977) designated the lectotypes of *Elachista juliensis* and *E. occidentalis* Frey, 1882 and considered them conspecific, but did not mention *E. freyi* in this context. Traugott-Olsen & Schmidt Nielsen (1977) designated the lectotype of *E. freyi*, without mention of *E juliensis*. Sruoga (1992) described the closely related *E. zonulae* from mountains of Central Asia, and Kaila (1992) supplemented the description by describing the female of this species, based on one specimen in bad condition.

Traugott-Olsen (1994) attempted to clarify the situation where the identity and possible conspecifity of *E. juliensis*, *E. freyi*, and *E. occidentalis* had not been properly investigated. This paper is the most comprehensive treatment of this species complex. Unfortunately, its many errors and uncritical treatment of supposed differences between taxa weaken its uselfulness. The identity of *E. juliensis*, i.e. the oldest name available in this complex, was not based on the lectotype and was misunderstood. Likewise, the illustrations representing *E. occidentalis* actually depict *E. juliensis*. The existence of *E. zonulae* (Sruoga, 1992) was overlooked although its male genitalia were illustrated in connection with the description of *Biselachista buvati* Traugott-Olsen, 1994 (cf. Liška 1998; Tokár et al. 1999; Baran 2003). Traugott-Olsen (1994) considered *E. juliensis*, *E. freyi*, and *E. occidentalis* to be valid species, and described four additional species as new in this complex. In the absence of identification keys or proper diagnoses the reader was left with few tools to identify any specimens of this complex. The problem is particularly severe because the suggested differences between the supposed species are tiny. In specific differences the emphasis was placed on wing venation characters for which the utility in species delimitation was found worthless by Albrecht & Kaila (1997), and genitalic characters such as the shape of the vinculum which seems to be one of the intraspecifically most variable and least reliable trait in the male genitalia of *Elachista*. The genital illustrations of Traugott-Olsen (1994) are not quite accurate either (some detailed discussion is given below): some genital illustrations were not drawn from primary types and in the case of *E. buvati* the male genitalia illustrations do not represent the same species as the description.

A closer scrutiny of the variation of the taxa involved suggests that the range of individual variation in populations easily exceeds the specific differences as suggested by Traugott-Olsen (1994). Thus, many, if not most specimens do not fit well any of these descriptions. There are extensive samples of this species complex in many collections that at present cannot be reliably identified, leading to haphazard distribution records based on educated guesses at best. Each specialist seems to have adopted a personal opinion about the validity and delimitation of the species which means that identifications made by different specialists are not fully comparable. It was therefore considered necessary to revise this complex again, but with an emphasis on the estimation of the nature and range of the intraspecific variation. For that purpose, we include photographic illustrations of the primary types involved and extensive samples from all over the Palaearctic region. The limits of species were established and the type specimens of each nominal species were examined in order to find the correct names for each valid species.

As a result, four species are considered to be valid. In Europe, three species occur: *Elachista juliensis*, *E. occidentalis*, and *E. zonulae*. The two first are somewhat variable and considered distinct on the basis of constant differences in the length of the labial palpus and in the shape of the female antrum, supplemented by other strongly correlated yet more variable characteristics: their forewing pattern, the size and differences in the colour of the head, and characteristics of the male genitalia, especially in the size and shape of the uncus. *E. zonulae* is more distinctive, always identifiable by both external appearance and genitalia. The fourth species, *Elachista ribentella* sp. n., occurs in Japan and the Russian Far East. Its status as a distinct species is based on its thicker flagellum of the antenna, shorter aedeagus with longer cornutus than in other species, and slight differences in the external appearance.

Material was received from the following collections:

BMNH	The Natural History Museum, London, U.K. (K. R. Tuck),
MNHB	Museum für Naturkunde, Humboldt-Universität Berlin, Germany (W. Mey),
SEHU	Laboratory of Systematic Entomology, Faculty of Agriculture, Hokkaido University, Japan (K. Sugisima),
TLMF	Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria (P. Huemer),
MZLU	Museum of Zoology, Lund University, Sweden (R. Danielsson),
MZH	Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland (L. Kaila),
ZMUC	Zoological Museum, University of Copenhagen, Denmark (O. Karsholt),
ZSM	Zoologische Staatssammlung, Munich, Germany (A. Segerer),
ZMUO	Zoological Museum, University of Oulu, Finland (J. Itämies),

and the private collections of G. Baldizzone (Asti, Italy), P. Grotenfelt (Kauniainen, Finland), J. Junnilainen (Vantaa, Finland), J. Kaitila (Vantaa, Finland), T. & K. Nupponen (Espoo, Finland), and P. G. Varalda (Morano, Italy).

In the material sections, rearing records by Varalda are indicated and refer to his rearing recording archive. The codes are indicated as, e.g. "rearing A.167".

Diagnosis of the *Elachista juliensis* complex

The members of the *Elachista juliensis* complex belong to the *E. tetragonella* (Herrich-Schäffer, 1855) group as defined by Kaila (1996 and 1999). Within the *E. tetragonella* group these species belong to a subgroup that is characterised by a bilobed mesal knob of the gnathos (= the genus *Biselachista* of Traugott-Olsen & Schmidt Nielsen, 1977). In this subgroup the representatives of the *E. juliensis* complex are not known to share any obvious synapomorphies, but they can be characterised by their dark grey to brown forewing ground colour lacking metallic sheen, combined with the non-serrate flagellum of the antenna, the slender shapes of the aedeagus and digitate process, the slightly longer than wide uncus lobes, and the cornutus of the aedeagus being a weak simple rod. Like most other species of the *E. tetragonella* group, the species of the *E. juliensis* complex feed on *Carex* (Cyperaceae). They seem to show high fidelity to certain *Carex* species, which may help in the field identification of the species.

Identification of the species of the *Elachista juliensis* complex

Elachista juliensis, *E. occidentalis*, and *E. ribentella* are all morphologically close to each other, while *E. zonulae* differs in several ways, bearing resemblance with *E. serricornis* with respect to some traits. *E. occidentalis* is the largest of the species and its wing pattern is characterised by a black oblique streak that basally delimits the white costal spot. This trait is especially distinctive in paler specimens; the ground colour of *E. occidentalis* varies from dark mottled grey to paler grey and brownish

(Fig. 10). Its labial palpi are longer than those of *E. juliensis*. *E. ribentella* externally resembles particularly mottled grey specimens of *E. occidentalis*, and they both also have a more or less white head. *E. ribentella* is slightly more broad-winged and the pale pattern of the male is indistinct, all spots being suffused by dark-tipped scales (Fig. 19). The flagellum of the male antenna is thicker and more clearly annulated in *E. ribentella* than in the other species. *E. juliensis* is smaller, its forewing ground colour always dark grey (Fig. 1). The colour of its head varies from unicolorous grey to white. The male genitalia of these three species closely resemble each other. *E. ribentella* differs from the other species by its shorter aedeagus and longer cornutus (compare Figs. 20–22). Its distal fold of the costa is also more pronounced, and usually distinctively broadened distally. The separation of *E. juliensis* from *E. occidentalis* using male genitalia is usually possible by the longer uncus lobes of *E. occidentalis*, and by its slightly more slender valva, digitate process, and aedeagus (cf. Figs. 4–8, 12–15). This difference seems not to be caused by allometry due to the generally larger size of *E. occidentalis*, as these characters do not display intraspecific trends that would correlate with their size. The female antrum is the most straightforward character to distinguish between *E. juliensis* and *E. occidentalis*: it is distinctly broader than deep in *E. juliensis* while it is as broad as deep in *E. occidentalis* (Fig. 18). The antrum shape of *E. ribentella* varies, but it seems to be more strongly armed with spines than in the other species. The shape of the signum is very variable and probably is of little use in identification of any of the species. However, it may be that the teeth are somewhat stouter in *E. occidentalis* than in *E. juliensis* (Fig. 17). *E. zonulae* is externally characterised by its invariably grey head and the costal and tornal spots of the forewing being situated opposite to each other, as in *E. humilis* Zeller, 1850 (Fig. 24). Its male genitalia are characterised by the narrow and long uncus lobes separated by a broad incision, the valva with the cucullus only weakly twisted on top of the costa, and the basally strongly bent aedeagus (Figs. 25, 26). The female genitalia differ from those of the other species by the smaller antrum (Fig. 18).

Elachista juliensis (Figs. 1–9, 17–18)

Elachista juliensis Frey, 1870: 279, *nec* Traugott-Olsen (1994)
Elachista freyi Staudinger, 1870: 322, **syn rev.**
Biselachista klimeschi Traugott-Olsen, 1994: 326, *nec* Dufrane, 1957, **syn rev.**
Biselachista ingeborgae Traugott-Olsen, 1994: 332, **syn. n.**
Biselachista occidentalis sensu Traugott-Olsen, 1994, nec Frey, 1882 (partim)

Material. Lectotype ♂ of *Elachista juliensis*, labelled: LECTO- / TYPE [rounded with blue margin]; *E. juliensis*. / Frey / Engadin; Frey coll. / Brit. Mus. / 1890-62; B. M. ♂ /Genitalia slide /No. 1932; LectoTYPUS ♂ / *Elachista* / *juliensis* / Frey / TESTE U. PARENTI 1976. (BMNH). Lectotype of *Elachista freyi*, labelled: 29/7; Macugnago m.; Origin.; *freyi* Stdgr; Genital praeparat nr. 1984 sex ♂ E. Traugott-Olsen, LECTOTYPE; Zool. Mus. Berlin (MNHB). Paralectotype slides: ♀, U. Parenti 82, 9519 (MNHB); ♂, teste Hering No. 608/1941 (MNHB). Holotype of *Biselachista klimeschi*, labelled: Holotype; Genital praeparat nr. 6433 sex: ♂; E. Traugott-Olsen; Wing praeparat nr. 6434 sex: ♂ E. Traugott-Olsen; Carinthia, H. Blut Tauernbg. 1800 m 14.8.1973 Klimesch; *Biselachista klimeschi* sp. n. det. E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark. Paratypes 2♂ with the same collection data (1♂ in ZMUC, 1♂ in ZSM with slide LK 3744). Type series of *Biselachista ingeborgae* (see remarks below): **1)** pin with holotype label, with two male specimens of which one lacks right wing pair and the other is without adomen, labelled: Holotype; Genital praeparat r. 6438 sex ♂ E. Traugott-Olsen; Wing praeparat nr. 6439 sex ♂ E. Traugott-Olsen; Trentino Val Sarca Pietramurata,

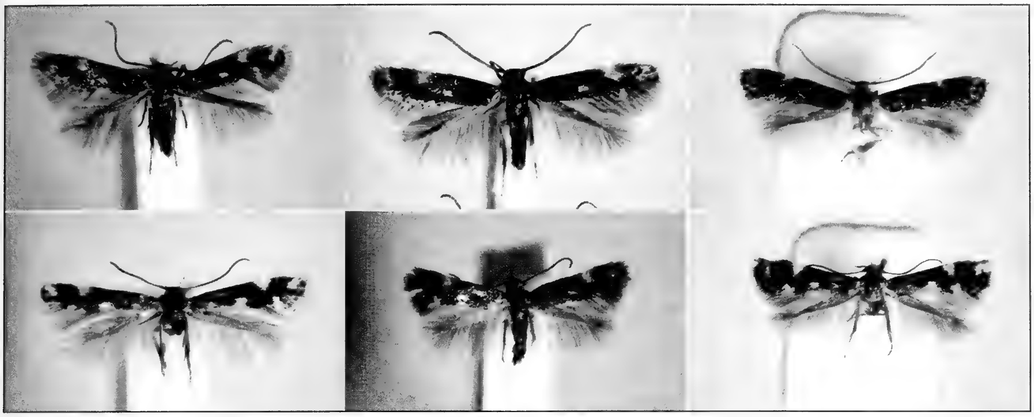


Fig. 1. Habitus of *Elachista juliensis*. Top row: males, bottom row females. Top left: Austria, Carinthia, Rossbach, Hl. Blut, 1700 m, 10.viii.1969, Klimesch leg. (ZSM). Top middle: Austria superior, Warscheneck, 1700 m, 8.viii.1937, Klimesch leg. (ZSM). Top right: Italy, V. d'Aosta, Aymavilles, frazione Ozein, 1250 m, ex ovo A. 131 1993, Varalda leg. et coll.. Bottom left: Austria, Carinthia Hl. Blut Tauernbg., 1800 m, 16.viii.1974, Klimesch leg. (ZSM). Bottom middle: Austria, Wien, Leopoldsberg, 5.vii.1942, Preissecker leg. (ZSM). Bottom right: Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m, ex ovo A. 193 1994, Varalda leg. et coll.

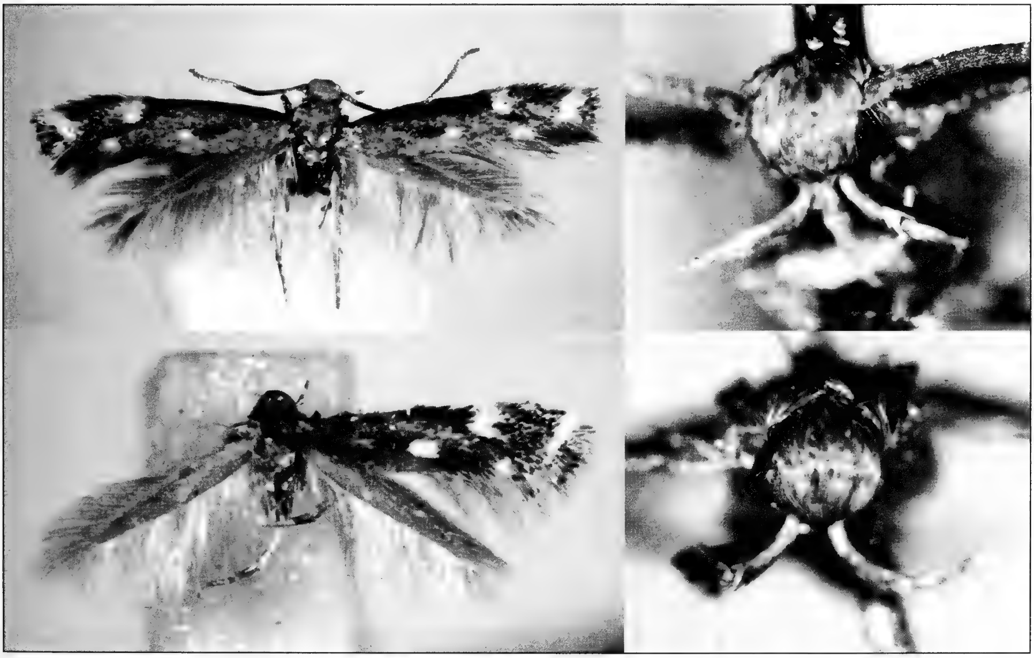
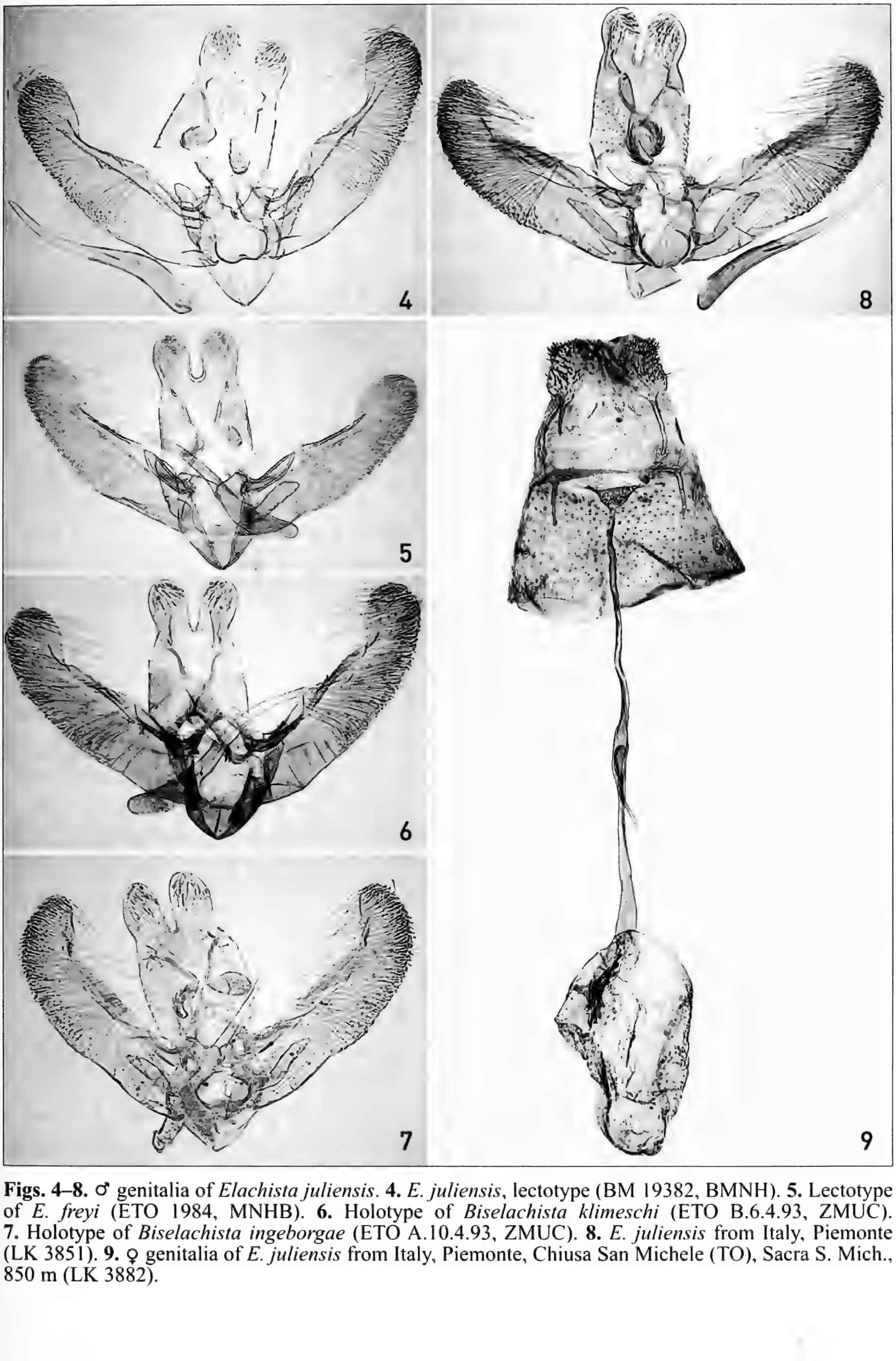


Fig. 2. Habitus and head of the primary types of taxa here considered conspecific with *Elachista juliensis*. Top: lectotype of *Elachista juliensis*. Bottom: lectotype of *Elachista freyi*.

m 250, nei boschi 28.vi.59 E. Jäckh; *Biselachista ingeae* sp. n. det. E. Traugott-Olsen; *Biselachista ingeborgae* sp. n. det. E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark. **2)** pin with paratype label containing two male specimens, one without abdomen, with preparation label 'Genital praeparat nr. 6446 sex: ♂; E. Traugott-Olsen'; otherwise with the same labeling as the holotype pin. **Austria:** 1♂ Austria inf., Dürnstein, 14.vii.1938, Klimesch leg. [in a pin together with a ♀ *Elachista*

Fig. 3. Habitus and head of the primary types of taxa here considered synonyms of *Elachista juliensis* Frey. Top: holotype of *Biselachista klimeschi*. Bottom: holotype of *Biselachista ingeborgae*.

martinii Her.] (LK slide 3772 *juliensis*, 3773 *martinii*, ZSM). 1♀ same data, but 18.vi.1938 (e. l. ex *Carex humilis*), Klimesch leg., with identification label "*Biselachista occidentalis* Frey det. E. Traugott-Olsen", Akvarel E. Traugott-Olsen (ETO slide 1782, ZMUC). 3♂ Austria superior, Klaus, 4.viii.1937, 19.vi.1946, Klimesch leg. (slide IS 4235) (MZLU). 1♂ Austria superior, Hinterstoder, 14.vii.1938, Klimesch leg. (LK slide 3774, ZSM). 2♂ Austria superior, Warscheneck, 1700 m, 8.viii.1937, [collector not mentioned] (ZSM). 2♂ Carinthia, H. Blut Tauernbg., 1800 m, 16.8.1974, Klimesch leg. (ETO slide 6536, ZMUC, 1♂ in ZSM); 5♂ same data, but 13.–14.viii.1973 (LK slides 3190, 3734, 3735, MZH). 1♂ Carinthia, Rossbach Hl. Blut., 1700 m, 10.viii.1969, Klimesch leg. (ZSM). 2♂ Teriolis sept. Innsbruck 18.vii.1941, 19.vii.1942, Klimesch leg. (TLMF). 2♂ Teriolis, Brenner Vennatal, 1400 m, 27.vii.1947, Klimesch leg. (ZSM). 1♀ Wien, Leopoldsberg 5.vii.1942 (e. l. ex *Carex* sp.), Preissecker leg. (ZSM). **Germany:** 1♂ Thuringia, Blankenburg, 21.vii.1970, Steuer leg., with identification label "*Biselachista occidentalis* Frey det. E. Traugott-Olsen" (LK slide 3771, ZSM). 1♂, 1♀ Blankenburg, Muschelkalk, 4.viii.1968 (ETO slide ♀ 5201, LK slide ♂ 3739); 1♀, same data, but 2.vii.1978 (e. l. ex *Carex humilis*), Steuer leg. (ZMUC); 1♂, same data, but 26.vii.1978 (e. l. ex *Carex humilis*) with identification label "*Biselachista occidentalis* Frey det. E. Traugott-Olsen" (ZSM). 2♂ Regensburg, 17.vii.1899, 19.vii.1900 (ex *Carex humilis*), coll. Frank, coll. Osthelder, with identification label "*Elachista juliensis* det. Kolbeck" (LK slide 3737, Kolbeck slide 18671/96, ZSM). **Italy:** 1♂, 1♀ Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m, rearing A.167, 5.–10.vii.1994 (ex *Carex humilis*); 13♂ 14♀, same data, but rearing A. 168, 18.vi.–10.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. (slides LK 3847–3856, 3881–3890); 6♂ 3♀ rearing A. 193, 12.vi.–5.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. (slide Varalda 0164). 1♂ 1♀ Piemonte, Ovada (Alessandria), per Gnocchetto, 260 m, rearing A. 152, 3.–13.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. 1♂ Piemonte, Mt. Rocciamelone (TO) Mompantero-Riposa, 1100 m, rearing A. 138, 3.vii.1993 (ex *Carex humilis*), Varalda leg. et coll. 5♂, Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Valdieri, Riserva Natur. Speciale dello *Juniperus phoenicea*, 900 m, 18., 22.vii.1998, Baldizzone leg., with identification label "*Biselachista freyi* Stgr. det. E. Traugott-Olsen", (ETO slide 6597, LK slide 3736, ZMUC); 8♂ 3♀ 17.vii.1999, 17., 20., 14.–27.vii.2000, Baldizzone leg., all with identification label "*Biselachista juliensis* P. G. Varalda det." (coll. Baldizzone); 43, 7♀ same data, but 13., 18., 22.vii.1998, 11.vi., 10.vii., 12., 17.vii.1999, Baldizzone leg., all with identification label "*Biselachista freyi* Stgr. det. E. Traugott-Olsen" (coll. Baldizzone). 16♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Palanfré – loc. Pascariund, 1450 m, 5.viii.2001,



Figs. 4–8. ♂ genitalia of *Elachista juliensis*. **4.** *E. juliensis*, lectotype (BM 19382, BMNH). **5.** Lectotype of *E. freyi* (ETO 1984, MNHB). **6.** Holotype of *Biselachista klimeschi* (ETO B.6.4.93, ZMUC). **7.** Holotype of *Biselachista ingeborgae* (ETO A.10.4.93, ZMUC). **8.** *E. juliensis* from Italy, Piemonte (LK 3851). **9.** ♀ genitalia of *E. juliensis* from Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m (LK 3882).

Baldizzone leg. et coll. 1♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Monte Ray, 1600–1800 m, 31.vii.2001, Baldizzone leg. et coll. 1♂ Piemonte, Parco Naz. Gr. Paradiso loc. Lago Serrù, 2275 m, 6.viii.1992, Delmastro leg., with identification label "*Biselachista klimeschi* Tr.-O. det. E. Traugott-Olsen" (ETO slide 6536, ZMUC). 1♂ Trentino, Val Sarca colline Lago di Cavedine, 7.viii.1970, Jäckh leg. (ZMUC). 1♂ Trento, 28.vi.1945, Klimesch leg. (LK slide 3191, MZH). 2♂, 3♀ Dintorni Trento 28.vi.1945, vii.1945, Klimesch leg. (MZH, LK slides 3767–3770, ZSM). 4♂ 4♀ V. d'Aosta, Aymavilles (Aosta), frazione Ozein, 1250 m, rearing A. 131, 18.vi.–9.vii.1994 (ex *Carex humilis*), Varalda leg. et coll. (slide Varalda 0162); 1♀ same data, but rearing A. 253, 16.vii.1995 (ex *Carex humilis*), Varalda leg. et coll. 7♂, 10♀ Aymavilles (Aosta), frazione Pondel, 890 m, rearing A. 250, 14.vi.–20.vii.1995 (ex *Carex humilis*), Varalda leg. et coll.

Description. Forewing length ♂ 2.6–3.3 mm, ♀ 2.5–3.0 mm. Male: Labial palpus ascending, length 1.0–1.2 times diameter of head; above white or pale ochreous except base of 3rd segment narrowly grey, below variably powdered with grey. Head varying: frons may be partly or entirely shiny white, head otherwise grey, or whole head unicolorous grey or mottled grey. Neck tuft mottled grey. Thorax mottled grey, scales of tegula and metascutum sometimes whitish, grey-tipped. Forewing ground colour dark grey, with five white markings for which size and brightness vary:
1 – indistinct small white streak basally, often absent, 2 – another more distinct streak distally from black streak situated at fold before middle of wing, 3 – triangular costal spot at distal 2/3 of costa, 4 – small, more or less rounded tornal spot beyond costal spot, and 5 – transverse streak at apex. Fringe scales grey, basal fringe scales black-tipped forming black fringe line. Hindwing grey. Underside of forewing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female otherwise as male but forewing with brighter and more expanded white pattern.

Male genitalia. Uncus lobes slightly longer than broad, distally rounded; median incision between them narrow u-shaped. Mesal margin of juxta lobes short, straight, distal margin almost straight, medially with group of long scales; digitate process rather narrow, distally variably oblique and acute-tipped or blunt, tongue-shaped; 0.28–0.30 times as long as valva; valva somewhat bent, width 0.3 times length at widest point; basal and distal fold of costa meet at 1/3 length of valva, distal fold even, sometimes slightly wrinkled; length of cucullus 1/4 of valva, longer than wide, somewhat bent towards costa, distinctly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, 0.80–0.95 times as long as valva, slightly bent S-shaped, caecum as long as basal opening of aedeagus; vesica with indistinctly sclerotised straight narrow cornutus, 0.22–0.24 times as long as aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, variable in length to some extent. Apophyses anteriores varying from 2/3 to full length of apophyses posteriores, stout or slender. Ostium bursae occupying half the width between apophyses anteriores, dorsal wall spinose; antrum broader than deep, internally spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. *E. juliensis* is univoltine. It seems to be monophagous on *Carex humilis*. The full-grown larva is 4.5–5.0 mm long, faded wax-coloured, with the prothoracic and anal plates almost concolorous with the body with the exception of the distal area of the tergal prothoracic plate which is striking as being melanised. The mine occupies the median part of the leaf; it is thin, 1.0–1.5 mm wide and about 8.5–10.5 cm long. The initial mine, constituting about half the total length of the mine, is very thin and then gradually widens. Towards the end it occupies about half the width of the leaf. Pupation takes place on the base of the leaf in the densely caespitose tussock of the host plant. The pupa is ochreous.

Distribution. Central Europe. Material studied from Austria, Germany, and Italy.

Remarks. According to the orginal description (Traugott-Olsen 1994) the type series of *Biselachista ingeborgae* consists of the male holotype and three male paratypes, all in the E. Traugott-Olsen collection (ETO). The types are stated to be as follows (loc. cit., verbatim): "Holotype male: Italia, Trentino, Val Sacra, Pietramurata, 28-vi-59, leg. E. Jäckh; gen-prep. 6438/ETO; wing prep. 6439/ETO; *Biselachista ingeborgae* sp. n. det. E. Traugott-Olsen. In coll. ETO.. Paratypes: 1) on pin with type, abdomen missing. 2) and 3) on joint pin, same data as type, anterior specimen with gen. prep 6440/ETO. In coll. ETO." In the Traugott-Olsen collection (now in ZMUC) there are four specimens labelled as type material. However, they do not fit the characteristics cited above. On the pin with the holotype label and the preparate labels, containing two specimens, one of the specimens lacks the abdomen and the other a pair of wings. Thus, the genital dissection and the wing preparation were made from different specimens. The slides corresponding to these numbers were not found in the ETO collection. There are, instead, a genital dissection numbered A.10.4.93 and a wing preparation numbered B 4.4.93. The paratype dissection no. 6440 has not been located. Ole Karsholt (pers. comm.) informed us that Traugott-Olsen changed his slide numbering system, but that this change had not been executed consistently. Therefore the existing wing slide almost certainly is the same as mentioned by Traugott-Olsen (1994), and the genital slide is either the holotype or the paratype slide. The male genital drawing of *B. ingeborgae* (Figs. 29, 37 in Traugott-Olsen 1994) generally resembles the genitalia on slide A.10.4.93 (cf. Fig. 7) although the digitate process is more compressed on the slide than on the drawing, and unlike the drawing, the tip of the aedeagus is not bifurcate on the slide. However, the general position of the genitalia drawing, agrees well with the genitalia on the slide. Similar discrepancies can be seen when the authentic genital slide of *Biselachista ruthae* Traugott-Olsen, 1994 (Fig. 13) is compared with Traugott-Olsen's drawing (1994: figs. 27, 35). In this case the digitate processes are drawn narrower and more three-dimensional than on the slide. This allowed the reconstruction of the natural shape of the digitate process which is now distorted on the preparation. Based on this evidence, we suggest that the slide A.10.4.93 of B. *ingeborgae* is the one mentioned as 6438/ETO in the original description. We further suggest that the specimen lacking the abdomen on the pin with the holotype label is indeed the holotype of *Biselachista ingeborgae*.

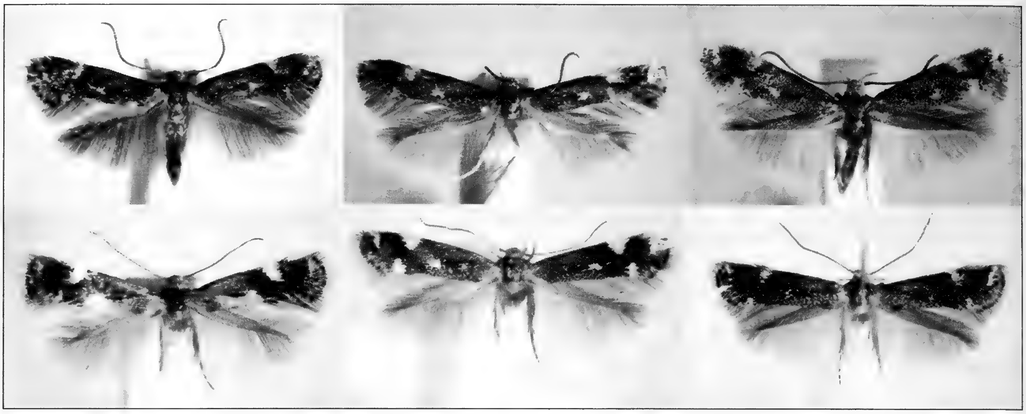


Fig. 10. Habitus of *Elachista occidentalis*. Top row: males, bottom row females. Top left: Austria superior, Umg. v. Linz, 18.vii.1937, Klimesch leg. (ZSM). Top middle: Italy, Piemonte, Parco Natur. Reg. Alpi Maritime 26.vii.1997, Baldizzone leg. (coll. Traugott-Olsen, ZMUC). Top right: Sweden, Sm. Marbäck 19.vii.1966, Svensson leg. (MZLU). Bottom left: Austria, Carinthia Hl. Blut Tauernbg., 1800 m, 18.viii.1974, Klimesch leg. (ZSM). Bottom middle: Finland, Oba: Utajärvi, e. l. 2003 (ex *Carex ericetorum*), Itämies leg. (ZMUO); Bottom right: Poland DV 57, 700 m, Pieniny Mts., Trzy Korony e.l. 2003 (ex *Carex digitata*), Baran leg. et coll.

Elachista occidentalis Frey (Figs. 10–18)

Elachista occidentalis Frey 1882: 372

Biselachista buvati Traugott-Olsen, 1994: 327, **syn. n**

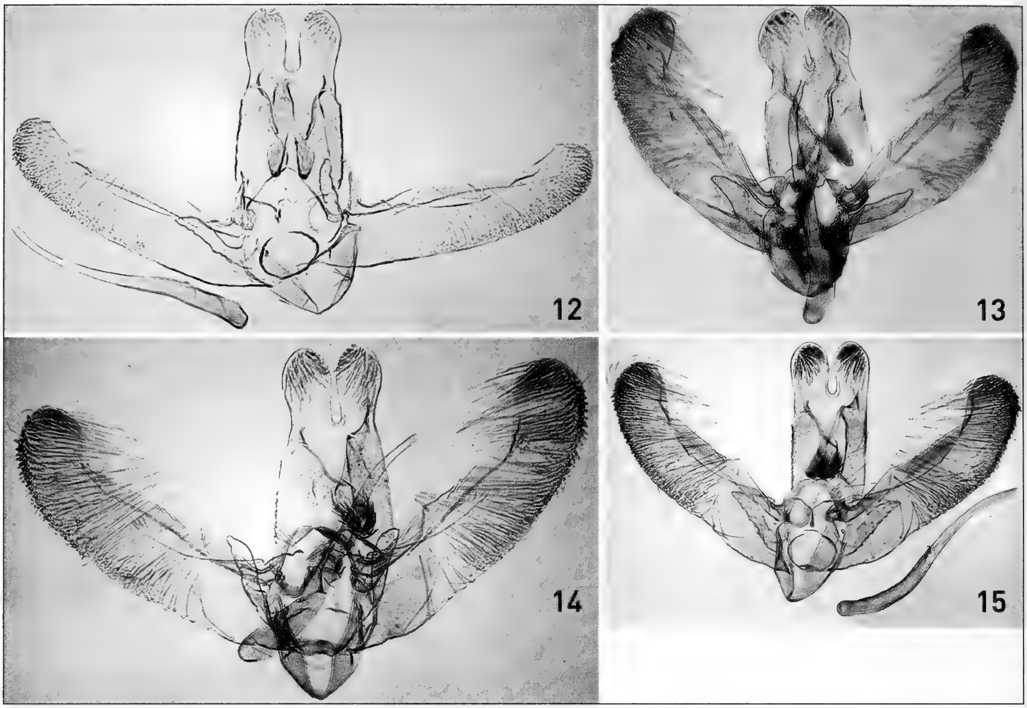
Biselachista ruthae Traugott-Olsen, 1994: 330, **syn. n.**

Biselachista freyi sensu Traugott-Olsen & Nielsen 1977, nec Staudinger, 1870

Material. Lectotype ♂ of *Elachista occidentalis*: LECTO- / TYPE [rounded with blue margin]; *E. occidentalis.* / Frey / Crassier (Loriol).; Frey coll. / Brit. Mus. /1890-62; B. M. ♂ / Genitalia slide / No. 19383; LectoTYPUS ♂ / *Elachista* / *occidentalis* Frey / TESTE U. PARENTI 1976. There is also another specimen, labelled as a paralectotype of *Elachista herrichii* Frey, B. M. slide 19377, *Elachista occidentalis* Frey L. Kaila det. 2000. (Frey coll., no further data, BMNH). Holotype of *Biselachista buvati*, labelled: Holotype; Genital praeparat nr. 5879 sex: ♂; E. Traugott-Olsen; Wing praeparat nr. 6426 sex: ♂ E. Traugott-Olsen; Italia - Piemonte Val Curone (Prov. AL) Poggio di Casasco 9.vi.1983 G. Baldizzone legit; *Biselachista buvati* sp. n. det. E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark. Holotype of *Biselachista ruthae*, labelled: Type; Teriolis mer.; Kreuzb. P. Sexten 1600 m 21.7.1986 J. Klimesch; Genital praeparat nr. B.5.4.93 sex: ♂; E. Traugott-Olsen; Wing praeparat nr. A.6.4.93 sex: ♂ E. Traugott-Olsen; coll. E. Traugott-Olsen; coll. ZMUC Copenhagen Denmark; Holotype *Biselachista ruthae* Traugott-Olsen. Paratypes of *Biselachista ruthae*: 2♂ 2♀, with the same collection data as in the holotype (2♂ 1♀ in ZMUC, ♀ with slides E. Traugott-Olsen B.10.4.93 (genitalia), A.15.4.93 (wings)), 1♂ LK slide 3745, ZSM). **Austria:** 1♂ Austria superior, Klaus, 4.vii.1937, Klimesch leg. (MZLU). 1♂ Umgeb. v. Linz 18.vii.1937, Klimesch leg. (ZSM). 2♂ Carinthia, Rossbach Hl. Blut, 1700 m, 10.viii.1968, 13.viii.1974, Klimesch leg. (TLMF). 4♂ Carinthia, Hl. Blut Tauernbg. 1800 m, 13.–14.viii.1974, Klimesch leg. (slides 3740, IS 6469) (ZSM, MZLU). 2♂ Carinthia, Hl. Blut Tauernbg. A 1700 m, 13.viii.1974, Klimesch leg., with identification label "*Biselachista juliensis* Frey det. E. Traugott-Olsen" (ETO slide 6435, ZMUC, LK slide 3738, ZSM). 1♀ Carinthia, Hl. Blut Tauernbg., 1800 m, 13.viii.1974, Klimesch leg. (ZSM). 1♂ Liesing, 1.viii.1919, '*freyi*' det. E. Jäckh. (ZMUC). 1♂ Osttirol, Virgental, Venedigergruppe, Timmeltal, 2100–2300 m, 1.viii.1993, Ryrholm leg. (TLMF). 3♂, 1♀ Osttirol, Virgental, Venedigergruppe, Sajatmähder E, 2300–2500 m, 12.viii.1993, Ryrholm leg. with identification label "*Biselachista juliensis* Frey det. U. Parenti" (slides U. Parenti 12231, 12519, 12520, 12522, TLMF). 4♂ N. Tirol, Glocknergruppe, Loweraze, 1660–1860 m, 30.–31.vii.1991, Karsholt, Rakosy & Tarmann leg. (slides LK 684, 688, 3192) (ZMUC). 2♂ N. Tirol, Glocknergruppe, above Kals, 1700–2200 m, 29.vii.1991, Karsholt & Rakosy leg. (slide LK 683) (ZMUC). 2♂, 1♀ N. Tirol, Glocknergruppe, Burg bei Kals, 1500 m, 28.–29.vii.1991, Karsholt & Rakosy leg. (ZMUC). 1♂, 1♀ Schnönau a.d. Enns O.Ö. 12.vii.1994, Wimmer leg. (TLMF). 1♂, 1♀ Windischgarsten, O.Ö., Veichltal, 4.vii.1994, Wimmer leg. (TLMF). 1♂ Wien, Haschberg, 10.vi.1917,

Fig. 11. Habitus and head of the primary types of *Elachista occidentalis* and taxa here considered its junior synonyms. Top: lectotype of *E. occidentalis*, middle: holotype of *Biselachista ruthae*, bottom: holotype of *Biselachista buvati*.

Preissecker leg., '*serricornis*' det. E. Jäckh (ZMUC). **Bulgaria:** 1♂ Asenograd, 20.vi.2000, Junnilainen leg. et coll. (LK slide 3194). 1♀ Pirin, Popovi Livadi, 1300 m, 21.–24.vi.2001, Junnilainen leg. et coll. **Croatia:** 3♂ Plitvice, 17.–20.vii.1984, Schnack leg. (LK slides 3197, 3553, ZMUC). **Estonia:** 2♂ Pidula, 4.vii.1994, Junnilainen leg. et coll. 1♀ Kogula, 20.vi.1994, Junnilainen leg. et coll. **Finland**: *Ab.* 21♂, 9♀ Lohja, 1.viii.1961, 22.vii.1965, 20., 25.vii., 17.viii.1966, 26.vii.1967, 30.vii.1968, 26.vii., 1.viii.1969, 18., 23.vii., 15.viii.1970, 26., 27., 28.vii.1971, 18.vii.1972, 17.vii.1973, 20.vii.1975, 29.vii.1983, 25.vii., 8.viii.1987, 28.vii.1991, Krogerus leg. (slides LK 3731, 3732) (MZH); 1♂ same data, but 1990 (e.l.), Junnilainen leg. (MZH). 1♂ Lohja, Torhola 1993 (e. l. ex *Carex digitata*), Kaila leg. (MZH). *N.* 14♂ 10♀ Siuntio, Andby 668:35, 1991 (e. l. ex *Carex digitata*), Kaila leg. (slides LK 530, 681, 682, 685, 686, 3198, 3199, 3733, 3760–3763) (MZH), 2♂ same data, but 1991, Kaitila leg. (MZH). *St.* 1♂ Säkylä, 27.vii.2003, Kaitila leg. (slide LK 3756) (coll. J.-P.Kaitila). *Ta.* 1♂ Hattula, 28.vi.1936, Lindberg leg. (MZH). 9♂ same data, but Hattula 8.–10.vii.1936, Karvonen leg. (slide LK 687) (MZH). *Sa.* 1♂ Imatra, 12.vii.1955, Nybom leg. (MZH). *Ok.* 1♂ Kuhmo, 9.vii.1980, Nybom leg. (MZH). *Ob.* 2♂ 2♀ Utajärvi 716:47, 24.vii.1976, Kyrki leg. (slides J. Kyrki 1066, 1067) (ZMUO); 3♂ 2♀ (e l.), same data, but larvae 7.v.2003 (in *Carex ericetorum*), Itämies & Leinonen leg. (ZMUO). **France:** 1♂ Hautes Alpes RN 05, Les Vigneaux, 1000 m, 5.vii.2002, Junnilainen leg. et coll. (LK slide 3757); 3♂ 5 km W les Vigneaux, 1250 m, 5.–6.vi.2003, Junnilainen leg. et coll. (LK slide 3759). 1♂ Provence, 2 km N. la



Figs. 12–15. ♂ genitalia of *Elachista occidentalis*. **12.** *E. occidentalis*, lectotype (BM 19383, BMNH). **13.** Holotype of *Biselachista ruthae* (ETO A.3.4.93, ZMUC). **14.** Holotype of *Biselachista buvati* (ETO 5879, ZMUC). **15.** *E. occidentalis* from Finland (LK 3772).

Mur, 17.v.2003, Hendriksen leg. (ZMUC). **Germany:** 4♂ Baden, Grenzacherhorn, Paravicini coll. B. M. 1937–383 (BMNH). 1♂ (abdomen missing) '*E. serricornis* (Sta vid.) Sta Baden Baden, Frey coll., Brit Mus. 1890-62 (BMNH). 1♂, 1♀ [no locality given] Frey coll., Brit. Mus. 1890-62 (BMNH). 1♂ Regensburg, 15.vi.1932 (e. l. ex *Carex silv.*), Sälzl. leg., (LK slide 3743, ZSM). **Greece:** 1♂ Peloponés, Taygetos, vi.1996, Lastuvka leg. (LK slide 3552) (ZMUC). 2♂ Pindos, Konitsa, Pades, 6.vii.1981, Grotenfelt leg. et coll. (LK slides 3549, 3551). **Italy:** 4♂, 1♀ Friuli, Fiume Felia nr. Carnia, 240 m, 26.vi–2.vii.2003, Skule & Hviid leg. (ZMUC). 8♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, S. Giacomo di Entracqua sopra Lago della Rovina, 1800–2000 m, 20., 26.vii.1997, and 1♂ same data, but 1550–1850 m, 20.vii.1997, all Baldizzone leg., and with identification label "*Biselachista ingeborgae* Tr.-O. det. E. Traugott-Olsen (coll. Baldizzone, ZMUC, LK slide 3862). 1♂ Piemonte (CN) Parco Natur. Reg. Alpi Maritime, Trinità (Entracque), Vallone Grande, 1400 m, 16.vii.1996, Baldizzone leg., with identification label "*Biselachista ingeborgae* Tr.-O. det. E. Traugott-Olsen (coll. Baldizzone). 1♂ Prov. Trento, Lago di Molveno, 10.vii.1983, De Prins leg. (LK slide 3741) (ZSM). 2♂ Südtirol, Montiggl Kl. Priol, 600 m, 26.vi.1993, 14.vii.1993, Huemer leg. (TLMF). 1♂ Südtirol, 400 m, Pfatten, Mitterberg, NO-Hang, 12.vii.1991, Huemer leg., with identification label "*Biselachista juliensis* Frey det. U. Parenti" (slide U. Parenti 12516) (TLMF). 1♂, 1♀ Teriolis mer., Kreuzberg Pass, 1600 m, 22.vii.1988, Klimesch leg. (♂ in ZSM, ♀ in MZH). 2♂ Kreuzberg, P. Sexten, 1660 m, 21.vii.1986, Klimesch leg., one specimen with identification label "*Biselachista juliensis* Frey det. E. Traugott-Olsen" (slide ETO 6437, ZMUC). **Poland**: Glinki n. Torún e. l. 23.v.1997 1♂, 14.v.1999 1♂, 31.v.2003 1♀ ex *Carex ericetorum*, all T. Baran leg. (LK slides 3746, 3860, 3864, MZH). 1♂, 1♀ Pieniny Mts. Trzy Korony, 700 m, 12., 15.vi.2003 (e. l., ex *Carex digitata*), Baran leg. (LK slides 3861, 3863, MZH). **Sweden:** *Gtl.* Fleringe 14.vii.1969 1♂ I. Svensson leg. (MZLU). 1♀ Frijel, 16.vii.1977, Svensson leg. (slide IS 5873) (MZLU). 1♀ Lojsta, 18.vii.1965, Svensson leg. (slide IS 4641) (MZLU). 1♀ Rute, 7.vii.1984, Svensson leg. (slide IS 6804) (MZLU). 1♂ Tingstide, 4.vii.1969, Svensson leg. (slide IS 4788) (MZLU). 1♂ Vamlingbo, 16.vii.1959, Ekström leg.; 1♂ same data, but 14.vii.1977, Svensson leg. (MZLU). 1♀ Öja, 21.vii.1933, Benander leg. (MZH). *Sm.* 1♂ Högsby' 13.–14.vii.1968, Svensson leg. (MZLU). 6♂, 1♀ Marbäck, 19.vii.1966, Svensson leg. (slide IS 4651) (MZLU). *Vg.* 2♂ Kinnekulle, 1.–2.vii.1966, 16.vi.1968, Svensson leg. (slide 4128) (MZLU). 2♂ Österplana 19.vii.1962, Svensson leg. (MZLU). *Öl.* 7♂ Gårdby, 4.vii.1989, 13.vii.1985, Svensson leg. (MZLU). 1♂ Hulterstad, 25.vi.1973, Svensson leg. (MZLU). 3♂

Karums alvar, 23.vi.1959, Svensson leg. (slide IS 3100) (MZLU). 1♂ Kårehamn 23.vi.1973, Svensson leg. (MZLU). 1♂ Vickleby 13.–15.vii.1961, Svensson leg. (MZLU). *Ög.* 1♂ Kolmården, 23.vii.1975, Svensson leg. (slide IS 5644) (MZLU). **Switzerland:** 1♂ Baselland, Hardwald, Paravicini coll. B. M. 1937-383 (BMNH). – uncertain locality: 1♂, 2♀ [no locality given] Stainton coll. Brit. Mus. 1893-134 (BMNH).

Fig. 16. ♀ genitalia of *E. occidentalis* from Finland, Siuntio (LK 3199).

Description. Forewing length ♂ 3.2–4.5 mm, ♀ 3.1–4.3 mm. Male: Labial palpus ascending, length 1.4–1.5 times diameter of head; above white except base of 3rd segment narrowly grey, below variably powdered with grey in middle of 2nd and 3rd segments. Head shiny white, variably mottled with grey-tipped scales above and sometimes laterally. Neck tuft usually mottled grey, sometimes almost entirely white. Thorax grey, scales of tegula and metascutum whitish, grey-tipped. Forewing ground colour varying from grey to dark grey or brownish, with five white markings which vary in size and brightness: 1 – indistinct small white streak basally, 2 – another more distinct streak distally from black streak situated at fold before middle of wing, 3 – triangular costal spot at distal 2/3 of costa, 4 – small more or less rounded tornal spot beyond costal spot, and 5 – transverse streak at apex; costal spot basally delimited with oblique straight black streak. Fringe scales grey, basal fringe scales black-tipped forming black fringe line. Hindwing grey. Underside of fore-wing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female as male but forewing ground colour dark grey with brighter and more expanded white pattern.

Male genitalia. Uncus lobes about 1.3 times longer than broad, distally rounded; median incision between them narrow, u-shaped. Mesal margin of juxta lobes short, straight; distal margin somewhat rounded, medially with a group of long scales; digitate process rather narrow, distally variable, oblique and acute-tipped; length 0.28–0.3 times length of valva; valva somewhat bent, width strongly variable, 0.25–0.30 times length at widest point; basal and distal fold of costa meeting at 1/3 length of valva; distal fold wrinkled; length of cucullus 1/4 length of valva, longer than wide, somewhat bent towards costa, distinctly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, 0.80–0.95 times length of valva, slightly bent s-shaped, caecum as long as basal opening of aedeagus; vesica with very indistinct straight and narrow cornutus about 0.15–0.22 times length of aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, length variable to some extent. Apophyses anteriores varying from 2/3 to full length of apophyses posteriores, stout or slender. Ostium bursae occupying over half width between apophyses anteriores, dorsal wall spinose; antrum as broad as deep, internally spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of

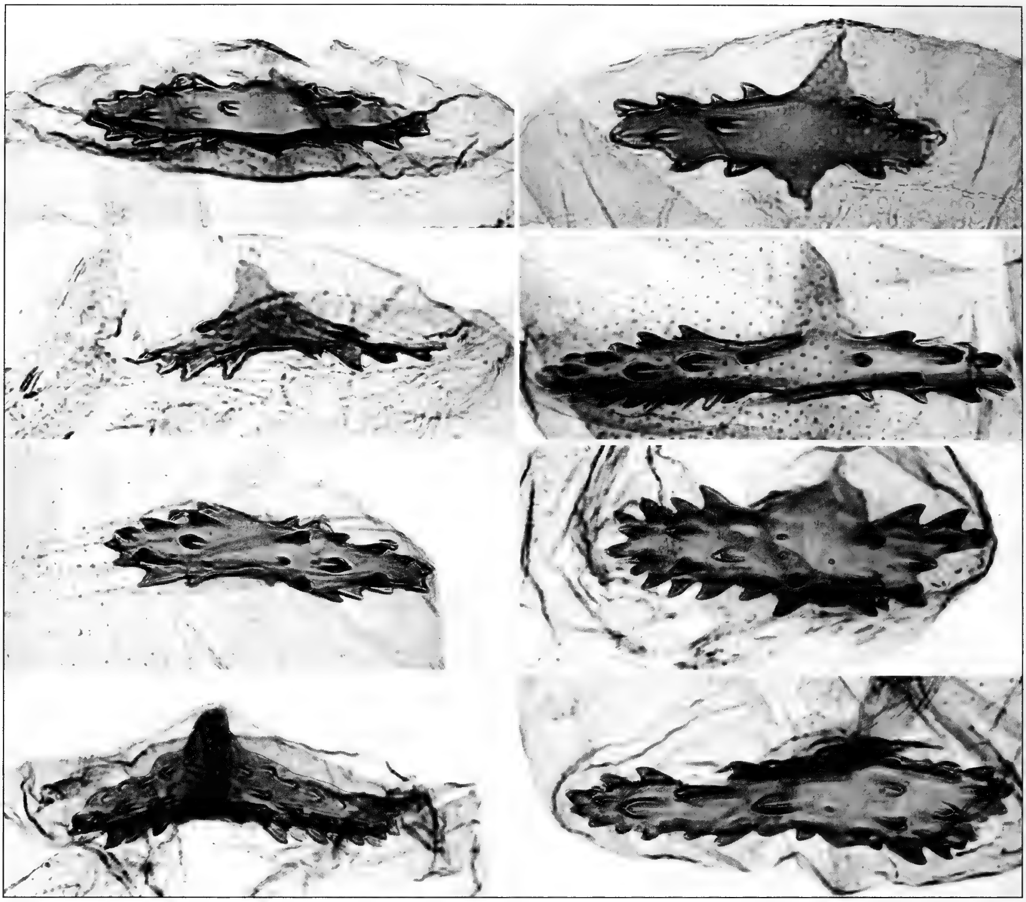


Fig. 17. Signum in *Elachista juliensis* and *E. occidentalis,* showing variation found within single populations. Left column: *E. juliensis*, all from ex ovo series: Italy, Piemonte, Chiusa San Michele (TO), Sacra S. Mich., 850 m, A.168 1994, P. G. Varalda leg., slides from top to bottom LK 3881, LK 3882, LK 3883, LK 3884. Right column: *E. occidentalis*, all from Finland Siuntio, Andby, larva ex *Carex digitata* 1991, Kaila leg., slides from top to bottom LK 3199, LK 3760, LK3761, LK3762.

ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. *E. occidentalis* occurs in montane areas in Central and southern Europe. In northern Europe it inhabits xerothermic sites. The adults sometimes have been caught in the evening, and in Central and southern Europe they are attracted to light. The species is univoltine. The larva feeds on *Carex digitata* and *C. ericetorum.* The full-grown larva is 5–7 mm long, greyish green, with the prothoracic and anal plates amber-coloured. The mine is 10–15 cm long, situated either along the mid-rib or the margin of the leaf. The initial mine, constituting about half the total length of the mine, is very thin and then gradually widens. Towards the end it occupies about half the width of the leaf. Pupation takes place in laboratory conditions usually on the mid-rib

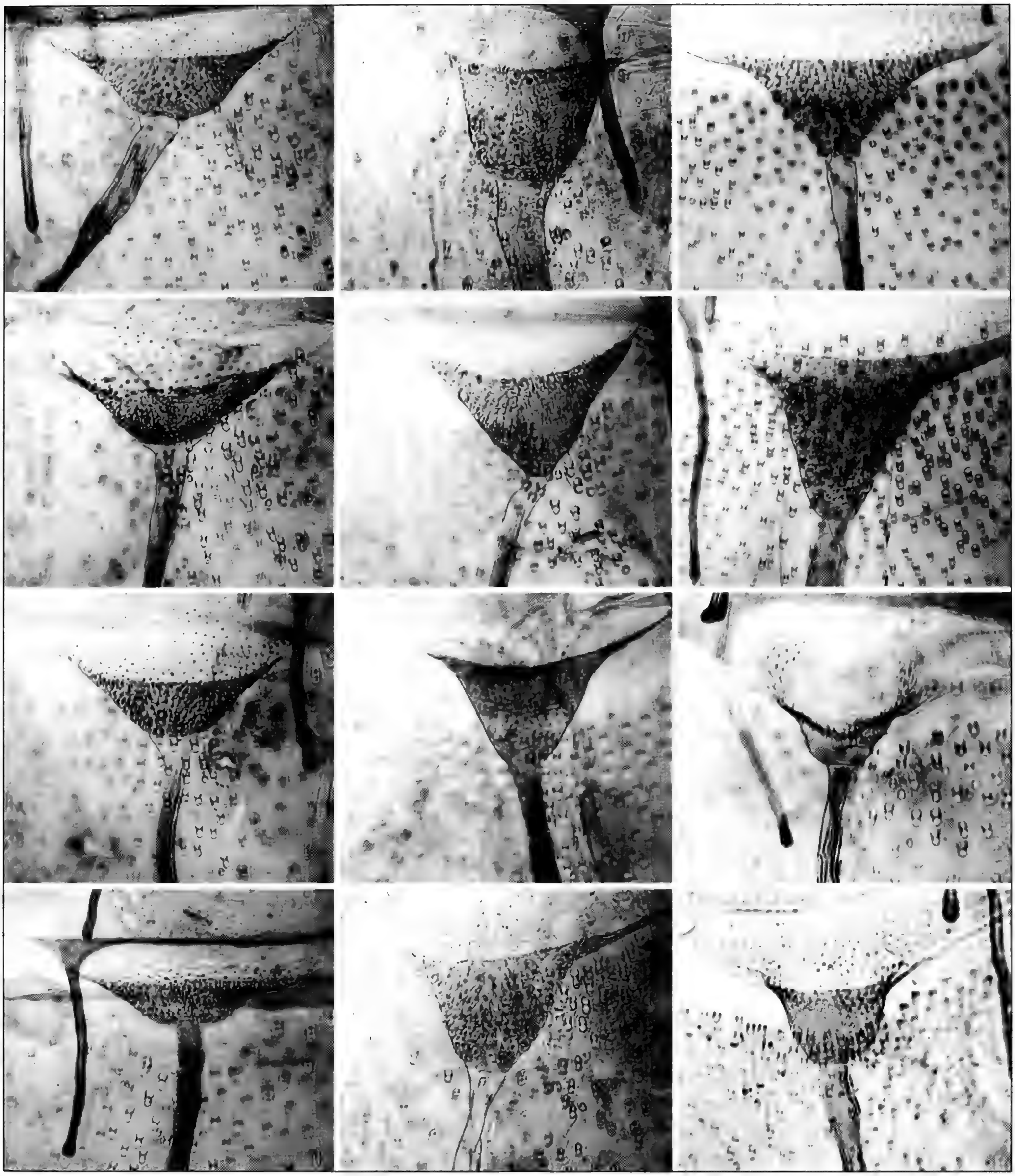


Fig. 18. Variation in the shape of the antrum in *Elachista juliensis*, *E. occidentalis*, *E. ribentella* and *E. zonulae*. Left column *E. juliensis*, from top: Austria inf. Dürnstein (slide LK 3772), Italy, Dintorni Trento (slide LK 3768), Italy, Piemonte Chiusa San Michele (TO), Sacra S. Mich., 850 m (slide LK 3890), Italy, Piemonte (slide LK 3890). Middle column *E. occidentalis*, from top: Italy Kreuzberg P. Sexten (paratype of *E. ruthae*) slide (ETO B.10.4.93), Finland N: Siuntio (slide LK 3199), ditto (slide LK3760) Sweden, Småland, Marbäck (slide I. Svensson 4651). Right column from top: *E. ribentella* sp. n. paratype, Japan, Hokkaido, Kyôwa-Town (slide Sugisima 0760), ditto (slide Sugisima 0983), *E. zonulae*, Poland, Tatra Mts., Giewont (slide LK 3201), ditto, Russia, Altai, Chuja Valley (slide LK 3907).

of the leaf, sometimes elsewhere, often in a corner of the rearing pot. The pupa is brown, attached to the substrate with a silken girdle.

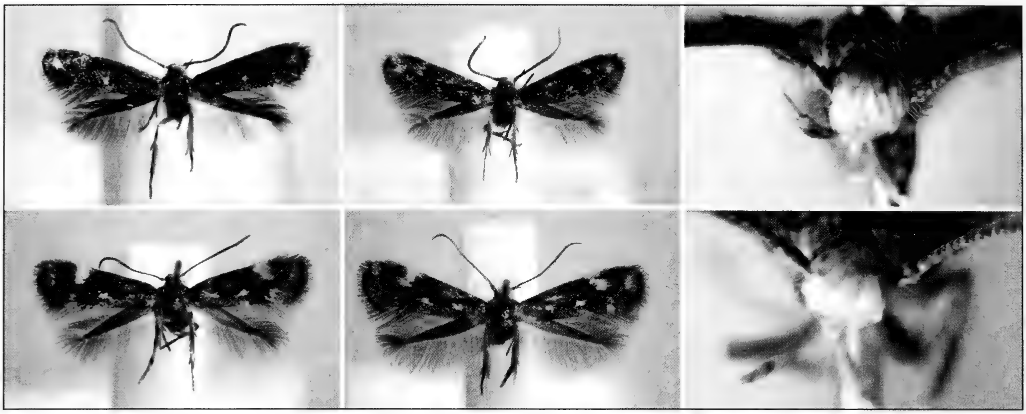


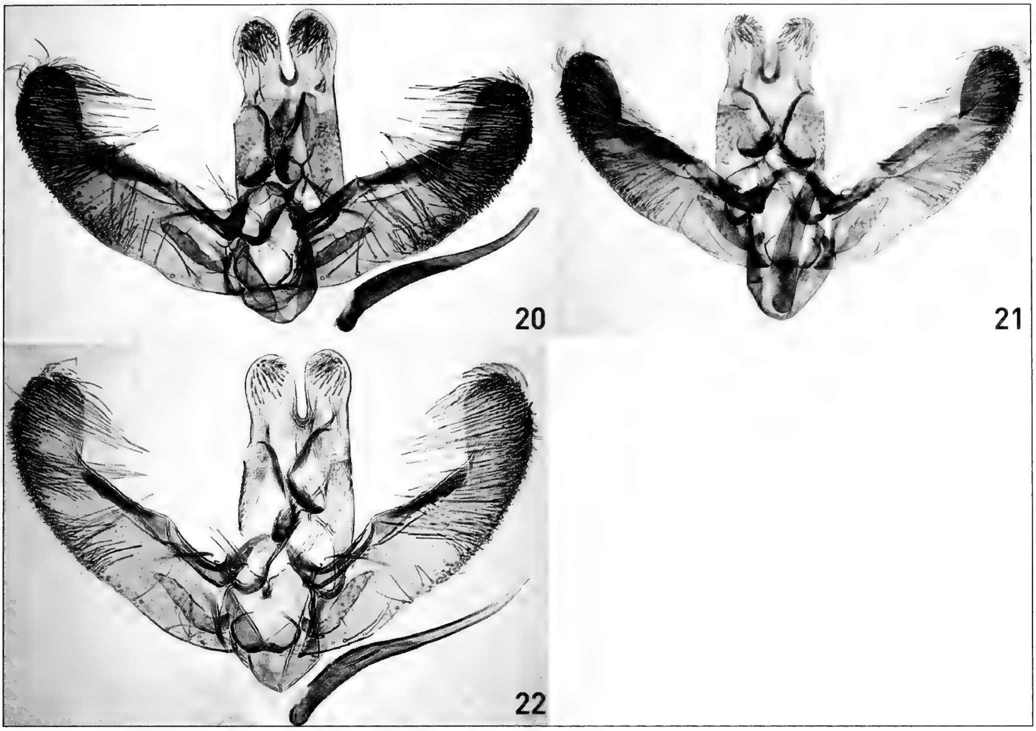
Fig. 19. Habitus of *Elachista ribentella* sp. n. Top row males: holotype (Japan: Hokkaido: Sinsennuma, Kyôwa-Town) paratype ditto, head of the holotype. Bottom row females: 2 paratype ditto.

Distribution. Widespread in Europe, material studied from Austria, Bulgaria, Croatia, Estonia, Finland, France, Germany, Greece, Italy, Poland, Sweden, and Switzerland.

Remarks. *E. occidentalis*, as here delimited, is a somewhat variable species, both in colouration and in male genitalia. No obvious trends in any character combination have been detected, and the range of variation in genitalia seems present in populations throughout the distribution range. In central and southern Europe, and in some dry sites also in northern Europe, specimens tend to be paler than those from more northern or humid areas, but variation is great and overlapping everywhere. The holotypes of *Biselachista buvati* Traugott-Olsen, 1994 and *Biselachista ruthae* Traugott-Olsen, 1994 are within the variation observed in *Elachista occidentalis*, and these names are here considered junior synonyms of *Elachista occidentalis*. Note, however, that the male genital illustrations of *Biselachista buvati* in its original description were drawn from a paratype, not the holotype (Figs. 25 and 33 in Traugott-Olsen 1994). They obviously depict *Elachista zonulae* Sruoga (the specimen was not studied). The specimen labelled as the holotype of *B. buvati* (habitus and wing venation illustration in the original description by Traugott-Olsen 1994: figs. 4, 16) is not conspecific with this paratype, and its characteristics, including those of the male genitalia (Fig. 14), fall well within the variation observed in *Elachista occidentalis*. The ♀ habitus acquarel showing *E. occidentalis* in Traugott-Olsen (1994) was painted from an *E. juliensis* specimen (in coll. ZMUC). The valva and the uncus lobes of the holotype of *E. ruthae* appear broader than in other specimens here assigned to *E. occidentalis*. This is due to distortion caused by superfluous squeezing of the genitalia on this slide. Other specimens from the same series from which the holotype of *E. ruthae* was selected, are just like any other representative of *E. occidentalis*.

Elachista ribentella sp. n. (Figs. 18–23)

Material. Holotype ♂, labelled: **Japan**: Hokkaido: Sinsen-Marsh, Kyôwa-Town, em. 13.vii.1995 K. Sugisima leg., Host 00118 *Carex blepharicarpa*, ♂ genitalia slide no. 0982 K. Sugisima, 2002. (SEHU).



Figs. 20–22. ♂ genitalia of *Elachista ribentella* sp. n. **20.** Holotype (Sugisima 0982). **21.** Paratype from Japan (Sugisima 0734). **22.** Paratype from Russia (LK 3749).

Paratypes (11♂, 2♀): 7♂, 2♀ same data, but, e. l. ex *Carex blepharicarpa*, 14.vii.1995, 1., 17., 19.vii.1996, 21.vi.1998, Sugisima leg. (SEHU, 2♂ in MZH); 2♂ Honsyû, Ueno, Azusagawa, Nagano Pref. 13.vii.1982, 22.vii.1982, Hirano leg. (SEHU). **Russia**: 1♂ S. Primorje, 43°16′N 134°04′E, Lazowski Res., 5.–9.viii.1998; 1♂ S. Primorje 43°38′N 132°33′E Ussuriskij Res., 250 m, 29.–31.vii.1998, Jalava, Kullberg & Kaare leg. (MZH). – Additional material: **Russia**: 2♂, S. Primorje, 20 km E Ussurijska, 7.viii.1982, 10.viii.1982, Puplesis leg. (MZH) [specimens in bad condition, glued on cardboard].

Description. Forewing length ♂ 2.7–3.5 mm, ♀ 3.5–3.7 mm. Male: Labial palpus ascending, length 1.2–1.3 times diameter of head; above greyish or ochreous white except base of 3rd segment narrowly grey, below powdered with grey in the middle of 2nd and 3rd segment. Head shiny ochreous or greyish white, variably mottled with grey-tipped scales laterally and on vertex. Scape and pedicel of antenna above mottled grey, flagellum thick greyish white below on basal 2/3, above grey, annulated with somewhat paler rings.

Fig. 23. ♀ genitalia of *Elachista ribentella* sp. n. paratype (Japan) (Sugisima 0983).

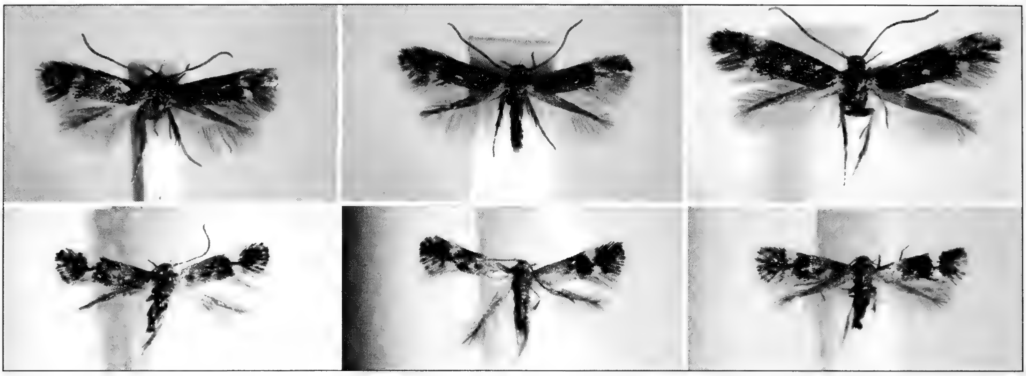


Fig. 24. Habitus of *Elachista zonulae*. Top row: males, bottom row females. Top left: Austria, Teriolis Sept., Nordkette, 1500 m, 29.vii.1943, Burmann leg. (TLMF). Top middle: Poland, Tatra Mts. 1350 m, Sarnia Skals 7.vii.1987, Buszko leg. (ZMUC). Top right: Poland, Tatra Mts. Kominiarski Wierch, 1700–1800 m 28.vii.1997, Nupponen & Junnilainen leg. (coll. T. & K. Nupponen). Bottom left and middle: Russia, Altai Mts., Chuja Valley, 1500 m, 5 km SE Aktash 14.vii.2001, Nupponen leg. (coll. T. & K. Nupponen). Bottom right: Russia, Altai Mts., Kuraisky Hrebet, 2300 m, 9.vii.201, Nupponen leg. (coll. T. & K. Nupponen).

Neck tuft mottled grey. Thorax mottled grey, scales of tegula and metascutum whitish, grey-tipped. Forewing ground colour mottled grey, with four indistinct mottled whitish markings: 1– small streak distally from black streak situated in fold before middle of wing, 2 – triangular costal spot at distal 2/3 of costa, 3 – small, more or less rounded tornal spot beyond costal spot, and 4 – transverse streak at apex; costal spot basally delimited with obliquely oriented, straight black streak and another pronounced streak at fold at 3/4 wing length. Fringe scales grey, basal fringe scales black-tipped forming black fringe line. Hindwing grey. Underside of forewing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female as male but forewing ground colour darker grey with brighter and more expanded white pattern, also with small white streak basally delimiting black streak of fold.

Male genitalia. Uncus lobes about 1.5 times longer than broad, distally rounded; median incision between them narrow, u-shaped. Mesal margin of juxta lobes short, straight; distal margin somewhat rounded, medially with a group of long scales; digitate process narrow, distally variable, oblique and acute-tipped; length 0.28–0.30 times length of valva; valva somewhat bent, width strongly variable, 0.28–0.31 times length at widest point; basal and distal fold of costa meeting at 1/3 length of valva; distal fold even or somewhat wrinkled, distinctly sclerotised and often remarkably widened distally; length of cucullus 1/4 length of valva, longer than wide, somewhat bent towards costa, distinctly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, length 0.75–0.78 times length of valva, slightly bent s-shaped, caecum as long as basal opening of aedeagus; vesica with straight narrow cornutus, 0.31 times as long as aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, length variable to some extent. Apophyses anteriores almost as long as apophyses

Fig. 25–26. ♂ genitalia of *Elachista zonulae*. **25.** *E. zonulae* from France (LK 3758). **26.** *E. zonulae* from Russia, Altai (LK 3732).

posteriores, slender. Ostium bursae occupying over half width between apophyses anteriores, dorsal wall spinose; antrum of variable shape, internally strongly spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. *E. ribentella* has been reared from *Carex blepharicarpa*. The type locality is the wet edge of a peat bog. Specimens from Ueno, Japan have been collected in a moderately humid conifer forest (K. Sugisima, pers. comm.). The specimens from the Russian Far East collected by Jalava, Kullberg, and Kaare were found in a lush meadow and in a ruderal village habitat (J Kullberg., pers. comm.).

Distribution. Japan, Russia (Far East).

Remarks. The specimens reported as *Biselachista freyi* from the Russian Far East by Sruoga (1995) are referable to *E. ribentella*.

Fig. 27. ♀ genitalia of *Elachista zonulae* (Sruoga) (Poland, Tatra Mts., Giewont, LK 3201).

Elachista zonulae (Sruoga, 1992) (Figs. 18, 24–27)

Biselachista zonulae Sruoga *in* Sruoga & Puplesis 1992: 440

Material. **Austria:** 1♂ Teriol. sept. Nordkette, 1400 m, 22.viii.1939, Burmann leg. (LK slide 3858, TLMF); 1♂ same data, but 1500 m, 29.vii.1943, Burmann leg. (LK slide 3857, TLMF), both with identification label "*Elachista juliensis* Frey det. U. Parenti". **France:** 1♂ Hautes Alpes RN05 5 km W Les Vigneaux, 1250 m, 5.–6.vi.2003, Junnilainen leg. et coll. (LK slide 3758). **Kyrgyzstan:** 2♂ 10 km SE Lake Song Köl, steppe/river bed, 41°30′N 75°35′E, 26.vii.1990, Kaila leg. 3♂, 1♀ 45 km NE Naryn, 2650 m, dry meadow, 41°40′N 76°31′E, 31.vii.1990, Kaila leg. 10♂ 41 km E Naryn, 2850–3300 m, steppe-alpine meadow, 41°20′N 76°26′E, 31.vii.–7.viii.1990, Kaila leg. (all in MZH). **Poland**: 19♂, 1♀ Tatra Mts., Bobrowiec, 1400–1500 m, Mnichy Chocholowskie, 23.vii.1997, Nupponen & Junnilainen leg. (LK slide 3193, coll. Junnilainen, coll. Nupponen, 1♂ in MZH). 3♂ Tatra Mts., Kominiarski Wierch, 1700–1800 m, 28.vii.1997, Nupponen & Junnilainen leg. et coll. (LK slide 3755). 1♀ Tatra Mts., Giewont, Mnich Malolacki, 24.vii.1997, Nupponen & Junnilainen leg. (LK slide 3201, coll. Junnilainen). 1♂ Tatra Mts., Sarnia Skała, 1350 m, 7.vii.1987, Buszko leg. (ZMUC). **Russia**: 4♂, 1♀ Altai Mts., 50°16–20′N 87°50–55′E, Kuraisky hrebet, 2300 m, 9.vii.2001, Nupponen leg. 2♂, 2♀ Altai Mts., Chuja valley, 5 km SE Aktash village, 1500 m, 50°14–16′N 87°40′E, 14.vii.2001, Nupponen leg. (coll. Nupponen, 1♀ in MZH).

Description. Forewing length ♂ 2.5–3.5 mm, ♀ 2.4–2.8 mm. Male: Labial palpus ascending, length 1.1–1.2 times diameter of head; above whitish grey except base of 2nd and 3rd segments variably grey, below grey. Head, neck tuft, and thorax mottled grey. Forewing ground colour dark grey, with three greyish white markings: 1 – streak distally from black streak situated at fold before middle of wing, 2 – triangular or rounded costal spot at distal 2/3 costa, 3 – another similar tornal spot opposite costal spot. Fringe scales grey, basal fringe scales darker grey-tipped forming indistinct fringe line. Hindwing grey. Underside of forewing dark grey, fringe at costal and tornal spots creamy white; underside of hindwing grey. Female as male but forewing ground colour darker with brighter and more expanded white pattern.

Male genitalia. Uncus lobes about twice longer than broad, distally rounded and slightly broadened; median incision between them almost as broad as basal width of uncus lobes, u-shaped. Mesal margin of juxta lobes short, straight, distal margin somewhat concave, laterally with group of long scales; digitate process blunt-tipped, length 0.22–0.28 times length of valva; valva somewhat bent, width variable, 0.27–0.30 times length at widest point; basal and distal fold of costa meeting at 1/4 length of valva; distal fold even; cucullus 1/4 length of valva, longer than wide, somewhat bent towards costa, weakly twisted over distal fold of costa. Aedeagus gradually tapered towards apex, 0.80–0.95 times as long as valva, strongly bent at basal 1/3, s-shaped, caecum shorter than basal opening of aedeagus; vesica with very indistinct, straight narrow cornutus, about 0.22–25 times length of aedeagus.

Female genitalia. Papillae anales rounded, covered with long and thin setae, distally also with short and stout setae. Apophyses posteriores stout, rather straight, length variable to some extent. Apophyses anteriores varying from 2/3 to full length apophyses posteriores, stout or slender. Ostium bursae occupying about 1/3 width between apophyses anteriores, dorsal wall spinose; antrum about as broad as deep, internally strongly spinose; ductus bursae posteriorly narrow, tubular, broader cephalad from inception point of ductus seminalis; sclerotisation of colliculum long, almost extended from antrum to inception of ductus seminalis; ductus bursae inserted distinct from corpus bursae; corpus bursae largely covered with distinctive internal spines; signum an elongate dentate plate of variable shape.

Life history. In Central Asia and Siberia *E. zonulae* occurs in high altitude xerothermic meadows. In Poland and the Alps the habitat is similar, although the species has been found in somewhat lower altitudes. Baran (2003), based on Buszko & Baraniak (1989), reports the larva to feed on *Carex sempervirens*. The adult is active in the afternoon and evening before sunset. The species is univoltine.

Distribution. Transpalaearctic; material examined from Austria, France, Kyrgyzstan, Poland, and Russia (Altai Mts.). Sruoga (1992) reports it also from Kazakhstan and Tajikistan, and Tokár et al. (1999) from Slovakia. *E. zonulae* is recorded from the Alps, Tatra Mts., Tian Shan Mts. in Kazakhstan, and Tajikistan, and Altai Mts. in Siberia.

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Nota lepid. **27** (2/3): 239–243

A taxonomic study on the genus *Rhopalovalva* Kuznetzov, 1964 from China (Tortricidae: Olethreutinae)

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Abstract. Seven species of the genus *Rhopalovalva* Kuznetzov from China are treated in this paper. Descriptions of two new species *R. ovata* sp. n. and *R. orbiculata* sp. n. are given, with genital structures illustrated. A key to all known Chinese species is provided.

Key words. Lepidoptera, Tortricidae, Olethreutinae, *Rhopalovalva*, new species, China.

Introduction

Kuznetzov erected the genus *Rhopalovalva* in 1964 for *Eudemis lascivana* Christoph, 1881 and transferred three more species to the genus: *R. exartemana* (Kennel, 1901), *R. cordelia* (Meyrick, 1935), and *R. grapholitana* (Caradja, 1916), but Clarke (1958) synonymized *A. cordelia* with *A. grapholitana*. Later, Diakonoff (1973) and Kuznetzov (1976b) transferred one species each from *Acroclita* Lederer, 1859 and *Phoxopteryx* Sodoffsky, 1837 to *Rhopalovalva*, viz. *R. catharotorna* (Meyrick, 1935) and *R. pulchra* (Butler, 1879). In addition, Oku (1974) described *Rhopalovalva amabilis* from Japan. Thus, up until now, six valid *Rhopalovalva* species were recognized. They occur in Korea, Japan, and Russia, and five of them have been recorded from China (Razowski 1999; Liu & Li 2002). In the present paper, two new species are described from China. The type specimens are deposited in the Department of Biology, Nankai University, Tianjin, China. The research was supported by the National Natural Science Foundation of China for the Special Program.

Rhopalovalva Kuznetzov, 1964

Rhopalovalva Kuznetzov, 1964: 883. Type species: *Eudemis lascivana* Christoph, 1881.

Key to Chinese species of *Rhopalovalva* based on male genitalia characters

1.	Cucullus ventrally with process spinous	2
-	Cucullus ventrally with process not spinous	3
2.	Sacculus angle with slender hairy lobe; valva constricted deeply	*R. catharotorna*
-	Sacculus angle with broad hairy lobe; valva constricted slightly	*R. pulchra*
3.	Socius ovate; cucullus with short clubbed process ventrally	*R. ovata* sp. n.
-	Socius long and narrow; cucullus with slender process ventrally	4
4.	Uncus with slightly broader apex; socius about equal in length to uncus	*R. orbiculata* sp. n.
-	Uncus with pointed apex; socius obviously longer than uncus	5
5.	Cucullus with process apically dilated	*R. grapholitana*
-	Cucullus with process not apically dilated	6
6.	Sacculus angle with slender hairy lobe	*R. exartemana*
-	Sacculus angle with broad and short hairy lobe	*R. lascivana*

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Rhopalovalva catharotorna (Meyrick, 1935: 53) (*Acroclita*)

Material. 1♂, Jixian (40°02' N, 117°24' E), Tianjin, 550 m, 23.vi.2001, leg. Houhun Li; 1♀, same data, but 510 m, 16.viii.1997.

Remarks. Wingspan 12.0 mm. The species was treated and transferred to *Rhopalovalva* by Diakonoff (1973: 629). It is known to occur in China (Tianjin, Shanghai, Zhejiang, Taiwan) and Japan.

Rhopalovalva exartemana (Kennel, 1901: 260) (*Acroclita*)

Remarks. The species was transferred to *Rhopalovalva* by Kuznetzov (1964: 885) and is recorded from China (Northeast part), Korea, Japan, and Russia (Far East).

Rhopalovalva grapholitana (Caradja, 1916: 60) (*Acroclita*)

Acroclita cordelia Meyrick, 1935: 52.

Material. 6♂, Wenxian (32°58' N, 104°41' E), Gansu Province, 2000 m, 5.vii.2001, leg. Houhun Li and Xinpu Wang; 1♂, Ziyang County (32°33' N, 108°32' E), Shaanxi Province, 350 m, 21.v.1994, leg. Jin Zhou; 2♂, Gushi County (32°10' N, 115°41' E), Henan Province, 120 m, 16.v.1995, leg. Guangyun Yan.

Remarks. Wingspan 18.0 mm. The species was redescribed and transferred to *Rhopalovalva* by Kuznetzov (1964: 886). It is found in China (Northeast part, Shanghai, Anhui, Jiangxi, Henan, Shaanxi, Gansu), Korea, and Russia (Far East).

Rhopalovalva lascivana (Christoph, 1881: 405) (*Eudemis*)

Material. 1♀, Libo County (25°24' N, 107°52' E), Guizhou Province, 23.v.1998, leg. Qirong Liao.

Remarks. Wingspan 10.5 mm. The species was treated and transferred to *Rhopalovalva* by Kuznetzov (1964: 885). It is distributed in China (Guizhou), Korea, Japan, and Russia (Far East).

Rhopalovalva pulchra (Butler, 1879: 79) (*Phoxopteryx*)

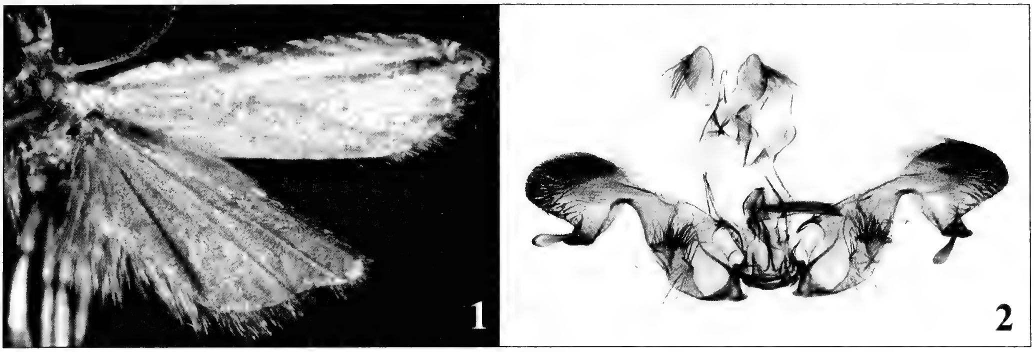
Material. 1♂, Mt. Tianmu (30°26' N, 119°34' E), Zhejiang Province, 350 m, 15.viii.1999, leg. Houhun Li et al.

Remarks. Wingspan 11.5 mm. The species was treated and transferred to *Rhopalovalva* by Kuznetzov (1976: 19). It is known from China (Zhejiang), Korea, Japan, and Russia (Far East).

Rhopalovalva ovata sp. n. (Figs. 1, 2)

Material. Holotype ♂, Sangzhi County (29°23' N, 110°10' E), Hunan Province, 1250 m, 13.viii.2001, leg. Houhun Li & Xinpu Wang, genitalia slide no. ZAH03773.

Description. Wingspan 14.0 mm. Vertex with brown scales between antennae. Antenna brown. Labial palpus white mixed with brown; second segment with long scales; third segment projecting forward. Thorax brown; tegula with basal half light



Figs. 1–2. *Rhopalovalva ovata* sp. n. **1.** Adult (♂). **2.** Male genitalia.

brown, apical half grey. Forewing pale yellow, without distinct spots and fasciae; apex protruded, outer margin concave below apex; costa with eight pairs of grey streaks ranging from 1/5 to apex , apical five pairs running to termen below apex; cilia pale yellow. Hindwing and cilia grey. Foreleg light brown; midleg and hindleg grey, with light brown scales on tarsi.

Male genitalia. Tegumen posteriorly with long V-shaped lateral sclerite supporting tuba analis. Uncus slender, thin, with slightly thinner apex; socius nearly ovate, setose, longer than uncus. Valva broad at base; neck distinct; sacculus angle with short and broad, straight-ended setose lobe directed dorsad; cucullus somewhat elliptic, setose, with short marginal spines and short clubbed process on triangular projection ventrally. Aedeagus thin, conical; with numerous cornuti.

Female. Unknown.

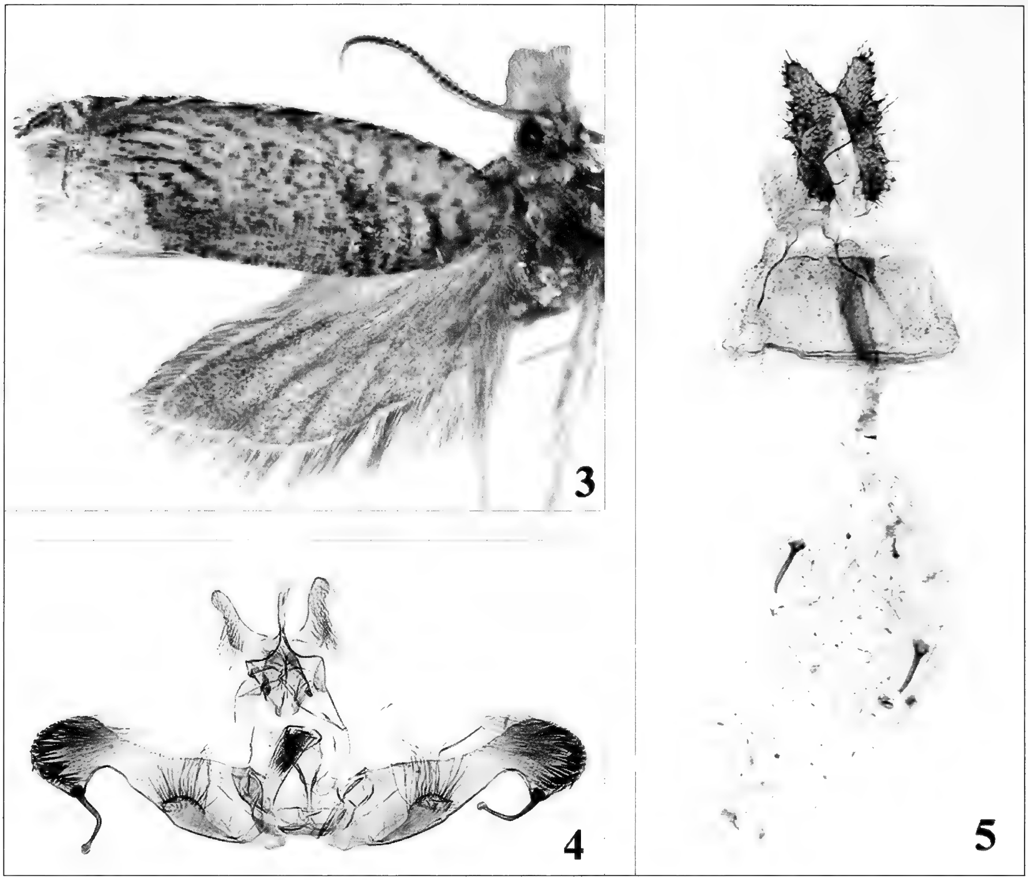
Diagnosis. This species is different from any other species of the genus in having the socius nearly ovate and the cucullus with a short clubbed process on a triangular projection ventrally; in the other species the socius is long and narrow and the cucullus bears a spine or slender process ventrally.

Derivatio nominis. The specific name is derived from the Latin "*ovatus*" (oval), referring to the nearly ovate socius in the male genitalia.

Rhopalovalva orbiculata sp. n. (Figs. 3, 4, 5)

Material. Holotype ♂, Mt. Mao'er (25°53' N, 110°25' E), Guangxi Province, 1100 m, 20.iv.2002, leg. Shulian Hao & Huaijun Xue, genitalia slide no. ZAH03720. Paratypes: 1♂, same data as holotype; 1♀, Mt. Fanjing (27°55' N, 100°41' E), Guizhou Province, 1300 m, 2.viii.2001, Houhun Li & Xinpu Wang; 1♂, 1♀, Xishui County (28°19' N, 106°12' E), Guizhou Province, 1200 m, 1.vi.2000, Yanli Du.

Description. Wingspan 10.0–12.0 mm. Vertex with brown scales. Antenna brown. Labial palpus white mixed with brown; second segment with long scales; third segment minute, concealed in scales of second segment. Thorax fulvous; tegula with basal half light brown, apical half grey. Forewing fulvous, with dark brown transverse lines; apex strongly protruded, falcate; outer margin deeply concave below apex; costa with seven pairs of grey streaks, apical two pairs meeting with each other and running



Figs. 3–5. *Rhopalovalva orbiculata* sp. n. **3.** Adult, ♀. **4.** Male genitalia. **5.** Female genitalia.

to termen below apex; basal 1/3 of dorsum with four unconspicuous tranverse fasciae; tornal marking elliptic, yellow; cilia grey. Hindwing and cilia grey. Legs pale white, with brown scales on tarsi. Abdomen light brown.

Male genitalia. Uncus somewhat clubbed, setose, with apex slightly broadened; socius oblong, broader at base, gradually narrowed beyond middle, as long as uncus, setose. Valva broad at base; neck only slightly narrower than base; sacculus with short, apically rounded setose lobe directed dorsad; cucullus nearly ovate, setose, ventrally with slender process roundly dilated distally. Aedeagus thin, tubular; with numerous cornuti.

Female genitalia. Papillae anales long and narrow, setose. Posterior apophysis slightly shorter than anterior apophysis, both shorter than papillae anales. Ostium opening on posterior margin of 7th sternite. Antrum long, about half length of ductus bursae. Ductus bursae slender; ductus seminalis originating from near corpus bursae. Corpus bursae irregularly elliptic; two signa slender, spined.

Diagnosis. This species is closely related to *Rhopalovalva lascivana* (Christoph) in external appearance, but differs from the latter in having the uncus slightly broadened apically and the socius about equal in length to the uncus, whereas in the other species the uncus is pointed apically and the socius is much longer than the uncus.

Derivatio nominis. The specific name is derived from the Latin "*orbiculatus*" (meaning round), referring to the cucullus of the male genitalia ventrally bearing a slender process roundly dilated distally .

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E. García-Barros, M. L. Munguira, J. Martín Cano, H. Romo Benito, P. Garcia-Pereira & E. S. Maravalhas 2004. Atlas de las mariposas diurnas de la Península Ibérica e islas Baleares (Lepidoptera: Papilionoidea & Hesperioidea). – Monografías Sociedad Entomológica Aragonesa **11**: 228 pp. (ISBN 84-932807-5-5). (in Spanish and English)

The very recently published atlas of the butterflies from the Iberian Peninsula and the Balearic islands is the result of a collaborative work by six authors and 33 further contributors. The atlas starts with a brief introduction, listing the contributors, giving acknowledgements and the financial supports. It is followed by a material and method chapter, which describes the data sources, how the data have been collected in a database, nomenclatural aspects, how the maps have been plotted and it is concluded with a statement on the state of the art. On pages 18–21 follows a list of the species which also refers to the map and page at which each species is treated (there is no separate index at the end). The main chapter (p. 22–72) contains the text for each species which is short and explanatory, primarily devoted to any outstanding problem not visible in the map. The text is written bilingual in Spanish and English throughout, formatted into two columns. The pages 73–184 contain the 224 maps, two maps on each A4 page. Altogether, 290.000 records based on more than 421,000 specimens are plotted on these maps with a 10×10 km grid of the UTM projection system. The book is completed with a regional and a general bibliography (p. 185–224), and thematic maps at the end show the administrative regions and provinces of Portugal and Spain, locations of the main mountain regions and the 100 km UTM squares of the area. The work is precisely presented, as the authors describe exactly what the did. Information gaps ('deserts of butterfly faunistic information') from Andalusia, southern Portugal, Castilla-La Mancha and southern Aragon are mentioned in the text and illustrated in fig. 3 (p. 17). I recommend this atlas to anyone interested in Mediterranean butterflies, especially Iberian and Balearic species.

The atlas gives a comprehensive overview of the known occurrence of each species and a comprehensive bibliography, and will certainly become a standard publication for all who are studying and conserving the butterflies from Portugal, Spain and the Balearic islands.

MATTHIAS NUSS

Nota lepid. **27** (2/3): 245–247

Description of the female of *Notocelia punicana* Kuznetzov, 1956 (Tortricidae: Olethreutinae)

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Abstract. The female of *Notocelia punicana* Kuznetzov, 1956 is described based on three females collected in the central part of Iran (Yazd province). Females are very similar to males in size and wing pattern. The female genitalia of this species can be separated from those of all other known west Palaearctic species by having broad papillae anales, a very strong eighth tergite, and a peculiar sterigma. In other *Notocelia* species, the sterigma is broader and longer, with well developed, proximally rounded anteostial section.

Key words. Lepidoptera, Tortricidae, Olethreutinae, *Notocelia punicana*, female, Iran.

Notocelia Hübner, [1825] comprises 20 species in the Palearctic region (Razowski 1989). *Notocelia punicana* was described by Kuznetzov (1956) from material collected in Kopet-Dagh (Kara Kala), Turkmenistan. The description was based on males only and the female remained unknown since then. During a survey conducted on the pest fauna of pomegranate (*Punica granatum*, Lythraceae) orchards in Yazd and Ghom provinces in Iran from 2000–2001, males and females of *N. punicana* were found. A redescription of the species is given below, with a description of the female genitalia and a comparison with closely related species.

Notocelia punicana Kuznetzov, 1956

Material. 1P, 3P Iran, Yazd province, Yazd, vii.2000, H. A. Ahmadian leg. (on pomegranate tree).

Description. Head. Vertex and upper frons light brown; labial palpus light brown, with some darker scales in apical segment; ocellus as six shining dark brown spots; antennae brown. Mesonotum light brown; tegulae brown.

Forewing (Fig. 1). Forewing length 7.0 mm (measured from base to apex, including fringes); male and female similar in ground color and pattern of both fore- and hindwings; forewing upperside ground color pale brownish intermixed with cream, with dark brown and orange scales arranged in perpendicular lines; pattern elements including two distinct brown fasciae (basal and subbasal), each surrounded by two dark brown lines, a creamy-white interfascial spot, white costal strigulae of which basal and subbasal confluent to form patch, a light brown to orange pretornal spot, a light brown median fascia, and a brownish orange terminal fascia; fringes brown; forewing underside light brown except white costal strigulae.

Hindwing. Upperside uniformly brown except where forewing overlaps anterior to SC+R1; underside uniformly brown, concolorous with forewing underside.

Figs. 1. *Notocelia punicana* from Iran

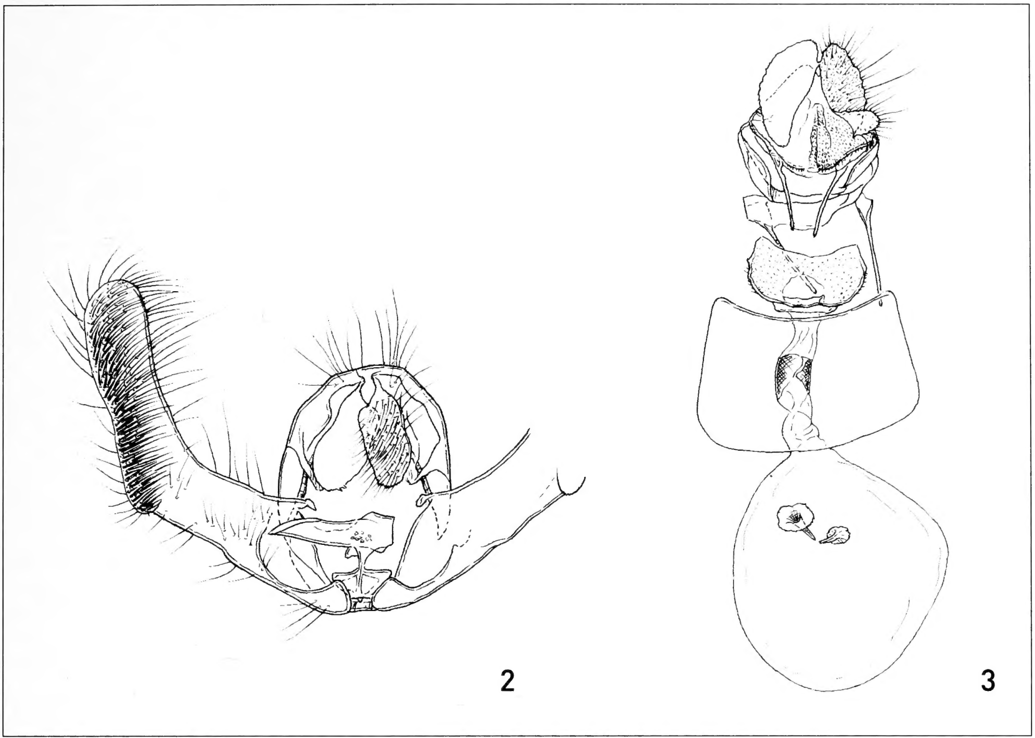
Male genitalia (Fig. 3). Tegumen rather short, broad; socius very large, expanding beyond naked base, especially beyond it internally; remnants of gnathos as slender, fairly long sclerites; valva long with weak ventral depression and rather broad neck; cucullus long, somewhat protruding ventro-proximally; aedeagus slender, with both deciduous and non-deciduous cornuti; the fixed cornuti with a pair of posterior spines, the deciduous cornuti are situated rather in middle of vesica.

Female genitalia (Fig. 4). Papilla analis broadest near middle, rather slender, tapering anteriorly; eighth tergite large with well sclerotized lateral folds; apophyses short; sterigma broad, moderately short with small median anteostial section, large ostium area, and weakly concave posterior edge; lateral edges of sterigma convex; ductus bursae moderately long; cingulum large, medially located; signa unequally sized.

Diagnosis. Externally, this species is similar to *N. trimaculana* (Haworth, [1811]) (= *N. suffusana* Zeller, 1846) and was originally compared with that species (Kuznetzov 1956). As in *N. rosaecolana* (Doubleday, 1850), males have no groups of melanic scales on the hindwing. The Iranian specimens have rather slenderer forewings than the populations of both above-mentioned European species. Their pattern is seemingly more strongly strigulated. The male genitalia are characterized by the very broad socii and long cucullus. This species differs in the lack of a terminal pair of non-deciduous cornuti and the horn-like process beyond the basal cavity of the valva. The female is quite different from all known west Palaearctic species in having broad papillae anales, a very strong eighth tergite, and a peculiar sterigma. The last character is similar in *Barbara herrichiana* Obraztsov, 1960, but it is broader and more concave posteriorly. In other *Notocelia* species the sterigma is broader and longer, with a well developed, proximally rounded anteostial section.

Life history. The reddish larvae of this species were collected for the first time under the bark of pomegranate trees (*Punica granatum*, Lythraceae) in the above-mentioned areas during April-May 2000. They feed on reproductive organs of flowers and cause the premature fall of the fruits.

Remarks. This is the first record of *N. punicana* from Iran. The external characters confirm the inclusion of this species in *Notocelia*. However, the lack of non-deciduous cornuti and the structure of the ovipositor and sterigma are possibly unique in this genus.



Figs. 2–3. *Notocelia punicana* from Iran. **2.** Male genitalia. **3.** Female genitalia.

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