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XIth European Congress of Lepidopterology
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22 - 26 March 1998

First announcement

The XIth European Congress of Lepidopterology will be organised by the *Societas Europaea Lepidopterologica* (SEL) in the "Provinciaal Vormingscentrum Malle", at about 25 km NE Antwerpen, Belgium, from Sunday 22 to Thursday 26 March 1998.

Plenary sessions:
- *Conservation biology*
- *Ecology and population biology*
- *Field reports and faunistics*
- *Systematics and phylogeny*
- *Zoogeography and biodiversity*

Parallel sessions / Workshops:
- *Computer workshop*
- *Microlepidoptera*
- *Noctuidae*
- *Pest control*
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Contents — Inhalt — Sommaire

XIth European Congress of Lepidopterology. First announcement 1
Cupedo, F. : Die geographische Variabilität und der taxonomische Status der *Erebia manto bubastis*-Gruppe, nebst Beschreibung einer neuen Unterart (Nymphalidae : Satyrinae) 3
Fibiger, M. : *Micronoctua karsholti* gen. et sp.n. : an astonishingly small noctuid moth (Noctuidae) 23
Kozlov, M. V. : New species of the genus *Nemophora* (Adelidae) from Primorye region and Sakhalin, Russia 31
Kozlov, M. V. : *Nemophora lapikella* sp. n., a new fairy moth species (Adelidae) from South-Eastern Asia 39
Pöyry, J. & Kullberg, J. : A taxonomic revision of the genus *Holoarctia* Ferguson, 1984 (Arctiidae) 45
Yu-Feng-Hsu, F. & Powell, J. A. : The systematic position of *Heliodines loriculata* Meyrick (Yponomeutoidea : Heliodinidae) 66
Wahlberg, N. : The life history and ecology of *Melitaea diamina* (Nymphalidae) in Finland 70
Triberti, P., Deschka, G. & Huemer, P. : Gracillariidae feeding on *Ostrya carpinifolia* 82
Hausmann, A. : The Lepidoptera of Israel. Faunistic data on Geometridae : I. Orthostixinae and Geometrinae 102

In memoriam : Andrzej W. Skalski (1938-1996) 137

Book reviews — Buchbesprechungen — Analyses 145

Loeliger, E. A. : Errata in and acknowledgement to *Nota lepidopterologica* Vol. 19, 1996 148

Nota lepid. 20 (1/2) : 3-22 ; 01.VI.1997 ISSN 0342-7536

Die geographische Variabilität und der taxonomische Status der *Erebia manto bubastis*-Gruppe, nebst Beschreibung einer neuen Unterart (Nymphalidae : Satyrinae)

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Summary

Distribution. Within the *Erebia manto*-complex there exists a group of morphologically well-defined populations : the *bubastis*-group. Its range is split into three subareas : in the Valais (ssp. *bubastis* Meisner,1818), in the Italian Maritime Alps (ssp. *valmaritima* Floriani, 1965) and in the Alps of Savoie (ssp. *willieni* ssp. n.). *Variation.* Within the *bubastis*-group three differentiation-levels can be recognised, which are correlated to successive periods of isolation : 1st level differentiation, resulting from postglacial isolation on different massifs, gave rise to differences between populations within the same subarea. 2nd level differentiation, resulting from isolation in different refugia during Würm-glaciation, led to the differences between the overall-populations of the three subareas (i.c. between the three subspecies). 3rd level differentiation, resulting from still earlier isolation (at the latest during Riss-glaciation), led to the differences between the *bubastis*-group as a whole and the remaining subspecies of *E. manto. Taxonomy.* As the differentiation levels result from the glaciation rhythm, they are to be found in all European montane and alpine butterflies. Within the genus *Erebia*, all taxa exhibiting 3rd level differences have been shown to be biological species. This strongly suggests that the *bubastis*-group represents a species different from *E. manto.* The striking differences in their genitalia do support this hypothesis. However, definite proof of their reproductive isolation is still lacking.

Zusammenfassung

Verbreitung. Innerhalb des *Erebia manto*-Komplexes gibt es eine Gruppe gut charakterisierter Populationen : die *bubastis*-Gruppe. Ihr Areal gliedert sich in drei Teilareale : im Wallis (ssp. *bubastis* Meisner, 1818), in den Italienischen Seealpen (ssp. *valmaritima* Floriani, 1965) und in den Französischen Alpen (ssp. *willieni* ssp. n.). *Variation.* Innerhalb der *bubastis*-Gruppe lassen sich drei Differenzierungsniveaus erkennen, die mit unterschiedlichen Isolationsphasen zu korrelieren sind : Differenzierung 1. Ordnung ist eine Folge postglazialer Isolierung auf einzelnen Gebirgsstöcken, und führte zu Unterschieden zwischen den Populationen innerhalb eines Teilareals. Differenzierung 2. Ordnung kam zustande während der Würmglazialen Isolierung in verschiedenen Refugien, und führte zu Unterschieden zwischen den Gesamtpopulationen der drei Teilareale (also zwischen den drei Unterarten). Differenzierung 3. Ordnung entstand während einer noch früheren Isolationsphase (also spätestens während der Riss-Vereisung), und verursachte die Unterschiede zwischen der *bubastis*-Gruppe und den übrigen Unterarten von *Erebia manto. Taxonomie.* Da die Differenzierungsniveaus vom Rhythmus der Eiszeiten hervorgerufen wurden, findet man sie bei allen montanen und alpinen Schmetterlingsarten wieder. Im Genus *Erebia* sind alle Taxa, die eine Differenzierung 3. Ordnung aufweisen, aus biologischen Gründen als selbständige Arten anerkannt worden. Das macht es wahrscheinlich, daß auch die *bubastis*-Gruppe eine von *E. manto* verschiedene Art darstellt. Der markante und konstante Unterschied der Valvenmerkmale unterstützt diese Annahme. Es fehlt jedoch bislang der Beweis ihrer reproduktiven Isolierung.

Résumé

Distribution. Dans le complexe d'*Erebia manto* il existe un groupe de populations nettement caractérisées morphologiquement : le groupe *bubastis.* Son aire de répartition discontinue est constituée de trois régions séparées : dans le Valais (ssp. *bubastis* Meisner, 1818), dans les Alpes Maritimes italiennes (ssp. *valmaritima* Floriani, 1965) et dans les Alpes de Savoie (ssp *willieni* ssp. n.). *Variation.* Dans le groupe *bubastis* on reconnaît trois échelons hiérarchiques de différenciation, dûs à des périodes successives d'isolement : différenciation du 1^er^ ordre, établie lors de l'isolement postglaciaire sur différents massifs montagneux. Elle a causé les différences entre les populations de la même région. Différenciation du 2^ième^ ordre, établie par l'isolement dans différents refuges glaciaires pendant la glaciation de Würm. Elle est à l'origine des différences entre les populations des trois régions considérées (donc entre les trois sous-espèces). Différenciation du 3^ième^ ordre, résultant d'un isolement plus ancien (au plus tard pendant le Riss), quand le groupe *bubastis* fut pour la première fois séparé d'*E. manto.* Elle donna lieu aux différences entre le groupe *bubastis* et les autres sous-espèces d'*E. manto. Taxonomie.* Puisque les échelons de différenciation résultent du rythme des glaciations, on les retrouve chez toutes les espèces montagnardes et alpines de papillons. Dans le genre *Erebia*, les taxa montrant des différences du 3^ième^ ordre sont tous classés comme espèces en vertu d'arguments biologiques. Cela suggère que le groupe *bubastis* et les autres sous-espèces d'*E. manto* représentent deux espèces distinctes, hypothèse qui est confortée par les remarquables différences entre leurs armures génitales. Néanmoins, il manque la preuve définitive de leur isolement reproductif.

Einleitung

1965 beschrieb Floriani eine sehr markante Rasse von *Erebia manto* ([Denis & Schiffermüller], 1775) aus den italienischen Seealpen, die er ssp. *valmaritima* nannte (Floriani, 1965). 1981 fand ich in den französischen Alpen eine mir vorerst unbekannte *E. manto*-Form, deren große Ähnlichkeit mit Florianis *valmaritima* sich aber bald herausstellte (Cupedo, 1991). 1983 zeigte Sonderegger, daß die von Meisner (1818) aus dem Wallis beschriebene *Erebia bubastis* nicht, wie allgemein angenommen wurde, eine individuelle Aberration darstellt, sondern eine distinkte Subspezies, die sich durch einige Flügelmerkmale von allen beschriebenen Subspezies der *E. manto* unterscheidet, und von diesen geographisch getrennt ist.

In den Jahren 1987-1991 war ich in der Lage, von den drei genannten Formen, *bubastis*, *valmaritima* und der französischen Form, Material zu sammeln. Dabei stellte sich heraus, daß sie sich in ihren Flügelmerkmalen und Genitalmerkmalen sehr ähnlich sind. Es gibt also, soweit jetzt bekannt ist, drei voneinander weit entfernte Vorkommen eines Taxons, dessen Beziehungen zu *E. manto* bislang ungeklärt sind. Jedes der drei Teilareale umfaßt mehrere, voneinander isolierte Populationen (siehe Abb. 1).

Ziel dieser Arbeit ist es, die morphologischen Merkmale dieser Gruppe mit denen der übrigen ssp. von *E. manto* zu vergleichen, und die Variabilität innerhalb dieser neuen Gruppe zu analysieren.

Material

Von ssp. *bubastis* sind vier Populationen bekannt : bei Leukerbad, bei Goppenstein, im Gredetschtal und im Baltschiedertal (alle im Wallis). Das studierte Material (20 ♂ und 15 ♀) stammt von letzterer Lokalität.

Von ssp. *valmaritima* sind zwei Populationen bekannt : bei Terme di Valdieri und bei San Giacomo di Entracque, beide Prov. Cuneo (Baldizzone, 1971). Nur von ersterer Lokalität konnte Material studiert werden (43 ♂, 41 ♀).

Das französische Teilareal umfaßt, soweit jetzt bekannt ist, zwei voneinander getrennte Gebirgsstöcke : 1. Das Gebiet zwischen Isère, Arc und Doron de Bozel (Savoie), und 2. das Massiv de Belledonne (Savoie und Isère). Aus ersterem standen 67 ♂ und 50 ♀, aus letzterem 64 ♂ und 46 ♀ zur Verfügung.

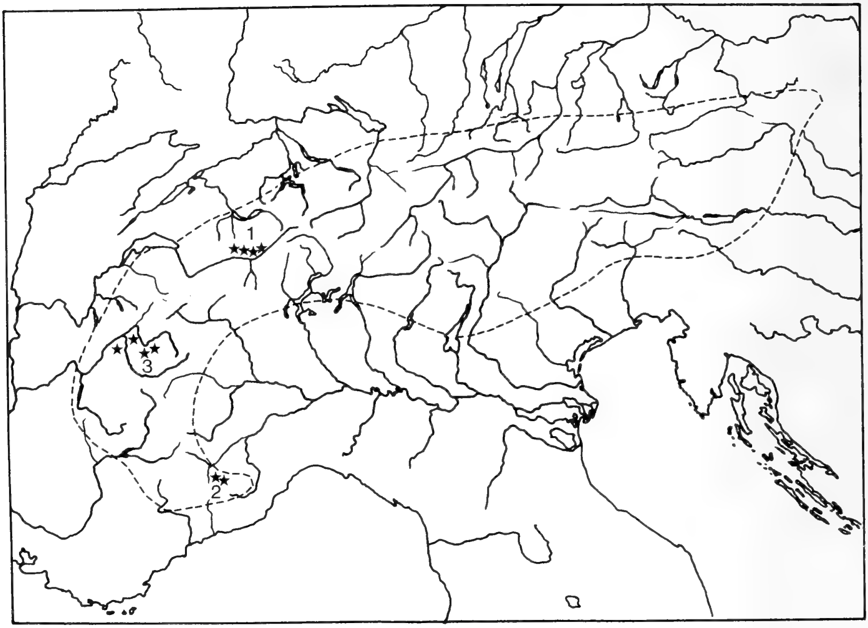


Abb. 1. Verbreitung der *bubastis*-Gruppe in den Alpen : 1 — ssp. *bubastis* Meisner, 1818 ; 2 — ssp. *valmaritima* Floriani, 1965 ; 3 — ssp. *willieni* ssp. n.

Vergleich der *bubastis*-Gruppe mit den übrigen Subspezies von *E. manto*

FLÜGELMERKMALE. Die Flügelmerkmale der Weibchen dieser Gruppe sind von Meisner (l.c.) ausführlich beschrieben, und von Sonderegger (l.c.) ergänzt worden. Die männlichen Flügelmerkmale sind von Sonderegger erstmals beschrieben worden.

Die wichtigsten Merkmale werden kurz zusammengefaßt, und mit denen der übrigen *E. manto*-Subspezies verglichen werden (zwischen Klammern).

1. Die Postdiskalflecke der VflOs der ♂♂ bilden meistens eine vollständige Binde, die bis zum Innenrand reicht und 2 bis 4 ungekernte Ozellen enthält. (Eine kontinuierliche Vorderflügelbinde ist auch die Regel bei den ssp. *manto*, *praeclara* und *vogesiaca* ; ist bei *trajanus* und *osmanica* nicht selten, kommt bei *mantoides* nur gelegentlich und bei *constans* und *gnathene* nie vor.)

2. Die Fransen der Vorderflügel der ♀♀ sind schwarz und weiß gescheckt. (Dieses Merkmal findet man auch, aber weniger ausgeprägt, bei den ssp. *vogesiaca*, *trajanus* und *osmanica*.)
3. Der Hinterrand der Hinterflügel der ♀♀ ist eingebuchtet. (Auch die ssp. *osmanica* zeigt dieses Merkmal; *vogesiaca* und *trajanus* nur ganz schwach.)
4. In den von Sonderegger untersuchten Populationen haben 14 bis 77% der ♀♀ weiße statt gelben Flecken auf der HflUs. (Diese Form findet man auch bei den ssp. *mantoides* (zwar selten), *vogesiaca* und *osmanica*. Von den übrigen ssp. sind mir solche Stücke nicht bekannt.)
5. Die Grundfarbe der HflUs der ♀♀ ist ganz hellgrau oder hell olivbraun. Dies wird durch eine dichte Bestäubung mit Schuppen in der Farbe der Fleckenbinde (also weiß oder gelb) verursacht. (Dieses Merkmal findet man in ähnlicher Weise bei den ssp. *vogesiaca*, *trajanus* und *osmanica*.)

In Tabelle 1 sind die Unterschiede zusammengetragen.

Tabelle 1

Flügelmerkmale.

Merkmal	1	2	3	4	5
bubastis	×	×	×	×	×
manto	×				
mantoides *					×
praeclara	× **				
vogesiaca	×	×		×	×
trajanus	×	×		×	
osmanica	×	×	×	×	×
constans					
gnathene					

* Einschließlich f. *pyrrhula* Frey, 1880.

** Am auffallendsten bei Exemplaren der großen und kleinen Fatra. Tiere aus der Tatra und aus dem Rodnaer Gebirge haben eine durchschnittlich schmalere, nicht immer vollständige Binde.

Merkmale:

1 — ♂ mit kontinuierlicher Vfl-Binde
2 — ♀ Vfl-Fransen gescheckt
3 — ♀ Hfl-Hinterrand eingebuchtet
4 — ♀ Hfl-Us hellgrau oder hell olivbraun
5 — ♀ Hfl-Us mit weißen Makeln

GENITALMERKMALE.

A) Warren (1936) gibt eine ausführliche Beschreibung der Valven von *Erebia manto* (siehe Abb. 2 bis 6) : „In *manto* the dorsal ridge and shoulder excrescence carry an armament of extremely coarse spines, which give place to much finer ones on the head. All these spines are as irregular in shape, size and position as the spines in *euryale*, it being scarcely possible to find two exactly similar specimens. But the system of an irregular mass of coarse spines (in many cases better described as teeth than spines) on the shoulder and body, followed by a fine terminal armature, is invariable“. Ergänzung : die Valvenspitze ist am Ende kolbenförmig verdickt.

Diese Beschreibung trifft für die ssp. *manto*, *mantoides*, *praeclara*, *constans*, *gnathene* und *osmanica* zu. Für die Zahl der Zähne pro Valve siehe Tabelle 2.

B) Die Valven der Falter der *bubastis*-Gruppe unterscheiden sich davon in charakteristischer Weise (siehe Abb. 7 bis 9) :

1. Die Valve ist kürzer und gedrungener.
2. Die Valvenspitze ist schlank, am Ende nicht verdickt.
3. Die Valvenspitze trägt drei bis fünf, in Ausnahmefällen bis 7, sehr kräftige Dornen ; dazu oft 1 bis 3 ganz kleine Zähne.
4. Auf der Dorsalseite finden sich 3 bis 7 sehr kräftige Dornen ; dazu oft 1 bis 5 ganz kleine Zähne.

C) Die ssp. *vogesiaca* und *trajanus* nehmen mehr oder weniger eine Zwischenstellung ein (siehe Abb. 10 und 11). Die Valvenform ist wie bei der *bubastis*-Gruppe. Die Zahl der Zähne ist aber ein wenig höher, und die Zähne sind weniger kräftig (siehe Tabelle 2).

ZUSAMMENFASSUNG. Es lassen sich innerhalb des *E. manto*-Komplexes drei morphologische Gruppen unterscheiden :

a. Die *manto*-Gruppe. Nach der Valvenform eine einheitliche Gruppe. Die Entwicklung der Flügelzeichnung variiert stark je nach der Subspecies.
b. Die *bubastis*-Gruppe. Unterscheidet sich von der *manto*-Gruppe durch ihre charakteristische Valvenform und Flügelmerkmale.
c. Die *vogesiaca*-Gruppe. Nach den Valvenmerkmalen ist diese Gruppe mehr oder weniger intermediär zwischen den beiden vorhergehenden Gruppen. Die Flügelmerkmale neigen eher zur *bubastis*-Gruppe.

Die Stellung der ssp. *osmanica* bleibt unklar. Ihre Flügelmerkmale neigen zur *bubastis*-Gruppe, ihre Valvenmerkmale jedoch zur *manto*-Gruppe (siehe Abb. 12).

Im Rahmen dieser Arbeit wird nur der *bubastis*-Gruppe weitere Beachtung geschenkt.

Tabelle 2

Die Zahl der Zähne pro Valve. Auch die kleinsten Zähne wurden mitgezählt.

Subspezies	Lokalität	N	M	SD
manto	Präbichl (A)	19	30.1	8.7
praeclara	H. Tatra (SK)	12	32.8	4.6
praeclara	M. Rodnei (R)	16	32.5	5.4
mantoides	Grindelwald (CH)	11	30.0	7.4
mantoides	Col de Roselend (F)	32	32.8	6.3
constans	Gourette (F)	12	33.8	4.1
gnathene	Puy Mary (F)	11	34.2	6.6
osmanica	Trebević (Bosnien)	8	26.6	6.6
bubastis	Baltschiedertal (CH)	18	9.6	1.9
valmaritima	Terme di Valdieri (I)	15	9.9	1.3
willieni	Belledonne (F)	11	10.4	1.5
willieni	Col de la Madeleine (F)	14	9.9	2.2
willieni	Pralognan (F)	19	10.8	2.3
vogesiaca	Hohneck (F)	21	13.2	3.7
trajanus	Retezat Mts (R)	9	14.9	4.2

N — Größe der Stichprobe
M — Mittelwert
SD — Standardabweichung

Tabelle 3

Prozentsatz der Weibchen mit unterschiedlich gefärbter Binde auf der HflUs.

Bindenfarbe Hfl. Us. der ♀♀ :		Gelb	Weiß	Braun	Farblos	N
Schweiz	Leukerbad*	86	14			7
	Goppenstein*	30	70			10
	Baltschiedertal	9	91			34
	Gredetschtal*	23	77			13
Italien	Valdieri	100				41
Frankreich	Pralognan	62	21	13	4	47
	Belledonne	78	4	18		46

* Daten nach Sonderegger (1983).
N — Stichprobegröße.

Variation innerhalb der *bubastis*-Gruppe

MORPHOLOGISCHE GLIEDERUNG. Im Genitalapparat konnten keine Unterschiede zwischen Tieren der drei Teilareale festgestellt werden. In der Flügelzeichnung gibt es jedoch eine deutliche geographische Variabilität.

Polymorphie der Hinterflügelunterseite der Weibchen. Die ♀♀ der Schweizer Populationen sind dimorph. Der Anteil weißer und gelber Individuen schwankt je nach der Population.

Weibchen der italienischen Population sind in dieser Hinsicht uniform. Alle 41 untersuchten ♀♀ besaßen gelbe Flecke. (Es wurde jedoch nur eine der zwei bisher bekannten Populationen untersucht.)

In den französischen Populationen finden sich dagegen vier Typen : mit gelben, weißen, dunkelbraunen und farblosen (sich kaum von der Grundfarbe abhebenden) Flecken. Der Anteil der vier Typen variiert auch hier je nach der Population stark. In Tabelle 3 sind die Daten eingetragen.

Bemerkung. Bei allen Tieren mit brauner oder farbloser Binde fehlt die dichte gelbe Bestäubung der HflUs ; außerdem haben sie keine (oder nur Spuren von) Basalflecken. Diese Merkmalkombination findet man in ähnlicher Weise bei Weibchen der ssp. *vogesiaca* und ssp. *osmanica.*

Zeichnung der Flügeloberseite der Weibchen. Bei den ♀♀ der französischen Populationen ist die Fleckenbinde aller Flügel (oberseits) auffallend reduziert (Abb. 13). Die Farbe der Fleckenbinde ist braun, bei schweizerischen und italienischen Weibchen ist sie braungelb.

TAXONOMISCHE GLIEDERUNG. Einzeltiere der ssp. *valmaritima* sind in ihrem Habitus nicht von schweizerischen *bubastis* zu unterscheiden. Nur das Fehlen weißgebänderter Weibchen deutet auf eine genetische Differenz hin. Weil noch nicht von beiden bekannten Populationen ausreichendes Material studiert worden ist, wäre es verfrüht, die Namensberechtigung von *valmaritima* jetzt zur Diskussion zu stellen. Die französischen Populationen unterscheiden sich jedoch in markanter Weise von den schweizerischen und italienischen Populationen. Sie werden hier deshalb als eine neue Subspezies betrachtet.

Erebia manto willieni **ssp. n.**
Abb. 13

HOLOTYPE ♂, „Le Rivier d'Allemont (F-38), Les Chaumes 1600 m, 13.VIII.87, F. Cupedo leg." (in coll. F. Cupedo). PARATYPEN. 20 ♂ und 21 ♀, gleiches Etikett (in coll. F. Cupedo) ; 20 ♂ und 10 ♀, gleiches Etikett, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum, Amsterdam.

BESCHREIBUNG. Männlicher Genitalapparat wie bei den ssp. *bubastis* und *valmaritima.* Etwa 85% der Weibchen sind durch die starke Ausdehnung der dunklen Grundfarbe und die dunklere Bindenfarbe auf den ersten Blick von *bubastis* oder *valmaritima* zu unterscheiden (vergleiche Abb. 14). Ein Teil der Weibchen (13-18%) hat dunkelbraunen Bindenflecken auf der HflUs.

VERBREITUNG. Die ssp. *willieni* wurde bis jetzt im Belledonnemassiv (Le Rivier d'Allemont, les Sept Laux, Grand Maison, Col du Glandon) und im Vanoisemassiv (Le Grand Arc, Col de la Madeleine, St.-Jean de Belleville, Pralognan) gefunden.

DERIVATIO NOMINIS. Die Namensgebung erfolgt zu Ehren des französischen Lepidopterologen Pierre Willien, dank dessen jahrelangen Bemühungen wir jetzt über eine vollständige Kartographie der französischen Erebien, die als Grundlage für zoogeographische Studien unentbehrlich ist, verfügen (Willien, 1990).

Bemerkung. Es fällt auf, daß ihr Areal mit dem der neulich beschriebenen *E. sudetica belledonnae* fast zusammenfällt (Cupedo, 1995).

Diskussion

BEWERTUNG DER UNTERSCHEIDUNGSMERKMALE. In der *bubastis*-Gruppe läßt sich eine deutliche Hierarchie der Unterscheidungsmerkmale erkennen :

1. Auf dem niedrigsten Niveau gibt es die Unterschiede zwischen heute voneinander isoliert lebenden Populationen innerhalb des gleichen Teilareals, weiterhin als Unterschiede 1. Ordnung gekennzeichnet.
2. Auf dem mittleren Niveau die Unterschiede zwischen den Gesamtpopulationen der drei Teilareale. (Unterschiede 2. Ordnung)
3. Und auf dem höchsten Niveau die Unterschiede zwischen der gesamten *bubastis*-Gruppe und den anderen Subspezies von *E. manto* (Unterschiede 3. Ordnung).

Diese Differenzierungsniveaus sind auf unterschiedliche Isolationsphasen zurückzuführen.

DATIERUNG DER DIFFERENZIERUNGSNIVEAUS. *Unterschiede 1. Ordnung.* Es betrifft hier lediglich die unterschiedlichen Frequenzen der Bindenfarben auf der HflUs der ♀♀. Weil die Populationen jedes Teilareals einem einzigen Glazialrefugium entstammen, müssen diese Unterschiede erst nacheiszeitlich entstanden sein : sie sind eine Folge der Isolation auf einzelnen Gebirgsstöcken oder (im Wallis) in einzelnen Tälern. Genetische Drift ist dabei als Hauptursache anzusehen. Zeitliche Minimalisierung der Populationsgröße kann diesen Effekt erheblich fördern (der „Flaschenhalseffekt“).

Unterschiede 2. Ordnung. Es betrifft hier die starke Ausdehnung der dunklen Grundfarbe der ssp. *willieni.* Das Merkmal ist in allen Populationen, obwohl sie jetzt völlig getrennt leben, in gleichem Ausmaß vorhanden. Unterschiede dieser Kategorie müssen, zwangsläufig, in einer Periode, in der die Populationen des Teilareals noch *eine* zusammen-

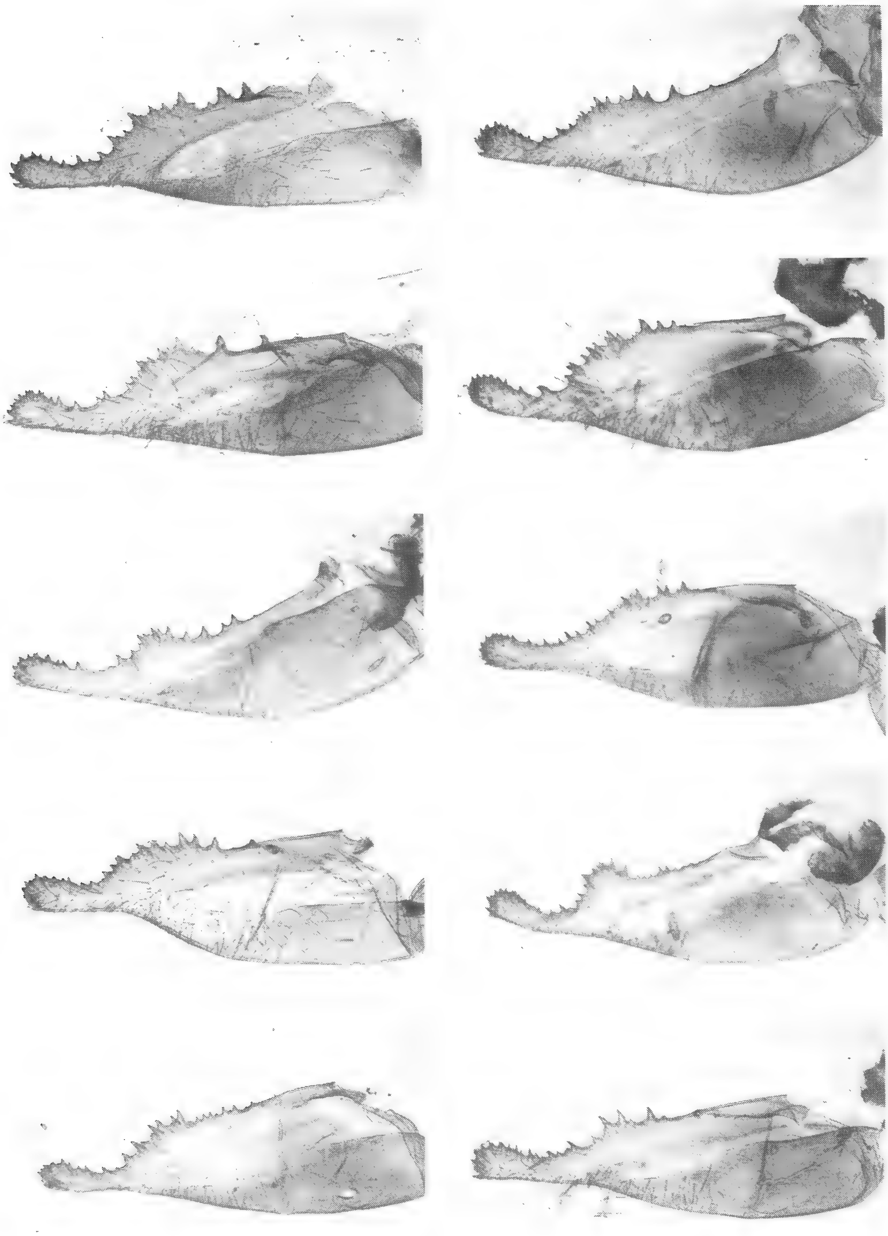
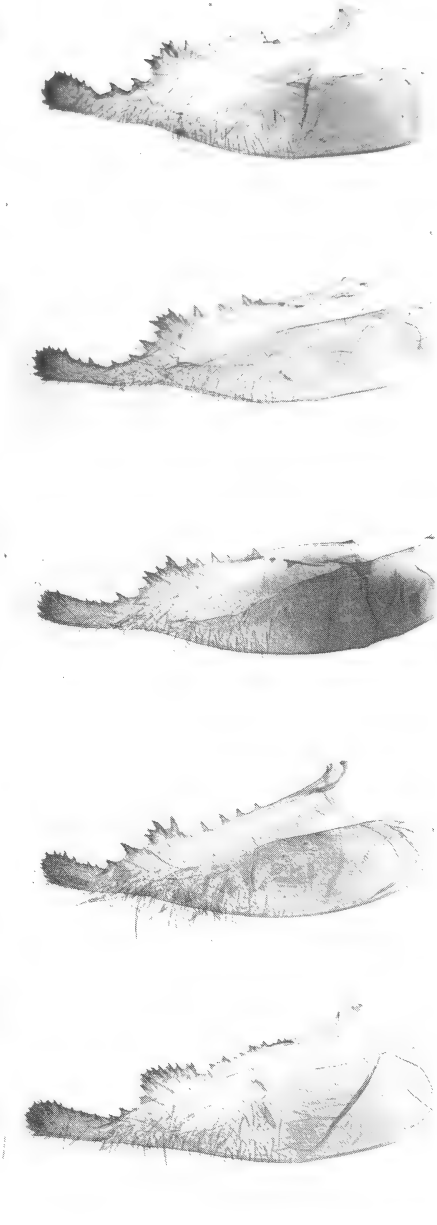


Abb. 2-12. Valven der Unterarten von *Erebia manto* (von jeder Unterart sind fünf Valven abgebildet) :

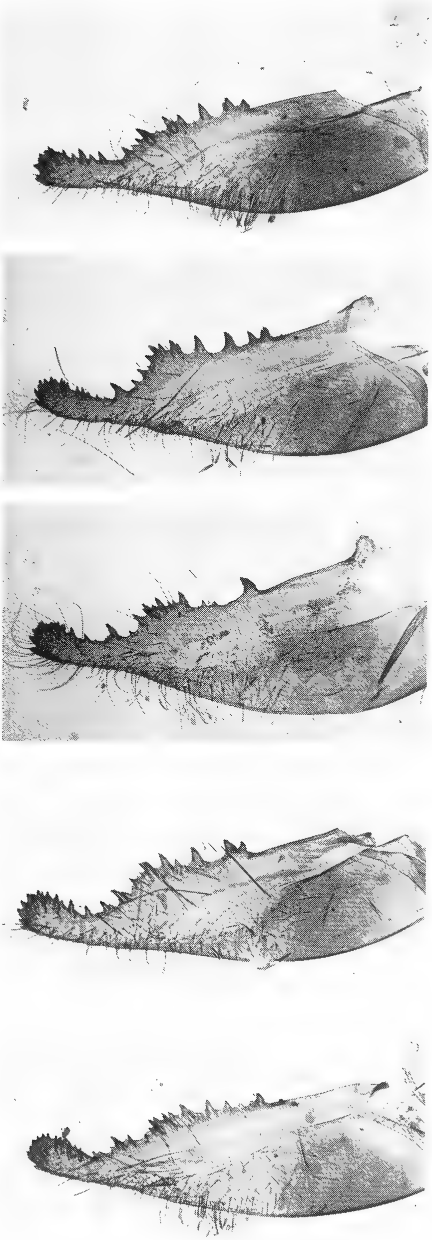
2 — *E. manto manto* ([Denis & Schiffermüller], 1775), Präbichl (A) ;

3 — *E. manto mantoides* (Esper, [1804]), Col de Roselend, Savoie (F) ;

4 — *E. manto constans* Eiffinger, 1908, Col de Tortes, Pyrenäen (F) ;



5 — *E. manto gnathene* Fruhstorfer, 1920, Puy Mary, Cantal (F) ;

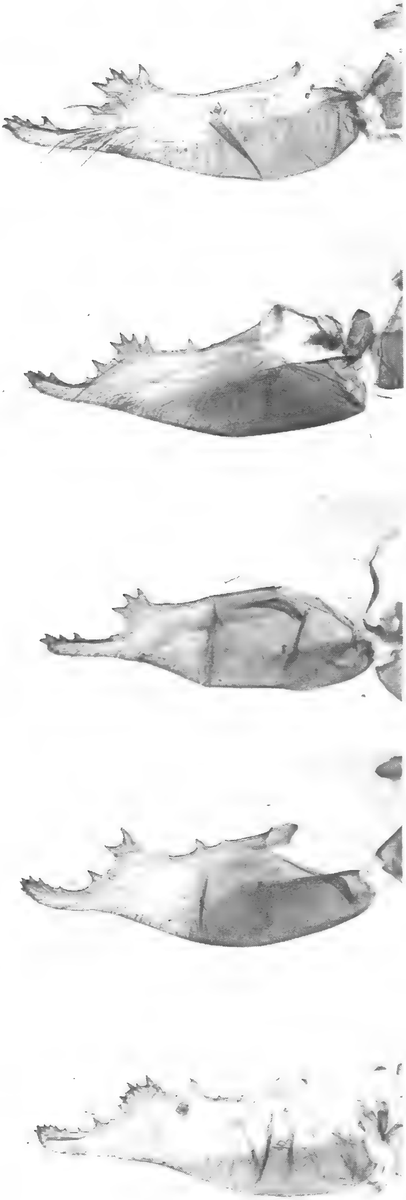


6 — *E. manto praeclara* Niesiolowski, 1929, Niedere Tatra (SK) ;

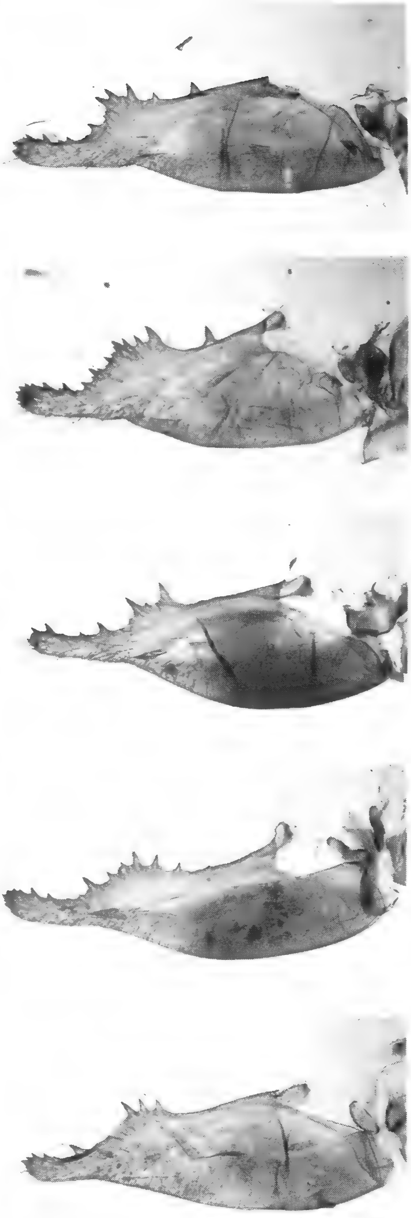
7 — *E. manto bubastis* (Meisner, 1818), Baltschiedertal, Wallis (CH) ;

8 — *E. manto valmaritima* Floriani, 1965, Terme di Valdieri, Cuneo (I) ;

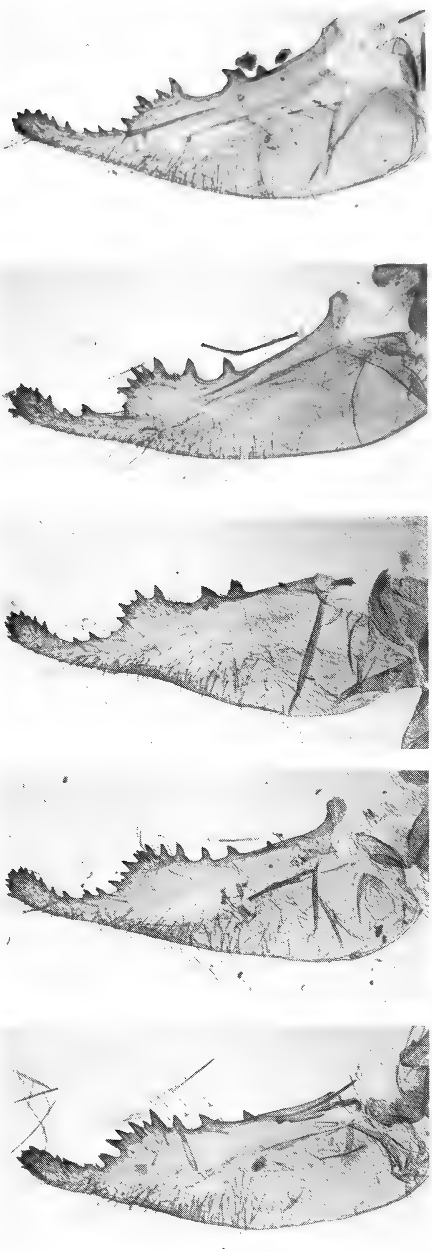
9 — *E. manto willieni* ssp. nov., Le Rivier d'Allemont, Isère (F) ;



10 — *E. manto vogesiaca* Christ, 1882, Gazon de Faing, Vogesen (F) ;



11 — *E. manto trajanus* Hormuzaki, 1895, Retezat Mts. (R) ;



12 — *E. manto osmanica* Schawerda, 1909.
Trebević (Bosnien).

hängende Population bildeten, entstanden sein. Das war der Fall vor der Wiederbesiedlung der Alpen, also während der letzten Eiszeit. Anscheinend hat die *bubastis*-Gruppe die Eiszeit am Alpenrand in drei voneinander getrennten Refugialräumen überdauert. Es betrifft hier räumlich beschränkte Gebiete am Alpenrand, die von de Lattin (1967 : 327) als „Kleinrefugien" bezeichnet wurden. (Ssp. *bubastis* und ssp. *valmaritima* könnte man, ihrer Ähnlichkeit wegen, als einem einzigen Refugium entstammend betrachten. Aus geographischer Sicht ist das jedoch nicht wahrscheinlich.)

Unterschiede 3. Ordnung. Die dritte Kategorie umfaßt die Unterschiede der ganzen *bubastis*-Gruppe gegenüber den anderen Gruppen. Sie sind entstanden, als die *bubastis*-Gruppe erstmals, (also als *eine* Gruppe), von den übrigen alpinen *E. manto* getrennt wurde und langfristig der

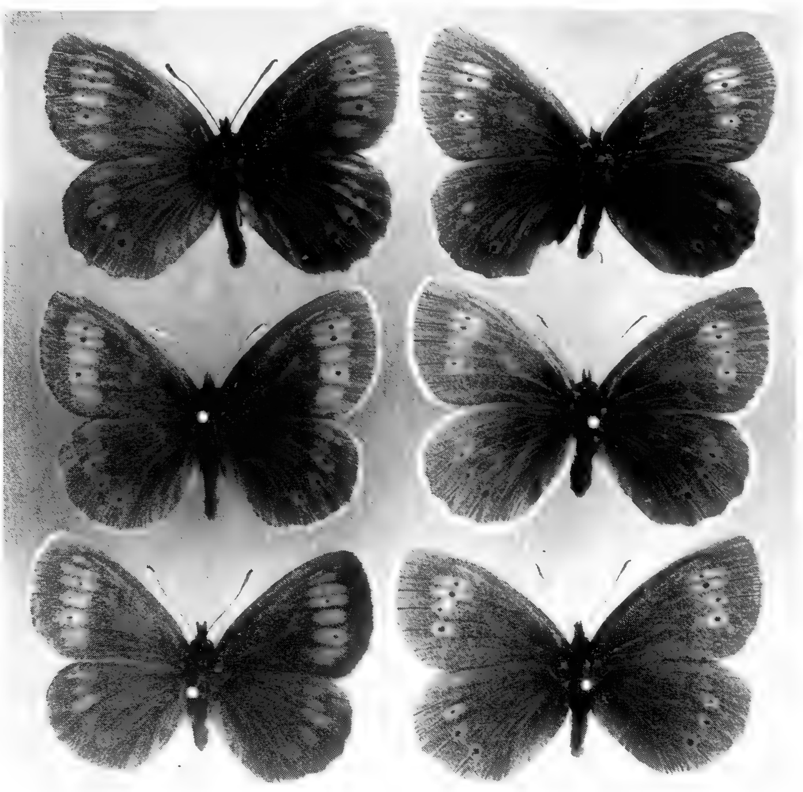


Abb. 13. *E. manto willieni* ssp. n., Le Rivier d'Allemont (F). Links ♂♂, rechts ♀♀. Links oben ♂ Holotypus.

Isolation ausgesetzt war. Das müßte also spätestens während des Riss-Glazials gewesen sein, möglicherweise aber früher, weil nicht jede Kältephase unbedingt morphologisch nachweisbar sein muß (siehe weiter im Text).

DIFFERENZIERUNGSWELLEN. Die heute wahrnehmbaren Differenzierungsgrade bilden also kein stufenloses Kontinuum. Im Falle von *bubastis* ist es außerdem möglich, einen bestimmten morphologischen Differenzierungsgrad mit einer minimalen Isolationsdauer zu korrelieren. Im Grunde genommen waren aber *alle* montanen, subalpinen und alpinen Schmetterlingsarten den gleichen Isolationsphasen ausgesetzt, und sie haben die gleichen Differenzierungswellen durchlaufen, wenn diese auch nicht immer gleich gut erkennbar sind. Interessant ist jetzt, daß sich bei den europäischen Erebien eine Korrelation zwischen Differenzierungsniveau und taxonomischem Status feststellen läßt.

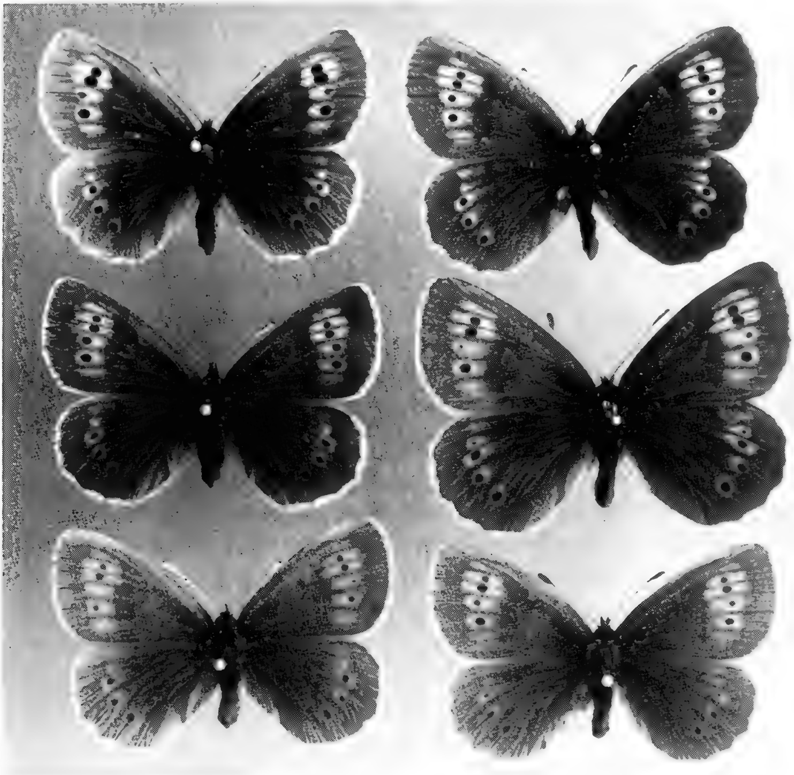


Abb. 14. Links : *E. manto bubastis* Meisner, Baltschiedertal (CH), 3 ♀♀ ; Rechts : *E. manto valmaritima* Floriani, Terme di Valdieri (I), 3 ♀♀.

Taxonomische Interpretation der Differenzierungsniveaus

Differenzierung 1. Ordnung. Postglaziale Differenzierung hat, wenigstens bei univoltinen Arten, meistens nur zu geringfügigen morphologischen Unterschieden geführt. Unterschiede der Genitalanlage sind mir aus dieser Kategorie nicht bekannt. In der französischen Tradition werden solche Taxa mit sehr beschränkter geographischer Verbreitung oft als „race“ bezeichnet (Siehe z.B. de Lesse, 1947 : 97-98), in der britischen Literatur oft als „form“. (Siehe z.B. Warren, 1936 : 2-3). Weil beide keine anerkannten taxonomischen Kategorien darstellen, sind viele früher oder später als Unterart bewertet worden.

Differenzierung 2. Ordnung. Eine Isolation während des Würmglazials führt, wie gesagt, zu Unterschieden 2. Ordnung. Wenn postglaziale Vermischung ausbleibt, führt das logischerweise zu großräumiger geographischer Variation. Es ist diese Variation, die allgemein als Grundlage einer subspezifischen Gliederung anerkannt wird. (Abgesehen von der Frage, wie groß die Unterschiede sein sollen, um eine Aufteilung in Unterarten zu rechtfertigen.) Alle Unterarten europäischer Erebien gehören zu dieser oder der vorigen Kategorie. Man könnte also sagen, es gibt Subspezies 1. Ordnung und Subspezies 2. Ordnung. Oder vielmehr : Unterarten postglazialen und glazialen Ursprungs. Nomenklatorisch ist der Unterschied nicht erfaßbar. Sie zu unterscheiden, ist jedoch eine Voraussetzung für ein gutes Verständnis der inneren Struktur einer Gruppe. Eine subspezifische Gliederung, die diesen Unterschied nicht berücksichtigt, kann bei weitverbreiteten Arten, deren Areale oft sehr zersplittert sind, zu unübersichtlichen Situationen führen. Die subspezifische Gliederung von *Parnassius apollo* (Capdeville, 1978-1980) ist davon ein einleuchtendes Beispiel (1).

Das Problem bei der Datierung ist, daß Unterschiede 2. Ordnung auch den kumulativen Effekt zweier (oder sogar mehr) Kältephasen darstellen können. Eine während einer Kältephase differenzierte Gruppe wird nämlich in der nächsten Wärmephase den angrenzenden Teil der Alpen besiedeln ; beim Auftreten einer neuen Kältephase ist es durchaus möglich, daß sich diese Gruppe ins gleiche Refugium zurückzieht (unter gleichzeitiger Ausgleichung eventueller interglazial entstandener Unterschiede 1. Ordnung). So entsteht eine kontinuierliche Isolation, über zwei Glaziale hinweg, und dementsprechend nur eine Differenzierungs-

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(1) Nikusch (1992) hat eine neue, auf Raupenmerkmale gegründete, subspezifische Gliederung von *Parnassius apollo* vorgeschlagen. Soweit es sich aus seinen bisherigen Veröffentlichungen beurteilen läßt, hat er ein brauchbares Unterscheidungsmerkmal 2. Ordnung entdeckt.

phase. Das erklärt wahrscheinlich, daß es unter Taxa die gegenüber ihren Verwandten nur Unterschiede 2. Ordnung aufweisen (also einem einzigen Refugium entstammen) auch solche gibt, die schon völlig artlich (2) differenziert sind (*E. sthennyo*, *E. tyndarus*, *E. calcarius*).

Von *Differenzierung 3. Ordnung* ist die Rede, wenn jedes von zwei Taxa sich in Subtaxa gliedern läßt, die nachweisbar auf verschiedene Glazialrefugien zurückzuführen sind (und die wieder postglazial zersplittert sein können). Von Differenzierungen 3. Ordnung, wie z.B. die Abtrennung der *bubastis*-Gruppe, kann man nur sagen, sie stammen spätestens aus dem Riss. Möglicherweise sind sie aber erheblich älter : Merkmalanalyse vermag darüber nichts auszusagen. Was ihre taxonomische Interpretierung angeht : die europäische Erebientaxa, die eine Differenzierung 3. Ordnung aufweisen, verhalten sich untereinander ausnahmslos als Arten.

DER TAXONOMISCHE RANG DER *BUBASTIS*-GRUPPE. Nur bei der *bubastis*-Gruppe liegt bislang kein biologischer Beweis ihres spezifischen Status vor. Es gibt aber weitere morphologische Kriterien, die diese Vermutung unterstützen. Morphologische Differenzierung und artliche Differenzierung sind zwar zwei voneinander unabhängige Folgen der Isolation, und morphologische Unterschiede erlauben im Prinzip keine Rückschlüsse auf das Ausmaß der artlichen Differenzierung. Weil aber die morphologische Differenzierung fortschreitet, wenn sich die reproduktive Isolation schon vollzogen hat, gibt es (in jeder Tiergruppe) morphologische Unterschiede die, *erfahrungsgemäß*, eine artliche Selbständigkeit wahrscheinlich machen. Beim Genus *Erebia* trifft das für die Genitalmerkmale zu. Die Arbeit Warrens (1936) illustriert das einleuchtend. Warren unterscheidet Arten lediglich nach ihren Genitalmerkmalen : ein rein typologisches Verfahren, das der modernen biologischen Artauffassung fernsteht. Trotzdem haben sich alle von ihm anerkannten Arten seitdem als berechtigt erwiesen, mit Ausnahme von *E. sudetica*, deren reproduktiver Isolationsgrad gegenüber *E. melampus* noch nicht festgestellt worden ist (Cupedo, 1995).

Was nun der *bubastis*-Gruppe angeht : so große Unterschiede wie sie zwischen der *bubastis*-Gruppe und der *manto*-Gruppe bestehen, wurden bei Erebien bisher nur zwischen aus biologischen Gründen gesicherten Arten festgestellt. Sie sind sogar größer als die Unterschiede zwischen manche nahverwandte Arten (*stirius*-*styx*, *aethiopella*-*mnestra*, die *tyn-*

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(2) Unter Arten wird in dieser Arbeit verstanden : Taxa die *aus biologischen Gründen* als Arten anerkannt worden sind. Also auf Grund eines sympatrischen Vorkommens, auf Grund experimentell nachgewiesener reproduktiver Isolation, oder auf Grund karyologischer Inkompatibilität.

darus-Gruppe, *neoridas-zapateri, pandrose-sthennyo*). Alles deutet also darauf hin daß die Populationen der *bubastis*-Gruppe eine selbständige, von *Erebia manto* verschiedene Art darstellen. Der endgültige Beweis steht jedoch noch aus.

Dankwort

Vielen Dank verschuldige ich einigen Kollegen die mir mit Material oder mit Informationen behilflich waren : Dr. Vilfrido Cameron-Curry, Torino (Italien), Dr. Sergio Cecchin, Torino (Italien), Dr. Giancarlo Floriani, Torino (Italien), Dr. Wilhelm Siepe, Neuss (Deutschland), Dr. Peter Sonderegger, Brügg (Schweiz). Besonders danke ich Dr. Peter Roos, Sprockhövel (Deutschland), für seinen kritischen Bemerkungen zum Manuskript, und Marcel Prick, Heerlen (Niederlande), der den deutschen Text korrigierte.

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Micronoctua karsholti gen. et sp.n. : an astonishingly small noctuid moth (Noctuidae)

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Summary

A new genus and species of the family Noctuidae, *Micronoctua karsholti*, gen.n., sp.n. is described. The new species, which is characterised by its extremely small size, has been found in southern Turkey and on the south-eastern Greek islands.

Zusammenfassung

Aus der Familie Noctuidae werden eine neue Gattung und eine neue Art, *Micronoctua karsholti*, gen.n., sp.n., beschrieben. Die neue Art, die durch eine besonders kleine Grösse characterisiert ist, wurde in der südliche Türkei und auf den südöstliche griechischen Inseln gefunden.

Résumé

Un nouveau genre et une nouvelle espèce de la famille des Noctuidae, *Micronoctua karsholti*, gen.n., sp.n., sont décrits. La nouvelle espèce, caractérisée par sa taille extrêmement réduite, a été trouvée dans le sud de la Turquie et les îles grecques du sud-est.

Introduction

This monotypic new genus has few similarities with other known Noctuidae in the world. It has so far remained undetected, probably because of its extremely small wingspan and its occurrence in what was until recently a sparsely collected area in southern Greece and Turkey.

Over many years I have collected moths in many countries outside my home country, Denmark. I made it a procedure to preserve all the 'Microlepidoptera' for Ole Karsholt of the Zoological Museum, University of Copenhagen. Although I am not an expert in 'Microlepidoptera' at species level, I have tried to cover the diversity and this has resulted in approx. 150.000 specimens for the Museum. Usually I am familiar with the 'Macrolepidoptera' and especially with the noctuid moths of the Palaearctic region, so Ole was apparently delighted when he could inform me that I had overlooked a noctuid moth, represented by more than 30 specimens among preserved 'Microlepidoptera' collected in Turkey in 1986. At first I did not believe him, but when I was informed that the wingspan of the species was on average 7.5 mm, about the size of an elachistid moth, it seemed possible.

Niels Peter Kristensen dissected some of these specimens and on the basis of the morphology (i.e. presence of tympanal organs) he confirmed that the species belongs to the family Noctuidae. With the kind assistance of Ian Kitching, some specimens were presented for examination at the famous 'coffee-break-corner' of the Entomology Department in the Natural History Museum in London. Nobody knew what it was and after further dissection Ian Kitching suggested that the species should be placed in a new genus in the (sub)family Noli(nae)dae — or Acontiinae. Later Don Lafontaine, Ottawa and Laszlo Ronkay, Budapest examined some specimens and confirmed the species to belong to the Noctuidae.

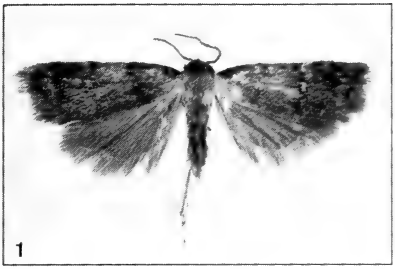
Additional specimens have also been recorded from the Greek islands of Rhodes, Kos, Samos and Crete and from southern Turkey.

Micronoctua, gen.n.

Type species : *Micronoctua karsholti*, sp.n.

Description

The genus is monotypical and established to include the smallest known species of the Noctuidae, at least in the Holarctic region. Wingspan : ♂ 6.2-8.6 mm, (average 7.5 mm, n = 53), ♀ 7-8,2 mm, n = 3 (Figs. 1-4). Male antenna finely pubescent, appearing triangular because of dark grey tufts of scales posteriorly on each segment. Female antenna filiform, with scales. Frons smooth, flat. Eye naked. Labial palpi straight, with grey scales suffused with black, 2nd segment twice as long as 3rd. Two pairs of each two long, narrow spurs, median and apical, on hind tibia. One apical pair of spurs on mid tibia. Head, tegula, patagium and thorax with grey scales. Abdomen light grey.



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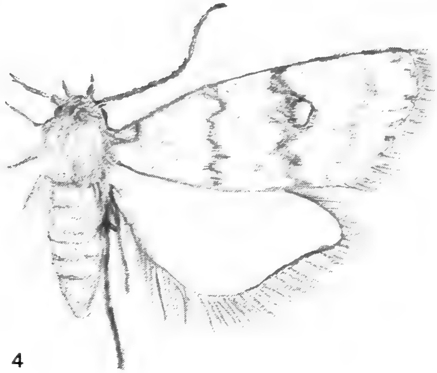

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Fig. 1. Holotype ♂, *Micronoctua karsholti* gen.n., sp.n., Turkey, Prov. Antalya, 40 km N Alanya, 5 km S Gündogmus, 1100 m, 14.vii.1987 (leg. M. Fibiger).
Fig. 2. Paratype ♂, *M. karsholti* sp.n., Greece, Rhodos, 2 km NW Lindos, 50 m, 24.v.1993 (leg. R. Sutter).
Fig. 3. Paratype ♀, *M. karsholti* sp.n., Greece, Samos, Kokkari, 10 m, 20.vi.1996 (leg. R. Sutter).
Fig. 4. Sketch of right half of ♂ *M. karsholti*.

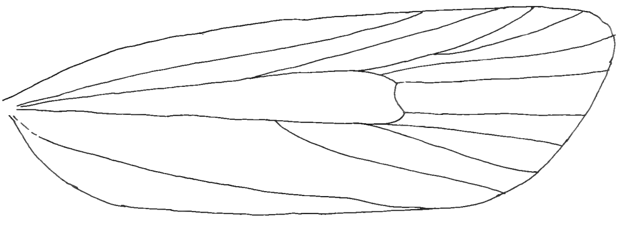

Fig. 5. Venation of forewing of *M. karsholti*.

Wing shape and venation. Forewing narrow, elongated, costa almost straight, slightly concave basally, apex blunt (Fig. 5). Venation reduced in both wings. Subcostal vein 12 (Sc) reaching beyond middle of wing. Radial vein 10 (R) and 8 (R) stalked anteriorly. Radial vein 9 (R) absent, Radial vein 7 (R5) separate. Three median veins. Two cubital veins. Only one anal vein 1b (A2) present. Hindwing elongated by apex, resulting in invaginated termen, (due to the preparation wing is slightly folded at vein 1b (2A) in Fig. 6). Half of veins reaching termen weakly marked, strongly reduced : median veins 5 (M2), 4 (M3), cubital vein 3 (Cu), anal veins 1a (3A) and 1b (2A). Other veins well marked : subcosta stalked together with radial vein 8 (Sc + R), radial vein 7 (Rs) and median vein 6 (M) branched from 8 by 1/4 from base of wing, 7 and 6 branched 3/4 from base of wing, cubital vein 2 (Cu) branched half way towards termen into 2b (Cu) and 2a (Cu). Median cross-vein between 6 (M1) and 5 (M2) hardly visible. Connection by cell slightly stronger.

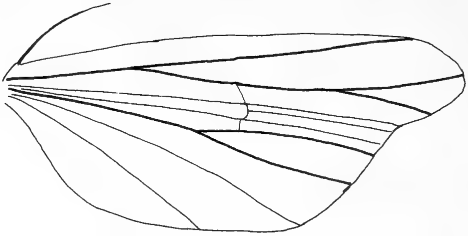

Fig. 6. Venation of hindwing of *M. karsholti*.

Male genitalia (Fig. 7) : Uncus absent. Tegumen narrow. Valve narrow basally, prominent, foot-shaped at cucullus, pubescence mixed with long, fine setae posteriorly. Costa with broad, triangular process, pubescent apically. Saccus small, short and rounded. Aedeagus bent medially. Vesica not everted, scobinate basally.

Female genitalia (Fig. 8) : Ovipositor rounded, with fine, long setae. Ductus bursae very long and narrow. Anterior half of corpus bursae narrow, posterior half globular, adorned inside with tiny cornuti. Ductus seminalis arises at base of corpus bursae.

Distribution

Eastern Mediterranean. *Micronoctua karsholti*, sp.n. is recorded from south-western Turkey and south-eastern Greece, on the islands of

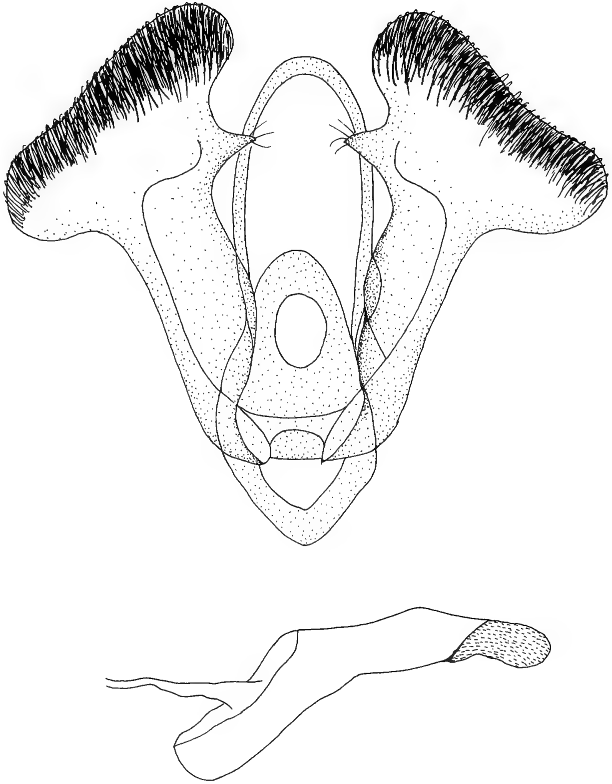

Fig. 7. Male genitalia, aedeagus separated, of *M. karsholti*.

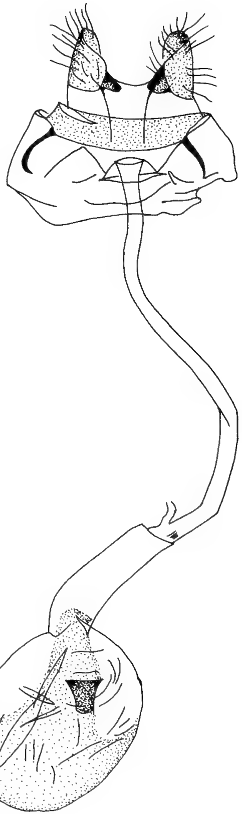

Fig. 8. Female genitalia of *M. karsholti*.

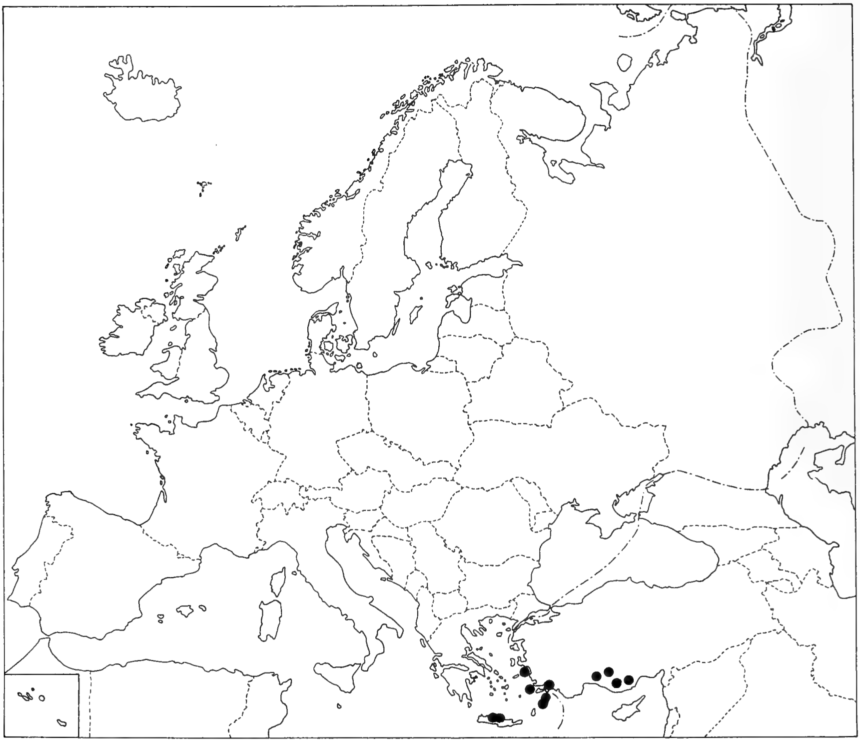

Fig. 9. Distribution of *M. karsholti.*

Samos, Kos, Rhodes and Crete (Fig. 9). There is probably also an old record from Crete based on Reisser (1974), who lists an "*Anachrostis* spec." from Episkopi near Rethymnon, 150 m, in October. Unfortunately, it has not been possible to examine this (or these) specimen(s) (coll. Landessammlungen für Naturkunde, Karlsruhe).

Remarks

The systematic position of *Micronoctua*, gen.n. is uncertain. The genus is placed *incertae sedis* as the last genus in the subfamily Acontinae (see Fibiger & Hacker, 1991).

Micronoctua karsholti, sp.n.

Holotype ♂ (Fig. 1). **Turkey :** Prov. Antalya, 40 km N Alanya, 5 km S Gündogmus, 1100 m, 14.vii.1987 (*M. Fibiger*), coll. M. Fibiger.

Paratypes. **Turkey :** 4 ♂, same data as holotype ; 30 ♂, 1 ♀, Prov. Içel (Mersin), Taurus, road Ermenek - Mut, 600 m, 15.vii. 1986, 1 ♂, gen. prep. 2169 L. Ronkay (*M. Fibiger*) ; 10 ♂, Prov. Içel (Mersin), Taurus, 27 km N Anamur by road Anamur - Ermenek, 750 m, 13.vii.1987, 1 ♂, gen. prep. 4727 O. Karsholt (*M. Fibiger*) ; 4 ♂, Prov. Mugla, 20 km N Marmaris, Cetibeli, 10 m, 12.vii.1992, 1 ♂, gen. prep. 1574 A. Scholz (*A. Lingenhöle*) ; 2 ♂, 2 ♀, Prov. Mugla, Degirmanyani, 300 m, 17.ix.1995 (*F. Iversen*) ; 11 ♂, 1 ♀, Prov. Mugla, Torunc, 650-750 m. 20-21.ix.1995 (*F. Iversen*) ; 3 ♂, Prov. Antalya, Palaz Dagi NE Akseki, 1500 m, 18.VII.1994 (*W. De Prins*) ; 2 ♂, Prov. Konya, 12 km SE Bozkir, 1350 m, 19.VII.1994, (*W. De Prins*) ; **Greece :** 5 ♂, 1 ♀, Rhodes, Ixia, 12-26.vi.1976, 1 ♂, gen. prep. 6376 L. Gozmány, 1 ♀ (allotype), 19.vi.1976, gen. prep. 4774 O. Karsholt (*C.Å. Petersson*) ; 1 ♂, Rhodes, Lalyssos, 5 km SW Rhodes, –.viii.1982 (*P. Olsen*) ; 1 ♂, Kos, Asfendion, 6-12.x.1988 (*R. Johansson*) ; 1 ♂ (Fig. 2), Rhodes, 2 km NW Lindos, 50 m, 24.v.1993 (*R. Sutter*) ; 4 ♂, Crete, Bali, 40 km W Heraklion, 2-6.x.1994 (*R. Sutter*), 1 ♀ (Fig. 3), Samos, Kokkari, 10 m, 20.vi.1996 (*R. Sutter*). Material distributed in colls : M. Fibiger (Denmark), W. De Prins (Belgium), G. Derra (Germany), B. Goater (England), H. Hacker (Germany), M. Hreblay (Hungary), O. Karsholt (ZMUC), I. Kitching (BMNH), D. Lafontaine (CNC), A. Lingenhöle (Germany), L. Ronkay (TMB), G. Ronkay (Hungary), and R. Sutter (Germany).

Description

Male and female. Head, thorax, abdomen, legs, wing and venation described under the genus.

Ground colour of forewing light grey suffused with dark greyish brown scales. Conspicuous bright yellow reniform spot, outlined black by the median line. Crosslines generally weakly marked, hardly distinguishable in dark specimens (light grey specimen illustrated on Fig. 4). Position of basal, antemedian, median, postmedian, subterminal and terminal line marked by small, dark costal spots. Black terminal spots present between the veins. Fringes long, dark grey. Hindwing and fringes unicolorous light grey.

The male and female genitalia are described under the genus.

Bionomics

Known habitats are the xerotherm Mediterranean maquis terrain, with bushes, grasses and other low plants, and open areas with *Pinus* trees.

The moth has been recorded at light, most of them on 8 watt super actinic tubes, from May to October, possibly occurring in several broods. The early stages are unknown.

Acknowledgements

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New species of the genus *Nemophora* (Adelidae) from Primorye region and Sakhalin, Russia

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Summary

Three new species of fairy moths (*Nemophora insulariella* sp. n., *N. sinevi* sp. n. and *N. ochrocephala* sp. n.) are described and illustrated from the Russian Primorye and Sakhalin Island. The phylogenetic relationships of these species with other representatives of the genus *Nemophora* Hoffmansegg are tentatively discussed.

Zusammenfassung

Es werden drei neue Arten der Langhornmotten (*Nemophora insulariella* sp. n., *N. sinevi* sp. n. und *N. ochrocephala* sp. n.) vom Fernen Osten Russlands und der Insel Sachalin beschrieben und abgebildet. Die phylogenetische Verwandtschaft dieser Arten mit den anderen Vertretern des Genus *Nemophora* Hoffmansegg in ihrer vorläufigen Gruppierung werden diskutiert.

Résumé

Trois nouvelles espèces d'Adelidae (*Nemophora insulariella* sp. n., *N. sinevi* sp. n. et *N. ochrocephala* sp. n.) sont décrites et illustrées, provenant du Primorye russe et de l'île de Sakhalin. Les relations phylogénétiques de ces espèces par rapport à d'autres représentants du genre *Nemophora* Hoffmansegg sont discutées provisoirement.

Introduction

The data on taxonomy and distribution of Adelidae (s. str.) in Russia east of Ural Mts are very scarce. Only eight species of fairy moths (genus *Nemophora* Hoffmansegg, 1798) have been mentioned from Russian Primorye (Primorskiy kray) by Moriuti (1982), and additionally *N. sylvatica* Hirowatari was recorded in Sakhalin and Kunashir Islands (Hirowatari, 1995).

In course of preparation of the manuscript for the forthcoming book "Keys to the insects of the Far East of Russia. Lepidoptera" (Kozlov, 1997) it became apparent that three species collected in this region are still undescribed. Although the taxonomic revision of the genus *Nemophora* is in progress now (Kozlov, 1995 ; Kozlov & Robinson, 1996), I was urged to publish the separate descriptions of these species to make them available prior to the appearance of the mentioned book.

The type specimens of *N. albiantennella* Issiki (kept in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C.) and *N. ahenea* Stringer (kept in The Natural History Museum, London), which are most closely related to *N. insulariella* sp. n. and *N. ochrocephala* sp. n., respectively, were examined during this study. Colour photos of *N. albiantennella* and *N. ahenea* were published by Moriuti (1982) ; for male genitalia of *N. ahenea*, see Kozlov (1997). The identity of *N. dumerilella* Dup., a common European species, is accepted according to Küppers (1980).

The male genitalia were examined and figured as described by Kozlov (1993). The interocular index was measured according to Davis (1975), being the ratio between the vertical diameter of the compound eye and the interocular distance measured at a point of the frons midway between the base of the antennal sockets and the anterior tentorial pits. The minimum distance between compound eyes is referred to as the occipital distance.

The type specimens are deposited in the Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZIN), the Zoological Museum, University of Helsinki (MZH) and the Zoological Museum, University of Copenhagen (ZMUC).

Nemophora insulariella n. sp.

HOLOTYPE ♂, "Russia, Sakhalin, surr. of Yuzhno-Sakhalinsk, 7.VII.1983, M. Kozlov" (ZIN).
PARATYPES : ♂, "Russia, Sakhalin, surr. of Yuzhno-Sakhalinsk, 8.VII.1983, M. Kozlov" (MZH) ; ♂, Sakhalin, surr. of Yuzhno-Sakhalinsk, 7.VII.1983, S. Yu. Sinev (labelled in Russian) (ZIN).

DIAGNOSIS. Differs from the closely related *N. albiantennella* Issiki by dark brown to black vertex, brassy green to bronze tint of forewings, gradual change of the colour along the male antenna, longer tegumen which exceeds the length of valva, very narrow arrow-head of juxta and smooth dorsal lobe at the apex of aedeagus in male genitalia.

DESCRIPTION. *Male.* Forewing length 5.0-5.3 mm ; wing expanse 10.8-11.4 mm. Vertex covered with dark brown to blackish raised hair-like scales ; frons with appressed dark bronze scales. Proboscis brown. Interocular index ca. 0.7. Labial palpus 1.1 × vertical eye diameter, dark bronze to brown. Antenna 3.5-3.6 × length of forewing, with simple inwardly directed pegs. Scape and proximal region of flagellum (0.7 × forewing length) brown, then colour gradually changes to light yellowish grey. Tegula, thorax (dorsum) and forewing dark, uniformly brassy green to bronze ; cilia dark brown, greyish on termen. Hindwing greyish brown, marginally purplish ; costal area grey ; cilia brown to grey. Legs dark brown, bronze shimmered. Epiphysis at one-half length of tibia, reaching its tip. Abdomen dark brown.

Female. Unknown.

Male genitalia (Figs. 3-7). Tegumen dome-shaped, without medial ridge. Length of socii equal to diameter of aedeagus. Vinculum 2.4 × length of valva, narrowly rounded anteriorly ; lateral margins slightly concave. Valva shorter than tegumen ; medial margin of valva with narrow lobe. Bases of valvae completely fused, with no signs of medial suture. Tip of valva narrow, tuberculate ; dorsal margin (viewed laterally) angulate. Aedeagus long, 1.3 × length of vinculum. Apical one-fifth of aedeagus consists of two lobes of equal length ; dorsal lobe smooth ; base of aedeagus of about the same diameter as the apex of aedeagus. Length of juxta 0.5 × length of aedeagus ; width of arrow-head 0.25 × its length ; both apex and lateral arms of arrow-head pointed.

BIOLOGY. Moths were collected flying at 1-1.5 m altitude in the daytime on a clearing in mixed forest near a small stream.

ETYMOLOGY. Insula (Latin) — an island.

NOTE. *N. insulariella* exhibits sister-group relationships with *N. albiantennella*, as supported by the completely accreted valvae, very short (not reaching valvar base) medial valvar apodeme, and apical part of aedeagus consisting of the ventral and dorsal lobes.

Nemophora sinevi **sp. n.**

HOLOTYPE ♂, “Russia, Primorye reg., Khasan distr., Slavyanka, 19.7.1990, M. Kozlov” (MZH).
PARATYPES : ♂ Primorskiy kray, Khasanskiy rayon, 3 km SE Andreevka, 22.VII.1985, S. Sinev (labelled in Russian) (ZIN) ; ♀, Primorskiy kray, Khasanskiy rayon, 3 km SE Andreevka, 21.VII.1985, S. Sinev (labelled in Russian) (ZIN) ; ♂, Primorskiy kray, Khasanskiy rayon, Zarubino, 6.7.1982,

S. Sinev (labelled in Russian) (ZIN) ; ♂, "Russia, Primorye reg., Khasan distr., Grebenchatyi Mountain Ridge, 4.7.1982, M. Kozlov" (MZH) ; ♂, "Russia, Primorye reg., Nadezhdinskij distr., Malaya Elduga river, 7.7.1982, M. Kozlov" (ZIN) ; ♀, Primorskiy kray, Khasanskiy rayon, Barabash-Levada, 21.VII.1989, S. Sinev (labelled in Russian) (ZIN) ; ♀, Primorskiy kray, 20 km E Ussurijsk, Gornotaezhnoye, on light, 30.VI.1990, S. Sinev (labelled in Russian) (ZIN) ; ♀, Primorskiy kray, Khasanskiy rayon, nature reserve "Kedrovaya Pad′", 26.VII.1988, S. Sinev (labelled in Russian) (ZIN).

DIAGNOSIS. Very similar to *N. dumerilella* Dup., from which it differs by darker forewings, dark brown hindwings, narrower (width of base to length ratio ca. 0.6) valvae with longer medial lobe (reaching ca. 0.8 of valvar length), almost pointed tip of valva and narrower arrowhead of juxta in male genitalia.

DESCRIPTION. *Male*. Forewing length 5.5-6.5 mm ; wing expanse 12-13 mm. Vertex black ; frons dark bronze. Proboscis dark brown. Interocular index 1.1 ; occipital distance 0.15 × vertical eye diameter. Labial palpus short (0.6 × vertical eye diameter), brown, with sparse dark brown hair-like scales. Antenna 2.0-2.5 × length of forewing, with simple inwardly directed pegs. Scape and proximal region of flagellum dark brown ; distal region of flagellum light brown. Tegula and thorax (dorsum) light, glossy bronze. Forewing brassy green basally, dark bronze with purplish lustre apically. Basal dark brown longitudinal spot usually long, 0.2 × length of forewing. Fascia at 3/5 of the forewing length. Costal third of fascia oblique, narrower near the wing margin, whereas the dorsal part of fascia is perpendicular to the wing margin. Fascia diffuse, formed by dark brown scales ; central zone with sparse yellow scales. Distal part of the forewing near the middle of the external margin with vagile spot formed by several dark brown scales suffused among bronze scales ; quite rarely, several yellow scales were observed in this spot. Cilia dark brown to purplish. Hindwing dark brown, costal area dark grey ; cilia brown. Legs dark bronze to light brown. Epiphysis at one-half length of tibia, not reaching its tip. Abdomen brown.

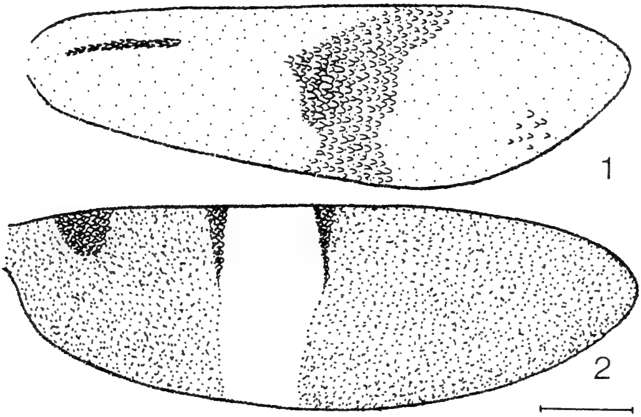
Female. Vertex ochreous, frons glossy golden. Interocular index 0.8. Labial palpus light, straw-yellow to ochreous, ventrally with sparse raised brown scales. Antenna 1.2-1.3 × length of forewing ; scape and proximal region of flagellum (about 2/3 of the total length) dark brown with purplish lustre ; distal region light brown to yellowish-grey. Otherwise similar to male.

Male genitalia (Figs. 8-12). Tegumen dome-shaped, without medial ridge. Length of socii equal to diameter of aedeagus. Vinculum relatively short (2.2 × length of valva), almost straight anteriorly ; lateral margins slightly concave. Valva longer than tegumen ; medial margin of valva with narrow lobe ; bases of valvae fused medially. Tip of valva narrow, with straight inner margin ; dorsal margin (viewed laterally) slightly S-shaped. Apical third of aedeagus consists of a narrow lobe swollen distally, with a small lateral hook-like process directed backwards ; diameter of the base of aedeagus 4 × diameter of the apical part of aedeagus. Length of juxta 0.5 × length of aedeagus ; width of arrow-head 0.5 × its length ; both apex and lateral arms of arrow-head pointed.

Biology. Moths were collected in broad-leaved forests ; swarming has not been recorded.

Etymology. Named after Dr. Sergei Sinev who collected a larger part of the type material.

Note. *N. sinevi* belongs to the *fasciella* species-group established by Küppers (1980), which includes *N. dumerilella*, *N. minimella* Den. et Schiff., *N. prodigella* Z., *N. fasciella* F., *N. auricella* Rag., *N. molella* Hb., and probably several other species.



Figs. 1-2. Forewing pattern : 1 — *Nemophora sinevi* sp. n. ; 2 — *N. ochrocephala* sp. n. (reference bar 1 mm).

Nemophora ochrocephala sp. n.

Holotype ♂, “Russia, Primorskiy kr[ay], Pogranichnyi rayon, Barabash-Levada, 21.VII.1989, S. Sinev” (labelled in Russian) (ZIN).
Paratypes : ♂, same label as in holotype, except the date “22.VII.1989” (ZIN). ♀, same label as in holotype, except the date “26.VII.1989” (ZIN). ♀, same

label as in holotype, except the date "31.VII.1989" (ZIN). ♀, "Russia, Primorye reg., 40 km E Luchegorsk, Verkhnyi Pereval, 12.7.1990, M. Kozlov" (MZH). ♂, "Far East [of Russia], Rogranitchnyj r[egion], Barabash-Levada, 29.VII. 1989, P. Ivinskis" (ZMUC).

DIAGNOSIS. Similar to *N. ahenea* Stringer, from which it differs by ochreous forewing fascia, longer tegumen reaching the tip of valva, and longer medial lobe of valva exceeding 2/3 of valvar length.

DESCRIPTION. *Male.* Forewing length 6.3-6.4 mm ; wing expanse 13.6-13.8 mm. Vertex and frons covered with ochreous to pale yellow raised hair-like scales. Interocular index 1.3 ; occipital distance 0.1 × vertical eye diameter. Labial palpus short (0.7 × vertical eye diameter), ochreous. Antenna 2.8-3.0 × length of forewing, with simple inwardly directed pegs. Scape light, yellow to ochreous, proximal region of flagellum brown, then colour changes gradually to light grey ; basal 7-8 segments dorsally with narrow line of long raised greyish-brown scales. Tegula and thorax (dorsum) light, glossy bronze. Forewing glossy bronze ; costa near the wing base with large dark brown, purplish shimmered spot. Outer border of fascia situated in the middle of forewing ; near the costa, pale ochreous band is on both sides bordered by dark brown scales forming narrow triangular spots. Cilia bronze. Hindwing brown, costal area light grey ; cilia brown. Legs bronze, apical regions of tibia blackish, with purplish lustre. Epiphysis at one-half length of tibia, not reaching its tip. Abdomen light, yellowish-brown.

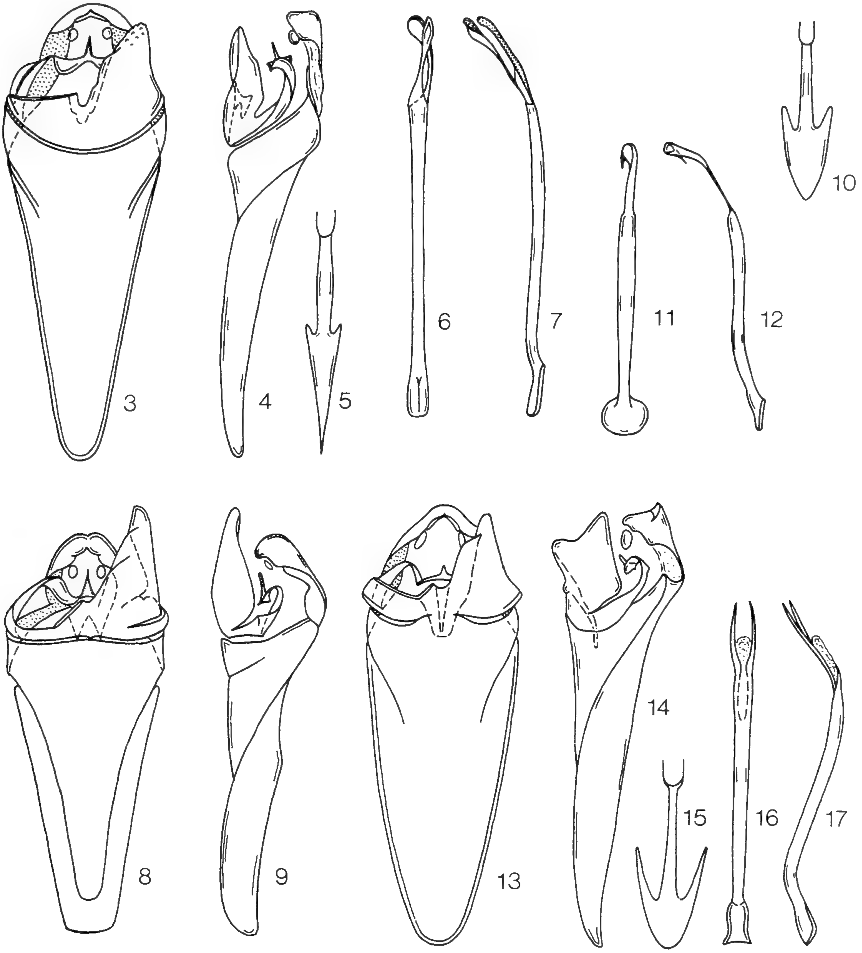
Female. Interocular index 0.7. Antenna 1.6-1.8 × forewing length ; scape yellow, flagellum dark brown with purplish lustre, slightly lighter in the distal region. Otherwise similar to male.

Male genitalia (Figs. 13-17). Tegumen dome-shaped, without medial ridge. Length of socii slightly exceeds diameter of aedeagus. Vinculum long (3 × length of valva), rounded anteriorly ; lateral margins almost straight. Valva longer than tegumen ; medial margin of valva with prominent lobe directed medioventrally ; valvae fused medially to each other and to the vinculum. Tip of valva narrow, almost pointed ; dorsal margin (viewed laterally) straight. Aedeagus (viewed laterally) S-shaped ; apex of aedeagus ventrally with two symmetrical carinae ; base of aedeagus slightly swollen. Length of juxta 0.5 × length of aedeagus ; width of arrow-head 0.7 × its length ; apex of arrow-head rounded but long lateral arms pointed.

BIOLOGY. Moths were collected in broad-leaved forests.

ETYMOLOGY. Ochros (Greek) — ochreous, kephale (Greek) — head.

NOTE. *N. ochrocephala* exhibits sister-group relationships with *N. ahenea*, as supported by the position of fascia in the basal half of the forewing, presence of large dark costal spot at the forewing base, accreted valvae, very long arms of arrow-head of juxta, presence of symmetrical carinae at the apex of aedeagus, and prominent medial lobe of valva in male genitalia. Both these species are related to *N. tyriochrysa* Meyrick which, however, has a pair of carinae on the dorsal side of the aedeagus.



Figs. 3-17. Male genitalia : 3-7 — *Nemophora insulariella* sp. n. ; 8-12 — *N. sinevi* sp. n. ; 13-17 — *N. ochrocephala* sp. n. (3, 8, 13 — genital complex, ventral view ; 4, 9, 14 — genital complex, lateral view ; 5, 10, 15 — juxta ; 6, 11, 16 — aedeagus, ventral view ; 7, 12, 17 — aedeagus, lateral view) (reference bar 0.25 mm).

Acknowledgements

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Nemophora lapikella sp. n., a new fairy moth species (Adelidae) from South-Eastern Asia

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Summary

Nemophora lapikella sp. n., closely related to *N. chalybeella* (Bremer) and of *N. staudingerella* (Christoph), is described and illustrated from Far East Russia, Korea, Mainland China and Taiwan. Species of the *degeerella* species-group recorded in South-Eastern Asia are listed, and their morphological affinities with *N. lapikella* are briefly discussed.

Zusammenfassung

Nemophora lapikella sp. n., eine nahe bei *N. chalybeella* (Bremer) und *N. staudingerella* (Christoph) stehende Art aus dem Osten Russlands, Korea, China und Taiwan wird beschrieben und abgebildet. Die Arten der *degeerella*-Artengruppe aus Südostasien werden aufgelistet und ihre mophologischen Ähnlichkeiten mit *N. lapikella* kurz diskutiert.

Résumé

Nemophora lapikella sp. n., étroitement apparentée à *N. chalybeella* (Bremer) et à *N. staudingerella* (Christoph), est décrite de l'Extrême Orient de la Russie, de Corée et de Chine (y compris Taiwan). Les espèces du groupe d'espèces *degeerella* mentionnées d'Asie du sud-est sont énumérées, et leurs affinités morphologiques par rapport à *N. lapikella* sont discutées brièvement.

In course of preparation of the manuscript for the forthcoming book "Keys to the insects of the Far East of Russia. Lepidoptera" (Kozlov, 1997) it became apparent that one species of fairy moths widely distributed across South-Eastern Asia still remains undescribed. This species belongs to the *degeerella*-group, one of the most problematic species assemblages in the genus *Nemophora* Hoffmansegg. Although the revision of this group is in preparation now, I was urged to publish a separate description of this new species to make the given name available prior to the appearance of the mentioned book.

The type material of all species of the *degeerella*-group to which *N. lapikella* sp. n. is compared (for the list see below), were examined during this study. Male genitalia of *N. chalybeella* (Bremer) and *N. staudingerella* (Christoph), two most similar species to *N. lapikella*, are figured by Kozlov (1997).

The male genitalia were examined and figured following the procedure previously described (Kozlov, 1993). The interocular index was calculated as the ratio between the vertical diameter of the compound eye and the interocular distance measured at a point of the frons midway between the base of the antennal sockets and the anterior tentorial pits (Davis, 1975).

The type specimens are deposited in Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZIN), College of Agriculture, Kangweon National University, Chuncheon, Korea (CAKU), Zoological Museum, University of Helsinki (MZH), The Natural History Museum, London, U. K. (BMNH), U. S. National Museum of Natural History, Smithsonian Institution, Washington, D. C., U. S. A. (USNM), Muzeul de Istorie Natural "Grigore Antipa", Bucureşti, Romania (MINGA) and National Museum of Natural Sciences in Taichung, Taiwan, China (NMNST).

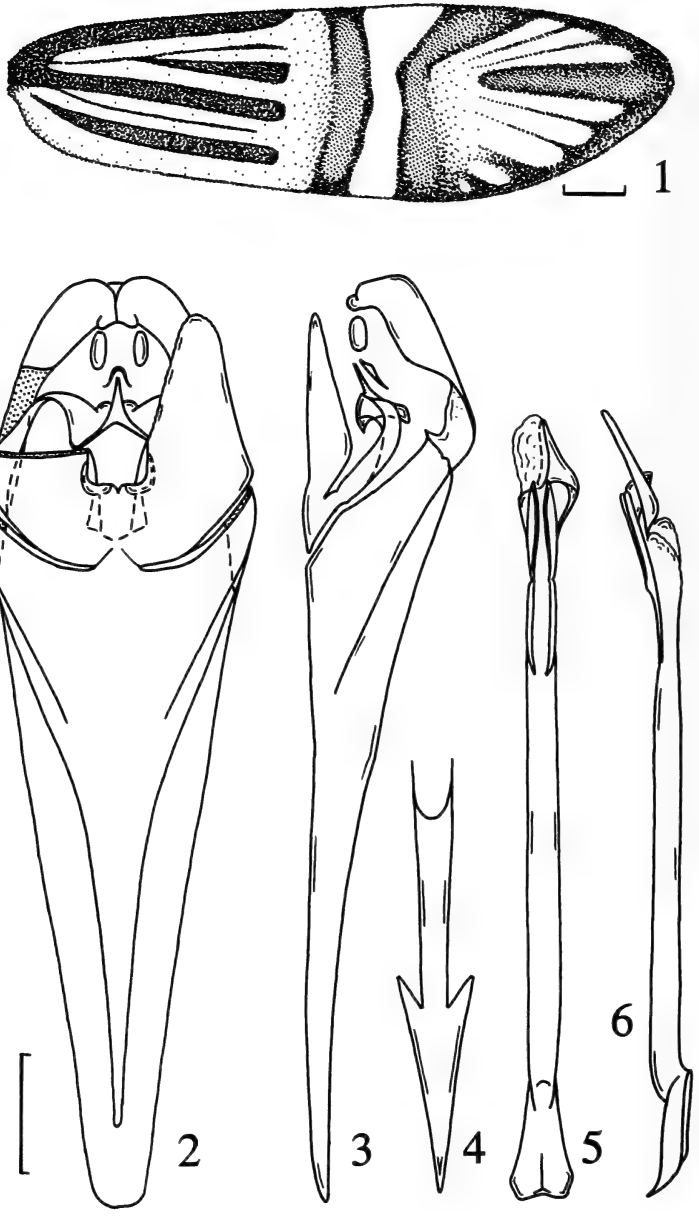
Nemophora lapikella n. sp.

HOLOTYPE ♂, "Southern Primorye, Khasan reg., Slavjanka, 19.7.1990, M. Kozlov" (MZH).

PARATYPES. *Russia* : ♂, "Southern Primorye, Khasan reg., Slavyanka, 19.7. 1990, M. Kozlov" (MZH) ; 5 ♂, "Southern Primorye, Khasanskiy rayon, Rjazanovka, 14.7.1983, M. Kozlov" (ZIN) ; ♀, Southern Primorye, Khasanskiy rayon, Rjazanovka, 5.8.1984, S. Sinev (labelled in Russian) (ZIN) ; 6 ♂, Southern Primorye, Khasanskiy rayon, 7 km N Zanadvorovka, 12-14.8.1984, S. Sinev (labelled in Russian) (ZIN) ; 2 ♂, "Amur, Staudinger [18]83" (BMNH) ; ♂, "Mandschurei, [Insel] Askold, Jankowski" (BMNH) ; ♂, ♀, "Ile Askold, 42 1/2° lat. N, 102° long (Mantschourie), M. Jankowski, 1878" (BMNH) ; ♂, ♀, "Ile Askold, M. Jankowski, 1880" (BMNH). *Korea* : ♂, "Korea North, Pyongsong 300 m, Chongryonsan Mts., 9.VII.1987, J. Jaros" (MZH) ; ♀, Southern Korea, "Seomyun, Yangyang, 10.VII.1987, K. T. Park" (CAKU). 2 ♂, "Gensan, Corea, 31.I.1886" (Leech) (BMNH) ; ♂, "Korea, E[nd].VI.1926, S. Issiki" (USNM). *China* : 38 ♂, 12 ♀, "China, Chang-Yang, 4000-6000 ft, Ichang, Pratt Coll. Leech 1886" (BMNH) ; ♂, "China, West Tien-Mu-Shan, 1600 m, P[rovin]z. Chekiang, 11.VI.1932, H. Höne" (MINGA) ; ♂, Shantung "Mou-Pin [Mou-p'ing], 1897, ex R. P. Déjean" (BMNH) ; ♂, ♀, "Taiwan, Tombara [Tunpala], 5.VI.1943, S. Issiki" (USNM) ; ♂, "Taiwan, Rarasan [Loloshan], 28.VI.1943, S. Issiki" (USNM) ; 2 ♂, 2 ♀, "Taiwan, Nökö [Nengkao], 26.VI.1929, S. Issiki" (USNM) ; ♂, "Taiwan, Hualien Co., Tayulin-Tzer-en, 15.VII.1995, S.H.Yen" (NMNST).

DIAGNOSIS. Very similar to *N. chalybeella*, differs from it in the abrupt change of male antennal colour at the level of forewing fascia, widely rounded apex of valva and symmetrical straight carinae on the ventral wall of aedeagus in the male genitalia.

DESCRIPTION. *Male*. Forewing length 8.8-11.6 mm ; wing expanse 19-25 mm. Vertex and upper part of frons yellow to ochreous ; frons otherwise yellow to bronze. Proboscis yellow. Interocular index ca. 0.5. Labial palpus short (1.2 × vertical eye diameter), thin, light yellow. Antenna 3.2-3.4 × length of forewing, with simple inwardly directed pegs. Scape and proximal region of flagellum bronze to cupreous brown ; distal region of flagellum light silver-white ; the coloration changes abruptly at the level of forewing fascia. Tegula and thorax (dorsum) bronze. Forewing (Fig. 1) bright yellow at base to ochreous near fascia. Basal part of forewing with four bronze longitudinal stripes bordered with dark brown scales ; two of these stripes jointly begin from the wing base and expand one along costal margin, another along CuA vein ; third stripe situated between these two is shorter (nearly a half of other three stripes), with narrow proximal part connected to thin dark line which follows radial stem ; another thin dark line follows CuP vein ; fourth stripe not connected to wing base and follows anal stem. Distally, all four stripes expand to 0.40-0.45 × forewing length and do not reach inner margin of fascia situated at ca. 0.5 × forewing length. Fascia medially narrow, 0.12-0.16 × forewing length, expanding both to the costal (0.20-0.35 × forewing length) and dorsal (0.17-0.25 × forewing length) wing margins. Median band of fascia yellow, nearly of the same width as glossy silver-grey marginal bands bordered with brown scales. Distal field ochreous near fascia, otherwise straw-yellow, with dark brown outer margin ; termen bronze, with golden shimmering. Neither narrow dark brown lines arising from forewing margin, nor prominent glossy violet to bronze spot situated between RS_4 and M_2, reach fascia. However, in some specimens the inner points of dark radial lines dorsad of glossy spot are fused, isolating oval yellow spots from ochreous zone adjacent to fascia. Forewing cilia bronze. Hindwing dark brown, glossy bronze ; costa yellowish ; cilia brownish grey. Legs yellow, except fore tibia and apical parts of other tibia and all tarsal segments which are purplish-brown to brown. Epiphysis at 1/2, reaching apex of tibia. Hind tibia with sparse yellow hairs ; proximal pair of spurs situated at ca. 3/5 from the base of tibia. Abdomen yellow ventrally, greyish yellow dorsally.



Figs. 1-6. *Nemophora lapikella* sp. n. : 1 — forewing pattern (reference bar 1 mm) ; 2 — male genital complex, ventral view ; 3 — same, lateral view ; 4 — juxta ; 5 — aedeagus, ventral view ; 6 — same, lateral view (reference bar 0.25 mm).

Female. Forewing length 7.8-8.5 mm ; wing expanse 17-19 mm. Antenna 1.1-1.2 × forewing length ; basal 2/3 of flagellum covered with dark brown to purplish scales ; distal part of flagellum light grey to silver white. Otherwise similar to male.

Male genitalia (Figs. 2-6). Tegumen dome-shaped, without medial ridge. Socii elongate, about 1.3 × diameter of aedeagus. Vinculum of moderate length (2.6-2.8 × length of valva), narrowly rounded anteriorly ; lateral margins almost straight. Valva slightly longer than tegumen ; valvae fused medially to ca. 1/3 × valval length. Medial margins of valvae proximally parallel to each other and forming almost right angle with the distal margin of fused valval base ; both median and dorsal margins of valvae distally straight ; tip of valva widely rounded. Length of aedeagus ca. 1.2 × length of vinculum ; ventral wall of aedeagus distally with two short (ca. 0.25 × length of aedeagus) well-sclerotized symmetrical carinae. Walls of aedeagus smooth ; tip asymmetrical, with the prominent band arising from right wall. Juxta ca. 0.5 × length of aedeagus, with very narrow (length ca. 3 × width) pointed arrow-head.

BIOLOGY. In Southern Primorye most specimens were collected in very sparse forests formed by *Quercus dentata*, near the sea shore. Males are gregarious, swarming in sunshine. The species occurs late in the season (mid-July to mid-August in Russian Primorye, end of June to July in China and Korea).

DISTRIBUTION. Russia (Southern Primorye), Korea, Mainland China, Taiwan.

NOTE. The external similarity of species resembling *N. degeerella* (L.), as well as variation in wing pattern and head coloration, have created numerous taxonomic problems. According to recent knowledge, in south-eastern Asia the *degeerella* species-group is represented by 15 species : *N. amatella* (Staudinger), *N. augites* (Caradja & Meyrick), *N. bellela* (Walker), *N. chalybeella* (Bremer), *N. congruella* (Fischer von Roeslerstamm), *N. disjunctella* (Caradja), *N. japonica* Stinger, *N. karafutonis* (Matsumura), *N. lapikella* sp. n., *N. ochsenheimerella* (Hübner), *N. polychorda* (Meyrick), *N. schrencki* (Bremer), *N. staudingerella* (Christoph), *N. syfaniella* (Caradja, 1927) and *N. wakayamensis* (Matsumura). Some more species remain undescribed, and the full taxonomic treatment of this group will be published elsewhere.

Five species (*N. chalybeella*, *N. japonica*, *N. lapikella* sp. n., *N. polychorda* and *N. staudingerella*) differ from the remaining representatives of the *degeerella* species-group by glossy (silver-grey to blue or bronze) metallic iridescent spot in forewing outside the fascia. This spot is directed along the veins and usually positioned between RS_4 and M_2. In external characters, *N. lapikella* sp. n. differs from the other four species in the coloration of the male antenna, and from *N. japonica* and *N. staudingerella* also in the smaller extension of the dark brown coloration in radial and cubital sectors of forewing (less than 1/2 of the zone outside fascia).

In the male genitalia, *N. lapikella* sp. n. differs from *N. polychorda* in the presence of a pair of carinae on the ventral wall of aedeagus, and from *N. japonica* in the absence of a funnel-shaped structure at the tip of aedeagus. In both *N. lapikella* and *N. staudingerella*, carinae on the ventral wall of aedeagus are symmetrical, whereas in *N. chalybeella* the left carinae is corkscrew-shaped apically. From *N. staudingerella* the new species differs by the longer vinculum (2.6-2.8 × length of valva) and the smooth right wall of aedeagus.

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A taxonomic revision of the genus *Holoarctia* Ferguson, 1984 (Arctiidae)

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Summary

The genus *Holoarctia* Ferguson, 1984 is rearranged on the basis of formerly unrecognised characters of everted male vesica and female bursa. Three species are included : *H. cervini* (Fallou, 1864), *H. marinae* Dubatolov, 1985 and *H. puengeleri* (O. Bang-Haas, 1927). The taxa *fridolini* (Torstenius, 1971) and *perunovi* Dubatolov, 1990 are considered as subspecies of *H. puengeleri*. The status of *H. sordida* (McDunnough, 1921) is discussed. The adults and genitalia of *cervini*, *marinae* and *puengeleri* are illustrated and the distribution is presented for each species.

Zusammenfassung

Die Gattung *Holoarctia* Ferguson, 1984 wird aufgrund bisher unbekannter Merkmale der ausgestülpten männlichen Vesica und der weiblichen Bursa neu geordnet. Drei Arten werden in die Untersuchung einbezogen : *H. cervini* (Fallou, 1864), *H. marinae* Dubatolov, 1985 und *H. puengeleri* (O. Bang-Haas, 1927). Das Taxon *fridolini* (Torstenius, 1971) und *H. perunovi* Dubatolov, 1990 werden als Unterart von *H. puengeleri* aufgefasst. Der taxonomische Status von *H. sordida* (McDunnough, 1921) wird diskutiert. Die adulten Tiere und die Genitalien von *cervini*, *marinae* und *puengeleri* werden abgebildet und es wird die Verbreitung jeder Art behandelt.

Résumé

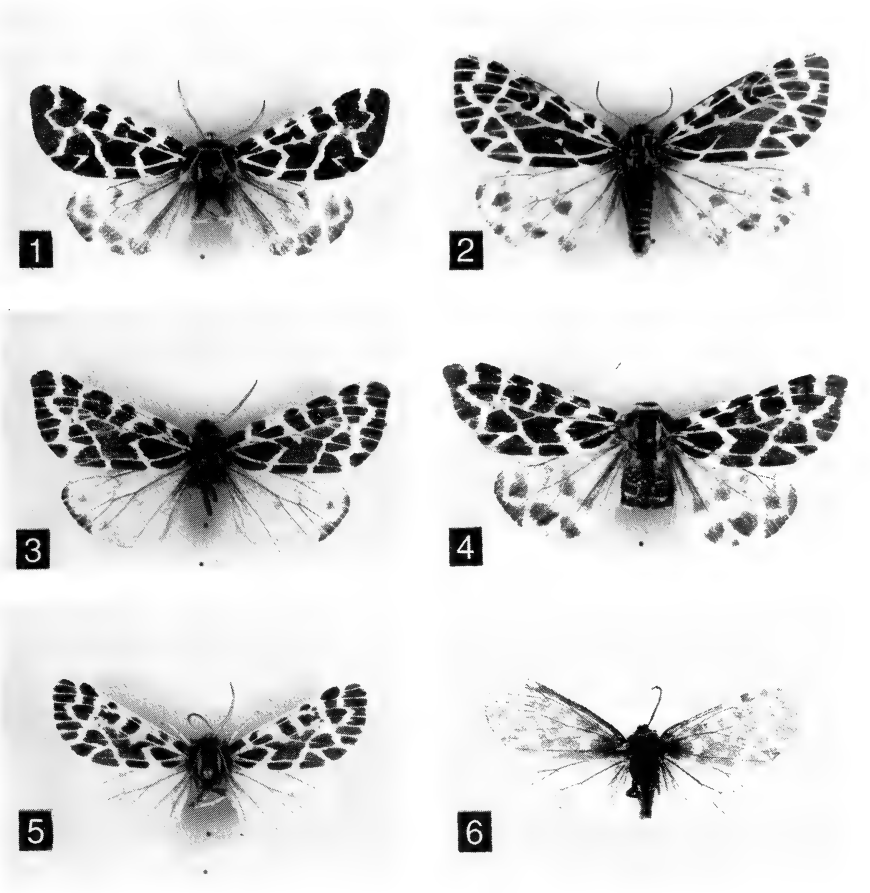
Les auteurs révisent le genre *Holoarctia* Ferguson, 1984 en se basant sur des caractères ignorés jusqu'à présent : vesica mâle evaginée, bursa de la femelle. Ce genre comprend trois espèces : *H. cervini* (Fallou, 1864), *H. marinae* Dubatolov, 1985 et *H. puengeleri* (O. Bang-Haas, 1927). Les taxons *fridolini* (Torstenius, 1971) et *perunovi* Dubatolov, 1990 sont considérés comme sous-espèces de *H. puengeleri*. Le status de *H. sordida* (McDunnough, 1921) est discuté. Illustration des imagos et des genitalia de *cervini*, *marinae* et *puengeleri* ; distribution géographique de chacune de ces espèces.

Introduction

In 1864 Fallou described *Nemeophila cervini* from Zermatt in the Swiss Alps. Later its distribution, habitat and ecology have been studied thoroughly (for a review see Sotavalta *et al.*, 1984). Burmann (1952) gave a good description of internal variation of this taxon, and Burmann (1975) and Gerber (1979) discussed the interpopulation differences. They also mapped its distribution in the Alps. In 1927 O. Bang-Haas described a close relative of *N. cervini* from the Sayan Mountains he named "*Orodemnias püngeleri*". Specimens of related taxa have been found in new areas later on : the Kola Peninsula (Kol'skiy poluostrov) in northwestern Russia (Kusnezov, 1935 ; Torstenius, 1971 ; Sotavalta *et al.*, 1984) and northern Sweden. The latter population has been described by Torstenius (1971) as *Orodemnias cervini* ssp. *fridolini* ; this name was mentioned by Kusnezov (1935) as a nomen nudum. Specimens of the *Orodemnias cervini*-complex were also reported from Mongolia (Alberti, 1971) and Kamchatka (Sedykh, 1979). Later *Orodemnias* Wallengren, 1885 was synonymized with *Grammia* Rambur, 1866 and thus Leraut (1980) has placed *cervini* among species of that genus. However, Ferguson (1984) showed the taxa *cervini*, *puengeleri* and *fridolini* to differ in many characters from the type-species of *Grammia*, *Bombyx quenseli* Paykull, 1793 and established for them the genus *Holoarctia.*

There has been confusion about the connections between different taxa described and specimens of this group from different regions. Ferguson (1984, 1985) considered *Holoarctia cervini*, *H. puengeleri* and *H. fridolini* to be distinct species and reported *H. fridolini* for the first time for the Nearctic region from Alaska. He also transferred *Neoarctia sordida* McDunnough, 1921 to *Holoarctia* and treated it to be identical with *H. cervini* without examination of the genitalia. As a result he stated that both, *H. cervini* and *H. fridolini*, are holarctic species and that distribution of *H. puengeleri* is restricted to the Sayan Mountains. Sotavalta *et al.* (1984) described the early stages of *H. fridolini* from Scandinavia and presented photographs of everted male vesicas and female bursae. They considered *H. cervini* and *H. fridolini* to be conspecific, as they could not find any differences in the internal genitalia. They mentioned, however, that there were differences between the taxa in wing shape and colouration. They also studied one specimen of *H. puengeleri*, but did not illustrate its genitalia for comparison.

Dubatolov (1985a) described *Holoarctia marinae* from the Altai Mountains on the basis of external genitalia and wing characters. He



Figs. 1-6. *Holoarctia* spp. : 1 — *H. puengeleri fridolini* ♂, wingspan 38 mm, Chukchi Peninsula, 64°55′ N 172°36′ W, 45 km N. of Provideniya, Russia ; 2 — *H. puengeleri puengeleri*, lectotype ♀, wingspan 41 mm, Obo Sarym, Sayan Mts., Russia ; 3 — *H. puengeleri puengeleri* f. *bicolor*, type ♂, wingspan 38.5 mm, Chulugaischa, Mondy, Sayan Mts., Russia ; 4 — *H. puengeleri puengeleri* ♀, wingspan 43 mm, Malyi Okonon river, Stanovoi Mts., Russia ; 5 — *H. puengeleri puengeleri* f. *immaculata*, type ♂, wingspan 34 mm, Sayan Mts., Russia ; 6 — *H. marinae*, holotype ♂, wingspan 34 mm, Onguday, Altai Mts., Russia.

also considered all other taxa and specimens from Alaska, the former Soviet Union and Scandinavia to be conspecific and merged them (Dubatolov, 1985b) into one holarctic species, *H. puengeleri*. However, later on he reconsidered the status of *H. puengeleri* and *H. fridolini* and considered them to be conspecific with *H. cervini* and accepted them as subspecies (Dubatolov, 1990). He also doubted the specific status of *H. marinae*.

This article presents a review of the genus *Holoarctia* based upon formerly unrecognized characters of the internal genitalia.

Material and Methods

The examined specimens are listed under each taxon studied. Following abbreviations of institutions and museums are employed throughout the text :

BIN — Biological Institute, Novosibirsk, Russia ; ZMH — Finnish Museum of Natural History, Zoological Museum, Helsinki, Finland ; MNHB — Museum für Naturkunde der Humboldt-Universität zu Berlin, Germany ; ZISP — Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia ; TLMF — Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria.

The genitalia were mounted by using the methods described by Lafontaine & Mikkola (1987). Both male vesicas and female corpus bursae were first everted with water and then fixed with absolute alcohol. Prepared genitalia were kept in alcohol until figured by using Leitz Wild M 10 stereomicroscope. The genitalia were not embedded into slide mounts before this, because three-dimensional structure of genitalia makes the interpretation of characters difficult. The length of forewing and the total wing span of all specimens studied was measured. The antennae, head, body and legs as well as wing pattern and colouration were studied as described in Sotavalta (1965) and Ferguson (1985). The terminology used follows them.

Holoarctia Ferguson, 1984

Proc. ent. Soc. Wash. 86 : 452.
Type-species by original designation : *Nemeophila cervini* Fallou, 1864, *Ann. Soc. ent. Fr.* 4 (4) : 23, pl. 1.

External characters. Medium-sized tiger-moths, wingspan 28-39 mm in males and 31-43 mm in females. Forewing length 12-19 mm in males and 11-21 mm in females. Forewing pattern comprises five transverse pale bands present at costa. The transverse bands are fused or broken so that only three of them meet the inner margin of the forewing. The primary longitudinal pattern at veins of the forewing may be present in some specimens and the secondary longitudinal pattern is weakly developed. The cubital and postcubital bands are always missing. The hindwing is usually pale yellow or white with a row of dark spots near the margin or may be suffused with dark. Eye elliptoid and bare, antenna bipectinate in male and serrate in female. Labial palpi long, with dark proximal and pale distal hairing. Head and thorax dark and hairy with pale stripes, abdomen dark with pale rings connecting segments. Legs pale with brown or black posterior shading on femur and tibia. In some specimens there are dark scales also on tarsomers.

MALE GENITALIA. The shape of the external male genitalia varies widely so that the species usually cannot be identified by using these characters. Valva unilobed and simple. Juxta longer than wide, in all but one species with teeth at upper lateral margins. There is one distal spot of teeth on aedeagus. The everted vesica is at least half of the length of aedeagus. The form of the vesica is highly three-dimensional with four to five projecting diverticulae. The position of the opening of ductus ejaculatorius varies slightly between specimens.

FEMALE GENITALIA. Ductus bursae strongly chitinized. Appendix bursae is expanded resembling a second corpus bursae in size. This character does not exist in any of the related genera. The opening of ductus seminalis is located at or laterally from the tip of appendix bursae.

For a detailed description see Ferguson (1984, 1985) and for a comparison of related genera see Ferguson (1985) and Dubatolov (1987, 1988).

***Holoarctia cervini* (Fallou, 1864)**

Figs. 9-12, 13, 18, 21.

Nemeophila cervini Fallou, 1864 : *Ann. Soc. ent. Fr.* 4 (4) : 23, pl. 1. Type-locality : Gornergrat near Zermatt, Walliser Alps, Switzerland.

Arctia Cervini var. *Hnateckii* Frey, 1872 : *Mitt. schweiz. ent. Ges.* 3 : 479. Type-locality : Wallis, Switzerland.

Orodemnias cervini rougemonti O. Bang-Haas, 1927 : In : Horae Macrolepidopterologicae Regionis Palaearcticae, p. 60, pl. 8. Type-locality : Augstbordpass, the Walliser Alps, Switzerland.

Orodemnias cervini steitei Röber, 1930 : *Ent. Z. Frankf. a. Main* 44 : 21. Type-locality : the Oetztaler Alps, 2900 m, Nordtirol, Austria.

Orodemnias cervini scriniensis Berthet, 1948 : *Rev. fr. Lép.* 11 : 369. Type-locality : "Glacier de l'Encoula", the Dauphiné Alps, France.

Orodemnias cervini f. *steitei* Burmann, 1952 : *Mitt. Münch. ent. Ges.* 42 : 179.

Orodemnias cervini f. *fumata* Burmann, 1952 : *Mitt. Münch. ent. Ges.* 42 : 182. Type-locality : "Oetztaleralpen", Austria.

Orodemnias cervini f. *fasciata* Burmann, 1952 : *Mitt. Münch. ent. Ges.* 42 : 182. Type-locality : "Oetztaleralpen", Austria.

Orodemnias c. teriolensis Burmann, 1975 : *Ber. nat.-med. Ver. Innsbruck* 62 : 124. Type-locality : "Terio. sept. Niedertal, Ötztaler-Alpen, 3000 m."

Orodemnias c. splendida Gerber, 1979 : *Mitt. ent. Ges. Basel* 29 : 36. Type-locality : the Oetztaler Alps, Austria, **syn. n.**

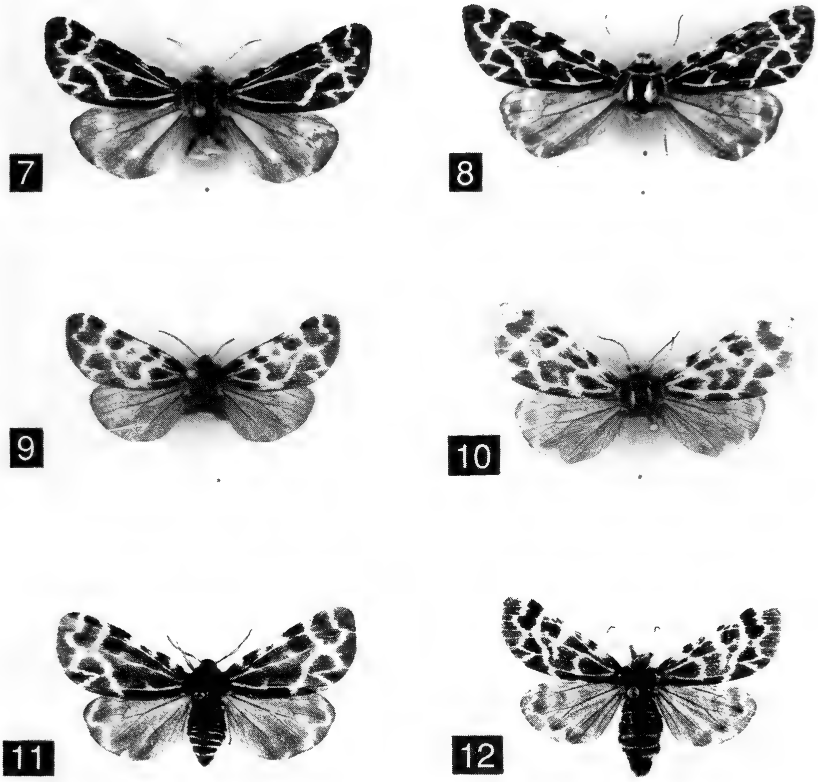
Grammia cervini Leraut, 1980 : Liste systématique et synonymique des Lépidoptères de France, Belgique et Corse. *Alexanor*, Suppl. : 155.

Holoarctia cervini Ferguson, 1984 : *Proc. ent. Soc. Wash.* 86 : 453, 454.

MATERIAL EXAMINED. ♂, "Zermatt, e. o. Huttwll, 17.4.63, M. Rüttimann" (ZMH) ; ♂, "Helvetia", Coll. Duske. (ZMH, genitalia studied) ; ♀, "Helvetia", coll. Duske. (ZMH, genitalia studied) ; ♂, "Helv., Gorner Grat, 3000 m e. l." (Coll. E. Suomalainen, genitalia studied) ; ♂, "Gornergrat, Zcht. i Huttwil, 15.9.52, Rüttimann leg." (Coll. E. Suomalainen) ; ♂, "Monte Rosa" (ZISP, genitalia studied) ; ♀, "2, Hel, Nf / Kol. Vel. Kn. Nikolaja Mikhailovitsha" (text in Cyrillics) (ZISP, genitalia studied) ; ♂, "Tirol, Samoar, Hütte e.l., 3000 m, 8.8.1948 / Koppeller, Innsbruck" (TLMF) ; ♂, "Tirol, Ötztal, Sammoar, Hütte 3000 m, 6.8.1948 / Koppeller, Innsbruck" (TLMF, genitalia studied) ; ♀, "e. o. 12.1.78, Eigel 5.8.76, Kreüzep. 3000 m, Ötzt. Alpen / P. Münck" (TLMF) ; ♀, "e. o. 22.1.77, Eigel. 5.8.76, Kreüzsp. 3000 m, Ötztal. Alpen / P. Münck" (TLMF, genitalia studied) ; ♂, "ex ovo BERN, ♂ Augstbord × ♀ Gornergrat, 20.4.1973, Rene DUSS" (coll. R. Johansson).

EXTERNAL CHARACTERS (Figs. 9-12). The smallest species of the genus. Ground-colour of the forewing greyish brown with sharp yellow transverse and longitudinal bands forming a reticulation. The width of yellow reticulation on forewing varies considerably between specimens and several forms or varieties have been described on this basis. These are reviewed by Burmann (1952, 1975). The extent of grey shading on forewing varies from darkly suffused to almost missing, and the colouration of hindwing varies from almost grey to bright yellow with only a row of dark spots near the margin. These differences have been used to distinguish between populations (Gerber, 1979). The colouration of head, thorax and abdomen are as that of forewing. Antenna is bipectinate in males and serrate in females.

The adult size is largest in the Oetztaler Alps population and smallest in the type locality. In our material from the type locality the length of forewing is 13.5-15.0 mm in males (n = 5) and 15.5-16.0 mm in females (n = 2). The wingspan 28.5-33.0 mm in males (n = 5) and 32.5 mm in females (n = 2). In the Oetztaler population the length of forewing is 15.0-15.5 mm in males (n = 2) and 15.5-17.0 mm in



Figs. 7-12. *Holoarctia* spp. : 7 — *H. puengeleri fridolini* ♂, wingspan 34 mm, Nissuntjårro, Torne Lappmark, Sweden ; 8 — *H. puengeleri fridolini* ♀, wingspan 37 mm, Nissuntjårro, Torne Lappmark, Sweden ; 9 — *H. cervini* ♂, wingspan 28.5 mm, Zermatt, Wallis, Switzerland ; 10 — *H. cervini* ♀, wingspan 32.5 mm, Zermatt, Wallis, Switzerland ; 11 — *H. cervini* ♂, wingspan 32.5 mm, Oetztaler Alps, Austria ; 12 — *H. cervini* ♀, wingspan 32.5 mm, Oetztaler Alps, Austria.

females (n = 2). The wingspan 32.5-33.5 mm in males (n = 2) and 32.5-36.0 mm in females (n = 2). In a male from a crossing between Augstbord and Gornergrat populations the wingspan is 28.0 mm and the forewing length is 13.5 mm.

Male genitalia (Fig. 13). Valva simple, tapering towards apex. The width of valva is variable, on the average broader than in *H. puengeleri.* Juxta bears teeth on the lateral margins, aedeagus with a group of spines at distal end, near the opening of vesica. Vesica is more than half of the length of aedeagus. The opening point of ductus ejaculatorius (arrow) is located at the middle of the distal third of the vesica diverticle.

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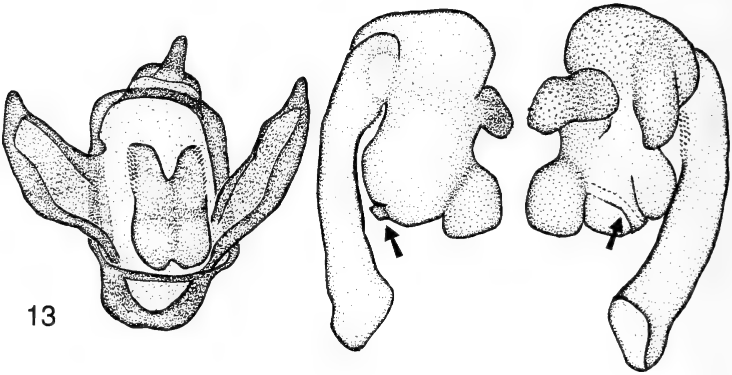

Fig. 13. Male genitalia of *Holoarctia cervini*, Zermatt, Wallis, Switzerland. Aedeagus with everted vesica shown from opposite directions (arrow indicates the opening point of ductus ejaculatorius).

Female genitalia (Fig. 18). Ductus bursae strongly chitinized, appendix bursae unusually broadened, resembling an additional corpus bursae. The opening of ductus seminalis (arrow) is located at the distal tip of appendix bursae. This is the strongest character to distinguish *H. cervini* from *H. puengeleri.*

We did not find any differences in genitalia between specimens from the type locality and the Oetztaler Alps.

Distribution (Fig. 21). The area of Zermatt in Wallis, Switzerland (nominotypical form) ; mountains between Turtmanntal and Mattertal in Wallis, Switzerland (*H. cervini hnateckii* — Gerber, 1979) ; Dauphiné Alps in France ; Oetztaler Alps in Austria (*H. cervini steitei*) and Italy ; Graubünden Alps in Switzerland.

REMARKS. Burmann (1975) placed the populations of *Holoarctia cervini* into two subspecies : *H. c. cervini* from the area of Wallis in Switzerland and described *H. c. teriolensis* from the Oetztaler Alps. Gerber (1979) described *H. c. splendida* also from the Oetztaler Alps. However, as noted by Ferguson (1985) *H. cervini steitei* (Röber, 1930) was described from the same locality and this is the oldest available name. The names *H. c. teriolensis* and *H. c. splendida* must therefore be treated as a junior subjective synonyms of *H. c. steitei.* Burmann based the distinction of the Oetztaler population on bigger size and more rounded forewing. The type series of *teriolensis* as well as the material from the Walliser Alps used by Burmann (1975) for comparison were reared from eggs and larvae, and the conditions under which they were reared could have caused these differences. However, Gerber (1979) used specimens collected in the wild and found the same differences between specimens from the type locality and these of the Oetztaler population. He also found the specimens from the area of Augstbordpass in Wallis to differ from the nominotypical form. These specimens are larger in size and paler in colouration, with more restricted dark shading on forewing. The hindwing is more extensively yellow with only a dark spots series near the margin. Gerber considered *H. cervini hnateckii* (Frey, 1872) to be described from this area by comparing the original description and his material, and stated the name to be valid for this population. The differences between populations are reviewed in more detail by Gerber (1979).

It seems obvious that there are constant, genetically fixed differences in wing colouration and size between the populations of *H. cervini* in the Alps. Our material does not allow a comprehensive study on this issue, but we question whether it is reasonable to consider these taxa as subspecies inside such a restricted geographical area, or just local forms, which bear the same biological information.

***Holoarctia marinae* Dubatolov, 1985**

Figs. 6, 14, 21.

Ann. ent. Fenn. 51 : 57. Type-locality : Onguday, Altai Mountains, Russia.

MATERIAL EXAMINED. Holotype ♂, 2.7.1908, Onguday, A. Jakobson leg. (ZISP, genitalia studied).

EXTERNAL CHARACTERS (Fig. 6). Resembles *H. cervini* in external appearance. Ground colour of forewing brown as in *H. cervini*, but the brown-yellow reticulation is more suffused and the hindwing is more intensely yellow. Head, thorax and abdomen have the same colouration of brown and yellow stripes. Male antenna is shortly bipectinate. Wingspan 34.0 mm, forewing length 16.0 mm in the holotype ; according to Dubatolov (1985a) it is 14 mm in the male paratype.

Male genitalia (Fig. 14). The external genitalia like those in *H. cervini*, but the marginal teeth of juxta are missing. Vesica is shorter than in *H. cervini*, about half of the length of aedeagus. On the distal part of vesica there are two large diverticulae, instead of three, and the opening point of ductus ejaculatorius (arrow) is located on the diverticulum proximal to aedeagus. Because of differences in the length and structure of the vesica we consider *H. marinae* to be a separate species.

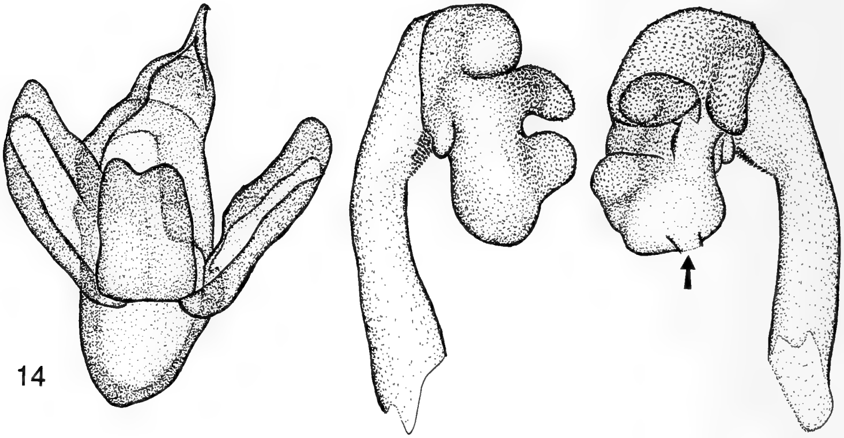

Fig. 14. Male genitalia of *Holoarctia marinae* holotype. Aedeagus with everted vesica shown from opposite directions (arrow indicates the opening point of ductus ejaculatorius).

Female genitalia. Not studied.

Distribution (Fig. 21). Known only after four specimens from the Altai Mountains in southern Siberia (Dubatolov, 1985a, 1985b, 1990).

Note 1. When examining the holotype we have pointed out that in the original description (Dubatolov, 1985a) the photographs of the holotype and the paratype have accidentally changed places. This does not effect changes in the validity of types because their label information is explained in the text, and the holotype is demonstrably designated with a red label on pin.

Note 2. Draudt (1931) described a yellow form of *H. puengeleri* as f. *flava*, probably from the Sayan Mountains. The description is short but the type specimen shown on the colour plate very much resembles *H. marinae*. Unfortunately, we were not able to locate this specimen. If it is found in the future, it should be checked whether it is conspecific with *H. marinae*. In that case the name *H. marinae* would become a junior subjective synonym of *H. flava*.

Holoarctia sordida **(McDunnough, 1921)**

Fig. 21.

Neoarctia sordida McDunnough, 1921 : *Can. Ent.* 53 : 167. Type-locality : Banff, Alberta, Canada.
Holoarctia cervini Ferguson, 1984 : *Proc. ent. Soc. Wash.* 86 : 453, 454.

MATERIAL. No material available.

This taxon was diagnosed by Ferguson (1984, 1985) and according to him it resembles very much *H. cervini* in the exterior appearance (Ferguson, 1985 : figs 23, 24). He identified *H. sordida* as *H. cervini* without examination of the genitalia. By 1985, *H. sordida* was known only after two females from the Rocky Mountains in Alberta and British Columbia, Canada. Unfortunately, the type specimen has lost its abdomen and Ferguson did not dissect the other known specimen. *H. sordida* may be a distinct species or a subspecies of *H. puengeleri*, but the connection to *H. cervini* seems improbable because of the large distributional gap between the Alps and Rocky Mountains.

Holoarctia puengeleri **(O. Bang-Haas, 1927), stat. rev.**

Figs. 1-5, 7-8, 15-17, 19-21.

EXTERNAL CHARACTERS (Figs. 1-5, 7-8). The most variable species in the genus *Holoarctia*. Forewing ground colour black with white reticulation. The width of the white reticulation varies in specimens from different regions and is widest in the surroundings of Lake Baikal and on both sides of the Bering Strait. In northern Fennoscandia and in the Altai Mountains this reticulation is narrow. The hindwing is suffused almost whole or completely black in Fennoscandia and in the Altai Mountains, but almost white with a series of black spots near the margin in the Baikal region and in Beringia. The size of moths is largest in the mountains of southern Siberia and decreases northwards. Also the forewing is widest in the south and gets narrower towards the north. Male antenna bipectinate, female antenna serrate. Colouration of head, thorax and abdomen is as that of forewing, with black and white hairing. Antennae and legs whitish with a varying number of black scales.

Male genitalia (Figs. 15-17). Valva simple, narrower than in *H. cervini.* Juxta bears teeth at lateral margins. Vesica compact with a few projecting diverticulae resembling that of *H. cervini,* but on the distal part of vesica there are two projecting diverticulae instead of three. The opening of ductus ejaculatorius (arrow) is located on the diverticulum proximal to aedeagus.

Female genitalia (Figs. 19-20). Appendix bursae dilated like if it is another corpus bursae. The opening of ductus seminalis (arrow) is located laterally from the tip of appendix bursae unlike *H. cervini.* This is the most confident character to distinguish *H. puengeleri.*

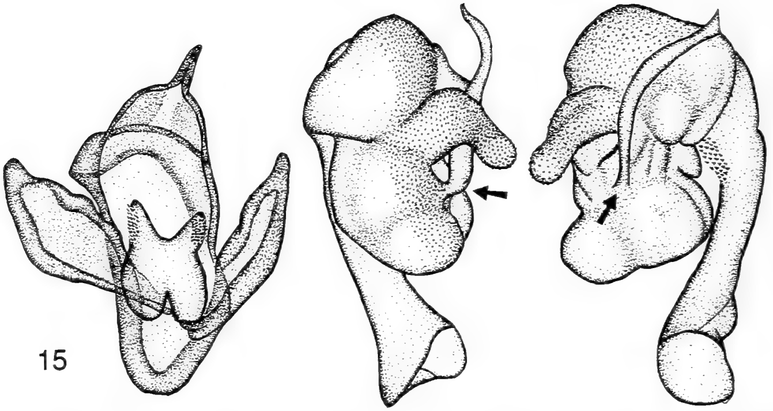

Fig. 15. Male genitalia of *Holoarctia puengeleri puengeleri*, type of f. *immaculata.* Aedeagus with everted vesica shown from opposite directions (arrow indicates the opening point of ductus ejaculatorius).

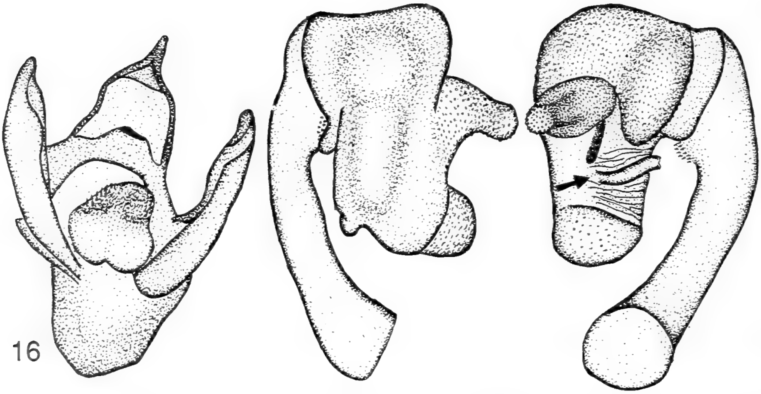

Fig. 16. Male genitalia of *Holoarctia puengeleri fridolini*, Chukchi Peninsula, Russia. Vesica poorly inflated (arrow indicates the opening point of ductus ejaculatorius).

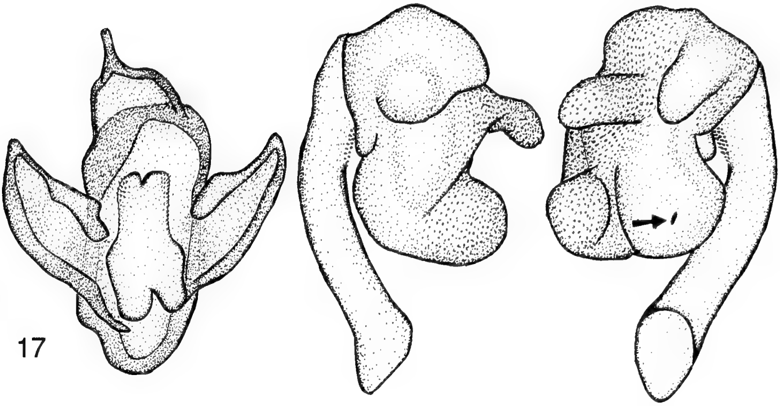

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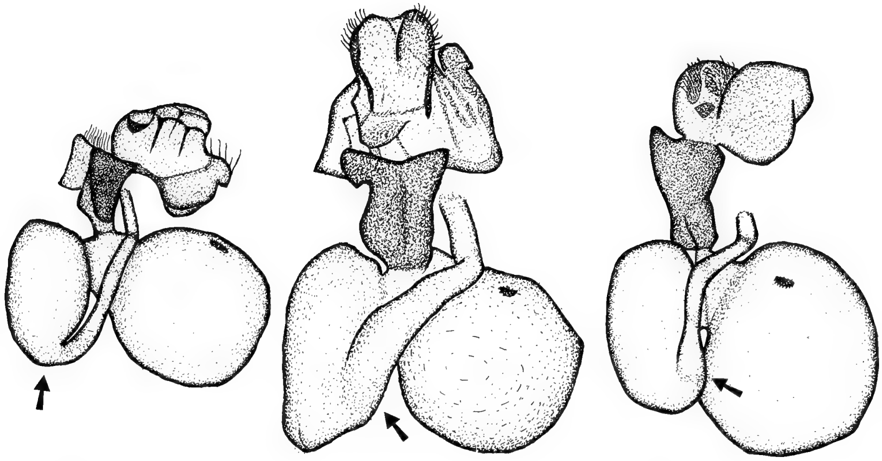
Fig. 17. Male genitalia of *Holoarctia puengeleri fridolini*, Nissuntjårro, N. Sweden. Aedeagus with everted vesica shown from opposite directions (arrow indicates the opening point of ductus ejaculatorius).



18 19 20

Figs. 18-20. Female genitalia of *Holoarctia* spp. with bursa everted : 18 — *H. cervini*, Zermatt, Wallis, Switzerland ; 19 — *H. puengeleri puengeleri*, Stanovoi Mts., Russia ; 20 — *H. puengeleri fridolini*, Nissuntjårro, N. Sweden (arrow indicates the opening point of ductus seminalis).

DISTRIBUTION (Fig. 21). Specimens of *H. puengeleri* are rare in collections, and samples which would completely show the variation between populations in exterior characters apparently do not exist. On the basis of specimens we examined, known populations of *H. puengeleri* may represent three subspecies : *H. p. puengeleri* (O. Bang-Haas, 1927) in the Sayan Mts., the Khamar-Dhaban Mts. (Dubatolov, 1990) and the Stanovoi Mts. ; *H. p. perunovi* (Dubatolov, 1990) in the Altai Mts. on both Russian (Dubatolov, 1985b, 1990) and Mongolian sides of the border (Alberti, 1971) ; *H. p. fridolini* (Torstenius, 1971) from N. Sweden and the Kola Peninsula over N. Siberia to Alaska. Thus, *H. puengeleri* is an arcto-alpine species having a typical holarctic distribution. We were not able to study the few known specimens from the S. Ural Mts. (Dubatolov, 1985b ; V. N. Olshvang, pers. comm.) and the Kamchatka Peninsula (Sedykh, 1979).

REMARKS. We could not find any constant differences in the internal genitalia between moths from different areas and mountain ranges. However, the size of genitalia is allometrically dependent on the body size of a moth.

***Holoarctia puengeleri puengeleri* (O. Bang-Haas, 1927)**

Figs. 2-5, 15-16, 19.

Orodemnias püngeleri O. Bang-Haas, 1927 : Horae Macrolepidopterologicae Regionis Palearcticae : 60, pl. 8. Type-locality : Obo Sarym and Mondy Sardyk, Sayan Mountains, Russia.

Orodemnias püngeleri f. *bicolor* Draudt, 1931. *In* : Seitz, A. (Hrsg.), 1930-1934, Die Palaearktischen Spinner und Schwärmer, Supplement : 77, pl. 6.

Orodemnias püngeleri f. *immaculata* Draudt, 1931. *In* : Seitz, A. (Hrsg.), 1930-1934, Die Palaearktischen Spinner und Schwärmer, Supplement : 66, pl. 6.

Holoarctia pungeleri Ferguson, 1984 : *Proc. ent. Soc. Wash.* 86 : 453, 454.

Holoarctia puengeleri Dubatolov, 1985b. *In* : Arthropods of Siberia and Far East, p. 150.

Holoarctia cervini ssp. *puengeleri* Dubatolov, 1990. *In* : Arthropods and helminths, p. 152.

MATERIAL EXAMINED. ♀, 8.7.1914, Stanovoi Mts., Malyi Okonon river, Dorogostaiskij leg. (ZISP, genitalia studied) ; ♀, “Chulugaischa, Mondy, Sajan Gbg., Burgät. Republ., 3100 m Juli” (ZMH) ; lectotype ♀, “gef. Juli 16.ten, Obo Sarym.” (designated by Ferguson (1985) ; a specimen figured by O. Bang-Haas (1927 : pl. 8, fig.14) and Draudt (1931-32 : pl. 6), MNHB) ; ♂, “e.l. 12.9.1929” (type of f. *immaculata*, MNHB, genitalia studied) ; ♂, “Chulugaischa, Mondy, Sajan Gbg., Burgät.[!] Republ., 3100 m Juli” (type of f. *bicolor*, MNHB, genitalia studied).

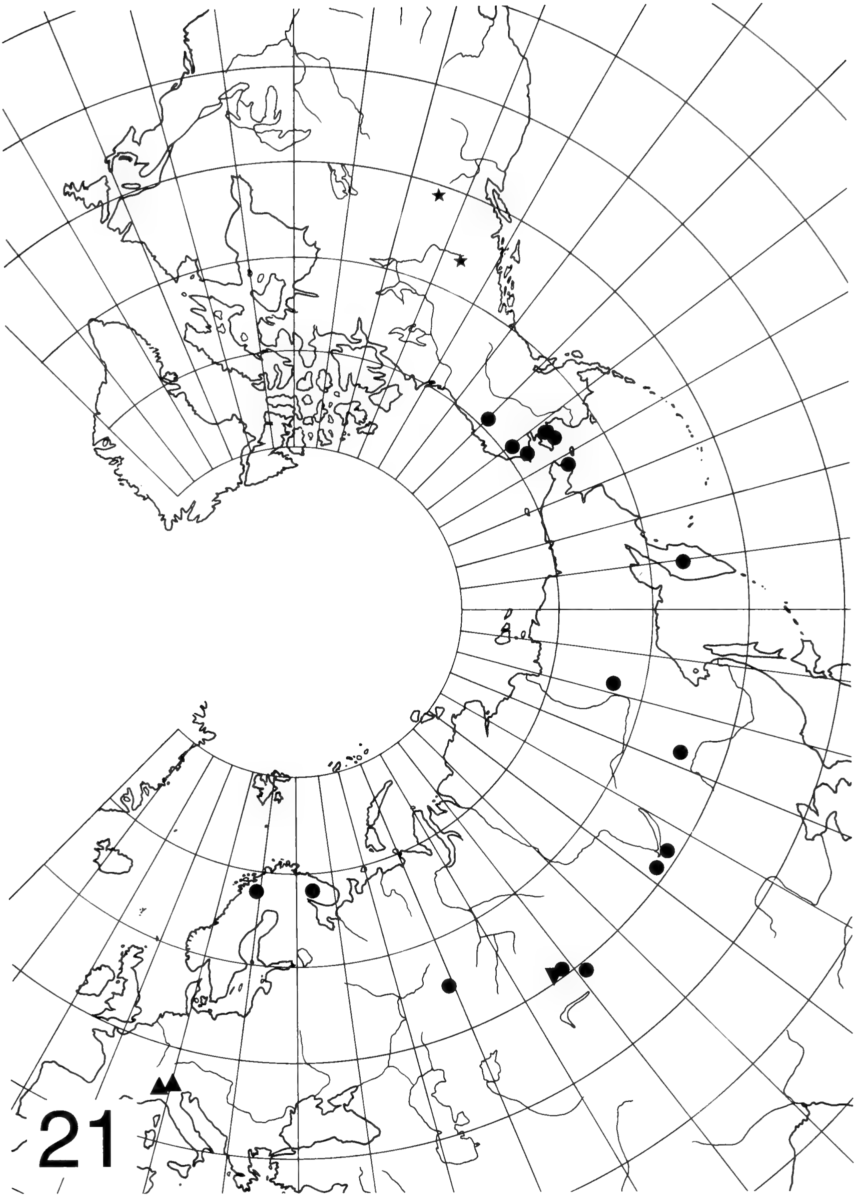


Fig. 21. Distribution of *Holoarctia* spp. : ▲ — *H. cervini*, ▼ — *H. marinae*, ● — *H. puengeleri*, ★ — *H. sordida*.

DIAGNOSIS. The largest of three subspecies (Figs. 2-5). Wingspan 34.0-38.5 mm in males (n = 2), 39.0-43.0 mm in females (n = 3). Forewing length 12-18,5 mm in males (n = 2) and 19.0-21.0 mm in females (n = 3). The smaller male studied (the type of f. *immaculata*) is reared from a larva, which may explain its small size. According to Ferguson (1985) the length of forewing of a male in the British Museum of Natural History is 20 mm. The white reticulation on the forewing is wide and the hindwing is white with black spots near the margin.

DISTRIBUTION. Sayan Mts., Khamar-Dhaban Mts. and Stanovoi Mts. in southern Siberia.

***Holoarctia puengeleri fridolini* (Torstenius, 1971)**
Figs. 1, 7-8, 17, 20.

Orodemnias cervini ssp. *fridolini* Torstenius, 1971 : *Ent. Tidskr.* 92 : 173. Type-locality : Nissuntjårro Mountain, E. of Abisko National Park, Torne Lappmark, northern Sweden.

Orodemnias fridolini Burmann, 1975 : *Ber. nat.-med. Ver. Innsbruck* 62 : 121.

Holoarctia fridolini Ferguson, 1984 : *Proc. ent. Soc. Wash.* 86 : 453, 454.

Holoarctia cervini fridolini Sotavalta *et al.*, 1984 : *Notul. entomol.* 64 : 161.

Holoarctia puengeleri fridolini Dubatolov, 1985b. *In* : Arthropods of Siberia and Far East : 150.

Holoarctia cervini fridolini Dubatolov, 1990. *In* : Arthropods and helminths : 152.

MATERIAL EXAMINED. ♂, 22.7.1926, ♂, 23.7.1926, Chibiny Mountains, tundra-zone, Tschetverikov leg. (ZISP, genitalia studied) ; ♀, 8.1931, Chibiny Mountains, Tshaska-Gadar Chain, Fridolin leg. (ZISP) ; ♂, “Sweden, To., Nissuntjårro, 700 m e.p., 12.VII.1990, R. Johansson” (coll. E. Suomalainen, genitalia studied) ; ♀, “Suecia To. ovo, 11.7.1980, Nissuntjårro, ca. 1050 möh., RN 1626/7579, G. Palmqvist” (coll. E. Suomalainen, genitalia studied) ; ♂, “SVERIGE / Nissuntjårro, To. lpm. Ova-80, e.p. 19.2.1981, G. Palmqvist & O.S.” (coll. E. Suomalainen) ; ♀, “Sweden, To., Nissuntjårro, 1300 m e.p., 16.VII.1990, R. Johansson” (coll. E. Suomalainen, genitalia studied) ; 2 ♂, “Sweden, To., Nissuntjårro, 670 m e. p., 8-15.VII.1982, R. Johansson” (ZMH, genitalia studied) ; ♀, “Sweden, To., Nissuntjårro, 670 m e.p., 8.VII.1984, R. Johansson” (ZMH, genitalia studied) ; ♀, “Sweden, To., Nissuntjårro, 1200 m e.p., 10.VII.1989, R. Johansson” (ZMH, genitalia studied) ; ♂, “Sweden, To., Nissuntjårro, 1300 m e.p., 11.VII.1988, R. Johansson” (coll. R. Johansson) ; ♂, “Sweden, To., Nissuntjårro, 670 m e.o., emg. 1983, R. Johansson” (coll. R. Johansson) ; ♀, “Sweden, To., Nissuntjårro, 1250 m e.p., 10-15.VII.1982, R. Johansson” (Coll. R. Johansson) ; ♂, “USSR, Chukchi Pns., 64°55′ N 172°36′ W, 45 km N. Providenya, Per. Medved. gravel 300 m, 9.7.1991, K. Mikkola leg.” (ZMH, genitalia studied).

DIAGNOSIS. In Fennoscandia moths of this subspecies are smaller than of the nominotypical subspecies (Figs. 7-8). In our material the wingspan 31.0-34.5 mm in males (n = 8) and 33.5-37.0 mm in females (n = 4). Forewing length 15.0-16.0 mm in males (n = 8) and 15.5-17.5 mm in females (n = 4). In the type specimens of Torstenius (1971) the wingspan was 35 mm (1 ♂) and 35.5 mm (1 ♀). The width of white reticulation varies but is narrower than in *H. p. puengeleri.* Hindwing is suffused with black with a whitish stripe near the margin, or completely blackish grey.

DISTRIBUTION. From northern Sweden and the Kola Peninsula (Kol'skiy poluostrov) in northwestern Russia eastwards to Yakutia, the Chukchi Peninsula (Chukotskiy poluostrov) and Alaska. The two known specimens from the S. Ural Mountains (V. N. Olshvang, pers. comm.) may also belong to this subspecies.

REMARKS. According to a specimen studied by us (Fig. 1) and specimens from both sides of the Bering Strait of which we have seen photographs (Ferguson, 1984, 1985 ; Dubatolov, 1985b ; Johansson, *in litt.*), the Beringian populations may represent a distinct subspecies. The wingspan of these specimens (altogether four from the Chukchi Peninsula and eight from Alaska) is 32.0-38.0 mm in males and 36.0-39.0 mm in females. Forewing length 15.0-17.5 mm in males and 17.0-18-0 mm in females. Thus, these specimens are slightly larger than *H. p. fridolini* from Fennoscandia, but smaller than the nominotypical subspecies from southern Siberia. Their colouration is similar to the nominotypic with wide white reticulation on forewing and a white hindwing with black spots near the margin. However, these specimens have a narrower forewing, as in *H. p. fridolini.* A single male from Yakutia is similar in wing shape and size (38.0 mm — Johansson, *in litt.*) to the Beringian specimens, but it has a wing colouration typical of Fennoscandian specimens. Because more material is needed for a study of this problem, we found it better to follow Ferguson (1984, 1985) and present these specimens under *fridolini.* The status of the Kamchatka population is to be clarified later on.

Holoarctia puengeleri perunovi **Dubatolov, 1990 comb. n.**

Fig. 22.

Holoarctia cervini ssp. *perunovi* Dubatolov, 1990. *In* : Arthropods and Helminths : 152.

MATERIAL EXAMINED. ♂, holotype, 16.7.1982, Kurai Chain, Taboshak, Perunov leg. (BIN, genitalia studied).

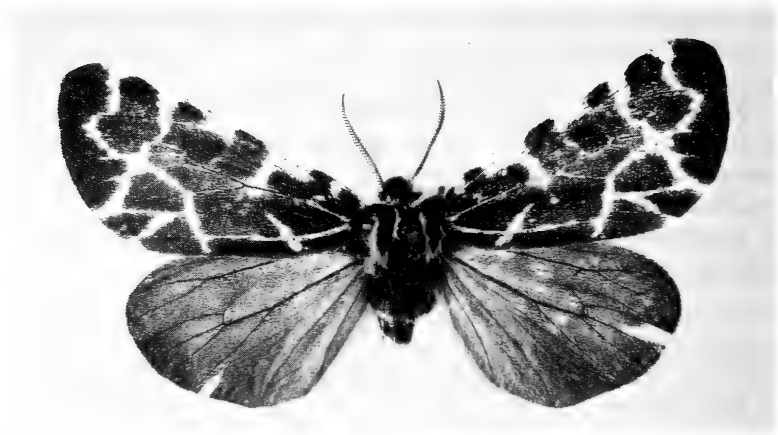


Fig. 22. *Holoarctia puengeleri perunovi*, holotype ♂, wingspan 36.5 mm, Taboshak, Altai Mts., Russia.

Diagnosis. Dubatolov (1990) described this subspecies on the basis of a specimen collected from the Russian Altai Mountains. The specimen resembles *H. p. fridolini* having narrow pale transverse bands with black forewing ground-colour and completely darkened hindwing (Fig. 22). The forewing is more rounded than in *fridolini.* Wingspan of the holotype 36.5 mm, forewing length 17.0 mm.

The specimen from Mongolia figured by Alberti (1971) is worn but its wing pattern is typical for *H. p. perunovi*, not for *H. cervini* as stated by Ferguson (1984, 1985).

Discussion

Following the reasons expressed by Lafontaine & Mikkola (1987) and Mikkola (1992) and using so far unrecognized diagnostic characters of the internal genitalia, we suggest *Holoarctia cervini*, *H. marinae* and *H. puengeleri* to be separate species. The status of *H. sordida* demands further studies. *H. cervini* and *H. marinae* are restricted to the Alps and Altai Mountains, respectively. *H. puengeleri* is a true holarctic species with three subspecies included at present. The relationships between described subspecies and many poorly studied populations of *H. puengeleri* can be solved only on the basis of new material from numerous mountain ranges of Siberia. Especially interesting in this respect are the Ural Mountains, the Verkhoyansk Mountains in

Yakutia, the whole arctic coast of Siberia and the Dzhugdzhur Mountains connecting southern Siberia to the Beringian region.

We are aware that the number of specimens examined during this study is limited and we apparently have not seen the whole variation range in the internal genitalia. This is especially the case with *H. marinae* known to us only after the holotype. However, differences between *H. cervini* and *H. puengeleri* seem to be fairly constant.

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The systematic position of *Heliodines loriculata* Meyrick (Yponomeutoidea : Heliodinidae)

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Summary

After examing the type specimen of *Heliodines loriculata* Meyrick, we found that this species is more suitably referred to the genus *Lithariapteryx*, a genus formerly only known from the western Nearctic, based on the external facies and genitalic structure.

Résumé

Après examen du type de *Heliodines loriculata* Meyrick, nous avons trouvé que cette espèce est classée de façon plus appropriée dans le genre *Lithariapteryx*, un genre précédemment connu que de l'ouest néarctique, basé sur le faciès externe et la structure des genitalia.

Heliodines loriculata Meyrick, 1932 was described on the basis of a single female specimen from Bolivia. Its systematic position has not been verified subsequently. After examining the unique type preserved in Naturhistorisches Museum Wien (NHMW), we discovered that this species is more suitably placed in genus *Lithariapteryx* Chambers, 1875, rather than *Heliodines*. Meyrick (1932) noticed that this taxon is similar to *L. abroniaeella* Chambers, the type species of *Lithariapteryx*, but he considered *Lithariapteryx* to be a subjective synonym of *Heliodines* (Meyrick, 1914). However, Comstock (1940) resurrected *Lithariapteryx* to accomodate two new species in California, and Powell (1991) confirmed the generic status. The female genitalia as well as external facies of *H. loriculata* indicate that this South American species is more suitably referred to *Lithariapteryx*, as the only known representative of the genus outside of the western Nearctic. The structure of female genitalia of the *Heliodines nyctaginella* species group of *Heliodines* is similar to that of *Lithariapteryx*, but there are three possible synapomorphies found in *Lithariapteryx* including *L. loriculata* : 1) lack of cylindrical sclerite at the ostium bursae, 2) each antennal banded with white at distal half, 3) raised scale tufts on forewing. We provisionally transfer *loriculata* to *Lithariapteryx*, pending discovery of the male, and redescribe it.

Lithariapteryx loriculata (Meyrick), comb. n.

Heliodines loriculata Meyrick, 1932 ; Heppner, 1984 (checklist).

EXAMINED MATERIAL. Holotype (Fig. 1), "Oal" Bolivia, Rio Songo, 750 m (presumably Rio Zongo which drains eastward from the Cordillera Real in the Province La Paz of western Bolivia) (NHMW) (YFH genitalia prep. 0933).

EXTERNAL MORPHOLOGY OF FEMALE. Forewing length 5.5 mm. *Head.* Metallic dark grey, hood-like scale band behind vertex creamy white. Antenna metallic grey banded with white. Labial palpus porrect, creamy white, distal segment banded with grey. Scales behind eyes linear, buff yellow. *Thorax.* Metallic grey dorsally, metallic grey mixed with creamy white ventrally. Linear buff yellow scales present on propleuron. Fore leg metallic grey with distal end of procoxa white. Middle leg metallic grey with coxa, distal end of tibia, tibial spurs, part of tarsi turning pearl white. Hind leg metallic grey with coxa, distal end of femur, areas adjacent to spurs, spurs pearl white. *Abdomen.* Metallic dark grey banded with creamy yellow, distal end creamy yellow. *Forewing.* Greyish ochreous to tornus, followed by faint orange, V-shaped mark from costa ; 3 costal and 2 dorsal upraised spots, silver margined with black. Silver marking present inside the V-shaped mark, additional silver narrowly margining the V subterminally. Fringe grey mixed with white. *Hindwing.* Uniformly pale ochreous. Fringe grey, turning buff yellow along costa.

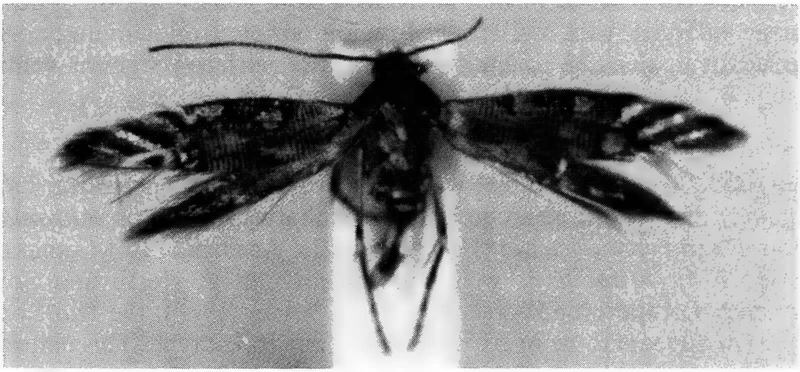

Fig. 1. The female holotype of *Lithariapteryx loriculata*.

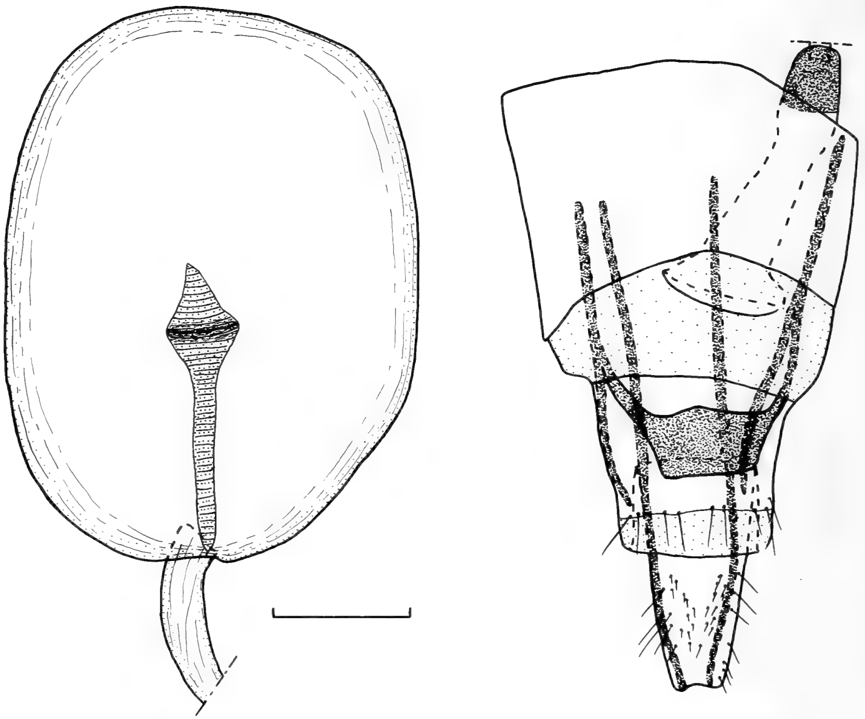

Fig. 2. The genitalia of the female holotype of *Lithariapteryx loriculata* ; middle portion of ductus bursae missing due to feeding by psocids on abdomen. Reference bar 0.25 mm.

Female genitalia (Fig. 2). Ventral branches of apophyses anteriores originated from broad medial sclerotized band ; basal portion of ductus bursae enlarged, with a sclerotized region remote from ostium ; corpus bursae oval, densely scobinate over entire surface ; signum ventral, elongate, enlarged into a diamond shape.

Male. Unknown.

Biology. Larval host unknown. Larvae of all four species of *Lithariapteryx* in western Nearctic feed as facultative miners on *Abronia* or *Mirabilis* in Nyctaginaceae (Powell, 1991). According to Mabberley (1987 : 374), *Mirabilis* is well represented both in North and South America. On the broad scale mapped by Eyre (1968), the Rio Songo at 750 m appears to be in a tropical montane forest type. This contrasts with the semi arid to arid habitats that the four *Lithariapteryx* occupy in the southwestern Nearctic (Powell, 1991).

Discussion. *Lithariapteryx loriculata* is similar to *L. abroniaeella* Chambers, 1875, but the two can be separated easily with the following characters : 1) signum in *L. abroniaeella* is not enlarged distally ; 2) ostium surrounded by a thin ring in *L. abroniaeella* whereas it is invaginated, forming a bowl-like sclerite in *L. loriculata* ; 3) ventral branches of apophyses anteriores with a triangular median band in *L. abroniaeella*, a transverse, broad band in *L. loriculata* ; 4) scaling inside the V-shape mark on the forewing is white in *L. abroniaeella*, silver in *L. loriculata*.

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The life history and ecology of *Melitaea diamina* (Nymphalidae) in Finland

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Summary

The previously unknown life history, ecology and early life stages of the endangered false heath fritillary *Melitaea diamina* (Lang, 1789) are described. The larval host plant in Finland is recorded definitely for the first time. Females lay eggs only on non-flowering *Valeriana sambucifolia* Mikan fil. plants. Larvae also feed exclusively on *V. sambucifolia.* Larvae go through six instars and diapause in the 4th instar. Males search for females using only the patrolling tactic. Females are more sedentary than males. The study contributes to the knowledge of other Melitaeini in Europe and North America.

Zusammenfassung

Es werden die bisher unbekannte Biologie, Ökologie und die ersten Stände der gefährdeten *Melitaea diamina* (Lang, 1789) beschrieben. Die Futterpflanze der Art wird für Finnland erstmals genannt. Die Weibchen legen ihre Eier nur an die noch nicht geöffneten Blüten von *Valeriana sambucifolia* Mikan fil. Die Larven fressen auschliesslich an dieser Pflanze. Die Männchen finden die Weibchen, indem sie in den Habitaten auf- und ab patrouillieren. Die Weibchen zeigen ein eher träges Verhalten und sitzen in der Vegetation. Die vorliegende Untersuchung erweitert unsere Kenntnisse auch anderer die Melitaeini in Europa und in Nordamerika.

Résumé

La biologie, l'écologie et les stades pré-imaginaux, précédemment inconnus, de l'espèce menacée qu'est le Damier noir *Melitaea diamina* (Lang, 1789), sont décrits. La plante nourricière de la chenille en Finlande est indiquée avec certitude pour la première fois. Les femelles ne pondent que sur les plantes non en fleurs de *Valeriana sambucifolia* Mikan fil. Ces chenilles se nourissent également exclusivement de *V. sambucifolia.* Les chenilles traversent six stades larvaires et entrent en diapause au quatrième stade. Les mâles adultes recherchent les femelles en utilisant la tactique du 'patrolling'. Les femelles sont plus sédentaires que les mâles. L'étude contribue à la connaissance d'autres Melitaeini étudiés en Europe et en Amérique du Nord.

Fig. 1. A mating pair of *Melitaea diamina.*

Introduction

The false heath fritillary *Melitaea diamina* (Lang, 1789) (Fig. 1) is a rare butterfly within much of its range in Europe (Heath, 1981). While some other Melitaeini species in Europe have been studied extensively (Porter, 1981 ; Warren, 1987a, 1987b, 1987c, 1994 ; Hanski *et al.*, 1994, 1995a, 1995b, 1996), very little has been published about the ecology and life history of *M. diamina* (see Ebert, 1991). In Finland, it is classified as endangered species and is protected (Rassi *et al.*, 1992). It occurs presently in two widely separated regions in south-western Finland (Marttila *et al.*, 1990) (Fig. 2). Prior to 1995, there were no records of the larval host plant in Finland and the ecology of adults was poorly known.

I studied the only well-known Finnish metapopulation of *M. diamina* in the Tampere region (Fig. 2) during spring and summer 1995. The main objective of this study was to survey an area of 20 × 30 km^2 for all suitable habitat patches and determine which patches were occupied by the species. The results of the survey are presented else-

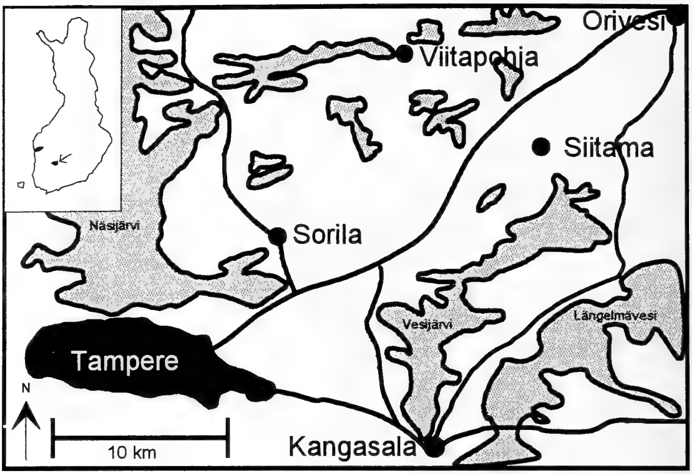

Fig. 2. A map of the study area in the Tampere region. Black areas are cities or towns, grey areas denote lakes and the lines are major roads. There were 35 populations of *M. diamina* spread throughout the study area in 1995. Most observations were made in the area of Siitama. The smaller map (insert) gives the current distribution of *M. diamina* in Finland with the study area indicated by an arrow.

where (Wahlberg *et al.*, 1996). I also made detailed observations on the ecology of the larvae and adults and report these observations in this article.

Study sites

I made most observations in the Siitama area within the 20 × 30 km^2 study area and close to the city of Tampere (Fig. 2). The Siitama area contains 18 meadows suitable for *M. diamina*, of which 14 were occupied by the butterfly in 1995. *M. diamina* has a classical metapopulation structure (Harrison, 1991 ; Hanski, 1994), in which local populations are connected to each other through infrequent migration and there is no large "mainland" population. The metapopulation of *M. diamina* exists in a stochastic equilibrium between extinction of local populations and colonisation of empty habitat patches (Wahlberg *et al.*, 1996).

In the Tampere region, *M. diamina* inhabits moist meadows with relatively low vegetation. The meadows are surrounded mainly by fields or spruce *Picea abies* (Karsten) forests. The plant community of the meadows is species rich, containing many flowering plants that are potential nectar sources for the adult butterflies. The meadows have been kept open largely as natural pastures for cattle. The amount of cattle in Finland has decreased in the last few decades (Raatikainen, 1986), which has led to the overgrowth of *M. diamina* habitat. This is probably the main reason for its decline in Finland.

Description of premature stages

EGG (Fig. 3a). Nearly spherical with flattened top and base. Approximately 22 longitudinal ridges extending from top to base. Sides and top with irregular pitting. Colour yellow-green when freshly laid.

1ST INSTAR LARVA (Fig. 3b). Head dark brown with some colourless setae. Body clear yellow with gut giving green colour to fore body. Body with colourless setae arising from papillae that are darker than body. Prolegs concolorous with body, true legs are brown. Body has 13 segments, 1st segment has a saddle-like pattern. Larvae about 2 mm long.

2ND INSTAR LARVA (Fig. 3c). Head black with light brown setae. Body developing characteristic colour pattern of later instars : being brown with light grey spiracles. Ventrolateral band dull grey. Saddle-like pattern on 1st segment with black setae. Prolegs light grey, true legs dark brown. Branching spines develop from papillae and simple setae of 1st instar ; shafts of spines light grey with black setae. Seven longitudinal rows of spines except in thoracic segment, where only 1st and 3rd ventral rows on both sides are present. Larvae about 4 mm long.

3RD INSTAR LARVA (Fig. 3d). Head capsule black with black setae. Body dark brown with grey spiracles. Ventrolateral band no longer distinct, but lighter brown in colour than rest of body. Prolegs grey and true legs dark brown. Spine shafts almost black with grey tips and black setae. Base of spine shafts have a grey ring around them. Larvae about 6 mm long.

4TH INSTAR LARVA. Head capsule black with black setae. Body dark brown with grey dots on upperside and a dark dorsal stripe, light brown on underside. True legs dark brown. Prolegs white with light brown bases. Spines black with yellow ring around base of spine shafts. Fringing spine shafts dark yellow. Dorsal spine shafts black with grey tips. Larvae about 7 mm long.

5TH INSTAR LARVA. Overall pattern as in previous instar, but body black and all spine shafts dark yellow with grey tips. Dots on body clearer and lighter grey in colour. Larvae about 11 mm long.

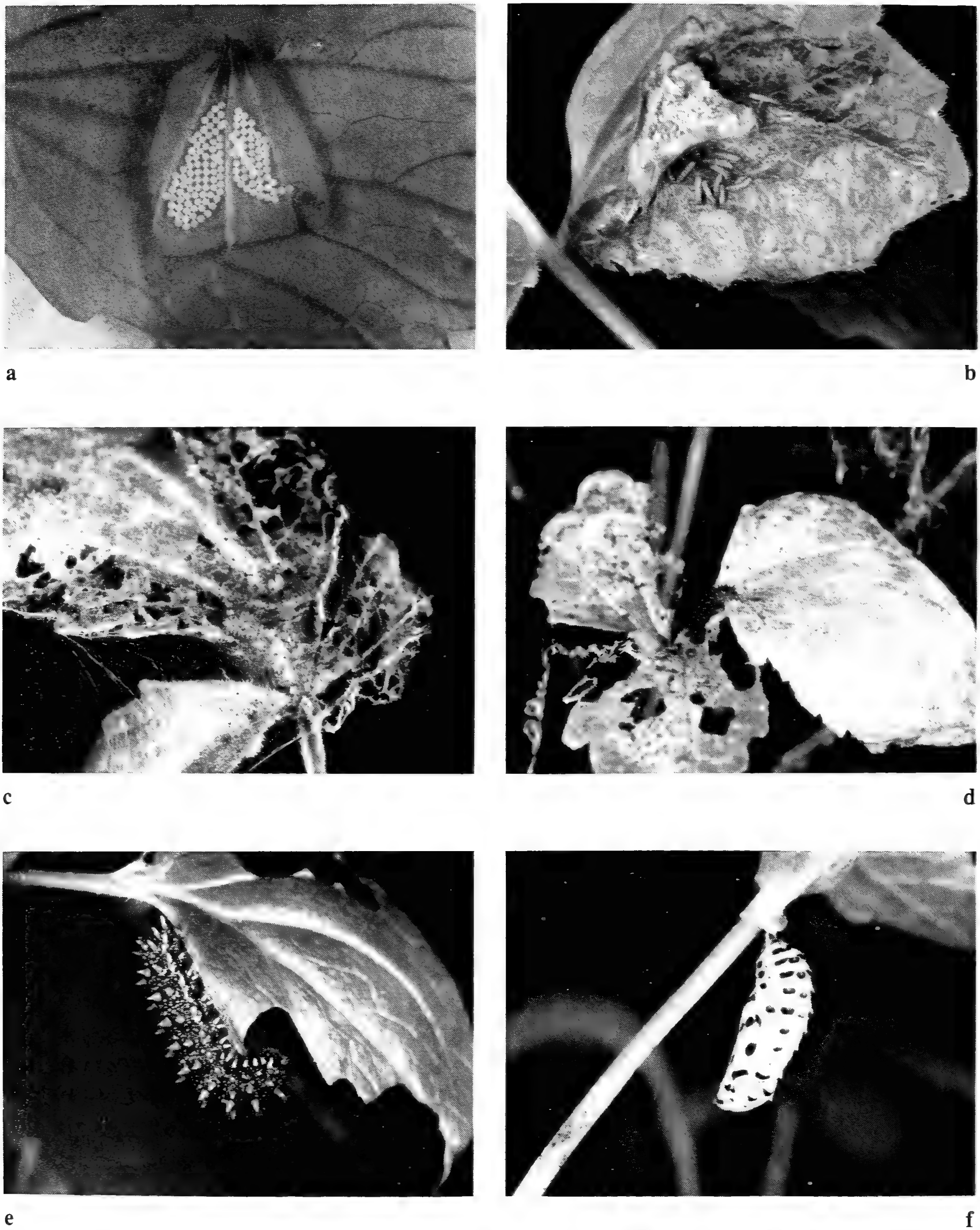

Fig. 3. Early life stages of *M. diamina* : a — egg cluster, b — 1st instar larvae, c — 2nd instar larvae, d — 3rd instar larva, e — 6th instar larva, f — pupa.

6TH INSTAR LARVA (Fig. 3e). Continued development of previous patterns. Dorsal spine shafts bright yellow with grey tips, fringing spine shafts entirely grey. Bases of spine shafts black along with rest of body. Larvae about 18 mm long.

PUPA (Fig. 3f). Ground colour ivory white with black markings. Abdominal segments have 3-5 bright orange warts on dorsal side. Pupae length about 11 mm.

Ecology

OVIPOSITION. The larval host plant has never been reported for Finland. My observations of both larvae and ovipositing adult females showed that *M. diamina* larvae feed exclusively on *Valeriana sambucifolia* Mikan fil. (Valerianaceae) in the Tampere region. *V. sambucifolia* is a large herb, growing up to 1 m tall, common in south-western Finland. The leaves are bipinnate with 3 to 7 leaflet pairs and a terminal leaflet. In central Europe other host plants have been recorded, e.g., *Valeriana officinalis* L., *V. dioica* L., *Plantago lanceolata* L. (Plantaginaceae) and *Veronica chamaedrys* L. (Scrophulariaceae) (Lepidopterologen-Arbeitsgruppe, 1987 ; Ebert, 1991). Of these species only *V. chamaedrys* occurs in the present study area, but I never observed larvae feeding on it.

I observed 13 ovipositing females by following them from a distance of a few meters. Ovipositing females were identified by their distinctive prealighting or postalighting behaviour (Mackay, 1985). For five females I recorded all the plant species on which they alighted before ovipositing. The other eight females were found immediately prior to the beginning of oviposition.

Females mainly oviposited during mid afternoon. They spent long periods of time searching for larval host plants (range 8-108 min, observed mean 51 min, n = 5). Females often landed on *Aegopodium podagraria* L. (Apiaceae) which has a similar leaf structure to *V. sambucifolia*. *A. podagraria* is a very common species on meadows suitable for *M. diamina*. According to Wiklund's (1984) terminology, this gives *V. sambucifolia* a low apparency to visually searching butterflies. The effect is compounded by an observation that females laid eggs only on non-flowering *V. sambucifolia* plants. I searched both flowering and non-flowering host plants intensively and found a total of 46 egg clusters (including those laid by the females that had been followed). All egg clusters were on non-flowering plants, even though females fed regularly on *V. sambucifolia* flowers (Table 1).

Table 1

The use of food sources by adult *Melitaea diamina* butterflies.

Food source	Number of observations
Ranunculus repens	289
Valeriana sambucifolia	137
Geranium sylvaticum	22
Moist soil	11
Aegopodium podagraria	7
Lathyrus pratensis	2
Leucanthemum vulgaris	2
Pilosella praealta	1
Achillea millefolium	1
Filipendula ulmaria	1
Campanula patula	1

Once a female found a host plant, it investigated the plant thoroughly, tapping the leaves with its fore legs and curling its abdomen underneath the leaves. The eggs were laid in clusters of about 100 eggs (range 30-200, mean 97, n = 46) on the underside of a host plant's leaflet. The eggs were usually placed in a single layer without regard to the position of the leaflet (Fig. 3a). Oviposition lasted 30 ± 1.6 min (mean ± SE, n = 11). The postalighting behaviour of *M. diamina* is similar to that in the congeneric *M. cinxia* (Linnaeus, 1758) (Wahlberg, 1995). Several *M. diamina* egg clusters can be found on a single *V. sambucifolia* plant, though usually on separate leaflets. In an extreme case, one plant had 17 egg clusters on it. I also observed two females ovipositing simultaneously a few centimetres apart on another plant.

EGG DEVELOPMENT AND PREDIAPAUSE LARVAE. In 1995, the egg clusters hatched from the middle of July to the beginning of August. Egg mortality appeared to be low, and most eggs in all the observed egg clusters hatched. The summer of 1995 was very sunny, but because the meadows have a dense cover of vegetation, humidity probably remained relatively constant around the egg clusters.

I observed the behaviour of prediapause larvae in the field and in indoor rearing. Newly emerged larvae fed partially on their egg shells and then began feeding on the underside of *V. sambucifolia* leaves. The larvae remain as a group and spin a thin silken web, under which they feed. The web becomes conspicuous when larvae reach the 3rd instar. 1st and 2nd instar larvae feed only on the lower epidermis and parenchyma of the leaves, leaving the upper epidermis and veins intact (Fig. 4). 3rd instar larvae feed also on the upper epidermis, but leave the thicker veins intact.

Fig. 4. A *Valeriana sambucifolia* plant that has been fed on by a group of 2nd instar *M. diamina* larvae. The silk spun by the larvae is fairly inconspicuous, but the upper epidermis left uneaten by the larvae becomes conspicuous when it dries.

I collected four groups of 2nd and 3rd instar larvae (613 individuals) and reared them to investigate the incidence of parasitoids in *M. diamina*. No parasitoids emerged from the larvae. It seems likely that specialist parasitoids are absent from the Tampere region, though in Sweden *M. diamina* is attacked by a braconid, *Cotesia melitaearum* (Wilkinson, 1937) (C. Eliasson, pers. comm.). The size of the *M. diamina* metapopulation in the Tampere region may be too small for a specialist parasitoid to persist, as has been suggested for some *M. cinxia* metapopulations (Lei & Hanski, 1997).

4th instar larvae enter diapause towards the end of August. The larvae diapause in dead, curled leaves beneath the plant that they fed on. Usually a larval group splits into smaller groups of 20 to 30 individuals that diapause within adjacent leaves. 4th instar larvae no longer feed even if conditions are favourable.

POSTDIAPAUSE LARVAE. Larvae terminate diapause soon after the snow melts, which usually happens around the beginning of May in the Tampere region. 4th and 5th instar larvae feed on newly sprouting *V. sambucifolia* either alone or in small groups of 2-16 individuals. They bask actively in small groups on cool but sunny days, as do the larvae of the congeneric *M. cinxia* (Kuussaari *et al.*, 1995). Larvae were difficult to find on warm sunny days. Presumably they were hidden in leaf litter. 6th instar larvae fed usually alone. *M. diamina* larvae spin only very thin webs during spring.

The incidence of parasitism was checked by rearing 24 larvae collected from 19 groups during May. All three spring instars were collected. Once again, no parasitoids emerged and all larvae pupated successfully.

PUPAE. Pupation takes place at the end of May. The pupal stage lasts about three weeks. I did not find pupae in the field. Presumably *M. diamina* pupates within the dense meadow vegetation, probably on or close to the ground, as has been observed in *M. cinxia* (Kuussaari *et al.*, 1995).

ADULTS. The adult flight season extends from the middle of June to about the middle of July (Marttila *et al.*, 1990). *M. diamina* is protandrous, as most butterflies are (Wiklund & Fagerström, 1977). In a mark-recapture performed in the Siitama area (Fig. 2), males predominated the captures for the first five days of the flight season. Conversely, females predominated the captures of the last five days of the mark-recapture study.

Males search actively for newly emerged females throughout the day, i.e. they use the patrolling tactic for mate location (Scott, 1974). Once a male finds a basking female, it lands next to it and initiates copulation immediately. There is no courtship ritual. Females probably mate only once, as the females in 14 observed mating pairs were all fresh. Mated females refused to remate by lifting their abdomen and spreading their wings out. I observed this in old females (which I inferred had mated earlier) and in females I had observed in copula earlier. One mating is enough for a *M. cinxia* female to fertilise all her eggs (Wahlberg, 1995). Freshly mated *M. diamina* females had a distinctive brown mass on the opening of the bursa copulatrix, which indicates that males place a mating plug in the female to prevent further matings. This has been recorded in several related species (Labine, 1964 ; Porter, 1981 ; Dickinson & Rutowski, 1989), but not in *M. cinxia* (Wahlberg, 1995).

Both sexes feed actively throughout the day. Of 474 recorded feeding bouts, 61% were on flowers of *Ranunculus repens* L. (Ranunculaceae) and 29% were on flowers of *V. sambucifolia*. The use of these flowers was separated temporally as *R. repens* flowers were used mainly in

June and *V. sambucifolia* flowers in July. A further eight species of flower were used occasionally (Table 1), but the majority of flower species on the meadows were unused. I observed males feeding on moist soil occasionally.

M. diamina is a fairly sedentary species, especially females. Of all females captured and marked (n = 285), only 6% were recaptured in a different meadow. Several females were recaptured repeatedly in the same small area of one meadow. Males are relatively more mobile, possibly as a consequence of their mate-searching tactic (see above). Of the 557 males captured and marked, 18% were recaptured in another meadow during their lifetime.

Discussion

Females actively feeding on *V. sambucifolia* flowers did not exhibit any interest in ovipositing on the same plants. The observation that females lay eggs on non-flowering host plants appears to be connected to the phenology of the larval host plants. *V. sambucifolia* is a perennial plant (Aalto, 1980), but I observed that flowering host plants senesced already at the beginning of August, when most larvae were in their 2nd instar. Thus there is strong selection on females to lay eggs on non-flowering host plants. The mechanism that females use to differentiate between flowering and non-flowering plants is probably visual, though this has not been studied.

Knowledge of the ecology and life histories of endangered species is necessary for their successful conservation. This study shows that only meadows containing *V. sambucifolia* are suitable habitat for *M. diamina* in Finland. I found that the butterfly is relatively sedentary and thus needs a dense network of habitat patches, which are usually small, for its metapopulation to persist. The decline in the number of populations in Finland during the last few decades can largely be attributed to meadows becoming unsuitable and the suitable meadows becoming more isolated from each other. This is apparent in the Tampere region, where I found six isolated populations (Wahlberg *et al.*, 1996). These populations are probably remnants of a network of meadows, in which the other meadows have already become overgrown. The overgrowth of the meadows by willows is the most important threat to *M. diamina* at present.

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Gracillariidae feeding on *Ostrya carpinifolia*

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Summary

Altogether 5 species of Gracillariidae are reported feeding on *Ostrya carpinifolia* Scopoli (Corylaceae). *Phyllonorycter aemula* sp. n. is described in this review from Italy (provinces South Tyrol, Trento, Verona, Udine, Trieste) ; it is restricted to *Ostrya* L. exclusively. *Phyllonorycter coryli* (Nicelli), *P. esperella* (Goeze), *P. tenerella* (Joannis) (Lithocolletiinae) and *Parornix carpinella* (Frey) (Gracillariinae) are oligophagous and feed on various Corylaceae. External characters and genitalia of all species are described and figured.

Zusammenfassung

Insgesamt 5 Gracillariidae-Arten ernähren sich oligophag oder monophag an *Ostrya carpinifolia* Scopoli (Corylaceae). *Phyllonorycter aemula* sp. n., eine hier neu beschriebene Art mit bekannten Vorkommen in Italien (Provinzen Südtirol, Trient, Verona, Udine, Triest), ist exklusiv an *Ostrya* L. gebunden. *Phyllonorycter coryli* (Nicelli), *P. esperella* (Goeze), *P. tenerella* (Joannis) (Lithocolletiinae) sowie *Parornix carpinella* (Frey) (Gracillariinae) ernähren sich oligophag an verschiedenen Corylaceae. Sämtliche Arten werden nach habituellen sowie genitalmorphologischen Kriterien beschrieben und abgebildet.

Résumé

5 espèces de Gracillariidae au total se nourissent en oligophage ou en monophage sur *Ostrya carpinifolia* Scopoli (Corylaceae). *Phyllonorycter aemula* sp. n., décrite ici et existant en Italie (dans les provinces du Sud-Tirol, de Trente, de Vérone, d'Udine et de Trieste), est strictement limité à *Ostrya* L. *Phyllonorycter coryli* (Nicelli), *P. esperella* (Goeze), *P. tenerella* (Joannis) (Lithocolletiinae) et *Parornix carpinella* (Frey) (Gracillariinae) sont oligophages et se nourissent de plusieurs Corylaceae. Les caractères externes et les genitalia de toutes les espèces sont décrits et figurés.

Introduction

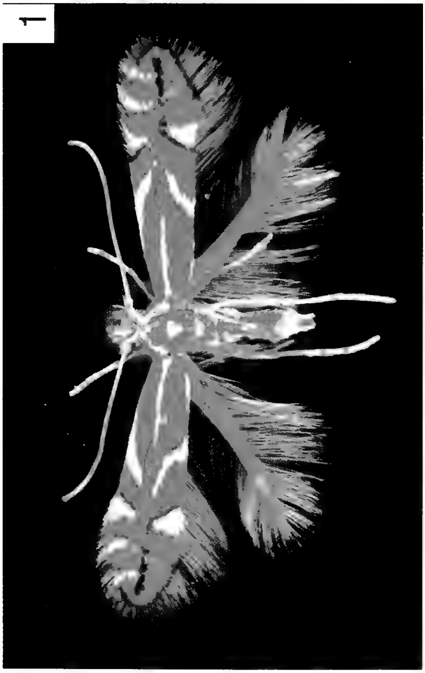
In autumn 1994 P. T. and P. H. independently dissected specimens of a species of *Phyllonorycter* from various Northern Italian localities which could not be identified according to standard identification literature (e.g. Bradley, Jacobs & Tremewan, 1969 ; Emmet, Watkinson & Wilson, 1985 ; Kuznetsov, 1989 ; Szöcs, 1977). Extensive correspondence with G. D. showed that the species was undescribed, although already represented in collections. From this material and from succeeding breeding results it became obvious that the host plant of the new species is *Ostrya carpinifolia* Scopoli (Corylaceae), but bred specimens were hitherto misidentified with other species of Corylaceae-feeding *Phyllonorycter*, namely *P. esperella*. The authors therefore intended to review the entire Gracillariid moth fauna on *Ostrya carpinifolia*, including the genera *Phyllonorycter* with four species and *Parornix* with one species.

The species

Phyllonorycter coryli (Nicelli, 1851)

Lithocolletis coryli Nicelli, 1851, *Stettin. ent. Ztg.* 12 : 36.
Lithocolletis danica Caradja, 1920, *Dt. ent. Z. Iris* 34 : 158.

Description of male and female (Fig. 1). Wingspan : 6.5-9.0 mm. Head with tuft yellow-ochre, white posteriorly ; face shiny white, labial palpus white, brownish on outer side. Antenna pale yellow, without any annulation ; pecten and scape white, latter fuscous above. Thorax orange, with three longitudinal stripes ; lateral and ventral surface whitish. All legs whitish ; foreleg with femur and tibia fuscous on outer side, latter with a fuscous band apically ; fore, mid and hind tarsi with two blackish spots or bands. Forewing orange with a golden reflection ; basal streak narrow, occupying little more than 1/3 of wing length, not dark-edged ; four costal and three dorsal whitish strigulae, dark-edged inwardly ; first costal edged on both sides, long and oblique, extending slightly along costa towards base ; second triangular and other two arc-shaped ; first dorsal very long and oblique, nearly meeting first costal and forming an acute angle ; second dorsal triangular and third small but distinct ; a small, white streak placed near base along dorsum ; an apical streak prolonged at junction of third pair of strigulae ; a fine black fringe line from fourth costal to second dorsal ; cilia light brown, in some specimens darker at tips from fourth costal to apex forming a very faint apical line. Hindwing pale grey, with cilia pale fuscous.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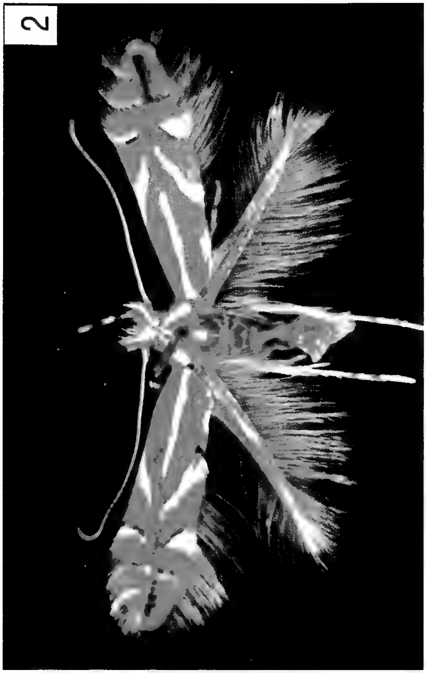
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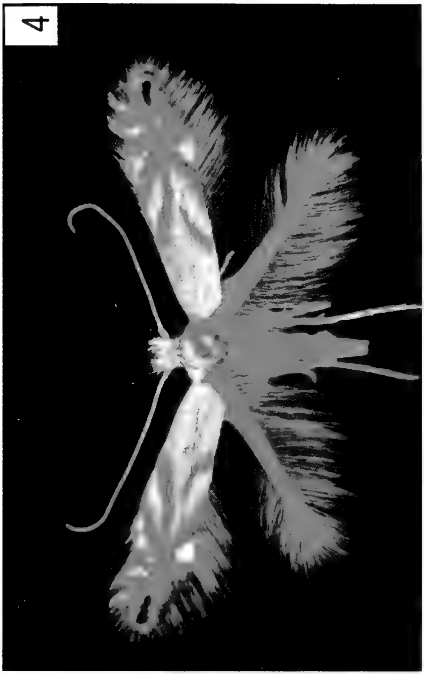
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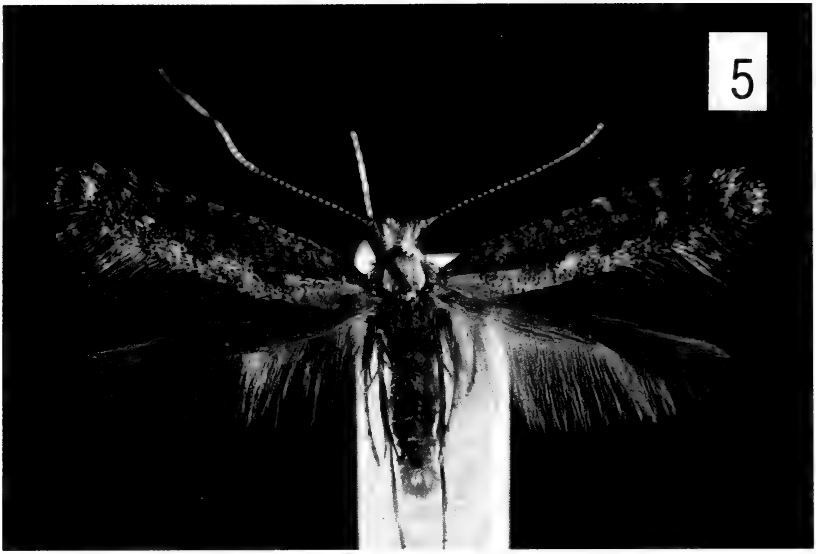


Figs. 1-5. Adults : 1 — *Phyllonorycter coryli* ♀, Austria, Oberösterreich, Steyr, 285 m, ex l. 24.IV.1964 (*Corylus avellana*), leg. Deschka ; 2 — *Phyllonorycter aemula* sp. n. ♀ paratype, Italy, Trieste, 300 m, ex l. 3-9.IV.1976 (*Ostrya carpinifolia*), leg. Deschka ; 3 — *Phyllonorycter esperella* ♂, Austria, Oberösterreich, Steyr, 340 m, ex l. 29.I.-23.II.1965 (*Carpinus betulus*), leg. Deschka ; 4 — *Phyllonorycter tenerella* ♀, Austria, Oberösterreich, Steyr, ex l. 26.III.-2.IV.1965 (*Carpinus betulus*), leg. Deschka ; 5 — *Parornix carpinella*♂ , Germany, Württemberg, Großbottwar, Kälbling, ex p. 29.III.1956 (*Carpinus betulus*), leg. Süssner.

Male genitalia (Fig. 6). Symmetrical. Tegumen slender and pointed, about 1/4 as long as aedeagus ; tuba analis without spinules ventrally. Vinculum short, rounded, without produced saccus. Valva wide, subrectangular, a long seta originating from produced top of sacculus and reaching cucullus. Aedeagus about twice length of valva, straight and slender, with an ovate apical barb. Flap of eighth sternite about 2/3 as long as valva, pointed apically.

Female genitalia (Figs. 10-11). Apophysis posterioris longer than anterioris. Eighth segment not scaled, only weakly sclerotized, about 1/4 as long as seventh, sinuous in lateral view ; tergal area of the seventh segment weakly membranous and reduced. Antrum long, occupying about distal third of ductus bursae ; corpus bursae globose with a sclerotized, circular plate, with a pair of cone-shaped teeth in the centre.

HOST PLANTS. *Corylus avellana* L., *Ostrya carpinifolia* Scopoli (Corylaceae).

BIOLOGY. Larva mines on the upperside of a leaf with formation, in the sap-feeding phase, of an almost circular whitish blotch. In the tissue-feeding phase the presence of silk contracts the upper surface of the mine with formation of many tiny creases and causing a strong folding of the leaf. If the mine is at the margin it resembles the fold made in later instars by *Parornix carpinella*. In the overwintering generation pupation takes place in a silk chamber at one end of the mine, generally on an uneaten part of parenchyma, the frass heaped at the opposite end. There are two generations, with adults flying from April to May and then in July - early August.

DISTRIBUTION. Widely distributed all over Europe, from the British Isles to Caucasus and from Scandinavia to Italy ; not recorded from Spain and Greece.

REMARKS. The identity of *Phyllonorycter coryli* is undisputed, due to the perfect description of the type-series, which was bred from *Corylus* exclusively, as well as the type-locality (surroundings of Szezin, Poland), an area where *Ostrya* is missing (Nicelli, 1851). *L. danica* was described after 4 Swedish specimens bred on *Corylus* (Caradja, 1920). Therefore conspecificity with *P. aemula* sp. n. can be excluded.

***Phyllonorycter aemula* sp. n.**

HOLOTYPE ♂, Italy, Verona, M. Lessini, Montecchio 500 m, mn 28.X.1994 *Ostrya carpinifolia*, ex l. 5.III.1995, leg. Triberti (coll. Tiroler Landesmuseum Ferdinandeum, Innsbruck).

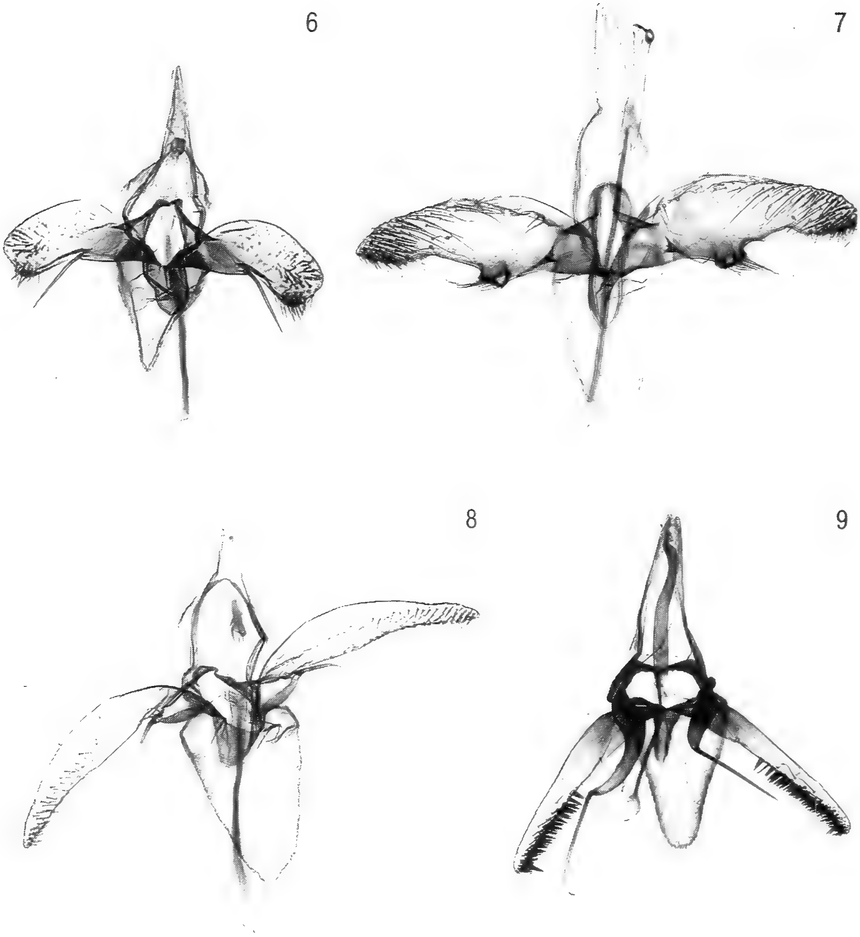
PARATYPES : *Italy* : ♂, ♀, Verona, Lago di Garda, Brenzone 80 m, mn *Ostrya carpinifolia*, ex l. 15-29.VII.1965, leg. Deschka (coll. Deschka, Steyr) ; ♂, Verona, Lago di Garda, Costermano, 29.V.1978, leg. Triberti ; ♀, Verona, M. Baldo 800 m, SS. Benigno e Caro, 25.V.1974, leg. Triberti ; 2 ♀, Verona, M. Baldo, Albisano 500 m, 4.VIII.1978, leg. Triberti ; ♀, Verona, M. Lessini, Monte 500 m, 1.VI.1974, leg. Triberti ; 10 ♂, 4 ♀, Verona, M. Lessini, Montecchio 500 m, mn 15.X-3.XI.1994 *Ostrya carpinifolia*, ex l. 7.-20.III.1995, leg. Triberti ; 4 ♂, 5 ♀, Verona, M. Lessini, Montecchio loc. Gaspari 400 m, 4.V.1988, leg. Triberti ; 3 ♀, Verona, M. Lessini, Quinzano 300 m, mn 8.VI.1988 *Ostrya carpinifolia*, ex l. 20.VI.1988, leg. Triberti ; ♂, as above, mn 1.VIII.1984 *Ostrya carpinifolia*, ex l. 22.VIII.1984, leg. Triberti ; ♂, Verona, Avesa, 15.IV.1981, leg. Triberti ; ♀, Verona, M. Lessini, Trezzolano 400 m, 13.VII.1978, leg. Triberti ; ♂, ♀, Verona, M. Lessini, Ponte di Veia 600 m, mn 9.X.1994 *Ostrya carpinifolia*, ex l. 20.III.1995, leg. Triberti ; ♀, Verona, M. Lessini, Corso loc. Schioppi 700 m, mn 7.XI.1994 *Ostrya carpinifolia*, ex l. 8.III.1995, leg. Triberti ; ♀, Verona, M. Lessini, Velo 950 m, 15.VI.1974, leg. Triberti ; 2 ♂, ♀, Trento, Pomarolo (Savignano) 700 m, mn 25.X.1994

Ostrya carpinifolia, ex l. 14.III.1995, leg. Triberti (all coll. Triberti, Verona) ; 4 ♂, 4 ♀, ditto, ex l. 10-16.II.1995, leg. Deschka (coll. Deschka, Steyr) ; 2 ♂, 3 ♀, ditto, ex l. 27.I.-19.II.1995, leg. Huemer ; 2 ♂, Südtirol, Montiggl, Kl. Priol 600 m, 1.IX.1993 (trap nr. 63) [only genitalia slides] ; ♀, ditto, mn 26.X.1994 *Ostrya carpinifolia*, ex l. 24.I.1995, leg. Huemer (coll. Tiroler Landesmuseum Ferdinandeum, Innsbruck) ; ♂, ♀, Friuli, Lago di Cavazzo 200 m, mn mid-VII.1968 *Ostrya carpinifolia*, ex l. 29.VII.-1.VIII.1968, leg. Deschka ; 3 ♂, 3 ♀, Trieste 300 m, mn 1-2.XI.1975 *Ostrya carpinifolia*, ex l. 3-9.IV.1976, leg. Deschka ; ♂, ♀, Trieste, Istria, Opicina 300 m, mn 30.X.-4.XI.1968 *Ostrya carpinifolia*, ex l. 6.III.1969, leg. Deschka (coll. Deschka, Steyr).

DESCRIPTION OF MALE AND FEMALE (Fig. 2). Wingspan : 6.3-8.0 mm. Head and face as *coryli*, labial palpus white. Antenna pale yellow, without distinct annulation, apical third greyish above, last three segments darker ; pecten and scape white, latter orange above. Thorax and legs as *coryli*, sometimes a third spot is present on first tarsal segment basally. Forewing orange with a golden reflection ; basal streak narrow, occupying about 1/3 of wing length, not dark-edged ; four costal and three dorsal whitish strigulae, narrowly margined with fuscous except first costal, that is very oblique, only slightly extending to base, other three strigulae arc-shaped ; a small, white streak placed near base along dorsum ; first dorsal oblique, not extending to base, second triangular and third very indistinct ; an apical streak darkish, paler basally, ending at apex of first dorsal strigula ; cilia and hind wing as *coryli*.

Male genitalia (Fig. 7). Symmetrical. Tegumen long and slender, pointed apically ; tuba analis without spinules ventrally. Vinculum short, rounded, without produced saccus. Valva arched upwardly in its costal margin, setae near apex being thickened like spine and a very strong seta on ventro-basal surface ; dorsum produced into a rounded lobe just before middle of valva with long setae at top and a cup-shaped structure, probably a sensorial organ. Aedeagus about 1.5 times as long as valva, straight and slender, with an ovate apical barb. Flap of eighth sternite about 2/3 as long as valva, truncated apically.

Female genitalia (Figs. 12-13). Apophysis posterioris longer than anterioris. Eighth segment not scaled, only weakly sclerotized, about 1/2 as long as preceding. Seventh segment with two rows of scales along ventro-lateral surface, sternite produced caudally forming an indented flap covering ostium bursae. Ductus bursae sclerotized in the apical fourth, corpus bursae globose with a sclerotized, circular plate, with a pair of cone-shaped signa in the centre.



Figs. 6-9. Male genitalia : 6 — *Phyllonorycter coryli*, Belgium, Prov. de Namur, Yvoir, 200 m, ex l. 23.XI.1980 (*Corylus avellana*), leg. Coenen, gen. slide 2778 Deschka ; 7 — *Phyllonorycter aemula* sp. n., Italy, Lago di Garda, Brenzone, 80 m. ex l. 25-29. VII.1965 (*Ostrya carpinifolia*), leg. Deschka, gen.slide 2683 Deschka ; 8 — *Phyllonorycter esperella*, Sweden, SK Lund, e.p. 11-28.IV.1983, leg. Svensson, gen. slide 2777 Deschka ; 9 — *Phyllonorycter tenerella*, Austria, Oberösterreich, Steyr, 290-340 m, ex l. 9-17.II.1995 (*Carpinus betulus*), leg. Deschka, gen. slide 2784 Deschka.

Pupal cremaster (Figs. 23-25). The cremasters of the three *Phyllonorycter* species *aemula* sp. n., *esperella* and *coryli* are very similar. They consist of two pairs : a pair of median and inwardly curved hooks and a pair of lateral, outwardly curved and stronger hooks. The cremaster of *aemula* sp. n. has the strongest appendages, esp. the median pair is well sclerotized, while *esperella* and *coryli* have weaker inner hooks. *P. aemula* sp. n. can also be separated by the lack of tiny dorsal setae of the cremaster.

HOST PLANT. *Ostrya carpinifolia* Scopoli (Corylaceae).

BIOLOGY. The mine is formed on the upper surface and does not show any difference from that of *coryli*, except for a slightly more lengthened shape. The adults fly from April to early June and again from July to early August.

DISTRIBUTION (Fig. 26). Up to the present the species is only known from the north of Verona, from Garda lake to Lessini Mountains and then along the Adige Valley as far as Bolzano and furthermore from Friuli and the area of Trieste. Concerning the geographic range of *Ostrya carpinifolia* Scopoli (Fig. 26) (Fenarolli & Gambi, 1976), it is likely that *aemula* sp. n. is more widely distributed but probably confused with *coryli* and *esperella*. However, a search for larvae at the northern limit of the range of *Ostrya* in Carinthia has failed. From this area as well as from Southern Italy (Potenza, Monte Vulture) *esperella* was bred from upperside *Ostrya* mines.

REMARKS. *P. aemula* sp. n. is very similar to *coryli* and *esperella* in forewing pattern. However, it may be readily distinguished from both by the presence of a long apical streak, prolonged to the apex of the first dorsal strigula, and more shaded basally.

The main charcteristic features are found in the genitalia, particulary of the male, which cannot be mixed with other species of *Phyllonorycter*.

Following the division into 9 groups fixed by Kumata (1963), *P. aemula* sp. n. can be included into group 1 with the other *Phyllonorycter* described in the present paper. This group includes most of the Fagaceae-, Betulaceae- and Rosaceae-mining species. The closest relationships are found among the Corylaceae- and Fagaceae-mining species, esp. the miners on deciduous oaks.

ETYMOLOGY. The specific name indicates that this species is an emulous of *coryli* and *esperella*.

Phyllonorycter esperella **(Goeze, 1783)**

Tinea esperella Goeze, 1783, *Ent. Beitr.* 3 : 166.
Tinea quinnata Fourcroy, 1785, *Ent Paris* 2 : 331.
Lithocolletis carpinicolella Stainton, 1851, *Suppl. Cat. Br. Tineidae and Pterophoridae* 1851 : 13.

DESCRIPTION OF MALE AND FEMALE (Fig. 3). Wingspan : 7.5-9.0 mm. Head and face as *coryli*, labial palpus white, spotted with ochre-brownish on outer side. Antenna pale yellow annulated fuscous, this annulation absent on apical ten segments ; pecten and scape white. Thorax pale orange, with three longitudinal white stripes ; lateral and ventral surfaces white. All legs white ; foreleg with femur and tibia fuscous on outer side ; fore, mid and hind tarsi with two blackish spots or bands. Forewing pale orange ; basal streak narrow, occupying about 2/5 of wing length, not dark-edged ; four costal and three dorsal whitish strigulae, narrowly black-edged inwardly ; first costal narrow and strongly angled, extended almost to base of costa, other strigulae arc-shaped ; first dorsal long and sinuate, extended along dorsum towards base, second and third triangular ; apical streak, cilia and hind wing as *coryli*.

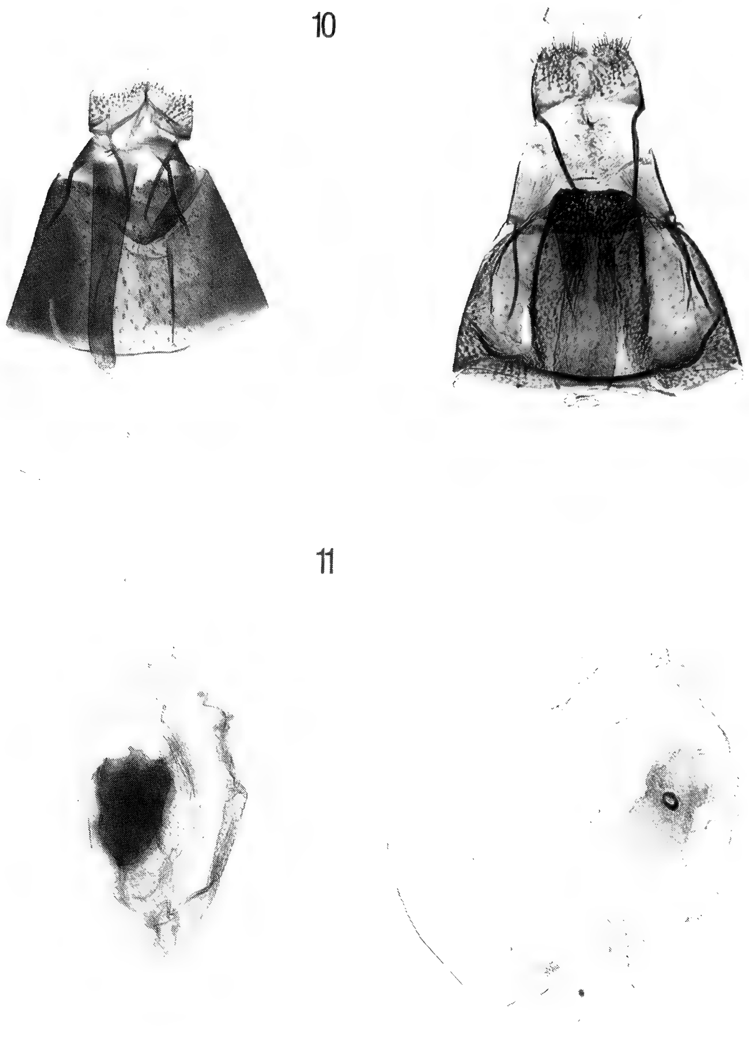
Male genitalia (Fig. 8). Symmetrical. Tegumen long and slender, pointed apically ; tuba analis without spinules on ventral surface. Vinculum short, rounded, without produced saccus. Valva slender, parallel-sided, slightly arched upwardly, setae near apex being thickened like spine ; a very strong seta originating from produced top of sacculus. Aedeagus a little longer than valva, straight and slender, with an ovate apical barb. Flap of eighth sternite about 2/3 as long as valva, rounded apically.

Female genitalia (Figs. 14-15). Apophysis anterioris about as long as posterioris. Eighth segment not scaled, very short. Ostium bursae wide, antrum sclerotized, occupying about 1/4 of ductus bursae ; corpus bursae globose with a sclerotized, circular plate, with a pair of cone-shaped signa, slightly serrate.

HOST PLANTS. *Carpinus betulus* L., *Ostrya carpinifolia* Scopoli (Corylaceae).

BIOLOGY. The species mines on the upperside of a leaf as *coryli* and also the pupation takes place in a similar way. Two generations are present, with adults flying from late April to May and in July - early August.

DISTRIBUTION. To the north known up to Denmark and southern Sweden ; common and widely distributed in all central European



Figs. 10-13. Female genitalia : 10 — *Phyllonorycter coryli*, Oberösterreich, Gersten, 303 m, ex l. 12.IV.1963 (*Corylus avellana*), leg. Deschka, gen. slide 1994 Deschka ; 11 — ditto, corpus bursae/signum enlarged) ; 12 — *Phyllonorycter aemula* sp. n., Trieste, Opicina, 300 m, ex l. 6.III.1969 (*Ostrya carpinifolia*), leg. Deschka, gen. slide 2684 Deschka ; 13 — dito, corpus bursae/signum enlarged ;

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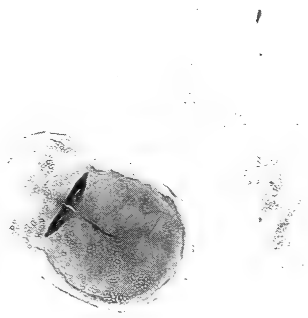

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Figs. 14-17. Female genitalia : 14 — *Phyllonorycter esperella*, Austria, Oberösterreich, Steyr, 340 m, ex l. 29.I.-23.II.1965 (*Carpinus betulus*), leg. Deschka, gen. slide 1990 Deschka ; 15 — ditto, corpus bursae/signum enlarged ; 16 — *Phyllonorycter tenerella*, Austria, Oberösterreich, Steyr, 285 m, ex l. 4.III.1964 (*Carpinus betulus*), leg. Deschka ; 17 — ditto, corpus bursae/signum enlarged.

countries, including southern England ; to the south not present in Spain, no records from Greece and Romania, known in Turkey up to Caucasus.

REMARKS. The adult of this species is readily distinguishable from *aemula* sp. n. (see above), more difficultly from *coryli*. The only reliable characters seem to be the first costal strigula, prolonged on costa basally, and the basal streak which is slightly longer.

P. esperella and *P. quinnata* are objective synonyms since both names refer to the same description by Geoffroy (1762). The latter work is nomenclatorially invalid, using no latin names (Karsholt, in litt.). The description of this species is vague and no type-material could be traced. However, we accept the present species status of *P. esperella* in the interest of stability.

Phyllonorycter tenerella **(Joannis, 1915)**

Lithocolletis tenerella Joannis, 1915, *Annls. Soc. ent. Fr.* 84 : 121.
Lithocolletis tenella Zeller, 1847, *Linn. Ent.* 2 : 236, homonym.

DESCRIPTION OF MALE AND FEMALE (Fig. 4).Wingspan : 6.0-8.5 mm. Head with tuft white, sometimes with a few brown scales anteriorly ; face and labial palpus shiny white ; sometimes latter with a few brown scales. Antenna whitish, more or less annulated with pale brown, pecten and scape white, sometimes spotted with brownish. Thorax white to yellow ochre, lateral and ventral surface white. All legs whitish ; foreleg almost completely fuscous on outer side in darker specimens ; mid and hind tarsi with two or three blackish spots or bands. Ground-colour of forewing ranging from white to yellow ochre basally, distally always yellow ochre ; basal streak distinguishable only in darker specimens, occupying about 2/3 of wing length, not dark-edged ; four costal and three dorsal whitish strigulae, dark brownish edged inwardly ; first costal very oblique, the second less, other two strigulae at right angle to costa ; first dorsal stopping well before end of first costal, second triangular, third dorsal indistinct ; apical streak slightly elongate, often to the second pair of strigulae ; fringe line as *coryli*, cilia whitish ; hindwing pale greyish fuscous.

Male genitalia (Fig. 9). Asymmetrical. Tegumen long and slender, pointed apically ; tuba analis with spinules on lateral surface. Vinculum short, subtriangular, with a produced saccus. Valvae straight and narrow, slightly longer than flap of eighth sternite ; left valva slightly wider than right one, both covered ventro-distally with short and strong spines, one of them, subapically, longer. Two asymmetrical processes are present, longer on left side than on right, from which filaments originate. Aedeagus slender, with apical barb, slightly longer than valva.

Female genitalia (Figs. 16-17). Apophysis posterioris longer than anterioris. Eighth segment not scaled, about 1/5 as long as seventh. Ostium wide, antrum partially sclerotized and subrectangular, almost as long as the seventh segment ; corpus bursae globose with a sclerotized, circular plate, which has a pair of cone-shaped signa in the centre.

HOST PLANTS. *Carpinus betulus* L., *Ostrya carpinifolia* Scopoli (Corylaceae).

BIOLOGY. Larva mines the lower surface of the leaf, between two veins. The mine is long and narrow, with a strong central fold, those collected on *Ostrya* are always shorter, with irregular outline. The pupal site is placed at one end of the mine, frass stacked in the central portion and alongside the cocoon. Two generations, adults flying from late April to first of June and then in July-August.

DISTRIBUTION. Widely distributed in central and eastern Europe up to Denmark, Sweden and Baltic Republics ; in the Mediterranean area only known from Italy.

REMARKS. *Lithocolletis tenella* Zeller, 1847, is a junior secondary homonym of *Lithocolletis tenella* Duponchel, 1843 (currently *Phyllonorycter harrisella* (Linnaeus, 1761)) and was therefore renamed as *Lithocolletis tenerella* (Joannis, 1915) (Emmet, Watkinson & Wilson, 1985). The identity of this species is undisputed though Zeller (1847) recorded his type-specimens flying around oaks. However, *Carpinus* occurs in the area of the type-localities (Vienna and Reichstadt) as well and in the absence of syntypes in Zeller's collection we accept the general interpretation of this species.

Parornix carpinella **(Frey, 1863)**

Ornix carpinella Frey, 1863, *Linn. Ent.* 15 : 19.

DESCRIPTION OF MALE AND FEMALE (Fig. 5). Wingspan : 8.5-10.5 mm. Head pale ochre, tuft with mixed brownish scales, white posteriorly ; labial palpus white with subapical fuscous band on third segment. Antenna ochreous annulated fuscous ; pecten and scape spotted with fuscous. Thorax pale ochre, tegulae brownish. All legs ochreous, strongly irrorated with fuscous scales ; fore and mid tarsus white, each segment annulated with dark brown apically. Forewing pale ochre, costa mixed fuscous with indistinct strigulation ; dorsal area less strongly mixed fuscous, with dark brown ante- and postmedian spots, preceded from few whitish scales ; an ochreous white spot in disc at 3/4 and an apical dark dot. All these spots are often hardly visible or absent. Cilia with three dark brown lines separated from whitish scales. Hindwing pale grey, with cilia whitish.

Male genitalia (Fig. 20). Tegumen short, rounded apically ; tuba analis moderate in length, with a pair of setaceous areas at base ; a short, subtriangular and well defined subscaphium is present. Valva slightly bent at basal 1/4, with sacculus slender, about 2/3 as long as aedeagus, apically hook-shaped. Aedeagus curved, pistol-shaped ; ductus ejaculatorius sclerotized anteriorly for a length equal to aedeagus.

Female genitalia (Figs. 18-19). Apophysis posterioris as long as anterioris. Eighth segment very short with a simple sterigma. Ductus bursae long, narrow, membranous, scobinate on whole length except antrum ; corpus bursae ellipsoid, entirely scobinate with two small, round signa.

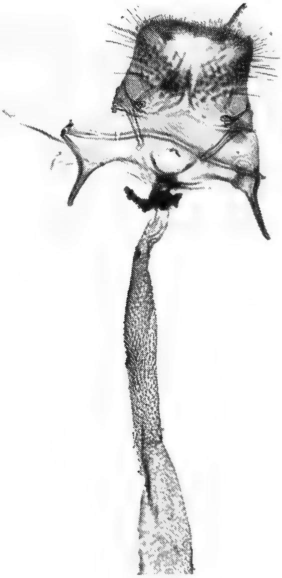
HOST PLANTS. *Ostrya carpinifolia* Scopoli, *Carpinus betulus* L. (Corylaceae).

BIOLOGY. Larva starts feeding with a gallery in the lower face, then absorbed by a blotch mine. This is very variable : it can be narrow as *tenerella* (but shorter), rounded, subrectangular. After leaving its mine, the larva folds the edge of a leaf downwards and feeds within. Each larva usually makes two such folds. Pupation takes place in a white cocoon under the edge of an upwards folded leaf. Two generations are present and e.g. in Lessini Mountains it is possible to find larvae from June to October.

DISTRIBUTION. Widely distributed in central and eastern Europe up to Sweden ; to the south not present in Spain.

Ecological remarks

Gracillariidae feeding on *Ostrya carpinifolia* Scopoli show a remarkable variety of mining habits. Two subfamilies are represented : Gracillariinae, with the genus *Parornix* Spuler and Lithocolletiinae with the genus *Phyllonorycter* Hübner. The principal character separating these two groups is the different way to conclude the tissue-feeding stage. The former has a phase in which the larva continues to mine and a second in which it feeds externally in folded leaves (Fig. 22). The latter has larvae mining for the whole tissue-feeding phase and pupating within the original mine (Fig. 21). Different mining habits may also be found within the species of *Phyllonorycter*. The mine of *P. tenerella* is built on the lower surface of a leaf, long and narrow between two veins,



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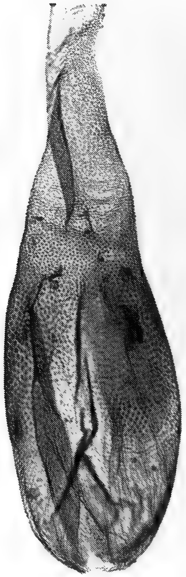

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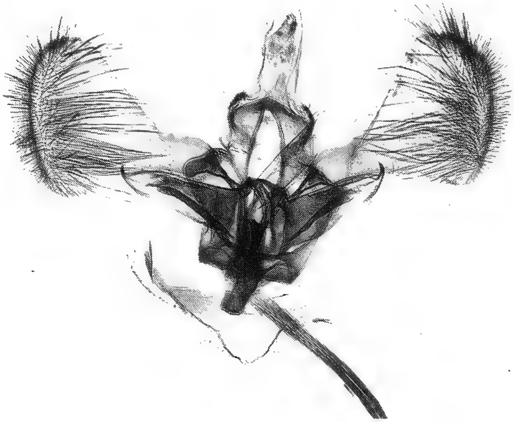

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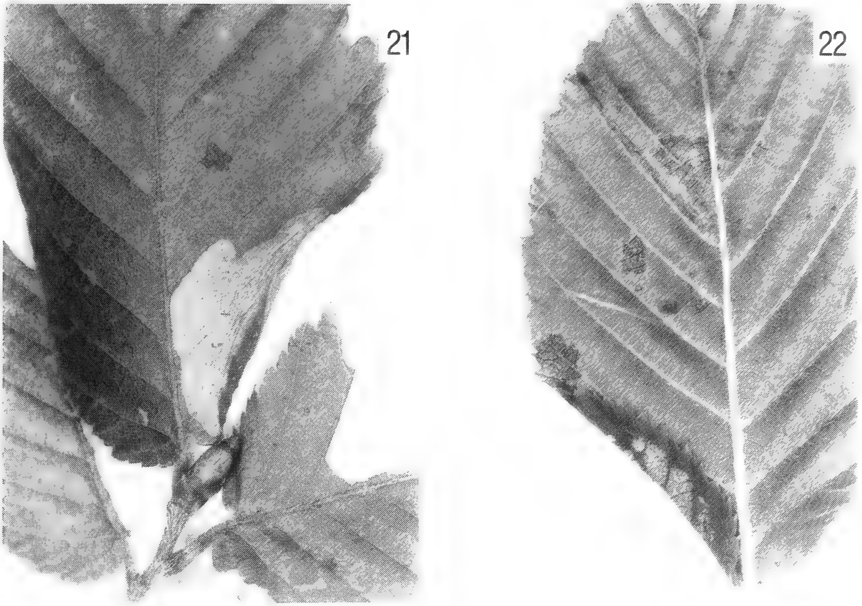
Figs. 18-20. Female/male genitalia : 18-19 — *Parornix carpinella*, female ; 20 — *Parornix carpinella*, male, Italy, Prov. Trento, Pomarolo, Savignano, 700 m, ex l. 10-16.II.1995 (*Ostrya carpinifolia*), leg. Deschka, gen. slide 2711 Deschka.

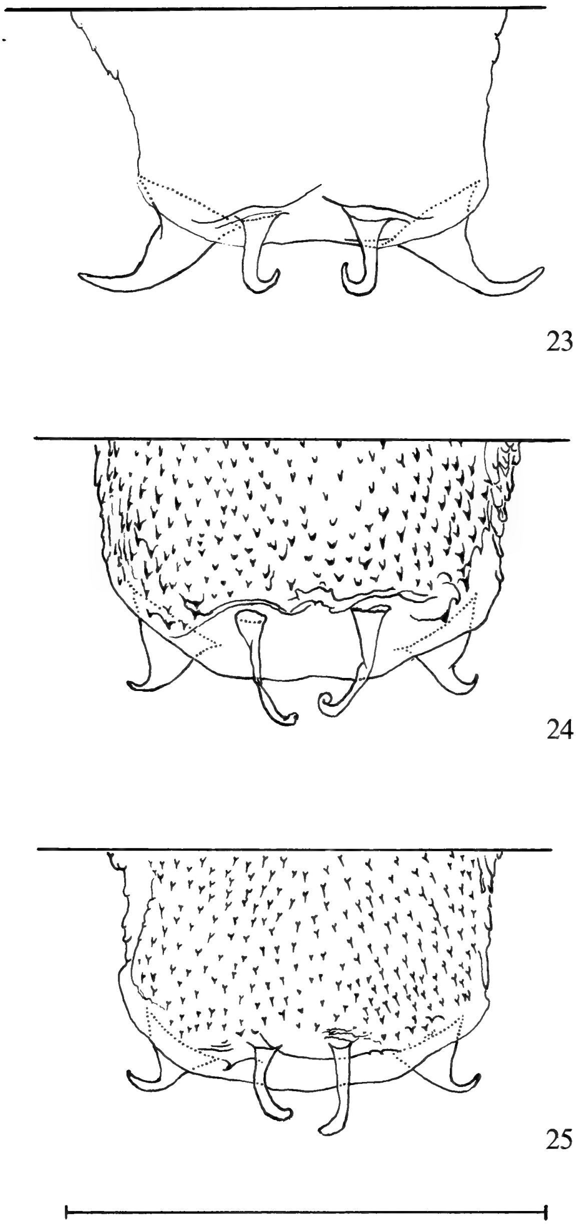


Figs. 21-22. Leaf-mines on *Ostrya carpinifolia* : 21 — *Phyllonorycter* sp., Italy, Prov. Trento, Pomarolo, Savignano, 700 m, X.1994 ; 22 — *Parornix carpinella*, Italy, Prov. Trento, Pomarolo, Savignano, 700 m, X.1994.

whereas larvae of the remaining species cause upperside mines, initially making a blotch mine between two veins and extending it sidewards (Fig. 21). These blotch mines are very similar and also the miners (*P. coryli*, *P. aemula* sp. n., *P. esperella*) are closely related.

Because of this poor differentiation at level of mining habits, the collecting localities of the upperside miners were examined, to find out possible ecological specializations. In particular Lessini Mountains were considered because the localities were more numerous and covering different environments. It is important to remember that these data may not be adequate for discussing ecological problems because they were not gathered according to a plan designed for this purpose. However, as they seem to show a "tendency" of these species to occupy specific environments, it was preferred to report these behaviours, even if further research will be necessary to explain them reliably.

The Lessini Mountains are a calcareous chain degrading slowly towards Po plain, representing a part of the southern border of the Alps. The



Figs. 23-25. Pupal cremaster : 23 — *Phyllonorycter aemula* sp. n., holotype ; 24 — *Phyllonorycter esperella* ; 25 — *Phyllonorycter coryli* (reference bar 300 µm).

lower part (below 1000 m) is formed by sunny and dry slopes with bushy vegetation characterized by *Fraxinus ornus* L., *Corylus avellana* L., *Cotinus coggyria* Scopoli, *Amelanchier ovalis* Med., *Quercus pubescens* Willd. and *Ostrya carpinifolia* Scopoli. These slopes are crossed by deep valleys, rather fresh and wet. Here the presence of *Ostrya* Scopoli is rather discontinuous, often mixed with *Carpinus betulus* L. In fact it is a thermophil and xerophilous element, with a distribution (Fig. 26) from Southern France to the Caucasus and Asia Minor.

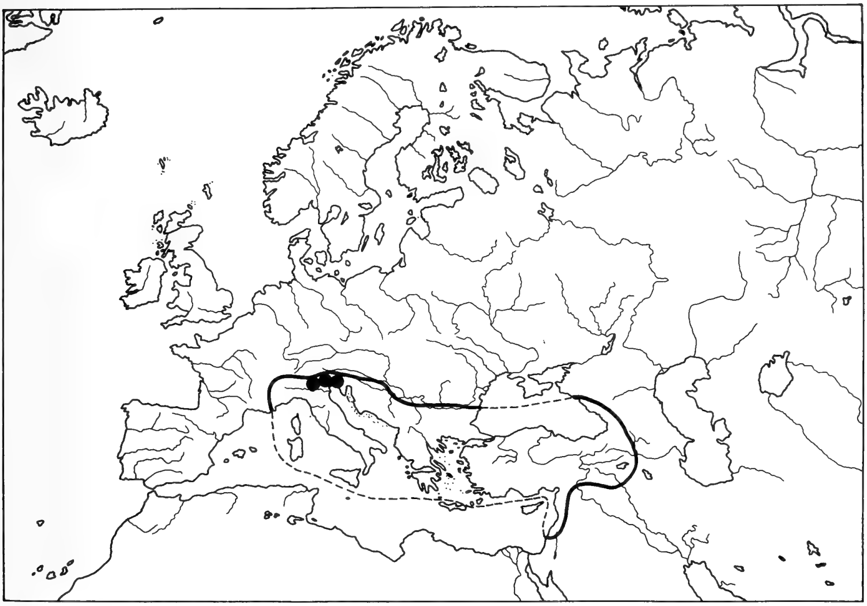


Fig. 26. Distribution map of *Ostrya carpinifolia* with records of *Phyllonorycter aemula* sp. n.

In the dry area 34 adults were obtained from *Ostrya* Scopoli, 32 belonging to *P. aemula* sp. n. and 2 to *coryli*. In the valleys, 50 adults emerged, 36 belonging to *coryli*, 11 to *tenerella* and 3 to *P. aemula* sp. n. These data show that *P. aemula* sp. n. may be restricted almost exclusively to thermophilous areas as it seems not to follow the host-plant when it occurs in fresher woods. On the contrary *Ostrya* Scopoli may be selected by *coryli* (and also *tenerella*) in these environments.

There is clearly some mechanism of host specificity, probably constrained by chemical stimuli, to which is due the limitation of these species to Corylaceae. However, also environmental factors, such as temperature and humidity, seem to play an important role for host selection, independently from a positive feeding response.

Parornix carpinella shows a considerable ecological valence and it was found everywhere where searched for, both on *Ostrya* Scopoli and *Carpinus* L.

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The Lepidoptera of Israel

Faunistic data on Geometridae : I. Orthostixinae and Geometrinae

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Summary

Faunistic data on 20 species of Orthostixinae and Geometrinae (family Geometridae) occurring in Israel are presented. About 2.800 examined specimens have been taken into account. Data from all available literature citations are included. Distribution pattern, ecology and phenology of each species are discussed. Threatened species are compiled in a "Red List" for the first time.

Zusammenfassung

Faunistische Daten von 20 in Israel vorkommenden Arten der Unterfamilien Orthostixinae und Geometrinae (Geometridae) werden vorgelegt. Das untersuchte Material umfaßt ca. 2.800 Exemplare. Unter zusätzlicher Berücksichtigung aller verfügbarer Literaturangaben werden Verbreitungsmuster, Ökologie und Phänologie einer jeden Art eingehend diskutiert. Die in ihren Beständen gefährdeten Arten werden erstmals in einer „Roten Liste Israels“ zusammengestellt.

Résumé

Des données faunistiques sur 20 espèces d'Orthostixinae et de Geometrinae (famille Geometridae) existant en Israel sont présentées. Le matériel examiné comporte environ 2.800 exemplaires. La répartition, l'écologie et la phénologie de chaque espèce est discutée, en tenant compte des données complètes existant dans la littérature. Pour la première fois, les espèces menacées sont énumérées dans une «Liste rouge».

Introduction

This paper is the first part of the third of three series of publications :

1) Systematic list of species occurring in the Levantine basin and its

neighbouring countries ; first part already published (Hausmann, 1996b).

2) Morphology of species occurring in the Levantine basin and its neighbouring countries ; first part already published (Hausmann, 1996a).
3) Faunistic data on the species occurring in the state of Israel within the political borders of 1990.

Therefore the present paper can omit detailed nomenclatorial or morphological information and concentrate on faunistics and ecology.

The fauna of Israel includes twenty species belonging to the subfamilies Orthostixinae and Geometrinae. This includes two pairs of sister species (*Victoria plantei / eremita* ; *Microloxia herbaria / ruficornis*), which are closely related to each other respectively. At present they have to be considered vicariant allopatric species pairs. Further studies are necessary to discover whether some gene-flow (rarely occurring interbreeding) is taking place or whether separation is complete.

The present publication is based on the (database-)recorded data on about 25.000 specimens of Geometridae from Israel, 2837 specimens belonging to the subfamilies Orthostixinae and Geometrinae, all of these examined and identified by the author. The major part of this material (17 species, about 2700 specimens) was collected in the course of the project "The Lepidoptera of Israel : a study of the taxonomy and distribution of the entire fauna with the aim of determining conservation needs" by the Zoologische Staatssammlung, Munich, the Nature Reserve Authority, Jerusalem and the Tel Aviv University.

The resulting data are grouped for each species into the following sections :

SCIENTIFIC NAME AND REFERENCES. References are mentioned when containing information about the distribution of the species in Israel.

MATERIAL EXAMINED. The total number of specimens examined by the author is mentioned, based mainly on material caught in the course of the project "The Lepidoptera of Israel", but also including material stored in various collections. Localities in which the species was found are grouped according to the 31 zoogeographical zones of the study area. They will be discussed extensively in a separate publication.

Abbreviations used in this paper :

LI — Specimens from the project "The Lepidoptera of Israel..." (number specified) ; CI — Specimens stored in the entomological collections in Israel (number specified) (cf. Hausmann, 1997) ; ZSM — Specimens stored in the Zoologische Staatssammlung München (number specified) ; ZMK — Specimens stored in the Zoologisk Museum København (number specified) ; NHMW — Specimens stored in the Naturhistorisches Museum Wien (number specified) ; Am — recorded by Amsel (1935) (number specified) ; Ha — recorded by Hausmann (1991) (number specified) ; St — recorded by Staudinger (1892 ; 1897/8) (abundance specified) ; Ka — recorded by Kalchberg (1897) (abundance specified) ; H&S — recorded by Halperin & Sauter (1992) ; r — rare ; c — common.

DISTRIBUTION PATTERN. Zoogeographical patterns are described considering the whole area of distribution of the species or subspecies respectively. Zoogeographical categories ("chorotypes") after Parenzan (1994), who bases his system on the studies of La Greca (1963) and Vigna Taglianti *et al.* (1992). This system needs to be slightly modified in the southeastern part of the W. Palaearctic Region (abbreviations and modifications see below). The local distribution patterns revealed by the examination of the material from within the study area are discussed.

Abbreviations of zoogeographical categories used in this paper (cf. Parenzan, 1994) :

1) Species widely distributed in the Holarctics : TUM — Turanian-Mediterranean ; 2) Species with European distribution : EUR — European (or Central-South-European) ; 3) Species with Mediterranean distribution : MED — (Holo-)Mediterranean, MEE — E. Mediterranean ; 4) Afrotropical and Oriental species partly ranging into the W. Palaearctics : AIM — Afrotropical-Indian-Mediterranean, AFM — Afrotropical-Mediterranean, AWA — Afrotropical-W.Arabian (Rift Valley distribution), *newly introduced category*, 5) Species widely distributed in marginal areas of the W. Palaearctics : SAS — Saharo-Sindian, SAA — Saharo-Arabian (SA in Wiltshire, 1990), *newly introduced category*, SAH — Saharian, ARA — Arabian, ARS — Arabian-Sindian (Eastern Eremic, EE in Wiltshire, 1990), *newly introduced category*.

Supplementary range in marginal areas of one of the categories given above : 2 — Anatolian ; 4 — Iranian ; 13 — Illyric ; 14 — Levantine ; 15 — Libyan.

ECOLOGY. Habitat preference (ecotype, vertical distribution) is described for adult stages according to data collected during the project "The Lepidoptera of Israel" (rarely using bibliographic citations). Larval foodplant spectrum is characterized ; the latter data often obtained from literature citations, preferably from authentic field observations rather than data resulting from rearing experiments. Life-history strategy of species is determined or estimated by considering all the available data, e.g. the phenological patterns (cf. Hausmann, 1990 :

Plate 1. Geometrid moth habitats in Israel.
Above : Nahal Ammud, N. Israel. View over the valley from the trapping site, habitat of *M. shohami*, *P. coronillaria*, *H. pruinosata*, *A. ononaria*, *P. pulmentaria*, *P. faustinata*.
Below : Hula Reserve, N. Israel, surroundings of the light trap operated in the project "Lepidoptera of Israel" (in the background the Golan Heights) ; habitat of *M. shohami*, *H. pruinosata*, *A. ononaria*, *P. neriaria*, *X. olympiaria*, *E. indigenata*, *P. pulmentaria*, *P. faustinata*, *M. herbaria*.

Plate 2. Geometrid moth habitats in Israel.

Above : Jerusalem, En Kerem, C. Israel, typical habitat in the surroundings. There are many literature citations from this locality : habitat of *M. shohami*, *H. pruinosata*, *M. pulchra*, *X. olympiaria*, *E. indigenata*, *C. prouti*, *P. pulmentaria*, *M. herbaria*, *H. semitaria*.

Below : Enot Zuqim, Dead Sea area, C. Israel, swamp vegetation surrounding the light trap operated in the project "Lepidoptera of Israel", habitat of *M. shohami*, *P. faustinata*, *N. pulvereisparsa*, *M. ruficornis*, *A. micra*, *H. sabulifera*.

104) : the r-K-continuum is abstracted into three groups : r-strategy, intermediate strategy, K-strategy (cf. e.g. Rejmanek & Spitzer, 1982).

Abbreviations used in this section :

m — meters above Sea Level ; FP1 — Flora Palaestina, Part 1 : Zohary (1966) ; FP2 — Flora Palaestina, Part 2 : Zohary & Feinbrun-Dothan (1972) ; FP3 — Flora Palaestina, Part 3 : Zohary & Feinbrun-Dothan (1978) ; FP4 — Flora Palaestina, Part 4 : Feinbrun-Dothan (1986).

Phenology. Flight periods of adult stages are characterized, as far as possible, from various localities (when sample size is sufficient). The phenology is compared with literature citations from neighbouring countries. Flight seasons are shown on diagrams for species with enough available data. However, the patterns on these diagrams can often be distorted by an uneven seasonal distribution of collecting efforts at a locality. An interpretation is given in the text part. Information about ♀-rate and possible protandrous emergence is sometimes based on small sample sizes and therefore has to be considered as preliminary.

Abbreviations used in this section :

B — beginning, M — mid, E — end of the month (numbers 1-12) respectively.

Red List category. Degree of threat to the species and degree of habitat isolation are estimated. The system of "Red List Categories" are defined as in IUCN Red List of Threatened Animals (1988). The categories I (indeterminate) and K (insufficiently known) are not used in this paper. The term T (threatened) is used according to the IUCN Red List as E + V + R. The classification into categories is made as a preliminary proposal ; the quantity of faunistic data is still insufficient to allow for a definitive judgement.

Abbreviations of categories :

Ex — extinct ; E — endangered ; V — vulnerable ; R — rare.

Maps. Examined records (spots of different size) and unexamined literature citations (asterisks) are presented on small maps ; in addition a hypothetical distribution area within Israel is generalized from the available data. It should be taken into account that collecting efforts are not the same for all parts of the country. Therefore a lack of spots does not necessarily means that a species is absent from the area.

Meaning of symbols :

* — literature reference ; • — 1-5 specimens ; ◉ — 6-20 specimens ; ● > 20 specimens.

Systematic Part

Orthostixinae

Myinodes shohami Hausmann, 1994

Pseudotagma Stgr. *interpunctaria* HS. : Staudinger, 1892 : 168.
Pseudotagma (*Eusarca*) *interpunctaria* HS. : Kalchberg, 1897 : 182.
Eusarca interpunctaria H.-S. : Amsel, 1933 : 109.

Material examined. 33 specimens : **1b** : Hula Reserve (LI : 11) ; Sede Nehamya (CI : 4) ; Neot Mordekhai (CI : 1). — **2** : Nahal Ammud (LI : 9) ; Gazit (CI : 1). — **3** : Haifa (NHMW : 1 ; Ka : c). — **9a** : Tel Aviv (NHMW : 1). — **11** : Jerusalem (St : 1 ♂. — **13b** : En Gedi (LI : 4) ; Enot Zuqim (LI : 1).

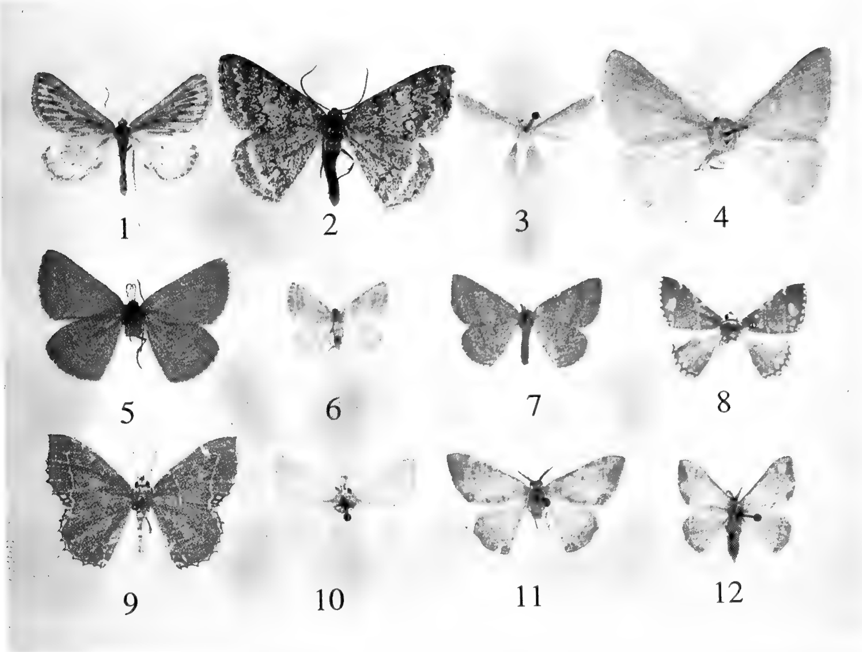
Distribution pattern (Map 1) : MEE, 2, 4, 15. In Israel probably widely distributed all over the northern and central parts. Populations nevertheless small, presumably quite isolated from each other.

Ecology. From – 400 up to 300 m (in S. Turkey, Jordan and N. Iraq up to 900 m). Probably K-strategy, females according to external appearance and ♀-rate at light seem to be inactive flyers. Larval foodplant unknown. Caterpillars of the closely related *Myinodes interpunctaria* (Herrich-Schäffer, 1839) in Italy perhaps feed on *Rhamnus cathartica* (cf. Parenzan, 1994 : 109 ; Spada, 1893).

→

Plate 3. Geometridae of the Levant, natural size (figs. 1-12).
1 — *Myinodes shohami* Hausm., ♂ ; 2 — *Pseudoterpna coronillaria halperini* Hausm., ♂ (holotype) ; 3 — *Holoterpna pruinosata* Stgr., ♂ (lectotype) ; 4 — *Holoterpna pruinosata* Stgr., ♀ ; 5 — *Aplasta ononaria* Fuessly, f. *berytaria* Stgr., ♀ (1st brood) ; 6 — *Aplasta ononaria* Fuessly, f. *faecataria* Hbn., ♀ (2nd brood) ; 7 — *Aplasta ononaria* Fuessly, f. near *berytaria* Stgr., ♀ (1st brood) ; 8 — *Microbaena pulchra* Stgr., ♂ (holotype) ; 9 — *Proteuchloris neriaria* H.-S., ♂ ; 10 — *Xenochlorodes olympiaria cremonaria* Stgr., ♂ ; 11 — *Victoria plantei* Herbulot, ♂ ; 12 — *Victoria eremita* Hausm., ♂ (paratype).

Plate 4. Geometridae of the Levant, natural size (figs. 13-26).
13 — *Eucrostes indigenata* Vill., ♂ ; 14 — *Culpinia prouti* Th.-Mieg, ♂ ; 15 — *Phaiogramma pulmentaria* Gn., ♂ ; 16 — *Phaiogramma faustinata* Mill., ♂ ; 17 — *Neromia pulvereisparsa jodisata* Stgr., ♂ ; 18 — *Kuchleria gisisi* Hausm., ♂ (holotype) ; 19 — *Microloxia herbaria* Hbn., ♂ ; 20 — *Microloxia herbaria* Hbn., ♀ ; 21 — *Microloxia ruficornis* Warr., ♂ ; 22 — *Acidaliastis micra* Hmps., ♂ ; 23 — *Hemidromodes sabulifera hessa* Prt., ♂ ; 24 — *Hemidromodes sabulifera hessa* Prt., ♀ ; 25 — *Hemidromodes sabulifera hessa* Prt., green form, ♂ ; 26 — *Hierochthonia semitaria* Pglr., ♂ (holotype).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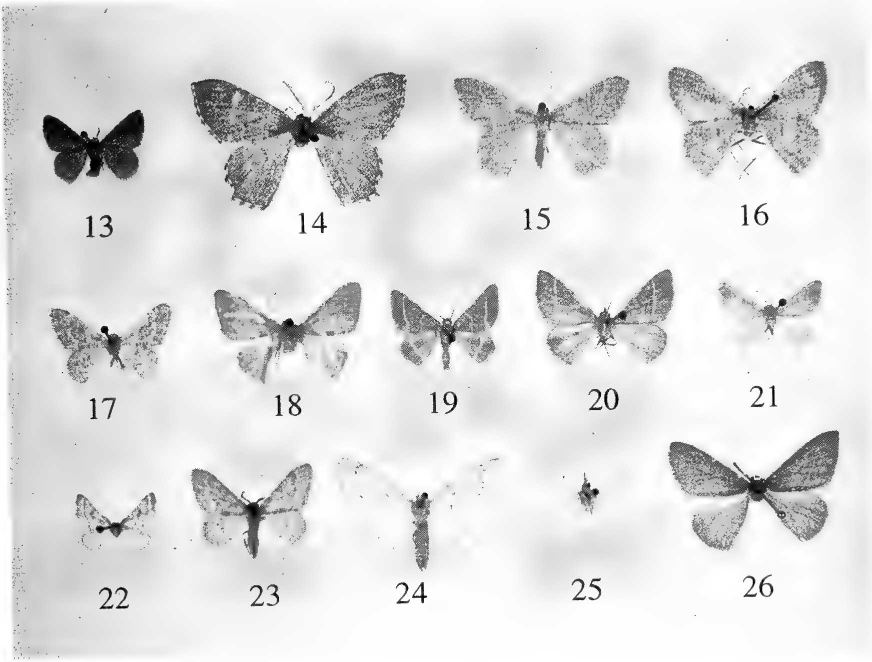
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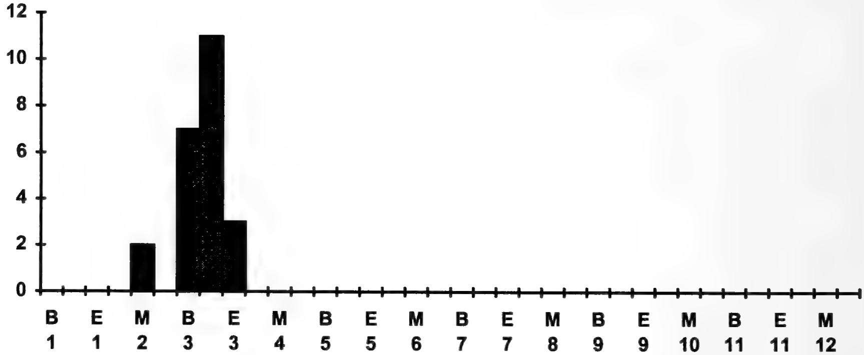


Fig. 27. *Myinodes shohami* : phenology in N. Israel ; n = 23.

PHENOLOGY (Fig. 27). Univoltine M2-E3, one specimen in "January". Larval development probably in April-May (no authentic data available). ♀-ratio at light rather low (9%). Not protandrous.

RED LIST CATEGORY. Not threatened.

REMARKS. For some closely related Mediterranean species see Hausmann (1994).

Geometrinae

Pseudoterpnini Warren, 1893

Pseudoterpna coronillaria halperini Hausmann, 1996

Pseudoterpna coronillaria Hb. : Kalchberg, 1897 : 179.
Pseudoterpna coronillaria Hb. : Amsel, 1933 : 107.

MATERIAL EXAMINED. 44 specimens : **1a** : Mt. Meron (CI : 1) ; Shetula (LI : 2). — **1b** : Sede Nehamya (CI : 12) ; Banyas (LI : 4). — **2** : Nahal Ammud (LI : 10). — **3** : Haifa (CI : 2 ; ZMK : 1 ; Ka). — **4a** : Nahal Bezet (LI : 1) ; Nahal Keziv (LI : 6). — **7a** : N. Lake Kinneret (LI : 1). — **11** : Jerusalem (LI : 1). — **18** : (Qibbuz) Senir (LI : 3).

DISTRIBUTION PATTERN (Map 2). MED, distribution of species disjunct ; subspecies endemic, constituting a "MEE-complex" with the closely related ssp. *axillaria* Guenée, 1857 from Lebanon. This complex is geographically quite isolated from the other populations of *Pseudoterpna coronillaria*. In Israel restricted to the Mediterranean Zone in the North and some higher and rather isolated localities in the Judean Mountains (C. Israel). Typical *P. c. halperini* in the Mt. Hermon area. Genital morphology of northwestern populations slightly different (Hausmann, 1996a).

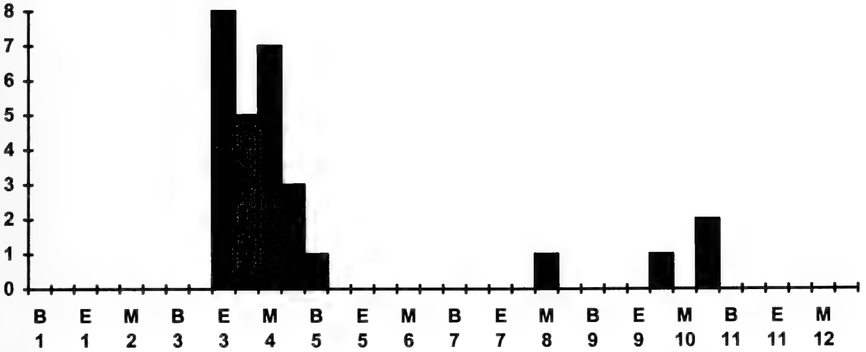


Fig. 28. *Pseudoterpna coronillaria halperini* : phenology in N. Israel ; n = 28.

ECOLOGY. From – 200 up to 1000 m with preference for ca. 200-500 m. Species of the shrubland Mediterranean. In Israel presumably K-strategy. Larval foodplants in Israel probably *Gonocytisus pterocladus* in Upper Galilee (FP2 : 47) and *Genista fasselata* on Mt. Carmel and its adjacent coastal hills (FP2 : 46). *P. c. coronillaria* (in S. Europe) feeds on *Ulex*, *Genista* and *Cytisus* (Culot, 1919 : 8 ; Rebel, 1903 : 2).

PHENOLOGY (Fig. 28). E3-E4 ; M8-E10 ; exceptionally B5 (Haifa, one specimen), M6 (Jerusalem, one specimen). Second generation not fully developed, only single specimens, which emerge as small "hunger-forms". In Cyprus from April to May (Wiltshire, 1948 : 82). One male recorded from Jordan (Hausmann, 1991 : 115) in M6. In the Lebanon (*P. c. axillaria*) however regularly "from June to December" (Ellison & Wiltshire, 1939 : 43) ! ♀-ratio at light low (12%). Not protandrous.

RED LIST CATEGORY. Not threatened.

REMARKS. Specimens from Jerusalem and Nahal Ammud genitalically (♂♀) corresponding well to the type series of *P. c. halperini*. Two specimens from E10 (Nahal Ammud) with forewing length of 12 mm only ; length of antennal branches (♂) 0.35 mm only (twice width of flagellum at same point).

"Pseudoterpna pruinata Hufn.", erroneously mentioned by Bodenheimer (1937 : 86) as occurring in Israel, has not been recorded from there and has to be deleted from the list.

Holoterpna pruinosata **(Staudinger, 1898)**

Eucrostis (?) *pruinosata* Stgr. : Staudinger, 1898 : 303.
Holoterpna pruinosata Stgr. : Amsel, 1933 : 107.

Holoterpna pruinosata Stgr. : Amsel, 1935 : 240.
Holoterpna pruinosata Stgr. : de Bros, 1993 : 95.

Material examined. 30 specimens : **1a** : Mapal Ha Tanur (IC : 1). — **1b** : Hula Reserve (LI : 2) ; Sede Nehamya (IC : 10). — **2** : Nahal Ammud (LI : 10) ; Gazith (IC : 1). — **5** : Megiddo (IC : 1). — **6a** : Daliyya (IC : 1). — **9a** : Ashqelon (de Bros 1993 : 1 ♀). — **11** : Jerusalem (IC : 2 ; St : c ; MNHU : 2 — types) ; Qiryat Anavim (Am : 1) ; En Kerem (Am : 1).

Distribution pattern (Map 3). Typical Levantine species (MEE, 13*, occurrence in NE. Italy anthropogenous, probably introduced by ship). Within Israel restricted to the mediterranean influenced North and the eastern part of C. Israel. Absent from the South, the Dead Sea area and the Lower Jordan Valley. Outside Israel known from the Lebanon.

Ecology. From 0 up to 700 m. Species of open grassland. Intermediate strategy? Oviposition on *Ferulago galbanifera* (Umbelliferae) in NE. Italy (Rebel, 1924 : 6), larva "feeding on its flowers". According to Staudinger (1898 : 303 ; data from Israel) caterpillars "lived on *Foeniculum* sp." (Umbelliferae). In Israel, *Foeniculum vulgare* is common all over the Northern and Central parts including the Dead Sea area (FP2 : 440) ; *Ferulago syriaca* is uncommon in Upper Galilee, Mt. Carmel and the Judean Mts. (FP2 : 432).

Phenology. B4-B6 ; B8-B11. In August only single specimens. In Israel apparently bivoltine ! First generation in the mountains somewhat later (E4-B6) than at lower level ; second generation earlier. Lebanese records from July and September (Ellison & Wiltshire, 1939 : 43). Larva in July, pupa overwinters, sometimes twice (NE. Italy ; Rebel, 1924 : 6). ♀-ratio at light 50%. Not protandrous.

Red List category. R. In the last thirty years recorded from only three localities.

Aplasta ononaria (Fuessly, 1783)

Aplasta ononaria Fuesl. var. *faecataria* Hb. : Kalchberg, 1897 : 182.
Aplasta ononaria Fuesl. : Amsel, 1933 : 107.

Material examined. 51 specimens : **1a** : Nahal Iyon (LI : 12). — **1b** : Banyas (LI : 2) ; Tel Dan (LI : 1) ; Hula Reserve (LI : 17) ; Sede Nehamya (IC : 13) ; Lahavot Ha-Bashan (IC : 1). — **2** : Nahal Ammud (LI : 1). — **3** : Haifa (Ka : not rare). — **7a** : Jordan Park (LI : 1) ; Buteiha (LI : 2). — **19** : Hermon (IC : 1).

Distribution pattern (Map 4). EUR, 2, 4, 14. In Israel restricted exclusively to the Mediterranean Zone of the North. Possibly there are two taxonomic entities : "f. *faecataria*" until now being the only form in the Mt. Hermon area, while e.g. in Nahal Iyon only "f. *berytaria*" has been recorded. Both forms fly sympatrically in the Hula Valley. The solution of this problem must await more extensive material and rearing data becoming available. Compare taxonomical and morphological notes in Hausmann (1996a).

ECOLOGY. From – 200 up to ca. 1000 m. Species of Mediterranean scrubland, hygrophilous according to Dannehl (1927 : 403 : "reproduction in wet localities", N. Italy). According to Koçak & Seven (1993 : 119) associated with "Artemisietea fragrantis anatolica", i.e. areas of tamarisk plants in Artemisietum fragrantis, according to Chapelon (1992 : 453) xerophilous on Festuco-Brometea. K-strategy. In Europe according to Rebel (1903 : 2), Culot (1919 : 6) and Leipnitz (field observation ; pers. comm.) larva monophagous on *Ononis spinosa* and appearing in April and July, according to Rebel (*l.c.*) May and E6. Wiltshire (1957 : 100) mentions only the generic name "*Ononis*" as foodplant in Iraq. In Israel 15 species of *Ononis* occur, but not *O. spinosa* (FP2 : 113f.). Perhaps oligophagous on various species of the genus. According to Chapelon (*l.c.*) also on *Genista* (France).

PHENOLOGY (Figs. 29, 30). Dark forms (f. *berytaria*) M4-E5, pale forms (f. *faecataria* : 2nd and 3rd generation) B6-B9. 1 ♂ (B5) from Buteiha rather pale and small (therefore considered here as f. *faecataria*) ; however postmedian line distinct, forewing termen rounded, base of hindwings with many dark scales. 1 ♀ from the same locality (E4) somewhat similar, but much darker, therefore considered here as f. *berytaria*. In the Lebanon according to Ellison & Wiltshire (1939 : 43) dark specimens E3-B6, the pale ones usually B6-E7, but even in August and April. ♀-ratio at light 28%. Not protandrous.

RED LIST CATEGORY. Not threatened.

REMARKS. More extensive material and rearings are necessary to clear up the status of the various "forms". Preliminarily they have to be considered seasonal forms.

Comibaenini Inoue, 1961

***Microbaena pulchra* (Staudinger, 1897)**

Phorodesma pulchra Stgr. : Staudinger, 1898 : 302.
Euchloris pulchra Stgr. : Amsel, 1933 : 107.
Comibaena (*Euchloris* Hb.) *pulchra* Stgr. : Amsel, 1935 : 240.

MATERIAL EXAMINED. 1 specimen : **11** : Jerusalem (MNHU : holotype). — **13a** : En Qelet near Jericho ("Georgskloster" Am : 1)

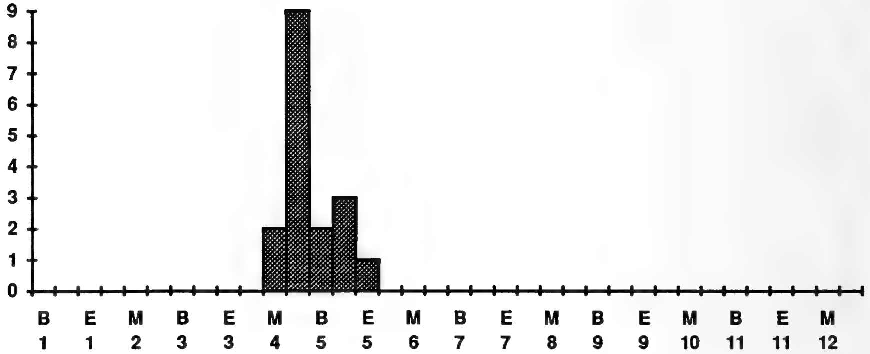


Fig. 29. *Aplasta ononaria* f. *berytaria* : phenology in N. Israel ; n = 17.

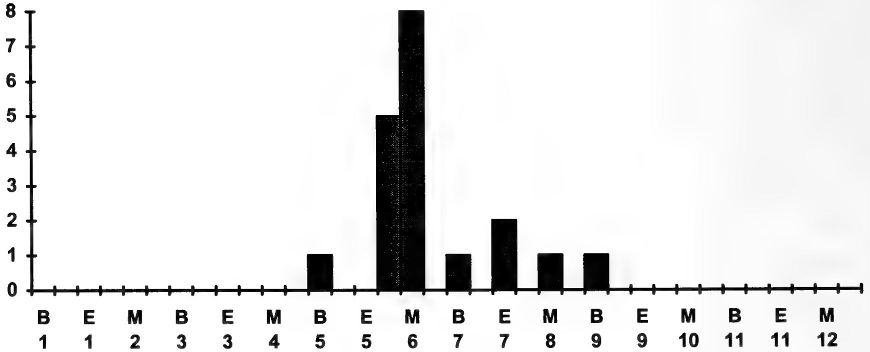


Fig. 30. *Aplasta ononaria* f. *faecataria* : phenology in N. Israel ; n = 19.

Distribution pattern (Map 5). Species AWA ; nominate subspecies endemic to Israel (or "ARA"). There are some doubts concerning the type locality, though the holotype bears the label "Jerusalem" : Staudinger (1898 : 302) notices, that the specimen has been caught at "Jerusalem (perhaps near Jaffa?)". The locality Jaffa (9a : Tel Aviv) would match better the ecological character of the other locality near Jericho. The species occurs (in another subspecies) also in the South of the Arabian Peninsula and in E. and C. Africa. The occurrence of an "AWA-element" near Jerusalem sounds quite improbable.

Ecology. Ecological niche, strategy and larval foodplant unknown.

Phenology. E5 (Amsel, 1935 : 240). In Saudi Arabia E2 (Wiltshire, 1990 : 108).

Red List category. Ex. Last record 1930 (Amsel, *l.c.*).

***Proteuchloris neriaria* (Herrich-Schäffer, 1852)**

Phorodesma neriaria : Staudinger, 1898 : 303.
Euchloris neriaria H.S. : Amsel, 1933 : 107.

MATERIAL EXAMINED. 77 specimens :**1b** : Banyas (LI : 2) ; Tel Dan (LI : 10) ; Hula Reserve (LI : 38) ; Sede Nehamya (IC : 14). — **4a** : En Afeq (LI : 1). — **7a** : Jordan Park (LI : 4) ; N. Yan Kinneret (LI : 3). — **7b** : Nahal Tavor (LI : 3). — **9a** : Miqve Israel (IC : 1). — **?** : Termoq (IC : 1 ; — Yarmuk, **7a**?).

DISTRIBUTION PATTERN (Map 6). MEE, 2. In Israel almost exclusively restricted to the Mediterranean Zone in the North. In C. Israel (coastal area) only isolated relict populations.

ECOLOGY. From – 230 up to 400 m. Probably this species is closely associated with (Tavor-)oak communities. K-strategy? *P. neriaria* from Bulgaria reared without problems on oak leaves (*Quercus* sp. ; pers. comm. by Müller and Gelbrecht, Berlin). In Israel there is one oak species with a distribution matching well that of *P. neriaria*, which is the deciduous Tavor oak, *Quercus* (*Cerris*) *ithaburensis*. Presumably this is the only foodplant of *P. neriaria* in Israel.

PHENOLOGY (Fig. 31). M3-E5 ; E5-B8 ; B9-E10. First and second generation overlapping. Specimens from M3-E5 mainly in the Hula Reserve, E5-B8 at Tel Dan, but belonging to two different generations as demonstrated by their different external appearance : first generation larger, yellowish green instead of deep green. In the Lebanon E5 ; June-September (Ellison & Wiltshire, 1939 : 43). ♀-ratio at light 19%. Not protandrous.

RED LIST CATEGORY. Not threatened.

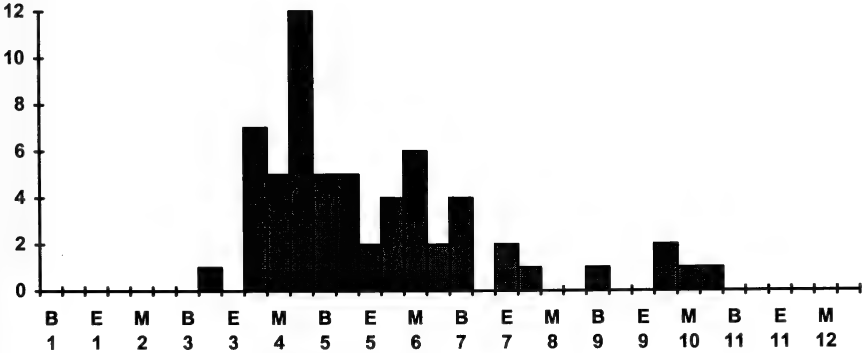


Fig. 31. *Proteuchloris neriaria* : phenology in N. Israel ; n = 61.

Hemistolini Inoue, 1961

Xenochlorodes olympiaria cremonaria (Staudinger, 1897)

Eucrostis olympiaria HS. var. *beryllaria* Stgr. : Kalchberg, 1897 : 179.
Eucrostis olympiaria HS. var.? *cremonaria* Stgr. : Staudinger in Kalchberg, 1897 : 179.
Eucrostes olympiaria H.S. : Amsel, 1933 : 107.
Eucrostes beryllaria Mann : Amsel, 1933 : 107.
Xenochlorodes (*Eucrostes* Hb.) *olympiaria* Mann : Amsel, 1935 : 240.
Xenochlorodes sp. : Halperin & Sauter, 1992 : 242.

MATERIAL EXAMINED. 13 specimens : **1b** : Hula Reserve (LI : 1) ; Sede Nehamya (IC : 1). — **3** : Haifa (IC : 2 ; ZSM : 2 ; Ka : 5). — **7a** : En Sheva ("Tabgha" Am : 2) ; Deganya (IC : 1). — **11** : Jerusalem (IC : 1 ; ZSM : 1 ; ZMK : 1 ; MNHU : syntype ; Ka : 6) ; Qiryat Anavim (Am : 2) ; Shefela, Avi'ezer (H&S). — **13a** : "Jericho" (Am : 1).

DISTRIBUTION PATTERN (Map 7). Species MED, subspecies with typical Levantine distribution (MEE). In Israel in local populations restricted to the Mediterranean Zone and the Lake Kinneret area. Southern border perhaps as described for *Phaiogramma pulmentaria* (see below). Recorded from Jericho "without date" by Amsel (1935 : 240), quite doubtful.

ECOLOGY. From – 210 up to 800 m. Typical species of Mediterranean scrubland. Intermediate strategy? Larva according to Millière (1864 : 268 ; S. Italy) and Rebel (1903 : 4) feeding on *Phillyrea angustifolia* and (suboptimally) *P. media*, "probably in two generations" (Rebel, *l.c.*). According to Halperin & Sauter (1992 : 118) also found on *Phillyrea* (Oleaceae) in Israel. The larva found on *Rhamnus lycioides graeca* (foliage) presumably belongs to this species (Halperin & Sauter, *l.c.* : 242). In Israel the genus *Phillyrea* is represented by one species only, *P. latifolia* (incl. *media* ; FP5 : 15), which is distributed in the Mediterranean influenced area (cf. description of distribution of *Phaiogramma pulmentaria*). *Rhamnus palaestinus* (incl. ssp. *graecus*), one of the four *Rhamnus* species in Israel, shows a similar distribution pattern (FP2 : 305). Rearing is easy with *Ligustrum* (Leipnitz, pers. comm.)

PHENOLOGY. E5-E6. In Amsel (1935) also recorded in the decades M3 and E4-A5. Univoltine in the Levant? In S. Europe usually bivoltine emerging until August-September. Lebanon records from June-July (Ellison & Wiltshire, 1939 : 43). ♀-ratio at light 40%.

RED LIST CATEGORY. E. Only three specimens caught in the last 60 years.

Victoria plantei Herbulot, 1976

Victoria plantei n.sp. : Herbulot, 1976 : 290.
Victoria plantei Herbulot : Hausmann, 1993 : 53.

MATERIAL EXAMINED. 5 specimens :**13b** : Sodom (Coll. Herbulot : 4 — type series) ; En Gedi (LI : 4).

DISTRIBUTION PATTERN (Map 8). Endemic oasis species apparently restricted to the Dead Sea area.

ECOLOGY. Xerothermophilous species of wadis and oases with *Acacia*-communities. Isolated occurrence (absent e.g. at Neot Hakkikar) and foodplant specialization probably indicating K-strategy. Larval foodplant presumably as in the following species (see below).

PHENOLOGY. Apparently univoltine E3-B6. Emergence protandrous (cf. Hausmann, 1993 : 54).

RED LIST CATEGORY. E. Rare in isolated habitats. Probably threatened through loss of habitats by desertification and water diversion projects.

REMARKS. Springtime specimens from Yotvata (S. Israel) genitalically similar to *V. plantei.* See remarks under following species.

Victoria eremita Hausmann, 1993

Victoria eremita sp. nov. : Hausmann, 1993 : 55.

MATERIAL EXAMINED. 707 specimens : **14** : Yotvata (LI : 706). — **16c** : Nahal Raham (IC : 1)

DISTRIBUTION PATTERN (Map 9). Endemic oasis species (as far as known until now). Possibly more widely distributed in southern Arava Valley, Negev or Sinai.

ECOLOGY. Xerothermophilous species of wadis and oases with *Acacia*-communities. Isolated occurrence and foodplant specialization probably indicating K-strategy. Larva has been found on the epiphytic plant *Loranthus acaciae* (Hausmann, 1993 : 57). This plant occurs as a parasite on various trees and shrubs (mostly on *Acacia* and *Ziziphus*) in the Judean Desert, N. Negev, Lower Jordan Valley, Dead Sea area and in the Arava Valley (FP1 : 46).

PHENOLOGY (Fig. 32). M2-E4 (rare) ; E5-B12 (common). Perhaps flying in 4-5 univoltine units (cf. Hausmann, 1993 : 58). ♀-ratio in light traps very low (3%). Emergence protandrous (Hausmann, *l.c.*).

RED LIST CATEGORY. Not threatened.

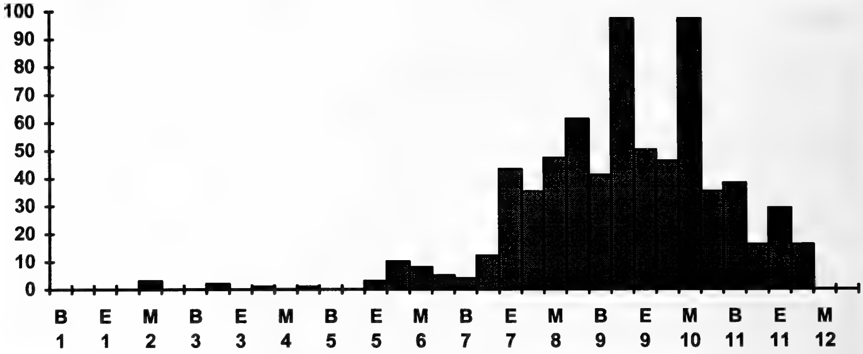


Fig. 32. *Victoria eremita* : phenology at Yotvata, S. Israel ; n = 700.

REMARKS. Some recently examined males from M2, M3 and April genitalically resemble *V. plantei.* More information (rearings) is necessary to decide whether they are conspecific with *V. eremita* or with *V. plantei.*

Comostolini Inoue, 1961

***Eucrostes indigenata* (de Villers, 1789)**

Eucrostis indigenata Vill. : Kalchberg, 1897 : 180.
Eucrostes indigenata Vill. : Amsel, 1933 : 107.
Eucrostes indigenata Vill. : Amsel, 1935 : 240.

MATERIAL EXAMINED. 9 specimens : **1b** : Hula Reserve (LI : 2 ♂♀) ; Sede Nehamya (IC : 5). — **3** : Haifa (Ka). — **11 :** Jerusalem (IC : 1 ♀ ; MNHU : 1 ♀) ; En Kerem (Am : 1).

DISTRIBUTION PATTERN (Map 10). MED ; constituting an "AFM-complex" with the near ally *Eucrostes disparata* Walker, 1861. In Israel ranging nearly all over the country, but in small, local populations. Absent in the Dead Sea area. According to Amsel (1933) evenly recorded over eremic areas. Compare the occurrence at Aqaba, S. Jordan, 5 km E. of Elat (Hausmann, 1991 : 118). Distribution area perhaps disjunct and divided into one eremic part in the extreme South (with taxonomic affinities to *E. disparata* ?) and a second area in the Mediterranean influenced parts of C. and N. Israel (preference for hills). Possibly a parallel to the species pair *Microloxia herbaria / ruficornis* (Mediterranean / Paleotropical).

ECOLOGY. From 0 up to 800 m. Found in various habitats where its foodplants occur ; diversity of habitats perhaps caused by disjunct populations with different niche-specialization. Larva feeding "auf

Euphorbia-Arten" (Rebel, 1903 : 4 ; Culot, 1919 : 13 ; Halperin & Sauter, 1992 : 114), according to Prout (1913 : 33) mainly *E. spinosa.* In Israel 34 species of *Euphorbia* occur, but not *E. spinosa* (FP1 : 269ff.). Many of these are locally distributed. In Israel the southern and the northern populations of "*Eucrostes indigenata*" are probably associated with different species of *Euphorbia.*

PHENOLOGY. Bivoltine E4-E6 (mainly B6-E6) ; M10-E10. Protandrous emergence according to the few available data. In the Lebanon recorded in June, July and October (Ellison & Wiltshire, 1939 : 43).

RED LIST CATEGORY. V.

Thalerini Herbulot, 1963

Culpinia prouti **(Thierry-Mieg, 1913)**

New for the Fauna of Israel.

MATERIAL EXAMINED. 2 specimens : **3** : Haifa, Mt. Carmel (IC : 1 ♀). — **11** : En Kerem (IC : 1 ♂).

DISTRIBUTION PATTERN (Map 11). Typical Levantine distribution (MEE). In Israel restricted to middle altitudes of the Mediterranean Zone.

ECOLOGY. From 300 (? — Carmel) up to 800 m. Ecological niche, strategy and larval foodplant unknown.

PHENOLOGY. B5 (Carmel ; only one date available). Probably univoltine.

RED LIST CATEGORY. Ex. Last record probably 1955 (labels incomplete).

Hemitheini Inoue, 1961

Phaiogramma pulmentaria **(Guenée, 1857)**

Nemoria pulmentaria Gn. : Kalchberg, 1897 : 180.
Nemorla (sic !) *pulmentaria* Gn. var. *palaestinensis* : Fuchs, 1903 : 51.
Nemoria pulmentaria Gu. : Amsel, 1933 : 107.
Chlorissa (*Nemoria* Hb.) *pulmentaria palästinensis* (sic !) Fuchs : Amsel, 1935 : 240.
Chlorissa pulmentaria Guenée : Hausmann, 1991 : 116.

MATERIAL EXAMINED. 93 specimens : **1a** : Nahal Iyon (LI : 3) ; Metulla (IC : 1) ; Shetula (LI : 2) ; Meron Village (LI : 1). — **1b** : Banyas (LI : 4) ; Sede Nehamya (IC : 9) ; Hula Reserve (LI : 19). — **2** : Nahal Ammud (LI : 7) ; Arbel (LI : 6) ; Oranim (IC : 1). — **4a** : Nahal Keziv (LI : 1) ; En Afeq (LI : 8). — **7a** : Jordan Park (LI : 6) ; N. Yam Kinneret (LI : 8) ; En Sheva

("Tabgha" Am : 1). — **7b** : Nahal Tavor (LI : 10). — **8** : Tulkarm (Ha : 1). — **9a** : Rehovot (IC : 1) ; Tel Aviv (IC : 1). — **11** : Jerusalem (LI : 2 ; Fuchs : 20 specimens) ; Qiryat-Anavim (Am : 1). — **15** : Gilat (LI : 1). — **18** : Senir Qibbuz (LI : 1).

DISTRIBUTION PATTERN (Map 12). TUM. In Israel typical Mediterranean distribution pattern : common in N. Israel, less common and perhaps in isolated populations in C. Israel down to the semicircular boundary line Jerusalem-Hebron-Beersheva-Gaza between the Eremic and the Mediterranean Zone. Range of *P. pulmentaria* in Israel almost entirely coinciding with areas with an annual rainfall over 300 mm. Absent from the lower Jordan Valley, the Dead Sea area and the South.

ECOLOGY. From – 230 up to 800 m. Species of open grassland, sometimes becoming abundant everywhere. R-strategy. Larva polyphagous : authors usually note various species of Umbelliferae such as "*Peucedanum*, *Bupleurum*, *Foeniculum*, *Seseli*, *Anthriscus*" etc. as larval foodplants (Dantart, 1990 : 168 ; Forster & Wohlfahrt, 1981 : 12 ; Rebel, 1903 : 4 ; etc.). The author reared the species on *Taraxacum* without any problems (S. Italy) ; according to Wiltshire (1957 : 101) "on *Althaea* (Malvaceae) and other herbs" (Iraq) ; the larva was found on *Paliurus* in S. Dalmatia (Schwingenschuss & Wagner, 1926 : 78) ; Dantart (*l.c.*) cites an old (and doubtful?) mention from N. Spain "*Clematis vitalba*, *Quercus ilex*, *Rosmarinus officinalis*". Suitable foodplants occur all over N. and C. Israel.

PHENOLOGY (Fig. 33). E3-E6 ; M8-B9 ; B10-M10. Probably plurivoltine, but only the first generation seems to be fully developed. First generation in the mountains later (B5-E6). ♀-ratio at light low, 13%. Not protandrous.

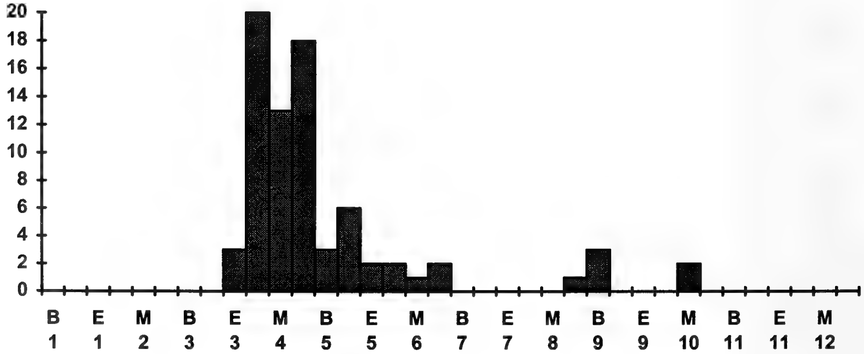


Fig. 33. *Phaiogramma pulmentaria* : phenology in N. Israel ; n = 76.

Red List category. Not threatened.

Remarks. With regard to some erroneous determinations in Amsel (1935) see remarks under *Phaiogramma faustinata*.

Phaiogramma faustinata **(Millière, 1868)**

Nemoria faustinata Mill. : Amsel, 1933 : 107.
Chlorissa faustinata Millière : Hausmann, 1991 : 116.
Chlorissa faustinata Mill. : Halperin & Sauter, 1992 : 141.
Chlorissa faustinata Mill. : de Bros, 1993 : 90.

Material examined. 300 specimens : **1a** : Nahal Iyon (LI : 2). — **1b** : Hula Reserve (LI : 187) ; Sede Nehamya (IC : 2). — **2** : Nahal Ammud (LI : 6) ; Hartuf (IC : 2) ; Ein Hoab (IC : 1) — **3** : Haifa (IC : 3). — **5** : Yitzre'el (IC : 1). — **6d** : Nahal Tirza (LI : 2). — **7a** : Jordan Park (LI : 6) ; N. Yam Kinneret (LI : 2) ; Hamat Tiberias (de Bros). — **7b** : Nahal Tavor (LI : 8) ; Tirat Zevi (LI : 2). — **8** : Herzliyya (de Bros) ; Nof Yam (IC : 3) "Coastal plain" (H&S). — **9a** : Ashqelon (IC : 1 ; de Bros) ; Tel Aviv (IC : 4) ; Yesodot (IC : 2) ; Ad Halom Bridge (IC : 1). — **10** : Tarum (IC : 2) ; Emeq Ha'Ela Road (IC : 2). — **13a** : Jericho (Ha : 9 ; Coll. Sommerer : 1 ; (=) Am "*C. pulmentaria*" : 3) ; En Qelet ("Georgskloster, *C. pulmentaria*" Am : 1) ; Allenby-Bridge ("*C. pulmentaria*" Am : 1). — **13b** : N. Dead Sea (Ha : 1 ; LI : 1) ; Enot Zuqim (LI : 1) ; Enot Qane (LI : 3) ; En Gedi (LI : 28 ; IC : 1) ; Nahal Arugot (LI : 1) ; Neot Hakikkar (LI : 6). — **14** : Yotvata (LI : 1) ; Arava Valley (H&S). — **15** : Gilat (LI : 6) ; Negev (IC : 2).

Distribution pattern (Map 13). AIM. Distributed almost all over the country, but somewhat unevenly : absent from the mountains ; rare in S. Israel, perhaps taxonomically different (cf. Hausmann, 1996a).

Ecology. From – 400 up to 200 m, exceptionally to 600 m (Nahal Iyon). Thermophilous and ubiquitous in lower-lying areas, usually limited by the isotherm of an annual mean temperature of (at least) 19°C. R-strategy. Very polyphagous : according to Rebel (1903 : 4) and Culot (1919 : 17) larva feeds on *Rosmarinus officinalis* ; according to Leipnitz (pers. comm.) not accepting *Rosmarinus*, but larvae found on flowers of *Ononis* sp., reared on *Daucus carota* ; in N. Africa on *Rhus oxyacantha* (under the name "*Microloxia rhoisaria*" in Prout, 1915 : 415) ; in Nubia and Egypt on *Acacia nilotica* (Fletcher, 1963 ; Andres & Seitz, 1924) ; in Egypt and Israel on *Acacia* sp. (Wiltshire, 1949 : 399f. ; Wiltshire, 1990 : 110 ; Halperin & Sauter, 1992 : 107) ; further foodplants in Israel *Crotalaria* (Fabaceae), *Inula* (Asteraceae), *Prosopis* (Mimosaceae) (Halperin & Sauter, 1992 : 113-121, 141) ; in Morocco larvae found on *Foeniculum dulce*, *Linum grandiflorum* and *Schinus terebinthifolius* (Rungs, 1981 : 225). Its (conspecific?) African ally *P. stibolepida* Butler occurs in Nigeria as a pest species on cotton (Zhang, 1994 : 132). It is possible that one day *P. faustinata* will be found as a pest species on cotton in Israel.

PHENOLOGY (Figs. 34, 35). Plurivoltine species, occurring in all months of the year, mainly M10-M12. Seasonal appearance in N. Israel complementary to that of *P. pulmentaria*. ♀-ratio at light rather low, 9% (e.g. Hula Reserve 5% only).

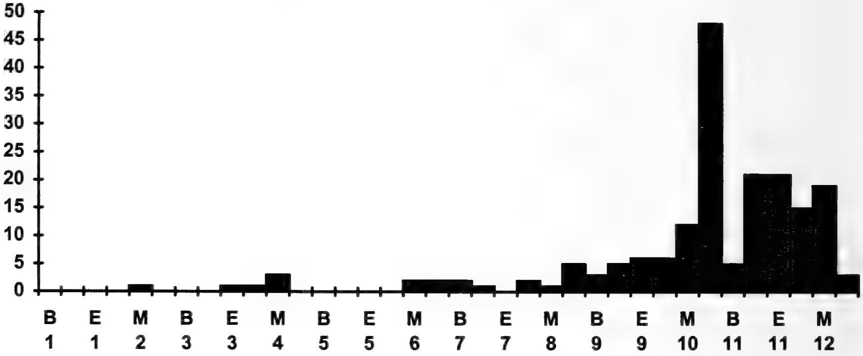


Fig. 34. *Phaiogramma faustinata* : phenology in the Hula Reserve, N. Israel ; n = 185.

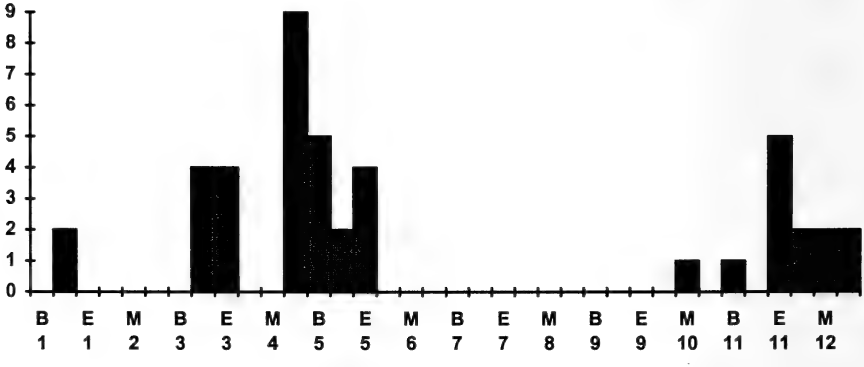


Fig. 35. *Phaiogramma faustinata* : phenology in the Dead Sea area, C. Israel ; n = 43.

RED LIST CATEGORY. Not threatened.

REMARKS. One original specimen leg. Amsel from Jericho (31.5.1930), identified and published as "*Chlorissa* (*Nemoria* Hb.) *pulmentaria palästinensis* Fuchs", has been examined by the author. Its true identity is *Phaiogramma faustinata*. Since no record of *P. pulmentaria* from the Lower Jordan Valley is yet known, preliminarily all the records from there (Amsel) have to be regarded as applying to *P. faustinata*. Genitalia of one ♂ examined from Gilat with three fields of aedeagal cornuti, as in specimens from N. and C. Israel (cf. Hausmann, 1996a).

Neromia pulvereisparsa jodisata Staudinger, 1898

Nemoria ? (*Neromia*) *jodisata* Stgr. : Staudinger, 1898 : 304.
Neromia jodisata Stgr. : Amsel, 1933 : 107.
Neromia pulvereisparsa Hmps. (=*jodisata* Stgr.) : Amsel, 1935 : 240.
Neromia pulvereisparsa Hampson : Halperin & Sauter, 1992 : 142.

MATERIAL EXAMINED. 297 specimens : **12** : "Judean Desert" (H&S). — **13a** : Jericho (LI : 2 ; Am : not rare) ; En Qelet ("Georgskloster" Am : not rare) ; Jordan Valley (St : 3). — **13b** : N. Dead Sea (LI : 3) ; Dead Sea environs (H&S) ; Enot Zuqim (LI : 9) ; Enot Qane (LI : 11) ; En Gedi (LI : 24 ; IC : 2) ; Nahal Arugot (LI : 1) ; Neot Hakikkar (LI : 31). — **14** : Yotvata (LI : 213) ; Arava Valley (H&S). — **15** : Gilat (LI : 1).

DISTRIBUTION PATTERN (Map 14). Species SAS ; subspecies "endemic" to Israel and Jordan ; populations from Egypt, Sudan and Libya (Tibesti) perhaps to be ascribed to *N. p. jodisata*. Typical distribution pattern of "eremic species" in Israel with centre in the Arava Valley. Northern distribution limit coinciding with the (desert-) isohyet of annual rainfall under 150 mm. Sinai : Bir Isla and El Arish, one specimen each (Wiltshire, 1949 : 400).

ECOLOGY. From – 400 up to 150 m. Desert moth, xerothermophilous and ubiquitous in the South. R-strategy. Polyphagous : foodplants according to Wiltshire (1949 : 400 ; 1990 : 110) "*Ochradenus* and probably other desert herbs" ; according to Andres & Seitz (1924) *Ochradenus baccatus* (Egypt) ; in Israel according to Halperin & Sauter (1992 : 115, 117) on foliage of *Gymnocarpos* (Caryophyllaceae) and *Ochradenus* (Resedaceae). Both foodplants *Gymnocarpos decandrum* and *Ochradenus baccatus* are the only species of their genus present in Israel. Their distribution patterns in Israel match exactly that of *Neromia pulvereisparsa* (FP1 : 130, 330).

PHENOLOGY (see Figs. 36, 37). Plurivoltine species, occurring in all months of the year ; in the Dead Sea area with peak of abundance in April, at Yotvata mainly B8-B12. ♀-ratio at light 21%.

RED LIST CATEGORY. Not threatened.

Kuchleria gisisi Hausmann, 1995

Kuchleria gisisi sp. nov. : Hausmann, 1995a : 588.

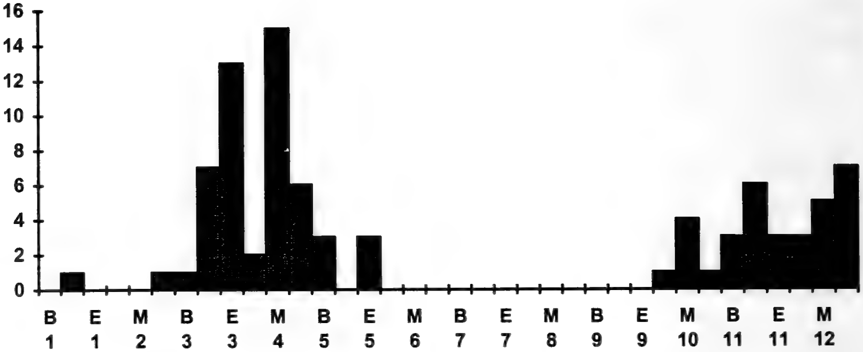


Fig. 36. *Neromia pulvereisparsa jodisata* : phenology in the Dead Sea area, C. Israel ; n = 85.

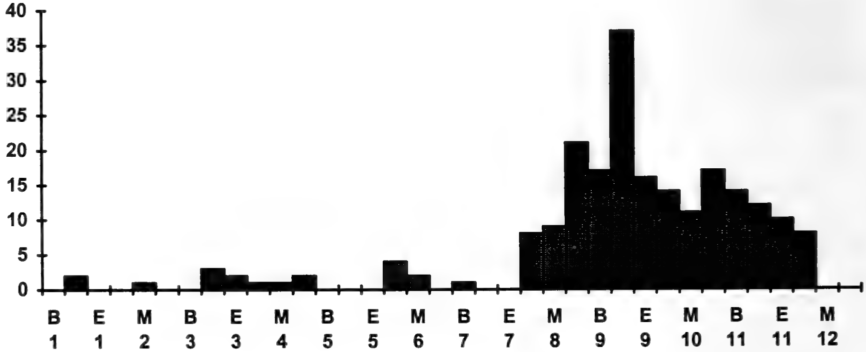


Fig. 37. *Neromia pulvereisparsa jodisata* : phenology at Yotvata, S. Israel ; n = 213.

Material examined. 2 specimens : **9a** : Tel Aviv (IC : ♂ holotype). — **11** : Qiryat Anavim (IC : ♀ paratype)

Distribution pattern (Map 15). Apparently an endemic species.

Ecology. From 0 up to 500 m. Ecological niche unknown. Probably K-strategy. Larva of the near ally *K. ephedrae* in Morocco found on *Ephedra nebrodensis* (Prout, 1935 : 16). Foodplant of *K. gisisi* very probably *Ephedra campylopoda*, which is distributed in the Acco Plain, Sharon Plain, Upper and Lower Galilee, Mt. Carmel, Esdraelon Plain, Samaria, Shefela and Judean Mts (FP1 : 23). Three further *Ephedra* species, occurring as desert plants in the southern parts of Israel, do not match the distribution pattern of *Kuchleria gisisi*.

PHENOLOGY. B3 (♀, paratype) ; M10 (♂, holotype). Apparently at least two generations ; ♂ from Tel Aviv rather small as often the case in autumnal generations.

RED LIST CATEGORY. Ex. Last catch 1961.

Microloxiini Hausmann, 1996

Microloxia herbaria (Hübner, [1813])

Eucrostis herbaria Hb. : Kalchberg, 1897 : 179.
Eucrostes herbaria Hb. : Amsel, 1933 : 107.
Microloxia (*Eucrostes* Hb.) *herbaria advolata* Ev. : Amsel, 1935 : 240.

MATERIAL EXAMINED. 21 specimens : **1a** : Nahal Iyon (LI : 6). — **1b** : Hula Reserve (LI : 3) ; Sede Nehamya (IC : 3). — **2** : Nahal Ammud (LI : 4). — **3** : Haifa (IC : 2 ; Ka). — **4a** : En Afeq (LI : 1). — **7a** : En Sheva ("Tabgha" Am : 1). — **7b** : "Hamdia" (Hamadya ; IC : 1). — **11** : En Kerem (Am : 1) ; Bethlehem (Coll. Sommerer : 1).

DISTRIBUTION PATTERN (Map 16). TUM ; constituting an AIM species complex with the near ally *Microloxia ruficornis* Warren, 1897. Local and small populations in N. Israel. One ♂ from Betlehem (11.VI.1931, leg. Amsel, coll. Sommerer) large, forewing length 8.5 mm, postmedian lines strongly marked as in N. Israeli *M. herbaria*, palpi ochraceous ; therefore it is ascribed to *M. herbaria* (cf. Hausmann, 1995a : 573). Occurrence in C. Israel however awaits verification with more extensive material. The actual known distribution resembles that of *Xenochlorodes olympiaria cremonaria* (see above) ; however the entire distribution in Israel will eventually prove similar to that of *Phaiogramma pulmentaria* (see above).

ECOLOGY. From – 210 up to 700 m. In the Mediterranean Zone in different habitats, mainly open grassland. Probably r-strategy (cf. *Microloxia ruficornis*). Larva on *Teucrium capitatum* (Rebel, 1903 : 4 ; Prout, 1913 : 26 ; S. Europe) ; in nature found near the coast on flowers of *Helichrysum* sp. (*stoechas* ? ; Leipnitz, pers. comm. ; S. Europe) ; rearing is possible on *Artemisia* sp. (Gelbrecht, pers. comm. ; S. Europe). Foodplant spectrum probably including many other plant species. In Israel distribution of *Helichrysum sanguineum* (here the only species of its genus) corresponds well to that of *Microloxia herbaria* (FP3 : 312). The genus *Teucrium* is represented by 11 species (not *T. capitatum*), most of these widely distributed in N. and C. Israel (FP3 : 101f.).

PHENOLOGY. M3-B4 ; B6 ; B8-M10. At Hamadya M5. Bivoltine or plurivoltine. ♀-ratio at light small (11%). Not protandrous according to the few available data.

RED LIST CATEGORY. R. Nowhere recorded abundantly.

Microloxia ruficornis Warren, 1897

Microloxia (*Eucrostes* Hb.) *herbaria advolata* Ev. : Amsel, 1935 : 240 (partim).
Microloxia herbaria Hübner : Hausmann, 1991 : 116.

MATERIAL EXAMINED. 152 specimens : **13a** : Jericho (LI : 3 ; Am : 3 ; Coll. Sommerer : 1) ; En Qelet ("Georgskloster" Am : 1). — **13b** : N. Dead Sea (Ha : 3) ; Enot Zuqim (LI : 15) ; Enot Qane (LI : 2) ; En Gedi (LI : 32) ; Nahal Arugot (LI : 5) ; En Boqeq ("Ein Bokek", ZMK : 1) ; Neot Hakikkar (LI : 16). — **14** : Yotvata (LI : 73). — **15** : Gilat (LI : 1).

DISTRIBUTION PATTERN (Map 17). AIM. In Israel shows typical pattern of an "eremic species" with centre of distribution in the Arava Valley. Distribution very similar to that of *N. pulvereisparsa.* Correlation with 150 mm isohyet, see remarks under *N. pulvereisparsa.* One ♂ from Gilat (LI) with typical features of *M. ruficornis* (see Hausmann, 1995a : 576). In specimens from the Sinai (Sta. Katherina monastery ; Wiltshire, 1949 : 403) wing pattern described as similar to *M. herbaria* ; to be verified.

ECOLOGY. From – 400 up to 150 m. Desert moth, xerothermophilous and ubiquitous in the South. Continuous distribution, continuous seasonal appearance, ♀ with many eggs indicating r-strategy. Larva of NW. African "*halimaria*" (synonym of *ruficornis*) on *Atriplex halimus* (Prout, 1913 : 26) ; in Lower Egypt bred on *Pluchea dioscoridis*, but determination of moth according to Wiltshire (1949 : 402) not completely certain. Distribution of *Atriplex halimus* in Israel matches well that of *Microloxia ruficornis*, 9 further species of *Atriplex* occur in Palestine (FP1 : 143f.). *Pluchea dioscoridis*, the only species of its genus in Israel, is distributed mainly in the South, but ranges northwards to the Upper Jordan Valley and the Golan (FP3 : 302).

PHENOLOGY (Figs. 38, 39). Plurivoltine species, occurring in all months of the year ; in the Dead Sea area with abundance peak in April ; at Yotvata one peak A6 (unusual for the locality), then common E7-E11. ♀-ratio at light 28%. Strongly protandrous in the Dead Sea area, ♀ mainly in May and December.

RED LIST CATEGORY. Not threatened.

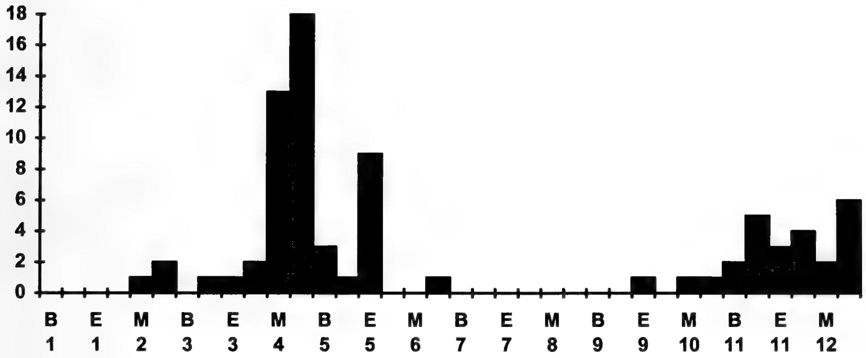


Fig. 38. *Microloxia ruficornis* : phenology in the Dead Sea area, C. Israel ; n = 77.

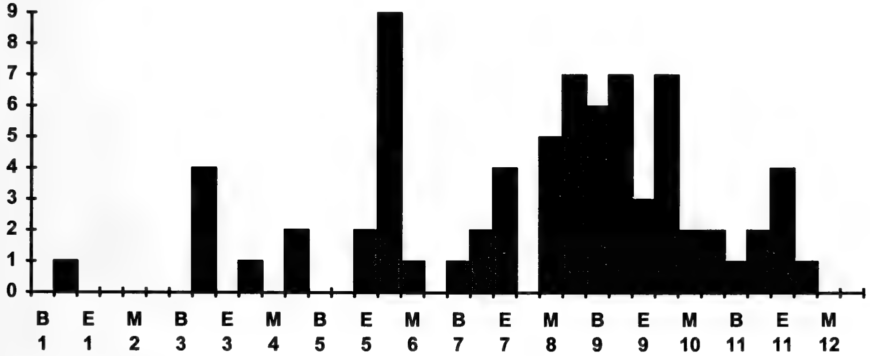


Fig. 39. *Microloxia ruficornis* : phenology at Yotvata, S. Israel ; n = 74.

Acidaliastis micra Hampson, 1896

New for the Fauna of Israel.

Material examined. 353 specimens : **1a** : Meron Village (LI : 1). — **13b** : Enot Zuqim (LI : 2) ; En Gedi (LI : 30) ; Neot Hakikkar (LI : 23). — **14** : Yotvata (LI : 296). — **15** : Gilat (LI : 1).

Distribution pattern (Map 18). SAA. In Israel shows typical pattern of an "eremic species" with centre of distribution in the southern parts of the Arava Valley. On warm nights with southerly winds single specimens wander up north without being able to reproduce there (e.g. 18.11.1988 : Meron Village ; cf. *Hemidromodes sabulifera hessa*). Occurs also in E. Sinai, Noucibat (Wiltshire, 1949 : 403) and S. Jordan, Aqaba (Hausmann, 1991 : 118).

Ecology. Successful at sites from – 400 up to 150 m. Desert moth, xerothermophilous and ubiquitous in the South. Continuous distribution, continuous seasonal appearance, ♀ with many eggs indicating r-strategy. Larval foodplant unknown.

Phenology (Figs. 40, 41). Plurivoltine species, occurring in nearly all months of the year (M2-E11) ; in the Dead Sea area mainly M3-M4, at Yotvata one peak E5/B6 (unusual for the locality), then common B8-M9. ♀-ratio at light comparatively high (42%). Protandrous in the Dead Sea area.

Red List category. Not threatened.

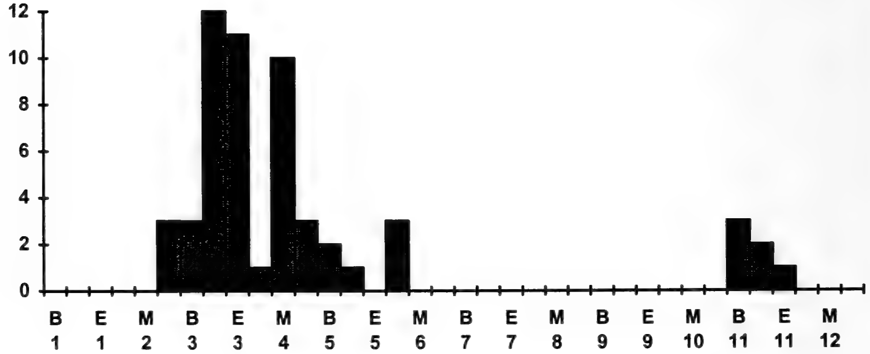


Fig. 40. *Acidaliastis micra* : phenology in the Dead Sea area, C. Israel ; n = 55.

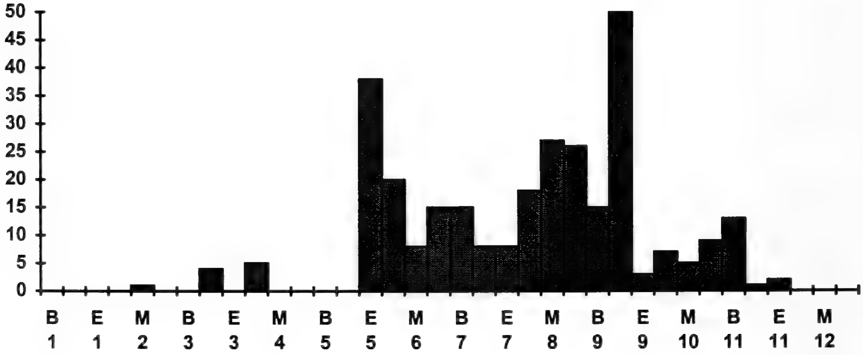


Fig. 41. *Acidaliastis micra* : phenology at Yotvata, S. Israel ; n = 298.

Hemidromodes sabulifera hessa Prout, 1935

New for the Fauna of Israel.

Hemidromodes sabulifera hessa subsp. n. : Prout, 1935 : 16 (locus typicus : Ghor el Safieh on the Jordan side of the border near Neot Hakikkar).

MATERIAL EXAMINED. 641 specimens : **1a** : Meron Village (LI : 1). — **1b** : Hula Reserve (LI : 2). — **13b** : N. Dead Sea (LI : 1) ; Enot Zuqim (LI : 9) ; En Gedi (LI : 150) ; Neot Hakikkar (LI : 65). — **14** : Yotvata (LI : 410). — **15** : Gilat (LI : 2).

DISTRIBUTION PATTERN (Map 19). Species ARS ; subspecies "endemic" to Israel and Jordan ; with centre of distribution in the Arava Valley. On warm nights with southerly winds single specimens wander up to the north probably without being able to reproduce there (e.g. 20.11.1988 : Meron Village ; cf. *Acidaliastis micra*). Northern breeding limit presumably in the Jordan Valley half way between the Dead Sea and Lake Kinneret ; cf. occurrence in the Lower Zerqa Valley, Jordan (Hausmann, 1991 : 116).

ECOLOGY. Successful at sites from – 400 up to 150 m. Desert moth, xerothermophilous and ubiquitous in the South. Continuous distribution, continuous seasonal appearance, ♀ with many eggs indicating r-strategy. Larval foodplant unknown.

PHENOLOGY (Figs. 42, 43). Plurivoltine species, occurring in nearly all months of the year (M2-E12) ; exceptionally high abundance peaks in the Dead Sea area M3 and E4, at Yotvata mainly E5-B11. ♀-ratio at light quite low (16%). Emergence strongly protandrous.

RED LIST CATEGORY. Not threatened.

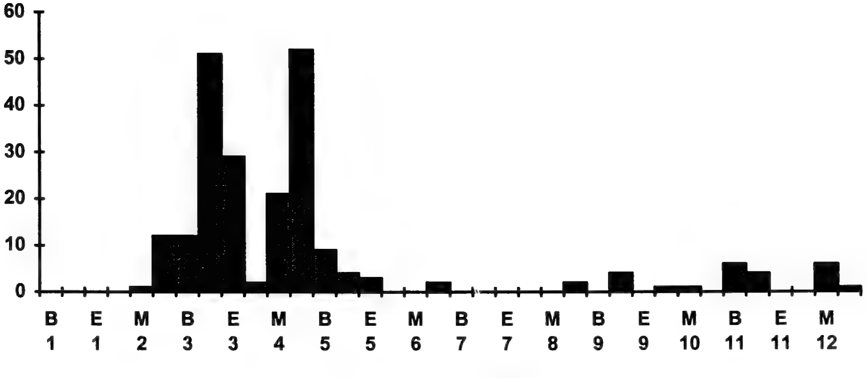


Fig. 42. *Hemidromodes sabulifera hessa* : phenology in the Dead Sea area, C. Israel ; n = 223.

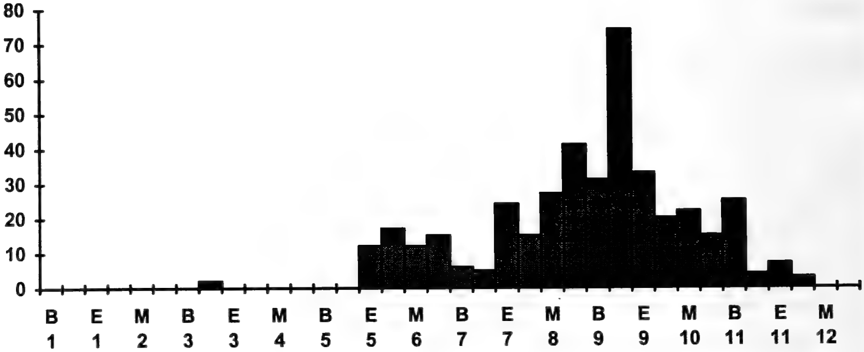


Fig. 43. *Hemidromodes sabulifera hessa* : phenology at Yotvata, S. Israel ; n = 410.

Hierochthonia semitaria (Püngeler, 1901)

Eucrostes semitaria sp. n. : Püngeler, 1901 : 333.
Eucrostes pulverata Warr. : Amsel, 1933 : 107.
Hierochthonia (*Eucrostes* Hb.) *pulverata* Warr. (=*semitaria* Püng.) : Amsel, 1935 : 240.

Material examined. 6 specimens : **3** : Carmel (IC : 1 ; Am : 1). — **11** : Jerusalem (LI : 1 ; IC : 2) ; En Kerem (Am : c). — **13a** : "Dead Sea" (MNHU : 2 types).

Distribution pattern (Map 20). Typical species of the Levant (MEE) ; in the Lebanon and S. Turkey replaced by the allopatric sister species *H. pulverata* (Warren, 1901). Except for the type locality in Israel and Jordan restricted to middle altitudes of the Mediterranean Zone. Type locality perhaps mislabelled ; in the original reference specified as "northern coast of the Dead Sea".

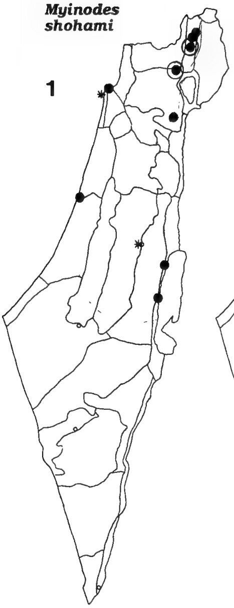
Ecology. Usually from 300 (? — Carmel) up to 800 m. Ecological niche, strategy and larval foodplant unknown.

Phenology. B4-M6. The few available data seem to indicate protandrous emergence. Flight period of the near ally *H. pulverata* in the Lebanon : July (Ellison & Wiltshire, 1939 : 43).

Red List category. E. Only two specimens caught in the last 60 years (1961 and 1992).

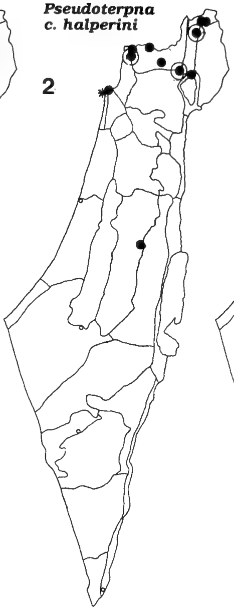
Myinodes shohami

1



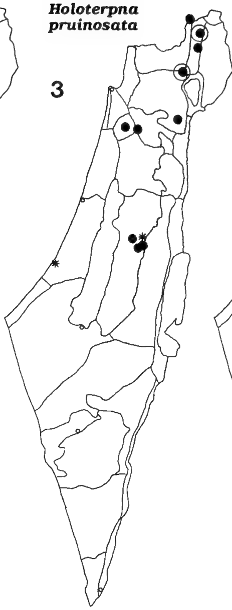
Pseudoterpna c. halperini

2



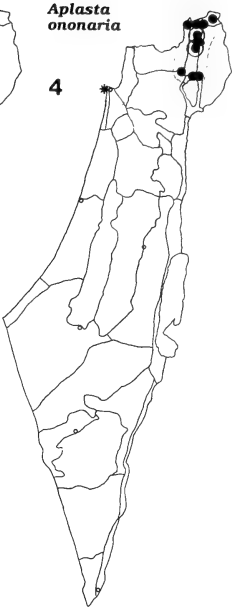
Holoterpna pruinosata

3



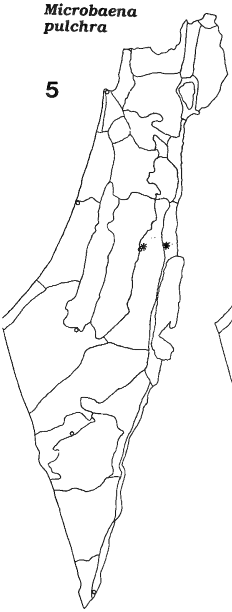
Aplasta ononaria

4



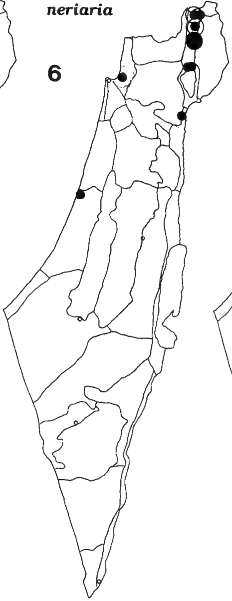
Microbaena pulchra

5



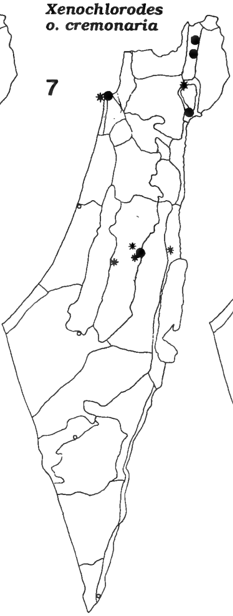
Proteuchloris neriaria

6



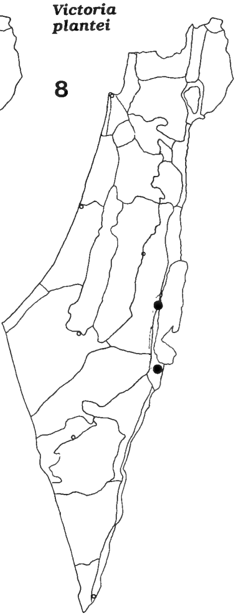
Xenochlorodes o. cremonaria

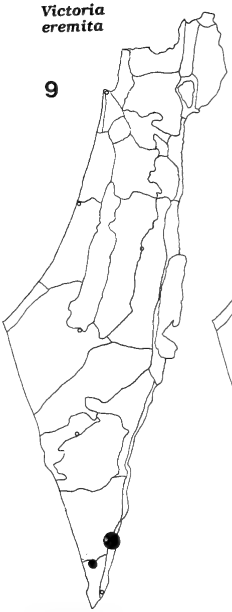
7



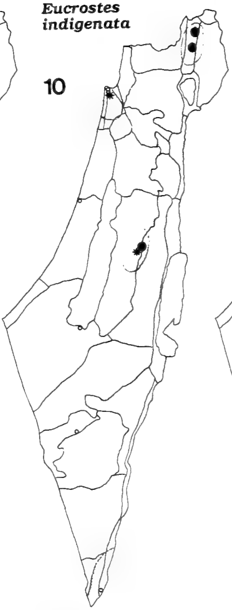
Victoria plantei

8

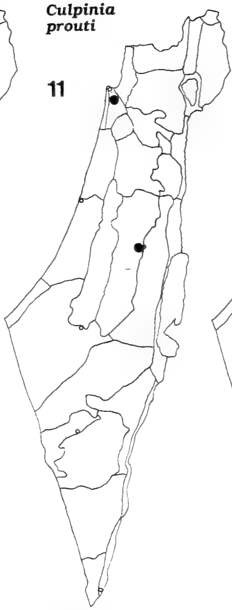




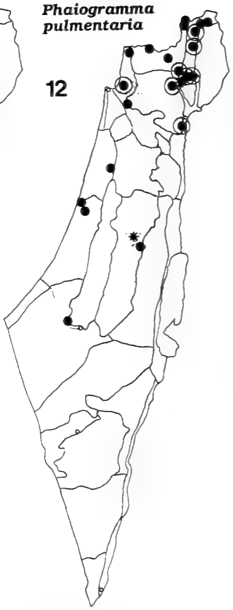
9 *Victoria eremita*



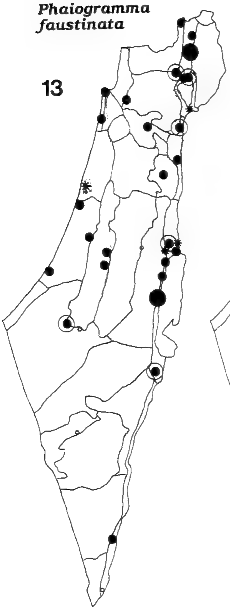
10 *Eucrostes indigenata*



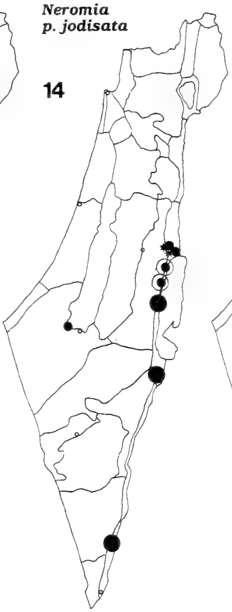
11 *Culpinia prouti*



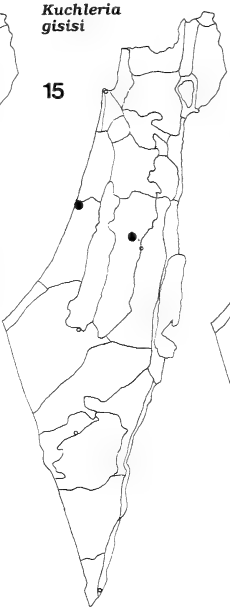
12 *Phaiogramma pulmentaria*



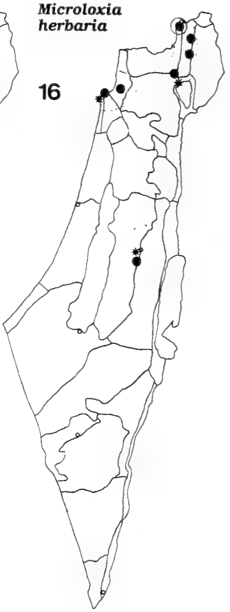
13 *Phaiogramma faustinata*



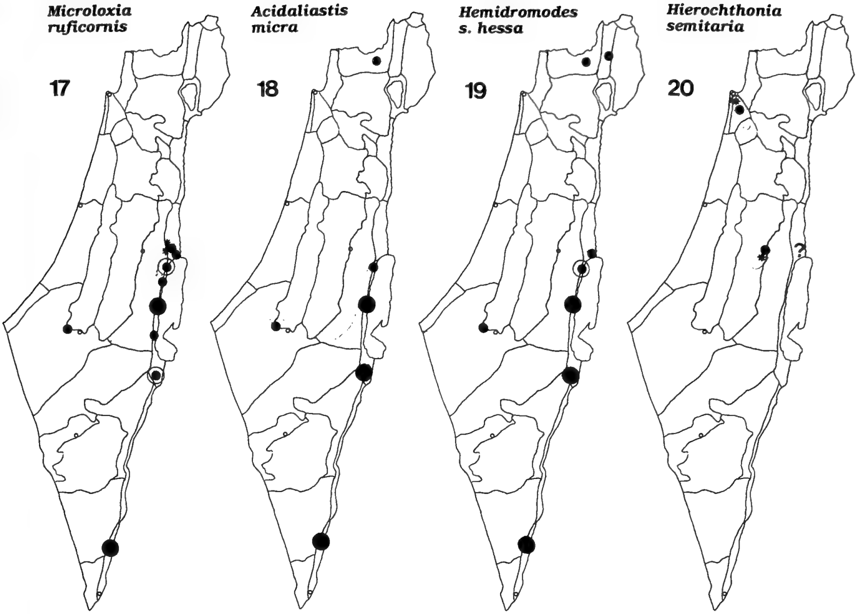
14 *Neromia p. jodisata*



15 *Kuchleria gisisi*



16 *Microloxia herbaria*



RED LIST OF THREATENED GEOMETRIDAE OF ISRAEL (Part 1)

Species	RL-category
Holoterpna pruinosata (Staudinger, 1898)	R
Microbaena pulchra (Staudinger, 1897)	Ex
Xenochlorodes olympiaria cremonaria (Staudinger, 1897)	E
Victoria plantei Herbulot, 1976	E
Eucrostes indigenata (de Villers, 1789)	V
Culpinia prouti (Thierry-Mieg, 1913)	Ex
Kuchleria gisisi Hausmann, 1995	Ex
Microloxia herbaria (Hübner, [1813])	R
Hierochthonia semitaria (Püngeler, 1901)	E

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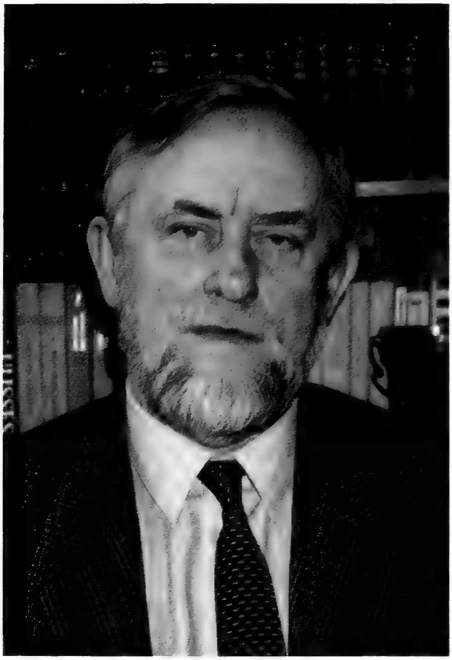
Andrzej W. Skalski
(1938-1996)



The lepidopterists' community, especially those interested in the Lepidoptera systematics, phylogeny and paleontology, lost a great friend and high level professional lepidopterist in the passing of Andrzej Wadysaw Skalski on 16 September 1996. He is survived by his wife, Barbara and daughter, Marta Skalska-Polańska. This sudden loss is equally sad for Poland and Europe where he served in key positions in the Polish Entomological Society (and its Lepidopterology Section as vice president) as well as more than 30 other societies, scientific and public organisations. He was an active SEL member since 1977, an outstanding participant of almost all SEL Congresses. He was also a reputed authority in biospeleology, groundwater Amphipoda systematics, hydrobiology and nature conservancy.

Andrzej Skalski, son of school teachers Zygmunt Skalski and Magdalena of Latacz family, was born in Cracow on 14 May 1938. Interested in natural history as a boy, he considered this a qualification for later professional study. He was educated at Plastic Arts Lyceum in Cracow, General Education Lyceum in Chrzanów, and Division of Biology and Earth Sciences of the Jagiellonian University in Cracow (graduated as Magister of Sciences in 1963). He received his Natural Sciences Doctor degree from the Adam Mickiewicz University in Poznań in 1978. During 27 years, from 1964 to 1991, he worked in the Regional Museum of Częstochowa, where he passed a carrier from junior research assistant and collections keeper to the Head of Natural History Division and Director of the Museum. At the same time and later on, until his death, he worked in Częstochowa Polytechnic Institute (Institute of Environment Engineering), Pedagogical High School as a lecturer of different biological and environmental disciplines, and in Environment Protection Inspectorate in Częstochowa.

Two major trends in his research interest have been formed during his early times, persisted up to his death : phylogenetics and systematics of the Lepidoptera and underground life with special emphasis to Amphipoda (mainly *Niphargus* and related genera). He published a number of papers on the Lepidoptera systematics and faunistics, paying much attention to the fossil forms, first of all those persisted as inclusions in the fossil resins, mostly in Baltic amber ; he also studied amber Lepidoptera deposited in numerous musea world over in order to establish their relationships with recent forms as a base for classification. This has resulted in the description of numerous new species and genera. Andrzej must be regarded as a sole expert of the amber Lepidoptera who continued classical work of N. J. Kuznetsov (1941). He was also interested in insect paleoecology within Tertiary period. The study of evolutionary mechanisms and faunal history have been the common base for these seemingly remote trends in his activity. His scientific interests were always focused upon the history of the environment, its biological diversity, present state, threats and conservation.

Andrzej Skalski explored different parts of Europe (including Ukraine and Crimea), remote areas of the Near East, Far East Russia, Japan, India, South-East Asia, North and South Americas. Upon collected materials numerous insect and mite taxa were described.

The scientific output which resulted the above was enormous. He published 158 scientific, 43 popular science articles, 23 reviews, 24 reports from congresses and symposia and about a hundred of mass media papers.

His outstanding work was recognised by numerous governmental awards.

However, Andrzej is best remembered by his multitude of friends as a warm, open, direct and friendly person. He was a great teacher, encouraging and stimulating new ideas. All who once met him were captivated by his vivid enthusiasm, encouraging energy and wonderful sense of humour. His research legacy will serve as an inspiration for those studying Lepidoptera (and not only Lepidoptera) for many years to come.

Our deepest sympathy is extended to his widow, daughter and to all who knew him personally or through his numerous publications.

Wieczne odpoczywanie racz mu dać Panie.

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1966

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1972

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1976

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1990

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1992

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1995

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1996

First fossil case of phoresy of pseudoscorpion on moth (poster). Abstracts. SEL. Xth European Congress of Lepidopterology, Miraflores (Madrid) 3-7 May 1996.

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Yuri P. NEKRUTENKO

Nota lepid. 20 (1/2) : 145-148 ; 01.VI.1996 ISSN 0342-7536

Book reviews — Buchbesprechungen — Analyses

Die Schmetterlinge Mitteleuropas. I. Band. Bestimmung – Verbreitung – Flugstandort – Bionomie. Drepanidae, Geometridae, Lasiocampidae, Endromidae, Lemoniidae, Saturniidae, Sphingidae, Notodontidae, Lymantriidae, Arctiidae. J. Fajcik & F. Slamka. 113 pp. 21 s/w Tafeln, 20 Farbtafeln. 1996. Bestellungen an : F. Slamka, Racianska 61, SK-83102 Bratislava, Slowakei. Preis : 50,– DM zzgl. Porto.

Bereits ein Jahr nach Herausgabe eines handlichen Feldführers über die Zünslerfalter Mitteleuropas (vgl. *Nota lepid.* 18 (1) : 38) liegt nunmehr in ähnlich guter Ausstattung der erste Band über Großschmetterlinge vor. Die Zielsetzung der Autoren war wiederum die Produktion eines preisgünstigen Bestimmungsführers und diese Lücke wird auch tatsächlich gut abgedeckt.

Behandelt werden die Gruppen der Spinner s.l. (mit Ausnahme der „primitiven" Familien) und Schwärmer sowie die Spanner, insgesamt 626 Arten. Gerade für die Geometriden existierte bisher in Mitteleuropa, im Gegensatz zu Nordeuropa, ein eklatanter Mangel an handlichen Determinationsunterlagen. Die weit verbreiteten Werke von Koch (1988) sowie Forster & Wohlfahrt (1981) sind entweder unvollständig oder schon lange vergriffen.

Die geographische Abgrenzung umfaßt ähnlich wie im Band über die Zünsler das zentrale und östliche Mitteleuropa inkl. Deutschland, Österreich, Polen, Tschechische Republik, Slowakei und Ungarn. Bedauerlicherweise sind die alpinen Arten nur teilweise inkludiert, ansonsten wird die mitteleuropäische Fauna aber fast vollständig dargestellt und es fehlen nur wenige Taxa wie z.B. *Maganophra abruptaria.*

Von beinahe sämtlichen Arten (617 spp.) werden Farbfotos in annähernd natürlicher Größe und ansprechender Qualität gegeben. Weitere 9 Taxa werden in Form von Strichzeichnungen der Imagines oder der Genitalien charakterisiert. Genitalabbildungen für eine Auswahl schwieriger zu bestimmender Arten (z.B. Gattungen *Idaea* und *Eupithecia*) runden die Zweckmäßigkeit des Buches als Bestimmungsführer ab. Meistens stützen sich die Autoren dabei auf die Reproduktion bereits publizierten Materials und entsprechend unterschiedlich ist auch die Qualität der Zeichnungen. Das Ziel einer möglichst zuverlässigen Bestimmung wird aber fast immer erreichbar sein. Der knapp gehaltene Text ist zweisprachig, Slowakisch und Deutsch gehalten. Er bringt angefangen von Artnamen mit den wichtigsten Synonymen, einen groben Überblick über die Verbreitung in Mitteleuropa sowie knappe Angaben zur Habitatwahl und Bionomie von Raupen und Imagines. Besonders gut hat sich das einheitliche Nummernsystem für Text und Abbildungen bewährt, das ein leichtes Auffinden der jeweiligen Art ermöglicht.

Insgesamt ermöglicht dieses Buch einen guten Einstieg auch in bisher vernachlässigte Großschmetterlingsgruppen und kann auch angesichts des niedrigen Preises nur wärmstens empfohlen werden

Peter Huemer

The Lepidoptera of Europe. A Distributional Checklist. Ole Karsholt & Józef Razowski (Editors). 380 pages, 5 tables, 21 × 29 cm, CD-rom enclosed, hardback. Apollo Books, Stenstrup, 1996. ISBN 87-88757-01-3. Obtainable from : Apollo Books Aps., Kirkeby Sand 19, DK-5771 Stenstrup, Denmark. Price : Danish Kroner 490, excl. postage.

The present work is a checklist presenting the distribution of 8470 species of Lepidoptera representing 1680 genera, 85 families, and 31 superfamilies in 31 European countries and 5 larger Mediterranean islands (Corsica, Sardinia, Sicily, Malta and Crete). The geographical coverage is shown on a map : in the East and South, the boundaries adopted extend along the eastern highlands of the Ural Mountains, along the Ural River, the northern coast of the Caspian Sea as far as the Kama-Manytch Depression, across the Azov Sea and Black Sea to the Bosporus and then through the Aegean Sea, including all the Aegean islands. Included is also Iceland, but the Atlantic Islands (Azores, Madeira, Canary Islands) have been omitted, as well as Cyprus. The checklist summarizes current knowledge about the countries from which individual species have been recorded, coded by two-letter abbreviations. In this list the higher classification of superfamilies, families and subfamilies follows Kristensen (Ed.) in press, Lepidoptera : Moths and Butterflies, with few exceptions. Subspecies have not been included in the main list since opinions about the appropriate use of this category are very divided among lepidopterists. In the case of Psychidae separate entries have been made for parthenogenetic and bisexual forms. The notes (pp. 300-344) include information supplementary to the list, especially on matters of nomenclature and taxonomy, a few notes also deal with distributional problems. No less than 40 authors have contributed to the present work, each dealing with a particular group. The choice of some arbitrarily selected islands rather than others is questionable, as other ones (e.g. the Greek islands of Híos, Lésvos, Sámos, Ikaría, Kárpathos and Níssiros) also have insular endemics or populations only occurring here within the boundaries of the area covered in the present book (e.g. *Maniola chia*, *Maniola megala*, *Maniola halicarnassus*, *Hipparchia mersina*, *Hipparchia pellucida*, *Hipparchia christenseni*, *Satyrium ledereri*, to name but a few among the Papilionoidea alone). The list of references is very limited, some important works have been omitted. The whole work is also contained on a CD-rom, produced together with the book. Although each ‘specialist’ will undoubtedly find some small omissions or mistakes here and there, this is a highly recommendable work, indispensable to all those working on European Lepidoptera.

Alain Olivier

The Conservation of Butterflies in Britain past and present. John Feltwell. x + 233 pages, 17 text figures, 12 tables, 14.8 × 21 cm, paperback. Wildlife Matters, Battle, Sussex, 1995. ISBN 0-907970-028. Obtainable from : Wildlife Matters, 'Marlham', Henley's Down, Battle, East Sussex, TN33 9BN, UK. Price : £ 9.50, incl. postage.

This comprehensive little work deals, within the frame of twelve chapters, with the various aspects of butterfly conservation in Great Britain, including general chapters (historical background ; why conserve butterflies ; flagship species ; habitat management ; threats ; legislation, etc.) and case studies (the Swallowtail, *Papilio machaon britannicus*, the Large Copper, *Lycaena dispar* and the Large Blue, *Maculinea arion*), in a very pleasant and readable style, constantly with a great attention to details. It was written to provide an insight into the conservation of butterflies in Britain, with its successes and failures, and concentrates on ecological issues when these are considered relevant. A series of appendices mention among other things a code for insect collecting, a code of conservation practice for insect re-establishment, conservation strategy, nature reserves. The book closes with a glossary and a very complete bibliography. This nice little book is recommended to people working on butterfly and, more generally, nature conservation, especially in Great Britain.

Alain Olivier

Checklist of the Lepidoptera of Australia (Monographs on Australian Lepidoptera Volume 4). E. S. Nielsen, E. D. Edwards & T. V. Rangsi (Eds.) xiv + 529 pages, black-and-white photographs in text, 18 × 25.7 cm, CD-rom enclosed, hardback. CSIRO Division of Entomology, Canberra, Australia, 1996. ISBN 0-643-05028-0.

This volume represents the first edition of a checklist of the entire described Australian Lepidoptera fauna : a complete documentation of its taxonomy, nomenclature and classification, including all names correctly associated with Australian Lepidoptera, as well as some names previously used because of major misidentifications or misspellings. It is based on an alphabetical collection of all original descriptions of Lepidoptera named from Australia ; an archive of colour transparencies of the corresponding primary types ; a comparison of slides and type information with material in the Australian National Insect Collection and other collections plus other available data ; published literature and a computer database derived from the above information. The Introduction provides a detailed protocol for the development of the Checklist and a guide to users. A summary of the higher classification used in the Checklist is given. A complete systematic listing of all valid generic and specific names with their synonyms, major misspellings and important misidentifications is provided. Synonyms for the family group names are also given. Where required, numbered notes explain the application of names.

The Checklist is intended to demonstrate our current state of knowledge of the Australian fauna of Lepidoptera. It therefore includes a large number of nomenclatural changes formally published for the first time ; new synonymies, new combinations, changes of status and reinstatements are clearly indicated as new in the Checklist. A complete index of all names is included together with a CD-rom containing all the actual Checklist files in ASCII format. The Checklist is multi-authored with one or more authors responsible for each family with contributions by A. Atkins, I. F. B. Common, E. D. Edwards, K. D. Fairey, M. Horak, F. Komai, T. Kumata, M. S. Moulds, P. B. McQuillan, E. S. Nielsen, G. S. Robinson, M. Shaffer and G. Tarmann. The family classification adopted in this work is that developed by I. F. B. Common and E. S. Nielsen for Moths of Australia (Common, 1990) and the treatment of Lepidoptera in The Insects of Australia (Nielsen & Common, 1991), with minor changes. The editors are to be congratulated for the high professionalism of the present achievement. This work presents a wealth of information in concise form and is absolutely indispensable to anyone working on Australian Lepidoptera.

Alain OLIVIER

Errata in and acknowledgement to *Nota lepidopterologica* Vol. 19, 1996

E. A. LOELIGER

Hofdijck 48, NL-2341 ND Oegstgeest, The Netherlands

In the articles of LOELIGER & KARRER, published 21.XI. and 21.XII.1996, pages 113-128 and 243-260, respectively, quantities of ecdysone injected into pupae are erroneously presented a thousand times too high in most instances, i.e. in mg instead of in µg. Correct figures are given in the first publication under Material and Methods, Table 3 and Figure 2, and the French Summary, on pages 113, 117-120 and 123, resp. ; and in the second article under Material and Methods on page 247.

The first author's address is also incorrectly given. In The Netherlands two capitals separate the numbering and wording of the domicile (vide supra).

As the author responsible for reviewing the proofs I apologize for the flaws.

Delightful news is the approval, just before publication, of our request for financial support by the Uyttenboogaart-Eliasen foundation in Amsterdam. Its gift satisfactorily compensates the costs of the colour printing of the figures 1-7, illustrating the results of our cross breeding experiments published in volume 19 (3/4) of *Nota lepid.*

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Contents — Inhalt — Sommaire

OLIVIER, A. & COUTSIS, J. G. : A revision of the superspecies *Hipparchia azorina* and of the *Hipparchia aristaeus* group (Nymphalidae : Satyrinae) 150
KURZ, M., KURZ, M. & ZELLER-LUKASHORT, C. : A new *Micropterix* species from northern Italy (Micropterigidae) 293
ŠULCS, I. & KERPPOLA, S. : A new *Dichrorampha* species from Latvia (Tortricidae : Oleothreutinae) 299
ASSELBERGS, J. : A new *Euzophera* species from Turkey (Pyralidae : Phycitinae) 305
FALKOVITSH, M. I., JALAVA, J. & MIKKOLA, K. : Records of casebearers (Coleophoridae) from Siberia, Russia 310
VASILENKO, S. V. : Eine neue *Scopula*-Art aus Transbaikalien (Geometridae) 322
SAITOH, K. & ABE, A. : The chromosomes of *Erebia ligea rishirizana* (Nymphalidae : Satyrinae) 326
KULFAN, J., KULFAN, M., ZACH, P. & TOPP, W. : Ist der Kleine Fuchs, *Aglais urticae* (Nymphalidae), in Zukunft gefährdet? 330

Short communications — Kurze Mitteilungen — En bref

CUPEDO, F. : The valid subspecific name for the *Erebia epiphron* (Knoch, 1783) population of Mt. Canigou, Pyrénées-Orientales (Nymphalidae : Satyrinae) 335

Book review — Buchbesprechung — Analyse 337

Vol. 20 — 1997

Dates of publication — Publikationsdaten — Dates de publication 338
Contents — Inhalt — Sommaire 338
New taxa described in Vol. 20 — Neue Taxa in Band 20 beschrieben — Nouveaux taxa décrits dans le Vol. 20 340

Nota lepid. 20 (3/4) ; 150–292 ; 10.XII.1997 ISSN 0342-7536

A revision of the superspecies *Hipparchia azorina* and of the *Hipparchia aristaeus* group (Nymphalidae : Satyrinae)

Alain Olivier* & John G. Coutsis**

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Summary

Arguments for the monophyly of *Hipparchia* (sensu Kudrna, 1977) and *Parahipparchia* are discussed : the latter taxon consists of one superspecies and two species groups. The *Hipparchia semele* group is characterized by two synapomorphies, including the (potential) presence of a sphragis at the end of the abdomen of the female when mated. The present study deals in particular with the other two entities, viz. superspecies *Hipparchia azorina* and the *Hipparchia aristaeus* group. Superspecies *H. azorina* is endemic to the Azores and consists of two semispecies, viz. *H. (azorina) azorina* and *H. (azorina) miguelensis* ; the former taxon consists of two subspecies, *azorina* (Pico and Faial) and *occidentalis* (Flores, Corvo, São Jorge and Terceira). *H. (azorina) miguelensis* is limited to the island of São Miguel. The nominal taxa *Hipparchia azorina cenjonatura* Bivar de Sousa, 1982, *Hipparchia azorina jorgense* Oehmig, 1983, *Hipparchia azorina barbara* Bivar de Sousa, 1985 and *Hipparchia azorina minima* Bivar de Sousa, 1985 are newly synonymized with *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ; this arrangement differs from the previous ones mainly in that *occidentalis* appears to occur not only on the western island group, but also on part of the central island group. The *Hipparchia aristaeus* group is composed of four taxa, viz. *H. maderensis* (Madeira), *H. algirica* (Morocco, Algeria, Tunisia), *H. aristaeus* (Corsica, Sardinia, Elba, Giglio, Capraia) and *H. senthes* (Sicily, S. Italy, Albania, Former Yugoslav Republic of Macedonia, S. Bulgaria, Greece including the Aegean islands, western half of Turkey). The following taxa are newly synonymized with *Hipparchia senthes* (Fruhstorfer, 1908) : *Satyrus semele blachieri* Fruhstorfer, 1908, *Satyrus Semele* race *Siciliana* Oberthür, 1914, *Satyrus semele* L. f. *neapolitana* Stauder, 1921, *Hipparchia algirica vallettai* de Lattin, 1952, *Hipparchia algirica vallettai* Valletta, 1972 and *Hipparchia ballettoi* Kudrna, 1984. Lectotypes are designated for *Satyrus Semele* race *Siciliana* Oberthür, 1914, *Satyrus semele* L. f. *neapolitana* Stauder, 1921 and *Satyrus semele* L. f. *blachierioides* Stauder, 1921. The latter taxon appears to be identical with *Hipparchia semele* (Linnaeus, 1758) and the synonymy established by Kudrna (1977) is thus confirmed. Each taxon is described in detail and a comprehensive treatment of its distribution and bionomics is also included, as well as its taxonomic history including discussions on some nomenclatural problems. A list of characters that could be useful for the construction of a cladogram of *Parahipparchia* is presented : sixteen characters are retained and a series of characters previously listed by Balletto *et al.* (1990) is critically reviewed. The monophyly of the superspecies *H. azorina* is well supported ; conversely, not a single synapomorphy has been detected for the *H. aristaeus* group, that could thus very well be a paraphyletic assemblage, either with or without the inclusion of the superspecies *H. azorina.* Priorities for further study are formulated : on one hand a comparative morphological study of all taxa (including early stages and adults) of *Parahipparchia* and *Hipparchia* **s. str.**, on the other hand a comprehensive study of molecular and allozyme data as an independent test of the phylogeny based on the morphological data set, as well as a means of estimating the possible divergence time of these taxa.

Zusammenfassung

Argumente für die Monophylie von *Hipparchia* (sensu Kudrna, 1977) und *Parahipparchia*, die eine Superspezies und zwei Artengruppen umfaßt, werden diskutiert. Die *Hipparchia semele* Artengruppe ist durch zwei Synapomorphien gekennzeichnet, darunter die Ausbildung einer Sphragis am Abdomenende von verpaarten Weibchen. Die vorliegende Arbeit widmet sich besonders den zwei anderen Gruppen, der Superspezies *Hipparchia azorina* und der *Hipparchia aristaeus* Artengruppe. Die Superspezies *H. azorina* ist endemisch für die Azoren und umfaßt zwei Semispezies, *H. (azorina) azorina* und *H. (azorina) miguelensis. H. azorina* enthält zwei Unterarten, *azorina* (Pico und Faial) und *occidentalis* (Flores, Corvo, São Jorge und Terceira). *H. (azorina) miguelensis* ist auf die Insel São Miguel beschränkt. Die nominellen Taxa *Hipparchia azorina cenjonatura* Bivar de Sousa, 1982, *Hipparchia azorina jorgense* Oehmig, 1983, *Hipparchia azorina barbara* Bivar de Sousa, 1985 und *Hipparchia azorina minima* Bivar de Sousa, 1985 werden mit *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 synonymisiert. Diese Anordnung unterscheidet sich von bisherigen Klassifikationen darin, daß *occidentalis* nunmehr nicht nur auf der westlichen sondern auch der zentralen Inselgruppe vorkommt. Die *Hipparchia aristaeus* Artengruppe besteht aus vier Arten, *H. maderensis* (Madeira), *H. algirica* (Marokko, Algerien, Tunesien), *H. aristaeus* (Korsika, Sardinien, Elba, Giglio, Capraia) und *H. senthes* (Sizilien, Süd-Italien, Albanien, ehem. jugoslawische Republik Mazedonien, Süd-Bulgarien, Griechenland inklusive der aegeischen Inseln, westliche Türkei). Die folgenden Taxa werden mit *H. senthes* (Fruhstorfer, 1908) synonymisiert : *Satyrus semele blachieri* Fruhstorfer, 1908, *Satyrus Semele* race *Siciliana* Oberthür, 1914, *Satyrus semele* L. f. *neapolitana* Stauder, 1921, *Hipparchia algirica vallettai* de Lattin, 1952, *Hipparchia algirica vallettai* Valletta, 1972 und *Hipparchia ballettoi* Kudrna, 1984. Lectotypen werden für *Satyrus Semele* race *Siciliana* Oberthür, 1914, *Satyrus semele* L. f. *neapolitana* Stauder, 1921 und *Satyrus semele* L. f. *blachierioides* Stauder, 1921, festgelegt. Das letztgenannte Taxon ist *Hipparchia semele* (Linnaeus, 1758) sehr ähnlich und die von Kudrna (1977) festgestellte Synonymie wird bestätigt. Alle behandelten Taxa werden detailliert beschrieben und ihre Verbreitung, Phänologie und bisherige taxonomische Stellung ausführlich dargestellt, sowie einige nomenklatorische Probleme diskutiert. Merkmale, die für die Erstellung eines Kladogramms von *Parahipparchia* nützlich/verwendbar sein können, werden aufgelistet, wobei 16 Merkmale vorgeschlagen werden und einige von Balletto *et al.* (1990) kritisch überprüft werden. Die Monophylie der Superspezies *H. azorina* is gut begründet, aber für die *H. aristaeus* Artengruppe konnte keine einzige Synapomorphie ermittelt werden. Es könnte sich hierbei um ein Paraphylum handeln, entweder mit oder ohne Einschluss der Superspezies *H. azorina.* Für künftige Untersuchungen werden folgende Prioritäten formuliert : Einerseits vergleichend morphologische Untersuchungen sowohl an Imagines wie Präimaginalstadien aller Taxa von *Parahipparchia* und *Hipparchia* **s. str.**, andererseits umfassende molekulare und enzymelektrophoretische Studien, mit Hilfe deren Daten ein unabhängiger Test der auf morphologischer Grundlage gewonnenen phylogenetischen Hypothesen möglich ist und die außerdem Anhaltspunkte zur Abschätzung des evolutionären Alters dieser Taxa bieten.

Résumé

Le caractère monophylétique de *Hipparchia* (sensu Kudrna, 1977) et de *Parahipparchia* est discuté : ce dernier taxon est composé d'une super-espèce et de deux groupes d'espèces. Le groupe de *Hipparchia semele* peut être identifié à l'aide de deux synapomorphies, incluant la présence (potentielle) d'un sphragis à l'extrémité de l'abdomen de la femelle fécondée. La présente étude traite en particulier des deux autres entités, à savoir la super-espèce *Hipparchia azorina* et le groupe d'espèces de *Hipparchia aristaeus.* La super-espèce *H. azorina* est endémique aux Açores et consiste de deux semi-espèces, à savoir *H. (azorina) azorina* et *H. (azorina) miguelensis* ; le premier taxon inclue deux sous-espèces, *azorina* (Pico et Faial) et *occidentalis* (Flores, Corvo, São Jorge et Terceira). *H. (azorina) miguelensis* est limité à l'île de São Miguel. Les taxons nominaux *Hipparchia azorina cenjonatura* Bivar de Sousa, 1982, *Hipparchia azorina jorgense* Oehmig, 1983, *Hipparchia azorina barbara* Bivar de Sousa, 1985 et *Hipparchia azorina minima* Bivar de Sousa, 1985 sont nouvellement établis comme synonymes de *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ; cet arrangement diffère des précédents principalement par le fait qu'il est démontré que *occidentalis* n'est pas limité au groupe d'îles occidental, mais occupe également une partie du groupe d'îles central. Le groupe de *Hipparchia aristaeus* se compose de quatre taxons, à savoir *H. maderensis* (Madère), *H. algirica* (Maroc, Algérie, Tunisie), *H. aristaeus* (Corse, Sardaigne, Elbe, Giglio, Capraia) et *H. senthes* (Sicile, Italie méridionale, Albanie, l'ancienne république yougoslave de Macédoine, Bulgarie méridionale, Grèce incluant les îles égéennes, moitié occidentale de la Turquie).

Les taxons suivants sont nouvellement établis comme synonymes de *Hipparchia senthes* (Fruhstorfer, 1908) : *Satyrus semele blachieri* Fruhstorfer, 1908, *Satyrus Semele* race *Siciliana* Oberthür, 1914, *Satyrus semele* L. f. *neapolitana* Stauder, 1921, *Hipparchia algirica vallettai* de Lattin, 1952, *Hipparchia algirica vallettai* Valletta, 1972 et *Hipparchia ballettoi* Kudrna, 1984. Des lectotypes sont désignés pour *Satyrus Semele* race *Siciliana* Oberthür, 1914, *Satyrus semele* L. f. *neapolitana* Stauder, 1921 et *Satyrus semele* L. f. *blachierioides* Stauder, 1921. Ce dernier taxon étant identique à *Hipparchia semele* (Linnaeus, 1758), la synonymie établie par Kudrna (1977) est confirmée. Chaque taxon est décrit en détail et sa distribution géographique et bionomie est également discutée de manière approfondie, ainsi que son histoire taxinomique, incluant des discussions sur quelques problèmes de nomenclature. Une liste de caractères qui pourraient être utilisables lors de la construction d'un cladogramme de *Parahipparchia* est présentée : seize caractères sont retenus et une série de caractères précédemment énumérés par Balletto *et al.* (1990) est discutée de manière critique. Le caractère monophylétique de la super-espèce *H. azorina* est bien corroboré ; en revanche, aucune synapomorphie propre au groupe de *Hipparchia aristaeus* n'a pu être détectée. Ainsi, ce dernier ensemble pourrait-il bien être paraphylétique, avec ou sans l'inclusion de la super-espèce *H. azorina.* Des priorités pour l'étude ultérieure sont formulées : d'une part une étude morphologique comparative de tous les taxons (incluant les premiers états et les adultes) faisant partie de *Parahipparchia* et de *Hipparchia* **s. str.**, d'autre part une étude complète de données moléculaires et enzymatiques (allozymes) comme test indépendant de la phylogénie basée sur l'ensemble des données morphologiques, ainsi que comme moyen d'estimation de l'âge de divergence possible de ces taxons.

1. Introduction

1.1. Delimitation of the genus *Hipparchia*

The genus *Hipparchia* (sensu Kudrna, 1977) consists of five currently recognized subgenera, i. e. *Hipparchia* Fabricius, 1807, *Parahipparchia* Kudrna, 1977, *Neohipparchia* de Lesse, 1951, *Euhipparchia* Kudrna, 1977 and *Pseudotergumia* Agenjo, 1948. Some of these subgenera have been considered by several authors as either distinct genera when compared to *Hipparchia* **s. str.** (e. g. Higgins, 1975 ; Koçak, 1981–1983) or species groups ("Artengruppen") that should not be named formally (e. g. Hesselbarth, van Oorschot & Wagener, 1995) : this is, however, merely a semantic issue. What matters is that the supraspecific taxon one recognizes be a monophyletic unit. In order to do so, one should identify at least one synapomorphy that characterizes it. The decision of ranking at any hierarchical level is largely dependent on the scope of one's study.

The monophyly of *Hipparchia* **s. l.** (sensu Kudrna, 1977) has recently been questioned, though it is, according to García-Barros & Martín (1991), supported by 7 synapomorphies, 5 of which are adult morphological characters. At least one of these, however — the presence of a Jullien organ — is irrelevant, as such a structure has been found as well in *Pseudochazara* (see Hesselbarth, van Oorschot & Wagener, 1995 : 939, figs. 66 & 67), in other genera of the subtribe Satyriti (sensu Harvey, 1991) and even in more distantly related satyrine taxa (Dampf, 1908 : 77, fig. 2 ; De Prins & Olivier, unpublished data). A structure, that was named Jullien organ as well, has also been found in *Maniola* (see e. g. Wüest-Jullien, 1980 ; Thomson, 1991) and it could therefore represent a homoplasy, as noted by García-Barros & Martín (1991 : 408).

1.2. Delimitation of the subgenus *Parahipparchia*

The subgenus *Parahipparchia* is presumably monophyletic : beside a recognizably distinct general wing pattern, the species composing it share at least one probable synapomorphy, i. e. androconial scales of the eomorphic/palaeomorphic type (Kudrna, 1977, 1984 ; Bivar de Sousa, 1982a, 1985b ; Oehmig, 1983), except for one single species, *Hipparchia (Parahipparchia) mersina* (Staudinger, 1871) (Kudrna, 1977 ; Olivier & De Prins, 1989). Its sister group is likely to be subgenus *Hipparchia* **s. str.** (see García-Barros & Martín, 1991), of which all known species have a neomorphic type of androconium (Kudrna, 1977). Such also seems to be the case with the three other subgenera of *Hipparchia* (sensu Kudrna, 1977), as well as in all remaining genera of the Satyriti investigated in this respect, when androconia are present at all (*Brintesia*, *Arethusana*, *Chazara*, *Pseudochazara*, *Satyrus*, *Berberia*, cf. Le Cerf, 1914 ; de Lesse, 1954 ; Higgins, 1975 ; Brown, 1976 ; Kudrna, 1977 ; Gross, 1978 ; De Prins & van der Poorten, 1981 ; Sakai, 1981 ; Nekrutenko, 1990 ; García-Barros & Martín, 1991 ; Skolka, 1997 ; Wakeham-Dawson, 1997), except *Karanasa*, where all conditions from the eomorphic/palaeomorphic to the neomorphic type have been found (Avinoff & Sweadner, 1951 ; Sakai, 1981). There is, however, no further evidence in support of a direct sister group relationship between *Parahipparchia* and *Karanasa*. It is worth mentioning that outside the Satyriti the various types of androconial scale have been found in other subtribes of the tribe Satyrini sensu Harvey (1991), i. e. in the genera *Erebia* (see Warren, 1936) and *Coenonympha* (see Davenport, 1941), while only the neomorphic type is known in the Manioliti (de Freina & Aussem, 1987 ; Thomson, 1987 ; Samodurov *et al.*, 1995, 1996a, 1996b).

1.3. Subdivisions within *Parahipparchia*

In the present study, we recognize one superspecies and two species groups within *Parahipparchia.* The arrangement adopted for the superspecies and the first group is totally new and is based on the results of the present revision (see below). The second group is based on our own preliminary analysis of data presented in Kudrna (1977, 1984, 1986, 1996), Coutsis (1984), Balletto *et al.* (1990) and Cesaroni *et al.* (1994), supplemented with our own unpublished results. This leads to the following new classification of subgenus *Parahipparchia* :

— Superspecies *Hipparchia azorina*
    Hipparchia (azorina) azorina (Strecker, 1899), **comb. n., stat. n.**
        Hipparchia (azorina) azorina azorina (Strecker, 1899), **comb. n., stat. n.**
        Hipparchia (azorina) azorina occidentalis Bivar de Sousa, 1982, **comb. n., stat. n.**
    Hipparchia (azorina) miguelensis (Le Cerf, 1935), **comb. n., stat. n.**
— *Hipparchia aristaeus* group
    Hipparchia maderensis (Baker, 1891)
    Hipparchia algirica (Oberthür, 1876)
    Hipparchia aristaeus (Bonelli, 1826)
    Hipparchia senthes (Fruhstorfer, 1908)
— *Hipparchia semele* group
    Hipparchia semele (Linnaeus, 1758)
    Hipparchia sbordonii Kudrna, 1984
    Hipparchia leighebi Kudrna, 1976
    Hipparchia cretica (Rebel, 1916)
    Hipparchia mersina (Staudinger, 1871)
    Hipparchia volgensis (Mazochin-Porshnjakov, 1952)
    Hipparchia turcmenica Heydemann, 1942
    Hipparchia christenseni Kudrna, 1977
    Hipparchia pellucida (Stauder, 1924)
        Hipparchia pellucida pellucida (Stauder, 1924)
        Hipparchia pellucida cypriensis (Holik, 1949)

The last-named group will not be revised in the present paper. Therefore, we will limit ourselves to the following comments.

The monophyly of the *H. semele* group is supported by at least two synapomorphies : the (potential) presence of a sphragis at the end of the abdomen of the female when mated and the average length of the dorsal lamella exceeding 0.7 mm (see section 7 for a further discussion). The sphragis is invariably present in *H. cretica*, *H. sbordonii*, *H. leighebi*, *H. mersina*, *H. volgensis* and *H. christenseni*. In *H. semele*, it is always present among material from Spain, southern France and southern Italy (Sicily, Calabria, Basilicata), while in material from Central Europe (e. g. Belgium) it is usually absent or barely visible. In *H. pellucida*, a sphragis is always present among specimens from Kípros (Cyprus) and most Turkish populations, while it was found in only one single female from the Greek island of Lésvos, but in none from the Greek island of Ikaría. In *H. turcmenica* we haven't noticed it, but we saw only two females. As far as we know, the phylogenetically most closely related species in which a sphragis has been recorded is the Australian satyrine *Heteronympha penelope* Waterhouse, 1937 (tribe Satyrini, subtribe Hypocystiti), while such a structure is known as well in *Acraea* (Nymphalidae), but especially in the Papilionidae (Orr, 1995).

We consider the unique condition of the androconium in *H. mersina* as an autapomorphy (character state reversal) of this species. Such seems to be the most parsimonious solution, otherwise one should have to assume that it is the sister species of the whole remainder of *Parahipparchia*, and hence that a series of other characters originated at least twice in this subgenus or became lost again in both superspecies *H. azorina* and the *H. aristaeus* group. A further discussion of these and other topics is beyond the scope of the present study. See, however, sections 7 and 8 for a preliminary phylogenetic analysis.

2. On the colour plates

Initially we intended to revise only the taxa of the *H. aristaeus* group from the Italian mainland, Sicily, the Balkans and Turkey. For that purpose, in 1995, all relevant type material was borrowed from several museums for illustration and lectotype designations. Specimens have since been sent back with a red label referring to the present publication, mentioning the number of the colour plate and of the figure on which each individual type specimen was to be shown. All this material was referred to either plate 1 or 2.

In the meantime, we considered it not only appropriate but also necessary to broaden the scope of our study to the other taxa of the *H. aristaeus* group, as well as those from the Azores : this has resulted in two more colour plates, that bear the numbers 3 and 4 in the present article. This choice of numbering, although in reverse of the order of treatment of each nominal taxon in the present paper, was made in order not to contradict the references on the labels of the type specimens we are dealing with in this study.

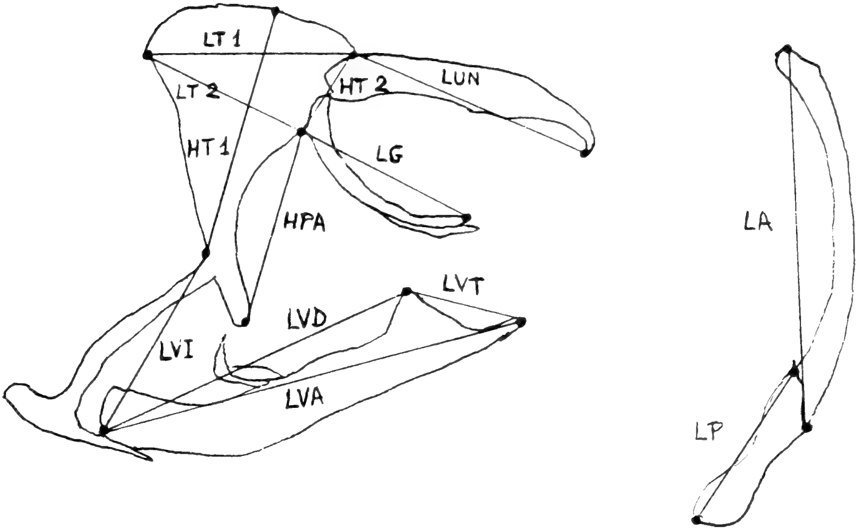


Fig. 1. Male genitalia : measurements used for table 2.

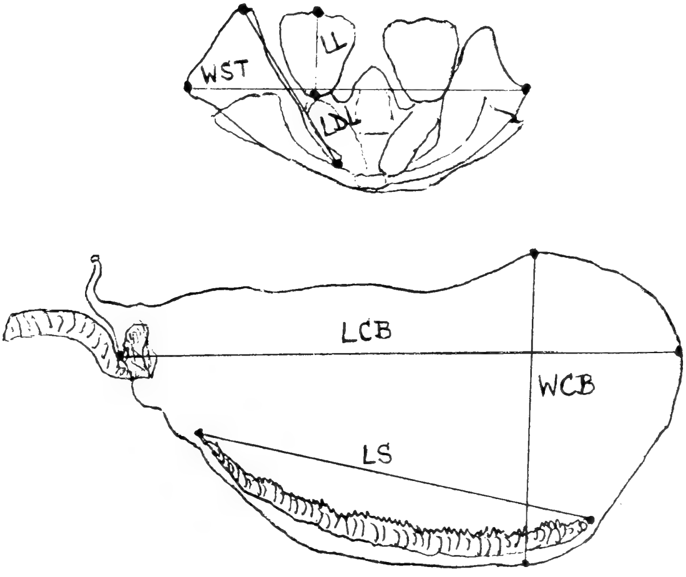


Fig. 2. Female genitalia : measurements used for table 3.

3. Methods

Material is listed under each recognised nominal taxon. Forewing size has been measured from the base (at the costa) to the apex (without fringes) : when larger samples for an area were available, we limited ourselves to samples of 25 specimens for each sex (see table 1 for results). No quantitative measurements of wing markings were made. Naming of wing veins and spaces follows Higgins & Riley (1984). The genitalia and androconia of several specimens were studied. Male and female genitalia were prepared and drawn according to the method described in Coutsis (1984 : 161–162). Drawings of the male genitalia are in side view : in a few instances, the Jullien organ has been drawn as well. Drawings of the female genitalia show the entire bursa copulatrix (sterigma and corpus bursae) in side view and the sterigma also dorsally. Sometimes the ductus bursae with cervix bursae is shown in detail separately. All the original drawings were made with a 25× magnification. The naming of the various structures and parts of the male and female genitalia follows Olivier & De Prins (1989). Various morphometric measurements were carried out, as shown on text figs. 1 & 2 and proportions of some of these structures in relation to each other were calculated (tables 2 & 3). Single androconial scales were photographed in black and white (phase contrast) with a 400× magnification.

Data on the biology, ecology, phenology and chorology are derived from our own field observations when available, supplemented by a comprehensive treatment of the literature on the subject.

In our heading “Comments” under each nominal taxon, considerable effort has been put into the analysis of the literature on matters dealing with taxonomy and nomenclature, especially concerning the *Hipparchia aristaeus* group. In doing so, we have tried to be exhaustive, though we are fully aware that we certainly have “missed” some references, especially about e.g. *H. senthes* from Turkey, Sicily or Malta. Nevertheless, we believe that our survey is comprehensive enough to include all important relevant information. Although this treatment may seem somewhat prolix to the reader, we are convinced of its usefulness, as so many conflicting views, errors and misinterpretations have been laid down over the years by various authors, either as a result of different species concepts, wrong applications of the rules of the International Code of Zoological Nomenclature (ICZN), or mere ignorance of the primary sources, i. e. the existing type specimens and the original descriptions. For each nominal taxon we will list the complete synonymy as well as the existing type material and its current depository when known. We have checked all the original descriptions ourselves, as well as the type specimens when this proved necessary : several of these are illustrated on plates 1 and 2 and we designate lectotypes for three nominal taxa in the present study.

The following abbreviations of collectors and (museum) collections are used throughout this publication :

AO = Alain Olivier
JGC = John G. Coutsis
NG = Nikos Ghavalas
VLCA = Vlaamse Lepidoptera Collectie Antwerpen (composed of the former individual collections of W. De Prins, J. Dils, A. Olivier & D. van der Poorten)
ZMA = Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum, Amsterdam

Table 1

Superspecies *Hipparchia azorina* and the *Hipparchia aristaeus* group : right forewing size (from base to apex) in mm

Taxon/Area of origin	**Males**				**Females**			
	Min.	Max.	Mean	n	Min.	Max.	Mean	n
H. (azorina) azorina azorina								
Portugal, Azores, Pico	19.7	21.8	21.1	9	22.3	25.0	23.8	3
Portugal, Azores, Faial	19.3	21.3	20.4	10	22.5	25.4	23.7	5
H. (azorina) azorina occidentalis								
Portugal, Azores, Flores	18.4	20.0	19.2	6	19.9	22.7	21.3	3
Portugal, Azores, São Jorge	20.0	22.0	21.2	4	22.6	23.5	23.1	2
Portugal, Azores, Terceira	18.6	20.8	19.7	8	20.0	23.5	21.9	4
H. (azorina) miguelensis								
Portugal, Azores, São Miguel	20.7	22.8	21.7	21	24.0	25.7	24.6	7
H. maderensis								
Portugal, Madeira	20.8	26.0	24.0	25	24.2	29.3	26.7	25
H. algirica								
Morocco, Middle Atlas	22.6	26.1	24.7	25	25.9	30.2	27.8	25
Algeria	23.4	26.6	24.9	7	24.9	29.8	27.7	10
H. aristaeus								
Italy, Sardinia	22.3	25.5	24.3	25	25.0	29.6	26.9	25
France, Corsica	22.7	25.6	24.6	25	24.5	28.5	26.2	14
Italy, Elba	24.3	26.2	24.9	4	26.9	28.6	27.6	6
H. senthes								
Turkey, Antalya	23.6	27.8	25.7	25	22.4	29.6	27.7	25
Greece, Sámos	24.2	27.8	26.6	23	27.7	31.4	29.5	8
Greece, Ikaría	24.5	30.0	27.0	16	26.4	31.0	28.7	25
Greece, Híos	24.1	27.7	26.0	25	26.0	29.9	27.7	25
Greece, Kikládes, Páros	26.1	30.8	28.8	15	28.6	32.1	30.5	9
Greece, Central Greece & Pelopónissos	24.5	28.3	27.2	23	25.6	31.6	29.8	15
Greece, Northeastern Greece	23.9	27.9	25.9	14	25.5	29.7	28.2	12
Italy, Sicily, Le Madonie	26.0	29.4	27.6	25	26.4	33.2	30.7	25
Italy, Calabria, La Sila	23.9	28.0	26.4	17	22.5	34.4	29.5	25
Italy, Campania, Monte Faito	24.9	28.4	26.7	25	24.8	31.3	29.0	25
Italy, Campania, Ísola d'Íschia	24.5	30.4	27.5	25	28.4	31.9	30.3	7

Table 2

Morphometric measurements (in mm) taken on male genitalia and various proportions (see fig. 1)

Prep. No.	Origin	LUN	LT1	LT2	LG	HT1	HT2	HPA	LVI	LVA	LVD	LVT	LA	LP	LA+ LP	LUN/ LT1	LUN/ LG	LUN+ LT1/ LVA	LUN+ LT1/ LA+LP
2543	Portugal, Azores, Pico	0.86	1.00	0.88	0.67	0.92	0.38	0.77	1.08	1.81	1.33	0.58	1.35	0.73	2.08	0.86	1.28	1.03	0.89
2814	Portugal, Azores, Pico	0.85	0.94	0.88	0.65	0.96	0.38	0.77	0.88	1.73	1.35	0.50	1.56	0.69	2.25	0.90	1.31	1.03	0.79
2815	Portugal, Azores, Pico	0.86	0.92	0.85	0.67	1.00	0.35	0.81	0.88	1.67	1.36	0.48	1.46	0.79	2.25	0.93	1.28	1.07	0.79
2542	Portugal, Azores, Faial	0.85	0.98	0.90	0.65	0.88	0.38	0.75	0.98	1.69	1.33	0.52	1.54	0.71	2.25	0.87	1.31	1.08	0.81
2810	Portugal, Azores, Faial	0.86	0.96	0.83	0.67	1.02	0.40	0.77	0.85	1.62	1.33	0.46	1.46	0.69	2.15	0.90	1.28	1.12	0.85
2811	Portugal, Azores, Faial	0.83	0.88	0.81	0.65	0.87	0.38	0.73	0.85	1.71	1.31	0.58	1.58	0.69	2.27	0.94	1.28	1.00	0.75
2795	Portugal, Azores, Flores	0.90	0.88	0.79	0.67	0.96	0.38	0.77	0.81	1.63	1.29	0.46	1.38	0.69	2.07	1.02	1.34	1.09	0.86
2796	Portugal, Azores, Flores	0.92	1.02	0.96	0.67	0.92	0.38	0.79	0.88	1.77	1.33	0.56	1.46	0.73	2.19	0.90	1.37	1.10	0.89
2797	Portugal, Azores, Flores	0.92	0.98	0.90	0.63	0.92	0.38	0.75	0.88	1.73	1.28	0.56	1.37	0.67	2.04	0.94	1.46	1.10	0.93
2805	Portugal, Azores, São Jorge	0.96	1.02	0.92	0.65	0.96	0.42	0.79	0.87	1.85	1.46	0.60	1.60	0.75	2.35	0.94	1.48	1.07	0.84
2806	Portugal, Azores, São Jorge	0.85	0.92	0.81	0.69	0.90	0.40	0.75	0.92	1.63	1.31	0.48	1.38	0.67	2.05	0.92	1.23	1.09	0.86
2807	Portugal, Azores, São Jorge	0.90	0.87	0.83	0.67	0.94	0.38	0.81	0.96	1.67	1.38	0.48	1.46	0.77	2.23	1.03	1.34	1.06	0.79
2544	Portugal, Azores, Terceira	0.77	0.87	0.81	0.62	0.90	0.35	0.75	0.83	1.48	1.19	0.42	1.35	0.73	2.08	0.89	1.24	1.11	0.79
2801	Portugal, Azores, Terceira	0.85	0.88	0.87	0.60	0.90	0.37	0.77	0.87	1.67	1.31	0.52	1.44	0.62	2.06	0.97	1.42	1.04	0.84
2802	Portugal, Azores, Terceira	0.85	0.87	0.77	0.60	0.87	0.37	0.75	0.83	1.58	1.27	0.50	1.29	0.63	1.92	0.98	1.42	1.09	0.90
2545	Portugal, Azores, São Miguel	1.11	1.00	0.88	0.77	1.06	0.40	0.85	0.96	1.77	1.42	0.50	1.60	0.71	2.31	1.11	1.44	1.19	0.91
2818	Portugal, Azores, São Miguel	1.08	1.00	0.94	0.73	1.06	0.40	0.88	1.02	1.77	1.40	0.54	1.42	0.77	2.19	1.08	1.48	1.18	0.95
2819	Portugal, Azores, São Miguel	1.04	0.94	0.90	0.63	0.96	0.38	0.85	1.00	1.69	1.38	0.42	1.35	0.67	2.02	1.11	1.65	1.17	0.98
2820	Portugal, Azores, São Miguel	1.06	0.96	0.90	0.71	1.00	0.42	0.83	1.02	1.77	1.40	0.50	1.42	0.71	2.13	1.10	1.49	1.14	0.95

Prep. No.	Origin	LUN	LT1	LT2	LG	HT1	HT2	HPA	LVI	LVA	LVD	LVT	LA	LP	LA+ LP	LUN/ LT1	LUN/ LG	LUN+ LT1/ LVA	LUN+ LT1/ LA+LP
2532	Portugal, Madeira	1.15	1.10	1.04	0.75	1.10	0.44	0.94	1.08	2.12	1.69	0.54	1.83	0.98	2.81	1.05	1.53	1.06	0.80
2533	Portugal, Madeira	1.19	1.08	1.00	0.80	1.15	0.40	1.02	1.00	2.17	1.73	0.62	1.85	0.94	2.79	1.10	1.49	1.05	0.81
2534	Portugal, Madeira	1.19	1.04	0.96	0.85	1.17	0.40	1.08	1.12	2.12	1.67	0.56	2.00	0.96	2.96	1.14	1.40	1.05	0.75
2535	Portugal, Madeira	1.23	1.17	1.10	0.81	1.21	0.40	1.13	1.17	2.21	1.85	0.60	1.96	1.04	3.00	1.05	1.52	1.09	0.80
2536	Portugal, Madeira	1.27	1.15	1.08	0.79	1.19	0.42	1.04	1.10	2.10	1.71	0.60	1.79	0.94	2.73	1.10	1.61	1.15	0.89
2411	Morocco, Middle Atlas	1.25	1.13	1.06	0.73	1.19	0.48	0.98	1.15	2.17	1.69	0.60	1.75	0.87	2.62	1.11	1.71	1.10	0.91
2412	Morocco, Middle Atlas	1.21	1.06	1.00	0.77	1.31	0.44	1.08	1.00	2.10	1.65	0.56	1.98	1.00	2.98	1.14	1.57	1.08	0.76
2524	Morocco, Middle Atlas	1.21	1.12	0.98	0.79	1.21	0.46	1.02	1.17	2.08	1.69	0.58	1.83	0.85	2.68	1.08	1.53	1.12	0.87
2525	Morocco, Middle Atlas	1.17	0.98	0.90	0.73	1.19	0.42	1.00	1.08	2.02	1.62	0.62	1.79	0.87	2.66	1.19	1.60	1.06	0.81
2526	Morocco, Middle Atlas	1.23	1.15	1.02	0.75	1.23	0.46	1.02	1.06	2.06	1.65	0.54	1.94	0.98	2.92	1.07	1.64	1.16	0.82
2271	Italy, Sardinia	1.29	1.02	0.98	0.77	1.19	0.40	1.10	1.19	2.15	1.77	0.58	1.86	1.06	2.92	1.26	1.68	1.07	0.79
2272	Italy, Sardinia	1.31	1.10	1.06	0.75	1.25	0.44	1.08	1.08	2.28	1.88	0.58	1.79	0.88	2.67	1.19	1.75	1.06	0.90
2273	Italy, Sardinia	1.19	1.19	1.08	0.73	1.17	0.46	0.98	1.15	2.19	1.77	0.60	1.75	0.87	2.62	1.00	1.63	1.09	0.91
2274	Italy, Sardinia	1.23	1.08	1.02	0.73	1.12	0.38	1.04	1.15	2.23	1.79	0.58	1.64	0.94	2.58	1.14	1.68	1.04	0.90
2294	Italy, Sardinia	1.33	1.10	0.96	0.79	1.23	0.48	1.10	1.31	2.38	1.92	0.62	2.06	1.04	3.10	1.21	1.68	1.02	0.78
2520	Italy, Sardinia	1.33	1.13	1.00	0.81	1.19	0.44	1.10	1.38	2.31	1.88	0.56	1.83	0.94	2.77	1.18	1.64	1.06	0.89
2521	Italy, Sardinia	1.27	1.06	1.02	0.73	1.23	0.46	1.04	1.10	2.15	1.75	0.54	1.69	0.96	2.65	1.20	1.74	1.08	0.88
2275	France, Corsica	1.23	1.06	0.94	0.73	1.15	0.44	1.00	1.15	2.06	1.69	0.52	1.71	0.94	2.65	1.16	1.68	1.11	0.86
2270	Italy, Elba	1.27	1.12	1.04	0.73	1.23	0.44	1.07	1.15	2.27	1.79	0.62	1.69	1.10	2.79	1.13	1.74	1.05	0.86
2276	Italy, Sicily	1.54	1.35	1.13	1.15	1.40	0.56	1.15	1.35	2.50	1.94	0.71	2.27	1.02	3.29	1.14	1.34	1.16	0.88

Prep. No.	Origin	LUN	LT1	LT2	LG	HT1	HT2	HPA	LVI	LVA	LVD	LVT	LA	LP	LA+ LP	LUN/ LT1	LUN/ LG	LUN+ LT1/ LVA	LUN+ LT1/ LA+LP
2277	Italy, Sicily	1.54	1.27	1.13	1.10	1.48	0.54	1.27	1.27	2.56	2.08	0.63	2.21	1.08	3.29	1.21	1.40	1.10	0.85
2278	Italy, Sicily	1.46	1.21	1.17	0.98	1.52	0.54	1.13	1.37	2.42	2.00	0.62	2.13	0.98	3.11	1.21	1.49	1.10	0.86
2292	Italy, Sicily	1.46	1.19	1.08	1.08	1.46	0.50	1.21	1.15	2.40	1.90	0.63	2.04	1.12	3.16	1.23	1.35	1.10	0.84
2299	Italy, Sicily	1.48	1.21	1.10	1.06	1.52	0.52	1.21	1.27	2.58	2.00	0.73	2.15	1.12	3.27	1.22	1.40	1.04	0.82
2386	Italy, Sicily	1.44	1.31	1.15	1.02	1.52	0.54	1.19	1.19	2.37	1.92	0.63	2.23	1.21	3.44	1.10	1.41	1.16	0.80
2387	Italy, Sicily	1.46	1.25	1.17	1.00	1.62	0.60	1.29	1.33	2.52	1.96	0.69	2.21	1.08	3.29	1.17	1.46	1.08	0.82
2344	Italy, Calabria, Aspromonte (RE)	1.54	1.21	1.06	1.10	1.54	0.54	1.19	1.27	2.60	2.02	0.71	2.10	1.13	3.23	1.27	1.40	1.06	0.85
2345	Italy, Calabria, Aspromonte (RE)	1.60	1.29	1.12	1.17	1.46	0.54	1.17	1.15	2.50	1.94	0.71	2.13	1.08	3.21	1.24	1.37	1.16	0.90
2358	Italy, Calabria, La Sila (CS)	1.54	1.23	1.02	1.23	1.54	0.56	1.15	1.27	2.33	1.98	0.56	2.17	1.25	3.42	1.25	1.25	1.19	0.81
2359	Italy, Calabria, La Sila (CS)	1.63	1.33	1.10	1.35	1.65	0.58	1.31	1.27	2.69	2.10	0.75	2.27	1.27	3.54	1.23	1.21	1.10	0.84
2362	Italy, Calabria, La Sila (CS)	1.67	1.23	1.04	1.31	1.54	0.56	1.29	1.27	2.52	1.96	0.69	2.29	1.29	3.58	1.36	1.27	1.15	0.81
2363	Italy, Calabria, La Sila (CS)	1.58	1.27	1.06	1.29	1.60	0.60	1.21	1.25	2.46	1.96	0.67	2.23	1.21	3.44	1.24	1.22	1.16	0.83
2364	Italy, Calabria, La Sila (CS)	1.67	1.31	1.13	1.25	1.58	0.58	1.27	1.17	2.63	2.06	0.73	2.29	1.23	3.52	1.27	1.34	1.13	0.85
2365	Italy, Calabria, La Sila (CS)	1.44	1.15	1.06	1.13	1.58	0.56	1.13	0.98	2.38	1.96	0.52	2.15	1.06	3.21	1.25	1.27	1.09	0.81
2285	Italy, Campania, Monte Faito (NA)	1.58	1.37	1.10	1.31	1.60	0.56	1.31	1.15	2.63	2.04	0.73	2.21	1.12	3.33	1.15	1.21	1.12	0.89
2293	Italy, Campania, Monte Faito (NA)	1.50	1.23	1.06	1.21	1.54	0.58	1.29	1.25	2.52	2.04	0.65	2.31	1.08	3.39	1.22	1.24	1.08	0.81
2295	Italy, Campania, Monte Faito (NA)	1.56	1.23	1.04	1.27	1.52	0.54	1.23	1.08	2.60	2.04	0.71	2.19	1.13	3.32	1.27	1.23	1.07	0.84
2298	Italy, Campania, Monte Faito (NA)	1.50	1.37	1.15	1.29	1.71	0.52	1.35	1.19	2.52	2.00	0.65	2.08	1.13	3.21	1.09	1.16	1.14	0.89
2323	Italy, Campania, Monte Faito (NA)	1.67	1.27	1.08	1.29	1.65	0.50	1.31	1.17	2.62	2.08	0.73	2.40	1.37	3.77	1.31	1.29	1.12	0.78
2287	Italy, Campania, Ísola di Capri (NA)	1.60	1.31	1.08	1.31	1.58	0.60	1.25	1.15	2.60	2.12	0.63	2.19	1.27	3.46	1.22	1.22	1.12	0.84

Prep. No.	Origin	LUN	LT1	LT2	LG	HT1	HT2	HPA	LVI	LVA	LVD	LVT	LA	LP	LA+ LP	LUN/ LT1	LUN/ LG	LUN+ LT1/ LVA	LUN+ LT1/ LA+LP
2286	Italy, Campania, Ísola d'Íschia (NA)	1.58	1.33	1.15	1.23	1.63	0.60	1.23	1.23	2.58	2.02	0.75	2.17	1.15	3.32	1.19	1.28	1.13	0.88
2291	Italy, Campania, Ísola d'Íschia (NA)	1.52	1.40	1.19	1.12	1.50	0.52	1.17	1.23	2.71	2.15	0.73	2.15	1.15	3.30	1.09	1.36	1.08	0.88
2503	Greece, Pelopónissos	1.63	1.23	1.08	1.12	1.46	0.54	1.13	1.21	2.60	2.06	0.67	2.23	1.06	3.29	1.33	1.46	1.10	0.87
2504	Greece, Pelopónissos	1.56	1.25	1.04	1.10	1.54	0.60	1.15	1.13	2.44	1.90	0.71	2.13	1.13	3.26	1.25	1.42	1.15	0.86
2505	Greece, Pelopónissos	1.62	1.19	1.04	1.17	1.50	0.56	1.29	1.19	2.63	2.04	0.73	2.29	1.12	3.41	1.36	1.38	1.07	0.82
2440	Greece, Pelopónissos	1.50	1.29	1.10	1.17	1.52	0.54	1.17	1.12	2.40	1.96	0.60	2.06	1.04	3.10	1.16	1.28	1.16	0.90
2506	Greece, Stereá Eláda	1.54	1.27	1.02	1.13	1.38	0.56	1.21	1.17	2.56	2.00	0.73	2.23	1.00	3.23	1.21	1.36	1.10	0.87
2507	Greece, Stereá Eláda	1.52	1.29	1.12	1.19	1.58	0.58	1.35	1.23	2.54	1.98	0.69	2.21	1.25	3.46	1.18	1.28	1.11	0.81
2508	Greece, Atikí	1.50	1.19	1.00	1.04	1.50	0.54	1.17	1.12	2.37	1.88	0.60	2.06	1.08	3.14	1.26	1.44	1.14	0.86
2439	Greece, Makedonía	1.54	1.21	1.06	1.19	1.60	0.52	1.25	1.02	2.38	1.87	0.69	2.06	1.08	3.14	1.27	1.29	1.16	0.88
2302	Greece, Kikládes, Síros	1.67	1.42	1.27	1.15	1.62	0.62	1.37	1.35	2.65	2.13	0.71	2.29	1.15	3.44	1.18	1.45	1.17	0.90
2441	Greece, Kikládes, Mílos	1.73	1.31	1.08	1.19	1.50	0.58	1.27	1.33	2.71	2.13	0.71	2.27	1.13	3.40	1.32	1.45	1.12	0.89
2509	Greece, Eastern Aegean islands, Ikaría	1.48	1.31	1.12	1.12	1.50	0.54	1.19	1.19	2.44	2.00	0.62	2.23	1.08	3.31	1.13	1.32	1.14	0.84
2510	Greece, Eastern Aegean islands, Ikaría	1.50	1.27	1.10	1.17	1.50	0.56	1.19	1.21	2.44	1.90	0.67	2.25	1.06	3.31	1.18	1.28	1.14	0.84
2511	Greece, Eastern Aegean islands, Ikaría	1.46	1.19	1.04	1.08	1.42	0.54	1.17	1.21	2.48	1.88	0.69	2.17	1.06	3.23	1.23	1.35	1.07	0.82
2410	Turkey, Muğla	1.38	1.15	0.98	1.04	1.42	0.50	1.08	1.02	2.23	1.77	0.58	2.08	1.02	3.10	1.20	1.33	1.13	0.82
2409	Turkey, Antalya	1.38	1.15	0.98	0.98	1.40	0.48	1.13	1.06	2.37	1.85	0.63	1.96	1.06	3.02	1.20	1.41	1.07	0.84
2408	Turkey, Konya	1.37	1.13	1.02	1.06	1.40	0.46	1.10	1.12	2.37	1.87	0.65	1.98	1.08	3.06	1.21	1.29	1.05	0.82

Table 3

Morphometric measurements (in mm) taken on female genitalia (see fig. 2)

Prep. No.	**Origin**	**WST**	**LDL**	**LL**	**LCB**	**WCB**	**LS**
2547	Portugal, Azores, Pico	1.88	0.92	0.35	2.02	1.35	1.04
2816	Portugal, Azores, Pico	1.65	0.88	0.35	1.71	1.10	1.10
2817	Portugal, Azores, Pico	1.83	0.88	0.38	1.90	0.88	0.96
2546	Portugal, Azores, Faial	1.96	0.81	0.42	1.96	1.04	1.00
2812	Portugal, Azores, Faial	1.87	1.15	0.44	2.19	1.23	1.15
2813	Portugal, Azores, Faial	1.65	0.92	0.35	1.90	1.27	1.17
2798	Portugal, Azores, Flores	1.60	0.96	0.37	2.10	1.35	1.08
2799	Portugal, Azores, Flores	1.58	0.88	0.37	1.71	1.13	0.80
2800	Portugal, Azores, Flores	1.62	0.87	0.37	1.71	1.21	1.12
2808	Portugal, Azores, São Jorge	1.67	0.87	0.37	2.12	1.37	1.25
2809	Portugal, Azores, São Jorge	1.83	0.90	0.37	2.33	1.27	1.27
2548	Portugal, Azores, Terceira	1.69	1.00	0.37	1.48	0.88	0.77
2803	Portugal, Azores, Terceira	1.56	1.00	0.37	1.90	1.21	0.96
2804	Portugal, Azores, Terceira	1.69	0.88	0.35	1.69	0.96	1.06
2821	Portugal, Azores, São Miguel	1.94	1.00	0.44	2.44	1.25	1.35
2822	Portugal, Azores, São Miguel	1.71	0.92	0.35	2.58	1.31	1.52
2823	Portugal, Azores, São Miguel	1.81	0.88	0.42	2.33	1.29	1.50
2537	Portugal, Madeira	2.08	1.25	0.56	3.92	1.77	2.88
2538	Portugal, Madeira	1.85	1.10	0.48	3.88	1.90	2.85
2539	Portugal, Madeira	1.90	1.19	0.48	3.85	1.88	2.62
2540	Portugal, Madeira	2.15	1.00	0.58	3.50	2.15	2.62
2541	Portugal, Madeira	1.88	0.88	0.56	3.85	1.77	3.06
2527	Morocco, Middle Atlas	1.77	1.06	0.52	2.96	1.13	2.42
2528	Morocco, Middle Atlas	1.67	0.96	0.48	3.58	1.60	2.65
2529	Morocco, Middle Atlas	1.92	1.02	0.46	3.19	1.81	2.35
2530	Morocco, Middle Atlas	1.79	0.98	0.52	3.38	1.87	2.52
2531	Morocco, Middle Atlas	1.60	1.08	0.46	3.52	1.83	2.27
2320	Italy, Sardinia	1.96	1.15	0.56	3.42	1.17	2.65
2321	Italy, Sardinia	1.92	1.23	0.54	3.65	1.42	2.69
2461	Italy, Sardinia	1.60	1.15	0.52	3.63	1.69	2.87
2462	Italy, Sardinia	1.83	1.13	0.56	3.90	1.71	2.96
2463	Italy, Sardinia	1.98	1.33	0.62	3.37	1.13	2.96

Prep. No.	Origin	WST	LDL	LL	LCB	WCB	LS
2522	Italy, Sardinia	1.69	1.25	0.54	3.65	1.85	2.69
2523	Italy, Sardinia	1.69	1.19	0.60	3.29	1.23	2.67
2464	France, Corsica	1.90	1.08	0.56	4.27	1.69	2.77
2465	Italy, Elba	1.90	1.12	0.50	3.75	1.98	2.96
2319	Italy, Sicily	1.94	1.27	0.48	4.56	2.21	3.19
2451	Italy, Sicily	2.00	1.29	0.62	4.23	1.79	3.17
2452	Italy, Sicily	2.00	1.19	0.62	4.48	1.83	3.38
2453	Italy, Sicily	2.02	1.10	0.58	4.67	2.23	3.40
2367	Italy, Calabria, La Sila (CS)	2.06	1.15	0.73	4.40	1.48	2.87
2368	Italy, Calabria, La Sila (CS)	1.92	1.17	0.69	4.10	1.54	3.23
2372	Italy, Calabria, La Sila (CS)	2.13	1.06	0.65	4.75	1.69	2.81
2373	Italy, Calabria, La Sila (CS)	2.00	1.33	0.79	3.58	1.62	2.60
2374	Italy, Calabria, La Sila (CS)	1.85	1.17	0.69	3.50	1.48	2.58
2379	Italy, Calabria, La Sila (CS)	2.23	1.25	0.67	4.10	1.83	2.88
2380	Italy, Calabria, La Sila (CS)	1.85	1.31	0.73	3.94	1.65	2.46
2381	Italy, Calabria, La Sila (CS)	2.27	1.35	0.75	3.77	1.56	2.73
2382	Italy, Calabria, La Sila (CS)	1.87	1.19	0.71	4.25	2.08	3.15
2383	Italy, Calabria, La Sila (CS)	1.92	1.04	0.58	3.98	1.44	2.79
2384	Italy, Calabria, La Sila (CS)	2.19	1.31	0.75	3.88	1.37	2.69
2824	Italy, Calabria, La Sila (CS)	2.37	1.31	0.73	3.67	1.50	2.88
2454	Italy, Campania, Monte Faito (NA)	1.85	1.12	0.58	3.44	1.17	2.88
2455	Italy, Campania, Monte Faito (NA)	2.13	1.31	0.65	3.33	1.90	2.69
2456	Italy, Campania, Monte Faito (NA)	2.10	1.10	0.54	4.54	2.50	3.27
2457	Italy, Campania, Monte Faito (NA)	2.02	1.08	0.63	3.50	1.12	2.85
2458	Italy, Campania, Monte Faito (NA)	2.04	1.23	0.71	4.00	1.96	2.90
2459	Italy, Campania, Ísola d'Íschia (NA)	2.02	1.42	0.75	3.50	1.29	3.02
2460	Italy, Campania, Ísola d'Íschia (NA)	2.02	1.10	0.73	3.77	1.44	3.06
2512	Greece, Pelopónissos	2.17	1.35	0.71	4.31	2.04	3.08
2517	Greece, Pelopónissos	2.00	1.23	0.71	3.63	1.88	2.75
2513	Greece, Stereá Eláda	1.92	1.23	0.67	3.77	1.87	2.65
2514	Greece, Stereá Eláda	2.04	1.04	0.60	3.71	1.85	2.46
2516	Greece, Stereá Eláda	2.00	1.21	0.69	4.38	1.87	2.67
2518	Greece, Eastern Aegean islands, Ikaría	2.19	1.25	0.63	3.85	1.44	3.06
2519	Greece, Eastern Aegean islands, Ikaría	1.85	1.02	0.56	3.33	1.17	2.42

4. Superspecies *Hipparchia azorina*

Description. Overall size less than any other *Parahipparchia* species. Ground-colour dark brown, wing markings on upperside much reduced to completely absent, especially in the males. Sex brand much reduced or even totally absent. Upperside forewing in females lighter brown-grey to creamy white in basal and discal area, due to thinner scaling in combination with lighter pigmentation. Male genitalia smaller than any other *Parahipparchia* species, both in overall size and (nearly always) in size of the different parts ; uncus $\leq$ tegumen (*azorina*) or $> 1.1 \times$ tegumen length (*miguelensis*) ; valve with well developed dorsal process ; aedeagus dorsally with small spines in its distal half. Female genitalia sterigma not significantly smaller to equally sized to *maderensis*, *algirica* and *aristaeus*, but dorsal lamella and — on average — dorso-lateral lobe always smaller than any other *Parahipparchia* species ; cervix bursae lightly sclerotized, corpus bursae distinctly smaller and signum distinctly shorter than in any other *Parahipparchia* species, except some *mersina* (cf. Olivier & De Prins, 1989).

Distribution. Restricted to the Azores (Portugal), where it is known to occur on the islands of Flores, Corvo, São Jorge, Terceira, Faial, Pico and São Miguel.

Comments. It was Le Cerf (1935 : 209) who discovered the presence of spines on the aedeagus in *azorina* from Pico and in *miguelensis*, highlighting its significance. Of all subsequent authors, only Bivar de Sousa (1982a) mentioned this character : we haven't seen any material from Corvo but we found it in all males dissected from the six other islands of the archipelago, while it has not been observed in any other *Hipparchia* **s. l.** Therefore, we consider it to be a synapomorphy of superspecies *H. azorina*. The superspecies concept, as defined by Mayr (1963), applies very well to the present case, i. e. "a monophyletic group of entirely or essentially allopatric species that are morphologically too different to be included in a single species (...) that reproductive isolation between them can be assumed". Oehmig (1983) already suggested use of this concept, recognizing three component species instead of two in the present study (see below).

Bernardi (1961) applied the superspecies concept to the *H. aristaeus* group with the inclusion of *azorina*. We have been unable to find any synapomorphy supporting the monophyly of the *aristaeus* group so far, either with or without *azorina*, and therefore we see no hard evidence for the existence of a superspecies *H. aristaeus* as viewed by Bernardi. For the same reason we cannot follow Leestmans (1968), Higgins (1975) and Higgins & Hargreaves (1983) in considering *azorina* as a subspecies of *H. aristaeus*. There is even less support for considering *azorina* as a subspecies of *H. semele* (cf. Cockerell, 1923 ; Rebel, 1938, 1940a, 1940b ; Carthy, 1957).

4.1. *Hipparchia (azorina) azorina* (Strecker, 1899) comb. n., stat. n.

"*Satyrus Azorinus* n. sp." Strecker, 1899. — Lepidoptera, Rhopaloceres and Heteroceres, Indigenous and Exotic. Supplement No. 2 : 3. Locus typicus restrictus : [Azores] Pico (Oehmig, 1983 : 139). Type material : holotype (by monotypy) ♂, Allyn Museum of Entomology, Sarasota, Florida, USA. For synonymy, see subspecies.

TYPE LOCALITY. Strecker (1899) reported his unique specimen as originating from the "Azores", without further specification. It is so worn, that it is impossible to attribute it to any island population with any certainty, except that it definitely doesn't come from São Miguel. Bivar de Sousa (1982a : 207) compared the original description of this taxon to a picture of the holotype and to some specimens from the island of Faial and concluded that it came from that island, the more as Faial was normally the island visited by ships en route between Europe and North America during the 19th Century. Oehmig (1983 : 139), however, having also examined pictures of that specimen (reproduced here on text fig. 3), not only concluded that it came from Pico, but formally proposed to restrict the type locality to this island. Therefore, Pico is to be considered as the type locality of the present species.

DESCRIPTION. Mean size in both sexes less than *H. (azorina) miguelensis*, varying to some extent among different islands : smallest on Corvo, Flores and Terceira, largest on Pico, São Jorge and Faial. Wing markings even more reduced than in *miguelensis* ; creamy yellow (or orange) submarginal patches upperside hindwing (usually present to various degrees in s2–s5(6) in all other *Parahipparchia* taxa) invariably absent. Basal and discal area upperside forewing lighter grey to creamy white, as in female, in few males of *H. (azorina) azorina azorina* and in all examined males of *H. (azorina) azorina occidentalis*. Upperside hindwing spot in s2 usually absent. Underside hindwing discal line bending abruptly distally in s4–s5 and often ending in a point, bordered distally by moderately broad whitish postdiscal band that is always well-expressed. Male genitalia smaller than in *miguelensis*, uncus ≤ tegumen. Female genitalia, mid-dorsal process as a rule wide at base, usually more or less triangular or rounded ; corpus bursae smaller than in *miguelensis* (and *mersina*) ; signum shorter than in *miguelensis* and in most *mersina*.

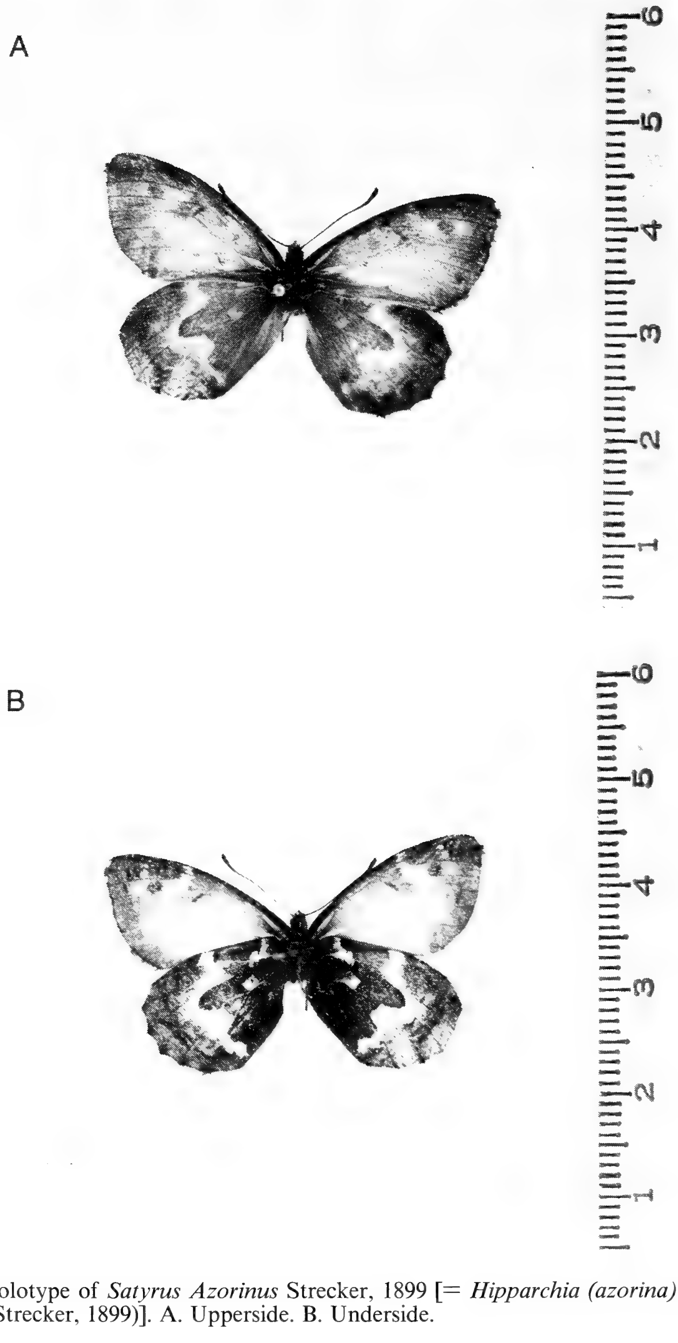


Fig. 3. Holotype of *Satyrus Azorinus* Strecker, 1899 [= *Hipparchia (azorina) azorina azorina* (Strecker, 1899)]. A. Upperside. B. Underside.

Distribution. As superspecies *H. azorina* (vide supra), but absent from São Miguel.

Bionomics. The biotope consists of natural grasslands, usually at altitudes from 500 m up to 2000 m on Pico, with various shrubs and herbs including a. o. *Calluna vulgaris* (L.), *Erica azorea* Hochst. ex Seub., *Rubus* spp. and *Potentilla* spp., both last ones visited by the imagines (for further details see Walker, 1931 ; Le Cerf, 1935 ; Carthy, 1957 ; Marsden & Wright, 1971 ; Oehmig, 1983 ; Meyer, 1991, 1993 ; Fuchs, 1993). Larval host-plant *Festuca jubata* Lowe (Poaceae) (Oehmig, 1983 ; according to Fuchs, 1993, *F. petraea* Bracen). Univoltine : adults from June (Rebel, 1940b) to October (Walker, 1931), in a protracted brood. Early stages : described in detail by Oehmig (1983) from material from both Faial and Flores.

Geographic variation. There is some (minor) inter-island variation in external and structural characters, as well as in morphology of the early stages. This has led to the formal description of a subspecies for each single inhabited island (Le Cerf, 1935 ; Esaki, 1936 ; Bivar de Sousa, 1982a, 1982b, 1985b ; Oehmig, 1983). Last-named author raised the Flores population to species rank, as opposed to those from the central island group (Pico, Faial and São Jorge) : in this he was followed by Kudrna (1986, 1996), Balletto *et al.* (1990), Vieira & Pintureau (1991), Meyer (1991, 1993), Balletto (1995) and Tolman & Lewington (1997). We recognize only one species with two subspecies for both central and western island groups, with a different distribution than was assumed until now (see below).

4.1.1. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) comb. n., stat. n.

"*Satyrus Azorinus* n. sp." Strecker, 1899. — Lepidoptera, Rhopaloceres and Heteroceres, Indigenous and Exotic. Supplement No. 2 : 3. Locus typicus restrictus : [Azores] Pico (Oehmig, 1983 : 139). Type material : holotype (by monotypy) ♂, Allyn Museum of Entomology, Sarasota, Florida, USA.

"*Satyrus azorinus* Strecker, ssp. *picœnsis*, nova" Le Cerf, 1935. — *Bull. Soc. ent. Fr.* 40 : 206–208, Pl. V, figs. 6–10. Locus typicus : Azores, Pico. Type material : syntypes 2 ♂, 1 ♀, in Muséum National d'Histoire Naturelle, Paris. — Junior subjective synonym of *Satyrus Azorinus* Strecker, 1899 (Rebel, 1940b : 16 ; Kudrna, 1977 : 97).

"*Oeneis ohshimai* sp. nov." Esaki, 1936. — *Annotnes. zool. jap.* 15 : 483–485. Locus typicus : Azores, Faial. Type material : holotype

♂, paratypes 2 ♂, 4 ♀, in Entomological Laboratory, Kyûshû Imperial University, Fukuoka. — Junior subjective synonym of *Satyrus Azorinus* Strecker, 1899 (Rebel, 1940b : 16 ; Kudrna, 1977 : 97).

"*Oeneis okohimae*" Rebel, 1940b. — *Soc. Scient. Fenn., Comm. Biol.* VIII.1 : 16. — Subsequent misspelling of the name *ohshimai* Esaki, 1936.

"*Hipparchia azorensis*" Bernardi, 1961. — *Colloques int. Cent. natn. Rech. scient.* 94 : 186. — Subsequent misspelling of the name *Azorinus* Strecker, 1899.

Illustrations. Plate 3, figs. 1–2 & 4–5. Plate 5, figs. 1–4 (androconial scales). Text fig. 3 (holotype ♂). Text fig. 4 (male genitalia). Text fig. 5 (female genitalia).

Material examined. Portugal, Azores, Pico : 9 ♂, 3 ♀ in coll. VLCA ; Portugal, Azores, Faial : 10 ♂, 5 ♀ in colls. VLCA, M. Meyer.

Description. Forewing length : see table 1. Male upperside ground-colour dark brown, not significantly darker in material from Faial when compared to specimens from Pico ; forewing dark brown spot in s5 always present and sometimes with a small white pupil in Pico specimens, much more weakly expressed and mostly without white pupil to entirely absent in material from Faial ; spot in s2 usually clearly visible in Pico material, mostly hardly noticeable or absent in Faial material ; basal and discal area only occasionally of a lighter colour than remainder of wing ; sex brand reduced to vestigial, but always at least traces of it ; whitish postdiscal band on underside hindwing clearly visible on upperside. Female forewing upperside basal and discal area lighter, but not distinctly so, than remainder of wing ; markings on upperside forewing more complete than in male, usually somewhat obliterated in Faial specimens. Underside forewing pale to middle ochreous colour, without significant differences between Pico and Faial specimens. No differences in both male and female genitalia between Pico and Faial specimens, no significant differences in androconial scales, which are small (plate 5, see also Oehmig, 1983 : 155, fig. 3).

Distribution. Limited to the islands of Pico and Faial.

Comments. The small differences between specimens from both islands, especially in the expression of the spots in s2 and s5 on male upperside forewing, do not justify their subspecific separation (in doing so, one could for instance recognize several subspecies of *H. senthes* on the Aegean islands alone !). On the contrary, they appear much more alike than compared to material from the remaining islands of the central and western groups, that is listed under the next subspecies.

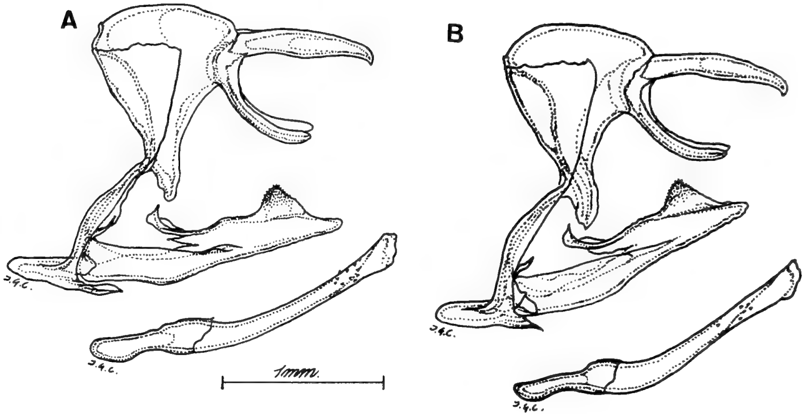


Fig. 4. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) : male genitalia.
A. Portugal, Azores, Pico, Châ do Pelado (800 m), 15.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2815). B. Portugal, Azores, Faial, Caldeira Cabeço Gordo (900 m), 12.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2810).

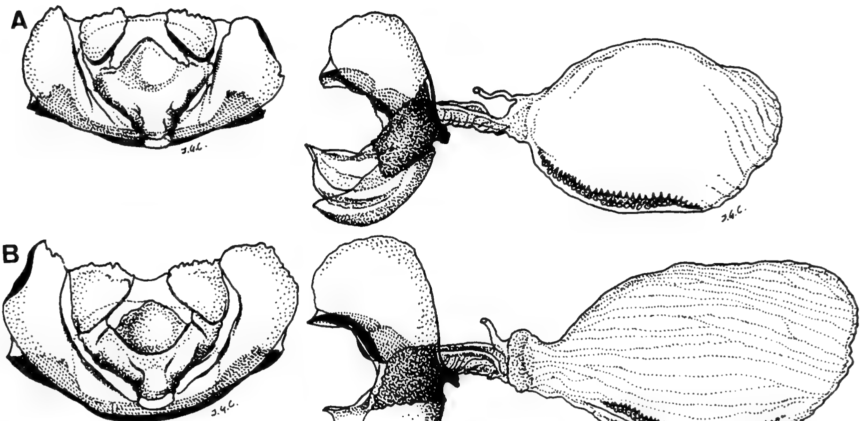


Fig. 5. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) : female genitalia.
A. Portugal, Azores, Pico, Châ do Pelado (800 m), 14.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2816). B. Portugal, Azores, Faial, Caldeira Cabeço Gordo (900 m), 12.VIII.1990, leg. et coll. M. Meyer (Prep JGC no. 2812).

4.1.2. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982, comb. n., stat. n.

"*Hipparchia (Parahipparchia) azorina* (Strecker) ssp. *occidentalis*" Bivar de Sousa, 1982. — *Bolm. Soc. port. Ent.* 7 (Supl. A) : 208–209, 211, figs. 3, 6, 212, figs. 9, 12, 213, figs. 14, 16. Locus typicus : Azores, Flores, "Planalto junto à Caldeira Funda". Type material : holotype ♂, paratypes 8 ♂, 2 ♀, in coll. Bivar de Sousa, single male paratypes in Museu Bocage (Faculdade de Ciências de Lisboa), Instituto Universitário dos Açores (Laboratório de Ecologia Aplicada), SPEN (Sociedade portuguesa de Entomologia).

"*Hipparchia azorina* (Strecker) ssp. *cenjonatura* n. ssp." Bivar de Sousa, 1982. — *Bolm. Soc. port. Ent.* 25 : 20. Locus typicus : Azores, São Jorge. — Unavailable name (Article 13(a) of ICZN). Nomen nudum, **syn. n.**

"*Hipparchia azorina jorgense* Oehmig new subspecies" Oehmig, 1983. — *J. Res. Lepidopt.* 20 (3) (1981) : 143–146, Pl. I, figs. a–d, 155, fig. 3, 158, fig. 6.5, 159, fig. 7.4. Locus typicus : Azores, São Jorge. Type material : holotype ♂, paratypes 1 ♂, 8 ♀, in coll. Oehmig. — Junior subjective synonym of *Hipparchia (Parahipparchia) azorina* (Strecker) ssp. *occidentalis* Bivar de Sousa, 1982, **syn. n.**

"*Hipparchia caldeirense* Oehmig new species" Oehmig, 1983. — *J. Res. Lepidopt.* 20 (3) (1981) : 148–150, Pl. I, figs. o–r, 156, fig. 4.3, 158, fig. 6.1, 159, fig. 7.1. Locus typicus : Azores, Flores, "Caldeira Seca". Type material : holotype ♂, paratypes 33 ♂, 6 ♀, in coll. Oehmig. — Junior subjective synonym of *Hipparchia (Parahipparchia) azorina* (Strecker) ssp. *occidentalis* Bivar de Sousa, 1982 (Kudrna, 1986 : 186).

"*Hipparchia (Parahipparchia) azorina* (Strecker) ssp. *barbara* Bivar de Sousa n. ssp." Bivar de Sousa, 1985. — *Bolm. Soc. port. Ent.* 4 (Supl. 1) : 378–379, 381, figs. 1–4, 382, fig. 9. Locus typicus : Azores, Terceira. Type material : holotype ♂, paratypes 13 ♂, 4 ♀, depository not mentioned (presumably at least partly in coll. Bivar de Sousa). — Junior subjective synonym of *Hipparchia (Parahipparchia) azorina* (Strecker) ssp. *occidentalis* Bivar de Sousa, 1982, **syn. n.**

"*Hipparchia (Parahipparchia) azorina* (Strecker) ssp. *minima* Bivar de Sousa n. ssp." Bivar de Sousa, 1985. — *Bolm. Soc. port. Ent.* 4 (Supl. 1) : 379–380, 381, figs. 5–8, 382, fig. 10. Locus typicus : Azores, Corvo. Type material : holotype ♂, paratypes 9 ♂, 2 ♀, depository not mentioned (presumably at least partly in coll. Bivar de Sousa). — Junior subjective synonym of *Hipparchia (Para-*

hipparchia) azorina (Strecker) ssp. *occidentalis* Bivar de Sousa, 1982, **syn. n.**

"[*Hipparchia*] *caldeirensis*" Balletto *et al.*, 1990. — *Atti Convegni Lincei* 85 : 185, 186, 189. — Subsequent misspelling of the name *caldeirense* Oehmig, 1983.

"*Hipparchia azorina barbarensis*" Tolman & Lewington, 1997. — Collins Field Guide. Butterflies of Britain and Europe : 195, 311. — Subsequent misspelling of the name *barbara* Bivar de Sousa, 1985.

ILLUSTRATIONS. Plate 3, figs. 3 & 6–12. Plate 6, figs. 1–4 (androconial scales). Text figs. 6–7 (male genitalia). Text figs. 8–9 (female genitalia).
MATERIAL EXAMINED. Portugal, Azores, Flores : 6 ♂, 3 ♀ in coll. VLCA ; Portugal, Azores, São Jorge : 4 ♂, 2 ♀ in colls. VLCA, M. Meyer ; Portugal, Azores, Terceira : 8 ♂, 4 ♀ in coll. VLCA.

DESCRIPTION. Forewing length : see table 1. Upperside forewing dark brown spot in s5 always, in s2 usually present ; basal and discal area in both sexes markedly lighter than remainder of wing, much more so than in nominotypical *azorina*, sex brand entirely absent, in material from São Jorge sometimes traces of it ; postdiscal band underside hindwing white, sharply contrasting and hence even more apparent on upperside than in nominotypical *azorina*. Both male and female genitalia not significantly different from nominotypical *azorina*. Androconial scales unknown in material from Flores, but detected in specimens from Corvo, São Jorge and Terceira ; individually (and perhaps to some extent geographically) variable, though not significantly different from nominotypical *azorina* from Pico and Faial (plate 6, see also figs. in Oehmig, 1983 and Bivar de Sousa, 1985b).

DISTRIBUTION. Known from the islands of Flores and Corvo (western group) and from São Jorge and Terceira (central group).

COMMENTS. Material from these islands shows some similarities in external features that may indicate a common origin, as opposed to nominotypical *azorina* (alternatively, these may have been acquired independently as a result of comparable environmental pressures). Such a treatment is certainly more informative than the naming of each and every island population and it may be testable in the future (e. g. with the aid of molecular techniques). Characters purported to differentiate the taxa *jorgense*, *barbara* and *minima* are part of the range of variation of *occidentalis*. Oehmig (1983) noted some differences in the number of micropyles and ribs in the eggs of "*H. caldeirense*" and "*H. azorina ohshimai*" (and *H. miguelensis*), largely basing his

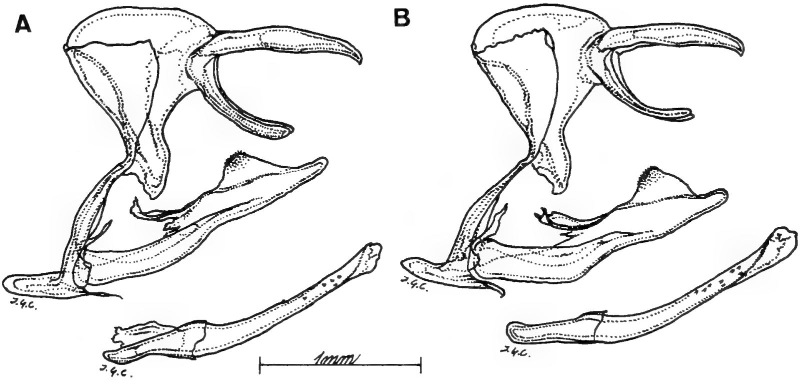


Fig. 6. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 : male genitalia. A. Portugal, Azores, Flores, Caldeira Comprida (580 m), 8.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2797). B. Portugal, Azores, Terceira, Serra de Santa Barbara (1000 m), 19.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2801).

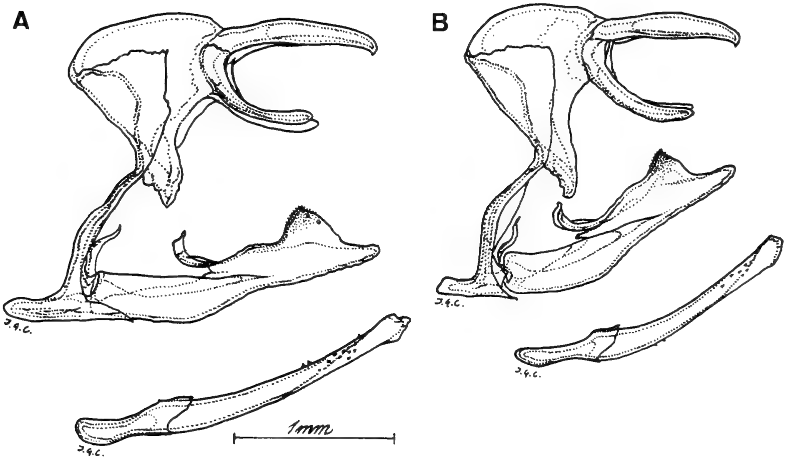


Fig. 7. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 : male genitalia. A. Portugal, Azores, São Jorge, Serra do Topo, Pedra Vermelha (800 m), 17.VII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2805 ; specimen illustrated on plate 3, fig. 8). B. same data as A (Prep. JGC no. 2806).

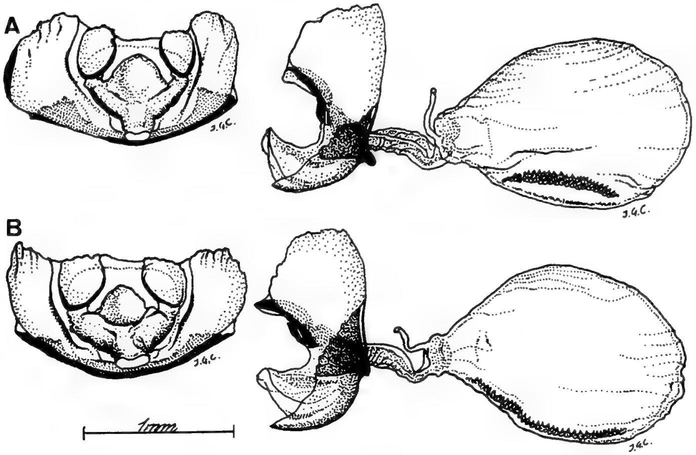


Fig. 8. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 : female genitalia. A. Portugal, Azores, Flores, Caldeira Comprida (580 m), 8.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2799 ; specimen illustrated on plate 3, fig. 10). B. same data as A (Prep. JGC no. 2800 ; specimen illustrated on plate 3, fig. 6).

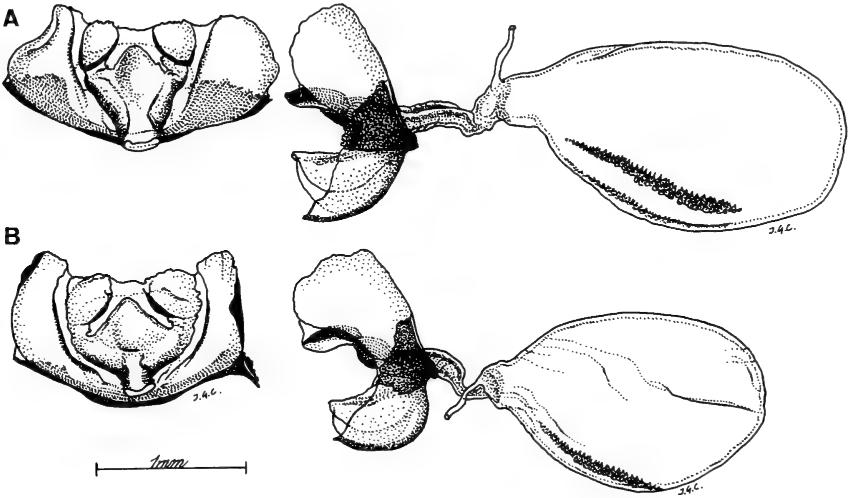


Fig. 9. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 : female genitalia. A. Portugal, Azores, São Jorge, Serra do Topo, Pedra Vermelha (800 m), 17.VIII.1990, leg. et coll. M. Meyer (Prep. JGC no. 2809). B. Portugal, Azores, Terceira, Serra de Santa Barbara (1000 m), 18.VIII.1990, leg. M. Meyer, in coll. VLCA (Prep. JGC no. 2803 ; specimen illustrated on plate 3, fig. 12).

argument for the specific separation of these taxa on such data. These, however, can vary substantially within a single species, e. g. in *H. semele*, but also in other *Hipparchia* species and in the Satyrini in general (Wagener, 1983 ; García-Barros & Martín, 1991, 1995 ; Thomson, 1992 ; Jutzeler, Grillo & de Bros, 1995 ; Jutzeler, Pitzalis & de Bros, 1995 ; Jutzeler *et al.*, 1997).

4.2. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) comb. n., stat. n.

"*Satyrus azorinus* Strecker, ssp. *miguelensis*, nova" Le Cerf, 1935. — *Bull. Soc. ent. Fr.* 40 : 207–208, Pl. V, figs. 1–5. Locus typicus : Azores, São Miguel. Type material : syntypes 3 ♂, 1 ♀, in Muséum National d'Histoire Naturelle, Paris.

ILLUSTRATIONS. Plate 3, figs. 13–15. Plate 7, figs. 1–4 (androconial scales). Text fig. 10 (male genitalia). Text fig. 11 (female genitalia).

MATERIAL EXAMINED. Portugal, Azores, São Miguel : 21 ♂, 7 ♀ in colls. VLCA, H. Henderickx.

DESCRIPTION. Forewing length : see table 1 ; both sexes larger than *H. (azorina) azorina*. Wings more elongated than in *H. (azorina) azorina*, forewing usually with pointed apex and convex outer margin, unlike any other taxon treated in the present study. Male upperside ground-colour dark brown, of a warmer tinge than in *H. (azorina) azorina* ; basal and discal area of forewing as dark as rest of wing, dark brown spots in s2 and s5 always visible, often encircled by a diffuse orange-ochreous patch that is usually quite reduced, but sometimes more extended and in a few cases well-expressed, occasionally an additional spot in s3, also encircled by an orange-ochreous patch ; sex brand vestigial but always present in s2, (nearly) touching median vein of cell, sometimes additional traces in s1b ; hindwing dark spot in s2 always present, often encircled by an orange-ochreous patch, additional small orange-ochreous patches in s3–s5 variously expressed, from entirely absent to well marked ; one specimen has an additional dark spot in s3. Female similar to male but markings usually more complete, creamy yellow, with distinctly lighter basal and discal area. Underside forewing in both sexes usually more vividly ochreous than in *H. (azorina) azorina*. Underside hindwing discal line bending much more gently distally in s4–s5 than in *H. (azorina) azorina*, evenly rounded (sometimes pointed in female), whitish postdiscal band much narrower than in *H. (azorina) azorina* (and hence less conspicuous on upperside hindwing). Male genitalia larger than in *H. (azorina)*

azorina, uncus > tegumen (1.1×), valve and especially gnathos longer than in most *H. (azorina) azorina*, dorsal spines on aedeagus usually better developed and extending more basad than in *H. (azorina) azorina*. Female genitalia sterigma with mid-dorsal process narrower at base, more elongated and pointed distally, unlike *H. (azorina) azorina* except for one female from Pico (Prep. No. 2547), corpus bursae larger and signum longer than in *H. (azorina) azorina*. Androconial scales more elongated than in *H. (azorina) azorina* (plate 7, see also Bivar de Sousa, 1982a, 1985b ; Oehmig, 1983).

DISTRIBUTION. Restricted to the island of São Miguel (eastern island group). Old records of "*Satyrus Janira*" from Santa Maria (Morelet, 1860 ; Drouët, 1861 ; Godman, 1870) could refer to *miguelensis*, but recent explorations (Bivar de Sousa, 1985b ; Meyer, 1991) failed to confirm its presence on the latter island.

BIONOMICS. In natural grasslands with *Festuca jubata*, the larval host-plant (according to Fuchs, 1993, *F. petraea*), from 600 m to 1100 m (for further details see Oehmig, 1983 and Fuchs, 1993). Univoltine : adults from June (Le Cerf, 1935 ; Oehmig, 1983) to September (Oehmig, 1983 ; Vieira & Silva, 1994). Early stages : described in detail by Oehmig (1983).

COMMENTS. It was Oehmig (1983) who first raised this taxon to species rank. In this he was followed by all subsequent authors except Bivar de Sousa (1985b), who still considered it to be a subspecies of *azorina*. *H. (azorina) miguelensis* differs significantly from all populations from the central and western Azores in wing shape, markings, male and female genitalia and androconial scales, suggesting a substantial degree of genetic differentiation, while closely related to *H. (azorina) azorina* phylogenetically and biologically (same larval host-plant) at the same time. For this reason we consider the superspecies concept sensu Mayr (1963), with two component species as recognized here, to apply convincingly to the present case.

5. The *Hipparchia aristaeus* group

DESCRIPTION. The four recognized taxa composing this group are quite distinct in wing markings. *H. maderensis*, *H. algirica* and *H. aristaeus* have quite similar genitalia, while those of *H. senthes* are distinct. A full description will be presented under each nominal taxon.

DISTRIBUTION. Madeira (*H. maderensis*) ; Morocco, Algeria, Tunisia (*H. algirica*) ; Corsica, Sardinia, Elba, Giglio, Capraia (*H. aristaeus*) ; Sicily, S. Italy, Albania, Former Yugoslav Republic of Macedonia,

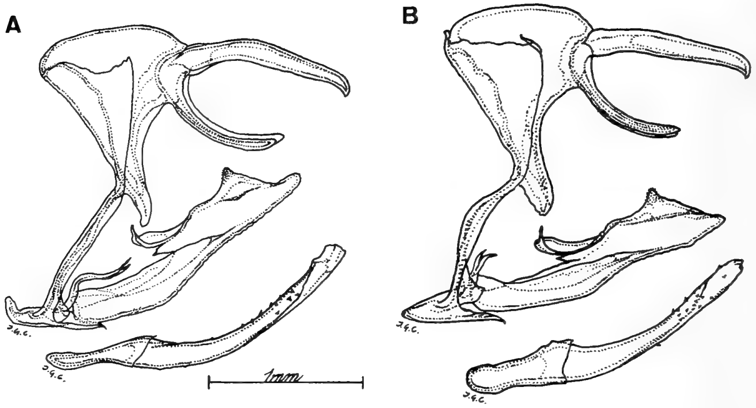


Fig. 10. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) : male genitalia.
A. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 22.VII.1994, leg. H. Henderickx, in coll. VLCA (Prep. JGC no. 2545 ; specimen illustrated on plate 3, fig. 13). B. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 24.VII.1994, leg. H. Henderickx, in coll. VLCA (Prep. JGC no. 2818).

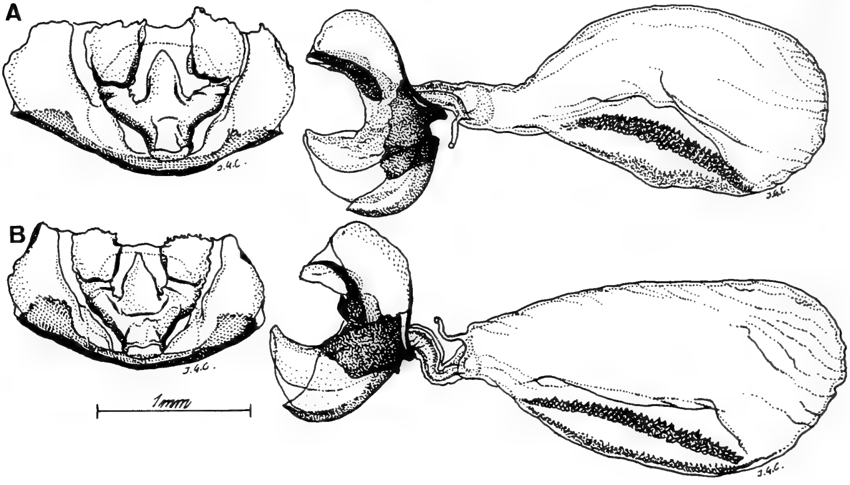


Fig. 11. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) : female genitalia.
A. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 22.VII.1994, leg. H. Henderickx, in coll. VLCA (Prep. JGC no. 2821). B. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 24.VII.1994, leg. H. Henderickx, in coll. VLCA (Prep. JGC no. 2822 ; specimen illustrated on plate 3, fig. 15).

S. Bulgaria, Greece including the Aegean islands, western half of Turkey (*H. senthes*).

COMMENTS. Since de Lattin (1949), the taxa of this group have been considered by most authors to form an entity on their own (de Lattin treated *H. maderensis* as a species distinct from the remaining "races" of *H. aristaeus*), either as full (morpho-)species (Kudrna, 1984, 1986, 1996 ; Taymans, 1989 ; Balletto *et al.*, 1990 ; Cesaroni *et al.*, 1994 ; Balletto, 1995) or as subspecies (Verity, 1953a, 1953b (using the term "eserge" [exerge], under *Hipparchia semele*) ; Higgins & Riley, 1970, 1984 ; Higgins, 1975 ; Kudrna, 1977 ; Higgins & Hargreaves, 1983 ; Coutsis, 1984 ; Hesselbarth, van Oorschot & Wagener, 1995 ; De Prins & Iversen, 1996 ; the latter authors erroneously treat *H. sbordonii* as a subspecies of *H. aristaeus* though it clearly belongs to the *H. semele* group, cf. Kudrna, 1984 ; Balletto *et al.*, 1990 ; Cesaroni *et al.*, 1994). Balletto *et al.* (1990) carried out a cladistic analysis of the subgenus *Parahipparchia* : in the resulting cladogram, the *H. aristaeus* group comes out as a monophyletic unit. According to that study, the original set of 27 multistate characters includes two characters purported to define this group, viz. the "sclerotized ductus bursae" and the "small sterigma" (although, in both cases, "*H. ballettoi*" is excluded) ; one other character ("[length of] uncus = [length of] tegumen") is shared with *miguelensis* and one more ("mid-dorsal process intermediate") is shared with *azorina*, *occidentalis* and *miguelensis*. Our own analysis does not support the usefulness of any of these characters as a possible synapomorphy (see below, section 7). Cesaroni *et al.* (1994) studied the evolutionary relationships among 17 Mediterranean populations belonging to eight *Parahipparchia* taxa (they synonymized a ninth and obtained congruent relationships among taxa from allozymes and male genital morphometrics : three taxa of the *aristaeus* group (*aristaeus*, *algirica* and "*ballettoi*") clustered together in both analyses. As we have been unable to find any convincing synapomorphy supporting the monophyly of the *aristaeus* group, it is very well possible that it is paraphyletic, either with or without the inclusion of superspecies *H. azorina*. We feel therefore compelled to treat it as such without conclusive support for its monophyly, albeit in doing so we follow common practice, that is based on overall similarity in structural characters and strict allopatry of the individual taxa. Evidence based on morphology, allozymes and ecology supports their status as full species (Cesaroni *et al.*, 1994 ; this study).

5.1. *Hipparchia maderensis* (Baker, 1891)

"*Satyrus semele* v. *maderensis*" Baker, 1891. — *Trans. ent. Soc. Lond.* 1891 : 202, 221, Plate XII, fig. 2, 2a. Locus typicus : Madeira. Type material : lectotype ♂, paralectotypes 11 ♂, 2 ♀, in British Museum (Natural History), London [now The Natural History Museum, London] ; design. Kudrna (1977 : 106).

"*Satyrus semele madarensis*" Cockerell, 1923. — *Entomologist* 56 : 246. Subsequent misspelling of the name *maderensis* Baker, 1891.

"*Hipparchia (Parahipparchia) mederensis*" Balletto *et al.*, 1990. — *Atti Convegni Lincei* 85 : 173. — Subsequent misspelling of the name *maderensis* Baker, 1891.

"*Hipparchia (Parahipparchia) madeirensis*" Balletto *et al.*, 1990. — *Atti Convegni Lincei* 85 : 186. — Subsequent misspelling of the name *maderensis* Baker, 1891.

ILLUSTRATIONS. Plate 4, figs. 1–2. Plate 8, figs. 1–4 (androconial scales). Text fig. 12 (male genitalia). Text fig. 13 (female genitalia).

MATERIAL EXAMINED. Portugal, Madeira : 168 ♂, 96 ♀ in colls. VLCA, ZMA.

DESCRIPTION. Forewing length : see table 1 ; both sexes larger than superspecies *H. azorina*, but slightly smaller than *H. algirica* and *H. aristaeus*, except females of last taxon from Corsica (but there n = 14!). Male upperside ground-colour dark brown, wing markings on upperside forewing much reduced to completely absent, except for the omnipresent blackish brown spots in s2 and s5, the latter one sometimes with a white pupil, but usually at least some traces of the orange-ochreous markings, though less so than in the better marked specimens of *H. (azorina) miguelensis* ; sex brand well developed, covering much of the cell except its base, and the basal part of s5 down to s1b, even invading s1a ; hindwing dark spot in s2 always present, usually with white pupil and usually encircled by an orange-ochreous patch, additional small orange-ochreous patches in s3–s5 usually vestigial but present, rarely better marked, but even more rarely entirely absent. Female similar to male but markings more complete, creamy yellow to orange-ochreous, basal and discal area upperside forewing not significantly lighter ; orange-ochreous patches on upperside hindwing rarely forming a complete row, often absent in s3–s4. Underside forewing in both sexes more vividly ochreous than in *H. (azorina) azorina* and most *H. (azorina) miguelensis*, basal-discal area corresponding to area of sex brand of upperside more orange in males, in the females also darker ochreous than postdiscal area, sharply bordered distally by blackish brown discal line. Underside hindwing discal line gently bending distally in s4–s5, evenly rounded to pointed in male, usually more pointed in female ; whitish postdiscal band well expressed, often invaded by greyish mottling, especially in the females. Male genitalia invariably larger than in superspecies *H. azorina*, both overall and in size of the individual parts ; uncus > tegumen (1.1) ; valve with prominent, pointed dorsal process ; aedeagus more curved than in superspecies *H. azorina* ; without any spines. Female genitalia overall size of sterigma approximately as large to slightly larger than in superspecies *H. azorina*, but dorsal lamella always larger ; mid-dorsal process either narrow or wide at base, but always short ; ductus bursae and cervix bursae as a rule more heavily sclerotized than in superspecies *H. azorina* ; corpus bursae much larger than in superspecies *H. azorina* and slightly larger than in *H. algirica* and *H. aristaeus* (except for 1 ♀ from Corsica), signum very long, much more than in superspecies *H. azorina* and slightly longer than in *H. algirica*. Androconial scales not significantly different from *H. (azorina) azorina*, shorter than in *H. (azorina) miguelensis* (plate 8).

Distribution. Restricted to the island of Madeira (Portugal).

Bionomics. Most commonly associated with areas of light (conifer) woodland with extensive grass and herb layers which also contain both bare earth and abundant nectar sources (especially *Origanum* and *Rubus* species), generally at mid-altitudes, between 800 and 1200 m, particularly in the south and southwestern parts of the island (Smith & Shreeve, 1990). Oehmig (1977) records the species from *Airopsis* meadows from 1400 m up to the highest summits, but sometimes lower, sitting on the trunks of pine trees in the forest zone, while Swash & Askew (1982) mention similar habitats with *Erica arborea* L. and bracken. One of us (AO) observed the butterfly in the field between 20.VII and 1.VIII.1993. It was particularly common near Poiso (1300–1350 m) and also relatively frequent at Eira do Serrado (1000–1500 m) and in the Pico do Areeiro-Pico Ruivo area (1750–1800 m). Adults were taking nectar on flowers of *Rubus* and *Origanum*, at Eira do Serrado on blossoms of the imported *Castanea sativa* Mill., a behaviour also reported by Meyer (1993). Males were often perching, mostly on rocks. Females occurred in the same habitats as the males, though generally larger aggregations were encountered in more bushy and grassy spots, while the males tended to congregate on more open, bare locations. A few specimens were recorded at lower altitudes (600–700 m) at Curral das Freiras. Larval host-plants : unknown. Smith & Shreeve (1990) observed egg-laying at Poiso : eggs

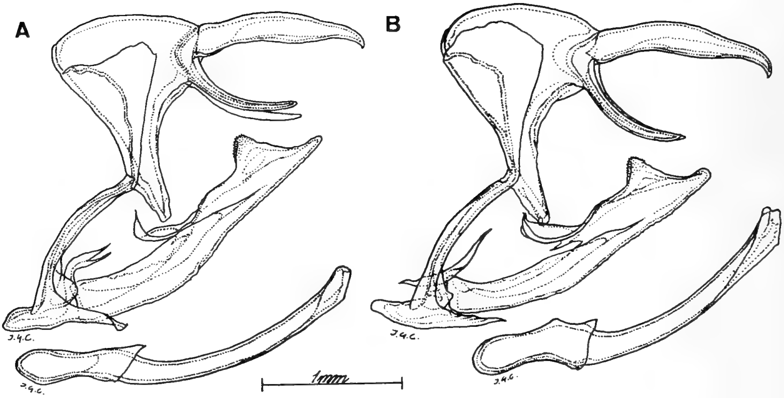


Fig. 12. *Hipparchia maderensis* (Baker, 1891) : male genitalia.
A. Portugal, Madeira, 2 km SW. Poiso (1350 m), 25.VII.1993, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2533). B. same data as A (Prep. JGC no. 2536).

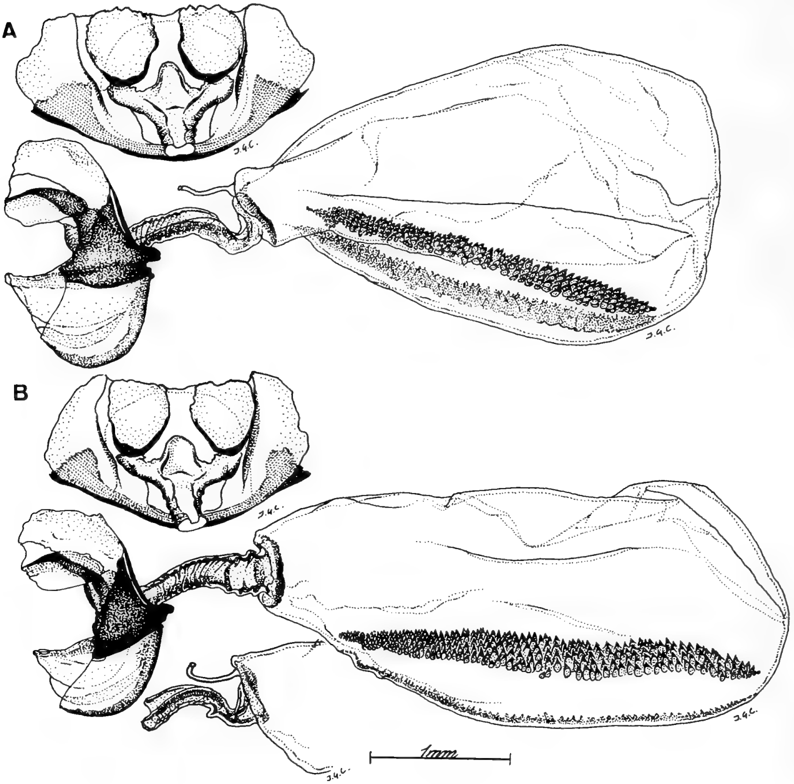


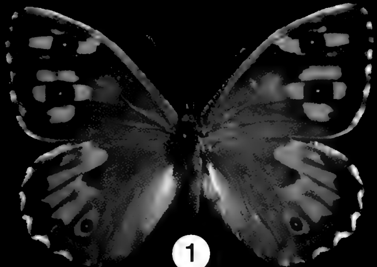
Fig. 13. *Hipparchia maderensis* (Baker, 1891) : female genitalia.
A. Portugal, Madeira, 2 km SW. Poiso (1350 m), 21.VII.1993, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2540). B. same data as A (Prep. JGC no. 2541).

were placed low (< 10 mm) on green shoots of a *Holcus* grass species, dry stems, and exposed roots of an *Agrostis* species. Oehmig (1977) records the grass species *Aira praecox*, *Aira caryophyllea* and *Agrostis castellana* as likely host-plants. For further details about the habitat etc. see Walker (1931), Rebel (1939b), Martin (1941), Kudrna (1977), Oehmig (1977), Swash & Askew (1982), Higgins & Riley (1984), Bivar de Sousa (1986), Meyer (1993) and, especially, Smith & Shreeve (1990). Univoltine : adults usually flying from mid-July (Rebel, 1939b) to late September (Kudrna, 1977 ; Smith & Shreeve, 1990), but there are reports from mid-June onwards (Martin, 1941 ; Kudrna, 1977 ; Swash & Askew, 1982) as well. Early stages : no published description, though Hesselbarth, van Oorschot & Wagener (1995 : 900) mention "einer von HESSELBARTH (unveröff.) durchgeführten Zucht von *maderensis*" without details and Aussem (1980) presents limited data on the mandibles of larvae of *H. maderensis*.

COMMENTS. Felder (1862) first reported this taxon from Madeira as "*Satyrus Semele* Lin.", followed by Lang (1884), and Baker (1891) described it as "*Satyrus semele* v. *maderensis*" (in modern terms as a subspecies of *Hipparchia semele*), a treatment that was adopted by all subsequent early authors (Tutt, 1896 ; Staudinger & Rebel, 1901 ; Kirby, 1903 ; Seitz, 1908 ; Stauder, 1915–1916 ; Rebel, 1917, 1939b, 1940a, 1940b ; Cockerell, 1923 ; Verity, 1923–1924 ; Walker, 1931 ; Gaede, 1931 and Martin, 1941). It was de Lattin (1949) who established distinct species status for it and who emphasized its closer affinity to *H. aristaeus* rather than to *H. semele*. In this he was followed by de Lesse (1951, 1952), Varin (1960), Kostrowicki (1969), Kudrna (1975, 1984, 1986, 1996), Taymans (1989), Balletto *et al.* (1990), D'Abrera (1992), Meyer (1993), Balletto (1995), Jutzeler *et al.* (1997) and Dennis (1997), though fairly recently Manley & Allcard (1970) and Fonteneau (1971) continued to consider it as a subspecies of *H. semele*. Leestmans (1968) and Higgins & Riley (1970, 1984) downgraded *maderensis* to a subspecies of *H. aristaeus* and since then most authors have treated it as such (or as a subspecies of *H. algirica*, i. e. Zangheri, 1975 ; Higgins, 1975 ; Kudrna, 1977 ; Oehmig, 1977 ; Heath, 1981 ; Swash & Askew, 1982 ; Higgins & Hargreaves, 1983 ; Coutsis, 1984 ; Lace & Jones, 1984 ; Bivar de Sousa, 1986 ; Karsholt, 1988 ; Smith & Shreeve, 1990 ; Fernández-Rubio, 1991 ; Owen & Smith, 1994 ; Hesselbarth, van Oorschot & Wagener, 1995 ; Tolman & Lewington, 1997). Finally, Bernardi (1961 ; and Leestmans, 1975 after him) listed *maderensis* as belonging to a superspecies *H. aristaeus* (vide supra, Section 4, opening part for critical discussion). The genitalia of *H. maderensis* are obviously quite similar to those of *algirica* and *aristaeus*, though

Plate 1. *Hipparchia senthes* (Fruhstorfer, 1908) : type specimens of various nominal taxa.

1. *Satyrus semele blachieri* Fruhstorfer, 1908. Lectotype ♀. "*semele blachieri* Fruhst." [handwritten]/"Ch. Blachier" [printed]/"Sicile" [handwritten]/"Type" [printed]/ "LECTO-TYPE" [printed]/"*Satyrus semele blachieri* Fruhstorfer, 1908. LECTOTYPE design. Kudrna (1977 : 109) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 1)" [red label, printed], in Muséum d'Histoire Naturelle, Genève.
2. *Satyrus semele blachieri* Fruhstorfer, 1908. Paralectotype ♀. "Coll. Blachier" [printed]/"Sicile" [printed]/"PARA-LECTO-TYPE" [printed]/"*Satyrus semele blachieri* Fruhstorfer, 1908. PARALECTOTYPE design. Kudrna (1977 : 109) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 2)" [red label, printed], in Muséum d'Histoire Naturelle, Genève.
3. *Satyrus Semele*, Linné, race *Siciliana* Oberthür, 1914. Lectotype ♀. "*Semele-Siciliana* Obthr. ♀" [handwritten]/uncoloured figure of the specimen with number "2315" [printed, proof copperplate of Oberthür, 1914 : Plate CCLXXXIV, fig. 2315]/"Ex. Coll. Bellier" [printed]/"Ex Oberthür Coll. Brit. Mus. 1927-3." [printed]/"Sicile" [handwritten]/"Specimen" [printed] "A" [handwritten]"TC1" [printed] "77" [handwritten]/"13/11-12" [handwritten]/"SYNTYPE *Satyrus semele siciliana* Oberthür" [handwritten]" det. P.R. Ackery 197" [printed] "7" [handwritten]/"SYN-TYPE" [printed]/"*Satyrus Semele-Siciliana* Oberthür, 1914. LECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 3)" [red label, printed], in The Natural History Museum, London.
4. *Satyrus Semele*, Linné, race *Siciliana* Oberthür, 1914. Paralectotype ♀. "*Semele-Siciliana* Obthr. ♀" [handwritten]/uncoloured figure of the specimen with number "2316" [printed, proof copperplate of Oberthür, 1914 : Plate CCLXXXIV, fig. 2316]/ "Ex Coll. Bellier" [printed]/"Ex Oberthür Coll. Brit. Mus. 1927-3." [printed]/"Sicile" [handwritten]/"Specimen" [printed] "B" [handwritten] "TC1" [printed] "77" [handwritten]/ "SYNTYPE *Satyrus semele siciliana* Oberthür" [handwritten] "det. P.R. Ackery 197" [printed] "7" [handwritten]/ "SYN-TYPE" [printed]/ "SYN-TYPE" [printed]/"*Satyrus Semele-Siciliana* Oberthür, 1914. PARALECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 4)" [red label, printed], in The Natural History Museum, London.
5. *Satyrus semele* L. f. *neapolitana* Stauder, 1921. Lectotype ♂. "*neapolitana* Stdr." [handwritten]/"Ital. mer." [printed] "300" [handwritten] "m. penins. Surrentina M. Faito" [printed] "14.6" [handwritten] "192" [printed] "0" [handwritten] "H. Stauder legit." [printed + vertically handwritten illegible citation]/"C/Roths 10/11" [printed]/ "*Satyrus semele* L. f. *neapolitana* Stauder, 1921. LECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 5)" [red label, printed], in The Natural History Museum, London (genitalia illustrated on text fig. 30).
6. *Satyrus semele* L. f. *neapolitana* Stauder, 1921. Paralectotype ♂. "Ital. mer." [printed] "400" [handwritten] "m. penins. Surrentina M. Faito 192" [printed] "0" [handwritten] "H. Stauder legit." [printed + handwritten "10/6" to the left of main text]/"B/Roths 10/11" [printed]/"*Satyrus semele* L. f. *neapolitana* Stauder, 1921. PARALECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 6)" [red label, printed], in The Natural History Museum, London.
7. *Satyrus semele* L. f. *neapolitana* Stauder, 1921. Paralectotype ♀. "Ital. mer." [printed] "800" [handwritten] "m. penins. Surrentina M. Faito" [printed] "1.7" [handwritten] "192" [printed] "0" [handwritten] "H. Stauder legit." [printed]/"K/Roths 10/11" [printed]/"*Satyrus semele* L. f. *neapolitana* Stauder, 1921. PARALECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 7)" [red label, printed], in The Natural History Museum, London.
8. *Satyrus semele* L. f. *neapolitana* Stauder, 1921. Paralectotype ♀. "Ital. mer." [printed] "800" [handwritten] "m. penins. Surrentina M. Faito" [printed] "1.7" [handwritten] "192" [printed] "0" [handwritten] "H. Stauder legit." [printed]/"G/Roths 10/11" [printed]/"*Satyrus semele* L. f. *neapolitana* Stauder, 1921. PARALECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 1, fig. 8)" [red label, printed], in The Natural History Museum, London.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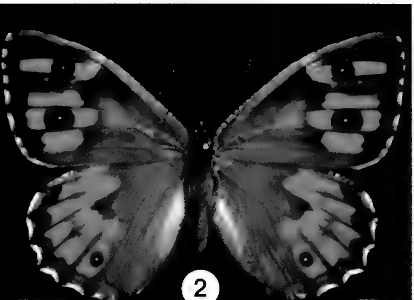
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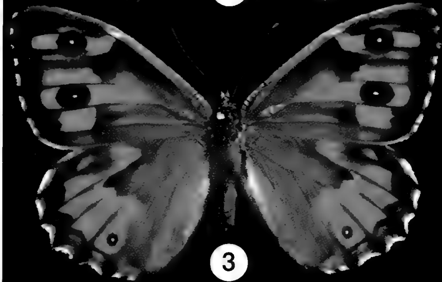
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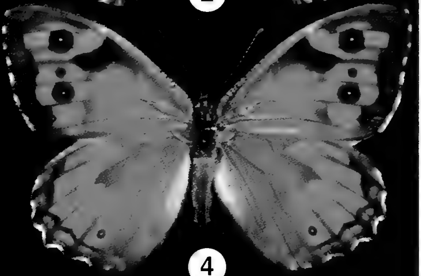
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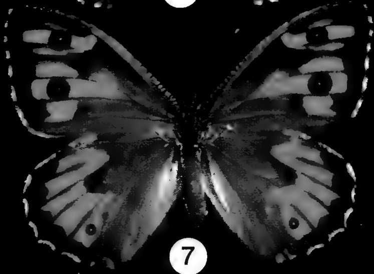
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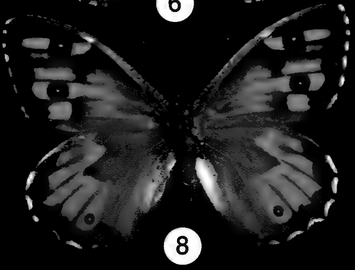
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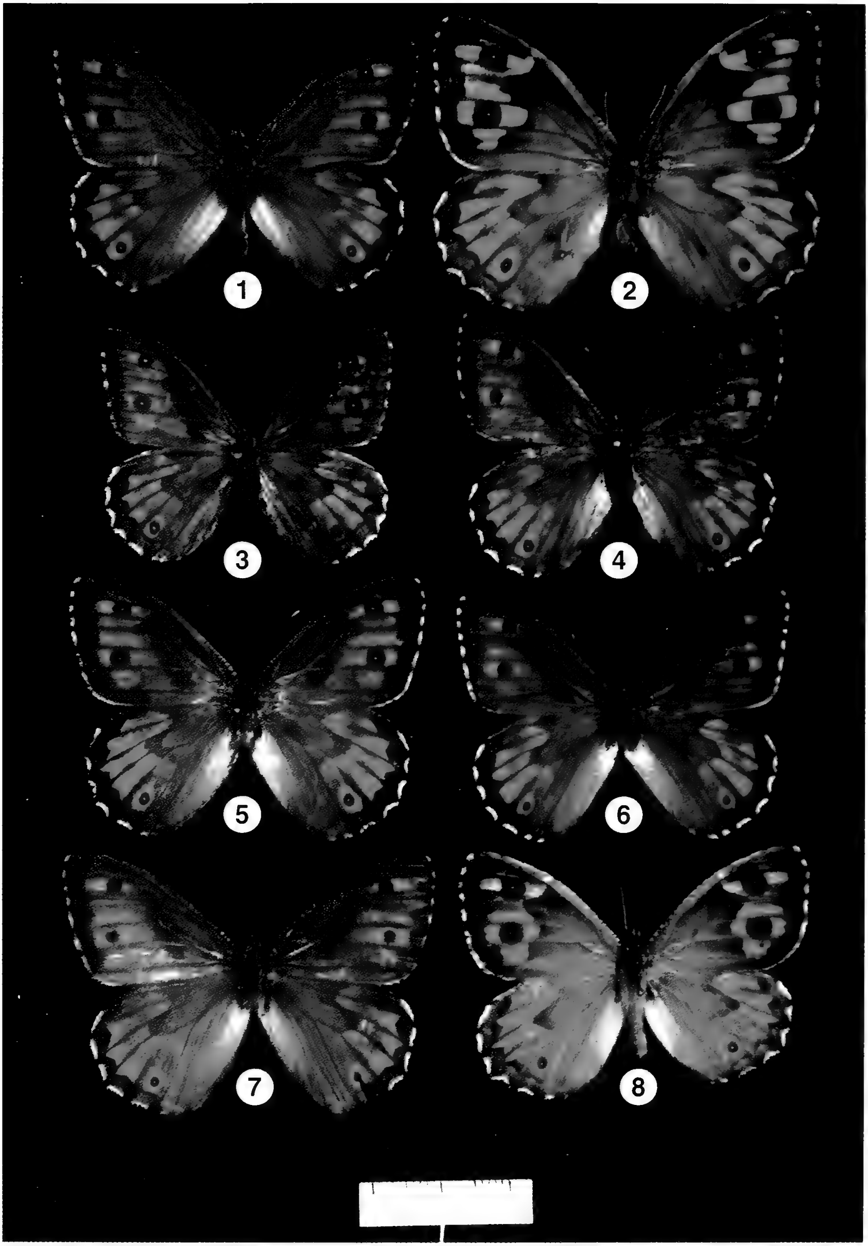
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Plate 2. *Hipparchia senthes* (Fruhstorfer, 1908) (figs. 1–5 & 7–8, including type specimens of various nominal taxa) and *Hipparchia semele* (Linnaeus, 1758) (fig. 6).

1. *Hipparchia ballettoi* Kudrna, 1984. Holotype ♂. "M. FAITO (NA) 29.VII.80" [handwritten]/"Holo-type" [printed]/"*Hipparchia ballettoi* Kudrna, 1984. HOLOTYPE ; illustr. Kudrna (1984 : 230, fig. 1) et Olivier & Coutsis (1997, Plate 2, fig. 1)" [red label, printed], in coll. E. Balletto.

2. *Hipparchia ballettoi* Kudrna, 1984. Paratype ♀. "M.te Faito (SA) 21-VII" [handwritten]/"*Hipparchia ballettoi* Kudrna, 1984. PARATYPE ; illustr. Kudrna (1984 : 230, fig. 2) et Olivier & Coutsis (1997, Plate 2, fig. 2)" [red label, printed], in coll. E. Balletto.

3. *Hipparchia senthes* (Fruhstorfer, 1908) ♂. Italy, Calabria, Prov. Cosenza, La Sila, Cerenzia (600–650 m), 27.VII.1995, leg. A. Olivier, in coll. VLCA (genitalia illustrated on text fig. 22).

4. *Hipparchia senthes* (Fruhstorfer, 1908) ♂. Italy, Calabria, Prov. Cosenza, La Sila, Cerenzia (600–650 m), 27.VII.1995, leg. A. Olivier, in coll. VLCA.

5. *Hipparchia senthes* (Fruhstorfer, 1908) ♂. Italy, Sicily, Prov. Palermo, Monti Le Madonie, Cozzo Pomieri, 7 km NW. Petralia Sottana (1150–1300 m), 17.VII.1991, leg. A. Olivier, in coll. VLCA (genitalia illustrated on text fig. 21).

6. *Satyrus semele* L. f. *blachierioides* Stauder, 1921. Lectotype ♂. "Calabria mer. Aspromonte" [printed] "900" [handwritten] "m." [printed] "3.VII" [handwritten] "192" [printed] "0" [handwritten] "H. Stauder legit." [printed + handwritten vertically "Polsi"]/"D/Roths 10/11" [printed]/"*Satyrus semele* L. f. *blachierioides* Stauder, 1921. LECTOTYPE design. Olivier & Coutsis (1997) ; illustr. Olivier & Coutsis (1997 : Plate 2, fig. 6)" [red label, printed], in The Natural History Museum, London (genitalia illustrated on text fig. 31).

7. *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908. Lectotype K. "*semele senthes* Fruhst." [handwritten]/"*Eumenis semele senthes* Fruhstorfer 1908 O Kudrna dd." [handwritten]/"Griechenland Fruhstorfer" [printed]/"Fruhstorfer Coll. B.M. 1937–285" [printed]/"Taygetos" [handwritten]/"Specimen" [printed] "C" [handwritten] "TC1/" [printed] "76" [handwritten]/"Type" [printed]/ "LECTOTYPE *Eumenis semele senthes* Fruhstorfer" [handwritten] det. P.R. Ackery 197" [printed] "7" [handwritten]/ "LECTO-TYPE" [printed]/"LECTO-TYPE" [printed]/"2639" [handwritten]/"Androconia" [printed] "061" [handwritten]/"*Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908. LECTOTYPE design. Kudrna (1977 : 116) ; illustr. Olivier & Coutsis (1997 : Plate 2, fig. 7)" [red label, printed], in The Natural History Museum, London (genitalia illustrated on text fig. 29).

8. *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908. Paralectotype ♀. "Griechenland" [handwritten] "Fruhstorfer" [printed] [on the other side handwritten "Krüper"]/ "Fruhstorfer Coll. B.M. 1937-285." [printed]/"Specimen" [printed] "D" [handwritten] "TC1/" [printed] "76" [handwritten]/"Type" [printed]/"PARALECTOTYPE *Eumenis semele senthes* Fruhstorfer" [handwritten] "det. P.R. Ackery 197" [printed]/ "7" [handwritten]/"PARA-LECTO-TYPE" [printed]/"*Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908. PARALECTOTYPE design. Kudrna (1977 : 116) ; illustr. Olivier & Coutsis (1997 : Plate 2, fig. 8)" [red label, printed], in The Natural History Museum, London.

this similarity may be symplesiomorphic (see Section 5, opening part : Comments). What is clear beyond any doubt is that it certainly is not conspecific with *H. semele*. We treat it as a full species on circumstancial but compelling evidence, viz. mainly total (and presumably long-lasting) geographical isolation, distinct habitat specialization and strongly differentiated external phenotype, in absence of corroborative evidence from allozymes (unlike with the three following species). An analysis of *H. maderensis* in this respect is highly desirable, but we confidently predict that it will add further support to its full species status.

5.2. *Hipparchia algirica* (Oberthür, 1876)

"*Satyrus Semele*, L., var., *Algirica*, Obr." Oberthür, 1876. — *Études d'Entomologie* 1 : 27. Locus typicus : [Algeria] Daya, Lambèze [Lambessa], Collo. Type material : lectotype ♂, Algérie : Lambessa, in British Museum (Natural History), London [now The Natural History Museum, London] ; design. Kudrna (1977 : 103).

"*Satyrus semele algerica*" Fruhstorfer, 1908. — *Ent. Z., Frankf. a. M.* 22 : 93. — Subsequent misspelling of the name *Algirica* Oberthür, 1876 (see also Chnéour, 1947–1948 [1947] : 22 ; Valletta, 1972 : 38 ; Coene, 1976 : 174 ; Brown, 1977 : 155 ; Devarenne, 1981 : 174 (the latter as "*algericus*") and Leigheb, 1988 : 122).

"*Hipparchia semele*, L. race *pallidalgirica*, mihi" Verity, 1923. — *Entomologist's Rec. J. Var.* 35 : 155. Locus typicus : Algeria, Lambèse [Lambessa] and Blida. Type material : syntypes 3 ♂ Algeria, Lambese [Lambessa], in Museo Zoologica 'La Specola', Firenze. — Junior subjective synonym of *Satyrus Semele*, L., var., *Algirica* Oberthür, 1876 (Kudrna, 1977 : 101).

"*Satyrus semele pallidalgerica*" Gaede, 1930. — Satyridae [part.]. In : Seitz, A. (Ed.) : Die Gross-Schmetterlinge der Erde. Eine systematische Bearbeitung der bis jetzt bekannten Gross-Schmetterlinge I. Supplement 1 : 163. — Subsequent misspelling of the name *pallidalgirica* Verity, 1923 (see also Chnéour, 1942 : 54).

"*Hipparchia algyrica*" Balletto & Passerin d'Entrèves, 1986. — *Boll. Mus. reg. Sci. nat. Torino* 4 : 133, 135. — Subsequent misspelling of the name *Algirica* Oberthür, 1876 (see also Balletto, Toso & Lattes, 1989 : 151, 154, 155, 157, 158, 161, 170, 181, 184 and Balletto *et al.*, 1990 : 185, 189).

Illustrations. Plate 4, figs. 3–4. Plate 9, figs. 1–4 (androconial scales). Text fig. 14 (male genitalia). Text fig. 15 (female genitalia).

Material examined. Morocco, Middle Atlas : 79 ♂, 41 ♀ in colls. VLCA, ZMA ; Algeria, vic. Oran : 1 ♂, 3 ♀ in coll. ZMA ; Algeria, Aurès Mts. : 6 ♂, 7 ♀ in coll. VLCA.

Description. Forewing length : see table 1 ; slightly larger than *H. maderensis*. Male upperside ground-colour a warm medium brown, wing markings well developed, blackish brown spots in s2 and s5 on forewing and in s2 on hindwing always present and with a white pupil, those on forewing much enlarged ; forewing as a rule with a more or less continuous row of creamy yellow patches from s1b up to s5, usually interrupted in s4 and the upper half of s3, extending basad to the sex brand, making the males look much like the females (this was already noticed by Oberthür, 1876 in his description of the taxon on p. 27 : "Dans le mâle d'Algérie, les taches fauves clair des ailes en dessus sont aussi vivement marquées que dans la femelle de France" [i. e. *H. semele* ♀ from France]) ; sex brand more reduced than in *H. maderensis*, *H. aristaeus* and most *H. senthes*, in the cell along the median vein and extending distad into the basal part of s2–s3 and the adjoining upper part of s1b ; hindwing with complete series of small light orange-ochreous patches in s2–s5(6), that remain separated by the broad brown underlining of the veins and that do not extend much basad. Female similar to male, but markings more complete, creamy yellow to orange-ochreous, sometimes with a shading of the same colour in the discal area in s2(3), touching the cell basad. Underside with same general pattern as *H. maderensis*, hindwing lighter than in the latter species ; discal line in both sexes distinctly bending distally in s4–s5, always pointed. Male genitalia much like *H. maderensis*, but gnathos tends to be slightly shorter (though not constantly so), tegumen slightly more robust (HT 2 *H. algirica* > *H. maderensis*), valve usually shorter than in *H. maderensis*. Female genitalia overall size of sterigma generally slightly less than in *H. maderensis*, much as in superspecies *H. azorina*, dorso-lateral lobe and dorsal lamella usually smaller than in *H. maderensis*, but there is overlap ; corpus bursae as a rule smaller than in *H. maderensis* and *H. aristaeus*, signum slightly shorter. Androconial scales as in *H. maderensis*, perhaps a little more slender (plate 9).

Distribution. Widespread in hilly or mountainous areas in the Maghreb states, from the High Atlas (Tizi-n-Test, Amizmiz, Ourika, Tizi-n-Tichka, Djebel Ayachi, Tizi-n-Talrhemt,...), the Middle Atlas (Col du Zad, Tizi Tarhzeft, Foum Kheneg, Timahdite, Djebel Hebri, Azrou, Mischliffen, Tizi-n-Tretten, Ifrane, Ras-el-Ma–Cèdre Gouraud, Imouzzèr-du-Kandar, Annoceur, Sefrou,...) and the Rif mountains

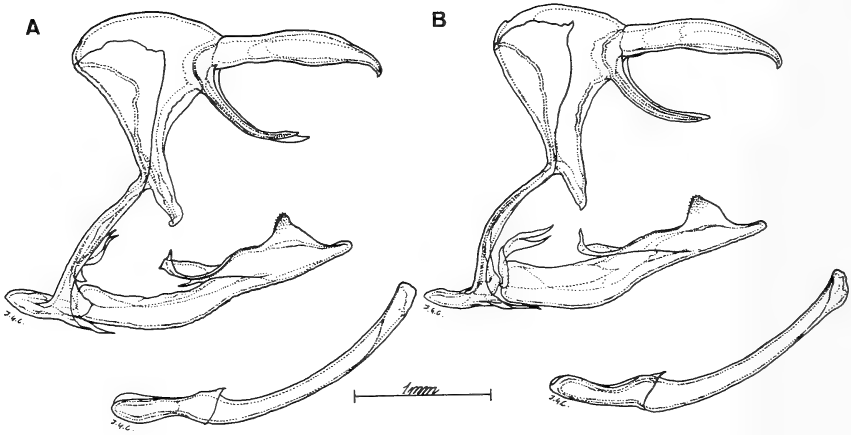

Fig. 14. *Hipparchia algirica* (Oberthür, 1876) : male genitalia.
A. Morocco, Middle Atlas, Tizi-n-Tretten (1950 m), 22.VI.1994, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2524). B. same data as A (Prep. JGC no. 2525).

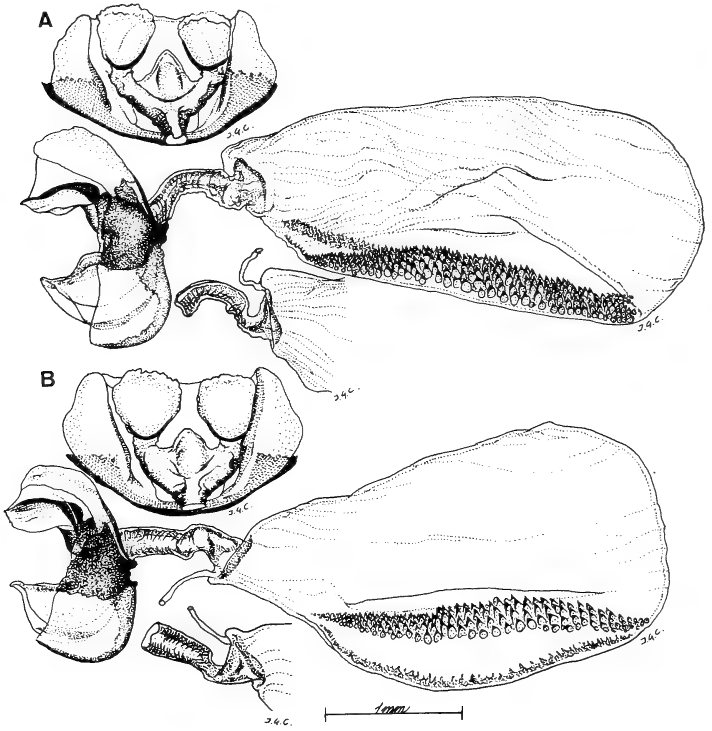

Fig. 15. *Hipparchia algirica* (Oberthür, 1876) : female genitalia.
A. Morocco, Middle Atlas, Tizi-n-Tretten (1950 m), 27.VI.1994, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2528). B. same data as A (Prep. JGC no. 2530).

(Djebel Tidirhine,...) in Morocco, over the High Plateaux (Magenta, Sebdou, Teniet-el-Amar, El Bayadh [formerly Géryville], Djebel Ksel, Stite, Oran, Mascara, Djelfa, Aflou), the Tell Atlas (Col de Chréa, Daya, Teniet-el-Had) via the region of Algiers (Hussein Day, Blida, Blida-les-Glacières, Guelt-es-Stel) and Kabylie (Grande Kabylie, Yakouren, Djurdjura Massif) eastwards till Collo and the Aurès mountains (Khenchela, El Kantara, Lambessa, S'Gag, Djebel Chelia, Batna,...) in Algeria, reaching Tunisia (Djebel Chambi, Djebel Semmama, etc.) (sources : Oberthür, 1876, 1909, 1914, 1922 ; Fountaine, 1906 ; Meade-Waldo, 1906 ; Powell, 1914 ; Rothschild, 1914, 1917, 1925a, 1925b, 1929 ; Korb, 1916 ; Faroult, 1917 ; Cros & Dupont, 1927 ; Fison, 1931–1932 ; Zerny, 1935 ; Chnéour, 1939, 1942, 1947–1948, 1954, 1963 ; Wagener, 1952 ; Barragué, 1954, 1961 ; Varin, 1959 ; Roell, 1963 ; Wyatt, 1968 ; de Worms, 1969, 1973 ; de Freina, 1975 ; Schuurmans, 1976 ; Kudrna, 1977 ; Schmidt-Koehl, 1978, 1981 ; de Bros & Schmidt-Koehl, 1979 ; Devarenne, 1981, 1990 ; Coutsis, 1984 ; Tennent, 1988, 1993, 1995, 1996a, 1996b ; Tarrier, 1996a, 1996b, 1997). Once collected on Malta (Jutzeler *et al.*, 1997).

BIONOMICS. The preferred habitat seems to be open *Quercus ilex* L. woodland with clearings, that contain abundant nectar sources, principally thyme (*Thymus*) and thistles (? *Carduus*), generally at altitudes from 1000 m to well over 2000 m, sometimes as high as 2600 m (Tennent, 1995 reports it on one occasion from an altitude of 2788 m on the Adrar-n-Guinnous, the highest peak above the Tizi-n-Test, at the western end of the High Atlas in Morocco), but occasionally much lower down, e. g. in El Kantara (Aurès mountains, E. Algeria) at 550 m (Powell, 1914 ; Wagener, 1952 ; Varin, 1959 ; Schuurmans, 1976 ; Thomas & Mallorie, 1985b ; Tarrier, 1996a, 1996b). In early summer (June) the butterfly visits flowers (Powell, 1914 ; Varin, 1959 ; Barragué, 1961), later (July–September), when habitats become barren (cf. Tennent, 1996b), the butterfly hides in bushes of *Quercus ilex* or sits on tree trunks, great numbers flying out of the bushes when disturbed (Powell, 1914). It has been noticed on *Cedrus* trunks as well (Varin, 1959) and there is one report of butterflies sitting on animal excrements (Oberthür, 1922). Powell (1914) also encountered *H. algirica* in uncultivated plains and on arid mountains and hills : in such treeless areas it settles on the ground or on rocks, often within the shade of a grass tussock. Barragué (1954) also notes that it settles exclusively on the ground. One of us (AO) observed the butterfly between 21 and 28.VI.1994 in several localities of the Middle Atlas in Morocco. They were mostly sitting on *Quercus ilex* trunks and branches at Ifrane (1650 m) and on the Tizi-n-Tretten (1950 m), a few on *Cedrus atlantica* trunks in the area of Ras-el-Ma–Cèdre Gouraud. No nectar taking behaviour was noticed. On the Col du Zad (2100–2350 m), butterflies were sitting on stones and rocks and on the ground. Larval host-plants : several Poaceae species, most probably including *Lyngeum spartum* (Powell, 1914). Univoltine : observations covering all months from May to October (Powell, 1914 ; Rothschild, 1914, 1917 ; Faroult, 1917 ; Chnéour, 1942, 1947–1948, 1954 ; Mokhlès, 1984 ; Tennent, 1993), a few literary sources mentioning April as well (Higgins & Riley, 1970 ; Schuurmans, 1976 ; Kudrna, 1977 ; Rungs, 1981 ; Devarenne, 1990 ; Tolman & Lewington, 1997). This extended flight period has lead some authors to believe that two broods are involved (Chnéour, 1942, 1954 ; Devarenne, 1981, 1990 ; Tennent, 1996b), a statement that certainly is not correct. Most probably the butterflies emerge in early summer (May–June) and aestivate from late June until late August, as suggested by their midsummer behaviour (cf. Powell, 1914 ; Tennent, 1993 ; Tarrier, 1996a ; Tolman & Lewington, 1997). Powell (1914) remarks that, at the end of August and in September, the male, that thus far seemed indifferent to the female, starts courting her. Females were induced by Powell to lay eggs in captivity : they never oviposited in June and July, starting only during the last days of August and, more easily, in September. This suggests a mechanism of photoperiodically controlled delayed ovarian maturation well known in several satyrine butterflies, including *H. semele* in central Spain (cf. García-Barros, 1988). Early stages : no description, but Powell (1914) presents some notes on larval behaviour. The larva grows slowly during winter ; when temperatures are not too low it feeds continuously. Pupation takes place underground in May. At Aflou (High Plateaux, Algeria), he found a few larvae under stones contiguous to tussocks of *Lyngeum spartum* during the day (15.V.1911) ; they were almost full grown and soon pupated. Several caterpillars were collected at night on the hills and mountains near Lambessa (Aurès mountains, E. Algeria) in May 1913, sitting on top of the leaves of several Poaceae species while feeding.

COMMENTS. This taxon was described as a “varietas” [= subspecies] of “*Satyrus Semele* L.” by Oberthür (1876), and subsequently considered as such (or sometimes as “race”) by all authors for nearly seventy-five years (Kirby, 1877 ; Lang, 1884 ; Heyne, 1895 ; Tutt, 1896 ; Staudinger & Rebel, 1901 ; Fountaine, 1906 ; Spuler, 1908 ; Oberthür, 1909, 1914, 1922 ; Powell, 1914 ; Rothschild, 1914, 1917, 1925a, 1925b, 1929 ; Stauder, 1915–1916 ; Korb, 1916 ; Rebel, 1916 ; Faroult, 1917 ; Verity, 1923–1924, 1938–1939, 1953b (as a “race” of “exerge” *aristaeus* in the latter publication) ; Cros & Dupont, 1927 ; Gaede, 1930, 1931 ;

Fison, 1931–1932 ; Zerny, 1935 ; Chnéour, 1939, 1942, 1947–1948) and, more recently, Wyatt (1956, 1968), Roell (1963) and de Toulgoët (1966), while Meade-Waldo (1906), Seitz (1908) and Barragué (1954) simply list it as "*Satyrus semele*". Verity (1923) described race *pallidalgirica* of *Hipparchia semele* from Lambessa and Blida. This taxon was recognized by Gaede (1930), Chnéour (1942), de Lattin (1949), Verity (1953b), Varin (1960) and Leestmans (1965, 1968). Kudrna (1977) synonymized it under nominotypical *H. algirica*, a decision fully supported both by the lack of differentiation of any Algerian population and by the fact that the lectotype of *algirica* and the syntypes of *pallidalgirica* originate from the same locality ! In his revision of the "*Hipparchia semele* Gruppe", de Lattin (1949) treated *algirica* as a "Rasse" [= subspecies] of *Hipparchia aristaeus*, in which he was followed by Varin (1960), Leestmans (1965, 1968), Higgins & Riley (1970, 1984), de Freina (1975), Zangheri (1975), Higgins (1975), Schuurmans (1976), Devarenne (1981, 1990), Higgins & Hargreaves (1983), Coutsis (1984), Vassilaina-Alexopoulou & Mourikis (1985), Thomas & Mallorie (1985b), Tennent (1993, 1996a, 1996b, 1997), Tarrier (1995a, 1996a, 1997) and Tolman & Lewington (1997), while some authors just report it as *Hipparchia aristaeus* (Bernardi, 1961 ; de Worms, 1969, 1973 ; Thomas & Mallorie, 1985a ; Tarrier, 1995b, 1996b and Tennent, 1995). Finally, *H. algirica* is listed as a species in its own right by de Lesse (1951, 1952), de Lattin (1952), Wagener (1952), Chnéour (1954, 1955, 1963), Varin (1959), Barragué (1961), Valletta (1972), Kudrna (1975, 1976, 1977, 1984), Varga (1977), Schmidt-Koehl (1978, 1981), de Bros & Schmidt-Koehl (1979), Battenfeld (1979), Rungs (1981), Koçak (1981–1983), Bivar de Sousa (1982a, 1985a, 1986), Mokhlès (1984), Balletto & Passerin d'Entrèves (1986), Tennent (1988), García-Barros (1988), Taymans (1989), Balletto *et al.* (1990), D'Abrera (1992), Meyer (1993), Cesaroni *et al.* (1994), Balletto (1995) and Jutzeler *et al.* (1997). We treat it as a full species because of its total geographical isolation, distinct habitat specialization, differentiated external phenotype and allozyme differentiation (the data by Cesaroni *et al.*, 1994 in this last respect convincingly support the full species status of *H. algirica*).

5.3. *Hipparchia aristaeus* (Bonelli, 1826)

"*Papilio Satyrus Aristaeus.* Bon." Bonelli, 1826. — *Memorie Accad. Sci. Torino* 30 : 177–179, Tav. II, Fig. 1. ♂, Fig. 1. ♀. Locus typicus : Sardinia, monte Genargentu [Monti del Gennargentu], 800–1000 m. Type material : lectotype ♂, paralectotypes 1 ♂, 2 ♀, in Museo zoologico della Università di Torino ; design. Balletto & Passerin d'Entrèves (1986 : 135).

"*Satyrus Aristaeus*" Bonelli *in* Desmarest, 1825. — *Bull. Sci. nat. Géol.* (2) 4 : 249. Locus typicus : Sardinia. — Unavailable name (Article 12(a) of ICZN). Nomen nudum (Balletto & Passerin d'Entrèves, 1986 : 134 (135).

"*Satyrus Aristeus*" Rambur, 1832. — *Annls. Soc. ent. Fr.* 1 : 252, 262 — Subsequent misspelling of the name *Aristaeus* Bonelli, 1826 (see also Rambur, 1833 : 53 ; Ghiliani, 1852 : 143 ; Sheldon, 1907 : 77 ; Varin, 1960 : 13, 16, 17 ; Fonteneau, 1962 : 228 ; Stempffer, 1962 : 266 ; Leestmans, 1965 : 24, 89, 92, 94, 114, 182, 184, 185, 1966 : 195, 1968 : 303, 351 ; de Granville, 1968 : 209 ; Schmidt-Koehl, 1975 : 54 ; de Bros & Schmidt-Koehl, 1979 : 15 ; Sammut, 1984 : 47, 111 ; Bivar de Sousa, 1986 : 49–50 ; Smith & Shreeve, 1990 : 275, 276, 277 ; Prola & Prola, 1990 : 45 ; Littler, 1991 : 27 and Dennis, Williams & Shreeve, 1991 : 46).

"Sátyrus sémele L. v. *sardóa*" Spuler, [1902]. — Die Schmetterlinge Europas. I. Band. Allgemeiner Teil — Spezieller Teil. Rhopalocera. Hesperiidae. Sphingidae. Notodontidae. Thaumatopoeidae. Drepanidae. Saturniidae. Lemoniidae. Endromididae. Lasiocampidae. Lymantriidae. Noctuidae. Cymatophoridae und Brephidae : 43. Locus typicus restrictus : Sardinia, Lago Alto del Flumendosa, ca. 1000 m (Kudrna, 1977 : 112). Type material : neotype ♂, in Landessammlungen für Naturkunde, Karlsruhe ; design. Kudrna (1977 : 112). — Junior subjective synonym of *Papilio Satyrus Aristaeus* Bonelli, 1826 (Verity, 1953b : 308, 310 ; Bernardi, 1961 : 198 ; Kudrna, 1984 : 237).

"*Satyrus Semele* var. nov. *Rautheri* m." Krausse-Heldrungen, 1912. — *Arch. Naturgesch.* 78A (9) : 159. Locus typicus : Sardinia, Monti del Gennargentu, "Sedda de Pranu". Type material : unknown. — Junior subjective synonym of *Papilio Satyrus Aristaeus* Bonelli, 1826. Infrasubspecific taxon (Hemming, 1931 : 502 ; Bytinski-Salz, 1934 : 92 ; Verity, 1953b : 307, 310 ; Kudrna, 1977 : 110).

"*Satyrus semele aristaens*" Gaede, 1930. — Satyridae [part.]. In : Seitz, A. (Ed.) : Die Gross-Schmetterlinge der Erde. Eine systematische Bearbeitung der bis jetzt bekannten Gross-Schmetterlinge I. Supplement 1 : 163. — Subsequent misspelling of the name *Aristaeus* Bonelli, 1826 (see also Robinson, 1971 : 679 and Bernardi, 1971 : 31).

"*Hipparchia semele*, Linn. ssp. *ichnusa*, nom. nov. pro *Papilio aristaeus*, Bonelli" Hemming, 1931. — *Trans. ent. Soc. London* 79 : 502.

— Junior objective synonym of *Papilio Satyrus Aristaeus* Bonelli, 1826 (Kudrna, 1984 : 237 ; Balletto & Passerin d'Entrèves, 1986 : 135) and junior subjective synonym of *Sátyrus sémele* L. v. *sardóa* Spuler, [1902] (Verity, 1953b : 308–309 ; Kudrna, 1977 : 110).

"*Satyrus semele* L. var. *aristaeus* Bon. ab. n. *postcaeca* m." Schawerda, 1931. — *Z. öst. EntVer.* 16 : 31. Locus typicus : Corsica, Evisa. Type material : unknown. — Junior subjective synonym of *Papilio Satyrus Aristaeus* Bonelli, 1826. Infrasubspecific taxon (Kudrna, 1977 : 113).

"*Hipparchia ariseus*" Smith & Shreeve, 1990. — *Entomologist's Rec. J. Var.* 102 : 277. — Subsequent misspelling of the name *Aristaeus* Bonelli, 1826.

"*Hipparchia aristhaeus senthes*" Cuvelier & Spruytte, 1994. — *Bull. Cercle Lépidopt. Belg.* 23 : 117. — Subsequent misspelling of the name *Aristaeus* Bonelli, 1826.

ILLUSTRATIONS. Plate 4, figs. 5–6. Plate 10, figs. 1–4 (androconial scales). Text figs. 16–17 (male genitalia). Text fig. 18 (female genitalia).

MATERIAL EXAMINED. Italy, Sardinia : 150 ♂, 44 ♀ in colls. VLCA, ZMA ; France, Corsica : 48 ♂, 14 ♀ in colls. VLCA, ZMA ; Italy, Elba : 4 ♂, 6 ♀ in colls. VLCA, ZMA.

DESCRIPTION. Forewing length : see table 1 ; slightly smaller than *H. algirica*, but larger than *H. maderensis* (except for the Corsica females, but n = 14 !). Male upperside ground-colour as in *H. algirica*, blackish brown spot in s2 on forewing small to minute, often without white pupil ; markings on forewing variably expressed, from entirely absent except for vestigial orange patches distad of spots in s2 and s5, to a more or less continuous orange-ochreous band from s1b up to s5, of a warmer, more reddish tinge and much wider than in *H. algirica*, filling the entire space except for the marginal area, basad till the sex brand ; sex brand much more extended than in *H. algirica*, quite as in *H. maderensis* ; hindwing with complete series of warm orange to reddish orange patches in s2–s6, usually filling the entire space except for the marginal area, extending basad almost until the cell, forming a continuous band only interrupted by thin, though well marked, brown veins, in the least marked specimens not extending beyond s5, which last space is then only barely coloured so distally. Female with markings much more complete, forewing moreover often with a shading of the same colour in the discal area in s1b–s3, sometimes even invading the cell, patches on hindwing always reaching s6. Underside forewing in both sexes entirely warm orange, except along costa, apex and outer margin, contrast between more vividly coloured basal-discal area and

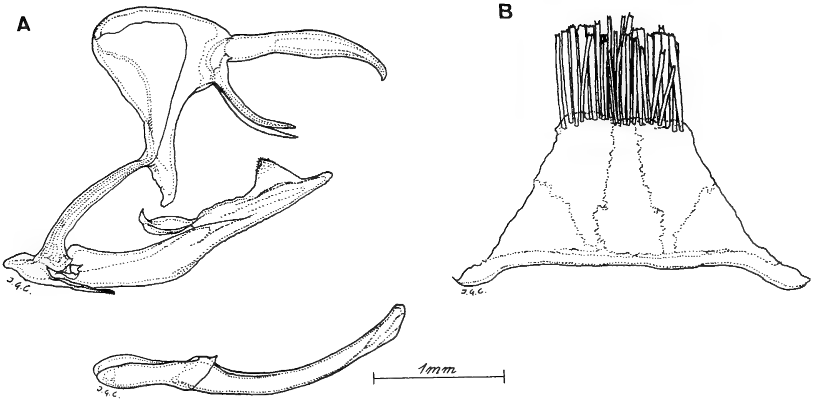

Fig. 16. *Hipparchia aristaeus* (Bonelli, 1826) : male genitalia (A) and Jullien organ (B).
Italy, Sardinia, Prov. Nuoro, Monti del Gennargentu, 4 km S. Fonni (1000 m), 22.VII.1992, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2274).

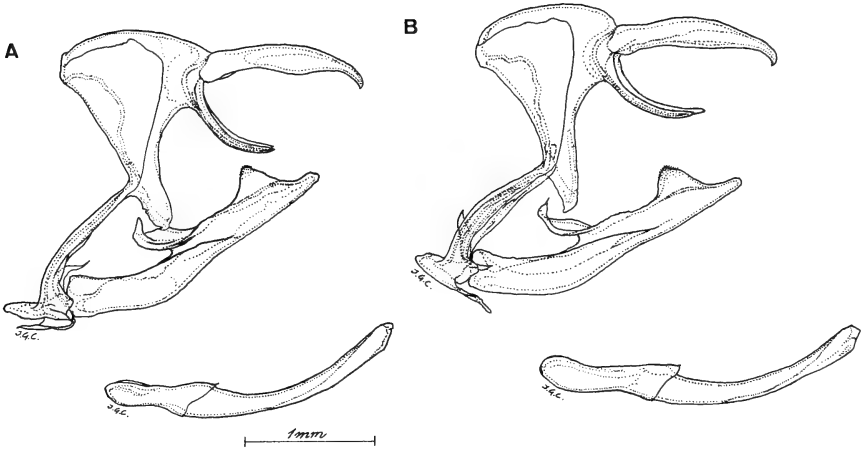

Fig. 17. *Hipparchia aristaeus* (Bonelli, 1826) : male genitalia.
A. Italy, Sardinia, Prov. Nuoro, Monti del Gennargentu, 4 km S. Fonni (1000 m), 24.VII.1992, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2273). B. Italy, Elba, Mt. Le Calanche (approx. 800 m), 9.VII.1988, leg. C. Warnotte, in coll. VLCA (Prep. JGC no. 2270).

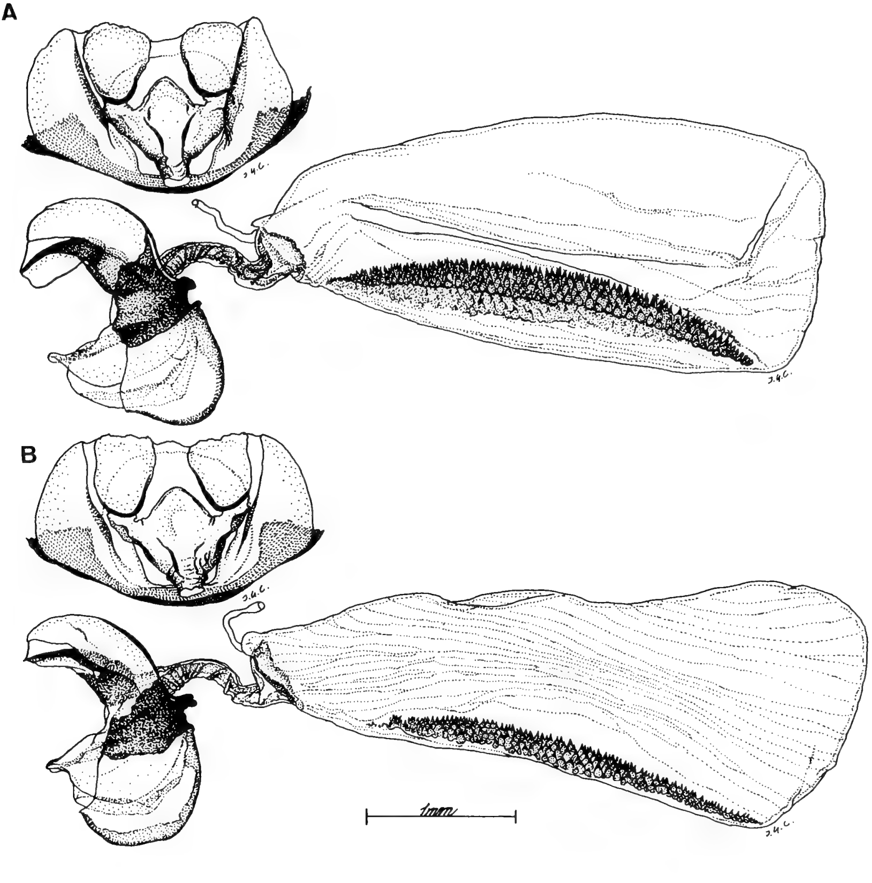

Fig. 18. *Hipparchia aristaeus* (Bonelli, 1826) : female genitalia.
A. Italy, Sardinia, Prov. Nuoro, Monti del Gennargentu, 4 km S. Fonni (1000 m), 22.VII.1992, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2462). B. France, Corsica, Haute-Corse, Calvi, 13/27.VII.1971, leg. Fam. van Oorschot & Fam. Coene, in coll. VLCA (Prep. JGC no. 2464).

lighter postdiscal area far less pronounced than in other species of this group, except for some extreme specimens of Sicilian *H. senthes* ; spot in s2 often absent in male. Underside hindwing discal line gently bending distally in s4–s5, evenly rounded in male, usually more pointed but sometimes also evenly rounded in female. Male genitalia much like *H. maderensis* and *H. algirica* : uncus, vinculum and valve sometimes longer than in these species, but there is overlap. Female genitalia sterigma much like *H. maderensis*, corpus bursae larger than in *H. algirica*, signum slightly longer. Androconial scales longer than in *H. (azorina) azorina*, *H. maderensis*, *H. algirica* and most *H. senthes*, much like *H. (azorina) miguelensis* (plate 10, see also Kudrna, 1984 : 236, fig. 10).

Distribution. Sardinia (known from the central and eastern part of the island : Monti del Gennargentu, Barbágia Seulo, Barbágia Ollolai, Lanusei, Ogliastra ; recently also found in the north : Porto Tórres, Monte Limbara, Témpio Pausánia, as well as the small offshore island of Asinara) ; Corsica (widespread over most of the island) ; Elba (rather widespread) ; Giglio ; Capraia (sources : Bonelli, 1826 ; Calberla, 1887 ; Verity, 1908, 1917, 1953b ; Rocci & Turati, 1925 ; Hartig & Amsel, 1951 ; Leestmans, 1965 ; Schmidt-Koehl, 1975 ; Hartig, 1975–1976 ; Kudrna, 1977 ; Biermann & Hesch, 1982a, 1982b ; Cesaroni *et al.*, 1994 ; Terzani, 1995, etc.). This species has erroneously been reported from other areas as well, either as a result of a more inclusive species concept, in which i. e. *H. algirica*, *H. "blachieri"* and *H. senthes* were assimilated under *H. aristaeus* (examples include North Africa (vide supra), Sicily (Costa, 1840 ; von Kalchberg, 1872 ; Lang, 1884, illustrating a Sicilian *H. senthes* female as *aristaeus* ; Heyne, 1895 ; Sichel, 1962, 1963 ; Bretherton, 1966 ; Higgins & Riley, 1970 (p. 141 : "A large race, f. *siciliana* Oberthur (...) occurs in the Lipari Islands, Sicily (Mt. Etna region) and Giglio") ; Zangheri, 1975 ; Bigger, 1977 ; D'Abrera, 1992, also illustrating Sicilian *H. senthes* specimens as *H. aristaeus* on p. 203 ; Cernigliaro, Di Benedetto & Lombardo, 1994), S. Italy (Higgins & Riley, 1970 ; Zangheri, 1975 ; D'Abrera, 1992), Malta (Bretherton, 1966) as well as the Balkans, including Greece with the Aegean islands, and Turkey (de Lesse, 1960 ; Bernardi, 1961 ; Sichel, 1962 ; Stempffer, 1962 ; Higgins, 1966 ; Bretherton, 1968, 1970 ; Coutsis, 1969, 1972, 1985a, 1985b, 1992, 1994 ; Robinson, 1971, 1990 ; de Worms, 1972 ; Koutsaftikis, 1974a, 1974b, 1974c ; Bigger, 1974 ; Cribb, 1974 ; Schaider & Jakšić, 1989 (on p. 74–75) ; Gaskin & Littler, 1993 ; Withrington, 1995 ; Pamperis, 1997, who makes the following curious statement (p. 333) : "There is great confusion about the names used for these species, because several other names had been used in the past, such as (...) *algirica* and *senthes* instead of *aristaeus*")) or due to misidentifications (one such instance is the series of reports from the Lipari Islands by Sichel, 1962 ; Higgins & Riley, 1970, 1984 ; Higgins, 1975 and Zangheri, 1975, that all apply in fact to *H. leighebi*). Quite recently, Tolman & Lewington (1997) erroneously reported it from Ponza, an island from where only *H. sbordonii* is known (these authors do not mention that taxon at all in their book). Heyne (1895) also mentions it from "Wiesbaden (in heissen Jahren)", suggesting that *aristaeus* is only a climatic form and Vorbrodt (1911) cites it as "Angeblich aus dem Wallis von Berisal (Favre)", presumably on similar grounds. Both last records evidently apply to *H. semele*. Verity (1911 : 313) describes "*Satyrus Aristaeus* Esp. race *variegata*" from Lardy near Paris, Pont-de-l'Arche and Authion. Obviously, this is a junior subjective synonym of *Papilio Semele* Linnaeus, 1758.

BIONOMICS. *H. aristaeus* has been observed in a variety of, mostly xeric, habitats, varying from dry rocky hills and garrigue (Verity, 1908, 1917 ; Hartig, 1975–1976 ; Kudrna, 1977 ; Biermann & Hesch, 1982a) and maquis with a. o. *Arbutus unedo* L. and *Erica arborea* L. (Bigot, 1959 ; Leestmans, 1965 ; Balletto, Toso & Lattes, 1989) to various stages of woodland (Bigot, 1959 ; Balletto, Toso & Lattes, 1989). Bytinski-Salz (1934) found it "in duncklen Waldesinnern" in mixed deciduous woodland (*Castanea sativa* Mill., *Corylus avellana* L., *Juglans regia* L.), while on Corsica it has even been recorded on humid alpine grassland up to the screes of the Monte d'Oro (Bigot, 1959). Last-mentioned author reviews the biocoenoses of Corsica and reports *H. aristaeus* (as "*Hipparchia algirica* Obth."!) from most of these. See Balletto, Toso & Lattes (1989) for data on Sardinia and Elba. On Corsica, *H. aristaeus* has occasionally been reported from sea level (Schmidt-Koehl, 1975 ; Rungs, 1982 ; Owen, 1986), but it usually occurs in mountainous areas from 500 m up to well over 1500 m (Bigot, 1959 ; Fonteneau, 1962 ; Leestmans, 1965 ; Schmidt-Koehl, 1975 ; Rungs, 1982). From Sardinia, the great majority of the literature records are from altitudes between 800 m (Bonelli, 1826) and about 1600 m (Hartig, 1975–1976), though Cesaroni *et al.* (1994) found it at some lowland localities near sea level in the north of the island and at 150 m on Asinara. One of us (AO) observed the butterfly between 19 and 25.VII.1992 in several localities in the central part of Sardinia (province of Nuoro). On 19.VII, one single male was taken 3 km W. Seui (Barbágia Seulo) at an altitude of only 400 m. On 22.VII, numerous freshly emerged males and only one female were noticed 12 km SE. Fonni (Monti del Gennargentu) at 500 m on dry garrigue with low bushes of *Quercus* sp. Most observations, however, were made daily from 21 to 25.VII on a habitat 4 km S. Fonni (Monti del Gennargentu) at 1000 m, at the beginning of emergence. Males were clearly outnumbering females, but after about two days the latter became progressively commoner. The main habitat consisted of rough, open ground with low vegetation, with the males perching on the ground or on rocks, flying actively towards any potential mate, the females only occasionally flying along. Females were encountered more often, especially on the last day of recording, among the undergrowth at a nearby woodland edge or, sometimes, sitting on *Rubus* sp. bushes. This suggests a partial habitat segregation between sexes, the females visiting male leks only for mating, a situation also reported for *H. leighebi* (Kudrna & Leigheb, 1988), *H. sbordonii* (Kudrna & Leigheb, 1988 ; Olivier, pers. obs. July 1991 on Ponza) and *H. maderensis* (vide supra). On Elba, the butterfly is found at low elevations (Verity, 1908) up to about 800 m (C. Warnotte, pers. comm.). On Giglio, Biermann & Hesch (1982a) found it "sehr häufig in Felsbereichen der Insel [very common in rocky areas of the island]" and Cesaroni *et al.* (1994) encountered it there at Giglio Castello (Grosseto), at an altitude of 500 m. On Capraia, one single male was found at Il Laghetto (318 m) on 4.VII.1994 (Terzani, 1995). The butterfly is often observed taking nectar : AO saw it occasionally on an unidentified low plant with blue flowers, females also on *Rubus* sp. (Rosaceae). Fonteneau (1962) and Jutzeler, Pitzalis & de Bros (1995) both mention *Carlina corymbosa* L. (Asteraceae) as the preferred nectar source of *H. aristaeus*, while Owen (1986) lists *Inula viscosa* (L.) Aiton (Asteraceae), *Mentha aquatica* L. and *Mentha ?suaveolens* Ehrh. (Lamiaceae). Larval host-plants : various Poaceae. Jutzeler, Pitzalis & de Bros (1995) mention the Sardinian endemics *Festuca morisiana* and *Poa balbisii* as predominating species in the habitat where *H. aristaeus* was observed. Rearing in captivity was successful on both forementioned grass species, as well as on *Brachypodium ramosum* (from S. Italy), *Festuca ovina*, *Festuca rubra* (both from Switzerland) and *Festuca* sp. (from near Genoa, N. Italy). Leestmans (1965) lists "*Aira canescens*, *Triticum repens*, les *Brachypodium*, *Festuca*, *Poa* et autres Graminées", which are exactly the species listed — in the same order — by Verity (1953b) as larval host-plants of *H. semele* ! Univoltine : on Corsica from the last week of June (Fountaine, 1907 ; Schmidt-Koehl, 1975 ; Verdonck, 1996) till October (Rungs, 1982 ; F. Coenen, pers. comm. : the latter found very worn specimens of both sexes on 2–8.X.1988). On Sardinia the flight period usually starts only at about mid-July (Hartig, 1975–1976 ; Biermann & Hesch, 1982b) or, on the Monti del Gennargentu, even late July (Hartig, 1975–1976 ; Olivier, pers. obs. 1992), but the butterfly is recorded there as early as 30.VI.1994 by Jutzeler, Pitzalis & de Bros (1995 : "nombre d'*aristaeus* mâles") ;

starting on 5.VII.1975 at Lanusei (Biermann & Hesch, 1992b). It flies until at least the end of August (Hartig & Amsel, 1951 ; Hartig, 1975–1976) and in coll. ZMA there are some worn specimens collected as late as 30.IX–6.X.1957 (leg. C. A. Jeekel), while Cesaroni *et al.* (1994) still found it on 12.X.1989 at Porto Tórres on the northern coast. From Elba there are reports covering a period from 20.VI to 8.X (Verity, 1917 ; Greenwood, 1964 ; Biermann & Hesch, 1982a : only worn females collected between 29.IX and 8.X.1980) and from Giglio we have precise data only from Biermann & Hesch (1982a : 3 & 4.VII.1979) and Cesaroni *et al.* (1994 : 20.VIII.1989). Early stages : described in detail by Jutzeler, Pitzalis & de Bros (1995). According to these authors, females started egg-laying after only three days. Also in material from Corsica, the females started oviposition in captivity soon after being captured (Jutzeler *et al.*, 1997). Records of worn specimens of both sexes in September–October (vide supra) suggest, however, that aestivation of the adults may occur as well, especially in lowland localities with a more extreme mediterranean climate. From L2 on, the larvae feed only at night, without real diapause in winter.

COMMENTS. Up until quite recently, there has been a lot of confusion, both nomenclatural and taxonomic, around this species, resulting in an unfortunate series of misunderstandings. The name *Satyrus Aristaeus* was first introduced by Bonelli *in* Desmarest (1825), but as no formal description accompanied it, it is a nomen nudum (cf. Article 12(a) of ICZN). Subsequently, Bonelli (1826) validly described the taxon *Papilio Satyrus Aristaeus* from the “monte Genargentu” on Sardinia, while Hübner ([1826]) illustrated on Plate 68, figs. 32 to 35, specimens agreeing in every respect with this new taxon under the name *Papilio Semele*. With the notable exception of Herrich-Schäffer ([1844]), who reported on it as *Satyrus Aristaeus*, all subsequent early authors for over a century listed it as a “varietas” [= subspecies] (or sometimes “race”) of “*Satyrus Semele*” (Rambur, 1832 : “Il n’est évidemment qu’une variété du *Semele* (L)” ; Ghiliani, 1852 ; Lederer, 1858 ; Staudinger, 1870, 1871, 1879 ; Kirby, 1871, 1903 ; Lang, 1884 ; Calberla, 1887 ; Heyne, 1895 ; Tutt, 1896 ; Mathew, 1898 ; Fletcher, 1901 ; Staudinger & Rebel, 1901 ; Rebel, 1903, 1904, 1916 ; Rosa, 1905 ; Gurney, 1906, 1914 ; Sheldon, 1907 ; Fountaine, 1907 ; Verity, 1908, 1916, 1917, 1923–1924, 1938–1939, 1953a, 1953b : in both latter publications as “*Hipparchia (Hipparchia) semele* L. eserge *aristaeus* Bon. razza *aristaeus* Bon.” ; Spuler, [1902] ; Seitz, 1908 ; Oberthür, 1909, 1914 ; Vorbrodt, 1911 ; Krausse-Heldrungen, 1912 ; Stauder, 1915–1916 ; Ragusa, 1916–1919 ; Verity & Querci, 1922–1924 ; Bubaček, 1923 ; Rocci & Turati, 1925 ; Reisser & Kautz, 1927 ; Schawerda, 1927, 1931 ; Warnecke, 1928 ; Gaede, 1930 ; Hemming, 1931 ; Bytinski-Salz, 1934 ; Holik, 1949). Spuler ([1902]), apparently not having consulted Bonelli's original description, wrongly assumed that the type locality of "*Sátyrus sémele* L. v. *aristaéus* Bon." was "Corsica (und Elba?)", and, considering the Sardinian population to be distinct, erected the new name "*Sátyrus sémele* L. v. *sardóa*" for the latter. This mistake about the type locality of *H. aristaeus* was subsequently perpetuated by Gaede (1930), Holik (1949), de Lattin (1949, 1967), Varin (1960) and Leestmans (1965, 1968). Hemming (1931) created additional confusion making the following statement (p. 502) : "This subspecies of *Hipparchia semele*, Linn. (1758), was described in 1826 by Bonelli as *Papilio aristaeus*. The latter name is invalid as it is a primary homonym of *Papilio aristeus*, Stoll (1780 in Cramer, *Uitl. Kapellen*, **4**(27) : 60) and of *Papilio aristeus*, Stoll (1781, *ibid.*, **4**(31) : 139). I therefore propose the name *Hipparchia semele*, Linn. ssp. **ichnusa*, nom.nov.** pro *Papilio aristaeus*, Bonelli". In doing so, Hemming (l. c.) made two mistakes : firstly, if the primary homonymy established by this author had been justified, Spuler's name *sardoa* was already available and both Verity (1953b) and Kudrna (1977) consequently correctly synonymized *ichnusa* under that name (only Biermann & Hesch, 1982a, 1982b since then have used the name *ichnusa*), secondly, following Article 58 of ICZN, both names listed as primary homonyms by Hemming (1931) are not, as they have a different origin and meaning (cf. Tremewan, 1978 ; Holloway & Robinson, 1979 ; Kudrna, 1984 ; Balletto & Passerin d'Entrèves, 1986 ; Hesselbarth, van Oorschot & Wagener, 1995). Stoll's *aristeus* could mean "a prince" (Tremewan, 1978), "the best, often used as a form of a title" (Kudrna, 1984), "un cavaliere greco [a Greek knight or horseman]" (Balletto & Passerin d'Entrèves, 1986) or it could be derived either from Aristeas, a wonder-worker and poet, or from Aristeas, son of Adeimantos (Hesselbarth, van Oorschot & Wagener, 1995). Bonelli's *aristaeus* undoubtedly applies to an epithet of Apollo (Tremewan, 1978 ; Kudrna, 1984 ; Balletto & Passerin d'Entrèves, 1986 : "In una nota manoscritta Bonelli indica che il suo *aristaeus* deriva da uno degli epiteti di Apollo"), although Hesselbarth, van Oorschot & Wagener (1995) state that it is derived from Aristaios, son of Apollo and the Nymph Kyrene, king of Arcadia, who introduced the apiculture and the olive culture. Therefore, the possible ambiguity about the original generic combination, discussed by e. g. Balletto & Passerin d'Entrèves (1986) becomes superfluous and irrelevant for the present case. By now there apparently is a consensus of opinion on at least the different origin and meaning of the names *aristeus* and *aristaeus* and hence we fully agree with Tremewan (1978), Holloway & Robinson (1979) and Balletto & Passerin d'Entrèves (1986) that, in the interest of stability [and in compliance with Article 58 of ICZN], the name *Hipparchia aristaeus* should be retained for this species. After Hemming (1931), it was Kudrna (1975) who again drew attention to the supposed case of homonymy between the two names and, considering *H. aristaeus* — as viewed in the present study — conspecific with North African *algirica*, used the latter name for it, and subsequently Higgins (1976) established *Hipparchia algirica sardoa* Spuler, [1902] as the "valid" name for the taxon from Sardinia and Corsica (a combination already used previously and for the first time by de Lattin, 1967). This combination, understood in the same sense as well, was subsequently used by Kudrna (1977), Leraut (1980), Rungs (1982), Fonteneau (1985) and Reinhardt (1992). Fonteneau (1962) presented the combination "*Hipparchia algirica aristeus* [sic!]", which is senseless, as Oberthür's name was published much later than both Stoll's and Bonelli's names. The "broad" species concept repeatedly used for the *Hipparchia aristaeus* group has resulted in some entries in the literature of "*algirica*" as the species name for *H. aristaeus* as understood here (e. g. Bigot, 1959 ; Johnson, 1963). The name *rautheri* was introduced by Krausse-Heldrungen (1912) as a "var.", though from his very description one may deduce that he himself considered it to be an individual form. Subsequently, it was used as a valid "subspecific" name by Gaede (1930), Varin (1960) and Leestmans (1965). After Bonelli (1825, 1826) and Herrich-Schäffer ([1844]), it was de Lattin (1949) who finally established the distinct species status of *Hipparchia aristaeus* and, after him, *H. aristaeus* has been listed as a species in its own right — and under its correct name! — by de Lattin (1950), Hartig & Amsel (1951), Varin (1960), Bernardi (1961 (also as superspecies, vide supra), 1971), Stempffer (1962), Sichel (1962), Bretherton & de Worms (1963), Greenwood (1964), Leestmans (1965, 1966, 1968, 1975), Bretherton (1966), de Granville (1968), Janse (1969), Kostrowicki (1969), Higgins & Riley (1970, 1984), Higgins (1973, 1975), Panchen & Panchen (1973), Schmidt-Koehl (1975), Zangheri (1975), Hartig (1975–1976), Roell (1977), Teobaldelli (1978), Tremewan (1978), Holloway & Robinson (1979), Heath (1981), Tennent (1983), Higgins & Hargreaves (1983), Coutsis (1984), Kudrna (1984, 1986, 1996), Balletto & Kudrna (1985), Balletto & Passerin d'Entrèves (1986), Bivar de Sousa (1986), Owen (1986), Kapfer (1987), Rungs (1988), Taymans (1989), Smith & Shreeve (1990), Prola & Prola (1990), Balletto *et al.* (1990), Dennis, Williams & Shreeve (1991), D'Abrera (1992), Cesaroni *et al.* (1994), Balletto (1995), Tarrier (1995b), Hesselbarth, van Oorschot & Wagener (1995), Terzani (1995), Jutzeler, Pitzalis & de Bros (1995), Jutzeler, Grillo & de Bros (1995), Jutzeler, Biermann & de Bros (1996), Verdonck (1996), De Prins & Iversen (1996), Tolman & Lewington (1997), Jutzeler *et al.* (1997) and Dennis (1997). We treat it as a full species for the same reasons as we do with *H. algirica* (vide supra).

5.4. *Hipparchia senthes* (Fruhstorfer, 1908)

"*Eumenis (Satyrus) semele senthes* nova subspec." Fruhstorfer, 1908. — *Int. ent. Z.* 2 : 10. Locus typicus : Taygetos [Greece, Pelopónissos, Óros Taígetos]. Type material : lectotype ♂, paralectotype ♀, in British Museum (Natural History), London [now The Natural History Museum, London] ; design. Kudrna (1977 : 116).

"*Satyrus Semele* L. ab. ♀ *Triocellatus* Ragusa" Ragusa, 1904. — *Naturalista sicil.* 17 : 109. Locus typicus : Sicily, Castelbuono. Type material : unknown. Unavailable name. Infrasubspecific taxon.

"*Satyrus semele blachieri* nov. subspec." Fruhstorfer, 1908. — *Ent. Z., Frankf. a. M.* 22 : 93. Locus typicus restrictus : Italy ; Sicily, Le Madonie (Kudrna, 1977 : 109). Type material : lectotype ♀, paralectotype ♀, in Muséum d'Histoire Naturelle, Genève ; design. Kudrna (1977 : 109). — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908, **syn. n.**

"*Satyrus Semele*, Linné, race *Siciliana*, Obthr." Oberthür, 1914. — *Études de Lépidoptérologie comparée* 10 : 130. Locus typicus : Sicily. Type material : lectotype ♀, paralectotype ♀, in The Natural History Museum, London ; **design. here Olivier & Coutsis.** — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908, **syn. n.**

"*Satyrus semele* L. f. n. *neapolitana*" Stauder, 1921. — *Dt. ent. Z. Iris* 35 : 29. Locus typicus : "Höhenlagen im Neapolitanischen" [Monte Faito, cf. Stauder, 1923–1924a[1924] : 7 "loc. class. Faitogebiet"]. Type material : lectotype ♂, paralectotypes 1 ♂, 4 ♀, in The Natural History Museum, London, 2 ♂, in Narodni Prirodovedecke Museum (National Natural History Museum), Prague ; **design. here Olivier & Coutsis.** — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908, **syn. n.**

"*Hipparchia semele* L. *blanchieri*" Troníček, 1949. — *Acta ent. Mus. natn. Pragae* 26 : 8. — Subsequent misspelling of the name *blachieri* Fruhstorfer, 1908.

"*Hipparchia aristaeus* Bon. *turcica* de Lattin i.l." de Lattin, 1950. — *Rev. Fac. Sc. Univ. Istanbul* 15, ser.B : 311. Locus typicus :

[Turkey] Bosporus area (Baltalımanı, Maltepe) ; Uludağ. Type material : 1 syntype ♀, Uludağ, in Biogeographische Sammlung der Universität des Saarlandes, Saarbrücken. — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908 (Kudrna, 1977 : 113 ; Hesselbarth, van Oorschot & Wagener, 1995 : 900).

"*Hipparchia algirica* Obth. *vallettai* n. ssp." de Lattin, 1952. — *Entomologist's Rec. J. Var.* 64 : 336. Locus typicus : Malta, Naxxar. Type material : holotype ♂, ex coll. Valletta, present depository unknown. — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908, **syn. n.**

"*Hipparchia semele* L. exerge *aristaeus* race *antherosenthes*" Verity, 1953. — *Entomologist* 86 : 175. Locus typicus : [Greece] Macedonia, lower altitudes on Mount Olympus. — Unavailable name (Article 13(a) of ICZN). Nomen nudum (Kudrna, 1977 : 117).

"*Hipparchia (Hipparchia) semele* L. [eserge *aristaeus*] razza *senthes* sottorazza *antherosenthes* nov." Verity, 1953. — Le Farfalle diurne d'Italia. Vol. 5. Divisione Papilionida. Sezione Nymphalina. Famiglia Satyridae : 305. Locus typicus : [Greece, Makedonía, Óros Ólimbos] Skála. Type material : unknown. — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908. Infrasubspecific taxon (Kudrna, 1977 : 117).

"*Hipparchia (Hipparchia) semele* L. [eserge *aristaeus*] razza *senthes* sottorazza *antherosthenes*" Verity, 1953. — Le Farfalle diurne d'Italia. Vol. 5. Divisione Papilionida. Sezione Nymphalina. Famiglia Satyridae : 305. — Subsequent misspelling of the name *antherosenthes* Verity, 1953.

"*Hipparchia aristeus* Bonelli ssp. *valletti*" Varin, 1960. — *Bull. Soc. ent. Mulhouse* 1960 : 17. — Subsequent misspelling of the name *vallettai* de Lattin, 1952 (see also Leestmans, 1965 : 95, 1968 : 303).

"*Hipparchia algirica* Obth. *vallettai* n. ssp." Valletta, 1972. — The Butterflies of the Maltese Islands : 37. — Junior objective synonym of *Hipparchia algirica* Obth. *vallettai* de Lattin, 1952 (Kudrna, 1977 : 107, 109) and junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908, **syn. n.**

"*Hipparchia ballettoi* sp. n." Kudrna, 1984. — *Fragm. ent.* 17 : 238. Locus typicus : Italy : Napoli : Monte Faito. Type material : holotype ♂, in coll. Balletto, paratypes 6 ♂, 1 ♀, in colls. Balletto, Kudrna & Museo Civico di Storia naturale "Giacomo Doria", Genova. — Junior subjective synonym of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908, **syn. n.**

"*Hipparchia balletoi*" Munguira, 1995. — Conservation of butterfly habitats and diversity in European Mediterranean countries. *In* : Pullin, A. S. (Ed.) : Ecology and Conservation of Butterflies : 284, 354. — Subsequent misspelling of the name *ballettoi* Kudrna, 1984 (see also Dennis, 1997 : 62).

"*Hipparchia blachieri* (...) *vallettae* Jutzeler, Biermann, Hesselbarth, Russo, Sala & de Bros, 1997. — *Linn. belg.* 16 : 118. — Subsequent misspelling of the name *vallettai* de Lattin, 1952.

Illustrations. Plate 1, figs. 1–8 (various type specimens). Plate 2, figs. 1–5 & 7–8 (including various type specimens). Plate 4, figs. 7–8. Plates 11–16, each figs. 1–4 (androconial scales). Text figs. 19–23 (male genitalia). Text figs. 24–28 (female genitalia). Text fig. 29 (genitalia of lectotype ♂ of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908). Text fig. 30 (genitalia of lectotype ♂ of *Satyrus semele* L. f. *neapolitana* Stauder, 1921).

Material examined (type-specimens not included). Turkey, Sivas : 1 ♂ in coll. ZMA ; Turkey, Adıyaman : 2 ♀ in coll. ZMA ; Turkey, Niğde : 3 ♀ in coll. ZMA ; Turkey, Adana : 2 ♂, 3 ♀ in colls. VLCA, ZMA ; Turkey, (Içel : 3 ♂, 1♀ in colls. VLCA, ZMA ; Turkey, Konya : 15 ♂, 12 ♀ in colls. VLCA, ZMA ; Turkey, Afyon : 2 ♂, 5 ♀ in colls. VLCA, ZMA ; Turkey, Isparta : 1 ♂, 1 ♀ in coll. ZMA ; Turkey, Antalya : 58 ♂, 117 ♀ in colls. VLCA, ZMA ; Turkey, Denizli : 1 ♀ in coll. ZMA ; Turkey, Muğla : 3 ♂, 3 ♀ in colls. VLCA, ZMA ; Turkey, İzmir : 2 ♀, in coll. VLCA ; Turkey, Ankara : 1 ♂, 1 ♀ in colls. ZMA, JGC ; Turkey, İstanbul : 9 ♂, 16 ♀ in coll. ZMA ; Bulgaria : 3 ♂, 4 ♀ in coll. VLCA ; Greece, Eastern Aegean islands, Kós : 4 ♂, 2 ♀ in coll. VLCA ; Greece, Eastern Aegean islands, Léros : 1 ♂ in coll. VLCA ; Greece, Eastern Aegean islands, Sámos : 23 ♂, 8 ♀ in coll. VLCA ; Greece, Eastern Aegean islands, Ikaría : 16 ♂, 25 ♀ in coll. VLCA ; Greece, Eastern Aegean islands, Híos : 45 ♂, 38 ♀ in colls. VLCA, ZMA, JGC, NG ; Greece, Eastern Aegean islands, Lésvos : 10 ♂, 9 ♀ in colls. VLCA, NG ; Greece, Northern Aegean islands, Thássos : 1 ♂ in coll. JGC ; Greece, Northern Aegean Islands, Samothráki : 1 ♂ in coll. VLCA ; Greece, Kikládes, Santoríni : 4 ♂, 4 ♀ in colls. VLCA, JGC ; Greece, Kikládes, Mílos : 7 ♂, 6 ♀ in coll. JGC ; Greece, Kikládes, Sífnos : 3 ♂, 5 ♀ in coll. JGC ; Greece, Kikládes, Páros : 20 ♂, 12 ♀ in colls. VLCA, JGC ; Greece, Kikládes, Síros : 6 ♂, 2 ♀ in coll. JGC ; Greece, Kikládes, Ándros : 6 ♂, 13 ♀ in colls. VLCA, JGC ; Greece, Évia : 1 ♂ in coll. JGC ; Greece, Égina : 2 ♂, 1 ♀ in coll. JGC ; Greece, Ídra : 9 ♂, 3 ♀ in coll. JGC ; Greece, Spétses : 3 ♂, 1 ♀ in coll. JGC ; Greece, Thráki : 4 ♂, 4 ♀ in colls. VLCA, JGC,

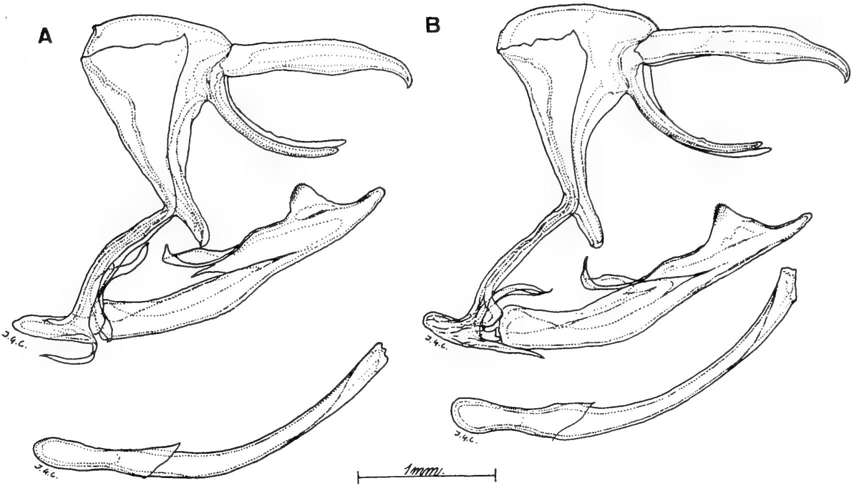

Fig. 19. *Hipparchia senthes* (Fruhstorfer, 1908) : male genitalia.
A. Turkey, Prov. Konya, Sultandağları, Akşehir (1100 m), 13/20.VII.1981, leg. H. & Th. van Oorschot & H. van den Brink, in coll. VLCA (Prep. JGC no. 2408). B. Greece, Eastern Aegean islands, Ikaría, 1 km E. Monokámbi (450 m), 7.VI.1990, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2511).

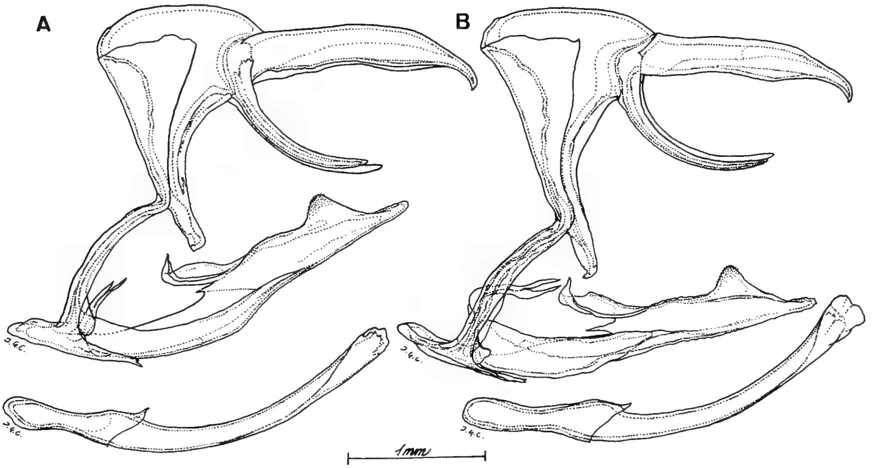

Fig. 20. *Hipparchia senthes* (Fruhstorfer, 1908) : male genitalia.
A. Greece, Pelopónissos, Lakonía, Óros Taígetos (1600 m), 15.VII.1983, leg. D. van der Poorten, in coll. VLCA (Prep. JGC no. 2503). B. Greece, Stereá Eláda, Fókida, Delfí (550 m), 20.V.1985, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2507).

NG ; Greece, Makedonía : 38 ♂, 20 ♀ in colls. VLCA, JGC, NG ; Greece, Stereá Eláda (mainly Óros Parnassós and Delfí) : 16 ♂, 15 ♀ in colls. VLCA, ZMA, JGC, NG ; Greece, Atikí : 16 ♂, 10 ♀ in colls. VLCA, ZMA, JGC, NG ; Greece, Pelopónissos : 11 ♂, 4 ♀ in colls. VLCA, ZMA, JGC ; Italy, Sicily, Le Madonie : 86 ♂, 79 ♀ in colls. VLCA, ZMA ; Italy, Calabria, Aspromonte : 2 ♂, 3 ♀ in coll. VLCA ; Italy, Calabria, La Sila : 19 ♂, 55 ♀ in coll. VLCA ; Italy, Campania, Ísola d'Íschia : 91 ♂, 7 ♀ in colls. VLCA, ZMA ; Italy, Campania, Ísola di Capri : 1 ♂ in coll. VLCA ; Italy, Campania, Monte Faito : 131 ♂, 25 ♀ in colls. VLCA, ZMA.

DESCRIPTION. Forewing length : see table 1 ; on average larger than *H. maderensis*, *H. aristaeus* and males of *H. algirica*, overlap with the latter taxon in females from Antalya and Híos. Male upperside ground-colour as in *H. algirica* and *H. aristaeus*, blackish brown spots in s2 and s5 on forewing and in s2 on hindwing always present and most often with a white pupil, those on forewing well developed but not as large as in *H. algirica* ; markings subject to considerable individual and geographic variation in their expression : on forewing much reduced in specimens from Turkey, the Aegean islands and the Balkans, that have small or even vestigial creamy yellow patches distad (and sometimes proximad) of s2 and s5 and occasionally traces of the same colouring in s3 or s1b (completely unmarked specimens, except for the spots, are, however, extremely rare), material from Calabria (especially La Sila) is very similar, but in several specimens the markings are more complete and their colour is more orange, in Campania (Monte Faito, Íschia) the markings are even more complete and orange, as much developed as in *H. algirica* in the most extreme specimens, on Sicily most specimens have a more or less continuous row of orange patches, sometimes even more expressed than in *H. algirica* (there are, however, specimens with very much reduced markings everywhere, even on Sicily) ; sex brand sometimes as reduced as in *H. algirica* in part of the specimens from Turkey, the Aegean islands and the Balkans, but generally more extended than in the latter taxon, well into s1b and often touching v1, though not invading s1a in some Greek and nearly all Italian specimens, including the Sicilian ones ; hindwing with complete series of light orange-ochreous patches in s2–s5(6), that remain separated by broad brown underlining of the veins, in material from Turkey, the Aegean islands and the Balkans as well as in most specimens from Calabria, small and not extending much basad, much as in *H. algirica* (very rarely vestigial or even entirely absent in single specimens from Turkey and Sámos), becoming progressively larger and extending more basad in material from Monte Faito, Íschia and Sicily, sometimes extending basad almost until the cell, as in *H. aristaeus* (and in *H. leighebi*), but even in the latter three areas casual specimens exist that are hardly distinguishable from Anatolian-Balkanic material. Female with markings much more complete, facultatively with a shading of the same colour in the discal area in s1b–s3, sometimes even invading the cell ; the latter feature singly in specimens from mainland Greece (Delfí) and the Kiklādes, but more frequently in Calabria, Campania (Monte Faito, Íschia) and, as a rule, on Sicily ; in material from Turkey, the Aegean islands and the Balkans, as well as part of the specimens from La Sila, the orange-ochreous patches in s2–s5(6) on upperside hindwing reduced, generally better expressed in material from Monte Faito, Íschia and Sicily, following a similar line of variation as with the male. Underside forewing quite variable : basal-discal area corresponding to area of sex brand of upperside more orange in male, usually bordered by a discal line that can be well marked, but sometimes non-existent ; in the female usually a strongly marked brown to blackish brown discal line, with an orange to coffee brown basal-discal area and a lighter orange to creamy yellow postdiscal area in material from Turkey, the Aegean islands, the Balkans, Calabria and part of the specimens from Campania (Monte Faito, Íschia) and Sicily : in the two last regions the distinction between the basal-discal and postdiscal area is less pronounced and the discal line occasionally becomes blurred, single extreme females from Sicily almost exactly like *H. aristaeus*. Underside hindwing discal line usually distinctly bending distally in s4–s5, evenly rounded or pointed : both conditions in the male, predominantly the latter condition in the female, though not always so ; white postdiscal band always well expressed in the male, less so in the female, in which it is often invaded by greyish mottling, though only infrequently entirely obliterated. Male genitalia distinctly larger than in *H. maderensis*, *H. algirica* and *H. aristaeus*, both in overall size and in the length of uncus, gnathos and penis and height of tegumen ; uncus always more robust than in these three taxa, length of tegumen and vinculum superior to that in the other three species, except for single largest specimens of those, valve always longer and broader than in *H. maderensis*, *H. algirica* and most *H. aristaeus*, but there is overlap between the largest specimens of last-mentioned and the smallest *H. senthes*, uncus > tegumen (mostly between 1.2 and 1.3), in other respects like the other three species of this group ; in SW. Turkey (Antalya, Muğla) and on Sicily most specimens with a distinctly short gnathos, but similar specimens in this respect are sometimes encountered among material from Calabria and Greece ; overall size of male genitalia very large in specimens studied from the

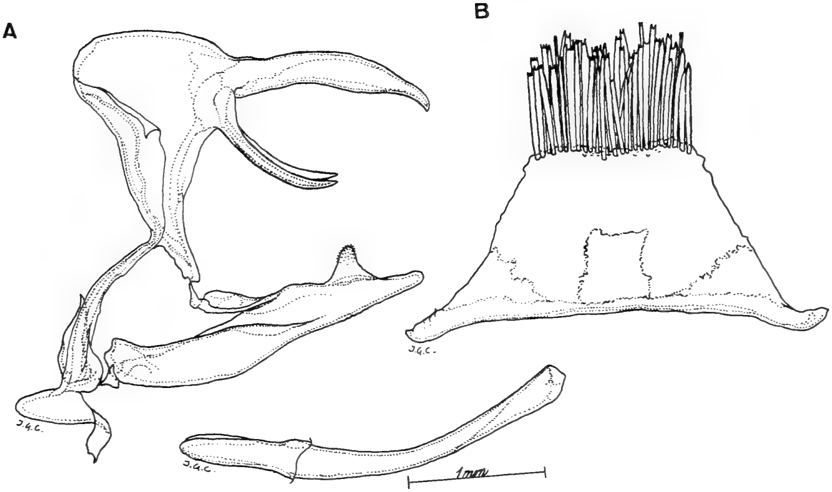

Fig. 21. *Hipparchia senthes* (Fruhstorfer, 1908) : male genitalia (A) and Jullien organ (B).
Italy, Sicily, Prov. Palermo, Monti Le Madonie, Cozzo Pomieri, 7 km NW. Petralia Sottana (1150–1300 m), 17.VII.1991, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2278) (specimen illustrated on plate 2, fig. 5).

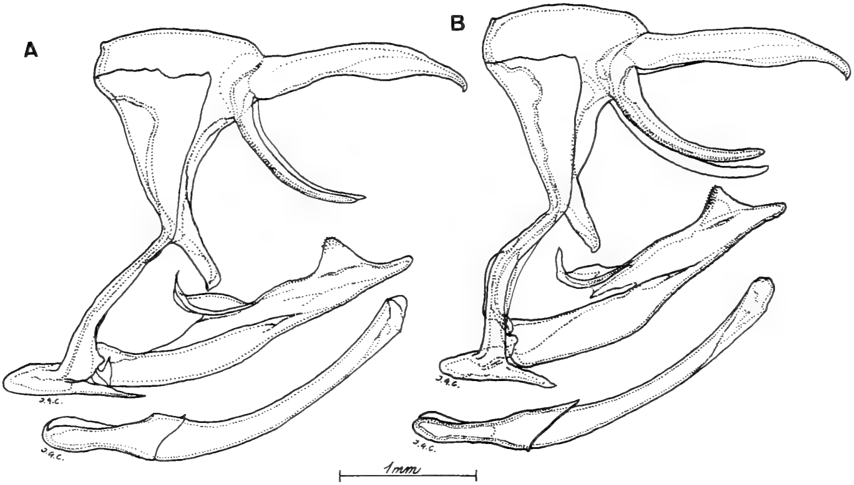

Fig. 22. *Hipparchia senthes* (Fruhstorfer, 1908) : male genitalia.
A. Italy, Sicily, Prov. Palermo, Monti Le Madonie, Cozzo Pomieri, 7 km NW. Petralia Sottana (1150–1300 m), 17.VII.1991, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2277). B. Italy, Calabria, Prov. Cosenza, La Sila, Cerenzia (600–650 m), 27.VII.1995, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2358) (specimen illustrated on plate 2, fig. 3).

Kikládes (Síros, Mílos), distinctly smaller in material examined from SW. Turkey (Antalya, Muğla), that have the uncus and tegumen distinctly shorter than in any other material of *H. senthes*. Female genitalia sterigma usually larger than in other taxa of the *H. aristaeus* group and in superspecies *H. azorina*, but there is overlap, dorsal lamella as a rule larger than in other *H. aristaeus* group taxa, but with overlap, especially among material from Sicily, largest in material from the Pelopónissos and — especially — Calabria (La Sila), mid-dorsal process as in other *H. aristaeus* group taxa, but usually more pointed distally (in about one-fourth of the investigated specimens from Cerenzia (La Sila) slightly more elongated than in any other material of this group) ; corpus bursae usually larger than in the other three taxa of this group, especially on Sicily and in S. Italy, but there is some overlap, signum as a rule longer than in *H. maderensis*, *H. algirica* and *H. aristaeus*, but again there is overlap, though Sicilian material invariably has longer signa than any of these. Androconial scales not significantly variable geographically, but quite so individually, sometimes either short and broad or relatively long and slender in material from the same area ; usually longer than in *H. (azorina) azorina*, *H. maderensis* and *H. algirica*, but rarely as long as in *H. (azorina) miguelensis* and *H. aristaeus* (plates 11 to 16, see also Kudrna, 1984 : 230, fig. 3).

DISTRIBUTION. *Turkey* : distributed over the western half of the country, including the European part, west of a line Tokat-Sivas-Malatya (see Hesselbarth, van Oorschot & Wagener, 1995 for a distribution map and a detailed locality list ; additional data in Baraniak, Bakowski & Nowacki, 1994 ; Koçak, 1994 ; Koçak & Seven, 1994 ; Seven, 1995, 1996 ; Seven & Bakowski, 1996). *Bulgaria* : isolated colonies along the Black Sea coast (Arkutino) and near Sliven, more widespread in the S. and especially the SW. of the country (Struma valley, Ograzden Mt.) and in the Alibotush Mts. (Ganev, 1983, 1984, 1986, 1988 ; Abadjiev, 1993, 1995). *Former Yugoslav Republic of Macedonia* (e. g. in the Vardar valley : Titov Veles, Delčevo ; see Jakšić, 1988 and Schaider & Jakšić, 1989 for a distribution map). *Albania* (Kudrna, 1977 ; Abadjiev & Beshkov, 1996 ; Tolman & Lewington, 1997). *Greece*. As, until quite recently (Pamperis, 1997), no detailed distribution maps had been published for the butterflies of this country, we present an exhaustive list of localities, per province and nomos, for the mainland ; for the islands, we generally do not enter into details about localities. Pamperis (1997) bases his identifications of the Greek *Parahipparchia* species on some characters of the pattern of male underside hindwing, that are unreliable, as the diagnostic features listed by him as species-

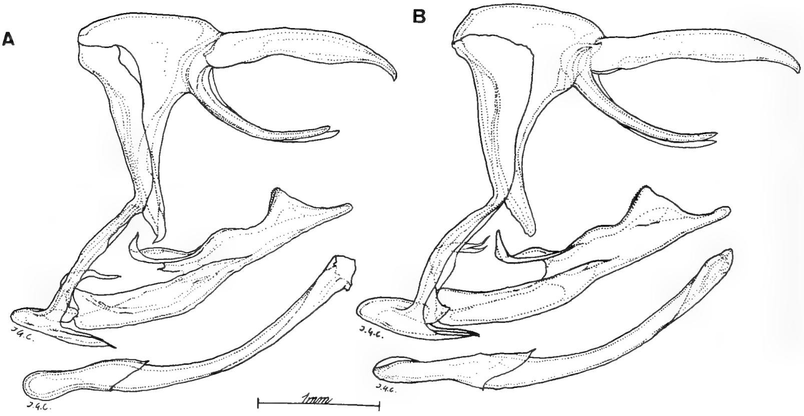

Fig. 23. *Hipparchia senthes* (Fruhstorfer, 1908) : male genitalia.
A. Italy, Campania, Prov. Nápoli, Monte Faito (1000–1100 m), 23.VII.1991, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2293). B. same data as A (Prep. JGC no. 2323).

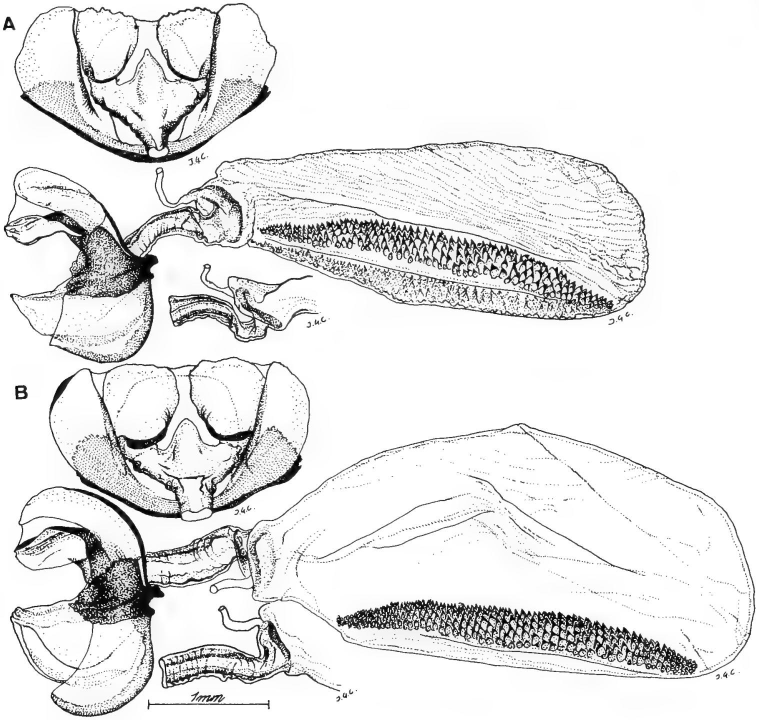

Fig. 24. *Hipparchia senthes* (Fruhstorfer, 1908) : female genitalia.
A. Greece, Eastern Aegean islands, Ikaría, Monokámbi (450 m), 6.VI.1990, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2518). B. Greece, Pelopónissos, Lakonía, Óros Taígetos (1600 m), 15.VII.1983, leg. D. van der Poorten, in coll. VLCA (Prep. JGC no. 2512).

specific for "*aristaeus*" [read *senthes*], for instance, do also occur in other species. Hence his distribution map should not be relied on, especially as far as records from western Makedonía and Ípiros are concerned. The following locality list is based on both personal data and reliable literature records. *GR, mainland*: Thráki — Évros (Didimótiho, Dadiá, Pessáni, Essími, Alexandroúpoli), Xánthi (Óros Ahladóvouno, Xánthi) ; Makedonía — Dráma (Rodópi-Kará Deré, Paranésti, Livaderó, Óros Falakró, Káto Nevrokópi, Vólakas, Granítis, Pírgi, Katáfito, Mikrópolis), Séres (Óros Órvilos, Promahónas, Laïliás, Óros Vrondoús, Óros Meníkio, Séres, Óros Kerkíni), Kilkís (Kendrikó, Kilkís), Péla (Lake Vegorítida, Óros Kaïmaktsalán), Péla-Flórina (old road from Édessa to Flórina), Flórina (Óros Varnoúndas, Vronderó), Imathía (Náoussa, Óros Vérmio), Pieriá (Óros Ólimbos : Litóhoro, Ágios Dioníssios, Skála, Leptokariá) ; Thessalía — Lárissa (Óros Ólimbos-Kariá, Vólos), Tríkala (Metéora, cf. Hecq, 1991 : possibly *H. volgensis*, confirmation required) ; Ípiros — Préveza (Párga, cf. Essayan & Cintré, 1980 : possibly *H. volgensis*, confirmation required) ; Stereá Eláda — Etolía-Arkananía (Amfilohía), Fthiótida (Pournaráki Pass, Óros Parnassós), Fókida (Delfí), Viotía (Aráhova), Atikí-Piréas (Inói, Óros Párnis, Néa Makrí, Óros Pendéli, Ekáli, Dáfni, Athína, Athína-Ellinikó, Voúla, Haidári, Óros Imitós, Cape Soúnio) ; Pelopónissos — Argolída (Tírintha, Óros Artemíssio), Korinthía (Óros Kilíni), Ahaía (Óros Helmós, cf. Brown, 1977, p. 155 : "It is extremely rare on Mt. Chelmos (Vytina) and flies in pine forests at about 1200 m in June" [sic!] ; we have been unable to trace this locality, but there is a place called Vitína in the nómos Arkadía), Arkadía (Óros Ménalo, Trípoli, Mantiréa, Ágia Sofía, Voúrvoura), Lakonía (Monemvassía, Areópoli, Óros Taígetos), Messinía (Langáda). *GR, islands* : Ionian islands — Lefkáda (Tsoukaládes, Nidrí, cf. Willemse, 1981 : possibly *H. volgensis*, confirmation required) ; Spétses ; Ídra ; Égina ; Évia (Psakhná, Oxílithos) ; Kikládes — Ándros, Síros, Náxos, Páros, Sífnos, Mílos, Folégandros, Kardiótissa, Santoríni ; Vóries Sporádes — Skíros ; Northern Aegean islands — Thássos, Samothráki ; Eastern Aegean islands — Lésvos, Híos, Sámos, Ikaría, Léros, Kós (sources : Staudinger, 1870 ; Fletcher, 1901 ; Fountaine, 1902 ; Rebel, 1902–1905, 1935, 1936, 1937, 1939a ; Fruhstorfer, 1908a ; Querci, 1935 ; Verity, 1936–1937, 1938–1939, 1953a, 1953b ; Hartig, 1940 ; Reisser, 1946 ; Bernardi, 1961, 1971 ; Johnson, 1965 ; Bretherton, 1970 ; Higgins & Riley, 1970 ; Koutsaftikis, 1970, 1974a, 1974b, 1974c ; de Worms, 1972, 1979 ; Coutsis, 1972, 1984, 1985a, 1985b, 1992, 1994, 1996 ; Cribb, 1974 ; Bigger, 1974 ; Brown, 1977 ; Kudrna, 1977 ; Dacie, Dacie & Grammaticos, 1977 ; Asselbergs, 1978 ; Dacie *et al.*, 1979 ; Essayan & Cintré, 1980 ; Löser, 1980 ; Willemse, 1981 ; Wiemers, 1983 ; Ulrich, 1985 ; Gaskin & Littler, 1986, 1988 ; Olivier, 1986, 1987, 1993, 1996, 1997 ; Olivier & De Prins, 1989 ; Luckens, 1990 ; Littler, 1991 ; Hecq, 1991 ; Cuvelier & Spruytte, 1994 ; Wakeham-Dawson, 1995, 1996 ; Holloway, 1996 ; Olivier & R. De Prins, 1996 ; Coutsis, De Prins, Dils, Ghavalas, Olivier & van der Poorten, unpublished records). Erroneously reported from Kríti (Mathew, 1898 ; Fletcher, 1901 ; De Prins & Iversen, 1996) and Ródos (Hesselbarth, van Oorschot & Wagener, 1995) : on the former island only *H. cretica* is known to exist, while no *Parahipparchia* taxon at all is known from the latter island (Olivier, 1993). *Italy* : Sicily — widely distributed in the northern and eastern part of the island : Monte Madonie, Monte Nebrodi, Monte Iblei, Etna, Monte Peloritani (Sichel, 1963 ; Kudrna, 1977 ; Leigheb, 1978 ; Cernigliaro, Di Benedetto & Lombardo, 1994 ; Tolman & Lewington, 1997) ; Calabria — Aspromonte, La Sila (Cesaroni *et al.*, 1994 ; Olivier, pers. obs. July 1995) ; Campania : Monte Faito, Íschia, Capri (Stauder, 1914–1915, 1917, 1921, 1923–1924a, 1923–1924b ; Kudrna, 1984 ; Kudrna & Leigheb, 1988 ; Jutzeler *et al.*, 1997 ; this study). *Malta* : reported at least once, but the butterfly certainly is not a resident there (de Lattin, 1952 ; Valletta, 1972 ; Sammut, 1984).

BIONOMICS. *Turkey, the Aegean islands and the Balkans.* Haploid chromosome number : n = 29 (Turkey, Amasya, cf. de Lesse, 1960 : 32). In Turkey, this species lives in a variety of flower-rich, poor grassland habitats at the edge of pine, cedar and evergreen oak forests of the mediterranean zone as well as of oak, beech and pine forests of the euxinian and subeuxinian zone ; the butterfly is often still found in remnants of destroyed forests. In open steppe-like habitats one will search in vain for it. The butterflies rest on tree trunks, on rocks and on the ground or in rocky crevices along paths and roads. Especially in the morning they look for such places in order to increase their body temperature, and towards the evening as well they try to benefit from the last sunbeams (Hesselbarth, van Oorschot & Wagener, 1995). On the Eastern Aegean islands, one of us (AO) noted the species in a series of seral stages from degraded garrigue, over bushy maquis to pinewoods. As the season advances, it becomes more strictly associated with pine forests, often sitting on the trunks, when sometimes up to almost ten specimens can be chased off one single trunk (e. g. on Híos and Sámos ; pers. obs., 1986–1990). On Ikaría it seems to be restricted to *Arbutus unedo* L. and *Erica arborea* L. dominated maquis (pers. obs., 1988 & 1990). On Kós it has been found only on Óros Díkeos, flying near (and nectaring on) thistles in open windswept areas near the summit at ca. 800 m (pers. obs., 1988 &

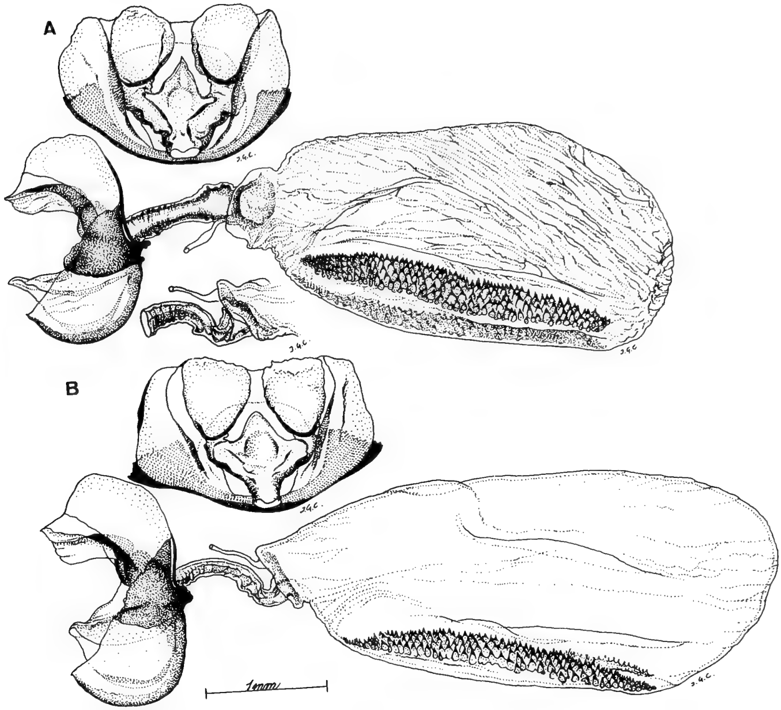

Fig. 25. *Hipparchia senthes* (Fruhstorfer, 1908) : female genitalia.
A. Greece, Stereá Eláda, Fókida, Delfí (550 m), 20.V.1985, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2513). B. same data as A (Prep. JGC no. 2516).

1992). On Léros one single male was found in an orchard, flying off from under a *Ficus* tree (pers. obs., 1992). On the Kikládes, one of us (JGC) found it mostly associated with orchards and cultivated areas, on Ándros near the shaded trunks of plane trees and olive trees (Coutsis, 1985a), on Santoríni near *Ficus* trees (Coutsis, 1992). In mainland Greece we both encountered it in garrigue, maquis, cultivated areas, pine forest (*Pinus halepensis* Miller and *P. brutia* Ten.), fir forest (*Abies cephalonica* Loudon), mixed evergreen-deciduous forest and deciduous forest. In the north of Greece also in steppe-like areas (Coutsis, pers. obs.). In Bulgaria, Abadjiev (1993) reports it as "An inhabitant of arid rocky formations near mixed forests with predominance of xerothermic oaks in Kresna Gorge, Kozhuh Hill, etc. The butterfly flies along bushes, low trees, often resting on stones, tree trunks". In Turkey, *H. senthes* has been observed from (almost) sea

Fig. 26. *Hipparchia senthes* (Fruhstorfer, 1908) : female genitalia.
A. Italy, Sicily, Prov. Palermo, Monti Le Madonie, Cozzo Pomieri, 7 km NW. Petralia Sottana (1150–1300 m), 17.VII.1991, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2452). B. same data as A (Prep. JGC no. 2453).

level (Muğla, Bodrum Peninsula ; Olivier, pers. obs. 1988) up to 1900 m in Antalya, Palaz Dağı, 2000 m on the Uludağ (Bursa) and even 2100 m in Niğde, Aladağları (Hesselbarth, van Oorschot & Wagener, 1995). On the Aegean islands, the butterfly is known from sea level (Littler, 1991) up to 1297 m on Óros Pelinéo on Híos (Olivier, pers. obs. 1990). On the Greek mainland it has been found from sea level up to 1700 m (Coutsis, pers. obs.), while according to Pamperis (1997) it has been encountered as high as 1900 m. It has been observed taking nectar on *Thymus* sp. (Lamiaceae) (Koçak, 1990a), *Rubus* sp. (Rosaceae) and *Sambucus ebulus* L. (Caprifoliaceae) (Hesselbarth, van Oorschot & Wagener, 1995). Pamperis (1997) shows several specimens taking nectar

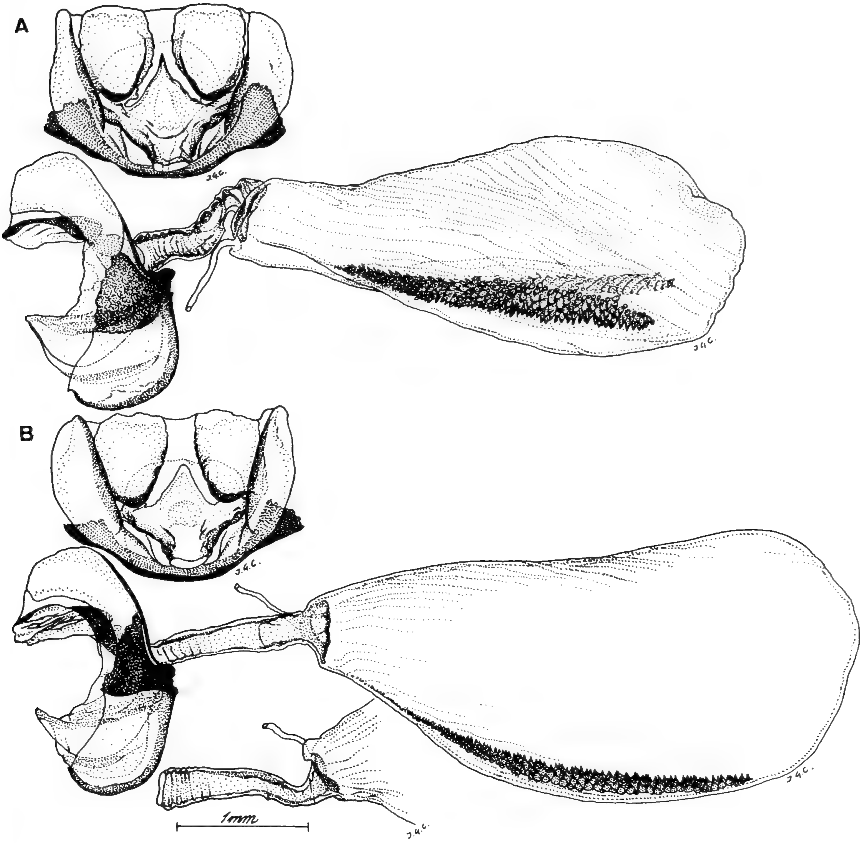

Fig. 27. *Hipparchia senthes* (Fruhstorfer, 1908) : female genitalia.
A. Italy, Calabria, Prov. Cosenza, La Sila, Cerenzia (600–650 m), 27.VII.1995, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2380). B. Italy, Calabria, Prov. Cosenza, La Sila, Cerenzia (600–650 m), 28.VII.1995, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2382).

from various flowers. One of us (AO) observed it drinking from mud as well as from the fallen fruits under mulberry (*Morus alba* L.) trees (Moraceae) on Híos (Nagós, 50 m) in midsummer (21.VII.1988), a behaviour it shared with *Hipparchia syriaca* (Staudinger, 1871), *H. fatua* Freyer, [1844], *Maniola chia* Thomson, 1987 and *Kirinia roxelana* (Cramer, [1777]). Univoltine : the flight period starts in the third week of May at Delfí (central Greece), on Sámos and on Híos (Eastern Aegean islands) and on the Bodrum Peninsula (Turkey) (de Worms, 1972 ; Olivier, pers. obs. 1985–1988) ; on the islands of Folégandros

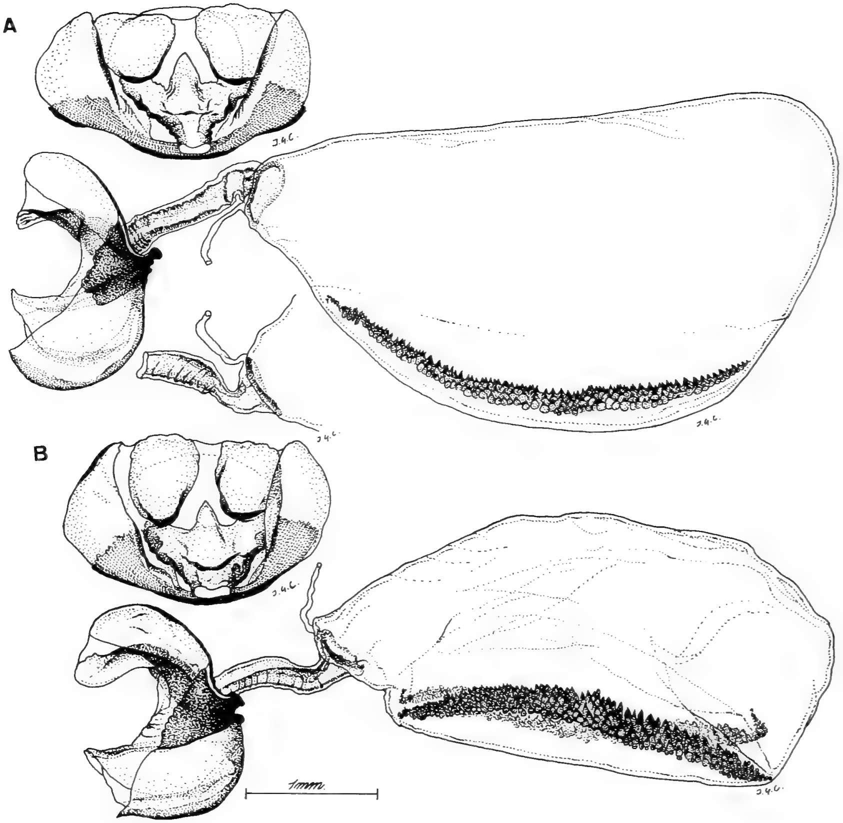

Fig. 28. *Hipparchia senthes* (Fruhstorfer, 1908) : female genitalia.
A. Italy, Campania, Prov. Nápoli, Monte Faito (1000–1100 m), 22.VII.1991, leg. A. Olivier, in coll. VLCA (Prep. JGC no. 2456). B. same data as A (Prep. JGC no. 2458).

and Kardiótissa (Kikládes) it has been found as early as 10/12.V. (Rebel, 1935) and on Síros even on 6/7.V.1995 (Coutsis, 1996). Remarkably, Fletcher (1901) encountered it on 27.IV at Tírintha near Náfplio (Pelopónissos, Argolída), but this is exceptional. It lasts throughout the summer with peaks in June–July in Greece and July–August in Turkey (Kudrna, 1977) until as late as the middle of October (Hesselbarth, van Oorschot & Wagener, 1995). According to Pamperis (1997), the flight period in Greece is from May to October. From Bulgaria, the flight period is stated by Ganev (1986) as "6–11" (!). Early stages, larval biology and larval host-plants unknown. The extended flight period suggests adult aestivation at least in the mediterranean zone of Turkey and on the Eastern Aegean islands (Gaskin & Littler, 1988 ; Hesselbarth, van Oorschot & Wagener, 1995), as well as in mainland Greece (e. g. Óros Imitós (400 m), 16.IX.1988, 1 ♀ leg JGC) and in Bulgaria (Ganev, 1984, 1986). It is worth mentioning that Koçak (1989a) reports a migration of *H. senthes*, involving both sexes, on 9.VII.1988 at Kayalıyatak, in the Ayas district in the province of Ankara (Turkey). Such behaviour was also noticed by one of us (JGC) in Greece. Feltwell (1976) discusses a migration of *H. semele* in southern France, while Hesselbarth, van Oorschot & Wagener (1995) also mention what is possibly a migration of *H. pellucida* near Uludere (Şırnak) in SE. Turkey. Such mass movements are, however, very rare events.

Sicily. The habitat consists of dry rocky ground with sparse bushes and trees (especially fig, carob and olive trees), orchards and occasionally open oak woodland, rarely pine or chestnut woods (though von Kalchberg, 1872 reports it "in grosser Menge, im Schatten des Kastanienlaubes Kühlung suchend"). It settles mostly on stones, rocks, bare ground and tree trunks, but — according to Leigheb (1978) — seldom on flowers (Bigger, 1977 ; Leigheb, 1978). One of us (AO) had the opportunity to observe this species in three localities of the Monte Madonie (Palermo) in July 1991. At Castelbuono (500 m) it was found commonly, sitting on tree trunks and branches in the shade, in a few apple tree orchards (15.VII) ; 3 km N. Petralia Sottana (900 m) it occurred frequently in oak woodland clearings, sitting on the ground as well as under small bushes (16.VII). Finally, at Cozzo Pomieri, 7 km NW. Petralia Sottana (1150–1300 m), it was often seen while taking nectar on a blue thistle species near the valley bottom and in adjoining grasslands uphill on open, rocky ground. Its numbers quickly dropped as one went higher up, and it was almost entirely absent on reaching wet acid meadows just below the line of beech forest. It is noteworthy that, in localities at lower altitudes, the butterfly is often closely associated with trees, being restricted to shady places (von Kalchberg, 1872 ; Bigger, 1977 ; Olivier, pers. obs. : vide supra). It is usually found at altitudes from 500 up to about 1500 m, sometimes as high as almost 1900 m, while its lower limit may descend to about 400 m and occasionally even to sea level (Sichel, 1963 ; Kudrna, 1977 ; Leigheb, 1978 ; Cernigliaro, Di Benedetto & Lombardo, 1994). One single protracted brood from the last third of May to September, sometimes even October, with one record as late as 5.XI (Ragusa, 1904 ; Sichel, 1963 ; Leigheb, 1978 ; Cernigliaro, Di Benedetto & Lombardo, 1994). Early stages, larval biology and larval host-plants unknown. The extended flight period is suggestive of adult aestivation.

S. Italy. In July 1995, one of us (AO) was able to observe this taxon both in Aspromonte (5–8 km SSE. Gambárie (1600–1700 m), 23 & 24.VII.1995) and in La Sila (Cerenzia (600–650 m), 26–28.VII.1995), thereby confirming a previous mention by Cesaroni *et al.* (1994). In the latter locality, 1 ♂, 1 ♀ had previously been collected on 2.VI.1975 and, in a nearby locality — San Giovanni in Fiore (1100 m) — 1 ♀ was found on 1.VI.1975 (Gallo & Cassulo, in litt.). The Aspromonte locality was a flower-rich roadside in a beech forest, while Cerenzia was a small, dense, pine wood, where the butterflies were congregating on the tree trunks, flying off only when disturbed. The male-female ratio was estimated at about 1:15. In Campania, the butterfly is known from the Monte Faito area on the Sorrento Peninsula (Nápoli), where it is met with on poor grasslands on limestone hills with many flowers, as well as in forest clearings in beech woodland, from as low as 130 m at Vico Equense up to the summit at 1100 m. Recorded nectar sources appear to change as the season advances, including *Spartium junceum* L. (Fabaceae), *Thymus* sp. (Lamiaceae), *Santolina* sp. (Asteraceae) and *Eryngium amethystinum* (Umbelliferae). After humid nights or rainfall it sits on the roads. Early in the season, males show strong territorial behaviour, pursuing every approaching butterfly, especially in the morning and again from about 4 p.m. until sunset. During the hottest hours of the day, activity is reduced to a minimum. Females also fly in the morning and disappear in the afternoon. As the season progresses, males become scarcer, disappearing completely by late August. Larval host-plants : various Poaceae. Jutzeler *et al.* (1997) mention *Festuca* spp. (*jeanpertii* or *circummediterranea*) and *Brachypodium distachyum* as predominating in its habitat on Monte Faito. Larvae in captivity accepted both these grass species, as well as *Festuca ovina* and *Poa annua*. The flight period starts in June and lasts until at least the end of August (Stauder, 1914–1915, 1923–1924a, 1923–1924b ; Cesaroni *et al.*, 1994 ; Jutzeler *et al.*, 1997). One of us (AO) observed this butterfly in the higher parts of Monte Faito (1000–1100 m) on 22 & 23.VII.1991. While some specimens were seen in clearings along the road in the beech forest, it was found in good numbers only near the top, on bare calcareous soil and on adjoining flower-rich slopes near the summit. Butterflies were often nectaring on a blue thistle species. Early stages : described in detail by Jutzeler *et al.* (1997). According to these authors, females collected in June failed to lay any eggs and oviposition took place after a rather long period, strongly suggesting delayed ovarian maturation. The species has also been recorded on the island of Íschia, where it has been observed along the southern coast, north of San Angelo, as well as in some lowland localities at 200–400 m (Ciglio, Fontana), penetrating vineyards (Kudrna & Leigheb, 1988 ; Jutzeler *et al.*, 1997 ; Olivier, pers. obs. 8 & 9.VII.1991). One of us (AO) found it to be extremely common on the western slopes of Monte Epomeo (600–780 m), the males still very fresh and the very first females just emerging. There males were sitting on the bare ground along a rocky path in poor dry grassland. Butterflies were also commonly taking nectar on blossoms of *Castanea sativa* Mill. It has been reported on this island from early June until August (Kudrna & Leigheb, 1988).

Fig. 29. Lectotype of *Eumenis (Satyrus) semele senthes* Fruhstorfer, 1908 [= *Hipparchia senthes* (Fruhstorfer, 1908)] : genitalia (specimen illustrated on plate 2, fig. 7).

SYMPATRY WITH RELATED TAXA. *Hipparchia senthes* is the only taxon treated in the present revision that is known to be sympatric with other *Parahipparchia* taxa, all belonging to the *Hipparchia semele* group (cf. section 1.3). In Turkey, it is syntopic and synchronous in several localities with either *H. mersina* or *H. pellucida* or both in Anatolia, with *H. volgensis* in the province of Kırklareli in the European part (Hesselbarth, van Oorschot & Wagener, 1995). On the Eastern Aegean islands it was found syntopic and — at least partly — synchronous with either *H. mersina* (Sámos), *H. pellucida* (Ikaría) or both (Lésvos) (Olivier & De Prins, 1989 ; Olivier, 1993). On the Greek mainland, one of us (JGC) encountered it syntopic and synchronous with *H. volgensis* in several localities in the western part of Makedonía (Óros Kaïmaktsalán, along the old road from Édessa to Flórina, Óros Varnoúndas, Vronderó) and such is also the case on the Pelopónissos as far south as on Óros Taígetos (Ichtiaroglou, pers. comm., see also Ulrich, 1997). Sympatry of *H. senthes* with *H. volgensis* certainly occurs as well in Bulgaria (Abadjiev, 1993) and in the Former Yugoslav Republic of Macedonia (Schaider & Jakšić, 1989) and is most likely to exist also in Albania. As both taxa look absolutely identical externally (the wing characters listed by Pamperis, 1997 as species-specific are not, being too variable and with a substantial degree of overlap between species), old records of *Hipparchia semele* (or "*Satyrus semele*") from the southern Balkans may apply to either *H. senthes* or *H. volgensis*. As a result, we have only considered distribution records that are absolutely reliable. We do not know of any substantiated record of sympatry of *H. senthes* with *H. semele* in the Balkans. On Sicily and in Calabria, *H. senthes* is syntopic and synchronous with *H. semele* in many localities (Sichel, 1963 ; Kudrna, 1977 ; Leigheb, 1978 ; Cernigliaro, Di Benedetto & Lombardo, 1994 ; Cesaroni *et al.*, 1994 ; Olivier, pers. obs. July 1991 & 1995), but in Campania (Monte Faito, Íschia, Capri) only *H. senthes* is known to occur.

COMMENTS. Before discussing the reasons that led us to the present conclusions, especially concerning the Sicilian and south Italian populations, it is useful to review the taxonomic views on the subject

Fig. 30. Lectotype of *Satyrus semele* L. f. *neapolitana* Stauder, 1921 [= *Hipparchia senthes* (Fruhstorfer, 1908)] : genitalia (specimen illustrated on plate 1, fig. 5).

up to the present. As prior to this study two, or even three species of the *H. aristaeus* group were believed to exist within the distribution area of *H. senthes*, we will discuss the situation separately for Turkey, the Aegean islands and the Balkans, Sicily, Malta and S. Italy. Old catalogues and standard works, covering the whole of Europe and Asia Minor, only mention "*Satyrus* [or *Hipparchia*] *semele*" for the whole area (Staudinger, 1871 ; Lang, 1884 ; Heyne, 1895 ; Tutt, 1896 ; Staudinger & Rebel, 1901 ; Kirby, 1903 ; Seitz, 1908 ; Spuler, 1908 ; Oberthür, 1909).

Turkey, the Aegean islands and the Balkans. Early authors simply listed it as "*Satyrus semele*" (Staudinger, 1870 ; Fountaine, 1902 ; Rebel, 1902–1905), with one notable exception (Fletcher, 1901, who lists it as "*Hipparchia semele* var. *aristaeus*"), until Fruhstorfer (1908a) described it as "*Eumenis (Satyrus) semele senthes*" from Óros Taígetos (Pelopónissos, southern Greece). It was subsequently treated under this subspecific combination (either as a "form", "race", "var.[iety]" or "ssp.") by most subsequent ones until 1949 (Rebel, 1910, 1916 ; Verity, 1923–1924, 1925, 1936–1937, 1938–1939 ; Graves, 1926 ; Gaede, 1931 ; Jachontov, 1935 ; Heydemann, 1942 ; Reisser, 1946), although several authors continued to list it simply as "*H. semele*" until very recently (Barraud, 1918 ; Buresch & Tuleschkov, 1929 ; Querci, 1935 ; Rebel, 1937, 1939a ; Johnson, 1965 ; Koutsaftikis, 1970 ; Fuchs, 1992). Some have mentioned it erroneously as "*semele cadmus*" (Rebel, 1935 ; D'Abrera, 1992), "*semele mersina*" (Verity, 1938–1939 ; Tuleschkov, 1951) or even "*semele cretica*" (Rebel, 1936 ; Hartig, 1940). In his revision of the "*Hipparchia semele* Gruppe", de Lattin (1949) treated *senthes* as a subspecies of *Hipparchia aristaeus*, in which he was followed by Varin (1960), Leestmans (1965, 1968), Bretherton (1966), Higgins & Riley (1970, 1984), de Worms & Bretherton (1975), Weiss (1975), Zangheri (1975), de Worms (1979), Dacie *et al.* (1979), Holloway (1979, 1996), Essayan & Cintré (1980), Baldock & Bretherton (1981), Higgins & Hargreaves (1983), Coutsis (1984), Gaskin & Littler (1986, 1988), Leestmans & Arheilger (1987–1988), Olivier & De Prins (1989), Gaskin (1990), Luckens (1990), Verhulst (1990), Littler (1991), D'Abrera (1992), Spruytte (1992), D'Hondt *et al.* (1992), Olivier (1993), Cuvelier & Spruytte (1994), Kolev (1994), Hesselbarth, van Oorschot & Wagener (1995), Wakeham-Dawson (1995, 1996), De Prins & Iversen (1996), Ulrich (1997) and Tolman & Lewington (1997), although several authors continued to report it as a subspecies of *H. semele* (Daniel, Forster & Osthelder, 1951 ; Thurner, 1964, 1967 ; Eckweiler, 1977 ; Schurian & Hofmann, 1983). Both a broader species concept and nomenclatural confusion (vide supra, comments under both *H. algirica* and *H. aristaeus*) have led to it being listed as well as *H. aristaeus* (de Lesse, 1960 ; Bernardi, 1961 ; Sichel, 1962 ; Stempffer, 1962 ; Higgins, 1966 ; Bretherton, 1968, 1970 ; Coutsis, 1969, 1972, 1985a, 1985b, 1992, 1994 ; Robinson, 1971, 1990 ; de Worms, 1972 ; Koutsaftikis, 1974a, 1974b, 1974c ; Bigger, 1974 ; Cribb, 1974 ; Schaider & Jakšić, 1989 ; Gaskin & Littler, 1993 ; Withrington, 1995 ; Pamperis, 1997), *H. algirica* (Schmidt-Koehl, 1969 ; Kudrna, 1975 ; Asselbergs, 1978 ; Koçak, 1981–1983, 1989a, 1989b, 1989c, 1990a, 1990b, 1994 ; Ulrich, 1985 ; Jakšić, 1988 ; Schaider & Jakšić, 1989 ; Koçak & Seven, 1991, 1994 ; van Oorschot & van den Brink, 1991, 1992 ; Baraniak, Bakowski & Nowacki, 1994 ; Seven, 1994, 1995 ; Seven & Bakowski, 1996), *H. algirica senthes* (Kudrna, 1977 ; Brown, 1977 ; Dacie, Dacie & Grammaticos, 1977 ; Milošević & Lorković, 1978 ; Goossens & Cromphout, 1978 ; Goossens, 1979 ; Hofmann, 1979 ; Löser, 1980 ; Schmidt-Koehl, 1980 ; Willemse, 1981 ; Wiemers, 1983 ; Jakšić, 1983 ; Ganev, 1983, 1984, 1985a, 1985b, 1986 ; Fuchs, 1985 ; Taymans & Taymans, 1985 ; Schmidt & Hassler, 1986 ; Kiriakov, 1988 ; Schmidt, 1989 ; D'Hondt *et al.*, 1992 ; Seven, 1996 ; Koçak, 1996) or even *H. aristaeus algirica* (Higgins, 1975 ; Vassilaina-Alexopoulou & Mourikis, 1985). Kudrna (1984, 1986, 1996) elevated *senthes* to full species rank, in which he has since been followed by Taymans & Taymans (1985), Olivier (1986, 1987, 1996, 1997), Ganev (1988), Gaskin & Littler (1989), Schaider & Jakšić (1989), Taymans (1989), Balletto *et al.* (1990), Hecq (1991), Abadjiev (1993, 1995), Balletto (1995), Abadjiev & Beshkov (1996), Coutsis (1996), Olivier & R. De Prins (1996), Kolev & van der Poorten (1997), Dennis (1997) and Jutzeler *et al.* (1997) : we treat it as such in the present study as well. It is quite funny to notice that a few authors have used two (Taymans & Taymans, 1985 ; D'Abrera, 1992 ; D'Hondt *et al.*, 1992) or even three (Schaider & Jakšić, 1989) different taxonomic combinations to designate this species within the same publication! From NW. Turkey, de Lattin (1950) described "*Hipparchia aristaeus* Bon. *turcica* de Lattin i.l.", while Verity (1953a, 1953b) described *antherosenthes* from Skála, on the lower slopes of Óros Ólimbos, as a (sub-)race of "*H. semele* L. exerge *aristaeus*" : both taxa were synonymized by Kudrna (1977). Schmidt-Koehl (1969) reported a "ssp. nova" of "*Hipparchia algirica* Oberthür" from Amasya and Ankara in Turkey, but it has remained undescribed, a fact we can only welcome! As both *H. senthes* and *H. volgensis* occur on Óros Taígetos, it is fortunate that a lectotype has been designated for *H. senthes* and that its identity has been established unambiguously by Kudrna (1977 : 116–117 ; compare text fig. 29 of present study). *Sicily*. The first record of which we know is that of "*S. arethusa* var. *aristaeus*" (!) by Costa (1840). Very soon it was realized that two related taxa occurred on Sicily, that were initially considered as "varietas" of the same species : von Kalchberg (1872) reported "*Satyrus Semele* var. *Aristaeus* Bon." from Castelbuono, in the lower parts of Le Madonie (p. 315), while recording "*Satyrus semele* L. (...) darunter selten var. *Aristaeus* Bon." from "Madonia-Gebirge" (p. 317). He was followed in this by Lang (1884) and Heyne (1895), while Staudinger & Rebel (1901), Oberthür (1909) and Barrett (1912) list it as "*Satyrus semele* var. *algirica*". Among the early authors, Ragusa (1904), Spuler (1908) and Barrett (1911) simply quote it as "*Satyrus semele*". Fruhstorfer (1908b) described "*Satyrus semele blachieri* nov. subspec." after two females in coll. Blachier [now in Muséum d'Histoire Naturelle, Genève]. These were designated as lectotype and paralectotype by Kudrna (1977) : they clearly do not belong to *H. semele*, as was erroneously stated by several authors (see below). Oberthür (1914) described "*Satyrus Semele*, Linné, race *Siciliana*, Obthr." after two females collected by Bellier de la Chavignerie [now in The Natural History Museum, London] and that we designate here as lectotype and paralectotype : Ragusa (1916–1919) — and Kudrna (1977) after him — correctly pointed out that the name *siciliana* is a junior synonym of the name *blachieri*. The name *blachieri* was correctly ascribed to what we now consider to be *H. senthes* by Verity (1915, 1916), Rebel (1916), Ragusa (1916–1919), Stauder (1920–1923) and Mariani (1939). It is not clear what Stauder (1915–1916[1916]) exactly understands when mentioning *Satyrus semele blachieri*. Verity (1923–1924[1924]) made a mistake in distinguishing both Sicilian taxa under the respective names of *siciliana* for what we at present consider as *H. senthes* (this is correct !) and of *blachieri* for what we at present consider as *H. semele* (sic !), without having studied Fruhstorfer's type specimens, stating explicitely on p. 25 : "In 1914, I made the mistake of describing in the *Bull. Soc. Ent. Italiana*, XLV., p. 219, the male of *siciliana*, Obth., as that of *blachieri*, but, now I am acquainted with the two Sicilian races, I can see that the darker one is that named by Frühstorfer". This misinterpretation of the name *blachieri* was perpetuated by Verity (1925, 1953b), Gaede (1930, 1931), Schwingenschuss (1942), de Lattin (1949), Bernardi (1961) and Valletta (1976, 1978). As a result, Sicilian *H. senthes* was reported as "*Satyrus semele* L. *siciliana* Oberth." by Gaede (1930, 1931), Verity (1938–1939[1938]) and Schwingenschuss (1942). In his revision of the "*Hipparchia semele* Gruppe", de Lattin (1949) treated *senthes* from Sicily under the name "*Hipparchia aristaeus* Bon. Rasse *siciliana* Obth.", in which he was followed by Varin (1960), Bernardi (1961), Bretherton (1965), Leestmans (1965, 1968), Higgins & Riley (1970, who treated it as "*H. aristaeus aristaeus* f. *siciliana*") and Higgins (1975). Kudrna (1977) erroneously considered *blachieri* as a subspecies of *H. algirica*, but correctly re-established it as the oldest available name for the "*aristaeus* group taxon" from Sicily, as understood at that time. The remainder of the story is analogous to what happened with *H. algirica*, *H. aristaeus* and *H. senthes* from Turkey and the Balkans, as a result of both a broader species concept and nomenclatural confusion : hence we find records as *H. aristaeus* (Sichel, 1962, 1963 ; Bretherton, 1966 ; Bigger, 1977 ; D'Abrera, 1992 ; Cernigliaro, Di Benedetto & Lombardo, 1994), *H. algirica* (Kudrna, 1975), *H. aristaeus blachieri* (Higgins & Hargreaves, 1983 ; Higgins & Riley, 1984 ; Coutsis, 1984 ; De Prins & Iversen, 1996 ; Tolman & Lewington, 1997), *H. algirica blachieri* (Kudrna, 1977 ; Leigheb, 1978), *H. algirica siciliana* (de Lattin, 1952) and *H. blachieri* (Kudrna, 1984, 1986, 1996 ; Balletto & Kudrna, 1985 ; Taymans, 1989 ; Balletto *et al.*, 1990 ; Meyer, 1993 ; Balletto, 1995 ; Balletto & Cassulo, 1995 ; Jutzeler *et al.*, 1997 ; Dennis, 1997). As we consider the Sicilian population to be conspecific with those from the Balkans, the Aegean islands and Turkey, *senthes* becomes the oldest available name with both *blachieri* and *siciliana* as junior subjective synonyms (Fruhstorfer's description of *senthes* was published on 11.IV.1908, that of *blachieri* on 5.IX.1908).

Malta. H. senthes is not a resident species on Malta : it has perhaps been observed twice there, and the first record is not certain. Sammut (1984) states (p. 85) : "One example seems to have been taken by H. Harford at St. Julians on the 10th. September 1910" ; this specimen could be either *H. senthes*, *H. algirica* or *H. semele*. A second specimen, a male collected by Valletta at Naxxar on 23.V.1939, served as a basis for the description by de Lattin (1952) of "*Hipparchia algirica* Obth. *vallettai* n. ssp.". We haven't seen this specimen, but there is an illustration of it in Valletta (1972) and Kudrna (1977), who examined the holotype, considered it "a worn specimen of *blachieri*", consequently synonymizing *vallettai* under "*Hipparchia algirica blachieri*". Previously, Verity (1953b) considered it as a "razza" (race) of "*Hipparchia (Hipparchia) semele* L. eserge *aristaeus* Bon.". Subsequently, it was listed as a subspecies of *H. aristaeus* by Varin (1960), Bernardi (1961) and Leestmans (1965, 1968), while Bretherton (1966) simply quoted it as "*H. aristaeus*". Valletta (1972) unintentionally redescribed it as "*Hipparchia algirica* Obth. *vallettai* n. ssp.", thus creating at the same time a junior objective synonym and a junior homonym of de Lattin's name. Cilia (1979) used the combination *H. algirica vallettai* again, and finally Sammut (1984) treated it as an infrasubspecific form of "*Hipparchia aristaeus algirica*". As a result of our treatment of the names *blachieri* and *siciliana* (vide supra), *vallettai* automatically becomes a junior subjective synonym of *senthes*.

S. Italy. Before the First World War, authors listed this taxon respectively as "*Satyrus Semele* v. *Algirica* Obth." (Staudinger & Rebel, 1901), "*Satyrus semele*" (Oberthür, 1909, p. 269 : "*Semele* du pays de Naples serait une forme agrandie du *Semele* français" ; Stauder, 1914–1915[1915]), *Satyrus semele blachieri* Verity [sic!] (Stauder, 1915–1916 [1916], p. 60 : "*S.s.* Uebergang von *cadmus* Fruhst. zur nächstfolgenden Rasse *blachieri* Verity in ganz Unteritalien") and "*Satyrus semele* trans. ad subsp. *blachieri* Obth." (Stauder, 1917). Subsequently, Stauder (1921) describes "*Satyrus semele* L. f.n. *neapolitana*" (on p. 29) as "eine Uebergangsform zu *aristaeus* mit aufgehelltem Ockerbraun ; diese aus Höhenlagen im Neapolitanischen", later specifying its type locality as Monte Faito (Stauder, 1923–1924a[1924], p. 7 : "Ich schlage daher für die Form aus Umgebung Neapel (loc. class. Faitogebiet, Ende VI, VII) den Namen *neapolitana*"). Some, mostly very recent, authors rightly consider this name as nomenclaturally available, either as a subspecies of *H. semele* (Varin, 1960) or as a distinct species (Jutzeler & de Bros, 1997 ; Jutzeler *et al.*, 1997 ; see also Cesaroni *et al.*, 1994). Indeed, while Stauder (1921) published some new names in the same publication as "subsp. n.", and the next year (Stauder, 1920–1923[1922]) reported it again as "*Satyrus semele blachieri* Obth.", thus clearly considering it to be an infrasubspecific form, it has been treated as a subspecies name in citations by a few subsequent authors before 1985 (Gaede, 1930, p. 163, as "*Satyrus semele* L. *neapolitana* Std.", 1931, p. 151, as "*Satyrus semele* Linné var. *neapolitana* Stauder" ; Varin, 1960, p. 16, as "*Hipparchia semele* L. ssp. *neapolitana* Staud.") ; therefore, in compliance with Article 45 (f, g) of ICZN, it is available and valid. As only *H. senthes* seems to occur on Monte Faito (Kudrna, 1984 ; Kudrna & Leigheb, 1988 ; Cesaroni *et al.*, 1994 ; Balletto, Gallo, Jutzeler & Thomson, pers. comm. ; Olivier, pers. obs. July 1991, reported variously as "*neapolitana*" or "*ballettoi*"), we have examined Stauder's specimens collected **before** 1921 (the date of publication of his *neapolitana* is 30.IV.1921) and designate here 1 ♂ as lectotype and a further 3 ♂, 4 ♀ as paralectotypes. Dissection of the genitalia of the lectotype (illustrated here on text fig. 30) confirmed its identity as *H. senthes*. Hence, Kudrna (1977) erroneously synonymized *neapolitana* under *H. semele semele* and unnecessarily described *Hipparchia ballettoi* in 1984 : the latter name quite correctly was sunk as a junior subjective synonym of "*Hipparchia neapolitana* (Stauder, 1921)" by Jutzeler & de Bros (1997 ; see also Jutzeler *et al.*, 1997). Verity (1923–1924[1924]) confused the matter completely, stating (p. 25) : "Stauder, too (*Zeit. wissen. Insektenbiol.*, 1916, p. 59), is not correct when he refers his *semele* of

Sorrento (...) to *blachieri* or a transition to it ; they, of course, are *paeninsulitaliae* and thus, if anything, they point distantly to *mersina*, and on the underside rather to *siciliana*, on account of the light gray tinge of the suffusion". Subsequently, Verity (1953b) listed it as "*Hipparchia (Hipparchia) semele* L. eserge *semele* L. razza *apenninigena* Vrty. sottorazza *paeninsulitaliae* Vrty forma *neapolitana* Stauder". Both Verity's names are junior subjective synonyms of *H. semele*, as correctly established by Kudrna (1977). Being influenced by de Lattin (1949) but, at the same time, apparently completely misled by Verity (1923–1924, 1953b), Varin (1960), as we have seen, considered *neapolitana* to be a subspecies of *H. semele*, but transferred *paeninsulitaliae* to a subspecies of *H. aristaeus* (!), in which he was slavishly followed by Leestmans (1965, 1968). Later on, it was reported from S. (or SW.) Italy as either "*Hipparchia aristaeus aristaeus*" (Higgins & Riley, 1970), "*H. aristaeus*" (D'Abrera, 1992), "*H. aristaeus siciliana*" (Higgins, 1975) or "*H. aristaeus blachieri*" (Parenzan, 1980 ; Higgins & Hargreaves, 1983 ; Higgins & Riley, 1984). Leraut (1997) lists *neapolitana* as a synonym of *Hipparchia semele cadmus* (Fruhstorfer, 1908). Nearly all authors since Kudrna (1984) have listed it as "*Hipparchia ballettoi*" (Balletto & Kudrna, 1985 ; Sbordoni & Forestiero, 1985 ; Kudrna, 1986, 1996 ; Kudrna & Leigheb, 1988 ; Taymans, 1989 ; Balletto *et al.*, 1990 ; Prola & Prola, 1990 ; Balletto, 1992, 1995 ; Meyer, 1993 ; Cesaroni *et al.*, 1994 (rightly noting, however, on p. 114 : "*neapolitana* (Stauder, 1921) (type locality : Monte Faito) may represent a senior synonym of *ballettoi*. Examination of Stauder's type material is necessary to establish the correct name for this taxon.") ; Balletto & Cassulo, 1995 ; Hesselbarth, van Oorschot & Wagener, 1995 (incorrectly stating, on p. 900 : "*ballettoi* Kudrna, 1984 (= *blachierioides* Stauder, 1921", see below) ; Dennis, Shreeve & Williams, 1995 ; Munguira, 1995 ; Jutzeler, Grillo & de Bros, 1995 ; Dennis, 1997), but De Prins & Iversen (1996) newly downgraded it as "*Hipparchia aristaeus ballettoi*". As we consider the Monte Faito population to be conspecific with those from the Balkans, the Aegean islands and Turkey, *senthes* becomes the oldest available name with both *neapolitana* and *ballettoi* as junior subjective synonyms.

General inference. Initially, we were inclined to consider the Italian populations (Sicily, Monte Faito, Íschia, Capri) as a distinct taxon when compared to *senthes* from the Balkans, the Aegean islands and Turkey, because of (nearly) constant differences in wing markings. The subsequent discovery of a rich colony at Cerenzia (La Sila) yielded material that included all stages in the expression of the wing markings from "true *senthes*" to "*blachieri*". When comparing all Italian material we have now in our possession, we at best note a clinal pattern of increase in the development, expression and colour intensification of the wing markings towards the Tyrrhenian coast : such an extreme development is also observed in other *Parahipparchia* taxa on some Tyrrhenian islands (*H. aristaeus*, *H. leighebi*, *H. sbordonii*), as well as in some other, more distantly related satyrine butterflies (e. g. *Hipparchia neomiris* (Godart, 1822), *Maniola nurag* (Ghiliani, 1852) and *Lasiommata paramegaera* (Hübner, [1824])) and is thus probably adaptively shaped by selective processes rather than following phylogeny, as already suggested by Cesaroni *et al.* (1994). Olivier & De Prins (1989) demonstrated significant clinal variation in the expression of various wing markings in *Hipparchia mersina*, also assuming that selection is involved. Structural characters (genitalia, androconia) also failed to reveal any discrete property of the Italian populations : to the contrary, if anything were worthy of further investigation in this respect, it would rather be a biometric study of the male genitalia in the various Anatolian populations. What we know of the bionomics of this species throughout its range does not allow us to retain anything in support of a taxonomic differentiation of any population. Therefore, we logically conclude that, when considering **all** known populations of *H. senthes* throughout its known range, there is no present evidence supporting a breakdown of this species into smaller taxonomic — not even subspecific — units. It is self-evident that a test of our conclusions by other means, especially molecular techniques, would be most revealing. We treat *H. senthes* as a full species when compared to the other three recognized *H. aristaeus* group taxa, because of its total geographical isolation, combined with a distinct habitat specialization, and its significant morphological and allozyme differentiation (Cesaroni *et al.*, 1994 present data for "*H. ballettoi*" (Monte Faito) that convincingly support its species status when compared to *H. algirica*, *H. aristaeus* and all further *Parahipparchia* taxa considered in that study). Direct observations of syntopic and synchronous occurrence of *H. senthes* with *H. semele*, *H. mersina*, *H. volgensis* and *H. pellucida* (vide supra) further corroborate their specific distinctness.

6. On the taxonomic status of "*Satyrus semele* L. f. *blachierioides*" Stauder, 1921

The recorded sympatry of *H. semele* and *H. senthes* in Aspromonte (Calabria) made it a priori not impossible that the taxon described as "*Satyrus semele* L. f.n. *blachierioides*" by Stauder (1921) could refer to *H. senthes*, as suggested by Hesselbarth, van Oorschot & Wagener

Fig. 31. Lectotype of *Satyrus semele* L. f. *blachierioides* Stauder, 1921 [= *Hipparchia semele* (Linnaeus, 1758)] : genitalia (specimen illustrated on plate 2, fig. 6).

(1995) and Jutzeler *et al.* (1997), albeit under the respective names "*ballettoi*" and "*neapolitana*"(vide supra, section 5.4). As, in Stauder's (1921) publication, *blachierioides* is quoted first on the same page as *neapolitana* (p. 29), it would have been, in that case, the valid name for the south Italian population if it deserved a name on its own. Despite the fact that Stauder (1921) published the name *blachierioides* for "die dunklere, trübere südkalabrische Montanunterrasse aus dem Aspromonte", i. e. as an infrasubspecific name ("mountain subrace"), it has subsequently been treated as a subspecies name in citations by Gaede (1930, 1931), de Lattin (1949) and Varin (1960 : the latter author inexplicably listing it as a subspecies from Austria!) and is thus, in compliance with Article 45 (f, g) of ICZN, available and valid. We therefore have examined Stauder's specimens collected **before** 1921 (the date of publication of his *blachierioides* is 30.IV.1921) and designate here 1 ♂ as lectotype (illustrated on plate 2, fig. 6 of the present study) and a further 5 ♂, 1 ♀ as paralectotypes. Dissection of the genitalia of the lectotype (illustrated here on text fig. 31) confirmed its identity as *H. semele*, hence this name does not apply to any *Hipparchia aristaeus* group taxon and it will not be dealt with further in the present study. The following synonymy is confirmed :

"*Papilio Nymphalis Semele*" Linnaeus, 1758. — Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, Cum Characteribus, Differentiis, Synonymis, Locis. Tomus I, Editio Decima, Reformata : 474. Locus typicus restrictus : S. Sweden (Kudrna, 1977 : 63). Type material : lectotype ♀, in coll. Linnean Society of London ; design. Kudrna (1977 : 63).

"*Satyrus semele* L. f.n. *blachierioides*" Stauder, 1921. — *Dt. ent. Z. Iris* 35 : 29. Locus typicus : Aspromonte. Type material : lectotype ♂, paralectotypes 2 ♂, 1 ♀, in The Natural History Museum, London, 3 ♂, in Narodni Prirodovedecke Museum (National Natural History Museum) Prague ; **design. here Olivier & Coutsis.** — Junior subjective synonym of *Papilio Nymphalis Semele* Linnaeus, 1758 (Kudrna, 1977 : 60).

"*Satyrus semele blachieroides*" Gaede, 1930. — Satyridae [part.]. In : Seitz, A. (Ed.) : Die Gross-Schmetterlinge der Erde. Eine systematische Bearbeitung der bis jetzt bekannten Gross-Schmetterlinge I. Supplement 1 : 163. — Subsequent misspelling of the name *blachierioides* Stauder, 1921 (see also Verity, 1953b : 310, 311, 340 ; Varin, 1960 : 16 ; Kudrna, 1977 : 60 and Leraut, 1997 : 191).

"*Hipparchia neapolitana* (...) forme *blacherioides*" Jutzeler, Biermann, Hesselbarth, Russo, Sala & de Bros, 1997. — *Linn. belg.* 16 : 118. — Subsequent misspelling of the name *blachierioides* Stauder, 1921.

7. Characters that could be useful for constructing a cladogram of *Parahipparchia*

The only attempt so far at constructing a cladogram of *Parahipparchia* has been made by Balletto *et al.* (1990). A first examination of it reveals that in both theirs and our own study *azorina*, *occidentalis* (reported as "*caldeirensis*" [sic !]) and *miguelensis* come out as a monophyletic group. In their study, the *Hipparchia aristaeus* group is treated as monophyletic as well, based on two putative synapomorphies that we have not been able to corroborate (see section 5 and below). Furthermore, the proposed interrelationship of the taxa within this group is not in agreement with our results : *H. aristaeus* and *H. senthes* are positioned much closer to each other than either one is to "*H. blachieri*" or "*H. ballettoi*".

Cesaroni *et al.* (1994), studying evolutionary relationships among part of the known *Parahipparchia* taxa, also obtained conflicting results when compared to those of Balletto *et al.* (1990), which made them conclude categorically (p. 113) : "As one example, their parsimony tree based on morphological characters puts two well-separated species, *H. aristaeus* and *H. algirica*, closer than the conspecific, allozymically identical, *H. s. semele* and *H. s. wilkinsoni.* This kind of bias is probably

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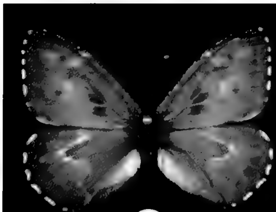
Plate 3. Superspecies *Hipparchia azorina.*

1. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) ♂. Portugal, Azores, Pico, Châ do Pelado (800 m), 15.VIII.1990, leg. M. Meyer, in coll. VLCA.
2. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) ♂. Portugal, Azores, Faial, Gordo (1000 m), 10.VIII.1982, leg. J. Demange, in coll. VLCA.
3. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♂. Portugal, Azores, Flores, Caldeira Funda, 29.VIII.1986, leg. E. Balletto, in coll. VLCA.
4. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) ♀. Portugal, Azores, Pico, Tronqueira (850 m), 14.VIII.1982, leg. J. Demange, in coll. VLCA.
5. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) ♀. Portugal, Azores, Faial, Gordo (1000 m), 10.VIII.1982, leg. J. Demange, in coll. VLCA.
6. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♀. Portugal, Azores, Flores, Caldeira Comprida (580 m), 8.VIII.1990, leg. M. Meyer, in coll. VLCA (genitalia illustrated on text fig. 8B).
7. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♂. Portugal, Azores, Flores, Caldeira Funda, 29.VIII.1986, leg. Balletto, in coll. VLCA.
8. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♂. Portugal, Azores, São Jorge, Serra do Topo, Pedra Vermelha (800 m), 17.VIII.1990, leg. M. Meyer, in coll. VLCA (genitalia illustrated on text fig. 7A).
9. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♂. Portugal, Azores, Terceira, Serra de Santa Barbara (1000 m), 17.VII.1994, leg. H. Henderickx, in coll. VLCA.
10. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♀. Portugal, Azores, Flores, Caldeira Comprida (580 m), 8.VIII.1990, leg. M. Meyer, in coll. VLCA (genitalia illustrated on text fig. 8A).
11. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♀. Portugal, Azores, São Jorge, Serra do Topo, Pedra Vermelha (800 m), 17.VIII.1990, leg. et coll. M. Meyer.
12. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 ♀. Portugal, Azores, Terceira, Serra de Santa Barbara (1000 m), 18.VIII.1990, leg. M. Meyer, in coll. VLCA (genitalia illustrated on text fig. 9B).
13. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) ♂. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 22.VII.1994, leg. H. Henderickx, in coll. VLCA (genitalia illustrated on text fig. 10A).
14. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) ♂. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 24.VII.1994, leg. H. Henderickx, in coll. VLCA.
15. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) ♀. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 24.VII.1994, leg. H. Henderickx, in coll. VLCA (genitalia illustrated on text fig. 11B).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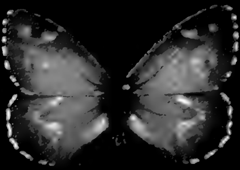
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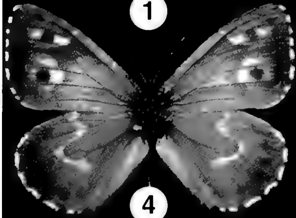
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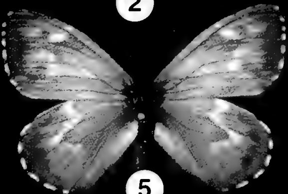
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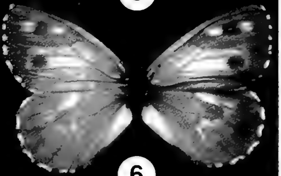
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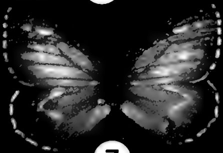
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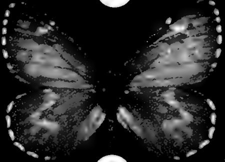
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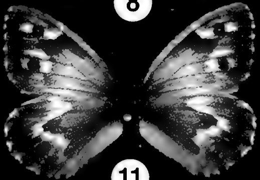
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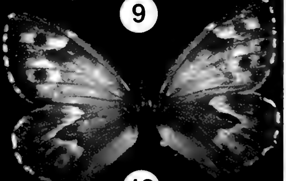
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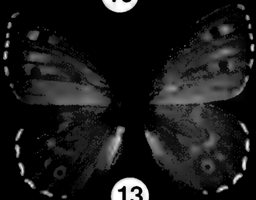
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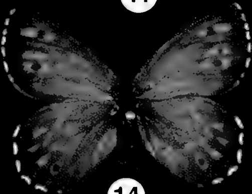
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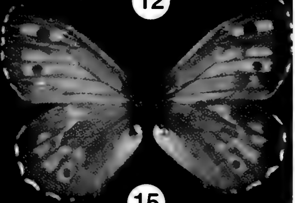
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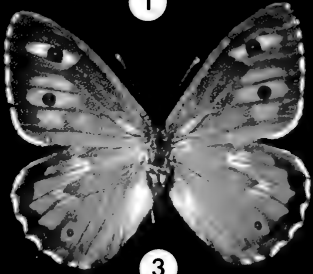
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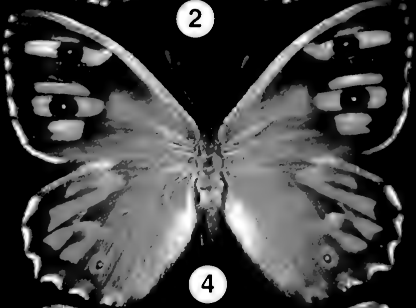
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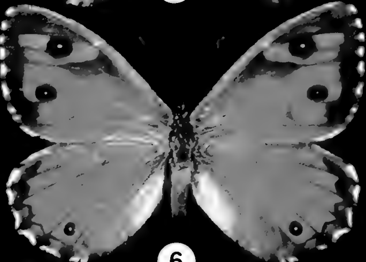
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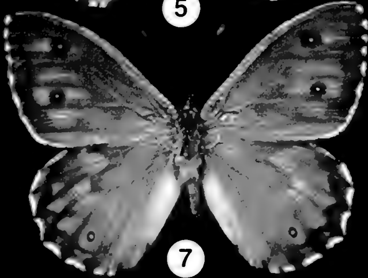
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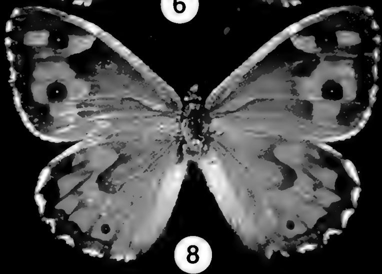
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the outcome of a questionable multistate coding of quantitative morphological characters. Thus the conflict between our results based on phenetic algorithms and Balletto *et al.*'s cladistic analysis is not due to a conflict of methodologies, but rather due to the selection and coding of characters".

In the present section, we will list a series of adult characters of potential use for constructing a cladogram of *Parahipparchia* and we will review the 27 multistate characters listed by Balletto *et al.* (1990) : these last ones will be dealt with at their appropriate place in the following discussion, being enumerated as "B" followed by the number given to it in their publication (on p. 172, table 2b). For ease of use in future phylogenetic work, each character will be coded as binary, "a" being the supposed plesiomorphous state and "b" the supposed apomorphous state. While Balletto *et al.* (1990) list only structural characters (androconial scales and genitalia), we include also wing characters. For determining the polarity of characters, we have applied the methodology of outgroup comparison. The outgroup is formed by *Hipparchia* **s. str.**, the supposed sister-group of *Parahipparchia* (cf. García-Barros & Martín, 1991) ; where appropriate, it will be extended to include the whole Satyriti sensu Harvey (1991) : when this is the case, it will be stated explicitly. For definitions on phylogenetic terminology see Appendix.

WING CHARACTERS

1. a) Apex forewing ≈ rounded
   All taxa of *Hipparchia* **s. str.** and *Parahipparchia* except *H. (azorina) miguelensis*

Plate 4. *Hipparchia aristaeus* group.
1. *Hipparchia maderensis* (Baker, 1891) ♂. Portugal, Madeira, Curral das Freiras (600–700 m), 24.VII.1993, leg. A. Olivier, in coll. VLCA.
2. *Hipparchia maderensis* (Baker, 1891) ♀. Portugal, Madeira, 2 km SW. Poiso (1350 m), 25.VII.1993, leg. A. Olivier, in coll. VLCA.
3. *Hipparchia algirica* (Oberthür, 1876) ♂. Morocco, Middle Atlas, Tizi-n-Tretten (1950 m), 27.VI.1994, leg. A. Olivier, in coll. VLCA.
4. *Hipparchia algirica* (Oberthür, 1876) ♀. Morocco, Middle Atlas, Ifrane (1650 m), 24.VI.1994, leg. A. Olivier, in coll. VLCA.
5. *Hipparchia aristaeus* (Bonelli, 1826) ♂. Italy, Sardinia, Prov. Nuoro, Monti del Gennargentu, 12 km SE. Fonni (500 m), 22.VII.1992, leg. A. Olivier, in coll. VLCA.
6. *Hipparchia aristaeus* (Bonelli, 1826) ♀. Italy, Sardinia, Prov. Nuoro, Monti del Gennargentu, 4 km S. Fonni (1000 m), 25.VII.1992, leg. A. Olivier, in coll. VLCA.
7. *Hipparchia senthes* (Fruhstorfer, 1908) ♂. Greece, Eastern Aegean islands, Híos, Kambiá (150 m), 20.VI.1990, leg. A. Olivier, in coll. VLCA.
8. *Hipparchia senthes* (Fruhstorfer, 1908) ♀. Greece, Eastern Aegean islands, Ikaría, Oxéa (450 m), 8.VI.1990, leg. A. Olivier, in coll. VLCA.

b) Apex forewing distinctly pointed
H. (azorina) miguelensis (autapomorphy)

2. a) Outer margin forewing ≈ straight
All taxa of *Hipparchia* **s. str.** and *Parahipparchia* except *H. (azorina) miguelensis* and *H. sbordonii* pro parte
b) Outer margin forewing convex
H. (azorina) miguelensis and *H. sbordonii* pro parte

As we found no other character shared only by *miguelensis* and *sbordonii* and their placement in distinct groups within *Parahipparchia* is supported by several synapomorphies for each of them, character state 2b represents a case of parallelism and hence an autapomorphy of each one.

3. a) ♀ upperside forewing basal and discal area of the same ground-colour as remainder of wing
All taxa of *Hipparchia* **s. str.** and, within *Parahipparchia*, both the *H. aristaeus* and *H. semele* species groups
b) ♀ upperside forewing basal and discal area lighter brown-grey to creamy white
Superspecies *H. azorina* (synapomorphy)

This character could be of some use in the males as well : state a is occurring in the same groups as for the females, plus invariably in *H. (azorina) miguelensis* and usually in *H. (azorina) azorina* ; state b is occurring invariably in *H. (azorina) azorina occidentalis*, but only occasionally in *H. (azorina) azorina azorina*. If completed by the qualification “potentially” for the males, it could perhaps be considered as a synapomorphy of both last-mentioned taxa (or as an autapomorphy of *H. (azorina) azorina*).

4. a) Sex brand normally developed
All taxa of *Hipparchia* **s. str.** and, within *Parahipparchia*, both the *H. aristaeus* and *H. semele* species groups
b) Sex brand vestigial or absent
Superspecies *H. azorina* (synapomorphy)

5. a) Sex brand vestigial, but always at least traces of it
H. (azorina) miguelensis and *H. (azorina) azorina azorina*
b) Sex brand absent, although scattered androconial scales may be present
H. (azorina) azorina occidentalis (autapomorphy)

A sex brand is always well developed in *Hipparchia* **s. str.** and, within *Parahipparchia*, in both the *H. aristaeus* and *H. semele* species groups : it is always “complete” in its development, although it may be somewhat reduced in extent, as e. g. in *H. pellucida cypriensis*. This appears also to be the case in e. g. *H. hansii* (Austaut, 1879) (*Neohipparchia*) and *H. tewfiki* (Wiltshire, 1949) (*Pseudotergumia*). Only in superspecies *H. azorina* is there a progressive disappearance of the sex brand. Outside *Hipparchia* **s. l.** the sex brand can be either well developed or completely absent within the same genus, e. g. in *Satyrus*. Having noticed that, in both *H. maderensis* and *H. aristaeus*, the sex brand often extends well into s1a, we have looked for this condition in both *Hipparchia* **s. str.** and in *Parahipparchia* : in the former we found it in *H. alcyone* ([Denis & Schiffermüller], 1775), in the latter in *H. mersina*. Therefore, it would seem unwise to us to list it as a possible synapomorphy of *H. maderensis* + *H. aristaeus*.

6. a) Upperside hindwing submarginal area consisting of either a more or less complete series of orange-ochreous patches in s2–s5(6), interrupted by veins (*Parahipparchia* except *H. (azorina) azorina*, *H. hansii* (!), *Arethusana*, some *Oeneis*) or a continuous, uninterrupted band (*H. neomiris* (!), most *Pseudochazara*, some *Karanasa*)
   b) Upperside hindwing submarginal area unmarked, being part of the groundcolour
   H. (azorina) azorina, remainder of the Satyriti

This character is probably useless at a level higher than *Parahipparchia* and it appears even impossible to determine its polarity. Within *Parahipparchia*, however, character state 6b is restricted to *H. (azorina) azorina*, while, interestingly, *H. (azorina) miguelensis* has condition 6a, as does the remainder of *Parahipparchia*. Therefore, the loss of the submarginal markings in *H. (azorina) azorina* is likely to be secondary and hence an autapomorphy of this taxon (or a “synapomorphy” of both subspecies *azorina* and *occidentalis*).

At this point we would like to mention that García-Barros & Martín (1991) list one character (no. 51 in their study) as a possible synapomorphy of *Hipparchia* **s. l.**, i. e. “Hindwing underside with inner margin postdiscal band forming a notch at the level of veins M2–M3”. While this is clearly the case with *Parahipparchia* (and other subgenera of *Hipparchia*, as for instance in *Pseudotergumia*), its expression is far less convincing in several *Hipparchia* **s. str.** taxa, while it sometimes is quite apparent outside *Hipparchia* **s. l.**, e. g. in males of *Pseudochazara anthelea* (Hübner, [1824]). Therefore, we are sceptical about its usefulness as a synapomorphy of *Hipparchia* **s. l.**

ANDROCONIAL SCALES

7. a) Androconium neomorphic
When androconial scales are present, this is the condition in all Satyriti, except some *Karanasa* and all *Parahipparchia* but one (*H. mersina*)
   b) Androconium eomorphic/palaeomorphic
Parahipparchia except *H. mersina*, some *Karanasa*

While the usefulness of this character (= B1, condition in *H. mersina* listed there as "paleo[morphic]/neom.[orphic]") could be questioned at some higher level in the Satyriti, and certainly when other subtribes of the Satyrini sensu Harvey (1991) are also considered (vide supra, section 1.2), it appears informative at the level of *Parahipparchia.* Character state 7b is a synapomorphy of *Parahipparchia*, while the re-appearance of 7a in *H. mersina* is a reversal of character state and, being secondary, an autapomorphy of that species.

As can be seen from the present study, androconial scales can be of some use as diagnostic features of a few nominal taxa within *Parahipparchia*, but their value for phylogenetic purposes, at least as far as superspecies *H. azorina* and the *H. aristaeus* group are concerned, appears very limited. B2 (length), consisting of six states (the seventh being "absent"), includes three states that apply to taxa treated in the present study, i. e. "normal" (*miguelensis*, "*ballettoi*", "*blachieri*", *aristaeus* and *senthes*), "short" (*azorina*, *algirica*, *maderensis*) and "long" ("*caldeirense*" [sic! recte *occidentalis*]), while the state "absent" is attributed to *sbordonii* : in the latter case, "*caldeirense*" and *sbordonii* have been switched mistakenly. The other taxa seem more or less well placed in their respective categories, except *senthes* (with "*ballettoi*" and "*blachieri*"), which possesses scales that could, taking the marked individual variation into account, be ascribed to either of the two first categories. As our own analysis of this character for the whole subgenus has not been completed yet, we will not comment further on this issue here, but we do not expect too much from future results in this field. B3 (apex with or without terminal filament) is a duplicate of [part of] B1 and thus adds no useful information.

MALE GENITALIA

B4 (overall size). Five categories have been distinguished, for which we can agree only with the attribution of taxa to the category "smallest" (*azorina*, *miguelensis* and "*caldeirense*"). All *Hipparchia aristaeus* group taxa are brought under into the category "average", along with *sbordonii* and the outgroup taxon *H. fagi* (Scopoli, 1763) — both of which have, in fact — very large genitalia. *H. turcmenica*, which has genitalia very similar to those of *H. pellucida*, is mistakenly placed in a category "very small", while the latter taxon is placed in the category "largest" : in this species, the overall size of these structures can indeed be very large (Caucasus). Furthermore, overall size can vary considerably within a single species, e. g. *H. mersina* (Olivier & De Prins, 1989). Thus, this character does not seem very well suited for our purpose.

B5 (thickness). Three states are distinguished, i. e. "normal", "stout" and "slender". Of the taxa considered in the present study, *miguelensis*, *algirica*, *maderensis*, "*ballettoi*", "*blachieri*" and *aristaeus* are placed in the first category, while *azorina*, "*caldeirense*" and *senthes* are placed in the second category. Curiously, *H. senthes* as we now understand it, is placed in two distinct categories. However, as it is not clear what the authors exactly mean by "thickness", we have difficulties in understanding what could be the value of this "character".

B6 (uncus : length). Five categories have been distinguished. Of the taxa considered in the present study, *azorina* and "*caldeirense*" are placed in the fifth category (< tegumen), while *miguelensis*, *algirica*, *maderensis*, "*ballettoi*", "*blachieri*", *aristaeus* and *senthes* are brought into the fourth category (= tegumen). It is true that in *H. (azorina) azorina*, we found the uncus to be shorter than the tegumen in twelve out of fifteen specimens (one specimen from Flores and from São Jorge, however, had LUN/LT1 values of resp. 1.02 and 1.03). In *H. (azorina) miguelensis* and in the *H. aristaeus* group, the uncus is never shorter than the tegumen, with values between 1.05 and 1.20 (in *senthes* between 1.10 and 1.36). In *Hipparchia* **s. str.**, the uncus is always longer than the tegumen, though in *H. fagi* both structures can be of almost equal length. In that subgenus, values are found that overlap largely with those of the *H. aristaeus* group and *miguelensis*. Therefore, beside the fact that category D (uncus = tegumen) does not correspond exactly to reality, the condition in this group is plesiomorphic anyway. Category E (uncus < tegumen) is not found in every *azorina* specimen and therefore we do not consider it to be a useful apomorphy. Furthermore, the uncus is invariably shorter than the tegumen in *Neohipparchia*, *Euhipparchia* and *Pseudotergumia*, making the potential value of this character state even more questionable. In the *H. semele* group, the uncus tends to become much longer than the tegumen, but there can be considerable intraspecific (geographic) variation in this feature : in *H. mersina*, for instance, LUN/LT1 can vary from 1.28 (Greece : Lésvos) to 2.10 (Turkey : Prov. Adana) (Olivier & De Prins, 1989) and in *H. semele* such tendencies exist as well, though not to such an extent (Olivier & Coutsis, unpublished data). There is also overlap in values with *Hipparchia* **s. str.**, although these tend to be very high in some *H. semele* group taxa, like *leighebi*, *sbordonii*, *cretica* and *christenseni*. For these reasons we do not consider this character to be reliable for phylogenetic analysis.

B7 (uncus : shape) and B8 (uncus : apex). For both these characters, Balletto *et al.* (1990) considered four states. We found it impossible to quantify these characters into the discrete categories distinguished by these authors, because of the considerable degree of variation within some species (e. g. *H. mersina*, cf. Olivier & De Prins, 1989). Furthermore, in the *H. aristaeus* group, for instance, the uncus is not thicker than, say, in *H. semele* or *H.* "*malickyi*" (the latter is a junior subjective synonym of *H. mersina*, cf. Olivier & De Prins, 1989) : this impression of thickness may just be due to the fact that these taxa have a shorter uncus. We will not consider these characters further in our analysis.

B9 (brachia [length]). Again, four states were listed. According to Balletto *et al.* (1990), in "*caldeirense*", the brachia [termed gnathos throughout the present study] is more or less equal in length to the uncus. The three males from Flores that we examined do not appear to show the proposed character state. *H. mersina* and *H.* "*malickyi*" are placed in a category "brachia ⩽ uncus", a result quite different from that of Olivier & De Prins (1989). The gnathos tends to be comparatively shorter than the uncus in *H. algirica* and *H. aristaeus*, but not so much as to justify a discrete category, and *H. senthes* is certainly not well placed in it. In general, the length of the gnathos is, like that of the uncus, subject to allometric growth. We therefore reject it as a reliable character for phylogenetic analysis.

B10 and B11 (brachia [shape]). The longer the gnathos, the more curved it is. Therefore, the distinctions proposed by Balletto *et al.* (1990) are an artefact. The relative thickness of the gnathos is correlated to that of the uncus. We therefore do not consider these characters reliable for similar reasons as we do with B6, B7 and B9.

B12 (phallus [shape]). The aedeagus tends to be more or less straight in superspecies *H. azorina*, while it appears more curved in the remainder of *Parahipparchia*. We have been unable to confirm Balletto *et al.*'s (1990) finding that the straight condition also appears to be diagnostic for *volgensis*, "*delattini*", *christenseni* and *cypriensis*, at least on a constant basis. In *Hipparchia* **s. str.** (and, we must say, in *Parahipparchia* as well), we found both conditions to exist, while it is sometimes impossible to ascribe unambiguously an observed case to one of both character states. Therefore, this character seems unlikely to be of any use for phylogenetic work with this group.

B13 (phallus [length]). Not surprisingly, the penis is, in absolute length, smaller in superspecies *H. azorina* than in the remainder of *Parahipparchia* (see also B4). In all the taxa revised in the present study, the penis is invariably longer than uncus + tegumen. According to Balletto *et al.* (1990), however, it should be shorter in *H. aristaeus* and *H. senthes*, and more or less equal in "*ballettoi*". We have not investigated this situation thoroughly in each single *Parahipparchia* taxon, but in *H. mersina* the penis is indeed shorter than uncus + tegumen, with only one single specimen being the exception (Olivier & De Prins, 1989). This suggests that the penis could be less subjected to allometric growth than is the case with the uncus and the gnathos. In Italian *H. semele*, *H. leighebi* and *H. sbordonii*, the penis appears to be either slightly shorter or slightly longer than uncus + tegumen. In *Hipparchia* **s. str.**, the penis always seems to be longer than uncus + tegumen. In view of these data, the validity of this character for phylogenetic analysis appears quite questionable : in any case, its state in both superspecies *H. azorina* and in the *H. aristaeus* group would appear plesiomorphic.

B14 (phallobase). Balletto *et al.* (1990) recognize two categories : A (broad) and B (narrow) : the whole *H. semele* group except *H. christenseni* is placed in the first group ; last-named species, superspecies *H. azorina* and the *H. aristaeus* group, as well as *H. fagi*, are placed in the second group. We have been unable to confirm any such distinction in the phallobase among *Parahipparchia* taxa and, consequently, we cannot view this as a reliable character for phylogenetic analysis.

8. a) Aedeagus without any spines
   All *Hipparchia* **s. str.** taxa and, within *Parahipparchia*, both the *H. aristaeus* and *H. semele* species groups
   b) Aedeagus dorsally with small spines in its distal half
   Superspecies *H. azorina* (synapomorphy)

It must be said that, in the Satyriti, small spines on the aedeagus have been found as well in *Berberia* (Le Cerf, 1914) and *Satyrus* (Nekrutenko, 1985, 1990). As, however, in *Hipparchia* **s. l.** these are present only in superspecies *H. azorina*, they certainly represent an informative and useful character at this level.

9. a) Valve with well developed dorsal process
   Hipparchia **s. l.**, except taxa listed under b)
   b) Valve with dorsal process reduced or (nearly) absent
   H. turcmenica, *H. christenseni*, *H. pellucida*, most *H. volgensis* (synapomorphy)

H. volgensis is quite variable in this respect : some populations (e. g. Óros Helmós) have a well developed dorsal process, as is invariably the case in this (sub-)genus, except for the taxa listed under b), while other populations have a reduced dorsal process, approaching the condition in *turcmenica* and *pellucida.* Balletto *et al.* (1990) consider three categories, whereby the "upper process" is considered to be rudimentary in "*hesselbarthi*" and absent in *pellucida* and *cypriensis* : they do not, however, emphasize the reduction of the dorsal process in *volgensis* (with "*muelleri*" and "*delattini*") and in *christenseni.*

FEMALE GENITALIA

B16 (signa [shape]). Two states are recognized : straight (*H. fagi*, all *Parahipparchia* taxa except *H. leighebi*) and curved (*H. leighebi*). We have not been able to confirm this distinction.

B17 (signa [size]). Five categories have been distinguished, with which we can agree only to a limited extent. Category E (very long) includes "*ballettoi*" and "*blachieri*" and indeed we found the longest signa in *H. senthes* material from Sicily and S. Italy. Category D (very short) includes *azorina* (and "*caldeirense*") : here we would certainly add *miguelensis* and *mersina.* The remainder of the *H. semele* group we would place in category A (average) rather than B (short), while the *H. aristaeus* group is well placed in category C (long). It seems impossible, however, to interpret these data phylogenetically, except for one category (i. e., D : very short ; see below), as values corresponding to those encountered in the majority of taxa in both *H. aristaeus* and *H. semele* groups have also been found in *Hipparchia* **s. str.** (Coutsis, 1984 ; Coutsis & Olivier, unpublished data).

10. a) Average signum length > 1.50 mm
    Hipparchia **s. str.**, *Parahipparchia* except superspecies *H. azorina*
    b) Average signum length < 1.50 mm
    Superspecies *H. azorina* (synapomorphy)

In superspecies *H. azorina*, the signum is distinctly shorter on average than in any other taxon of both *Hipparchia* **s. str.** and *Parahipparchia*, but there is little overlap in absolute length with some *H. mersina* specimens (cf. Olivier & De Prins, 1989). As there is no further evidence for a possible sister group relationship between superspecies *H. azorina* and *H. mersina*, it may be assumed that character state 10b is a synapomorphy of superspecies *H. azorina*, while the condition in *H. mersina* (n = 59, average = 1.57, calculated after Olivier & De Prins, 1989 : 214–215, table 7) could be regarded as an autapomorphy of that species.

B18 (corpus bursae [size]). We investigated this character in all taxa revised in the present study, as well as in several *H. semele* group and *Hipparchia* **s. str.** taxa. Balletto *et al.* (1990) distinguished five classes : we agree with their attribution of superspecies *H. azorina* to the category "very small" and of *H. mersina* to the category "small", while *fagi*, *algirica*, *maderensis*, *aristaeus* and *senthes* are well placed in the class "large" and "*blachieri*" (i. e. Sicilian *senthes*) indeed has the largest corpus bursae in *Parahipparchia*. We did, however, find similar values as for the *H. aristaeus* group in *H. sbordonii* and, partly, *H. leighebi* and *H. semele* from Calabria and Sicily. Furthermore, we do not agree with the attribution of "*ballettoi*" to the category "normal" and that of "*malickyi*" to the category "large". Because of overlap with *Hipparchia* **s. str.** in both the *H. aristaeus* and *H. semele* groups, we cannot support the postulated value of this character for phylogenetic work, at least the way it is presented by these authors. It is, however, possible to consider the following character for our purpose.

11. a) Average length of corpus bursae $>$ 2.50 mm
    Hipparchia **s. str.**, *H. aristaeus* and *H. semele* groups
    b) Average length of corpus bursae $<$ 2.50 mm
    Superspecies *H. azorina* (synapomorphy)

Single specimens of *H. mersina* may have a corpus bursae as small as that of *miguelensis*, but on average it remains distinctly larger in the former species.

B19 (corpus bursae [distal end : sic! recte cervix bursae]). Three categories have been distinguished, viz. "little sclerotized", "sclerotized" and "very sclerotized" . It is true that superspecies *azorina*, as well as *semele*, *leighebi* and *sbordonii*, has a little sclerotized cervix bursae, as is the case with *Hipparchia* **s. str.** (Coutsis, 1984 ; Coutsis & Olivier, unpublished data). The sclerotization is, as a rule, more pronounced in the *H. aristaeus* group (including "*ballettoi*"!) and in *H. cretica* (Coutsis, 1984 ; this study), and even more in *mersina*, *volgensis*, *christenseni*, *turcmenica* and *pellucida* (Coutsis, 1984 ; Olivier & De Prins, 1989). This could be interpreted as a synapomorphy of the *H. aristaeus* group and last-named six taxa of the *H. semele* group. As this contradicts the monophyly of the *H. semele* group that is well supported by other characters, we believe that this condition (more heavily sclerotized cervix bursae) is homoplasous. Assuming that this condition originated at least twice, and excluding the *H. semele* group taxa, one would be inclined to list it as a synapomorphy of the *H. aristaeus* group. Considering the presumably homoplasous nature of the character and, not least, the degree of intraspecific (individual) variation in its expression, we seriously doubt its potential value as a reliable character for the present purpose. We found, however, another character state that we consider useful for phylogenetic work.

12. a) Cervix bursae relatively narrow and flat, little to moderately sclerotized
    Hipparchia **s. str.**, superspecies *H. azorina*, *H. aristaeus* group, *H. semele*, *H. leighebi*, *H. sbordonii*, *H. cretica*
    b) Cervix bursae distinctly broader, often cup-shaped and moderately to heavily sclerotized
    H. mersina, *H. turcmenica*, *H. volgensis*, *H. christenseni*, *H. pellucida* (synapomorphy)

This character is useless for our analysis of both superspecies *H. azorina* and the *H. aristaeus* group, but it appears informative for part of the *H. semele* group. Coutsis (1984) studied only two females of *H. mersina* : the condition reported in that study is quite atypical for that species (cf. Olivier & De Prins, 1989).

B20 (ductus bursae [degree of sclerotization]). Balletto *et al.* (1990) report it as “sclerotized” in *H. algirica*, *H. maderensis*, *H. “blachieri”*, *H. aristaeus* and *H. senthes*, and as “little sclerotized” in all other *Parahipparchia* taxa (including *H. “ballettoi”* !) as well as in *H. fagi*. We found the ductus bursae to be indeed more sclerotized in the *H. aristaeus* group in general, but there is quite some variation in the degree of sclerotization. *H. senthes* from S. Italy does not appear to differ markedly from the other taxa of this group in this respect. It would be tempting to consider this character state as a synapomorphy of the *H. aristaeus* group, but this appears not to be the case. Some specimens of *H. senthes*, for instance, show hardly any difference in this respect from some *H. semele* specimens. The degree of sclerotization in *H. mersina* appears to vary substantially individually : in most specimens the ductus bursae is membranous or weakly sclerotized, but in some specimens it is well sclerotized, much as in the *H. aristaeus* group taxa (cf. Olivier & De Prins, 1989). Exceptionally, such may even be the case with *H. volgensis* from Greece (Olivier & De Prins, unpublished data). We are therefore compelled to discard the present character as well.

13. a) Bend of ductus bursae prominent and well separated from cervix bursae
    Hipparchia **s. str.**, superspecies *H. azorina*, *H. aristaeus* group, *H. semele*, *H. sbordonii*, *H. leighebi*
    b) Bend of ductus bursae less prominent to imperceptible, highly compressed against cervix bursae
    H. cretica, *H. mersina*, *H. volgensis*, *H. turcmenica*, *H. christenseni*, *H. pellucida* (synapomorphy)

Balletto *et al.* (1990) recognize three character states, viz. "prominent", "compressed" and "very compressed" and Coutsis (1984) makes a similar distinction. Their first category corresponds exactly to our character state 13a and includes the same taxa as in our study (with some additional ones, that we consider synonymous). Their second category includes *H. mersina*, though, as we have already said while discussing character 12, the specimens dealt with by Coutsis (1984) appear atypical : in most specimens of that species, the bend of ductus bursae is highly compressed against the cervix bursae, much as in *volgensis*, *turcmenica*, *christenseni* and *pellucida*. We would rather place it in their third category, leaving only *cretica* in the second one. As already stated, we code each character as binary, hence *cretica* is also listed under 13b. Again we have here a useless character for superspecies *H. azorina* and the *H. aristaeus* group but, interestingly, the same group — plus *H. cretica* — comes out again as a monophyletic unit.

B22 (bend [of ductus bursae] : prox.[imal] end). Balletto *et al.* (1990) consider four categories : "normal", "wider", "narrower" and "inflated". According to them, "*malickyi*" and *mersina* belong to resp. the first and the third category, *turcmenica* is also placed in the third category, while *cretica* is the only taxon in the category "wider". The fourth category comprises *H. fagi*, *H. volgensis* (with "*muelleri*" and "*delattini*") and *H. pellucida*, while *christenseni* surprisingly is put into the first category. All this does not agree with our own observations ; the more, as a matter of fact, the width of the proximal end of the bend of the ductus bursae varies a lot individually and depends entirely on the width of the cervix bursae. For these reasons this character appears not to be adequately defined nor worthy of further consideration.

B23 (ductus bursae [shape]). According to Balletto *et al.* (1990), it is "thin" in all *Parahipparchia* taxa, except *H. pellucida* (with *cypriensis*) that, together with *H. fagi*, has a "thick" one. It is true that it is wider in *H. pellucida* than in any other taxon in both *Parahipparchia* and *Hipparchia* **s. str.** (including *H. fagi*, that does not differ from the other *Parahipparchia* taxa in this respect). This character appears in fact to be correlated with character 12 (and, consequently, a duplicate of it). At best, one could consider the state in *H. pellucida* as an autapomorphy of that single taxon, and hence of no use for a reconstruction of the phylogeny of *Parahipparchia*.

B24 (ductus [bursae] : length). There is a rather important variation in the length of the ductus bursae, both interspecifically and intraspecifically ; in *Hipparchia* **s. str.**, this structure appears to be very long in *H. fagi* and *H. syriaca* (Staudinger, 1871), but much shorter in, for instance, *H. alcyone* ([Denis & Schiffermüller], 1775) (Coutsis, 1984), while in *Parahipparchia* it is proportionally shorter in *H. pellucida* and hence could perhaps be regarded as an autapomorphy of that species. It is also short in *azorina* (and "*caldeirense*"), as pointed out by Balletto *et al.* (1990), but this is logical considering the small size of the corpus bursae in this taxon (vide supra, character 11) : nevertheless, its length in superspecies *H. azorina* sometimes overlaps with that of *H. maderensis*, *H. algirica* and *H. aristaeus* (in *H. senthes*, the ductus bursae tends to be longer than in the three last-named species). It thus appears that this character is not informative for our purpose.

B25 (sterigma [overall size]). Five categories have been distinguished, which seems very arbitrary to us, the more as there is a relatively important range of variation within each taxon in this respect. It is true that superspecies *H. azorina*, as well as the *H. aristaeus* group, tend to have a smaller sterigma than the *H. semele* group taxa on average, but there is a rather broad range of overlap. As far as we have been able to ascertain, values in *leighebi*, *sbordonii* and *cretica* do always exceed those in both forementioned complexes. In *H. mersina*, Olivier & De Prins (1989) found WST values between 1.97 and 2.78, its lower values covering part of the range of variation of both superspecies *H. azorina* and the *H. aristaeus* group. Interestingly, the taxa within superspecies *H. azorina* do **not** appear to have a smaller sterigma than the *H. aristaeus* group taxa. Within last group, *H. senthes* tends to have a larger sterigma than the other taxa, the highest scores occurring in some Calabrian (La Sila) specimens. In *Hipparchia* **s. str.**, *H. fagi* indeed has an exceedingly large sterigma, but in other species like *H. ellena* (Oberthür, 1894) and, especially, *H. neomiris* (Godart, 1822), size is comparable to that in *Parahipparchia* (Coutsis, 1984 ; Coutsis & Olivier, unpublished data). Consequently, this character does not seem very well suited for our purpose, at least as far as WST is concerned (but see below, characters 14 and 15).

14. a) Average length of dorso-lateral lobe (LDL) > 1.00 mm
Hipparchia **s. str.**, *H. aristaeus* group, *H. semele* group
b) Average length of dorso-lateral lobe (LDL) < 1.00 mm
Superspecies *H. azorina* (synapomorphy)

The dorso-lateral lobe appears to be larger in *H. fagi* than in any other taxon within both *Hipparchia* **s. str.** and *Parahipparchia*. In some *Hipparchia* **s. str.** species, however, this structure does not exceed that of some *Parahipparchia* taxa in length (e. g. *H. autonoe* (Esper, [1784]) and *H. neomiris*, cf. Coutsis, 1984 ; Coutsis & Olivier, unpublished data). It tends to be distinctly smaller in *H. maderensis* and *H. algirica*, but there is overlap with other *Parahipparchia* taxa. In superspecies *H. azorina*, however, it is on average constantly inferior in size and length.

15. a) Average length of dorsal lamella (LL) $\leq$ 0.7 mm
Hipparchia **s. str.**, superspecies *H. azorina*, *H. aristaeus* group
b) Average length of dorsal lamella (LL) > 0.7 mm
Hipparchia semele group (synapomorphy)

In *Hipparchia* **s. str.** the dorsal lamella is very small, both in absolute size and in proportion to the entire sterigma. In superspecies *H. azorina*, it is even smaller in absolute size ; in this taxon, this condition is entirely correlated to the very small size of the dorso-lateral lobe and therefore we prefer not to consider it as an additional synapomorphy of this superspecies, as it would do nothing more than to duplicate character 14. The dorsal lamella becomes distinctly larger in the *H. semele* group taxa, but there is a slight amount of overlap in absolute length between the *H. aristaeus* group taxa and, for instance, *H. mersina* (cf. Olivier & De Prins, 1989) ; the average length of this structure, however, is always superior in the *H. semele* group taxa when compared to the remainder of *Parahipparchia* and to *Hipparchia* **s. str.**

B26 (mid-dorsal process). Balletto *et al.* (1990) qualify this structure as either "elongate flat" (*H. semele* group), "intermediate" (superspecies *H. azorina* and *H. aristaeus* group), "short flat" (none !) and "short grooved" (*H. fagi*). We found two basic types, viz. either broad at base, short and triangular to rounded, or narrow at base, longer and pointed distally : the former condition predominates in superspecies *H. azorina* and in the *H. aristaeus* group and is also found in some *Hipparchia* **s. str.** taxa like *H. syriaca* and *H. ellena* (Coutsis, 1984), the latter one is the rule in the *H. semele* group. The situation, however, is not that simple and the two types appear to be linked by intermediate stages in several taxa. In *H. senthes* from La Sila, for instance, the mid-dorsal process remains broad at its base, but is moderately long and distinctly pointed distally. In several specimens of *H. semele* (Sicily, S. Italy), *H. leighebi* and *H. sbordonii*, the mid-dorsal process is narrow at its base and pointed distally, but rather short. Finally, Olivier & De Prins (1989) encountered both types in *H. mersina*, although the latter type predominates largely. For these reasons, we cannot retain this character for a phylogenetic analysis of *Parahipparchia*.

SPHRAGIS

16(B27) a) Sphragis absent
All Satyriti except the *H. semele* group
b) Sphragis present
Hipparchia semele group (synapomorphy), but unknown in *H. turcmenica*

The distribution of the sphragis within *Parahipparchia* has already been discussed in detail in section 1.3. The sphragis is indeed constantly large ("carenate") in *cretica*, *christenseni* and *pellucida* (with *cypriensis*), as noticed by Balletto *et al.* (1990), but we found its development to be quite comparable in *semele* from Sicily and Monte Pollino (S. Italy, Calabria/Basilicata), as well as in *leighebi* and *sbordonii*. This is also the case with *H. mersina* from the Taurus chain in Turkey (Olivier & De Prins, 1989). The absence of the sphragis in *H. turcmenica* is probably due to secondary loss (or simply because of lack of material), but that problem is beyond the scope of the present study.

As a result of our analysis, only three out of Balletto *et al.*'s (1990) 27 characters, when slightly modified and/or formulated differently, were retained as useful for constructing a cladogram of *Parahipparchia*, i. e. B15 [= 9], B21 [= 13] and B27 [= 16]. Nevertheless, our preliminary results agree with those presented by these authors (on p. 185, fig. 3) in the following respects :

- *azorina*, "*caldeirensis*" [*occidentalis*] and *miguelensis* form a monophyletic unit (our characters 3, 4, 8, 10, 11 and 14)
- the *H. semele* group also comes out as a monophyletic unit (our characters 15 and 16)
- *H. volgensis*, *H. turcmenica*, *H. christenseni* and *H. pellucida* constitute a monophyletic subunit within the *H. semele* group (our character 9).
- the same subgroup plus *H. mersina* and *H. cretica* makes up a larger monophyletic subunit within the *H. semele* group (our character 13).

Altogether, we found 16 characters of potential use for our purpose, including six wing characters, one relating to the androconial scales, two to the male genitalia, six to the female genitalia and one to the presence vs. absence of a sphragis in mated females. Out of these characters, only 13 are synapomorphic, while the remaining three are autapomorphies : hence only 12 adult characters appear valuable for a measure of the relative degree of relationship between taxa within *Parahipparchia*, as character 7 is a synapomorphy of the whole subgenus. We expect that, perhaps with the aid of more refined, statistical procedures, some other characters including part of those advanced by Balletto *et al.* (1990), be it in a slightly different formulation, will perhaps become available and useful. In the next section, we discuss the consequences of the results obtained from our character analysis.

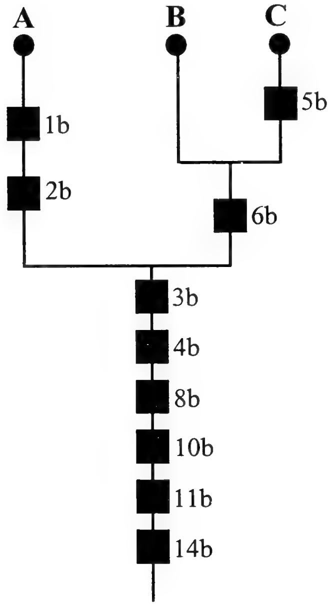

Fig. 32. Cladogram of superspecies *Hipparchia azorina*. A. *H. (azorina) miguelensis* (Le Cerf, 1935) ; B. *H. (azorina) azorina azorina* (Strecker, 1899) ; C. *H. (azorina) azorina occidentalis* Bivar de Sousa, 1982. Numbers correspond to apomorphies discussed in section 7.

8. Discussion

8.1. Superspecies *Hipparchia azorina*

The current debate among historical biogeographers whether the present-day distribution patterns of organisms are the result of either vicariance or dispersal, is far from settled (Myers & Giller, 1988). As is often the case with such polemics, time will probably show increasingly that these apparently conflicting views are complementary rather than antagonistic. In the case of the North Macaronesian islands (Azores, Madeira), it seems beyond doubt now that they are of oceanic origin (Mitchell-Thomé, 1982) ; hence, the current *Hipparchia* species observed there can only have arrived through long-distance dispersal.

The monophyly of superspecies *H. azorina* is well supported (text fig. 32 ; see also section 7), thus strongly suggesting that the current Azorean populations result from one single colonization event. The ancestor of this superspecies acquired its present synapomorphies either in its source area or, what seems more likely, they developed *in situ.* The common use of one single larval host-plant, if that grass species proves endemic to the Azorean archipelago (we have no data at hand), would lend further support to the latter possibility (it could then be listed as an additional synapomorphy of superspecies *H. azorina*). Which single island was colonized first is a matter of conjecture, but the cladogram on text fig. 32 suggests that *miguelensis* split off first, as it lacks character state 6b that is shared by both *azorina* and *occidentalis* (see also discussion of character 3 !) : it developed some distinct features of its own (characters 1b and 2b). An initial arrival on the Azores by way of the eastern island group thus seems quite plausible, whereby the present-day absence of any *Hipparchia* on Santa Maria in no way excludes the possibility of its past colonization by the ancestor of superspecies *H. azorina.* Subsequently, the central and western groups were reached from the east, probably first Pico and Faial, whose populations still retain the plesiomorphic character state 5a. Later on, the remainder of the archipelago was reached : the precise sequence of colonization of each island is impossible to reconstruct at present, but there is some evidence that the islands of São Jorge and Terceira — geographically the nearest — were reached first (in São Jorge material, there are sometimes still traces of a sex brand) and that the western group (Flores and Corvo) was the latest to be invaded. The common possession of character state 5b (and the invariably distinct light colouring of the basal and discal area of upperside forewing in the males) in *occidentalis* was probably acquired first by one single island population of this subspecies, after which it spread to the other islands in a quite recent past. Alternatively, these features were each acquired independently by each single island population of this taxon, a scenario that is less parsimonious and hence more unlikely. The sequence of colonization just outlined correlates rather well with the comparative geomorphological age of the different islands and island groups (Mitchell-Thomé, 1982 ; Forjaz *in* Vieira & Pintureau, 1991). According to these authors, São Miguel is about 3.5 to 4.5 million years old while Flores has less than 0.6 million years (no data for Corvo). According to Forjaz *in* Vieira & Pintureau (1991), the central group originated between 2.6 (Faial) and 0.6 (Graciosa) million years ago, with about 2.0 million years for São Jorge and Terceira and 1.1 million years for Pico. It would be most rewarding to test this possibility by an independent method and molecular data (e. g. allozymes) seem to offer promising perspectives (cf. Cesaroni *et al.*, 1994). At present, however, we have no further clues at hand : in order to improve our insights into the evolutionary history of superspecies *H. azorina*, we should know which is its sister group or species. Kudrna (1977), Bivar de Sousa (1982a, 1985a) and Balletto *et al.* (1990) have suggested that it is probably one of the phylogenetically oldest taxa of the genus, though they do not present any hard evidence in support of their view. Several authors have suggested a close affinity to the *H. aristaeus* group (Kudrna, 1977 ; Balletto *et al.*, 1990) or even to *H. maderensis* in particular (Rebel, 1940b ; Bernardi, 1961 ; Meyer, 1993), Bivar de Sousa (1982a) even stating that *miguelensis* is the oldest taxon, probably originating from Madeira from the ancestor of *H. maderensis*. An affinity with *H. maderensis* would seem likely at first sight because of the relative geographical proximity of São Miguel to Madeira and the superficial similarity of both *H. maderensis* and superspecies *H. azorina* (and especially *miguelensis*) in wing pattern (very dark upperside with reduced markings) : the latter feature, however, is most probably the result of a common response to the oceanic climate and hence no indication of close phylogenetic relationship. There is indeed no support at all for a sister group relationship between superspecies *H. azorina* and either the *H. aristaeus* group or one of its component species, the relative similarity of these taxa being due to the common possession of symplesiomorphic characters. What seems probable however, is that, within *Parahipparchia*, both superspecies *H. azorina* and the *H. aristaeus* group taxa split off before the common ancestor of the *H. semele* group. As a matter of fact, we cannot decide at present to which other *Parahipparchia* taxon superspecies *H. azorina* is most closely related, nor can we form any possible hypothesis concerning its likely source area.

8.2. The *Hipparchia aristaeus* group

As already stated (section 5), the *H. aristaeus* group could very well be a paraphyletic assemblage : a thorough search for synapomorphies in *Parahipparchia* (section 7) did not produce one single character that could be positively interpreted as a synapomorphy of this species group. The geographic distribution of each of its four composing nominal taxa suggests an ancient, relict pattern. The directional argument of vicariance, as used in the methodology of phylogenetic systematics, cannot be applied, as this presupposes the monophyly of the group in question. Whether we like it or not, in absence of any positive evidence for the monophyly of this group, it is senseless to discuss this problem further until more data become available.

8.3. Priorities for future study

While it is true that we could not find any evidence in favour of the monophyly of the *H. aristaeus* group, it is equally true that there is no evidence at all against it. We feel that the most promising areas for future research would be a thorough investigation of the comparative morphology of the early (and adult) stages of all *Parahipparchia* and *Hipparchia* **s. str.** taxa in order to find additional synapomorphies that would corroborate (or perhaps, contradict) our present results and provide solutions to some at present unresolved problems encountered with the phylogenetic reconstruction of *Parahipparchia* (i. e. ranking of superspecies *H. azorina*, ranking and phylogeny of the taxa currently placed in the *H. aristaeus* group, ranking and phylogeny of *H. semele* + *H. leighebi* + *H. sbordonii*, resolution of the phylogeny of the individual taxa within the complex *H. volgensis* + *H. turcmenica* + *H. christenseni* + *H. pellucida*) and, in parallel, a comprehensive study of molecular and allozyme data as an independent test of the phylogeny based on the morphological data set as well as a means of estimating the possible divergence time of the taxa under consideration (the study by Cesaroni *et al.*, 1994 is a first interesting endeavour in this field). We hope that the present study will have contributed to setting a framework for further study on these and related topics, and that it may be an impetus for it.

9. Acknowledgements

With great pleasure we would like to thank the following persons, whose help was much appreciated and, on more than one occasion, even proved invaluable : Mr. P. R. Ackery (Dept. of Entomology, Lepidoptera Section,

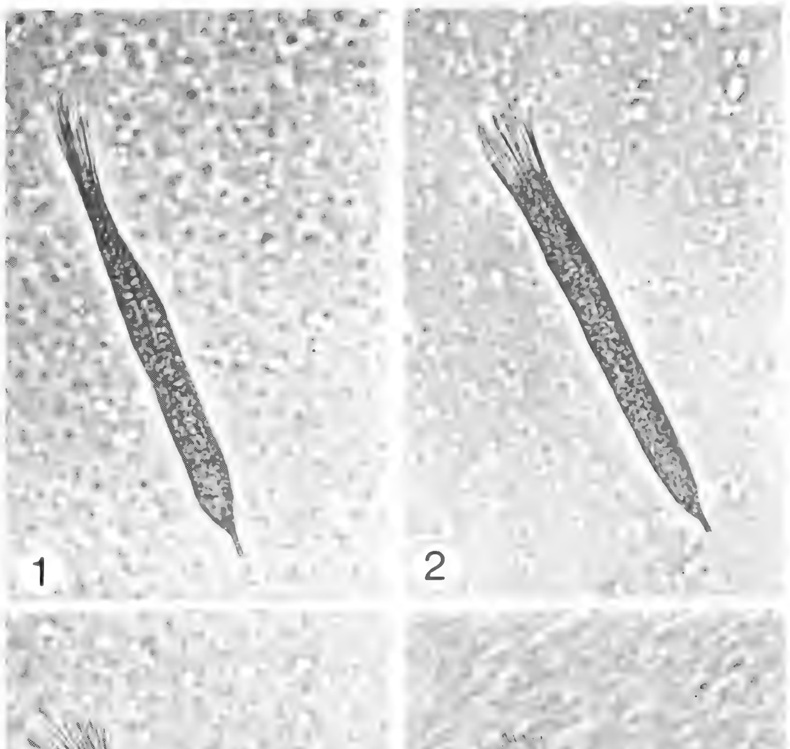

Plate 5. *Hipparchia (azorina) azorina azorina* (Strecker, 1899) : androconial scales.
1–2. Portugal, Azores, Pico, C. do Teicho (850–920 m), 17.VIII.1981, leg. J. Demange, in coll. VLCA.
3–4. Portugal, Azores, Faial, Caldeira/Cabeço Gordo (900 m), 12.VIII.1990, leg. M. Meyer, in coll. VLCA.

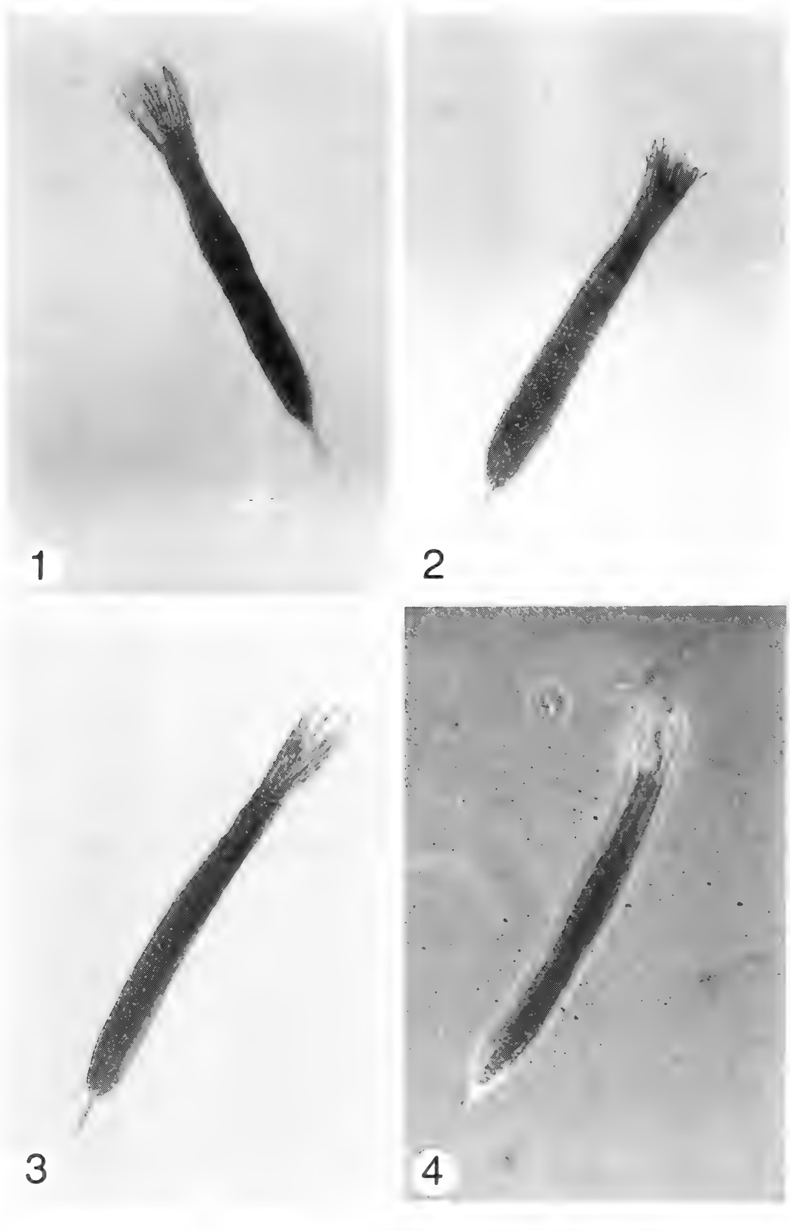

Plate 6. *Hipparchia (azorina) azorina occidentalis* Bivar de Sousa, 1982 : androconial scales.

1-2. Portugal, Azores, São Jorge, Serra do Topo, Pedra Vermelha (800 m), 17.VIII.1990, leg. M. Meyer, in coll. VLCA.

3. Portugal, Azores, Terceira, Serra de Santa Barbara (1000 m), 19.VIII.1990, leg. M. Meyer, in coll. VLCA.

4. Portugal, Azores, Terceira, Serra de Santa Barbara (1000 m), 17.VII.1994, leg. H. Henderickx, in coll. VLCA.

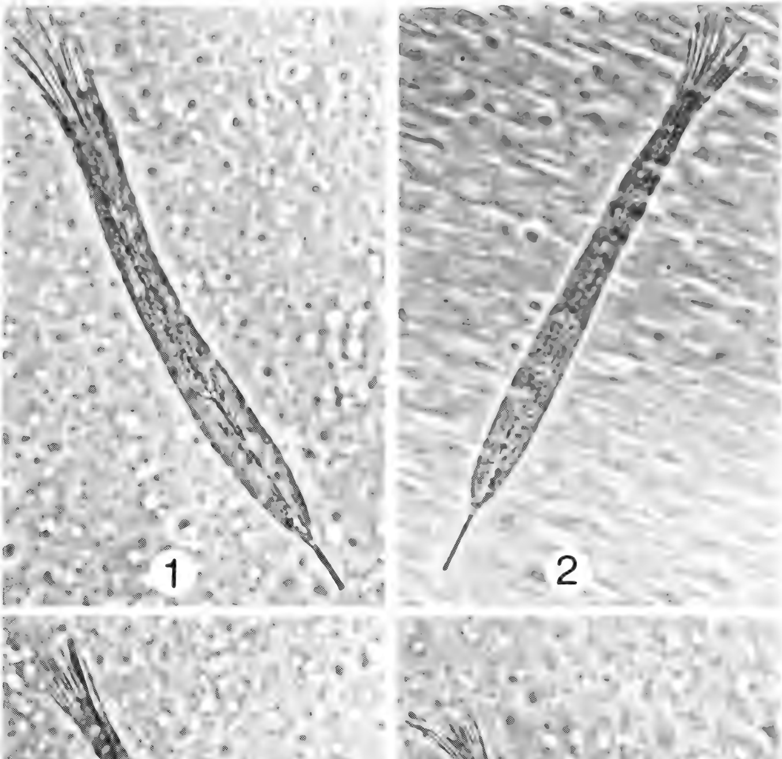

Plate 7. *Hipparchia (azorina) miguelensis* (Le Cerf, 1935) : androconial scales.
1–4. Portugal, Azores, São Miguel, Serra de Agua de Pau (900 m), 24.VII.1994, leg. H. Henderickx, in coll. VLCA.

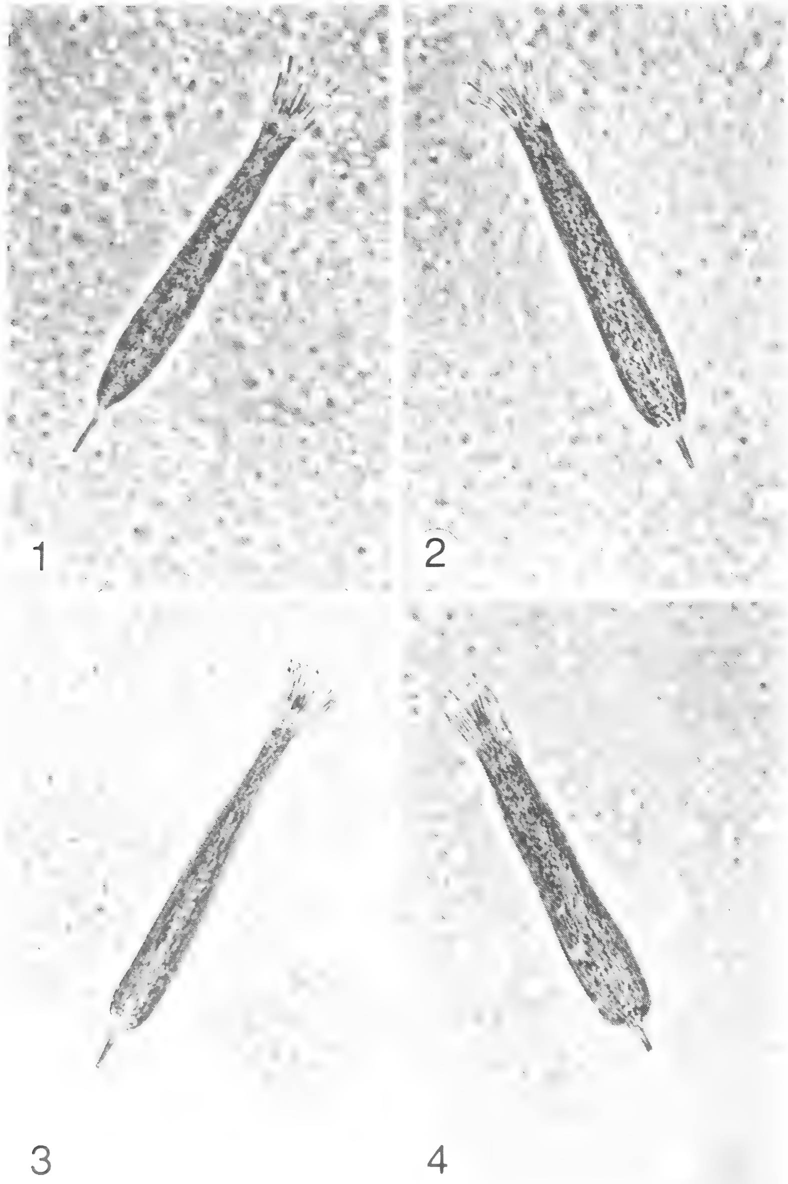

Plate 8. *Hipparchia maderensis* (Baker, 1891) : androconial scales.

1. Portugal, Madeira, 2 km SW. Poiso (1350 m), 29.VII.1993, leg. A. Olivier, in coll. VLCA.

2. as 1, but 25.VII.1993.

3. Portugal, Madeira, Eira do Serrado (1000–1050 m), 24.VII.1993, leg. A. Olivier, in coll. VLCA.

4. Portugal, Madeira, Curral das Freiras (600–700 m), 24.VII.1993, leg. A. Olivier, in coll. VLCA.

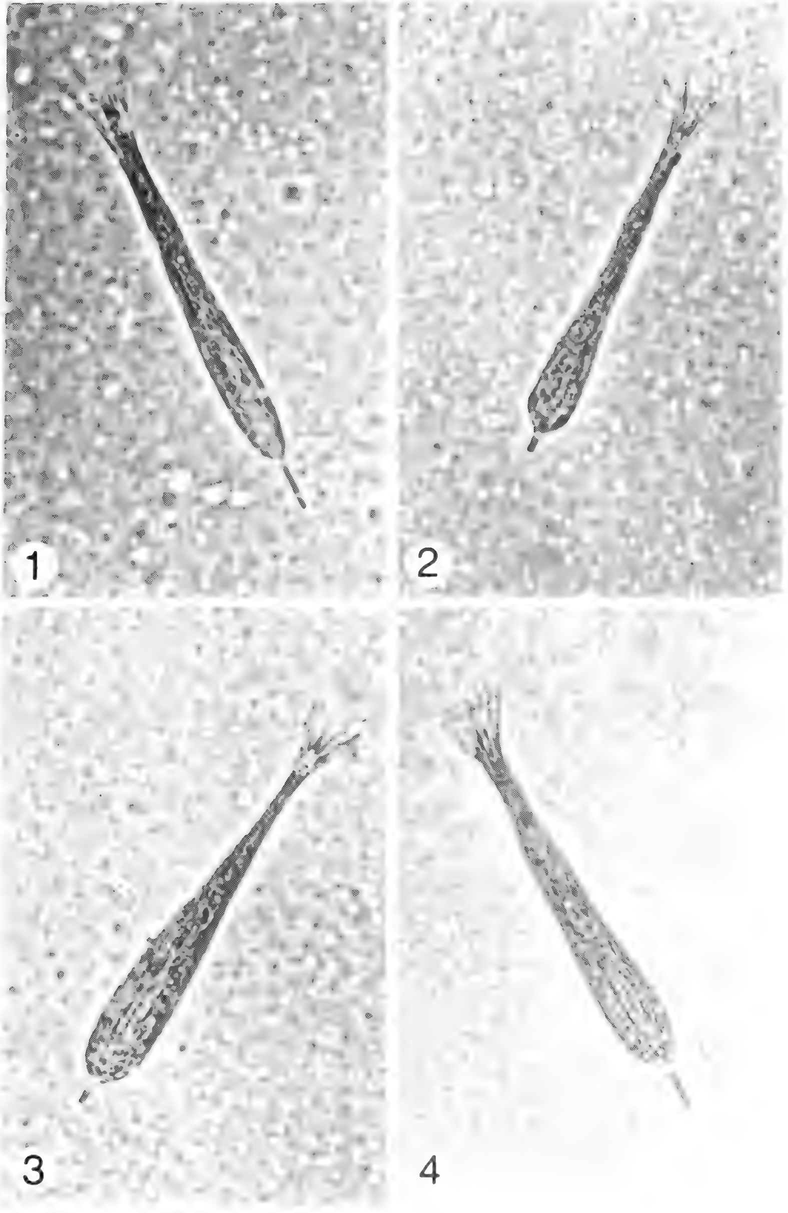

Plate 9. *Hipparchia algirica* (Oberthür, 1876) : androconial scales.
1. Morocco, Middle Atlas, Ifrane (1650 m), 24.VI.1994, leg. A. Olivier, in coll. VLCA.
2. Morocco, Middle Atlas, Tizi-n-Tretten (1950 m), 27.VI.1994, leg. A. Olivier, in coll. VLCA.
3. as 2, but 22.VI.1994.
4. Morocco, Middle Atlas, Ras-el-Ma–Cèdre Gouraud (1600–1700 m), 25.VI.1994, leg. A. Olivier, in coll. VLCA.

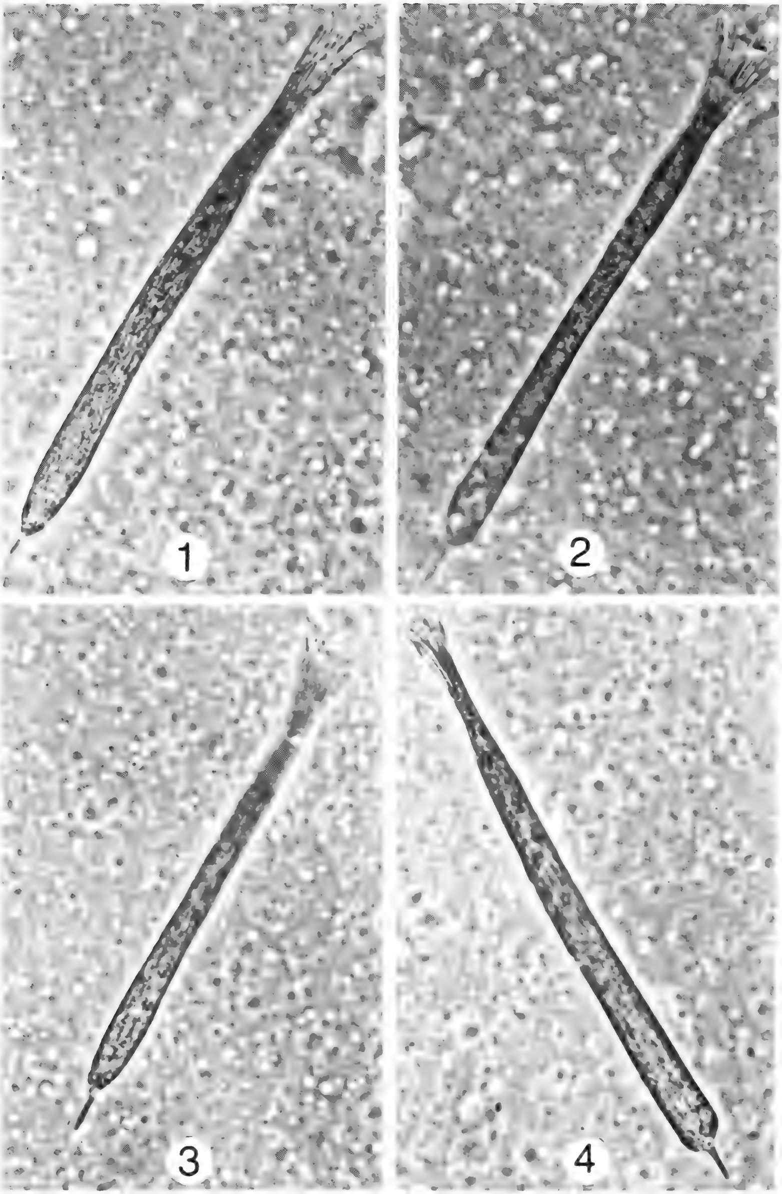

Plate 10. *Hipparchia aristaeus* (Bonelli, 1826) : androconial scales.
1. Italy, Sardinia, Prov. Nuoro, Monti del Gennargentu, 4 km S. Fonni (1000 m), 22.VII.1992, leg. A. Olivier, in coll. VLCA.
2. as 1, but 23.VII.1992.
3. France, Corsica, Haute-Corse, Calvi, 13/27.VII.1971, leg. Fam. van Oorschot & Fam. Coene, in coll. VLCA.
4. Italy, Elba, Mt. Le Calanche (approx. 800 m), 9.VII.1988, leg. C. Warnotte, in coll. VLCA.

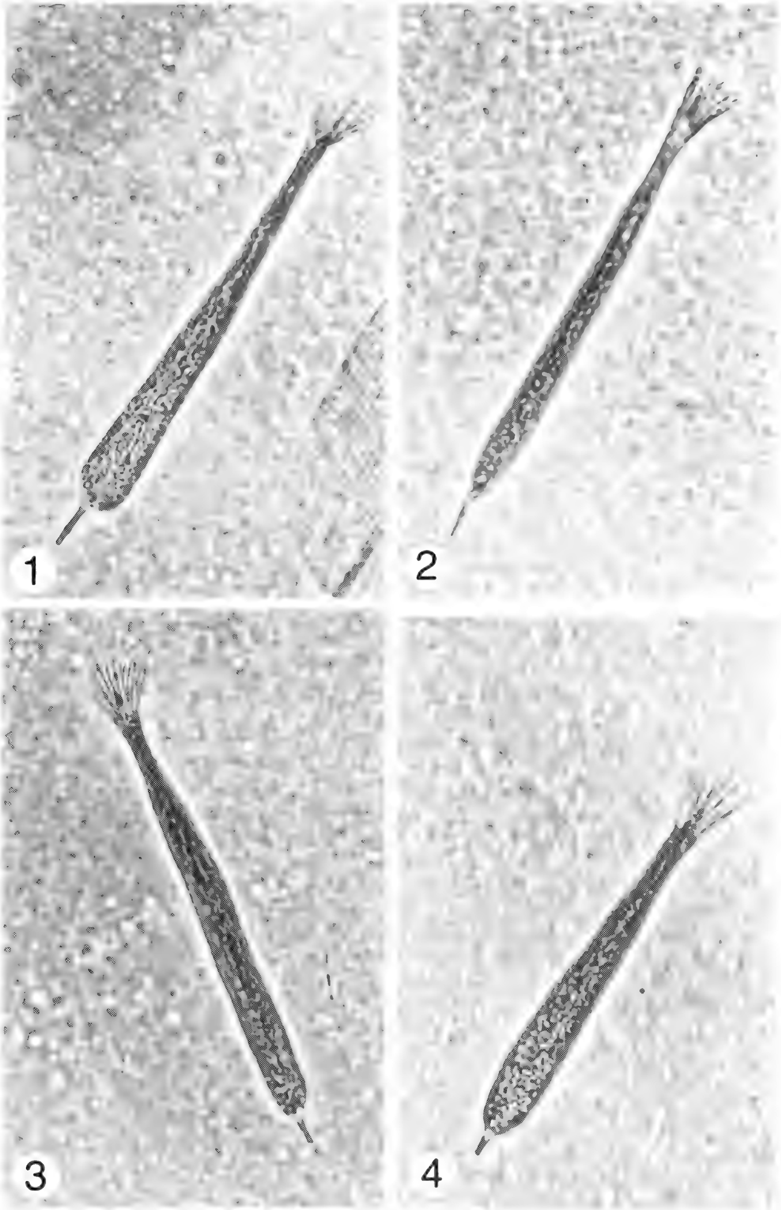

Plate 11. *Hipparchia senthes* (Fruhstorfer, 1908) : androconial scales.

1. Turkey, Prov. Adana, S. Tekir (900 m), 8/10.VIII.1984, leg. B. van Oorschot, in coll. VLCA.

2. Turkey, Prov. Konya, Sultandağları, Akşehir (1100 m), 13/20.VII.1981, leg. H. & Th. van Oorschot & H. van den Brink, in coll. VLCA.

3. Turkey, Prov. Muğla, 60 km NE. Fethiye (1050 m), 8.VII.1981, leg. H. & Th. van Oorschot & H. van den Brink, in coll. VLCA.

4. Turkey, Prov. Muğla, W. side Ak Dağ, Arsada (1000 m), 5.VII.1981, leg. H. & Th. van Oorschot & H. van den Brink, in coll. VLCA.

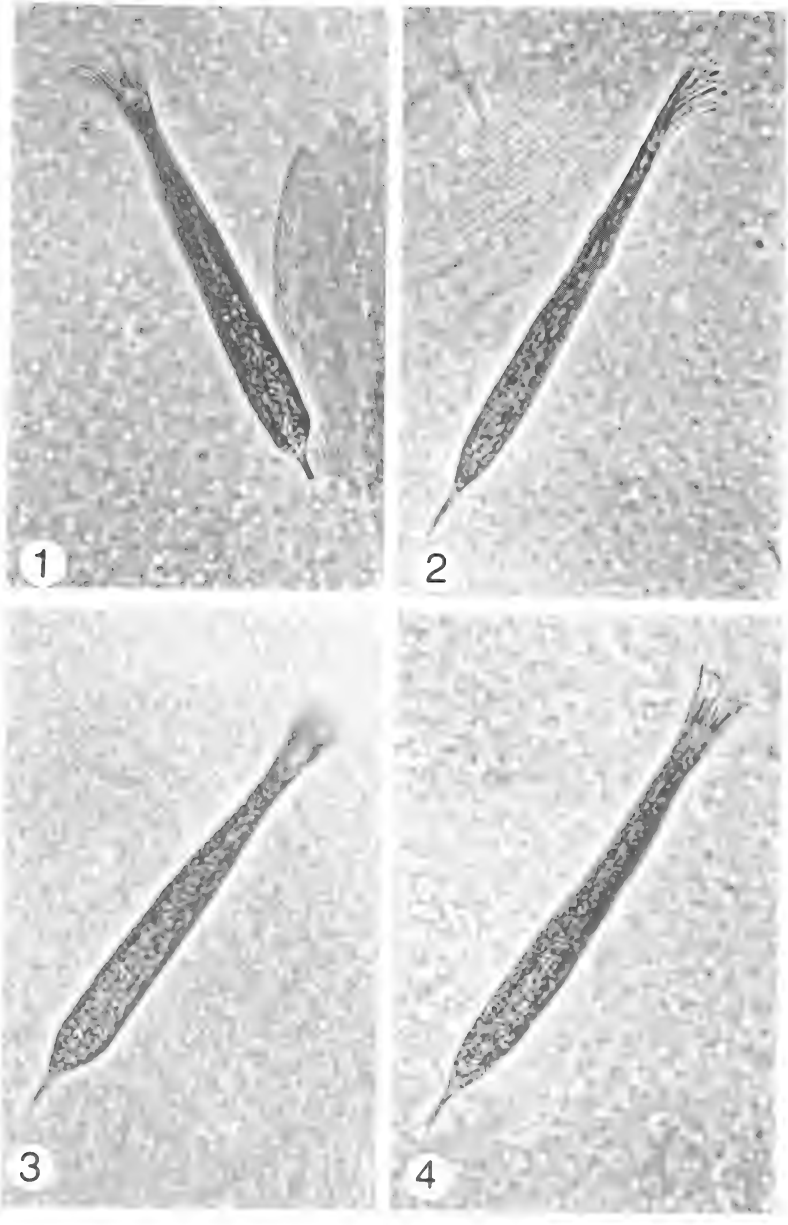

Plate 12. *Hipparchia senthes* (Fruhstorfer, 1908) : androconial scales.

1. Greece, Eastern Aegean islands, Kós, Óros Dikeos (750–846 m), 4.VI.1992, leg. A. Olivier, in coll. VLCA.

2. Greece, Eastern Aegean islands, Sámos, Óros Kerketevs (950–1200 m), 20.VII.1989, leg. A. Olivier, in coll. VLCA.

3. Greece, Eastern Aegean islands, Híos, Néa Moni (500 m), 25.V.1986, leg. A. Olivier, in coll. VLCA.

4. Greece, Eastern Aegean islands, Híos, Nagós (50 m), 7.VI.1987, leg. A. Olivier, in coll. VLCA.

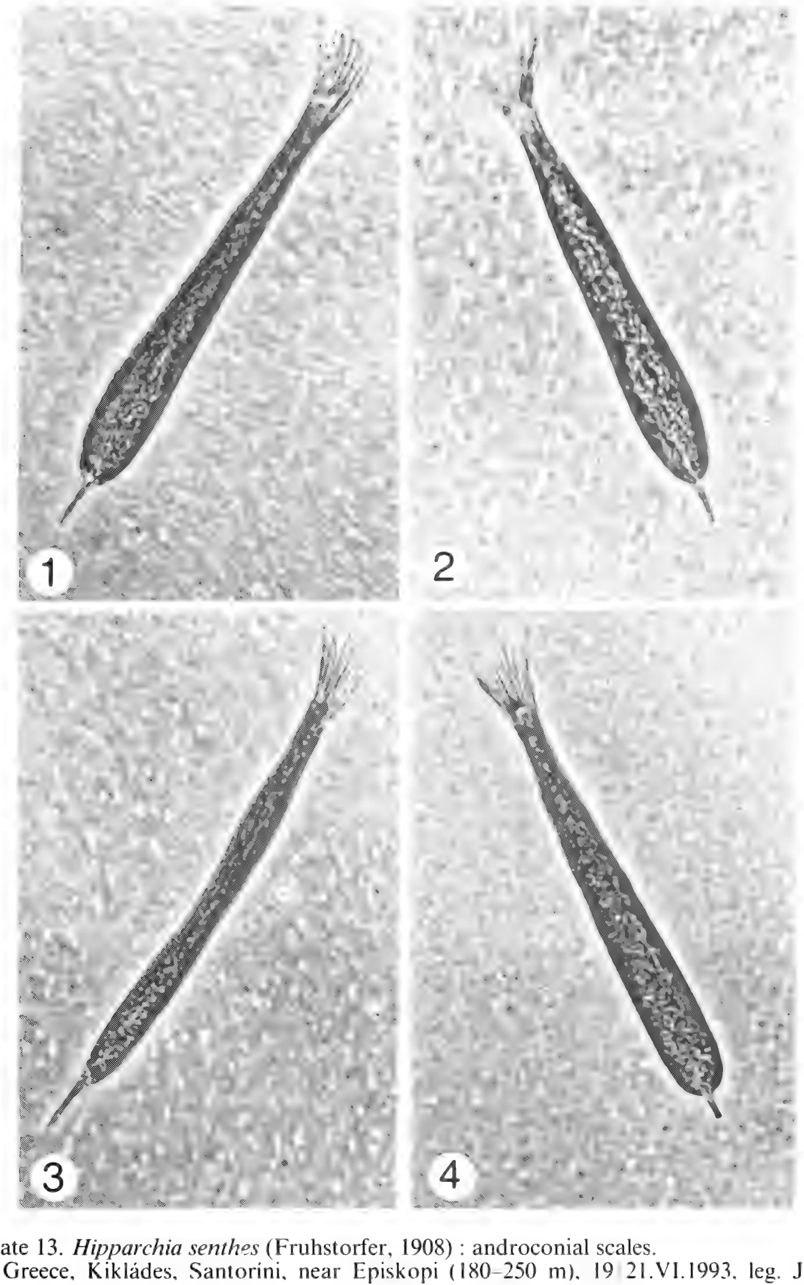

Plate 13. *Hipparchia senthes* (Fruhstorfer, 1908) : androconial scales.
1. Greece, Kikládes, Santorini, near Episkopi (180–250 m), 19 21.VI.1993, leg. J.G. Coutsis, in coll. VLCA.
2. Greece, Makedonía, Dráma, Óros Falakró (700 m), 20.VII.1982, leg. J. Dils, in coll. VLCA.
3. Greece, Stereá Eláda, Fókida, Delfí (550 m), 20.V.1985, leg. A. Olivier, in coll. VLCA.
4. Greece, Pelopónissos, Lakonía, Óros Taígetos (1600 m), 15.VII.1983, leg. D. van der Poorten, in coll. VLCA.

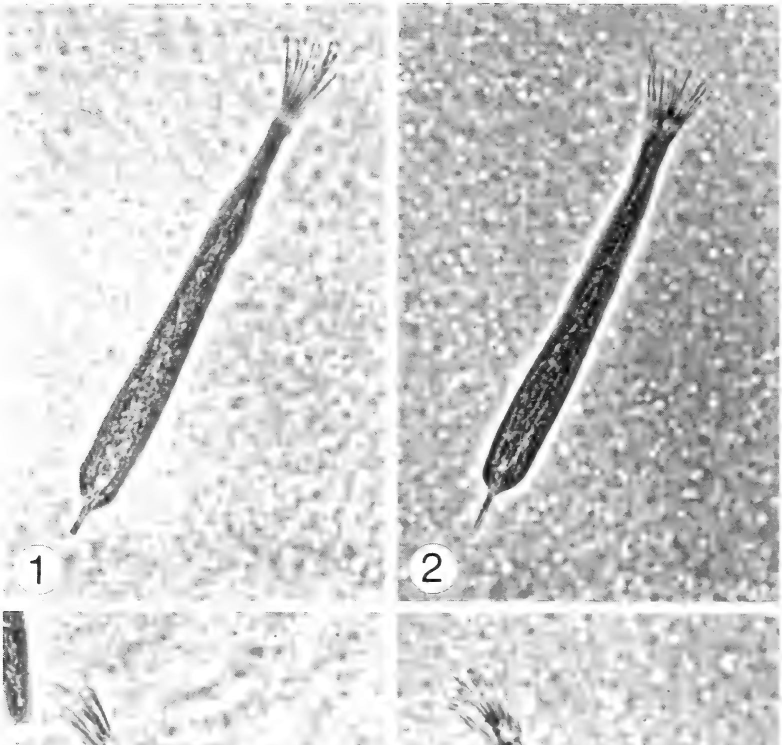

Plate 14. *Hipparchia senthes* (Fruhstorfer, 1908) : androconial scales.
1–2. Italy, Sicily, Prov. Palermo, Monti Le Madonie, Castelbuono (500 m), 15.VII.1991, leg. A. Olivier, in coll. VLCA.
3. Italy, Sicily, Prov. Palermo, Monti Le Madonie, 3 km N. Petralia Sottana (900 m), 16.VII.1991, leg. A. Olivier, in coll. VLCA.
4. Italy, Sicily, Prov. Palermo, Monti Le Madonie, Cozzo Pomieri, 7 km NW. Petralia Sottana (1150–1300 m), 17.VII.1991, leg. A. Olivier, in coll. VLCA.

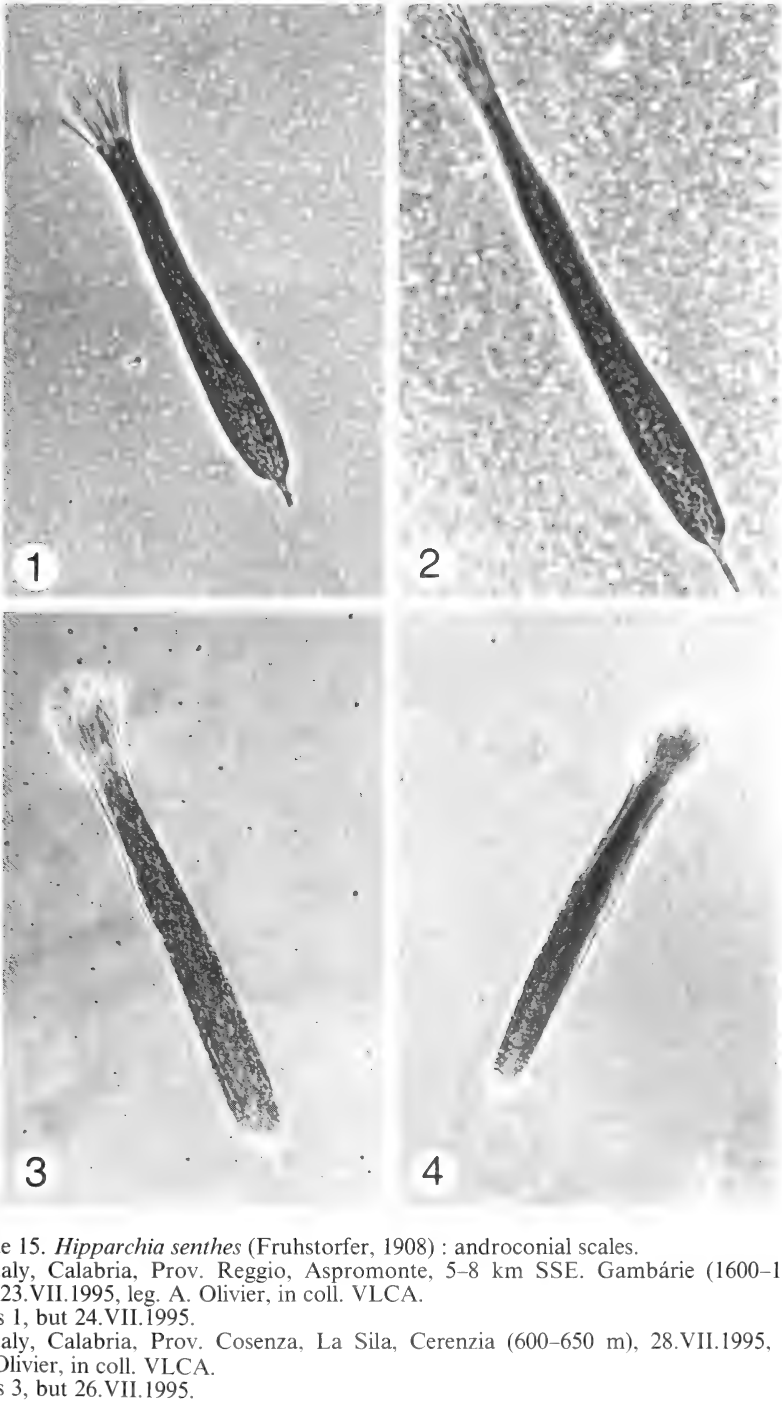

Plate 15. *Hipparchia senthes* (Fruhstorfer, 1908) : androconial scales.

1. Italy, Calabria, Prov. Reggio, Aspromonte, 5–8 km SSE. Gambárie (1600–1700 m), 23.VII.1995, leg. A. Olivier, in coll. VLCA.
2. as 1, but 24.VII.1995.
3. Italy, Calabria, Prov. Cosenza, La Sila, Cerenzia (600–650 m), 28.VII.1995, leg. A. Olivier, in coll. VLCA.
4. as 3, but 26.VII.1995.

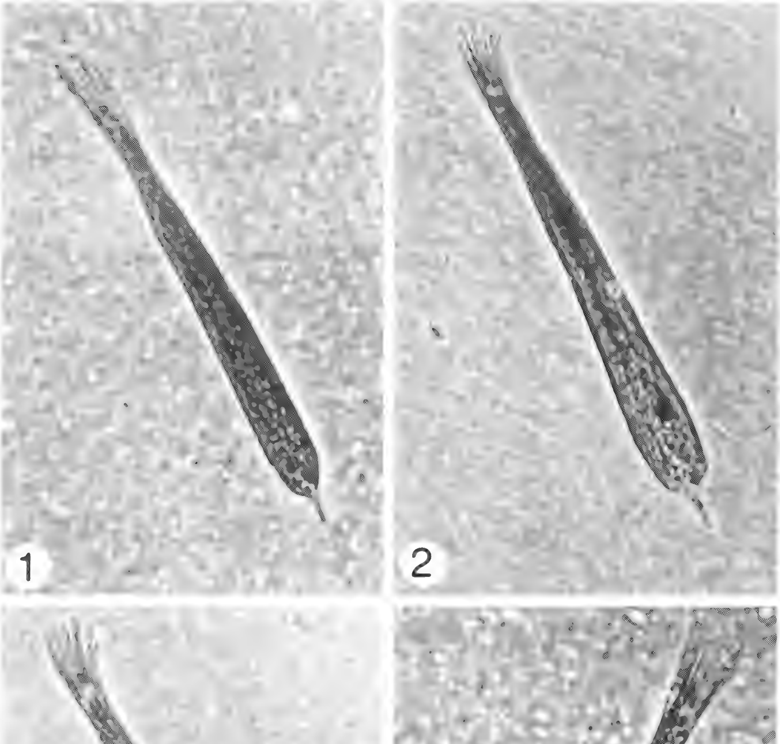

Plate 16. *Hipparchia senthes* (Fruhstorfer, 1908) : androconial scales.
1–3. Italy, Campania, Prov. Nápoli, Monte Faito (1000–1100 m), 23.VII.1991, leg. A. Olivier, in coll. VLCA.
4. Italy, Campania, Prov. Nápoli, Ísola d'Íschia, Fontana (400 m), 8.VII.1991, leg. A. Olivier, in coll. VLCA.

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APPENDIX

Glossary of terms used in studies on phylogenetic systematics, as mentioned partly in the present study

apomorphy : of a homologous pair of characters, the apomorphic character [or apomorphy] is the character evolved directly from its preexisting homologue (synonyms : apomorphous character, derived character, advanced character and specialized character) (Wiley, 1981 : 122).

autapomorphy : a character evolved from its plesiomorphic homologue in a single species (Wiley, 1981 : 123). Hennig (1979 : 90) called autapomorphous characters "the apomorphous features characteristic for a particular monophyletic group (present only in it) that can be ignored in discussing its relations to other groups", while Ax (1987 : 3) defined it as "each evolutionary novelty of the stem species". In the present study, we consequently apply this term in Wiley's sense, to denote an apomorphy restricted to one single species. According to the definitions of Hennig (1979) and Ax (1987), the teeth on the penis in superspecies *H. azorina* would have been an autapomorphy of this taxon. To the contrary, we call it a synapomorphy of this superspecies, because it is shared by its two component sister species, *H. (azorina) azorina* and *H. (azorina) miguelensis*, i. e. it gives us information on their supposed monophyly and degree of relationship. It is true that this character does not give us any information on the degree of relationship of superspecies *H. azorina* with any other *Parahipparchia* taxon. Autapomorphies are useful to characterize a species (as a diagnostic feature), but useless for determining its degree of relationship with other species or supraspecific taxa.

cladogram : a branching diagram of entities where the branching is based on the inferred historical connections between the entities as evidenced by synapomorphies. That is, a cladogram is a phylogenetic or historical dendrogram.

convergence : development of similar characters from different pre-existing characters (Wiley, 1981 : 12). Compare to homoplasy and parallelism.

correlation of transformation series (directional argument of) : if in a monophyletic group two or more phenoclines occur in the same species, the direction of change is identical in these transformation series (de Jong, 1980 : 14).

dendrogram : a branching diagram containing entities linked by some criterion (Wiley, 1981 : 97).

differentiation and complexity (directional argument of) : in a monophyletic group the character states that show the highest degree of differentiation or complexity are the apomorphous states (de Jong, 1980 : 19).

homology : a character of two or more taxa is homologous if this character is found in the common ancestor of these taxa, or, two characters (or a linear sequence of characters) are homologues if one is directly (or sequentially) derived from the other(s) (Wiley, 1981 : 121–122).

homoplasy (nonhomology) : a character found in two or more species is homoplasous (nonhomologous) if the common ancestor of these species did not have the character in question, or if one character was not the precursor of the other (Wiley, 1981 : 122). Compare to convergence and parallelism.

monophyletic group : a group of species that includes an ancestral species (known or hypothesized) and all of its descendants (Wiley, 1981 : 76, 84). Characterization (cf. Hennig, 1979) : a group based on synapomorphous similarity.

monophyly : of a species group when its members, without exception, descend from a single stem species shared by them alone (Ax, 1987 : 21).

outgroup : an outgroup is a species or higher monophyletic taxon that is examined in the course of a phylogenetic study to determine which of two homologous characters may be inferred to be apomorphic. One or several outgroups may be examined for each decision. The most critical outgroup comparisons involve the sister group of the taxon studied (Wiley, 1981 : 7).

outgroup occurrence (directional argument of), often termed "outgroup comparison" : if a character occurs in more than one state in a monophyletic group, the state that occurs also outside the group is likely to be the plesiomorphous state (de Jong, 1980 : 12).

parallelism (or parallel development) : the independent development of similar characters from the same plesiomorphic character (Wiley, 1981 : 12). Compare to convergence and homoplasy.

paraphyletic group : a group [of species] that includes a common ancestor [an ancestral species (known or hypothesized)] and some but not all of its descendants (Wiley, 1981 : 84). Characterization (cf. Hennig, 1979) : a group based on symplesiomorphous characteristics.

plesiomorphy : of a pair of homologues, the plesiomorphic character [or plesiomorphy] is the character that arose earlier in time and gave rise to the later, apomorphic character (synonyms : plesiomorphous character, primitive character, ancestral character and generalized character) (Wiley, 1981 : 122).

polyphyletic group : a group [of species] in which the most recent common ancestor [an ancestral species (known or hypothesized)] is assigned to some other group and not to the group itself (Wiley, 1981 : 84). Characterization (cf. Hennig, 1979) : a group based on convergent similarity.

reversibility (reversal of character state) : a character that reverts to its original condition (Hennig, 1979 : 93). A reversal to the structurally plesiomorphic condition in one particular species should be considered as an autapomorphy of that species (e.g. the neomorphic androconium in *H. mersina*, cf. section 1 : Introduction).

sister groups : species groups that arose from the stem species of a monophyletic group by one and the same splitting process (Hennig, 1979 : 139).

sister species : two species that arose from the stem species shared only by them by one and the same splitting process (our definition). For this and the foregoing case, Ax (1987 : 36) coined the term adelphotaxon, which he defined as follows : "Adelphotaxa are evolutionary species, or monophyletic species groups, of the first degree of phylogenetic relationship. They arise by the dichotomous splitting of a stem species common to them alone". As this term has not been widely used (or perhaps not at all) in literature on Lepidoptera phylogeny, we prefer to mention the terms "sister groups" and "sister species".

specialization (directional argument of) : a character state is considered apomorphous, if it restricts the niche of the organism. Niche restriction means restriction to a particular mode of life or to a particular environmental factor (de Jong, 1980 : 16).

symplesiomorphy : a shared plesiomorphy [by two or more taxa] (Wiley, 1981 : 123). Ax (1987 : 53) gives a more complete and explicit definition : "An agreement between evolutionary species or monophyletic species groups in a feature which did not arise in their common stem lineage but was taken over from stem species that were even more remote".

synapomorphy : a homologous character found in two or more taxa that is hypothesized to have arisen in the ancestral species of these taxa and in no earlier ancestor (Wiley, 1981 : 123).

vicariance (directional argument of) : if in a monophyletic group two species are vicarying, these species are more closely related to each other than to any other species, and character states restricted to them are considered apomorphous (de Jong, 1980 : 17).

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A new *Micropterix* species from northern Italy (Micropterigidae)

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Summary

Micropterix renatae sp. n. is described from the province of Tuscany (northern Italy) and compared with its closest relatives, i.e. *Micropterix uxoria* Walsingham, 1919, *Micropterix erctella* Walsingham, 1919 and *Micropterix italica* Heath, 1981. The new species is well characterized by the structure of the male genitalia.

Zusammenfassung

Aus der Toskana (Norditalien) wird *Micropterix renatae* sp. n. beschrieben und mit ihren nächsten Verwandten verglichen. Dies sind *Micropterix uxoria* Walsingham, 1919, *Micropterix erctella* Walsingham, 1919 und *Micropterix italica* Heath, 1981. Die neue Art ist sehr gut durch den Genitalapparat des Männchens charakterisiert.

Résumé

Micropterix renatae sp. n. est décrit de Toscane (Italie du Nord) et comparé aux espèces les plus apparentées, à savoir *Micropterix uxoria* Walsingham, 1919, *Micropterix erctella* Walsingham, 1919 et *Micropterix italica* Heath, 1981. La nouvelle espèce est bien caractérisée par la structure des genitalia mâles.

Introduction

Italy is well known for its many endemic species of the genus *Micropterix* Hübner, [1825]. During the last decades many species of this genus have been newly described (cf. Viette, 1951 ; Heath, 1960, 1963, 1965, 1981 ; Heath & Kaltenbach, 1984), so that up to the present Italy is one of the best investigated countries concerning Micropterigidae.

On a trip to the northern Apennines in 1993 we have concentrated primarily on collecting Micropterigidae and Psychidae. Astonishingly, besides two probably undescribed species of Psychidae, a series of 7 ♂♂ and one ♀ of a hitherto unnamed species of *Micropterix* has been found in the Province of Tuscany (near the border to Romagna). Although very similar in wing pattern to other Italian species of the genus and therefore at first assumed to be *Micropterix italica* Heath, 1981, it is clearly separable from these by characters of the male genitalia.

Males of *Micropterix uxoria* Walsingham, 1919 and *Micropterix erctella* Walsingham, 1919, labelled as lectotypes in The Natural History Museum, London (BMNH ; designation not yet published) have been investigated as well for comparative purpose. It turned out that both taxa are virtually indistinguishable in the characters of the male genitalia, whereas the external differences in the extension of the silvery fasciae may be subject to variation. For this reason we only refer to *Micropterix erctella* in the diagnosis. Due to the lack of further material a detailed analysis of these two species must await further studies.

Micropterix renatae sp. n.

HOLOTYPE : ♂ : n. Apennin ; Alpi Apuane ; Castelnuovo/Arni [44°05′ N, 10°23′ E] ; 600–800 m ; 14.V.1993 pm ; leg. H/Z/K (genitalia preparation 628 M. Kurz) ; coll. M. Kurz
PARATYPES : 6 ♂♂, 1 ♀ : same data (genitalia preparation 602 M. Kurz) ; coll. Tiroler Landesmuseum Ferdinandeum (Innsbruck), C. Zeller and M. Kurz

DESCRIPTION. *Adult* (Fig. 1). Forewing length : ♂♂ 2.7-3.1 mm ; ♀ 3.3 mm ; wing expanse : ♂♂ 5.8-6.4 mm ; ♀ 7.0 mm. Head dirty to rusty yellow ; antennae approximately 3/4 (male) or 2/5 (female) of forewing length, golden fuscous. Thorax and tegulae dark bronzy golden, apically purplish, sometimes with single bluish scales ; forewings bronzy to reddish-golden, apically slightly tinged purplish ; base of costa purple ; wing markings silvery white : a narrow straight fascia at about 1/4, especially in female not quite reaching costa ; a similiar, sometimes slightly irregular fascia at about 1/2 over the whole width of the wing ; at 3/4 a more or less pear-like diagonal costal spot, extending almost to centre of wing ; cilia bronzy grey, basally purple-tinged, apically whitish-golden ; hindwing deep bronzy golden, more or less tinged purplish (especially apically) ; cilia bronzy golden ; abdomen golden fuscous.

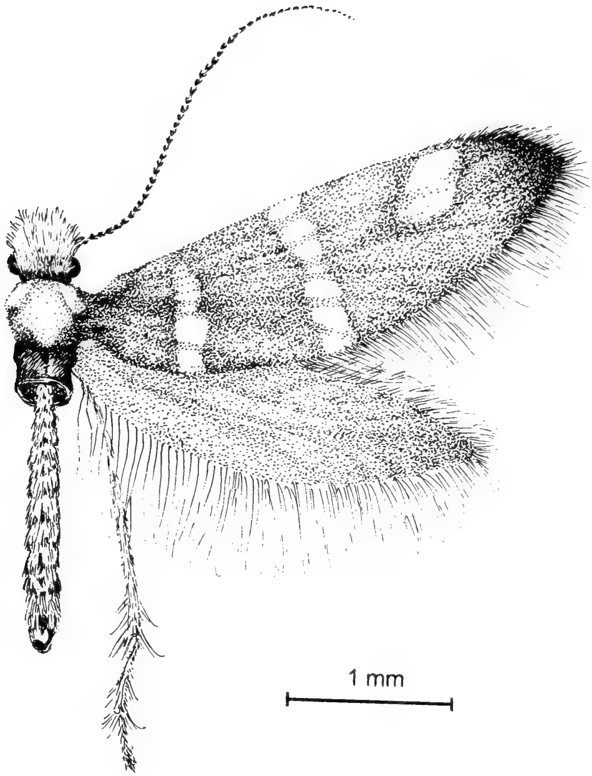

Fig. 1 : Male (paratype) of *Micropterix renatae* sp. n.

Male genitalia (Fig. 2) (n = 2). Uncus (medial lobe of the segment IX ring) long and fairly slender with broad rounded tip ; beyond uncus a slightly sclerotized, hairy structure ; accessory clasper on inner surface with a marginal series of 10-13 long stout setae and a group of about 20 moderately long, partly sickle-shaped setae ; a small lobe, situated on each side of the posterior margin of the segment IX ring between the base of the valva and the accessory clasper ; valva moderately long, narrow in the middle and distinctly spatulate at the distal end ; on the inner surface with a postbasal irregular group of more than 10 short, fine setae and an irregular group of moderately long stout setae in the distal part ; aedeagus typical for the genus, without cornuti.

Due to the persisting problems in preparing female genitalia of specimens of the genus *Micropterix*, no attempt has been made to prepare the genitalia of the single available female of the new species.

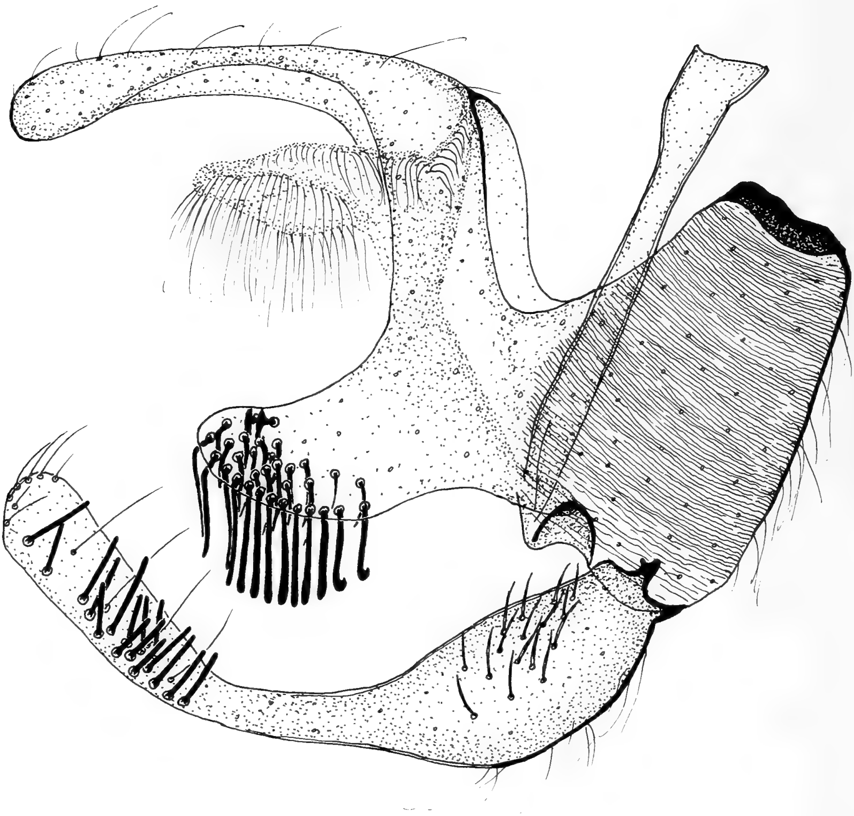

Fig. 2 : Male genitalia of *Micropterix renatae* sp. n. ;
holotype ; genitalia preparation 628, M. Kurz

Diagnosis. Externally the new species is quite well separated from most other *Micropterix* species by the combination of the reddish-golden forewings with silvery fasciae, the fascia at one-quarter being reduced near the costa. *M. renatae* sp. n. seems to be closely related to *M. erctella*, *M. uxoria* and *M. italica*, being separable with certainty only by the characters of the male genitalia. It differs from these species in the shape of the dorsal part of the segment IX ring (uncus-tegumen-complex) and the accessory claspers, both being more slender in *M. renatae* sp. n., the more numerous setae on the accessory claspers (more than 30 in *M. renatae* sp. n., about 20 or less in the other species) and the shape of the valvae (cf. figs. 2 and 3), being distinctly more

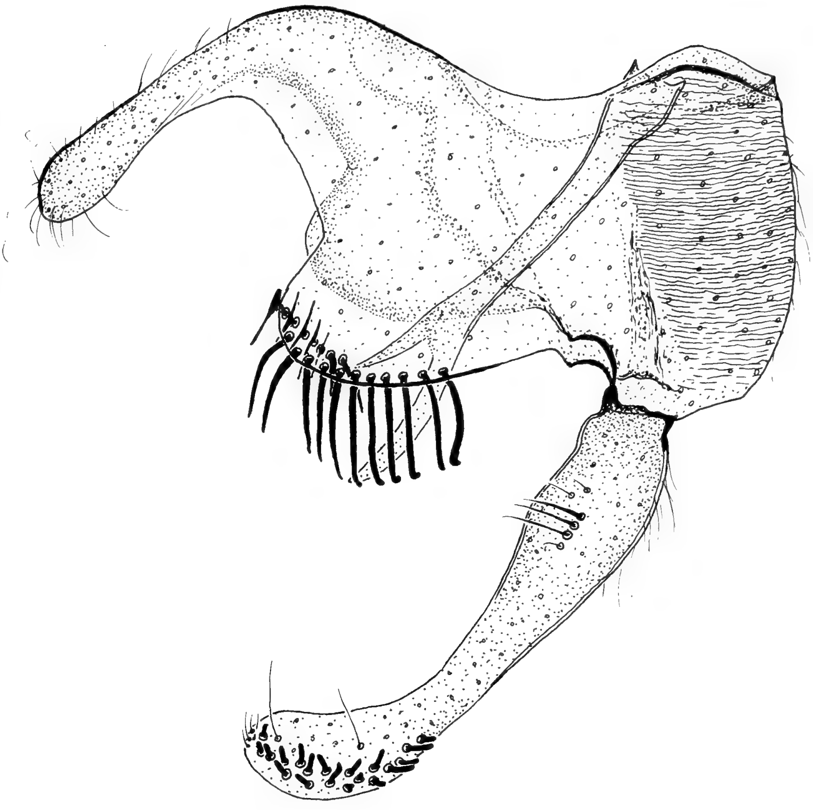

Fig. 3 : Male genitalia of *Micropterix uxoria* Walsingham, 1919 ; GU 7079, BMNH

spatulate in the new species. Furthermore the postbasal setae on the inner surface of the valva are more numerous in *M. renatae* sp. n. (more than 10) than in *M. italica* (8) and *M. erctella* (3).

DISTRIBUTION. To our present knowledge, *M. erctella* and *M. uxoria* are restricted to Sicily, *M. italica* inhabits southern Italy (province of Campania), whereas *M. renatae* sp. n. dwells within the range of the northern Apennines. Material (females) from Tuscany and Romagna identified by Heath (1981) as *M. italica*, but excluded from the type series of that species, most probably belongs to *M. renatae* sp. n.

ETYMOLOGY. The new species is named in honour of Miss Renate Hausenblas, who has proved to have a great feeling for finding unexpected specimens.

Further type material examined

Micropterix erctella Walsingham, 1919
1 ♂ : Palermo 13.III.1918 ; labelled as "Lectotype" ; GU 7082 ; coll. British Museum (Natural History), London [now The Natural History Museum, London] (BMNH)

Micropterix uxoria Walsingham, 1919
1 ♂ : Taormina, Sicilia, 1.V.1918 ; labelled as "Lectotype" ; GU 7079 ; coll. BMNH ; 1 ♀ : Sicilia s. Cefalù, 22.4.1982, J. Klimesch (genitalia preparation 522 M. Kurz) ; ex coll. J. Klimesch, now in Zoologische Staatssammlung, München (ZSSM)

Acknowledgements

We are grateful to Dr. Klaus Sattler, London for his most valuable hints and to the late Dr. Josef Klimesch, Linz for the loan of the female of *M. uxoria*.

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A new *Dichrorampha* species from Latvia (Tortricidae : Olethreutinae)

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Summary

Dichrorampha teichiana sp. n. is described from material collected in the eastern part of Latvia at the bank of the River Daugava. It resembles *D. plumbana* (Scopoli, 1763) externally but *D. sedatana* (Busck, 1906) in genitalia. The species occurs flying around *Achillea salicifolia* Besser (= *A. cartilaginea* Ledeb. ex Reichenb., *A. ptarmica* subsp. *cartilaginea* (Ledeb. ex Reichenb.)) on wet meadows. The species is collected only in Latvia.

Zusammenfassung

Dichrorampha teichiana sp. n. wurde aus gesammeltem Material im östlichen Teil Lettlands am Ufer der Flusses Daugava beschrieben. Die neue Art ist äusserlich dem *D. plumbana* (Scopoli, 1763) ähnlich, aber genitalisch ist sie *D. sedatana* (Busck, 1906) nahe. Die neue Art wurde um *Achillea salicifolia* Besser (= *A. cartilaginea* Ledeb. ex Reichenb., *A. ptarmica* subsp. *cartilaginea* (Ledeb. ex Reichenb.)) fliegend beobachtet. Die Art ist bis jetzt nur von Lettland bekannt.

Résumé

Dichrorampha teichiana sp. n. est décrit d'après du matériel récolté dans la partie orientale de la Lettonie sur la rive de la rivière de la Daugava. Cette espèce ressemble à *D. plumbana* (Scopoli, 1763) d'après l'aspect extérieur, mais plutôt à *D. sedatana* (Busck, 1906) d'après les genitalia. L'espèce est inféodée à *Achillea salicifolia* Besser (= *A. cartilaginea* Ledeb. ex Reichenb., *A. ptarmica* subsp. *cartilaginea* (Ledeb. ex Reichenb.)) dans des prés humides. Jusqu'à présent, l'espèce n'est connue que de Lettonie.

Introduction

The valley of the River Daugava is rich in fauna and flora with many species of eastern European origin. During one of the excursions to the valley near Daugavpils city, the first author discovered a *Dichrorampha* species unknown to him. When checking its genitalia according to Kuznetsov (1978), the species corresponded to *D. sedatana* (Busck, 1906), though otherwise externally it resembled *D. plumbana* (Scopoli, 1763). When comparing the unknown species with some genuine *D. sedatana* specimens from Denmark and Sweden some remarkable external and genitalic differences were found. The taxon is described here as a new species.

Fig. 1. From above :
(1) *Dichrorampha teichiana* sp. n. ♂, Latvia, Daugavpils, 7.VI.1992, I. Šulcs leg.
(2) *Dichrorampha sedatana* (Busck, 1906) ♂, Suecia, Sk. Ålabodarna UTM 33V UC 6101, 20.V.1984, I. Svensson leg.

***Dichrorampha teichiana* sp. n.**

HOLOTYPE ♂, Latvia, Daugavpils, 1.VI.1990, I. Šulcs leg. in the collection of I. Šulcs.

PARATYPES (38 ♂♂, 3 ♀♀) : Latvia, Daugavpils, 1.VI.1990, 2 ♂♂, gen. slide 352X/B. Å. Bengtsson, I. Šulcs leg. ; Latvia, Daugavpils, 9.VI.1991, 2 ♂♂, I. Šulcs leg. ; Latvia, Daugavpils, 7.VI.1992, 15 ♂♂, 1 ♀ gen. slide 576X/B. Å. Bengtsson, I. Šulcs leg. ; Latvia, Piedruja, 14.VI.1994, 5 ♂♂, N. Savenkov leg. ; Latvia, Naujene, 15.VI.1994, 14 ♂♂, 2 ♀♀, N. Savenkov leg. The holotype and paratypes have been deposited in the collection of the Latvian Museum of Natural History in Riga (Latvijas Dabas muzejs).

DESCRIPTION. *Male.* Forewing length 5.5-6.5 mm. — Palpi and face brownish grey. Thorax and base of tegulae brownish grey. Ground-colour of forewing dark brown with sprinkling of black scales in the middle and subapical areas. Scattered yellowish irroration extending from base to apical area of wing. Scales, causing the irroration, dichromatic, basally dark brown and apically yellowish. Five pale yellow marks of costal strigulae in apical half of wing. Plumbeous lines very faint. Ocellus weak with three black streaks or dots. Medio-dorsal blotch diffuse and weakly strigulate, constricted at median fold. Hindwing dark brown without yellow irroration, looking darker than forewing. Cilia line double, inner one stronger than outer one. Abdomen dark brown with brownish grey scales. Anal tuft brownish grey.

Male genitalia. Ventral edge of valva with prominent excision. Apex of sacculus forming almost right angle. Margins of valva tapering to cucullus. Ventral edge of cucullus rounded. Outline of basal pit of valva forming right angle with costal margin of valva. Aedeagus straight without any denticulation.

Female. Forewing length 7.5 mm. — Wing pattern as in male.

Female genitalia. Lamella postvaginalis large. Ostium and antrum weakly sclerotized. Signum comparatively small.

DIAGNOSIS. In general, all the species belonging to the genus *Dichrorampha* are quite similar and difficult to identify externally and can be distinguished primarily by checking genitalia (Bradley & Tremewan, 1970 ; Bradley, Tremewan & Smith, 1979 ; Danilevsky & Kuznetsov, 1968 ; Hanneman, 1961 ; Sauter, 1960).

The new species resembles externally and in genitalia construction either *D. sedatana* or *D. plumbana* (fig. 1). *D. sedatana* has a uniform yellowish olive-green irroration covering the whole forewing; *D. plumbana* lacks the yellowish irroration in the basal part but this appears in the middle and apical parts of the wings. *D. teichiana* shows a scattered yellowish irroration of forewing. The new species is closer to *D. plumbana* in colour but, in genitalia, to *D. sedatana*.

The following genitalia characters distinguish *D. teichiana* from *D. sedatana* :

- In the male genitalia (fig. 2), the ventral edge of cucullus of the valva is more rounded and the ventral margin of valva is more abrupt and deeper emarginate as in *D. sedatana*
- the aedeagus lacks the dorsal single or double denticulation present in *D. sedatana*
- the outline of the basal part of valva forms an acute angle instead of a right angle in *D. sedatana*

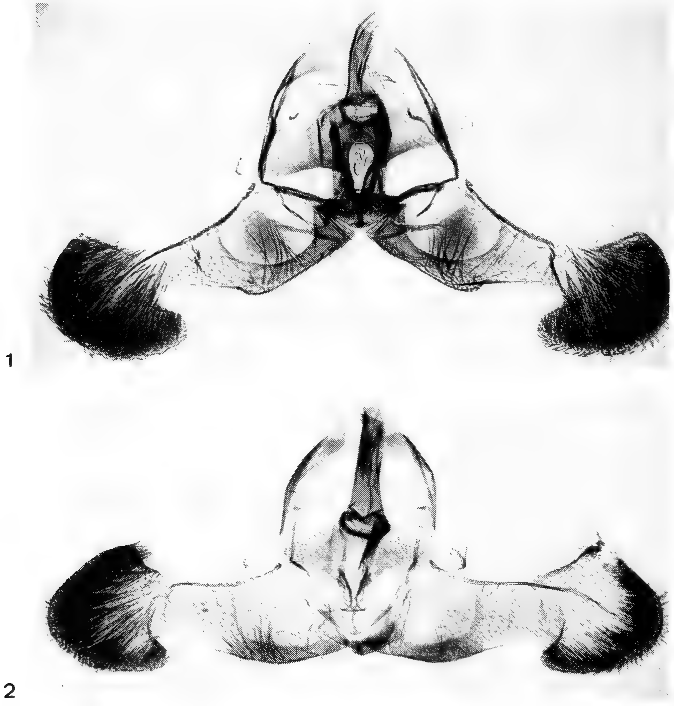

Fig. 2. From above :
(1) Male genitalia of *Dichrorampha teichiana* sp. n., paratype, gen. slide BÅB 352X, Latvia, Daugavpils, 1.VI.1990, I. Šulcs leg.
(2) Male genitalia of *Dichrorampha sedatana* (Busck, 1906), gen. slide BÅB 350X, Latvia, Virga, 20.VI.1987, I. Šulcs leg.

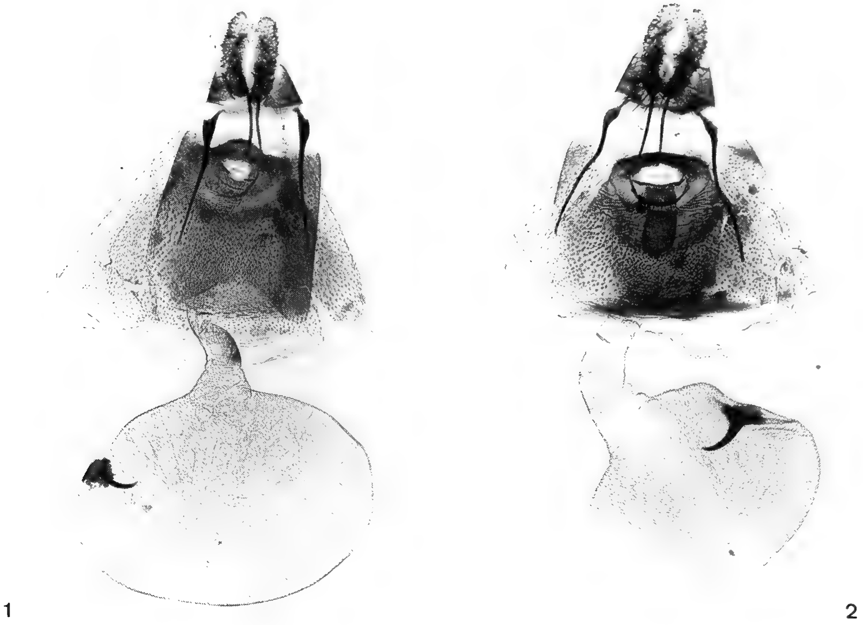

Fig. 3. From left :
(1) Female genitalia of *Dichrorampha teichiana* sp. n., paratype, gen. slide BÅB 576X, Latvia, Daugavpils, 7.VI.1992, I. Šulcs leg.
(2) Female genitalia of *Dichrorampha sedatana* (Busck, 1906), gen. slide BÅB 596X, Suecia, Sk. Ålabodarna UTM 33V UC 6101, 20.V.1984, I. Svensson leg.

— in the female genitalia (fig. 3), the structure of antrum is similar to *D. sedatana* but, in *D. teichiana*, the sclerotization is weaker
— the signum of *D. teichiana* is smaller.

Biology. The type material has been collected in the dusk on wet river bank meadows. The immature stages of *D. teichiana* are still unknown but the moths were flying around *Achillea salicifolia* Besser (= *A. cartilaginea* Ledeb. ex Reichenb., *A. ptarmica* subsp. *cartilaginea* (Ledeb. ex Reichenb.)), which could be the larval host-plant.

Distribution. Latvia (Daugavpils, Naujene, Piedruja). *D. teichiana* is now known only from Latvia. In comparison, *D. sedatana* has a wide distribution in northern and central Europe. The more eastern distribution of *D. teichiana* could be explained apparently by *A. salicifolia*, the probable larval host-plant of this species, occurring only in eastern Europe. In the biotope of *D. teichiana*, I have also collected another very interesting species with an eastern distribution, *D. uralensis* Danilevsky, 1948.

Etymology. The species is named after the late lepidopterologist Carl August Teich (1838-1908), well known for his research of the Lepidoptera of Latvia.

Acknowledgements

We thank Bengt Å. Bengtsson (Löttorp, Sweden) for photographing the genitalia, Knud Larsen (Søborg, Denmark) and N. Savenkov (Riga, Latvia) for comments on the manuscript.

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A new *Euzophera* species from Turkey (Pyralidae : Phycitinae)

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Summary

Euzophera fibigerella sp. n. is described and the male genitalia are figured. An introduction is given in reference to the subfamily Phycitinae Zeller and the genus *Euzophera* Zeller.

Zusammenfassung

Euzophera fibigerella sp. n. wird beschrieben und das männliche Kopulationsorgan wird abgebildet. Eine Einleitung wird gegeben in bezug auf die Subfamilie Phycitinae Zeller und das Genus *Euzophera* Zeller.

Resumé

Description de *Euzophera fibigerella* sp. n. Les genitalia du mâle sont représentés et une introduction est donnée par rapport à la sous-famille Phycitinae Zeller et au genre *Euzophera* Zeller.

Introduction

The Phycitinae Zeller, 1839 form a very large subfamily within the Pyralidae. The highest concentrations of species can be found in dry-hot eremial regions but in the tropics and subtropics they are also well represented. The subfamily Phycitinae has a worldwide distribution. The only character which they have in common is the absence of vein r_5 in the forewing. The frenulum is a long firm spine in both sexes.

The subfamily Phycitinae can be divided in 4 tribes, one of which is subdivided in two subtribes :

1. Cryptoblabini Roesler, 1968
2. Phycitini Agenjo, 1958
    - 2a. Phycitina Agenjo, 1958
    - 2b. Acrobasiina Agenjo, 1958

3. Cabniini Roesler, 1968
4. Anerastiini Hasenfuss, 1960

The genus *Euzophera* Zeller, 1867 forms a part of the so-called trifine Acrobasiina in which in the hindwing m_3 completely coincides with m_2. The trifinity has to be understood as a progressing development from the quadrifinity. It is not an important systematic character : in the Cryptoblabini, Phycitini and Anerastiini both quadrifine and trifine species do occur.

45 species of *Euzophera* occur in the Palaearctic region (Roesler, 1973) and the genus has a worldwide distribution. The labial palps are short and often strongly uprised. In the hindwing s_c and r_r are at least half stalked. The antennae of the male are medially without excrescences and the culcita is, if present, simply built without 3-dimensional scales. None of the Acrobasiina has a scale bush behind the basal antennal segment.

Euzophera fibigerella sp. n.

HOLOTYPE ♂, Turkey, Prov. Gaziantep, 16 km NE Kadirli, 700 m, 10.VII.1987, leg. M. Fibiger, GP 3125 Ass in coll. ZMA Amsterdam.

DESCRIPTION. *External characters* (fig. 1). Exp. 17 mm, forewing 8 mm. Frons flatly curved, adjacently scaled, without a cone of scales. Proboscis entirely rudimentary. Labial palps slightly upcurved, 1,5 ×

Fig. 1. Holotype ♂, *Euzophera fibigerella* sp. n., Turkey, Prov. Gaziantep, 16 km NE Kadirli, 700 m, 10.VII.1987 (leg. M. Fibiger).

eye diameter and roughly scaled ; 3rd segment D 3 × eye diameter. Maxillary palps small and slender and 0.75 × third segment of the labial palps. Scapus sligthly swollen and 1.5 × longer than wide. Antennae 0.8 × forewing length, filiform and pubescent, indistinctly banded with light brown. Forewing 3 × longer than wide and rather sharp at the apex (± 80). Ground-colour tawny yellowish, surface irregularly covered with light brown scales, postmedial line visible, running from 5/6 of the costa parallel to the termen downwards till it reaches the inner border. Hindwing ground-colour tawny yellowish, covered with fine brown scales except for the base of the wings.

Genitalia (fig. 2). Uncus A-formed, triangular, not extended at base and with a rather sharply ending apex. Scaphium reaching beyond top of uncus. Gnathos bottle-formed with a rounded top, ± 0.5 × uncus length, lateral gnathos components list-formed, somewhat swollen at base and terminally ending in sharp hook. Tegumen with relatively slender medial parts and rather bluntly ending laterally. Anellus U-formed, plumply built with lateral components which are swollen, bent towards one another and provided with some hairs.

Costa of valve with list-like enforcement ending before distal end of valve. Length of valve, measured from the medial beginning of the costa till the middle of the distal top of the valve, 3 × the width. Proximally just under the costa of the valve lies a knot provided with some hairs. Vinculum V-formed, long drawn out. Aedeagus characteristic, compactly built, well-sclerotized and a little longer than uncus : the greatest width is about half the length. Small excavation at the side where ductus ejaculatorius becomes visible. Numerous little cornuti forming a triangle, the tip of which is directed to the rounded proximal end of aedeagus and reaching halfway of its total length. Culcita absent.

The different shape of the right valve in fig. 2, of which only the outlines are drawn, is due to a little distortion during preparation.

Female. Unknown.

BIOLOGY. Unknown.

DISTRIBUTION. So far only known from the province Gaziantep in Turkey.

DERIVATIO NOMINIS. Named after the collector Mr. Michael Fibiger, who collected in Turkey, apart from his specialty Noctuidae, many Pyralidae among which several of great interest.

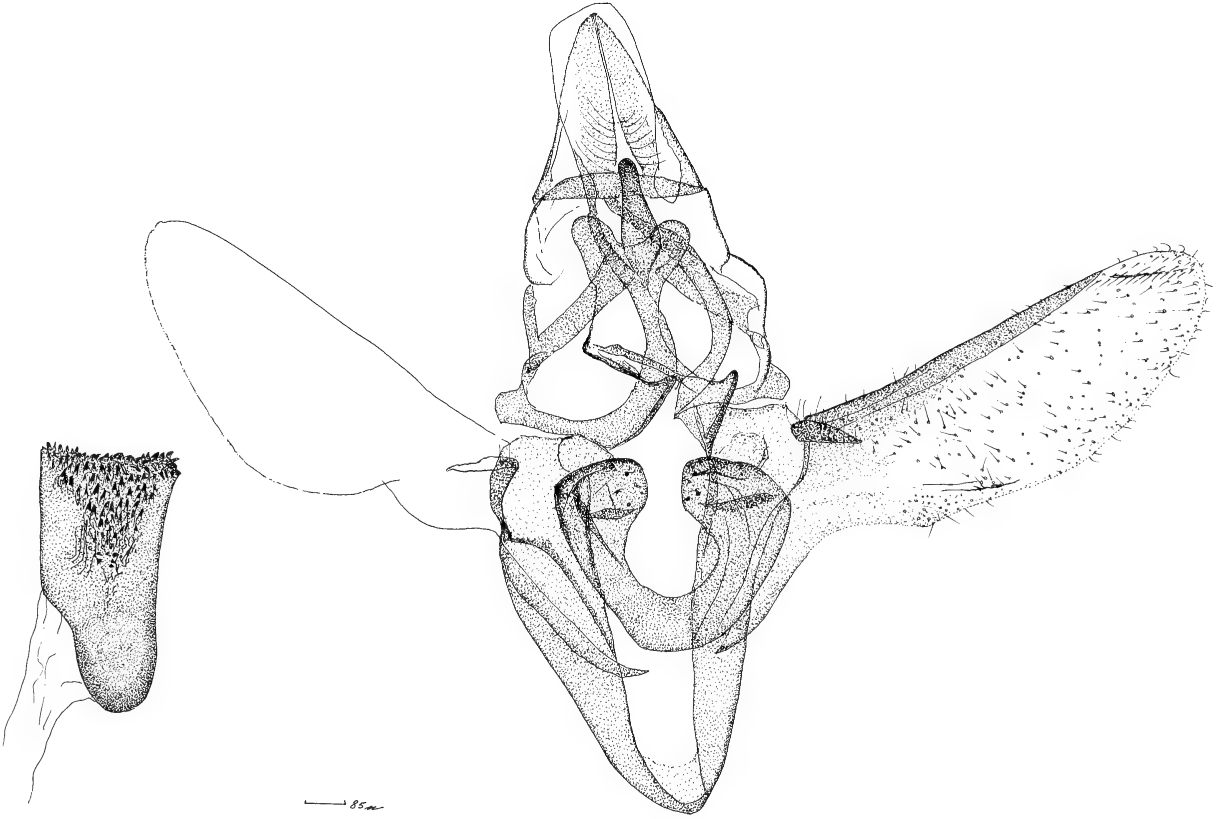

Fig. 2. Holotype ♂, *Euzophera fibigerella* sp. n., genitalia.

Discussion and conclusion

Only the male and none of the early stages, nor the biology of *Euzophera fibigerella* sp. n., is known. This is often the case with Phycitine moths. However, the very distinctive male genitalia justify the description of the new *Euzophera* species. The discovery of a fresh male and of the hitherto unknown female remain highly desirable.

Acknowledgements

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Records of casebearers from Siberia, Russia (Coleophoridae) (¹)

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Summary

As a result of six joint Finnish-Russian expeditions to Siberia, in the years 1982–1991, a list of Coleophoridae, comprising 93 species, is published. The descriptions of nine new species and two new subspecies collected during the expeditions have been published elsewhere. More than 70 species are reported for the first time from Siberia, and for many others the most eastern or northern records are published.

Zusammenfassung

Als Ergebnis von sechs gemeinsamen finnisch-russischen Expeditionen nach Sibirien in den Jahren 1982–1991 wird ein Verzeichnis der Coleophoridae mit 93 Arten vorgelegt. Die Beschreibungen von neun neuen Arten und zwei neuen Unterarten, die während der Expeditionen entdeckt wurden, sind bereits an anderer Stelle veröffentlicht worden. Mehr als 70 Arten werden erstmals für Sibirien nachgewiesen und für zahlreiche andere Arten werden die nördlichsten bzw. östlichsten bekannten Fundorte veröffentlicht.

Résumé

À la suite de six expéditions communes finno-russes en Sibérie pendant les années 1982–1991, une liste des Coleophoridae, comprenant 93 espèces, est publiée. Les descriptions de neuf nouvelles espèces et de deux nouvelles sous-espèces récoltées pendant ces expéditions ont été publiées ailleurs. Plus de 70 espèces sont rapportées pour la première fois de Sibérie et pour bon nombre d'autres espèces les localités les plus orientales ou septentrionales connues sont publiées.

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(1) Report No. 19 from the joint Finnish-Russian entomological expeditions to Siberia (Project No. 20).

The fauna of the casebearer moths (Coleophoridae) of the vast territory from the Ural Mountains to the Pacific Ocean has been largely unknown. Thus, in the recent world list of this family (Vives Moreno, 1988 : 29), Siberia was largely excluded from its area. The first species of Coleophoridae from Siberia was described nearly 120 years ago, *Coleophora lativittella* Erschoff, 1877. For a long time only a few descriptions of new species appeared (Snellen, 1884 ; Filipjev, 1925 ; Falkovitsh, 1964, 1974 ; Reznik, 1976 ; Pleshanov, 1982). Information on species described from elsewhere is presented in very few works (e.g. Tibatina, 1973 ; Ammosov, 1975 ; Reznik, 1977, 1988). In the years 1982–1991, the participants of six joint Finnish-Russian entomological expeditions collected a considerable material of casebearers in Siberia, from the Altai Mountains in the southwest to the Chukchi Peninsula in the northeast. During the study of these collections descriptions of nine new species and two subspecies were published (Falkovitsh, 1991, 1993a, 1993b). Here, a complete list of the species found during the expeditions, accomplished with some earlier and recent records from Siberia (coll. MZH) is published.

Materials and methods

Under all species, the material is divided into records from five areas which were visited during the expeditions as follows :

(A) The Altai Mts. were visited in 1982 and 1983. Altai 1 : material was collected in the year 1983 by K. Mikkola, H. Hippa and J. Jalava at about 50 N 86 E in SW Altai, Katun valley, 10 km W Katanda, 1000 to 1200 m 22.vi–27.vii ; light traps and netting were used. The habitats were floristically rich xerotherm steppe slopes, with small forests of *Betula* and *Larix*, and the fauna of Coleophoridae was very diverse and abundant. Altai 2 : two short trips were made "upstairs" to mountain tundra, 2000–2300 m Bert-kum 10–14.vii, and 7 km N Katanda 2200–2500 m 20–21.vii. Two visits were made to taiga — Altai 3 : Kuragan valley, 1000 m 6.vii. and 23–25.vii. Altai 4 : one short visit was made to N.-Altai, Lake Teletskoye, taiga, 18–22.viii.1982, from where only few specimens of Coleophoridae were caught by light-trap ; in 1990 the place was visited by Gunilla Ståhls.

(B) Novosibirsk region. The small town Akademgorodok, 30 km S from Novosibirsk, was visited in August 1982 and in June 1983 and 1984. The collecting took place in a *Pinus-Betula* forest ; for this place, only the year is given (collectors : 1982 K. Mikkola, 1983 see above, 1984 K. Mikkola & M. Viitasaari). In 1982, K. Mikkola collected for a few days at Karasuk steppe, 350 km SW of Novosibirsk.

(C) Irkutsk region. Irkutsk 1 : the vicinity of Lake Baikal (about 51 N 104 E) was visited in 1984 by K. Mikkola and M. Viitasaari. Light traps were used south of Lake Baikal near the town Sludyanka on 6 & 7.vii on a habitat with meadows and *Betula* and a bog with *Ledum* ; and 8–31.vii 50 km east of the town of Sludyanka, at an elevation of 500–600 m, on a burned taiga with *Picea-Betula*. Irkutsk 2 denotes the Khamar-Daban Mts., at elevations of 1450 to 2000 m 14–28.vii, habitats from taiga to mountain tundra. Irkutsk 3 : collecting took place 1–3.viii.1984 with light traps on a steppe slope 40 km NE of Irkutsk.

(D) Magadan region. The materials were collected by K. Mikkola with light traps in July 1987 at and near Aborigen Biological Station, Upper Kolyma River in the Magadan oblast, at elevations from 400 to 1250 m in *Larix* forests, on scree slopes and mountain tundra. In 1990 the students J. Kullberg, M. Kuussaari and M. Nieminen visited the Magadan region.

(E) Chukchi aut. okrug. (autonomous area) was visited by K. Mikkola in July 1989 (Anadyr River) and in July 1991 (the extreme southeast of Chuckhi Peninsula near Provideniya at the Bering strait).
Additional records (materials in coll. MZH). J. G. Granö collected 1901–1905 in Roskovka, 13 km E of Omsk, River Om. Yu. Ammosov collected in Yakutia, near the town Yakutsk in the 1970's.
The records are presented in this order under each species. The material is deposited mainly in the Finnish Museum of Natural History, Helsinki (MZH) ; the holotypes of the new species and parts of the other material are deposited in the Zoological Institute, St. Petersburg (ZIN).

Systematic list

An asterisk * in front of the species name means that the species is described after this material.

Coleophora albella (Thunberg, 1788) (= *leucapennella* (Hübner, 1796). Novosibirsk : 1983, 2 ♂♂, 2 ♀♀ ; 1984, 1 ♂. Range : Europe, N-Africa, Asia Minor, SW-Siberia.

C. milvipennis Zeller, 1839. Novosibirsk : 1984, 7 ♂♂ ; Irkutsk 1 : 3 ♂♂. Range : Transpalaearctic.

C. siccifolia (Stainton, 1856). Altai 1 : 1 ♂, 1 ♀, 22vi.–8.vii ; Novosibirsk : 1984, 1 ♂. Range : Europe, W Siberia.

C. gryphipennella (Hübner, 1796). Altai 1 : 2 ♂♂, 22.vi–8.vii ; Irkutsk 1 : 3 ♂♂, 1 ♀ ; 2 : 1 ♂ ; Magadan : 1 ♂, 22.vii. Range : Transpalaearctic.

*C. *katunella* (Falkovitsh, 1991). Altai 1 : 21 ♂♂, 28.vi–27.vii. Range : known only from the type locality, Katun valley.

C. *serratella* (Linnaeus, 1761) (=*fuscedinella* Zeller, 1849). Novosibirsk : 1984, 8 ♂♂ ; Irkutsk 1 : 2 ♂♂. Range : Holarctic.

C. *orbitella* Zeller, 1849. Altai 1 : 6 ♂♂, 1 ♀, 22.vi–8.vii. Range : Europe, W Siberia.

C. *unigenella* Svensson, 1966. Altai 2 : 1 ♂, 21.vii on an alpine *Dryas* meadow. Range : described from northern Fennoscandia, reported also from Austria (Huemer & Tarmann, 1993) ; an arcto-alpine species.

C. *obscuripalpella* Kanerva, 1941. Irkutsk 2 : 1 ♂. Range : formerly known only from Fennoscandia ; probably Transpalaearctic in the taiga zone.

C. *idaeella* Hofmann, 1869. Altai 3 : 1 ♂, 23.–25.vii ; Irkutsk 1 : 3 ♂♂ ; 2 : 2 ♂♂. Range : a boreomontane species, northern and central Europe ; S-Siberia eastward to the Baikal Area.

C. *ledi* Stainton, 1860. Irkutsk 1 : 4 ♂♂, 2 ♀♀ ; 2 : 1 ♂. Range : Holarctic.

C. *vitisella* Gregson, 1856. Magadan 20 km N, 800–1200m 1 ♀, 2.vii.1990, Kullberg, Kuussaari & Nieminen leg. Range : Transpalaearctic.

C. *glitzella* Hofmann, 1869. Irkutsk 1 : 8 exx. ; 2 : 4 ♂♂ ; Magadan : 10 ♂♂, 15.–23.vii. Range : Transpalaearctic.

C. *murinella* Tengström, 1848. Irkutsk 1 : 1 ♂. Range : N Europe, Siberia eastward to the Baikal Area.

C. *sibiricella* Falkovitsh, 1965. Altai 1 : ca 70 exx., 28.vi.–19.vii. Range : Finland, NW Russia, Siberia eastward to the Baikal Area.

C. *sp.* (without abdomen) Altai 1 : 1 ♂, 15–19.vii.

C. *albicostella* Duponchel, 1843. Altai 1 : 4 ♂♂, 22.vi.–8.vii. Range : Europe, Asia Minor, SW Siberia, Mongolia.

C. *vulpecula* Zeller, 1849. Altai 1 : 1 ♂, 15–19.vii. Range : Europe, Asia Minor, SW Siberia.

C. *sergiella* Falkovitsh, 1979. Altai 1 : 34 ♂♂, 22.vi–19.vii. Range : Altai, Tuva, Mongolia ; recorded also from Austria (Baldizzone, 1981) and Mt. Ventoux in southern France (Baldizzone *et al.*, 1981).

C. *gallipennella* (Hübner, 1796). Altai 1 : 2 ♀♀, 15–19.vii ; Novosibirsk : 1984 15 exx. Range : Europe, Asia Minor, SW Siberia, Mongolia.

*C. *lacera* (Falkovitsh, 1993). Altai 1 : 3 ♂♂, 5 ♀♀, 22.vi–5.vii ; Novosibirsk : 1983 3 ♂♂. Range : the steppe zone of the European part of Russia and W Siberia.

C. *dignella* Toll, 1961. Altai 1 : 4 ♂♂, 1 ♀, 22.vi–8.vii. Range : S Europe, Asia Minor, N Kazakhstan, SW Siberia.

C. spargospinella Reznik, 1974. Altai 1 : 1 ♂, 28.vi–5.vii. Range : Altai and Mongolia. This and the following nine species were published by Reznik (1988).

C. tshiligella Reznik, 1976. Altai 1 : 48 exx., 28.vi–19.vii. Range : steppe zone from S Ural to Altai.

C. fuscociliella Zeller, 1849 (= *medicaginis* Herrich-Schäffer, 1861). Altai 1 : 4 ♂♂, 28.vi–8.vii. Range : Europe, Caucasus, Asia Minor, SW Siberia.

C. caelebipennella Zeller, 1839. Altai 1 : 4 ♂♂, 28.vi–19.vii ; 3 : 1 ♂, 23–25.vii. Range : Transpalaearctic.

C. solenella tariata Reznik, 1975. Altai 1 : 52 exx., 6.–27.vii. ; Irkutsk 3 : 1 ♂. Range : steppes of S Siberia and Mongolia. The nominate subspecies in S Europe.

C. conspicuella Zeller, 1849. Altai 1 : 1 ♂, 26–27.vii. Range : Transpalaearctic.

C. inconstans Reznik, 1975. Altai 1 : 1 ♂, 22–27.vi ; 2 : 1 ♂, 10–14.vii. Range : Altai and Mongolia.

C. ditella Zeller, 1849. Altai 1 : 3 ♂♂, 22.vi–5.vii. Range : Europe, Asia Minor, SW Siberia, Mongolia.

C. vibicigerella Zeller, 1839. Altai 1 : 30 exx., 22.vi–8.vii. Range : Transpalaearctic.

C. partitella Zeller, 1849. Altai 1 : 1 ♂, 28.vi–5.vii. Range : Europe, Asia Minor, Caucasus, SW Siberia.

C. sp. (pr. *oriolella* Zeller, 1848). Altai 1 : 1 ♀, 26.vii.

C. hospitiella Chrétien, 1915. Altai 1 : 1 ♂,1 ♀, 6–8.vii. Range : S Europe, N Africa, Uzbekistan, Iran, Afganistan, steppe zone of W Siberia.

C. deauratella Lienig & Zeller, 1846. Altai 1 : 16 exx., 21.vi–8.vii ; Novosibirsk : 1983 1 ♂, 1984 3 ♂♂ ; Irkutsk 1 : 1 ♂ ; 3 : 2 ♂♂. Range : Holarctic ; introduced in N America (Landry, 1991).

C. trifolii (Curtis, 1832). Altai 1 : 2 ♂♂, 28.vi–19.vii ; Novosibirsk : 1984 1 ♂ ; Irkutsk 3 : 1 ♂. Range : Holarctic ; introduced in N America (Landry & Wright, 1993).

C. pustulosa Falkovitsh, 1979. Irkutsk 3 : 2 ♂♂. Range : the Baikal Area area and Mongolia.

C. alcyonipennella (Kollar, 1832). Altai 1 : 1 ♂♂, 1 ♀, 6–8.vii ; Novosibirsk : 1984 10 exx. ; Irkutsk 3 : 1 ♂ ; Yakutia : Pokrovsk near Yakutsk, 1 ♂, 1.viii.1980, Yu. Ammosov leg. Range : Transpalaearctic ; introduced in Australia and New Zealand.

C. albidella (Denis & Schiffermüller, 1775). Altai 1 : 28 exx., 28.vi–19.vii ; 3 : 1 ♂, 23–25.vii ; Novosibirsk : 1984 1 ♂. Range : Transpalaearctic.

C. bernoulliella (Goeze, 1783) [= *anatipennella* (Hübner, 1796)]. Altai 1 : 9 exx., 28.vi–19.vii. Range : Europe, S Siberia, Mongolia.

C. currucipennella Zeller, 1839. Novosibirsk : 1984 1 ♂. Range : Transpalaearctic.

C. serpylletorum E. Hering, 1889. Altai 1 : 16 ♂♂, 2 ♀♀, 28.vi–19.vii. Range : Europe, S Siberia.

**C. halepa* (Falkovitsh, 1993). Altai 1 : 1 ♂, 22–27.vii. Range : known only from the type locality, Katun valley.

C. sp. (pr. *ptarmicia* Walsingham, 1910) Altai 1 : 1 ♂, 15–19.vii.

C. sp. *ornatipennella*-group. Altai 1 : ca 60 exx., 28.vi–27.vii. The specimens from Altai agree rather well with the description of *C. nevadella* from Spain by Baldizzone, 1985, but as we are dealing with a very difficult species-group, we leave the question open for the time being.

C. ornatipennella (Hübner, 1796). Omsk 1 ♀ in the 1900's, J. G. Granö leg. Range : Europe, Asia Minor, Turkmenistan, SW Siberia.

C. ballotella Fischer v. Rösslerstamm, 1839. Novosibirsk : 1984 1 ♂. Range : Central and S Europe, Asia Minor, S Siberia eastward to Altai.

C. pulmonariella Ragonot, 1874. Altai 1 : 1 ♂, 22–27.vi. Range : Europe, S Siberia eastward to Altai.

C. lineolea (Haworth, 1828). Altai 1 : 2 ♂♂, 22.vi–5.vii. Range : Europe, S Siberia eastward to Altai.

C. chalcogrammella Zeller, 1839. Altai 1 : 3 ♂♂, 22–27.vii. Range : Europe, S Siberia eastward to Altai.

C. lativittella Erschoff, 1877. Altai 3 : 1 ♂, 23–25.vii ; Irkutsk 3 : 4 ♂♂. Range : steppes of S Siberia and Mongolia.

C. salicorniae (Heinemann & Wocke, 1877) Novosibirskaya oblast : 350 km SW Novosibirsk, Karasuk steppe, 1 ♂, 25–28.viii.1982, K. Mikkola leg. Range : Europe, Novosibirskaya oblast, Central Asia.

C. artemisicolella Bruand, 1855. Altai 1 : 1 ♂, 28.vi–5.vii ; 3 : 1 ♂, 15.vii ; Irkutsk 3 : 1 ♂ ; Magadan : 1 ♂, 15.vii, scree slope, 1 ♂, 3.viii, steppe slope. Range : Transpalaearctic.

**C. exul* (Falkovitsh, 1992). Magadan : 1 ♀, 8.vii. 1250 m mountain tundra. Range : known only from the type locality.

C. adelogrammella Zeller, 1849 (= *separatella* Benander, 1939). Magadan : Aborigen st., N-steppe slope 1 ♂, 5.vii.1990, Kullberg, Kuussaari & Nieminen leg. Range : Europe, Asia Minor, E Siberia.

C. moronella Falkovitsh, 1975. Altai 2 : 1 ♂, 10–14.vii. 2500 m. Range : Altai, Mongolia.

C. derasofasciella Klimesch, 1952. Chukchi Pns. : 45 km N Provideniya, Pestsovaya river valley, 1 ♂, 10.vii.1991, K. Mikkola leg. Range : formerly known only from Austria, apparently an arcto-alpine species.

C. directella Zeller, 1849. (ssp.?) Altai 4 : 2 ♂♂, 18–22.viii ; Irkutsk 3 : 1 ♂. Range : Europe, S Siberia eastward to the Baikal Area and Mongolia.

C. argentula (Stephens, 1834). Altai 1 : 10 ♂♂, 1 ♀, 28.vi–19.vii ; Novosibirsk : 1984 1 ♂. Range : Europe, Asia Minor, S Siberia eastward to Altai.

**C. microdon* (Falkovitsh, 1993). Altai 1 : 1 ♂, 15–19.vii. Range : known only from the Altai Mountains.

C. ramosella Zeller, 1849. Altai 2 : 1 ♂, 10–14.vii. Range : Europe, S Siberia eastward to Altai.

**C. diplodon* (Falkovitsh, 1993). Altai 3 : 1 ♂, 23–25.vii ; Irkutsk 3 : 1 ♂. Range : S Siberia from Altai to the Baikal Area.

**C. zygodon* (Falkovitsh, 1993). Altai 1 : 1 ♂, 26–27.vi. Range : known only from Altai.

**C. loxodon* (Falkovitsh, 1993). Altai 1 : 1 ♂, 1 ♀, 22.vi–5.vii. Range : known only from Altai.

C. discifera Falkovitsh, 1976. Irkutsk 3 : 2 ♂♂. Range : steppes of the Baikal area and Mongolia.

C. paripennella Zeller, 1839 (= *aereipennis* auct.). Altai 2 : 2 ♂♂, 10–14.vii ; 4 : 3 ♂♂, 11–17.vi.1990, Malaise-trap, G. Ståhls leg. ; Irkutsk 3 : 1 ♂. Range : Europe, S Siberia eastward to the Baikal Area.

C. silenella Herrich-Schäffer, 1855. Altai 1 : 22 exx., 28.vi–27.vii. Range : Transpalaearctic.

C. ciconiella Herrich-Schäffer, 1855. Altai 1 : 2 ♂♂, 6–8.vii. Range : Europe, S Siberia eastward to Altai.

C. nutantella Mühlig & Frey, 1857. Altai : Gorno-Altaisk 1 ♂, 21.vi.1983 ; Novosibirsk : 1984 2 ♂♂, 1 ♀. Range : Europe, Asia Minor, S Siberia to Altai.

C. dianthi Herrich-Schäffer, 1855. Altai 1 : 15 exx., 22.vi–19.vii. Range : Europe, Asia Minor, Iraq, S Siberia to Altai.

C. palifera Falkovitsh, 1977. Altai 1 : 3 ♂♂, 28.vi–19.vii. Range : Altai and Mongolia.

C. darigangae Falkovitsh, 1976. Altai 1 : 1 ♂, 15–19.vii ; Magadan : 1 ♂, 3.viii. Range : eastern Palaearctic, westward to Altai.

C. striatipennella Nylander, 1848. Altai 3 : 1 ♂, 6.vii ; 1 ♂, 23–25.vii ; Gorno-Altaisk 1 ♂, 21.vi ; Novosibirsk : 1984 6 ♂♂ ; Magadan : Mys Ostrovnyj (20 km W Magadan), 1 ♂, 3.vii.1990, J. Kullberg, M. Kuussaari & M. Nieminen leg. Range : Transpalaearctic.

C. clarissa Falkovitsh, 1977. Altai 1 : 4 ♂♂, 27.vi–27.vii. Range : Altai and Mongolia, recorded also from Portugal (Vives Moreno, 1987).

**C. spiralis provecta* (Falkovitsh, 1993). Altai 1 : 3 ♂♂, 15–19.vii. The nominate subspecies is distributed in Mongolia.

**C. asteris abbreviata* (Falkovitsh, 1993). Irkutsk 3 : 5 ♂♂. The nominate subspecies occurs in Europe.

C. therinella Tengström, 1848. Altai 1 : 17 exx., 28.vi–27.vii ; 3 : 1♂, 23–25.vii. ; 4 : 1 ♂ ; Irkutsk 3 : 3 ♂♂ ; Yakutia : Elanka 136 km S Yakutsk, 1 ♂, 8–11.viii.1979, Yu. Ammosov leg. Range : Transpalaearctic.

C. monoceros Falkovitsh, 1975. Altai 2: 2 ♂♂, 20.vii ; 3 : 2 ♂♂, 23–25.vii ; Irkutsk 1 : 1 ♂. Range : Altai, the Baikal area, Mongolia.

C. pandionella Baldizzone, 1988. Altai 1 : 1 ♂, 5 ♀♀, 28.vi–19.vii. Range : Altai and Amur area.

**C. subula* (Falkovitsh, 1993). Altai 1 : 6 ♂♂, 6–21.vii. Range : known only from Altai.

**C. kolymella* (Falkovitsh, 1992). Magadan : 1 ♂, 14.vii, 600 m, scree slope. Range : known only from the type locality.

C. pseudolinorysis Kasy, 1979. Novosibirskaya oblast : 350 km SW Novosibirsk, Karasuk steppe, 1 ♂, 1 ♀, 25–28.viii.1982, K. Mikkola leg. ; Irkutsk 1 : 1 ♂. Range : C Europe, Kazakhstan, S Siberia eastward to the Baikal Area.

**C. bajkalella* (Falkovitsh, 1993). Altai 4 : 1 ♂, 18–25.vi.1990, Malaise-trap, G. Ståhls leg. ; Irkutsk 1 : 1 ♂. Range : S Siberia from Altai to the Baikal Area.

C. hsiaolingensis Toll, 1942. Irkutsk 3 : 4 ♂♂. Range : the Baikal Area, Mongolia, N China.

C. sternipennella (Zetterstedt, 1839). Altai 1 : 2 ♂♂, 1 ♀, 5–19.vii ; 3 : 1 ♂, 23–25.vii. Range : Europe, Caucasus, W Siberia.

C. sittella Baldizzone, 1989 (ssp.?). Altai 1 : 18 exx., 28.vi–27.vii ; 2 : 1 ♂, 23–25.vii. The species is described from SE China.

C. versurella Zeller, 1849. Altai 1 : 1 ♂, 3 ♀♀, 28.vi–19.vii. Range : Holarctic ; recorded also from Argentina.

C. motacillella Zeller, 1849. Altai 1 : 2 ♂♂, 28.vi–19.vii. Range : Europe, SW Siberia eastward to Altai.

C. vestianella (Linnaeus, 1758) [= *laripennella* (Zetterstedt, 1839)] Altai 1 : 1 ♀, 28.vi–5.vii ; 3 : 1 ♂, 23–25.vii ; 4 (abundant) ; Irkutsk 1, 2, 3 ; Yakutia : Elanka, Yu. Ammosov leg. (seems to be widely common). Range : Transpalaearctic.

C. virgaureae Stainton, 1857 Altai 2 : 1 ♂, 10–14.vii. ; Irkutsk 1 : 2 ♂♂ ; 2 : 4 ♂♂. Range : Europe, Caucasus, Kazakhstan, Siberia eastward to the Baikal area.

C. squamosella Stainton, 1856 (= *erigerella* Ford, 1935) Altai 4 : 1 ♂, 18–25.vi.1990, Malaise-trap, G. Ståhls leg. ; Irkutsk 3 : 1 ♂ ; Chukchi aut. okrug. : Anadyr r., Markovo, 1 ♂ 7–12.7.1989. Range : Transpalaearctic.

C. alticolella Zeller, 1849 (= *caespititiella* auct.) Altai 4 : 1 ♂, 18–25.vi.1990, Malaise-trap, G. Ståhls leg. ; Chukchi aut. okrug. : Anadyr airp., 1 ♂, 6.vii.1991. Range : Holarctic.

C. glaucicolella Wood, 1892 Novosibirsk : 1984 1 ♂. Range : Holarctic.

C. otidipennella (Hübner, 1817) [= *murinipennella* (Duponchel, 1844)]. Altai 2 : 1 ♂, 20–21.vii ; 4 : 3 mm 11–28.vi.1990, Malaise-trap, G. Ståhls leg. Range : Europe, W Siberia.

Discussion

Before this study, only about 20 species of casebearers were known from Siberia. Hence, an overwhelming majority of the 93 species reported here is recorded from Siberia for the first time. About 20 species are mentioned for the first time from Russia. The results of this study clearly indicate that the proportion of Westpalaearctic (from Europe to Southern Siberia) or even transpalaearctic species within the family Coleophoridae is higher than supposed before. These may be, by and large, divided into the following groups :

1. Arcto-alpine species : *C. unigenella* (Northern Fennoscandia and Altai) and *C. derasofasciella* (Austria and Chuckhi Pns.), both feeding on *Dryas*.
2. Boreomontane forest (mainly taiga) species : *C. ledi*, *C. obscuripalpella*, *C. glitzella*, *C. murinella*, *C. vitisella*, *C. idaeella*, all living on Ericaceae ; as well as many species living on deciduous trees e.g. *Betula* and *Salix* : *C. milvipennis*, *C. serratella*, *C. albidella* and others. To this group belong also some species living on herbaceous plants of the forest meadows, e.g. *C. virgaureae* on *Solidago* and *C. silenella* on *Silene* and *Viscaria*.
3. Species living on weeds : e.g. *C. vestianella* and *C. versurella* on *Chenopodium* and *C. artemisicolella* on *Artemisia vulgaris*.
4. Some species are associated with the flora of moist soils, e.g. *C. alticolella* and *C. glaucicolella*, both feeding on *Juncus*.

The main part of the material for this study originates from the Altai mountains. From the zoogeographical point of view, this region is very interesting, as it is situated near the River Yenisei — the real borderline between the Eastern and Western Palaearctic zones. The close neighbourhood of the steppes of Mongolia and the taiga and alpine elements give richness and diversity to the insect fauna of the Altai. 80 species of Coleophoridae (76 of these identified to nominal species) are so far recorded from Altai. According to their distribution types, these can be grouped as follows :

1. Transpalaearctic or Holarctic — 19 spp.
2. Eurosiberian with distribution eastward to Altai (this group includes some "true" steppe species) — 26 spp.
3. Eurosiberian with distribution eastward to the Lake Baikal Area — 13 spp.
4. East-Siberian (from Far-East westward to S Siberia) — 3 spp.
5. S Siberian-Mongolian (mainly eastern steppe species) — 15 spp. (six of them known only from the Altai).

Thus, very widely distributed — Transpalaearctic or wider — casebearers form about a quarter (25 %) of the Altai fauna. Another quarter (24 %) consists of species of eastern distribution ; the remaining half (51 %) consists of Western Palaearctic species. So far we have only moderate knowledge of the casebearer fauna of the Altai, but we can already say that a very great part of the species has a western distribution.

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Eine neue *Scopula*-Art aus Transbaikalien (Geometridae)

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Summary

A new Geometrid species from the Transbaikal region, *Scopula agutsaensis* sp. n., is described and illustrated.

Zusammenfassung

Eine neue Geometriden-Art aus Transbaikalien, *Scopula agutsaensis* sp. n., wird beschrieben und abgebildet.

Résumé

Une nouvelle espèce de géomètre de Transbaikalie, *Scopula agutsaensis* sp. n., est décrite et illustrée.

Scopula Schrank, 1802, Fauna boica 2 (2) : 162.

Typ : *Pyralis paludalis* Schrank, 1802, Fauna boica 2 (2) : 62 (= *Scopula ornata* (Scopoli, 1763)) durch Prout, 1906, *Entomologist* 39 : 266.

Charakterisiert durch das Vorhandensein einer freistehenden Mappa mit Cerata am achten Hinterleibssegment wie bei einigen anderen Genera. Kritische Betrachtungen über die generischen Unterschiede bei Sterneck (1940 : 199–208).

Scopula agutsaensis sp. n.

Typenmaterial. Holotyp ♂ und 1 Paratyp ♂, Naturschutzgebiet Sokhondo : Agutza, 24.VI.1991, leg. Dubatolov, in coll. Zool. Museum des Institutes für Systematik und Ökologie, Novosibirsk.

Präzisierung des Fundplatzes : Russland : südliches Transbaikalien : Chitragebiet (der Fundplatz 42 km in Richtung ONO vom Dorf Kyra).

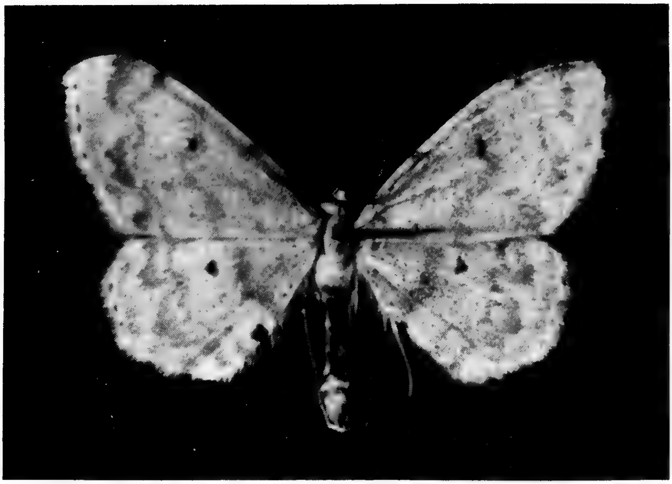

Abb. 1. *Scopula agutsaensis* sp. n. Holotyp ♂. 4 ×

BESCHREIBUNG. *Männchen* (Abb. 1). Vorderflügellänge 11–12 mm. Der Kopf dunkelbraun, dessen Scheitel und Rücken jedoch ockergelb. Die Palpen lang und flach, unten und seitlich mit eingemischten weisslichen Schuppen. Die Länge der Palpen gleich dem Augendurchmesser. Die Fühler ockergelb, Glieder schwach gezähnt, mit je zwei Paaren von Wimpern. Thorax und Abdomen ockergelb. Die Hintertibien leicht verdickt, mit Haarpinseln, ohne Sporen. Die Länge der Hintertarsen gleich der Länge der Hintertibien. Die Flügel oben und unterseits goldglänzend ockergelb mit Beimischung von zerstreuten rußig braunen Schuppen. Die Fransen ockergelb, an den Adern weisslich, in der vorderen Flügelhälfte mit dunklen Strichen längs dem Aussenrande. Die Flügelzeichnung braun, an den Vorderflügeln bestehend aus einer antemedianen Querlinie, an der Costa durch einen Flecken (Costalfleck) angedeutet, sonst kaum erkennbar einer medianen Linie in Form eines unscharfen, schmalen Bandes einer postmedianen Linie in Form eine scharfen, leicht gewellten Linie mit Costalfleck und distal davon mit einem an zwei Stellen unterbrochenem Schatten ; einer schwachen Subterminallinie längs dem Aussenrand (Termen) ; an den Hinterflügeln aus einer medianen Linie, einer postmedianen Linie mit Schatten und einer Subterminallinie wie an den Vorderflügeln ; ein deutlicher Diskalpunkt auf allen Flügeln.

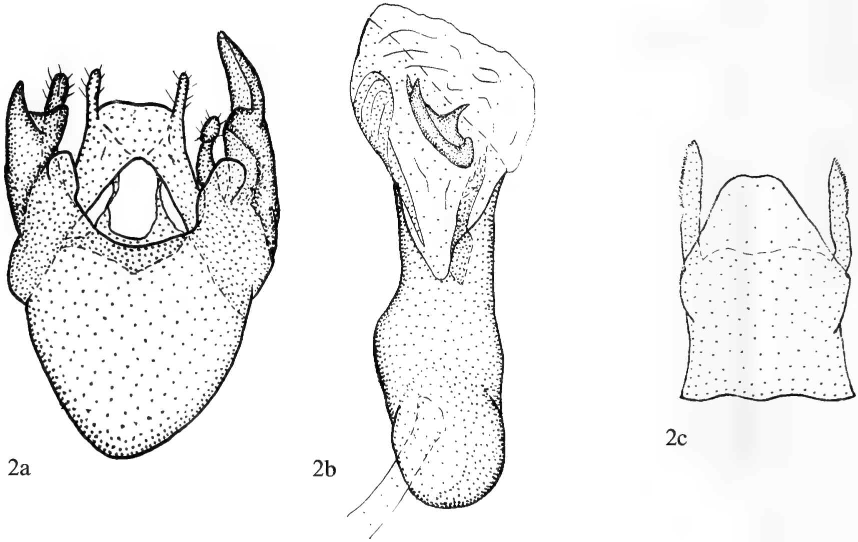

Abb. 2. *Scopula agutsaensis* sp. n. Holotyp, Genitalien. — 2a. Hauptstruktur (Links in der Abbildung ist rechts am Exemplar). — 2b. Aedeagus. — 2c. Cerata mit Mappa.

Männliche Genitalien (Abb. 2). Der Saccus elliptisch, die Socii kurz, deren Abstand grösser als deren Länge, die Hauptstruktur (Abb. 2a) der neunten und zehnten Abdominalsegmente sonst unsymmetrisch wegen der längeren Valva und kürzeren Fibula an der linken Seite ; die linke Valva löffelförmig, die rechte backenzahnförmig ; die Fibulae schwarz an der Spitze ; am Aedeagus (Abb. 2b) das Verhältnis der Länge zur Breite des Rohres gleich 4.3, entsprechend der Form 1 "Kurzpenis" bei Sterneck (1940 : 13, 214) da kleiner als 5, die Öffnung des Rohres schräg und lang ; die Vesica mit einem länglichen Cornutus mit einem seitlich gerichteten Dorn ; die Cerata (Abb. 2c) von mäßiger Länge, deren Basis (Sterneck, 1941 : 20) annähernd quadratisch, links und rechts im caudalen Teil leicht nach aussen gewölbt, ohne Vorsprung in oraler Richtung.

Weibchen. Unbekannt.

DIAGNOSE. Im Habitus sehr ähnlich *Scopula limbata* (Wileman, 1915), die Genitalien jedoch verschieden. Die Verbreitung von *S. limbata* erstreckt sich auf die Inseln Formosa, Yakushima, Amamioshima, Takunoshima und Hainan (Inoue, 1932). Wegen der Form des Aedeagus (Form 1 bei Sterneck) und das vorhandensein eines einzigen Cornutus

(„Stachel“ bei Sterneck, 1940 : 214) kann *Scopula agutsaensis* sp. n. in die Gruppe 1 von *Scopula* im System von Sterneck (1941 : 27–28) eingefügt werden.

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The chromosomes of *Erebia ligea rishirizana* (Nymphalidae, Satyrinae)

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Summary

The chromosome number of *Erebia ligea rishirizana* males from Hokkaido, Japan is 56 in diploid (brain cells and spermatogonia) and 28 in haploid (primary and secondary spermatocytes), while 29 chromosomes have been counted in the first division of *E. ligea* females from Finland (Federley, 1938).

Zusammenfassung

Die Chromosomenzahl bei *Erebia ligea rishirizana* Männchen von Hokkaido, Japan, ist 56 in diploidem (Zellen des ZNS und Spermatogonien) und 28 in haploidem Zustand (Spermatocyten I. und II. Ordnung), während 29 Chromosomen in der ersten Reifeteilung bei *E. ligea* Weibchen aus Finnland ermittelt worden waren (Federley, 1938).

Résumé

Le nombre de chromosomes chez des mâles de *Erebia ligea rishirizana*, en provenance de Hokkaido au Japon, est de 56 à l'état diploïde (cellules du cerveau et spermatogonies) et de 28 à l'état haploïde (spermatocytes de premier et de deuxième ordre), alors que 29 chromosomes ont été comptés en première division chez des femelles de *E. ligea* de Finlande (Federley, 1938).

The genus *Erebia* (Nymphalidae Satyrinae) comprises a good many taxa karyologically examined. Previously, Federley (1938) reported the occurrence of 29 bivalents in females of *Erebia ligea* (Linnaeus, 1758) from Finland, though no chromosome figures of them are shown. As well known, this species ranges widely from Europe to the Far Eastern regions of Asia. In Japan, two subspecies are found : *E. ligea rishirizana* Matsumura, 1928 in Hokkaido and *E. ligea takanonis* Matsumura, 1909 in Central Honshû. Recently, we have had the opportunity to examine karyologically the former subspecies from Japan. The results of this chromosome examination are described below.

Material and methods

Adult females caught on a woodland path through Muri-dake (Mt. Muri) of Hokkaido, Japan laid eggs. Laboratory-reared pupae and larvae were exclusively used for the present chromosome examination.

Both brains and testes were taken out from all males, and the brains from females too. All of the brains and some of the testes were fixed in Carnoy (3 : 1). These were carefully acid-dissociated and air-dried. Chromosome spreads of these preparations were stained with Giemsa (4 %). Other testes were squashed with lacto-acetic orcein for the examination of spermatocyte chromosomes.

Observations and remarks

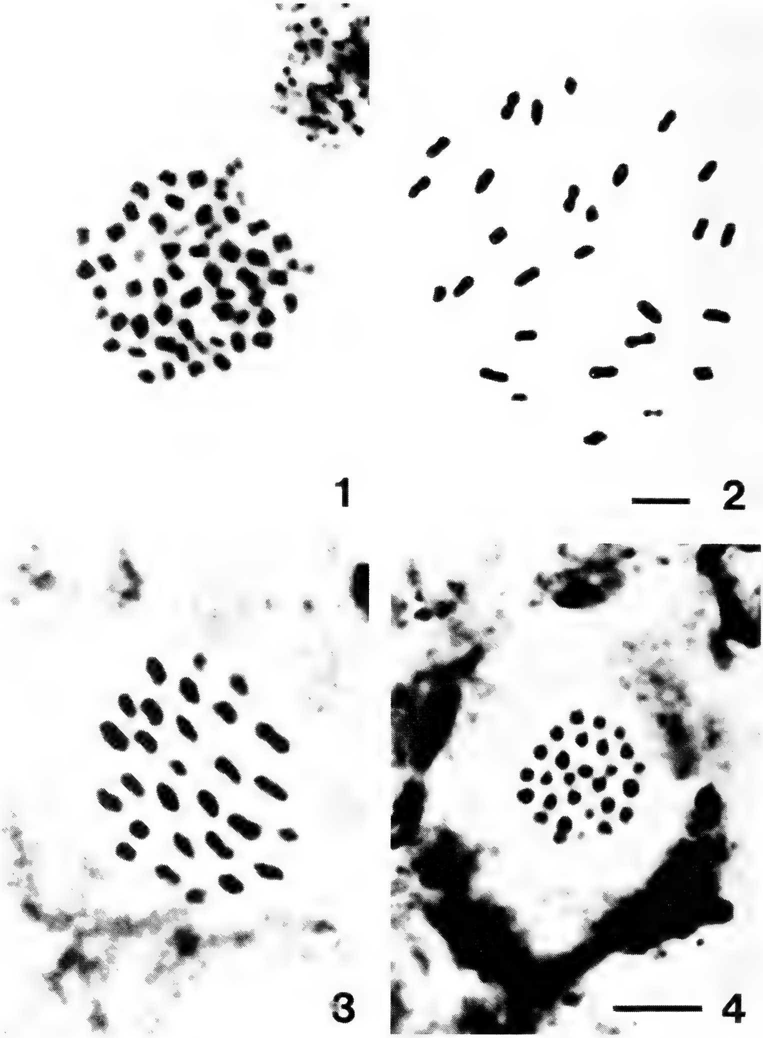
Chromosomes were successfully observed in males. Both diploid and haploid chromosome numbers, 56 and 28, were determined with certainty in the acid-dissociated preparations (figs 1, 2) ; counts were made in metaphases of thirteen brain cells and thirty spermatogonia, and in those of twenty-six primary spermatocytes and twenty-four secondary spermatocytes from five mature final instar larvae.

The haploid chromosome number, 28, was confirmed also with testis-squashes (figs 3, 4) ; counts were made in metaphases of 409 primary spermatocytes and 118 secondary spermatocytes from three pupae and three young final instar larvae. Variation in the haploid number was not observed.

From these findings, it is safe to conclude that the males of this subspecies have a $2n$, 56 ; n, 28 karyotype.

In fig. 1, a spermatogonial metaphase (2n, 56) is shown as a representative of the diploid complements examined. The haploid complements in the first and second divisions (n, 28) are shown in figs 2, 3, 4. As evident from these, the haploid chromosomes are round, or somewhat oval in shape in polar view. The chromosomes which are remarkable in behaviour are not observed in the present material.

It has thus become evident that *E. ligea* from Finland (n, 29) and *E. ligea rishirizana* (n, 28) examined here differ from each other in their chromosome constitution. Therefore, a comparison of their chromosome complements is indispensable for phyloanalysis of *E. ligea* and its subspecies. Consequently, a karyological re-examination of *E.*



Figs 1–4. Diploid and haploid germ-line chromosomes of *Erebia ligea rishirizana* males. 1 & 2. Chromosome complements from acid-dissociated testes (Giemsa) : 1 — Spermatogonial mitosis (2*n*, 56) ; 2 — First division (*n*, 28). Scale bar : ca. 5 m.
3 & 4. Haploid chromosome complements from testis-squashes (Orcein) : 3 — First division (*n*, 28) ; 4 — Second division (*n*, 28). Scale bar : ca. 5 m.

ligea from Finland is necessary, because, as stated above, mention was made of its haploid number alone (Federley, 1938).

On one hand, another subspecies in Japan, *E. ligea takanonis* still remains unexplored karyologically. We are intending to examine its chromosomes in the nearest future.

The congener in Japan, *E. niphonica* Janson, 1877 has a quite distinct karyotype of 2*n*, 38 ; *n*, 19 (male) (Saitoh, 1988 ; 1989 ; Saitoh *et al.*, 1991a, b). Therefore, the inquiry into the chromosome complement is one of the reliable ways to discern these two Japanese taxa of *E. ligea rishirizana* and *E. niphonica.*

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Ist der Kleine Fuchs, *Aglais urticae* (Nymphalidae), in Zukunft gefährdet?

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Summary

In 1993-1995 the Small Tortoiseshell — *Aglais urticae* (Linnaeus, 1758) population strongly declined in all explored lowlands and hilly areas of the Slovak Republic. The butterfly formerly was more frequent in the mountain areas above 1000 m but now its population is certainly decreased. Decline of this well-known species is discussed.

Zusammenfassung

Nach faunistischen Untersuchungen, die in letzten Jahren in den meisten Landesteilen der Slowakei durchgeführt wurden, konnte ein Rückgang von *Aglais urticae* (Linnaeus, 1758) sowohl in seiner Ausbreitung als auch in seiner Populationsdichte festgestellt werden. Dabei waren Populationen im Flachland und in mittleren Gebirgslagen stärker betroffen als Populationen in Gebirgslagen über 1000 m Höhe. Sollte sich der beobachtete Trend fortsetzen, so ist zu beführchten, daß *A. urticae* bereits in wenigen Jahren zu der gefährdeten Fauna der Slovakei gehören wird.

Résumé

En 1993-1995 la population de la Petite Tortue — *Aglais urticae* (Linnaeus, 1758) a fortement décliné dans toutes les régions basses et collinéennes de la République Slovaque. Le papillon était plus fréquent dans les régions montagneuses à plus de 1000 m d'altitude, mais là aussi les nombres ont reculés. Le déclin de cette espèce bien connue est commenté.

Einleitung

Der Kleine Fuchs — *Aglais urticae* (Linnaeus, 1758) war bisher in ganz Europa weit verbreitet (Higgins & Riley, 1978). Er wurde besonders in Mitteleuropa häufig gefunden und kommt dort nach verschiedenen Autoren (Seitz, 1906 ; Spuler, 1908 ; Joukl, 1910 ; Lampert, 1923 ; Schwarz, 1949 ; Blab & Kudrna, 1982 ; Geiger, 1991) in den unterschiedlichsten Biotopen vor. In der Slowakei wurde *A. urticae* an recht zahlreichen Lokalitäten vom Flachland bis zu den Hochgebirgslagen festgestellt (Hrubý, 1964). Somit dürfte es sich bei *A. urticae* um einen weit verbreiteten und nicht bedrohten Tagfalter handeln (Kulfan & Kulfan, 1991).

Material und Methoden

Vorkommen und Abundanz von *A. urticae* wurden während unserer entomologischen Forschungen in mehreren Gebieten der Slowakei untersucht. Bei der Erfassung von *A. urticae* wurde die Transektmethode verwendet (Erhardt, 1985).

Regelmäßige Untersuchungen wurden in folgenden Regionen durchgeführt : Westslowakei — Niederung Borská nížina (136-160 m, 1990-1995), Podunajská rovina (Donau Ebene) (112-132 m, 1984-1995), Südwestslowakei — Levice und Umgebung (171-274 m, 1988-1995), Mittelslowakei — Zvolen und Umgebung (300-600 m, 1986, 1994-1995), Pol'ana Gebirge (500-1300 m, 1987-1989), Nordslowakei — Umgebung des Flusses Váh (Waag) zwischen den Orten Žilina und Strečno (320-350 m, 1992-1995) und Malá Fatra Gebirge (600-1610 m, 1982, 1991). Zusätzlich haben wir 1995 in den Gebirgen Pol'ana, Malá Fatra und Vysoké Tatry (Hohe Tatra) einige Sammelreisen durchgeführt.

Ergebnisse

In der Niederung Borská nížina kam *A. urticae* in den Jahren 1990-1992 regelmäßig vor. Die höchste Individuenzahl wurde in der Nähe von Devínska Nová Ves beobachtet — 8 Exemplare auf einem 200 m langen Transekt (19. März 1992). In den Jahren 1993-1995 wurden keine Individuen festgestellt.

Im Gebiet von Podunajská rovina war der Kleine Fuchs bis 1992 sehr verbreitet und relativ häufig. An einem xerothermen Standort (Ostrov Kopáč) wurden am 7. August 1991 auf einem Transekt von 500 m Länge bis zu 12 Tiere beobachtet. In dem darauffolgenden Jahr (1993) konnten nur noch 2 Individuen unmittelbar nach der Überwinterung erfaßt werden. Seitdem wurde diese Art nicht mehr festgestellt.

In der Stadt Levice (171 m) und Umgebung war *A. urticae* in den Jahren 1988-1992 häufig. Dagegen wurde diese Art 1993 nur auf dem

Hügel Vápnik (274 m) beobachtet (4-8 Tiere in der ersten Augusthälfte). Seitdem liegen keine weiteren Funde vor.

In der Umgebung von Zvolen war der Kleine Fuchs bis zum Jahre 1986 weit verbreitet und häufig. Im Jahre 1994 war *A. urticae* nur noch selten. So wurden in der Umgebung des Flusses Slatina und der Talsperre Môt'ová nur noch 6 Individuen beobachtet (20. Juni - 4. Juli, Rajtar leg.). Im Jahre 1995 lebte dort nur noch ein Einzelstück (12. Juli, Rajtar leg.).

In der Nordslowakei war *A. urticae* in den Jahren 1992-1993 zwischen den Orten Žilina und Strečno verbreitet und häufig. Bei Mojšova lúčka wurden auf einem 500 m langen Transect bis zu 22 Exemplare festgestellt (23. Juni 1992). In den Jahren 1994 und 1995 wurde in diesem Gebiet kein Individuum mehr beobachtet.

Auch im Gebiet des Gebirges Pol'ana war der Kleine Fuchs in den Jahren 1987-1989 überall verbreitet und häufig. Im Jahre 1995 wurden in 1060 m Höhe 3 Individuen festgestellt.

In dem Gebirge Malá Fatra war *A. urticae* in den Jahren 1982 und 1991 ebenfalls überall verbreitet und häufig. Wir konnten *A. urticae* am 1. September 1991 bei Medziholie (1200 m) in einer großen Anzahl feststellen (etwa 100 Exemplare an Disteln auf einem 100 m langen Transekt). Im Jahre 1995 wurden am 5 km langen Transekt Štefanová - Vel'ký Rozsutec (600-1610 m) nur im Gebiet des Gipfels des Berges Velký Rozsutec 3 Individuen beobachtet (12. September). In einer relativ hohen Gebirgslage (1475 m) haben wir diese Art (ein Individuum) auch am 27. Mai 1995 in dem Vysoké Tatry Gebirge bei der Mündung des Tales Malá Studená dolina angetroffen.

Nach Deván (1995) verschwand der Kleine Fuchs im Laufe der Jahre 1994-1995 aus dem Gebiet des Gebirges Biele Karpaty (Westslowakei), obwohl er dort vorher häufig war. Dies konnten wir nach unseren Beobachtungen aus den vorgehenden Jahren bestätigen. Smetana hat diese Art in den Jahren 1994-1995 nur in den hohen Gebirgen der Slowakei beobachtet (Deván, 1995).

Nach den Angaben von Rajtar wurde *A. urticae* im Jahre 1995 auch in der Umgebung von Zlaté Moravce (200 m, Westslowakei) nicht mehr beobachtet.

Diskussion

Die Beobachtungen zum Vorkommen and zur Abundanz von *A. urticae* lassen die Notwendigkeit erkennen, in Zukunft auch häufige, weit verbreitete und bisher nicht als bedroht erscheinende Tierarten zu erfassen. In der Literatur gibt es keine Angaben über einen allmählichen Rückgang von *A. urticae*. Dabei ist interessant, daß eine verwandte Art, mit ähnlicher Bionomie und Umweltanforderungen, das Tagpfauenauge, *Inachis io* (Linnaeus, 1758), weiterhin sehr verbreitet und häufig ist.

Es bleibt spekulativ, Ursachen für die erwähnten Veränderungen beim Kleinen Fuchs hinsichtlich seiner Verbreitung und Abundanz anzuführen. Allerdings sollte in diesem Zusammenhang darauf hingewiesen werden, daß in den letzten Jahren die Tagfalterfauna der Slowakei manche Änderungen erfahren hatte. Hierzu gehört die unerwartete Ausbreitung des Gelblings *Colias erate* (Esper, [1805]) seit 1989, die in vielen Bereichen der Slowakei zu hohen Populationsdichten mit hoher Konstanz führte, oder die Ausbildung einer 2. Generation beim Kleinen Schillerfalter, *Apatura ilia* ([Denis & Schiffermüller], 1775), in der südlichen Slowakei. Beide Beobachtungen sind dazu geeignet, klimatische Veränderungen (global warming) für die Faunenverschiebungen verantwortlich zu machen. Für *A. urticae* kann eine solche Erklärung aber nicht gültig sein, da es sich bei ihr um eine Art mit breiter ökologischer Potenz handelt, die auch in warmen Teilen Europas verbreitet ist.

Welche Erklärungen für die faunistischen Veränderungen von *A. urticae* auch immer verantwortlicht gemacht werden können, sollte sich der aufgezeigte Trend fortsetzen, so wird *A. urticae* in wenigen Jahren zur bedrohten Fauna der Slowakei gehören.

Wir sehen es daher als notwendig an, den gegenwärtigen Stand der Verbreitung und Abundanz von *A. urticae* nicht nur in der Slowakei, sondern auch in anderen Staaten Europas eingehend zu kartieren. Sehr vorteilhaft dürfte es sein, ein regelmäßiges Monitoring durchzuführen, ähnlich wie es in Großbritannien verwirklicht ist (cf. Pollard & Yates, 1995).

Wir möchten uns deshalb an alle Entomologen mit der Bitte wenden, das Vorkommen und die Häufigkeit dieser leicht unterscheidbaren Art in ganz Europa zu verzeichnen und Beobachtungen evtl. den Verfassern mitzuteilen. Auch alle Beobachtungen aus den Jahren 1993-1995 wären für uns wertvoll.

Wir erhoffen uns aus einer weiterführenden und ausgedehnteren Kartierung nicht nur genauere zoogeographische Erkenntnisse, sondern darüberhinaus mögliche Hinweise über die Ursachen, die zu dem veränderten Ausbreitungsmuster von *A. urticae* geführt haben.

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Short communication — Kurze Mitteilung — En bref

The valid subspecific name for the *Erebia epiphron* (Knoch, 1783) population of Mt. Canigou, Pyrénées-Orientales (Nymphalidae : Satyrinae)

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Until 1946, the Canigou race of *Erebia epiphron* (Knoch, 1783) has been considered identical with the Vosgian form, and consequently has been called ssp. *mackeri* Fuchs, 1914 (see Warren, 1936). De Lesse (1947) drew attention to the differences between both populations, and considered the Canigou population to be a distinct taxon which he named "race" *fauveaui* ; he emphasizes that he uses the term "race" for the taxonomic unit called "form" by Warren, because the French "forme" would not have the same meaning as the English "form", and thus would not represent a correct translation of the latter. It is because of this argumentation that I consider Art. 45g of the Code (ICZN, 1985) applicable to the taxa called "race" by de Lesse in the paper cited. According to art. 45g (ii) (1) *fauveaui*, though originaly established as a quadrinomen, should be considered as a subspecific name since, prior to 1985, it has been treated as an available name and has been adopted as the name of a subspecies (Dufay, 1961 ; Warren, 1981).

However, a year before de Lesse's publication, Eisner, after studying the *Erebia*-collection of the Nationaal Natuurhistorisch Museum at Leiden, The Netherlands, described a number of new subspecies and aberrations (Eisner, 1946). Among them the Canigou population of *Erebia epiphron* he named ssp. *orientpyrenaica* Eisner, 1946. This name, generally overlooked for more than 40 years, has priority over *fauveaui* de Lesse, 1947 which, though in common use all that time, should be considered as a junior subjective synonym of *E. epiphron orientpyrenaica* Eisner, 1946 (holotype ♂, Mont Canigou, VII.1928, leg. J. Staettermayer, coll. Mezger, Nationaal Natuurhistorisch Museum, Leiden, The Netherlands).

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Book review — Buchbesprechung — Analyse

Oecophorine Genera of Australia II. The *Chezala*, *Philobata* and *Eulechria* Groups (Lepidoptera : Oecophoridae). I. F. B. COMMON. *In* : NIELSEN, E. S., Monographs on Australian Lepidoptera, volume 5. 407 pages, 774 text figures, 18 × 26 cm, hardback. CSIRO Publishing, 150 Oxford Street, Collingwood, Victoria 3066, Australia, 1997. ISBN 0-643-05934-2. In Europe obtainable from : Eurospan, 3 Henrietta St. Covent Garden, London WC2E 8LU, England. Price : AUS $ 130.00.

With its 5,500 species, the subfamily Oecophorinae is one of the most species-rich animal groups of the Australian fauna. The larvae of most species live from fallen eucalyptus leaves containing many toxic compounds and hence being avoided by most insects.

In this revision, 84 genera are treated, of which 39 are newly described. Further reference is made to the 842 described and about 800 more still undescribed species, that have already been recognized in the diverse collections examined. The study further includes 160 new combinations and five new synonyms in the species group category. Using 64 characters, the author has tried to frame a cladogram by means of the program Hennig86. By this, a better insight into the phylogeny of this large insect group could be attained.

The book includes identification keys to the genera. The text presents information about the external morphology (head, thorax, wings, abdomen), the male and female genitalia, diagnostic features, distribution and biology. At the back follows a list of species that belong to the genus, including a cross-reference to the original description, possible synonyms, as well as the type locality and data about the type specimens. Usually a number of still undescribed species is added. Thus the book is clearly not intended as an identification work for the single species.

The text figures consist mainly of black and white photographs of adults, male and female genitalia and specific morphological details when these are important for identification purposes, like antennae, eyes and palpi. The author further presents line drawings of wing venation. All these figures are of a very good quality. The book is very carefully edited and well bound. It is an indispensable standard work for all those interested in the family Oecophoridae, or those working on Australian Microlepidoptera.

Willy DE PRINS

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Vol 20 — 1997

Dates of publication — Publikationsdaten — Dates de publication

20 (1/2) : 01.VI.1997 pp. 1–148
20 (3/4) : 10.XII.1997 pp. 149–340

Contents — Inhalt— Sommaire

No. P.
Abe, A. — cf. Saitoh, K.
Asselbergs, J. : A new *Euzophera* species from Turkey (Pyralidae : Phycitinae) 3/4 305
Coutsis, J.G. — cf. Olivier, A.
Cupedo, F. : Die geographische Variabilität und der taxonomische Status der *Erebia manto bubastis*-Gruppe, nebst Beschreibung einer neuen Unterart (Nymphalidae : Satyrinae) 1/2 3
Cupedo, F. : The valid subspecific name for the *Erebia epiphron* (Knoch, 1783) population of Mt. Canigou, Pyrénées-Orientales (Nymphalidae : Satyrinae) 3/4 335
Deschka, G. — cf. Triberti, P.
Falkovitsh, M.I., Jalava, J. & Mikkola, K. : Records of casebearers (Coleophoridae) from Siberia, Russia 3/4 310
Fibiger, M. : *Micronoctua karsholti* gen. et sp. n. : an astonishingly small noctuid moth (Noctuidae) 1/2 23
Hausmann, A. : The Lepidoptera of Israel. Faunistic data on Geometridae : I. Orthostixinae and Geometrinae 1/2 102
Huemer, P. — cf. Triberti, P.
Jalava, J. — cf. Falkovitsh, M.I.
Kerppola, S. — cf. Šulcs, I.
Kozlov, M.V. : New species of the genus *Nemophora* (Adelidae) from Primorye region and Sakhalin, Russia 1/2 31
Kozlov, M.V. : *Nemophora lapikella* sp. n., a new fairy moth species (Adelidae) from South-Eastern Asia 1/2 39
Kulfan, J., Kulfan, M., Zach, P. & Topp, W. : Ist der Kleine Fuchs, *Aglais urticae* (Nymphalidae), in Zukunft gefährdet? 3/4 330
Kulfan, M. — cf. Kulfan, J.
Kullberg, J. — cf. Pöyry, J.
Kurz, M., Kurz, M. & Zeller-Lukashort, C. : A new *Micropterix* species from southern Italy (Micropterigidae) 3/4 293

Kurz, M. — cf. Kurz, M.
Loeliger, E.A. : Errata in and acknowledgement to *Nota lepidopterologica* Vol. 19, 1996 .... 1/2 148
Mikkola, K. — cf. Falkovitsh, M.I.
Olivier, A. & Coutsis, J.G. : A revision of the superspecies *Hipparchia azorina* and of the *Hipparchia aristaeus* group (Nymphalidae : Satyrinae) 3/4 150
Powell, J.A. — cf. Yu-Feng-Hsu, F.
Pöyry, J. & Kullberg, J. : A taxonomic revision of the genus *Holoarctia* Ferguson, 1984 (Arctiidae) 1/2 45
Saitoh, K. & Abe, A. : The chromosomes of *Erebia ligea rishirizana* (Nymphalidae : Satyrinae) 3/4 326
Šulcs, I. & Kerppola, S. : A new *Dichrorampha* species from Latvia (Tortricidae : Oleothreutinae) 3/4 299
Topp, W. — cf. Kulfan, J.
Triberti, P., Deschka, G. & Huemer, P. : Gracillariidae feeding on *Ostrya carpinifolia* 1/2 82
Vasilenko, S.V. : Eine neue *Scopula*-Art aus Transbaikalien (Geometridae) 3/4 322
Wahlberg, N. : The life history and ecology of *Melitaea diamina* (Nymphalidae) in Finland 1/2 70
Yu-Feng-Hsu, F. & Powell, J.A. : The systematic position of *Heliodines loriculata* Meyrick (Yponomeutoidea : Heliodinidae) 1/2 66
Zach, P. — cf. Kulfan, J.
Zeller-Lukashort, C. — cf. Kurz, M.

In Memoriam : Andrzej W. Skalski (1938–1996) 1/2 137

Book reviews — Buchbesprechungen — Analyses

Die Schmetterlinge Mitteleuropas. I. Band. Bestimmung — Verbreitung — Flugstandort — Bionomie. Drepanidae, Geometridae, Lasiocampidae, Endromidae, Lemoniidae, Saturniidae, Sphingidae, Notodontidae, Lymantriidae, Arctiidae 1/2 145
The Lepidoptera of Europe. A Distributional Checklist 1/2 146
The Conservation of Butterflies in Britain past and present 1/2 147
Checklist of the Lepidoptera of Australia (Monographs on Australian Lepidoptera Volume 4) 1/2 147
Oecophorine Genera of Australia II. The *Chezala*, *Philobata* and *Eulechria* Groups (Lepidoptera : Oecophoridae) (Monographs on Australian Lepidoptera Volume 5) 3/4 337

Notice

XIth European Congress of Lepidopterology 1/2 1

New taxa described in Vol. 20
Neue Taxa in Band 20 beschrieben
Nouveaux taxa décrits dans le Vol. 20

MICROPTERIGIDAE

Micropterix renatae Kurz, Kurz & Zeller-Lukashort, 1997	3/4	294

ADELIDAE

Nemophora insulariella Kozlov, 1997	1/2	32
Nemophora sinevi Kozlov, 1997	1/2	33
Nemophora ochrocephala Kozlov, 1997	1/2	35
Nemophora lapikella Kozlov, 1997	1/2	40

GRACILLARIIDAE

Phyllonorycter aemula Triberti, Deschka & Huemer, 1997	1/2	86

TORTRICIDAE

Dichrorampha teichiana Šulcs & Kerppola, 1997	3/4	301

PYRALIDAE

Euzophera fibigerella Asselbergs, 1997	3/4	306

NYMPHALIDAE

Erebia manto willieni Cupedo, 1997	1/2	10

GEOMETRIDAE

Scopula agutsaensis Vasilenko, 1997	3/4	322

NOCTUIDAE

Micronoctua Fibiger, 1997	1/2	24
Micronoctua karsholti Fibiger, 1997	1/2	28

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All manuscripts should be clearly typed with double spacing and wide margins, and submitted in triplicate. In addition to the original figures, three copies should be supplied in a format not exceeding A4. A computer diskette (preferably IBM, but Macintosh also accepted) should also be sent where possible. Full articles must include a summary of not more than 200 words. A translation of the summary in at least one other European language will be added by the editors, if not already supplied by the author. Current issues of the journal should be checked for style and format. Do not hyphenate words at the right-hand margin or type surnames in capitals. References should be styled as follows :

Heath, J., 1985. New species of *Micropteryx* Hübner (Lepidoptera, Zeugloptera : Micropterigidae) from Greece and Cyprus. *Nota lepid.* 8 : 336-340.
Heath, J., Pollard, E. & Thomas, J.A., 1984. Atlas of butterflies in Britain and Ireland. 158 pp. Viking Press, Harmondsworth.

Legends to figures should be typed on a separate sheet. All figures should be suitably mounted and numbered where necessary. When adding numbers and letters, any final reduction in size should be allowed for. Drawings should be in black waterproof ink. Photographs for black & white reproduction should be glossy positive prints. The cost of coloured plates must be borne by the author (currently from about FB11,000 for a half- or full-page).

The first mention of any insect should include the full scientific name with the author and year of description. Alternatively, the nomenclature used should follow a recent list or other suitable work and this must be cited. New descriptions must conform with the current edition of the International Code of Zoological Nomenclature. We strongly urge deposition of types in major museums and all type depositions must be cited.

Manuscripts not conforming with these instructions may be returned.

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