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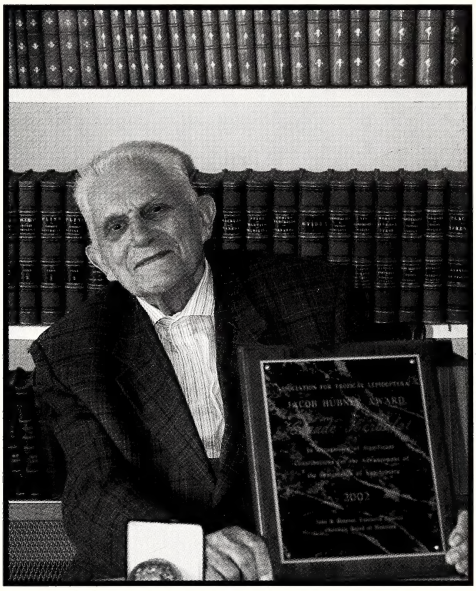

Claude Herbulot

19 February 1908 – 19 January 2006

In the afternoon of 25 January 2006, a ceremony was organized in St. Bruno's church, Issy-les-Moulineaux (Hauts-de-Seine) in the memory of Claude Herbulot, the well-known French lepidopterist, who passed away a few days earlier in a Parisian hospital (after a rather short stay for heart troubles). The ceremony was attended by his nearest and dearest – in particular his daughters Christiane and Hélène, and his second wife Colette –, also by a number of close colleagues (Claude's first wife, Thérèse, had alas died several years ago). Among the notable absentees were those Geometridae enthusiasts who, at that time, were in Tasmania on the occasion of the 4th "Forum Herbulot"... hence also paying homage to Claude Herbulot, though in a different, entomology-oriented, way (see the obituary notice written by Axel Hausmann & Manfred Sommerer, 2006, *Spixiana* 29 (2): 97–98).

Claude Herbulot was indeed among the best specialists in the world for the family Geometridae. In this short note, I will not insist on this obvious aspect, already emphasized in other obituary notices, namely the above-mentioned one and those written, in French, by Georges Orhant (2006, *Lambillionea* 106 (1): 125; *Bull. Soc. ent. Mulhouse* 62 (1): 12–15) and Philippe Darge (2006, *Bull. Soc. ent. Fr.* 111 (3)). This last notice enumerates the ca. 290 publications of Claude Herbulot and, thanks to Axel Hausmann, a similar list is also available on the Web (www.herbulot.de). For his impressive achievement Claude was honoured with the Spix Medal (1999) of the Friends of the ZSM (Zoologische Staatssammlung München) and with the Jacob Hübner Award (2002) of the Association for Tropical Lepidoptera (Gainesville, Florida).

In fact Claude Herbulot had shown an interest in various groups of Lepidoptera, not only in geometrid moths. He was born in Charleville-Mézières (Ardennes), on 19 February 1908, and several of his early papers dealt with the lepidopteran fauna of the Ardennes. Two of his first notes were even devoted to the taxonomy of a micromoth genus, namely *Agdistis* Hübner, 1825 (Pterophoridae). His most general works are the volumes 2 and 3 (moths) of an excellent popular guide to the Lepidoptera of France, Belgium and Switzerland (1948 and 1949, respectively. *Nouvel Atlas d'Entomologie*, nº 6. Editions N. Boubée & Cie, Paris). With a judicious selection of species and nice aquarelles made by three artists (R. Métaye, A. Moreau & R. Préchac), these two volumes were rewarded, in 1950 (for year 1949), with a prize – Prix Constant – of the SEF (Société Entomologique de France). I remember having often used these books in my young days, even in Madagascar when I tried to identify, with Herbulot's key (vol. 2, pp. 7–10), the families of the macromoths I caught in that country. Usually I did this exercise successfully, even though a few strictly tropical families were, of course, not included in this dichotomous key. The second work of Herbulot that I managed to get early in my life was a paper headed "Nouveaux Geometridae malgaches" (1954, *Mém. Inst. scient. Madagascar* (E) 5: 81–123, 2 pls): thanks to its black-and-white plates, I was able to identify to species certain of my Malagasy Geometridae. Actually, Claude Herbulot took a strong interest in the study of the fauna of Madagascar. He described, during his life, about one-third of the geometrid species currently recorded from this island.

In search of his favourite insects, Claude Herbulot has explored, besides Madagascar, many exotic countries, often in the oriental and afrotropical regions (see Darge's above-mentioned article). In addition to the material collected in these missions, he got thousands of specimens from various colleagues and/or insect dealers, and also bought a number of historical types of Geometridae. He has thus constituted one of the best worldwide collections of geometrid moths (more or less comparable to that of Prof. Hiroshi Inoue), as well as a very rich entomological library. The former was sold to the ZSM and is now under the well advised cure of Axel Hausmann. Claude Herbulot used to visit the MNHN (Muséum National d'Histoire Naturelle, Paris, in relation to which he was "Attaché"), often to see his colleagues and friends (e.g. H. de Toulgoët and P. Viette), sometimes to see the collections or to discuss with me the possible systematic position of any enigmatic geometrid-like moth: thanks to his generosity, the MNHN has got many interesting non-geometrid moths, especially among the Hedyloidea, Drepanoidea and Geometroidea. Like many colleagues, I have very pleasant memories of Claude Herbulot, a nice, clever, cultured person and an active, highly competent lepidopterist.

For various reasons I am indebted to Philippe Darge, Hélène Decaux (CH's daughter), Axel Hausmann (who gave me the photo of CH – see also *Spixiana* 29: 98), Colette Herbulot, Gilbert Hodebert (who made so many line drawings for CH), Matthias Nuss, Christiane O'Keefe (CH's daughter), Georges Orhant, Gertraud and Manfred Sommerer, Paul Thiaucourt, Hervé de Toulgoët, and Pierre Viette.

Joël Minet

The establishment of an American butterfly in the Arabian Gulf: *Brephidium exilis* (Boisduval, 1852) (Lycaenidae)

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Abstract. This paper documents the successful establishment and spread in the Arabian Gulf of the North American butterfly *Brephidium exilis* (Boisduval, 1852) (Lepidoptera: Lycaenidae). First recorded from Sharjah in 1995, it can now be found throughout the United Arab Emirates, in northern Oman and in eastern Saudi Arabia feeding on exotic as well as native Chenopodiaceae and Aizoaceae. The possible mode of entry into the region is discussed, as is the potential final range.

Key words. Lepidoptera, Lycaenidae, *Brephidium exilis*, introduced species, invasive species, spread, geographical distribution, establishment, United Arab Emirates, Oman, Saudi Arabia, host plants, Chenopodiaceae, Aizoaceae.

Introduction

In November 1999, Larsen [then in Manila] received an e-mail from Legrain, who had just returned from the United Arab Emirates (UAE). He had caught a tiny Lycaenid that could not be identified from existing works on Arabian butterflies (Benyamini 2002; Brown 1992; Larsen 1974, 1982, 1983, 1984, 1990; Larsen & Larsen 1980; Pittaway 1979, 1980, 1981, 1985; Walker & Pittaway 1987; Wiltshire 1957, 1964). He thought it might belong to the genus *Brephidium* Scudder, 1876, a taxon known only from South Africa and the Sonoran dry zone of Mexico and the USA. A good photograph was attached to the e-mail. Larsen was convinced it was a species new to the region, and that nothing like it occurred in the Oriental Region.

At the same time Legrain also contacted Gillet in the UAE. He knew the butterfly well, identifying it as the Western Pygmy Blue (*Brephidium exilis* (Boisduval, 1852)), a common butterfly in southern California, Arizona and Texas; he had even written a small note for a local newspaper about its discovery at Al-Ain in 1998. Larsen contacted Pittaway, who was of the opinion that the species had probably been imported along with exotic plants from North America. Larsen (2000, 2004) documented its presence and asked – 'What was it doing in the Emirates?"

In 2005, when Weidenhoffer contacted Larsen with a 2004 record of *B. exilis* from eastern Saudi Arabia, it became evident that the colonization of the Arabian Gulf by this alien butterfly had never been properly documented.

Such firm establishment of exotic butterflies is a very rare event. There are not more than 20–30 similar cases – and there are more than 18,600 recorded butterfly species worldwide (Larsen 2005).

Fig. 1. Halophyte-dominated breeding locality for *B. exilis*, 'Half Moon Bay', 15 km SW Dhahran, eastern Saudi Arabia (Photo: J. Majer).

Present distribution in the Arabian Gulf

The butterfly seems to be quite common – though local – in the UAE and northern Oman, particularly in and near urban areas in association with *Sesuvium verrucosum*. In February 2004, further examples were collected by J. Majer from farther north, near Dhahran and Al Qatif, Saudi Arabia.

The Dhahran locality was a small sandy coastal strip with tufts of halophytic plants at 'Half Moon Bay', 15 km southwest of Dhahran (Fig. 1). At 14.00h, in strong sunshine and with the temperature around 30°C, *B. exilis* was the only butterfly present, either sitting inside the tufts or flying just above the ground around the plants. When disturbed they took refuge inside the plants and were very difficult to catch. Six specimens were secured – 5 males and 1 female.

One week later Majer collected one male 3 km west of Al Qatif (15 km northwest of Dammam) on a sandy strip between embankments of oil pipelines partly covered with grass, small yellow-bloomed flowers and several bushes (Fig. 2). Also present were *Spialia doris doris* Walker, 1870 (the first record for eastern Saudi Arabia), *Colias crocea* (Geoffroy, 1785) and *Cynthia cardui* (Linnaeus, 1758).

In another recent reference Jongbloed (2003) writes: "It *[B. exilis]* is a very small, but very beautiful butterfly that can be observed in large numbers around the *Sesuvium verrucosum* plants that grow profusely on the dumpsite near the American University of Sharjah".

Fig. 2. Locality for *B. exilis*, 3 km west of Al Qatif, eastern Saudi Arabia (Photo: J. Majer).

Specific details are: **UAE**: Ajman (April 1999 (A. Legrain)), Al-Ain (April 1998 (M. Gillet)), Dubai (M. Gallagher; G. Feulner), Das Island (R. Western), Fujairah (April 2000 (A. Legrain)), Merawwah Island (M. Gallagher), Sharjah (5–7 December 1995 (E. Rutjan); (M. Jongbloed); 1998 (A. Legrain); April 1999 (A. Legrain)); **OMAN**: Buraimi & Mahdan (M. Gallagher); **SAUDI ARABIA**: Dhahran (26°10'N 50°00'E, 13 February 2004 (J. Majer)); Al Qatif (26°32'N 49°59'E, 20 February 2004 (J. Majer))

Pittaway (1979, 1980, 1981) is almost certain that he could not have overlooked this butterfly during his extensive collecting in eastern Arabia. Brown (1992) did not record it from the UAE. Given that the first records are from 1995 and that the present range is relatively limited, the establishment of *B. exilis* in the region probably took place sometime during the early 1990s.

Native range of *B. exilis*

This species – the smallest butterfly in North America – is a native resident of the dry regions stretching from the southern USA (Texas, New Mexico, Arizona, Nevada, California) down through Mexico and Belize (Jan Meerman, pers. comm. 2005) to Venezuela. It is also found on many Caribbean islands, such as the Bahamas, Cuba, Grand Cayman, Jamaica, Hispaniola, the Turks & Caicos, Aruba and Bonaire (Riley

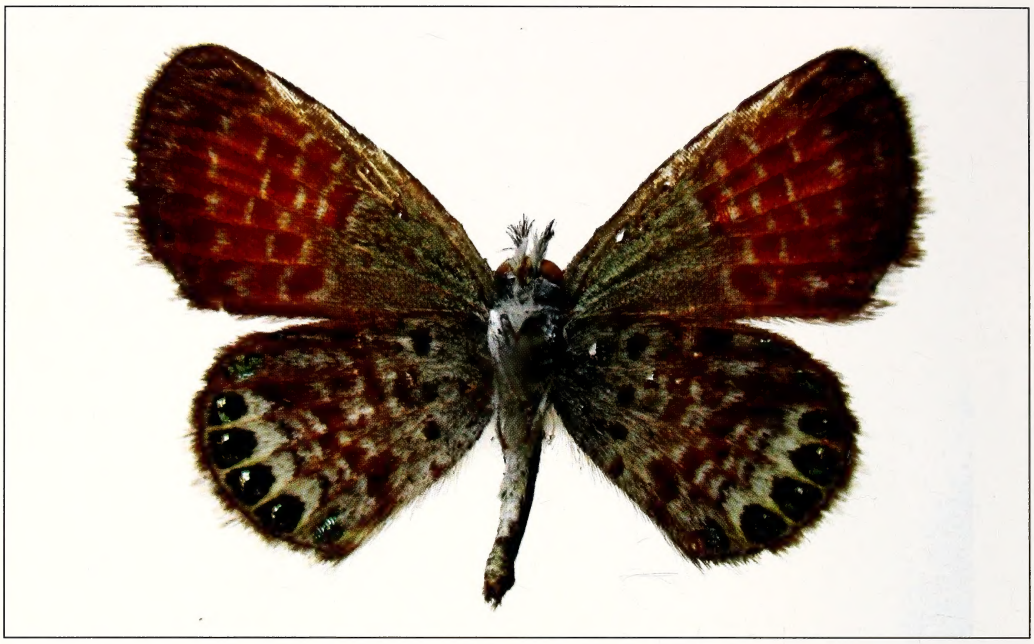

Fig. 3. Underside of *B. exilis*, Dhahran, Saudi Arabia (Photo: Z. Weidenhoffer).

1975; Miller, Debrot & Miller 2003). Around 1979 it was accidentally introduced into Hawaii, where it seems to be thriving (on introduced host plants).

In the USA this species also ranges (apparently as a wind-blown summer migrant) north to south-eastern Oregon and southern Idaho, and east to the prairie areas of Nebraska, Arkansas, and Missouri (Pyle 1981); however, the full status of these northern populations needs further study.

There is some confusion, however, as to the status of the *Brephidium* species found in the south-eastern USA, namely *B. isophthalma* (Herrich-Schäffer, 1862). *Lycaena pseudofea* was described by Morrison in 1873 (without figures) from three specimens collected at Key West, Florida, where it is a local, but common, butterfly. However, its proper taxonomic status is still unsettled. Scott (1986) treats *pseudofea* as a subspecies of *Brephidium exilis*. Calhoun (1997) treats *pseudofea* as a subspecies of *B. isophthalma,* but states that it may be a subspecies of *B. exilis*. Opler & Krizek (1984) treat *B. i. pseudofea* and *B. exilis* as separate species. Pavulaan & Gatrelle (1999) are of the opinion that all these taxa are probably part of the same species – *B. exilis*. We are grateful to B. Walsh of the University of Arizona for confirming that Arabian material conforms to that of typical *B. e. exilis*.

Ecology and habitat preferences

Although it can be found in deserts and prairies in North America, the Western Pygmy Blue is most abundant in lowland coastal areas rich in halophytic Chenopodiaceae,

such as washes, salt marshes, alkali flats, railroad tracks, disturbed places and vacant lots (Pyle 1981). Such habitats are also common in the Arabian Gulf. In California it ranges across San Diego County wherever the alien *Atriplex semibaccata* is to be found; however, although the larval host plants in coastal California are primarily *Atriplex* and *Sueda*, *Salsola* is more typically utilized farther inland during the summer months.
In the Turks & Caicos it is most commonly found in marshy areas in association with the low-growing succulent *Trianthema portulacastrum* (Aizoaceae). On Jamaica it has been reported as utilizing *Batis maritima* (Riley 1975) – a possibly erroneous record as this species belongs to a totally unrelated family and order of plants (Capparales: Bataceae) than do its other hosts.
This butterfly is almost always seen fluttering weakly about one of the low-growing larval host plants in a manner similar to *Chilades trochylus* (Freyer, 1844). Even though the species often occurs in large numbers, many people probably walk right by these delicate blues because of their tiny size and dainty, low-to-the-ground flight (Pyle 1981).
This is one butterfly whose populations have probably increased greatly in North America since the coming of Europeans and the introduction of alien weeds (such as tumbleweed (*Salsola* spp.)), which have been utilized to a great extent as larval host plants (Graves & Shapiro 2003). This rapid spread and exploitation of new hosts has no doubt been aided by the ability of *B. exilis* to disperse using strong summer winds and weather fronts – a mechanism used by other desert species in many parts of the world – to found new, if mainly ephemeral, colonies, e.g. *Anaphaeis aurota* (Fabricius, 1793) (Pittaway 1980, 1985). Many of the populations established in new areas during the summer months die out with the onset of winter as their annual host plants die, or the weather gets too cold, or the habitat floods (Thacker 2004).

Biology and life history

The Western Pygmy Blue is a small butterfly, with a wingspan of 10–15mm. The upper side is chocolate-brown, with blue shading at the base of the white-fringed wings. Underneath, the wings are grey-brown, blending to bluish-grey at base. The forewing underside is shaded with orange across the outermost half; the hind wing is marked with brown patches in the middle and is edged marginally with a row of small iridescent blue-green centred black spots; there are whitish striations across the wings (Fig. 3). Females are larger than males and less blue on the upper side.
Males actively patrol for receptive females. The latter lay their blue-green eggs singly on all parts of the host plant, with most placed on the topsides of leaves and near flowering stems. These hatch into light green caterpillars; however, larval coloration can vary, but generally it is yellowish green to tan and shaded or striped with yellow on the back and sides. Alternatively, it may be green, shaded or striped with dark green or dark pink, or it may be green with a dark coloured head and lacking stripes altogether. Often it is covered with brownish or whitish bumps. Its average, full-grown length is 11mm.
This species has no diapause and continues breeding throughout the year where resident (Thacker 2004).

Larval hosts plants

Caterpillars eat the leaves, flowers and fruits of many Chenopodiaceae and Aizoaceae, including goosefoot (*Chenopodium* spp.), orache/saltbush (*Atriplex* spp.), glasswort (*Salicornia* spp.) and *Sesuvium* spp. (Pyle, 1981)

In the USA it has been recorded from *Atriplex canescens, A. coulteri, A. serenana, A. leucophylla, A. patula, A. patula var. hastata, A. semibaccata, A. rosea, A. cordulata, A. hymenelytra, A. lentiformis var. breweri, Suaeda fruticosa, S. californica, S. moquinii, S. torreyana, Salicornia virginica, Chenopodium album, C. leptophyllum, Salsola iberica, S. kali var. tenuifolia, Halogeton glomeratus, Tetragonia tetragonioides, Trianthema portulacastrum* and *Sesuvium verrucosum*. A fuller list is given by Shapiro (1973).

The most important host in the USA is the fourwing saltbush (*Atriplex canescens* (Pursh.) Nutt.). This shrublet is the most widely distributed native woody plant in North America, its native range extending north-south from southern Alberta to central Mexico and east-west from the Missouri River to the Pacific Coast. It is widely planted in temperate regions of North America as an ornamental, and has become locally naturalized east of the plains grasslands (its native boundary). In the Sonoran deserts, fourwing saltbush may dominate or co-dominate salt-desert scrublands and alkali flats.

This shrub has been planted worldwide (as has the Australian *A. semibaccata*) to increase forage production on arid rangelands. It has become naturalized in deserts and arid regions throughout the world, including many Arabian Gulf states.

Many countries around the Gulf have extensive areas of salt-desert scrublands and alkali flats dominated by numerous native and alien Chenopodiaceae and Aizoaceae. Thus the potential host plants in the Gulf are several species of *Anabasis, Atriplex, Arthrocnemum, Bienertia, Chenopodium, Halopeplis, Salsola* and *Suaeda*, as well as *Sesuvium* and *Trianthema* (Collenette 1985; Al-Turki, Omar & Ghafoor 2000). The genus *Salsola* is particularly well represented.

Possible mechanism of introduction into the UAE

Two possible routes of introduction are envisaged. The first – and least likely – is that one of the many US expatriates working in the UAE brought back some 'infested' ornamental succulents from Texas/Arizona/California to brighten up their garden.

The other, and much more likely scenario, is that this butterfly was introduced by accident during one of the many documented trials of North American halophytes as potential fodder plants or for degraded land reclamation (Khan 1981; Riley 1989; Glenn et al. 1994; Lieth & Al Massoum 1991–1992; Dakheel, Alhadrami & Peacock 2001; Peacock et al. 2002).

Land reclamation and fodder plant projects in the UAE

Starting in the 1970's, it was realised by the UAE governments that something needed to be done about the severe overgrazing and land degradation afflicting the region. Khan (1981) reviewed the progress of several afforestation and agricultural develop-

ments during 1975–80. Forest areas managed by the Forest and Agriculture Departments were extensively interplanted with fodder shrubs such as *Atriplex*.
In 1990 an international symposium was held at the UAE University in order to draw together the worldwide experience in this field (Lieth & Al Massoum 1991–1992). Parallel to this activity, Mr. Armin Lieth was asked to collect a large number of halophytic species in the Caribbean and trial them in the UAE desert environment. Some scientists invited to participate in the above mentioned symposium were also asked to provide plant material (see Lieth & Al Massoum (1991–1992) for more detail). A quarantine station was erected near Mussafah from where the surviving specimens were later transferred to an experimental farm near Nahshallah.
The International Atomic Energy Agency (IAEA) initiated a multinational project in 1997 – known as the 'Sustainable Utilization of Saline Groundwater and Wastelands for Plant Production' – in order to introduce and domesticate halophytes for commercial crop production throughout North Africa and the Middle East. This project was subsequently expanded to include large tracts of 'wasteland', new species and other regional habitats throughout Africa and the Middle East. Several species of *Atriplex* were an important component.
In 1999 the International Centre for Biosaline Agriculture (ICBA) was established at Dubai. Its brief was to develop sustainable management systems to irrigate food and forage crops (and ornamental plants) with saline water and to provide a source of salt-tolerant plants for socio-economic development in arid and semi-arid areas.
Wakabayashi (2000) gives details of a major project to use seawater as irrigation for halophyte plantations on the Arabian Peninsula. Planting halophytes was proposed as a way to re-establish vegetation along the periphery of the Rub Al Khali desert and the coastline of the UAE. The five species suggested as most suitable were *Batis maritima, Atriplex canescens, Salicornia bigelovii, Suaeda esteroa* and *Sesuvium verrucosum*.
Peacock et al. (2002), outlined research undertaken to identify forage halophytes that were tolerant of saline soils, with research sites being located in Oman, in the UAE and at the ICBA in Dubai. Research at the UAE University in Al-Ain looked at the salt tolerance of several *Sporobolus* and *Atriplex* species.
The pan-tropical *Sesuvium portulacastrum* has been extensively used throughout the Arabian Peninsula in landscaping and land reclamation projects since its first introduction to Abu Dhabi in 1989 (Böer 2002). It has become widely naturalized and its presence has probably aided the establishment and spread of *B. exilis*.
Including the above, a large number of halophyte research and development projects have been carried out in the Arab Gulf States over the last 25 years, mainly in the UAE (in particular Abu Dhabi and Dubai) and Saudi Arabia. These projects involved exotic and indigenous species. Most of these projects imported plants directly from North America for evaluation (Böer 2002).

Potential new range of *B. exilis*

The overall climate of the UAE is subtropical, warm and arid. Midday air temperatures range between 35° and 50°C from May to October, and from 20° to 35°C during the

winter months. In the desertic interior the highest ground temperatures during summer reach 70°C, but may fall to freezing in winter. The average rainfall over the Emirates is less than 100 mm per annum, but this is very spasmodic and up to 50% of the annual total may fall in a single day. Some monsoon-like showers are also received during the summer months on the east coast, and in the mountain belt which forms the watershed between the Arabian Gulf and the Gulf of Oman. Moisture also condenses in the form of fog and dew, especially along the coastal belt. Strong winds and sand storms are common throughout the Emirates, being especially frequent and severe in summer. Sand dunes are a dominant landscape feature. These conditions are very similar to those found across much of the natural North American range of *B. exilis*.

Soils are generally coarse, sandy and undeveloped. They are deficient in organic matter, nitrogen, available phosphorus, and trace elements such as zinc, iron and manganese. Non-calcareous soils may also be deficient in potassium. Soils in the 'subkha' coastal belt and low-lying depressions in the interior of the desert are highly saline.

To a greater or lesser extent, these conditions can be found across the arid regions of North Africa and into Spain, parts of eastern Africa, the Levant and Arabian Peninsula, southern Iran and large areas of India. This is thus the potential range of *Brephidium exilis*. Benyamini (2000) predicts it will reach Israel in the near future.

Biogeography of *Brephidium*

There is a very similar species to *B. exilis* resident in southern Africa, namely *B. metophis* (Wallengren, 1860) (confined to South Africa, Namibia, Botswana, Mozambique and Zimbabwe). The genitalia and external features show clearly that they belong to the same genus. Another related taxon, namely *Oraidium barberae* (Trimen, 1868) (which also has very similar genitalia), is also endemic to South Africa. This New World/Old World distribution is odd, but not unknown for other plant and animal taxa.

H. Stempffer (discussions with Larsen 1974) considers *Brephidium* to be a true Gondwanaland relict genus, its evolution preceding the split up of Africa, Antarctica and South America. This reflects the thoughts of Miller & Miller (1997), who believe that some Biblidinae from the island of Hispaniola in the Caribbean are so close to African species as to indicate a common Gondwanaland origin. In the same paper they also make the comment – "A similar situation exists [in the Lycaenidae] where one genus, *Brephidium*, is represented in both hemispheres and its sister genus, *Oraidium*, in southern Africa ... these butterflies are not vagile and their intercontinental dispersal is highly unlikely." Clench (1963) also comments on this African/New World connection. However, in the absence of supporting molecular data this Gondwanaland hypothesis remains pure conjecture. Butterflies as a whole appear to be mid- to late Cretaceous in origin. Whether a Polyommatine genus is as old as the Africa/Americas split is debatable. As *B. exilis* exhibits what is known as 'waif dispersal' (a form of wind dispersal), the trans-Atlantic split in the genus may well have occurred some time in the Tertiary when the Atlantic Ocean was more narrow. This discussion need not concern us here, but it would be very interesting to observe the interaction of

B. exilis with *B. metophis* should the former reach southern Africa. Considering its ecology and method of dispersal, this is not an impossibility.

Discussion

From the data we have it seems clear that the Sonoran butterfly, *Brephidium exilis*, has irreversibly established itself in the Arabian Gulf on exotic as well as native hosts since its probable introduction in the early 1990s, and that there is a very real possibility that it will spread farther. The introduction and use of several known New World host plants in landscaping and land reclamation projects has facilitated this, and may have even been the route of entry. Although a number of such establishment events are known, it is never-the-less a very rare occurrence. There are some 18,600 butterfly species worldwide and only a few have managed to establish themselves away from their natural ranges.

There are several ways in which this has occurred, nearly all of them human-assisted. The introduction and use of host plants beyond their natural ranges can facilitate natural range expansion in butterfly species which can utilize those plants. This has occurred in North America with *B. exilis*, which utilizes both native and exotic weeds. Graves & Shapiro (2003) and Thacker (2004) have documented the use of many alien hosts in California by native butterflies, including *B. exilis*. Another good example is the natural spread of *Danaus plexippus* (Linnaeus, 1758) across the Pacific Ocean, and subsequent colonization of Australia in 1871, using already established weed species of Asclepiadaceae (Zalucki & Clarke 2004).

Alternatively, the transplantation by humans of host plants to new regions of the world (as ornamentals or crops) can 'prime' these areas for colonization should a suitable butterfly accidentally or intentionally be introduced there. Such butterfly species, in effect, are 'chasing' their host plants. This is the case with *B. exilis* in both Hawaii and the Arabian Gulf.

Over the last 100 years, with increasing international trade and travel, several butterflies have managed to hitch lifts to new regions. The most recent parallel to *B. exilis* has been the establishment of *Cacyreus marshalli* Butler, 1897 in southern Europe. This South African butterfly feeds on wild geraniums (*Pelargonium* spp.) in South Africa, cultivated forms of which are/were widely grown throughout the Mediterranean region. This butterfly was first recorded from Mallorca in 1989, having probably been brought in by some nice blue-rinse lady from Cape Town visiting friends or relatives and bearing a cutting of her favourite geranium, or perhaps via the ornamental flower trade. It has since spread around the coast of Morocco, Spain and France, and down Italy as far as Rome. Vagrants have even been found as far north as Belgium and the UK (Baufeld 1993).

Others are *Pieris rapae* (Linnaeus, 1758), which was introduced to North America in the 1860s (and into Australia around 1937); *Thymelicus lineola* (Ochsenheimer 1808), introduced into Ontario, Canada in 1910 and now found as far west as British Columbia; *Pieris brassicae* (Linnaeus, 1758), which established itself in Chile in the

early 1980's and then in Cape Province, South Africa, in 1994. The banana skipper (*Erionota thrax* (Linnaeus, 1767)) has been accidentally introduced into Guam (1956), Mauritius (around 1970), Hawaii (1973) and New Guinea (1983), where it is a serious pest of bananas. Many species have been introduced to Hawaii, including *B. exilis*. Two butterflies were deliberately established to control the exotic weed *Lantana camara*, namely *Strymon bazochii* (Godart, 1824) (in 1902) and *Tmolus echion* (Linnaeus, 1767) (in 1902), and butterfly enthusiasts took advantage of the widespread establishment and cultivation of *Passiflora* and *Citrus* to introduce both *Agraulis vanillae* (Linnaeus, 1758) (around 1977) and *Papilio xuthus* Linnaeus, 1767 (around 1971).

The most recent exotic colonisations that have come to our attention are *Papilio demoleus* Linnaeus, 1764 in the Caribbean (Guerrero et al. 2004) and *Dryas iulia* (Fabricius, 1775) in Thailand (Pittaway, pers. obs. 2005). The latter Neotropical species has established itself in Phuket (in 2004) and is now spreading on *Passiflora foetida*, itself an alien which can grow in profusion on any derelict site. The invasive nature of this plant has also helped *Acraea violae* (Fabricius, 1775) extend its range; Larsen saw huge numbers in the centre of Bangkok in 2004.

Acknowledgements

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References

Al-Turki, T. A., S. Omer & A. Ghafoor 2000. A synopsis of the genus *Atriplex* L. (Chenopodiaceae) in Saudi Arabia. – Feddes Repertorium **111** (5–6): 261–293.

Baufeld, P. 1993. Zur Risikobewertung von *Cacyreus marshalli* Butler (Lepidoptera, Lycaenidae) aus der Sicht der Pflanzenbeschau. – Nachrichtenblatt des Deutschen Pflanzenschutzdienstes **45** (12): 257–262.

Benyamini, D. 2000. The Pygmy Blue is getting closer to Israel. – News of the Israeli Lepidopterists Society **17** (2): 25.

Benyamini, D. 2002. A field guide to the butterflies of Israel including butterflies of Mt. Hermon, Sinai and Jordan, Edition 5. – Keter Publishing House Ltd., Israel.

Böer, B. 2002. Halophyte Research: UNESCO supports halophyte research and development in Arabia. – Biosalinity News **3** (2): 6–7.

Brown, J. N. B. 1992. Butterflies of the United Arab Emirates. – Tribulus **2** (1): 10–11.

Calhoun, J. V. 1997. Updated List of the Butterflies and Skippers of Florida (Lepidoptera: Papilionoidea and Hesperioidea). – Holoarctic Lepidoptera **4** (2): 39–50.

Clench, H. K. 1963. A synopsis of the West Indian Lycaenidae, with remarks on their zoogeography. – Journal of Research on the Lepidoptera **2** (4): 247–270.

Collenette, S. 1985. An illustrated guide to the flowers of Saudi Arabia. – Scorpion Publishing Ltd., London.

Dakheel, A. J., G. A. Alhadrami & J. M. Peacock 2001. Yield Potential and Nutritional Value of Five *Atriplex* Species Grown in the UAE Under Different Salinity and Fertilizer Levels. – International Symposium on Prospects of Saline Agriculture in the GCC Countries, Dubai, UAE, 18 –20 March.

Glenn, E. P., R. S. Swingle, J. J. Riley, C. U. Mota, M. C. Watson & V. R. Squires 1994. North American halophytes: Potential use in animal husbandry, pp.165–174. *In*: Squires, V.R. & A. T. Ayoub (eds.) Halophytes as a resource for livestock and for rehabilitation of degraded lands. – Kluwer Academic Publishers, Netherlands.

Graves, S. D. & A. M. Shapiro 2003. Exotics as host plants of the California butterfly fauna. – Biological Conservation **110**: 413–433.

Guerrero, K. A., D. Veloz, S. L. Boyce. & B. D. Farrell 2004. First New World Documentation of an Old World Citrus Pest, the Lime Swallowtail *Papilio demoleus* (Lepidoptera: Papilionidae), in the Dominican Republic (Hispaniola). – American Entomologist **59** (4): 227–229.

Jongbloed, M. 2003. Of Butterflies and Moths. – Al Shindagah **54** (Sept./Oct.): ??.

Khan, M. J. R. 1981. Afforestation and agricultural development in the western region of Abu Dhabi. – Pakistan Journal of Forestry **31** (1): 4–11.

Larsen, T. B. 1974. Butterflies of Lebanon. – National Council for Scientific Research, Beirut.

Larsen, T. B. 1982. The butterflies of the Yemen Arab Republic, with a review of species in the Charaxes viola-group from Arabia and East Africa. – Biologiske Skrifter, Kongelige Danske Videnskabernes Selskab, Biologiske Skrifter **23** (3):1–85.

Larsen, T. B. 1983. Insects of Saudi Arabia; Lepidoptera, Rhopalocera (a monograph of the butterflies of the Arabian Peninsula). – Fauna of Saudi Arabia **5**: 333–478.

Larsen, T. B. 1984. Butterflies of Saudi Arabia and its neighbours. – Stacey International, London.

Larsen, T. B. 1990. The butterflies of Egypt. – Apollo Books, Denmark.

Larsen, T. B. 2000. Hazards of butterfly collecting – late 1999. What is *Brephidium exile* doing in the Emirates? – Entomologists' Record and Journal of Variation **112** (2): 273–274.

Larsen, T. B. 2004. Hazards of butterfly collecting. – Cravitz Printing Co. Ltd., UK.

Larsen, T. B. 2005. Butterflies of West Africa, Vols. 1 & 2. – Apollo Books, Denmark.

Larsen, T. B. & K. Larsen 1980. Butterflies of Oman. – John Bartholomew & Son. Ltd, Edinburgh.

Lieth, H. & A. Al Massoum (eds.) 1991–1992. Towards the Rational Use of High Salinity Tolerant Plants. – Proceedings of the first ASWAS Conference, Dec. 8–15, 1990 at Al Ain, Vols. 1 & 2.

Miller, J. Y., A. O. Debrot & L. D. Miller 2003. A survey of butterflies from Aruba and Bonaire and new records for Curaçao. – Caribbean Journal of Science **39** (2): 170–175.

Miller L. D. & J. Y. Miller 1997. Gondwanan butterflies: the Africa-South America connection. The inaugural conference on African Lepidoptera. Nairobi – Kenya – 1–8 May 1977. – Metamorphosis **3** (Occasional Supplement): 42–51.

Morrison, H. K. 1873. Notes on North American Lepidoptera. – Bulletin of the Buffalo Society of Natural Sciences **1**: 186–187.

Opler, P. A. & G. O. Krizek 1984. Butterflies East of the Great Plains, An Illustrated Natural History. – Johns Hopkins Univ. Press, USA.

Pavulaan, H. & R. R. Gatrelle 1999. A new subspecies of *Brephidium isophthalma* (Lycaenidae: Polyommatinae) from coastal South Carolina. – The Taxonomic Report of the International Lepidoptera Survey **1** (7): 1–4.

Peacock, J. M., M. E. Ferguson, G. Al-Hadrami, A. Saleh, I. R. McCann & A. Dakheel 2002. Desert forages of the Arabian Peninsula – the sustainable use of salt affected soils through conservation and evaluation. *In*: Prospects for saline agriculture, pp. 43–56. – Kluwer Academic Publishers, Netherlands.

Pittaway, A. R. 1979. The butterflies and hawkmoths of eastern Saudi Arabia. – Proceedings & Transactions of the British Entomological & Natural History Society **12**: 90–101.

Pittaway, A. R. 1980. Butterflies (Lepidoptera) of Qatar, April–June, 1979. – Entomologist's Gazette **31**: 103–111.

Pittaway, A. R. 1981. Further notes on the butterflies and hawkmoths of eastern Saudi Arabia. – Entomologist's Gazette **32**: 27–35.

Pittaway, A. R. 1985. Lepidoptera: Rhopalocera of western Saudi Arabia. – Fauna of Saudi Arabia **7**: 172–197.

Pyle, R. M. 1981. National Audubon Society Field Guide to North American Butterflies. – Alfred A. Knopf, Inc., New York.

Riley, J. J. 1989. Halophytes: A New Dimension for Oman's Agriculture. – International Symposium on Agriculture & Fisheries Development in Oman held at Sultan Qaboos University, Muscat, Sultanate of Oman, 15–19 October 1989.

Riley, N. D. 1975. A field guide to the butterflies of the West Indies. – William Collins Sons & Co. Ltd., London.

Scott, J. A. 1986. The Butterflies of North America. – Stanford University Press, California, USA.

Shapiro, A. M. 1973. Host records for *Brephidium exilis* (Lycaenidae). – Journal of the Lepidopterists' Society **27** (2): 157–158.

Thacker, P. D. 2004. California butterflies: at home with aliens. – BioScience **54** (3): 182–187.

Wakabayashi, H. 2000. Use of seawater irrigation for halophyte plantation on the Arabian Peninsula, pp. 617–626. *In*: Fodder shrub development in arid and semi-arid zones. Volume 2. – Proceedings of the Workshop on Native and Exotic Fodder Shrubs in Arid and Semi-arid Zones, 27 October–2 November 1996, Hammamet, Tunisia. ICARDA

Walker, D. H. & A. R. Pittaway 1987. Insects of eastern Arabia. – Macmillan Publishers Ltd., London.

Wiltshire, E. P. 1957. The Lepidoptera of Iraq. – Nicholas Kaye Ltd., London.

Wiltshire, E. P. 1964. The Lepidoptera of Bahrain. – Journal of the Bombay Natural History Society **61**: 99–141.

Zalucki, M. P. & A. R. Clarke 2004. Monarchs across the pacific: the Columbus hypothesis revisited. – Biological Journal of the Linnean Society **82** (1): 111–121.

Additional revisionary actions and corrections in the *Turanana endymion* species-group (Lycaenidae)

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Absract. The separation of *Turanana taygtica micrasiatica* ssp. n. from *Turanana taygetica endymionoides* Coutsis, 2005 is effected on the basis of their having constant external differences between them and of their being geographically isolated from one another. The sympatric occurence of *Turanana endymion endymion* (Freyer, 1850) and *Turanana endymion ahasveros* (Bytinski-Saltz & Brandt, 1937) in Iran is discussed.

Key words. Lycaenidae, *Turanana endymion*, *T. taygetica*, taxonomy, typification, new subspecies, Greece, Turkey, Iran, Israel.

Introduction

In the revision of the *Turanana endymion* (Freyer, 1850) species-group (Coutsis 2005) the following were effected: the separation at species level of *T. taygetica* (Rebel, 1902) from *T. endymion*; the re-description of *T. endymion endymion*, *T. endymion ahasveros* (Bytinski-Saltz & Brandt, 1937) and *T. taygetica taygetica*; the description of *T. taygetica endymionoides* ssp. n., as well as the tentative placement of Turkish *T. taygetica* under ssp. *endymionoides*; and lastly the necessary typifications for all the above mentioned species-group taxa.

Later on (Coutsis 2006), a correction was carried out in respect of the true identity of *Turanana* material from Kopetdagh, Turkmenistan, originally wrongly assumed to be *T. endymion ahasveros*, and eventually correctly identified as *T. dushak* Dubatolov, 1989.

The recent obtainment of a large number of *T. taygetica* from Turkey, as well as of a few fresh individuals of *T. endymion* from Iran, led to a better and more detailed comparison between, and understanding of the various *T. endymion* species-group taxa, while at the same time it revealed the need for carrying out further revisionary actions within this species-group, as well as of making a few necessary corrections to the original revision (Coutsis 2005).

Abbreviations

ZMAN	Zöologisch Museum, Universiteit van Amsterdam
RMNH	Naturalis, National Museum of Natural History, Leiden
TL	type locality
FW	forewing
HW	hindwing
v	vein
s	space

A comparison between Turkish and Mt. Helmós *Turanana taygetica*

The original placement of both Turkish and Mt. Helmós *T. taygetica* under one ssp., i.e. *endymionoides*, was done because of insufficient comparative material from Turkey, because of the lack of material from a good many geographically intermediate areas between Greece and central Asia Minor that might have conceivably revealed the existence of an external character cline, and because of the occasional external character overlap between the Turkish and the Mt. Helmós populations.

The extensive material of Turkish *T. taygetica* now at hand suggests that the overlap in external characters is not present in a collective way, but rather involves the single character of the width of the upperside blackish marginal border of the wings.

Furthermore, the rather pronounced external differences between the geographically extremely close nominotypical *T. taygetica* and topotypical ssp. *endymionoides* (Coutsis 2005), suggests that it is highly improbable that a character cline should exist between the geographically distant and disjunct Mt. Helmós and Turkish *T. taygetica*.

The main external differences now known to exist between Turkish and Mt. Helmós *T. taygetica* are as follows:

In Turkish *T. taygetica* the hindwing upperside blackish marginal border may have a maximum width of up to about 2.0 mm (in Mt. Helmós *T. taygetica* this width never surpasses 1.3–1.4 mm), the forewing upperside blackish marginal border always invades the post-discal area of the wing basad from its apex (in Mt. Helmós *T. taygetica* this is never the case), the wings on their upperside have the veins more extensively lined in black, and the orange sub-marginal spotting on hindwing underside is as a rule more extensive.

For all the reasons mentioned above, as well as because of the geographic isolation between Greek and Turkish populations of *T. taygetica*, it is now deemed appropriate to separate Turkish *T. taygetica* from the Greek ssp. *endymionoides* and to describe it as a good ssp. in its own right.

Turanana taygetica micrasiatica ssp. n.

Material. Holotype ♂ (Figs. 2, 3), **Turkey**, Isparta province, 15 km S of Akşehir, Sultandağları, 1800 m, st. 323, 4.vii.1986 (gen. prep. no. 3931), W. O. De Prins leg., ZMAN. – Paratypes: 2♀ (Figs. 7, 8) Afyon province, 8 km SW of Dereçine, Sultandağları, 2200 m, 19/20.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN. 7♂ Isparta province, 15 km S of Akşehir, Sultandağları, 1800 m, st. 323, 4.vii.1986, W. O. De Prins leg., ZMAN. 4♂ Isparta province, 15 km S of Akşehir, Sultandağları, 1500 m, 12/21.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN. 1♂ Konya province, Akşehir, Sultandağları, 1100 m, 17/26.vii.1980, H. v. Oorschot leg., ZMAN. 1♂ Afyon province, 20 km SE of Çay, Sultandağları, 2000 m, 14.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN. 1♂ Afyon province, 8 km SW of Dereçine, Sultandağları, 2200 m, 19/20.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN (figured in Hesselbarth et al. 1995: pl. 97, fig. 58). – Additional specimens: 3♂ Konya province, Akşehir, Sultandağları, 1100 m, 17/26.vii.1980, Fam. H. v. Oorschot leg., ZMAN; 3♂ Konya province, 22 km SE of Akşehir, Sultandağları, 1600-1900 m, 29.vii.1995, H. A Coene & J. H. H. Felten leg., ZMAN; 2♂ Konya province, 6 km S of Çankaturan, 23 km SSE of Akşehir, Sultandağları, 1700 m, 20.vii.1995, H. A Coene & J. H. H. Felten leg., ZMAN; 1♂ Konya province, Akşehir, Sultandağları, 1100 m, 13/20.vii.1981, st. 0100, H. & T. v. Oorschot & H. v. d. Brink leg., ZMAN; 2♂ Konya province, 15 km S of Akşehir, Sultandağları, 1500 m, 16./19.vii.1980, H. v. Ooorschot leg., ZMAN; 4♂ Afyon province, 10 km S of Çay, Sultandağları, 1300 m, 18/25.vii.1980, H. v. Ooorschot leg., ZMAN; 1♂ Afyon province, 8 km SW of Dereçine, Sultandağları, 1700-2200 m, 19/20.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN; 2♂ Afyon province, 8 km SW of Dereçine, Sultandağları, 2200 m, 19./20.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN; 13♂ Isparta province, 15 km S of Akşehir, Sultandağları,

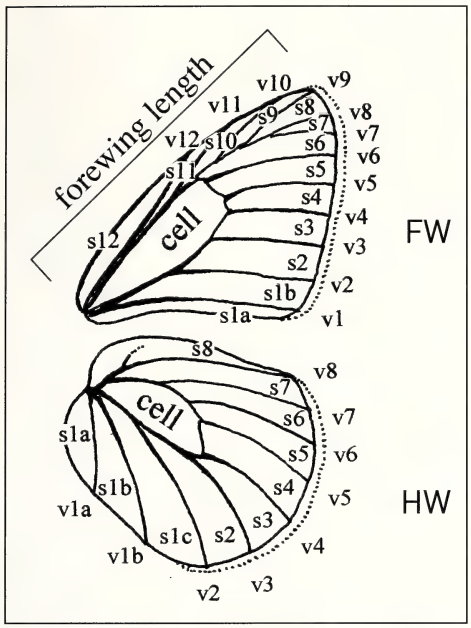
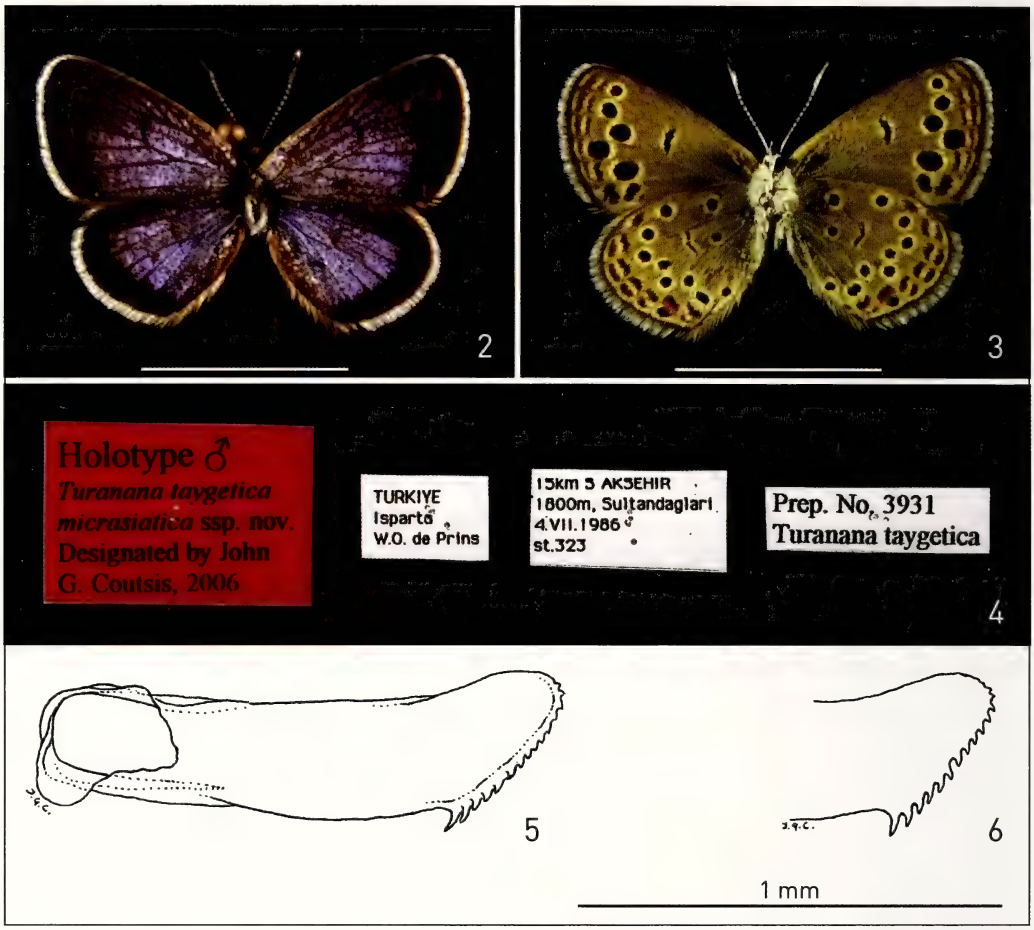


Fig. 1. Diagram of the wings of a butterfly, defining 'forewing length', and showing the cell, the veins and the inter-venal spaces of the fore- and hindwing.

1500 m, 12./21.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN; 1♂ Afyon province, 15 km SE of Çay, Sultandağları, 1400–1600 m, 14./18.vii.1981, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN; 2♂ Isparta province, 15 km S of Akşehir, Sultandağları, 1800 m, st. 323, 4.vii.1986, W. O. De Prins leg., ZMAN; 2♂ Isparta province, 10 km NE of Gelendost, Sultandağları, 1000 m, 15.vii.1980, H. v. Oorschot leg., ZMAN; 2♂ Karaman province, Sertavul Geçidi, 1500 m, 1.viii.1995, H. A. Coene & J. H. H. Felten leg., ZMAN; 1♂ Antalya province, Ímrasan Geçidi, 12 km N of Akseki, 1500–1900 m, 24./27.vii.1981, H. Coene, J. Lucas & H. v. Oorschot leg., ZMAN; 1♂ Asia Minor, Taurus, coll. Snellen RMNH; 1♂ Anatolien, Ak–Chehir, 1900 m, Korb, ZMAN, 1♀ Konya province, Akşehir, Sultandağları, 1100 m, 17./26.vii.1980, H. v. Oorschot leg., ZMAN; 1♀ Isparta province, 15 km S of Akşehir, Sultandağları, 1500 m, H. & Th. v. Oorschot & H. v. d. Brink leg., ZMAN; 1♀ Asia Minor, Taurus, Lederer leg., coll. Snellen RMNH.

Description. Holotype (Figs. 2, 3). Forewing length 10.9 mm. Upperside ground-colour blue; blackish marginal borders averaging 1.8 mm in width; blackish border on forewing invading post-discal area basad from apex; wing veins thinly lined in black; apex of cell on both forewing and hindwing marked by a fine, black stria, shaped like shallow crescent, which is weakly-defined in the former, and narrower, shorter and barely visible in the latter; fringes pure white. Underside ground-colour light grey-brown, giving impression of 'dirty and rough' texture; basal area of hindwing with faint, shiny, whitish-blue dusting; post-discal black spots on forewing large and surrounded by off-white rings; post-discal spot in s3 conspicuously displaced distad; apex of cell on forewing with fine, well-defined black-brown stria shaped like shallow crescent; both wings with double row of well-defined black-brown sub-marginal markings, the darkest (almost black) and most conspicuous being situated nearest wing margin in s2 of hindwing; space between outer and inner row of dark sub-marginal markings of hindwing filled with macroscopically conspicuous orange scaling in s1c, s2 and s3, and microscopically discernible orange dusting also in s1b and s4; post-discal black spots on hind-wing likewise surrounded by off-white rings, but smaller than their forewing counterparts; apex of cell on hindwing underside with black-brown stria shaped like shallow crescent as in forewing, but narrower and shorter than its forewing counterpart; single black spot enclosed by off-white ring also present in cell of hindwing, just basad from and slightly diagonally to dark stria of cellular apex; fringes pure white. Valva (Figs. 5, 6) 1.23 mm in length, with 14 terminal spikes present, that extend all along the valval distal margin, reaching its apex; most proximal spike decidedly the longest.

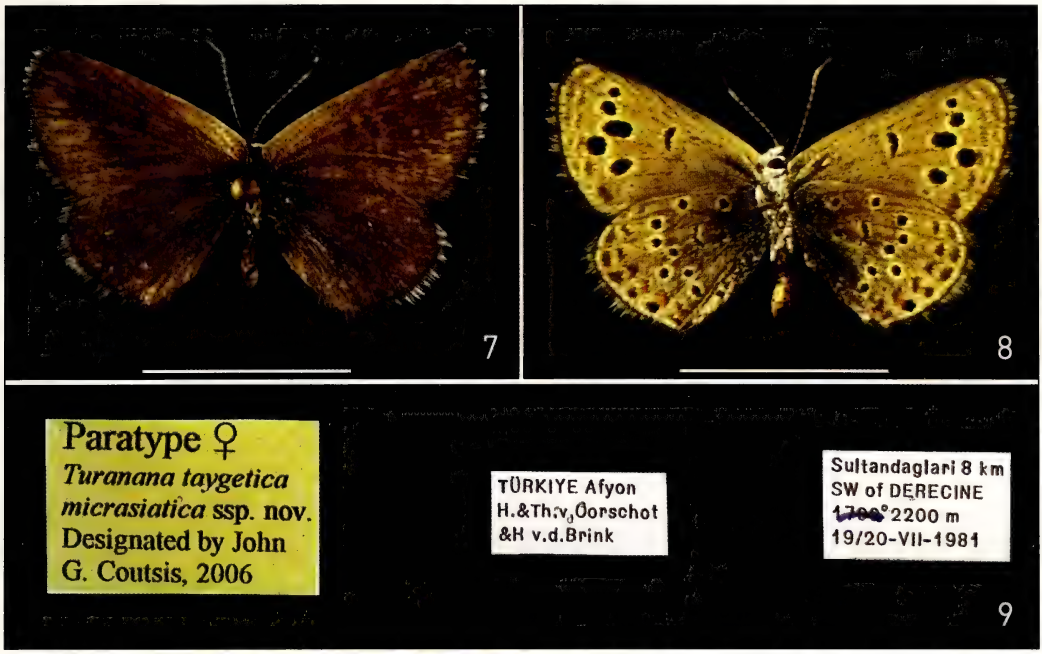
♀ paratype (Figs. 7, 8). (Due to the unavailability of fresh material, the description that follows is that of a worn specimen, and cannot be considered as being accurate in all details. The specimen chosen is from Sultandağları, a locality where only *taygetica*



Figs. 2–6. *Turanana taygetica micrasiatica* ssp. n., holotype ♂. **2.** Upperside. **3.** Underside. **4.** Data labels. **5, 6.** Right valva. **5.** View of mesal wall of valva. **6.** Flat view of distal part of mesal wall of valva.

flies, thus excluding the possibility of a misidentification due to a mix-up with *endymion*). Forewing length 10.8 mm. Upperside ground-colour dark brown; blue basal scaling not evident macroscopically, but scattered blue scales in evidence when viewed microscopically; outer margin of wings thinly lined black-brown; black-brown stria at apex of cell clearly evident on forewing, less so on hind-wing; remnants of fringes pure white. Underside as in male, but ground-colour slightly browner.

Variation. This is expressed in the males by their overall size (forewing length from about 9.0 mm to about 12.5 mm), by the width and degree of definition of the upperside blackish marginal border, by the extent or absence of black spotting within this border, by the degree of definition of the black stria at the apex of the cell on the hindwing, and by the degree of intrusion of the blackish marginal border into the post-discal area of the forewing, basad from its apex. On the underside it is expressed primarily by the extent of sub-marginal orange scaling and of the basal, shiny, whitish-blue dusting on the hindwing, as well as by the distance from the wing's outer margin of the hindwing



Figs. 7–9. *Turanana taygetica micrasiatica* ssp. n., paratype ♀. **7.** Upperside. **8.** Underside. **9.** Data labels.

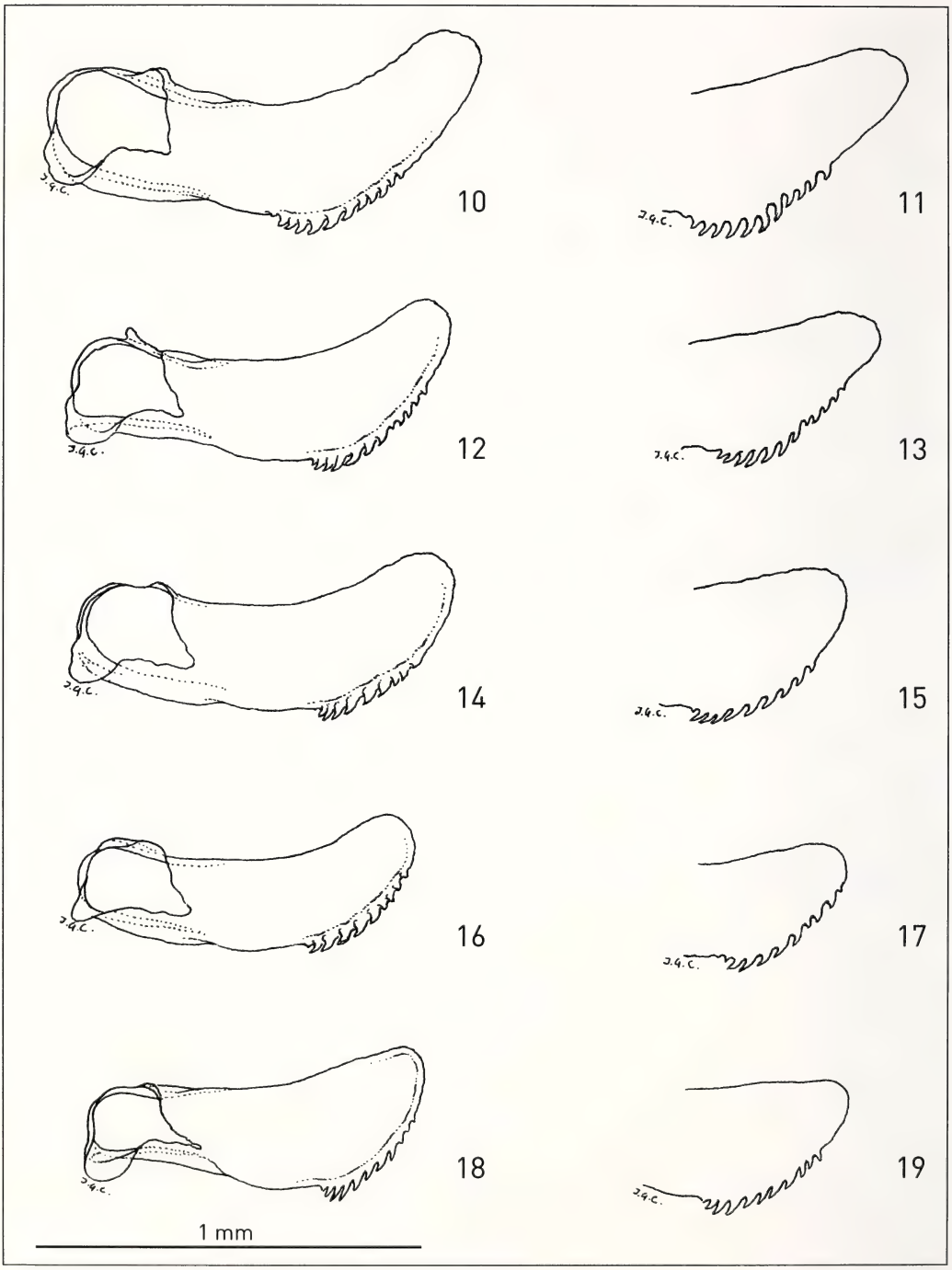
post-discal row of black spots. Variation in the females cannot be defined due to lack of sufficient material.

Male genitalia. Identical to those of nominotypical *T. taygetica* and of ssp. *endymionoides* (Coutsis 2005); right and left valvae roughly symmetrical to one another; number of valval terminal spikes varying from 11 to 25, even within a single locality, and always spreading the whole length of valval distal margin irrespective of their number; length of valva from about 1.03 mm to about 1.23 mm, proportionate to overall size of the butterfly.

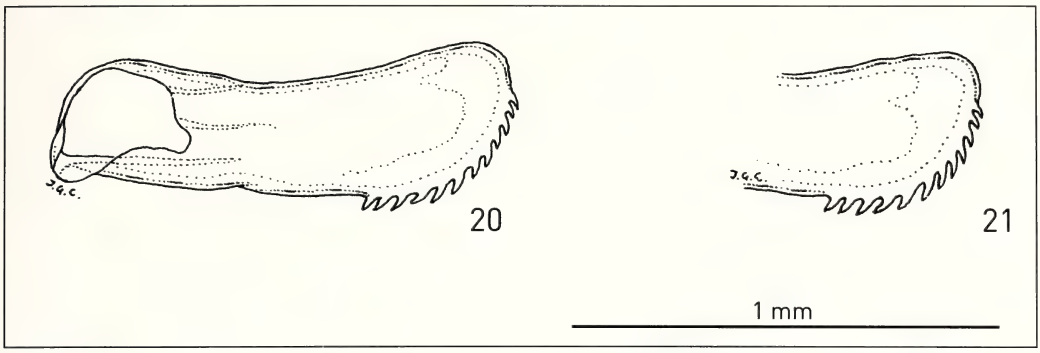
Distribution. *Turanana taygetica micrasiatica* has only been found so far in the southern part of central Asia Minor, as well as in part of the western half of Asia Minor, and namely in the Turkish provinces of Isparta, Afyon, Konya, Antalya, Kayseri, Niğde and Karaman. In one particular site, on Bolkardağları, Niğde province, it has been recorded as syntopic and synchronous with *T. endymion endymion* (Coutsis 2005). On Sultandağları it appears to be the sole *Turanana* taxon or ssp. present there.

Derivatio nominis. The name being given is derived from the latinized version of the Greek term 'Mikrá Asía', meaning Asia Minor, and its derivative 'Mikrasiatikí', meaning 'from Asia Minor'.

Diagnosis. *T. taygetica micrasiatica* may be distinguished from both nominotypical *T. taygetica* as well as from ssp. *endymionoides* by the fact that the forewing upperside blackish border always invades the post-discal area of the wing basad from its apex; it may also be distinguished from nominotypical *taygetica* by the darker upperside and underside ground-colours, by the wider, darker and more sharply defined upperside



Figs. 10–19. Right valva of *Turanana endymion* species-group taxa. **10, 12, 14, 16, 18.** View of mesal wall of valva. **11, 13, 15, 17, 19.** Flat view of distal part of mesal wall of valva. **10, 11.** *T. endymion ahasveros* from Iran, Tehran province, Resteh Ye Alborz, Ab Ali, 2500 m, 28.vii.1974, Blom leg., RMNH, specimen no. 3927. **12–21.** *T. endymion endymion*. **12, 13.** Turkey, Van province, 8–32 km N of Çatak, 1500–2200 m, 13.–19.vii.1990, Riemis & v. d. Poorten leg., ZMAN, specimen no. 3929. **14–19.** Iran, Mazandaran province, Khosh-Yeylaq, 2000–2500 m, Blom leg. 14.–17. 15./21.vi.1973, ZMAN. **14, 15.** Specimen no. 3925. **16, 17.** Specimen no. 3926. **18, 19.** Gorgan, 28.vi.–2.vii.1971, RMNH, specimen no. 3944.



Figs. 20–21. Right valva of *Turanana endymion endymion*, Israel, Hermon, 2000 m, 23.vi.1973, Benyamini leg., coll. Coutsis, specimen no. 3828. **20.** View of mesal wall of valva. **21.** Flat view of distal part of mesal wall of valva.

blackish borders, by the fact that the underside black post-discal spots are as a rule placed more basad, and by the orange sub-marginal scaling on hindwing, which is substituted by yellowish-beige in nominotypical *taygetica*. From nominotypical *T. endymion* it differs only in the male genitalia, there being no apparent external character differences between the two. From *T. endymion ahasveros* it differs both structurally as well as by external characters, in the latter case much in the way as does nominotypical *T. endymion* differ from *T. ahasveros* (Coutsis 2005). It is also worth noting that *T. endymionoides* appears to be closer externally to the geographically distant *micrasiatica* than it does to the geographically proximate nominotypical *T. taygetica*.

T. endymion species-group taxa from Iran and Israel

In Coutsis (2005) it is mentioned that specimens from Mazandaran province, Iran, though externally similar to *T. endymion ahasveros*, possess genitalia that are identical to those of nominotypical *endymion*. These specimens were referred to as '*endymion ?ahasveros*'. The assumed external similarity between *T. ahasveros* and *T. ?ahasveros* was based on a misjudgment caused by the worn condition of the Mazandaran material and the faded ground-colour of the relevant specimens.

A single recently acquired male specimen from Iran, Tehran province, Resteh Ye Alborz, Ab-Ali, 2500m, 28.vii.1974, W. L. Blom leg. agrees with *T. endymion ahasveros* both in external characters, as well as in genitalia (Figs. 10, 11), these being identical to those of *T. ahasveros* figured in Coutsis (2005). Two recently acquired male specimens in fresh condition, both from Mazandaran province, Khosh-Yelaq, 2000–2500 m, 15./21.vi.1973, W. L. Blom leg., as well as one recently acquired male, likewise in fresh condition, from Mazandaran province, Khosh-Yelaq, Mt.Gorgan, 2000–2600m, 28.vi.–2.vii.1971, W. L. Blom leg., were found to possess nominotypical *T. endymion*-like genitalia (Figs. 14–19), agreeing fully with those of *T. ?ahasveros* in Coutsis (2005), and to exhibit external characters that appear closer to those of nominotypical *T. endymion*, than to those of *ahasveros* (darker blue uppersides, darker undersides and purer orange underside spotting).

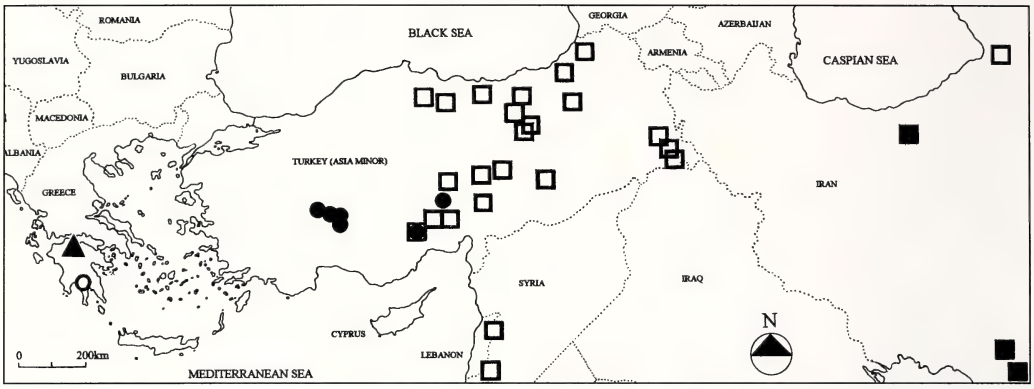


Fig. 22. Map indicating sampling localities of *T. endymion* and *T. taygetica*, based both on Coutsis (2005), as well as on present paper. □ = *T. endymion endymion*. ■ = *T. endymion ahasveros*. ○ = *T. taygetica taygetica*. ● = *T. taygetica micrasiatica*. ▲ = *T. taygetica endymionoides*.

In view of this it can now be said with a degree of certainty that in Iran *T. endymion* is represented by two structurally distinct subspecies, which in the future may conceivably prove to be separate species. The only reason for not adhering at present to this last position is that in Turkey there are rare instances whereby specimens with external characters that are similar to those of nominotypical *endymion* possess genitalia (Figs. 12, 13) that are somewhat reminiscent of those of *T. ahasveros*.

A single specimen from Israel, Hermon, 2000m, 23.vi.1973, D. Benyamini leg., which was found to possess genitalia that are identical to those of nominotypical *T. endymion* (Figs. 20, 21), is presently tentatively placed under this ssp.

Proposed taxonomic arrangements

With all present evidence at hand it is proposed that the following taxonomic arrangements be put to effect within the *Turanana* species-group.

Turanana endymion endymion (Freyer, 1850). TL: Turkey, Amasya province, 10 km SW of Ladik. Distribution: eastern half of Asia Minor, Iran (Mazandaran province), Lebanon and Israel.

Turanana endymion ahasveros (Bytinski-Saltz & Brandt, 1937). TL: Iran, Elburs Mts., Keredj. Distribution: Iran (Tehran & Fars provinces).

Turanana taygetica taygetica (Rebel, 1902). TL: Greece, Pelopónnisos, Mt. Taíyetos. Distribution: Greece, Mt. Taíyetos only.

Turanana taygetica endymionoides Coutsis, 2005. TL: Greece, Pelopónnisos, Mt. Helmós. Distribution: Greece, Mt. Helmós only.

Turanana taygetica micrasiatica ssp. n. TL: Turkey, Isparta province, Sultandağları. Distribution: so far known from south-central Asia Minor, as well as from parts of the western half of Asia Minor.

Corrections

The following corrections should be carried out in Coutsis (2005): p. 258, under heading Description, line 3: 'post-distal' should read 'post-discal'; p. 260, line 4, 'distad' should read 'basad'; p. 260, line 5, '1.26 mm' should read '1.03 mm'; p. 263, line 9, '1.27 mm' should read '1.04 mm'; p. 267, line 12, '1.59 mm' should read '1.28 mm'; p. 270, line 12, '1.48 mm' should read '1.16 mm'. The last four errors were caused by an inadvertent scale calibration mistake; the scale bars that appear in the plates, however, are correct.

Acknowledgments

I would like to extend my sincerest thanks and express my gratitude to Harry van Oorschot of the Zöologisch Museum, Universiteit van Amsterdam, to Dr. Rienk de Jong of the Naturalis, National Museum of Natural History, Leiden, to Dirk van der Poorten and to Jos Dills from Belgium, for directly or indirectly providing me with all the Turkish and Iranian material necessary for carrying out this endeavour. Many thanks are also due to Dubi Benyamini who had the kindness to give me the *Turanana* from Mt. Hermon, Israel.

References

Bytinski-Salz, H. & W. Brandt 1937. New Lepidoptera from Iran. – Entomologist's Records & Journal of Variation **49** (Supplement): (1)–(15).

Coutsis, J. G. 2005. Revision of the *Turanana endymion* species-group (Lycaenidae). – Nota lepidopterologica **27** (4): 251–272.

Coutsis, J. G. 2006. Revision of the *Turanana endymion* species-group (Lycaenidae) – a correction. – Nota lepidopterologica **28** (3): 193.

Freyer, C. F. 1831–1858. Neuere Beiträge zur Schmetterlingskunde mit Abbildungen nach der Natur **6** (81–100): 195 pp, 120 pls. (1846 – 1852).

Hesselbarth, G., H. van Oorschot & S. Wagener 1995. Die Tagfalter der Türkei. Vols. 1–3: 2201 pp. – Bocholt.

Rebel, H. 1902. Lepidopteren aus Morea gesammelt von Herrn Martin Holtz im Jahre 1901. – Berliner entomologischer Zeitschrift **47**: 83–110.

Torben B. Larsen 2005. Butterflies of West Africa. – Apollo Books, Stenstrup. – Text-Volume: 595 pp.; Plate-Volume: 125 pls. Size 28 × 217 cm. Hardcover (ISBN 87-88757-43-9). DKK 1280.00 (excluding postage). (In English).

Regarding systematics, butterflies are certainly the best studied large group of lepidopterans although many questions remain for future generations, for example to answer sibling species problems or well supported phylogenetic relationships. In contrast, the number of species seems to have reached an equilibrium as descriptions of new species are well balanced by synonymisations. One remaining problem is that taxonomic knowledge is usually scattered over uncountable publications, and syntheses to summarize this information and make it available to a broader public are still wanting. Torben Larsen already did so for the *Butterflies of Lebanon* (1974), the *Butterflies of Egypt* (1990), and the *Butterflies of Kenya* (1991), for example, and now he adds his comprehensive *Butterflies of West Africa* to the list of his contributions. What makes his books so outstanding is the fact that, among others, Torben Larsen knows the butterflies himself from the field, and, incidentally, one can read about his field experience in his *Hazards of Butterfly collecting* (2004), a joyful and humorful reading. The Afrotropical region is home to about 4000 butterfly species, or 21% of the world fauna. However, a much higher proportion, 32%, of all lycaenid species occurs in this region and the Lipteninae (Lycaenidae), with 599 species, are endemic to this region. More than one third of the entire afrotropical butterfly fauna can be found in West Africa. These are about 1,450 butterfly species, which are treated by Torben Larsen in *Butterflies of West Africa*. The book starts with three pages of contents, which are necessary to use the book efficiently. This is followed by a foreword by Steve Collins, a preface by Dick Vane-Wright, an "About this Book" by the author, and three full pages of acknowledgements. The introduction starts with a detailed description of the geography of the area covered, which comprises 15 countries from the south of Mauritania in the West to the northwest of Cameroon in the East. For the same area, the biogeography, biodiversity, history of collecting, ecology, migration, threats and extinctions, as well as butterfly conservation issues are treated in detail. In addition to descriptions of the main habitats, the reader learns that the rain forests in West Africa declined to between 4 and 43% (average 13.2%) of their original area depending on country – but this was the state of the losses in 1986! Happily, Torben Larsen shows by his own observations that this habitat loss probably did not lead to the extinction of any butterfly species yet. However, further destruction would evidently increase the risk of extinctions. Monitoring this process is a necessary prerequisite to discover species that are in danger and to develop programmes for their conservation and that of their habitats. This requires expertise in *systematics*, which is the subject of the next chapter in *Butterflies of West Africa*: it starts with an introduction into terminology (unfortunately, the author still uses a numerical system for the wing venation) and a list of Afrotropical butterfly genera indicating the distribution of the species included in every genus as well as the number of species occurring in West Africa. Then, the taxa are treated hierarchically, from superfamily to genus, with the species in each genus arranged systematically. Each taxon is shortly described. For each supraspecific taxon the numbers of species and general distribution are indicated, and some diagnostic characters are given. For species the text is divided in sections on identification, habits, early stages, and distribution, with detailed information on the occurrence in West Africa, habitat preferences and behavior of the butterflies, and host plant records of early stages (altogether, about 2000 host plant records are given in the book). Sometimes a paragraph of additional information and illustrations, e.g. images of butterflies or genitalia structures, are included in the text. The text-volume is completed with the reference section, which contains about 600 references – an important pool for further study! – and an index to scientific names. The plate-volume starts with the contents of the 125 plates, which enables the reader to find the first plate of each subfamily, while generic and species group names can be found via the index at the end of this volume. About 1450 species (3900 specimens) are figured in colour, some of them for the first time! This book provides a unique, comprehensive, and illustrative source to the butterflies of West Africa. It enables the user to identify the species and to learn about their occurrence and host plants. It is perfectly suitable as a basic tool to study West African butterflies, but also to use butterflies as indicators for habitat management; hence, it is certainly worth its price. Let's hope that it will find a wide distribution and use in favour of West African nature and particularly its butterflies.

MATTHIAS NUSS

Description of the unknown female of *Agriopis beschkovi* Ganev, 1987 (Geometridae: Ennominae), and illustration of the larvae

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Abstract. We describe the unknown female of *Agriopis beschkovi* Ganev, 1987 (Geometridae, Ennominae), a species so far only reported from Bulgaria and Iran. The findings are based on material collected in oak forests of the West-Iranian provinces Lorestan and Kermanshah where *A. beschkovi* can cause calamities. Apart from the distinctive habitus the long antennal setae and morphological details of the genitalia are diagnostic features of the females. The female's genitalia and habitus, the reduced tympanal organ, male specimens, the male genitalia and the two colour forms of the hitherto unknown larvae are illustrated. Observations on the biology of *A. beschkovi* are given. The female genitalia of the related species *Agriopis leucophaearia*, *Agriopis aurantiaria*, *Agriopis marginaria* and *Agriopis bajaria* are illustrated for comparison.

Zusammenfassung. Wir beschreiben das unbekannte, flügellose Weibchen von *Agriopis beschkovi* (Geometridae, Ennominae), einer Art, die bislang nur aus Bulgarien und dem Iran bekannt ist. Die gewonnenen Ergebnisse basieren auf Material, das in Eichenwäldern der westiranischen Provinzen Lorestan und Kermanshah gesammelt wurde, wo *A. beschkovi* Kalamitäten verursacht. Neben dem unverwechselbaren Habitus des Weibchens stellen die langen Setae auf den Antennen und morphologische Details des Genitalorgans diagnostische Merkmale dar. Wir bilden das weibliche Genitalorgan sowie den Habitus und das reduzierte Tympanalorgan des Weibchens ab. Neben einem lebenden männlichen Exemplar zeigen wir die männlichen Genitalorgane und die beiden Farbvarianten der bislang nicht bekannten Larve. Die Arbeit enthält außerdem Angaben zur Biologie von *A. beschkovi*. Weiterhin zeigen wir die weiblichen Genitalorgane der verwandten Arten *Agriopis leucophaearia*, *Agriopis aurantiaria*, *Agriopis marginaria* und *Agriopis bajaria*.

Key words. Lepidoptera, Geometridae, Ennominae, *Agriopis*, apterous female, genitalia morphology, tympanal organ, winter moths, larvae, pest, Iran.

Introduction

Members of the genus *Agriopis* Hübner, 1825 (Scoble et al. 1999) are generally active during the cold season as it is well known for *A. leucophaearia* ([Denis & Schiffermüller], 1775), *A. aurantiaria* (Hübner, 1799), *A. bajaria* ([Denis & Schiffermüller], 1775), and *A. marginaria* (Fabricius, 1776). *A. beschkovi* Ganev, 1987 displays a similar activity pattern as indicated by the collection dates mentioned by Ganev (1987) and the dates of the material investigated here. The species was described by Ganev in 1987 on the basis of Bulgarian specimens. Until now the species has only been recorded from Bulgaria and Iran (Ganev 1987; Müller 1996; Hausmann pers. comm.). However, the female of *A. beschkovi* has remained unknown and is described here by external characters and genitalia morphology.

Material

The investigated specimens were reared from larvae collected in 2004 and 2005 in West-Iran (Lorestan: Ghelaie, Shor-abe, Evandar and Kermanshah: Gahvareh) by the

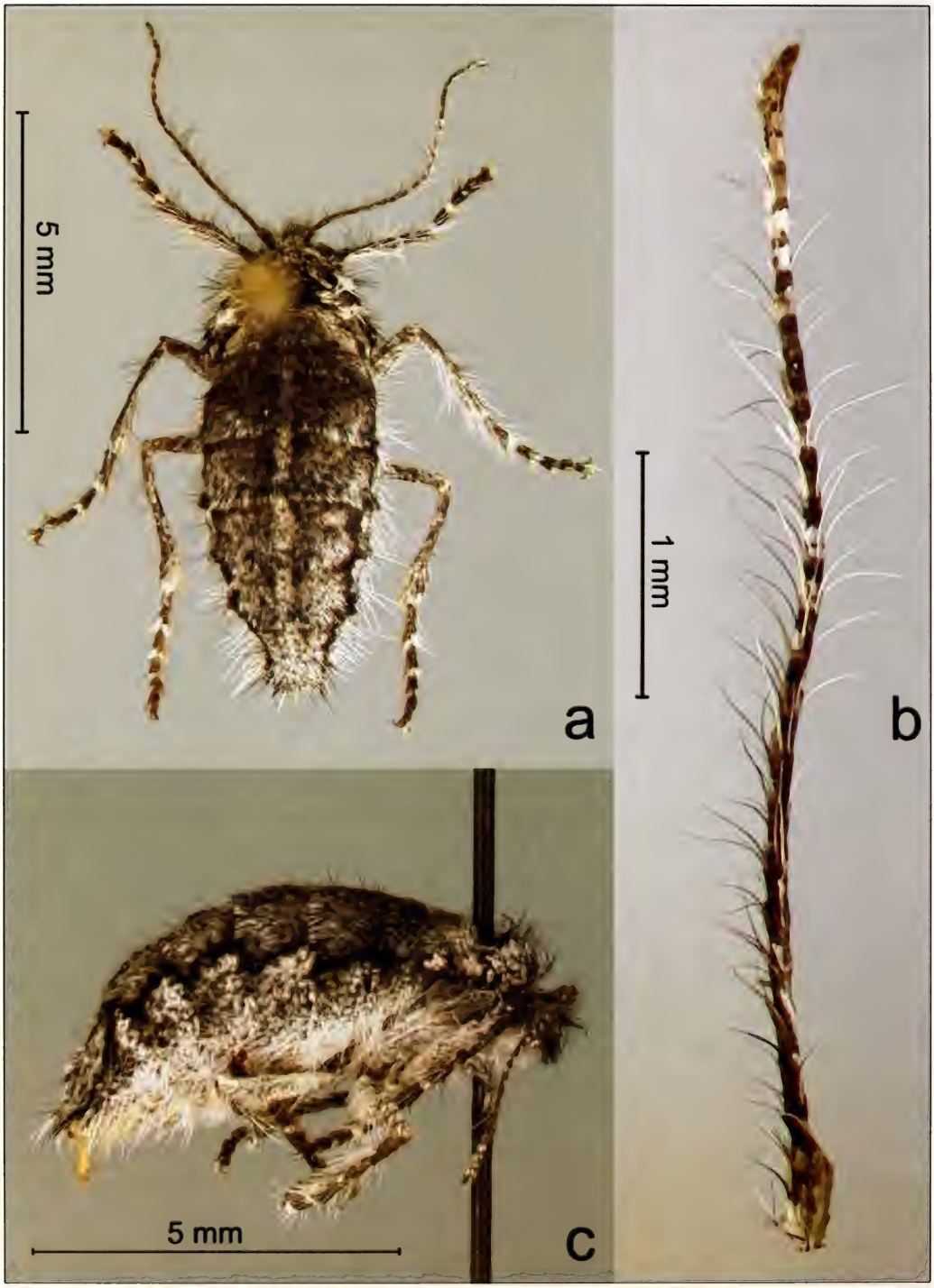

Fig. 1. Female of *Agriopis beschkovi* Ganev, 1987 from W-Iran, 2004-2005, ex larva, leg. M. Tavakoli; **a.** dorsal view of a female, **b.** right antenna of another specimen, **c.** lateral view of the female shown in picture a before mounting.

second author. The biological observations were also made at these locations. For the investigation of external characters four female specimens were used. The description of the female genitalia relies on further five specimens. The illustrated and dissected males were also reared from these larvae. In habitus (Fig. 3c, 4) and male genitalia (Fig. 5) we could not observe any noteworthy differences from the illustrations given in Ganev (1987). We compared the female genitalia of *A. beschkovi* with those of other *Agriopis* species. For this purpose we dissected the following material (citations as written on the labels): *A. leucophaearia*. 2♀♀ Austr. inf., Wien, Kahlenberg, 4.ii.1923., A. Ortner. *A. marginaria*. 1♀ Austria Inferior, W.-Wald 4.iv.1920, coll. H. Reisser, Wien; 1♀ Austria Inferior, Mauer 12.iii.1937, coll. H. Reisser, Wien; 1♀ Neubau-Kreuzstetten, Austr. Inf. 14.iv.1940, coll. H. Reisser, Wien. *A. aurantiaria*. 2♀♀ Austr. inf., Neuwaldegg, 2/11 1930, Ing. Kautz, Wien; 1♀ [Germany, Baden-Württemberg], Ettlingen, Stadtgeb., 22.xi.1956.; 1♀ Austr. inf., Wien, 3-markstein, 10.xi.1946, A. Ortner. *A. bajaria*. 1♀ E Larva, [Austria], Muellendorf, Burgenld 2.xi.1933, coll. H. Reisser. Wien; 1♀ E Larva, [Austria], Muellendorf, Burgenld 19.xi.1933, coll. H. Reisser. Wien; 2♀♀ [Germany, Bayern], Ingolstadt, el. 20.x.1959, Schlusche leg. The investigated material is deposited in the Staatliches Museum für Naturkunde Karlsruhe (SMNK); the images of figs. 1, 2, 5, 6 were taken with the automontage technology.

Description of the female

Habitus. The habitus of an *A. beschkovi* female is shown in Fig. 1 (a, c). Length (distance from frons to the tip of abdomen) ranges from 7 to 8.5 mm (n = 5).
Head. Proboscis present but strongly reduced, palps whitish. Vertex greyish, frons bearing a black tuft of long hair-like scales. Parts of the antennae chequered (annulated) dark and light, covered with long setae (Fig. 1b).
Thorax. Wings completely reduced, tegulae present. Legs with white femora; ventral side of tarsi light brown-coloured; apical scales of tibia and tarsomeres pale.
Pregenital abdomen. Dorsal side of abdomen grey with a light medial line; ventral side white, separated from the darker upperside by a pleural, black, zigzag line (Fig.1c). The tympanal organ of males seems to be regularly developed as it has a large tympanal cavity. In the females the tympanal organ is reduced to a conspicuous hook (Fig. 2c). The bulla tympani is largely reduced and only a small residue of the former cavity is present. Genitalia. Apophyses posteriores long and slender, proximal end curved and flattened, hockey-stick-shaped (Fig. 2). Apophyses anteriores about 60% length of apophyses posteriores, proximal end similarly flattened but less curved. Tergum A8 weakly sclerotized, lamella antevaginalis crescent-shaped. Posterior part of ductus bursae membranous and funnel-shaped. Anterior part of ductus bursae curved, long and slender, more strongly sclerotized and three to four times longer than the funnel-shaped posterior part (measured from the proximal border of lamella antevaginalis to origin of ductus seminalis and from origin of ductus seminalis to junction with corpus

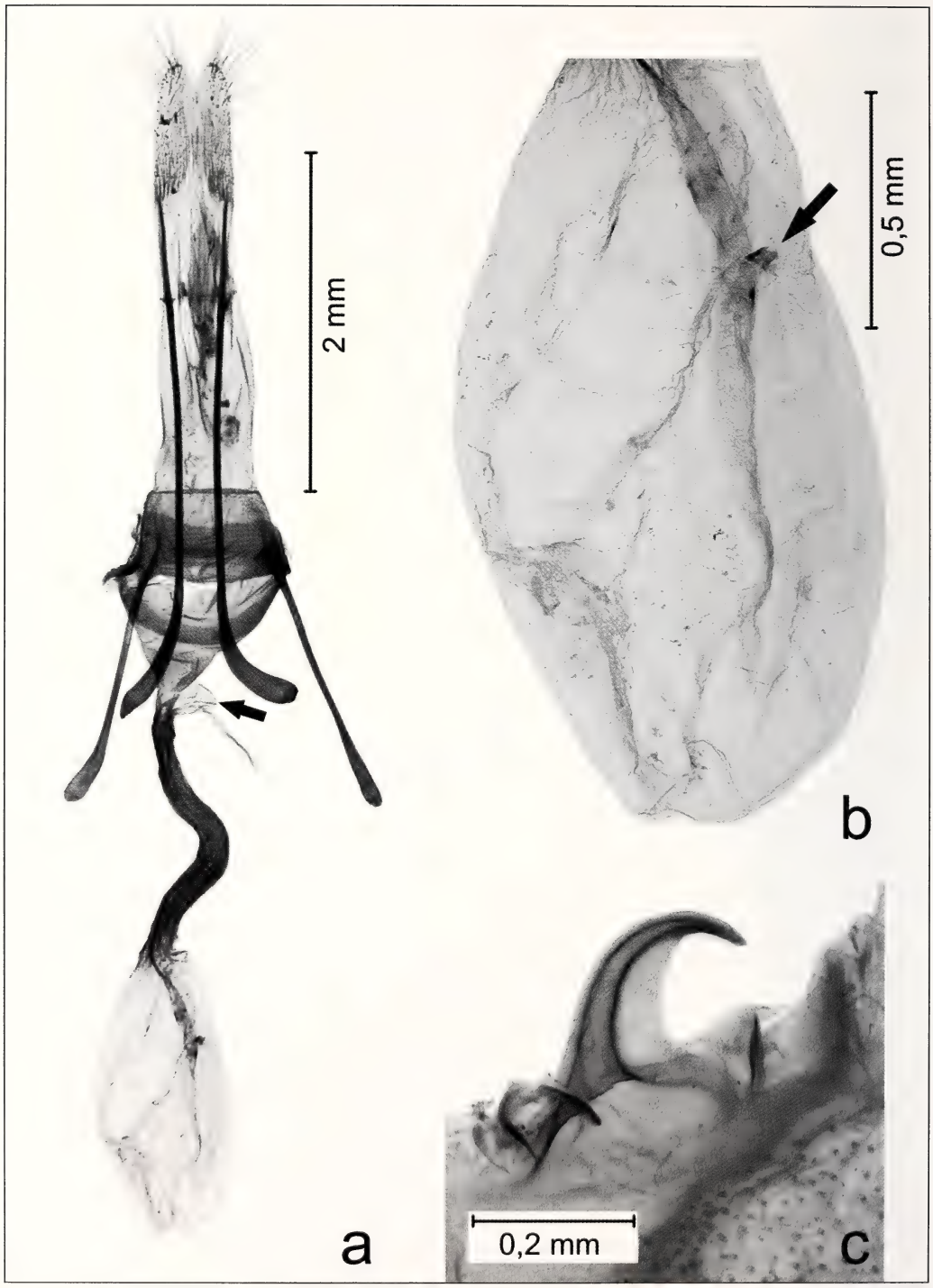

Fig. 2. Female genitalia and tympanal organ of *A. beschkovi*, **a.** female genitalia, with blind sac of the basal ductus seminalis (arrow), **b.** corpus bursae (stronger magnified), with small signum bursae (arrow), **c.** reduced left tympanal organ (slides: G-1307 (genitalia), G-1283 (tympanal organ), SMNK).

Fig. 3. Larvae and live male adult of *A. beschkovi* from W-Iran, 2004-2005, leg. M. Tavakoli, **a.** grey-greenish form of the larva, **b.** grey-brown form of the larva, **c.** resting specimen of a male *A. beschkovi*. Differences in colouration between the specimen shown above and the specimen shown in Fig. 4 are due to artificial light photography.

bursae). Ductus seminalis entering ductus bursae at the border between the funnel shaped and the stronger sclerotized part of the ductus bursae. The basal part of ductus seminalis bears a blind sac (Fig. 2a, arrow). Corpus bursae membranous and hyaline, approximately as long as the curved part of ductus bursae, oval shaped, with only one small signum in the posterior part of corpus bursae (Fig. 2a, b, arrow). The signum bursae varies considerably in shape. In one case it can be described as a pyramidal structure the tip of which is projecting into the lumen of corpus bursae.

Diagnosis. Apart from the characteristic habitus (Fig. 1a, c), the long setae on the antennae can serve as a diagnostic character of the females of *A. beschkovi*. The related species *A. marginaria*, *A. bajaria*, *A. leucophaearia* and *A. aurantiaria* lack these long setae.

The morphology of the female genitalia organ of *A. beschkovi* is clearly different from those of the females of the other investigated species (see Fig. 6). Apart from the unmistakable overall shape (compare Figs. 2a, 6a–d) there are several morphological character states which allow an easy identification of *A. beschkovi*. The crescent-

Fig. 4. Males of *A. beschkovi* from W-Iran, 2004-2005, ex larva, leg. M. Tavakoli, **a.** upperside, **b.** underside.

shaped lamella antevaginalis is unique to *A. beschkovi* within the investigated species. Furthermore the strongly curved (hockey-stick-shaped) apophyses posteriores and the curved, long anterior part of ductus bursae are characteristic.

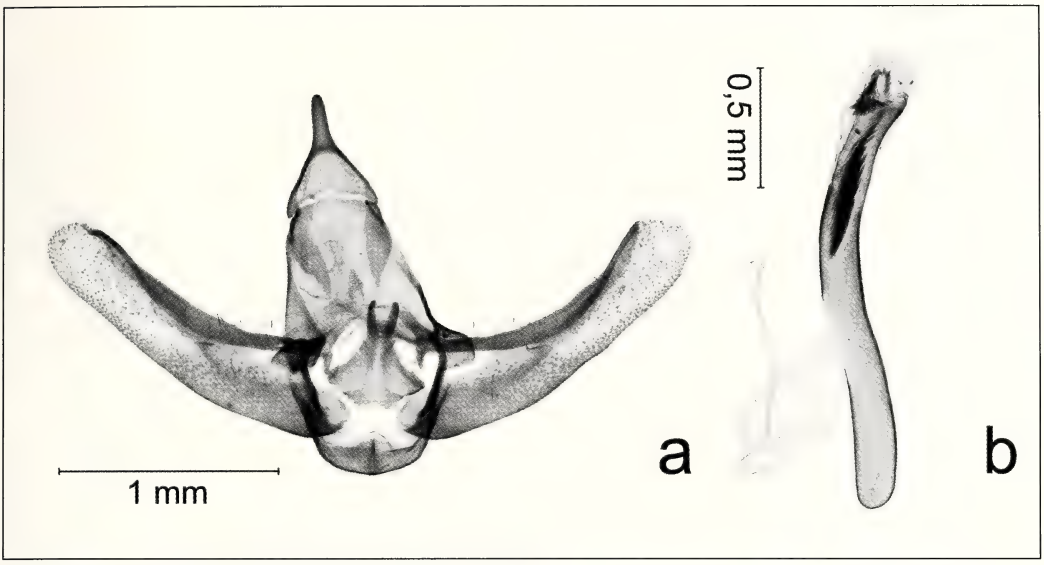

Fig. 5. Male genitalia organs of *A. beschkovi*, **a.** genitalia, **b.** aedeagus (gen. prep. G-1328, SMNK).

Life history. The formerly unknown larvae of *A. beschkovi* are presented in Figs. 3a–b. One form has a grey-greenish (Fig. 3a) another has a grey-brown habitus (Fig. 3b). The larvae feed exclusively on trees and shrubs of *Quercus brantii* and *Quercus infectoria* (Fagaceae). They are active at night and show reduced activity during daytime. The larval period spans about 55–65 days under laboratory conditions. In nature, larvae hatch from early March to early April, depending on the weather conditions. They are found until mid-May. Observed parasites are Hymenoptera (Ichneumonidae) and fungi. The adults occur in December and January in the forests. In Iran, *A. beschkovi* causes calamities with economic importance due to the defoliation of oaks by larvae. The species inhabits subtropical oak forests with an average altitude of 1.100 to 1.750 m above sea-level and snow in the winter. The mean annual temperature is about 15–20 °C and the mean annual precipitation is estimated at 450–650 mm. *A. beschkovi* is a dominant species compared with other oak-feeding moth species occurring in these habitats (*Catocala* spp., *Dicycla oo, Malacosoma* sp., *Porthesia melania*, *Tortrix viridana* and others).

Discussion

Wing reduction in female winter moths is a well known phenomenon (cf. Sattler 1991). The females of all *Agriopis* species are wingless (concerning *A. dira*, cf. Inoue et al. 1982). So it is not surprising that the female of *A. beschkovi* is wingless, too. Another interesting feature of winter moths is the usual reduction of mouthparts (Sattler 1991) which is also the case in *A. beschkovi* females as well as in the males. The reduction of the tympanal organs is observed in a considerable number of wing-reduced females of geometrid moths. In the species formerly included into the genus *Hibernia* (*Agriopis*

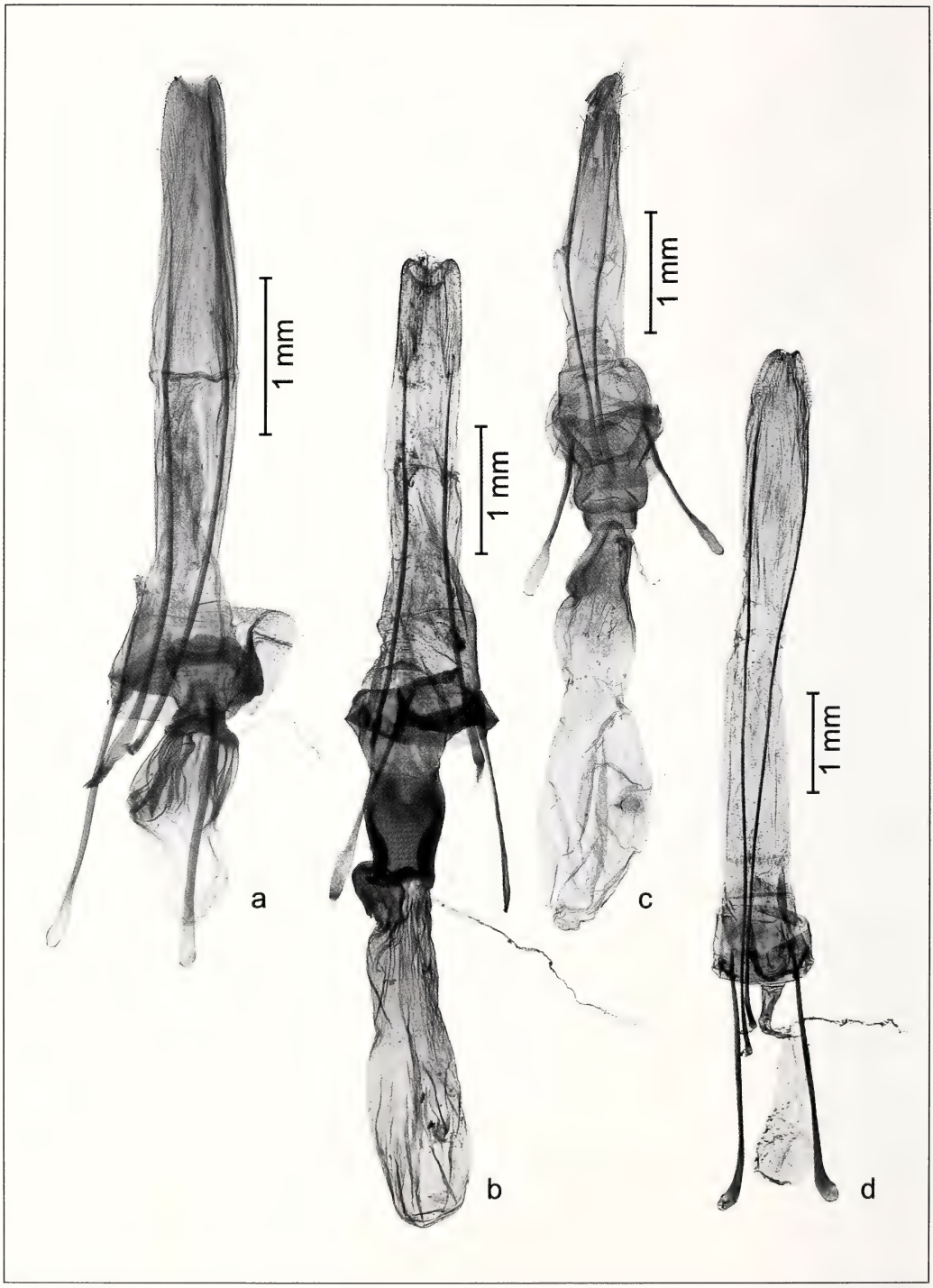

Fig. 6. Female genitalia of *Agriopis* species, **a.** *A. leucophaearia,* Austria (gen. prep. G-1339, SMNK), **b.** *A. aurantiaria*, Germany (gen. prep. G-1402, SMNK); **c.** *A. marginaria*, Austria (gen. prep. G-1398, SMNK), **d.** *A. bajaria*, Germany (gen. prep. G-1403, SMNK).

marginaria, Agriopis bajaria, Agriopis leucophaearia, Theria rupicapraria, Erannis defoliaria) male tympanal organs are well developed whereas those of the females are reduced (Heitmann 1954). This applies also to *A. beschkovi*. In reduction of wings and tympanal organs the females of *A. beschkovi* match the characteristics of other *Agriopis* females.

An interesting feature of the female genitalia of *A. beschkovi* is the blind sac at the basal part of the ductus seminalis which is also present in the female genitalia of *A. marginaria*. In *A. leucophaearia* the structure could not be observed. The blind sac seems also to be absent in the remaining two species *A. aurantiaria* (in three of the four investigated specimens the blind sac was absent, in one case the ductus seminalis was ruptured during dissection) and *A. bajaria* (two of four investigated specimens did not possess a blind sac; in the other two specimens it was not possible to decide whether a blind sac is present or not due to the poor quality of the material). However, further study is needed to examine if this character is really homologous in *A. beschkovi* and *A. marginaria*.

Acknowledgements

We are greatly indebted to Christiana Klingenberg and Alexander Riedel (both Karlsruhe) for their valuable help with photography and image processing and Axel Steiner (Wöschbach) who revised our English. Furthermore we would like to thank N. Pöll (Bad Ischl) and an anonymous referee for valuable comments.

Literature

Ganev, J. 1987. Eine neue Geometriden-Art aus Bulgarien *Agriopis beschkovi* sp.n. (Lepidoptera, Geometridae, Boarmiinae). – Entomofauna **8** (18): 273–275.

Heitmann, H. 1954. Die Tympanalorgane flugunfähiger Lepidopteren und die Korrelation in der Ausbildung der Flügel und der Tympanalorgane. – Zoologische Jahrbücher (Anatomie) **59**: 135–200.

Inoue, H., S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe 1982. Moths of Japan, Vol. 2. pp. 1–552. – The Kyodo Printing Co. Ltd., Tokyo.

Müller, B. 1996. Geometridae. Pp. 218–249. – *In*: O. Karsholt & J. Razowski (eds.), The Lepidoptera of Europe. A distributional checklist. – Apollo Books, Stenstrup.

Sattler, K. 1991. A review of wing reduction in Lepidoptera. – Bulletin of the British Museum (Natural History) Entomology **60** (2): 243–288.

Scoble, M. J. (ed.) 1999. Geometrid moths of the world – a catalogue, 2 vols. – Apollo Books, Stenstrup. 1016+129 pp.

Eliasson, C. U., N. Ryrholm, M. Holmer, K. Jilg & U. Gärdenfors 2005. Nationalnyckeln till Sveriges flora och fauna. Fjärilar: Dagfjärilar. Hesperiidae-Nymphalidae. – ArtDatabanken, SLU, Uppsala. 407 pp. – 28 × 23 cm. Hardcover (ISBN 91-88506-51-7), distributed outside Sweden by Apollo Books, Stenstrup, DKK 280.00 (excluding postage). (in Swedish)

This is the first published volume of the National Encyclopedia of the Swedish Flora and Fauna. This Encyclopedia is part of the ambitious "Svenska artprojekt" which aims at scientifically describing and illustrating all the metazoans, plants, and fungi living in Sweden, and at popularizing the collected information. The protection of biodiversity depends on the cooperation of everybody, and knowledge of the problems should stimulate people to become active in this field. For this reason, the Swedish parliament finances the "Nationalnyckeln" as the educational tool to promote knowledge of biodiversity and interest in biological sciences in all Swedes, regardless of age. The books are available at a relatively low price thanks to this generous funding. The butterfly volume includes all the Papilionoidea and Hesperioidea distributed in Sweden, Norway, Denmark, Finland, and Iceland, with keys for the identification of all 140 species found in the region. The keys are illustrated and bilingual (Swedish and English); a short abstract in English is provided for each species and English vernacular names can be searched for in the index; the rest of the text is in Swedish. A table at the end of the book indicates the correspondance between scientific names and vernacular names in Swedish, Norwegian, Danish, Finnish, and Icelandic. Here the entry names are the Latin ones, although the Swedish ones would have been preferable, since in the text they are often used alone. A political map shows the subdivisions of the Nordic countries and their provinces. Maps illustrate the distribution of each butterfly species in the Nordic countries before and after 1980. This is generally an interesting idea, but the choice of year 1980 as borderline is however curious, since the most dramatic changes in distribution are said to have happened in the Sixties. Coming to the text in Swedish, the introductory chapter is very well made, including suggestions to recognize all life stages of butterflies from those of moths and other insects, and information on butterfly phylogeny, anatomy, intraspecific variability, ethology, ecology, and distribution patterns. The section on ecology is particularly ample and focused on the environmental conditions typical of Nordic countries. It includes a history of land-use in Sweden, where the causes of the dramatic decline of butterfly populations are analyzed and possible solutions are suggested, both at a small scale (practicable by single citizens) and at a large scale. The reader is encouraged to get practical experience on butterflies, including rearing and butterfly watching; collectors are warned about the presence of protected species. All citizens are invited to enter their observations on species distribution on the national web page "Artportalen." In the special part, information about morphology, ethology, and world distribution is given for each family and lower-rank taxon. For each species, information is also given on habitat, life cycle, food plants, present trends in geographical distribution, synonymy, reference to the original description, and meaning of the Latin name. The "correct" (Swedish) pronunciation of Latin names is indicated. The whole book is illustrated in colour; photographs of different biotopes from all regions of Sweden were taken by the authors themselves. The drawings of the species are well-made, very big (for the joy of children!) and provided with a bar to indicate natural size. However, in some cases additional illustrations would have been desirable, for example to show the underside of the wings in *Thymelicus* spp. and the larvae of *Colias alfacariensis* and *C. hyale*. Some of the butterflies illustrated in resting position have the head to the right, others to the left, which does not facilitate comparison in difficult genera such as *Pyrgus*. The information given in the text is generally up-to-date, although the recently re-established synonymy of *Pontia edusa* with *P. daplidice* has been missed. I noticed a few excessive simplifications; for example, the head is counted as the first segment of a caterpillar's body. Moreover, wing coupling without hooks or hairs is considered a good character to recognize a butterfly from a moth, without mentioning the existence of macro-moths without a frenulum. I checked the key with specimens belonging to ten species and to all the five families treated in the book, encountering only two minor problems. In my (German) specimens of *Hamearis lucina*, the submarginal dots are isolated from the dark border of both pair of wings, and not fused to it as illustrated in the book. This may cause some troubles at point 17 of the main key, although such light-coloured specimens may not occur in Nordic countries. At point 3 of the key to Heliconiinae, it might be wise to replace "a large number of... spots" with a more precise "20 or more... spots". For the rest, this is a very good popular book, from which professional entomologists can learn something new as well... provided that they can read Swedish!

Francesca Vegliante

The taxonomy and life history of *Epimetasia monotona* (Amsel, 1953) comb. n. from Northwest Africa (Pyraloidea: Crambidae: Odontiinae: Odontiini)

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Abstract. The genus *Thyridopsis* Amsel, 1953 (originally established in Pyralidae: Schoenobiinae) is synonymised with *Epimetasia* Ragonot, 1894 (Crambidae: Odontiinae) and the type-species of *Thyridopsis*, *Thyridopsis monotona* Amsel, 1953, is transferred to *Epimetasia*. A description of larvae, pupae and adults of *Epimetasia monotona* (Amsel, 1953) **comb. n.** is given and information on the life history, including larval food plant and habitat is provided. A catalogue is given for the genus *Epimetasia*. *Pionea vestalis* Hampson, 1900 **syn. n.** is regarded as a junior subjective synonym of *Epimetasia vestalis* (Ragonot, 1894: 173) (*Metasiodes*) and therefore becomes a junior secondary homonym of the latter.

Resumé. Les auteurs synonymisent le genre *Thyridopsis* Amsel, 1953 (décrit dans les Pyralidae Schoenobiinae) avec *Epimetasia* Ragonot, 1894 (Crambidae: Odontiinae) et transfèrent l'espèce type de *Thyridopsis*, *T. monotona* Amsel, 1953 dans *Epimetasia*. En outre, ils décrivent la chenille, la chrysalide, ainsi que l'adulte d'*Epimetasia monotona* et ajoutent des informations concernant la plante-hôte et l'habitat. Ils fournissent aussi un catalogue du genre *Epimetasia*. *Pionea vestalis* Hampson, 1900 **syn. n.** est considéré comme un synonyme subjectif plus récent de *Epimetasia vestalis* (Ragonot, 1894: 173) (*Metasiodes*) et donc aussi comme un homonyme secondaire de ce nom.

Key words. Insecta, Lepidoptera, Morocco, Mauritania, larval host plant, *Trichodesma calcarata*, Boraginaceae.

This paper is dedicated to Mr. Abdelkader, forester in Telouet (High Atlas), for his untiring efforts for the reforestation of the region south of the Tizi-n-Tichka (a pass between Marrakech and Quarzazate).

Introduction

Our knowledge of the pyraloid fauna of Morocco is scattered in numerous taxonomic publications (e.g., Rebel 1896; Oberthür 1922; Rothschild 1925; Le Cerf 1933; Schmidt 1934; Lucas 1937; Amsel 1952, 1953, 1956, 1966; Asselbergs 1998). Though Charles Rungs (1979) wrote a synthesis on this knowledge (for all Lepidoptera), our understanding of the pyraloid fauna of Morocco is still limited due to the need of taxonomic revision of many pyraloid taxa which have representatives in Northwest Africa. These problems came into focus when Rolf Bläsius returned from Morocco with pyraloid specimens reared from a boraginaceous plant. Investigation of male genitalia structures undoubtedly refer this species to the Odontiinae, but for this taxon, the same situation holds true as mentioned for the pyraloid fauna of Morocco as a whole: there is no review available to enable ready identification. After searching the literature and museum collections, and discussions with colleagues, we find close

affinities of this species with the odontiine genus *Epimetasia* Ragonot, 1894. However, there was no species included in this genus which could be regarded as conspecific with "our" species from Morocco. Surprisingly, our investigations of further taxa described from north-western Africa showed conspecifity with a taxon described by Amsel (1953) in the Schoenobiinae, *Thyridopsis monotona*. This species is certainly a close relative of two species placed in the genus *Epimetasia*, *E. abbasalis* Amsel, 1974 and *E. rufoarena*lis (Rothschild, 1913). Because of this taxonomic situation, we herewith synonymise *Thyridopsis* Amsel, 1953 with *Epimetasia* Ragonot, 1894 and transfer *Thyridopsis monotona* Amsel, 1953 to the latter genus. However, a phylogenetic study remains necessary to test whether *Epimetasia* with its current constituent species is monophyletic. Here, we provide a re-description of the adults of *E. monotona* Amsel, 1953 comb. n. including a differential diagnosis and publish our observations on the life history and some morphological characters of the larvae and pupae of *E. monotona*.

Catalogue of *Epimetasia*

Epimetasia Ragonot, 1894: 226 (objective replacement name for *Metasiodes* Ragonot, 1894). Type species: *Metasiodes vestalis* Ragonot, 1894, by original designation (for *Metasiodes* Ragonot, 1894).

Metasiodes Ragonot, 1894 (July 30): 172–173. Type species: *Metasiodes vestalis* Ragonot, 1894, by original designation. *Metasiodes* Ragonot, 1894 (July 30) is a junior homonym of *Metasiodes* Meyrick, 1894 (May 11): 8 (Pyraloidea).

Thyridopsis Amsel, 1953: 1441 **syn. n.** Type species: *Thyridopsis monotona* Amsel, 1953, by original designation.

Epimetasia abbasalis Amsel, 1974: 197–198, fig. 1a, Abb. 2 fig. 4. Type locality: South Iran, Issin, 240 m.

Epimetasia albalis Amsel, 1959: 54. Type locality: Iraq, Shaqlawa.

Epimetasia eoa (Meyrick, 1936: 28) (*Neoschoenobia*). Type locality: Iraq, Rayat. Amsel 1959: 54 (*Epimetasia*).

Epimetasia gregori Amsel, 1970: 56–58, text-fig. 20, pl. 3 figs. 41, 42. Type locality: Afghanistan, Band-i-Amir, 2900 m.

Epimetasia gregori gulbaharalis Amsel, 1970: 58, pl. 3 fig. 46. Type locality: Afghanistan, Straße Gulbahar-Sarobi, 1600 m.

Epimetasia gregori panjaoalis Amsel, 1970: 58, pl. 3 fig. 45. Type locality: Afghanistan, Mullah-Jacub-Paß, Oberlauf des Helmand, 3000 m.

Epimetasia monotona (Amsel, 1953: 1442, figs. 1, 1a). **comb. n.** Type-locality: Mauritania, Oum el Ahmar.

Epimetasia rhodobaphialis (Ragonot, 1894: 173–174) (*Metasiodes*). Type locality: [Uzbekistan] Samarkand.

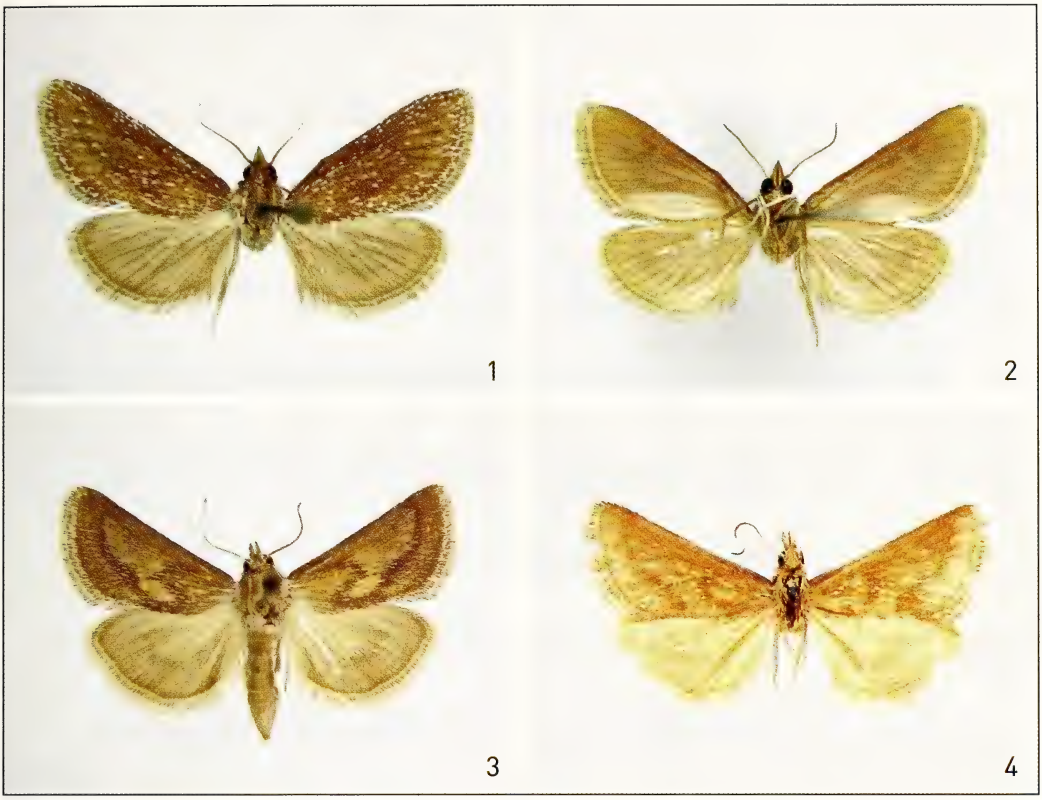
Epimetasia rufoarenalis (Rothschild, 1913: 140–141) (*Calamochrous*). Type locality: [Algeria] central western Sahara, north of Aïn Guettara. Speidel & Hassler 1989: 33, pl. 5 fig. 7 (*Epimetasia*).

Pionea simplicealis Rothschild, 1915: 401–402. Type locality: [Algeria] Hoggar mountains, Oued Ag'elil. Speidel & Hassler 1989: 33, pl. 5 fig. 7 (syn.?).

Epimetasia vestalis (Ragonot, 1894: 173) (*Metasiodes*). Type locality: [Turkey] Mardin.

Pionea vestalis Hampson, 1900: 395, **syn. n.** Type locality: [Turkey] 'Armenia, Mardin'. *Pionea vestalis* Hampson, 1900 is regarded here as a junior subjective synonym of *Metasiodes vestalis* Ragonot, 1894 and therefore a secondary junior homonym of *Epimetasia vestalis* (Ragonot, 1894). It is evident from Hampson's (1900) description that he described a new species, which is originally indicated by "n. sp. (Stgr. MS)".

Epimetasia vestalis rubrilinealis Zerny, 1939: 173, pl. 11 fig. 9. Type locality: Iran, Elburs-Gebirge, Tarsee Gebiet, 2100–2200 m.



Figs. 1–4. Adult specimens of *Epimetasia*. **1.** *E. monotona* comb. n., dorsal view. from Morocco, 15 km northeast Agadir, Asif Tamrhakht river, 300–600 m, Bläsius leg., coll. MTD. **2.** *E. monotona* comb. n., ventral view (same specimen as in Fig. 1). **3.** *E. abbasalis* Amsel, 1974, holotype ♀, with labels: "Holotypus ♀ | Epimetasia | abbasalis Amsel", "S-Iran, Issin 240 m | 5.4.1973, Periploca- | aphylla-Steppe | leg. H. G. Amsel", SMNK. **4.** *E. rufoarenalis* (Rothschild, 1913), syntype ♀, with labels: "Type", "N. of Ain Guettara | Centr. W. Sahara | 8.–11.iv.1912 | Hartert & Hilg.", „Calamachrous | rufoarenalis | Type Rotsch.", BMNH. 1♀ India, BMNH.

Methods

In the field, the larvae were found in the roots of the food plant. The infested roots were cut off and transported in plastic bags to preserve a certain amount of humidity. At home, the roots containing larvae were planted in plastic pots with a mixture of sand and soil. This was regularly sprinkled with water to prevent total dehydration of the roots. The larvae collected in late April presumably were fully grown and did not feed much more, whereas the larvae collected on 27.ii.2004 presumably starved in the dying roots.

The larval morphology is described on the base of one exuvia of the last larval stage. Description of colours is based on the dry specimen. For further investigations, the exuvia was macerated in 10% KOH, subsequently neutralised in water, stained with Chlorazol Black and finally investigated in 70% Ethanol. After investigation, the larval exuvia was mounted on a slide in Euparal. The chaetotaxy is described using the nomenclature of Hasenfuss (1960) and Hasenfuss & Kristensen (2003).

Fig. 5. The habitat of *E. monotona* on the road from Tamrhakht to Imouzzer-des-Ida-Ouatanane in the Asif Tamrhakht river valley, 15 km northeast of Agadir at 300–600 m. **Fig. 6.** The flower of *Trichodesma calcarata*, the host plant of the larvae of *E. monotona*.

The description of pupal morphology is based on two pupal exuviae which were investigated dry. After investigation, both specimens were mounted on two separate slides in Euparal. The description of pupal morphology follows the nomenclature of Patocka (1999, 2001). Most parts of the pupal head are not described because they were lost during ecdysis.

Few data are available on preimaginal stages of Odontiinae. For comparison, we investigated larvae of *Cynaeda dentalis* ([Denis & Schiffermüller], 1775) (6 larvae (L3-L5?), Germany, Brandenburg, Jänschwalde/Ost, 24.iv.2000, leg. Stübner), which, however, might not be a close relative of *Epimetasia*.

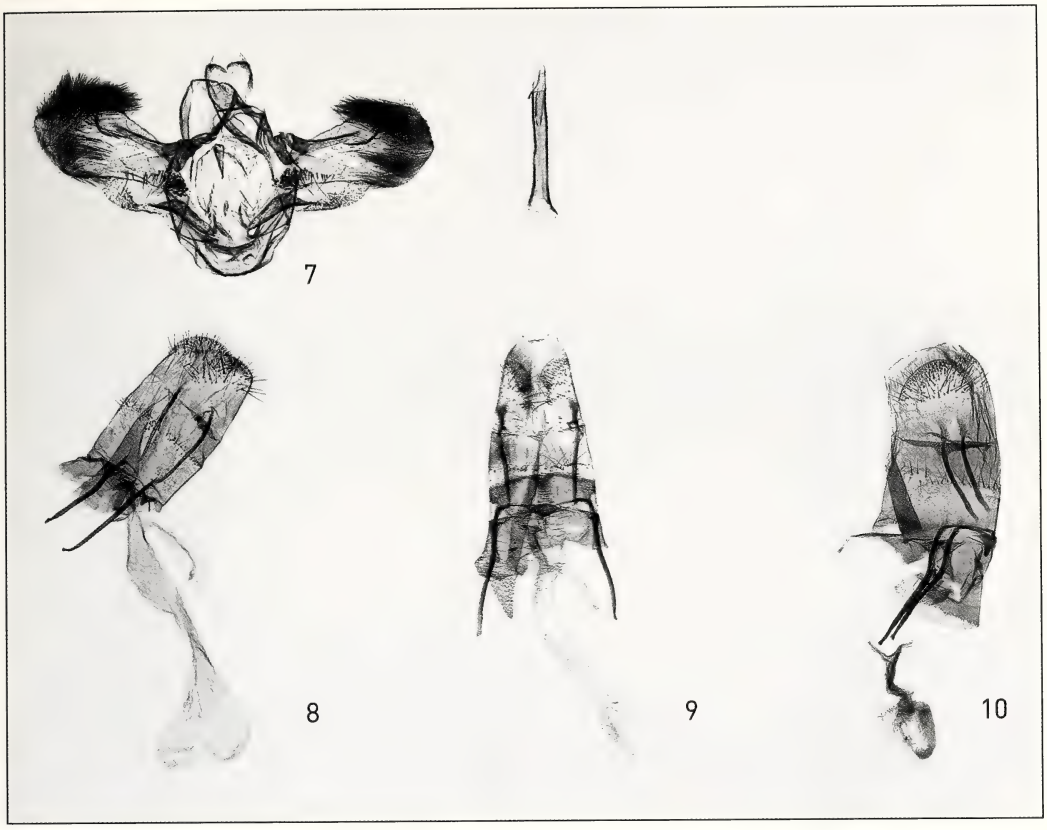
For the investigation of all exuviae, a stereo-microscope with a maximum magnification of 56× was used and, as in Hasenfuss (1960), only the macrosetae were investigated.

All specimens listed below were investigated by the authors with the exception of the holotype of *Thyridopsis monotona*, for which we have seen a digital colour image taken by Patrice Leraut (MNHN).

The catalogue of *Epimetasia* was compiled using the online database GlobIZ (www.pyraloidea.org).

Abbreviations

Cl	clypeal setae
Frl	frontolateral setae
GlobIZ	Global Information System on Pyraloidea
MNHN	Muséum national d'Histoire naturelle, Paris
MTD	Museum für Tierkunde, Dresden
SMNK	StaatlichesMuseum für Naturkunde, Karlsruhe



Figs. 7–10. Genitalia of *Epimetasia* specimens. **7.** *E. monotona*, ♂ (prep. Nuss 1065). **8.** *E. monotona*, ♀ (prep. Nuss 1049, same specimen as Fig. 1). **9.** *E. rufoarenalis* (prep. Nuss 1055, BMNH 22021). **10.** *E. abbasalis*, ♀ paratype from S-Iran, Bandar-Abbas, Kuhe-Genau, 550 m, 1. and 5.iii.1973, Ebert leg., SMNK (prep. Nuss 1066).

Epimetasia monotona (Amsel, 1953) comb. n.

Material. Holotype (by monotypy): ♀, 'Type', 'P. de Miré leg | 1.1.1949 | Oum el Ahmar | **Mauritanie'**, 'Slide 15159-SB | ♂ | Bleszynski 1969', 'det. H. G. Amsel 1952 | Thyridopsis | monotona | Ams.', 'Thyridopsis | monotona', MNHN. – 1♀ **Morocco**, 15 km northeast Agadir, Asif Tamrhakht river, 300–600 m, 22.iv.2001 (larva), 12.vi.2001 (adult), Bläsius leg., coll. MTD. 4♂, 7♀, 1 larva, 1 pupa, same data, but 1.–15.v., 8., 10., 12., 13.vi.2001 (adults) (gen. prep. Nuss ♂ 1065, ♀ 1049), Bläsius leg., coll. Bläsius and coll. MTD. 1♂ Maroc Saharien, Maader Asfer, 10.v.1969, Rungs leg. (gen. prep. Leraut 6040), MNHN.

Adults (Fig. 1). Head. Head capsule globular; frons not protruded as typical for many odontiines; compound eyes about 1 mm in diameter; maxillary palpi upright, about 400 μm long; labial palpi porrect, about 1 mm long; flagellum filiform, ventrally densely setose; flagellomeres of basal half of flagellum about as long as their diameter (10 μm). Head dorsally, maxillary and labial palpi light ochreous, with protruding scales at frons; ventrally contrasting, white.

Thorax. Forewing length ♂ 11–12 mm (N=2), ♀ 10 mm (N=1). Costa remarkably straight, sc, r1 and r2 distally approximate; r2 basally close to r3+r4; r5 free from

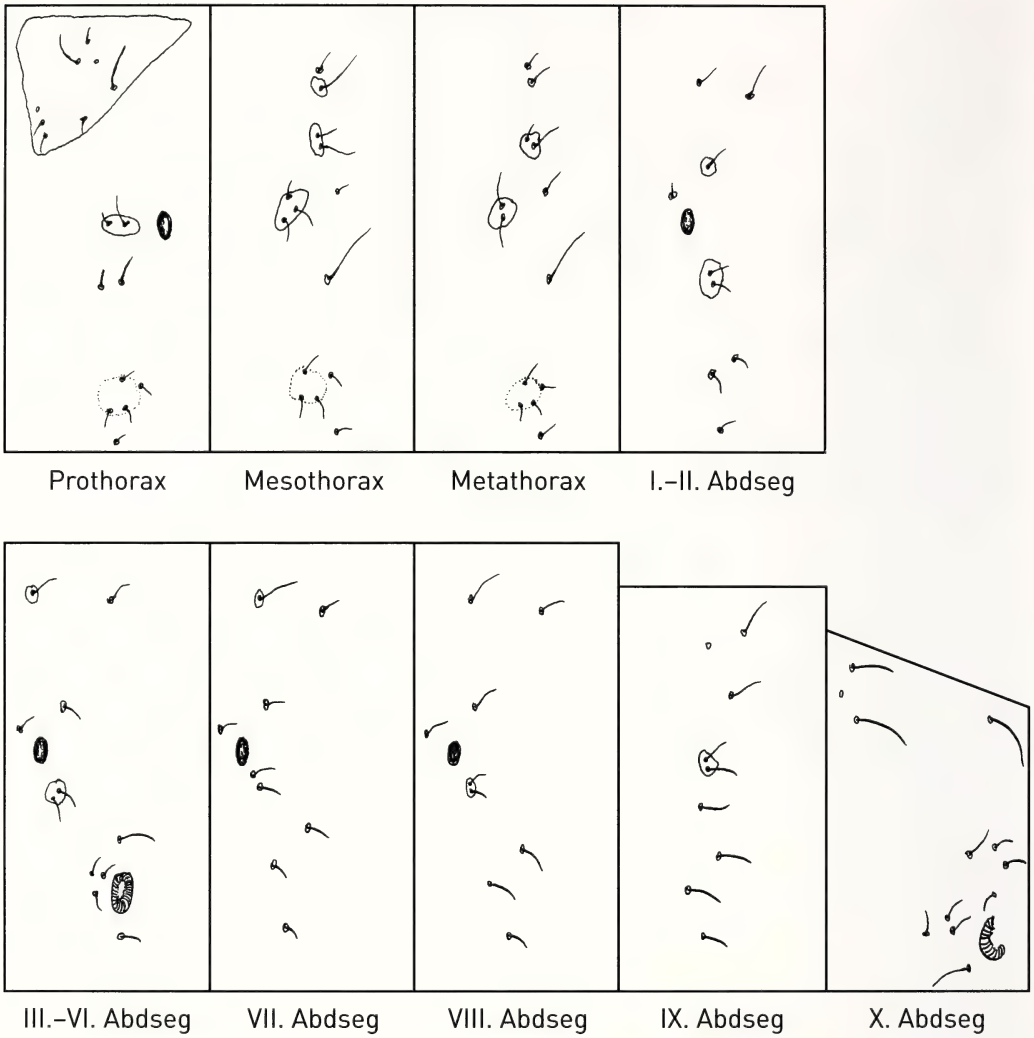
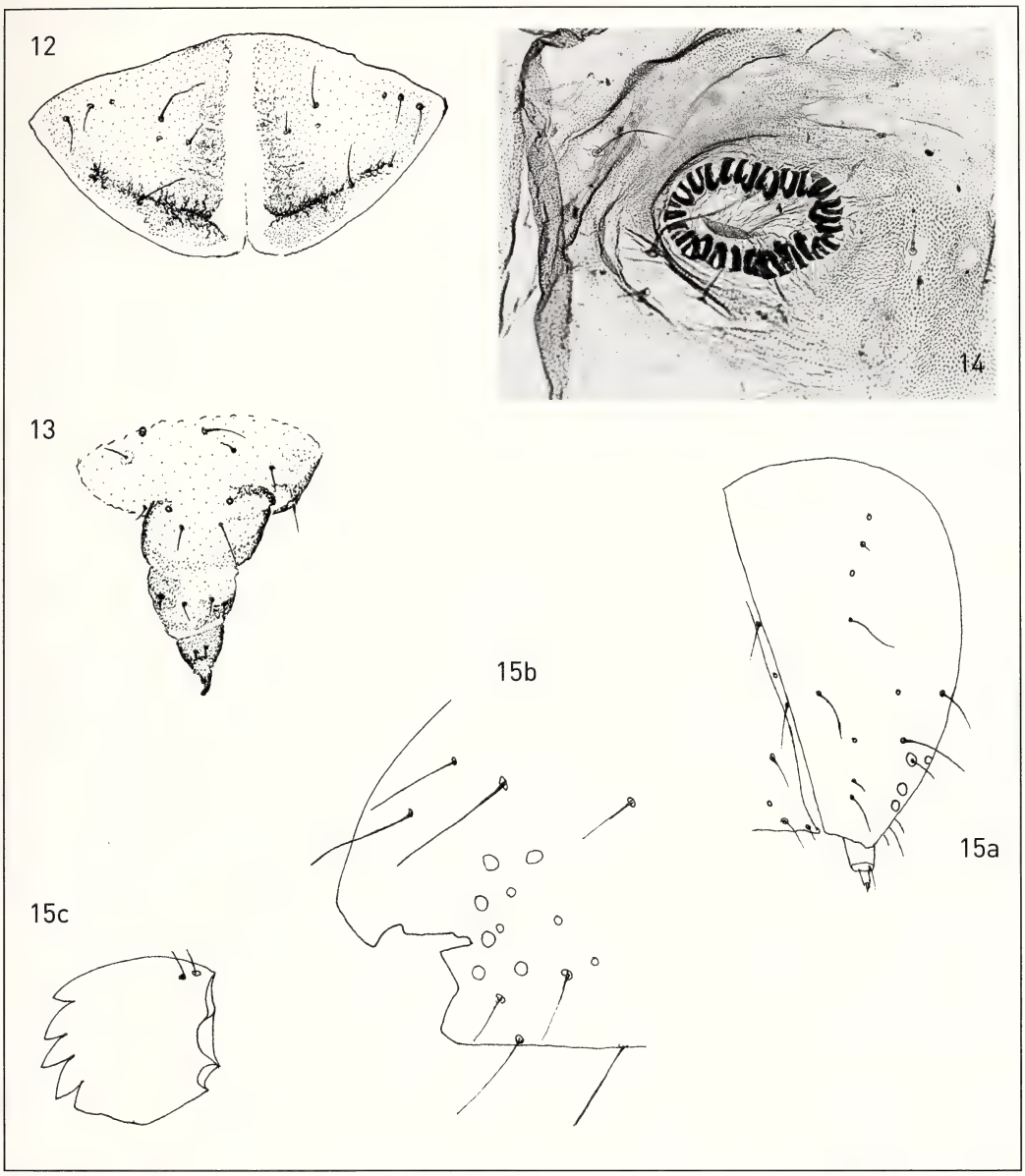


Fig. 11. Chaetotaxy of larva of *E. monotona* (prep. and drawing by Thomas Sobczyk).

cell; m2 and m3 close to each other; discoidal cells of fore- and hindwings distally open; hindwing sc+r1 fuse with rs for some distance along discoidal cell; m2 and m3 close to each other. Male and female frenulum with one bristle; male retinaculum with hamus. Forewings light ochreous, with inconspicuous antemedian and postmedian lines, approximated at dorsum; entire wing surface with scattered white, spatulate scales; underside uniform ochreous, but paler than dorsally and dorsum creamy white-scaled; hindwing brownish white, darker towards termen; fringe of fore- and hindwings brownish white, with a dark line.

Tympanal organ. Tympanum placed nearly vertically in body cavity; fornix conspicuously exceeding venula prima in lateral view; praecinctorium present; saccus



Figs. 12–15. Larval characters of *E. monotona*. **12.** Prothoracic shield. **13.** Foreleg. **14.** Proleg. **15.** Head: **a.** frontal view, **b.** lateral view, **c.** mandible (prep. and drawing by Thomas Sobczyk).

well developed; venulae secundae absent, but post-tympanal area with a pair of sclerotised lines medially.

Male genitalia (Fig. 7). In lateral view, uncus directed ventrally at an angle of about 45°, tegumen convex, conspicuously exceeding uncus. In caudal view, uncus distally conspicuously bilobed, each lobe rounded; gnathos arms basally fixed to tegumen, medio-distal extension short; vinculum semicircular, narrow; juxta rectan-

gular, lateral edges bent anteriorly; valvae medio-ventrally convex, caudally radially fluted and strongly setose (characteristic for Odontiinae); sacculus strongly sclerotised, with numerous stiff setae of different length. Phallus without cornuti; opening for ductus ejaculatorius at anterior tip; caudally with a one-sided elongation of phallic apodeme. Absent are the 'structurae squamiformes' and the riffled membrane, which assigns this species to the Odontiini (cf. Nuss & Kallies 2001).

Female genitalia (Fig. 8). Corpus bursae and ductus bursae membranous, very fragile, entire length 2300 μm; corpus bursae ovoid, with appendix bursae inserted postero-laterally; ductus bursae straight, up to 200 μm in diameter, insertion of ductus seminalis close to ostium; segment VIII sclerotised with apophyses anteriores 860–940 μm long; papillae anales lobiform with apophyses posteriores 800 μm long.

Larva (Figs. 11–15). Exuvia 17 mm long, whitish grey, head brown, prothoracic shield slightly paler brown than head, wrinkled, posterior area with two low crests, each forming acute angle with midline; stigmata black. Frons Frl 1 and Frl 2 close to each other, F_1-F_1 closer to each other than the longer and thicker Cl_2-Cl_2. Mandibles with 4 (5) teeth. Prothorax with paired, strongly melanised thorns at anterior ventral edge; prestigmatal shield weakly sclerotised; prothoracic stigmata about twice as large as following stigmata; prestigmatal setae horizontally directed. Stigmata of abdominal segments II–VI larger than pinaculum III. Prolegs III–VI ovate, with hooks of crochets uniordinally arranged in full circle, each circle with 33–38 hooks. Abdominal segment VII in dorsal view with setae I–I and II–II equidistant; seta IV distant from stigma by about two times stigmatal diameter. Pinacula of all segments weakly sclerotised. Anal prolegs with 15 hooks each.

Pupa (Fig. 16). Exuviae 15.0 mm long, diameter 4.0 mm. Integument pale brown, weakly sclerotised. Compound eyes large, round; proboscis short; forelegs reaching tips of antennae; midlegs reaching tips of forewings; hindlegs situated dorsally of median legs (only distal tips visible), only slightly exceeding tips of forewings. Wings terminating at anterior part of segment V; ventrally, only the forewings are visible. Abdominal segments V–VI with rudimentary proleg insertions. Segments V–IX with a pair of two tiny thorns. Segment X with two pairs of tiny thorns ventrally, and 6 thorns distally. Anal sulcus posteriorly bifurcated. Cremaster reduced to small protuberance. Abdominal segments VIII–IX with transverse rows of tiny thorns; segment X with two thorns only.

Differential diagnosis. *Epimetasia monotona* is similar to *E. rufoarenalis* (Fig. 4) and *E. abbasalis* (Fig. 3) in having ochreous forewings, with scattered white spatulate scales on the dorsal side. *E. monotona* differs by the uniform and darker ground colour and the inconspicuous pattern elements of the forewings. Contrastingly, *E. rufoarenalis* and *E. abbasalis* have paler forewings and more contrasting pattern elements. They differ from each other in the antemedian and postmedian lines, which meet at dorsum in *E. abbasalis*, but remain separate at dorsum in *E. rufoarenalis*. Also, the postmedian line meets the dorsum vertically in *E. rufoarenalis*, but in a pointed angle in *E. abbasalis*. Other species of *Epimetasia*, e.g. its type-species *E. vestalis* and *E. gregori* have a dominant pale yellow forewing colouration and lack the white spatulate scales on the dorsal forewing surface. Thus, a phylogenetic study remains necessary to test whether

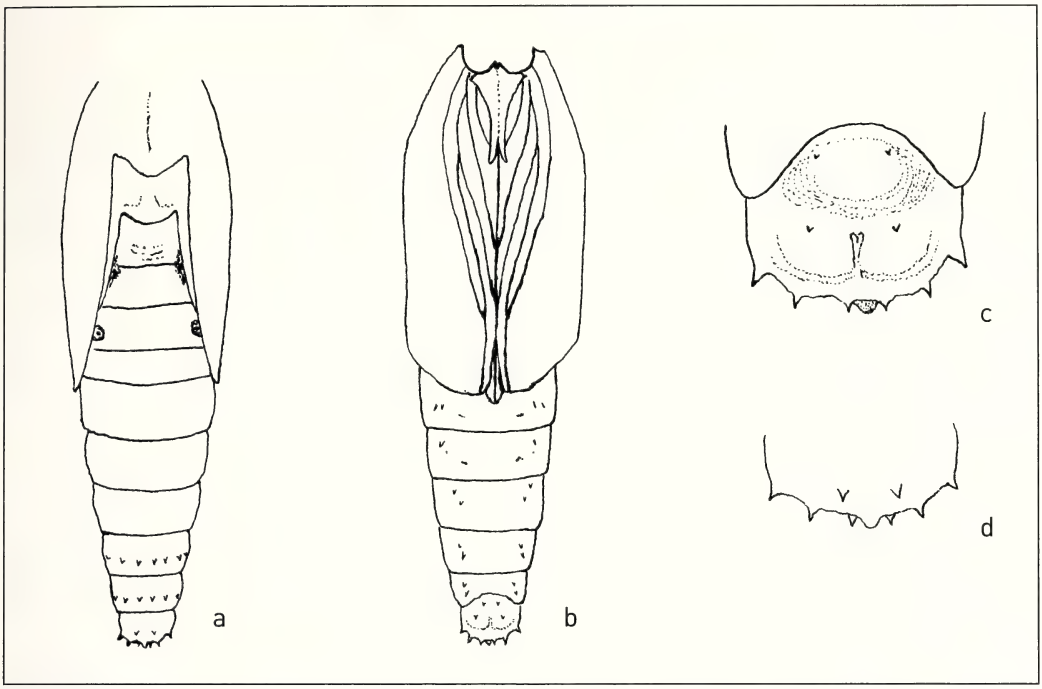


Fig. 16. Pupa of *E. monotona*: **a.** dorsal view, **b.** ventral view, **c.** cremaster, ventral virew, **d.** cremaster, dorsal view. (prep. and drawing by Thomas Sobczyk)

Epimetasia with its current constituent species is monophyletic. In the female genitalia, the corpus bursae is not divided in *E. rufoarenalis* and *E. abbasalis*, but it is divided into one larger and one smaller corpus in *E. monotona*. In contrast with *Epimetasia monotona*, the larvae of *Cynaeda dentalis* have the head and pinacula black (brown in *E. monotona*); the pinacula are conspicuously sclerotised and elevated; the head is prognathous (orthognathous in *E. monotona*); the prolegs are round (each circle with 35 hooks). According to Patocka (2001), the pupae of *C. dentalis* bear a conspicuous cremaster with two pairs of hooks.

Distribution. Known from Oum el Ahmar in Mauritania and from lower montane western Morocco near Agadir and Maader Asfer.

Life history. The larvae feed in the stout (thumb-thickness) roots of *Trichodesma calcarata* Batt. (Boraginaceae). Infested plants are characterised by a reduced growth and parts of the plant becoming dead. Knee high plants along the road were rarely infested. During April and May, only full grown larvae have been found. It might be interesting to mention that the ground colour of the moths camouflages them well on the brown calcareous soil surface.

Boraginaceae are used as larval host plants by other odontiine species also. For example, larvae of *Epascestria pustulalis* (Hübner, 1823) are leaf miners in *Anchusa officinalis* and larvae of *Cynaeda dentalis* are miners in *Echium vulgare* (Hasenfuss 1960).

Habitat. The locality at 15 km northeast Agadir in the Asif Tamrhakht river valley is situated on the road from Tamrhakht to Imouzzer-des-Ida-Ouatanane and belongs to the

westernmost foothills of the High Atlas. The annual precipitation in this area is about 200 mm. The habitat is within the *Argania spinosa* (L.) Skeels forest, which is endemic to southwestern Morocco. This forest is associated with succulent spurges, such as *Euphorbia officinarum beaumierana* (Coss. & Hook.f.) J.Vindt and *E. regisjubae* Webb & Berthel. The foodplant of the larvae of *E. monotona*, *T. calcarata*, grows on an embankment that has been repeatedly disturbed by construction work on the road during recent years. It is not known yet to what extent these disturbances may favour or damage this plant population.

Remarks. In the original description of *Epimetasia abbasalis*, Amsel (1974: 197, fig. 4) describes and figures the female genitalia with the corpus bursae horseshoe-shaped and at both tips with a small, streak-like appendage. This structure is probably a gland, which is larger in size than the corpus bursae of *E. abbasalis*, which is figured here and is a simple, globular sac (Fig. 10).

Acknowledgements

We very much acknowledge the advise given by Wolfgang Speidel, which taxa within the Odontiinae might be checked first to identify the specimens reared on *Trichodesma calcarata*. Without his help it would probably have taken much more time to solve this taxonomic problem. Our thanks also go to the curators Robert Trusch (SMNK) and Kevin Tuck (BMNH) of the museum collections we have visited for this study. We are delighted to thank Michael Shaffer and Klaus Sattler (BMNH) for interesting and helpful discussions. After reading the description of *Thyridopsis monotona*, we were especially happy that Patrice Leraut (MNHN) provided a digital image of the holotype of this species and thus supported a fast completion of the manuscript. Last but not least, we thank Camille Peyre (Bram, France) for the determination of the host plant *Trichodesma calcarata* and Andreas Stübner (Jänschwalde-Ost, Germany) for providing immature specimens of *Cynaeda dentalis*. Francesca Vegliante (Dresden), Bernard Landry (Genève) and Martin Corley (Faringdon) provided useful comments on the manuscript.

Literature

Amsel, H. G. 1952. Neue Maroccanische Kleinschmetterlinge. – Bulletin de la Société des Sciences Naturelles du Maroc, Rabat **31** (1951): 65–73.

Amsel, H. G. 1953. Neue Kleinschmetterlinge aus Nordwest-Afrika. – Bulletin de l'Institut Français d'Afrique Noire, Série A: Sciences Naturelles, Dakar **15** (4): 1441–1460.

Amsel, H. G. 1956. Über die von Herrn Emmanuel de Bros in Spanisch-Marokko gesammelten Kleinschmetterlinge. – Zeitschrift der Wiener entomologischen Gesellschaft **41** (67) (1): 17–31, pls. 1–4.

Amsel, H. G. 1959: Irakische Kleinschmetterlinge II. – Bulletin de la Société Entomologique d'Egypte, Le Caire **43**: 41-83.

Amsel, H. G. 1966. Zur Kenntnis der Microlepidopterenfauna von Marokko. – Notulae entomologicae, Helsingfors **46** (4): 125–130.

Amsel, H. G. 1970: Afghanische Pyraustinae (Lepidoptera: Pyralidae). – Beiträge zur Naturkundlichen Forschung in Südwestdeutschland, Karlsruhe **29** (1): 25-66, pls. 1–4.

Amsel, H. G. 1974: Neue iranische Kleinschmetterlinge. – Beiträge zur Naturkundlichen Forschung in Südwestdeutschland, Karlsruhe **33**: 197–203.

Asselbergs, J. E. F. 1998: A new *Acrobasis* species from Morocco (Pyralidae: Phycitinae). – Nota lepidopterologica **21** (2): 111–118.

Hampson, G. F. 1900: New Palaearctic Pyralidae. – Transactions of the Entomological Society of London: 369–401, pl. 3.

Hasenfuss, I. 1960. Die Larvalsystematik der Zünsler (Pyralidae). – Akademieverlag Berlin, 263 pp.

Hasenfuss, I. & N. P. Kristensen 2003. Skeleton and muscles: Immatures. Pp. 133–164. – *In*: N. P. Kristensen, Lepidoptera, moths and butterflies. Vol. **2**: Morphology, physiology, and development. – *In*: M. Fischer, Handbook of Zoology. Vol. **4** (36). – Berlin, Walter de Gruyter.

Le Cerf, F. 1933: Lépidoptères Hétérocères nouveaux du Maroc. – Bulletin de la Société entomologique de France, Paris **38**: 213–219.

Lucas, D. 1937: Contribution à l'étude des Lépidoptères de l'Algérie et du Maroc. – Bulletin de la Société entomologique de France, Paris **42**: 159-160.

Meyrick, E. 1894: On a collection of Lepidoptera from Upper Burma. – Transactions of the Entomological Society of London: 1–29.

Meyrick, E. 1936: Exotic Microlepidoptera **5** (1). – Taylor & Francis, [London]. 1–32.

Nuss, M. & A. Kallies 2001. *Titanio caradjae* (Rebel, 1902) comb. n., transferred from Brachodidae (Sesioidea) to Crambidae (Pyraloidea). – Nota lepidopterologica **24** (3): 33–39.

Oberthür, C. 1922: Liste des Travaux qui jusqu'ici ont été publiés sur les Lépidoptères du Maroc. – Études de Lépidoptérologie Comparée **19** (1): 1-402.

Patocka, J. 1999. Die Puppen der mitteleuropäischen Schmetterlinge (Lepidoptera. Charakteristik, Bestimmungstabelle der Überfamilien und Familien. – Beiträge zur Entomologie **49** (2): 399–445.

Patocka, J. 2001. Die Puppen der mitteleuropäischen Zünsler (Lepidoptera: Pyraloidae, Pyralidae). Unterfamilien Acentropinae, Odontiinae, Evergesterinae und Pyraustinae. – Linzer biologische Beiträge **33** (1): 347–405.

Ragonot, E. L. 1894: Notes synonymiques sur les microlépidoptères et descriptions d'espèces peu connues ou inédites. – Annales de la Société Entomologique de France, Paris **63**: 161–226, pl. 1.

Rebel, H. 1896: Zwei neue Microlepidopteren aus Marocco. – Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien **46**: 174–176.

Rothschild, L. W. 1913: Expedition to the central western Sahara by Ernst Hartert. VII. Lepidoptera. – Novitates Zoologicae, London **20**: 109–143.

Rothschild, L. W. 1915: On the Lepidoptera collected in 1913–1914 by Herr Geyr von Schweppenburg on a journey to the Hoggar mountains (Sahara). – Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser.8) **16**: 392–402.

Rothschild, L. W. 1925. List of the Lepidoptera collected April to end of june 1925 by E. Hartert and F. Young in Morocco. – Bulletin de la Société des Sciences Naturelles du Maroc, Rabat **5**: 324–345.

Rungs, C. E. E. 1979. Catalogue raisonné des Lépidoptères du Maroc. Inventaire faunistique et observations écologiques. Tome I. – Travaux de l'Institut Scientifique, Sér. Zoologie, Rabat **39**: [i]–[x], 1–244, 2 maps.

Schmidt, A. 1934: On the Pyralidae collected by Messrs. F. le Cerf and G. Talbot in the Great Atlas of Morocco. – Annals and Magazine of Natural History, including Zoology, Botany and Geology, London (ser. 10) **14**: 533–546, pl.17.

Speidel, W. & M. Hassler 1989: Die Schmetterlingsfauna der südlichen algerischen Sahara und ihrer Hochgebirge Hoggar und Tassili n'Ajjer (Lepidoptera). – Nachrichten des entomologischen Vereins Apollo, Frankfurt a. M. suppl. **8**: 1–156.

Zerny, H. 1939: Mikrolepidopteren aus dem Elburs-Gebirge in Nord-Iran (Fortsetzung). – Zeitschrift des Wiener Entomologen-Vereins **24** (12): 171–175, pl. 11.

Correction

Goater, B., M. Nuss & W. Speidel, 2005. Pyraloidea I (Crambidae: Acentropinae, Evergestinae, Heliothelinae, Schoenobiinae, Scopariinae). – *In:* P. Huemer & O. Karsholt (eds): Microlepidoptera of Europe 4: 1–304. Apollo Books, Stenstrup.

We have been informed about a printing error in the numbering of the specimens in Plate 2 of the above mentioned book. The illustrations on the Plate are in the correct order, but the numbers of some figures on the Plate are incorrect. Fig. 40 (*politalis*) should be 39c, Fig. 41a (*marocana*) should be 40, and Fig. 41b (*dumerlei*) should be 41. The information in the captions to plate 2 is correct, and is compatible with the text.
We are grateful to Martin Corley and Norman Hall for bringing this error to our attention.

(Editors of Microlepidoptera of Europe)

Faunistic notes on Momphidae, Batrachedridae, Stathmopodidae and Cosmopterigidae from the Maltese Islands

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Abstract. An annotated list of Momphidae, Batrachedridae, Stathmopodidae and Cosmopterigidae (Lepidoptera) collected on the Maltese Islands is provided. Sixteen species are recorded (1 Momphidae, 1 Batrachedridae, 1 Stathmopodidae, 13 Cosmopterigidae), one of them is new to the Maltese Islands and Europe: *Bifascioides leucomelanellus* (Rebel, 1917) and three of them are new to the Maltese Islands: *Mompha subbistrigella* (Haworth, 1828), *Anatrachyntis badia* (Hodges, 1962), and *Ascalenia echidnias* (Meyrick, 1891). *Mompha subbistrigella* (Haworth, 1828) and *Eteobalea serratella* (Treitschke, 1833) are mentioned as new for Sardinia.

Key words. Lepidoptera, Momphidae, Batrachedridae, Stathmopodidae, Cosmopterigidae, Maltese Islands, new records.

Introduction

The Maltese Islands are a group of small, low-lying islands situated almost at the centre of the Mediterranean, from 35°48'28"to 36°0'0"N and 14°11'04" to 14°34'37"E. They are 92 km south of Sicily and 252 km north of the Libyan coast. The total area of the archipelago is 320 km/sq. The Maltese archipelago is composed of three inhabited islands, Malta, Gozo and Comino and a number of smaller, uninhabited islets and rocks. From the ecological point of view, the most important of these are Cominotto, Filfa, St. Paul's Island and Fungus rock. Malta is the main island. The highest point is at Dingli, on the west side of Malta and is 253 m above sea level. Lakes and rivers are lacking and only a few permanent freshwater springs are to be found.

The islands are composed of sedimentary rocks, mostly limestone which were laid down in the sea during the Oligo-Miocene period. The five principal types of rock exposed, listed in order of decreasing age are, Lower Coralline Limestone, Globigerina Limestone, Blue Clay, Greensand and Upper Coralline Limestone.

The Maltese climate is typically Mediterranean, with mild, wet winters and hot dry summers. Annual rainfall is variable and the average for the last forty years is about 500mm. Most of the rain falls between October and March and the period between April and September constitutes the dry season. The mean temperature for the last 45 years was 18.7 °C. The average for February, the coldest month is 12.36 °C, while that for August, the hottest month is 26.39 °C. Snow never falls Relative humidity is generally high (65–80%) all the year round. Windy conditions are the norm. About 92% of the days of the year have a minimum of 1.85 km per hour of wind and the prevailing wind is the *mistral* or the north-westerly wind.

The islands have been settled since Neolithic times. In 2000, the population was 388, 613 and the population density reached approximately 1240 inhabitants per km^2. These

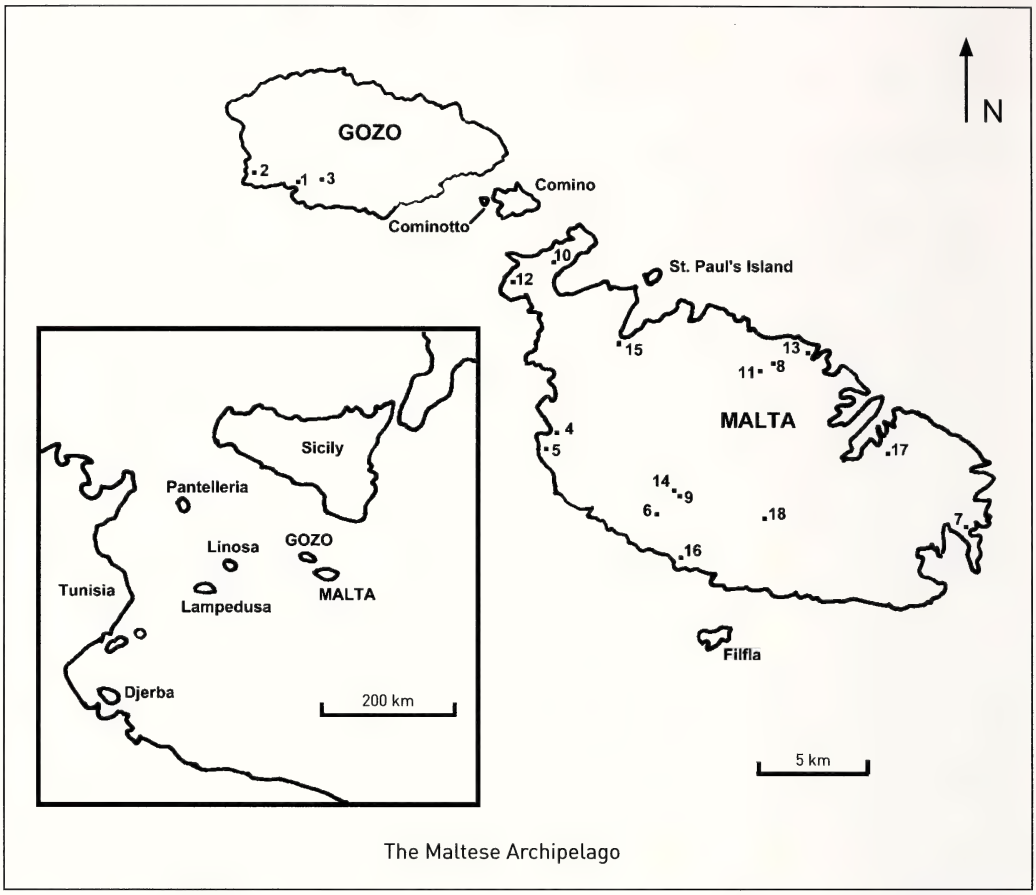


Fig. 1. Map of the Maltese Archipelago with the location of the collecting sites: 1. Gozo, Kercem, San Raflu, 2. Gozo, Wied il-Lunzjata, 3. Gozo, Xlendi, 4. Malta, Bahrija, Fomm ir-Rih, 5. Malta, Bahrija, Wied tal-Bahrija, 6. Malta, Buskett, Wied il-Luq, 7. Malta, Delimara, 8. Malta, Gharghur, 9. Malta, Mdina, 10. Malta, Mellieha, Ghadira, 11. Malta, Naxxar, 12. Malta, Paradise Bay, 13. Malta, Pembroke, 14. Malta, Rabat [including Dwejra, Ta' Koronja & Wied ta' Liemu], 15. Malta, Salina, 16. Malta, Siggiewi, Ghar Lapsi, 17. Malta, Zabbar, 18, Malta, Zebbug, Wied il-Kbir.

figures do not take into account the number of tourists who visit the islands every year. In the same year the estimated number of tourists who visited Malta was 1,216,000. Agricultural land accounts for 46.8% while built up areas and roads account for 30.6% of the land area. Only about 20% of the land is still in its natural state (Schembri et al. 1999).

The natural vegetation of the Maltese Islands is dominated by the Mediterranean scrub communities of which the best representatives are the various types of garigue typical of rocky ground and characterized by such species as *Coridothymus capitatus, Anthyllis hermanniae, Teucrium fruticans, Erica multiflora* and the endemic *Euphorbia melitensis* (Lanfranco 1995). Garigue ecosystems, such as at Ras il-Pellegrin, Il-Kortin tal-Mellieha and Ta' Cenc in Gozo, make up to about 10% of the natural environment. (Lanfranco 2002). In favoured situations, such as under cliff faces, scrub community

occurs as maquis, with *Ceratonia siliqua, Olea europaea, Pistacia lentiscus, Rhamnus oleoides, Teucrium flavum, Prasium majus, Lonicera impexa, Smilax aspera, Acanthus mollis, Capparis orientalis* and others (Lanfranco 1995). Less than 3% of the natural environment is of this type (Lanfranco 2002).

No natural woods occur, although remnants of a few *Quercus ilex* woods, such as at Buskett, near Dingli, at Wardija and Mellieha still remain or are reduced to maquis. The semi-artificial woodland at Buskett is fairly characteristic of a Mediterranean evergreen wood (Lanfranco 1995). Wooded areas account to only 1.4% of the natural environment. (Lanfranco 2002).

Freshwater habitats are scarce in Malta, especially during the summer months. Permanent streams, such as at Wied il-Luq in Buskett, Wied tal-Bahrija in Bahrija and Wied il-Lunzjata in Gozo are dominated by plant communities comprising *Arundo donax, Cyperus longus, Holoschoenus vulgaris, Populus albus, Salix pedicellata, Ulmus canescens*, sometimes accompanied by *Laurus nobilis*.

Dune communities are also very rare and are largely degraded. These are characterized by species belonging to *Salicornia, Suaeda, Crithmum, Limonium, Phrgamites australis, Juncus acutus, Pancratium maritimum, Euphorbia, Salsola, Medicaga,* and others (Lanfranco 1995). Dune areas still exist at Ghadira Bay and Rdum il-Hmar in Mellieha, at Armier Bay and Ramla in Gozo.

The fauna of the Maltese Islands, like its flora is numerous, varied and very interesting. Considering the insects alone, no less than 4200 species have been recorded so far from the Maltese Islands (Schembri 1996), of which about 600 species belong to the Lepidoptera. There exists a large literature on Lepidoptera. Notable summaries include the contributions of Valletta (1972, 1973), and Sammut (1982, 1983, 1984, 1985, 2000). The first mention of lepidoptera from the Maltese Islands is by De Reville (1750) of a larva feeding on the vine, later named by Stainton as *Antispila rivellei* in 1855. Other important works on Maltese Lepidoptera and which also contain references to microlepidoptera are those of Gulia (1858), De La Garde (1892), Andres (1916), Fletcher (1904–1905), Caruana Gatto (1905), J. Borg (1922), P. Borg (1932), Amsel (1950, 1954, 1955), DeLucca (1948, 1949, 1950, 1951, 1953, 1965, 1969), Valletta (1950, 1951, 1953, 1955, 1973) and Sammut (1984, 2000).

The first publication about Microlepidoptera belonging to the families mentioned in the title of this paper was made by DeLucca (1949). Later followed by Amsel (1955) and DeLucca (1950, 1956). Faunistic lists of Lepidoptera of the Maltese Islands were published by Karsholt & Razowski (1996), Sammut (1984, 2000) and Valletta (1973). The present contribution is a compilation of old records from the literature and many new ones from collected material from the second author and others.

Material and methods

The recent material has been collected by A. Catania, P. Sammut and A. Seguna (Malta) and H. Hendriksen, B. Petersen, U. Seneca and B. Skule (Denmark). Most material has been collected by a mercury vapour light source (120W) or by a moth trap with an

actinic tube (15W) as source of light. All of the material examined, except *Cosmopterix pulchrimella* which was reared from its food plant, was collected at light as explained above.
Taxonomy and nomenclature follow Koster & Sinev (2003), and additional references to the life histories of the single species can also be found in that work.

Abbreviations

AC	coll. A. Catania
AS	coll. A. Seguna
AV	coll. A. Valletta
DL	coll. DeLucca
PS	coll. P. Sammut
ZMUC	The Zoological Museum, University of Copenhagen

Results

MOMPHIDAE

Mompha subbistrigella (Haworth, 1828)

Material. **Malta**, Naxxar, 28.v.2001, leg. A. Seguna, (AS).

Life history. Larvae feed in the seed pods of small species of *Epilobium*-species like *E. montanum* L., *E. palustre* L., *E. parviflorum* Schreb., and *E. tetragonum* L. They eat the unripe seeds and the seed pods become distorted by these activities and have a small hole in the side. The moths are on the wing throughout the year and are most frequently found in spring after hibernation (Koster & Sinev 2003). Both *Epilobium parviflorum* and *E. tetragonum* occur on the Maltese Islands.
Distribution. The species has a wide range of distribution in Europe and is found in most countries including in the Mediterranean area (Koster & Sinev 2003). The most nearby location of Malta is Sicily, and recently it has also been established from Sardinia: Sardegna merid., Musei, 120 m, 7.vi.[19]72, coll. Hartig (coll. Baldizzone) (Koster, pers. det.).
Remarks. This is the most southern location of this species so far. New to the lepidopterofauna of the Maltese Islands.

BATRACHEDRIDAE

Batrachedra parvulipunctella Chrétien, 1915

Eustaintonia phragmitidella Mariani, 1936

Material. **Gozo**, Xlendi, 9.ix.1953, 8.ix.1954, leg. C. DeLucca (DL). **Malta**, Buskett, Wied il-Luq, 6.vii.2004, 2 exx., leg. P. Sammut (PS).

Life history. Larvae live in white silky cases, feeding on the waxy secretions of the coccid-species *Aclerda berlesii* Buffa (Homoptera: Aclerdidae) or other species of coccids, which occur on *Phragmitis australis* (Cav.) Trin. ex Steud. and *Arundo donax*

L. (Poaceae). The moths are on the wing in two generations from May–June and again in July–September.
Distribution. Southern Europe and Northern Africa (Koster & Sinev 2003).
References. DeLucca 1956: 256; DeLucca 1965: 514; Valletta 1973: 90; Mariani 1936: 97; Sammut 1984: 17; Riedl 1996: 84; Sammut 2000: 51.
Remarks. The occurrence of *Aclerda berlesii* as well as *Phragmitis australis* and *Arundo donax* on the Maltese Islands demonstrates that *Batrachedra parvulipunctella* is a resident species here.

STATHMOPODIDAE

Neomariania partinicensis (Rebel, 1937)

Material. **Malta,** Mellieha Bay, Ghadira, 19.–31.viii.1992, leg. B. Petersen, det. S. Yu. Sinev (ZMUC); Rabat, Dwejra, 21.vi.2002, 31.viii.2001, 13.vii.2004, at light, 6 exx., leg. Sammut (PS).

Life history. Biology unknown. Adults have been collected from the end of June till mid-September.
Distribution. Mediterranean area.
References. Riedl 1996: 83; Sammut 2000: 51; Parenti 2000: pl. 72/8.
Remarks. The systematic position of the genus *Neomariania* is uncertain. Rebel (1937) placed it in Momphidae. Later the genus was transferred to Oecophoridae (Riedl 1986) and then to Stathmopodidae (Riedl 1990) and it still remains there in most recent catalogues.
Sammut (2000) stated that the species does not occur in Malta, despite the publication in Karsholt & Razowski (1996). At that time he was not aware of the single specimen mentioned above, collected by a Danish hymenopterist.

COSMOPTERIGIDAE

Cosmopteriginae
Cosmopterix pulchrimella **Chambers, 1875**

Cosmopteryx parietariae M. Hering, 1931

Material. **Malta**, Gharghur, 29.viii.1953, leg. A. Valletta (AV); Salina, 19.ix.1949, leg. C. DeLucca (DL); Zabbar, 20.iii.1995, reared from *Parietaria judaica*, leg. C. Farrugia (PS).

Life history. In Europe the larvae are leaf miners on *Parietaria officinalis* L. (Urticaceae). The mine starts as a gallery that soon widens to an irregular blotch. The larva constructs a web inside the mine which often contracts the leaf. The frass is partly removed from the mine and the larva makes several of these mines. Pupation takes place inside the mine. Adults fly in several overlapping generations from spring to autumn.
Distribution. Holarctic. In Europe in the Mediterranean area north to the south of England, Switzerland and Hungary, also on the Canary Islands and Madeira.
References. DeLucca 1950: 233; Amsel 1955: 28; Valletta 1973: 90; Sammut 1984: 17; Riedl 1996: 103; Sammut 2000: 57.
Remarks. *Parietaria judaica* L. has not been mentioned before as food plant of this species.

Cosmopterix coryphaea Walsingham, 1908

Cosmopteryx donatellae Mariani, 1932
Cosmopteryx formosa Amsel, 1935

Material. **Gozo**, Wied il-Lunzjata, 19.ix.1953, 2 exx., leg. C. DeLucca (DL). **Malta**, Mellieha, Ghadira, 80 m, 10.iv.2004, (southern storm), leg. B. Skule, (ZMUC).

Life history. The larvae are leaf miners on *Phragmites australis* (Cav.) Trin. ex Steud. (Poaceae). The mine starts as a gallery and widens into an elongate blotch, frass is piled in the lower, narrower part and is partly ejected. Pupation inside the mine. Adults fly from the end of February till June. The specimens from Gozo have been collected in September, indicating a second generation.
Distribution. Mediterranean area and Northern Africa towards the Near East, also on the Canary Islands.
References. Amsel 1955: 28; DeLucca 1956: 256; Valletta 1973: 90; Sammut 1984: 18; Riedl 1996: 103; Sammut 2000: 57.
Remarks. A recent addition to the fauna of the island Malta.

Pyroderces argyrogrammos (Zeller, 1847)

Pyroderces goldeggiella Herrich-Schäffer, 1853

Material. **Gozo**, Kercem, San Raflu, 15.vi.2001, leg. A. Seguna (AS); **Malta**, Bahrija, Fomm ir-Rih, 3.viii.2001. leg. A. Seguna (AS); Bahrija, Wied tal-Bahrija, 23.viii.2003, leg. A. Seguna (AS); Buskett, Wied il-Luq, 6.vii.2001, 27.viii.2001, leg. P. Sammut (PS); Delimara, 22.vi.2001, leg. A. Seguna (AS); Gharghur, 18.vii.1993, leg. A. Seguna (AS); Mellieha, Ghadira, 20.–25.v.1994, 3 exx., leg. U. Seneca, (ZMUC); Naxxar, 28.iv.1992, 14.v.1998, 22.iv.1999, 13 and 30.v, 25.vi, 2.vii. and 10.viii.2001, 18.v.2002, leg. A. Seguna (AS); Paradise Bay, 15.v.1999, leg. P. Sammut (PS); Paradise Bay, 19.vi.1998, leg. A. Seguna (AS); Pembroke, 26.x.1984, 5 and 27.iv and 25.ix.1990, 4 exx., leg. A. Catania (AC); Rabat, 3.vi and 30.vii.1983, 15.v., 4.vi., 20.vii.1999, 16.vii.2001, leg. P. Sammut (PS); Rabat, Dwejra, 13.vii.2004, leg. P. Sammut (PS); Rabat, Ta' Koronja, 14.vi.2002, leg. A. Seguna (AS); Siggiewi, Ghar Lapsi, 23.iv.1999, 2 exx., leg. P. Sammut (PS); Zebbug, Wied il-Kbir, 21.iv.1999, leg. A. Seguna (AS).

Life history. Larvae in the seed heads of Asteraceae like *Carlina* spp., *Centaurea* spp. and *Carduus* spp. where they eat from the seeds. Pupation takes place in between the down of the seeds in a light cocoon. The moth flies in two generations from the end of April to the end of Sepember, but a third generation is possible in warm seasons.
Distribution. From Central Europe (Mid-Germany) southwards to the Mediterranean area, Canary Islands, Northern Africa, the Middle East and Central Asia. Recently also found in Great Britain on the Channel Islands (Sterling et al., 2004).
References. DeLucca 1950: 250; Valletta 1973: 90; Sammut 1984: 18; Riedl 1996: 103; Sammut 2000: 57.
Remarks. According to DeLucca (1950) the species on Malta can be very common at light in many places.

Pyroderces wolschrijni Koster & Sinev, 2003

Material. **Malta**, Mellieha, Ghadira, 30.iv., 3., 4., 5.vii.2002, leg. H. Hendriksen (ZMUC); Naxxar, 30.iv.2001, leg. A. Seguna (AS); Rabat, 1.x.2001, 11.vi.2004, 2 exx., leg. P. Sammut (PS); Rabat, Dwejra, 13.vii.2004, leg. P. Sammut (PS).

Life history. Biology unknown. Adults fly from mid-April to mid-May and again from early July to mid-October, indicating two generations.
Distribution. So far the species has only been found in Spain, Morocco and Malta.
Remarks. Appears to be widely distributed on the island of Malta.

Anatrachyntis badia (Hodges, 1962)

Material. **Malta**, Mellieha, Ghadira, 80 m, 9., 10.iv.2004, (southern storm), 2 exx., leg. B. Skule, (ZMUC).

Life history. Larvae on a variety of material such as lime, grapefruit, banana, cabbage, blossoms of coconut, elm leaves and also on pine cones infested by *Dioryctria* sp. (Pyralidae) and rust infected cones of several pine trees. The adults fly in two, in the south maybe three, generations and can be found in most months of the year.
Distribution. Originally described from North America. Recently also found outdoors in southern Europe (Canary Islands, Spain and France) and introduced in Great Britain and Holland.
Remarks. The species may have been introduced to Malta and may have established a population due to the subtropical climate. New to the lepidopterofauna of the Maltese Islands.

Coccidiphila gerasimovi Danilevsky, 1950

Material. **Malta**, Buskett, Wied il-Luq, 27.viii.2001, leg. P. Sammut (PS); Mellieha, Ghadira, 2., 4., 5.vii.2002, 4 exx., leg. H. Hendriksen, (ZMUC); Naxxar, 6.iii.2001, leg. A. Seguna (AS); Rabat, 26.viii.1983, 15.v.1999, 6., 8.vii.2001, 4 exx., leg. P. Sammut (PS); Rabat, Dwejra, 31.viii.2001, leg. P. Sammut (PS); Rabat, Wied ta Liemu, 17.viii.2001, leg. P. Sammut (PS); Siggiewi, Ghar Lapsi, 3.viii.2001, 2 exx., leg. P. Sammut (PS).

Life history. Immature stages not described. The larvae feed on the eggs of Coccidae (Homoptera). The adults fly from early March to October, probably in more than one generation
Distribution. Mediterranean area, Canary Islands, Northern Africa towards the Near East.
Remarks. The species is well established and widely distributed on the island of Malta. *Coccidiphila ledereriella* (Zeller, 1850) has also been reported from the Maltese Islands (Koster & Sinev), but since validation of this record is not possible the species will be excluded from the list of the Maltese Lepidoptera. The species is externally very similar to *C. gerasimovi*, but the yellowish colour on the forewing is more prominent.

Eteobalea intermediella (Riedl, 1966)

Material. **Gozo**, Kercem, San Raflu, 15.vi.2001, leg. A. Seguna (AS). **Malta**, Bahrija, Fomm ir-Rih, 3.viii.2001. leg. A. Seguna (AS); Bahrija, Wied tal-Bahrija, 23.viii.2003, leg. A. Seguna (AS); Buskett, Wied il-Luq, 6.vii., 27.viii.2001, leg. P. Sammut (PS); Delimara, 22.vi.2001, leg. A. Seguna (AS); Gharghur, 18.vii.1993, leg. A. Seguna (AS); Mellieha, Ghadira, 20.–25.v.1994, 3 exx., leg. U. Seneca, (ZMUC); Naxxar, 28.iv.1992, 14.v.1998, 22.iv., 13.v.1999, 30.v, 25.vi, 2.vii.10.viii.2001, 18.v.2002, leg. A. Seguna (AS); Paradise Bay, 19.vi.1998, leg. A. Seguna (AS); Paradise Bay, 15.v.1999, leg. P. Sammut

(PS); Pembroke, 26.x.1984, 5., 27.iv., 25.ix.1990, 6 exx., leg. A. Catania (AC); Rabat, 3.vi., 30.vii.1983, 15.v., 4.vi., 20.vii.1999, 16.vii.2001, leg. P. Sammut (PS); Rabat, Ta' Koronja, 14.vi.2002, leg. A. Seguna (AS); Siggiewi, Ghar Lapsi, 23.iv.1999, 2 exx., leg. P. Sammut leg (PS); Zebbug, Wied il-Kbir, 21.iv.1999, leg. A. Seguna (AS).

Life history. Larvae in the roots of *Linaria vulgaris* Mill., *L. pontica* L., *L. genistifolia* (L.) Mill., *L. dalmatica* (L.) Mill., and *Anarrhinum bellidifolium* (L.) Willd. (Scrophulariaceae). The immature stages are very similar to *Eteobalea serratella*. Adults fly from late April till early November in two generations (one generation in the north and east of its distributional area).

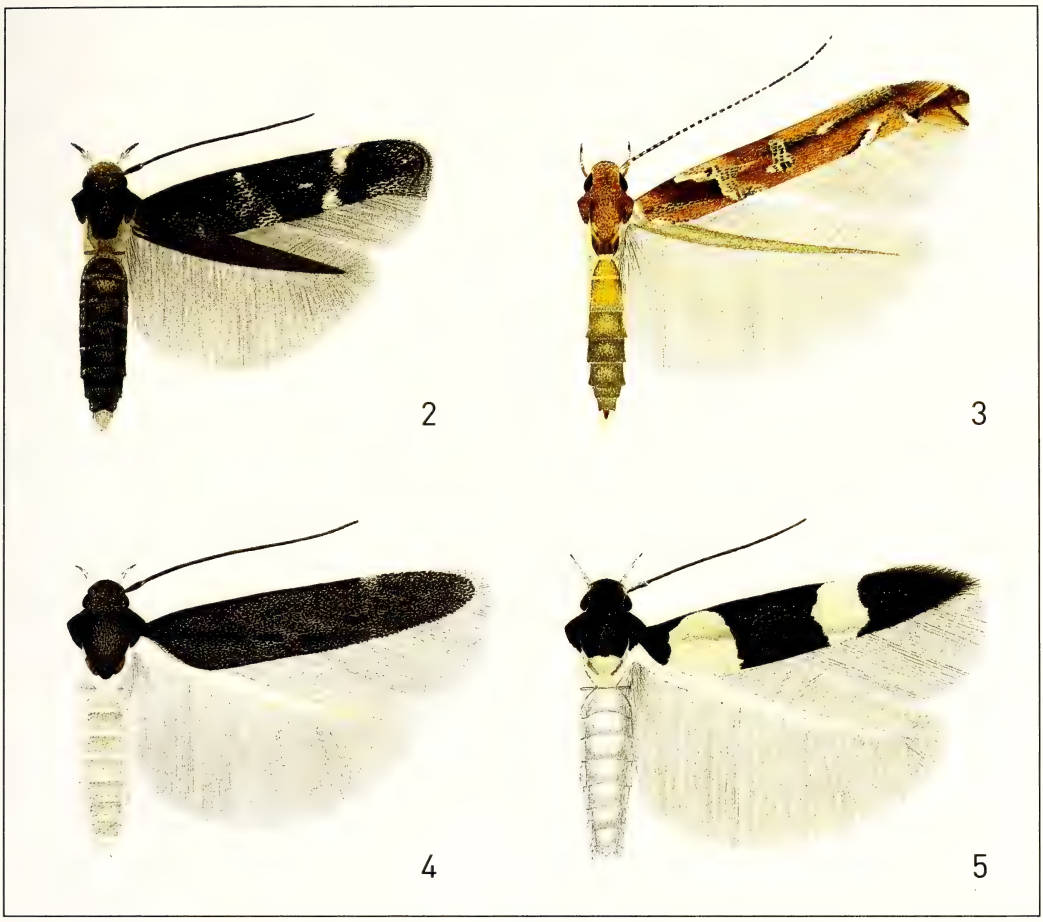
Distribution. Central and Southern Europe, eastwards to the Caucasus, Asia Minor, Near and Middle East towards Central Asia. Northern Africa (Morocco, Algeria, Tunesia)

Remarks. DeLucca (1949) reported the occurrence of *Eteobalea serratella* (Treitschke, 1833) on Gozo, Xlendi, at light, summer of 1953 and Malta, Salina, 6.ix.1953. This was followed by Amsel (1955). These only known records of *E. serratella* cannot be validated and the species should be removed from the list of Maltese Lepidoptera. In that time *Eteobalea intermediella* and the very similar looking *E. anonymella* (Riedl, 1965) have not been described for science yet. Therefore it is very well possible that these records also refer to *E. intermediella*. However it cannot be excluded that *E. serratella* is native on the Maltese Islands for both *E. serratella* and *E. anonymella* occur on Sicily, and recently *E. serratella* has also been established from Sardinia: Sardegna, Nuoro, 10 km W Dorgali, 26.vii.[19]99, Triberti (coll. Baldizzone) (Koster, pers. det.).

It is recommendable that in future all collected material of the "*E. intermediella*-complex" be carefully checked because it is possible that besides *E. serratella, E. anonymella, E. beata* and *E. sumptuosella* will be found on the Maltese Islands since these last three species also occur in the Mediterranean area.

Chrysopeleiinae

The subfamily Chrysopeleiinae is a very recent addition to the fauna of the Maltese Islands. The four species mentioned here are widespread from Northern Africa to the Middle East and further eastwards. They all occur in dry or desert-like habitats. For two of them, *Ascalenia acaciella* and *Gisilia stereodoxa*, the foodplants of the larvae are known, they both live on *Acacia*-species (Mimosaceae). The biology of the remaining two species, *Ascalenia echidnias* and *Bifascioides leucomelanellus*, is unknown. It cannot be excluded that the larvae of these two species also feed on *Acacia*. During the last 25 years several species of *Acacia* has been introduced to the Maltese Islands and planted often in large quantities for landscaping. Before that time *Acacia* were not present on the islands. As the Maltese Islands are situated relatively close to the coast of North Africa, the species involved could have migrated by southern winds. There is more or less evidence for this because in 2004 two new species for the fauna of the islands could be added, collected at nights with a strong southern wind. In the past it was not possible for these species to settle because of lack of food plants, but this



Figs. 2–5. Watercolours of spreaded adults. **2.** *Mompha subbistrigella* (Haworth, 1828). **3.** *Anatrachyntis badia* (Hodges, 1962). **4.** *Ascalenia echidnias* (Meyrick, 1891). **5.** *Bifascioides leucomelanellus* (Rebel, 1917).

Fig. 6. *Bifascioides leucomelanellus*, sitting inside the light trap (photo: J. J. Borg).

Figs. 7–8. Habitats on Malta. **7.** Bahrija, Wied tal-Bahrija, with *Arundo donax*. **8.** Mellieha, Garigue at Ghadira Bay.

Figs. 9–10. Habitats on Malta. **9.** Mdina, with shrubs of *Acacia karroo*. **10.** Malta, Paradise Bay, Garigue with *Acacia* in the background.

situation has been changed now. Although the Chrysopeleiinae are treated as a family in Microlepidoptera of Europe, Volume 5 (Koster & Sinev 2003), we follow here the more widely accepted opinion (Hodges 1999; Kaila 2004; Sinev & Koster 2004) that Chrysopeleiinae are a subfamily of Cosmopterigidae.

Ascalenia acaciella Chrétien, 1915

Scythris tergipunctella Turati, 1924
Scythris maculatella Lucas, 1937
Tischeria noviciata Gozmány, 1960

Material. **Malta,** Buskett, Wied il-Luq, 27.viii.2001, 4 exx., leg. P. Sammut (PS); Mdina, 16.vii., 13., 15., 16., 27., 29.viii.2004, 17 exx., leg. P. Sammut (PS); Mellieha, Ghadira, 2., 3., 4., 5.vii.2002, 11 exx., leg. H. Hendriksen (ZMUC); Mellieha, Ghadira, 80 m, 10.iv.2004, (southern storm), leg. B. Skule (ZMUC).

Life history. Larvae in the flower heads of *Acacia farnesiana* (L.) Willd., *A. karroo* Heyne, and *A. tortilis* (Forsk.) Hayne (Mimosaceae). Pupation amongst flowers in a transparent cocoon covered with frass. Adults fly almost throughout the year, probably in several generations.
Distribution. Not on the European mainland. From the Canary Islands (Gomera), Malta, Northern Africa, Near and Middle East, eastwards to Afghanistan and Pakistan.
Remarks. Most probably introduced with *Acacia* trees which are not native to Malta but which are widely used in landscaping. In the locality from where the Mdina specimens were collected are numerous trees of *Acacia karroo* Hayne. New to the lepidopterofauna of the Maltese Islands.

Ascalenia echidnias (Meyrick, 1891)

Ascalenia acaciella var. *signatella* Chrétien, 1915: 352.
Ascalenia oranella Lucas, 1939: 209.
Ascalenia satellite Gosmány, 1960: 420.

Material. **Malta**, Mellieha, Ghadira, 80 m, 9.iv.2004, (southern storm), 7 exx., leg. Skule, (ZMUC).

Life history. Biology unknown. Adults have been collected from April to June and in September–October.
Distribution. From Madeira and the North African countries to Asia Minor.
Remarks. Malta is the second locality of this species in Europe. New to the lepidopterofauna of the Maltese Islands.

Bifascioides leucomelanellus (Rebel, 1917)

Ascalenia pirastica Meyrick, 1936

Material. **Malta**, Mdina, 13, 15, 16, 26 and 27.viii.2004, 55 exx., leg. P. Sammut (PS); Rabat, 1.viii.2001, 24.viii.2003, 3 exx., leg. P. Sammut (PS);

Life history. Biology unknown. Adults have been collected in February and from May till the end of August. There is probably more than one generation.
Distribution. So far only mentioned from Libya and Egypt.

Remarks. If the larvae feed on Mimosaceae like many of these desert species in Chrysopeleiinae do, *Acacia karroo* is most likely the foodplant. It is the only species of this plant family that is available on the site where most of the specimens of *Bifascioides leucomelanellus* under study have been collected. New to the lepidopterofauna of the Maltese Islands and Europe.

Gisilia stereodoxa (Meyrick, 1925)

Ascalenia evitans Meyrick, 1925
Stagmatophora alfieriella Rebel, 1926

Material. **Malta**, Mdina, 16., 26., 29.viii.2004, leg. P. Sammut (PS); Pembroke, 20.ix.1990, leg. A. Catania (coll. Sauter).

Life history. Larvae on the inflorescences of *Acacia nilotica* (L.) Dell. (Mimosaceae). Adults have been collected in January–February, April–May and July till October.
References. Riedl, 1996: 101; Sammut 2000: 56.
Distribution. Along the coast of the Mediterranean area, Sardinia, Malta, Egypt towards Iran and India.
Remarks. *Acacia nilotica* does not occur on the Maltese Islands. *Acacia karroo* has been widely introduced, but also *A. saligna* (Labille) H.L. Wendl. and *A. cyclops* A. Cunn. ex G. Don. On the collecting sites only both latter *Acacia*-species occur, so the food plant of the larva can either be one of them or both.

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We thank Ole Karsholt (ZMUC) for the loan of material recently collected on the Maltese Islands, we also thank Aldo Catania (Zebbug, Malta) and Anthony Seguna (Naxxar, Malta) for making their collections available for study, John J. Borg (Rabat, Malta) for providing us with the photograph of *Bifascioides leucomelanellus* and Bjarne Skule (Veksø, Denmark) for providing additional data. We also thank Peter Huemer (Innsbruck, Austria) and Ole Karsholt (Copenhagen, Denmark) for their contructive comments on the manuscript.

References

Amsel, H. G. 1950. Neue microlepidopteren aus Marocco, Malta und dem Lebanon. – Bulletin de la Société des Sciences Naturelles du Maroc **30**: 178–179.

Amsel, H. G. 1954. Neue Pterophoridae, Gelechiiden und Tineiden aus Palastina und Malta. – Bulletin de la Société Fouad 1er. d' Entomologie, Caïro **38**: 51–57.

Amsel, H. G. 1955. Über Mediterrane Microlepidopteren und Einige Transcaspische Arten. – Institut Royal des Sciences naturelles de Belgique, Bulletin **31** (83): 1–64.

Andres, A. von 1916. Verzeichnisdar wahred meiner Kreigsgefangeschaft von mir auf Malta gesammelten (Lepidoptera) – Entomologische Rundschau. **33** (9): 43–45, (10): 48–49, (11): 50.

Borg, J. 1922. Cultivation and Diseases of Fruit Trees in the Maltese Islands. – Government Printing Press, Malta. 622 pp.

Borg, P. 1932. The Lepidoptera of the Maltese Islands. – Goverment Printing Press, Malta. 25 pp.

Caruana Gatto, A. 1905. Seconda Contribuzione alla Fauna Lepidotterologica dell'Isola di Malta – Eteroceri. – Tipografia del 'MALTA', Valletta. 32 pp.

De La Garde, P. 1892. Mediterranean Lepidoptera. – Mediterranean Naturalist **1** (9): 133–135, (10): 147–148.

DeLucca, C. 1948. Some species of Crambidae (Lepidoptera, Heteroneura, Pyralina) observed in Malta. – The Entomologist **81** (1025): 228.

DeLucca, C. 1949. Microlepidoptera new to the Maltese Islands. – The Entomologist **82** (1034): 148–149.

DeLucca, C. 1950. Additional records of Micro-lepidoptera from Malta. – The Entomologist **83** (1050): 249–251.

DeLucca, C. 1951. New additions to the Lepidoptera of Malta. – The Entomologist **84** (1062): 258–259.

DeLucca, C. 1953. Additions to the list of Maltese Microlepidoptera. – Entomologist's monthly Magazine **89**: 129.

DeLucca, C. 1956. New additions to the Lepidoptera of the Maltese Islands. – The Entomologist **89** (1121): 253–256.

DeLucca, C. 1965. The Place of the Lepidoptera in the Zoogeography of the Maltese Islands. Extrait des Rapportes et Proces-verbaux de reunions de la C.I.E.S.M.M. **18** (2): 511–515.

DeLucca, C. 1969. Lepidoptera from the Maltese Islands. – Entomologists's Record **81**: 137–140.

De Reville, M. G. 1750. Histoire d'une Chenille mineuse des feulle de vigne, extraite d'une lettre écrite de malte à M. de Reaumur. – Mémoires de mathématique et de Physique, Présentes a l'Académie Royale des Sciences par divers Scavans, & lus dans ses Assemblées, **1**: 177–191.

Fletcher, T. B. 1904–1905. A Preliminary List of the Lepidoptera of Malta. – The Entomologist **37**: 273–276, 315–319, **38**: 18–20.

Gulia, G. 1858. Corso elementare di Entomologia Maltese dato nel Palazzo di Sant'Antonio. – Lezione quarta. Classe sesta: 46–56.

Hodges, R. W. 1999. The Gelechioidea. – *In*: N. P. Kristensen (ed.), Lepidoptera: Moths and Butterflies **1**: Evolution, Systematics and Biogeography: 131–158. De Gruyter, Berlin and New York.

Kaila, L. 2004. Phylogeny of the superfamily Gelechioidea (Lepidoptera: Ditrysia): an exemplar approach. – Cladistics **20**: 303–340.

Koster, J. C. & S. Yu. Sinev 2003. Momphidae, Batrachedridae, Stathmopodidae, Agonoxenidae, Cosmopterigidae, Chrysopeleiidae. – *In*: P. Huemer, O. Karsholt & L. Lyneborg (eds), Microlepidoptera of Europe **5**: 1–387. Apollo Books, Stenstrup.

Lanfranco, E. 1995. – *In*: F. Giusti, G. Manganelli & P. J. Schembri, 1995: The non-marine molluscs of the Maltese Islands. Monografie XV. – Museo Regionale di Scienze Naturali, Torino. 607 pp.

Lanfranco, S. 2002. Kullana Kulturali 45 – L-Ambjent Naturali tal-Gzejjer Maltin. Pubblikazzjonijiet Indipendenza. Malta. 196 pp.

Parenti, U. 2000. A Guide to the Microlepidoptera of Europe. Vol.1. Museo Regionale di Scienze Naturali, Torino. 426 pp.

Rebel, H. 1937. Neue europäische Tortriciden und Tineiden. – Zeitschrift des österreichischen entomologen-Vereins Wien **22** (5): 46–47.

Riedl, T. 1986. Revue des lépidoptères Gelechioidea de Grèce conserves au Musée Zoologique de Copenhaque, y compris la redescription de femelle de *Ramphis libanoticus* Riedl (Cosmopterigidae). – Nota lepidopterologica **9**: 227–228.

Riedl, T. 1990. Sur quelques Gelechioidea conservés au Musée Zoologique de Copenhague (Lepidoptera) (Partie II). – Nota lepidopterologica **12**: 319–327.

Riedl, T. 1996. Batrachedridae, Cosmopterigidae, Stathmopodinae. – *In*: Karsholt, O. & J. Razowski (ed) 1996: The Lepidoptera of Europe – A Distributional Checklist. – Apollo Books, Stenstrup. 380 pp.

Sammut, P. 1982. Eine Revision über die Tagfalterfauna (Lepidoptera – Rhopalocera) der maltesischen Inselgruppe. Entomologische Nachrichten **81**: 71–78

Sammut, P. 1983. Die Geometriden der Maltesischen Inseln (Lepidoptera: Geometridae). Neue Entomologische Nachrichten **6**: 61–64.

Sammut, P. 1984. A Systematic and Synonymic List of the Lepidoptera of the Maltese Islands. – Neue Entomologische Nachrichten **13**: 1–124.

Sammut, P. 1985: Further Additions to the Lepidoptera of the Maltese Islands. – SHILAP Revista de Lepidopterologia **13** (52): 304–306.

Sammut, P. 2000. Kullana Kulturali. 12 – Il-Lepidoptera. Pubblikazzjonijiet Indipendenza, Malta. 246 pp.

Schembri, S. 1996. Insects. – *In*: J. Sultana, & V. Falzon, (eds.), Wildlife of the Maltese Islands. – Environment Protection Departiment, Malta. 336 pp.

Schembri, P. J., A. E. Baldacchino, A. Camilleri, A. Mallia, Y. Rizzo, T. Schembri, D. T. Stevens, & C. Tanti 1999. Living resources, fisheries & agriculture: 109–283. – *In*: State of the Environment report for Malta 1998. Environment Protection Department, Malta. 448 pp.

Sinev, S. Yu & J. C. Koster 2004. Fauna Europaea: Cosmopterigidae – Chrysopeleiinae. – *In*: O. Karsholt & E. v. Nieukerken (eds.), Lepidoptera. – Fauna Europaea version 1.1, http://www.faunaeur.org

Sterling, P. H., J. C. Koster & P. D. M. Costen 2004. *Pyroderces argyrogrammos* (Zeller, 1847) (Lepidoptera: Cosmopterigidae) new to the Channel Islands. – Entomologist's Gazette **55**: 161–165.

Valletta, A. 1950. Recent additions to the known Lepidoptera Heterocera of the Maltese Islands. – Entomologist **83**: 252–254.

Valletta, A. 1951. Additions to the list of Lepidoptera Heterocera of of the Maltese Islands. – Entomologist **84**: 64–66.

Valletta, A. 1953. Additions to the known lepidoptera of the Maltese Islands. – The Entomologist **86**: 8–9.

Valletta, A. 1955. Further additions to the list of Lepidoptera of the Maltese Islands. – Entomologist's monthly Magazine **91**: 246–247.

Valletta, A. 1972. The Butterflies of the Maltese Islands. – Progress Press, Malta. 64pp.

Valletta, A. 1973. The Moths of the Maltese Islands. – Progress Press, Malta. 120 pp.

Giorgio Baldizzone, Hugo van der Wolf & Jean-François Landry 2006. Coleophoridae, Coleophorinae (Lepidoptera). – *In*: B. Landry (ed.), World Catalogue of Insects 8. – Apollo Books, Stenstrup. 215 pp. – Hardcover (ISBN 87-88757-76-5). DKK 360.00 (excluding postage). (In English)

The taxon Coleophorinae is known to most European lepidopterists as Coleophoridae (Vives 1988; Karsholt & Razowski 1996). The moths have narrow forewings with a conspicuous, pointed apex and a characteristic resting position with the antennae held straight forward. The larvae initially feed internally on leaves, flowers, or seeds of their host plants. Later on they feed externally and usually construct a protective case. For this reason, the group is often known as case-bearers, a term which is also in use for Psychidae. Coleophorinae are present on all continents, but the majority are found in temperate areas of the Northern Hemisphere. There are numerous coleophorine species and the descriptions of new species still continues. All but 16 coleophorine species are treated in the genus *Coleophora* Hübner, 1822. Within this genus, species have been treated in artificial groups within a numerical system introduced by Toll (1953), which makes the subfamily difficult to handle even for specialists of Microlepidoptera. First attempts for a more rigorous system of species groups are probably those by J.-F. Landry & B. Wright (1993) and Emmet et al. (1996). A cladistic study by Bucheli et al. (2002) investigated the architectural and ecological characters of the larval cases and supported for the first time some monophyletic groups within *Coleophora* according to their case architecture, which correlates with the exploitation of certain plant tissues (seeds versus leaves) and growth forms (herbaceous versus woody) rather than preference for certain plant taxa. However, most Coleophorinae species are still placed in an artificial system and much revisionary work remains necessary to overcome the present situation. A useful prerequisite for such a work would be an easy-to-use catalogue of all available names of the Coleophorinae. The last available catalogue for these insects was published by Vives (1988) and included 1009 species in 14 genera. Since that time, the number of described species increased by 25% to 1343 species in 5 genera (the reduction in the number of genera is due to the exclusion of tropical taxa from the subfamily). Therefore, the publication of a new world catalogue of Coleophorinae by G. Baldizzone, H. van der Wolf and J.-F. Landry was well justified. The introduction of this book provides a brief review of the history of the family–group classification, until Lauri Kaila's cladistic analysis of the Gelechioidea in 2004, and of the systematic treatment of the genus *Coleophora*, which has 105 synonyms. The catalogue gives full synonymy of the family-, genus-, and species-group names and provides full bibliography of original descriptions and type designations. For each species the distribution is indicated with the relevant zoogeographical region and each country of occurrence is listed. An appendix includes unavailable names, incorrect spellings, and taxa excluded from the Coleophorinae. The reference section lists about 1500 citations. The book is well completed with an index to all genus- and species-group names. The catalogue includes a number of nomenclatural changes: three type species fixations, seven new synonyms of family-group names, four new synonyms of genus-group names, eight new synonyms of species-group names, eight new generic combinations, as well as the protection of two more recent names against nomina oblita. With all this information, the world catalogue of Coleophorinae is a comprehensive, easy-to-use guide to coleophorine names and bibliography. However, with

regard to completeness, its standard is behind that of other volumes of the "World catalogue of insects" series, such as the volume on Gracillariidae by W. & J. De Prins (2005). In summary, Baldizzone and co-authors do not give the references for the synonymisation of names and generic transfers nor for the distribution of the species. Furthermore, they do not give the known host plants of the species because of much "errors and unverified" data in the literature. Even though this might be true, the aim of a catalogue is to be a guide to published information and the lack of this information will certainly not contribute to verify or correct already published host-plant records. In reading the new catalogue itself we found eight missing names (1 missing valid species), five misspellings, and one wrong authorship:

missing taxa

Coleophora tiliella Schrank, 1801: 107, a junior subjective synonym of *C. bernoulliella* (Goeze, 1783) (see Patzak 1974a; Leraut 1997).

Coleophora herniariae Baldizzone, 2001a: 132, 133 (Distribution. Palearctic: Turkey).

Coleophora praeposita Toll, 1952b: 43, pl. 4 fig. 35, a junior subjective synonym of *C. involucrella* Chrétien, 1905 by Baldizzone (1981c: 71).

Ornix argyropennella Treitschke, 1835: 221, a junior subjective synonym of *C. laricella* (Hübner, 1817) by Baldizzone (1991a: 160), who also designated the lectotype of *O. argyropennella*.

Coleophora annulipes Herrich-Schäffer, 1855b: 230, a junior subjective synonym of *C. lithargyrinella* Zeller, 1849 (see Vives 1988).

Coleophora frischella aurata Toll, 1960a: 249. Vives (1988: 122) treated *aurata* as a subspecies of C. *trifolii* (Curtis, 1832).

Coleophora nivifera Meyrick, 1930b: 625, a junior subjective synonym of *C. versurella* Zeller, 1849: 352 by Baldizzone, 1989e: 207.

Coleophora amarantivora Oku, 1965: 122, a junior subjective synonym of *C. atlanticella* Rebel, 1896 by Baldizzone, 1982a: 384.

misspellings (corrections are indicated in red)

Phalaena Linnaeus, 1758 (not 'Phalena') can be found on pages 25, 34, 73, and 105.

Coleophora asieaeminoris Toll, 1952 (not 'asiaeminoris'). The continuation of the original description on page 27 is not mentioned in the catalogue.

Coleophora schaeuffeleella Toll, 1959 (not 'schauffeleella').

Coleophora zofodella Baldizzone, 2001 (not 'zophodella').

Coleophora frankii Schmid, 1886 (not Schmidt)

wrong authorship

Coleophora adjectella Herrich-Schäffer, 1861: 142. "*Coleophora adjectella* Schmid" is an in litteris name, made nomenclaturally available by Herrich-Schäffer (1861). The authorship "E. M. Hering, 1937" as given by Baldizzone et al. (2006) is invalid.

Despite the above criticisms, we want to add that this catalogue shows an improvement in some details, such as spellings of author names and localities, over the Tortricidae or Pterophoridae volumes of the World Catalogue of Insects. We highly recommend this world catalogue to anybody interested in Coleophorinae. There is no comparable comprehensive source available on these fascinating moths and we are convinced that it will be of great help to study the Coleophorinae in greater detail, e.g. their phylogeny, evolution, and ecology.

References mentioned in this book review generally refer to those given in the catalogue by Baldizzone et al. (2006). The references given in full detail below are not listed in the catalogue, with the exception of Herrich-Schäffer (1860–1861), for which the dates of publication have been given unprecisely - the hard-to-obtain orginal was verified by Andreas Segerer (Munich).

Bucheli, S. R., J.-F. Landry & J. W. Wenzel 2002. Cladistic analysis of larval case architecture and implications of host-plant associations for North American *Coleophora* (Lepidoptera, Coleophoridae). – Cladistics **18**: 71–93.

Emmet, A. M., J. R. Langmaid, K. P. Bland, M. F. V. Corley & J. Razowski 1996. Coleophoridae. pp. 126–338, pls. 1–8, 12–15. – *In*: A. M. Emmet (ed.), The moths and butterflies of Great Britain and Ireland, vol. 3. – Harley Books, Colchester.

De Prins, W. & J. De Prins 2005. Gracillariidae. 502 pp. – *In*: B. Landry (ed.), World catalogue of insects **8**. – Apollo Books, Stenstrup.

Herrich-Schäffer, G. A. W. (1860–1861): Revision der europäischen Schmetterlingsfauna. – Correspondenzblatt für Sammler von Insekten, insbesondere von Schmetterlingen. 1860: 25-28, 52-54, 59-61, 67-69, 76-79, 85-87; ibidem 1861: 100-103, 106-107, 119, 133-135, 142-144, 158-160, 163-168, 173-174.

Schrank, F. von P. 1801: Fauna Boica. Durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. 2. Band, 1. Abteilung. – Johann Wilhelm Krüll, Ingolstadt. 274 [recte: 374] pp.

Andreas 'Karl' Stübner & Matthias Nuss

Xerantica tephroclysta Meyrick, 1930 (Tineidae), a new member of the Palaearctic fauna, with description of its life history and early stages

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Abstract. Numerous specimens of a tineid species were reared from larvae found in the stems of *Capparis spinosa* in Morocco. It has been determined as *Xerantica tephroclysta* Meyrick, 1930, the first record of this species from the Palaearctic region. Larva, pupa and adult are described together with the male and female genitalia, and the systematic position of the genus is discussed.

Zusammenfassung. Aus Larven, die im Stamm von *Capparis spinosa* in Marokko gefunden wurden, konnten zahlreiche Falter einer Tineide gezogen werden, die als *Xerantica tephroclysta* Meyrick, 1930 determiniert wurde. Es handelt sich hierbei um den Erstnachweis dieser Art für die paläarktische Fauna. Es wird eine Redeskription des Falters sowie eine erstmalige Beschreibung der männlichen und weiblichen Genitalien gegeben. Die systematische Stellung der Art im System der Tineidae wird diskutiert.

Key words. Lepidoptera; Tineidae; *Xerantica*; *Capparis*; palaearctic; Atlas Mountains.

Introduction

At the end of February 2004 Rolf Bläsius examined capers (*Capparis spinosa*, Capparidaceae) growing on the roadside cliffs of the southern slopes of Tizi-n-Test, south-west Morocco (Fig. 1). The stem base of one caper was riddled with holes and these holes spun with silvery threads mixed with expelled frass. The stem-base was malformed and appeared to have been subject to fungal attack. When the stem was cut open it was found to contain several whitish larvae. Examination of the larval prolegs showed they were not the expected Sesiidae, and in early summer of the same year, specimens of Tineidae emerged. On 18 May 2005, in the same locality, more *Capparis* was sampled and, as in the previous year, numerous moths emerged, a total of 48 specimens. Capers examined on the northern slopes of the High Atlas near Asni and Demnate did not show any trace of infestation.

The vegetation of the southern slopes of Tizi-n-Test suffers from heavy grazing. The capers on the cliffs are out of reach, however. In winter, snow sometimes reaches as low as the collecting-locality (1500 m) and on 23 February 2004, the snow line was at 1800 meters. In the dry period, coastal mists often envelop the roadside cliffs bringing considerable humidity.

Tizi-n-Test on the southern slope of the High Atlas, is a remarkable locality where the terrain rises from 300 m in the Sous Valley to 3600 m on the peaks to the north-west and to over 4000 m in the north-east. The Sous Valley divides the mass of the African continent (and the comparatively low Anti Atlas) from the folds of the High Atlas.

Fig. 1. Moroccan biotope of *Xerantica* with *Capparis spinosa*.

The tineid reared from *Capparis* was unfamiliar within the Palaearctic context and was eventually submitted to GSR who identified it by comparison with specimens in the Natural History Museum, London (BMNH), as *Xerantica tephroclysta* Meyrick. *Xerantica* is a monobasic genus. *X. tephroclysta* was described by Meyrick (1930) from a single male specimen from Uganda and it has never hitherto been illustrated; Gozmány & Vári (1973: 183) listed *Xerantica* among their "taxa incertae sedis" and noted that "The holotype has lost its abdomen ... the species may belong to the Hapsiferinae". Robinson (2001, 2005) placed *Xerantica* in the Tineinae.

The purpose of this paper is to draw attention to this large and colourful tineid, record its first occurrence in the Palaearctic region, note its biology, and provide an illustrated redescription that includes early stages and adult genitalia.

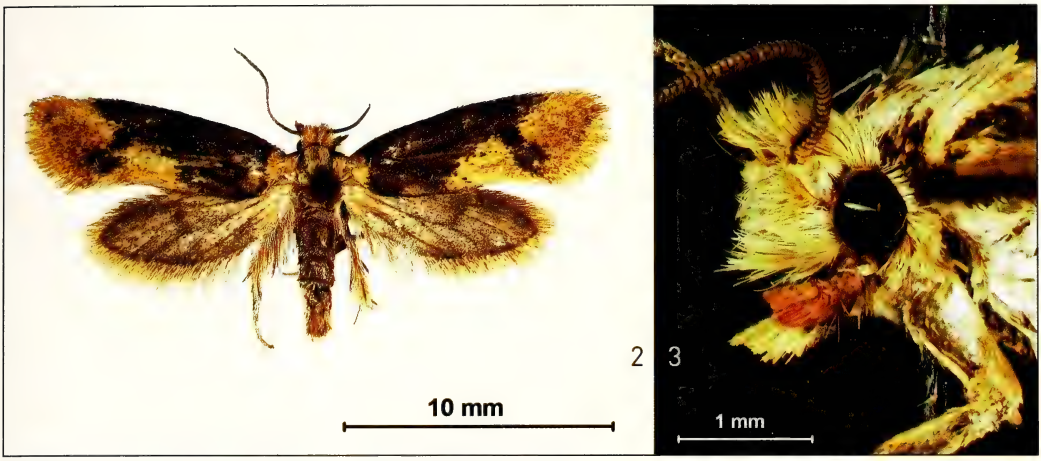
Its occurrence in North Africa raises the question whether it may have crossed the Mediterranean and may be found, for example, in *Capparis* vegetation in south-eastern Spain.

Xerantica Meyrick, 1930: 553

Type-species: *Xerantica tephroclysta* Meyrick, 1930, by monotypy.

Xerantica tephroclysta Meyrick, 1930: 553

Material. Holotype (Fig. 10) ♀ [not ♂ as stated by Meyrick], **Uganda**: Madi, v.1927 (G.D.H. Carpenter) [abdomen missing] (BMNH). – (A) tropical West Africa (BMNH) (3♂): 1♂, N. **Nigeria**: Zaria, Samaru, 10.x.1975 (J.C. Deeming) (genitalia slide no. 1353; BMNH); 1♂, similar data but 15.–22.vi.1970 (P.H. Ward) (BMNH); 1♂, S. Nigeria: U[niversity] C[ollege] Ibadan, 19.iv.1958 (H.J. Sutton) [abdomen missing] (BMNH). (B) North Africa (48+ adult specimens, 1 larva, 3♂ and 2♀ pupal exuviae): **Morocco**, Haute Atlas, Tizi-n-Test, larvae in *Capparis spinosa*, e.l. 17.vi.–18.vii.2004 and 10.vi.–18.vii.2005 (R. Bläsius); specimens are in the following collections: E. Bettag (Dudenhofen), R. Bläsius (Eppelheim), D. Bartsch (Stuttgart), DEI (Müncheberg), BMNH (London).



Figs. 2–3. *Xerantica tephroclysta*. **2.** Adult. **3.** Adult head.

Description

Imago (Figs. 2–3). Wingspan. 14–22 mm. Coloration. Head and palpi yellow ochre, underside of palpi with some darker scales; tegulae and thorax with similar coloration, tegulae at base and thorax in first half overlaid with fuscous scales; fore- and mid-legs fuscous, the ends of the legs ochreous yellow, posterior legs fuscous only on outer surface, posterior tibiae with long dense scales. Ground colour of forewing yellow-ochre, dusted with darker greyish scales, especially towards apex, and with conspicuous rhomboidal blackish brown patch extending from costa to posterior margin and extending in a broad, irregular streak towards tornus; extent of dark patch somewhat variable; with small scattered groups of 4–10 raised scales especially in distal and posterior areas; cilia dull yellow. Hindwings grey, cilia pale yellow.

Head. Eye moderate, interocular index: 1.0. Epicranial suture strongly developed. Occiput with transverse band (divided medially by narrow, scale-free area) of erect piliform scales forming a pair of whorls; scale-bases of each whorl traversed by oblique scale-free line, with few scale-bases anterior to the line; occipital suture well developed. Vertex with scaling similar to occiput forming untidy whorls and tufts. Frons with similar scaling; transfrontal sulcus present, broad; scaled medial area oval, one-third width of frons; scale-bases forming a continuous U-shaped field adjacent to margins of eyes and across lower half of frons. Pilifers triangular, conspicuous, with elongate medially-directed yellow scales. Mandible rudiment large and conspicuous, club-shaped. Maxillary palpus small, short and inconspicuous, elongately conical, probably three-segmented [description based on denuded head – head preparation not made]. Galea not visible, possibly rudimentary or absent. Labial palpus ~1.5× height of head, second segment with at least six or seven lateral bristles and a sparse terminal (dorsal) whorl of seven or eight bristles. Antenna reaching 0.75× length of forewing; scape with pecten of at least 15 stout bristles; flagellar segments each completely covered by one row of narrow, elongate appressed scales; cilia in male ~0.75× flagellar diameter, but most of this length obscured by scales, in female shorter and more sparse.

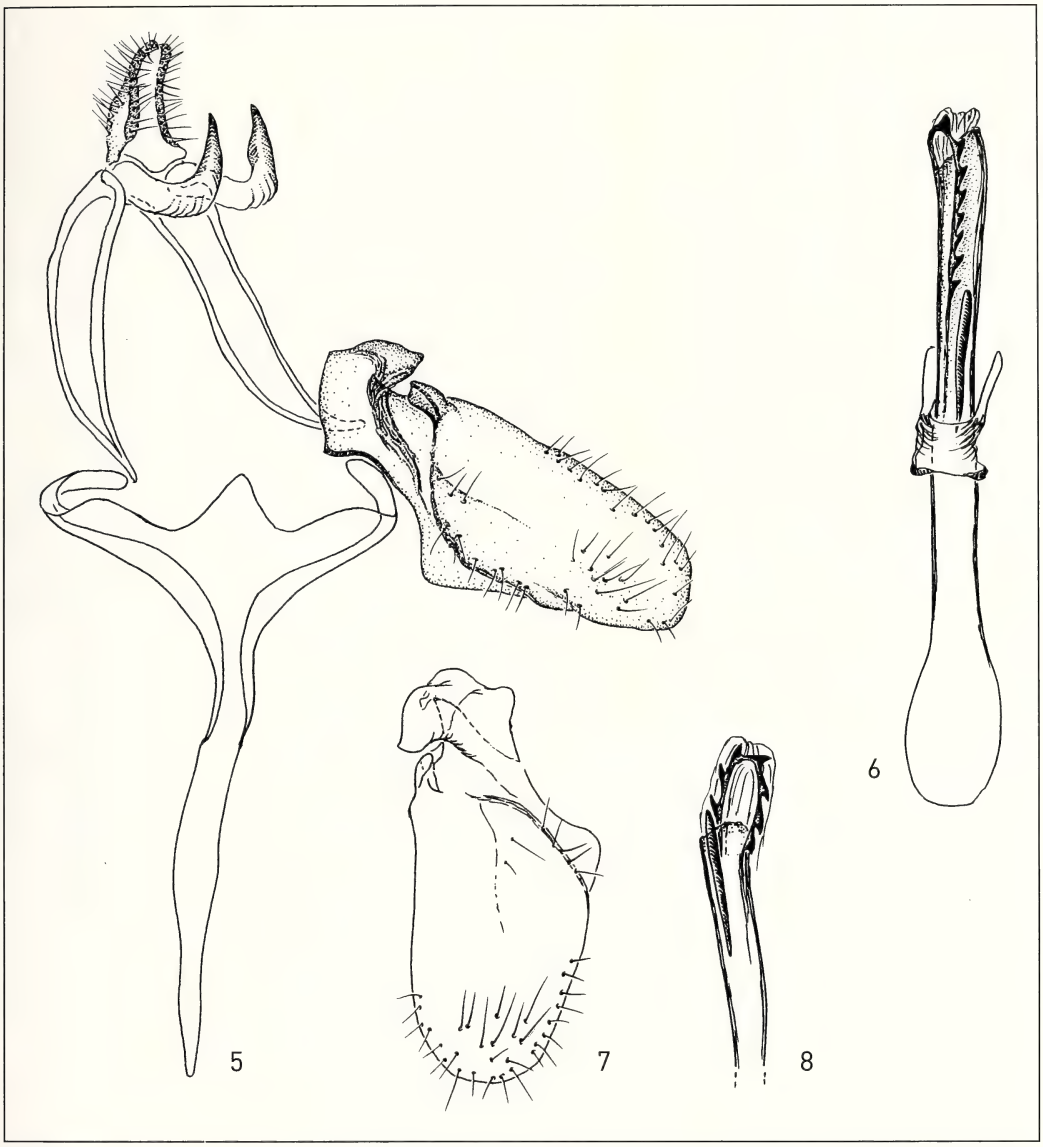
Fig. 4. Pupa protruded from the stem of *Capparis spinosa*.

Thorax. Forewing index: 0.30; hindwing index: 0.38. Retinaculum in male absent, but base of Sc swollen. Forewing with all veins present and unmodified; R5 to apex; cell 0.55× length of forewing, with traces of chorda and (?)unbranched M [venation description based on superficial examination]. Hindwing of male with frenulum of one very stout, thick composite bristle comprised of numerous acanthae fused but distinct for their entire length; female frenulum similar but larger and flatter with oblique apex; cell 0.6× length of wing, containing well developed branched M; all other veins present and unmodified, strong 3A present.

Pregenital abdomen. Unremarkable, without specialized structures; apodemes broad-based, tapered and convergent, from truncated heart-shaped area occupying anterior half of S II; T I without sclerotization within frame, coincident with but probably not fused medially with T II; T II to T VII more strongly sclerotized anteriorly, trapezoidal, T VIII (male) elongately trapezoidal, as long as broad, more strongly sclerotized than preceding segments. Segments II and III with free dorsal sclerite close to spiracle, VIII without coremata in male.

Male genitalia (Figs. 5–8). Uncus broad at base, narrowing to blunt apex, the two uncus lobes appressed but clearly differentiated. Tegumen narrow, margins thickened, tapered towards vinculum. Gnathos arms strongly curved caudad, with acute apices, a short serrate length on inner surface of curve [in specimen from Nigeria]. Vinculum with triangular medial process; saccus elongate. Valva subovate with ridged protuberance bearing a shallow, lobate process at base of costa, and with ridge running from this parallel to anterior margin; apodeme broad, with subquadrate process directed ventrally [as seen *in situ*]. Phallus as long as saccus, with rounded base that is sclerotized only distally; with two cornuti, one thin and lanceolate, at one-half length of phallus when vesica is retracted, the other resembling a length of fretsaw blade with 7–9 teeth, straight and occupying caudal half of phallus when vesica retracted. Juxta very small, trapezoidal, with a pair of elongate posterior processes.

Female genitalia (Fig. 9). Eighth tergite shield-shaped, anterior margin rounded; ostium mushroom-shaped, together with the ductus bursae highly sclerotized, ductus merging gradually with corpus bursae; corpus with numerous small, irregular linear sclerotizations.



Figs. 5–8. *Xerantica tephroclysta*, male genitalia. **5.** Uncus-tegumen-vinculum-complex, one valva removed. **6.** Phallus. **7.** Valva separated. **8.** Tip of phallus with partly protruded vesica.

Larva (Figs. 11–12). [Described from a single damaged specimen, presumed to be of final instar, in which many setae are wholly or partially broken. A supernumerary (?pathological) AF seta is present on the left of the head.] Length ~18 mm; head capsule width 1.7 mm. Head strongly sclerotized but thoracic and abdominal segments with little or no sclerotization, though margins of pinacula are usually well-defined. Head with six small, poorly defined, shallowly convex pale stemmata. Ventral prolegs with ~28 crochets. Coxae well-separated with V1 distant from coxal plates. Spiracles nearly round, with those of prothorax and A8 slightly larger than anterior abdominal spiracles.

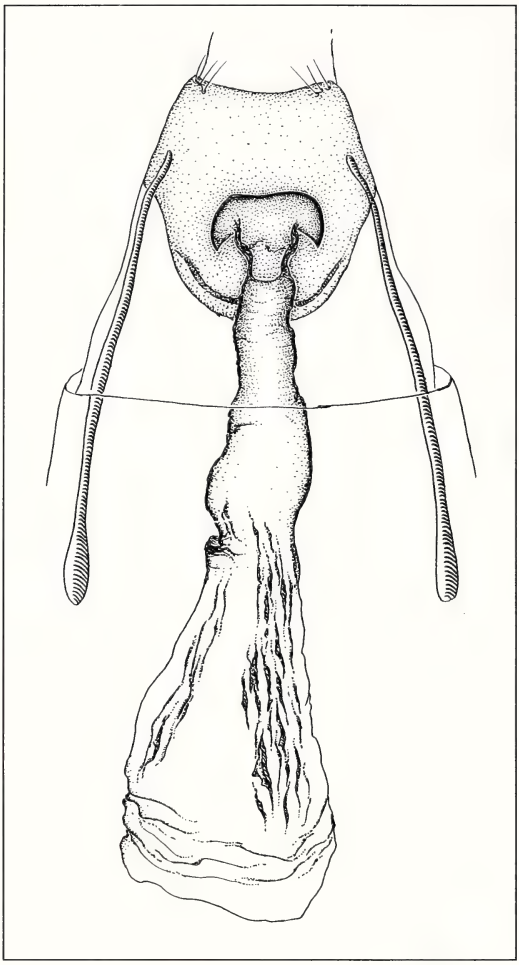


Fig. 9. *Xerantica tephroclysta*, female genitalia.

Chaetotaxy. Head with setae generally elongate, O2, A1 and SO3 reaching apex of mandible; AF2, AFa and AF1 roughly equidistant; V and P setae and pores roughly linear except for Pb which is almost level with P3; L1 well below A3. Prothorax with L group trisetose; SV setae in a horizontal line; XD2 and SD1 on the prothoracic plate. Mesothorax and metathorax with SV group unisetose. First abdominal segment with D2 setae more widely separated than D1 setae, and SD1 above SD2; L3 posterior to L2; SV2 vertically above SV1. Sixth abdominal segment with D1 setae more widely separated than D2 setae; SD2 dorsal to SD1 which is on common pinaculum with L1; L2 anterior to spiracle; SV group trisetose. Eighth abdominal segment with D2 setae slightly below D1; SD group unisetose with SD2 apparently absent; L1 posterior to spiracle; L3 level with L2; SV group bisetose. Ninth and tenth abdominal segments as illustrated.

Pupa (Figs. 4, 13–19). [Based on 3♂ and 2♀ exuviae.] Antennae almost reaching wing-tips; wing-tips reaching middle of fourth abdominal segment, hind legs reaching middle of fifth segment in both sexes. Facial plate comprised of eye-plates and frons with, posteriorly, galeae (centrally) and, laterally, short maxillary palpi reaching only one-half length of galeae; mandibular rudiment large, remaining attached to fore leg on eclosion. Anterior bands of transverse spines present on abdominal segments 3–8 in both sexes but represented by only a narrow, inconspicuous, rugose ridge on third segment; eighth segment in females with additional coarse rugosity anterior to band of spines; posterior band of spines (present in most tineid pupae) represented only by a thin, narrow, inconspicuous, denticular ridge on segments 3–7 in males and 3–6 in females; segments 9+10 rugose/spinose dorsally, ventrally with cremaster comprised of a pair of small, shallow, anteriorly-directed hooks surrounded by rugosity similar to but finer than that of dorsal region.

Distribution. Uganda; Nigeria; Morocco.

Life history. Larva feeding within stems of *Capparis spinosa* (see above).

Remarks. *Xerantica tephroclysta* is a conspicuous and distinctive species, and its superficial appearance is such that it cannot be confused with any other tineid known

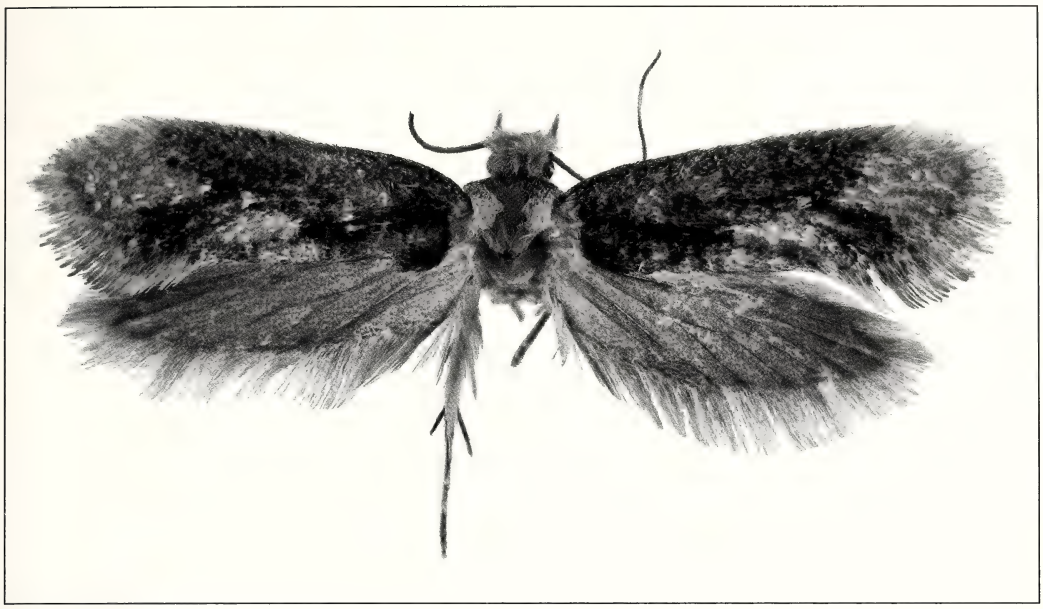


Fig. 10. Holotype female of *Xerantica tephroclysta*, Uganda.

to us. However, its systematic position is more of a puzzle. Superficially, adults bear some resemblance to large, pale Tineinae such as *Ceratophaga*. There are no significant derived characters apparent in the head structure or the wing venation, though the labial palpus has an apical whorl of bristles in addition to lateral bristles, a feature typical of Tineinae and several other groups. The frenulum is not markedly dimorphic between the sexes, being a very stout, thick composite bristle comprised of numerous acanthae fused but distinct for their entire length; the retinaculum is absent in the male. Comparable but not entirely similar frenular modifications are scattered throughout the Tineidae, for example *Coryptilum* (Myrmecozelinae) and *Edosa* (Perissomasticinae) (Robinson, submitted); in *Ceratophaga* (in which a retinaculum is present) the male frenulum is stout but with the acanthae entirely fused; in females the acanthae are fused to form a stout, sinuous spine and a smaller, slender accessory spine.

The structure of the uncus is strongly suggestive of tineine affiliations; the paired uncus lobes present in many Tineidae are more or less fused in Tineinae to form a single articulated hook. "The bilobed origin of the tineine uncus is invariably obvious, however, betrayed by a medial suture and, frequently, a distinctly (if minutely) bifid apex" (Robinson & Nielsen, 1993). In the case of *Xerantica* the lobes are distinct and the uncus structure is reminiscent of some species of *Acridotarsa*. There are no further features of the male or female genitalia to suggest positive associations with any non-tineine groups. It is much easier to exclude *Xerantica* from particular groups than to include it!

Absence of various adult synapomorphies precludes membership of most subfamilies, as they are currently defined, other than Tineinae. The saccus is not articulated, precluding membership of Siloscinae. Lack of a corethrogyne rules out most Myrme-

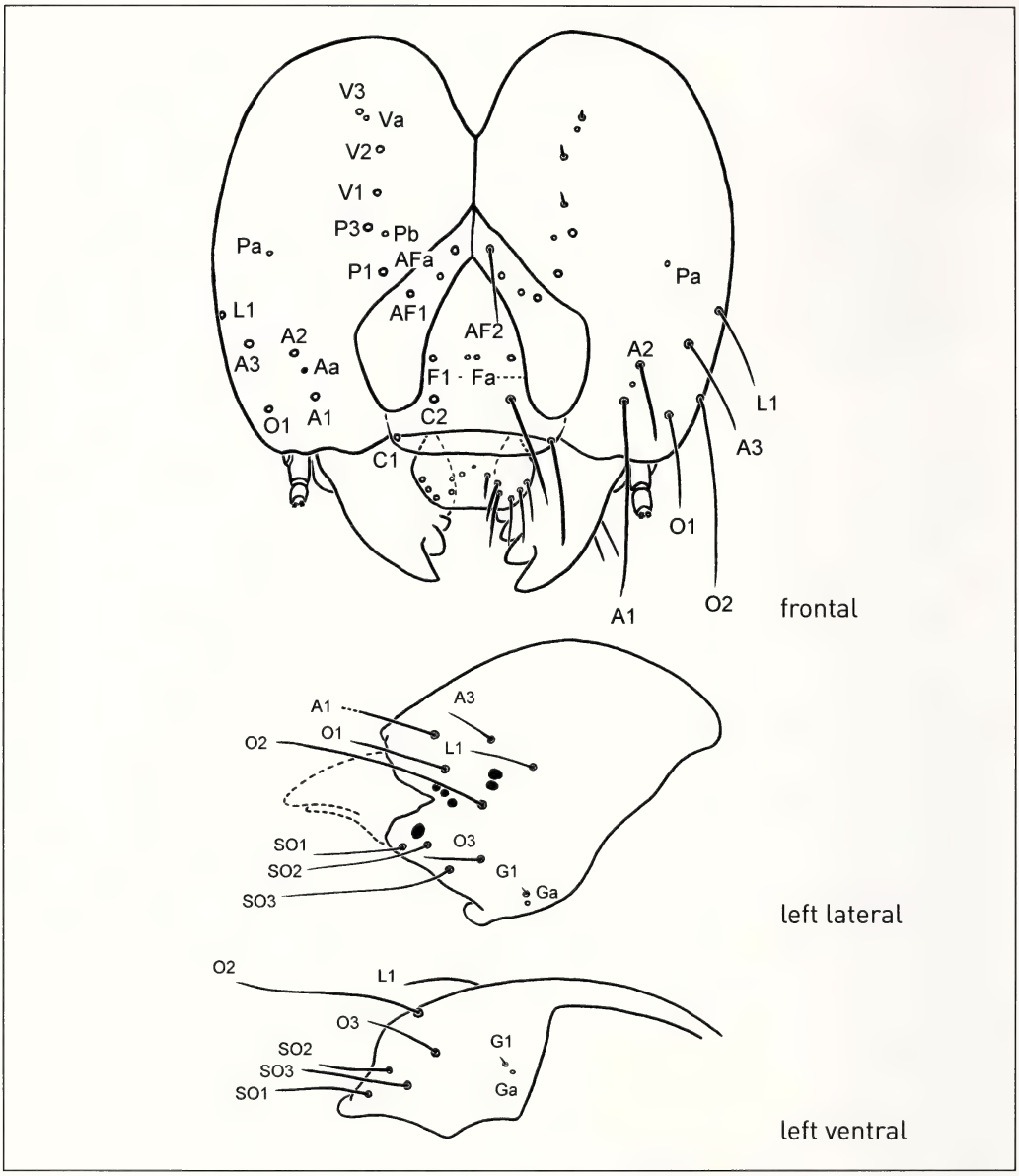


Fig. 11. Larval head of *Xerantica tephroclysta*: setal maps as frontal, left lateral and left ventral views.

cozeline subgroups (the subfamily itself is probably paraphyletic), Hapsiferinae and Perissomasticinae. The simple antenna precludes Euplocaminae. Lack of a piercing ovipositor rules out Teichobiinae. Symmetrical male and female genitalia rule out Dryadaulinae or Stathmopolitinae. Full wing venation and the antennal scaling pattern probably preclude membership of the Meessiinae, not a proven monophyletic group. Lack of any combination of the suites of synapomorphies for Setomorphinae, Nemapogoninae or Hieroxestinae noted by Robinson & Nielsen (1993) and Robinson &

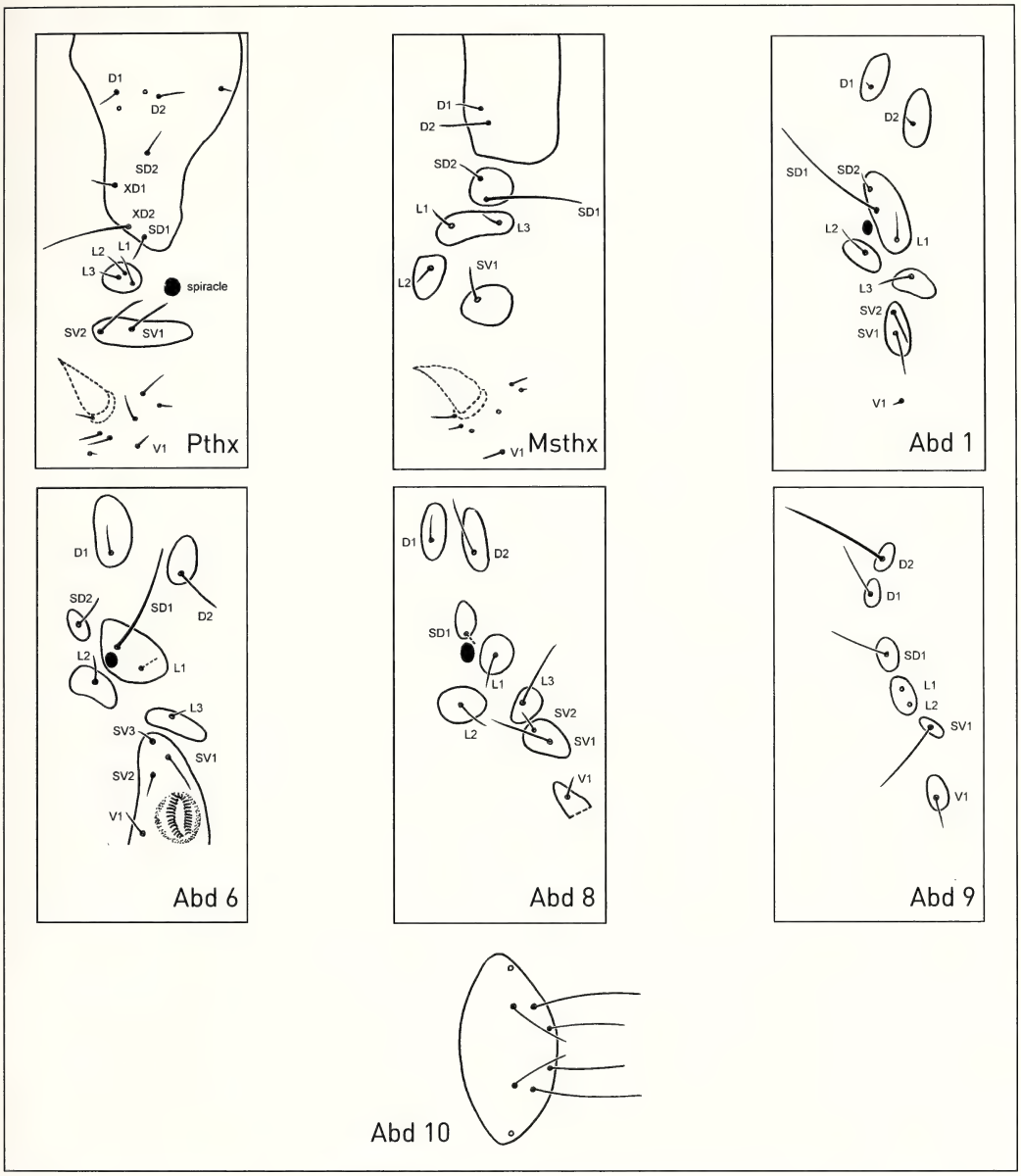
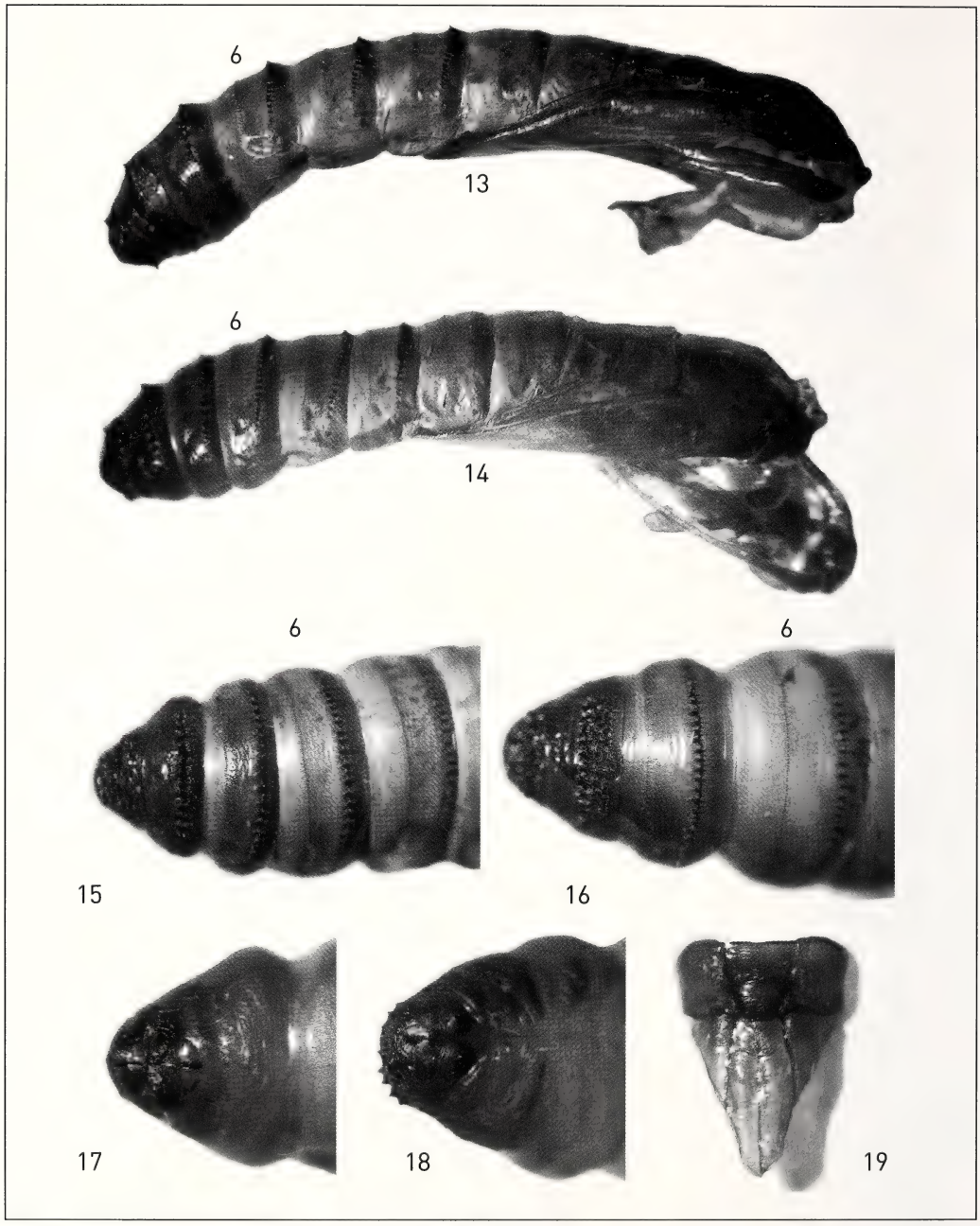


Fig. 12. Larva of *Xerantica tephroclysta*: setal maps of prothorax (Pthx), mesothorax (Msthx), and abdominal segments 1, 6, 8, 9 and 10 (Abd 1 – Abd 10).

Tuck (1997) rule out these subfamilies. Absence of a juxtal pouch rules out Erechthiinae. The posterior margin of abdominal tergite I is not thickened, the mid-tibia is not striped, and the uncus is not broad and distinctly bilobed as in Scardiinae.

Larval structure is not particularly illuminating and there are very few detailed descriptions of tineid larvae available for comparison. However, the presence of a full complement of albeit poorly-defined stemmata is unusual if *Xerantica* were to be a tineine



Figs. 13–19. Pupae of *Xerantica tephroclysta*. **13.** Male, lateral view. **14.** Female, lateral view. **15.** Male, abdominal apex, dorsal view. **16.** Female, abdominal apex, dorsal view. **17.** Male, abdominal apex, ventral view. **18.** Female, abdominal apex, ventral view. **19.** Facial plate. Abdominal segment 6 is labelled for orientation purposes.

– the stemmata are usually reduced to one or none in this subfamily. The prothoracic L-group is trisetose, unlike all known Scardiinae in which it is bisetose (Robinson, 1986). The meso- and metathoracic SV group is unisetose (as in Nemapogoninae and

Scardiinae, bisetose in Tineinae); the D1 setae on the anterior abdominal segments are less widely separated than the D2 setae, as in Tineinae and Nemapogoninae. The unisetose SD group on the eighth abdominal segment is a feature otherwise unknown in any tineid, as far as we can discover. On the ninth abdominal segment the L-group is bisetose, as it is in Scardiinae and unlike all Tineinae known (trisetose) except *Tineola*; however, the SV group is unisetose as in Tineinae.

The pupa exhibits one typical feature: the posterior band of dorsal spines usually present on abdominal segments 3–6 in females and 3–7 in males is reduced to a narrow and inconspicuous denticular ridge. This reduction occurs in all Tineinae known, and in most the posterior spine-band is completely absent.

In conclusion, *Xerantica* does not fit comfortably within any currently recognised tineid subfamily with the exception of Tineinae. Even then, several larval characters make it atypical. However, the paucity of comparable, detailed descriptions of early stages of Tineidae make dubious any predictions of taxonomic placement based upon the morphology of the early stages.

The larval feeding of *Xerantica* makes it unusual in the tineine context. Practically all Tineinae of which the biology is known feed on dead animal tissue – a substrate list dominated by keratin or chitin. The only exceptions we can find are the few fungivorous *Monopis* species described and discussed by Powell (1967).

Most Tineidae other than Tineinae feed on lichen or on plant material that is dead, dying or moribund and has been invaded by fungal mycelia, or on the fungus itself (Robinson & Nielsen, 1993). *Xerantica* conforms to the second trophic pattern by stem-boring in moribund *Capparis*, and as such it is a notable exception if, indeed, it is a tineine.

References

Gozmány, L. A. & L. Vári 1973. The Tineidae of the Ethiopian Region. – Transvaal Museum Memoir **18**: vi + 238 pp., 570 figs.

Meyrick, E. 1930. *Xerantica tephroclysta*. – Exotic Microlepidoptera **3**: 553–554.

Powell, J. A. 1968. Taxonomic status and descriptions of some fungus-feeding Tineidae (Lepidoptera). – Pan-Pacific Entomologist **43**: 292–307.

Robinson, G.S. 1986. Fungus moths: a review of the Scardiinae (Lepidoptera: Tineidae). – Bulletin of the British Museum (Natural History), Entomology **52** (2): 37–181.

Robinson, G.S. 2001. Global taxonomic database of Tineidae (Lepidoptera). – http://www.nhm.ac.uk/entomology/tineidae/index.html

Robinson, G.S. 2005. Global taxonomic database of Tineidae (Lepidoptera). – *In*: F. Bisby et al., Species 2000. ITIS Catalogue of Life: 2005 Annual Checklist. – CD-ROM; Species 2000: Reading, UK.

Robinson, G.S. [submitted]. Hidden diversity in small brown moths – the systematics of *Edosa* (Lepidoptera: Tineidae) in South-East Asia. – Systematics and Biodiversity.

Robinson, G.S. & E. S. Nielsen 1993. Tineid Genera of Australia (Lepidoptera). – Monographs on Australian Lepidoptera **2**. xvi + 343 pp, 734 figs. CSIRO, Melbourne.

Robinson, G.S. & K. R. Tuck 1997. Phylogeny and composition of the Hieroxestinae (Lepidoptera: Tineidae). – Systematic Entomology **22**: 363–396.

Patočka, J. & M. Turčáni 2005. Lepidoptera Pupae. Central European species. – Apollo Books, Stenstrup, Text volume: 542 pp., Plate volume: 321 pp. – Hardcover (ISBN 87-88757-47-1). DKK 960.00 (excluding postage) (in English).

Most of our current knowledge on the pupal morphology of European Lepidoptera has been the result of years of research by Prof. Patočka and his collaborators, who published a huge series of papers in German on this topic. In this book, Prof. Patočka and Dr. Turčani summarize their results and make them available in English for the great benefit of the scientific community. The two volumes are an illustrated key to the identification of the pupae and pupal exuviae of more than 2500 species of Lepidoptera (approximately 2/3 of the Central European fauna). Some families, for which the pupal morphology is still almost unknown, are not included; they are the Opostegidae, Lypusidae, Deuterogoniidae, Pterolonchidae, Autostichidae, and Lecithoceridae. Other families, such as the Micropterigidae, Eriocraniidae, Nepticulidae, Douglasiidae, Coleophoridae, and Blastobasidae, are only superficially treated, with no keys to the species. To each of the treated families a paragraph is dedicated, with information on morphology, life habits, and food plants. A short introduction on pupal morphology and biology, including methods for collecting and studying lepidopterous pupae, is given at the beginning of the book. This introduction is essential to become familiar with the terminology used in the keys, but it is not recommendable as a standard reference for pupal terminology. In fact, the authors use a series of uncommon terms (like „oculi“ for the eyes and „ommata“ for the ocelli), and there is some confusion about Latin terms, culminating in the substitution of meanings between decticous and adecticous pupae. The plate volume fully illustrates the text, with more than 8000 line drawings. Unfortunately, the legends to some figures are missing and some abbreviations used in the plates are not explained in the list. Figures A1–B5, essential for the understanding of the introductory part, are strangely never cited in the text. I tested the keys with 14 specimens from the collection of the Museum für Tierkunde in Dresden. Most of the specimens were pupal exuviae identified by Staudinger and Bang-Haas, who reared the pupae to adults. The correct identification to family or species level was easily possible in nine cases, while in five cases problems occurred in assigning a species to the correct family. In *Cepphis advenaria* (Geometridae), for example, the mandibles are located caudo-laterally to the labrum, which may lead to an erroneous identification (point 29 of the key). Moreover, psychid „pupae semiliberae“ can be misidentified as Heterogynidae due to the absence of maxillary palpi in many of them (point 8 of the key). The extent to which the forewings cover the abdomen, often used as a character in the key, may be altered by dehydration in dead, non-obtect pupae. For example, in two dried pupae of *Synanthedon spheciformis* (Sesiidae), the forewings reached the border between the 5th and 6th abdominal segments, while in theory (point 24 of the key) they should not extend beyond the 4th. Some variability is to be taken into account even in the obtect pupae of drepanids, as regards the extent to which the forewings cover the hindwings (point 81 of the key). A visible labium is an essential character to identify a specimen as a zygaenid (point 21 of the key). However, as correctly stated in the paragraph dedicated to this family, in most zygaenid pupae the labium is concealed; only in a few cases a very small part of it is visible. A common problem in this publication is represented by typesetting errors. Some of them are likely to generate confusion, like the „Lb“ (= labium) that appears instead of „Pb“ to indicate the proboscis in fig. 14.20. This figure is cited at point 18 of the key to illustrate the absence of a labium! Moreover, at point 98 of the key to geometrid species, one is redirected to point 33, instead of 99. In spite of the above-mentioned problems, this book discloses the surprising diversity of lepidopterous pupae to non German-speaking scientists. I would suggest all lepidopteran morphologists to use it. They would find interesting ideas for their research and the chance to help the authors with improving the key. In this way, Patočka's and Turčani's key may soon become a useful tool also for non-specialists, like ecologists or hymenopterists interested in pupal parasitoids.

Francesca Vegliante

A new species of *Amicta* Heylaerts, 1881 from the south of Iran (Psychidae)

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Zusammenfassung. *Amicta sericata* sp.n. wird beschrieben, abgebildet und ihr Status diskutiert. Sie lebt an verschiedenen Büschen und Sträuchern im klimatisch sehr unwirtlichen Sandheidegebiet der Provinz Fars im Süden des Zagros Gebirges im Iran. Die Raupen leben in einem gegen die grossen Temperaturschwankungen im Lebensraum auffallend gut isolierten Sack.

Abstract. *Amicta sericata* sp.n. is described, illustrated and its systematic status is discussed. It feeds on several species of bushes and shrubs in a climatically most inhospitable sand heath or desert of the Fars province, in the south of the Zagros mountain chain of Iran. The larvae live in a bag that is exceptionally well insulated against the high temperature variations of the area.

Résumé. Les auteurs décrivent, illustrent et discutent de la position systématique d'*Amicta sericata* sp.n.. L'espèce vit aux dépens de plusieurs arbrisseaux et arbustes dans un milieu désertique très inhospitalier de la province de Fars, au sud des Monts Zagros, en Iran. Les larves construisent un fourreau les isolant parfaitement des grandes variations de température ambiantes.

Key words. Lepidoptera, Psychidae, *Amicta sericata*, Iran, Fars Province, host plants

Introduction

In the eastern part of Fars province, south of Iran, HA and Seyed Asghar Alehoseni discovered an unknown species of *Amicta* Heylaerts, 1881 feeding on several species of bushes and shrubs. The host plants are desert adapted with needle or fleshy like leaves; they are native to western Asia and distributed through Afghanistan, the Arabian Peninsula, Iran, and Pakistan (temperate and tropical regions) (Wiersema & Leon 2004). In the literature, no Psychidae species have previously been reported from these plants. The adult males were recognized to belong to the genus *Amicta* Heylaerts, 1881 (Oiketicinae Herrich-Schäffer, 1850: Acanthopsychini Tutt, 1900). However, the larvae do not build the known square-shaped bags typical of *Amicta* species, but bags with a circular cross section and a thick silk coating on the outside.
In the same area there were also bags of an *Oiketicoides* Heylaerts, 1881 (species not identified) with a circular cross section and with plant material arranged lengthwise, and bags of *Amicta murina* Klug, 1832, which have a square-shaped cross section.

Material and Methods

All the material was collected by HA and Seyed Asghar Alehoseni on June 14, 2000, June 1–4, 2004, and between June 3 and mid September 2005, in Qatrouyeh, Neyriz, Fars Province, Iran. This locality averages 1640 meters above sea level and its coordinates are 54°42'E and 29°8'N. A smaller population of the species was also found at Abadeh, in the northwestern part of Fars Province at 1580 m. Most bags still contained larvae

and some had started to fix their bags to branches and were preparing for pupation. The bags with active larvae were kept in cages and the larvae were fed with *Artemisia* sp. and *Zygophyllum* sp. until pupation.

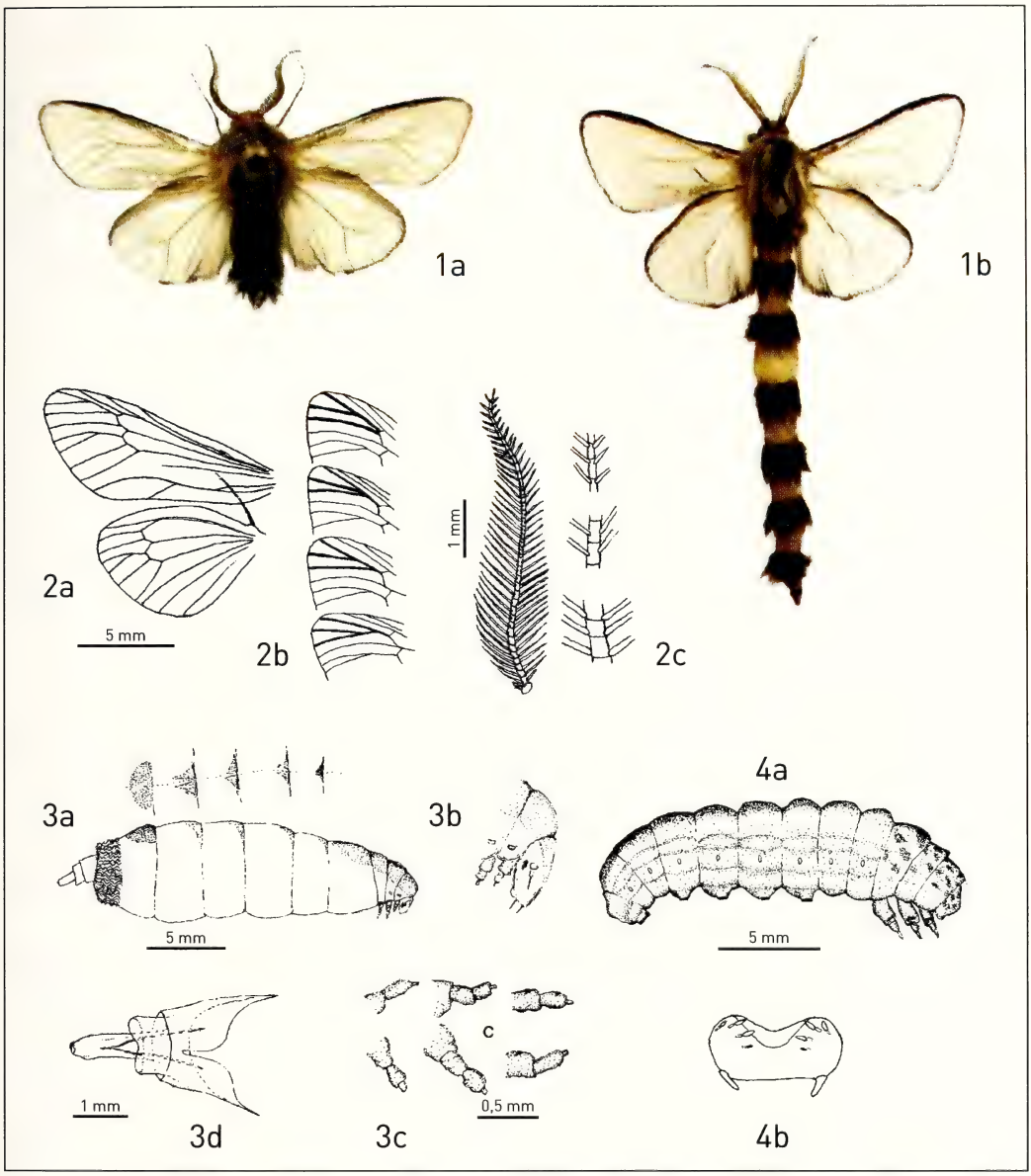
The male type material is pinned and mounted. The wingless females were taken out of their bags and preserved in 70% alcohol. All specimens and bags are labelled with the date and location on a white label and with the name on a red label.

***Amicta sericata* sp. n.** **Figs. 1–4, 5a, b, d, 6, 7a, b, 8a, 9a, 10**

Material. Holotype: ♂, **Iran**, Qatrouyeh, Neyriz, Fars province, 1640 m, 5.ix.2004, ex larva, 29°8'N 54°42'E, coll. Naturmuseum Luzern (together with the respective bag). – Paratypes: same data, but 3♂ 1.ix.2000; 1♂ 25.viii., 2♂ 31.viii, 15♀ 17.–20.ix.2004, ex larva or ex pupa with bags, 7 larvae 18.vi. and 25 additional bags as well as 40♂ 29.viii., 20♀ 29.viii., 9♀ 10.–16.ix. 2005, and 60 additional bags; deposited in the following collections: Hayk Mirzayans Insect Museum, Insect Taxonomy Research Department, Plant Pest & Disease Research Institute, Teheran, Iran (HMIM); Natural Resources Insect Museum, Plant Protection Department, Research Center for Agriculture and Natural Resources of Fars Province, Shiraz, Iran (NRIM); The Natural History Museum, London; Naturmuseum Luzern, Switzerland; Museum d'Histoire Naturelle, Genève, Switzerland; Collection Willi Sauter, Illnau, Switzerland; Museum für Tierkunde, Dresden, Germany; Naturhistorisches Museum, Wien, Austria; Collection Erwin Hauser, Wolfern, Austria; Collection Thomas Sobczyk, Hoyerswerda, Germany; Collection R. & P. Hättenschwiler, Uster, Switzerland.

Diagnosis. Male with a strong structure, all wings transparent. Anal veins in forewings cup separate not merging with an1, sc and rr in hindwings fused over large part of the wing. Body with dark brown to black hairs, thorax mixed with whitish hairs. Male genitalia long and slender saccus short, tegumen trapezoid, phallus longer than the whole genitalia. Bag round in cross section coated with a thick layer of gray silk.

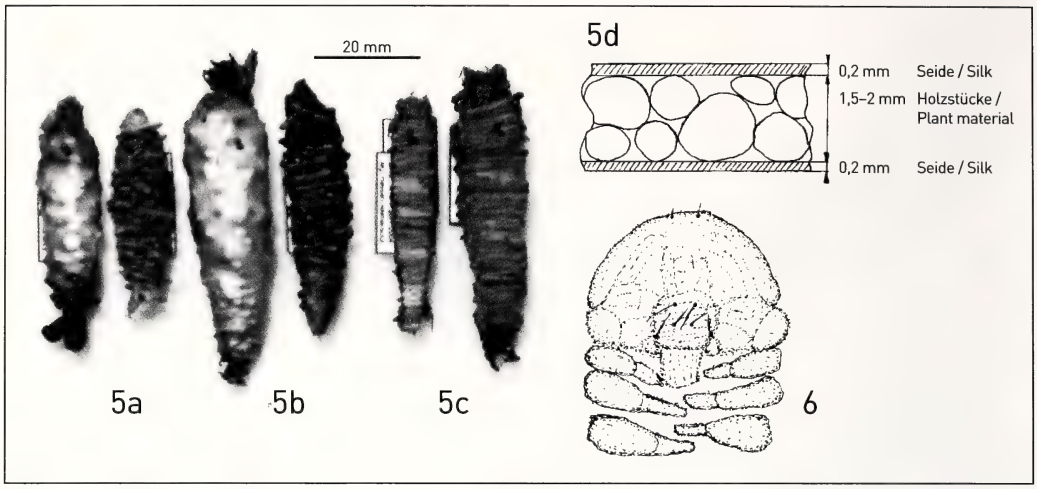
Description. Male. Wing expanse: 25–28 mm, average 26.6 mm (n = 32); forewings wide, with rounded apex (Fig. 1a), with 10 veins off discoidal cell (Fig. 2a); r3, r4, and r5 extremely variable, normally with one stem and divided in various ways, can differ on left and right wings of same specimen (Fig. 2b); m2+m3 stalked. Wing scales hair-like, pointed, short, class 1 (Sauter & Hättenschwiler 1999), dark brown, mixed with longer, whitish scales, loosely attached and set widely separated from one another (therefore wings appear light colored), easily lost with first wing movements (therefore wings become naked and fully transparent). All wing margins with dark brown, nearly black scales or hairs remaining attached during flight; narrow, hair-like scales located on front and rear margins and wide, toothed scales on apex and outer margin. Hindwing with 6 veins off discoidal cell, m2+m3 stalked, rr fused with sc over a large part of wing; scales and fringes as on forewing. Antenna (Fig. 2c) with 40–45 segments; except for 2–3 basal segments, all segments pectinated with sensory hairs and few individual scales; on basal flagellomeres pectinations arise from base of flagellomeres, in middle of antenna arising from middle of flagellomeres, and near apex arising from apex of flagellomeres. Large, round eyes as large as height of head itself, distance between eyes as long as half eye diameter. Ocelli absent. Labial palps strongly reduced. Face with long, brown hair tuft; forehead and thorax with mixture of brown and gray hairs. Foreleg longest, with long epiphysis; mid and hind legs without spurs or only very small apical spurs; all legs coated with appressed dark hairs. Abdomen dark brown to black.



Figs. 1–4. *Amicta sericata* sp. n. **1a.** Freshly emerged male, **b.** Male with abdomen extended for mating (photos by H. Alemansoor). **2.** Characters of wings and antenna, ♂. **a.** Shape and venation of fore- and hindwing. **b.** Forewing variation in veins r3–5. **c.** Antenna with enlarged details on the right. **3.** Female. **a.** Lateral view. **b.** Head enlarged. **c.** Legs. **d.** Genitalia, ventral view. **4.** Larva. **a.** Lateral view. **b.** Ventral side of labrum.

Genitalia (Fig. 8a) long and slender; saccus short; tegumen trapezoid; valves inserted into vinculum with moveable joint; phallus very long, longer than whole genitalia.

Female. Vermiform, thin skinned, whitish to faded yellow, or with pastel greenish shade, 20–24 mm long, 5–6 mm in diameter (n = 20) (Figs. 3a, b). Ocelli missing. With 3-segmented, unfunctional legs (Fig. 3c). Antennae represented by small studs;



Figs. 5–6. 5. Bags of *Amicta* species. **a, b.** *A. sericata* sp. n. with silk coating removed on the right (a: ♂, b: ♀). **c.** *A. murina*, male on the left, female on the right (photo by S. Parpan). **d.** Cross section of wall of *A. sericata* sp. n. bag showing the three layers: silk – wood – silk. **Fig. 6.** *A. sericata* sp. n. head plate of female pupa (only the leg sheaths can be recognized clearly).

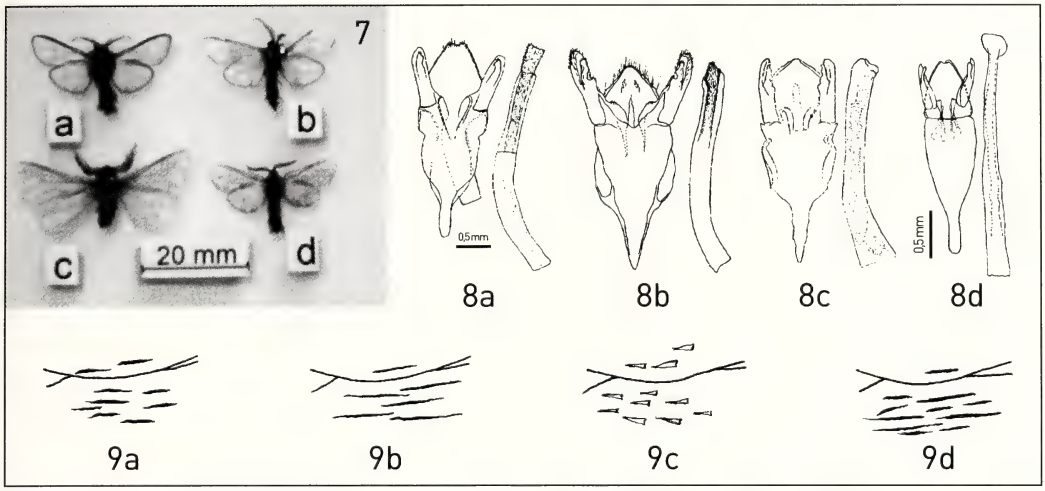
eyes by few dark dots. Head, first three thoracic segments and first abdominal segment more thickly sclerotized dorsally; following abdominal segments often with small dark plates larger on each subsequent segment until segment 6; segment 7 with complete circle of brown hairs. Genitalia (Fig. 3d) strongly sclerotized; ovipositor long, reaching twice its diameter.

Egg. Slightly oval, without clearly visible structures, whitish when fresh, but gradually changing to dark gray during development.

Larva. Prior to pupation, 20–30 mm long; whole body light gray-brown; head and thorax with dorsal and lateral, irregularly arranged, dark brown markings (Fig. 4a); arrangement of setae on ventral side of labrum as shown on fig. 4b.

Bag. Male 32–38 mm long, round in cross section, 10–12 mm in diameter; female 35–48 mm long with diameter of 11–16 mm (Fig. 5a, b), round, slightly tapered to nearly cylindrical. Foreign matter attached to bag consisting of short, thin sections of branches of food plant cut to proper length by larva and attached to front end of bag. Outside of bag coated with layer of silver-gray silk. Wall of bag composed of three layers (Fig. 5d): First layer inside silk cushion of approx. 0.2 mm thickness; second layer of foreign plant material for approx. 1.5–2 mm and third layer silk coating of another 0.2 mm thickness.

Pupa. Male pupa 13–16 mm long (average 14.9 mm), 3.5-4.5 mm in diameter (average 4.1 mm, n = 59); female 16–21 mm long, 4.5–6 mm in diameter. Dark brown prior to hatching; empty exuvia light brown. Head plate with 4 pairs of bristles, one of them near neck. Female head plate with individual sheaths not clearly demarcated only leg sheaths can clearly be recognized (Fig. 6). Abdominal segments and intersegmental membranes in both sexes equipped with thorns allowing pupa to move



Figs. 7–9. 7–8. Males of *Amicta* and *Hyalopteronia* species. **7.** Adults. **a, b.** *A. sericata* sp. n. (a: freshly emerged ♂; b: worn ♂ after mating flight). **c.** *A. murina*, the abdomen (partly removed) is lighter in color. **d.** *A. quadrangularis* (photo by S. Parpan). **8.** Genitalia. **a.** *A. sericata* sp. n. **b.** *A. murina* (from Dierl 1964). **c.** *A. quadrangularis* (from Bourgogne 1949). **d.** *Hyalopteronia davarica* (from Solyanikov 2002). **9.** Hairs and scales of forewing anal area of. **a.** *A. sericata* sp.n. **b.** *A. murina*. **c.** *A. quadrangularis*. **d.** *Hyalopteronia davarica*.

forwards or backwards within bag or out of it. Long rows of thorns directed forward on anterior edges of inter-segmental membranes 1–2, 2–3, 3–4, and 4–5 allowing to move backward. Dorsal plate of segment 5 with row of 20–23 strong thorns, segment 6 with row of 12–15 thorns, and segment 7 with 4–6 thorns all directed backward and serving to move forward.

Life history. L a r v a . The young larvae hatch from the eggs after 2–4 weeks in their mother's exuvia, but hurry to get out of the bag. Their first action is to build a miniature bag with silk and often with plant material taken from the mother's bag. During their whole life the larvae will be busy to maintain, repair, and enlarge their bag to accommodate their increasing size, but they will never leave it. The bag must be kept long enough and wide enough so that the larva can turn around within it. To enlarge the bag suitable sticks or branches are cut to the required length with the mandibles and fixed with silk at the edge of the front opening. One stick is fixed beside the other until the bag is long and wide enough for the growing larva. The rear end, which becomes too narrow, is bitten off and dropped. The new end is carefully equipped with an exit that closes by itself. This is done with silk threads under tension which, by virtue of their elasticity, pull the walls of the soft end together and keep the opening closed to prevent enemies from entering. From the inside, however, the larva can push it open easily to dispose of the excrements. Early in their life the larvae start spinning a solid silken coating all over the plant material of the bag. The larva stretches out from the front opening to cover the anterior half of the bag, the other half is reached through the rear opening. The silk is applied crosswise in many layers on top of the layer of wooden fragments. The three layers of the wall of the bag and the trapped air between the wooden pieces together perfectly isolate the insect against extreme weather conditions,

Tab. 1. Field data on percentages of attack or parasitism on bags of *A. sericata* sp. n. on two separate dates.

	Spiders	Torymidae	Chalcididae	Tachinidae	Totals
14.viii.2005	36%	5%	1.8%	13.85%	56.65%
27.viii.2005	9%	28.9%	0%	25.7%	63.6%

but also offer strong mechanical protection. The smaller rear opening is used to dispose of the excrements, the males hatch through this opening, and the females use it for mating. The larvae of some species in the genera *Ptilocephala* Rambur, 1866 and *Phalacropterix* Hübner, 1825 also cover their bags with some layers of silk prior to pupation, but by far not as thick as in *A. sericata* sp.n. Could it be that due to the very large variations between the day- and night-time temperatures, that the species developed the thick coating as additional insulation?

While rearing *A. sericata* sp. n., parasitoid Ichneumonidae and Chalcididae were obtained as well as Tachinidae of the genus *Chetogena* Rondani and *Nealsomyia rufella* (Bezzi) (det. by H. P. Tschorsnig and B. Merz). A remarkable number of larvae were killed by the fungus *Aspergillus parasiticus* Speare (det. by S. Keller and S. Balazy). Apparently this fungus is not as dominant in the natural habitat of *A. sericata* sp.n. than in our lab colonies. Observations in the field also showed that spiders were waiting to ambush larvae at the front end of the bag. Whenever these larvae wanted to feed, the spiders attacked them. HA also observed spiders in bags sucking on larvae and only leaving their skin. These spiders of the family Heteropodidae, genus *Micromata* (det. J. Walter and U. Kloter) appear to be a key mortality factor for *A. sericata* sp.n. On August 14, 2005 HA collected 136 bags and on August 27 166 others in the same area. These bags were attacked or parasitized in the proportions shown on Tab. 1. These observations based on a total of 302 bags cannot tell us whether or not these percentages are representative for the whole population, which is spread out over a wide area. Some of the relatively large population of this big species also is eaten by some local birds, which manage to break open the hard bags, but bags with mechanical damages that could be made by a strong-billed beak were found only occasionally. However, it appears that the *A. sericata* population studied lives in a balanced equilibrium with its parasitoids and predators.

Pupa. In summer, normally between July and early August, the bag is tightly attached at the front end with many silk threads to a branch or stem of the food plant, often the one on which the larva spent its whole development. Then, the bowels are emptied and the male molts to a pre-pupa. The female turns around, head towards the rear end, and directly pupates. After a few days the male pre-pupa also turns around towards the rear opening. Without having taken any food it finally pupates. Depending on temperature the adult moth will be ready for hatching after 2–3 weeks.

Adult. Mating occurs early at night. The females break open the head plate of the exuvia and move one quarter to one third out of the exuvia; while in this position within the still closed bag the females call the males with their pheromones which penetrate through the bag. The males hatch at sundown or a little later. Prior to hatching the male

Fig. 10. The type locality of *A. sericata* sp. n. in Qatrouyeh, Fars province (photo by H. Alemansoor).

pupa moves about halfway out of the bag by bending and stretching with the help of the dorsal thorns of its segments 5–7. Then, the head plate of the pupa is pushed open and the moth crawls out. After about a quarter to half an hour the wings are expanded and dried, and as soon as female pheromones reach a male, it flies toward the source of the scent. Upon reaching the female bag the male opens the rear entrance of the bag by pushing its abdomen (Fig. 1b) through the opening that is still closed by the telescopic abdomen to reach the genitalia of the attracting female. Mating only takes a few minutes. Immediately after, the female begins to lay her 300–400 eggs into the pupal exuvia and rubs off her abdominal hairs to place them between the eggs for cushioning and insulation. When finished, the female remains like a plug at the opening of the exuvia and slowly dies. The sex ratio is well balanced.

Seasonal development. The mating season is late August to mid September, somewhat depending on the altitude. There is one generation per year. In winter the larvae do not feed and the bags are strongly affixed to branches of the food plants or other solid material.

Habitat. The species is mainly known from a sandy, desert-like area with bushes, shrubs, and sparse grass in the hills and mountains of the south west of Iran, Fars province, 54°42'E / 29°8'N between 600 to 2800 meters above sea level (Fig. 10). The area experiences high climatic changes. The 16 year summer day averages are 25.9 °C (June) and 27.6 °C (July) with highs over 38 °C, but with cool nights of only 10–12 °C; in winter temperatures drop below –5 °C. The annual rainfall varies between 100 to 300 mm only. The rains mainly come between December and March, mainly in two or three downpours, thus washing the soil away.

The bags with feeding larvae of *A. sericata* sp. n. were found on the following local plants: *Zygophyllum atriplicoides* F.E.L. v. Fischer & C.A. Meyer, *Artemisia sieberi* W.S.J.G. v. Besser, *Pteropyrum olivieri* H.F. Conte de Jaubert & E. Spach, *Noaea mucronata* (P. Forsskal) P.F.A. Ascherson, *Heliotropium aucheri* A.P. de Candolle, *Ephedra* cf. *strobilacea* Bunge ex Lehmann, and *Alhagi persarum* P.E. Boissier &. F.A. Buhse (det. by Ahmad Hatami). In the locality goats and sheep graze the sparse

Tab. 2. Comparison of some characters of the Psychidae species found at the type locality of *A. sericata* and that look similar.

	Wing expanse	Mating season	Eyes interocular distance	Body color	Male genitalia (Fig. 8)	Scales on forewing (Fig. 9)
Amicta sericata	25–28 mm	mid Aug. – mid Sept.	large, as high as head, distance, 0.5 × eye diameter	Abdomen dark, thorax gray to light gray	tegumen notched (Fig. 8a)	Anal area short, dark hairs, class 1–2
Amicta murina	27–32 mm	mid Aug. – mid Sept.	large, as high as head, distance, 0.5 × eye diameter	Abdomen and head light yellow-gray, forehead dark-brown	Tegumen rounded (Fig. 8b)	Whole wing yellow-gray with loosely scattered, fine, long hairs, class 1
Amicta quadrangularis	23 mm approx	mid Aug. – mid Sept.	small, less than height of head, dist. 1.3 × eye diameter	Abdomen dark, thorax with some long silver hairs	Tegumen rounded (Fig. 8c)	Anal area with wide, short scales, class 3–5, mostly with two tips
Hyalopteronia davarica	26 mm approx.	April	large, nearly as high as head, distance 0.8 × eye diameter	Abdomen dark brown, thorax with some long, light brown hairs	Structure different (Fig. 8d)	Anal area with long and short, narrow scales mixed

grasses and bushes. Bags of *Amicta murina* (Klug, 1832) and of the genus *Oiketicoides* (species not identified yet) were also found at this locality, but in both cases their numbers made just a fraction of those of *A. sericata* sp.n.

Derivatio nominis. The name derives from the silk coating that the larva spins over the layer of wooden fragments on its case: *Serica* = silk, sericatus = "dressed in silk." to match with the genus *Amicta sericata* sp. n.

Discussion

The genus *Amicta* Heylaerts, 1881 was based on forewing venation and bag characters. Later, Jean Bourgogne (1949) made detailed studies of the genus and appended the description with three important characters: (1) forewing anal venation (Fig. 2a) (forewings cup separate not merging with an1, sc and rr in hindwings fused over large part), (2) features of the male genitalia (Fig. 8), and (3) cross section of bag (Fig. 5) (bag square shape in cross section no silk coating). *A. sericata* sp. n. matches the type species of *Amicta* for characters 1 and 2, but it builds an entirely different bag with a design that is not known in other species of the Acanthopsychini. Therefore, *A. sericata* sp. n. is here only placed conditionally in the genus *Amicta*.

The type of the genus, *A. quadrangularis* (Christoph, 1873), along with the largest species, *A. murina*, are from the Near East and known from Iran (in coll. Hättenschwiler), but they were often confused. Under *A. quadrangularis* Staudinger (1899) described

two forms that vary in hair color of the male abdomen. These are form *nigrescens*, with black abdominal hairs, and form *albescens*. However, Dierl (1964) stated that form *albescens* is synonym with *A. murina*. According to the descriptions these forms build square shaped bags. Therefore, *A. sericata* sp. n., which also has a dark haired abdomen, can not be confused with form *nigrescens*. It is no problem to determine the females because they never leave the bag. The males (Fig.7) can be distinguished by the features mentioned in Tab. 2.

Solyanikov (2002) described a new genus and a new species, *Hyalopteronia davarica*, from Angorchan, southern Iran. This taxon is known by five adult males only, which, at first glance look very much like *A. sericata*. However, *H. davorica* flies early April (*A. sericata* from late August to mid September), it has nine veins on the forewing (*A. sericata* has 10 veins off the discoidal cell), and there are several differences in the structure of the genitalia (Fig. 8d).

Acknowledgements

We enjoyed the help of the following people, to whom we are sincerely thankful: Prof. Dr W. Sauter for advices and reading the manuscript; Dr B. Merz and Dr H. P. Tschorsnig for the identification of the parasitoid flies; Dr S. Keller and Dr S. Balazy for the identification of the fungus; Dr J. Walter and U. Kloter for studying the spiders and its behavior; E. Manhart for providing food plants, Dr B. Landry for reviewing the manuscript; and last but not least, the staff of the Research Center for Agriculture and Natural Resources of the Fars Province, especially Seyed Asghar Alehoseni for his assistance in the field and Ahmad Hatami for identifying the food plants.

References

Bourgogne, J. 1949. Remarques sur le genre *Amicta* (sensu lato) et détermination de la position systématique d'*Amicta Ecksteini* Led. – Bulletin de la Société entomologique de France **1949**: 98–103.

Dierl, W. 1964. Zur Kenntnis von *Amicta murina* (Klug). *Amicta mauretanica* Rothsch. Bona Species. – Opuscula Zoologica **80**: 1–9.

Heylaerts, F.-J.-M. 1881. Essai d'une monographie des Psychides de la faune européenne. – Annales de la Société entomologique belge **28**: 66.

Sauter, W. & P. Hättenschwiler 1999. Zum System der palaearktischen Psychiden. 2. Teil Bestimmungsschlüssel für die Gattungen. – Nota lepidopterologica **22** (4): 262–295.

Solyanikov, V. P. 2002. New genus and species of Bagworm Moths from Iran and Kabardino Balkaria. – Entomological Review **81** (6): 745–749.

Staudinger, O. 1899. Neue Lepidopteren des palaearktischen Faunengebietes. – Deutsche Entomologische Zeitschrift Lepidoptera Iris **12**: 356–357.

Wiersema, J.H. & B. Leon 2004. Data from GRIN Taxonomy. Taxonomic information on cultivated plants in the USDA-ARS Germplasm Resources Information Network (GRIN), Online Database. Available from: http://www.ars-grin.gov/cgi-in/npgs/html/taxon.pl?14774 (accessed 27 November 2004).

Penestoglossa pyrenaella sp. n. aus den Pyrenäen (Psychidae)

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Abstract. *Penestoglossa pyrenaella* sp. n. is described from the Spanish Pyrenees. The new species is similar to *Penestoglossa dardoinella* (Millière, 1865), but it can be distinguished by the conspicuously reduced wings of the females and by the flat larval cases covered with small flat pebbles.

Zusammenfassung. *Penestoglossa pyrenaella* sp. n. wird aus den spanischen Pyrenäen beschrieben. Die neue Art ist ähnlich zu *Penestoglossa dardoinella* (Millière, 1865), kann aber durch die zurückgebildeten Flügel der Weibchen sowie die Larvensäcke, welche mit flachen Steinplättchen belegt sind, unterschieden werden.

Key words. Psychidae, Pyrénées, *Penestoglossa pyrenaella* sp. n., *Penestoglossa dardoinella* (Millière, 1865).

Einleitung

Den Erstnachweis der neuen Art erbrachten P. und S. Hättenschwiler (Uster, Schweiz), welche im Mai 1981 einige adulte, leere Säcke, nahe Soldeu (Andorra) sowie später im Jahre 1986, ebensolche an 3 weiteren Fundstellen in den zentralen spanischen Pyrenäen, eintragen konnten.

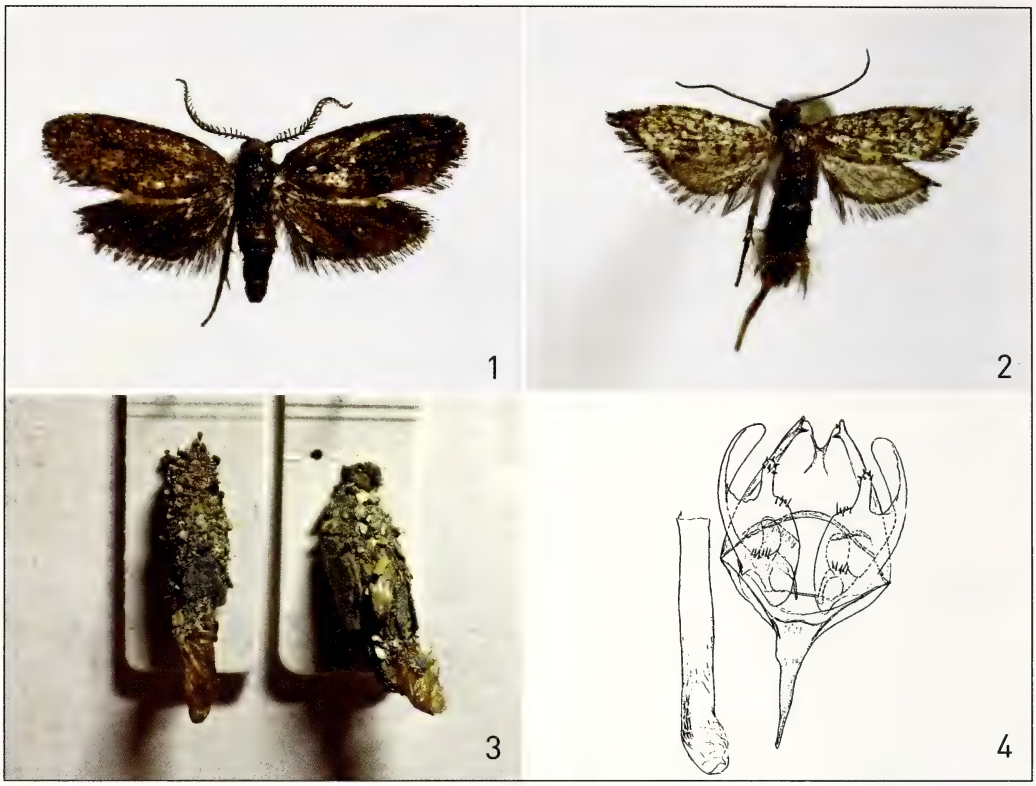
Im Jahre 1984 reiste der Autor zur Erforschung der Psychiden in das etwa 50 km westlich vom ersten Fundplatz entfernt gelegene Gebiet von Esterri d´ Aneu und fand dort dieselbe Art in einer individuenstarken Population. Es ließ sich bei dieser Untersuchung eine erhebliche Anzahl von Raupen (-Säcken) auffinden, die sich in der Folge problemlos bis zur Imago züchten ließen.

Schon ein Jahr später wurden in diesem Teil der Katalanischen Hochpyrenäen fünf weitere Fundstellen entdeckt, an welchen die neue Art zuweilen ebenso zahlreich registriert werden konnte.

Verwandtschaftlich steht die neue Art der *Penestoglossa dardoinella* (Milliére, 1865) am nächsten. Für diese Festlegung sprechen einige Merkmale (wie z.B. das Flügelgeäder der Männchen), welche bei beiden Arten ähnlich strukturiert sind, und die eine systematische Einordnung in die Gattung *Penestoglossa* Rogenhofer, 1875 möglich machen.

Auffallend sind bei den kleinen, gutbeweglichen aber flugunfähigen Weibchen der neuen Art die stark reduzierten Flügel und bei den Säcken der Belag, welcher denselben, durch die oberflächlich angesponnenen Gesteinsteinsplättchen, eine ganz charakteristische Note verleiht.

Eine Verwechslung mit einer schon bekannten Art wird ausgeschlossen.



Figs. 1–4. *Penestoglossa pyrenaella* sp. n. **1.** Männchen. **2.** Weibchen. **3.** Säcke (links Weibchen, rechts Männchen). **4.** Männliches Genital (Zeichnung W. Sauter).

Penestoglossa pyrenaella sp. n.

Material. Holotypus ♂, **Spanien**, Katalonien, Lerida, Esterri d'Aneu, 1100 m, 21.VIII.1984 (e.l.), leg. et coll. Herrmann. – Paratypen:: 7♂, 7♀ gleiche Daten, aber 12., 20., 21., 22., 25., 27., 29.8., 1.9.1984 (e. l.), leg. et coll. Herrmann; 3♂, 7♀ gleiche Daten, aber 28. (e. l.), 30.7.1991 (Freilandfund), 3., 4., 7., 13., 30.8., 29.9.1991 (e. p.), leg. Bläsius, coll. Herrmann; 7♀ gleiche Daten, aber 20.7.1994 (e. l.), leg. et coll. Bettag; 3♂, 3♀, Lerida, Sorpe, 18., 20.8.1994 (e. l.), leg. et coll. Bettag; 1♂, 1♀, Lerida, Martinet, 800m, 20.9.2001 (e. l.), leg. et coll. Herrmann; Säcke: 45 S (= Säcke, ohne Falter), Spanien, Katalonien, Lerida, Esterri d' Aneu, 1100 m, 19.8.1985; leg. et coll. Herrmann; 3 S, Lerida, Sorpe, 1200 m, 21.8.1985, leg. et coll. Herrmann; 4 S, Lerida, Espot, 1300 m, 21.8.1985, leg. et coll. Herrmann; 4 S, Lerida, Berrós-Josa, 900 m, 22.8.1985, leg. et coll Herrmann; 3 S, Lerida, Espot, Pista al Estany Negro, 2000 m, 22.8.1985, leg. et coll. Herrmann; 2 S, Lerida, Rialp, 800 m, 23.8.1985, leg. et coll. Herrmann; 12 S, Lerida, Avellanet, 1250 m, 3.5.1986, leg. et coll. Hättenschwiler; 6 S, Lerida, Llavorsi, 3.5.1986, leg. et coll. Hättenschwiler; 1 S, Puerta da Menga, 14.5.1986, leg. et coll. Hättenschwiler; 4 S, **Andorra**, Soldeu, 1700 m, 5. 1981, leg. et coll. Hättenschwiler.

Beschreibung. Männchen (Abb. 1). Kopf, Rücken, Brust und Hinterleib einfarbig dunkelbraun beschuppt. Labialpalpen dreigliedrig. Fühler mit 21–27 Gliedern. Die schmalen, gestreckten Vorderflügel (VFL) nach außen kaum erweitert. Vorderrand hingegen leicht nach außen gewölbt; Apex leicht zugespitzt. Expansion der VFL zwischen 9–13,2 mm (im Mittel 11,1 mm); Länge derselben zwischen 4,4–6,2 mm (im Mittel 5,3 mm). 9 Adern entspringen aus der Mittelzelle, wobei die Adern r4 und r5 verschmolzen und die Medianadern 2 und 3 gestielt oder auch getrennt sein können. Anhangzelle

meist vorhanden, die Eingeschobene Zelle hingegen stets fehlend. Deckschuppen mit Schuppenklasse V–VI (nach Sauter 1956), feingezähnt und meist von glänzender, dunkelbrauner Farbe. Weißgraue Schuppen bzw. schwach angedeutete Gitterung selten und nur bei wenigen Exemplaren festgestellt. Die Flügelfransen grau bis dunkelbraun gefärbt. Hinterflügel gestreckt, mit spitzem Apex und dunkelbraun gefärbten Schuppen. 5 Adern entspringen aus der Mittelzelle. Die Adern m2 und m3 dabei verschmolzen. Die Vordertibien mit verhältnismäßig langer Epiphysis. Die Mitteltibien mit je einem und die Hintertibien mit je zwei Spornpaaren. Im Genitalapparat (Abb. 4) Tegumen am Ende kräftig eingekerbt, mit zwei gekrümmten, bedornten Spitzen. Saccus sehr lang mit spitzem Ende. Die Valven nach innen gebogen, mit schmalem Sacullus. Cuiller mit distal mit stumpfen Dornen. Die Valve trägt basal an der Dorsalkante einen lappenförmigen, rundgeformten Fortsatz. Beide Valven sind ventral durch eine stärker sklerotisierte und gekrümmte Spange und dorsal durch die fadenförmige Transtilla verbunden, welche sich basal an der dorsalen Valvenkante befinden. Phallus fast gerade, mit stumpfen Dornen besetzt und einer auffallend rundlichen Verbreiterung an seinem distalen Ende.

Weibchen (Abb. 2). Kopfbehaarung grau, Augen dunkelbraun bis schwarz gefärbt. Fühler haarförmig, mit 24–27 Gliedern (N = 3). Körperfarbe grau. Afterwollhaare lang und weißlich bis dunkelgrau gefärbt. Sämtliche Sternite geschlossen. Die Flügel stark zurückgebildet, daher die Flugunfähigkeit der Imagines. Die Imagines sind flugunfähig. Vorderrand der Vorderflügel leicht nach außen gewölbt und Apex zugespitzt. Expansion zwischen 7,5–10,5 und im Mittel 9,1 mm, bei einer Flügellänge von 3,2 – 4,8 und einem Mittelwert von 4,1 mm. Geäder vorhanden, wenn auch meist nur unvollständig. So können einzelne Adern bisweilen gänzlich fehlen oder sie sind schwach angedeutet bzw. nur noch als Fragmente vorhanden. Die weißlich bis dunkelgrau gefärbten Deckschuppen breit und mit kurzen Zacken besetzt. Hinterflügel mit spitzem Apex, grau gefärbten schmalen Schuppen und stark rudimentierten Geäderstrukturen. Die Vordertibien mit langer, schlanker Epiphysis. An den Mitteltibien wie beim Männchen je ein und an den Hintertibien je zwei Spornpaare. Tarsus der Vorderbeine mit fünf Gliedern. Im Genitalapparat der Ovipositor schmal und lang gestreckt und an seinem distalen Ende mit einzelnen Tastborsten versehen. Die Postvaginalplatte kaum sklerotisiert und daher nur wenig sichtbar. Etwas besser hingegen die Antevaginalplatten erkennbar sowie mit stärkerer Sklerotisierung auch der Bursabogen. Der Fühlerscheidenansatz der weiblichen Puppenhülle ohne merkliche Einkerbung und daher, wie bei *Taleporia tubulosa* (Retzius, 1783) und *Dahlica triquetrella* (Hübner, 1813), stumpfwinklig abgeschlossen (nach Hättenschwiler, 1977).

Säcke (Abb. 3). Die leicht gerundeten und oftmals etwas gekrümmten, länglichen Säcke sind zu den Enden hin verjüngt und in der Mitte zuweilen bauchig verdickt. Ihre Länge bewegt sich beim Männchen zwischen 7–11 mm, (im Mittel 8,91 mm), bei 12 untersuchten Exemplaren. Geringfügig größer sind hingegen die weiblichen mit Werten zwischen 8–12 mm und einem Mittelwert von 9,83 mm (N = 12). Bei beiden Geschlechtern schwankt die Breite zwischen 2,5 und 4 mm, wobei auch hier die Weibchen höhere Durchschnittswerte erreichen. Die Säcke sind meist unregelmäßig

Figs. 5–6. Lebensräum von *Penestoglossa pyrenaella* sp. n. **5.** Bei Espot, 1300 m NN. **6.** Die Larven von *Penestoglossa pyrenaella* sp. n. leben auf flechten- und algenreichen, südexponierten Felsen, wie sie in der Umgebung von Esterri d´Aneu, 1100 m NN vielfach anzutreffen sind.

mit kleinsten Sandkörnchen sowie vielfach mit flachen Gesteinsplättchen geschmückt, welche kristallinen Bodenverhältnissen (z. B. Granit) entstammen. Weniger hingegen kommen Flechten- und Grasteilchen als Baumaterialien in Betracht.

Derivatio nominis. Nach dem Gebirge benannt, in dem Penestoglossa pyrenaella in Teilen heimisch ist.

Lebensweise. Die neue Psychidenart findet sich sowohl in trocken heißen und submediterranen Felsheiden der zentralen und östlichen Pyrenaen zwischen 700–1100m ü. NN, wie auch in winterkalten und schneereich geprägten alpinen Gebirgslagen, wo ihre Entwicklungshabitate, südexponiert, noch in 2000 m ü. NN liegen können (Abb. 5 und 6). Stets wurden die Larven und vielfach auch die zur Verpuppung angesponnenen Säcke an sonnenexponierten Felsen festgestellt, welche zuweilen durch reichlichen Algen- und Flechtenüberzug gekennzeichnet waren. In den unteren, wärmegetönten Berglandschaften, wie beispielsweise um Esterri d´Aneu, wo die durchschnittlichen Jahresniederschläge bei etwa 700 mm liegen, zeigt sich die Psychidenfauna besonders artenreich. So fanden sich hier neben der neuen Art auch *Dahlica lichenella* (Linné, 1761) f. parth., *Dahlica triquetrella* (Hübner, 1813) f. parth., *Taleporia tubulosa* (Retzius, 1783), *Psyche* sp., *Luffia lapidella* (Goeze, 1783), *Canephora unicolor* (Hufnagel, 1766), *Apterona* sp. (kleine Säcke wie bei *Apterona helicoidella* (Vallot, 1827) parth. und *Eumasia parietariella* (Heydenreich, 1851)). Geringer war die Anzahl der Arten in Lagen oberhalb von 1500 m, wo die Säcke von *Taleporia tubulosa* (Retzius, 1783), *Epichnopterix* sp., *Ptilocephala pyrenaella* (Herrich-Schäffer, 1852) und *Apterona nylanderi* (Wehrli, 1927), angesponnen an den hellen Granitfelsen, neben solchen der neuen Art, festgestellt werden konnten.

Die Falter schlüpften in der Zeit zwischen dem 20. Juli und 29. August, wobei die meisten Adulten im August erschienen. Ein frisch geschlüpftes Männchen fand R. Bläsius

im Freiland am 30.7.1991. Es saß an einem südexponierten, der Sonne ausgesetzten Felsen, nahe Esterri d´Aneu, neben seinem Sack. Unmittelbar nach dem Schlüpfen der Imagines zwischen 12–14 Uhr schließt sich der Paarungsphase an. Dabei stülpt das sehr bewegliche Weibchen den Ovipositor weit heraus um Pheromone auszustoßen. Nach vollzogener Paarung läuft das Weibchen in auffallender Unruhe umher, um mit der Legeröhre den felsigen Untergrund nach kleinsten Ritzen und dergleichen für die unmittelbar bevorstehende Eiablage abzutasten.

Diskussion

Bei Vergleichsuntersuchungen mit anderen Psychidenarten zeigte sich, dass die neue Art am besten mit *Penestoglossa dardoinella* (Millière, 1865) verwandtschaftlich in Verbindung zu bringen ist. So verfügen beide Arten, bei ähnlich strukturiertem Flügelschnitt, im Vorderflügel über neun Adern, welche aus der Mittelzelle ausstrahlen. Im Hinterflügel sind es bei beiden Arten hingegen nur fünf. Lediglich bei den Weibchen der neuen Art trifft dies nicht zu, denn deren Flügelgeäder muss als außerordentlich deformiert bzw. als nur rudimentär entwickelt bezeichnet werden. Identisch ist bei beiden Arten das Vorhandensein einer Eingeschobenen Zelle. Eine Anhangzelle, welche bei *P. dardoinella* vorhanden ist, fehlt hingegen der sp. n.

Darüber hinaus bestehen habituelle Unterschiede, welche sich u.a. in der Spannweite der Vorderflügel (bei *P. dardoinella* 16–24 mm) und in der Färbung der Falter (bei *P. dardoinella* hellgrau bis dunkelbraun) sowie im Aussehen der Säcke manifestieren. So sind dieselben von *P. dardoinella* mit 12–20 mm wesentlich größer und nur mit Pflanzenteilchen belegt.

Gewisse Verschiedenheiten zeigen sich auch im Bau der männlichen Genitalarmatur, wie etwa den Valven, die bei der sp. n. etwas schmaler sind, und die im Gegensatz zu denen von *P. dardoinella* über einen charakteristischen, lappenförmigen Fortsatz an der Dorsalkante verfügen. Deutlich zugespitzt ist bei der sp. n. distal der Saccus, der bei *P. dardoinella* hingegen abgerundet endet.

Danksagung

Allen Personen, die mir bei der Erstellung dieser Arbeit geholfen haben, möchte ich auf diesem Wege meinen herzlichen Dank aussprechen. Im Besonderen möchte ich dabei Herrn P. Hättenschwiler (Uster, Schweiz) und Herrn Prof. Dr. W. Sauter (Illnau, Schweiz) erwähnen, von denen ich eine großzügige Fachberatung und Unterstützung erhielt. Weiterhin bin ich für die Bereitstellung von Untersuchungsmaterial den Herren E. Bettag (Dudenhofen, Deutschland) und R. Bläsius (Eppelheim, Deutschland) zu großem Dank verpflichtet.

Literatur

Hättenschwiler, P. 1977. Neue Merkmale als Bestimmungshilfe bei Psychiden und Beschreibung von drei neuen *Solenobia*-Dup.-Arten. – Mitteilungen der Entomologischen Gesellschaft Basel **27** (2): 33–60.

Sauter, W. 1956. Morphologie und Systematik der schweizerischen *Solenobia*-Arten (Lep. Psychidae). – Revue Suisse de Zoologie **63** (3) : 451–550.

Sauter, W. & P. Hättenschwiler 1991. Zum System der palaearktischen Psychiden. 1. Teil: Liste der palaearktischen Arten. – Nota lepidopterologica **14** (1): 69–89.

When disrupted characters between species link: a new species of *Conistra* from Sicily (Noctuidae)

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Abstract. *Conistra iana* sp. n. is described from Sicily. The new species is characterised by an unusual intermingling of characters deemed to be diagnostic for *C. vaccinii* (Linnaeus, 1761) and *C. ligula* (Esper, 1791), and shows also some exclusive features. An overall survey of closest congeners revealed that all checked females of "*C. ligula*" from the south-east Mediterranean are devoid of signum and sparse "*C. alicia*" from southern Spain and Morocco show markedly dilated postero-lateral processes of antrum, both findings calling for further research on these nominal taxa inasmuch additional entities might be hidden. *Orrhodia vaccinii nigra* A. Bang-Haas, 1907 is shown to be a senior synonym for *Conistra (Orrhodia) alicia* Lajonquière, 1939 **syn. n.** and declared as *nomen oblitum* in favour of the younger name as *nomen protectum*.

Key words. *Conistra*, Noctuidae, new species, Sicily.

Introduction

Zilli (1995) quoted the bizarre occurrence in Sicilian specimens of "*Conistra vaccinii* (Linnaeus, 1761)" of an outwardly produced apex of forewing (Figs. 1–2), a feature hitherto considered to be diagnostic of *C. ligula* (Esper, 1791) (e.g. Guenée 1852; Tutt 1892; South 1961; Bretherton et al. 1983), thus raising doubts about the published records for the latter species in Sicily. The preliminary identification of those specimens as *C. vaccinii* rather than *C. ligula* was based on the occurrence of characters deemed to be diagnostic for *C. vaccinii*, viz. a clearly lobed submarginal shade on the forewing underside (Fig. 9), an anchor-shaped juxta and a bulbous and apically blunt basal cornutus on the everted vesica (viz. the distal cornutus of the aedeagus, if vesica is not everted) (cf. Lajonquière & Boursin 1943; Koch 1958; Berio 1985) (Figs. 13, 17a–c, 22a–c, 27a–d). Nevertheless, new insights into the morphology of both male and female specimens from Sicily further revealed the linkage of 'vaccinioid' and 'liguloid' characters in the relevant populations. This fact, together with the detection of some unique features, indicates that these populations cannot be assigned to either of the two or any other taxon of the *C. vaccinii* species-group, as defined by Ronkay et al. (2001). The Sicilian populations are therefore deemed to represent a new species which is described here. Nevertheless, in order to properly address the issue of the taxonomic characterisation of the new species, it was first necessary to circumscribe clearly the ranges of variation shown by its closest congeners. This was done by surveying material from different districts of the species' ranges.

Materials and methods

A thorough check of published information on the structural characters of taxa of the *Conistra (Conistra) vaccinii* species-group was first made (Pierce 1909, 1910; Lajonquière 1939; Lajonquière & Boursin 1943; Kostrowicki 1956; Sugi 1959, 1982; Rungs 1972; Kishida & Yoshimoto 1979; Laever 1979; Berio 1983, 1985; Calle 1983; Gómez de Aizpúrua 1987; Yela et al. 1988; Hacker 1990; Hreblay 1992; Yela 1992; Rákosy 1996; Fibiger 1997; Hreblay & Ronkay 1998; Ronkay et al. 2001; Kononenko 2003). As the Sicilian taxon was found to be more closely related to a triplet of species consisting of *C. vaccinii*, *C. ligula* and *C. alicia* Lajonquière, 1939, traditionally regarded as difficult to differentiate from one another, study material of the four species from the following locations was gathered and specimens dissected:
Conistra vaccinii: Finland, France, Corsica, Switzerland, Italy, Czech Republic, Romania, Bulgaria, Russia (Ural), Turkey (28 ♂, 13♀).
Conistra ligula: Morocco, Algeria, Spain, Holland, Germany, Switzerland, Italy, Sicily, Bulgaria, Greece, Turkey (25♂, 34♀).
Conistra alicia: Morocco, Algeria, Tunisia, Spain, France (4♂, 8♀).
Conistra sp.: Sicily (10♂, 11♀).

Genitalia preparations, pictures and drawings were produced following the standard methods in lepidopterology (e.g. Grassi & Zilli 2005a). Measurements and counts were taken with the aid of a camera lucida. Numbers of the median cornuti include even the smallest. A random subset of *C. vaccinii* and *C. ligula* was also taken in order to compare the mean lengths (expressed in mm) of quantitatively varying characters with respect to the Sicilian species by Student's *t* test (Scossiroli & Palenzona 1971). The chosen characters were the basal bulbous cornutus (this shared only between *C. vaccinii* and *Conistra* sp.) and the antrum, which was measured from anterior margin to bottom point of ostial curved slit. In contrast, a non-parametric Mann-Whitney *U*-test was performed in order to compare the medians of the distributions of the small cornuti between *C. vaccinii* and *C. ligula*, inasmuch counts of discrete objects rarely show a normal distribution which allow *t* test to be applied (Fowler & Cohen 1993).

Abbreviations

AG	coll. A. Grassi, Rome
AZ	coll. A. Zilli, Rome
HNHM	Hungarian Natural History Museum, Budapest
MF	coll. M. Fibiger, Sorø
MHNG	Muséum d'Histoire Naturelle, Geneve
MNHB	Museum of Natural History, Bergamo, Italy
MZR	Museum of Zoology, Rome
PP	coll. P. Parenzan, Bari
L	length
N	sample size
P	probability level
s	standard deviation
t	Student's *t*
U	Mann-Whitney *U*
x	mean

Results

The new species was shown to be more closely related to *C. vaccinii* and *C. ligula* than to *C. alicia*. The main diagnostic differences between these species and their ranges of variation can be synthetically summarised as follows.

Figs. 1–8. Habitus of *Conistra* spp. **1–2.** *C. iana* sp. n., Sicily, Bosco della Ficuzza, **1.** Holotype ♂, **2.** Paratype ♀. **3–4.** *C. ligula*, Central Italy, surroundings of Rome, **3.** ♂, **4.** ♀. **5–6.** *C. vaccinii*, Central Italy, Latium, ♀. **7.** *C. alicia* ♀, Algeria, Algier (syntype of *Orrhodia vaccinii* v. *nigra* A. Bang-Haas, 1907). **8.** Idem, Morocco, Ifrane, ♂.

Conistra vaccinii (Linnaeus, 1761) Figs. 5–6

Diagnosis. Antennal segments of male approximately square with straight basal and distal margins in side view, so as to appear as tightly adpressed in a 'continuous' flagellum. Forewing with apex little or not produced, due to termen almost regularly straight or

convex subapically, submarginal shade on underside distinctly lobed with indentations in correspondence with veins (Fig. 11); hindwing and abdomen comparatively pale, the former often showing postmedial line; valvae moderately asymmetrical in length (the right longer) with smooth costal angles, juxta inferiorly anchor-shaped with nearly rectangular inner angles and rather narrow superior plate, vesica with bulbous and apically blunt basal cornutus, median bundle with 7–27 small cornuti (Figs. 14, 18a–c, 21a–c, 26a–d); antrum short and narrow, with narrow and tapering posterolateral lobes, bursa with two small elongate signa, sclerotisation of cervix bursae little extended (Figs. 30, 35a–e).

Remarks. The species is remarkably variable in colour, although most often orange brown or reddish brown; blackish specimens are extremely rare (cf. Steiner 1997: 466). As specimens with slightly produced forewing apex are not uncommon, the best diagnostic character in external habitus with respect to *C. ligula* is represented by features of the submarginal shade on the forewing underside. Asymmetry in the length of valvae has not been generally noted in the literature, but this is fairly frequent, although to a variable extent, and most emphasized in populations from peninsular Italy (e.g. the ratios of lengths left/right valva varied in our sample between 0.88–0.93). The bundle of median cornuti is generally stated as being not numerous, but a lot of variation has been found both in the number and size of these cornuti. As a matter of fact, the medians of the distributions of these cornuti do not significantly differ between *C. vaccinii* (N=20) and *C. ligula* (N=13) ($U = 125$; $P < 0.05$). It should not be underestimated, however, that these cornuti are likely to detach during copula (cf. Ronkay et al. 2001: 111, under *C. alicia*) and statistical comparisons should be better performed with bred unmated males.

Distribution. Palaearctic, from western Europe to the Russian Far East (Amur), as far south as southern Europe, Turkey, Iran and Turkestan. Records from China (Chen 1999) seem ascribable to other taxa. We have been unable to identify any authentic specimen from Northwest Africa, where the species is stated to occur (Ronkay et al. 2001). Not known from Sicily, despite some quotations from this island.

Conistra ligula (Esper, 1791) — Figs. 3–4

Diagnosis. Antennal segments of male approximately rectangular (longer than wide) with straight basal and distal margins in side view, so as to appear as tightly adpressed in a 'continuous' flagellum. Forewing with apex often distinctly produced because termen is slightly concave subapically, submarginal shade on underside straight or irregularly festooned (Fig. 10); hindwing more uniformly smoky, rarely showing postmedial line, abdomen dark; valvae asymmetrical in length (the right longer) with smooth costal angles, juxta generally deltoidal inferiorly with broader superior plate than in *C. vaccinii* (but see remarks here below), vesica with slender and sharply pointed basal cornutus, median bundle of cornuti 5–43 (Figs. 15, 19a–c, 23a–c, 24c 28a–b); antrum long and wide, with large and apically rounded posterolateral lobes, bursa with 0–1 small elongate signum (see remarks below), sclerotisation of cervix bursae moderately extended (Figs. 31–32, 37a–e).

Figs. 9–12. Ventral side of *Conistra* spp. **9.** *C. iana* sp. n. ♂, Sicily, Bosco della Ficuzza (paratype). **10.** *C. ligula* ♂, Switzerland, Magden. **11.** *C. vaccinii* ♀, Central Italy, surroundings of Rome. **12.** *C. alicia* ♂, France, Pyrénées-Orientales, Vernet-les-Bains (syntype).

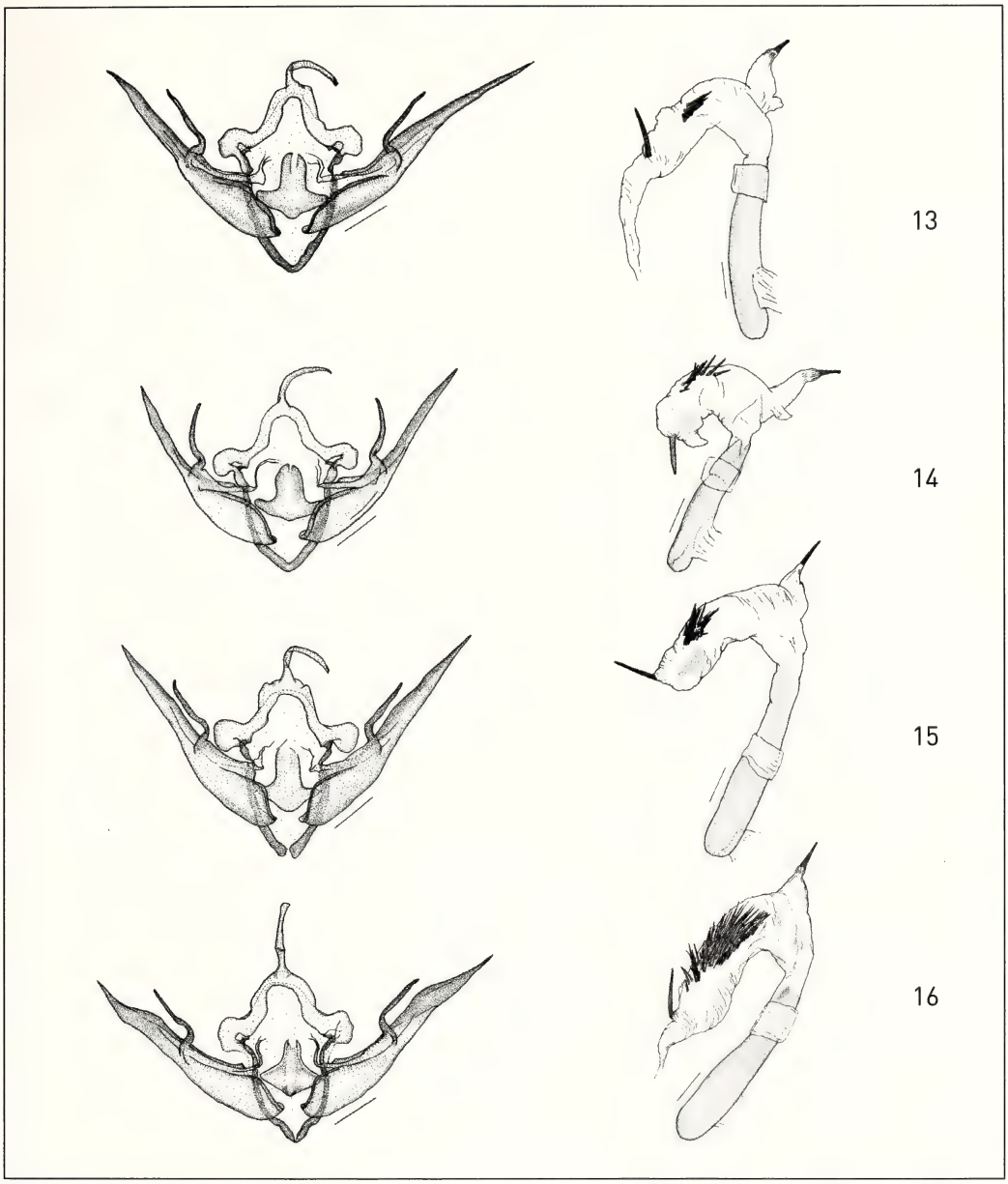
Remarks. Colour variation is less than in *C. vaccinii* and most individuals are either deep reddish brown or blackish brown, both equally frequent. As shown above under *C. vaccinii*, the well-known character of the falcate forewing apex is not of absolute value for diagnosis. Whereas on the one hand specimens of *C. vaccinii* with slightly falcate apex may occur, on the other hand some of *C. ligula* may indeed show a fairly

regular forewing termen, although they appear to be rare (cf. Fig. 4, specimen checked through dissection). Some characters of the genitalia usually considered as constant are very variable and alike *C. vaccinii*. Of these it is worth mentioning the shape of the juxta, which is occasionally anchor-shaped with inner angles nearly rectangular and rather narrow apical plate (this configuration was found in three Bulgarian examples out of eight together with two intermediates and the more usual form; Figs. 24a–b) and the number and size of median cornuti. Nevertheless, also specimens with a "vaccinioid" juxta tend to show a taller inferior plate and straighter inferior margins than *C. vaccinii*. Moreover, a surprising outcome was the finding that all the females dissected from Peninsular Italy (8♀), Sicily (1♀), Bulgaria (3♀), Greece (1♀) and Turkey (1♀) are devoid of any signum (Fig. 32), while the presence of one signum was considered as a fixed character for *C. ligula* in all the consulted references. It is worth noting that also the female from Hungary illustrated by Ronkay et al. (2001) appears devoid of the signum. This outcome shows a clear geographical congruence and calls for further research in order to assess whether or not more entities are involved into the current concept of *C. ligula*. For the time being we prefer to take a conservative view and consider the expression of the signum in *C. ligula* from the North-West to the South-East to be clinal (cf. Grassi & Zilli, 2005b). As a matter of fact, the existence of a NW–SE cline in Europe, or a corresponding contact between closely related sister taxa, seems to be quite common among European Lepidoptera, some examples from the Noctuidae being *Hadena bicruris* (Hufnagel, 1766) / *H. capsincola* ([Denis & Schiffermüller], 1775), *Shargacucullia caninae* (Rambur, 1833) / *S. blattariae* (Esper, 1790), *Spudaea ruticilla* (Esper, 1791) / *S. pontica* Klyuchko, 1968 and *Agrochola pistacinoides* (d'Aubuisson, 1867) / *A. nitida* ([Denis & Schiffermüller], 1775) (cf. Ronkay & Ronkay 1994; Ronkay et al. 2001; Hacker et al. 2002).

Distribution. Western-Palaearctic, from western Europe and Northwest Africa to the Urals, Caucasian region, Iraq and Iran. Records from China (Chen, 1999) seem ascribable to other taxa. Old records from Siberia have been subsequently amended (Kononenko, 2005). Present in Sicily.

Conistra alicia Lajonquière, 1939 — Figs. 7–8

Diagnosis. Antennal segments of male approximately rectangular (wider than long) with sligthly concave basal and distal margins in side view, so as to give the flagellum a more 'articulated' appearance. Forewing a little more elongate than in closest congeners, apex of forewing as in *C. vaccinii*, submarginal shade on forewing underside straight (Fig. 12); hindwing generally less smoky than in *C. ligula*, with variable expression of postmedial line, abdomen comparatively pale; valvae moderately asymmetrical in length (the right longer) with slightly produced costal angles; juxta basally rhomboidal; vesica with bulbous and feebly apically blunt basal cornutus, median bundle of cornuti numerous (approx. 20–50), cornuti more thread-like (Figs. 16, 20a–c, 25a–c, 28c–d); antrum moderately elongate and wide, with very large and well-rounded posterolateral lobes, bursa with one small circular signum, sclerotisation of cervix bursae greatly extended (Figs. 33, 38a–c).



Figs. 13–16. ♂ genitalia of *Conistra* spp. **13.** *C. iana* sp. n., Sicily, Bosco della Ficuzza (paratype). **14.** *C. vaccinii*, Switzerland, Mte Ceneri. **15.** *C. ligula*, Central Italy, surroundings of Rome. **16.** *C. alicia*, Algeria, Algier. Scale bars = 1 mm.

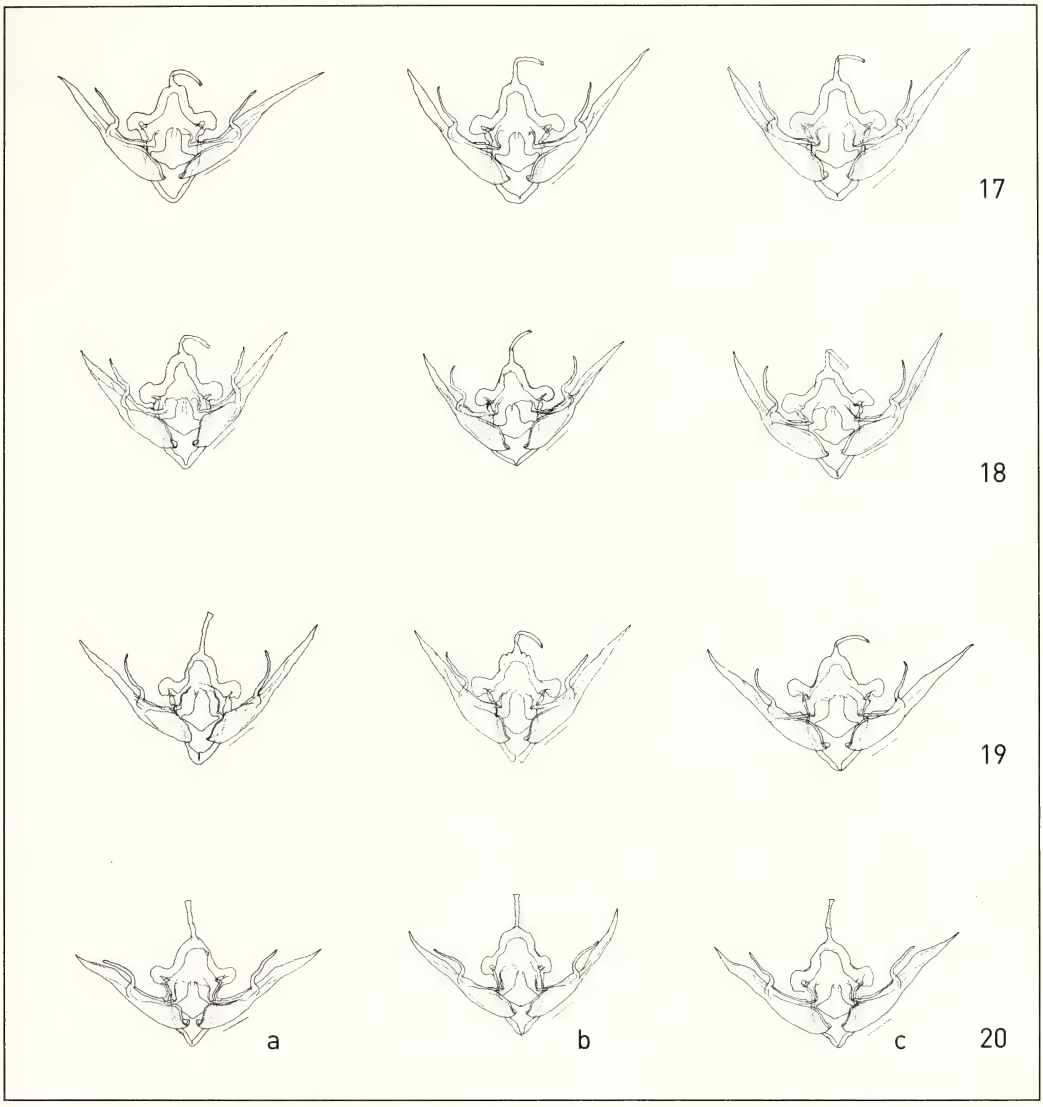
Remarks. Variation occurs in the length of the basal bulbous cornutus and number of median cornuti. In the light of the slender and apically sharp basal cornutus and too scanty bundle of median cornuti we are unable to confirm the identification of the aedeagus of "*C. alicia*" illustrated by Ronkay et al. (2001) as belonging to this species and suggest that a mistake for *C. ligula* might have occurred. Some females

show a signum not perfectly circular, but never as elongate as in closest congeners. A few females from Southern Spain and Morocco are characterised by the unusually large and rounded posterolateral lobes of the antrum (Figs. 34, 38d–e), alongside with normal females occurring in the same areas, so that also in this case further research is necessary to assess whether or not the current concept of *C. alicia* has to be split.
Distribution. Atlanto-Mediterranean. Not known from Sicily.

***Conistra iana* sp. n.** **Figs. 1–2**

Material. Holotype ♂, **Italy**, Sicily, Palermo Province, Bosco della Ficuzza, 'Alpe Cucco', 1050 m, 16.xi.1990, Zilli leg., MZR. – Paratypes: 15♂, 14♀, same data as holotype; 9♂, 17♀, idem, but 'Crocifisso', 1000 m, 22.xi.1990; in AG, AZ, HNHM, MF, MHNG, MZR; 1♂, idem, [no site stated], 2.xii.1995, Grillo leg., in AZ; 2♂, idem, 'torrente', 730 m, 24.xi.1991, Pantini & Valle leg., MNHB. – Additional material. 1♀, Sicily, Etna, Linguaglossa, Contrada Salici 13.iii.1994, Bella & Russo leg., in PP; 1♀, Sicily, Etna, Pineta di Linguaglossa, 'Etna Nord', 1450 m, 5.iv.1989, Grillo leg., in AZ.

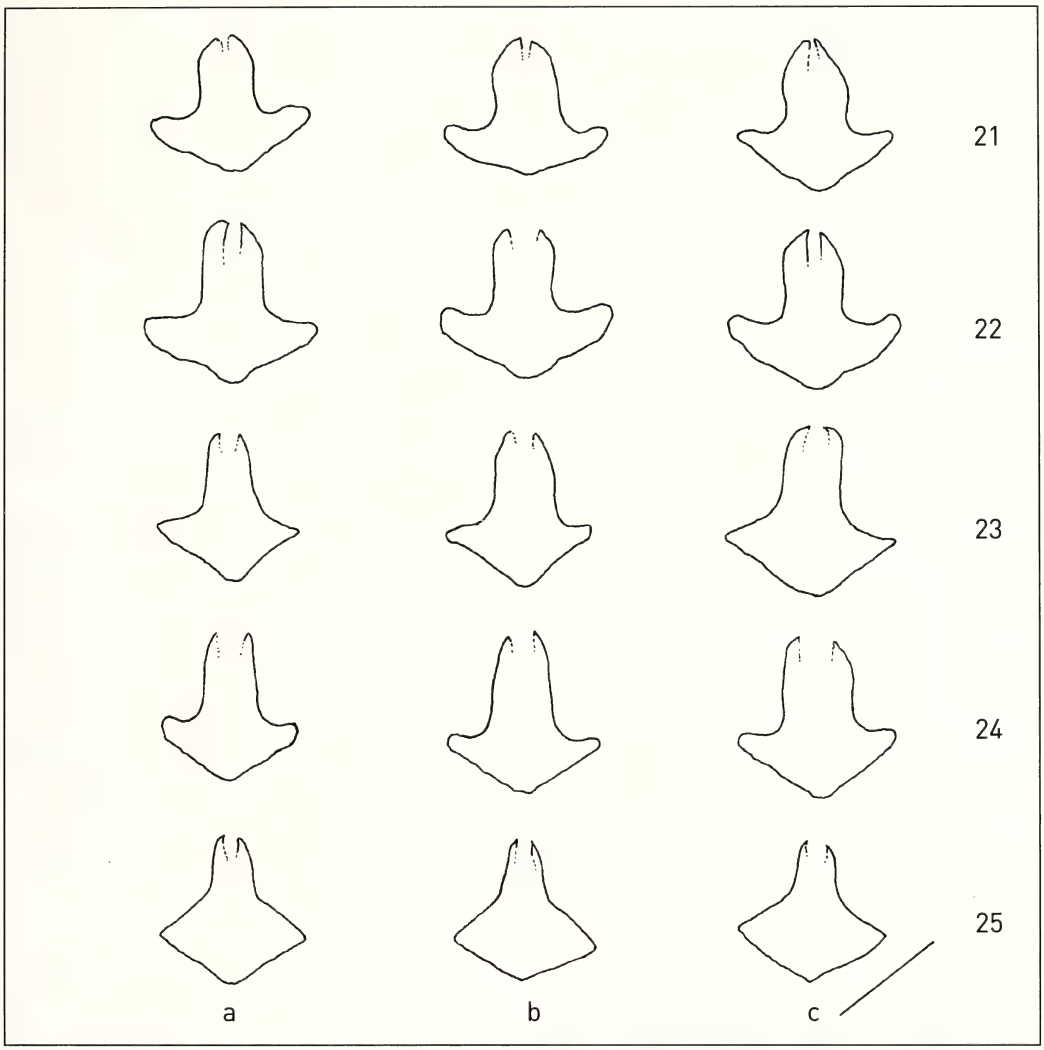
Description. Male (Fig. 1). Wingspan 32.50–37.50 mm (x = 34.82, N = 28). Specimens falling into two main categories as to colour of background, dark reddish brown or blackish brown, occasionally pale orange-brown, pattern elements as in close congeners, generally little outstanding but conspicuous in rare contrasted specimens mottled by pale yellowish. Antennal segments approximately square, as in *C. vaccinii*. Forewing with apex distinctly pointed and produced, the termen being subapically concave much as in *C. ligula*, cilia concolorous with ground colour; hindwing glossy, pale basally and irregularly suffused by brown, with fairly evident postmedial and submarginal lines, the latter often followed by some clearing before dark terminal line, cilia pale creamy brown. Abdomen fairly dull coloured. Underside very clear and contrasted, with prominent postmedial lines and discal spot of hindwing, submarginal shade of forewing distinctly lobed with indentations in correspondence with veins (Fig. 9).
Male genitalia (Figs. 13, 17a–c, 22a–c, 27a–d). Armature as in *C. vaccinii* except for valvae, greatly asymmetric in length, right one remarkably longer than left one and often tapering into rod-like point. Aedeagus vesica with very short bulbous and apically blunt basal cornutus, bundle of 9–18 small median cornuti and distal cornutus.
Female (Fig. 2). Wingspan 32–37 mm (x = 34.74, N = 33). Habitus essentially as described for male.
Female genitalia (Figs. 29, 36a–e). Armature as in *C. vaccinii* except for antrum, longer and broader than in *C. vaccinii* but distinctly shorter than in *C. ligula*, with narrow and pointed posterolateral lobes, and with only one elongate signum.
Derivatio nominis. The species is named after the 'two-faced' Roman god Ianus, in order to emphasise the twofold facies of the forewing, more closely resembling that of *C. ligula* on the upperside because of dark colour and falcate apex, and of *C. vaccinii* on the underside because of lobed submarginal shade.
Distribution. So far known from Sicily.
Diagnosis. The new species is essentially characterised by a combination of features that separately occur in *C. vaccinii* and *C. ligula*. It shows the habitus of *C. ligula*, particularly in the slightly falcate apex of forewing, and the same tendency to occur



Figs. 17–20. ♂ genital armatures of *Conistra* spp. **17a–c.** *C. iana* sp. n., Sicily, Bosco della Ficuzza (paratypes). **18a–c.** *C. vaccinii*: (a) Finland, Maarianhamina, (b) Czech Republic, Borek, (c) Southern Italy, Calabria, Domanico. **19a–c.** *C. ligula*: (a) Switzerland, Magden, (b) Central Italy, surroundings of Rome, (c) Southern Italy, Calabria, Donnici. **20a–c.** *C. alicia*: (a) Spain, Guadalajara, Trillo, (b) Morocco, Middle Atlas, Ifrane, (c) Algeria, Algier. Scale bars = 1 mm.

with dark phenotypes, either reddish brown or blackish brown (with around same frequency), but on the forewing underside the submarginal shade is distinctly lobed and indented in correspondence with veins, not straight as in *C. ligula* (and *C. alicia*). In the male genitalia, the shape of the juxta and the blunt apex of the basal bulbous cornutus correspond with *C. vaccinii*, the cornutus being sharp and not bulbous in *C. ligula*; on the other hand, in the female genitalia the presence of only one elongate signum corresponds with *C. ligula*, as *C. vaccinii* has two such signa. Features exclusive of

C. iana sp. n. are a greatly emphasized asymmetry in length between the valvae, the right one being extraordinarily elongate, the shortness of the basal bulbous cornutus, and the antrum clearly intermediate in size between those of *C. vaccinii* and *C. ligula*. Concerning the basal cornutus, the ranges of variation of *C. vaccinii* and *C. iana* sp. n. slightly overlap, but the differences are greatly statistically significant (P = 0.01): for *C. vaccinii* $0.72 \leq L \leq 0.92$, x = 0.86, s = 0.059 (N = 27); for *C. iana* $0.56 \leq L \leq 0.73$, x= 0.65, s = 0.068 (N = 8), with *t*(*vaccinii-iana*) = 21.23. As regards the length of the antrum, the differences are also greatly statistically significant (P = 0.01) between the three species: for *C. vaccinii* $0.90 \leq L \leq 1.22$, x = 1.10, s = 0.086 (N = 13); for *C. iana* $1.22 \leq L \leq 1.52$, x = 1.36, s = 0.106 (N = 10); for *C. ligula* $1.70 \leq L \leq 2.28$, x = 1.95, s = 0.166 (N = 18); with *t*(*vaccinii-iana*) = 15.55, *t*(*vaccinii-ligula*) = 46.56 and *t*(*iana-ligula*) = 25.76.
With regard to *C. alicia*, the new species can be separated by the forewing shape more like that of *C. ligula*, submarginal shade on forewing underside lobed, valvae very asymmetrical in length with smooth costal angle, juxta inferiorly anchor-shaped, smaller number of median cornuti, smaller antrum with narrow and tapering posterolateral lobes, less extended sclerotisation of cervix bursae, signum elongate instead than circular.
Remarks. Interestingly, *Conistra alicia* is commonly stated to be intermediate between *C. vaccinii* and *C. ligula* (e.g. Boursin & Lajonquière 1943), but the features of *C. iana* sp. n. clearly show the Sicilian species to be the truly intermediate between the two. In fact, some qualitative characters fully match those of *C. vaccinii* (e.g. lobed subterminal shade, bulbous and blunt basal cornutus), some those of *C. ligula* (e.g. colour, falcate forewing apex, presence of only one elongate signum), and some quantitative ones are intermediate (e.g. length of antrum). A few quantitative traits are eccentric, such as the shortness of the basal cornutus and the great asymmetry in the length of valvae, but the latter feature occurs at a certain extent also in *C. vaccinii* (particularly from the Italian Peninsula) and *C. ligula*. This situation may be *a priori* ascribable either to *C. iana* being basal to both *C. vaccinii* and *C. ligula* or an hybridogenic origin of the Sicilian species. Even if the second hypothesis appears as more parsimonious, the frequency of archaic elements showing relic distribution and most derived ones being widespread gives some support also to the first scenario. The facts that only *C. iana* and *C. ligula* are present with certainty in Sicily, and *C. vaccinii* and *C. ligula* in southernmost Italian Peninsula (Calabria), are compatible with both hypotheses. Nevertheless, whitin the context engendered by presuming that *C. iana* is ancestral, the loss of the signum in southeastern populations of *C. ligula* (including Sicilian ones) and its acquisition in northwestern ones would represent an unlikely reversal of character toward the condition shown by *C. iana*, so we are inclined to provisionally dismiss this hypothesis. Nevertheless, we clearly recognise that such a rejection is based on the assumption that by virtue of their geographic proximity *C. iana* should be more related to the *C. ligula* populations without signum than those with signum. In contrast, should the settlement of signum-devoided *C. ligula* in Peninsular Italy and Sicily be a secondary one, e.g. following a spread from the Balkan Peninsula, the sharing of the signum between *C. iana* and northwestern *C. ligula* might well be symplesiomorphic. On this respect, it is worth noting that there are other examples of characters shared between Sicilian and northern populations which are missing in those from the Italian Peninsula (cf. Zilli

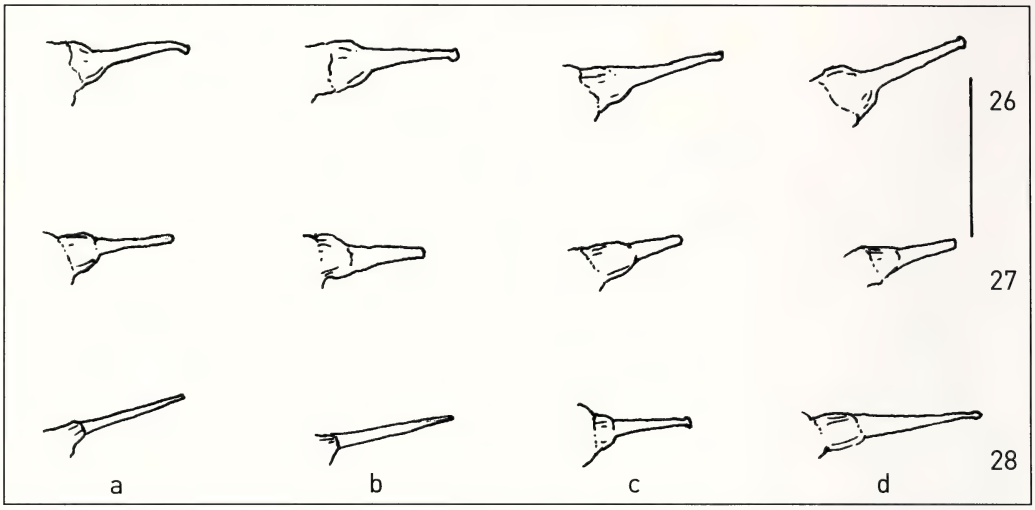


Figs. 21–25. Juxtae of *Conistra* spp. **21a–c.** *C. vaccinii*: (a) Czech Republic, Borek, (b) Switzerland, Mt Ceneri, (c) Southern Italy, Calabria, Domanico. **22a–c.** *C. iana* sp. n., Sicily, Bosco della Ficuzza (paratypes). **23a–c.** *C. ligula*: (a) The Netherlands, Utrecht, (b) Switzerland, Magden, (c) Southern Italy, Calabria, Donnici. **24a–c.** Idem: (a) Bulgaria, Kozuch, (b) idem, (c) Central Italy, Rome. **25a–c.** *C. alicia*: (a) Spain, Guadalajara, Trillo, (b) Morocco, Middle Atlas, Ifrane, (c) Algeria, Algier. Scale bar = 1 mm.

1996). A clear resolution of the phylogeny of this group of species will therefore largely depend on the assessment of the phylogeographic relationships between the various populations of "*C. ligula*".

Nomenclatural aspects

While checking whether or not there were available species-group names of *Conistra* corresponding with the concept of the new Sicilian species, the following ones based on Northwest-African material had to be taken into account and are here discussed.



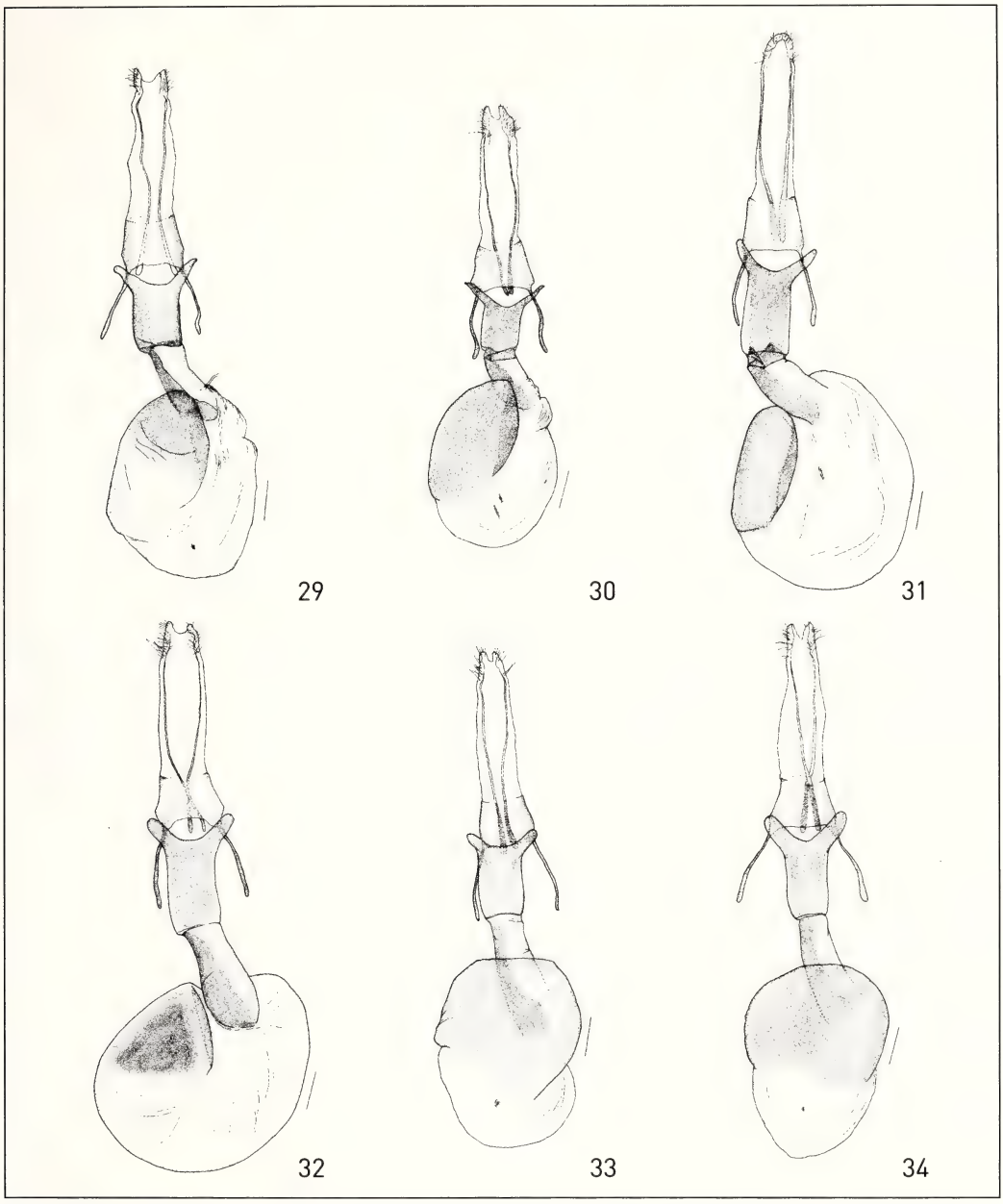
Figs. 26–28. Basal cornuti of *Conistra* spp. **26a–d.** *C. vaccinii*: (a) Finland, Koski, (b) Switzerland, Mt Ceneri, (c) Southern Italy, Calabria, Domanico, (d) idem, Mt Cocuzzo. **27a–d.** *C. iana* sp. n., Sicily, Bosco della Ficuzza (paratypes). **28a–b.** *C. ligula*: (a) The Netherlands, Utrecht, (b) Southern Italy, Calabria, Donnici. **28c–d.** *C. alicia*: (c) Spain, Guadalajara, Trillo, (d) Algeria, Algier. Scale bar = 1 mm.

Orrhodia sebdouensis Austaut, 1880: 221. Type-locality: Algérie, Sebdou.

Despite the clear association by Austaut (1880) of his "*Orrhodia sebdouensis*" with species of the subgenus *Dasycampa* Guenée, 1837 of *Conistra*, this name, representing a full synonym or a subspecies of *C.* (*D.*) *staudingeri* (de Graslin, 1863) (cf. Lajonquière & Boursin 1943; Rungs 1972, 1981; Poole 1989; Ronkay et al. 2001), began to be associated with *C. vaccinii* (e.g. Staudinger & Rebel 1901; Hampson 1906; Lucas 1911; Warren 1911, in 1909–1914; Rothschild 1920). Oberthür (1918), moreover, mixed two species in his illustrations of "*Cerastis sebdouensis*", as also evidenced by Lajonquière & Boursin (1943), viz. Figs. 4091 (*sebdouensis* type) and 4092 represent *C. (D.) staudingeri*, while figs. 4093–4104 actually relate to *C. alicia*.

Orrhodia vaccinii nigra Bang-Haas, 1907: 74. Type-locality: Algier.

The dissection of the two female syntypes of *nigra* (Figs. 7, 38b) by courtesy of the Museum für Naturkunde, Berlin, enables us to fully confirm the opinion of Lajonquière & Boursin (1943) that this name relates to the current concept of *C. alicia*, a view overlooked by Poole (1989), who wrongly put it into the synonymy of *C. vaccinii*. Nevertheless, Boursin (in Lajonquière & Boursin 1943: 177) explicitly did not want to grant a 'variety' with subspecific status and described *Conistra alicia barbarica* Boursin, 1943 with reference to the North African populations. Of course, had *nigra* been considered as an available species-group name, as in fact it is (cf. Bang-Haas, 1907: "*Orrhodia vaccinii* v. *nigra* n. var."), it would have taken full priority over *C. alicia*. We are therefore compelled to fully explicit the synonymy *Orrhodia vaccinii nigra* Bang-Haas, 1907 = *Conistra* (*Orrhodia*) *alicia* Lajonquière, 1939 **syn. n.**, but



Figs. 29–34. ♀ genitalia of *Conistra* spp. **29.** *C. iana* sp. n., Sicily, Bosco della Ficuzza (paratype). **30.** *C. vaccinii*, Czech Republic, Černošice. **31.** *C. ligula*, Spain, Guadalajara, Trillo. **32.** idem, Southern Italy, Calabria, Scuotrapiti (without signum). **33.** *C. alicia*, Tunesia, Tunis. **34.** "*C. alicia*", Morocco, Agadir (with dilated lobes of antrum). Scale bars = 1 mm.

also to consider the younger name as *nomen protectum* and the older as *nomen oblitum* as the conditions of both articles 23.9.1.1. and 23.9.1.2. of the ICZN (1999) are fully met. Evidence for this is as follows (full references omitted inasmuch not compulsory by provisions of the Code):

To our knowledge the name *nigra* Bang-Haas has not been used as a valid name since its publication, but only as infrasubspecific (Warren 1911; Boursin & Lajonquière 1943; Berio 1985) or was listed in publications not to be taken into account in determining usage such as catalogues or synonymy lists (e.g. Poole 1989; Vives Moreno 1994), as ruled by art. 23.9.6. (ICZN 1999). The junior synonym *C. alicia* has been used as presumed valid name for the taxon in more than 25 works published by more than 10 authors since 1956 over a span of more than 10 years, among the others Agenjo (1958), Mouterde & Dufay (1959), Dufay (1961, 1962, 1966), Rungs (1972, 1981), Calle, Yela & Motta (1974), Calle & López (1974), Gómez de Aizpúrua (1974, 1987), Gomez Bustillo, Arrojo Varela & Yela Garcia (1979), Laever (1979), Calle (1980, 1983), Garcia, Perez de Gregorio & Romaña (1984), Berio (1985), Requena (1987), Yela (1987, 1992), Yela, Olano & Marcos (1988), Hreblay (1992), Redondo (1990), Yela & Herrera (1993), Beck (1999–2000), Calle, Lencina, González & Ortiz (2000), Cifuentes (2000) and Redondo, Blasco-Zumeta & King (2001).

Orrhodia vaccinii nigra Lucas, 1911: 483. Type-locality: Algérie, Tarf.

Despite the fact that Lucas (1911) published this name relating to *C. alicia* (cf. Lajonquière & Boursin 1943) as "*Orrhodia vaccinii* var. *nigra*, nov.", the content of the article clearly reveals that *nigra* Lucas is infrasubspecific, as some other "formes" are stated to be sympatric in the type-locality. The name *nigra* Lucas, therefore, does not enter into zoological nomenclature and, had it entered, it would be a junior primary homonym and, at the same time, a junior subjective synonym of *Orrhodia vaccinii nigra* Bang-Haas, 1907.

Orrhodia vaccinii ab. *flavofasciata* Lucas, 1911: 483. Type-locality: Algérie, Tarf.

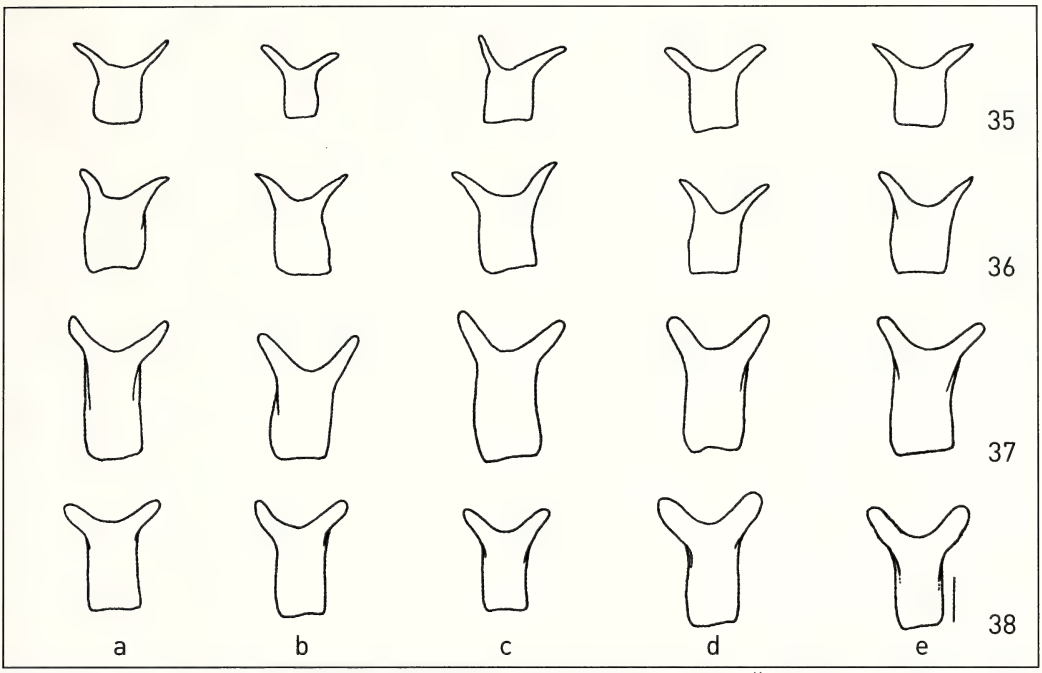
Explicitly described as aberrational and clearly intended as infrasubspecific in the text (Lucas 1911), the name *flavofasciata* Lucas relates to *C. alicia* but does not enter into zoological nomenclature.

Conistra alicia barbarica Boursin [in Lajonquière & Boursin], 1943: 178, pl. 10 figs. 9–12, pl. 11 figs. 7–18. Type-locality: Algérie, dept. Constantine, Le Tarf près la Calle.

In the light of the weak differences between African and European populations of *C. alicia*, Ronkay et al. (2001) synonymised *barbarica* Boursin, 1943 with nominotypical *C. alicia*.

Conistra ligula gemella Rungs, 1972: 680, pl. 1 fig. 15, pl. 3 [nec pl. 2] figs. 1, 5. Type-locality: Maroc, Moyen Atlas, Ifrane.

Judging from the original description (Rungs 1972) and examination of some specimens from Morocco there is no doubt that the name *gemella* relates to *C. ligula*, of which it is currently considered to represent a full synonym (Ronkay et al. 2001).



Figs. 35–38. Antra of *Conistra* spp. **35a–e.** *C. vaccinii*: (a) Czech Republic, Černošice; (b) Northern Italy, Trient, (c), Piedmont, Pralormo, (d, e) Central Italy, Latium, S. Severa. **36a–e.** *C. iana* sp. n.: (a–c) Sicily, Bosco della Ficuzza (paratypes), (d) Etna, north slope, (e) Linguaglossa. **37a–e.** *C. ligula*: (a) Spain, Guadalajara, Trillo, (b) France, Alpes-de-Haute-Provence, Digne, (c) Bulgaria, Kozuch, (d) Central Italy, surroundings of Rome, (e) Southern Italy, Calabria, Scuotrapiti [c–e from specimens without signum]. **38a–c.** *C. alicia*: (a) Morocco, Middle Atlas, Ifrane, (b) Algeria, Algier (syntype of *Orrhodia vaccinii* v. *nigra* A. Bang-Haas, 1907), (c) Tunesia, Tunis. **38d–e.** "*C. alicia*", with dilated lobes of antrum: (d) Morocco, Middle Atlas, Ifrane, (e) Agadir. Scale bar = 1 mm.

Conistra plantei Rungs, 1972: 681, pl. 1 fig. 16, pl. 3 figs. 2, 6. Type-locality: Maroc, Moyen Atlas, forêt de Jaba.

This little known species, known with certainty only on the male sex, is clearly distinct from the Sicilian one on account of the stouter valvae (Rungs states the left one to be longer, but probably the plate in his work is reversed of 180°, as also the specimen illustrated of *C. ligula gemella* shows a longer left valva), wider and stouter clasper, longer and thinner superior plate of juxta, less blunt basal bulbous cornutus and scarcer bundle of median cornuti.

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References

Austaut, J.-L. 1880. Lépidoptères nouveaux d'Algérie. – Le Naturaliste **2**: 220–221.

Bang-Haas, A. 1907. Neue oder wenig bekannte palaearctische Macrolepidopteren. – Deutsche entomologische Zeitschrift Iris **20**: 69–88, pl. 3.

Berio, E. 1983. Riabilitazione di *Conistra intricata* (Bdv.) e suoi rapporti morfologici e sistematici con *C. veronicae* (Hbn.). – Annali del Museo Civico di Storia Naturale di Genova **84**: 349–372.

Berio, E. 1985. Lepidoptera Noctuidae 1. Generalità Hadeninae Cuculliinae. – Fauna d'Italia, 22. Calderini, Bologna, XXIII + 970 pp., 32 pls.

Bretherton, R.F., B. Goater & R.I. Lorimer 1983. Noctuidae: Cuculliinae to Hypeninae. – *In*: Heath, J. & A. M. Emmet, The moths and butterflies of Great Britain and Ireland 10: 36–413. – Harley Books, Colchester.

Calle, J.A. 1983. Noctuidos Españoles. – Ministerio de Agricultura, Pesca y Alimentación, Madrid, 430 pp.

Chen, Y. 1999. Fauna sinica, Insecta 16. Lepidoptera Noctuidae.– Science Press, Beijing, lxxiii + 1596 pp., 68 pls.

Fibiger, M. 1997. New noctuid moths from Cyprus with winter appearance (Lepidoptera, Noctuidae). – Entomologiske Meddelelser **65**: 17–27.

Fowler, J. & L. Cohen 1993. Statistica per ornitologi e naturalisti. – F. Muzzio editore, Padova, 240 pp.

Gómez de Aizpúrua, C. 1988. Biologia y morfologia de las orugas, Noctuidae, 4. – Boletin de Sanidad vegetal (f.s.) **10**: 1–248.

Grassi, A. & A. Zilli 2005a. New data on the distribution and ecology of some italian species of *Eilema* and reappraisal of *Eilema marcida* new rank (Insecta, Lepidoptera: Arctiidae). – Aldrovandia **1**: 5–15.

Grassi, A. & A. Zilli 2005b. Is the doublet *Conistra vaccinii-C. ligula* (Noctuidae) a quartet? – XIV European Congress of Lepidopterology (abstracts volume): 48.

Gueneé, A. 1852. Histoire naturelle des Insectes, Species général des Lépidoptères 5. Noctuélites 1. – Roret, Paris, xcvi + 407 pp.

Hacker, H. 1990. Die Noctuidae Vorderasiens (Lepidoptera). – Neue entomologische Nachrichten **27**: 1–707, pls. 1–16.

Hacker, H., L. Ronkay & M. Hreblay 2002. Noctuidae Europaeae **4**. Hadeninae 1 – Entomological Press, Sorø, 419 pp.

Hampson, G. F. 1906. Catalogue of the Lepidoptera Phalaenae in the British Museum, **6**. – Trustees of the British Museum, London, xiv + 532 pp.

Hreblay, M. 1992. Neue Taxa und Synonyme der Gattung *Conistra* Hübner, [1821]. – Esperiana **3**: 531–544, pl. S.

Hreblay, M. & L. Ronkay 1998. Noctuidae from Nepal. – *In*: T. Haruta, Moths of Nepal 5, Tinea **15** (Suppl. 1): 117–310, pls. 144–157.

ICZN, 1999. International code of zoological nomenclature. – 4th edn. The International Trust for Zoological Nomenclature, London, xxix + 306 pp.

Kishida, Y. & H. Yoshimoto 1979. Description of a new species of the genus *Conistra* Hübner from Formosa (Lepidoptera: Noctuidae). – Tyo to Ga **30**: 73–75.

Koch, M. 1958. Wir bestimmen Schmetterlinge **3**. – Neumann, Radebeul & Berlin, 291 pp., 24 pls.

Kononenko, V. S. 2003. Key to the Insects of Russian Far East **5**. Trichoptera and Lepidoptera, 4. – Dal'Nauka, Vladivostok, 688 pp.

Kononenko, V. S. 2005. Noctuidae Sibiricae **1**. – Entomological Press, Sorø, 243 pp.

Kostrowicki, A. S. 1956. Klucze do oznaczania owadów polski, **27**, Lepidoptera, 53a, Noctuidae, Cuculliinae. – Państwowe wydawnictwo naukowe, Warszawa.

Laever, E., de 1979. Considérations sur le genre *Conistra* Hb. et son sous-genre *Dasycampa* Gn. avec description d'une espèce nouvelle pour la science: *Conistra camastra* n. sp. d'Italie méridionale (Lepidoptera – Noctuidae). – Entomologica **15**: 145–157.

Lajonquière, Y., de 1939. Une espéce nouvelle de *Conistra* (*Orrhodia*) (Noctuidae) découverte en France. – Revue française de Lépidoptèrologie **9**: 224–225.

Lajonquière, Y., de & C. Boursin 1943. Sur une *Conistra* nouvelle de la faune atlanto-méditerranèenne. – Mémoires du Muséum National d'Histoire Naturelle (N.S.) **18** (4): 161–190, pls. 10–13.

Lucas, D. 1911. Lépidoptères nouveaux ou peu connus de France, d'Algérie et de Tunisie. – Annales de la Société entomologique de France **79**: 473–495, pl. 18.

Oberthür, C. 1918. Faune des Lépidoptères de Barbarie. Noctuidae. – Etudes de Lépidoptèrologie comparée **16**: 1–251, pls. 482–484, 490–498.

Pierce, F. N. 1909. The genitalia of the group Noctuidae of the Lepidoptera of the British Islands. An account on the morphology of the male clasping organs. – Duncan, Liverpool, xii + 88 pp., 32 pls.

Pierce, F. N. 1910. The genitalia of the group Noctuidae of the Lepidoptera of the British Islands. An account on the morphology of the female reproductory organs. – Duncan, Liverpool, 62 pp., 15 pls.

Poole, R. W. 1989. Noctuidae. – *In*: J. B. Heppner, Lepidopterorum catalogus (N.S.) **118**: 1–1314. – Brill, Flora & Fauna Publ., Leiden.

Rákosy, L. 1996. Die Noctuiden Rumäniens (Lepidoptera, Noctuidae). – Stapfia **46**: 1–648.

Ronkay, L. & G. Ronkay 1994. Noctuidae Europaeae **6**, Cucullinae 1. – Entomological Press, Sorø, 282 pp.

Ronkay, L., J. L. Yela & M. Hreblay 2001. Noctuidae Europaeae **5**, Hadeninae 2. – Entomological Press, Sorø, 452 pp.

Rothschild, W. 1920. Supplemental notes to Mr. Charles Oberthür's Faune des Lépidoptères de la Barbarie, with lists of the specimens in the Tring museum. – Novitates zoologicae **27**: 1–127, pls. 14–17.

Rungs, C. E. E. 1972. Lépidoptères nouveaux du Maroc et de la Mauritanie. – Bulletin du Muséum national d'Histoire naturelle (3) **60** (Zoologie 46): 669–698, pls. 1–3.

Rungs, C. E. E. 1981. Catalogue raisonné des lépidoptères du Maroc. Inventaire faunistique et observations écologiques, 2. – Travaux de l'institut scientifique, Rabat (Série Zoologie) **40**: 223–588.

Scossiroli, R. E. & D. L. Palenzona 1971. Manuale di Biometria. – Zanichelli, Bologna, 259 pp.

South, R. 1961. The moths of the British Isles 1. – 4h edn. F. Warne & Co., London & New York, 427 pp., 148 pls.

Staudinger, O. & H. Rebel 1901. Catalog der Lepidopteren des palaearctischen Faunengebietes, 1. Famil. Papilionidae–Hepialidae. – R. Friedländer & Sohn, Berlin, xxx + 411 pp.

Steiner, A. 1997. Nachfalter 4. – *In*: G. Ebert, Die Schmetterlinge Baden-Württembergs **6**: 1–622. – Ulmer, Stuttgart.

Sugi, S. 1959. Noctuidae. – *In*: H. Inoue et al., Iconographia insectorum japonicorum colore naturali edita **1**: 105–159, pls. 64–106. Hokuryukan, Tokyo.

Sugi, S. 1982. Noctuidae. – *In*: H. Inoue et al., Moths of Japan **1**: 669–913; **2**: 80–107, 138–146, 344, 405, pls. 164–223, 355–392. Kodansha, Tokyo.

Tutt, J. W. 1892. The British noctuae and their varieties **3**. – Warne & Son, London, xxiv + 140 pp.

Warren, W. 1909–1914. Eulenartige Nachtfalter. – *In*: Seitz, A., Die Gross-Schmetterlinge der Erde, 3. Abteilung. Die Gross-Schmetterlinge des Palaearktischen Faunengebietes. – Stuttgart, vii + 511 pp., 75 pls.

Yela, J. L., I. de Olano & J. M. Marcos 1988. El genero *Conistra* Hübner, [1821] (Lepidoptera, Noctuidae) en el pais vasco y alrededores, con especial atencion a la caracterizacion genital de sus especies. – Estudios Instituto Alavés de la Naturaleza **3**: 257–280.

Yela, J. L. 1992. Los Noctuidos (Lepidoptera) de la Alcarría (España central) y su relación con las principales formaciones vegetales de porte arbóreo. – Ministerio de Agricultura, Pesca y Alimentación, Madrid, 569 pp.

Zilli, A. 1995. Noctuidae. – *In*: V. Raineri & A. Zilli, Checklist delle specie della fauna italiana 91: 9–40. Calderini, Bologna.

Zilli, A. 1996. Colour polymorphism of *Callimorpha dominula* (Linnaeus, 1758) in Italy, and the problem of polytopic subspecies (Lepidoptera, Arctiidae, Callimorphinae). – Mitteilungen der Münchner entomologische Gesellschaft **86**: 79–98.

The validity of the family name Roeslerstammiidae Bruand (Lepidoptera)

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Abstract. Roeslerstammiidae Bruand, [1851], originally proposed as Röslertammidae, an incorrect original spelling, is a justified emendation and the valid family-group name based on the type genus *Roeslerstammia* Zeller, 1839. The recent rejection of Roeslerstammiidae by Heppner (2005) is refuted, and the priority over Amphitheridae Meyrick, 1913, is maintained.

Zusammenfassung. Roeslerstammiidae Bruand, [1851], ursprünglich in der ungültigen Schreibweise Röslertammidae veröffentlicht, ist eine berechtigte Emendation und ein gültiger Familienname basierend auf *Roeslerstammia* Zeller, 1839 als der Typusgattung. Der kürzlich erfolgten Ablehnung dieses Names durch Heppner (2005) wird widersprochen, und die Priorität über Amphitheridae Meyrick, 1913, wird beibehalten.

Key words. Family name; Nomenclature; Priority; Microlepidoptera

The Roeslerstammiidae are a small family of Microlepidoptera (Gracillarioidea) with only two European representatives in the genus *Roeslerstammia* Zeller, 1839 (Agassiz & Friese 1996; Karsholt 2004), but they are more diverse in the Old World tropics with about 60 species (Davis & Robinson 1998; Heppner 2005). After a long period of uncertain placement, Kyrki (1983) recognized that the genus *Roeslerstammia* and the tropical species placed in the Amphitheridae belong to the same family.
In a recent review of the family, Heppner (2005) is challenging the validity of the senior family name Roeslerstammiidae and is re-establishing the junior Amphitheridae as the valid name. We examine the reasons put forward by Heppner, and show that his rejection is based on a misinterpretation of the *Code* (International Commission on Zoological Nomenclature 1999).

Heppner provided two arguments against the validity of Roeslerstammiidae:
1) The original author based the name on a misspelled genus name;
2) The original type genus was misidentified, and is not the same as *Roeslerstammia* Zeller, 1839; Bruand did not specifically include nominal species that are *now* (2006) in *Roeslerstammia*.

Zeller (1839) described the genus *Roeslerstammia* (not *Röslerstammia* as cited by Heppner) to accommodate five species, viz.: A. 1. granitella, 2. assectella, 3. heleniella, 4. cariosella and B. 5 erxlebeniella [current names *Digitivalva granitella* (Treitschke, 1833), *Acrolepiopsis assectella* (Zeller, 1839), *Acrolepia autumnitella* Curtis, 1838, *D. reticulella* (Hübner, 1796) and *Roeslerstammia erxlebella* (Fabricius, 1787)].

This assemblage is now considered to belong to two families, the Acrolepiidae (first four species) in the Yponomeutoidea and the Roeslerstammiidae in the Gracillarioidea. In the first half of the 19th century the division of the Microlepidoptera into genera was in full swing, and many of the newly established genera contained still assemblages based on superficial similarity, which we would now no longer consider as natural. Zeller did not designate a type species; this was done almost a century later by Fletcher (1929), who selected the last species: *Roeslerstammia* (*Chrysitella*) *erxlebeniella* Zeller, 1839, a junior objective synonym and unjustified emendation of *Alucita erxlebella* Fabricius, 1787. According to Huemer (1997), the designation was invalid, because the type species did not belong to the nominotypical subgenus, but was described in the 'section' *Chrysitella* Zeller; Kyrki (1983) held the different opinion that the designation had been correct according to the *Code*. For various reasons, including problems with the identity of the type species, *Roeslerstammia* (*Chrysitella*) *erxlebeniella* Zeller, 1839, was again formally designated as the type species by the International Commission on Zoological Nomenclature (1998).

Bruand ([1851]) erected the family Röslertammidae [sic!] and included the genus *Röslertammia* [sic!]. Röslertammidae, without the second 's' is an incorrect subsequent spelling (ICZN art. 33.3), because there is no indication that Bruand had intentionally changed the name. Moreover, there would be no reason to do so, as the name is based on the 19th century lepidopterist 'Fischer von Röslerstamm'. Also the use of ö rather than oe is an incorrect subsequent spelling. [However, it should be noted that both spellings, Röslerstamm and Roeslerstamm are used by Fischer himself (Fischer von Röslerstamm 1834–[1843])]. Bruand included ten species, amongst them the first two also listed by Zeller, now belonging to Acrolepiidae. Other species included by him are now regarded as belonging to Agonoxenidae, Epermeniidae, Gelechiidae, Momphidae and Scythrididae respectively. Bruand did not include what we now regard as the type species (*R. erxlebella*), but neither did he explicitly exclude it. He did not list that species, simply because he had not found it in the French department 'Doubs', the subject of his paper.

The family-group name based on the genus *Roeslerstammia* was later used again by Herrich-Schäffer (1857) as Röslerstammina [again an incorrect subsequent spelling], who did not cite any species.

A few other authors used the family group name for subordinate taxa, and Handlirsch (1925) was the first to make the justified emendation to Roeslerstammiini when he used it as a tribe within Tineidae. An overlooked fact is that Moriuti (1982a; 1982c) raised Roeslerstammiidae to family status before Kyrki (1983) discussed its family status and synonymised it with the junior name Amphitheridae. All family group names are listed in the catalogue below.

Let us now look again at Heppner's (2005) reasoning: his first argument is about the use of a misspelled type genus. This is dealt with by the Code in article 32.5.3, which reads:

"A family-group name is an incorrect original spelling and must be corrected if it
32.5.3.1. has an incorrectly formed suffix [Art.29.2]
32.5.3.3. is formed from an incorrect subsequent spelling of a generic name [Art 35.4.1.]".

According to this article there is thus no problem, the incorrect original spelling Röslertammidae must be emended to Roeslerstammiidae, the corrected 'oe' and 'st' according to 32.5.3.3 and the ending 'iidae' according to 32.5.3.1. and 35.4.1: the ending 'idae' should be placed after the stem of *Roeslerstammia*, being 'Roeslerstammi'. This emendation was done by Handlirsch (1925).

The second argument refers to article 65.2, which deals with the misidentified or altered concept of the type genus for the family.

Bruand erected the family on the basis of a genus named by him '*Röslertammia*', which – as we have seen – is an incorrect subsequent spelling of *Roeslerstammia* Zeller. According to Heppner (2005), Bruand did not cite the type species *Roeslerstammia erxlebella* and thus is using a different concept. However, nowhere does the Code demand that the type species be cited when establishing a family name; only the type *genus* is relevant. That *Röslertammia* is the type genus follows from article 11.7.1.1 ['indicated by express reference to the generic name or by inference from its stem…]. According to article 65.1 'It is to be assumed, unless there is clear evidence to the contrary, that an author who establishes a nominal family-group taxon has correctly identified its type genus'. As shown above, Bruand's concept of the genus was not very different from that of Zeller; he merely included several additional species, whilst retaining those of the original species that were known to him. It would be too far-fetched to conclude that by not citing a type species that was to be designated more than 75 or even 150 years later, he misidentified the genus or altered its concept!

Moreover, article 65.2 only deals with situations where "stability or universality is threatened, or confusion is likely to be caused". The rest of the article requires that in all cases the Commission is asked for a ruling. Heppner (l.c.) has not shown that the stability is threatened nor has he taken steps to ask the Commission for a ruling.

In our view (and that of other lepidopterists whom we have canvassed) there is no threat to stability: two family names, Amphitheridae and Roeslerstammiidae were synonymised in 1983, a synonymy not questioned ever since. Both names had been used in relatively few publications before 1983, but Amphitheridae more often. Contrary to Heppner's view, the family-group name Roeslerstammiidae was used several times between Bruand (1851) and Kyrki (1983) (see below), even shortly before Kyrki's work, in 1982, together with Amphitheridae in the same book as two valid family names (Moriuti 1982a, 1982b, 1982c, 1982d). Since 1983 the name Roeslerstammiidae is in almost universal use; only Heppner maintains Amphitheridae in several papers (Heppner 1984). It is true that Moriuti also used Amphitheridae as well (Moriuti 1984, 1987), but from the treatment in *Moths of Japan* (1982, as cited above) we conclude

that he considered *Roeslerstammia* and *Amphithera* as belonging to two different families. Below we provide a catalogue of citations for this family, without the aim to be exhaustive.

A few other statements in Heppner's (2005) paper need to be corrected: the first paragraph on page 25 is somewhat confusing but, in short, Heppner is stating that Kyrki (1983) preferred the name Roeslerstammiidae because the genus *Roeslerstammia* is the oldest genus of the family. However, such argumentation is absent from Kyrki's paper; he simply followed priority of the family names. A next statement that the rule of priority does not apply to higher category names is essentially true, but only for ranks higher than Family-Group names, whereas Family-Group names are ruled by the *Code* and follow the Principle of Priority (articles 1.2; 23).

Finally Heppner (l.c.) lists the Neotropical genus *Dasycarea* Zeller, 1877, as Amphitheridae but of uncertain affinity, overlooking the fact that Becker (1999) had transferred it from Roeslerstammiidae to Acrolepiidae. As to the best of current knowledge the Roeslerstammiidae are absent from the New World, and only known from the Australian, Oriental and Palaearctic regions.

Our conclusion is that as long as the type genera of Amphitheridae and Roeslerstammiidae are considered to belong to the same family, the senior name Roeslerstammiidae is the valid one.

Our argumentation was checked and approved by the following specialists: D. Davis (Smithsonian Institution, Washington, USA), P. Huemer (Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria), K. Sattler (Natural History Museum, London, UK), J. van Tol (National Museum of Natural History Leiden, Netherlands, member ICZN). We also informed J. Heppner (Gainesville, USA), who after reading our argumentation maintains his interpretation of the invalidity of Roeslerstammiidae.

Catalogue of Roeslerstammiidae

Röslertammidae Bruand, [1851]: 43 [incorrect original spelling]
Type genus *Röslertammia*, an incorrect subsequent spelling of *Roeslerstammia* Zeller, 1839.

Röslerstammina Herrich-Schäffer, 1857: 58. [incorrect subsequent spelling]

Roeslerstammiini [justified emendation] [as tribe of Tineidae: Tineinae]; Handlirsch 1925: 878.

"Roeslerstammiinen" [as subfamily of Tineidae or family, not clear from text]; Börner 1939: 1410.

Roeslerstammiinae [as subfamily of Yponomeutidae]; Kloet & Hincks 1945: 134.

Roeslerstammiidae [as family]: Moriuti 1982a: 206; 1982c: 194; Kyrki 1983: 322; 1984: 80; Buszko & Baraniak 1985: 3; Schnack 1985: 51; Nye & Fletcher 1991: xxv; Common 1990: 186; Scoble 1992: 234; Robinson 1988: 120; Budashkin & Kostjuk 1993: 81; Huemer & Tarmann 1993: 29; Robinson et al. 1994: 41; Gaedike

et al. 1995: 15; Agassiz & Friese 1996: 46; Agassiz 1996: 110; Nielsen 1996: 44; Savenkov et al. 1996: 10; Leraut 1997: 92; Budashkin 1997: 431; Huemer 1997: 22; De Prins 1998: 36; International Commission on Zoological Nomenclature 1998: 244; Karsholt & Stadel Nielsen 1998: 23; Laštůvka 1998: 21; Gaedike & Heinicke 1999: 50; Davis & Robinson 1998: 109; Becker 1999: 150; Aarvik et al. 2000: [27]; Jürivete et al. 2000: 19; Huemer & Segerer 2001: 207; Holloway et al. 2001: 195; Kullberg et al. 2002: 59; Buszko & Nowacki 2000: 21; Rákosy et al. 2003: 32; Karsholt 2004 – internet.

Oeslerstammiidae [lapsus]; Svensson et al. 1987: 3–12.

Amphitheridae [as family]; Meyrick 1914: [64]; Diakonoff 1955: 71; Moriuti 1978: 1; 1982b: 226; 1982d: 199; Heppner 1984: 18; Moriuti 1984: 407; 1987: 87; Heppner & Inoue 1992: 65; Heppner 1998: 19; 2005: 24.

Amphiterinae [as subfamily of Tineidae]; Handlirsch 1925: 887.

There are many online citations for Roeslerstammiidae, only a few for Amphitheridae (checked January 2006), these are not listed here.

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References

Aarvik, L., K. Berggren & L. O. Hansen 2000. Catalogus Lepidopterorum Norvegiae. – Zoologisk Museum, Oslo. 192 pp.

Agassiz, D. J. L. 1996. Yponomeutidae. Pp. 39–114. – *In:* A. M. Emmet (ed.), The moths and butterflies of Great Britain and Ireland, 3. Yponomeutidae – Elachistidae. **3**. – Harley Books, Colchester.

Agassiz, D. J. L. & G. Friese 1996. Roeslerstammiidae. Pp. 46, 303. – *In:* O. Karsholt & J. Razowski (eds.), The Lepidoptera of Europe. A distributional checklist. – Apollo Books, Stenstrup.

Becker, V. O. 1999. Family reassignments and synonymy of some taxa of Neotropical Microlepidoptera. – Revista Brasileira de Zoologia **16** (Suppl 2): 141–170.

Börner, C. 1939. Die Grundlagen meines Lepidopterensystems. 7th International Congress of Entomology. – Berlin. **2**: 1372–1424.

Bruand, T. [1851]. Catalogue systématique et synonymique des Lépidoptères du Département du Doubs. [6]Tinéides. – Mémoires de la Société d'Emulation du Doubs **3**: 58–92.

Budashkin, Y. I. 1997. 17. Sem. Roeslerstammiidae – Reslershtammidy. Pp. 431–432. – *In:* V.S. Kononenko (ed.), Ruchejniki i Cheshuekrylye 1 (Trichoptera and Lepidoptera part 1). Opredelitel' nasekomykh Dal'nego Vostoka Rossii. Key to the insects of Russian Far East **5**. – Dal'nauka, Vladivostok.

Budashkin, Y. & I. Kostjuk 1993. A new moth species of the genus *Roeslerstammia* (Lepidoptera, Roeslerstammidae [Roeslerstammiidae]) from s.-e. Transbaikalia. – Vestnik Zoologii **4**: 81–83.

Buszko, J. & E. Baraniak 1985. [Roeslerstammiidae, Acrolepiidae, Orthotaeliidae.]. – Klucze do Oznaczania Owadow Polski **27** (17–18 (no 134)): 1–31.

Buszko, J. & J. Nowacki 2000. The Lepidoptera of Poland. A distributional checklist. – Polish Entomological Monographs **1**: 1–178.

Common, I. F. B. 1990. Moths of Australia. – E. J. Brill, Leiden, New York etc. 535 pp.

Davis, D. R. & G. Robinson 1998. The Tineoidea and Gracillarioidea. Pp. 91–117. – *In:* N. P. Kristensen (ed.) Lepidoptera, Moths and Butterflies, 1. Evolution, systematics and biogeography. Handbuch der Zoologie/ Handbook of Zoology **4 (35)**. – De Gruyter, Berlin, New York.

De Prins, W. 1998. Catalogue of the Lepidoptera of Belgium. – Studiedocumenten van het K.B.I.N. **92**: 1–236.

Diakonoff, A. 1955. Microlepidoptera of New Guinea. Results of the Third Archbold Expedition (American-Netherlands Indian Expedition 1938–1939). Part V. – Verhandelingen der Koninklijke Nederlandsche Akademie van Wetenschappen, Amsterdam, Afdeling Natuurkunde (2e reeks) **50** (3): 1–212.

Fischer von Röslerstamm, J. E. 1834–[1843]. Abbildungen zur Berichtigung und Ergänzung der Schmetterlingskunde, besonders der Microlepidopterologie als Supplement zu Treitschke's und Hübner's europaeischen Schmetterlingen, mit erläuterndem Text. – Leipzig. 304 pp., 100 colour plates.

Fletcher, T. B. 1929. A list of the generic names used for Microlepidoptera. – Memoirs of the Department of Agriculture in India, Entomological Series **11**: i–ix, 1–244.

Gaedike, R., P. Hättenschwiller, P. Triberti & S. Zangheri 1995. Lepidoptera Tineoidea I. – Checklist delle Specie della Fauna Italiana **81**: 1–21.

Gaedike, R. & W. Heinicke 1999. Verzeichnis der Schmetterlinge Deutschlands (Entomofauna Germanica 3). – Entomologische Nachrichten und Berichte **Beiheft 5**: 1–216.

Handlirsch, A. 1925. Geschichte, Literatur, Technik, Paläontologie, Phylogenie, Systematik. – Handbuch der Entomologie, 3. Fischer, Jena. viii, 1202 pp.

Heppner, J. B. 1984. Amphitheridae. Pp. 25. – *In:* J. B. Heppner (ed.) Atlas of Neotropical Lepidoptera, Checklist 1: Micropterigoidea-Immoidea. Atlas of Neotropical Lepidoptera **1**. – W. Junk, The Hague etc.

Heppner, J. B. 1998. Classification of Lepidoptera. Part 1. Introduction. – Holarctic Lepidoptera **5** (Supple ment 1): i–iv, 1–148.

Heppner, J. B. 2005. Review of the family Amphitheridae (Lepidoptera: Tineoidea). – Tinea **18** (Suppl. 3): 24–40.

Heppner, J. B. & H. Inoue 1992. Lepidoptera of Taiwan. Volume 1. Part 2: checklist. – Scientific Publishers Inc. Gainesville, Florida. xlix + 276 pp.

Herrich-Schäffer, G. A. W. 1857. Kritischer Anzeiger des zoologischmineralogischen Vereines in Regensburg. – Korrespondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg **11** (3–5): 33–72.

Holloway, J. D., G. Kibby & D. Peggie 2001. The families of Malesian moths and butterflies. – Fauna Malesiana Handbooks, 3. Brill, Leiden. xi + 455 pp.

Huemer, P. 1997. Case 2963. *Roeslerstammia* Zeller, 1839 and *Acrolepiopsis* Gaedike, 1970 (Insecta, Lepidoptera): proposed conservation by the designation of *Alucita erxlebella* Fabricius, 1787 as the type species of *Roeslerstammia*; and *A. erxlebella* and *Tinea imella* Hubner, (1813) (currently *Roeslerstammia erxlebella* and *Monopis imella*): proposed conservation of the specific names by the designation of a neotype for *A. erxlebella*. – Bulletin of Zoological Nomenclature **54** (1): 22–25.

Huemer, P. & G. Tarmann 1993. Die Schmetterlinge Österreichs (Lepidoptera). – Beilageband zu den Veröffentlichungen des Museum Ferdinandeum, 73. Tiroler Landesmuseum Ferdinandeum, Innsbruck. 224 pp.

Huemer, P. & A. H. Segerer 2001. Polyphaenismus bei "Kleinschmetterlingen" am Beispiel von *Roeslerstammia erxlebella* (Fabricius, 1787) und *R. pronubella* ((Denis & Schiffermueller), 1775) (Lepidoptera: Roeslerstammiidae). – Entomologische Zeitschrift **111** (7): 207–211.

International Commission on Zoological Nomenclature 1998. *Roeslerstammia* Zeller, 1839 and *Acrolepiopsis* Gaedike, 1970 (Insecta, Lepidoptera): conserved by the designation of *Alucita erxlebella* Fabricius, 1787 as the type species of *Roeslerstammia*; and *A. erxlebella* and *Tinea imella* Hubner, (1813) (currently *Roeslerstammia erxlebella* and *Monopis imella*): specific names conserved by the designation of a neotype for *A. erxlebella*. – Bulletin of Zoological Nomenclature **55** (4): 244–245.

International Commission on Zoological Nomenclature 1999. International Code of Zoological Nomenclature. Fourth edition. – The International Trust for Zoological Nomenclature, London. xxix + 306 pp.

Jürivete, U., J. Kaitila, T. Kesküla, K. Nupponen, J. Viidalepp & E. Õunap 2000. Estonian Lepidoptera, catalogue. – Estonian Lepidopterists' Society, Tallinn. 150 pp.

Karsholt, O. 2004. Fauna Europaea: Acanthopteroctetidae, Axiidae, Castniidae, Cossidae, Drepanidae, Eriocottidae, Eriocraniidae, Gelechiidae, Heterogynidae, Limacodidae, Lypusidae, Micropterigidae, Roeslerstammiidae, Somabrachyidae, Uraniidae. – *In*: O. Karsholt & E. J. van Nieukerken (eds.) 2004. Lepidoptera, Moths. Fauna Europaea version 1.1. Fauna Europaea, Copenhagen, Amsterdam, Paris. – http://www.faunaeur.org/. [Accessed 11.i.2006]

Karsholt, O. & P. Stadel Nielsen 1998. Revideret katalog over de danske Sommerfugle. – Entomologisk Forening & Lepidopterologisk Forening, København. 144 pp.

Kloet, G. S. & W. D. Hincks 1945. A check list of British insects. – Kloet & Hincks, Stockport. 483 pp.

Kullberg, J., A. Albrecht, L. Kaila & V. Varis 2002. Checklist of Finnish Lepidoptera. Suomen perhosten luettelo. – Sahlbergia **6** (2): 45–190.

Kyrki, J. 1983. *Roeslerstammia* Zeller assigned to Amphitheridae, with notes on the nomenclature and systematics of the family (Lepidoptera). – Entomologica Scandinavica **14** (3): 321–329.

Kyrki, J. 1984. The Yponomeutoidea: a reassessment of the superfamily and its suprageneric groups (Lepidoptera). – Entomologica Scandinavica **15** (1): 71–84.

Laštůvka, Z. (ed.) 1998. Checklist of Lepidoptera of the Czech and Slovak Republics. – Konvoj, Brno. 117 pp.

Leraut, P. 1997. Liste systématique et synonymique des Lépidoptères de France, Belgique et Corse (deuxième édition). – Supplément à Alexanor, Paris. 526 pp.

Meyrick, E. 1914. Hyponomeutidae, Plutellidae, Amphitheridae. – Lepidopterorum catalogus **19**: 1–[64].

Moriuti, S. 1978. Amphitheridae (Lepidoptera): four new species from Asia, *Telethera blepharacma* Meyrick new to Japan and Formosa and *Sphenograptis* Meyrick transferred to the family. – Bulletin of the University of Osaka Prefecture Series B Agriculture and Biology. **30**: 1–17.

Moriuti, S. 1982a. Roeslerstammiidae. Pp. 206. – *In:* H. Inoue, S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe (eds.), Moths of Japan 1. Text. **1**. - Kodansha, Tokyo.

Moriuti, S. 1982b. Amphitheridae. Pp. 226–227. – *In:* H. Inoue, S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe (eds.), Moths of Japan 1. Text. **1**. - Kodansha, Tokyo.

Moriuti, S. 1982c. Roeslerstammiidae. Pp. 194, plates 8, 237, 249. – *In:* H. Inoue, S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe (eds.), Moths of Japan 2. Plates and synonymic catalogue. **2**. – Kodansha, Tokyo.

Moriuti, S. 1982d. Amphitheridae. Pp. 199, plates 9, 235, 238, 244. – *In:* H. Inoue, S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe (eds.), Moths of Japan 2. Plates and synonymic catalogue. **2**. – Kodansha, Tokyo.

Moriuti, S. 1984. A new *Agriothera* (Lipidoptera [Lepidoptera], Amphitheridae) from Thailand. – Kontyû **52** (3): 407–410.

Moriuti, S. 1987. Amphitheridae (Lepidoptera) of Thailand. – Microlepidoptera of Thailand **1**: 87–95.

Nielsen, E. S. 1996. Roeslerstammiidae. Pp. 44. – *In:* E. S. Nielsen, E. D. Edwards & T. V. Rangsi (eds.), Checklist of the Lepidoptera of Australia. Monographs on Australian Lepidoptera **4**. – CSIRO, Canberra.

Nye, I. W. B. & D. S. Fletcher (eds.) 1991. Microlepidoptera. The generic names of the moths of the world **6**. – British Museum (Natural History), London. xxix + 368 pp.

Rákosy, L., M. Goia & Z. Kovács 2003. Catalogul Lepidopterelor României. Verzeichnis der Schmetterlinge Rumäniens. – Societatea Lepidopterologica Romana, Cluj-Napoca. 446 pp.

Robinson, G. S. 1988. A phylogeny for the Tineoidea (lepidoptera). – Entomologica Scandinavica **19**: 117–129.

Robinson, G. S., K. R. Tuck & M. Shaffer 1994. A field guide to the smaller moths of South-East Asia. – Malaysian Nature Society, Kuala Lumpur. 308 pp.

Savenkov, N., I. Šulcs, S. Kerppola & L. Huldén 1996. Checklist of Latvian Lepidoptera. – Baptria **21** (3a): 1–71.

Schnack, K. 1985. Roeslerstammidae. – In: K. Schnack (ed.), Katalog over de danske Sommerfugle. – Entomologiske Meddelelser **52** (2–3): 51.

Scoble, M. J. 1992. The Lepidoptera: form, function and diversity. – Oxford University Press, New York. xi, 404 pp.

Svensson, I., H. Elmquist, B. Gustafsson, H. Hellberg, L. Imby & G. Palmqvist 1987. Catalogus Lepidopterorum Sueciae. – Kodlista, L1. Naturhistoriska Riksmuseet, Stockholm. 11 + 1 + 9 + 96 + 28 + 3 + 27 + 6 pp.

Zeller, P. C. 1839. Versuch einer naturgemässen Eintheilung der Schaben. – Isis von Oken **1839** (3): 167–220.

Notes on *Cochylimorpha* Razowski, 1959 with description of one new species from Tibet (Tortricidae)

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Abstract. A review of the Chinese species of *Cochylimorpha* Razowski, 1959 is given. *Cochylimorpha yangtseana* sp.n. is described, notes on three more species are given, and an annotated list of 20 species known from China is provided. *C. conankinensis* (Ge, 1992), comb.n., *C. cuspidata* (Ge, 1992), comb.n., and *C. gracilens* (Ge, 1992), comb.n. are transferred to *Cochylimorpha*.

Key words. *Cochylimorpha*, China, list of species, *C. yangtseana* sp.n.

Introduction

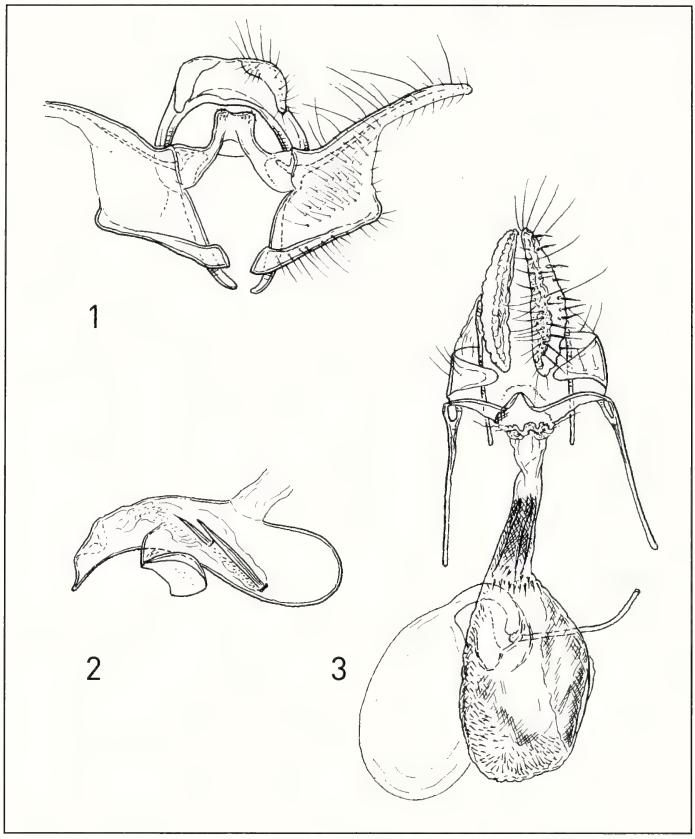
The available data on Palaearctic *Cochylimorpha* Razowski, 1959 were summarized by Razowski (1970, 1991) and those pertaining to the Chinese fauna by Liu & Li (2002), who compiled a list of 15 species. Three species were described by Ge (1992). In the two Chinese publications the data are mentioned under *Stenodes* Guenée, 1845, which, however, is preoccupied by *Stenodes* Dujardin, 1844 (Nye & Fletcher 1991).
The present paper is based on material from the Grigore Antipa Museum Bucharest (MINGA), already examined in the sixties by the author. The species are arranged after Razowski (1991). In the following list recording the 20 species of *Cochylimorpha* known from China I give the general distribution based on my former data (Razowski 1970), and those of Liu & Li (2002). The general and Chinese distributions are mentioned from W to E and from N to S.

1. Taxonomy

Cochylimorpha yangtseana sp. n.

Material. Holotype: ♂, Batang (Tibet) Im Tal des Yangtse, ca. 2800 m, 7.vi.1936, H. Hoene, GS 7733, MINGA. Paratype ♀, same data as holotype, but 8.vi.1936, MINGA.

Description. Wing span 18.0 mm. Head, thorax and ground colour of forewing white; base of tegula brownish; labial palpus ca twice longer than diameter of eye, darker; markings similar to those od *C. hedemanniana*, yellow-brown, more distinctly browner at costa and dorsum; cilia pale brown. Hindwing pale brownish grey; cilia paler.
Male genitalia (Figs. 1, 2). Socii slender, broadened basally; valva broad til middle, very slender distally; sacculus rather straight ventrally with distinct caudal angle; phallus broad, somewhat bent beyond zone; vesica with two cornuti with small capituli, one twice longer than the other.



Figs. 1–3. Genitalia of *Cochylimorpha yangtseana* sp.n. **1, 2.** Male, holotype. **3.** Female, paratype.

Female genitalia (Fig. 3). Papilla analis large, broadest near middle, hairy and spiny; distal arms od sterigma slender; anterior part of ostium in a membranous collar; colliculum without sclerite; ductus bursae with slender longitudinal sclerites; rather weak sclerites and spiny areas in corpus bursae; accessory bursae and ductus seminalis in postmedian area of corpus dorsally.

Diagnosis. The male genitalia are similar to those of *C. hedemanniana* (Snellen, 1883) but easily distinguished by the very slender distal part of the valva; the female is similar to the East Asian *C. discolorana* (Kennel, 1899) but with larger areas of sclerites and numerous minute spines in the corpus bursae.

2. New records

***Cochylimorpha asiana* (Kennel, 1899).** One specimen representing a new provincial record is from Mien-shan, Shanxi (collected on 1.viii.1937 at an altitude of ca 2000 m by H. Hoene). It is characterized by a distinctly elongate median part of the transtilla.

***Cochylimorpha conankinensis* (Ge, 1992: 303) (*Stenodes*) comb.n.** This species is most probably conspecific with *C. isocornutana* (Razowski, 1970) from Likiang, North Yunnan and it was omitted from Liu & Li (2002). The drawings of the original

description and those of Liu & Li are rather superficial, thus making an exact comparison difficult.

***Cochylimorpha hedemanniana* (Snellen, 1883).** Five specimens from A-tun-tse, North Yunnan collected at the altitude of ca 3000 m between 22.v. and 20.vi.1937 by H. Hoene. This is a new provincial record.

***Cochylimorpha pallens* (Kuznetzov, 1966).** One specimen from Mien-shan, Shanxi, 30.vi.1937 collected by H. Hoene represents a new provincial record. This species was already recorded from Tapaishan in Tsinling, S Shaanxi. The Chinese examples were collected at the altitudes of 1700–2000 m. It was described from the Russian Far East, in the vicinity of Vladivostok. It is known also from Sutchansk in the Ussuri territory.

3. Annotated checklist of Chinese species of *Cochylimorpha*

***C. jaculana* (Snellen, 1883).** East Asia from Mongolia to Ussuri territory and Primorsk, Korea, Japan; China: Manchuria, Yunnan,Heilongjiang, Jilin, Inner Mongolia, Shaanxi, Shandong, Anhui, Yunnan.

***C. asiana* (Kennel, 1899).** Distributed from E Ukraine, Kazakhstan, Iran, Afghanistan to C Asia and Mongolia, known also from Libya. China: Prov. Shanxi, Beijing, Hailongjiang, Hebei, Shaanxi, Shandong, Gansu, Quingai.

***C. cultana* (Lederer, 1855).** Known fwom W Europe to Ural Mts, NW Africa, Turkmenia, Altai. China: Shanxi, Jilin, Shandong, Shanxi, Shaanxi, Quinhai.

***C. gracilens* (Ge, 1992), comb. n.** China: Tibet (Xizang).

***C. nankinensis* (Razowski, 1964).** China: Chekiang, Kiangsu; Jiangsu, Shaanxi, Zhejiang, Shaanxi.

***C. nomadana* (Erschoff, 1874).** China: Xinjiang.

***C. perturbatana* (Kennel, 1900).** E Ural Mts to Thian Shan, Djarkent; China: Xinjiang.

***C. pallens* (Kuznetzov, 1966).** East Asia: Russia: Ussuri Territory, Primorsk; China: Shanxi, Beijing, Shaanxi.

***C. maleropa* (Meyrick, 1937).** China: North Yunnan.

***C. isocornutana* (Razowski, 1964).** China: North Yunnan.

***C. conankinensis* (Ge, 1992), comb.n.** China: Sichuan.

***C. hedemanniana* (Snellen, 1883).** East Asia: Minussinsk to Primorsk; China: Kiangsu, Shanxi, Yunnan, Beijing, Heilongjiang, Shanxi, Shaanxi, Jiangsu, Anhui, Yunnan.

***C. nipponana* (Razowski, 1977).** Japan: Shikoku; China: Heilongjiang, Shaanxi.

***C. yangsteana* Razowski, sp. n.** China: Tibet.

***C. amabilis* (Meyrick, 1931).** China: Kwanhsien.

***C. cuspidata* (Ge, 1992), comb. n.** China: Beijing, Shaanxi.

***C. alticolana* (Razowski, 1964).** China: Tibet.

***C. lungtangensis* (Razowski, 1964).** China: Kiangsu, Jiangsu, Zhejiang, Shaanxi.

***C. fuscimacula* (Falkovitsh, 1963).** SE Europe, Kazakhstan, Turkmenia; China: Shaanxi.

***C. emiliana* (Kennel, 1919).** Central Asia from Schawyr to Mongolia; China: Heilongjiang.

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References

Ge, X. 1992. Study on the Chinese *Stenodes* Guenée (Lepidoptera: Cochylidae) with description of new species. – Sinozoologia **9**: 299–306.

Liu, Y. & G. Li 2002. Tortricidae – *In*: Fauna Sinica, Insecta vol. 27, Lepidoptera. – Science Press, Beijing. 463 pp., pls. i–cxxxvi, + 2 colour pls.

Nye, I. W. B. & D. S. Fletcher 1991. The generic names of moths of the world, vol. **6**: Microlepidoptera. – British Museum (Natural History), London. Pp. i–xxx, 1–368.

Razowski, J. 1970. Cochylidae. – *In*: Amsel, H. G., Gregor, F., Reisser, H. (eds), Microlepidoptera Palaearctica **3**. Fromme, Wien. iv + 528 pp., 161 pls.

Razowski, J. 1991. The catalogue of the species of Tortricidae (Lepidoptera). Part I: Palaearctic Chlidanotinae and Tortricinae: Cochylini, Tortricini, Ceracini, Cnephasiini. – Acta Zoologica Cracoviensia **34** (1): 99–162.

Where to find the eggs and how to manage the breeding sites of the Brown Hairstreak (*Thecla betulae* (Linnaeus, 1758)) in Central Europe?

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Abstract. We investigated the oviposition preferences of the Brown Hairstreak (*Thecla betulae* (Linnaeus, 1758)) by characterising egg-deposition sites in an urban park in Münster (North Rhine-Westphalia, Northwestern Germany) in January and February 2002. Based on these preferences, we suggest methods for population surveys and the management of breeding sites of *T. betulae*. Covering a total area of 409 m^2, we systematically searched all *Prunus spinosa* host plant individuals for *T. betulae* eggs and recorded various host plant traits to characterise oviposition patterns. About 80% of all 320 clutches (348 eggs) were laid on the fork and 17% on the bud. The vast majority of the clutches (299 or 94%) was deposited at 50 to 170 cm above ground (median = 110 cm). Young plants or young suckers were strongly preferred. Oviposition height preferences and host plant use in *T. betulae* throughout Europe can best be explained by temperature. Oviposition heights and the size of selected host plants both tend to increase in warmer climates. Presumably, the preference for young plants and young suckers could to be determined by avoidance of inter-specific competition or a better plant quality, but this requires further evaluation. A "success-oriented" survey method for *T. betulae* should focus on the conspicuous white eggs that are best found on young plants or young suckers at 50 to 170 cm above ground in winter. We suggest that rotational scrub cutting is an appropriate tool for managing *T. betulae* sites.

Zusammenfassung. Die Eiablagepräferenzen des Nierenfleck-Zipfelfalters (*Thecla betulae* (Linnaeus, 1758)) wurden im Januar und Februar 2002 in einem Stadtpark in Münster (Nordrhein-Westfalen, Nordwestdeutschland) untersucht. Auf Grundlage der Ergebnisse werden Vorschläge zur Erfassung von *T. betulae*-Populationen und zum Management der Lebensräume gemacht. Alle potenziell geeigneten *Prunus spinosa*-Wirtspflanzen wurden systematisch nach Eiern abgesucht und verschiedene typische Wirtspflanzenparameter ermittelt. Auf einer untersuchten Gebüschfläche von 409 m^2 wurden insge-samt 320 Gelege mit 348 Eiern gefunden. Etwa 80% der Gelege befand sich an Astgabeln und 17% an Knospen. Die überwiegende Zahl der Gelege (299 bzw. 94%) war in Höhen zwischen 50 und 170 cm angeheftet. Jungpflanzen und Stockausschläge wurden stark präferiert. Die Eiablagehöhen und die Wirtspflanzennutzung werden innerhalb Europas vor allem durch die Temperatur bestimmt. Je wärmer das Klima desto höher über dem Boden erfolgt die Eibablage und umso stärker werden hochwüchsige Wirtspflanzenarten genutzt. Die Präferenz für Jungpflanzen und Stockausschläge scheint auf Vermeidung interspezifischer Konkurrenz oder eine bessere Wirtspflanzenqualität zurückzuführen zu sein. Die Erfassung von *T. betulae* erfolgt am Besten im Winter durch die Suche nach den auffälligen weißen Eiern an Jungpflanzen oder Stockausschlägen in Höhen zwischen 50 und 170 cm. Ein Auf-den-Stock-setzen der Gebüsche in jährlich wechselnden Abschnitten scheint eine geeignete Maßnahme zum Management der *T. betulae*-Habitate zu sein.

Key words. Blackthorn, Germany, host plant quality, inter-specific competition, oviposition preference, *Prunus spinosa*, survey method, urban park, young sucker

Introduction

Habitat quality is one of the main factors explaining the distribution of butterflies (Dennis & Eales 1997; Thomas et al. 2001; Fleishman et al. 2002; Fred & Brommer 2003; Anthes et al. 2003; WallisDeVries 2004). Due to their low mobility and proportionally long life time (Fartmann 2004), the immature stages often have more specific habitat requirements and are more susceptible to inadequate habitat management than the

adults (Thomas 1991; Clarke et al. 1997; Thomas et al. 1998, 2001; Bourn & Thomas 2002; Fartmann 2004; Fartmann & Hermann, in press; García-Barros & Fartmann, submitted). Therefore the habitat requirements of preimaginal stages are often used to ascertain habitat quality.

Eggs or larvae are not only good indicators for habitat quality, they are also sometimes easier to detect than the adult stages and, conveniently, surveys are not weather dependent. In fact, Hermann (1999, in press) suggested that survey methods focusing on the immature rather than the adult stages are more adequate and more successful for approximately one quarter of the Central European species. This applies specifically to the hairstreaks, because their adults live mostly in the treetops and occur in low densities.

While extensive data on the distribution, status and ecology of the Brown Hairstreak (*Thecla betulae* (Linnaeus, 1758)) have been gathered for Britain (Thomas 1974, 1991; Thomas & Emmet 1989; Bourn & Warren 1998; Asher et al. 2001), the published knowledge of the species' ecology in continental Europe is still poor. Heddergott (1962) described a *Thecla betulae* outbreak in 1959 in Westphalia. A more detailed overview of the host plants and habitats in Southwest Germany was given by Ebert & Rennwald (1991). Koschuh et al. (2005) analysed the oviposition habitats in Southeast Austria and Stefanescu (2000) published data on the host plant species and the ant caterpillar associations in Northeast Spain.

We here supply information on the species' ecology in Central Europe. To do so, we will (i) describe the oviposition habitats, (ii) give hints for assessing the status and (iii) make recommendations for management.

Material and Methods

Study species. *Thecla betulae*, the Brown Hairstreak, has a wide distribution in the Nemoral zone of the Palaearctic (Thomas 1974). It reaches its distribution borders in southern England, Wales and Ireland to the west (Asher et al. 2001), in southern Scandinavia to the north and in the northern Mediterranean region to the south (Thomas 1974; Ebert & Rennwald 1991; Kudrna 2002).

The Brown Hairstreak is present in all German federal states, but the general distribution and the status are still poorly known. Recent egg surveys in the Saarland (Caspari pers. comm.) and the city of Münster (Leopold pers. comm.) revealed surprisingly wide distributions in regions that have previously been thought to be sparsely inhabited, suggesting that the species is more widespread than often assumed.

The flight period in Germany extends from early July to mid-October (Ebert & Rennwald 1991; Fartmann 2004). The eggs of *T. betulae* hibernate firmly attached to the bark of the host plants. Hatching of the larvae coincides with the leaf break of the host plant (Thomas 1974). The main host plant throughout Europe is *Prunus spinosa* (Blackthorn). First caterpillars usually appear in late April or early May (Heddergott 1962; Ebert & Rennwald 1991; own observation). All four larval instars consume only leaves. Adult *T. betulae* may predominantly feed on aphid honeydew secretion, but this

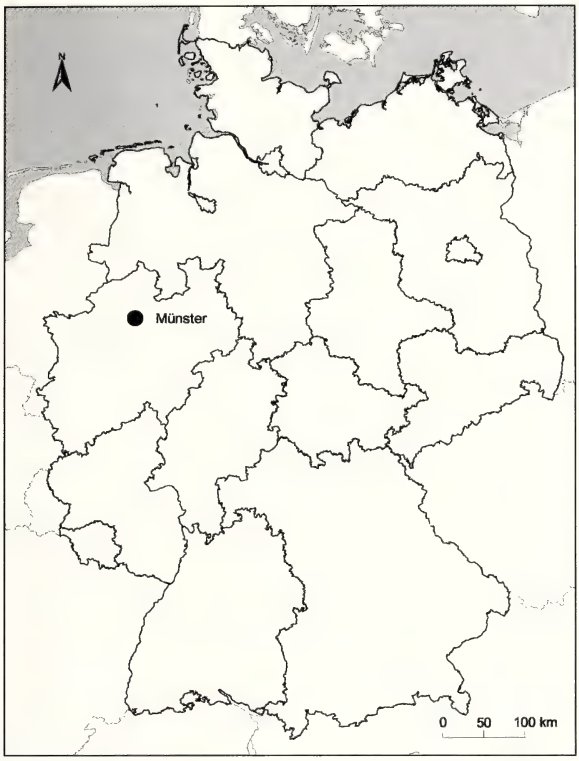

Fig. 1. Location of the study area in northwestern Germany.

is seldomly observed because of its inconspicuousness in the treetops (Thomas 1974). In addition, females regularly feed on plant nectar (Bourn & Warren 1998). The fecundity of females is linearly correlated with the longevity of the individual. The highest realised fecundity observed by Thomas (1974) was by a female that lived 39 days and laid 147 eggs.

T. betulae breeds over a wide array of habitats of the countryside, ranging from parks, gardens, hedges, woodland edges to other shrubby sites with *Prunus* species (Ebert & Rennwald 1991; Asher et al. 2001). The adults assemble at the beginning of the flight period on prominent "master" trees, mostly along wood edges in order to find mates (Thomas 1974; Asher et al. 2001).

Study area. The study area (hereafter called "Wienburg" park, 51°57'N/7°37'E) of about 26 ha is located in the northwest of the district of Münster, belonging to the northwestern part of the federal state of North Rhine-Westphalia (Northwest Germany) at an elevation of 55 m a.s.l. (Fig. 1). The climate is suboceanic (Müller-Wille 1981) with an annual precipitation of 757 mm and an average annual temperature of 9.2 °C (Deutscher Wetterdienst 2006). The Wienburg park was established in 1987 as a recreational area. It consists of a wet part with semi-natural ponds, swamp woods and abandoned wet grassland and a drier section with meadows, lawns, managed hedges, solitaire trees and groves. Before this, most parts of the study area were used as arable fields (Stadt Münster 1988, 2000). In the west and east the park is bordered by woodland.

Material and methods. The study area was selected because of its exceptionally high density of *T. betulae* eggs. In January and February 2002 all *Prunus spinosa* bushes and hedges of the study area were systematically checked for eggs. Two other *Prunus* species (*P. padus* and *P.* ×*fruticans*) occur in the study area, but they are rare and were not controlled. The survey was restricted to a section of 50 cm depth of the bushes and ranging from ground to 350 cm height. We searched for eggs until no more eggs were found on the plant, but individual *Prunus* plants were considered unoccupied if no egg was found within 10 min. To avoid duplicate counting, all eggs were marked with a strip. For each occupied Blackthorn we determined total height (cm), egg-laying height

above ground (cm) and the position of the clutch (bud, fork, stem, twig). The number of eggs was recorded for each clutch. For all surveyed bush groups – whether occupied or not – aspect (using a compass) and ground coverage (m^2) were determined.
Statistical analysis was performed using SPSS 8.0 statistical package. To establish habitat preferences, we compared host plant traits between occupied and unoccupied *Prunus* individuals using a chi-square test. Because this test does not allow empty categories, frequencies were conservatively set to 1 in those cases.

Results

We found a total of 320 clutches of *T. betulae* with 348 eggs in an area of 409 m^2. The mean density was 0.8 clutches and 0.9 eggs per m^2 *Prunus spinosa* bushes. Eggs were laid singly (92%), in pairs (7%) or rarely in small batches of 3 eggs (1%). Oviposition occurred preferably into the fork (80%), followed by buds (17%). Stem and twig played a minor role in egg deposition (Fig. 2).
Both, the distribution of host plant and egg-deposition height were more or less bell-shaped, but the peak of the host plant height shows a clear shift towards higher values. The vast majority of clutches (299 or 94%) was deposited in heights between 50 and 170 cm above ground (median = 110 cm, range 15 to 350 cm, Fig. 3). Almost all clutches (285 or 90%) were found on *P. spinosa* plants with a height between 80 and 260 cm. The median plant height was 180 cm.
Eggs were found in almost all aspects (Tab. 1), but the orientation of the available host plants and that of the host plants used for oviposition differed significantly

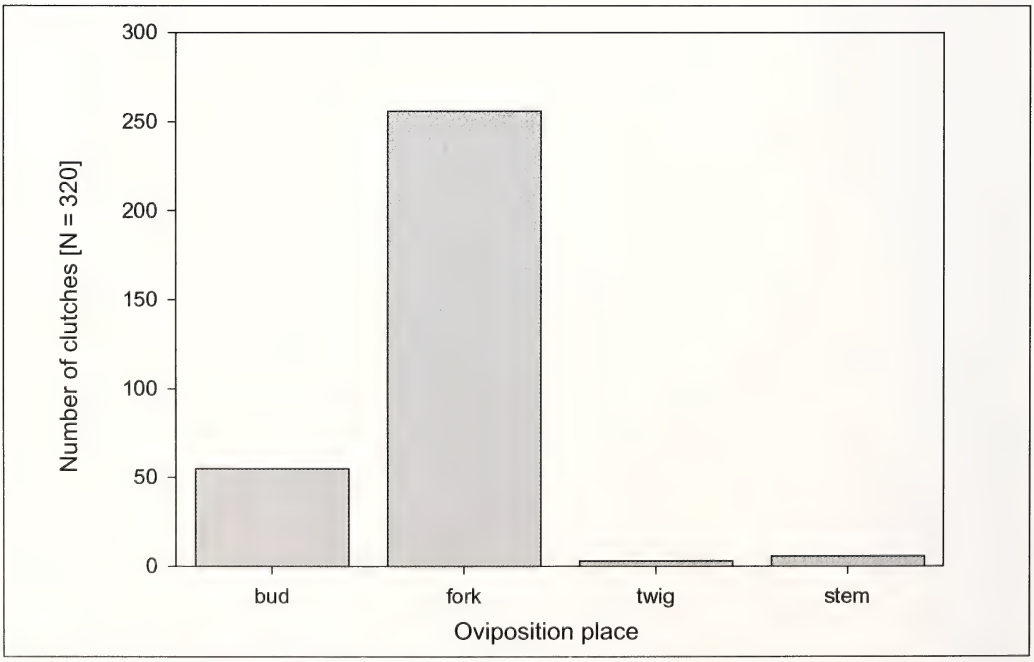

Fig. 2. Oviposition places of *Thecla betulae* on *Prunus spinosa*.

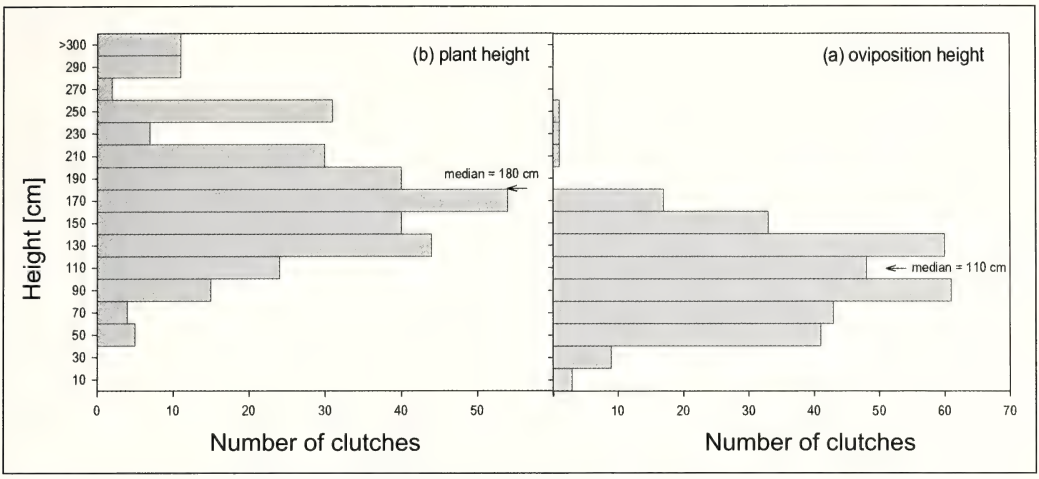

Fig. 3. Host plant and oviposition height of *Thecla betulae* (N = 318 clutches).

Tab. 1. Aspects of used and available host plants of *Thecla betulae*. χ^2 = 169.879, df = 16, P < 0.001. + = overrepresented (absolute difference in proportion > 5%), – = underrepresented (absolute difference in proportion > 5%), – – = strongly underrepresented (absolute difference in proportion > 10%).

aspect	used host plants		available host plants		
	no. of batches	proportion (%)	area (m²)	proportion (%)	
N	0	0.0	14.3	3.5	.
NNE	9	2.8	6.5	1.6	.
NE	5	1.6	6.3	1.5	.
ENE	0	0.0	7	1.7	.
E	24	7.5	34.3	8.4	.
ESE	16	5.0	13.5	3.3	.
SE	53	16.5	42	10.3	+
SSE	47	14.6	30.5	7.5	+
S	32	10.0	28.3	6.9	.
SSW	8	2.5	6	1.5	.
SW	13	4.1	17.1	4.2	.
WSW	34	10.6	44.5	10.9	
W	16	5.0	79.9	19.5	– –
WNW	5	1.6	28.8	7	–
NW	33	10.3	21	5.1	+
NNW	4	1.3	20.5	5	.
–	22	6.9	8.8	2.1	.
Total	321	100	409	100	

(χ^2 = 169.879, df = 16, $P < 0.001$). There is no clear trend/preference for the main aspects N, E, S and W, but bushes exposed to SE, SSE and NW were used disproportionally often for oviposition, while W and WNW aspects were underrepresented.
It was striking that searching for the first egg on young Blackthorn shoots seldom took longer than one or two minutes, while many hours of searching in old bushes produced only a few eggs. The proportion of young, not flowering bushes and suckers in the study area is below 20% of all *P. spinosa* individuals. But far more than 50% of all eggs were found on these plants.

Discussion

Oviposition preferences. The eggs of *Thecla betulae* were usually laid singly on forks of *Prunus spinosa* at a height of less than 170 cm above ground. Young plants or suckers were strongly favoured.
The overall clutch sizes and the positions of the eggs on the plant documented here corroborate the findings of previous studies (Thomas 1974; Henriksen & Kreutzer 1982; Bourn & Warren 1998; Asher et al. 2001; Koschuh et al. 2005). The few differences between studies concerning oviposition height, host plant use and sun exposition seem to be related to the variation in climate conditions across Europe. The warmer the climate the more different host plant species are used, the higher the clutches are laid and the more eggs are found on shadier sites: The main host plant in Scandinavia as well as in Britain is *P. spinosa* (Thomas 1974; Henriksen & Kreutzer 1982). In most Central European regions and in most of the years the major host plant is also *P. spinosa* (SBN 1987; Ebert & Rennwald 1991; Weidemann 1995; Hermann pers. comm.). However, other *Prunus* species like *P. avium*, *P. domestica*, *P. insititia* or *P. padus* are also mentioned as a host plant (Ebert & Rennwald 1991; Koschuh et al. 2005). Heddergott (1962) described the intensive use of *P. domestica* by *Thecla betulae* in dry summers in Westphalia, whereas the normal host plant in this region is *P. spinosa*. Koschuh et al. (2005) found *P. insititia* as the main host plant in Southeast Austria. Stefanescu (2000) also mentioned a wider range of *Prunus* host plant species from Northeast Spain.
In Scandinavia only the smallest bushes were used for egg-laying (Henriksen & Kreutzer 1982). In Britain most eggs were found below 200 cm above ground with a peak at around 50 cm (Thomas 1974). In the own study area in Northern Germany the median oviposition height was 110 cm. Koschuh et al. (2005) found a preferred oviposition height between 100 and 200 cm in Southeast Austria. Comparable shifts in oviposition habitats along climatic gradients throughout Europe are well known from other butterfly species; maybe one of the best studied examples is *Maculinea arion* (Thomas et al. 1998).
While references from Britain stated a preference for sun exposed egg-laying sites (Thomas 1974; Bourn & Warren 1998; Asher et al. 2001), Koschuh et al. (2005) described the oviposition habitats in Austria as sunny to half shady. The own data show no clear results because aspect features are superposed by other parameters like shoot

age. An overall impression is that host plants should not grow in particularly shady conditions. However, after very hot summers as 2003 or in generally warmer regions of Central Europe as Southwest Germany many or even the majority of the eggs are laid on shaded parts of the host plant (Caspari pers. comm.; Hermann pers. comm.).

The general preference for young plants, young projecting growth or young suckers is well documented by Thomas (1974). He showed that shoots younger than 6 years but older than 1 year are preferred for egg-laying. Most eggs were found on 4 years old shoots. Only *P. spinosa* plants older than 6 years are able to produce flowers. Epicormic growth can start flowering two years after coppicing (Hermann pers. comm.). The preference for young shoots in the study area would have been far more striking if the surface had also been taken into account. The bark surface area of an old bush may present the 100-fold of that of a young plant (Thomas 1974). In contrast to this Ebert & Rennwald (1991) state that most larvae and eggs were found on older specimen of *P. spinosa* and that this applies to Baden-Württemberg in general. According to our study and further own observations, females use old *P. spinosa* plants for oviposition if they have no other choice. However, if young suckers a few years after coppicing are present, females will clearly prefer these plant individuals. Egg densities on old shoots will usually never reach the values of the young shoots. Hermann (pers. comm.) also found a preference for young growth in Baden-Württemberg.

But why are young plants or young suckers preferred? Young plants are comparatively small and they do not flower. Older plants are tall growing, but they usually have also twigs near the ground and they are producing flowers. Microclimatic features could not explain the preference for young plants or suckers because the old *P. spinosa* bushes also provide many potential egg-laying places with leaf buds in the favoured layer near ground. Young plants could invest all their energy into leaf growth and development, whereas older plants need energy for flower production. Therefore, the total amount of leaves and the content of water and nutrients in the leaves can be different between these two groups. Enough food is essential for the survival of the larvae (Fartmann & Hermann, in press; García-Barros & Fartmann, submitted). However, food shortage due to intra-specific competition is unlikely a problem for *Thecla betulae*. Eggs are usually deposited singly, and in rather low densities per plant such that competition between caterpillars should hardly occur. In consequence, defoliation of a host plant individual has thus far only been documented once, in an extraordinarily warm year (Heddergott 1962).

More likely, inter-specific competition or food plant quality could act as the key for the understanding of the preference for young shoots. There are many *Prunus* feeding and egg-clustering moth species (e.g. *Yponomeuta* spp.), that are able to defoliate *Prunus* bushes during the larval period of *Thecla betulae*. Due to the high demand of food for their offspring they seem to live predominantly on older plants (Caspari pers. comm.). Therefore, egg-laying on young shoots by *Thecla betulae* could be interpreted as avoidance of interspecific competition.

In addition, another reason for the preference for young shoots could be the host plant quality. Butterflies that feed on nutrient-rich parts of a plant often have a faster larval

development and the survival rates of the butterflies are higher (see review by Fartmann & Hermann, in press). Both explanations require further evaluation.

Thomas (1974) found that almost all observations of *T. betulae* are from wood edges or hedges near woods. The egg density was significantly higher within a distance of 250 m from woods than further away. Fartmann (2004) showed in a study of 53 butterfly transects in calcareous grasslands in northern Germany, that *T. betulae* was more steady in sites adjacent to woods. Thomas (1974) explains this with the importance of prominent trees ('master trees') on wood edges for congregations of adults. Here they feed on honeydew and search for mates (Thomas 1974; Asher et al. 2001). In Britain, Ash trees (*Fraxinus excelsior*) are preferred probably because honeydew producing aphids are abundant on them (Asher et al. 2001).

Although the host plant is abundant, large areas of a *T. betulae* breeding site are often characterised by low egg densities, only certain areas have high egg numbers (Thomas 1974). Comparable density data from Europe are still missing, but based on our own field experience the Wienburg park is certainly a high-density area with a mean density of 0.8 clutches and 0.9 eggs per m^2 of *Prunus* bushes. Reasons could be the high abundance of the preferred young shoots due to the rotational cutting of the hedges and probably the adjacent woods with their feeding and congregation places for the adults.

How to survey *Thecla betulae*? Our knowledge on the status of *Thecla betulae* in most of its range is scarce because of the cryptic way of living of the butterflies and their low densities. The most effective method of surveying the species is searching for the conspicuous white eggs in winter (i.e. between November and February) (Thomas 1974; Bourn & Warren 1998; Hermann 1999). Therefore you need to know were to search. Based on our own results, searching will be most successful on young plants or young suckers in a height between 50 and 170 cm. Old and tall flowering bushes with lichens and algae are hardly suitable. Especially for presence/absence studies this searching scheme will be useful. For counting total egg number in a distinct area it could be helpful to mark every spotted egg. In our study the recording accuracy decreased with recording duration. After a lengthy time of extensive searching the concentration of the recorders usually fell. Continuing the survey the next day at the same place often revealed new and previously overlooked eggs. Therefore it would be good to stop searching when concentrating becomes difficult and to continue when recovered.

Management. In most German federal states, *Thecla betulae* is a species of low conservation concern (see summary of red list categories in Reinhardt & Settele 1999). Sometimes *T. betulae* and more specialised and more highly endangered species such as *Eriogaster catax*, *Iphiclides podalirius* or *Satyrium acaciae* share the same host plant. In these cases or where other conservation aims are more important, conservation efforts cannot focus on *T. betulae*. Nevertheless, *T. betulae* breeding sites without species of high conservation interest – like our study area and other urban parks – could be managed for the Brown Hairstreak. On the one hand, cutting and trimming of hedges is one of the most important mortality factors in *T. betulae*. On the other hand, optimal habitats are created by this management. Thomas (1974) ascertained egg losses between 50 and 100% due to cutting. Most eggs are deposited on the younger projecting growth

rather than deep within the hedge and therefore they are affected by cutting. To reduce the heavy egg losses and in return to assure the presence of many *Prunus* shoots in the preferred age (2–6 years), rotational scrub cutting is an appropriate tool (Thomas 1974). After Thomas (1974) a quarter of the breeding site should be trimmed every fourth year. Observations from Oates (in Bourn & Warren 1998) showed that *T. betulae* responded well to Blackthorn coppicing, favouring plants 3–5 years after the cut (Oates in Bourn & Warren 1998).

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References

Anthes, N., T. Fartmann, G. Hermann & G. Kaule 2003. Combining larval habitat quality and metapopulation structure – the key for successful management of pre-alpine *Euphydryas aurinia* colonies. – Journal of Insect Conservation **7**: 175–185.

Asher, J., M. Warren, R. Fox, P. Harding, G. Jeffcoate & S. Jeffcoate 2001. The millenium atlas of butterflies in Britain and Ireland. – Oxford University Press, Oxford. 430 pp.

Bourn, N. A. D. & J. A. Thomas 2002. The challenge of conserving grassland insects at the margins of their range in Europe. – Biological Conservation **104**: 285–292.

Bourn, N. & M. Warren 1998. Species action plan – Brown Hairstreak *Thecla betulae*. Butterfly Conservation, Dorset. 21 pp.

Clarke, R. T., J. A. Thomas, G. W. Elmes & M. E. Hochberg 1997. The effects of spatial patterns in habitat quality on community dynamics within a site. – Proceedings of the Royal Society of London B **264**: 347–354.

Dennis R. L. H. & H. T. Eales 1997. Patch occupancy in *Coenonympha tullia* (Müller, 1764) (Lepidoptera: Satyrinae): habitat quality matters as much as patch size and isolation. – Journal of Insect Conservation **1**: 167–176.

Deutscher Wetterdienst 2006. http://www.dwd.de/de/FundE/Klima/KLIS/daten/online/nat/index_mittelwerte.htm.

Ebert, G. & E. Rennwald 1991. Die Schmetterlinge Baden-Württembergs. Band 2: Tagfalter II. – Ulmer, Stuttgart. 535 pp.

Fartmann, T. 2004. Die Schmetterlingsgemeinschaften der Halbtrockenrasen-Komplexe des Diemeltales – Biozönologie von Tagfaltern und Widderchen in einer alten Hudelandschaft. – Abhhandlungen aus dem Westfälischen Museum für Naturkunde **66** (1): 1–256.

Fartmann, T. & G. Hermann (in press). Larvalökologie von Tagfaltern und Widderchen in Mitteleuropa – von den Anfängen bis heute. *In*: Fartmann, T. & G. Hermann (Hrsg.): Larvalökologie von Tagfaltern und Widderchen in Mitteleuropa. – Abhandlungen aus dem Westfälischen Museum für Naturkunde **68** (3/4).

Fleishman, E., C. Ray, P. Sjörgen-Gulve, C. L. Boggs & D. D. Murphy 2002. Assessing the roles of patch quality, area and isolation in predicting metapopulation dynamics. – Conservation Biology **16**: 706–716.

Fred, M. S. & J. E. Brommer 2003. Influence of habitat quality and patch size on occupancy and persistence in two populations of the Apollo butterfly (*Parnassius apollo*). – Journal of Insect Conservation **7**: 85–98.

García-Barros, E. & T. Fartmann (submitted). Oviposition sites. – *In*: J. Settele, T. G. Shreeve, M. Konvička & H. van Dyck (eds.), Ecology of Butterflies in Europe. – Cambridge University Press, Cambridge.

Heddergott, H. 1962. Zur Biologie von *Thecla betulae* L. (Lep., Lycaenidae). – Anzeiger für Schädlingskunde **35**: 152–154.

Henriksen, H. J. & I. Kreutzer 1982. The butterflies of Scandinavia in nature. – Skandinavisk Bogforlag, Odense. 215 pp.

Hermann, G. 1999. Methoden der qualitativen Erfassung von Tagfaltern. Pp. 124–143. – *In*: J. Settele, R. Feldmann & R. Reinhardt (eds.), Die Tagfalter Deutschlands. – Eugen Ulmer, Stuttgart.

Hermann, G. (in press): Präimaginalstadien-Suche als Nachweismethode für Tagfalter – Rahmenbedingungen, Chancen, Grenzen. *In*: Fartmann, T. & G. Hermann (Hrsg.): Larvalökologie von Tagfaltern und Widderchen in Mitteleuropa. – Abhandlungen aus dem Westfälischen Museum für Naturkunde **68** (3/4).

Koschuh, A., V. Savas & J. Gepp 2005. Winter-Eifunde von Zipfelfalterarten (Lepidoptera: Lycaenidae) in Graz und Umland (Steiermark, Österreich). – Naturschutz und Landschaftsplanung **37** (2): 46–53

Kudrna, O. 2002. The distribution atlas of European butterflies. – Oedippus **20**: 1–342.

Müller-Wille, W. 1981. Westfalen. Landschaftliche Ordnung und Bindung eines Landes. 2. Aufl. – Aschendorfsche Verlagsbuchhandlung, Münster.

Thomas, J. A. 1974. Factors influencing the numbers and distribution of the Brown Hairstreak, *Thecla betulae* L. (Lepidoptera, Lycaenidae) and the Black Hairstreak, *Strymonidia pruni* L. (Lepidoptera, Lycaenidae). – Thesis, University Leicester. 288 pp.

Thomas, J. A. 1991. Rare species conservation: butterfly case studies. Pp. 149–198. – *In*: Spellerberg, I. F., Goldsmith, F. B. & M. G. Morris eds. The scientific management of temperate communities for conservation. – Blackwell Scientific, Oxford.

Thomas, J. A. & A.M. Emmet 1989. *Thecla betulae* (Linnaeus), the Brown Hairstreak. Pp. 123–126. – *In*: A. M. Emmet & J. Heath (eds.), The moths and butterflies of Great Britain and Ireland (Hesperiidae to Nymphalidae). Volume 7, Part 1. – Colchester Harley Books.

Thomas, J. A., D. J. Simcox, J. C. Wardlaw, G. W. Elmes, M. E. Hochberg & R. T. Clarke 1998. Effects of latitude, altitude and climate on the habitat and conservation of the endangered butterfly *Maculinea arion* and its *Myrmica* ant hosts. – Journal of Insect Conservation **2**: 39–46.

Thomas J. A., N. A. D. Bourn, R. T. Clarke, K. E. Stewart, D. J. Simcox, G. S. Pearman, R. Curtis & B. Goodger 2001. The quality and isolation of habitat patches both determine where butterflies persist in fragmented landscapes. – Proceedings of the Royal Society of London B **268**: 1791–1796.

Reinhardt, R. & J. Settele 1999. Arteninventar, Verbreitung und Gefährdungseinstufung. Pp. 18–33. – *In*: J. Settele, R. Feldmann & R. Reinhardt (Hrsg.), Die Tagfalter Deutschlands. – Ulmer, Stuttgart.

Schweizerischer Bund für Naturschutz, Lepidopterologen-Arbeitsgruppe (SBN) (Hrsg.) 1987. Tagfalter und ihre Lebensräume. Arten, Gefährdung, Schutz. – Fotorotar AG, Egg/ZH.

Stadt Münster 1988. Information Stadtpark Wienburg. – Informationsheft des Amtes für Grünflächen und Naturschutz Münster.

Stadt Münster 2000. Natürlich draußen. Unterricht im Wienburgpark. – Informationsheft des Amtes für Grünflächen und Naturschutz Münster.

Stefanescu, C. 2000. New data on the ecology of *Thecla betulae* in the northeast of the Iberian Peninsula (Lycaenidae). – Nota Lepidopterologica **23** (1): 64 –70.

WallisDeVries, M. F. 2004. A quantitative conservation approach for the endangered butterfly *Maculinea alcon*. – Conservation Biology **18** (2): 489–499.

Weidemann, H. J. (1995, 2nd edn.): Tagfalter: beobachten, bestimmen. – Naturbuch-Verlag, Augsburg. 659 pp.

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