

*Plebeius sephirus* (FRIVALDSZKY, 1835)  
 in Pannonia,  
 with special reference to its  
 status and ecology in Hungary

by

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**Key Words:** *Plebeius sephirus*, (Lepidoptera: Rhopalocera, Butterflies; Lycaenidae); Distribution; Ecology; Hostplants; Myrmecophily; Conservation.

**Abstract:** *Plebeius sephirus* occurs in isolated populations throughout the Pannonian region. The species is restricted to relict patches of sandy steppe with large stands of its hostplant. Near Budapest, *P. sephirus* is monophagous on *Astragalus exscapus*. The life-cycle is univoltine, the caterpillars diapausing throughout the dry summer and cold winter. The larvae are myrmecophilous and live in symbiosis with several ant species, notably with *Lasius* species. Hungarian populations of *P. sephirus* are threatened by the increasing cultivation of, and human influence on, the remaining steppe relict habitats. To protect *P. sephirus* together with a diverse array of other steppe species of xeromontane origin, the conservation of all remnant steppe habitats is necessary. These westernmost enclaves of the xeromontane oreal biome deserve high priority for the conservation of biodiversity.

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## 1. INTRODUCTION

The geologically young Carpathian mountains were only partially glaciated during the last glacial period. The Carpathian range encircles a distinct lowland region, namely the Carpathian Basin. In this area we find, in small or large numbers, typical representatives of many different faunal elements comprising the fauna of the western Palaearctic region.

One of the most characteristic regions in the central Carpathian Basin is the humanly caused Hungarian steppe, the "puszta". The puszta was originally covered by forest steppe strongly influenced by several different biotic elements (VARGA 1989b). Its fauna and flora originated from Central Asia and the steppes of the Volga region. Today, such species communities are restricted to a few fragmented relict habitats. One of the most interesting characteristic species of these remaining forest steppe habitats is *Plebeius sephirus* (FRIVALDSZKY 1835).

The Hungarian Red Data Book lists *P. sephirus* as an endangered species (VARGA 1989a), similar to its closest western European relatives (*P. hespericus*: VIEDMA & GOMEZ BUSTILLO 1976; *P. trappi*: GONSETH 1987). Although *P. sephirus* was, in Hungary, known only from a single locality up to the eighties (BALINT 1985), numerous Hungarian specimens can be found even in small private collections. This contrasts sharply with the paucity of published records concerning the distribution and ecology of the species (BALINT 1992a).

*P. sephirus* is protected by law in Hungary and its larval food-plants, two *Astragalus* species threatened in Hungary, are listed as protected plants (CSAPODY 1982). Furthermore, the first discovered habitat of *P. sephirus* (Fót, Somlyóhegy) is a nature reserve since 1954, chiefly because of the occurrence of *P. sephirus* and the very rich lepidopterous fauna of the area (KOPASZ 1953; SZALKAY 1962). Between 1988-1990 the Hungarian Natural History Museum performed a program for the exploration of the Somlyóhegy near Fót. Adjacent areas were also surveyed for *P. sephirus*; preliminary results have been published (BALINT & KERTÉSZ 1990b).

In 1990 the senior author received a commission from the Hungarian Ornithologists' Society to survey the Lepidoptera in the vicinity of the villages Csomád and Göd near Budapest. These habitats represent relict areas of Pannonian phytocoenologic steppe associations with many animal and plant species relevant to conservation measures. In this area we have found several small and one large population of *P. sephirus*. Some of these newly discovered colonies of *P. sephirus* were studied using a mark-release-recapture method. As a result of the survey, recommendations for the conservation of *P. sephirus* and its habitats have been submitted to the authorities concerned (BALINT 1991a).

The relevant literature contains very few thorough conservation analyses of forest steppe species because this whole biome is almost totally absent from western Europe. Ecological studies of butterflies are relatively well advanced in western Europe, but almost non-existent in eastern Europe and Asia except Japan. The aim of the present paper is to make available the results of the aforementioned report, in a much revised form, to a wider public. Supplementary observations by the junior author concerning the

larval biology of *P. sephirus* are also given. This study is the first comprehensive report on the ecology of the lycaenids of the Carpathian Basin; similar studies concerning *Polyommatus admetus* (ESPER, 1785), *P. damon* (DENIS & SCHIFFERMÜLLER, 1775), *P. thersites* (CANTENER, 1834), and *P. dorylas* ([DENIS & SCHIFFERMÜLLER], 1775) are being carried out.

## 2. TAXONOMIC NOTES ON *PLEBEIUS SEPHIRUS* AND ITS RELATIVES

The "Zephyr Blue" was described by the Hungarian entomologist IMRE (Emericus) FRIVALDSZKY from the foothills of the Balkan mountains as *Lycaena sephirus* (FRIVALDSZKY 1835:269). The type locality is the hill "Haemus" near "Szlivno" (Bulgaria: Sliven) as subsequently specified by FRIVALDSZKY (1841-1845:165) himself. *P. sephirus* was recognized as distinct a species (e.g. STAUDINGER & REBEL 1901) up to 1938.

FORSTER (1938) tried to clarify the taxonomic relationships between *sephirus* and numerous closely related taxa (the *pylaon*-group sensu Forster). As a result, *sephirus* was classified as the Balkan subspecies of *Lycaena pylaon* FISCHER von WALDHEIM, 1832. Other taxa, which were formerly known as distinct species (e.g. *lycidas* = *trappi*, and *hespericus*) were likewise downgraded to the subspecies-rank. This treatment was accepted by some subsequent authors (e.g. GOZMANY 1968; HIGGINS 1975) and rejected by others (e.g. SZABO 1954, 1956; ROSE 1986). *P. pylaon* sensu FORSTER contained over 30 nominal "subspecies" (BALINT & KERTÉSZ 1990a). At present the *Plebeius pylaon* species-group is classified as follows (BALINT 1991, 1992b; BALINT & KERTÉSZ 1990a):

### Xeromontane stock:

#### Patriarcha lineage:

*P. patriarcha* BALINT, 1992  
(Tadzhikistan)

#### Pylaon lineage:

##### Atlantomediterranean-Iberian group:

*P. hespericus* (RAMBUR, 1839)  
(Iberian Peninsula)

##### Atlantomediterranean-Alpine group:

*P. trappi* (VERITY, 1927)  
(The Alps)

##### Pontomediterranean-Pontocaspian group:

*P. sephyrus* (FRIVALDSKY, 1835)  
(E. Europe, Anatolia, Caucasus)

*P. zephyrinus* (CHRISTOPH, 1884)  
(from Caucasus to Tarbagatai)

*P. nichollae* (ELWES, 1901)  
(Syria, Palestine)

*P. usbecus* FORSTER, 1939  
(Uzbekistan, Kazakhstan)

##### Turanian-Siberian group:

*P. pylaon* (FISCHER von WALDHEIM, 1832)  
(Russia, Siberia, Mongolia, Kazakhstan)

### Eremial stock:

*P. indicus* (EVANS, 1925)  
(Baluchistan, Afghanistan, W. Tibet)

*P. philbyi* (GRAVES, 1925)  
(Arabian Peninsula, Sinai)

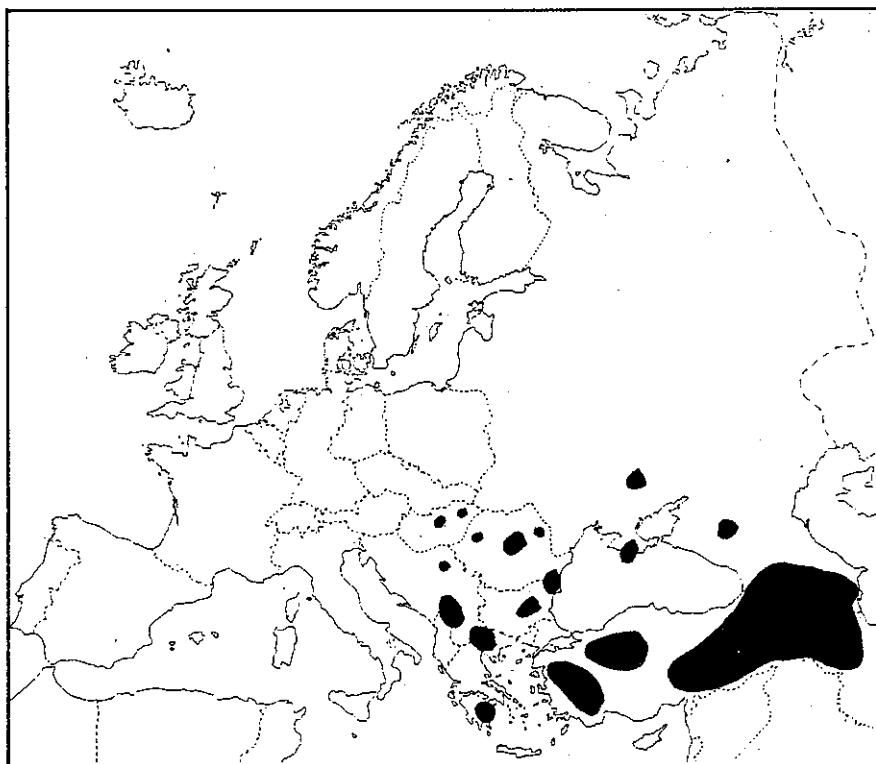


Fig. 1. The range of *Plebeius sephirus*.

The *P. pylaon* lineage is a good example of a "superspecies" (cf. KUDRNA 1986:136-137). The marginal population groups of this complex are widely isolated and represent distinct allopatric species (*P. hespericus*, *P. trappi*, *P. pylaon*); they can be separated by external characters. The taxonomic interpretation of the central group (*P. sephirus*, *P. zephyrinus*, *P. usbekus*, *P. nicholae*) remains questionable.

*P. pylaon* (s.str.) is an Asian species occurring in the Kazakh steppes and Altai mountains, just penetrating into Europe in the Volga district (BALINT & LUKHTANOV 1990).

*P. sephirus* is distributed in the eastern Mediterranean region eastwards to Caucasus and southwards to Kurdistan. The north-western limit of its range reaches the Carpathian Basin.

In the Caucasus *P. sephirus* is replaced by *P. zephyrinus*; this extends to the Tarbagatai mountains, where *pylaon* (s. str.) can also be found (BALINT & KERTÉSZ 1990a). *P. sephirus* and *P. zephy-*

*rinus* appear to differ ecologically. These taxa occur sympatrically, but allochronically (and most probably also allotopically) in Armenia and Azerbaijan (BALINT 1991b, BALINT & KERTÉSZ 1990a). Specimens of putative hybrid populations were collected by the late L. G. HIGGINS at Sersang and Salahuddin in Kurdistan (collection data of the Natural History Museum, London). Hybrid populations between *sephirus* and *nichollae* occur in SE Anatolia and the Taurus Mountains ("ssp." *akbesianus* OBERTHÜR, 1904). The taxa *usbekus* and *zephyrinus* seem to be allopatric in Central Asia. The former one inhabits semiarid steppes and mountain ranges (L. PEREGOVITS pers. comm., TSCHIKOLOWEZ 1991), while *zephyrinus* is associated with rich vegetation in mountain valleys or along water courses (G. RONKAY pers. comm., GROUM-GRSHIMAILO 1890). Taxonomic affinities of these taxa require further study.

Like many other lycaenids, *Plebeius sephirus* shows considerable individual variation; several individual forms have been named (COURVOISIER 1914; VICOL 1980). Some of them were erroneously treated as "subspecies" in FORSTER's (1938) revision.

### 3. *PLEBEIUS SEPHIRUS* IN PANNONIA

#### 3.1. Taxonomy

In the Carpathian Basin *P. sephirus* occurs in several isolated and strongly fragmented colonies. Four taxa have been described as different "subspecies":

*Lycaena sephyrus uhryki* REBEL, 1911: S. Pannonia: Banat  
*Plebejus sephyrus kovaci* SZABO, 1954: N. Pannonia: Budapest vic.  
*Plebejus sephyrus foticus* SZABO, 1956: N. Pannonia: Budapest vic.  
*Plebejus sephyrus proximus* SZABO 1954: C. Transylvania: Campaneum

None of these taxa deserves subspecific status because they are indistinguishable from each other by morphological characters and their ecology is extremely similar (flight period, choice of habitat, etc.). The present scattered distribution of *P. sephirus* in the Carpathian Basin is not due to glacial or postglacial isolation, but must be seen as a result of recent, very intensive anthropogenic influences (BALINT & KERTÉSZ 1990b). Most probably, none of the remaining Carpathian and Pannonian "subspecies" of *P. sephirus* (incl. *magnificus* BALINT, 1987 and *brethertoni* BROWN, 1976) can be taxonomically separated. Accordingly, all these taxa should be treated as junior synonyms of monotypic *P. sephirus*. Biogeographical considerations (BALINT & KERTÉSZ 1990b; VARGA 1989b) and a comparison with lycaenids of similar range support this treatment.

#### 3.2. Distribution in Pannonia

##### Surroundings of Budapest (Central Hungary)

In Hungary *P. sephirus* was first recorded by REBEL (1912) in the vicinity of Budapest: "Ofen". That locality is probably destroyed because the loess steppe at the foothills of the dolomite regions on the Buda side of the river Danube has been heavily urbanized

since the beginning this century. The only remaining locality of the hostplant *A. exscapus* in this district (Disznófö) is very small, and *P. sephirus* does not occur there.

Later FORSTER (1938) also mentioned *P. sephirus* from Budapest based on a single ♂ captured by the Hungarian lepidopterist Viktor BARTHA and carrying the label "Budapest, coll. V. BARTHA", deposited in the Lepidoptera collection of the Hungarian Natural History Museum; the exact site of capture is unknown.

*P. sephirus* was captured in 1944 by two Hungarian lepidopterists in Somlyóhegy, near Fót (SZABO 1954). At that time it was believed to be the first record of the species from Hungary (KOVACS 1951); the collectors were unaware of the aforementioned data.

The well known Fót locality became a "place of pilgrimage" for Hungarian collectors (SZALKAY 1962: 379: "*Plebejus zephyrus* FRIV. is the animal for which all lepidopterists must go to Fót in May, if they want to have specimens in their collections captured by themselves"). Fót remained the only known Hungarian colony of *P. sephirus* up to the late eighties (BALINT 1985; VARGA 1989a).

Later several further populations were found to the northeast of Budapest (BALINT 1989; BALINT & KERTÉSZ 1990b). They were studied during 1989-1991. The estimated population sizes and the estimated areas of suitable *P. sephirus* habitat - sandy steppes with *Astragalos-Festucetum-rupicolae* - were scored using five categories:

Populations size 1 - 5 (individuals, adults):  
>1000;      500-1000;      250-500;      100-250;      <100

Habitat area 1 - 5 (in m<sup>2</sup>):  
>20000;      10000;      5000;      250;      <100.

The eight *P. sephirus* populations were evaluated as follows:

<u>Population</u>	<u>Size</u>	<u>Category</u>	<u>Area</u>
1. Dunakeszi: Gyartelep	< 100	5	< 100
2. Szödliget: Debegio	100-250	4	250
3. Göd: Tetetlem	< 100	5	< 100
4. Fót: Somlyóhegy	> 1000	1	> 20000
5. Csomad: Gödi-árok	< 100	5	< 100
6. Csomad: Öreg-hegy	< 100	5	5000
7. Szenzendrei-sziget: Also-Merzsán	< 100	5	< 100
8. Szenzendrei-sziget: Pocsmegyer	100-250	4	250

Marking of adults was carried out in Szödliget/Debegiő, Csomád/Öreg-hegy and Gödi-árok by the first author. In 1992, 32 adults were marked in Szödliget/Debegiő, 24 adults in Csomád/Öreg-hegy and 226 adults in Csomád/Gödi-árok during four days. Only specimens marked in the same population were recaptured. This indicates that *P. sephirus* populations in the Budapest area are isolated from each other.

#### Tokaj (Abaúj County, northeastern Hungary)

This population of *P. sephirus* was very recently discovered by Z. VARGA (BALINT 1991c). The habitat is situated in a loess steppe

with *Astragalus dasyanthus* on the southern slope of the andesit hill of Kopasz-hegy. Oviposition was observed on *A. dasyanthus*, the most likely larval foodplant of *P. sephirus* here. The study of this population has started in 1992, organized by Z. VARGA.

Csehtelek (Tauti, County Bihor, Western Romania)

Specimens of *P. sephirus* were found in the butterfly collection of the Natural History Museum, London (BALINT & KERTESZ 1990b). A good description of this locality, where several xerophilous species were also collected was given by ROTHSCHILD & WERTHEIMSTEIN (1913). Interestingly, *P. sephirus* was not listed by the authors. Further investigations are required to locate the site.

Flamunda (Deliblát, Banat, Serbia)

In Banat *P. sephirus* also inhabits sandy steppes (REBEL 1911). The larval foodplant in this locality is not known, but females originating from Flamunda laid eggs on *A. dasyanthus* in captivity and the caterpillars were successfully reared on this plant (FRO-HAWK 1914). There are no published data on the occurrence of *A. exscapus* in this region (PODLECH 1988). The Banatian *P. sephirus* populations have never been mentioned since REBEL (1911) and FRO-HAWK (1914); they have been overlooked by JAKSIC (1988), too.

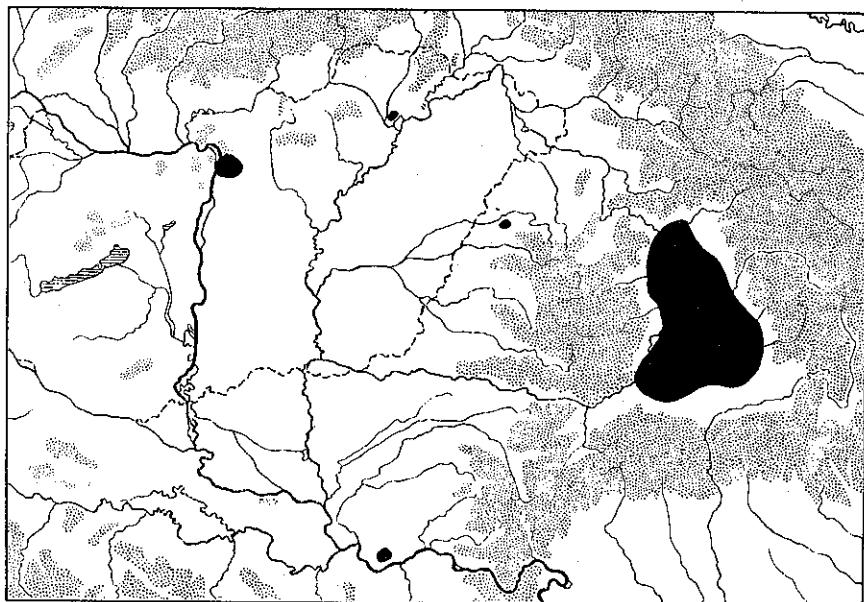


Fig. 2. The distribution of *Plebeius sephirus* in Carpathian Basin.

### 3.3. Ecology of adults

This section is based on observations made in the vicinity of Budapest (Csomád, Fót, Göd, Szentendrei-sziget). Since no ecological studies of other *P. sephirus* populations have been made, there is no possibility of comparing our results. It is possible that some populations may show slightly different habitat requirements. However, we feel sure that all populations in the surroundings of Budapest at least share the same ecological characteristics as described below.

In the Szödliget habitat we studied the behaviour of *P. sephirus* adults using a mark-release-recapture (MRR) method. This site covers an area of about 120 x 150 m, and is divided in North-South direction by a 12 m wide railway. The track is devoid of vegetation, and along the track there are ruderal belts about 5 m wide with richly flowering *Salvia nemorosa* and *S. pratensis*. Low sand dunes with *Astragalo-Festucetum rupicolae* are situated along both sides of the railway. Squares (5 x 5 m) were designated on both sides for vegetation analysis and to locate marked butterflies. During the flight period a circular transect path touching the squares on both sides was used.

At the Csomád site (about 20,000 m<sup>2</sup>) similar studies are still continuing. This *P. sephirus* habitat is the largest, shows less anthropogenic influence, and supports a very strong population of the hostplant *A. exscapus*. Preliminary results from Csomád were included here if they yield additional information.

#### Habitat

The populations of *P. sephirus* in the vicinity of Budapest occur exclusively on calcareous, sandy or loess steppe in a transitional state between pioneer open grass steppe (*Festucetum vaginatae*) and true steppes (e.g. *Cleistogeneti-Festucetum rupicolae*). This transitional plant community (*Astragalo-Festucetum rupicolae*) is a short grass steppe, with about 60-70 % of the ground being sparsely covered by vegetation.

*P. sephirus* is absent from other kinds of steppe biotopes (e.g. dolomit-grasslands) and is furthermore confined to large patches of its hostplant *A. exscapus*. Observed local distributions of *P. sephirus* adults and larval foodplants were always closely associated. We have never found the butterflies in small tufts of *A. exscapus* which were isolated from larger hostplant patches by other types of vegetation (e.g. by *Stipa* steppe of more than 20 m width). Likewise, large stands of the main adult nectar resources, *Dianthus pontederae* and *Thymus degenianus* were not visited if *A. exscapus* was absent there.

According to SEREGÉLYES' (1990) analysis of the flora of the Fót site of *P. sephirus*, the following plants are characteristic for the habitat of this species: *Adonis vernalis*, *Alyssum tortuosum*, *Astragalus vesicarius*, *Colchicum arenarium*, *Cytisus austriacus*, *Dianthus collinus*, *D. serotinus*, *Dictamnus albus*, *Genista tinctoria*, *Globularia aphyllanthea*, *Helichrysum arenarium*, *Iris arenaria*, *Iris pumila*, *Iris variaegata*, *Jurinea mollis*, *Linaria angustissima*, *Linum austriacum*, *Peucedanum arenarium*, *Polygonum arenarium*, *Pulsatilla nigricans*, *Sedum hillebrandtii*, *Stipa pennata*, *S. pulcherrima*, *Teucrium montanum*, *Thalictrum minus*, *Vinca herba-*

cea. The same phytocenosis characterizes the Csomád site.

Butterfly species associated with *Plebeius sephirus*

The following species were recorded in the sites of Fót, Csomád and Göd occurring synchronically and syntopically with *P. sephirus*. Their flight period coincides with the late spring aspect of the semiarid or xeromontane habitats.

PAPILIONIDAE: *Papilio machaon* LINNAEUS, 1758; *Zerynthia polyxena* (DENIS & SCHIFFERMÜLLER, 1775)

PIERIDAE: *Anthocharis cardamines* (LINNAEUS, 1758); *Aporia crataegi* (LINNAEUS, 1758); *Colias alfacariensis* RIBBE, 1905; *C. erate* (ESPER, 1705); *Conepteryx rhamni* (LINNAEUS, 1758); *Leptidea sinapis* (LINNAEUS, 1758); *Pontia daplidice* (LINNAEUS 1758); *Pieris brassicae* (LINNAEUS, 1758); *P. napi* (LINNAEUS, 1758); *P. rapae* (LINNAEUS, 1758).

LYCAENIDAE: *Callophrys rubi* (LINNAEUS, 1758);, *Celastrina argiolus* (LINNAEUS, 1758); *Cupido argiades* (PALLAS, 1771); *C. decoloratus* STAUDINGER, 1886; *C. minimus* (FUESSLY, 1775); *Glaucoopsyche alexis* (PODA, 1761); *Lycaena phlaeas* (LINNAEUS, 1761); *L. thersamon* (ESPER, 1784); *L. tityrus* (PODA, 1761); *Plebejus argus* (DENIS & SCHIFFERMÜLLER, 1775); *P. argyrogynon* (BERGSTRÄSSER, 1779); *Polyommatus agestis* (DENIS & SCHIFFERMÜLLER, 1775); *P. bellargus* (ROTTEMBURG, 1775); *P. dorylas* (DENIS & SCHIFFERMÜLLER, 1775); *P. icarus* (ROTTEMBURG, 1775); *P. semiargus* (ROTTEMBURG, 1775); *P. thersites* (CANTENER, 1834); *Pseudophilotes schiffermuelleri* (HEMMING, 1929); *Satyrium acaciae* (FABRICIUS, 1787); *S. ilicis* (ESPER, 1779); *S. pruni* LINNAEUS, 1758; *S. spini* (DENIS & SCHIFFERMÜLLER, 1775); *Scolitantides orion* (PALLAS, 1771); *Hamearis lucina* LINNAEUS 1758).

NYMPHALIDAE: *Aglais urticae* (LINNAEUS, 1758); *Argynnis pandora* (DENIS & SCHIFFERMÜLLER, 1775); *Boloria dia* (LINNAEUS, 1758); *Brenthis hecate* (DENIS & SCHIFFERMÜLLER, 1775); *Coenonympha arcania* (LINNAEUS, 1758); *C. glycerion* (BORKHAUSEN, 1788); *C. pamphilus* (LINNAEUS, 1758); *Inachis io* (LINNAEUS, 1758); *Issoria lathonia* (LINNAEUS, 1758); *Lasiommata maera* (LINNAEUS, 1758); *L. megera* (LINNAEUS, 1767); *Maniola jurtina* (LINNAEUS, 1758); *Melitaea aurelia* (NICKERL, 1850); *M. cinxia* (LINNAEUS, 1758); *M. didyma* (ESPER, 1779); *M. fascalis* (ESPER, 1784); *M. phoebe* (DENIS & SCHIFFERMÜLLER, 1775); *Polygonia c-album* (LINNAEUS, 1758); *Vanessa atalanta* (LINNAEUS, 1758); *V. cardui* (LINNAEUS, 1758).

LIBYTHEIDAE: *Libythea celtis* (LAICHARTING, 1782).

HESPERIIDAE: *Carcharodus alceae* (ESPER, 1780); *C. flocciferus* (ZELLER, 1847); *C. lavatherae* (ESPER, 1783); *Erynnis tages* (LINNAEUS, 1758); *Pyrgus carthami* (HÜBNER, 1813); *P. malvae* (LINNAEUS 1758); *Spialia orbifer* (HÜBNER, 1823); *Thymelicus acteon* (ROTTEMBURG, 1775); *T. lineola* (OCHSENHEIMER, 1808).

Flight season

According to our observations and collated label data of museum specimens, *Plebeius sephirus* is univoltine; it is on the wing from early May to early or mid June. The first specimens are males, first females emerge about four days later. The peak flight is between 20 and 31 May in the surroundings of Budapest. We are not aware of any records of adults after 20th June. The flight period of *P. sephirus* and the longevity of the adults are strong-

ly influenced by climatic factors. The butterflies usually do not survive longer cool and rainy periods.

#### Behaviour

Two males and a single female were found with limp wings in the morning (between 10.09 and 10.23 hours) coming out from the roots of *A. exscapus* and surrounded by *Lasius* ant workers. The insolation was very strong and soil temperatures exceeded 30° C in all three cases.

Active adults were observed from about 10.30 hours on, but only in bright sunshine when ground temperatures exceeded 25°C (air temperatures 23°C or higher). Adult activity ceased when there was a strong wind or overcast sky. Then the butterflies were resting or basking in the low vegetation. During rainfall, the butterflies went down into the dense grass and rested on the ground. *P. sephirus* is highly thermophilous, well adapted to the climatic conditions of semidesert or arid districts.

*P. sephirus* is stenotopic and both sexes are highly sedentary. No adults were encountered away from the site even if a large patch of nectar plants was available within 50 m from it. Nevertheless, a vegetation-free railway line was no real barrier for *P. sephirus*. From 36 recaptured males, 29 specimens remained in the colony, whereas only 7 (= 19.4 %) crossed the railway line. Females crossed the railway more frequently: 15 out of 26 recaptured females remained on the same side of the railway, 11 females crossed it at least once. However, this sex difference is statistically only marginally significant ( $\text{Chi}^2 = 2.801$ ,  $p = 0.091$ ). Only 2 females, but no male crossed the barrier several times. 20 males and 11 females were not recaptured.

Like in *P. hespericus* (MUNGUIRA & MARTIN 1989) males of *P. sephirus* are typically patrolling. They seem to be much more active than the females. 156 of 237 behavioural records (65.8 %) refer to males. Both sexes spent most of their time resting or basking, but the flying activity of the males is much higher than that of the females. Nevertheless the males move far less than the females, showing a type of territorial behaviour. Some male specimens were recaptured exclusively in one place; they appeared to search for females around larger stocks of *A. exscapus*.

We have not studied possible correlations between butterfly density and *Lasius* ant nests because the most frequent symbiotic partner of *P. sephirus* caterpillars, *Lasius* spp., does not always build obvious nests (RAVENSCROFT 1990, JORDANO et al. in press). Two observations made in Göd (1992), however, suggest that, like in *P. argus*, there might be a more intricate spatial association between *P. sephirus* and *Lasius* ants. We observed the highest butterfly densities in 2 microhabitats:

- in a closed short grass steppe habitat with the dominant plant *Hippocrepis comosa* with a very strong colony of *P. argus*;
- in a closed short grass steppe habitats, with *A. exscapus* and *P. sephirus*.

In these habitats the upper level of the soft calcareous sandy soil (e.g. the roots and stems of *H. comosa* and *A. exscapus*) was completely underburrowed (ant galleries). In contrast, the density of *P. sephirus* did not increase next to large *Formica pratensis* nests in Szödliget (1989) and in Göd (1992) sites.

### Feeding

The nectaring was almost entirely confined to *D. pontederae* at Szödliget site. Near Csomád in 1992 the main nectar source was *Thymus degenianus*, but *D. pontederae* was also important. There were no marked differences in the preference of flowers used by males or females. Nectaring only occurred where at the same time *A. exscapus* was available though this larval hostplant was never used for nectaring.

The following flowers were used for nectaring by adult *P. sephirus* in Szödliget (1989) and in Csomád (1992) respectively:

<i>Dianthus pontederae</i>	44	-	12
<i>Salvia pratensis</i>	4	-	5
<i>Thymus degenianus</i>	0	-	24
<i>Veronica austriaca</i>	2	-	0

There are some records of species of the *P. pylaon* group being found in large numbers in lycaenid assemblages on moist ground ("mud-puddling": NEKRUTENKO 1985, MURZIN 1986). We could observe only one puddling male of *P. sephirus*, although such lycaenid assemblages were common on moist ground or animal droppings in the close vicinity of *P. sephirus* habitats. The most common butterflies observed on puddles were: *Celastrina argiolus* (LINNÆUS, 1758), *Glaucopsyche alexis* (PODA, 1761), *Plebejus argus* (LINNÆUS, 1758), *Polyommatus icarus* (ROTTEMBURG, 1775), *Melitaea phoebe* (DENIS & SCHIFFERMÜLLER, 1775), *M. cinxia* (LINNÆUS, 1758) and *P. napi* (LINNÆUS, 1758); *Pseudopanthera macularia* (LINNÆUS, 1758) was also present in large numbers.



Fig. 3. *Astragalus exscapus*: Fót, Somlyó-hegy. (Photo A. Keve).

### Parasitoids and predators

The natural enemies of *P. sephirus* are little known; we could make only a few casual observations. During our breeding experiments we obtained no parasitoids. Two adult butterflies were observed being preyed upon by spiders sitting on flowers (Araneidae: Thomisidae), and on one occasion a robber-fly (Diptera: Asilidae) caught one adult. Furthermore, the lizards *Lacerta viridis* (several times) and *L. agilis* (one observation) occasionally captured *P. sephirus* adults. One male had damaged hindwings, possibly after a lizard's attack.

### Oviposition

Egg-laying was observed exclusively on *A. exscapus*. Eggs were always laid singly on leaves, stems and flowers at the base of the plants. The females were not searching for ants, but as we have mentioned above, the ground under the stocks of *A. exscapus* has a very high ant density (c.f. *P. argus*: MENDEL & PARSONS 1987; JUTZELER 1989; JORDANO et al. in press).

### Hostplants

The first students of *P. sephirus* already recognized its strong association with *A. exscapus* and this plant was presumed to be the larval hostplant (KOVACS 1951). Later SZABO (1954, 1956) confirmed this for the Fót colony. ANTALFALVI (1971) collected several larvae on this hostplant in nature. We have found caterpillars exclusively feeding on *A. exscapus* in the vicinity of Budapest. Thus, *P. sephirus* appears to be monophagous there.

Flowering *A. exscapus* is very conspicuous to the observer because of its brightly yellow center. These yellow spots could be used by the butterflies in assessing the presence of their hostplants. To test this hypothesis, the following experiment was conducted: Ten yellow papers, similar to natural hostplants in size and form and partly covered with grass, were offered in two squares at the Csomád site in May 1992. These "Astragalus fakes" were never visited by *P. sephirus* adults, suggesting that visual cues play no major role in hostplant recognition. However, due to the small number of experiments, this result must be taken with caution. Detailed studies of host-finding strategies of *P. sephirus*, including chemical cues, remain to be carried out. The second Hungarian hostplant of *P. sephirus* is *A. dasyanthus*. This species, like *A. exscapus*, is widely distributed in the Kiskunság National Park/Tokaj (BALINT 1991c; FROHAWK 1914).

A specific survey of all Hungarian *A. dasyanthus* populations for the occurrence of *P. sephirus* colonies has not been conducted. An examination of a very small protected population of *A. dasyanthus* located near Budapest revealed no *P. sephirus* population. Several further sites south of Budapest were surveyed in 1990 for *P. sephirus*. In two localities (County Pest: Bugyi and Taksony) *A. exscapus* was plentiful, but *P. sephirus* was absent. *A. exscapus* occurs locally throughout eastern and central Europe (BALINT 1991). In Hungary, it is known from numerous sites (herbarium specimens deposited in the Botanical Department of the Hungarian Natural History Museum and literature data). Many of these localities remain to be surveyed for the *P. sephirus* and have never been explored by lepidopterists so far.

### 3.4. Ecology of early stages

FROHAWK (1914) and ANTALFALVI (1971) reared caterpillars of *P. sephirus* in captivity and published some observations about the young larvae. They feed on both surfaces of *Astragalus* leaves, but prefer the underside. They eat small holes in the leaf tissue, but leave the upper epidermis intact, little semitransparent blotches on the leaves being produced (FROHAWK 1914). Feeding behaviour is similar under natural conditions. After the second moult the larvae stop feeding and aestivate. In captivity they crawled down the hostplant stems and buried themselves within the cotton layer of the rearing vials for aestivation and hibernation. According to FROHAWK (1914), the larvae in the wild descend the stems and diapause among dead leaves or in similar shelters. In Spanish populations of the closely related *P. argus*, young larvae hibernate in the soil beneath their hostplants, usually in pavillons or galleries of *Lasius* ants (RODRIGUEZ et al. 1991); while English *P. argus* hibernates as dormant eggs (THOMAS 1985). The possible relationship of hibernating *P. sephirus* larvae to ants under natural conditions requires further study.

After hibernation the caterpillars feed on the young shoots and leaves in the central part of the plant. Even at the very beginning of the vegetation period we always found several different instars (L2-L4) simultaneously. Three possible explanations can be made:

- Larvae might feed again in autumn when some stocks of *Astragalus* growing in optimal microclimatic conditions produce new foliage after the long, very dry summer period; this would imply that there is a second (optional) feeding period between aestivation and hibernation.
  - The larvae grow at different rates, possibly influenced by microclimate and hostplant quality.
  - Some larvae obtain some food from ants (e.g. regurgitations) when hibernating in their close proximity. Given the unspecific ant-association of *P. sephirus* larvae, however, there is no evidence for the latter explanation.
- Clearly, the life-cycle of *P. sephirus* is not yet fully understood.

A few pupae were found under the stocks of *A. exscapus*, in the upper end of the ant galleries or earth pavillions. The pupae of *P. sephirus* are most probably attended by ants (group IIb: FIEDLER 1988), but exact observations remain to be carried out.

### 3.5. Observations on the symbiosis with ants

The relationships between *P. sephirus* caterpillars and/or pupae and ants were largely neglected in previous accounts, although the presence of myrmecophilous organs on the caterpillars has already been reported in detail by FROHAWK (1914). BALINT & KERTESZ (1990a) confirmed that the caterpillars are in fact tended by ants. Some anecdotal observations (e.g. ants carrying pupae away from the root of the hostplants, possibly into the nests by attendant ants (BALINT 1992a) even indicated that this relationship might be a very close or obligatory one, as in the closely related *P. argus* (RAVENSCROFT 1990; RODRIGUEZ et al. 1991; JORDANO & THOMAS in press).

On 26th and 30th April 1991 three habitats of *P. sephirus* in the vicinity of Budapest (Csomád: Gödi-árok, Öreg-hegy; Szentendreisziget: Pócsmegyer) were visited in order to make further observations about the ant-associations of *P. sephirus* larvae. Owing to the short observation period they are preliminary. The following notes summarize the results.

#### Incidence of ant attendance

Practically all caterpillars observed (only fourth and fifth instars were present at the time of observation) were associated with ants. This finding agrees well with previous observations of differnt Hungarian lepidopterists, who nearly always found caterpillars being attended by ants (KOVACS 1949, SZABO 1956, ANTAL-FALVI 1971). In addition, we observed ants on or under all plants housing *P. sephirus* larvae, even if no direct association with the larvae could be found. A few larvae were found without ants in direct contact: To find the caterpillars one has to lift the hostplant leaves and to examine the substrate beneath. Thereby some ants may easily be frightened away. Larvae of *P. sephirus* are almost constantly attended by ants during the last two larval instars and can thus be included in the category of "steadily myrmecophilous" species (FIEDLER 1991).

It is yet unknown from which instar on the larvae are visited by ants. Two of their three types of myrmecophilous organs (the dorsal nectary organ and the paired tentacle organs) do not develop prior to the third instar (FROHAWK 1914), and in most related species of the *Polyommatus* section ant-associations commence with the development of these organs. However, in one related species (*P. argus*) with its obligatory association with certain *Lasiurus* ants, even first instars are attractive to these ants (RAVENSCROFT 1990, C.D. THOMAS pers. comm.). Furthermore, young larvae of *P. sephirus* have been claimed to be transported by ants into their nests or upper alleries.

#### Behavioral interactions

All larvae were intensively and permanently antennated by their attendant ants, and the ants behaved peacefully towards the caterpillars. The harvesting of secretions from the dorsal nectary organ (DNO) could be observed repeatedly. In contrast, the tentacle organs (TO) were seen being everted only very seldom.

In general, the behavioural interactions between *P. sephirus* and ants completely matched the pattern known from numerous other facultatively myrmecophilous lycaenids. There was no behavioural evidence of a more sophisticated association. The DNO secretions were highly attractive to the ants and were always immediately taken up. But even when no secretion droplets were delivered, the ants remained by the caterpillars and antennated them, probably due to the attractiveness of the pore cupola organs.

#### Ant species involved

The ants we observed tending *P. sephirus* caterpillars belong to three genera from two subfamilies. The dominant symbiotic partner species was a member of the *Lasiurus alienus* FÖRSTER species-group (Formicinae). This is a psammophilous species with pronounced pubescence, very abundant and often ecologically dominant in steppe

habitats of eastern Europe. The species will be described in the course of an ongoing revision of the *Lasius alienus* complex by B. SEIFERT (Germany). In the habitats near Göd and Csomád, more than 90 % of the larvae located were tended by this ant species, while on Szentendrei sziget roughly 65% of the larvae were associated with it (in total about 100 caterpillars were found).

*Formica pratensis* (Formicinae) was the second most important ant associated with *P. sephirus* larvae. It is an aggressive and ecologically dominant species of dry open habitats, and on Szentendrei sziget approximately one third of the larvae were tended by these ants. One caterpillar from Göd was experimentally offered to *F. pratensis* near a large nest mound. After initial alertness and some attempts to bite the caterpillar (the usual behaviour of ants when new objects are transferred to their nests), the ants soon accepted the larva and antennated it intensively. Several times the harvesting of nectar-like secretions could be observed, while even during attacks the caterpillar never everted its TOs.

On one occasion two *Camponotus aethiops* (Formicinae) workers (a large ant species of dry warm habitats) attended a rather small fourth instar larva at the Göd no. 5 site and another caterpillar at the Göd site no. 6. was found associated with a species of the *Tetramorium caespitum* complex (Myrmicinae); more precise determination is not yet possible since this group is in need of a taxonomic revision (B. SEIFERT pers. comm.). The *Tetramorium* tended

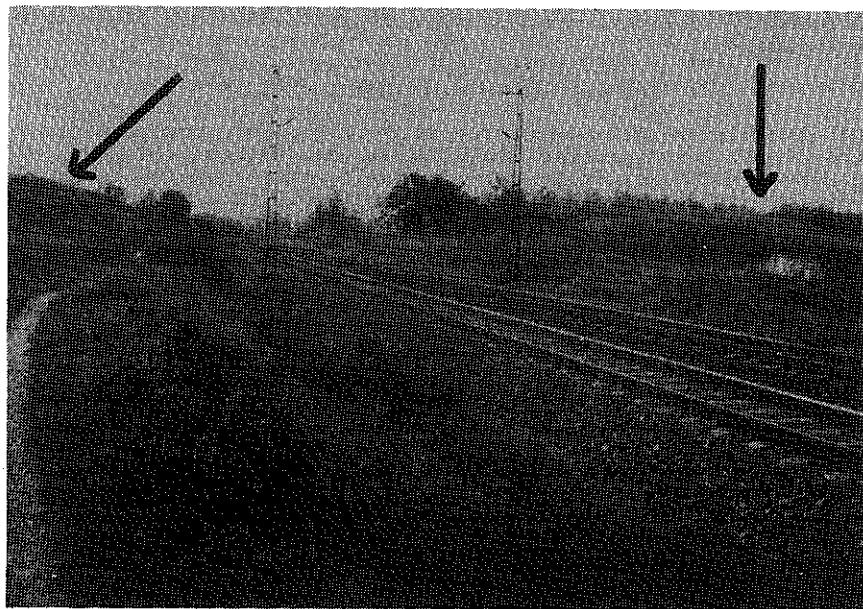


Fig. 4. *P. sephirus* locality in the vicinity of Szödliget in September, 1989. Arrows indicate *A. exscapus*. (Photo A. Kertész)

caterpillar was buried in a cell of loose earth ("earth pavillon"). This is typical for many ant genera that protect their trophobionts in pavillons (e.g. *Lasius* spp.) and has been observed with larvae and pupae of several myrmecophilous lycaenids.

These observations indicate that although *P. sephirus* larvae are highly myrmecophilous, their association with ants is facultative and not strictly specific. Records of ant-associations of further, closely related taxa of the *P. pylaon* complex likewise demonstrate a facultative, unspecific symbiosis with ants.

It seems possible that in the course of a more detailed survey further symbiotic ants will be detected for *P. sephirus* as well, notably from the genera *Plagiolepis* (Formicinae), *Crematogaster*, *Myrmica* (Myrmicinae) and *Tapinoma* (Dolichoderinae). All these ants are represented in the *P. sephirus* localities. Further research should try to compile a list of all species involved and note their relative significance.

This is particularly important in the light of recent findings on the obligatory ant-association of *P. argus* in western Europe. In this species, freshly eclosed adults are still tended by ants (BEURET 1924; THOMAS 1985) and myrmecophily commences at a very early larval stage (even in L1). In *P. sephirus*, fresh adults have been observed visited by ants, and diapausing early instars might also be myrmecophilous. Furthermore, *Lasius* ants predominated as tending partners. Possibly, *P. sephirus* provides an example of more advanced myrmecophily, intermediate between purely facultative cases, where the ant-associations are largely governed by the ecological dominance hierarchy of the ant guild present and the obligatory cases where active selection of ant partners takes place.

#### Perspectives of future research

The observations presented here allow only a sketchy assignment. Accordingly, the association of *P. sephirus* with ants is supposed to represent a case of true trophobiosis, but this view needs experimental support. In particular, the protective effect of ants and the nutritive value of caterpillar secretions should be assessed experimentally.

Further interesting questions are:

- Are there any affinities between the incidence of trophobiotic associations with aphids, and the colonization or survival of caterpillars on the hostplants? Ant-tended aphid colonies were repeatedly found on the hostplants, as they may help to attract a sufficient ant guard.
- Does competition take place among the ant colonies and/or species for the trophobionts? Are the larvae attended by ants from the same colonies or species throughout their life, or does displacement or interference occur?
- Do different ant species exert different effects upon survival or mortality of the caterpillars?
- What interactions take place between ants and pupae or between ants and emerging adults?

It is hoped that these and other questions can be answered in the course of future research.

#### 4. CONSERVATION OF *PLEBEIUS SEPHIRUS* IN THE SURROUNDINGS OF BUDAPEST

##### 4.1 Anthropogenic harmful influences on *P. sephirus* habitats

The Danube Basin has been strongly affected by human activities since the Roman epoch. The original mosaic forest steppe of this region has been drastically transformed for agricultural purposes since the middle of the 19th century. The river beds were canalized, the original ecosystems destroyed, and the region largely turned into an "agricultural steppe". The indigeneous steppe vegetation as well as the hygrophilous ecosystems almost totally disappeared. The remaining valuable grassland habitats with several interesting plants (e.g. *Adonis volgenis*, *Salvia nutans*) are mainly secondary ones, e.g. on burial hills of nomadic Kumans, on ancient fortifications against Tartars or on railway embankments (KISS 1968). In case of *P. sephirus* there is no specific threatening factor in Pannonia. However, various anthropogenic influences negatively affect its biotopes in the vicinity of Budapest:

###### Intensification of grassland management

The change from the traditional pastoral methods to overgrazing by sheep is dangerous. Overgrazed *Dianthus* and *Astragalus* plants blossom later, reducing the availability of these crucial nectar and oviposition sources. In particular, the phenology of adult nectar sources and larval hostplants changes under overgrazing conditions. For a steppe species like *P. sephirus* phenological changes cause severe threats. Traditionally of *P. sephirus* habitats is light grazing in the very early spring, late autumn and winter time. The setting-up of sheep-pens must be totally forbidden because these places become rapidly overgrown with weeds and totally lose their original grass steppe character.

###### Afforestation

The policy to plant *Pinus nigra* and *Robinia pseudoacacia* to bind sand-dunes and to use the "abandoned" grassy places for the purpose of forestry has drastically changed the ecosystems in parts of Pannonia. This is also a prominent threat to some *P. sephirus* habitats in the close vicinity of Budapest. Several formerly suitable habitats have been destroyed by tree plantations. Rapidly declining populations of characteristic plants like *Astragalus exscapus*, *Iris pumila* and *Dictamnus albus* in clearings of *Robinia* and *Pinus* forests at Csomád site demonstrate the degradation of the steppe biocenosis as a consequence of afforestation with allochthonous trees. An important conservation measure is the prevention of growth (or removal) of *Pinus nigra* and *Robinia* in the localities.

###### Weed control

All known habitats of *P. sephirus* in the vicinity of Budapest are surrounded by intensively used fields. Large *Pinus* plantations cover the close vicinity of the Csomád and Fót sites. Several very small populations of *P. sephirus* inhabit sand dunes along railway tracks. These habitats are regularly treated with herbicides sprayed from aircraft (forestry and agriculture) or spe-

cial trains (spraying distance is about 10 m each side of the track). One must assume a negative effect of herbicide-spraying on *P. sephirus* by way of its hostplant. Accordingly, weed control should be reduced to the lowest possible level in the proximity of the localities.

#### Pest control

The Pinus plantations are defoliated by "pest" insects in certain years. Insecticides are sprayed from aircraft; they most probably also kill the young larvae of *P. sephirus*. Buffer zones around the steppe habitats to reduce harmful effects of agrochemicals are strongly recommended.

#### Earthworks

Sand mining has totally destroyed one habitat on Szentendrei-sziget. Illegal sand mines can be observed everywhere in the region causing damage to habitats. Some sand mines subsequently even became illegal rubbish dumps. A new highway will be built in the near future across the whole Csomád-Göd region. The few remaining natural and seminatural habitats of this region are very small. Most probably they will be entirely destroyed during the building operations, the Nature Reserve Fót and the Csomád site excepting. The site Alsó-Merzsán was destroyed by the Soviet army who used the area as a training ground for heavy weapons, mainly tanks.

#### Urbanization

Several places near Fót, formerly good localities of Pannonian steppe elements, were built up. Human population in Fót, Göd and Dunakeszi is steadily increasing and the only larger natural sites close to these settlements are the steppe habitats and forests in the vicinity of Csomád and Fót. In consequence, bit by bit these areas are becoming sites for weekend and leisure activities. Illegal cross-country motorbike riding have already caused much damage to the vegetation of the Csomád and Fót sites.

#### Air pollution

Emissions of air-pollutants in the vicinity of Budapest have already heavily affected the *Pinus* plantations ("acid rain"). Industrial processes as well as increasing traffic will certainly continue to cause a strained environmental situation for decades. The surroundings of Budapest are suffering very badly from these effects.

#### Overcollecting

In spite of its restricted occurrence, *P. sephirus* can be found in almost all private collections in Hungary. It was repeatedly and heavily collected in Fót after its discovery. This is well documented: In the butterfly collection of the Hungarian Natural History Museum, Budapest, there are 700 specimens of *P. sephirus* from two localities. There is no evidence that the large populations of Fót have declined due to collecting activities over the years.

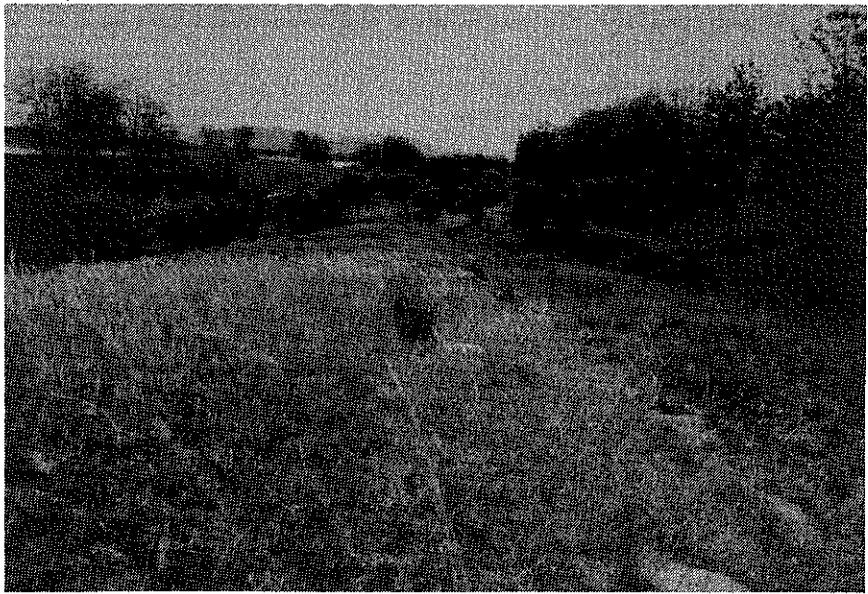


Fig. 5. Csomad, Gödi-árok (20.V.1992): *Astragalo-Festucetum rupicolae*. (Photo Z. Bálint).

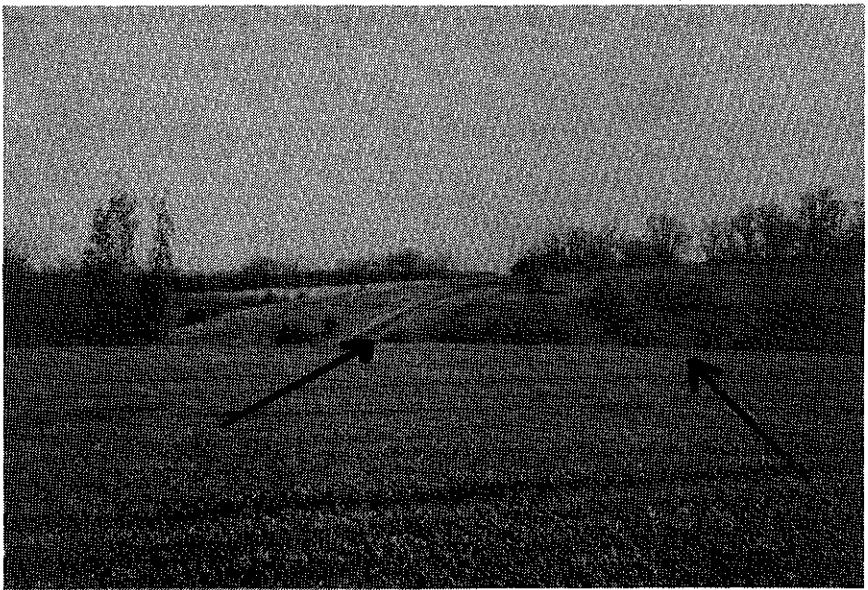


Fig. 6. Locality Csomad, Gödiárok; arrows indicate damage caused by cross-country motorbike racing. (Photo Z. Bálint).

#### 4.2. Suggestions for the management and conservation

In view of the aforementioned harmful factors affecting *P. sephirus* and its localities, it is most likely that some small isolated populations will become extinct in the foreseeable future. The maintenance of *P. sephirus* as part of the natural heritage of the Pannonian region requires active conservation measures. Unique ecosystems like the calcareous sandy steppe habitats in the vicinity of Budapest still contain a substantial proportion of the original biodiversity of Pannonia. The only promising way of protecting *P. sephirus* is to protect sufficiently large habitats as a whole, i.e. to protect the biocenosis. Even then, only a few large populations of *P. sephirus* are likely to survive indefinitely. The following measures are to be taken:

- (1) All habitats of *P. sephirus* must be protected. In particular, the localities between Csomád and Göd must be declared a Nature Reserve. The administration of this area should work hand in hand with the Nature Reserve Fót. The two reserves should be managed together. Alternatively, the new Nature Reserve Csomád-Göd could be included in the of Kiskunság National Park, which was founded on several smaller or larger isolated valuable habitats.
- (2) The area of the open sandy steppes must be enlarged by felling the *Pinus* and *Robinia* woods. New afforestation must be forbidden in all relict steppe areas. To re-create steppe-like habitats, the clearings have to be extensively grazed by sheep in the first years to keep the vegetation low. Controlled burning each autumn at least in the first years is recommended (steppe elements are well adapted to withstand regular fires). Sowing of indigenous steppe plants (e.g. *Astragalus*, *Iris*, *Salvia*, *Thalictrum*) could help to recreate seminatural plant communities, should natural re-invasion fail (e.g. if the areas concerned are too far away from remaining steppe habitats).
- (3) Human activities in the reserves must be strictly controlled. Illegal building, ploughing-up, setting-up of sheep-pens, etc.) should be heavily fined. Collecting of *P. sephirus* is to remain forbidden (purely scientific purposes excepted).
- (4) Successful protection is impossible without the support from the public. Educational measures at all levels are necessary to promote the value of the protected habitats as part of the natural heritage of Pannonia and to inform the public.
- (5) The ecology (biocenology) and behaviour of *P. sephirus* is to be studied in detail. In particular, the hostplant associations and the symbiosis with ants require further study, since both aspects may be crucial for the long-term survival of the species. There is no indication that the conservation of *P. sephirus* requires inclusion of special measures to protect the associated ant fauna; the dominant ant-associate is also the most abundant ant species of intact steppe habitats.
- (6) All known populations should be monitored, even after the establishment of nature reserves. Special surveys of all potential *P. sephirus* localities are necessary to complete our knowledge of all existing populations.

## 5. OUTLOOK

*P. sephirus* and its relatives form a taxonomic group of xeromontane origin. *P. sephirus* is a characteristic member of a forest-steppe ecosystem, which is today strongly influenced by human activities. The forest-steppe ecosystem has made a valuable contribution to the unique species-composition in Europe (VARGA 1989).

In spite of the present endangered status and strong fragmentation of complex oreal biota in the cultivated regions of Europe, the vitality of oreal elements is obvious. Many oreal species, including members of the *pylaon* complex (BALINT & KERTÉSZ 1990b; ROSE 1988; NEKRUTENKO 1975; SHELDON 1914), are able to colonize certain anthropogenic secondary biotopes. Several agricultural pests, but also other Lepidoptera species typical for anthropogenic open habitats are of oreal, and mainly of xeromontane origin (e.g. *Polyommatus icarus*, *Pieris* spp., *Agrotis exclamacionis*, *Autographa gamma*). Accordingly, the western Palaearctic relict species of the oreal biome are of special significance for the European fauna, and their preservation should attain high international priority. *P. sephirus* may become a hallmark for this important conservation task.

The close Westpalaearctic relatives of *P. sephirus* - *P. hesperioides* and *P. trappi* - are threatened or protected by law in Europe (GEIGER 1987; GONSETH 1987; VARGA 1989a; VIEDMA & GOMEZ-BUSTILLO 1976). This is due to the fragmented distribution of all these taxa as a consequence of their glacial and postglacial history. Some of *P. sephirus* relatives live in nature reserves or national parks: *P. martini*, *P. trappi*, *P. zephyrinus*, *P. usbekus*, *P. pylaon*. If these reserves receive proper management, their survival is probably secure. Nevertheless, further ecological research is necessary to secure their long-term existence.

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## 7. ZUSAMMENFASSUNG

*Plebeius sephirus* ist der südosteuropäisch-vorderasiatische Vertreter der *pylaon*-Artengruppe. Im pannischen Raum existiert *P. sephirus* nur noch in isolierten Kolonien. Die Art ist streng an Reliktstandorte von Waldsteppen-Gesellschaften gebunden, die westlichsten Vorkommen liegen in der Umgebung von Budapest. Futterpflanze der Raupen sind Astragalus-Arten, in der Umgebung von Budapest ausschließlich *A. exscapus*. *P. sephirus* ist einbrütig mit Imaginalfl-

lugzeit im Mai/Juni. Die Raupen überdauern den trockenen Sommer und kalten Winter in einer langen Diapauseperiode. Ältere Raupenstadien sind stark myrmekophil und werden vor allem von Ameisen der Gattung *Lasius* besucht. Eine spezifische oder gar obligate Bindung an bestimmte Ameisen liegt anscheinend nicht vor, doch bedarf die Larvalökologie von *P. sephirus* weiterer Klärung. Die verbliebenen Kolonien von *P. sephirus* sind durch anthropogene Einflüsse stark bedroht, insbesondere durch land- und forstwirtschaftliche Übernutzung der Habitate, aber auch durch Bauvorhaben, Freizeitnutzung und möglicherweise durch Schadstoffeintrag. Ein Schutz dieser Populationen, und zugleich ein Schutz der letzten Waldsteppenrelikte im östlichen Mitteleuropa, kann nur durch Schutz der gesamten Biozönosen erzielt werden. Ausweisungen von Schutzgebieten sind dringend geboten. Zudem müssen ökologische Forschungen zur Lebensweise und den Habitatansprüchen von *P. sephirus* fortgesetzt werden, um gegebenfalls spezifische Schutzprogramme zu etablieren.

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### Literaturspiegel

J. BLAB et al.:

**Sauvons les Papillons.**

Duculot, Paris (F) 1988. 192 pp., col. ill. ISBN 2-8011-0758-1. Price not stated. (Hardback 20 x 27 cm).

Das vorliegende Buch ist die französische Ausgabe des bekannten populärwissenschaftlichen Buches "Aktion Schmetterling" des Ravensburger Buchverlages, von einem der führenden Lepidopterologen Frankreichs, G.C. LUQUET, ergänzt und französischen Verhältnissen angepasst. Das Buch richtet sich an den in der Lepidopterologie völlig unerfahrenen Anfänger und versucht, ihm die Problematik des Schmetterlingschutzes aus wildbiologischer Sicht verständlich zu machen. Die Gestaltung und die Bebilderung (Fotos von T. RUCKSTUHL) des Buches sind durchaus attraktiv; leider sind störende hart "geblitzte" Aufnahmen allzuoft anzutreffen, die vielen Experten nicht gut gefallen werden. Das Buch wendet sich aber eben nicht an Schmetterlingskundler, von Experten ganz zu schweigen.

Otakar Kudrna (August 1991)

E. de BROS & T. RUCKSTUHL:

**Unsere Schmetterlinge.**

Mondo-Verlag, Vevey (CH) 1989. 153 pp., coll. ill. (unnumbered). ISBN 2 88168 038 0. Price not stated. (Hardback 23 x 25 cm).

Als 1986 von den deutschen, österreichischen und schweizerischen Umweltverbänden die "Aktion Schmetterling" ausgerufen wurde, war das Werk "Tagfalter und ihre Lebensräume" der Lepidopterologischen Arbeitsgruppe vom Schweizer Bund für Naturschutz im fortgeschrittenen Stadium der Erstellung. So beschloß der Mondo-Verlag an der "Aktion Schmetterling" mit dem vorliegenden Buch "teilzunehmen". Es ist eine deutsche Übersetzung (von R. SCHNIEPER) der französischen Originalfassung des Textes von E. de BROS; die Bebilderung (Fotos von T. RUCKSTUHL) wurde übernommen; sie entspricht in etwa den Bildern des selben Autors im Buch "Aktion Schmetterling" des Ravensburger Buchverlages. Während das SBN Werk "Tagfalter und ihre Lebensräume" inzwischen in der Fachwelt hoch angesehen ist und einen großen Beitrag zum Schutz der Tagfalter in Mitteleuropa geliefert hat, richtet sich der attraktiv bebilderte und gestaltete Band von BROS & RUCKSTUHL an den Anfänger und versucht, ihm schmetterlingskundliche Grundkenntnisse zu vermitteln, wozu die Fotos in entscheidenum Maße beitragen. Der Text ist eine vereinfachte Darstellung der Biologie (s.l.) der Tagfalter der Schweiz, mit einigen Absätzen über die am besten bekannten und attraktivsten Arten der Nachbarländer. Naturfreunde werden an diesem Buch bestimmt viel Freude haben.

Otakar Kudrna (August 1991)

R. CABO:

**Spanien. Reiseführer Natur.**

BLV Verlagsgesellschaft, München (D) 1991. 239 pp., unnumbered col. figs. and maps. ISBN 3-405-14078-1. Price 39,80 DM. (Sofback 15 x 21 cm).

Spanien ist das zweitgrößte Land der EG und zeichnet sich durch eine für euro-

päische Verhältnisse niedrige Bevölkerungsdichte aus. Die spanische Natur wird bis heute über großen Landstrecken nur extensiv genutzt, wozu u.a. eben die niedrige Bevölkerungsdichte positiv beigetragen hat. Darüberhinaus ist die Natur Spaniens sehr vielfältig. Der Nordwesten ist stark atlantisch beeinflußt, im Südosten findet man wüstenartige Landschaften; das Relief ist durch die zahlreichen Gebirge geprägt, wovon das höchste, die Sierra Nevada im Süden Spaniens, nahe der Mittelmeerküste und Nordafrika liegt und mit den Gipfeln Veleta und Mulhacen 3398 bzw. 3293 m NN erreicht. Der vorliegende Reiseführer informiert auf hervorragende Weise über typische Landschaften Spaniens und ihre Pflanzen- und Tierwelt (mit zahlreichen Farbfotos und einigen Landkarten ausgewählter Gebiete). Außerdem informiert er über einige die spanische Natur prägende Aspekte, wie Forstpolitik, Espartogräser, Stierkampf, Geier, Jagd, Naturschutz und schlägt ausgewählte Reiseziele vor. Man findet auch Informationen über Klima, Entstehung, naturräumliche Gliederung, Landkarten, Übernachtungsmöglichkeiten. Da Spanien eine außerordentlich interessante und reiche Schmetterlingsfauna besitzt, die sehr viele Endemismen enthält, und sich gerade die Tagfalter gut beobachten lassen, sucht der interessierte Leser nach entsprechenden Angaben. Leider findet er nur ganz wenige Fotos und einige nichtssagende Sätze über Arten wie *Parnassius apollo* oder *Zerynthia rumina* und *Thaumatepoea pityocampa*. Trotz der ungenügenden Behandlung der Schmetterlinge empfehle ich das sonst schön gestaltete und gut ausgewogene Buch jedem Lepidopterologen, der nach Spanien fährt. Dem Verlag empfehle ich für die nächste Auflage dringend, den Reichtum und einige der typischen Arten bzw. Endemismen der spanischen Schmetterlingsfauna entsprechend zu berücksichtigen.

Otakar Kudrna (Januar 1992)

A.M. EMMET:

The Scientific Names of the British Lepidoptera.

Harley Books, Colchester (GB), 1991. 268 pp., 7 pls. ISBN 0 946589 35 6. Price £ 24.95 (Softback 15 x 23 cm) or £ 49.95 (Hardback, ISBN 0 946589 28 3).

The well produced paperback under review is a remarkable product of the author's combined expert knowledge as an acknowledged lepidopterist and classical scholar. After the Foreword and an Introduction the book opens with a most interesting chapter: A History of Scientific Nomenclature of Lepidoptera. This is followed by the "Systematic Section" listing in systematic order all 2496 (numbered) species of British Lepidoptera arranged according to families and genera, including the name of the author and the year of publication, placed in parenthesis if the name is currently treated in a non-original combination. For each name listed, the meaning with an appropriate reference to Latin or Greek is listed, often supplemented by notes. The book is completed by four appendices, references and an index. Appendix 1 lists persons commemorated in the scientific names of Lepidoptera"; Appendix 2 lists geographical names; Appendix 3 lists 35 (surprisingly few!) unresolved names; Appendix 4 corrects apparent errors in R.D. McLeod's "Key to the Names of British Butterflies and Moths". I found only one important point to criticize: the author failed to state the gender of genus-group names, a most regrettable omission in view of the rules contained in the International Code of Zoological Nomenclature valid at present. In spite of this, the book is a must for every taxonomist studying the Lepidoptera of Europe.

Otakar Kudrna (December 1991)

A.M. EMMET & J. HEATH (Editors):

The Moths and Butterflies of Great Britain and Ireland. Volume 7, part 2.

Harley Books, Colchester (GB), 1991; 400 pp., 7 col. pls., 3 figs., 28 maps. ISBN 0 946589 26 7. Price £ 55.50 (Hardback 21 x 26 cm).

Das o.a. monographische mehrbändige Werk wurde unseren Lesern schon im ersten Heft dieser Schriftenreihe vorgestellt und empfohlen. Das vorhandene Material für den siebten Band überschreitet den geplanten Umfang diese Werkteils bei weitem, wurde die Materie auf zwei Bände verteilt. Um den zweiten Teil nicht zu dünn erscheinen zu lassen, wurde er durch das Kapitel "Life History and Habits of British Lepidoptera" von A.M. EMMET ergänzt. In diesem Kapitel wurden in tabellarischer Form alle 2495 Schmetterlingsarten Großbritanniens und Irlands übersichtlich aufgelistet; für jede Art werden Informationen zur Entwicklungsgeschichte, Status, Verbreitung, Biotoptyp, Flugzeit und Nahrungspflanzen, teilweise mit Anmerkungen, angegeben. Das zweite Ergänzungskapitel "Resting Postures in the Lepidoptera" von M.W.F. TWEEDIE & A.M. EMMET enthält 64 Farbfotos. Ein drittes und letztes Ergänzungskapitel "Classification of the Lepidoptera" von M.J. SCOBLE bietet eine kompakte und empfehlenswerte Übersicht der Schmetterlingsklassifikation der Vergangenheit und begründet die gegenwärtige, moderne Auffassung. Die "Systematic Section" beträgt in diesem Band nur etwa ein Viertel des Gesamtumfangs. Es werden nur fünf kleine Familien behandelt, drei davon gehören zu Bombycoidea, drei zu Geometroidea. Ob diese Lösung wirklich die einzige mögliche war, ist ohne Hintergrundinformationen schwierig zu beurteilen; die beste Lösung war es m.E. nicht. In diese Kritik darf jedoch nicht die Bearbeitung der fünf Familien einbezogen werden. Es sind Lasiocampidae von B. GOATER, Saturniidae von B. GOATER, Endromidae von M.R. YOUNG, Drepanidae von B. GOATER und Thyatiridae von B. GOATER. Jede Artmonographie behandelt die Nomenklatur, Beschreibung aller bekannten Entwicklungsstadien, die Unterscheidungsmerkmale (Vergleich mit ähnlichen Arten) und wird durch eine Verbreitungskarte abgerundet. Auch dieses Buch bestätigt das hohe Niveau der Serie, sowohl fachlich als auch verlagstechnisch, und kann empfohlen werden. Dabei ist zu beachten, daß bald auch dieser Band als ein hochwertiges Softback zum etwa halben Preis auf den Markt kommen wird.

Otakar Kudrna (November 1991)

M. FIBIGER & H. HACKER:

Systematic list of the Noctuidae of Europe.

Esperiana 2:1-109. Delta-Druck & Verlag; Schwanfeld (D) 1991. ISBN 3-9802644-1-6. Price 30,-- DM. (Hardback 17 x 24 cm).

Mit dem zweiten Band der Schriftenreihe Esperiana erhält der Leser ein systematisches Verzeichnis der europäischen Arten der Familie Noctuidae, und zwar mit 382 Anmerkungen und einem recht umfangreichen Verzeichnis zitiertter Literatur. Die mehrsprachige Einleitung (englisch, deutsch, französisch, spanisch, italienisch, dänisch und sogar russisch) erleichtert die Benutzung des Buchs. Die Gliederung des Systems schließt Unterfamilien, Gattungen und Untergattungen und Arten ein; die bei den Noctuiden nicht so üblichen Unterarten werden nicht behandelt, was nicht unbedingt als Nachteil zu bewerten ist. Wünschenswert wäre eher die Einbeziehung wichtigster Synonyme und Originalkombinationen mit den entsprechenden Angaben der Literaturquellen. Offensichtlich wollte man (leider) der kommenden Monographie der Noctuiden Europas vorgreifen. Ein alphabetischer Index - unterteilt in Gattungs- und Artennamen - rundet die Arbeit ab. Das Buch ist auf Kunstpapier gedruckt und gut gebunden, was bei einer Publikation dieser Art zwar selbstverständlich sein sollte, aber leider nicht immer ist. Dem Verlag wünschen wir eine glückliche Hand bei der Wahl der nächsten Themen für den dritten Band der Esperiana.

Otakar Kudrna (März 1992)

D.J. FUTUYAMA:

Evolutionsbiologie.

Birkhäuser Verlag, Basel (CH), 1990. 679 pp., ill; ISBN 3 7643 2200 4. Price 118,-- DM (Hardback 18 x 25 cm).

Das vorliegende Buch ist die deutsche Übersetzung eines amerikanischen Bestsellers unter den Lehrbüchern der Biologie, der gleichzeitig als ein sehr empfehlenswertes Nachschlag- und Standardwerk betrachtet werden kann. Der Umfang der Evolutionsforschung ist in den letzten Jahren stark gewachsen und umfasst jetzt Fächer wie Biochemie, Molekularbiologie, Physiologie, Genetik, Entwicklungsbiologie, Morphologie, Anatomie, Ethologie, Ökologie und nicht zuletzt Populationsbiologie. Die Auflistung dieser Disziplinen allein ist ein Argument für den Kauf dieses Werkes. Nur stichwortartig können hier einige der interessantesten im Buch behandelten Themen erwähnt werden: Ursprung und Einfluss des evolutionären Denken; ökologischer Kontext des evolutionären Wandels; Vererbung: Wandel und Bewahren; Variation; Populationsstruktur; genetische Drift; natürliche Selektion und Genfrequenzen; Selektion anhand polygener Merkmale; Artbildung; Anpassung; Erforschung der historischen Evolution; fossile Überlieferungen; Geschichte der biologischen Diversität; Biogeographie; Entstehung evolutionärer Neuheiten; Evolution auf molekularer Ebene; Evolution der Wechselwirkung zwischen Arten und Evolution des Menschen. Das sehr gut gelungene Buch ist mit einem detaillierten Glossar und einem umfangreichen Literaturverzeichnis abgerundet. Es gibt einen ausgezeichneten Überblick über das gesamte Spektrum der Evolutionsbiologie im weitesten Sinne und wird zu einem günstigen Preis angeboten. Der Lepidopterologe findet Schmetterlinge als Evolutionsmodelle ausreichend berücksichtigt und wird sich besonders für die Kapitel "Variation" und "Artbildung" interessieren.

Otakar Kudrna (Oktober 1991)

S. GROVE, G. HERBERT (Autoren) & J. NORTON (Illustrator):  
*Butterflies of the Southern Chalk Downlands*.  
British Butterfly Conservation Society, Loughborough (GB) 1987; 24 pp., ill.;  
ISBN 0 9512452 2 8. Price f 1,-- (Softback A5).

Die zweite Broschüre aus der Schriftenreihe der Britischen Gesellschaft für Schmetterlingsschutz behandelt in einer gut verständlichen und sachlichen Bearbeitung die Tagfalterarten der berühmten "Southdowns", einer der zweifellos artenreichsten Regionen Englands. Es werden insgesamt 14 Tagfalterarten behandelt (Verbreitung, Biologie, Phänologie, Schutz): *Polyommatus bellargus*, *P. coridon*, *Cupido minimus*, *Aricia agestis*, *Hesperia comma*, *Thymelicus acteon*, *Hamearis lucina*, *Argynnis aglaja*, *Euphydryas aurinia*, *Melanargia galathea*, *Callophrys rubi*, *Pyrgus malvae*, *Erynnis tages* und *Polyommatus icarus* (überraschenderweise in dieser Eindnung!). Ausgeschlossen wurden alle Ubiquisten und andere weitverbreitete Arten, die auch gelegentlich auf den "Chalkdowns" beobachtet werden können. Die Autoren beschreiben auch die Eigenschaften und Charakteristika des Biotoptyps. Den Schluß bilden eine Übersichtskarte der wichtigsten "Chalk Southdowns" in süd-östlichen England und eine Tabelle zu ihrem Status und genauen topographischen Lage sowie Hinweise für ihre Besucher. Hiermit wird die (erfolgreiche) englische Philosophie des Naturschutzes (etwa "Kennenlernen und dadurch Schützen") im Vergleich zu der deutschen (etwa "Schützen durch Angst und Schüren") wieder einmal deutlich.

Otakar Kudrna (November 1991)

L.G. HIGGINS & N.D. RILEY:  
*Guide des Papillons d'Europe*. (Ed. 3)  
Delachaux & Niestle, Paris (F) 1988. 455 pp., 63 col. pls., 384 maps, unnumbered figs. ISBN 2-603-00638-X. Price not stated. (Hardback 14 x 20 cm).

Der 1970 zum erstenmal erschienene "Field Guide to the Butterflies of Britain and Europe" ist in der Fachwelt so bekannt und in so viele europäische Sprachen übersetzt worden, daß eine allgemeine Beschreibung nicht notwendig ist. Noch weniger notwendig erscheint mir, das wohl bekannteste europäische Tagfal-

terbuch zu loben bzw. die überall bekannte Schwächen, vor allem was die Abbildungen anbelangt, im Detail zu erwähnen. Die nun schon dritte französische Ausgabe ist gegenüber der zweiten um drei Farbtafeln und um 35 Textseiten erweitert. Die Bedeutung der französischen Auflage für den nicht-französischen Benutzer liegt in erster Linie in der landesspezifischen Ausweiterung im Hinblick auf die französische Tagfalterfauna (Verbreitungsangaben, Nahrungspflanzen, Unterarten etc.). Darüberhinaus wurden auch einige Nordwestafrika betreffende Angaben gemacht bzw. überarbeitet. Deshalb lohnt sich den Kauf dieses Buches für jeden Lepidopterologen, der sich für die französischen Tagfalter besonders interessiert. Dies ist vor allem im Hinblick auf die unglaubliche Tatsache zu sehen, daß es überhaupt kein modernes und vollständiges Bestimmungswerk oder faunistische Bearbeitung der Tagfalter Frankreichs gibt. Bedauerlicherweise setzt sich der gegenwärtige französische Trend - "Atomisierung" der Tagfaltergattungen - auch in diesem Buch fort. So wurden aus der gut definierbaren Gattung *Limenitis* gleich drei monotypische genera: *Limenitis populi*, *Ladoga camilla* und *Azuritis reducta*, um nur ein Beispiel zu nennen. Diese (vor allem, aber nicht nur französische) "Modeerscheinung" ignoriert die Ergebnisse taxonomischer Forschung.

Otokar Kudrna (September 1991)

**H. HINTERMEIER & M. HINTERMEIER:**

**Schmetterlinge im Garten und Landschaft.**

Bayerischer Verband für Gartenbau und Landespflege, München (D) 1991. 143 pp., 51 col. pls.; ISBN 3-87596-094-7. Price 16,- DM. (Softback 21 x 20 cm).

Hinter diesem Titel verbirgt sich eine Neuauflage der schönen, jedem Lepidopterologen gut bekannten Farbtafeln aus der von H. REBEL verfassten 9. Auflage des "Berge's Schmetterlingsbuches", allerdings von den ursprünglichen ca. 18 x 24 auf nur 14 x 18 cm reduziert. Der Text beschränkt sich neben einer sehr vereinfachten Einführung in die Lepidopterologie auf eine Legende zu den Abbildungen: Namen, Flugzeit, Vorkommen, Futterpflanzen, Verbreitung etc. in stichwortartiger Darstellung. Darüberhinaus wird der Lebensraum "Garten" aus lepidopterologischer Sicht kurz behandelt, mit Angaben zu Schmetterlingsarten, Blütenpflanzen und Gefährdung. Das Buch ist auf Kunstpapier gedruckt und die Qualität der Farbtafeln besser als in den meisten Schmetterlingsbüchern auf dem Markt; der Text soll hier nicht unter die Lupe genommen werden. Schade, daß der Verlag nicht rechtzeitig einen Lepidopterologen um Rat gebeten bzw. mit der Herausgabe dieses Werkes beauftragt hat! Für nur etwas mehr Geld hätte hier ein modernes einbändiges Bestimmungs- und Nachschlagewerk (mit den Farbtafeln in Originalgröße) zu günstigem Preis mit dem Potential zum Bestseller auf diesem Gebiet entstehen können. Zwar gebührt dem Verlag ein Lob für die Idee und den niedrigen Verkaufspreis, aber der große Wurf wurde eben verpasst.

Otokar Kudrna (Januar 1992)

**H. KÖHNERT:**

**Blumenkinder.**

Verlag Mlakar, Judenburg (A) 1990. 160 pp., ill.; ISBN 3 900289 22 0. Price not stated. (Hardback 15 x 21 cm).

Wie der Titel vermuten läßt, ist die vorliegende Veröffentlichung ein populärwissenschaftliches Buch Untertitel: "Vom Leben der Schmetterlinge"), das sich in erster Linie an den mit den Schmetterlingen nicht vertrauten Anfänger wendet. Ein solches Buch kann nicht mit strengen Maßstäben gemessen werden. Der Text besteht aus einem allgemeinen und einem speziellen Teil. Wie die meisten alten Schmetterlingsbücher beginnt es im allgemeinen Teil mit einer einfachen Vorstellung der Schmetterlinge (Stellung im Tierreich, Körperbau, Entwicklungsgeschichte etc.) und endet mit der Übersicht über eine Auswahl von Arten,

Über die nur einige Grundinformationen geliefert werden. Darüberhinaus enthält das Buch einige wenige Sätze über die exotischen Falter der Tropen, einige Fau-chausdrücke werden erläutert und im Literaturverzeichnis einige gängige Schmetterlingsbücher zitiert. Die Bebilderung erfolgt z.T. in Farbe und besteht hauptsächlich aus Fotos ausgewählter Arten und einiger Fundorte. Die fotografische Qualität der Falteraufnahmen entspricht nicht dem gegenwärtigen Niveau; darüberhinaus handelt es sich offensichtlich z.T. um tote, auf Blüten und andere Gegenstände aufgesetzte Exemplare. Auch die Fundortaufnahmen lassen einiges zu wünschen.

Otakar Kudrna (Dezember 1991)

M. PAYNE (Autor) & J. NORTON (Illustrator):  
*Gardening for Butterflies.*

British Butterfly Conservation Society, Loughborough (GB) 1987; 16 pp., ill.; ISBN 0 9512452 1 X. Price £ 1,-- (Softback A5).

Das dritte bisher veröffentlichte Heft der Schriftenreihe der Britischen Gesellschaft für Schmetterlingsschutz behandelt das Thema der Schaffung, Gestaltung und Erhaltung eines schmetterlingsfreundlichen Gartens. Neben einer kurzen Behandlung der in einem Garten potentiell vorkommenden Tagfalterarten und der als Voraussetzung dazu notwendigen Pflanzen werden hier auch einfache Gartenbaupläne vorgestellt. Angesichts der Beliebtheit der Hobbygärtnerei und dementsprechenden Häufigkeit von Kleingärten überrascht die Inflation englischer Bücher zu diesem Thema kaum mehr. Die vorliegende Broschüre darf man zu den besten Arbeiten zum Thema rechnen.

Otakar Kudrna (Januar 1992)

T. RACHELI:

*Sinossi degli Zygaenini Italiani.*

Centro Internazionale di Studi e Ricerche per le componenti extrapaleearctiche della Fauna Italiana e Mediterranea, Roma (I) 1990. 174 pp., 7 col. pls., [28] maps, 5 figs. ISBN and price not stated. (Softback 17 x 24 cm).

This publication is a comprehensive taxonomic synopsis of the Italian species of the genus *Zygaena* by a specialist. All species are figured in colour on seven plates produced from photos of (about 300) set specimens; the legend provides full data on the specimens figured. This alone makes the publication one of the most important current treatments of the genus anywhere in Europe. The general part includes a brief treatment of some morphological and anatomical aspects, an identification key to Italian species (the inclusion of enlarged simplified drawings of the wing patterns would have surely been most useful), and an (in principle far too brief, but adequate for a synopsis s.s.) account of the larval host plants. Each of the 28 species monographs includes the following subheadings: nomenclature incl. synonymy, range, early stages, description, discussion and material examined. Distribution maps show localities of specimens examined and the supposed general distribution in Italy. The comprehensive bibliography lists almost 300 papers. The publication provides a sound basis for the study of Italian *Zygaena* and will certainly find many readers. It is regretted that a similar work on *Zygaena* of C. Europe does not exist.

Otakar Kudrna (December 1991)

A.M. RILEY:

*A Natural History of the Butterflies and Moths of Shropshire.*

Swan Hill Press, Shrewsbury (GB) 1991. 205 pp., 32 col. pls., 8 figs., [36] maps. ISBN 1 85310 249 0. Price £ 10.95 (Softback 15 x 21 cm).

Bei dem vorliegenden Buch handelt es sich wieder um eine sorgfältige faunistische Veröffentlichung über Schmetterlinge von der Art, wie sie in Großbritannien fast schon zum Standard geworden ist. Nach der Beschreibung des Untersuchungsgebietes werden die im Shropshire festgestellten Arten auf drei Ebenen bearbeitet. Die Tagfalter werden besonders aufmerksam behandelt; für jede Art liegt eine kleine Verbreitungskarte vor. Die übrigen Macrolepidoptera werden verständlicherweise nicht so detailliert behandelt und ihre Verbreitung wird nicht graphisch dargestellt. Für die Inventarisierung der Microlepidoptera wird nur eine im Telegrammstil kommentierte Artenliste veröffentlicht. Alle im Buch erwähnten Fundorte sind in einem alphabetischen Index aufgelistet. Die Aufnahmen der Falter sind zwar farbig, aber fototechnisch nur durchschnittlich. Die Artenmonographien der Tagfalter sind ziemlich detailliert und bieten damit eine nützliche Grundlage für den Schutz der Arten der Grafschaft. Erfreulich ist, daß sich in Großbritannien offensichtlich der Trend weg von der Atomisierung der Genera langsam durchsetzt; so werden z.B. die Arten *euphrosyne* und *selene* der Gattung *Boloria* und die Art *aglaja* der Gattung *Argynnis* zugeordnet. Sieht man von den (meisten) Fotos ab, ein gut gelungenes, empfehlenswertes Buch, dessen günstiger Preis den Spenden heimatkundlicher Stiftungen und Vereine zu verdanken ist.

Otakar Kudrna (Dezember 1991)

C. STEEL, J. NORTON & A. WATERS:  
Woodland butterflies.

British Butterfly Conservation Society, Loughborough (GB) [1991]; 48 pp., ill.; ISBN 0 9512452 3 6. Price f 1,50. (Softback 15 x 21 cm).

Das neueste Heft der Schriftenreihe der BBCS behandelt 23 Tagfalter der Wälder Großbritanniens: *Apatura iris*, *Quercusia quercus*, *Thecla betulae*, *Satyrium pueri*, *S. w-album*, *Limenitis camilla*, *Gonepteryx rhamni*, *Celastrina argiolus*, *Boloria euphrosyne*, *Boloria selene*, *Argynnis paphia*, *Argynnis adippe*, *Melitaea athalia*, *Carterocephalus palaemon*, *Hamearis lucina*, *Erynnis tages*, *Pyrgus malvae*, *Pieris napi*, *Anthocharis cardamines*, *Leptidea sinapis*, *Polygonia c-album*, *Pararge aegeria* und *Aphantopus hyperantus*. Die Arten wurden nach dem Vorkommen ihrer Larven in drei ökologische Gruppen aufgeteilt: Bewohner der Bäume und Gebüsche; Bewohner der frischen Kahlschlagfluren; Bewohner der Waldwege. Alle Arten werden in Form kurzer, mit Strichzeichnungen durchsetzten Monographien behandelt; die Strichzeichnungen können jedoch gute Fotos oder Farabbildungen nicht ersetzen und müssen eher als gestalterisches Füllmaterial betrachtet werden. In der Einleitung werden die verschiedenen Waldtypen und ihre Tagfalterarten bzw. Verbreitung behandelt und Beobachtungsvorschläge gemacht. Zum Schluß werden Waldmanagement und Schutz der Waldarten kurz angesprochen und Informationen zu der zeitlichen Erscheinung der im Heft behandelten Arten gegeben. Damit entspricht auch dieses Heft der BBCS Schriftenreihe eher dem Interesse des fortgeschrittenen Amateurs. Erst am Ende des Heftes erfährt der Leser, wer die Autoren sind; das Jahr der Veröffentlichung wird im Heft nicht angegeben, was heutzutage aus bibliographischer Sicht nicht entschuldigt werden kann!

Otakar Kudrna (Januar 1992)

C. van SWAAY:

Bibliographie van de Nederlandse Dagvlinders.

De Vlinderstichting, Wageningen (NL) 1991. 165 pp. ISBN 90-72578-11-2. Price 25,- Hfl. (Softback 17 x 25 cm).

During the past decade the Author of this important publication collated 1463 publications relevant to the conservation of Dutch butterflies, concluding his work in 1988. The criteria for inclusion were: that the paper was published in

Dutch or specifically about the butterflies of the Netherlands or Flanders. Each paper was given certain key words and classified accordingly. Thus the chapter "Titles" is followed by the chapter "Index" including the key words as well as the species, genus and family names. In addition to this there is an English-German dictionary translating all the Dutch key words. To make the use of this book really easy, the introduction is written in three languages: English, German and Dutch. This is an excellent little book and I sincerely recommend it to any European lepidopterist, even if he takes only marginal interest in Dutch butterflies or in butterfly conservation.

Otakar Kudrna (November 1991)

I. WYNHOFF, J. van der MADE & C. van SWAAY:

Dagvlinders de Benelux.

De Vlinderstichting, Wageningen (NL), 1990. 187 pp., 44 col. pls., 8 b/w pls., [160] maps. ISBN 90 5011 034 7. Price 34,50 Hfl. (Hardback 13 x 21 cm).

The book under review is a guide for the identification of the butterflies of the Benelux countries: The Netherlands, Belgium und Luxemburg. All species are figured in colour, some smaller species are slightly enlarged, some larger ones somewhat reduced. Each species is shown ventrally and dorsally, in some cases both sexes and/or seasonal forms complete the picture. The colour plates are of photographic origin and exact dates of capture of all specimens are given in an appendix. There are no descriptions as we know them in most books: instead a brief diagnosis indicates the species specific features useful for identification. Thus the reader is provided with good colour photographs and told exactly what to look for. In addition to this, simplified line drawings depicting enlarged identification characters of "critical species" are included. In this respect the book is one of the best butterfly field guides I know. The fact, that this field guide, too, promises what it cannot fulfil: to facilitate correct identification of *Melitaea*, *Aricia*, *Plebejus*, *Lycaenidae* and some *Hesperiidae* species according to their wing markings, which are not constant, is regrettable; but perfect field guides probably do not exist. In the systematic section, similar species are arranged traditionally according to families and genera, with the exception of *Hamearis lucina* placed conveniently with *Argynnis paphia* on one plate. In the general part, the species are split into "biological groups" according to their mode of hibernation; I fail to see the practical use of this classification. The book is well produced and I would recommend it to anyone interested in the butterflies of Benelux only as long as he or she has mastered the Dutch. It is written in Dutch and this alone makes it hard to use for anyone not familiar with the language; this is stepped-up by the extensive use of Dutch vernacular names for cross references between the species. Latin names are seldom used and so far as I could see never as cross-references in the text. Apart from the Dutch names, English, German and French names are listed on the plates facing pages; needless to mention that as there is no standard German vernacular butterfly nomenclature and everyone can use the name ones choice. Centuries ago, Carolus Linnaeus invented a universal nomenclature and generations of biologists followed, aware that the universal system of names is the only means of communication. I have always admired old, now often disgraced collectors, who in spite of their often only basic education, managed to learn a few hundred Latin names from their books. Is the new generation of butterfly watchers of united Europe lazy to learn a few Latin names? Are they inventing new "national vernacular systems of zoological names" unaware of the confusion they are bringing about?

Otakar Kudrna (Februar 1992)