

Hesperioidea and Papilionoidea of the Ionian island of Kefaloniá, Greece : Additional species and a review of faunal components (Lepidoptera)

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Summary

Lepidoptera in some regions of Greece have been studied intensively during the last 20 years, but those of the large Ionian island of Kefaloniá (38°15'N, 20°30'E) remain poorly known. The present article reports on 16 additional butterfly species not encountered by Gaskin and Littler (1986), bringing the confirmed total to 45, although this number will surely increase with further surveys. The recorded composition of the butterfly fauna of Kefaloniá is reviewed in the context of the ecology and historical biogeography of the region and it is speculated why some ubiquitous species have yet to be recorded.

Résumé

Les Lépidoptères de quelque régions de la Grèce ont fait l'objet de recherches intensives durant ces vingt dernières années ; ceux de l'île Ionienne de Céphalonie (38°15'N, 20°30'E) sont en revanche peu connus. Le présent travail signale 16 espèces de Lépidoptères diurnes que Gaskin & Littler (1986) n'avaient pas trouvées, ce qui donne un total de 45 espèces. ce nombre sera certainement encore accru par de nouvelles recherches. La composition de la population des Lépidoptères diurnes connue de Céphalonie est appréciée sur le plan de l'écologie et de la biogéographie historique de la région. L'auteur se demande pourquoi certaines espèces ubiquistes n'ont pas encore été signalées.

Introduction

The butterfly fauna of several regions of Greece has been studied quite intensively. However, except for Kérkira (Corfu) (Baldock & Bretherton, 1981), the islands of the Ionian chain have been rather neglected. I have found no published accounts specific to the Lepidoptera of Kefaloniá, although four major studies of the flora have been published (Heldrich, 1882 ; Bornmüller, 1928 ; Cufodontis, 1936, & Knapp, 1965). Gaskin

& Littler (1986) surveyed 13 sites across Kefaloniá during the first half of May 1983, but three large areas, the mid-south-east, mid-north central and the south coast could not be investigated. Most of these localities were re-examined and seven new sites, all in the three regions missed in 1983, were surveyed in the first half of June 1992. The sites at Lássi and Minía were found to have been drastically modified by developments associated with the tourist industry.

Methods

Each site was examined by two observers for a minimum of two hours and for half a day whenever possible (see Fig. 1). Priority was given to focal searches of each discernible type of habitat to maximize potential contact with all species flying at each locality. There is as yet no universally accepted system of anglicizing Greek place names. In this contribution I follow Gaskin & Littler (1986), in spelling names of most localities as in the Toubis series of maps of the Grecian islands, which are published in Athens and widely available to visitors. In cases where these are clearly at odds with the pronunciation of demotic Greek, e.g. "Chíos", I have followed the Times Atlas (Bartholomew *et al.*, 1990), in this case "Khíos", which is a more accurate rendition. On the other hand, the Toubis version "Kefaloniá" is far more often used than the Times Atlas "Kefallinía" !

Results

The forty species observed during the first half of June 1992 are given below ; the 16 recorded for the first time on Kefaloniá are indicated by asterisks. Five species were recorded only in May 1983 : *Papilio alexanor* Esper, 1799, *Euchloe ausonia* (Hübner, 1804), *Gonepteryx rhamni* (Linnaeus, 1758), *Callophrys rubi* (Linnaeus, 1758), and *Glaucopteryx alexis* (Poda, 1761).

Hesperioidea

Spialia orbifer (Hübner, [1823]) : ENS, TZA.

Carcharodus alceae (Esper, 1780)* : AGN, PLA.TZA.

Carcharodus orientalis Reverdin, 1913* : AGN.

Thymelicus acteon Rottemburg, 1775* : PDK, TZA.

Thymelicus flavus (Brünnich, 1763) : AGN, CAG, ENS, PDK, TZA, VAV.

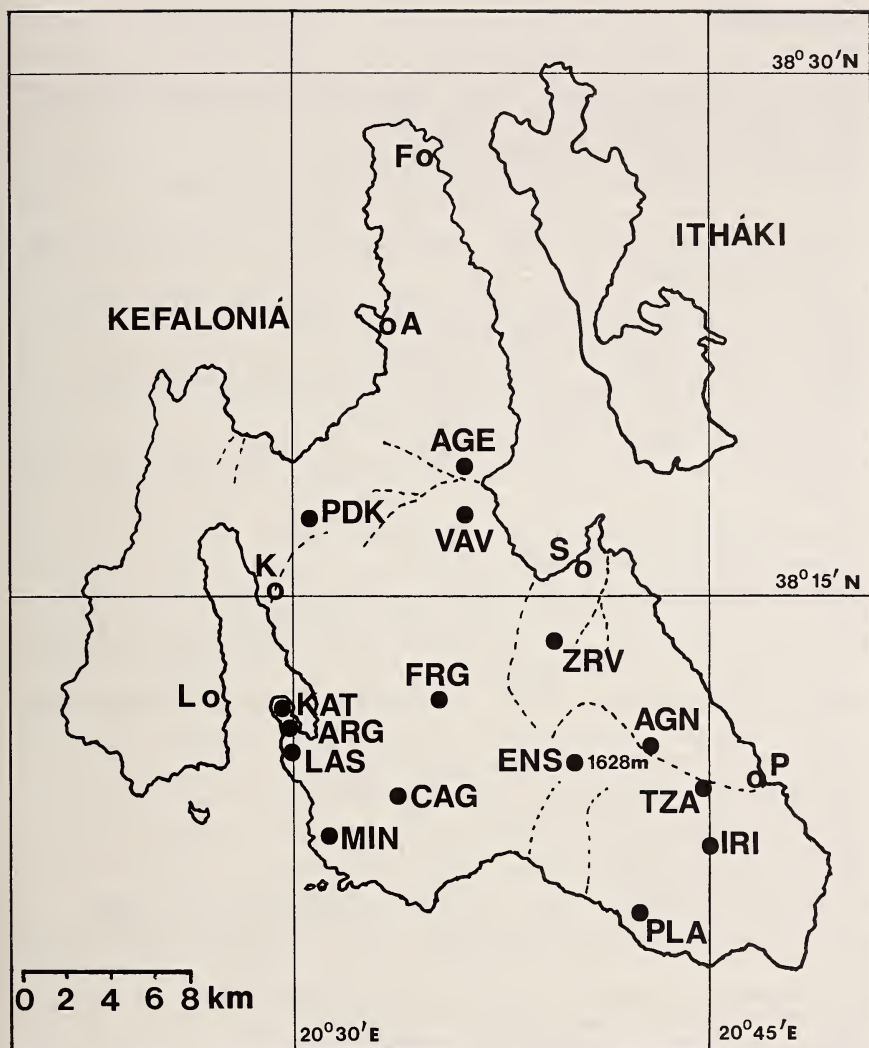


Fig. 1. Butterfly observation sites on Kefaloniá. June 1992 (solid circles): Ag. Eufímia AGE; Ag. Nikoláos AGN; Argostóli ARG; Castle of Ag. Giórgios CAG; Mt. Énos ENS; Frangáta FRG; Perdikáta PDK; Platies PLA; Tzanatá TZA; Váthi Avláki VAV; Zerváta ZRV. Four 1986 sites were unproductive in 1992; Ag. Iríni IRI; Lássi LAS; Katavóthres KAT, and Miniá MIN. Other sites worked by Gaskin and Littler (1986) are shown by open circles and identified by single letters: Ássos A; Fiskárho F; Kouroukláta K; Lixouíri L; Póros P; and Sámi S. Broken lines indicate seasonal or subterranean water-courses.

Papilionoidea

- Papilio machaon* Linnaeus, 1758 : CAG.
Iphiclides podalirius (Linnaeus, 1758) : AGN, CAG, FRG, PDK, TZA, ZRV.
Pieris brassicae (Linnaeus, 1758) : AGN, TZA.
Pieris rapae (Linnaeus, 1758) : ARG, PDK, TZA.
Aporia crataegi (Linnaeus, 1758) : AGN, ENS, PDK, TZA, ZRV.
Colias crocea (Fourcroy, 1785) : AGN, CAG, ENS, PDK, PLA, TZA.
Gonepteryx farinosa (Zeller, 1847) : AGE, AGN, CAG, ENS, FRG, PDK, PLA, TZA, VAV.
Gonepteryx cleopatra (Linnaeus, 1767) : AGN, CAG, ENS, FRG, PDK.
Leptidea sinapis (Linnaeus, 1758) : CAG, FRG, TZA.
Charaxes jasius (Linnaeus, 1776)* : TZA, VAV.
Limenitis reducta Staudinger, 1901 : AGN, ENS, PDK, PLA, TZA, VAV.
Nymphalis polychloros (Linnaeus, 1758)* : TZA.
Polygonia egea (Cramer, 1775) : CAG, TZA.
Cynthia cardui (Linnaeus, 1758) : AGN, CAG, ENS, FRG, PLA, TZA, VAV, ZRV.
Vanessa atalanta (Linnaeus, 1758) : AGE, CAG, VAV.
Argynnis paphia (Linnaeus, 1758)* : TZA.
Melitaea didyma (Esper, 1779)* : CAG.
Hipparchia syriaca (Fruhstorfer, 1908) : ENS, PDK, VAV.
Hipparchia volgensis Mazochin-Porshjakov, 1952* : AGE, AGN, CAG, ENS, FRG, PDK, TZA, VAV, ZRV.
Maniola jurtina (Linnaeus, 1758) : AGE, AGN, CAG, ENS, FRG, PDK, TZA, VAV, ZRV.
Coenonympha pamphilus (Linnaeus, 1758) : CAG.
Lasiommata megera (Linnaeus, 1767) : ENS, PLA.
Lasiommata maera (Linnaeus, 1758) : CAG.
Pararge aegeria (Linnaeus, 1758)* : CAG, TZA.
Kirinia roxelana (Cramer, 1777)* : TZA.
Nordmannia ilicis (Esper, 1779)* : AGN, CAG, ENS, FRG, TZA, VAV.
Strymonidia spini (Denis & Schiffermüller, 1775)* : AGN, CAG, FRG, PDK, PLA.
Lycaena phlaeas (Linnaeus, 1761) : AGN, ENS, PDK, TZA.
Lampides boeticus (Linnaeus, 1767)* : CAG, FRG.
Syntarucus pirithous (Linnaeus, 1767)* : ENS.
Celastrina argiolus (Linnaeus, 1758)* : PDK, PLA, TZA.
Pseudophilotes vicrama (Moore, 1865) : AGN, CAG, FRG, PDK, PLA, VAV.
Aricia agestis (Denis & Schiffermüller, 1775) : CAG, ENS, PDK, PLA.
Agrodiaetus thersites Cantener, 1834* : AGN.
Polyommatus icarus (Rottemburg, 1775) : ENS, PDK, PLA.

Discussion

As on most Grecian islands, the extant butterfly fauna of Kefaloniá will have been influenced historically not only by physical and climatic

factors and the composition of the flora, but also by modification of habitats by human settlers and their domestic animals. This pre-dates the classical period, as Paleolithic and Neolithic stone tools have been found on Kefaloniá (Melas, 1985). The processes that structured the composition of the modern butterfly fauna of Greece are likely to be at least as complex as those described by Dennis (1977) for the British Isles.

For a preliminary and non-rigorous zoogeographic exercise from a "Graeco-centric" point of view, based on 216 species recorded for Greece to the early 1990s, I allocated the butterfly fauna of Greece to four distributional groups, using the maps of Higgins & Riley (1983) and information from subsequent publications by Coutsis (1984, 1986), Coutsis *et al.* (1989), Coutsis & Ghalas (1988; 1991), Fuchs (1987), Gallo (1989), Koutroubas (1991; 1992; 1993; 1994), Leestmans & Arheilger (1988), Olivier (1987; 1988; 1989a; 1989b; 1990; 1993), Van der Poorten (1981; 1985a; 1985b; 1990), Van der Poorten *et al.* (1988), Schmidt & Hasler (1986), Thomson (1985; 1987a; 1987b; 1990) and Vanholder (1993). Coutsis informed me very recently that the species total had now reached 223, but the increase does not modify present conclusions significantly.

Group I consists of 123 species, ubiquitous at least through central and southern latitudes of Europe, though some are restricted to specific habitats or altitude zones within this range. Because of the evolution of marked regional endemism I omitted most species of *Erebia*. Group II comprises 30 species with essentially Mediterranean distributions, Group III contains 45 which occur in Greece, but are confined to south-eastern Europe or penetrate into that region from the east, while Group IV consists of 18 species endemic to the Grecian peninsula or archipelagos. These numbers convert to the following percentages: Group I - 57%, Group II - 14%, Group III - 21% and Group IV - 8%. Equivalent values for the known butterfly fauna of Kefaloniá are: Group I - 71%, Group II - 18%, Group III - 11% and Group IV - 0%. A statistical comparison using a χ^2 test, with Groups III + IV lumped, showed that the frequencies differed significantly from those for Greece as a whole ($\chi^2 = 6.9$, $p < 0.05$). However, if Groups II, III and IV were lumped and compared with Group I, then the differences between Kefaloniá and Greece are not significant and χ^2 drops to 2.8 ($p > 0.05$).

The 45 butterfly species recorded from Kefaloniá to date depict a fauna typical of larger offshore islands, i.e. depauperate in comparison to the adjacent mainland, yet still reasonably representative. The dominance of Group I (wide-spread European) species on Kefaloniá is predictable.

Many of the butterfly species abundant in Greece are quite vagile, and some are seasonal migrants. The Ionian Islands have few central European elements in their floras (Turrill, 1929), but nevertheless, in some areas of the east coast of Kefaloniá narrow belts of deciduous trees, more typical of northern Greece and central Europe, crowd the margins of a few narrow and precarious riparian corridors. Four of the Group I species recorded on Kefaloniá in June 1992 were only in the riparian margins. Yela (1992) emphasized the importance of protecting such habitat to maintain biodiversity in Iberian ecosystems ; this should be a consideration in conservation strategies in Greece also. Other Group I species, locally abundant on the mainland, but perhaps less vagile, have yet to be recorded from Kefaloniá, e.g. *Melanargia galathea* (Linnaeus, 1758), *M. larissa* (Geyer, 1828) and *Hyponephele lupina* (Costa, 1836). Such taxa best exhibit movement when suitable habitat is continuous (Shreeve, 1992), so presumably these species might be poor candidates for successful island-hopping.

As one might anticipate from its geographical position, the proportion of Group II species (Mediterranean) reported from Kefaloniá is not dissimilar to that of the mainland, while the under-representation of Group III (south-eastern) species reflects Kefaloniá as an offshore island at the western extremity of the Grecian peninsula, relatively distant from the source.

The lack of endemic elements in the Kefalonian flora noted by Heldrich (1982), Bornmüller (1928), Cufondontis (1936), Knapp (1965) and Polunin (1980) is consistent with relatively recent and perhaps frequent links to the mainland during the Pleistocene. The probability of finding insect species endemic to Kefaloniá is low in these circumstances. Many butterflies endemic to Greece are characteristic of and restricted to montane habitats, so the lack of such Group IV species on Kefaloniá is not surprising. The central Énos (Aínos) Massif may have supported a true alpine fauna at some time in the past, but it is too small in area, too low and too far south to support one in the present climatic regime (see Huxley & Taylor, 1984 and Sfikas, 1987).

Nevertheless, there are still puzzles to be solved. The coastal islands of the eastern Aegean Sea also have a complex (and better understood) history of connections and segregations during the late Tertiary and Quaternary (Dermitzakis, 1990 ; Dermitzakis & Goedicke, 1977 ; Dermitzakis & Sondar, 1979 ; Muelencamp, 1985), yet in this region three endemic butterflies have been discovered recently. These are *Maniola chia* Thomson, 1987 on Khíos, *M. halicarnassus* Thomson, 1990 on Níssiros (also on Bodrum Peninsula) and an endemic sub-

species, *Satyrium ledereri christiana* Olivier, 1989, on Sámos. More may be identified (Olivier & Coutsis, 1993 ; Thomson, 1990), despite isolation of the islands from the mainland of Turkey that is unlikely to be much older than 20,000-75,000 B.P. Yet Kefaloniá (33 km from Pelopónnisos, 40 km from Stereá) is about twice as far from the mainland of western Greece as are Khíos (12-19 km) and Sámos (11 km) from the coast of Anatolia, and there is a trench of relatively deep water through the channel from Levkás, to the Gulf of Kiparissía off the west coast of the Pelopónnisos. However, if one takes into account the extended shelf that must have existed at various times in the Pleistocene around Itháki, Kálamos and other small islands between Kefaloniá and Levkás (19 km apart), distances were probably comparable. Probably there was and is, little hindrance to intermittent dispersal of vagile winged insect species between these islands and prevailing winds presumably play an important role in seasonal and year-to-year variations in such a flow. Perhaps some taxa are pre-disposed to more rapid rates of genetic segregation than others, and studies of morphology alone will not necessarily produce a good measure of this (Collins, 1991).

Detailed studies of butterfly populations on Kefaloniá will be necessary before the differences between the Ionian and the eastern Aegean regions can be fully understood. More basic surveys are also needed. The addition of another 10-15 species to the Kefalonian list after further research would not be surprising, because survey time expended on the island to date is still barely one month. Excursions in the spring should discover more pierids and the hotter months should produce more species of the larger satyrids of Groups II and III. Intensive attention to the riparian zones should be profitable in both cases. While discovery of *Nymphalis polychloros* and *Kirinia roxelana* on Kefaloniá were pleasant surprises, the failure to find *Anthocharis cardamines* (Linnaeus, 1758), *Pontia edusa* (Fabricius, 1777) and *Argynnis pandora* (Denis & Schiffermüller, 1775) can be ascribed perhaps to bad luck with timing or weather conditions. In general, however, I would predict that investigations will further increase the preponderant representation of Group I species on Kefaloniá.

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