

Observations on the biology and distribution of *Pseudophilotes barbaggiae* (Lycaenidae, Polyommataini)

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Summary. Present knowledge of the distribution of *Pseudophilotes barbaggiae* De Prins & van der Poorten, 1982 in Sardinia (Italy) and of the different species of plants and lepidoptera associated with it is presented. The ethology of the species is discussed. The scanning electron microscopic structure of the ovum is described in detail for the first time.

Zusammenfassung. Der gegenwärtige Kenntnisstand zur Verbreitung und Ethologie inklusive der assoziierten Tagfalter- und Pflanzenarten von *Pseudophilotes barbaggiae* De Prins & van der Poorten, 1982 auf Sardinien (Italien) wird diskutiert. Die Feinstruktur des Chorion wird mittels rasterelektronenmikroskopischer Aufnahmen erstmals beschrieben.

Résumé. Discussion des connaissances actuelles sur la répartition géographique et l'éthologie de *Pseudophilotes barbaggiae* De Prins & van der Poorten, 1982 en Sardaigne (Italie) et sur les plantes et lépidoptères associés à cette espèce. La structure de l'œuf, étudiée au microscope électronique à balayage, est décrite en détail pour la première fois.

Key words: Lycaenidae, *Pseudophilotes barbaggiae*, distribution, bionomics, Sardinia, Italy

Bionomics

Pseudophilotes barbaggiae De Prins & van der Poorten, 1982, a lycaenid butterfly endemic to central Sardinia (Italy), was described relatively recently. Previously, this rarely reported taxon had been reported as *Pseudophilotes baton* (Bergsträsser, 1779), which exists in Corsica (France) but not in Sardinia, as erroneously stated by Higgins & Riley (1983). Even Hartig (1975), who lived for many years in Sardinia, in Aritzo, a locality close to where *P. barbaggiae* occurs, only mentions *P. baton*. However, there are no specimens of *P. baton* (or *P. barbaggiae*) in his collection, now in the Piedmont Regional

Museum in Turin, nor in the Natural History Museum of Gavoi, a village close to Aritzo, in which a series of butterflies collected by Hartig in Sardinia is also preserved.

Considering the substantial morphological differences between *P. baton* and *P. barbagiae*, it is surprising that the latter has not even been described as a subspecies of *P. baton*. Verity (1943) reports the presence of *P. baton* in Corsica and mentions that Ghiliani describes it as fairly common in Sardinia, but shows no specimen from this island.

In the past, *P. barbagiae* has apparently been neglected by lepidopterists. This can be attributed in the first place to the fact that very few specimens have been collected, as it is a very localized species, restricted to small areas scattered over the slopes of the Gennargentu mountains, the highest range in Sardinia, situated in the centre of the island. These localities have only recently become easily accessible. Moreover, although this univoltine butterfly is on the wing from the end of April to July, depending on the altitude, it lives only for 15–20 days in each locality.

The results of our observations over a period of four consecutive years (1992–1996) in Sardinia are reported here.

P. barbagiae is most common in May at an altitude of 800–1000 m, where the most numerous colonies are present (De Prins & van der Poorten, 1982; Riemis, 1984). A few specimens have been observed in July at higher altitudes, up to 1500 m and more: these have erroneously been attributed to a hypothetical second generation. *P. barbagiae* has been found to be much more widely distributed than formerly believed. It was originally found to the east of the Gennargentu mountain chain (whose highest peak is Punta La Marmora, at 1833 m), where it is not uncommon over an extension of many km² in widely scattered, limited, arid, uncultivated areas. The butterfly is also present north of the Gennargentu and has recently been found by Leighb west of these mountains, near Aritzo.

The number of individuals in each colony varies from year to year and is affected by the weather conditions. The distribution is very irregular in every single locality: where only isolated individuals have previously been found, 20–30 butterflies may be observed on another occasion within a few m².

The areas inhabited by *P. barbagiae* are characterized by distinctive geological and botanical features, but even here the distribution of the

colonies is very localized and discontinuous. *P. barbaggiae* prefers sunny, arid, rocky slopes facing south or south-west, with a scanty vegetation of sparse bushes or trees, a typically xerothermic montane habitat where the soil is very hot during the summer months, although due to the winter rains there is a fairly abundant low vegetation in springtime (corresponding to the flight period of the butterfly) (fig. 3).

In winter the temperature may fall below freezing point and there may be snow at the higher altitudes.

The underlying geological structure, typical of the Gennargentu range, consists of outcropping metamorphic palaeozoic rock covered by a thin layer of humus, forming irregular slopes and gullies.

The vegetation consists of bushes of *Erica arborea* L. and *Juniperus oxycedrus* L., clumps of *Stachys spinosa* L., *Lavandula stoechas* L., *Teucrium marum* L. and *Thymus herba barona* Loisel. The latter, which is the larval host plant of *P. barbaggiae*, is generally common over the Gennargentu range. Other plants that are present at 800–1000 m include *Asphodelus microcarpus* Salzm, *Rumex bucephalophorus* L., *Tunica* sp., *Cistus salvifolius* L., *Linaria pelisseriana* L (Miller), *Anthemis cotula* L., *Helichrysum saxatile* Moris and *Carlina corymbosa* L.

The most common butterflies that fly together with *P. barbaggiae* in May are *Coenonympha pamphilus* (Linnaeus, 1758), *Maniola nurag* (Ghiliani, 1852), *Lasiommata paramegaera* (Hübner, [1824]), *Lycaena phlaeas* (Linnaeus, 1761), *Polyommatus icarus* (Rottemburg, 1775), *Aricia cramera* (Eschscholtz, 1821), *Euchloe insularis* Staudinger, 1861, *Anthocharis cardamines* (Linnaeus, 1758), *Spialia therapne* (Rambur, 1832) and, rarely, *Aglais ichtnusa* (Hübner, [1824]) and *Papilio hospiton* Guenée, 1839, and among the day-flying moths *Zygaena corsica* Boisduval, [1828].

Behaviour

P. barbaggiae is active more or less from dawn to dusk. When the temperature is low, as in the early morning and in the evening, it rests with its wings open or slightly lowered in order to absorb as much heat as possible, whereas in the full sunlight it holds its wings closed over its body facing the sun (figs. 1, 2). It settles preferably on the stalks of *Teucrium* and thyme and on the leaves of asphodel and *Erica arborea*, rarely on the ground. Like many other lycaenid species, it often moves its hindwings in a rotatory fashion. At mid day, its flight is rapid and erratic and therefore hard to follow, also on account of



Fig. 1. *Pseudophilotes barbaggiae* on an asphodel leaf.



Fig. 2. *Pseudophilotes barbaggiae* on an asphodel leaf.



Fig. 3. Typical habitat of *Pseudophilotes barbaggiae* in May.



Fig. 4. Typical habitat of *Pseudophilotes barbaggiae* in August (clumps of *Thymus herba barona* shrivelled by the heat).

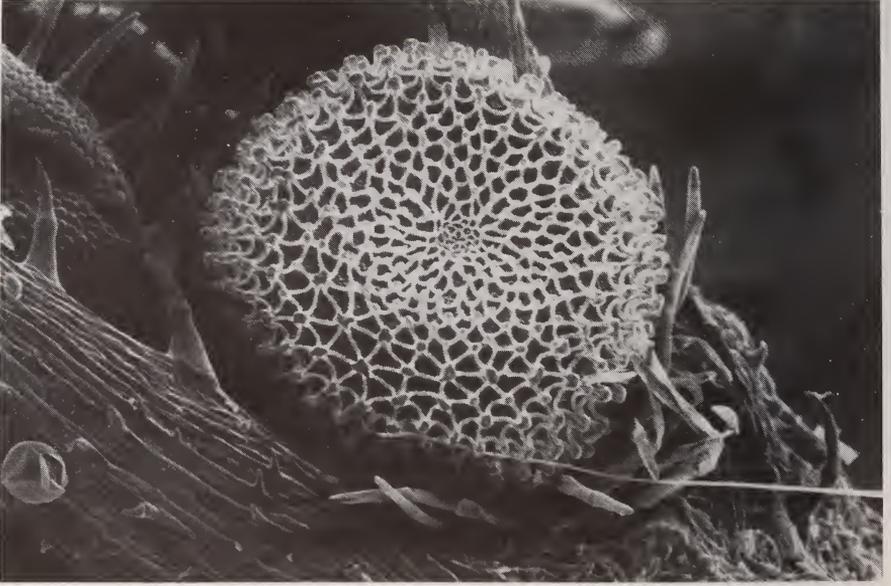


Fig. 5. Ovum of *Pseudophilotes barbaggiae*: top view, $\times 100$.

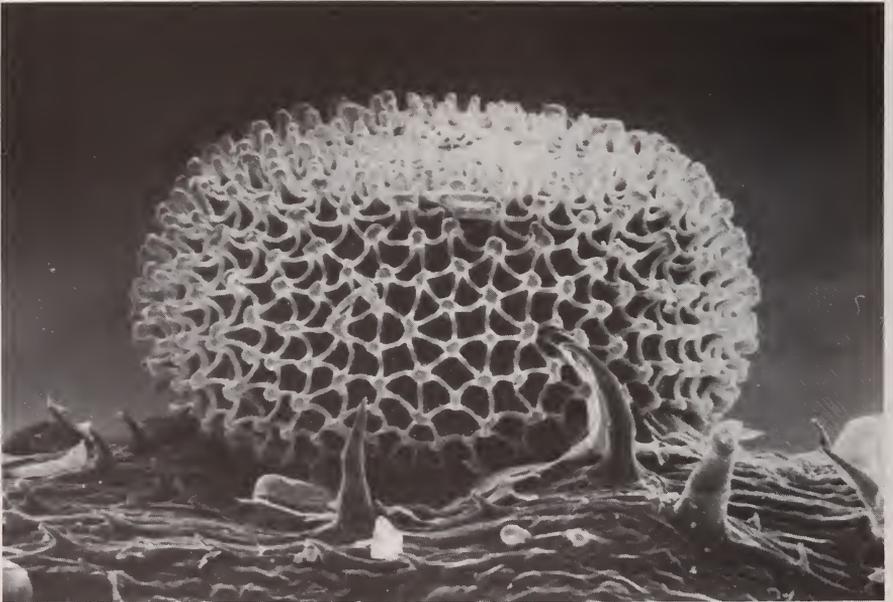


Fig. 6. Ovum of *Pseudophilotes barbaggiae*: side view, $\times 135$.

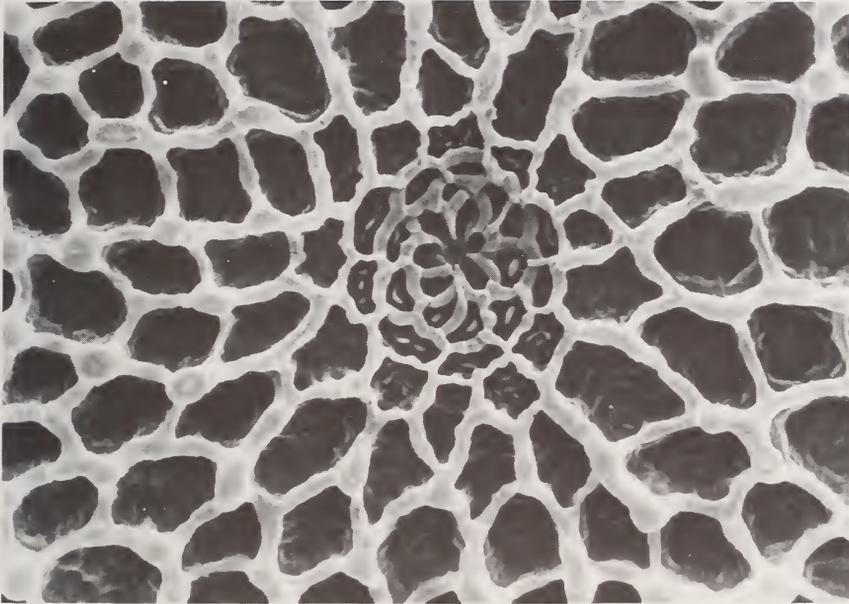


Fig. 7. Ovum of *Pseudophilotes barbaggiae*: micropyle, $\times 500$.

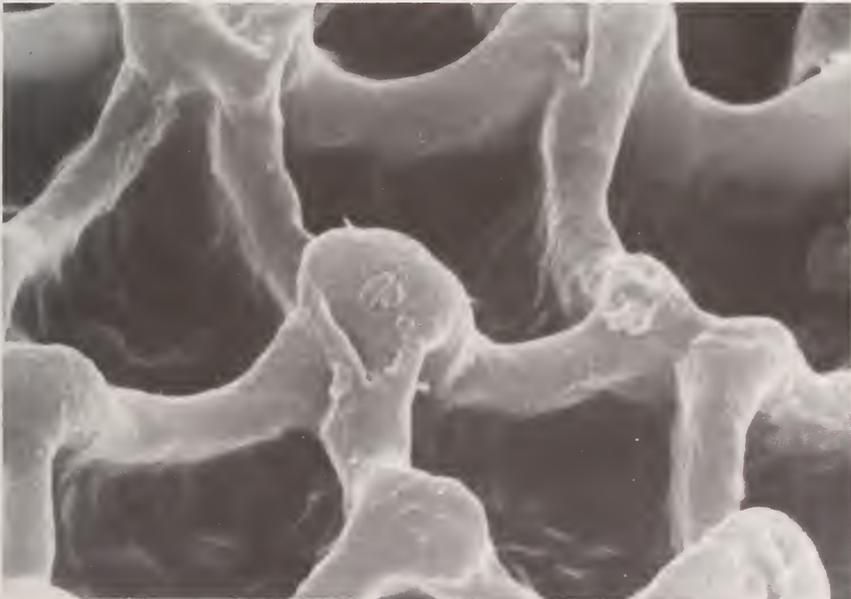


Fig. 8. Ovum of *Pseudophilotes barbaggiae*: intersections of the meshes, $\times 1600$.

its dark colour and small size. When alarmed, it immediately disappears from sight, flying low over the vegetation, rarely more than one metre from the ground. At sunset, the butterflies can be seen resting with their wings closed on the plant stems where they pass the night.

The eggs are laid singly on the flower heads, leaves or stems of thyme. In captivity, a female may lay as many as 20–30 eggs, 1 or 2 at a time, over a period of 2–4 days.

No significant variations or aberrations have been observed. The males are smaller and darker than the females, and may sometimes be lightly dusted with blue scales. Many males are particularly small.

Ovum

The egg is very small, 0.3–0.4 mm high, with a diameter of 0.6–0.7 mm; shape a much flattened spheroid; colour greenish white, later turning to white. At scanning electron microscopy, the surface shows a reticular pattern of high ridges that circumscribe a series of triangular or square pits, with a tendency to form a radial structure of larger polygonal units with 6–7 sides (figs. 5, 6). The reticulation is very uniform over the entire surface of the egg except in an area of about 200 μm around the micropyle, where it is finer with radially arranged prevalently rectangular meshes (fig. 7). The slightly depressed micropyle is surrounded by a rosette-shaped area, 50 μm in diameter, formed by a series of semilunar cells arranged in a circular fashion around the micropyle (fig. 7). The intersections of the meshes are very prominent, button-shaped and flattened superiorly (fig. 8).

Acknowledgement

We extend our sincere gratitude to Dr. Vittorio Mazzarello (Department of Anatomy, University of Sassari, Italy), who prepared the illustrations of the ovum under the SEM.

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Jahr/Year: 1998

Band/Volume: [21](#)

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