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Biology and distribution of the endangered Lycaenid *Aricia morronensis* (Ribbe) *

M.L. Munguira & J. Martín, Departamento de Zoología, Facultad de Ciencias, Universidad Autónoma de Madrid, Cantoblanco, E-28049 Madrid, Spain.

Summary

Aricia morronensis (Ribbe, 1910) is an Iberian endemic species which lives in all the main Spanish mountain ranges, excluding the southern part of the Sistema Ibérico. A distribution map (UTM) of the species is given. The larva feeds on *Erodium carvifolium* and *E. castellanum* growing on siliceous grassland, on *E. valentinum, E. cazorlanum, E. glandulosum* and *E. daucoides* in rocky limestone habitats, on *E. paui* on calcareous grassland and on *E. cheilantifolium* over schist screes. The egg and larval stages are described. The sexual and feeding behaviour of *A. morronensis* males and females are briefly discussed. Although the butterfly is extremely local, the risk of extinction is low due to its presence on nature reserves, its wide distribution range, and the improbable destruction of the stony slopes on which most populations live.

Introduction

Aricia morronensis was first described by Rambur in 1838 with the name *idas*, which is an invalid homonym, changed by Verity (1929) to *ramburi*. However, Ribbe (1910) had already described the race from Sierra Espuña under the name *morronensis*.

Chapman (1907) describes the egg which was found on a plant of the genus *Erodium*. Other citations of the foodplant species have been made, but they are mistaken (Manley & Allcard, 1970 ; Gomez-Bustillo and Fernandez-Rubio, 1974) or not based on oviposition observations (Lencina, 1980).

Some other papers include faunistic information, the most extensive being those of Wyatt (1952), Manley & Allcard (1970), Eitschberger and

* Since this paper was presented, in 1986, new data concerning the species have been published in Munguira & Martín (1988) and Munguira (1989).

Steiniger (1973), Viedma and Gomez-Bustillo (1976, 1985) and Gomez de Aizpurua (1977).

It has been generally accepted that the species is very local and scarce, but we have gathered records from 50 localities, in some of which it is rather abundant.

In 1976 and 1985 the species was included by Viedma and Gomez-Bustillo in the Spanish Lepidoptera Red Data Book as 'endemic', encouraging the study of its biology and control of its populations for conservation purposes, the former being the aim of the present work.

Distribution (Fig. 1)

A total of 21 (42%) localities covering the whole range of the species were monitored and additional information from collections and bibliography was compiled to complete the distribution map.

The map shows the species as widespread in the Iberian Peninsula ; it is present in all the main mountain ranges above the 1000 m level. The heights at which the butterfly can be found are variable, ranging from 800 to 3000 m, but increasing slightly towards the south.

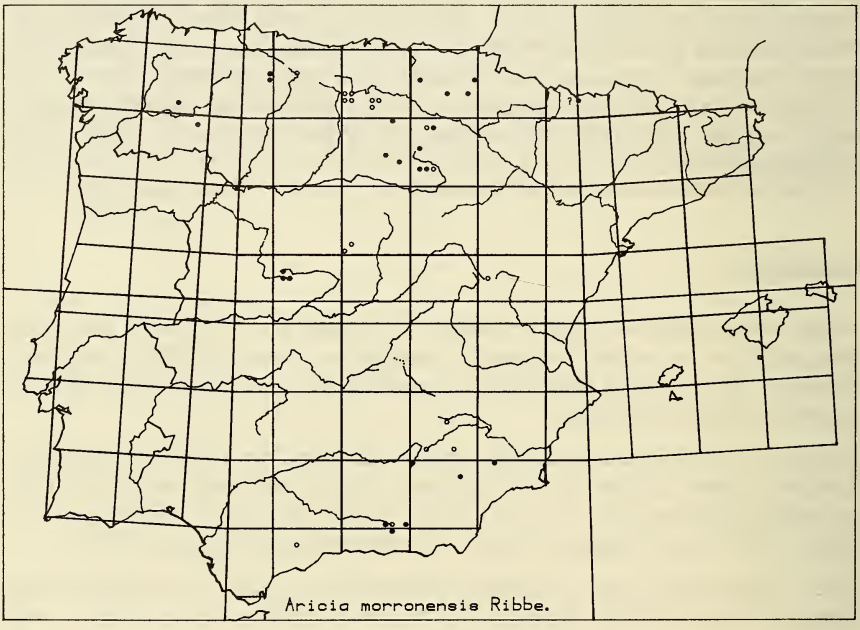

Fig. 1. UTM distribution map of *Aricia morronensis* (Ribbe). Each circle represents the presence of the species in a 10 × 10 km square. Filled circles (●) are citations from which the authors have seen material. Open circles (○) are from bibliographical data. Question mark (?) is a mistaken citation.

The distribution pattern is that of a species that has used mountains as refuges. Changing climate has fragmented its habitat into 'islands' separated by lower areas of unsuitable habitat. This explains why the species is apparently evolving at the subspecific level, and has encouraged the authors to describe nine subspecies, each with a morphology constantly different from other populations. However, a more comprehensive study is needed with material from a wider range of localities to demonstrate the real distribution of each subspecies.

Biology

Eggs are laid on the foodplant from the end of July until the beginning of September. The ovipositing female flies from one plant to another in short, direct flights. Eggs are laid one by one on fresh leaves of the plant and between each egg the female rests for about one minute with opened or closed wings, but with extended abdomen. When laying the egg the female walks over the *Erodium* tuft with curled abdomen, bends its body and lays the egg in the correct site.

The egg is esferic, depressed at its poles and has the typical chorionic network common to all lycaenids. The ribs of this network are smooth in the annular region that surrounds the micropyle and porous in the transition region. In the tubercule-aeropyle region (Downey and Allyn, 1984) ribs form three to four-sided cells whose intersections are enlarged to form a tubercule with an aeropyle at its tip.

Eggs hatch eight to ten days after oviposition. Larvae leave the egg by means of an opening in the micropilar pole. The first instar larva is pale yellow, with two rows of large hairs on the dorsal carina and another row on the lateral region, and between them are small hairs and large perforated cupolas. The larva mines the parenchema of young leaves through a hole in the epidermis.

The second instar larva is larger, with more hairs, but has the same general appearance and feeds in the same way. At the beginning of September the second moult takes place and at the end of this month the third instar larva hides between the bracts and stalk of the foodplant for overwintering.

The third instar larva is more hairy, large hairs are still in two dorsal and two lateral rows. Between these rows short club-like hairs and perforated cupolas are abundant, the latter mainly around the spiracles and Newcomer's gland.

We have also found fourth instar larvae in the Autumn ; it is not certain whether there is a real diapause or whether the larva continues its development whenever temperature and food conditions are favourable.

In the Spring, when weather conditions become better, the larva begins to feed by day, hiding by night between the dead leaves of the foodplant. It moults soon after and grows until reaching its maximum size (10 mm) after

a further moult. In southern Spain we have found fourth and fifth instar larvae with attendant ants. This relationship is facultative.

As other *Aricia* species (Høegh-Guldberg, 1969), *morronensis* has five larval instars, while the general rule in lycaenids is to have four instars.

The full grown larva is pale yellow or green with dorsal and lateral pink and white ribs, in southern populations, markings are purple instead of pink. It has both Newcomer's gland and tentacles, and short hairs and perforated cupolas surrounding the latter. Dorsal and lateral hairs are larger and more abundant than in other instars.

Pupation occurs in the ground. We have obtained under laboratory conditions a pupa on 3rd March, but in natural habitats pupation takes place later, at the end of June in southern Spain. The pupa is 9.3 ± 0.74 mm (n = 16) long. It is green or yellow brown, with setae on the head, dorsal line of abdomen, ocular area and near the spiracles. Perforated copulas are also found around each spiracle and in the ocular area. It is not fixed to any substrate, but surrounds itself with some silk threads. We have obtained adults 8 to 18 days after pupation, in warmer conditions adults emerge sooner.

There are great developmental differences between individuals. This explains the observation made in the more extensively monitored localities, that the flight period of imagines lasts for more than three months in a single generation.

Behaviour

Males are active between 07.00 and 17.00 h. In the early morning males rest with opened wings oriented towards the sun, and fly for short distances. Females are scarcely seen at this hour and usually rest with closed wings perpendicular to the sun's rays. Later on males begin to fly for larger distances resting with closed wings, while females begin oviposition and feeding.

The male's principal activity is searching for females. They fly close to the ground inspecting all the *Erodium* and similar plants, where females are expected to rest. This behaviour makes males more conspicious and they are therefore more common in collections (72.1% were males and 27.1% females out of 616 specimens studied). Following Scott (1974) sexual behaviour should be considered 'patrolling'. When a male find a female it alights near her with fluttering wings, sometimes virgin females fly away followed at a short distance by the male. Unreceptive females display the typical rhopalocerous rejecting attitude which makes copulation impossible. In all other cases the male would approach the female with bent abdomen and extruded claspers and begin copula, achieving soon after the typical copulating attitude of opposed heads.

Foodplants

Adult nectar sources include plants of the genus *Armeria, Centaurium, Erodium, Eryngium, Knautia, Lavandula, Lotus, Medicago, Melampyrum, Scabiosa* and *Sideritis*, which are the dominant flowering plants in the sites where adults fly.

Nomenclature of the *Erodium* taxa follows Guittoneau (1972), who states that the genus has 35 species in the Iberian Peninsula. A total of eight species belonging to two different subsections of the genus have been recorded by us as foodplants.

E. carvifolium is the foodplant on prairies over shales and granites in western Spain ; *E. castellanum* on prairies with sandstone substrate in central Spain ; *E. valentinum, E. cazorlanum, E. glandulosum* and *E. daucoides* on rocky limestone slopes of southern Spain (first two species) and of northern Spain (last two species) ; *E. paui* growing over calcareous grassland in central Spain ; *E. cheilantifolium* is the foodplant over schist screes in Sierra Nevada (southern Spain).

All these plants are perennial, unstalked and form tufts in rocky places or are scattered among other plants when growing in grassland habitats.

Conservation

The species is local, but widespread and abundant so as to consider it out of danger. Populations on rocky slopes are restricted to small areas, but some of them are on nature reserves, while others are not vulnerable as their habitats are unsuitable for development projects.

However, populations on calcareous or siliceous grassland are more vulnerable, because changes in grazing regimes or the planting of coniferous forests could seriously alter their habitat's ecological equilibrium.

Temporal grazing seems to be important for an adequate growth of the *Erodium* plants in grassland habitats. It would be therefore important to create nature reserves in four selected grassland sites (one for each habitat type), where management would consist mainly in maintaining traditional land uses that would clearly favour the survival of the species preserving its present status.

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