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Aricia cramera (Erschscholtz, 1821) in Sardinia (*Lycaenidae, Plebejinae*)

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Historical

Apparently the first record from Sardinia of a species of *Aricia* is by Staudinger (*Dt. ent. Z. Iris*, 5 : 580 (1892)), who described his *Lycaena astrarche* ab. *ornata* from Mauretania, Tunis, Teneriffa (Canary Islands), Chiclana (Cadiz), Corsica and Sardinia. Later on, Verity (*Entomologist's Rec. J. Var.*, 32 : 149 (1920)) described an *Aricia medon* f. *infracacaotica* based upon material from the Island of Elba and recorded it subsequently, though with some taxonomic uncertainty, also from Sardinia (in a marshy place near Tempio Pausania, 560 m ; Farfalle diurne d'Italia, 2 : 209, pl. 11, figs 73 ♂, 74 ♀ (1943)).

The Sardinian material of this species, however, is likely to be rather scarce in most European collections, if one considers that even Bayard (1936) and Bernardi (1960) in his review of the distribution of *Aricia* species in the Mediterranean islands, failed to quote any specimen from Sardinia existing in the collections of the Paris Museum.

Concerning the taxonomy of the genus *Aricia* (s.s.) it is to be considered, as well, that until very recently the picture was quite confused, even as to the number of species involved.

The first entity which was separated from *agestis* (Schiffermüller) (s.l.) has been *cramera* (Erschscholtz). The first author who strongly suggested a species-level distinction between this pair of siblings was Verity (1929), but some hints at this possibility were given already by Oberthur (1922) and by Querci & Romei (1925). The existence of some slight, but constant, differences in male genitalia was first shown by Bayard (1936) and later confirmed by several authors, while Høeg-Guldberg (1979), from rearing and crossing experiments, demonstrated the existence of a genetic barrier between Spanish *Aricia cramera* and Northern-European populations of *Aricia agestis*. So, at present, two bivoltine species are currently recognised : *Aricia agestis*, inhabiting the whole of Europe and *Aricia cramera* of the SW Mediterranean basin. At least one more species, single brooded, is, however, to be considered.

Aricia artaxerxes (Fabricius), ranging, with various described subspecies, from Scotland to the Alps and Southern Russia, was shown, in crossing-experiments, to represent a distinct Boreo-Alpine faunistic element which might well be proved to embrace also the little known *Aricia montensis* Verity.

Morphology

As has been correctly stated by Verity (1943), few or none of the external features may help to distinguish the Sardinian specimens from the so called *Aricia agestis* ssp. *calida* Bellier from Corsica (type locality) and most of the Mediterranean countries. Only the underside colouring is generally warmer, as in Spanish *cramera*, particularly in specimens of the second brood. The orange lunules of the four wings are often very like those of the majority of *Aricia agestis* populations ; it is however to be recalled that also in Spain and NW Africa *Aricia cramera* specimens with large, strong lunules may be found living side by side with very less marked ones, whose recognition is possible only through the study of genitalic structures (Monteiro & Bernardi, 1961). It is known, however, that typical orange-banded females of *cramera* may well generate specimens with few or small orange markings (Høeg-Guldberg, 1979). External morphology cannot, therefore, be considered anymore a reliable character for the identification of *Aricia cramera*. For this, and other theoretical reasons, we do not consider these Sardinian populations worthy of any subspecific status.

Genitalia

Male genitalia (Fig. 1) are perfectly consistent with what is known for Spanish and North-West African specimens of *Aricia cramera*. The free appendage of the subunci (brachia) is generally much shorter than the humped, fixed branch. In only a few specimens of the first brood this free appendage may nearly reach in length that of the fixed arm, but it can never exceed it, as always happens with *agestis* and *artaxerxes*. The shape itself of the free arm is different. Female genitalia of the *Aricia agestis* complex were first studied by Beuret (1960) who was unable to show any difference of taxonomicaL use. Yet the study of large series of the known species allowed us to point out that in *Aricia cramera* the triangular plate representing the top of the henia, under the ostium bursae, is narrower and more elongate than in the other species ; this same plate, moreover, is laterally and anteriorly connected to the henia with a couple of rather evident sclerotized bumps that are generally lacking in other species (Fig. 2).

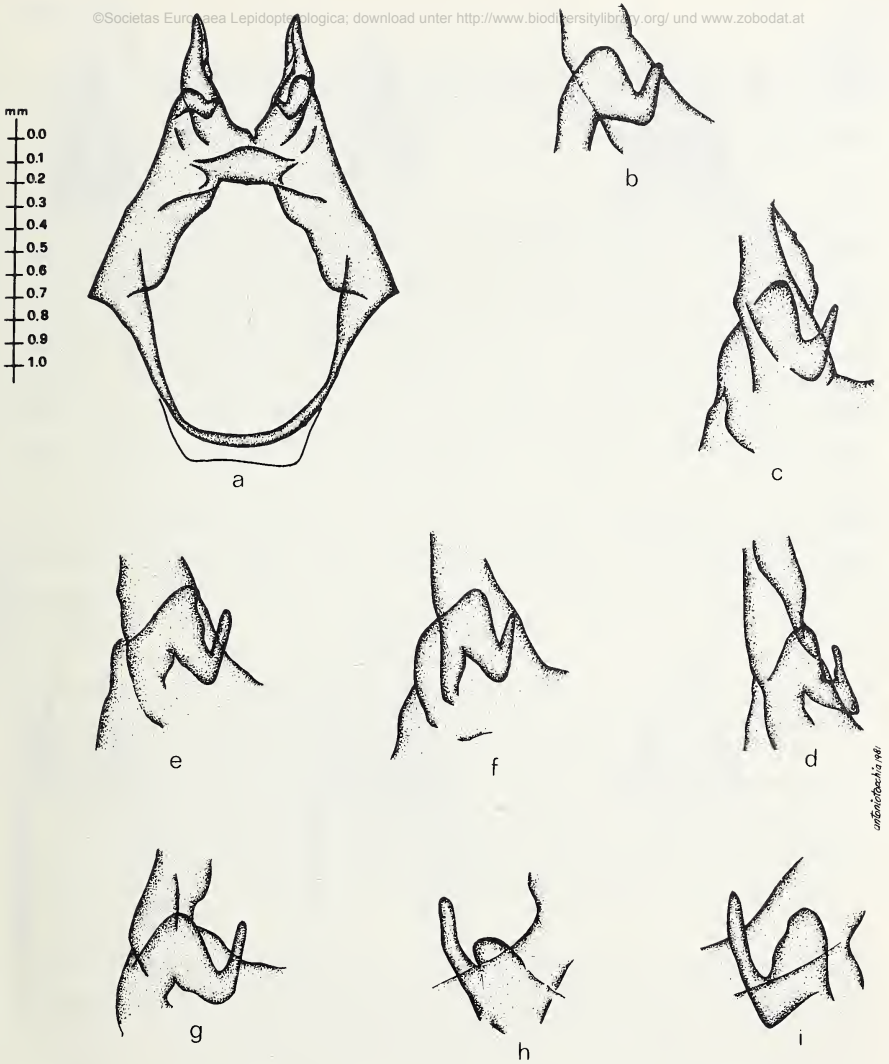


Fig. 1. Male genitalia of *Aricia cramera* (Ersch.) from Sardinia :
a, b : Cagliari (JN)
c, d : Mt Limbara, Prov. of Sassari, 18.VII.1980 (LN)
e : Lake of Baratz, Prov. of Sassari, 17.VII.1980, (LM)
f : Santu Lussurgiu, Prov. of Cagliari (KM)
g : Mt Linas, Prov. of Cagliari, 27.VII.1980 (JM)
(See fig. 5 for reference to topographical UTM system)
and comparison with *Aricia agestis* (Schiff.) : h
and *Aricia artaxerxes* (?) *montensis* : i : Middle Atlas, Morocco.
Scale for subunci (falces) as in Fig. 2.

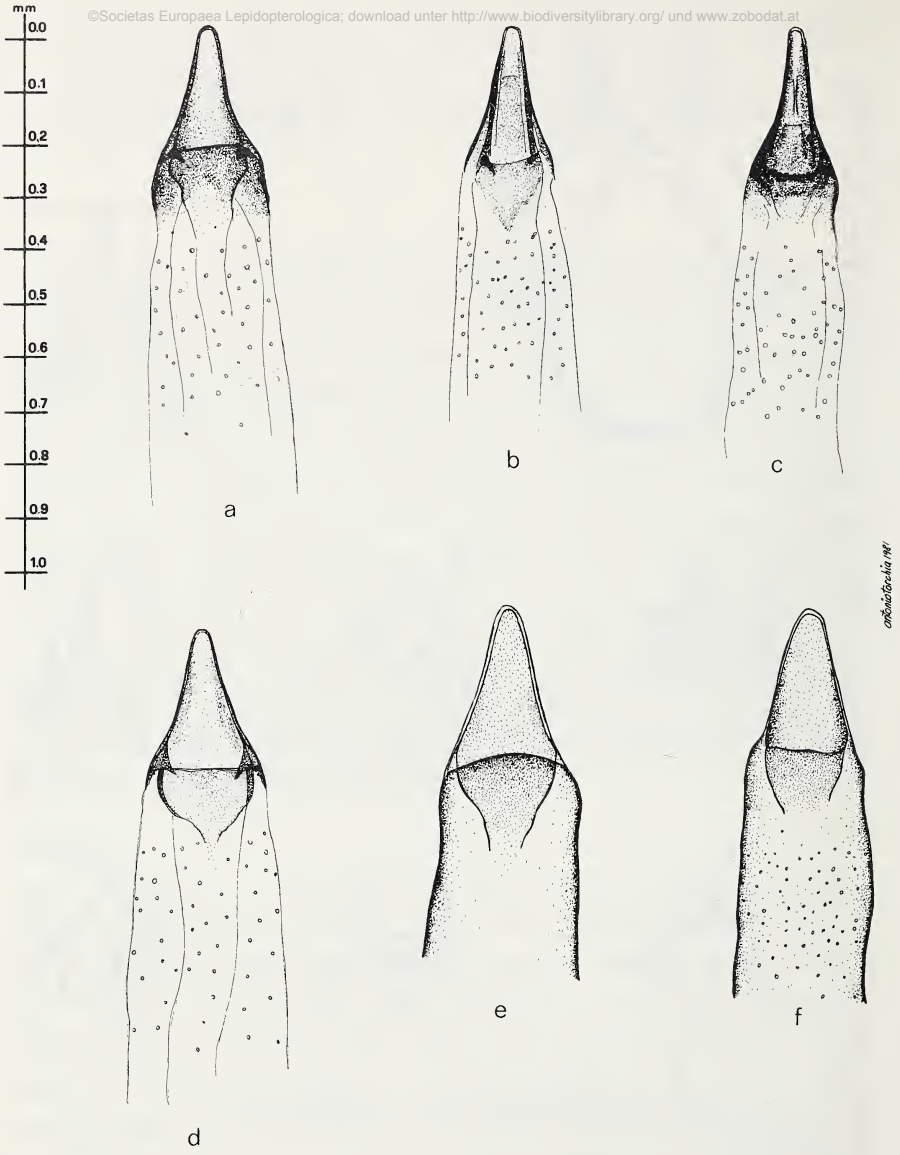


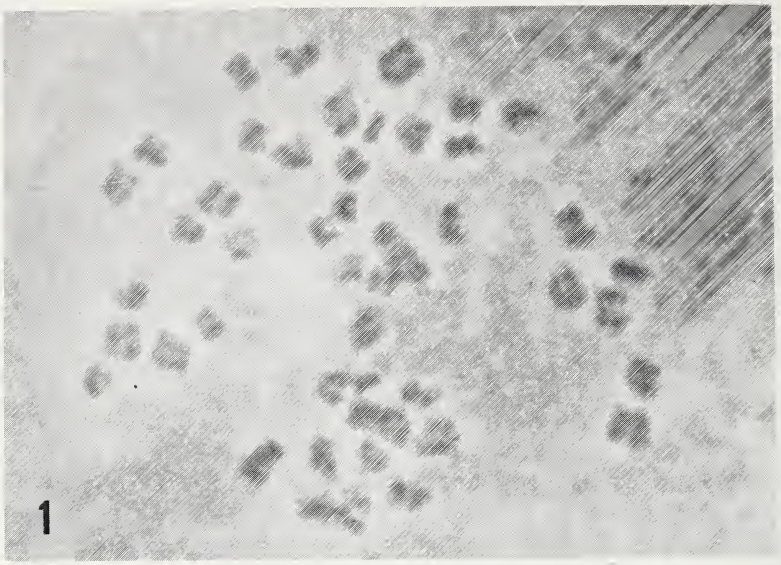
Fig. 2. Female genitalia of *Aricia cramera* (Ersch.) from Sardinia :
a : Orgosolo, Prov. of Nuoro, 24.VII.1980 (KN)
b : Mt Linas, Prov. of Cagliari, 27.VII.1980 (JM)
c : Oliena, Prov. of Nuoro, 23.VII.1980 (KN)
d : Mt Albo, Prov. of Nuoro, 22.VII.1980 (KN)
and comparison with *Aricia agestis* (Schiff.) : e : Malta Isl.
and *Aricia artaxerxes* cfr. *montensis* : f : East Lebanon.

No such study has been made, as yet, in *Aricia cramera* but a few, rather conflicting data, are reported for *A. agestis* (Federley, 1938; Lorkovic, 1941; Bigger, 1960; Lorkovic, 1966) and *A. artaxerxes* (Lorkovic, 1966).

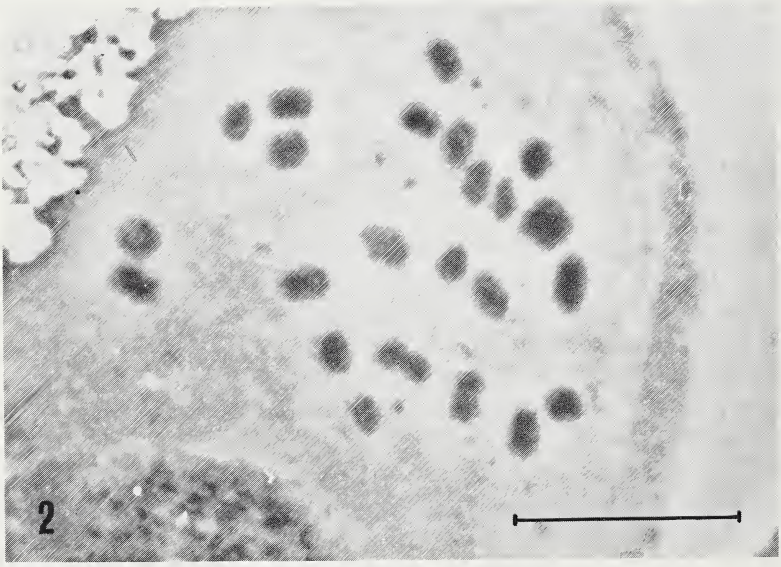
Karyotype analysis was made from male gonad squash preparations, as outlined in a previous paper (Troiano & Giribaldi, 1979), with some minor modification. After dissection, testes were rinsed in distilled water for about 5 minutes and fixed again in 3:1 absolute alcohol and glacial acetic acid. Testes were then stained "in toto" in 1% acetic orcein for 5 minutes, transferred in a drop of 60% acetic acid and squashed between slide and coverslip after about 10 minutes. In this way remarkable improvement in staining and spreading of material has been achieved.

All specimens showed advanced gonadal maturation, as is the rule for most Lepidoptera. Therefore only a few mitotic metaphases were found whereas meiotic stages were mostly available for chromosome study. Metaphase I was the most useful stage to determine aploid number. At this stage 23 bivalents may be easily observed. They are usually rounded or, in some case, handle-shaped bodies, owing to their double nature. The chromosomes are of different size, ranging from 1 to 2,5 micron although most of the chromosomes are of intermediate size and only one pair seems rather bigger. This is especially evident in mitotic metaphase which also shows chromosome shape and position of the centromere, by which most of the chromosomes appear clearly monocentric and of metacentrical type. Some diplotene, showing elongated chromosomes, and diakinesis stages were also observed. In these latter, chiasmata are very clear in several bivalents.

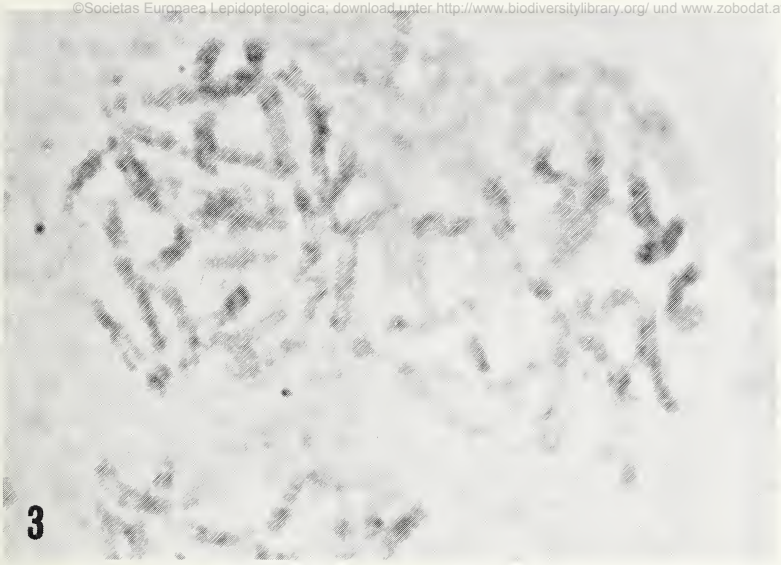
The chromosome number of *A. cramera* seems to be different only by two from the diploid number of *Aricia agestis*, although some uncertainty does exist on the exact chromosome number of the latter species. In fact the aploid number reported first by Federley (1938) is 23. Afterwards Lorkovic (1941) and Bigger (1960) reported 24 for the same species. More recently Lorkovic again (1966) reported 23 for *A. agestis* and *A. artaxerxes*. We don't know whether a true variability of chromosome number of *A. agestis* exists or whether it is a question of the precise identification of the species. Apart from the chromosome number, further comparisons between the different karyotypes are not possible as the figures of Federley and Bigger are not favourable. Therefore the true relationships existing between the karyotypes of the different species cannot be ascertained at the moment.



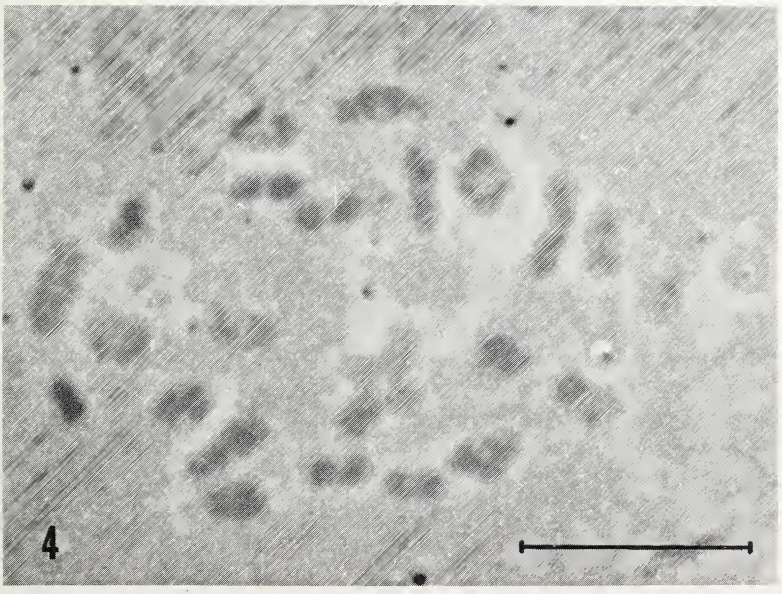
1 – Mitotic metaphase from testes



2 – Metaphase I



3 – Diplotene



4 – Diakinesis
Scale represents 10 micron

The overall distribution of *Aricia cramera* covers most of the Iberian Peninsula (see Gomez-Bustillo & Fernandez-Rubio, 1974), NW Africa (Higgins & Riley, 1980) and the Canary Islands, its type locality being Teneriffa. Among the Mediterranean Islands this species is known to occur only on the Balearic Islands (Bernardi, 1960). In Corsica only *Aricia agestis* is known, but we do not consider it unlikely that a more thorough investigation may prove that the two species do actually live there side by side.

Concerning Sardinia, it now seems that *Aricia cramera* is the only representative of the genus living on the main island, where a rather complete study accomplished during the spring and summer of 1980 failed to show the existence of *Aricia agestis*. The localities where we were able to demonstrate the presence of this species, both with field research or from existing collections, are shown in Fig. 5.

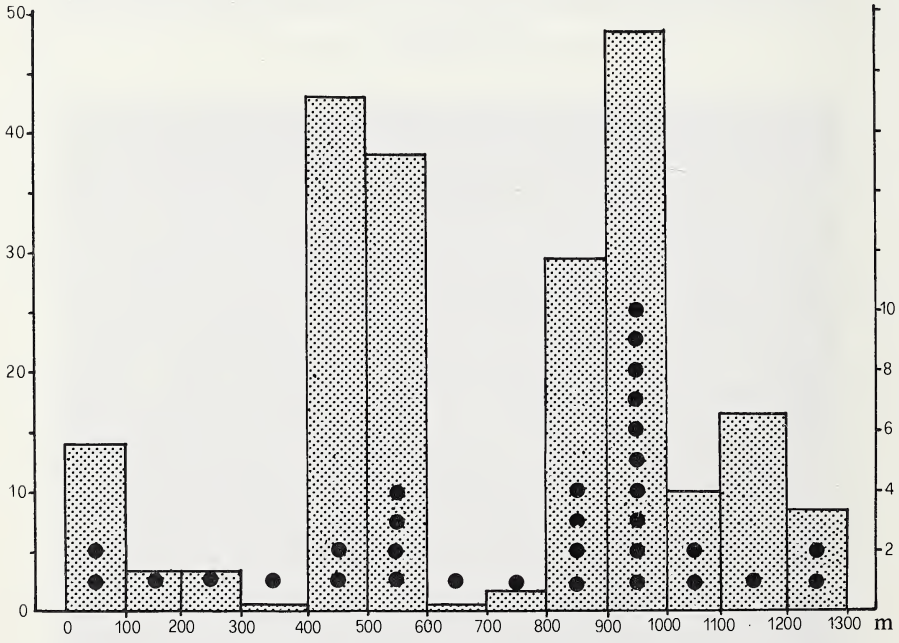


Fig. 3. Ecological features of Sardinian *Aricia cramera* (Ersch.), vertical distribution. Histograms : average number of specimens in a hectare ; filled-in circles : number of colonies.

Abscissa : altitudes ; ordinates, left : number of specimens ; right : number of colonies.

In Sardinia *Aricia cramera* proved to be a rather abundant species, forming small, but often numerically consistent colonies, scattered from sea-level up to 1200 m or more. The distribution along this altitudinal gradient, however, is not homogenous (Fig. 3) and both number of colonies and related individuals, expressed in specimens per hectare, are more numerous from 400 m to 1200 m, but with a rather sudden drop between 600 and 800 m, which might well be related to the vegetational cover (high maquis, ilex woodlands). The observed density of the studied populations varied from 0.5 to 10.0 specimens/ha, for the first brood, and from 0.9 to 17.6 sps/ha for the second, being slightly more abundant.

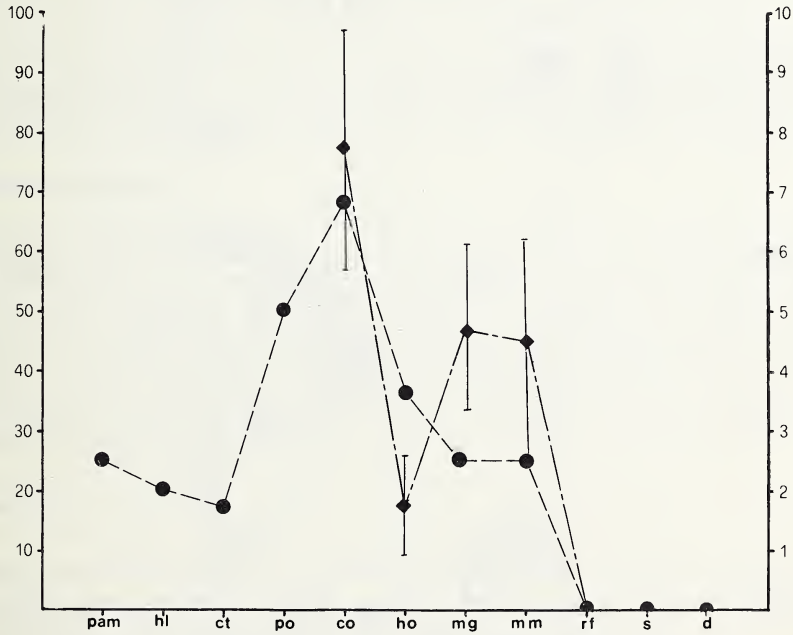


Fig. 4. Distribution of *Aricia cramera* (E r s c h .) over Sardinian vegetational formations (111 localities). Diamonds : mean densities (specimens/hectare) detected for each vegetation-type investigated (ordinate, right)
Filled-in circles : percentage of each vegetation-type investigated where the species was to be found (ordinate, left)

Abscissa : pam = pseudo-alpine meadows ; hl = heathlands ; ct = chestnut groves ; po = pubescent-oak ; co = cork-oak ; ho = holm-oak ; mg = maquis ; mm = mowed meadows ; rf = riparian formations ; s = screes ; d = sand dunes (sea-shore).

Aricia cramera inhabits, in Sardinia, a wide variety of vegetational formations, from mowed meadows, with *Bromus mollis* L. and *Cynosurus* sp. to maquis and several kinds of thermophilic and more mesophilic

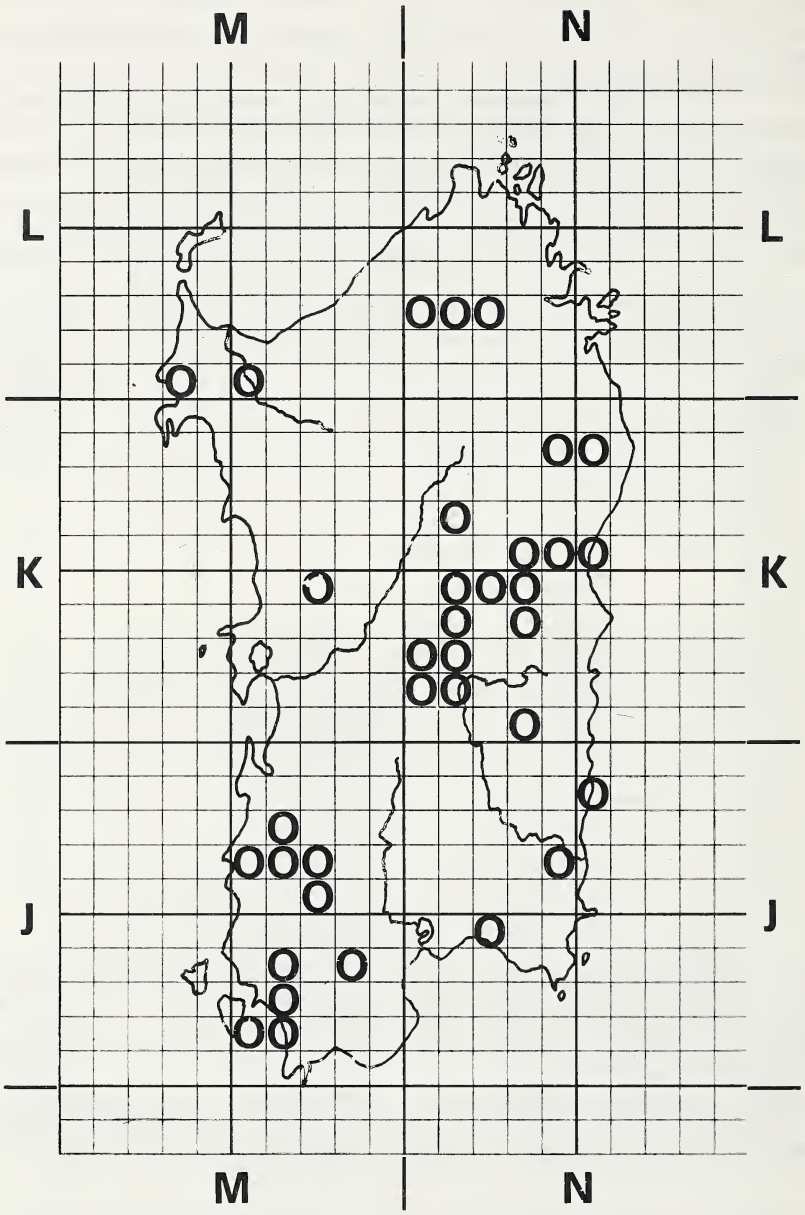


Fig. 5. Sardinian distribution of *Aricia cramera* (Ersch.) and UTM notation of 10×10 kms squares.

woodlands and groves, with holm-oak, cork-oak, pubescent-oak and even chesnut plantations ; in a few cases (see also Verity, 1943) they were found also in swampy areas, with *Juncus* spp. etc. The less suitable of these habitats appears to be the holm-oak groves (mean density 1.8 ± 0.8 sps/ha), while the most favourable are the more mesophilic woodlands (cork-oak, pubescent-oak and chestnut formations), where the average density was 9.1 ± 2.0 sps./ha and 7.9 ± 2.0 for cork-oak only (Fig. 4). Among all Sardinian vegetational formations studied (111 localities), no specimen of *Aricia cramera* was detected on screes or in riparian groves (with *Nerium oleander* L., etc.). The overall pattern of the remaining coenosis is consistent with the density-based one, with a peak of 70% of presencies for cork-oak woods where the species was present (Fig. 4).

As a whole, therefore, *Aricia cramera* is, in Sardinia, a rather mesophilic and sciaphilic species, which quite often shelters in cool, open woods with some bushy undergrowth, particularly in the hottest parts of the day.

Acknowledgments

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Summary

Aricia cramera (Ersch.) is reported from Sardinia, where it appears to represent the only species of its genus. Some morphological, anatomical, karyological, distributional and ecological data are provided.

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