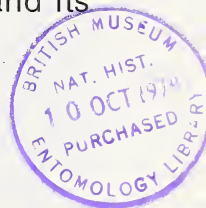


The relationship of *Aricia agestis* (Lycaenidae) and its closest relatives in Europe*

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Until 1929 the classification of *Aricia agestis* included all of the European members of the above stated group. In 1929 Verity demonstrated that *Aricia cramera* must be considered an independent species: It was described by Eschscholtz in 1821 as an Iberian-Mauretania-Canarian form of *agestis*. Verity partly came to his conclusion because of outward appearance and partly on the fact that in the contact zones with another *Aricia* form the forms remained distinct. This other form was *montensis*, described by Heyne in 1895 under the name *montana*, but in 1928 named by Verity *montensis*. He considered it an *agestis* form.

Some years later Bayard (1936) confirmed his separation by showing definite differences in male genitalia between *agestis*, *montensis* and *cramera*. Four other forms were still considered of the species *agestis*. They are:

- 1) *artaxerxes* Fabricius 1793 from Scotland
- 2) *salmacis* Stephens 1831 from Northeast England
- 3) *allous* Geyer and Hübner 1837 from the Alps
- 4) *inhonora* Jachontov 1909 from Russia.

In 1935 *allous* was awarded specific rank by Obratzov (1935) with *inhonora* as its Eastern subspecies. He claimed to have found distinct genital differences between *allous* and *agestis*. But from the extensive analysis of all the *agestis*-*allous*-*montensis* complex Beuret (1960) was not able to confirm Obratzov's claim. From other criteria Beuret agreed that *agestis* and *allous* were separate species.

Beuret (1960) shortly demonstrated that in Europe there are two groups: A) the bivoltines, with *cramera* in the south-west and *agestis* in the northeast.

B) the univoltines with *montensis* in the south-west and *allous* in the northeast.

The bivoltines are separated from another by the Pyrenées, and this is partially so for the univoltines except that it is thought that *montensis* is found in Southern France across to the Balkans.

While Beuret regarded the specific separation of *cramera*, *agestis* and *montensis* to be complete, he felt that the separation between *montensis* and *allous* was not so far advanced.

Beuret only worked with dead material and he himself regretted not being able to rear and cross. The problem in this respect lay in the incomplete

*) Read at the 1st European Congress of Lepidopterology under the heading: Taxonomic difficult groups of species.

knowledge of the biological history of *Aricia* in such aspects as their early stages, food plants etc. Sadly enough Beuret died prematurely in 1960, unable to complete his investigation.

About the time of Beuret's conclusions and with the discovery of *allous* in Denmark (1961) in the same year, 1960, I first became interested in this problem. Since then I have found the foodplants, described the pre-imaginal stages of *allous* and studied *Ariciae* in many parts of Northern and Central Europe. My conclusions can be found published in a number of papers (Høegh-Guldberg 1966, 1968, 1971, 1973, 1974 a, b; Frydenberg & Hoegh-Guldberg 1966; Høegh-Guldberg & Hansen 1977; Høegh-Guldberg & Jarvis 1969) and my material is deposited in the Natural History Museum of Aarhus, Denmark.

The absolute vital precondition to rearing and crossing experiments is the ability to breed more than one generation in a year. This normally is out of the question for a univoltine species.

The first two years rearing after finding the pre-imaginal stages were therefore in vain. But with great luck in 1963 I came in touch with the British lepidopterist F.V.L. Jarvis, with whom I have cooperated ever since. He had worked on British *Aricia* since 1954 and had developed a method whereby he could rear more generations a year (1958—59). His method involved giving larvae artificial light at night: permanent light (24 hours a day) broke the diapause and two or three generations could be reared during the summer and the autumn.

My *Aricia* investigations can be divided into three groups.

The first group involves biological-ecological studies. Entailed in this group are:

- a) the rearing- and crosspairing-experiments with *agestis* and *allous* from eight countries;
- b) the circumstances of the various contact zones (here the two groups remain separate);
- c) the ecological and physiological differences in foodplants and biotopes, and in the critical photoperiod of the larvae as well as the larval demands on temperature (which decides the Northern limit of *agestis*).
- d) the indoor rearing in Denmark of the *Ariciae* from various countries.
- e) the study of the difference in the rate of growth of the larvae and in the dispersion in time of the larval stage of the two species.

The crucial distinctions are the circumstances in the contact zones and the difference in the critical photoperiod. This determines that *agestis* has two broods and that *allous* has only one a year. And so from this alone it is clear that they are two separate species.

The second group comprises all morphological investigations. Among these are the study of the foreleg measurements of the imagines (as something new) and of the pre-imaginal stages, which was now made possible after they were found.

When large numbers are compared the difference is clear between the two groups, however there is no single morphological character (and this is also with the enzymes studied) that does not overlap.

But the result still shows clear evidence of Obraztsov's and Beuret's suggestion from morphology alone that *agestis* and *allous* are two separate species.

And so to number three. After knowing the results of the investigations of the previous two groups we then could establish the following: in Norway

only *allous* is flying;

in Sweden *allous* flies also from North to South, *agestis* occurs in the extreme South;

in Denmark both *agestis* and *allous* occur;

in Southern England we have the bivoltine *agestis*. In the middle part of England no *Aricia* is found;

in Durham on the north-eastern coast *Aricia* occurs again, but the population here is univoltine- and it is polymorphic; this is ssp. *salmacis*. Whilst 95 % look like a dark *agestis*, 5 % are similar to the Scottish *artaxerxes*, which is quite apart from that. These two forms pair freely in nature. As they are univoltine, they are consequently to be considered *allous* — not *agestis* as previously thought.

The same is true concerning Scotland's famous strange looking *artaxerxes*, which Fabricius in 1793 described as a species but was later degraded to an *agestis*-form.

And so now England had got a new species and Scotland's *Aricia* had to change name again.

However, this explanation implied that all names in this respect had to change — because the *artaxerxes* name is from 1793, whilst *allous* was named 44 years later. And as Lempke (personal communication) has put it: „The result would be that *allous* has a subspecies antedating it“ — if we retained the old nomenclature.

Consequently, the total *allous* complex had to change name, with the Scottish *artaxerxes* being the nominate form and the other *allous* forms being subject to the *artaxerxes* species, the particular subspecies forming the third name. Only the Alpine form can, according to my proposal (1966; Høegh-Guldberg & Jarvis 1969), keep its *allous* name as *Aricia artaxerxes* ssp. *allous*.

So by 1966 we could make a new distribution map of Europe for *Aricia* (1966) — in form of a correction of Beuret's map from 1960. With this, much more was understandable concerning Northern and Central Europe, and only small additions have been placed after this time.

There are still problems regarding *artaxerxes inhonora*, which has its type locality in Kiev in Ukraine. To judge from the descriptions it must diverge strongly from the forms in southern Scandinavia and in the Harz; yet these resemble specimens as far away as Turkey and this is curious. The only two specimens of *inhonora* I have so far seen (in spite of many attempts) do not correspond at all to the description, to which I therefore put a question mark. But today I have seen Mr. E Palik's *artaxerxes* specimens from Bialowieska in Poland (and after the Congress I have received five Kiev specimens from Mr. Boris Izenbek, Lithuania). None of these either fit exactly the descriptions of *inhonora*; however, the underside ground colour indeed is more greyish than the just mentioned groups.

Thus the name ssp. *inhonora* can be maintained for the Polish and southern Russian groups, but it must be emphasized that they are different from ssp. *rambringi* and ssp. *hercynica* as well as from ssp. *alpina*.

And then there is much confusion about the Spanish *Aricia* of this group. In Bustillo & Fernandez-Rubio's (1974) book we find *agestis* and *cramera* described, both of them with two annual broods. But any single brooded *montensis* is not mentioned.

Manley and Allcard (1970) have *cramera* and *montensis*, but they do not mention the number of generations.

Higgins and Riley (1970) also mention two species, *cramera* and *montensis*, as doublebrooded and singlebrooded, respectively. But in Higgins (1975) has "*agestis* ssp. *cramera*", and *montensis*. In both books, however, the area of *montensis* is expanded to the Balkans, Poland — and Denmark!

If one looks at a larger quantity of Spanish material the picture is confusing. We find specimens with strong lunules — in the females bands — which must be named *cramera*. And there are large specimens with few lunules to be named *montensis*.

But then we also find many specimens, which are much like northern European *agestis*, only the genitalia are like *cramera*. (Here I can confirm Monteiro's and Bernardi's statement from 1961).

There are now two possibilities: 1) They are all *cramera*; so this species is polymorphic, and its description must be completed. Or 2) they are separate species, the *cramera* — and the *agestis* like species. This could be determined in crossing-experiments and by studying their pre-imaginal stages. Already now it looks as if the first explanation is correct because a wild typical *cramera* (with orange bands) in my experiment last summer only got progeny with *agestis*-like lunules.

Finally we have the problem, if *montensis* is an *artaxerxes* form? This question must also be decided biologically in crossing-experiments with other univoltine *Ariciae*.

Recently I have tried to make rearing- and crossing-experiments with Spanish and Northern European *Aricia*, and last year I succeeded (owing to the help from Dr. Galante, Salamanca) in trying *cramera*- (Danish) *agestis* crossings in four experiments. As expected the result was negative. (From the rearings of *cramera* I can now give a description of its early stages, compared with *agestis*).

In 1978 I hope to be able to go to Spain to provide *montensis* for attempt to cross it with *artaxerxes vandalica*. In Spain I also hope to find typical and atypical *cramera*, which will be used in crossing-experiments with one another, and with *montensis*. If possible, I will experiment with *agestis* from southern France, too.

Only such rearing and crossing experiments can decide if *montensis* is an *artaxerxes* subspecies, and if *agestis* can also occur in Spain.

My object has been to demonstrate that only when the biology of the larval and pupal stages became known and crossing-experiments have been performed can the classification and relationship of the various forms become more certain.

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Zeitschrift/Journal: [Nota lepidopterologica](#)

Jahr/Year: 1979

Band/Volume: [2](#)

Autor(en)/Author(s): Hoeg-Guldberg Ole

Artikel/Article: [The relationship of *Aricia agestis* \(Lycaenidae\) and its closest relatives in Europe 35-39](#)