

Distribution of *Maculinea* genus in Romania

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Rezumat

Distribuția genului *Maculinea* în România

Speciile genului *Maculinea* aparțin unuia dintre cele mai studiate grupuri de fluturi din Eurasia (PECH și colab. 2004). Vulnerabilitatea lor la orice modificare a habitatului, puternica specializare, corelate cu intensificarea presiunii antropice, au dus la declinul populațiilor din toată Europa și la micșorarea ariei de răspândire, fiind în momentul de față foarte periclitați (WINHOFF 2001). În România sunt încă prezente toate cele 4 (5) specii ale acestui gen: *Maculinea arion*, *M. teleius*, *M. nausithous*, *M.alcon/rebeli*, dar datele referitoare la distribuție, densitatea populațională, gazde, efectul antropic etc., sunt precare. În lucrare se prezintă pentru prima dată informații referitoare la distribuția speciilor de *Maculinea* în România, precum și considerații cu privire la statutul acestora.

Abstract

The blues of the genus *Maculinea* belong to one of the most studied butterflies in Eurasia (PECH & all 2004). Their vulnerability to any change in their habitat, their tremendous specialization together with the intensification of the antropic pressure led to population decline all over Europe and decrease of their distribution, therefore they are highly endangered at present (WINHOFF 2001). However, in Romania, all the 4 (5) species of this genus are still present: *Maculinea arion*, *M. teleius*, *M. nausithous*, *M.alcon/rebeli*, but few things are known about their distribution, population density, hosts, antropic influences etc. This paper presents, for the first time, important information regarding the distribution of *Maculinea* species in Romania and also certain considerations about their status.

Key words: *Maculinea*, The Habitats Directive, distribution, Romania

The *Maculinea* genus represent a group of highly specialised and sensitive butterflies which require a specific combination of ecological conditions. These species are particularly interesting because, in a certain stage of their life cycle, they parasitise ant nests and this is one of the most complex forms of parasitism in the animal world.

Adults fly from June or earlier, in the case of *Maculinea arion*, until the end of September. Each species lay its eggs on the specific host plant and in the first instars the caterpillars are phytophagous. The other larval instars and the pupa instar are spent in anthills of the *Myrmica* genus where the caterpillars are feeding with the ant brood or they are fed by the worker ants. Myrmecophilous caterpillars have different types of glandes which produce various kinds of secretions to interest and attract ants and suppress, at the same time, low levels of aggressiveness (COTTRELL 1984, AKINO & all. 1999). This is probably the most important means by which the caterpillars deceive their hosts (WYNHOFF 2001).

The caterpillars stay in the ant nests for approximately 10 months, where they will feed with

the ant grubs and hibernate. The pupation takes place in the upper chambers of the ants' nests. Most butterflies eclose and leave the nest in the morning, before the ants become active. Besides, there seems to be some spreading in eclosion. This prevents more than one or two butterflies leaving the ant nest on the same day. How this spreading in eclosion comes about rests unknown (WYNHOFF 2001).

Maculinea arion (Linnaeus, 1758) (fig. 1)

The upperside of the wings is violet-blue with black margins and black oblong spots on the fore-wings. The hind-wings have a vague row of dark spots. The females are brown-black. The underside is ashen-grey, the base of wings shot with blue scales. Also it has white-ringed



Fig. 1. *Maculinea arion*

black spots and a double row of black spots before the margins.

Wingspan: 32-40 mm

Habitat:

It occurs in xerothermophilous pastures, meadows, bushy places, woodland clearings or with scarce vegetation. The essential structure of their habitat lies in the existence of empty patches in vegetation, which can be occupied by the host plant *Thymus sp.* and also preferred by the host ants. It is most common on limestone soils, but may also occur on different types of soils.

Distribution:

It occurs from northern and central Spain, eastern Italy, Greece and southern Scandinavia, Central Europe to eastern Asia. In Great Britain the indigenous population is extinct but the species was recently reintroduced in south-west. Absent from Portugal, northern Belgium, The Netherlands, Germany and Mediterranean islands except Corsica. In Central-Eastern Europe the subspecies status is more complicated because of the occurrence of some relic subspecies (BALINT 1996).

Distribution in Romania (map 1):

Maculinea arion is widely spread throughout the country, being the most frequent species of the *Maculinea* genus.

Population:

Although it is widely spread, the population density does not exceed 15 - 25 individuals / ha when it comes to vigorous populations, which occur on limestone soils.

Ecology and behavior:

The flying period is from the end of May or the beginning of June until August, according to locality and altitude. It is a univoltine species. The host plants are species from the *Thymus* genus, but in some areas, like forest edges, they deposit their eggs on *Origanum vulgare*. Its life cycle is similar to the one of *M. alcon*. The eggs are laid on flowers and the larvae are attended by *Myrmica sabuleti* or *M. scabrinodis*.

Conservation measurements:

As a rule, the decline of *Maculinea* populations is due to changes in the way agriculture is practiced. *Maculinea arion* withstand much better than *M. teleius* and *M. nausithous* to the intensification of grazing, but is more sensitive to the

abandonment of land. Because of its ethereal oils, *Thymus* is not very affected by grazing, and what is more, grazing maintains a low density of vegetation and creates open surfaces of vegetation, conditions which are essential to maintain the population of *M. arion*. Traditional mowing without the leveling of the land or fertilization is beneficial for *M. arion*, too. The intensification of agriculture and the abandonment of land by farmers led to the disappearance of this species from some large areas of Europe (WYNHOFF 2001). Both situations constitute a real threat for the populations in Romania, which are still relatively stable. *Maculinea arion* is listed in Annex IV of The Directive Flora-Fauna-Habitats and is also mentioned alongside *M. teleius* and *M. nausithous* in The Berne Convention. The category of endangerment established by the IUCN is that of vulnerable species (VU).

***Maculinea teleius* (Bergsträsser, 1779) (fig. 2)**



Fig. 2. *Maculinea teleius*

The upperside of the wings is blue with black spots, black margins, broader at females than males. The underside of the wings is light brown with two rows of white-ringed black spots. Compared to *Maculinea nausithous* its appearance is more silvery.

Wingspan: 27-36 mm.

Habitat:

M. teleius occurs in humid, boggy meadows with high density of *Sanguisorba officinalis*.

Distribution:

It occurs in the Pyrenees, Central Europe, Caucasus, the central and south of Urals, Siberia, Kazakhstan, Mongolia, northern China, Korea and Japan. In Europe is more rare than *M. nausithous*: France, northern Sweden, northern Italy (Piemont, Trieste), central and southern Germany, Austria, Hungary, Slovakia, southern Poland, south-west of Latvia (a single population is known). In Belgium it is considered extinct. It has been recorded in Spain, at Valle d'Aran, but confirmation is needed. It often co-exists with *Maculinea nausithous* (TOLMAN & LEWINGTON 1997).

Distribution in Romania (map 2):

Maculinea teleius has a point-like distribution. Isolated populations are recorded in Transyl-

vania, Maramureș, Banat, Crișana and in northern Moldova, near Botoșani. It co-exists with *M. nausithous* in the colonies from Dealurile Clujului and Rădăuți. In Romania is more frequent than *M. nausithous*.

Population data:

The population density is over 100 individuals / ha, in vigorous populations. The largest populations are recorded in Poiana Narciselor from Vad (1,000 - 3,000 individuals), Cluj surroundings and Satu Mare. Many colonies and populations disappear because the cities are expanding more and more and construction authorizations on the surface of former meadows and pastures are easily granted.

Ecology and behavior:

Research regarding the ecology and biology of the species is ongoing. The flight begins in mid-June until mid-August. Eggs are deposited on the very young, green inflorescence of *Sanguisorba officinalis*. The larvae / pupae are mainly attended by *Myrmica scabrinodis*, but they were also found in nests of *M. rubra*, *M. gallienii*, *M. salina* or *M. vandeli* (TARTALLY 2008).

Conservation measurements:

The same measures as in the case of *M. nausithous* are required, keeping in mind the phenological gap between the two species. The sites will be mowed before the flight period and after the first three larval span, respectively before the first of June and after 15 August. Regarding the corridors and connections between colonies, *M. teleius* is more dynamic than *M. nausithous*, being able to fly more than 1-2 km. The data found in the specialized literature together with our observations suggest that *M. teleius* prefers habitats with a higher density of the host plants *S. officinalis*, while *M. nausithous* can occur in sites with a smaller number, even with only a few individual stalks. The species is protected by The Flora-Fauna-Habitat Directive and it is also listed on The Red List of Romanian butterflies as an endangered species (EN) (RÁKOSY 2003).

***Maculinea nausithous* (Bergsträsser, 1779) (fig. 3)**

Maculinea nausithous differs from *M. teleius* by the darker shade of the wings fund. The margin of the upperside wings is ashen-black and the middle part is dark blue, with a series of black spots on both wings. The difference between these two species is more noticeable on the underside of the wings,

which in the case of *M. nausithous* does not have the marginal row of black spots. The underside is cinnamon-brown.

Wingspan: 28-37 mm

Habitat:

The preferred habitat is represented by mesohygrophilous *Molinion* and *Arrhenaterion* vegetations (EBERT & RENNWALD 1991) on limestone, boggy or clay silt soils. They thrive on grasslands with low-intensity agricultural use or meadows which are mowed manually and incomplete, usually after 10 - 15 August.

Distribution:

It is a Euro-Asian species. In Central Europe it has an insular distribution, represented by populations and colonies of different sizes. Because many habitats were deteriorated and the corridors between them were interrupted, numerous colonies and populations have disappeared. In some countries (The Netherlands, some parts in Switzerland, Germany etc.) the species has gone extinct. In Europe the distribution is discontinuous, from northern Spain to Russia, and the populations are grouped in metapopulations.

Distribution in Romania (map 3):

In Romania no certain recording was known until the 1990's. The population from Fântălele Clujului was the first such recording, followed a few years later by the one from Botoșani. Two years ago the species was also mentioned in Răscruți – Dăbâca – Borșa area. It seems that between the populations from Transylvania and the ones from Hungary, respectively Central Europe, there is no connection. The same lack of continuity exists between the population near Cluj and the one from Moldova. Between individuals in Central Europe and those in Transylvania there are significant morphological differences which makes us believe that we are dealing with a relic population, respectively with another subspecies than the one in Western Europe. To elucidate the taxonomic aspect, molecular genetics and studies of comparative ecology of populations have been initiated.



Fig. 3. *Maculinea nausithous*

Population data:

The estimated population density for the populations in the western parts of the country is between 5-25 individuals/ha and in north-east between 5-10 individuals / ha.

Ecology and behavior:

The butterflies are on the wing after 10 July until the end of August, but some specimen were also seen at the beginning of September. The habitat of *Maculinea nausithous* can be very small and point-like and often it co-exists with *M. teleius*. Because adults do not fly more than 1.000 m from one habitat to another, isolation and fragmentation of habitat is the major cause of population decline. High density of the host plant, *Sanguisorba officinalis*, is not mandatory. There are colonies that live around only a few threads of *S. officinalis* (RÁKOSY 2001). The connection corridors between colonies and populations is essential for the existence of the species (WYNHOFF 2001). The larvae are myrmecophilous, associated with different *Myrmica* ant species. The most common host ant is *Myrmica rubra*, except the populations from Spain and Romania (Transylvania) which use *Myrmica scabrinodis* as host ant (TARTALLY & all. 2008). In Romania thorough studies on this species started a year ago.

Conservation measurements:

The species is endangered because of the deterioration of its habitat. All known populations remained in the hilly region, where a traditional low-intensity agricultural land use is practiced. The colonies inhabit meadows which are mowed manually and once a year, usually after 10 – 15 August. After 1990, more and more plots used in the last hundred years as meadows were abandoned, without being mowed anymore. In some cases the meadows were turned into pastures for sheep. If the meadows were not mowed, after 4 – 5 years the structure of plant associations was significantly altered to the detriment of the host plant, *Sanguisorba officinalis*, and also to the detriment of the host ants, which do not tolerate a vegetation which is too dense. After 4 – 5 years of abandonment shrubs begin to settle in. If the meadow is grazed by sheep they damage the site even faster, because of the large number of sheep / surface and the long period of grazing (sometimes it lasts all year). On such conditions, the vegetation is used entirely and the soil is tamped, being unsuitable for *Myrmica* colonies. But if the meadow is grazed by a smaller number of sheep, before the first of June and after the first of September, the colonies of *Maculinea nausithous* and *M. teleius*

can be maintained in optimal conditions and also shrubs are stopped to settle in. Immediate protection and conservation measurements are necessary, regarding the maintenance of traditional agricultural practices as well as the establishment of protected areas (natural reserves or natural parks). Regarding mowed patches, specific mowing periods must be set. Traditionally, the meadows from Dealurile Clujului area are mowed only once a year, after 10 August. We assume that once the mowing process will be mechanized, the farmers will mow twice a year. If this is the case, the site should first be mowed before 1 June and the second time preferably after 20 August. In this way the first three larval instars can develop on the host plant and also the caterpillars can be adopted by the host ants. The species is protected by The Flora-Fauna-Habitat Directive and it is also listed on The Red List of Romanian butterflies as an endangered species (EN) (RÁKOSY 2003).

Maculinea alcon (Denis & Schiffermüller, 1775) (fig. 4)



Fig. 4. *Maculinea alcon*

The upperside of male's wings is violet-blue, while the female is ashen-brown with some shades of blue at the base of the wings. The upperside is brown with white-ringed black spots.

Wingspan: 25-35 mm

Habitat:

They occur in mesohygrophylous meadows, boggy sites or even marshes, up to 800 – 900 m altitude.

Distribution:

Local, scarce in most regions. It occurs from central and eastern Europe to southern Siberia. The exact distribution of this species is difficult to determine because it is very similar to *Maculinea rebeli*. In the old literature the two species were treated as subspecies of *M. alcon* and were rarely separated in the data referring to their distribution (WYNHOFF 2001). Their status as different species is still questioned.

Distribution in Romania (map 4):

In Romania one can find *M.alcon* in Transylvania, Maramureş, Crişana, southern Moldova and northern Oltenia.

Population:

Maculineaalcon populations are formed, in general, by small, isolated colonies and the density of individuals is between 10-30 individuals / ha, sometimes even more.

Ecology and behavior:

Adults begin to fly from June (sometimes even from the beginning of the month) to mid-August, depending on the locality. The host plant is *Gentiana pneumonanthe*, but in different European regions *Maculineaalcon* may use other species of *Gentiana*. The eggs are deposited on flowers, buds, leaves and the floral stem, usually only in the upper side. The host ants are *Myrmica scabrinodis*, *M.vandeli* and *M.salina*. In Dealurile Clujului and Dejului area *M.alcon* co-exists with *M.rebeli*. Study aimed to find differences for these populations are still in progress.

Conservation measurements:

Maculineaalcon occurs in sites which are grazed by a small number of sheep or cows or wet meadows which are mowed only once a year. In the absence of grazing or mowing the vegetation would be too dense for the host plant to restore therefore the host ants would disappear (KOCKELKE & all. 1994). On the other hand, intensive grazing when the larvae are still on the host plant leads to population decline. Abandonment of land by farmers is an important cause for the species decline in Romania. In recent years, drainage of wet lands has been intensified, and this process will also lead to the disappearance of many populations. Another reason for the decline is the expansion of cities and also, the fact that construction authorization on the surface of former meadows and pastures are easily granted. The category of endangerment is vulnerable (VU) (RÁKOSY 2003).

***Maculinea rebeli* (Hirschke, 1904)**

It resembles very well with *Maculineaalcon*. Taxonomic status of this taxa is still uncertain. Af-

ter it was considered a separate species, molecular genetics research have shown that this taxonomic status can no longer be kept (Bereczki 2005). The issue is still open, especially after syntopic populations have been identified (Rákósy in prep.)

Wingspan: 25-35 mm

Habitat:

They can be found in wet meadows, but also in xerothermophilous meadows in the hilly-mountain level.

Distribution:

In Europe, isolated populations of *Maculinea rebeli* can be found in France, Spain, Germany, in general at over 800 m altitude. It has not been recorded in Turkey and Siberia (WYNHOFF 2001).

Distribution in Romania (map 5):

Until now, *M.rebeli* is known only in Transylvania, Cluj area, Răscruci and in Alba County at Rimetea. The rest of the recordings must be reconfirmed or verified.

Population:

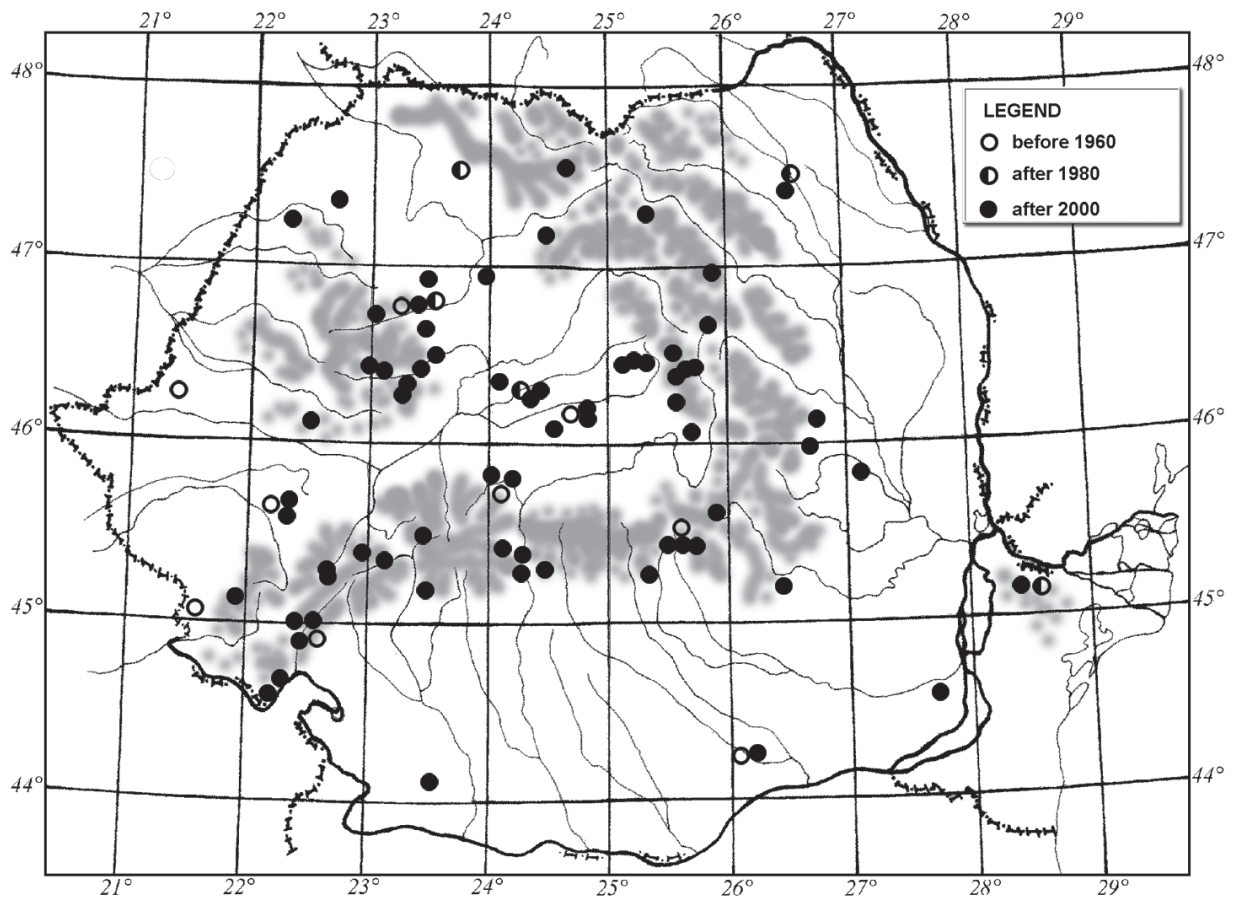
We have no data referring to the ecology of populations of this taxa.

Ecology and behavior:

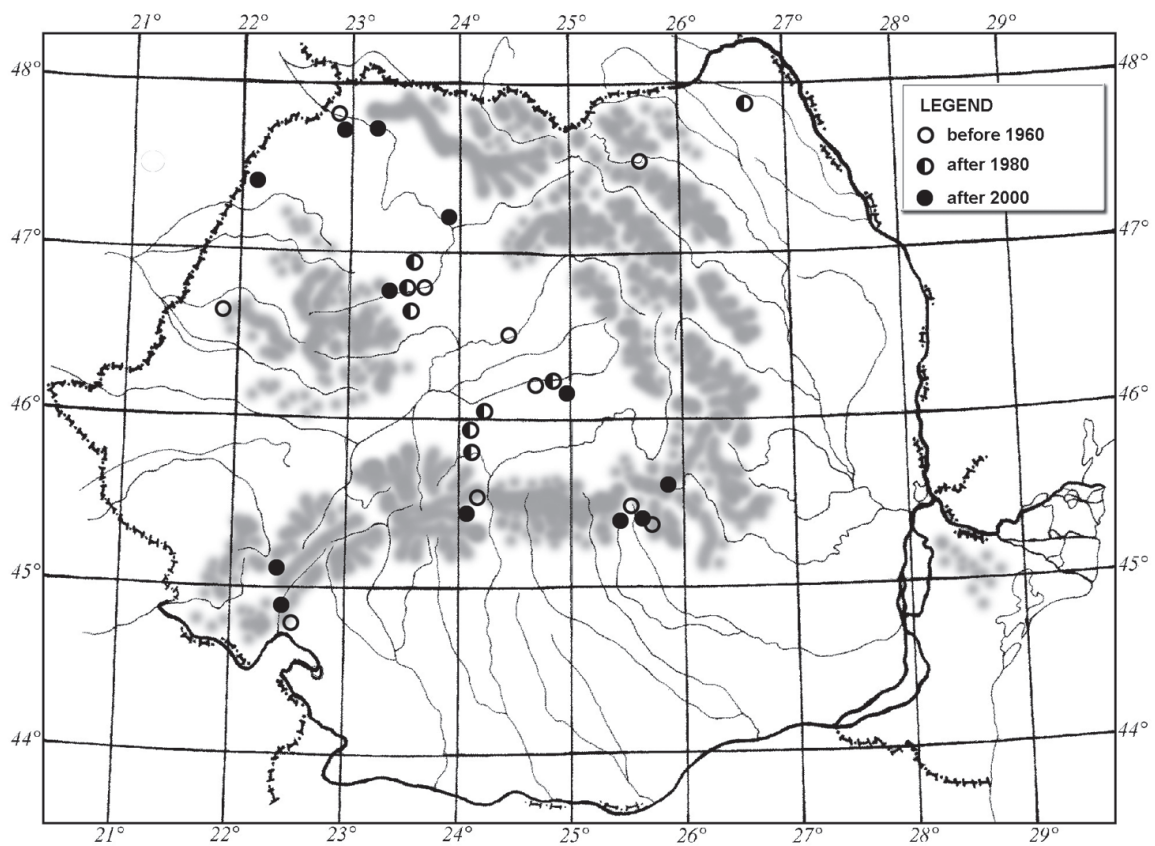
The host plant is *Gentiana cruciata*, but it can lay its eggs on other species of *Gentiana*. Oviposition and life cycle is very similar to *Maculineaalcon*. *M.rebeli* is also parasiting *Myrmica* ants: *M.scabrinodis*, *M.sabuleti*, *M.schenki*, *M.lonae*, *M.speciooides* (TARTALLY 2008).

Conservation measurements:

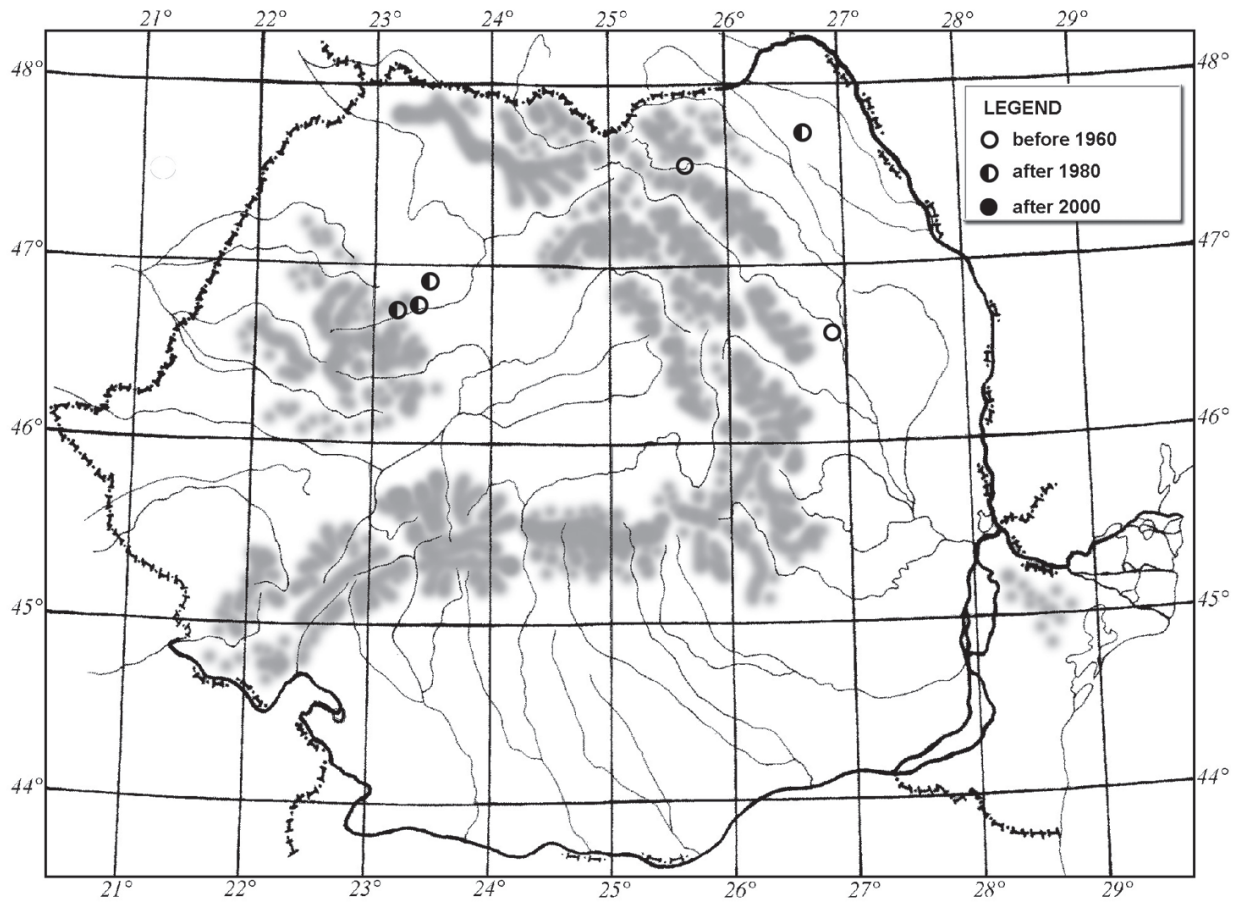
It is the least protected species of the *Maculinea* genus, probably because of its still unclear taxonomic status (WYNHOFF 2001). It is jeopardized because of intensive grazing and habitat fragmentation, considering that its habitat is very limited. As *M.alcon*, *M.rebeli* is not included in The Annexes of The Flora-Fauna-Habitat Directive and is not mentioned in The Berne Convention, either. Category of endangerment: vulnerable (VU) (RÁKOSY 2003).



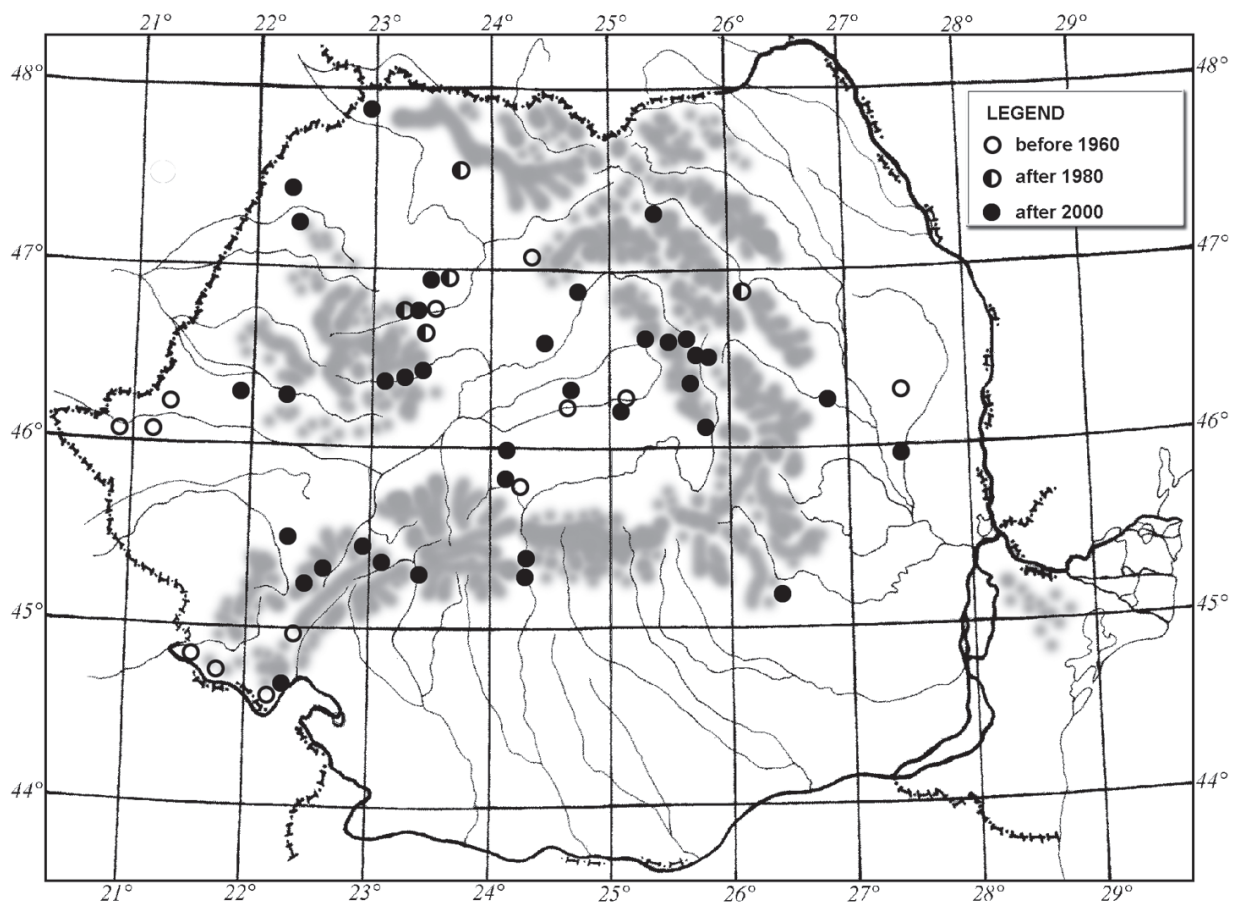
Map 1: Distribution of *Maculinea arion* in Romania



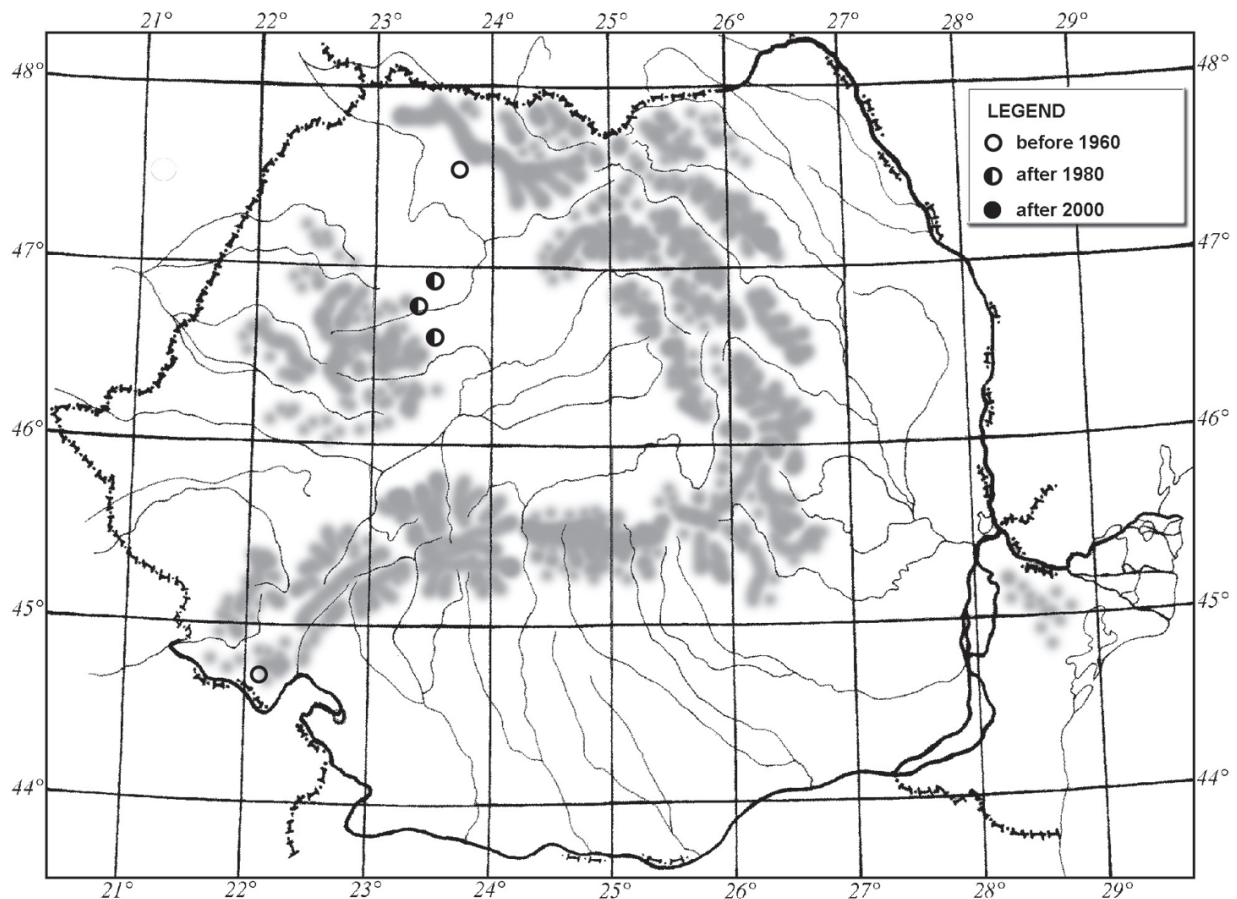
Map 2: Distribution of *Maculinea teleius* in Romania



Map 3: Distribution of *Maculinea nausithous* in Romania



Map 4: Distribution of *Maculinea alcon* in Romania



Map 5: Distribution of *Maculinea rebeli* in Romania

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Received: 26.10.2008

Accepted: 28.11.2008

Printed: 5.12.2008