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FIRST FINDING OF THE CRITICALLY  
ENDANGERED BUTTERFLY *MACULINEA ALCON*  
(DENIS & SCHIFFERMÜLLER, 1775)  
(LEPIDOPTERA: LYCAENIDAE)  
IN THE PANNONIAN PART OF CROATIA

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The critically endangered butterfly *Maculinea alcon* was found at the locality Grubišnopljaska Bilogora in August 2006. That is the first finding of this species in the Pannonian part of Croatia and the second in Croatia as a whole. The biology of this critically endangered species is discussed, as well as some aspects of ecology and protection measures.

**Key words:** *Maculinea alcon*, Grubišnopljaska Bilogora, distribution, habitat, protection measures

Mihoci, I., Delić, A., Gjurašin, B., Bučar, M. & Kučinić, M.: Prvi nalaz kritično ugrožene vrste leptira *Maculinea alcon* (Denis & Schiffermüller, 1775) (Lepidoptera: Lycaenidae) u panonskom dijelu Hrvatske. *Nat. Croat.*, Vol. 16, No. 1., 19–28, 2007, Zagreb.

Kritično ugrožena vrsta leptira *Maculinea alcon* pronađena je u kolovozu 2006. godine na lokalitetu Grubišnopljaska Bilogora. To je prvi nalaz ove vrste na prostoru panonske regije Hrvatske, odnosno drugi za Hrvatsku. U radu se raspravlja o biologiji vrste, nekim aspektima ekologije kao i potrebnim mjerama zaštite ovog kritično ugroženog leptira u fauni Hrvatske.

**Ključne riječi:** *Maculinea alcon*, Grubišnopljaska Bilogora, rasprostranjenost, stanište, zaštita

## INTRODUCTION

In Croatia the genus *Maculinea* is represented by all five European species: Alcon Blue *Maculineaalcon* (Denis & Schiffermüller, 1775), Mountain Blue *Maculinea rebeli* (Hirschke, 1904), Large Blue *Maculinea arion* (Linnaeus, 1758), Dusky Large Blue *Maculinea nausithous* (Bergsträsser, 1779) and Scarce Large Blue *Maculinea telejus* (Bergsträsser, 1779). All five species are listed in the Red List of Butterflies in Croatia, *M.alcon*, *M. nausithous* and *M. telejus* in CR category, *M. rebeli* in VU and *M. arion* in DD category (ŠAŠIĆ & KUČINIĆ, 2004). Also, they are all considered threatened and listed in the Red Data Book of European Butterflies, *M. arion* in EN-SPEC 3 category, *M.alcon*, *M. nausithous* and *M. telejus* in VU-SPEC 3 category and *M. rebeli* in VU-SPEC 1 category (VAN SWAAY & WARREN, 1999). *M. telejus* and *M. nausithous* are also listed in Annex II and Annex IV of the Habitats Directive and *M. arion* in Annex IV of the Habitats Directive (ANONYMOUS, 1992a; 1992b). Due to the endangerment of and severe decline in the abundance of *Maculinea* populations, numerous projects of management, applied protection, conservation and reintroduction have been attempted in many European countries (ALS *et al.*, 2004).

Species from the *Maculinea* genus have been study objects of many researches because of their specific life-cycle. All five species have one brood per year and live in relatively closed populations (GADEBERG & BOOMSMA, 1997). They are the best known example of parasitic butterflies (ALS *et al.*, 2004), precisely obligate parasites, which feed on their larval host plants in first three larval instars and then must be taken in a *Myrmica* host ants' nest to complete their development to adulthood (ALS *et al.*, 2002; TARTALLY, 2004; CLARK *et al.*, 2005). According to VAN DYCK *et al.* (2000) obligatory myrmecophilous *Maculinea* butterflies, when adopted by ants, spend their further development in the colony feeding on the ant brood, like *M. arion*, *M. telejus* and *M. nausithous*, or being actively fed by worker ants, in a cuckoo-like manner (ALS *et al.*, 2002; 2004) like *M.alcon* and *M. rebeli*. According to ALS *et al.* (2004) cuckoo species have evolved from predatory ancestors, around five million years ago when two *Maculinea* clades diverged, leading to the different parasitic strategies seen in *Maculinea* species nowadays.

Butterflies from the *Maculinea* genus have evolved on the diverging survival strategies which operate in different temporal and spatial scales at different stages of the butterfly life-cycle. From an egg laid on a particular oviposition plant, larval competition on particular and individual larval host plant to adoption and further development within particular host ant nests (CLARK *et al.*, 2005).

Along with the highly studied ecology, recently throughout morphometric and molecular studies, the phylogeny of the genus has become a relevant issue (ALS *et al.*, 2004; PECH *et al.*, 2004; BEREZKI *et al.*, 2005).

## MATERIAL AND METHODS

Butterflies were collected with an entomological net and observed in August 2006 at the locality Grubišnopoljska Bilogora (Fig. 1). All collected specimens are kept in a private butterfly collection (I. Mihoci). Butterfly systematics follows KARS-

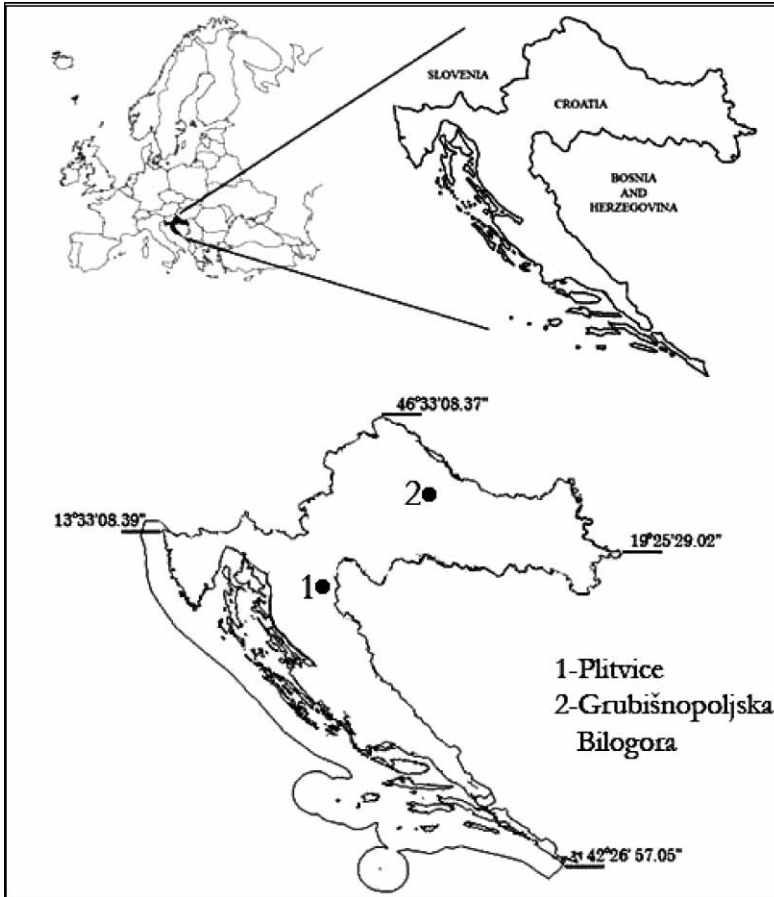


Fig. 1. Finding sites of the butterfly *Maculinea alcon* Den. & Sch. in Croatia (1-Plitvice, ŠAŠIĆ (2004); 2-Grubišnopoljska Bilogora, new data)

HOLT & RAZOWSKI (1996) and taxonomic determination of species regarding wing morphology was done according to TOLMAN & LEWINGTON (1997). Plants were determined using NIKOLIĆ & TOPIĆ (2005). Altitude of the finding locality was determined using the GPS device Garmin eTrex Summit while the photographs were taken using Canon EOS 20D.

## RESULTS AND DISCUSSION

The Alcon Blues of Europe are nowadays differently treated. The level of genetic (ALS *et al.*, 2004) and morphological (PECH *et al.*, 2004) differentiation between the traditional species *M. alcon* and *M. rebeli* has been proven rather low (TARTALLY,

2004). According to BERCZKI *et al.* (2006) taxonomic status of Alcon Blues in Central and Western Europe (conventionally *M.alcon* and *M.rebeli*) is quite confused. Some authors distinguish them as separate species within the *M.alcon* species group and others as subspecies or ecological forms. According to BERCZKI *et al.* (2006) there are »Pneumonanth« and »Cruciata« types of *M.alcon*. According to ÁRNYAS *et al.* (2006) *M.rebeli* is considered as xerophilous ecotype of *M.alcon*. We will distinguish them as two distinct species according to the different initial food plants (*Gentiana pneumonanthe* and sometimes also with *Gentiana asclepiadea* for *M.alcon* and *Gentiana cruciata* sometimes also with *Gentiana germanica* and *Gentiana lutea* for *M.rebeli*) and host ant species (LEPIDOPTEROLOGEN-ARBEITSGRUPPE, 1987; BERCZKI *et al.*, 2005). However, according to SIELEZNIOW & STANKIEWICZ (2004), *Gentiana cruciata* has been recorded as an additional host plant of *M.alcon* in eastern Poland. *M.alcon* is usually dependent on *Myrmica scabrinodis*, *M.ruginodis* and *M.rubra* host ants and *M.rebeli* on *Myrmica schencki*, *M.sabuleti* and *M.scabrinodis* host ants (THOMAS *et al.*, 1989; TARTALLY, 2004; BERCZKI *et al.*, 2005; NOWICKI *et al.*, 2005).

According to ALS *et al.* (2004) the two above mentioned species show little genetic divergence and are considered a single ecologically differentiated species. The minor extent of these differences suggests that *M.rebeli*'s status as a different species is highly questionable. On the other hand, some of the predatory *Maculinea* morphospecies have considerable genetic divergence and they can be considered cryptic species (especially, *M.nausithous*).

The locality Grubišnopoljska Bilogora is the first finding site of the *M.alcon* (Fig. 2) in the Pannonian part of Croatia, and the second for Croatia as a whole. For the first time, *M.alcon* was recorded for Croatia at the locality Vrelo Koreničko in the



Fig. 2. *Maculineaalcon* Den. & Sch., August 2006, Grubišnopoljska Bilogora (photo: I. Mihoci)



Fig. 3. *Gentiana pneumonanthe* L. host-plant of the species *Maculinea alcon* Den. & Sch. – with ova, August 2006, Grubišnopoljska Bilogora (photo: I. Mihoci)

Plitvička jezera National Park when the presence of ova on the larval host plant *G. pneumonanthe* was determined (ŠAŠIĆ, 2004).

For the second time in Croatia *M. alcon* was found in August 2006 in the locality Grubišnopoljska Bilogora at 131 m a.s.l. Both sexes were recorded from the beginning till the end of August in hovering flight near the larval host plant *G. pneumonanthe* (Fig. 5). Average height of gentians on the finding site was 60 centimetres. On flower heads of the Marsh Gentians we detected one or usually more ova (Fig. 3). We have detected the particular act of laying eggs by female butterflies on the mentioned plant (Fig. 4). In each flower head we most often found three larvae. When emerging from the flower head the larva falls to the ground and waits for *Myrmica* ants (DE VRIES, 2004). Unfortunately, due to the overgrowth of the surrounding vegetation we did not collect and determine ants under the gentians.

Grubišnopoljska Bilogora is marshy lowland meadow; occasionally mowed, and characterized by the plant association *Arrhenatheretum elatioris* Br.-Bl. According to BEREZKI *et al.* (2005) marshy lowland meadows are a typical habitat for *M. alcon* butterflies. The meadows of Grubišno Polje area originated from the felling of woodland *Carpino betuli-Quercetum roboris typicum fagetosum*, Rauš 1971 and *Carpino betuli-Quercetum roboris typicum*, Rauš 1971. The meadow where *M. alcon* was established spreads over an area of 6400 square meters and has not been mowed for a few years so it is now overtaken by succession. On an area of more than 3500 square meters the invasive species Golden Rod (*Solidago virgaurea* L.) has taken hold. The lower, marshy part of the meadow (beside the old river bed of the Injatica) has been overgrown with *Carex* spp., the Water Mint (*Mentha aquatica* L.) and the Yellow Iris (*Iris pseudacorus* L.). On somewhat higher but still moist part of

habitat we have recorded the Lax-Flowered Orchid (*Orchis laxiflora* Lam.) while on better drained and dryer parts we established the Cuckoo Flower (*Cardamine pratensis* L.), the Green-Winged Orchid (*Orchis morio* L.), the Ragged Robin (*Lychnis flos-cuculi* L.), Thyme (*Thymus serpyllum* L.), the Marsh Gentian (*Gentiana pneumonanthe* L.) – larval host plant of the *M.alcon*, the Hawthorn (*Crataegus* sp.) and the Black Thorn (*Prunus spinosa* L.). Adjacent meadows are regularly mowed two to three times a year (in June, in August and exceptionally in October if autumn is rainy).

In the same locality besides *M.alcon* we found the hesperiid *Ochlodes venata* (Bremer & Grey, 1853); papilionid *Papilio machaon* Linnaeus, 1758; pierids *Leptidea* sp., *Pieris napi* (Linnaeus, 1758); *Colias croceus* (Fourcroy, 1785); *Gonepteryx rhamni* (Linnaeus, 1758); lycaenids *Lycaena phleas* (Linnaeus, 1761); *Lycaena dispar* (Haworth, 1802); *Cupido argiades* (Pallas, 1771); *Polyommatus semiargus* (Rottemburg, 1775); *Polyommatus icarus* (Rottemburg, 1775) and nymphalids *Argynnis paphia* (Linnaeus,



**Fig. 4.** Laying eggs by female butterflies on the *Gentiana pneumonanthe* L., August 2006, Grubišnopljaska Bilogora (photo: A. Delić)



Fig. 5. *Gentiana pneumonanthe* L. on the locality Grubišnopoljska Bilogora (photo: I. Mihoci)

1758); *Argynnis pandora* (Denis & Schiffermüller, 1775); *Vanessa atalanta* (Linnaeus, 1758); *Vanessa cardui* (Linnaeus, 1758); *Araschnia levana* (Linnaeus, 1758); *Melitaea didyma* (Esper, 1778); *Melitaea athalia* (Rottemburg, 1775); *Neptis sappho* (Pallas, 1771); *Coenonympha glycerion* (Borkhausen, 1788); *Coenonympha pamphilus* (Linnaeus, 1758); *Maniola jurtina* (Linnaeus, 1758) and *Satyrus ferula* (Fabricius, 1793).

Conservation and protection of the habitat of this European-widethreatened butterfly must be a priority. According to DE VRIES (2004) the key to its survival lies in maintenance of a sufficient area of suitable habitat and the maintenance of the quality of remaining habitat patches. In addition, several measures must be emphasized: stopping habitat fragmentation and transformation of meadows into arable land, suppression of land drainage due to protection of marsh and wet meadows, untimely mowing (not before September is proposed) and all the other measures that favour species maintenance. The locality Grubišnopoljska Bilogora is so far

well preserved although if needed in the future, the proposed measures could be promptly implemented.

Future studies should be directed to the research of all potential finding sites of *M. alcon* in Croatia according to the spatial distribution of the larval host plant *G. pneumonanthe*, more precisely, to localities in east-Pannonian, west-Pannonian and mountain macro region (TOPIĆ & PALKOVIĆ, 2005). Also, future surveys must be focused on assessing the size and abundance of all estimated populations, understanding species phenology and some unrevealed details of life-cycle as well as ecological requirements which affect population structure, dynamics and abundance.

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## S A Ž E T A K

### Prvi nalaz kritično ugrožene vrste leptira *Maculinea alcon* (Denis & Schiffermüller, 1775) (Lepidoptera: Lycaenidae) u panonskom dijelu Hrvatske

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Rod *Maculinea* u Hrvatskoj zastupljen je sa svih pet europskih vrsta: *Maculinea alcon* (Denis & Schiffermüller, 1775), *Maculinea rebeli* (Hirschke, 1904), *Maculinea arion* (Linnaeus, 1758), *Maculinea nausithous* (Bergsträsser, 1779) i *Maculinea telejus* (Bergsträsser, 1779). Svih pet vrsta nalazi se na Crvenom popisu danjih leptira Hrvatske, *M. alcon*, *M. nausithous* i *M. telejus* u CR kategoriji, *M. rebeli* u VU kategoriji, a *M. arion* u DD kategoriji (ŠAŠIĆ & KUČINIĆ, 2004).

Taksonomski status plavaca iz »alcon grupe« *M.alcon* i *M.rebeli* nije u potpunosti razjašnjen. Danas je dokazano da je razina genetičke (ALS et al., 2004) i morfološke diferencijacije (PECH et al., 2004) između tradicionalnih vrsta *M.alcon* i *M.rebeli* relativno niska (TARTALLY, 2004). Neki autori odvajaju ih kao odvojene vrste unutar grupe vrste *M.alcon*, dok ih drugi smatraju podvrstama ili ekološkim formama (BERECZKI et al., 2006). Prema BERECZKI et al. (2006) razlikuju se »Pneumonanth« i »Cruciata« tipovi vrste *M.alcon*, a prema ÁRNYAS et al. (2006) *M.rebeli* je kserofilni ekotip vrste *M.alcon*. Mi ćemo ih promatrati kao zasebne vrste prema ekološkim karakteristikama odnosno razlikama u životnom ciklusu. *M.alcon* vezana je uz biljku hraniteljicu *Gentiana pneumonanthe*, a osim nje ponekad i uz *G.asclepiadea*, te u razvoju nakon trećeg stadija gusjenice uz mrave domaćine *Myrmica scabrinodis*, *M.ruginodis* i *M.rubra*. *Maculinea rebeli* vezana je uz biljku hraniteljicu *Gentiana cruciata*, a osim nje ponekad i uz *G.lutea*, te u razvoju nakon trećeg stadija gusjenice uz mrave domaćine *Myrmica schencki*, *M.sabuleti* i *M.scabrinodis* (THOMAS et al., 1989; TARTALLY, 2004; BERECZKI et al., 2005; NOWICKI et al., 2005). Mirmekofilija roda *Maculinea* najbolji je poznati primjer obligatnog parazitizma u svijetu leptira (ALS et al., 2004).

Nakon prvog objavljenog nalaza vrste u ŠAŠIĆ (2004), vrsta je po drugi puta zabilježena na vlažnoj livadi lokaliteta Grubišnopljaska Bilogora u kolovozu 2006. godine. Fotodokumentirana je ovipozicija na cvjetnim pupovima plućne sirištare (*G.pneumonanth*), gusjenice u cvjetnom pupu, kao i imago ženke i mužjaka.

Lokalitet nalaza vrste relativno je dobro očuvan, ali su na temelju propadanja mnogih sličnih u Europi potrebne mjere zaštite staništa ove kritično ugrožene vrste. Između ostalih one se očituju u sprečavanju fragmentacije staništa, sprečavanju pretvaranja vlažnih livada u poljoprivredno obradive površine, hidromelioracije te nepravovremene košnje i ispaše.

Buduća istraživanja ove vrste, ali i ostalih vrsta unutar roda, trebalo bi usmjeriti na utvrđivanje stvarnog rasprostranjenja u Hrvatskoj, kod *M.alcon* posebno s obzirom na lokalitete nalaza biljke hraniteljice *G.pneumonanth* (TOPIĆ & PALKOVIĆ, 2005), na utvrđivanje veličine populacija, specifičnosti životnog ciklusa, kao i svih ekoloških parametara koji utječu na veličinu, strukturu i dinamiku utvrđenih populacija.