



# NEW FINDINGS OF THE BUTTERFLY DALMATIAN RINGLET, *PROTEREBIA AFRA* *DALMATA* (GODART, [1824]) (LEPIDOPTERA, SATYRINAE) IN CROATIA

IVA MIHOCI<sup>1</sup> & MARTINA ŠAŠIĆ<sup>2</sup>

<sup>1</sup>Preloška 66, 40000 Čakovec, Croatia

<sup>2</sup>Department of Zoology, Croatian Natural History Museum,  
Demetrova 1, Zagreb, Croatia

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This paper presents new findings of the rare butterfly *Proterebia afra dalmata* (Godart, [1824]) along the Dalmatian coast in Croatia. The subspecies was found on seven new sites: in Lozovac near the Krka National Park, in the vicinity of the main spring of the Cetina River, near Velo Blato on the island of Pag and at four locations on the northern slopes of Mt Biokovo between Lončari, Kaoci and Turija (all inside the borders of Biokovo Nature Park). The range and the habitat characteristics of this threatened subspecies are also discussed.

**Key words:** *Proterebia afra dalmata*, butterflies, Satyrinae, distribution, Croatia

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U radu se navode nova saznanja o rasprostranjenosti rijetke vrste leptira *Proterebia afra dalmata* (Godart, [1824]) duž dalmatinske obale u Hrvatskoj. Svojtja je novozabilježena na sedam nalazišta: kod Lozovca u blizini Nacionalnog Parka »Krka«, u okolici glavnog izvora rijeke Cetine, kraj Velog Blata na otoku Pagu, te na četiri lokaliteta na sjevernoj ekspoziciji masiva Biokova između Lončara, Kaoca i Turije, koji se nalaze unutar granica Parka Prirode »Biokovo«. Raspravlja se o rasprostranjenosti te karakteristikama staništa ove ugrožene svojte.

**Ključne riječi:** *Proterebia afra dalmata*, leptiri, Satyrinae, rasprostranjenost, Hrvatska

## INTRODUCTION

In European fauna, there are three endemic representatives of the butterfly *Proterebia afra* (Fabricius, 1787) (syn: *phegea* (Borkhausen, 1788): the Greek endemic sub-

species *Proterebia afra pyramus* de Louker & Dils, 1987, the Crimean endemic subspecies *Proterebia afra krymaea* (Sheluzhko, 1929) and the Croatian, Dalmatian Ringlet, *Proterebia afra dalmata* (Godart, [1824]).

*Proterebia afra krymaea*, the Crimean endemic subspecies was described by Sheluzhko in 1929 (SHELZHKO, 1929). The type-locality of the species is the Jajla mountain range, near Jalta on the Crimean Peninsula (HESSELBARTH *et al.*, 1995).

The second European representative of the species is Greek endemic subspecies *Proterebia afra pyramus*. *P. afra pyramus* is spread over the north west region of Greece: the province of Kozani from an altitude of 600 m a.s.l. up to 850 m a.s.l. (DE LOUKER & DILS, 1987; ABADJIEV, 2002) as well as in the vicinity of the Lake Vegoritis, the Askion Mts and the Vourinos Mts from 550 m a.s.l. up to 1250 m a.s.l. (TOLMAN & LEWINGTON, 1997).

The Croatian subspecies *Proterebia afra dalmata* was first described by Godart in 1824 according to one female specimen collected by Dejean in 1817 in the surroundings of the Dalmatian coastal town Šibenik »au bord de la mer, dans les environs de Sebennico en Dalmatie« (GODART in LATREILLE & GODART, [1824]). *P. afra dalmata* and *P. afra pyramus* occupy different geographical regions by means of allopatric speciation and can be easily morphologically distinguished. The Croatian subspecies has much brighter ground colour, veins are heavily marked, the wing apex is beige-grey, and ocelli surrounded with yellowish-orange circles (Fig. 1, Fig. 2).

The Dalmatian Ringlet is known as a univoltine butterfly, with adults flying from the end of April to late May and an altitudinal distribution from 150 to 500 m a.s.l. (TOLMAN & LEWINGTON, 1997). Adult butterflies can be found in open mountain grassland or on grassy and rocky limestone slopes close to *Juniperus* bushes.



**Fig. 1.** *Proterebia afra dalmata* God., female, specimen caught near the Biokovo Brzice – Kaoci mountain road (coll: I. Mihoci, photo: I. Mihoci).



Fig. 2. *Proterebia afra dalmata* God., male, specimen caught near the Biokovo Brzice – Kaoci mountain road (coll: I. Mihoci, photo: I. Mihoci).

According to TOLMAN & LEWINGTON (1997) females often visit the flowers of *Globularia* and yellow flowers from the Asteraceae family.

In captivity, *ab ovo*, the embrional development of the egg lasts for 19 days (ROOS *et al.*, 1984). Females lay their eggs singly, closely to the ground. Eggs are morphologically similar to eggs of some species of the *Pararge* or *Lasiommata* genus (ROOS *et al.*, 1984). A good deal is known about characteristics of the species' five larval stages. The larval host-plant is green fescue (*Festuca ovina* L.). After 228 days they pupate, low down at the ground level. The pupal stage is very short, only 20 days long and pupae are very strongly built (ROOS *et al.*, 1984; HESSELBARTH *et al.*, 1995).

The Dalmatian Ringlet is one of the rarest satyrid butterflies in Croatia. Until now, this subspecies was known from only four localities: Šibenik (GODART, [1824]; NICHOLL, 1899; STAUDER, 1913; SIJARIĆ, 1991); Zadar (STAUDER, 1919–1927; SIJARIĆ, 1991), Knin (HAFNER, 1994; CARNELUTTI, 1994) and Korčula (JAKŠIĆ, 1993), mostly in areas with stressed urbanisation pressure. That was the reason for introducing this subspecies on the Red Data List of Croatian Butterflies, in Data Deficient (DD) category (ŠAŠIĆ & KUČINIĆ, 2004).

## MATERIAL AND METHODS

### Material:

- (1) unnamed hill near the city of Šibenik, 183 m a.s.l., April, 24<sup>th</sup> 1979, 7 males and 1 female, leg. Z. Lorković;
- (2) Lozovac, 186 m a.s.l., April, 24<sup>th</sup> 1979, 1 male, leg. Z. Lorković;

- (3) near the Glavaš spring of the Cetina River, 300 m a.s.l., May, 1<sup>st</sup> 2000, 2 males and 1 female, leg. B. Jalžić;
- (4) near Velo Blato on the island of Pag, 40 m a.s.l., April, 18<sup>th</sup> 2003, 1 male, leg. F. Perović;
- (5) in the grass of the karst sinkhole Donji Stublac (Biokovo Nature Park) near the Brzice – Kaoci mountain road, 700 m a.s.l., April, 28<sup>th</sup> 2003, 1 male and 1 female, leg. I. Mihoci;
- (6) in Lončari village (Biokovo NP), 213 m a.s.l., April, 29<sup>th</sup> 2003, 2 males, leg. I. Mihoci;
- (7) in Stanići village (Biokovo NP), 346 m a.s.l., April, 30<sup>th</sup> 2003, 1 female, leg. I. Mihoci;
- (8) on the Turija hill (Biokovo NP), 687 m a.s.l., April, 30<sup>th</sup> 2003, 1 female, leg. I. Mihoci.

Butterflies were collected at the localities mentioned and are now kept in the collection of the Department of Zoology of the Croatian Natural History Museum, Zagreb (CNHM) and a private butterfly collection (the MIHOCI collection). Taxonomic determination was done by wing morphology according to TOLMAN & LEWINGTON (1997). Data from the famous Croatian lepidopterist Prof. Zdravko Lorković were found in his field notes, kept in CNHM, Zagreb (unpublished data). The geological bedrock was proved by Geological Sheet-Maps of Croatia (Geological Sheet-Map Omiš No. 32, Imotski No. 33 and Ploče No. 35) and vegetation belts by KUŠAN (1969) and HORVATIĆ (1971).

## RESULTS

In April 1979 Lorković collected eight specimens (seven males and one female) of *Proterebia afra dalmata* on a hill near the city of Šibenik at 183 m a.s.l. and one old male ten kilometres distant from Šibenik, in Lozovac, near the valley of the Krka River (LORKOVIĆ, unpublished field notes). In May 2000 three specimens were collected about 50 meters from the Glavaš spring in the valley of the former source of the Cetina River. In April 2003 one specimen was collected on calcareous slopes with the presence of *Juniperus* bushes in the vicinity of the freshwater lake Velo Blato on the island of Pag, and six specimens on four locations (all of them inside borders of Biokovo Nature Park) on the northern slopes of the Biokovo Massif. The altitudinal range of the Dalmatian Ringlet on Mt Biokovo thus extends from the lower limit of 213 meters to the upper at 700 meters. The distance as the crow flies from the easternmost (Lončari village) to the westernmost point (Turija Hill) on Mt Biokovo is 10.5 km. According to Geological Sheet-Maps of Omiš No. 32, Imotski No. 33 and Ploče No. 35 the geological surface on all locations on the northern slopes of Mt Biokovo is dominantly calcareous. In addition, all localities are semi-natural habitats with *Juniperus* bushes. Most of our eight finding localities are situated in the Mediterranean belt characterized by the presence of *Quercus pubescens*



**Fig. 3.** Distribution of the species *Proterebia afra dalmata* in Croatia: (1) Šibenik (GODART, [1824]; LORKOVIĆ, unpublished records), (2) Zadar (STAUDER, 1919–1927), (3) the island of Korčula (JAKŠIĆ, 1993), (4) Strana, near the city of Knin (HAFNER, 1994), and new localities: (5) Lozovac, (6) the Glavaš spring of the Cetina River, (7) Velo Blato on the island of Pag, and (8–11) four localities on Mt Biokovo (in Biokovo Nature Park on the Dalmatinska Zagora side). New findings of the subspecies are coloured green, and numbers of locations follow the chronological order of the finding of the localities.

and *Carpinus orientalis* (40–346 m a.s.l.) and only two of them in the area of upper Mediterranean belt with *Q. pubescens* and *Ostrya carpinifolia* (687–700 m a.s.l.).

On April 28, 2003 we first came upon a population of the Dalmatian Ringlet on the way to a flowery meadow in the karst sinkhole Donji Stublac on Mt Biokovo. In this habitat, surrounded with *Ostrya carpinifolia* woodland, the following were also found: *Pieris brassicae* L., *Pieris napi* L., *Anthocharis cardamines* L., *Callophrys rubi* L., *Glaucopsyche alexis* Poda, *Pseudophilotes vicrama schiffermuelleri* Hemm. and *Melitaea cinxia* L. At this location the population of the Dalmatian Ringlet was numerous while on other three locations it was presented with a small number of specimens. The specimens taken from all four localities on Mt Biokovo had heavily damaged wing scales.

All material collected dates from April 18 to May 1. The area of the distribution of the subspecies is shown in Fig. 3.

## DISCUSSION

The range of the *Proterebia afra dalmata* spreads along the Dalmatian coast. Including our data there are now 11 known localities. Before our findings, according to GODART [1824] and NICHOLL (1899) the presence of the subspecies was estimated for Šibenik: »...appearance of the scarce *Erebia afer* var. *dalmata*...to the best of my belief, to be had only in the neighbourhood of Sebenico...« NICHOLL (1899). STAUDER (1913, 1919–1927) gives Zadar as well as Šibenik. From the localities Šibenik and Zadar several specimens are kept in the Mihljević Collection in the National Museum in Sarajevo, all collected in 1982, seven in Šibenik and three in Zadar, by the Slovenian entomologist Lasan (SIJARIĆ, 1991). Nine specimens without an exact locality were found by Rogulja on the island of Korčula in 1928 and are now kept in the Rogulja Collection (JAKŠIĆ, 1993). In 1935 Hafner collected one specimen, and in 1936 Hafner Jr ten specimens at the Strana locality on the southern slopes of Spas Hill near the city of Knin (HAFNER, 1994). Specimens collected by Hafner and Hafner Jr are kept in the Slovenian Natural History Museum, Ljubljana (CARNELUTTI, 1994). From two more localities we have only unconfirmed notes, probably misinterpreted citations from previous papers. The first is a dot on the map for the Pelješac Peninsula in the provisional distribution maps of the butterflies of Yugoslavia (JAKŠIĆ, 1988). According to WERNER (1895), systematic field research in Lepidoptera in the Pelješac Peninsula has never revealed this species in this area, although no recent research has been done. The second is a wrong citation of *locus typicus* in the review book on the history of entomology in Dalmatia by Prof. Guido Nonveiller, who misstates Dubrovnik as a type-locality (NONVEILLER, 1989).

A historical review of scientific studies of the fauna of Rhopalocera on the Adriatic coast and some Central Dalmatian Adriatic Islands (Čiovo, Šolta, Brač and Hvar) by STAUDER (1919–1927) states the presence of the Dalmatian Ringlet only in Zadar and Šibenik. Studies on the butterfly fauna, including the spring aspect, on the island of Krk (BARTOL & MICIELI, 1964), the island of Pag (MLADINOV, 1965), the island of Brač (MOUCHA, 1965), the island of Unije (MLADINOV, 1967) and the island of Rab (LUY, 1993) show no records of *Proterebia afra dalmata* in the investigated area of Adriatic coast. It seems that this species has a jumped dispersion and is restricted to a specific microhabitat with as yet unknown requirements with respect to ecology and vegetation. Therefore, this new knowledge on the distribution of the Dalmatian Ringlet constitutes important records.

The Dalmatian Ringlet is, in general, a xerothermophile satyrid, usually found on heaths or calcareous grasslands, tolerant of cold winters and demanding long and dry summers/biotopes as dominant eco-factor (KUDRNA, 1986). According to HESSELBARTH *et al.* (1995) the flight-period of the species is only two to three weeks. Specimens collected on Mt Biokovo had heavily damaged wing-scales, so we concluded they probably emerged at the end of March or at the beginning of April, before the time of emergence cited in TOLMAN & LEVINGTON (1997).

Our observations shows that the altitudinal distribution of the subspecies ranges from 40 m a.s.l. to 700 m a.s.l. and it is present in deciduous (Sub-Mediterranean) belts of the Mediterranean region, with the exception of the island of Korčula in the



Mediterranean proper belts. Specimens collected on Mt Biokovo were observed in hovering flight nearby bushes of prickly juniper (*Juniperus oxycedrus* L.) which are usually present in the whole of the Sub-Mediterranean zone. According to Horvatić (1971) the whole zone is characterized by unique climazonal vegetation of the association of *Quercus-Carpinetum orientalis croaticum*. Around Lončari and Stanići villages, groves and scrubs of Oriental Hornbeam (*Carpinetum orientalis* Mill.) are dominant. According to KUŠAN (1969) that zone is characterised by the *Carpinetum orientalis croaticum* forest association, and it is precisely these habitats that are semi-natural, having been mostly devastated and partly replaced with agricultural areas and settlements. On Turija Hill and on the way to the karst sinkhole Donji Stublac we have estimated the domination of prickly juniper (*Juniperus oxycedrus* L.), grasses from *Sesleria* genus and scrubs and forests of Hop Hornbeam (*Ostrya carpinifolia* Scop.). The climazonal vegetation of this zone is *Seslerio – Ostryetum* (KUŠAN, 1969). At all locations specimens of the Dalmatian Ringlet were found near to *Juniperus* bushes.

Future surveys will be focused on establishing the distribution of *P. afra dalmata* in Croatia, conducting an enquiry into the size and number of populations, understanding species ecology as well as the ecological requirements that affect population structure and dynamics.

The subspecies is listed on the Red List of endangered butterfly species of Croatia (ŠAŠIĆ & KUČINIĆ, 2004) and should be statutorily protected. After detailed research into the biology of species conservation, measures should be suggested and put into practice at once, before pressures like urbanisation (Zadar, Knin, Šibenik) and building (building of a tunnel through Mt Biokovo from Zagvozd to Baška Voda, which started in December 2004), affect the population by habitat destruction and fragmentation. Changes in habitat management could also bring about a decline in this endemic subspecies.

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## SAŽETAK

### Novi nalazi leptira dalmatinskog okaša, *Proterebia afra dalmata* (Godart, [1824]) (Lepidoptera, Satyrinae) u Hrvatskoj

I. Mihoci & M. Šašić

Prema dosadašnjim saznanjima dalmatinski okaš (*Proterebia afra dalmata*) jedna je od najrjeđe zastupljenih vrsta danjih leptira u Hrvatskoj. Podvrstu je na temelju jednog ženskog primjerka prikupljenog u Šibeniku 1817. godine opisao Godart 1824. godine (GODART, [1824]). Areal rasprostranjenja vrste dosad je zabilježen duž jadranske obale i otoka: od Knina (HAFNER, 1994; CARNELUTTI, 1994), preko Zadra i Šibenika (NICHOLL, 1899; STAUDER, 1913, 1919–1927) do Korčule (JAKŠIĆ, 1993). Iako JAKŠIĆ (1988) u »Privremenim kartama rasprostranjenosti dnevnih leptira Jugoslavije« označava poluotok Pelješac kao stanište i nalazište vrste, pregledom objavljenih radova o fauni leptira toga područja (WERNER, 1895), te entomoloških zbirki, nije utvrđena prisutnost vrste te smatramo da je došlo do pogreške prilikom izrade karte. Također smatramo da je NONVEILLER (1989) u djelu »Pioniri proučavanja insekata Dalmacije« zabunom naveo Dubrovnik kao *locus typicus* podvrste *dalmata*. Podvrsta je ponovno pronađena na nekoliko novih lokaliteta na području Hrvatske: kod Lozovca 1979. godine (LORKOVIĆ, neobjavljeni podaci), u blizini izvora rijeke Cetine 2000. godine, te 2003. godine na otoku Pagu i na četiri lokaliteta na sjevernoj ekspoziciji masiva Biokova.

Novotvrđeni lokaliteti su faunistički veoma značajni za poznavanje ekologije vrste te će u budućim istraživanjima neki od njih biti predmetom detaljnije ekološke analize. Težište će biti na utvrđivanju stvarnog rasprostranjenja vrste i brojnosti populacija, analizi životnog ciklusa i ekologiji te utvrđivanju svih čimbenika koji ugrožavaju opstanak ove endemične svojte na našim prostorima.

Zakonska zaštita vrste i njezinog staništa je nužna kao i poduzimanje svih mjera koje mogu spriječiti negativne antropogene utjecaje na stanište i ekosustav. Pritisci poput urbanizacije, građevinskih radova te intenziviranja automobilske prometa teoretski mogu neposredno djelovati na populacije dalmatinskog okaša putem nestanka ili degradacije staništa. Kako je vrsta ovisna o uvjetima staništa, zakonska zaštita staništa na lokacijama nalaza trebala bi biti prioritetna.