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## *Carabus variolosus* (Fabricius, 1787) (Coleoptera: Carabidae) in Bulgaria: rediscovered after 111 years

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**Abstract:** The rediscovery of the rare and endangered species *Carabus (Hygrocarabus) variolosus* is reported after its last record from 1909. The only known locality (Stara Planina Mts, Varshets Town) was confirmed. New records at similar habitats in the region could be expected in the future, based on extensive surveys with the proposed methods.

**Keywords:** beetles, monitoring, Natura 2000, protection

### Introduction

*Carabus (Hygrocarabus) variolosus* (Fabricius, 1787) was originally recorded for Bulgaria by Apfelbeck (1904). The record was based on material gathered by the Hungarian collector and tradesman of beetles Eduard Merkl from “Serbien, Bulgarien (Stara Planina-Merkl)” [Serbia, Bulgaria (Stara Planina-Merkl)]. Unfortunately, no data on the exact location, altitude or time of collection of the material were provided. Many authors usually referenced this imprecise locality to either Serbia and Bulgaria (see Guéorguiev & Guéorguiev 1995 and Ćurčić et al. 2007, among others). Later, Rambousek (1912) also mentioned Apfelbeck’ *C. variolosus* locality for Bulgaria, and provided a new record from the valley of the Stara Reka River [= Botunya River] near Varshets

Town (Stara Planina Mts). The material near Varshets was either observed or collected (unclear) by P. Drenski and F. Rambousek themselves, and the event supposedly happened on 20 May 1909 (ibid.). A few years later, Buresch & Kantardjieva (1928) gave a short overview of the morphology of *C. variolosus*, discussed its two subspecies, and reported one specimen they examined from the collections of the former Tsar’s Entomological Station in Sofia. The specimen in question has been collected by D. Joakimov along the valley of Stara Reka River on 8.05.1909. Interestingly, D. Joakimov and the pair P. Drenski and F. Rambousek independently encountered their specimens in the same month and year. Breuning (1928) examined a specimen of *Carabus variolosus* from Bulgaria (most probably the one discussed in Buresch & Kantardjieva, 1928) sent him by I. Buresch;



Fig. 1. Habitat of *Carabus variolosus* at Botunya River, above Varshets Town, Bulgaria.

as a result, this famous authority on the genus *Carabus* Bonelli concluded that the Bulgarian population belongs to the nominotypical subspecies. *Carabus variolosus* is a glacial relict, polytypic species with two subspecies: *C. variolosus nodulosus* Creutzer, 1799 occurring in France, Belgium, Germany, Austria, Hungary, Italy, Slovenia, Croatia, Bosnia and Herzegovina, Kosovo, and Serbia, and *C. variolosus variolosus* reported to inhabit Poland, Czech Republic, Slovakia, Ukraine, Romania, Moldova, Serbia, and Bulgaria (Turin et al., 2003). The population in Germany shows very clear genetic separation, even at close distances (2–3 km), and probably the two subspecies have survived in different refugial conditions during the Last Glacial Maximum (Matern et al., 2008; Matern et al., 2010; Mossakowski et al., 2020).

In most of Europe, the species seems very rare and endangered. It is included in the Habitats Directive 92/43/EEC (Annex II). In the Red Book of Bulgaria the

species is with the status of critically endangered CR [B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv)] (Guéorguiev, 2015). On the other hand, in Romania, it is widespread and frequent in undisturbed wet forests (Turin, 2003; Barloy & Prunar, 2012).

According to its ecological requirements, it is a stenotopic, hygrophilous, hygrobiont and primary forest dwelling species. It inhabits very humid forest habitats in foothills and mountains or near forests, at low and medium altitudes (up to 1000 m above sea level). Habitats of the species include banks of flowing mountain rivers and streams, bogs, swamps and their adjacent territories, often overgrown with standing trees (mainly *Alnus* sp.), less often moist forest meadows. Thus, it is considered an indicator species for natural (preserved) forest streams and smaller mountain rivers. *Carabus variolosus* (s.l.) is mainly nocturnal, slowly moving, strictly attached to the streams and its surroundings (Drees et al., 2008; Matern et al., 2007).



Fig. 2. A pitfall trap, placed on the bank of Botunya River.

The species was researched in Natura 2000 protected area BG0001040 – Western Stara Planina and Pre-Balkans, during many years and different monitoring projects conducted in 2011–2015 (B. Guéorguiev, E. Chehlarov), 2019–2020 (M. Antov, P. Boyadzhiev, G. Zemdzhikova), and 2022 (R. Kostova, R. Bekchiev). Here we reported the results from the successful expedition in 2020.

### Material and methods

The material was collected in 2020, during field expeditions in Stara Planina Mts, in the valley of Botunya River (Fig. 1), near Varshets Town. Adult specimens were caught in a predetermined monitoring area using pitfall traps (plastic containers) (Fig. 2). The traps are buried in the soil up to their upper edge. The traps used for monitoring purposes are live traps and accordingly no fixative or other killing agent was used. In order to

avoid predation and cannibalism, which occur in such traps, at the bottom were placed forest litter and twigs from the surroundings ensuring hiding places for the specimens. To sample *Carabus variolosus* – as a water-bound species, traps should be placed linearly along the banks of mountain streams, small rivers, and other appropriately suitable habitats, at a distance of 1.5 meters maximum from the shore of the respective waterbody. The exposure of the traps lasted 24 hours.

### Results

*Carabus (Hygrocarabus) variolosus* (Fabricius, 1787)  
Figs 3, 4

Stara Planina Mts, Varshets Town, bank of Botunya River, *Fagus sylvatica* forest, N43.149617° E23.232467°, a single specimen, collected in the pitfall traps (without fixative agent) set on 13–14.06.2020 and



Fig. 3. Adult *Carabus variolosus* in a pitfall trap (Botunya River).



Fig. 4. *Carabus variolosus* – in situ, on a tree stem near site of capture (Botunya River).

released alive at the same place. The only one individual was observed by M. Antov, P. Boyadzhiev, G. Zaemdzhikova.

## Discussion

The increase of funding for field studies of protected species in recent years led to the expected positive results and many records of new localities and confirmation of old ones for species that were even considered extinct or non-existing on the territory of Bulgaria (Bekchiev et al. 2018, 2020). The current finding of *Carabus variolosus* confirms the above mentioned trend, and future large-scale surveys of the entire Varshets and West Stara Planina region are needed to establish the possible optimal and potential habitats of the species. It is very likely that the population above Varshets is small, with a limited range and possibly genetically rather isolated from the closest Carpathian populations. Also, it is very possible that the species' population in Western Stara Planina Mts (Bulgaria and Serbia) is the southernmost and peripheral in terms of the range of the species. Therefore, a strict and strong protection of the species' potential habitats – riparian forests and meadows, in Natura 2000 protected area BG0001040 – Western Stara Planina and Pre-Balkans, is necessary.

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