

Remarks on the current situation of *Carabus variolosus nodulosus* relating to the interpretation of its Habitats Directive status, the 2013 report under that directive, and its threat level in Germany and Central Europe

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Abstract: Remarks on the current situation of *Carabus variolosus nodulosus* relating to the interpretation of its Habitats Directive status, the 2013 report under that directive, and its threat level in Germany and Central Europe - *Carabus variolosus* has been listed under the EU Habitats Directive since 2004, in annexes II and IV. Depending on the interpretation of the two taxa *variolosus* and *nodulosus* as subspecies or distinct species there is some ambiguity whether the listing includes *nodulosus* or not. Both taxa are remarkably close in regard to morphology and life history. The European Topic Center has communicated (ETC 2011) that the taxonomic status is subject to a pending decision, and has asked member states to report for both taxons, separately. Hence, for the reporting period 2007 to 2013 there is data on this species for all member states for the first time.

The vast majority of the German occurrences lie in Bavaria, where the species is present in 28 map quadrants. Nineteen of these occurrences are situated in habitats directive sites (SCI/SAC). The only recent record from outside Bavaria comes from the Arnsberger Forest in Northrhine-Westphalia. The species is extinct in Baden-Wuerttemberg and Lower Saxony.

While *variolosus* s.str. is regularly reported from mixed mountain forests in the Carpathians, *nodulosus* in Central Europe is much more restricted to wet forests along springs and seepages. The reason for this difference is to likely to be sought in the different degree to which the two landscapes have been altered. The species is extinct in several member states of west central Europe, like Belgium and Northern Italy, while the east European population does not seem to have suffered such habitat and range losses so far.

Carabus variolosus is a species of the subgenus *Hygrocarabus*, endemic to Europe. Since 2004, it has been listed in the Annexes II and IV of the EU Habitats Directive, thus obliging the EU member states to protect this species and its habitat in several ways. The member states Hungary and Slovakia proposed amending these annexes with this species. Two taxa commonly considered as subspecies to *Carabus variolosus* inhabit Europe. While the Eastern European *variolosus variolosus* inhabits the Carpathian mountain systems in a broader sense, the Central European *nodulosus* once ranged eastward from Belgium, Eastern France, Switzerland and Northwestern Italy. The ranges of the

two taxa are separated today but it appears possible that they once (almost) adjoined each other.

While *Carabus variolosus variolosus* is without doubt a species of Annexes II and IV, the situation is more ambiguous for *nodulosus*. This taxon is considered a distinct species by some authors and would thus not automatically be included in the listing of *Carabus variolosus*. Reasons for considering the two species as distinct are differences in the male genital morphology and the non-overlapping ranges (for a discussion cf. MÜLLER-KROEHLING 2006).

However, at the time the amendment was adopted, the majority of authors favoured the subse-

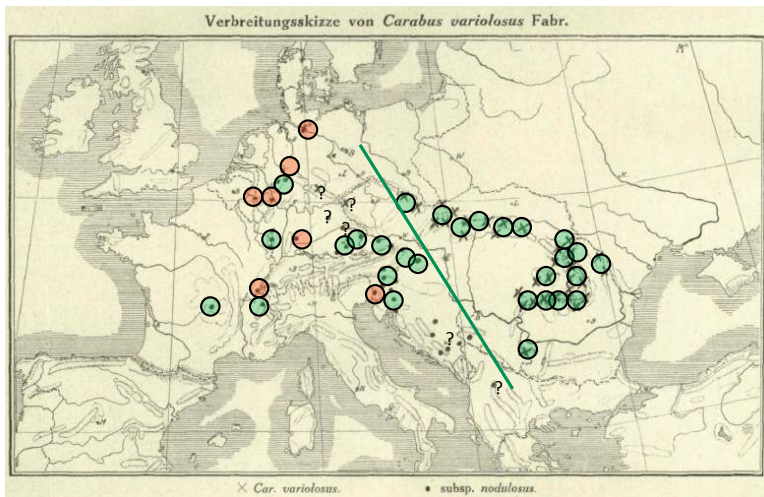


Figure 1: *Carabus variolosus* and its two subspecies' distribution in Europe from Breuning (1926), updated and amended; **line:** border between the two taxa; **circles:** green = recent (semi-schematic for eastern part/ssp. *variolosus*); red = extinct; ? = no recent publications available.

cific rank (MÜLLER-KROEHLING 2006), and this is the case still. The European Carabidologist's Meeting (ECM) issued a statement in 2007 calling for the inclusion of ssp. *nodulosus* in the interpretation of annex species *Carabus variolosus*.

There is no direct proof for either position as breeding experiments have not been conducted and genetic studies would be subject to interpretation. Both arguments for specific rank can be contested as there are species which clearly only have subspecific rank (e.g. *Carabus violaceus violaceus* and *C.v. purpurascens*, ASSMANN & SCHNAUDER 1998) and also have differences in the male genitalia to the same degree as *C. variolosus* and taxon *nodulosus*. Nor does the fact that currently the ranges of both taxa do not overlap prove that both taxa have a long history of separate evolution. Other species of the genus which survived the last glaciation in different European refugia did not have sufficient time to evolve into distinct species, but to the contrary have re-merged their populations since. Examples of this are the above-mentioned *C. violaceus* as well as *C. problematicus* (BLUMENTHAL & NÜSSLER 1967) and *C. auronitens* (ASSMANN et al. 1994, DREES 2003).

Hence, there is no uncontested proof that both taxa would warrant the status of distinct species. To the contrary, both taxa are remarkably similar in appearance and life history, while the species exhibits quite strong characteristics distinguishing it from

all other *Carabus* species in both regards. Both its outer appearance with a pronouncedly "dented" elytral structure and its strongly semi-aquatic way of life (STURANI 1963) set this species apart from all other *Carabus*.

For the report under with Article 17 of the Habitats Directive, an "unfavourable" status was declared for this species in the Continental region for 2001-2007. Some member states in which the taxon *nodulosus* occurs did not report (Germany, Austria), while others did (Slovenia, France). In a third group of member states that were formerly home to ssp. *nodulosus*, no report was issued since the species is extinct there (Belgium, Italy), as is also the case

in Switzerland (which is of course not a member of the EU), as shown in an updated version of Breuning's (1926) map (Figure 1).

The ETC-BD (2011) has made it clear that it encourages reporting for both taxa, albeit separately, pending a decision on the status of *nodulosus*. Accordingly, all member states also within the range of *nodulosus* reported on the status for 2008-2013. It can be assumed that the data thus reported will endorse the decision to assign this taxon Habitats Directive status.

In Germany, this species is currently found only in Bavaria and North Rhine-Westphalia. While in the latter only two occurrences at one site are known (WEBER & WEBER 1966, KOTH 1974, MATERN et al. 2008), there are currently (post-1990) about 28 occupied map quadrants (TK 25 quadrants) of this taxon in Bavaria. Nineteen occurrences are located within sites of Community Interest (SCI). In the German regions of Baden-Wuerttemberg, Lower Saxony and in the Rhineland part of North Rhine-Westphalia (KLESS 1965, GERSDORF & KUNTZE 1957, HANNIG 2006) the species is extinct.

For this study, all old records, both published and in museum and private collections, were assembled into a database. In Bavaria, it occurs south and east of the Isar river and east of the river Lech, according to a record collection conducted in 2010 (LWF, unpublished). There are few old records west of the Lech river

and none north of the Isar.

It can be confirmed that the species is a predominantly hygrobiontic species of intact brook margins, seepages, spring swamps and spring marshland, all mostly forested or else covered by natural marsh reedland. In southeastern Bavaria the species also inhabits acidic bog habitats under certain circumstances. There, it has even been found co-occurring with stenotopic bog dwellers such as *Agonum ericeti* and the Annex II species *Carabus menetriesi pacholei* its the local, subspecific taxon *witzgalli* (REISER, pers. comm. 2001, MÜLLER-KROEHLING 2006, unpubl.). This is in line with authors from neighbouring Austria like MANDL (1965), who lists bogs as one habitats used by the species, and GEISER (2001), who mentions the species from a bog wetland. It is assumed that this regional "habitat enlargement" can be explained by the law of regionality of stenoecious behaviour ("Gesetz der regionalen Stenökie", KÜHNELT 1943).

In the Carpathian region including the bordering mountain systems, the nominate subspecies seems to be more widespread as compared to *nodulosus* in Central Europe. Apparently, no major extinction events have occurred and left part of the range unoccupied, much unlike the situation in *nodulosus*. In studies of the Carpathian mountain forests it is found relatively frequently in "normal" mixed mountain forests and clearings (e.g. KORBEL 1973, VARVARA 2000), which suggests that it is not entirely confined to wetlands there, as is the case in Germany. A more intact landscape much more interspersed with springs, seepages and brooks, where these habitats have been diminished and cut off from the remaining forest by forest roads and skidding tracks to a much lesser degree, would offer an explanation for this observation. Since in the Carpathians many species inhabit higher elevational belts as compared to Central European mountains, it is possible that this species finds suitable climatic conditions in an altitudinal belt where forests have been subjected to fragmentation and habitat degradation to a much lesser degree than in the colline and below-mountain zone forests in Central Europe.

Overall, this taxon is European in its worldwide distribution. While the eastern taxon (*ssp. variolosus*) is still widespread in Transcarpathia, the western taxon *nodulosus* has lost substantial portions of its range, as well as distribution within that range. Threats in West Central Europe have come from drainage, brook regulation, forest fragmentation and habitat destruction. The situation of the two subspecies can

be considered typical of the situation many natural habitats face when comparing the "old" and the "new" EU member states. With this situation in mind it is obvious both taxons need protection, and *nodulosus* certainly no less than *ssp. variolosus*. While national species protection regimes exist in those member states where it still occurs, the programmatic approach of a network of sites designated for the protection of the species, also linking genetically isolated habitats (MATERN et al. 2008), which is the core approach of the Natura 2000 network, seems indispensable as part of a viable protection strategy for the future survival of the species from a scientific standpoint.

Zusammenfassung

Der Gruben-Großlaufkäfer oder Schwarze Grubenlaufkäfer *Carabus variolosus* ist eine Art der Untergattung *Hygrocarabus*, die seit der EU-Erweiterung 2004 dem Anhang II und IV der FFH-Richtlinie angehört. Je nach Interpretation können die beiden Taxone *variolosus* und *nodulosus* als Unterarten, oder als eigene Arten aufgefasst werden. Beide sind sich in Morphologie und Lebensweise überaus ähnlich. Die Auffassung, das Taxon als eigene Unterart zu betrachten, basiert auf Unterschieden in der Morphologie der Aedeagus-Spitze und in dem räumlich nicht zusammenhängenden Areal der beiden Taxone. Beides ist jedoch auch von Unterarten anderer *Carabus*-Arten bekannt, von denen durch Kreuzungen bekannt ist, dass es sich um Unterarten handelt, wie *Carabus violaceus*. Das European Topic Center hat mitgeteilt (ETC 2011), dass der taxonomische Status im Sinne der FFH-Richtlinie noch einer zu treffenden Entscheidung unterliegt, und die EU-Mitgliedsstaaten aufgefordert, zu beiden Taxonen zu berichten. Somit liegen 2013 erstmals Berichtsinformationen aller Mitgliedsstaaten im Verbreitungsgebiet des *Carabus variolosus* sensu lato vor. Der deutsche Verbreitungsschwerpunkt der Art liegt in Bayern. Hier sind 28 Meßtischblattquadranten als rezent anzusehen. 19 der Vorkommen liegen in FFH-Gebieten. Die Isar stellt offenbar die nördliche Verbreitungsgrenze der Art in Bayern dar. Es gab nur wenige historische Nachweise westlich des Lechs und keine neueren Datums. Das einzige rezente deutsche Vorkommen der Art außerhalb Bayerns liegt im Arnsberger Wald Nordrhein-Westfalens. Die Vorkommen in Baden-Württemberg und Niedersachsen sind ausgestorben, bzw. die Art hier verschollen. Während das Taxon *variolosus* in den Karpaten re-

gelmäßig aus Bergmischwäldern gemeldet wird, ist das Taxon *nodulosus* wesentlich stärker auf quellige Feuchtwälder beschränkt. Die Ursachen hierfür dürften eher in den unterschiedlichen Landschaften als in der unterschiedlichen Biologie der Taxa zu suchen sein. In mehreren Ländern Mitteleuropas ist die Art bereits ausgestorben, in den anderen ist sie „vom Aussterben bedroht“, während sie in Osteuropa noch über stabile Bestände zu verfügen scheint.

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