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Notes on old or unverified faunistic records on the Alpine Longhorn (*Rosalia alpina*) distribution in the Czech Republic

(Cerambycidae: Coleoptera)

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Abstract

Rosalia alpina is an endangered cerambycid beetle and a flagship species of the saproxylic insect fauna. Today, only a few populations of this beetle are known from the Czech Republic. However, several old faunistic records suggest a wider distribution of *Rosalia alpina* then present. Many of these records are several decades old and have not been validated or repeated, leading to doubts on their creditability. This paper lists all the historic records and uses a potential natural vegetation map to validate their creditability. The records were plotted on a digitalised map of potential natural vegetation of the Czech Republic. It seems it can be confirmed that *Rosalia alpina* is native to Bohemia and Moravia and used to be widely distributed through the country and may have disappeared due to the reduction of old oak forests and change in forestry practices. Further comments on species biogeography are provided. The suitability of maps of potential and reconstructed natural vegetation for future entomofaunistic research is discussed.

Zusammenfassung

Rosalia alpina ist eine bedrohte Bockkäfer- und Flaggschiffart der xylobionten Insektenfauna. Aus der Tschechischen Republik sind nur wenige Populationen dieser Käfer bekannt. Etliche ältere faunistische Nachweise zeugen jedoch von einer weiteren Verbreitung von *Rosalia alpina* als der heutige Stand widerspiegelt. Viele dieser Nachweise sind mehrere Jahrzehnte alt und wurden nicht bestätigt oder erneut nachgewiesen, was zu Zweifeln an ihrer Glaubwürdigkeit führte. In dieser Arbeit werden alle historischen Nachweise aufgelistet und die potentielle natürliche Vegetation wird verwendet, um die Glaubwürdigkeit zu bestätigen. Die Nachweise wurden auf einer digitalisierten Karte der potentiellen natürlichen Vegetation der Tschechischen Republik geplottet. Es sieht so aus, als könnte *Rosalia alpina* für Böhmen und Mähren bestätigt werden, und dass die Art im Land weit verbreitet war; möglicherweise ist sie aufgrund des Verlustes alter Eichenwälder und Änderungen der Forstpraktiken verschwunden. Weitere Anmerkungen über die Biogeographie der Art werden vorgelegt. Die Brauchbarkeit der Karten über die potentielle und rekonstruierte natürliche Vegetation für zukünftige entomofaunistische Forschung wird diskutiert.

Introduction

The Alpine longhorn *Rosalia alpina* L., 1758, also known as the Alpine longicorn is a flagship species of saproxylic beetle diversity and is protected in the whole of Central Europe by the Berne Convention, it is listed in the Red List of Threatened Species of the Czech Republic as critically endangered. Understanding the species ecology and biogeography is thus crucial for any conservation efforts. It is known to be distributed throughout lowlands to mountainous areas on dead or dying broadleaf trees. In the Czech Republic it is the most frequently encountered on beech trees (*Fagus* spp.) (SLÁMA 1998) but recently it was also recorded from elm trees (*Ulmus* spp.) (ČÍŽEK et al. 2009) and oviposition on alder trees (*Alnus* spp.) was observed. Outside of the Czech Republic it is known from hornbeam (*Carpinus* spp.), ash (*Fraxinus* spp.), lime/linden trees (*Tilia* spp.), chestnut trees (*Castanea* spp.), walnut trees (*Juglans* spp.), oak (*Quercus*) and maple (*Acer* spp.) (CIACH & MICHALCEWICZ 2013).

Traditionally, the Alpine longhorn is considered to be a typical representative of old elm forests fauna, but recently it was reported from several novel localities on new host plants, which lead some authors to assume that the species is changing its ecological preferences (CÍZEK et al. 2009; MICHALCEWICZ & CIACH 2012, 2014). Aiming at better understanding the ecological preferences of *R. alpina,* the present study compiled older faunistic records (until 2000) of the beetle from the Czech Republic. The creditability of the older records is also reviewed, because many of them were impeached in the past.

Materials and Methods

The present work utilised the GIS technology (Geographic Information System) which can be used to digitalise and analyse geographic data. The software ArcGIS Online (Esri, USA)

was used. All published historic records of *R. alpina* distribution were plotted on the map. Then the digitalised Map of the potential natural vegetation of the Czech Republic (NEUHÄUSOVÁ 1998) was projected. Potential natural vegetation is the flora that would develop in a given territory after a certain period of time without human interference. The map however considers irreversible human impact (atmosphere pollution and others). It was assumed that the Map of potential natural vegetation would provide an insight into the history of the localities from which *R. alpina* was recorded. Thus, the land cover of the localities from the times when they were less affected by humans could be obtained. Even if this flora already diminished, the Alpine longhorn could still survive on these localities, as the species is known to survive even on single trees (SLÁMA 1998). Unlike the reconstructed natural vegetation that maps the localities past, potential natural vegetation predicts what the flora would be like if human interference stopped. Nonetheless, with regard to the Czech Republic, the differences between the two are not significant in most cases (NEUHÄUSOVÁ 1998). It must be noted that due to the resolution of the Map of potential natural vegetation presents, it presents somewhat of a simplification and may not be accurate on all localities.

Results

The results of the literature search that aimed at compiling all published records of *R. alpina* distribution in the Czech Republic is displayed in Figure 1. Today, the last localities where this iconic beetle can be found include the Malý and Velký Bezděz. During the years 2008 and 2009 a total of 1002 individuals were captured (DRAG et al. 2010). Recently *R. alpina* was also reported from Moravia (Dinotice, Karolinka – Kobylská, Nový Hrozenkov – Březitá – Kohútka, Dolní Bečva - Radhošť Mt. – Mešná, Valašské Klobouky), however in most of the cases no prove was provided (KONVIČKA 2005). The beetle was also supposedly collected on Kralický Sněžník, Žákova hora and the proving ground Mimoň (SLÁMA 1998). It is assumed that the large scale decline of the Alpine longhorn populations is caused by destruction of old beech forests and other modern forestry practices (SLÁMA 1998; TRÝZMA 2008).

In Tab. 1 each historic record of the Alpine longhorn is assigned to a vegetation mapping unit according to (NEUHÄUSOVÁ 1998). In total, *R. alpina* was reported from 19 different mapping units. In most cases, beech trees are known to occur in these mapping areas. However on the localities Břehyně (5454), Hranice (6472), Milotice (6473?), Milovice (5755), Lipových doubrav Bosyně (5553), Opava (6073), and (Babice (6766) beech trees would not develop. This means that the either the Alpine longhorn or beech wood was introduced to those localities by man, or the record is flawed. Potentially, this could also be a result of the simplification of the Map of potential natural vegetation of the Czech Republic. In any case, it seems that *R. alpina* is not native to the above listed localities.

Tab. 1. List of localities where *Rosalia alpina* was recorded assigned to their respective mapping units. Note that some localities were assigned to more than one mapping unit.

Mapping unit: **Oak-hornbeam woodland with *Melampyrum nemorosum* (n=9)**

Localities: Brno (train station), Brno (surrounings), Čelákovice, Horní Jiřetín, Hřebečovský hřbet, Most, Okna, Peruc, Sedlo u Úštěka.

Mapping unit: **Bird cherry-ash woodland (n=5)**

Localities: Milovice, Milotice, Hranice, Břehyně, Brno (surroundings).

Mapping unit: **Woodrush-beech woodland (n=5)**

Localities: Bezděz, Děčín-Bynov, Děčínský Sněžník, Kopřivník, Vrátenská hora.

Mapping unit: **Woodrush-oak and/or silver fir-oak woodland (n=4)**

Localities: Dobřenice, Cheb, Pomezí nad Ohří, Slapy nad Vltavou.

Mapping unit: **Oak woodland with *Potentilla alba* (n=3)**

Localities: Brno (surroundings), Nové Hrady, Říp.

Mapping unit: **Carpathian oak-hornbeam woodland with *Carex pilosa* (n= 2)**

Localities: Morkovice, Valašské klobouky.

Mapping unit: **Lime-oak woodland (n=2)**

Localities: Bosyně, Opava.

Mapping unit: **Pannonian oak-hornbeam woodland with *Primula veris* (n=2)**

Localities: Babice, Brno (surroundings).

Mapping unit: **Beech woodland with *Carex pilosa* (n=1)**

Localities: Lopeník.

Mapping unit: **Beech woodland with *Dentaria glandulosa* (n=1)**

Localities: Ralsko.

Mapping unit: **Elm-pedunculate oak woodland (n=1)**

Localities: Brno (surroundings).

Mapping unit: **Lime-beech woodland with *Tilia platyphyllos* (n=1)**

Localities: Milešovka.

Mapping unit: **Pannonian elm-ash woodland (n=1)**

Localities: Babice.

Mapping unit: **Pine-oak woodland with *Vacinium vitus-idaea* (n=1)**

Localities: Bělá pod Bezdězem.

Mapping unit: **Spruce-beech woodland (n=1)**

Localities: Kleť.

Mapping unit: **Spruce woodland with *Athyrium distentifolium* (n=1)**

Localities: Lysá hora.

Mapping unit: **Spruce woodland with *Calamagrostis villosa* (n=1)**

Localities: Lysá hora.

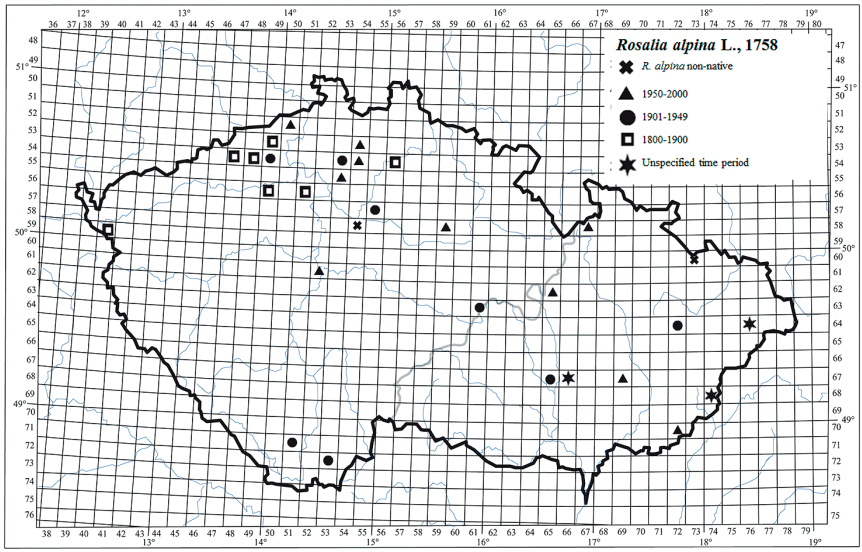

Fig.1. Historic records (18th to 20th Century) of *Rosalia alpina* distribution in the Czech Republic plotted on a faunistic grid. Uncertain localities were excluded.

Discussion

Beech, the main host plant of the Alpine longhorn, would according to the map of potential natural vegetation of the Czech Republic, be a dominant species of sub-mountainous and mountainous regions of the Czech Republic (NEUHÄUSOVÁ 1998). This explains why the Alpine longhorn is usually reported from localities with an altitude between 600 and 1000 m a.s.l. (HEYROVSKÝ & SLÁMA 1992). The large-scale disappearance of beech forests due to human activity corresponds to the loss of *R. alpina* in Czechia (FASSATI & POLÁČEK 1964).

During the 19th Century, the Alpine longhorn was reported from a number of sub-mountainous and mountainous regions, but later these findings were not repeated (FASSATI & POLÁČEK 1964). Because of this, during the course of the 20th Century many of the former records were considered uncreditable. For example some questionable records from the Krkonoše mountain range are known (SEGET 1956). According to the map of potential natural vegetation, without human interference, large beech forests would develop in the area. This suggests the older records may in fact be trustworthy.

Another challenged locality is the Říp Mountain. Older literature (KLIMENT 1899; KLAPÁLEK 1906) states that *R. alpina* used to be collected here; however it was pointed out that by the mid-19th Century the Říp Mountain was largely a pasture, not woodland

(FASSATI & POLÁČEK 1964). On the other hand, SLÁMA (1998) claims that the Alpine longhorn is able to survive even on solitary trees in vast areas of pasture land. The remaining question is whether the Říp Mountain used to be vegetated with beech forest. The Map of potential natural vegetation of the Czech Republic suggests that without human interference an oak woodland with *Potentilla alba* would develop on the locality. Oak woodlands with *Potentilla alba* are known to include beech trees, so it is possible that *R. alpina* inhabited this locality in the past.

Unverified records from the late 1970s originate from the Brdy hills (SLÁMA 1998). These would be partially vegetated with beech, so the Alpine longhorn could potentially live there.

Regarding the recent findings claiming that the host range of *R. alpina* is much wider than previously thought, it would be adequate to ask whether the Alpine longhorn developed in plants other that beech in the past. The present study revealed that the beetle was found on seven localities without naturally occurring beech. Unfortunately older Czech entomological literature does not specify the host range of the species in a great depth. The author assumes that the Alpine Longhorn probably did not use other host plants in the past, because most of the records of novel host plant come from a relatively recent period (MICHALCEWICZ & CIACH 2012).

Maps of potential natural vegetation present an interesting tool for future entomofaunistic research as it reliably predicts the locality development without human interference. On the other hand, the resolution of the maps must be taken into account. Also, the suitability of maps of potential natural vegetation over maps of reconstructed natural vegetation must be considered in each study specifically.

In conclusion, historic faunistic data on the Alpine longocorn (*Rosalia alpina*) from the Czech Republic were compiled. The localities were plotted on a digitalised Map of potential natural vegetation of the Czech Republic (NEUHÄUSOVÁ 1998). Since the 19th Century *R. alpina* was reported from 19 different vegetation mapping units. Beech, the major host plant of the beetle in the studied area, was present in most of the localities. The beetle was probably not native to the seven localities without beech, or the faunistic records were flawed. These records may also suggest an unknown host plant of the species. Alternatively, this could be caused by the simplification of the Map of potential natural vegetation (NEUHÄUSOVÁ 1998). Apart from verifying the creditability of 39 historic faunistic records, the creditability of three controversial localities (Krkonoše mountain range, Brdy hills and the Říp Mountain) was assed. Without human interference, it was predicted that beech forests would develop on the respective localities and so it seems these records, despite being of an older date are trustworthy. It is recommended that distribution records should not be disputed just because of their seniority; otherwise the whole purpose faunistics is defeated. The Map suggests that beech forests would be the dominant land-cover in sub-mountainous and mountainous areas of the country without human interference, and thus in the past *R. alpina* was probably distributed across the territory. Future entomofaunistic research should consider maps of potential or reconstructed natural vegetation as useful tools that help shed light into the past and future of the studied localities.

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