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## Biogeographical outlines of boreal moths (Lepidoptera) of the Šumava/Böhmerwald Mountains: a concise review<sup>1</sup>

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**A b s t r a c t:** A concise review of boreal moths (Lepidoptera), which occur in the Šumava/Böhmerwald (= the Bohemian Forest Mountains) is given with biogeographical and ecological notes. One new subspecies *Coenophila subrosea* (Stephens) *malickyi* nov. ssp. is described from peatlands of the Šumava Mountains. The valid subspecies *C. subrosea kieferi* REBEL 1912 stat. rev. is recalled from synonymy.

**K e y w o r d s :** Boreal Lepidoptera, Šumava/Böhmerwald Mountains, new subspecies of *Coenophila subrosea*, biogeography.

### Introduction

The Šumava Mts./Böhmerwald (= the Bohemian Forest Mountains) is a relatively well isolated highland area situated North of Danube and the Alps. This montane area is characterised by a number of azonal fragments of the boreal zone situated within the temperate zone (cf. FIRBAS 1949, 1952, TUHKANEN 1984, VARGA 1988-1989). MALICKY (2003) noted: "The Böhmerwald is a meeting point of species of different zoogeographical origin which were found in Austria only here or mainly here". The most characteristic isolated, ancient habitats are glacial lakes, peatbogs (including waterlogged spruce forests), and scree communities. Boreal and boreoalpine cold adapted paleorefugial biota have been recorded among various groups of terrestrial and aquatic insects (e.g. Lepidoptera, Trichoptera, Coleoptera and Diptera).

With respect to boreal moths and butterflies (Lepidoptera), the most interesting species are closely associated with the extensive boreal-type peatlands and wet open spruce forests of the Šumava Mts. A number of unusual "relict" moths have been recorded from Šumava Mts. during the authors extensive research (e.g. SPITZER 1981, SPITZER & JAROŠ 1997, 2001, SPITZER et al. 2003, SPITZER & DANKS 2006, BEZDĚK et al. 2006). Two basic types of distribution of cold adapted moths have been ascertained: (1) classical disjunct distribution of arctic (boreal)-alpine type and (2) boreal type. For our concise review we selected the characteristic boreal species which outline the southern fragmentated frontier of the boreal zone and which are **not distributed** in high elevation of the Alps (e.g. boreoalpine species like *Anarta cordigera* THNBG., *Xestia rhaetica* STGR. or *Carsia sororiata* HB. are excluded).

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<sup>1</sup> This paper is dedicated to Prof. Dr. Hans Malicky on the occasion of his 75<sup>th</sup> birthday.

## Several annotated examples of the most characteristic boreal species recorded from the Šumava/Böhmerwald Mts.

### Crambidae

#### *Pediasia truncatella* (ZETTERSTEDT 1840)

A subarctic-boreal species with circumpolar distribution (forest-tundra of northern Holarctic region), and isolated relict occurrence in most peatlands of the Šumava Mts. (between 740–1200 m alt.) and in some mountains of southern Siberia (SOFFNER 1930, BLESZYNSKI 1965, and a comprehensive review by SPITZER 1988). It is a charismatic typhobiontic moth of the Šumava fauna (“Böhmerwald-Zünsler”), with larvae feeding on grasses, e.g. *Molinia* spp.

### Tortricidae

#### *Apotomis fraterculana* KROGERUS 1946 (Fig. 1)

A rare subarctic and northern boreal species associated with forest tundra of Fennoscandia and Russia. Recently recorded from two peatbogs of the Šumava Mts. (Velká Niva bog – 750 m alt. and Jezerní Slat’ bog – 1050 m alt.), which represent the only localities outside the Subarctic region. The larva is not safely recorded, probably associated with *Betula* spp. (KROGERUS 1972, JAROŠ & SPITZER 2004).



**Fig. 1:** *Apotomis fraterculana* KROGERUS, ♂, Šumava Mts., Velká Niva bog.

### ***Epinotia gimmerthaliana* (LIENIG & ZELLER 1846)**

Widely distributed in boreal and subarctic zones of the Palaearctic region. Usually abundant in montane peatbogs of the Šumava and Novohradské hory Mts. (740-1100 m alt.), not only in Bohemian parts of the mountains. The larva feeds on *Vaccinium uliginosum* (KLIMESCH 1973 – pers. comm., ELSNER et al. 1981, KLIMESCH 1991, SPITZER & JAROŠ 1997, SPITZER et al. 2003).

### ***Pammene luedersiana* (SORHAGEN 1885)**

A local boreal and northern temperate species of the Palaearctic region, in central Europe probably associated with *Vaccinium uliginosum* only. In the Šumava Mts. recorded from several montane peatbogs (740-910 m alt.). Records from southern Europe and Turkey are evidently incorrect (SPITZER et al. 2003).

## **Noctuidae**

### ***Coenophila subrosea* (STEPHENS 1829)**

Very local boreal and northern temperate palaearctic species, classical typhobiont. *C. opacifrons* (GROTE) is a nearctic and closely related vicariant peatbog species. Characteristic and distinct subspecies and “geographical races” of *C. subrosea* are well known from several European isolated peatbogs. Two very isolated subspecies are described from the foothills of the Alps (Ennstal, ca. 630 m alt.) – ssp. *kieseri* REBEL 1912 and from the Šumava/Böhmerwald Mts. (730-750 m alt.) – ssp. *malickyi* nov.ssp. (Fig. 2), (HOFFMANN & KLOS 1914, DE LATTIN 1958, SPITZER & NOVÁK 1969, SPITZER et al. 1996, ŠULA & SPITZER 2000). The oligophagous larvae of central European populations prefer *Andromeda polifolia*. *C. subrosea* is a very important noctuid moth as a bioindicator regarding conservation projects of peatlands (see e.g. TILLOTSON & SPITZER 1998).

#### **Description of *Coenophila subrosea* (STEPHENS 1829) *malickyi* nov.ssp. (Fig. 2)**

H o l o t y p e . Bohemia mer., Volary env., Mrtvý luh, 740 m, 30.VII.1992, 1♂, Jaros & Spitzer leg., coll. Institute of Entomology, BC CAS, České Budějovice.

P a r a t y p e s . 40 ♂♂, 10 ♀♀, the same locality and data as the holotype (material was collected in July and August 1970-2005).

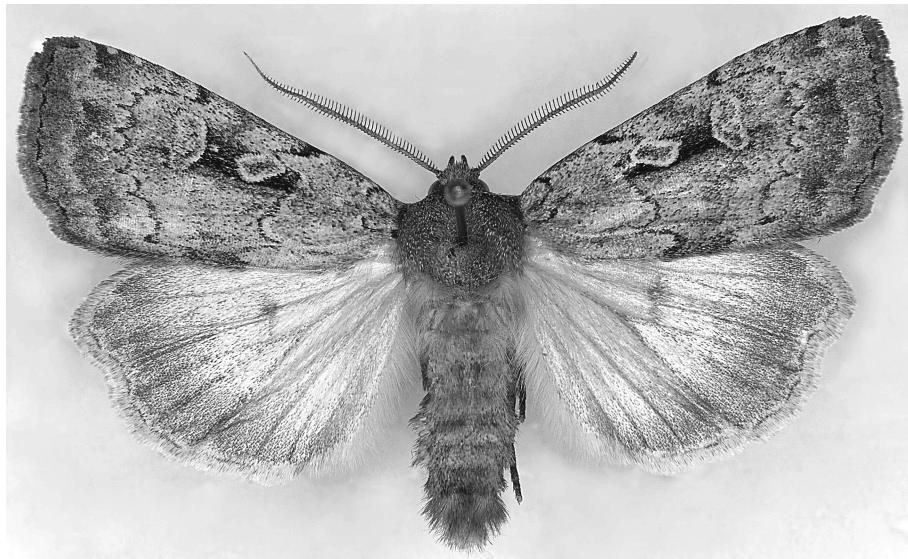
L o c u s t y p i c u s . Šumava Mts., valley peatbog Mrtvý luh near Volary.

D e r i v a t i o n o m i n i s . The name of the subspecies is dedicated to Professor H. MALICKY.

D i a g n o s i s . Forewing length 18.5 mm, ground colour varying greyish-brown to rosy-grey, transverse lines contrasting, postmedian fascia distinctly sharp dentate, stigmata contrasting and well defined. Hindwing lines and discoidal spot usually contrasting. The largest subspecies of *C. subrosea*. Male and female genitalia are identical in all Palaearctic subspecies (“geographical races”) of *C. subrosea*, no distinct variability was observed.

D i s t r i b u t i o n . Only the Šumava/Böhmerwald Mts. (Bohemian and Austrian slopes, usually valley peatbogs of lower montane zone).

**R e m a r k s .** *C. subrosea malickyi* is not only different from all central European subspecies by its large size and wing coloration, but by allozyme polymorphism as well. The average forewing dimensions are  $18.54 \pm 0.56$  mm. Morphometric analysis revealed significant differences between the isolated populations too – cf. ŠULA & SPITZER (2000). The



**Fig. 2:** *Coenophila subrosea malickyi* nov. ssp., ♂, male holotype, Šumava Mts., Mrtvý Luh bog.

comparative genetic and morphological analyses of three well isolated central European “geographical races” (=subspecies) *C. subrosea malickyi* nov. ssp. (Šumava Mts.), *C. subrosea kieferi* REBEL 1912 stat. rev. (Styria, Ennstal) and *C. subrosea* ssp. ? related to ssp. *subcaerulea* STAUDINGER 1871 (North Bohemia, Doksy env.) are given by ŠULA & SPITZER (2000). A DNA-analysis is in preparation. The synonymization of all subspecies of *C. subrosea* by FIBIGER (1993) seems to be evidently incorrect.

### Discussion and conclusion

Outside the territory of the Šumava Mts. in southern Bohemia, the only paleorefugial centre is the Třeboň Basin and its transient and raised peatbogs. The best example is the Červené Blato bog with large formation of *Ledum palustre* (SPITZER & JAROŠ 1993). This subcontinental bog is covered by a relict community of the boreal “Labrador tea” – *L. palustre* which is the largest in central Europe. Such type of a unique paleorefugial community and local subcontinental bog mesoclimate is the most important historical condition for the survival of characteristic cold adapted boreal moths (e.g. *Olethreutes ledianus* L., *Chloroclysta infuscata* TNGSTR. and *Eupithecia gelidata* MÖSCHL.), which are unknown in the Šumava Mts. and in the Alps (see e.g. SPITZER et al. 1991, KRAMPL 1992, SPITZER & JAROŠ 1993). In the Šumava Mts. the climate is slightly more oceanic and the specific food plant *Ledum palustre* is here very rare. The most important paleorefugial food plant of most boreal Lepidoptera in the Šumava Mts. seems to be *Vaccinium uliginosum*. The frontier range Novohradské Hory Mts. and adjacent highland in Austria form some “stepping stones” for boreal biota between the Šumava/Böhmerwald Mts. and the Třeboň Basin. The insect communities of this central European region represent one of the most important ecofaunistic and biogeographical subjects of nature conservation.

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## Zusammenfassung

Ein kurzer Überblick über boreale Schmetterlinge (Lepidoptera) des Šumava/Böhmerwald-Gebietes mit Anmerkungen zur Biogeographie und Ökologie wird präsentiert. Eine neue Unterart, *Coenophila subrosea* (STEPHENS) *malickyi* nov.ssp., wird von Moorbereichen des Böhmerwaldes beschrieben. Der Unterartrang von *C. subrosea kieferi* REBEL 1912 wird wiederhergestellt (stat. rev.).

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