

THE CHOROLOGY, ECOLOGY & POPULATION BIOLOGY OF THE GENUS  
*ORTHOTRICHUM*, *ULOTA* & *ZYGODON* IN THE CENTRAL EUROPE  
PART I. METHODS & FIRST RESULTS

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**Résumé** : Durant les 10 dernières années, les auteurs ont rédigé les rapports de distribution et des exigences écologiques des espèces épiphytes en Europe Centrale. Ils ont localisé par GPS toutes les populations des bryophytes enregistrées parmi la famille des *Orthotrichaceae* et en plus, leurs données écologiques. Ils y ont inclus les données déjà connues et publiées. Les analyses des données suivantes et leur interprétation peuvent nous aider à comprendre les exigences écologiques de base des bryophytes étudiées. De plus ces données seront très utiles lors de la création d'un management de conservation moderne des espèces.

**Samenvatting** : Gedurende de laatste 10 jaar zijn opdrachten over distributie en ecologische eisen van de epyfitische soorten in Centraal Europa door de auteurs uitgevoerd. Alle mossensoorten binnen de familie van *Orthotrichaceae* werden met GPS gelokaliseerd en bovendien werden hun ecologische gegevens beschreven, inclusief de al gekende en gepubliceerde gegevens. Volgende gegevens betreffende de analyse en interpretatie ervan kunnen ons helpen de ecologische basiseisen van de bestudeerde bryofieten te verstaan. Bovendien zullen deze gegevens heel nuttig zijn om een modern management voor het behoud van de soorten op te stellen

**Summary** : The surveys of distribution and ecological requirements of the epiphytic species in the Central Europe have been carried out during last 10 years by authors. All recorded moss populations within the *Orthotrichaceae* family were located by GPS and moreover their ecological data were noted. The known published data were also included. Following data analysis and interpretation can help us to understand basic ecological requirements of the studied bryophytes. In addition these data will be very useful for creating a modern conservation-management of the species.

#### Key words

Bryophyta, *Orthotrichaceae*, data analyzing, ecological requirements, threatened mosses

#### 1. Introduction

In the Central Europe, the epiphytic bryophytes started to be rare and threatened since 1950's in the respect of air pollution. Since 1990 the air quality was improved there and that is why the epiphytic mosses have started to recolonize the former habitats. The fact has been confirmed through the observational studies carried out in the Western Carpathians and Sudetes mountain ranges by authors during last 10 years ( cf. Motyka & Plášek 2006 ).

#### 2. Methods

The surveys were focused on the distribution as well as ecological requirements of the epiphytic species. All recorded moss populations

within the *Orthotrichaceae* family were located by GPS and moreover their ecological characteristics and selected environmental factors ( habitat type etc. ) were noted. The known reliable published data were also included in the main database. For better summarizing of all the information the database in MS Access was made up. The main objective is to analyze maximum of available information on the selected taxa to understand their basic ecological requirements. In addition these data will be very useful for creating a modern conservation-management of the species.

### 3. Distribution

So that we know precise historical and recent distribution of the species we had to make: compile historical data about distribution, verify 'suspicious' specimens, perform field research and localize the most important populations. We collected data from the territory of Czech Republic ( ca 8.000 notes ), Poland ( ca 1.500 notes ), Slovakia ( ca 500 notes ) and Austria ( ca 100 notes ).

### 4. Ecological information

For each recorded species were noted data about: phorophyte preferences, position on the tree, inclination, exposition, height above ground, information about moisture & shadow conditions.

### 5. Population data

For all taxa data about population size, presence/absence of sporophyte and gemmae were noted.

For selected species - *Orthotrichum patens*, *Ulota crispa*, *Zygodon rupestris* & *Z. dentatus* - each population of the 'observed taxa' was localized, and population data were noted in detail: number and size of cushions or turfs was counted /each month/, number of sporophytes ( *Orthotrichum*, *Ulota* ) per turf and colony was recorded /each month/, spreading of the metapopulations was monitored, accessories species were recorded, etc.

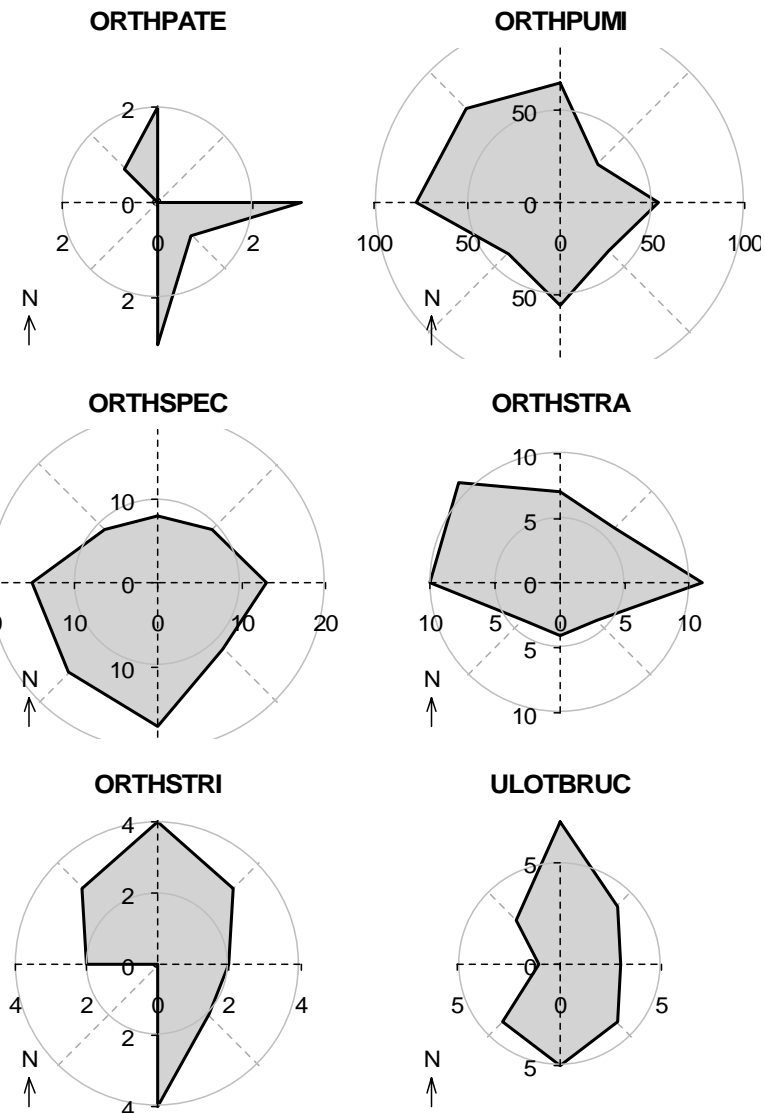
### 6. Data analysis

Database of bryofloristical records was built in Microsoft Access 2000 ( Fig. 1 ). Obtained data were analyzed using software R ( R Development Core Team 2006 ). Polynomial regression model ( order=2 ) was computed for testing relationships between time and reproductive propagules findings.

### 7. Conclusions

Both of literature and in field-collected data were analyzed together.

Vertical disperse of the epiphytic mosses were tested to divide the mosses into obligate and facultative epiphytes. According the literature,



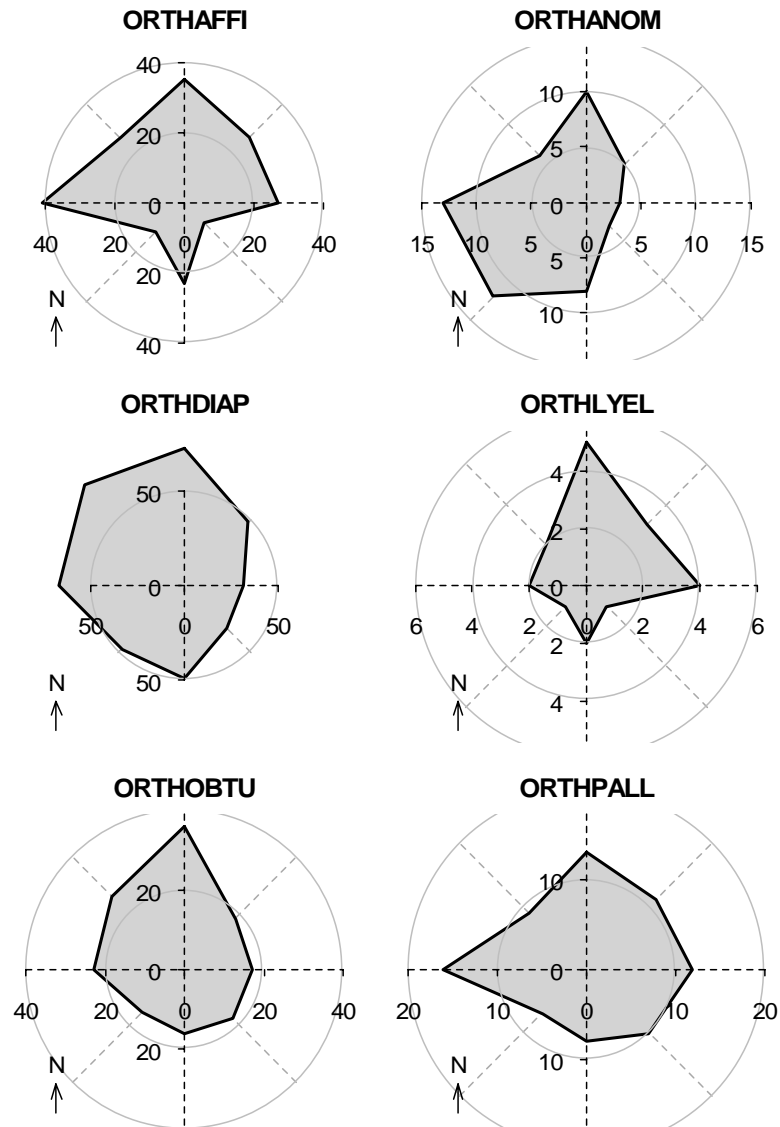


Fig. 5 : left and right page : Frequency diagrams of exposition preferences of selected mosses ( abbreviations: ORTHAFFI - *Orthotrichum affine*, ORTHANOM - *O. anomalum*, ORTHDIAP - *O. diaphanum*, ORTHLYEL - *O. lyellii*, ORTHOBTU - *O. obtusifolium*, ORTHPALL - *O. pallens*, ORTHPATE - *O. patens*, ORTHPUMI - *O. pumilum*, ORTHSPEC - *O. speciosum*, ORTHSTRA - *O. stramineum*, ORTHSTRI - *O. striatum*, ULOTBRUC - *Ulota bruchii* )

the height line was appointed up on high 60 cm ( Szövényi, Hock & Tóth 2004 ). As the chart ( Fig. 2 ) shows only few of epiphytic mosses can be marked as just obligate. Almost all of them more or less can derive benefit from entire trunk.

Each specimen was checked for presence or absence the propagules of reproduction ( spores, gemmae ). The differences were found between total number of reproductive propagules findings during year ( Fig. 3 left ) /sporogones  $F = 12.18$ ,  $p < 0.005$ ; gemmae  $F = 5.44$ ,  $p < 0.05$ / in comparison with the same data weighted by the total number of records ( Fig. 3 right ) /sporogones  $F = 3.3$ ,  $p > 0.05$ ; gemmae  $F = 0.53$ ,  $p > 0.5$ /. However preliminary statistical tests of the reproductive propagules dynamics hypothesis logically rejected null hypothesis (  $H_0$ : relationships between propagules occurrence and time during year does not exist ), model weighted by total number of findings cannot reject the hypothesis.

The comparison of altitude preferences of the mosses exposes some of them rather occur in middle or higher altitudes ( e.g. *Orthotrichum pallens* or *O. stramineum* ) whereas others prefer lowlands ( *O. diaphanum* ) - see Fig. 4.

Within the frame of gathering ecological data the cardinal points of occurrence was noted for each the moss-cushion. The results of the analyses generally do not verify the hypothesis about exposition preferences of epiphytic bryophytes ( Fig. 5 ). Instead it seems the placing of the moss-cushions on the tree is depends on microclimatic conditions ( shadow, humidity, etc. ).

The relationships between number of records from each tree species ( 53 tree taxa ) and total number of recorded bryophytes species was also studied ( Fig. 6 ) but the preliminary analysis included some problematic tree taxa ( *Salix* species etc. ) and demand of more precise analysis with a special experimental design.

It is obvious that the paper does not bring the final results about studying of epiphytic bryophytes ecological characteristics. It intends to present a preliminary report with proposals of data collecting and storing methods and following analysis of ecological requirements. Next step of the survey should be including data about type of biogeographic region, climatic area, detailed characteristic of biotopes, etc.

## 8. Bibliography

Motyka, O. & Plášek, V., 2006. - Small witnesses of air quality improvement.- In: Kočárek, P., Plášek, V. & Malachová, K. [eds.]: Environmental changes and biological assessment III. Scripta Fac. Rerum Natur. Univ. Ostraviensis Nr. 163, 155-156.

R Development Core Team, 2006, R. - A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL <http://www.R-project.org>.  
 Szövényi, P., Hock, ZS., Tóth, Z., 2004. - Phorophyte preferences of epiphytic bryophytes in a stream valley in the Carpathian Basin.- J. Bryol., 26:137-146.

Fig. 1: Main form of the species database.

**Species:** Orthotrichum pallens Bruch ex Brid. (Main) Size: 5

**Coll.:** Plášek, V. **Det.:** Plášek, V. **Date:** 20.4.2007 **Date of entry:** 17.6.2007 **Herbarium:** OP **NrSpecimen:** 166621

**Country:** Czech Republic **Province:** Moravia **Land Unit:** Drahanská vrchovina highlands

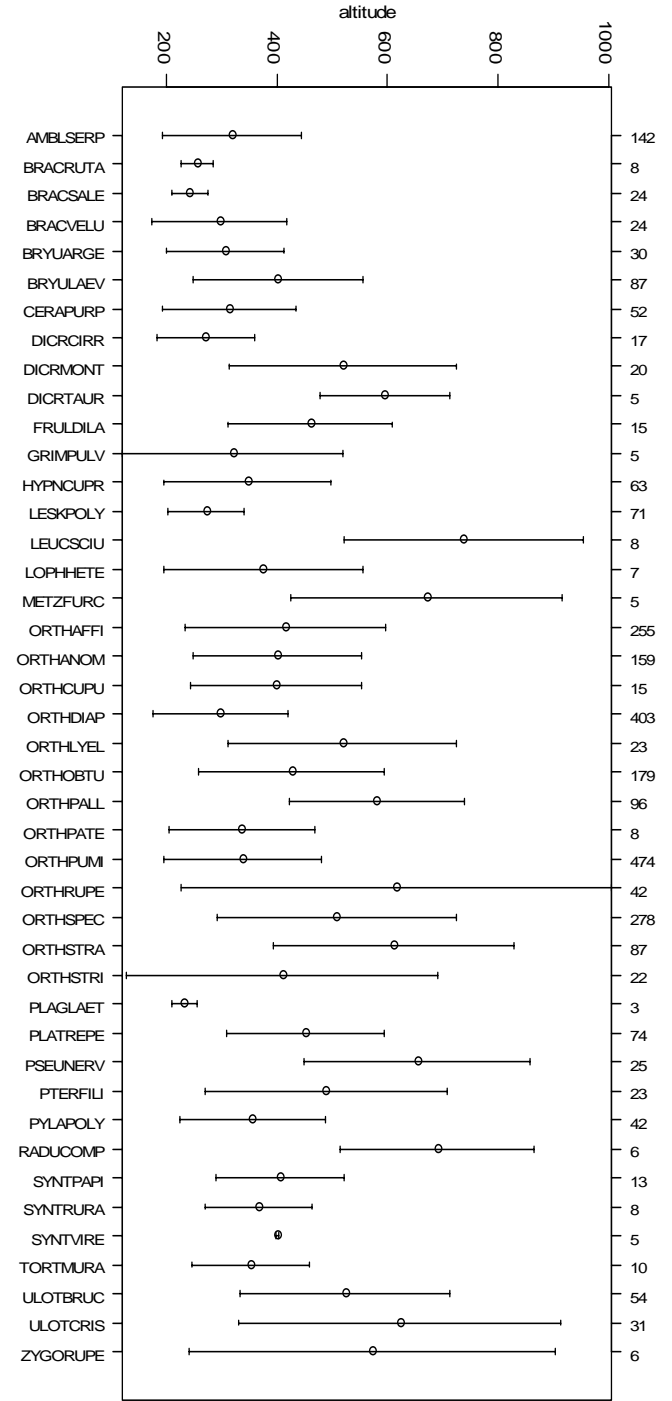
**Locality:** E edge of Krásenka village, valley of Malá Haná stream

**Altitude:** 507 **GPS System:** WGS 84 **N:** 49 21 59.4 **E:** 16 50 19.4 **Grid:**

**Habitat:** bark of tree **Position:** trunk **Habitat Specification:** Salix fragilis **Inclination:** ver **Exposition:** W

**Height:** 120 **Citation:**

Fig. 4 : Mean recorded altitude (with standard deviation) for each species ( above chart - number of records ).



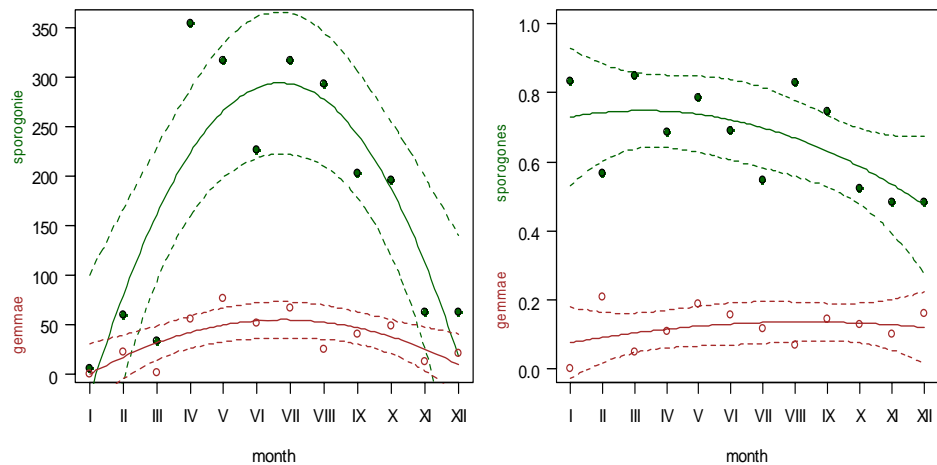


Fig. 3 : Total number of reproductive propagules findings ( left, sporogones  $F = 12.18$ ,  $p < 0.005$ ; gemmae  $F = 5.44$ ,  $p < 0.05$  ) in comparison with the same data weighted by the total number of records ( right, sporogones  $F = 3.3$ ,  $p > 0.05$ ; gemmae  $F = 0.53$ ,  $p > 0.5$  ).

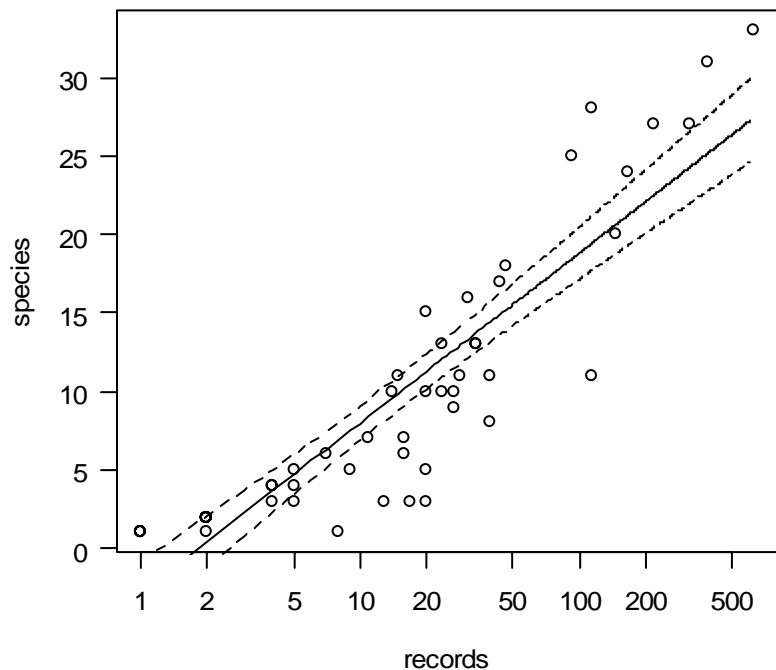


Fig. 6 : Relationships between number of findings (from 53 tree taxa) and number of recorded species.

Fig. 2 : A number of records on bark under ( red - negative scale ) and above ( green - positive scale ) the height line - zero means 60 cm above ground

