

## TAXONOMY AND DISTRIBUTION OF *MICROBOTRYUM PINGUICULAE*, A SPECIES OF SMUT FUNGI NEW FOR THE CARPATHIANS

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**Abstract.** *Microbotryum pinguiculae* (Rostr.) Vánky on *Pinguicula alpina* L., a rarely collected smut fungus belonging to the genus Microbotryales in the class Urediniomycetes, is reported for the first time from the Carpathians as well as from Poland and Slovakia. The species is described and illustrated by a drawing of infected plants and SEM micrographs of spores. *Microbotryum pinguiculae* is a very rare fungus parasitizing various species of *Pinguicula* (Lentibulariaceae). It is known from Europe, Asia and North America, where it shows a true arctic-alpine type of distribution. Taxonomically its generic position is not completely stabilized and needs further studies employing modern techniques (e.g., molecular, ultrastructural).

**Key words:** *Microbotryum*, *Pinguicula alpina*, smut fungi, Microbotryales, Urediniomycetes, Carpathians, Poland, Slovakia

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### INTRODUCTION

In the current circumscription, the smut genus *Microbotryum* Lév. *emend.* Vánky includes species occurring in various organs of host plants belonging to different dicotyledonous families. They develop sori without a peridium, without columella and without sterile cells, and with variously ornamented, more or less violet-tinted spores (Vánky 1998). The genus does not belong to the class Ustilaginomycetes like most smut fungi, but is included in the Urediniomycetes based on morphological, ultrastructural, biochemical and molecular results (Bauer *et al.* 1997, 2001; Begerow *et al.* 1998).

During a collecting trip at the beginning of June 2004 to the Tatra Mts, we observed violet anthers in some specimens of *Pinguicula alpina* L. (Lentibulariaceae) growing in the Dolina Jaworzynka valley. Normally the anthers in this plant are white or creamy. These plants were infected by the smut fungus *Microbotryum pinguiculae* (Rostr.) Vánky. Further investigation in various parts of the Tatra Mts by us and our colleagues revealed that the

species occurs in other populations of *Pinguicula alpina* as well. Up to now, *M. pinguiculae* has not been found in the Tatra Mts, nor in the Carpathians (Vánky 1985). This is also a new species for Poland and Slovakia.

The microscopy routine and SEM studies proceeded as described by Piątek *et al.* (2005). The values of the size ranges are the means of 20 spores measured in 5% KOH. The specimens examined for the present study are deposited in HeMP (herbarium of the first author) and LBML.

### DESCRIPTION

*Microbotryum pinguiculae* (Rostr.) Vánky  
(Figs 1–5)

Mycotaxon 67: 48. 1998.

Sori in anthers as a light violet, powdery spore mass, the spores usually fallen down to the petals of the host plant; in white flowers (e.g., in



**Fig. 1.** Sori of *Microbotryum pinguiculae* (Rostr.) Vánky in anthers of *Pinguicula alpina* L. Scale bar = 1 cm.

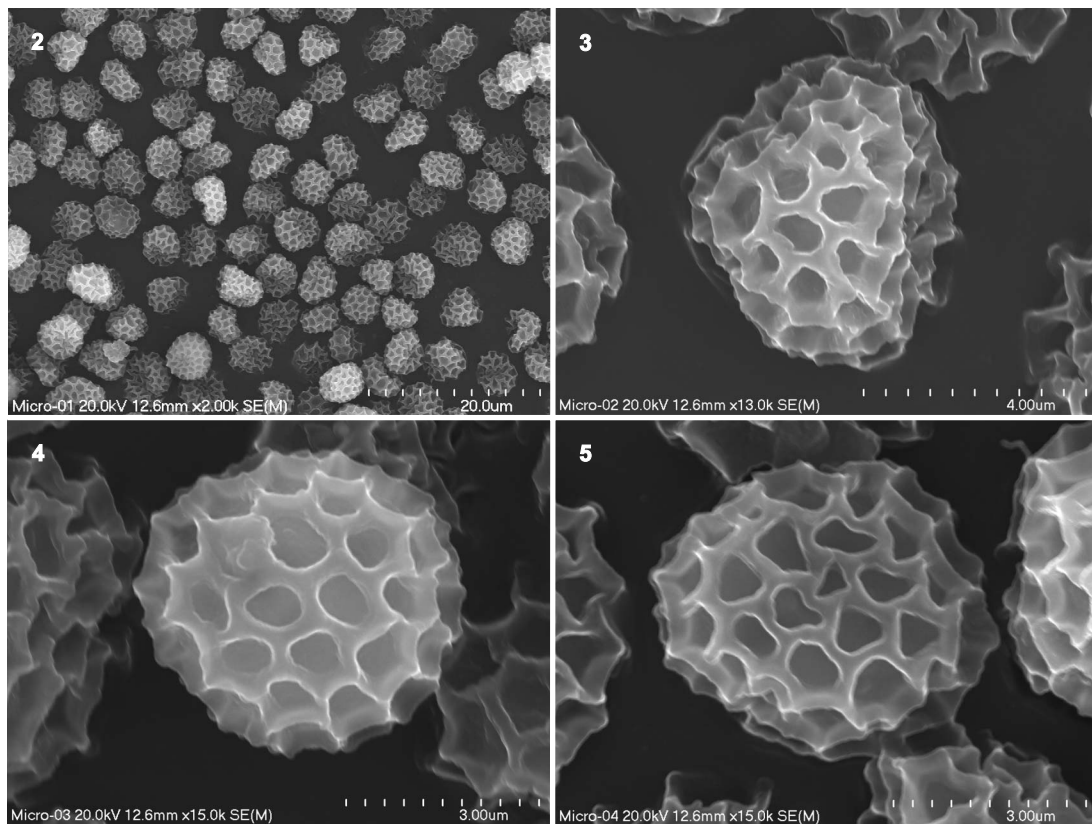
*Pinguicula alpina*) the petals become delicately violaceous, simplifying the identification of infected plants. Spores globose, subglobose, ovoid to slightly irregular, pale brownish-violet,  $5.0\text{--}8.5 \times 6.0\text{--}9.0 \mu\text{m}$ , wall reticulate, 5–8 meshes per spore diameter.

**SPECIMENS EXAMINED:** On *Pinguicula alpina* L.: POLAND. WESTERN CARPATHIANS, Tatra Mts: Dolina Jaworzynka valley, Polana Jaworzynka glade, 1070 m a.s.l., calcareous grassland, 4 Jun. 2004, leg. M. Piątek & J. Piątek (HeMP-7), 1057 m a.s.l., calcareous grassland, 28 May 2005, leg. U. Świdorska & M. Mamcarz (LBLM); Dolina Jaworzynka valley, Długi Żleb gully, 1188 m a.s.l., calcareous grassland, 28 May 2005, leg. U. Świdorska & M. Mamcarz (LBLM); Dolina Jaworzynka valley, Hala Jaworzynka glade, Skupniów Uplaz, 1444 m a.s.l., calcareous grassland, 28 May 2005,

leg. M. Mamcarz & U. Świdorska (LBLM); Skupniów Uplaz, 1330 m a.s.l., calcareous grassland, 28 May 2005, leg. M. Mamcarz (LBLM); Żleb pod Czerwienią gully, 1300 m a.s.l., calcareous grassland, 4 Jun. 2004, leg. M. Piątek & J. Piątek (HeMP-8); Mała Królowa Kopa Mt., 1570 m a.s.l., calcareous grassland, 4 Jun. 2004, leg. M. Piątek & J. Piątek (HeMP-9); by yellow hiking trail between Żleb pod Czerwienią gully and Przełęcz między Kopami pass, 1460 m a.s.l., calcareous grassland, 27 June 2005, leg. M. Piątek & J. Piątek (HeMP-16); by green hiking trail from Murowanica to Nosal, 1102 m a.s.l., calcareous grassland, 2 June 2005, leg. M. Mamcarz (LBLM); on S slope of Mały Giewont Mt, 1580 m a.s.l., calcareous grassland, 25 June 2005, leg. M. Piątek & J. Piątek (HeMP-17); Wielka Świstówka cirque in Czerwone Wierchy massif, 1200 m a.s.l., calcareous grassland, 27 Jun. 2004, leg. A. Ronikier, M. Ronikier & P. Schönswetter (HeMP-10); Kobylarzowy Żleb gully in Czerwone Wierchy massif, 1500 m a.s.l., calcareous grassland, 27 Jun. 2004, leg. A. Ronikier, M. Ronikier & P. Schönswetter (HeMP-11), 1522 m a.s.l., calcareous grassland, 24 June 2005, leg. M. Mamcarz & U. Świdorska (LBLM); Polana Uplaz glade in Czerwone Wierchy massif, 1237 m a.s.l., calcareous grassland, 26 May 2005, leg. W. Mulenko (LBLM); SLOVAKIA. WESTERN CARPATHIANS, Bielskie Tatra Mts: Dolina Bielych plies valley, SW slope of Bielska Kopa Mt. below Predne Kopske sedlo pass, 1700 m a.s.l., calcareous grassland, 22 June 2005, leg. W. Mulenko (LBLM).

## DISCUSSION

This species was originally described as *Ustilago pinguiculae* by Rostrup (1890) from a specimen infecting *Pinguicula vulgaris* L. collected by E. Warming in Jutland (Jylland), Denmark. For a long time its taxonomic position was stable, until studies in the past two decades revealed that species of *Ustilago* (Pers.) Roussel are restricted to host plants belonging to Poaceae. During this time, two different generic concepts appeared to accommodate violet-spored species on dicots. The first step was reinstatement of the forgotten genus *Microbotryum* Lév. by Deml and Oberwinkler (1982) for some anthericolous smut fungi on Caryophyllaceae. In subsequent studies more species were transferred to the genus, including those parasitizing members of host families other than Caryophyllaceae (Prillinger *et al.* 1991;



**Figs 2–5.** Spores of *Microbotryum pinguiculae* (Rostr.) Vánky on *Pinguicula alpina* L., in SEM (HeMP-7).

Bauer *et al.* 1997). Vánky (1998) made the most comprehensive study of the genus, transferring 55 violet-spored species of *Ustilago* on various dicot families to *Microbotryum*, and recognizing 72 species in this genus. One of them was *Microbotryum pinguiculae*.

A different generic concept for violet-spored species was elaborated by Moore (1992, 1996). He restricted the genus *Microbotryum* to species parasitizing Caryophyllaceae, and for the remaining taxa he established the genus *Bauhinus* R. T. Moore. Denchev (1997) proposed the corresponding combination *Bauhinus pinguiculae* (Rostr.) Denchev. Because there are no known morphological characters differentiating the genera *Microbotryum* and *Bauhinus*, most authors (Bauer & Oberwinkler 1997; Vánky 1993, 1998) consider the two synonymous, with *Microbotryum* having

priority. However, recent molecular studies (Almaraz *et al.* 2002) have shown that in the present circumscription *Microbotryum* is heterogeneous, including three distinct clades. One was formed by anthericolous species on Caryophyllaceae, the second by ovaricolous species on Caryophyllaceae, and the third by species on other host families, with *Microbotryum pinguiculae* in the latter clade. In such a situation the genus *Bauhinus* perhaps should be rehabilitated for this clade. In the present study, however, we hesitate to take such a decision until more material is analyzed.

*Microbotryum pinguiculae* occurs on *Pinguicula alpina* L., *P. grandiflora* Lam., *P. variegata* Turcz., *P. villosa* L. and *P. vulgaris* L. (Lentibulariaceae; Karatygin & Azbukina 1989; Vánky 1994). It seems to be a rare species. Vánky (1994) wrote thusly about it: ‘rather inconspicuous, not

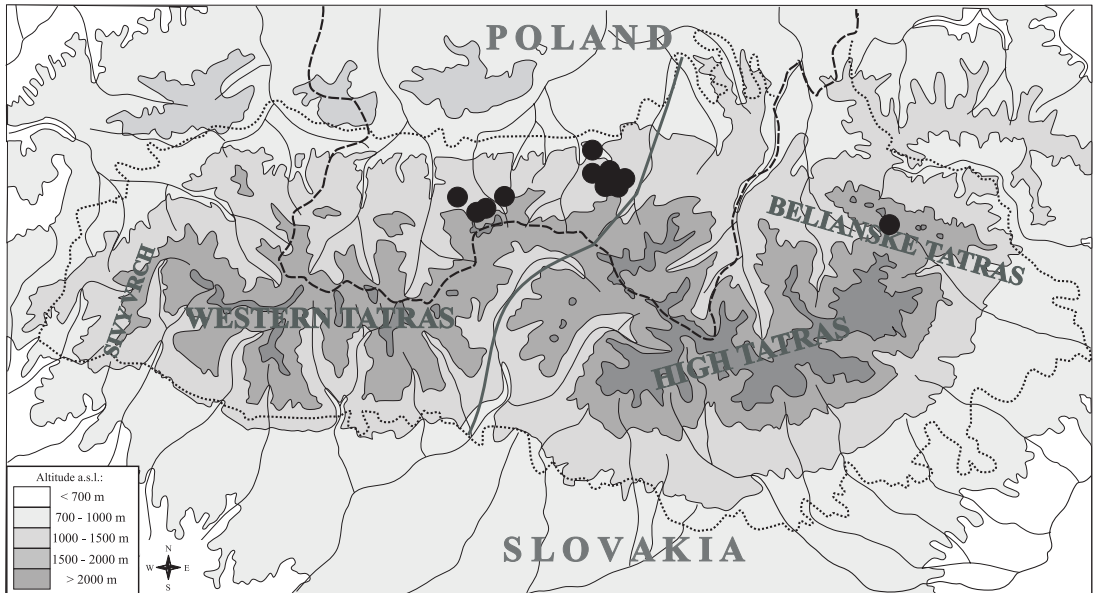


Fig. 6. Distribution of *Microbotryum pingiculae* (Rostr.) Vánky in the Tatra Mts.

often collected. Its range is insufficiently known. It seems to be a circumboreal, high mountain species'. Only scattered records are known from Europe, Asia and North America.

In Europe, the distribution of *Microbotryum pingiculae* is disjunctive. One set of localities is scattered in the northern boreal zone, and the other in Central European mountains. In Northern Europe the species is known from Denmark, Estonia, Finland, Iceland, Latvia, Norway, Sweden, and the European part of Russia (Karelia, Leningrad Oblast', Murmansk Oblast') (Liro 1924; Zundel 1953; Lindeberg 1959; Jørstad 1963; Karatygin & Azbukina 1989; Vánky 1994; Aarnæs 2002). In Central European mountains, *Microbotryum pingiculae* has been reported from various localities in the Alps (Germany, Italy, Switzerland; see Zundel 1953; Zogg 1986; Scholz & Scholz 1988). In the Carpathians this species has not been reported previously (Vánky 1985), and the present records are the first in this mountain chain. During the investigation we found it in several populations of *Pinguicula alpina* in the Tatra Mts (Fig. 6). Most of them were recorded in the Polish part of the mountains, but this is probably because *Microbotryum pingiculae* was more thoroughly

searched in this part of the Tatra Mts. In the studied localities, usually numerous specimens of the host plant were infected, sometimes even 50% of the population. The smut appeared from late May till late June. It should be added here that Zundel (1953) reported *M. pingiculae* on *Pinguicula alpina* from Czechoslovakia, but this fungus was not included in the latest checklist of Slovakian fungi (Lizoň & Bacigálová 1998) where that host plant is known. It has not been recorded in the Czech Republic either (P. Kokeš, pers. comm.), where *P. alpina* is absent as well.

Outside Europe there are only a few reports of the occurrence of *Microbotryum pingiculae*. Karatygin and Azbukina (1989) recorded it from the Russian Far East (Magadansk Oblast'), and Savile (1957, 1981) found it in boreal North America.

ACKNOWLEDGEMENTS. We are grateful to Dr. Petr Kokeš (Vyškov, Czech Republic) for information about the absence of *Microbotryum pingiculae* in the Czech Republic, to our colleagues Anna Ronikier and Michał Ronikier (Kraków, Poland), Magda Mamczarz and Urszula Świdarska (Lublin, Poland) for giving us specimens of the discussed smut fungus, to anonymous reviewer for helpful comments on the paper, and to Anna Łatkiewicz (Kraków, Poland) for assistance with the

SEM micrographs, which were taken in the Laboratory of Field Emission Scanning Electron Microscopy and Microanalysis at the Institute of Geological Sciences of the Jagiellonian University, Kraków. This study was supported by the Polish Ministry of Education and Science (grant nos. 2 P04G 019 28 and 2 P04C 089 27) and by the Slovak Grant Agency VEGA (project no. 2/4032/04).

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Received 12 April 2005

