

## Two species of smut fungi on *Polygonaceae* from Tian Shan, Kazakhstan

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Two rare smut fungi, collected by the author during an expedition in 2005, are reported from Tian Shan: *Microbotryum dehiscens* on a new host, *Polygonum nitens*, and *M. piperi* on *Polygonum undulatum*. Details of spore morphology are presented. A list of smuts on *Polygonaceae* from Kazakhstan is added.

**Key words:** *Microbotryum*, *Polygonum*, spore morphology

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Jsou publikovány nálezy dvou vzácných druhů snětí sbíraných autorem článku během expedice do Ťan-šanu v roce 2005: *Microbotryum dehiscens* na novém hostiteli (*Polygonum nitens*) a *M. piperi* na *Polygonum undulatum*. Připojeny jsou obrázky ukazující detaily morfologie výtrusů a přehled druhů snětí rostoucích na rostlinách čeledi *Polygonaceae* v Kazachstánu.

### INTRODUCTION

Smuts inhabiting *Polygonaceae* were thoroughly revised by Vánky and Oberwinkler (1994). However, the genus *Ustilago* (Pers.) Roussel and the genus *Microbotryum* Lév. separated from it are recently under permanent change (Vánky 1994, 1998, 2004; Almaraz et al. 2002; Begerow et al. 2004; Lutz et al. 2005). According to Moore (1992, 1996) and Denchev (1997) the species parasiting on *Caryophyllaceae* should be included into the genus *Microbotryum* whereas species parasitising on non-caryophyllaceous dicotyledons should be put into the genus *Bauhinus* Moore. Moore (1996) proposed the following host delimitation for this genus: *Polygonaceae*, *Dipsacaceae* and *Asteraceae*. However Bauer and Oberwinkler (1997), Vánky (1998) and Almaraz et al. (2002) do not accept the genus *Bauhinus*. Recent investigations showed that the genus *Microbotryum* is really monophyletic and confined only to the *Caryophyllaceae* (Almaraz et al. 2002, Begerow et al. 2004, Lutz et al. 2005). The genus *Ustilago* should be retained to monocotyledonous hosts, as pointed out by Blanz and Gottschalk (1984). I tempo-

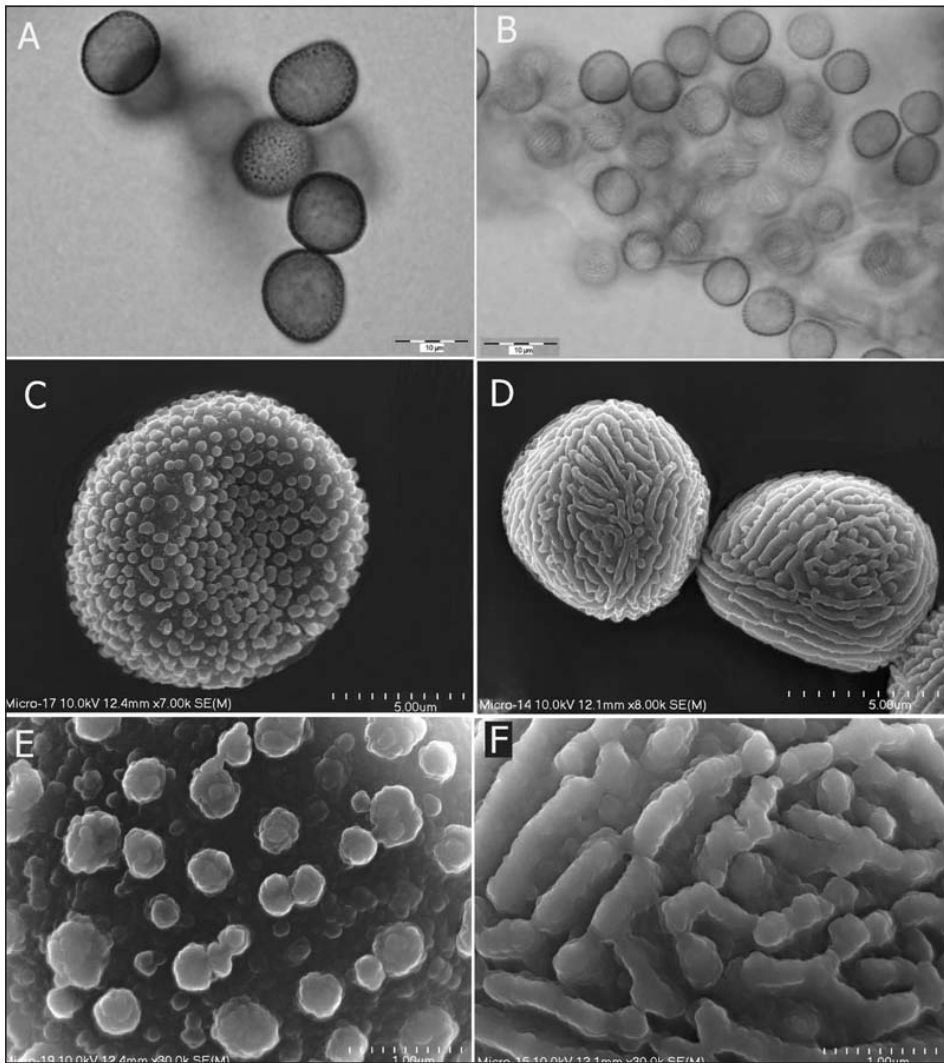
rarily use the classification of Vánky (1998) where all purple spored *Ustilago* species on dicotyledonous host plants were included in the genus *Microbotryum*. However it is clear from the latest investigations that species inhabiting *Polygonaceae* should be transferred to another genera. According to Almaraz et al. (2002), smuts occurring on *Polygonaceae* belong to the genus *Sphacelotheca* and two other groups of “dicot *Ustilago*”.

The mountains of Central Asia are very rich in smut fungi (Mundkur 1944, Zundel 1953, Schwarzman 1960, Vánky and Guo 1986, Kakishima and Ono 1988, Wang and Piepenbring 2002, Paul and Sharma 2003, Chlebicki and Suková 2005). Investigations in West Thian Shan were carried out by Schwarzman (1960) and Vasyagina (1977). They reported 14 smut species on *Polygonaceae*. Because both synonyms of *Microbotryum bistortarum* (DC.) Vánky – *Sphacelotheca ustilaginea* (DC.) Ciferri and *Sphacelotheca candollei* (L. R. et C. Tul.) Ciferri – were noted as separate species, in fact there were noted 13 species of smut fungi, ten on *Polygonum*, one on *Oxyria* and two on *Rheum*. These are: *Melanopsichium austro-americanum* (Speg.) Beck (= *Zundeliomyces polygones* Vánky) on *Polygonum alpinum*, *M. aviculare* (Liro) Vánky on *Polygonum aviculare* L., *M. bistortarum* (DC.) Vánky on *Polygonum viviparum* L. and *Polygonum bistorta* L., *M. bosniacum* (Beck) Vánky on *Polygonum alpinum* All., *Polygonum bucharicum* Grigorj. and *Polygonum songaricum* Schrenk, *M. cordae* (Liro) Deml. et Prill. on *Polygonum hydropiper* Michx., *M. marginale* (DC.) Vánky on *Polygonum nitens*, *M. nepalense* (Liro) Vánky on *Polygonum alatum* Buch. – Ham. ex Spreng, *Microbotryum pustulatum* (DC.) Bauer et Oberw. on *Polygonum nitens* (Fisch. et Mey.) Petrov, *M. reticulatum* (Liro) R. Bauer et Oberw. on *Polygonum scabrum* Poir., *M. rhei* (Zundel) Vánky (= *Sphacelotheca titovii* Golovin) on *Rheum maximoviczi* Losinsk. and *R. wittrockii* Lundstrom, *M. vinosum* (Tul. et C. Tul.) Denchev on *Oxyria digyna* (L.) Hill, *Sphacelotheca hydropiperis* (Schumach.) de Bary on *Polygonum hydropiper* and *Thecaphora schwarzmaniana* Byzova on *Rheum cordatum* Losinsk.

## METHODS

Dried spores were rehydrated in lactophenol by gently heating to boiling point and studied under an (LM) Olympus BX-51 light microscope with an oil immersion lens, at a magnification of 1000 ×. Thirty spores of each specimen were measured and pictured (LM photographs). For scanning electron microscope (SEM) studies, dried spores were coated with carbon, and photographed using a Hitachi S-4700 SEM with a working distance of c. 12.4 mm.

Host plants were identified on the basis of Flora of Kazakhstan according to the Ageeva et al. (1960). Specimens collected during an expedition in Thian Shan



**Fig. 1.** Spores of two *Microbotryum* species from Thian Shan. *M. dehiscens*: A – spores under LM Olympus BX-51; C – spore in SEM, E – sculpture of spore surface. *M. piperi*: B – spores under LM Olympus BX-51; D – spores in SEM; F – sculpture of spore surface.

(2005) are deposited in KRAM (W. Szafer Institute of Botany in Kraków), HUV (Herbarium Ustilaginales Vánky, Gabriel-Biel-Str. 5, D-72076 Tübingen, Germany) and PRM (National Museum in Prague, Czech Republic).

## RESULTS AND DISCUSSION

***Microbotryum dehiscens*** (L. Ling) Vánky, 1998: 43.

Syn.: *Ustilago dehiscens* L. Ling, 1949: 124.

Sori inside nuts, with purplish-brown spore mass, ustilospores nearly subglobose to irregular 9–10 x 10–13 µm, densely covered with large, truncate, rounded and apically flattened spines visible in SEM at low magnification (Fig. 1A, C). At high magnification two kinds of protuberances were visible: apically flattened spines and small warts in the space between the spines as well as on the spine surface (Fig. 1E).

Material examined: Kazakhstan: Thian Shan, Zailiyski Alatau Mts., valley of Issyk river, mosaic of meadows near river and tall spruce forest (*Picea schrenkiana*), 2346 m elev., N 43°10'23" E 77°27'21", in nuts of *Polygonum nitens* (Fisch. et Mey.) Petrov, 26 July 2005, coll.: A. Chlebicki, KRAM F 55199, HUV 21135.

The species occurs on *Polygonum* (sect. *Bistorta*). Host of the type is *P. amplexicaule* from Kashmir in India. Other collections are on *P. viviparum* from India and China (Vánky and Oberwinkler 1994). *Polygonum nitens* is a new host for this species. This smut infected almost all plants at the site shaded by trees of tall spruce (*Picea schrenkiana*).

***Microbotryum piperi*** (G. P. Clinton) Vánky, 1998: 48.

Syn.: *Ustilago piperi* G. P. Clinton, 1904: 382.

Sori as pustules located between secondary veins of the abaxial side of the leaf, sometimes confluent over a very large area, in the beginning covered by epidermis, after opening, the purplish-brown, powdery mass of spores becomes visible. Ustilospores globose 6–8 x 7–10 µm, brownish-violet with striae covering the surface of the ustilospore wall (Fig. 1B). In SEM, mostly non-anastomosing, but interconnected, ramified and very densely situated parallel ridges are visible (Fig. 1D). At high magnification low warts on the ridges are visible (Fig. 1F).

Material examined: Kazakhstan: Thian Shan, Zailiyski Alatau Mts., valley of Issyk river, mosaic of meadows near river and tall spruce forest (*Picea schrenkiana*), 2340 m elev., N 43°10'23" E 77°27'21", on leaves and axis of inflorescences of *Polygonum undulatum* P. J. Bergius, 26 July 2005, coll.: A. Chlebicki, KRAM F 55190, HUV 21136.

According to Vánky and Oberwinkler (1994) the smut inhabits plants of the genus *Polygonum* (sect. *Aconogonon* Meisn.), such as: *P. alpinum* All. (the Alps and mountains in China), *P. davisiae* Brewer (California and Oregon, USA), *P. phytolaccaefolium* Meisn. (USA) and *P. songaricum* Schrenk (Thian Shan, Kazakhstan).

Schwarzman (1960) reported *Sphacelotheca bosniaca* (Beck) Maire on *Polygonum alpinum*, *P. bucharicum* Grigorj. and *P. songaricum*. In her drawing, the ustilospores from *Polygonum alpinum* and *P. bucharicum* possess a dis-

tinctly irregular shape and are covered with small warts as in true *Microbotryum bosniacum* (Beck) Vánky, whereas ustilospores of specimens from *Polygonum songaricum*, with indistinctly marked striae, are similar to *M. piperi*. Schwarzman (l.c.) noticed pustules of this last fungus on leaves, inflorescences and roots. But the size of the spores (9–14 × 13.5–19 µm) does not agree with the spore description of *M. piperi*. It is not clear which fungus Schwarzman collected on *Polygonum songaricum*.

Spores of *M. piperi* possess parallel and anastomosing ridges (Vánky 1994, Vánky and Oberwinkler 1994). The Thian Shan specimen mostly does not have such anastomosing ridges. Its ridges are very densely distributed and interconnected. It should be considered as variability of the spore morphology.

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