SHORT COMMUNICATION

MICROBOTRYUM SCOLYMI, A RARE SMUT FUNGUS NEW FOR GREECE

J. Kashefi [1] and K. Vánky[2]

[1]*USDA ARS, European Biological Control Laboratory, Tsimiski 43, 54623 Thessaloniki, Greece*
[2] *Herbarium Ustilaginales Vánky (HUV), Gabriel-Biel-Strasse 5, 72076 Tübingen, Germany*

SUMMARY

The rare *Microbotryum scolymi*, a micromycete recently discovered in Greece, damages heavily the heads of *Scolymus hispanicus*, thus is regarded as a potential biological control agent for *Scolymus* thistles. Description, illustrations, synonyms, host plant range and geographical distribution of *M. scolymi* are given, together with a key to the *Microbotryum* species on *Compositae*.

Key words: *Microbotryales*, *Microbotryum*, *Scolymus hispanicus*, smut fungi, thistles, biological control.

In the mid 1970s, the smut fungus *Entyloma ageratinae* R.W Barreto *et* H.C. Evans was successfully used for the biological control of Mist Flower [*Ageratina riparia* (Regel) R.M. King *et* H. Rob = *Eupatorium riparium* Regel, Asteraceae] in Hawaii, and the level of control has remained stable ever since (Trujillo, 1985; Barreto and Evans, 1988). The same fungus was subsequently introduced to South Africa and New Zealand, again for the biological control of Mist Flower (Morin *et al.*, 1997).

The fact that some smuts can be affective agents of biocontrol for weeds is confirmed by earlier records. Thus, for instance, in 1889 a smut fungus that damaged heavily the flower heads of *Scolymus hispanicus* L. (*Compositae*) was collected near Algier by L. Trabut and deposited as entry No. 5129 in Roumeguère's *Fungi selecti exsiccati*, under the name of *Ustilago scolymi* sp. nov., without a description (*nomen nudum*). Shortly afterwards, the same fungus was found, again in Algeria, on *Scolymus grandiflorus* Desf., and described as *U. scolymi* (Juel, 1901). Further records of the same fungus were from *S. hispanicus* L. in Algeria (Maire, 1920), and in Spain by P.L.M. Unamuno in 1927 (included in Petrak, *Mycotheca Generalis* No. 1059) and R. Lami in 1932 (see Yen, 1937).

Corresponding author: J. Kashefi
Fax: +30.2310.473272
E-mail: javidk@afs.edu.gr

To the best of our knowledge (see also Zundel, 1953), no records of *U. scolymi* seem to exist after 1932. Although this fungus may be a rare parasite, it cannot be excluded that the paucity of its records may depend on the fact that it was not systematically and extensively searched for in nature.

S. hispanicus is normally not a problem in cultivated land, but it can become one in pastures and grassland where, because of its deep taproot (up to 60 cm), it competes with other plants for water and replaces the native vegetation. The United States Department of Agriculture has classified this thistle as an invasive weed in four different USA States. Since *S. hispanicus* is a biennial plant propagated only be seeds, seed destruction represents an attractive method for its control. *M. scolymi* can effectively destroy flower heads, thus acting as a very efficient bioherbicide in the areas where it occurs naturally and in those where it was introduced. A major advantage of the use *M. scolymi* as a bioherbicide is the possibility of its mass production and utilization on large surfaces.

In the course of a search for parasites of thistles as potential biocontrol agents, the senior author discovered heavily infected plants in a population of *S. hispanicus* L. (Fig. 1 A, B) in a Greek station with the following coordinates: Thessalia, Lárisa Province, 30 km South of Larisa, road to Farsala, at Chalkiades, 39°24'02" N, 22°25'40" E, alt. c. 275 m, 11.VIII.2003. A specimen that proved to be infected by *U. scolymi* was deposited as entry No. 1200 in Vánky's *Ustilaginales exiccata*.

Remarkably, two additional smut fungi that damage floral heads of thistles, had been collected previously in the same area, namely *Ustilago onopordi* Vánky, (Vanky, 1991) [(= *Microbotryum onopordi* (Vánky) Vánky)] on *Onopordum bracteatum* Boiss. *et* Heldr. subsp. *ilex* (Janka) Franko (Vánky, *Ustilaginales exsiccata* No. 882), and *M. silybum* Vánky *et* Berner (Vánky and Berner, 2003) on *Silybum marianum* (L.) Gaertner (Vánky, *Ustilaginales exsiccata* No. 1188 and 1188/B). These three species differ in spore morphology (Fig. 2 A, B and key below).

Ultrastructural (Bauer *et al.*, 1997), molecular (Blanz and Gottschalk, 1984; Begerow *et al.*, 1997), and mor-

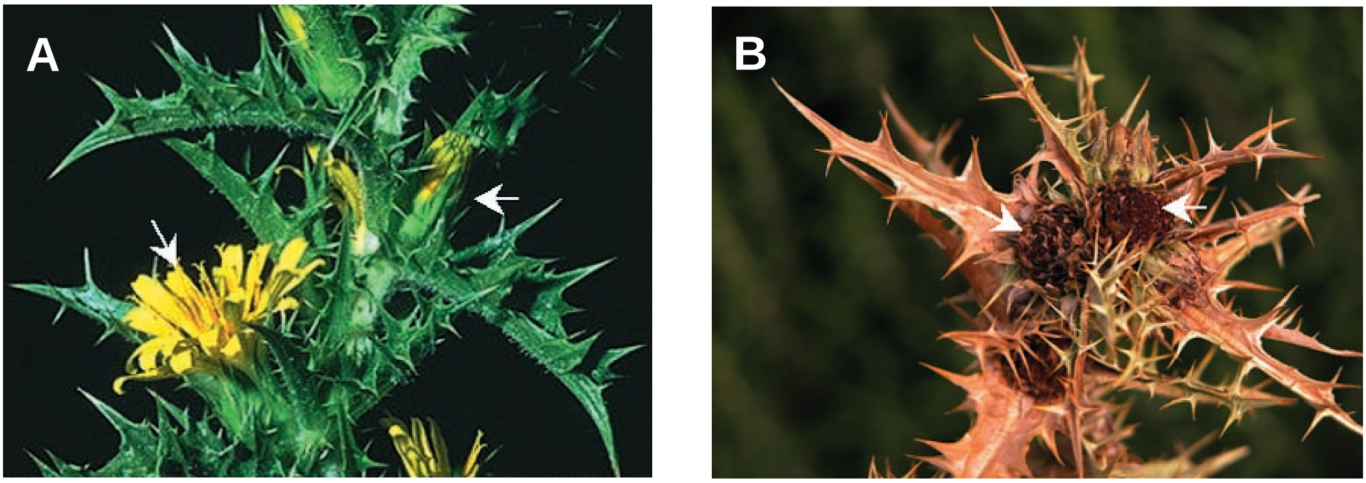

Fig. 1. Healthy **(A)** and *M. scolymi*-infected **(B)** tops of *Scolymus hispanicus* plants. Arrows point at flower heads.

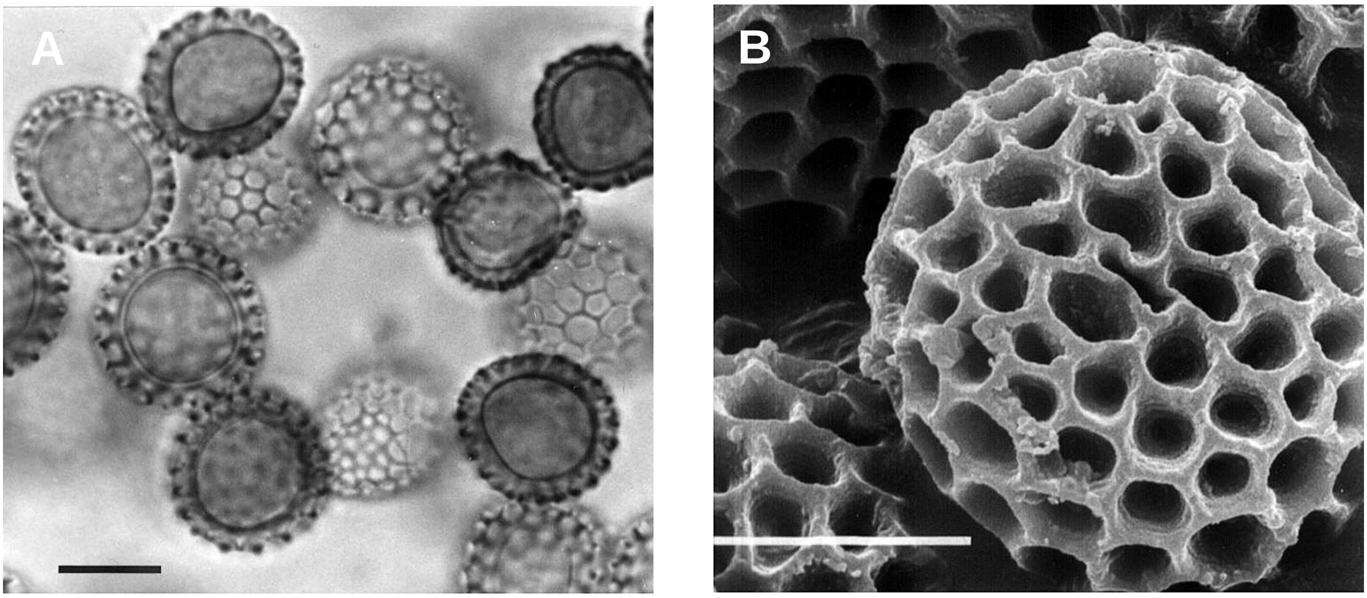

Fig. 2. Light **(A)** and scanning electron microscope **(B)** pictures of *M. scolymi* spores. Magnification bars = 10 µm.

phological studies (Vánky, 1998) have shown that most of the *Ustilago* species infecting dicotyledonous host plants belong to the genus *Microbotryum* Lév., within the family *Microbotryaceae* R.T. Moore, order *Microbotryales* Bauer *et* Oberwinkler. It is interesting that *Microbotryales* (with *ca.* 100 species) are phylogenetically more closely related to rust fungi (*Urediniomycetes*) than to the remaining group of smut fungi (*Ustilaginomycetes*, *ca*. 1350 species).

What follows is a description of *M. scolymi* after Vánky (1998):

Microbotryum scolymi (Juel) Vánky

Ustilago scolymi Roumeguère, in Roumeguère., *Fungi Selecti Exsiccati* No. 5129, 1890 (*nomen nudum*); *Ustilago scolymi* Juel (Juel,1901); *Bauhinus scolymi* (Juel) Denchev (Denchev, 1997). Type on *Scolymus grandiflorus* Desf., Algeria, at Constantine, 24.02.1901, O. Juel. Holotype in Herbarium of the Botany Department, Swedish Museum of Natural History, Stockholm, Sweden.

Sori destroy all ovaries and flowers of a head, transforming them into a semi-agglutinated, later powdery, dark brownish-violet mass of spores. Infection is systemic. All heads of an infected plant are affected. Spores are globose to ellipsoidal (Fig. 2A), 12–17 x 13–20 µm, pale yellowish-brown with a violet tint, uniformly pigmented. Wall is reticulate, 6–10 meshes per spore diameter, muri 1.5–2.5(–3) µm high, blunt in optical median view. In the scanning electron microscope, meshes appear infundibuliform with muri with a few parallel rings (Fig, 2B). Spore germination results in 4-celled basidia, one, rarely two from a spore, measuring 3.6–6 × 30–37.2 µm. Sessile, ellipsoidal basidiospores measuring 2.4–3.6 × 9.6–18 µm are produced laterally and terminally on basidia. No fusion between basidial cells or basidiospores was observed (Yen, 1937).

On *Compositae* (*Cichorioideae*): *Scolymus grandiflorus* Desf., and *Scolymus hispanicus* L., N. Africa (Algeria), S. Europe (Greece, Spain).

Key to the *Microbotryum* species on *Compositae*
(after Vánky and Berner, 2003)

1. Spore mass pale brownish-violet. Muri in median view spiniform. On *Onopordum*…………*M. onopordi*
   – Spore mass dark brownish-violet. Muri in median view not spiniform……………………………………2
2. Muri over 1.5 µm high. Spores uniformly pigmented……………………………………………3
   – Muri up to 1.5 µm high. Spores often lighter on one side…………………………………………… 5
3. Reticulum in median view does not appear as radiate marginal wings. Meshes per
   – Spore diam. 6–10. On *Scolymus*…………*M. scolymi*
   – Reticulum in median view appears as radiate marginal wings. Meshes per spore diam. up to 8……. 4
4. Spores relatively variable, 15–20 µm long. Meshes per spore diam. (4–)5–8. Muri 2–4 µm high. On *Carduus*………………………………………… *M. cardui*
   – Spores relatively uniform, 13–17.5 µm long. Meshes per spore diam. 4–6. Muri (1.5–)2–3 µm high. On *Silybum*…………………………… *M. silybum*
5. Spores 10–15 µm long. On *Scorzonera*...*M. scorzonerae*
   – Spores 13–19 µm long…………………………… 6
6. Interspaces with evident warts. On *Tragopogon* *M. tragopogonis-pratensis*
   – Interspaces without evident warts. On *Cichorium*…………………………. *M. cichorii*

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