

THREE SPECIES OF *Entyloma* (ENTYLOMATALES,
USTILAGINOMYCOTINA) NEWLY RECORDED
FROM BULGARIA

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Abstract

Three smut fungi are reported for the first time from Bulgaria: *Entyloma fergussonii* on *Myosotis orbelica*, *E. pastinacae* on *Pastinaca sativa* subsp. *urens*, and *E. thalictri* on *Thalictrum minus*, extending the known species of *Entyloma* to 11 in this country. Brief descriptions and illustrations are provided for the newly recorded smut fungi. *Myosotis orbelica* is a new host plant for *Entyloma fergussonii*.

Key words: Bulgaria, *Entyloma*, fungal diversity, smut fungi

Introduction. *Entyloma* is a cosmopolitan genus of smut fungi, belonging to the family Entylomataceae. It was introduced by DE BARY [1] and is typified with *E. microsporum* (Unger) J. Schröt. on *Ranunculus repens* L. *Entyloma* is a large genus, with 189 recognised species on host plants belonging to 27 families of eudicots [2–12]. The species of *Entyloma* form sori in vegetative organs of plants, mostly in leaves, rarely in stems or roots, usually forming few to numerous spots, sometimes swellings or galls formed by hypertrophic growth of host tissue. The spores are permanently embedded in the host tissue, single or in irregular groups, hyaline, yellow or yellowish brown, usually with a smooth, two-layered wall; very

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rarely the outer layer is tuberculate or torn apart into prismatic, pyramidal or coarse and irregular pieces [12]. For many of the *Entyloma* species, an asexual morph is recorded [2].

Eight species of *Entyloma* have been recorded from Bulgaria on hosts in the Asteraceae, Papaveraceae, and Ranunculaceae [13–15]. The present article aims to increase the knowledge about the diversity of this genus in Bulgaria. Three species, *Entyloma fergussonii*, *E. pastinacae*, and *E. thalictri*, are reported for the first time from this country.

Materials and methods. Dried specimens from the mycological collections SOMF (Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences) and BUCM (Institute of Biology Bucharest, Romanian Academy) were examined under light microscope. Spores were mounted in lactoglycerol solution (w:la:gl = 1:1:2) on glass slides, gently heated to boiling point to rehydrate the spores, and then cooled. The measurements of spores are given as min–max (extreme values) (mean $\pm$ 1 standard deviation). The descriptions below are based entirely on the specimens examined. The lists of shapes of spores are arranged in descending order of frequency.

Results and discussion. *Entyloma fergussonii* (Berk. & Broome) Plowr., Monogr. Brit. Ured. Ustilag. (London): 289, 1889. (Fig. 1(A–C)).

Sori in leaves, forming rounded spots, 0.7–2.5 mm in length, larger by fusion, amphigenous, not limited by veins, sometimes slightly protruding, brown, sometimes peripherally greenish. *Spores* usually single, sometimes in small groups, embedded in leaf tissue, subglobose, broadly ellipsoidal or slightly irregular, (8–)9–13(–14) $\times$ (7.5–)8.5–11 (–12) ($10.9 \pm 1.0 \times 10.0 \pm 0.8$) μm ($n = 100$), subhyaline to pale yellow; spore wall 0.6–1.1(–1.3) μm thick. *Anamorph* present.

Specimen examined. On *Myosotis orbelica* (Velen.) Peev & N. Andreev, BULGARIA, Rila Mts, near Yakoruda Lakes, above Ribno Yakoruda Lake, 42°06'03.3" N 23°35'15.6" E, alt. 2218 m, 20 July 2020, T. T. Denchev, no. 2034 (SOMF 30384).

Host plants and distribution. On Boraginaceae: *Myosotis alpestris* F. W. Schmidt subsp. *alpestris*, *M. alpestris* subsp. *pyrenaeorum* (Blaise & Kerguélen) Valdés (*M. alpina* Lapeyr.), *M. amoena* (Rupr.) Boiss., *M. arvensis* (L.) Hill (*M. intermedia* Link), *M. discolor* Pers. (*M. versicolor* Sm.), *M. laxa* subsp. *baltica* (Lindm.) Nordh., *M. laxa* subsp. *caespitosa* (Schultz) Nordh., *M. orbelica*, *M. ramosissima* Rochel (*M. hispida* Schltdl.), *M. scorpioides* L., *M. soleirolii* Gren. & Godr., *M. stricta* Roem. & Schult., and *M. sylvatica* Hoffm.; Europe, Asia, and New Zealand [2, 16–21].

In some countries in Europe, *Entyloma fergussonii* is a common leaf-spotting fungus on species of *Myosotis*, but it was not recorded from Bulgaria. *Myosotis orbelica* is endemic to Bulgaria and is reported here as a new host plant for this smut fungus.

Entyloma pastinacae Jaap, Ann. Mycol. 14: 19, 1916. (Fig. 2(A, B)).

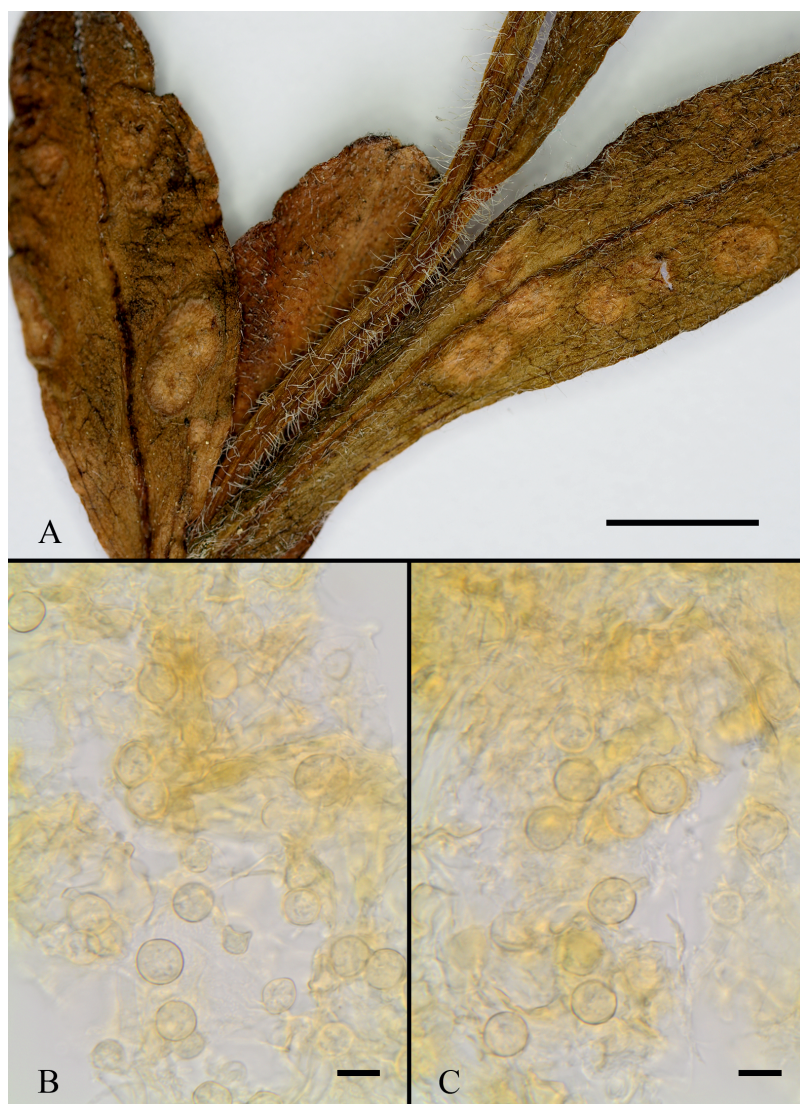


Fig. 1. *Entyloma fergussonii* on *Myosotis orbelica* (SOMF 30384): A – habit, B, C – spores in LM. Scale bars: A = 0.5 cm; B, C = 10 µm

Sori in leaves, forming irregular spots, 0.2–2.0(–3.0) mm in length, larger by fusion, amphigenous, not limited by veins, usually not protruding, sometimes very slightly protruding, clay buff on both sides of leaves. *Spores* crowded in groups, embedded in leaf tissue, subglobose, broadly ellipsoidal or irregular, (7–)8–12 (–13) × (6–)7–10.5(–11.5) ($10.2 \pm 1.3 \times 8.8 \pm 0.9$) µm ($n = 100$), subhyaline to pale yellow; spore wall 0.8–1.3(–1.5) µm thick. *Anamorph* present.

Specimen examined. On *Pastinaca sativa* subsp. *urens* (Godr.) Čelak., BULGARIA, Dobrich Province, Balchik, 25 May 1999, G. Negrean, s.n. (BUCM 136 808).

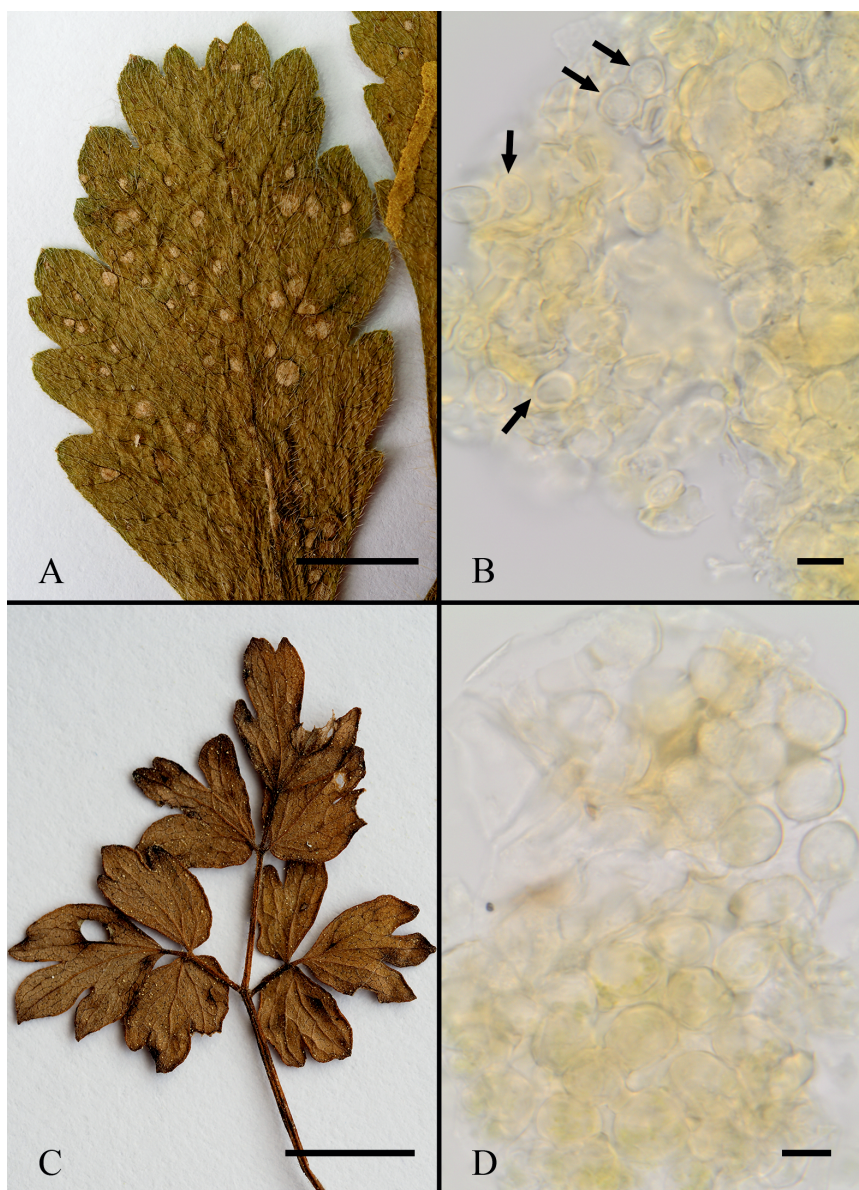


Fig. 2. Species of *Entyloma* from Bulgaria. A, B – *E. pastinacae* on *Pastinaca sativa* subsp. *urens* (BUCM 136 808): A – habit, B – spores in LM (indicated with arrows). C, D – *E. thalictri* on *Thalicttrum minus* (SOMF 30385): C – habit, D – spores in LM. Scale bars: A, C = 0.5 cm; B, D = 10 μ m

Host plants and distribution. On Apiaceae: *Pastinaca sativa* L. subsp. *sativa* and *P. sativa* subsp. *urens*; Europe [2,17].

Entyloma thalictri J. Schröt., in Cohn, Kryptog.-Fl. Schlesien (Breslau) 3: 282, 1887. (Fig. 2(C, D)).

Sori in leaves, forming irregularly rounded spots, 0.5–1.5 mm in length, amphigenous, not limited by veins, dark reddish brown. *Spores* crowded in groups, embedded in leaf tissue, subglobose, broadly ellipsoidal or irregular, $8.5\text{--}16 \times 7\text{--}13.5$ ($12.4 \pm 1.6 \times 11.0 \pm 1.5$) μm ($n = 100$), subhyaline to pale yellow; spore wall $0.7\text{--}1.3$ ($\text{--}1.5$) μm thick. *Anamorph* not seen.

Specimen examined. On *Thalictrum minus* L., BULGARIA, Blagoevgrad Province, Pirin Mts, near Banderitsa Hut, in a *Pinus heldreichii* forest, $41^{\circ}46'05.2''$ N $23^{\circ}25'25.7''$ E, alt. 1883 m, 15 July 2020, T. T. Denchev & C. M. Denchev, no. 2027A (SOMF 30385).

Host plants and distribution. On Ranunculaceae: *Thalictrum aquilegifolium* L., *T. dasycarpum* Fisch. & Avé-Lall., *T. dioicum* L., *T. flavum* L., *T. foetidum* L., *T. lucidum* L., *T. minus* subsp. *minus*, *T. minus* subsp. *majus* (Crantz) Hook. f., *T. polygamum* Muhl. ex Spreng., *T. revolutum* DC., *T. simplex* L., and *T. tuberosum* L; Europe, Asia, and North America [2, 16, 17, 19].

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