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Distribution and ecology of *Xerula melanotricha* Dörfelt in the Czech Republic (Basidiomycetes, Physalacriaceae)

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ANTONÍN V. 2009: Distribution and ecology of *Xerula melanotricha* Dörfelt in the Czech Republic (Basidiomycetes, Physalacriaceae). *Acta Musei Moraviae, Scientiae biologicae* (Brno) **94:** 127–135. – *Xerula melanotricha* Dörfelt is a distinctive fungus known from 36 localities in the Czech Republic. Most collections (with three exceptions explained in text) come from coniferous trees or forests (*Picea abies* and *Abies alba*). It is a late summer and autumnal species, usually growing from July to October, and occurs on both calcareous and acid soils. It is widely distributed in central, southern and western Europe, but has not yet been found in the Nordic countries. In the Czech Republic it grows in near-natural, man-influenced, and man-made forests and is not, therefore, of use as a bio-indicative species.

Key words. Basidiomycota, *Xerula melanotricha,* ecological valence, distribution, Czech Republic

Introduction

Xerula melanotricha Dörfelt is a distinctive agaricoid fungus described as a new species only 30 years ago (DÖRFELT 1979) from the former Czechoslovakia (recently Slovakia, Velká Fatra Mts., Holý vrch). According to DÖRFELT (1979), it is a saprotrophic fungus associated with conifers especially on calcareous soils. The only host exception is represented by a find on a fallen branch of beech in Liechtenstein (KOTLABA 2001). In central Europe it usually forms basidiocarps in the second half of summer and in autumn. According to KOTLABA (1995), it should be a fungus typical of herb-rich beech, fir-beech and fir forests of the *Abietion* alliance and *Cephalanthero-Fagenion* and *Eu-Fagenion* suballiances, often on calcareous soils. The aim of this paper is to summarise its distribution in the Czech Republic to date and evaluate its ecological valence.

Systematically, *Xerula melanotricha* was traditionally included in *Tricholomataceae* (e.g. HAWKSWORTH *et al.* 1995, SINGER 1986). However, recent molecular studies indicate that it is part of a group within *Physalacriaceae* (e.g. MATHENY *et al.* 2006, MONCALVO *et al.* 2002, KIRK *et al.* 2008).

Xerula melanotricha is a rare fungus included into the list of fungi protected by Regulation No. 395/1992 in the Czech Republic (ANTONÍN & BIEBEROVÁ 1995) under the classification of critically endangered species (but as an endangered species in the update of this regulation; unpublished list.) It is also included in the Red Data Book (KOTLABA 1995) as a very endangered species and in the Red List of the Czech macromycetes (HOLEC & BERAN 2006) as an endangered species.

Material and methods

Data on localities of *Xerula melanotricha* were obtained from field research by the author and his collaborators (specimens are preserved in the herbarium of the Department of Botany, Moravian Museum, Brno – BRNM) and from all important herbaria in the Czech Republic (BRNU, CB, FMM, HR, LIT, MJ, OSM, OLM, PL, PRC, PRM, Rokycany, and ZMT); some data were kindly provided by other Czech mycologists. Older herbarium specimens of *Xerula pudens* (Pers.: Fr.) Singer [Syn. *X. longipes* (P. Kumm.) Maire] were also revised because the species was unified with *X. melanotricha* before the latter was distinguished as a separate species. Herbarium abbreviations used in this paper follow Holmgren & Holmgren (1998). The abbreviation "not." (= *notavit*) indicates "recorded only without preservation of a herbarium specimen" (Kotlaba 1999). Places at a distance of *c*. 1 km are considered separate localities.

Results

***Xerula melanotricha* Dörfelt,** Feddes Repert. 90(5–6): 367, 1979. (Fig. 1)

≡ *Oudemansiella melanotricha* (Dörfelt) M.M. Moser, in: Kleine Kryptogamenflora, Ed. 5, 2b/2: 156, 1983.

Detailed macroscopic and microscopic descriptions and/or colour photos or paintings have been published e.g. by Breitenbach & Kränzlin (1991), Courtecuisse & Duhem (1994), Dörfelt (1979), Ludwig (2000, 2001), and Ronikier (2003).

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(All localities are in the original wording of their labels, translated from Czech and/or Latin into English only. In cases of exactly located records, the co-ordinates are added.)

Bohemia

Žamberk, *c.* 1 km SW of the village, on a bank of the Lukavický rybník pond, on clayey soil under *Abies*, Aug. 1983 leg. J. Mann, det. V. Antonín (BRNM 289489). – Žamberk, around the hamlet of Záhoří, *c.* 3 km S of the village, near the Lukavický rybník pond, in a clearing covered with mosses on the boundary between a young spruce stand and an old coniferous (spruce, fir) forest, co-ord. 50°30′03″N, 16°27′37″E, alt. 400–450 m, 30 Aug. 2005 leg. et det. J. Mann (BRNM 709810).

Říčany near Praha, 4 Sept. 1934 leg. V. Sak (PRM 660449, as *Collybia longipes*, rev. 10 Dec. 1978 H. Dörfelt; Antonín 1982, Dörfelt 1979, Kotlaba 2001).

Olešovice, Struhařov, spruce forest, on a stump of *Picea abies* (?), 1 Aug. 1957 leg. et det. K. Kult (PRM 6605554, as *Oudemansiella longipes*, 15 Dec. 1978 rev. H. Dörfelt; Antonín 1982, Dörfelt 1979, Kotlaba 2001).

Rataje nad Sázavou, mixed forest, 28 Aug. 1946 leg. et det. A. Procházka (BRNU 363620, as *Collybia longipes*; 12 Jan. 1972 rev. Hrnčíř as *Oudemansiella longipes*; 22 Aug. 2009 rev. D. Dvořák).

Plzeň-sever [Plzeň-North] distr., near the Střela river, on stumps of *Abies alba* or around them in the soil, alt. *c.* 370 m, July 1978, 22 July 1979, 8 Aug. 1980, 21 Sept. 1980, 7 May 1981, 2 Aug. 1981, 10 Oct. 1981 leg. et det. Z. Hájek (Hájek 1982). – Plzeň distr., among Koryta and Dolní Hradiště, on a stump of *Abies alba*, 8 Aug. 1980 leg. Z. Hájek (junior), det. Z. Pouzar (PRM 871739). – Ibid., Dolní Hradiště, recreational settlement, on the base of a stump of *Abies alba*, 4 Aug.1981 leg. Z. Hájek (PL).

W Bohemia, between the villages of Cheznovice and Smolárna, Trhoň Nature Reserve, in a young spruce forest known as Nad Smolárnou, alt. 500 m, co-ord. 49°46′10″N, 13°46′13″E, 10 Sept. 2001 leg. et det. O. Jindřich (PRM 895587).

Brdy Mts., Kokšín National Nature Reserve, on a stump of *Abies alba*, alt. *c.* 670 m, co-ord. 49°36′20″N, 13°40′34″E, 5 Sept. 1981 leg. et det. J. Sedláček (Hájek 1982).

Malovidy, Na (Knížecí) Stříbrné Nature Monument, in an old fir forest, on marl substrate, alt. 300–330 m, co-ord. 49°48′59″N, 14°56′39″E, 27 July 1937 leg. S. Havlena (PRM 487716, as *Collybia longipes*, 6 Dec. 1978 rev. H. Dörfelt, Dörfelt 1979).

Vlkančice near Stříbrná Skalice, east slope of Baba Hill, near a stump of *Carpinus betulus* (also with the presence of *Picea abies* and *Abies alba* on site), co-ord. 49°53′36″N, 14°52′54″E, 11 July 2009 leg. et det. J. Borovička, rev. V. Antonín (PRM).

Hartvíkov, distr. Votice [notes on the label by Dr. F. Kotlaba: Polánka Nature Park, an inundated spruce forest known as U (červeného) kříže, SW of the village, alt. *c.* 640 m], co-ord. 49°28′34″N, 14°51′12″E, 1 Sept. 1993 leg. V. Krs, det. Z. Pouzar (PRM 882101; Kotlaba 2001).

Nedvědice near Soběslav, in a forest known as V starém, SE of the village, among living roots of *Picea abies*, 2 Aug. 2000 leg. F. Kotlaba, det. F. Kotlaba and Z. Pouzar (PRM 894173, Kotlaba 2001). – Ibid., on a decaying stump of *Picea abies*, 1 Aug. 2000 leg. et det. F. Kotlaba (PRM 894165; Kotlaba 2001).

Komárov, W slope of Chlum, E of the village, alt. 380 m, a decaying stump of *Abies alba*, 23 July 1998 leg. et det. O. Jindřich (CB 11953; Kotlaba 2001).

Moravia

Štramberk, site known as Libotínské paseky, fir-spruce stand, under *Abies alba*, alt. 400 m, co-ord. 49°34′32.4″N, 18°04′47.5″E, 12 June 2002 leg. et det. H. Deckerová (not. H. Deckerová; Deckerová 2009).

Hanušovická vrchovina hills, Raškov near Hanušovice, ruins of Nový hrad castle E of the village, mixed stand on ruins, on decaying stump of *Abies* (?), alt. 500–520 m, co-ord. 50°02′25″N, 16°55′11″E, 24 July 2003 leg. et det. D. Dvořák 49/03 (BRNU).

Hostýnské vrchy Mts., Tesák Nature Reserve, fir-spruce stand, under *Abies*, alt. 650 m, co-ord. 49°22′19″N, 17°47′27″E, 30 Aug. 2008 leg. et det. H. Deckerová (herb. Deckerová HD269/5211). – Ibid., central part, fir-spruce stand, large decayed stump of *Abies alba*, alt. 650 m, 2 Sept. 2006 leg. et det. M. Beran (CB).

Jamné near Tišnov, *c.* 2 km NW of the village, at the boundary of a *Picea* plantation and a mixed forest (*Betula, Larix decidua, Picea abies, Pinus* sp.), partly decayed stump of *Picea abies* covered with mosses, 15 Sept. 1995 leg. et det. Z. Bieberová 811 (BRNM; Bieberová 2000, Kotlaba 2001).

Velké Opatovice, 12 Oct. 1926 leg. E. Baudyš, det. A. Pilát (PRM 660448, as *Collybia longipes*, 6 Dec. 1978 rev. H. Dörfelt; Antonín 1982, Bieberová 2000, Dörfelt 1979, Kotlaba 2001).

Borotín, near Boskovice, *c.* 1.4 km NNW of the church in the village, under *Betula, Larix* and *Picea*, alt. 490 m, co-ord. 49°30′57″N, 14°36′23″E, 28 Aug. 1997 leg. et det. A. Vágner (BRNM 612561; Bieberová 2000, Kotlaba 2001).

Chlébské near Nedvědice, in forest close to the road to Hodonín, alt. *c.* 500 m, on a stump base of *Picea abies*, 28 Aug. 1986 leg. et det. V. Antonín (BRNM 383963).

Heroltice near Tišnov, forest, on a fir stump, alt. *c.* 350 m, 12 Aug. 1944 leg. F. Šmarda (BRNM 325301, as *Collybia longipes*, rev. 13 Sept. 1985 V. Antonín).

Březina near Tišnov, Aug. 1926 leg. E. Baudyš, det. A. Pilát (PRM 660453, as *Collybia longipes*, rev. 15 Dec. 1978 H. Dörfelt; Bieberová 2000, Dörfelt 1979).

Tišnov, site known as Výrovka, on stump, Sept. 1960 leg. et det. K. Koncerová (BRNM 325320, as *Collybia longipes*, rev. 13 Nov. 1985 V. Antonín).

Dolní Loučky, slope above the railway in the direction of Řikonín, on a stump of *Picea abies* on limestone, alt. *c.* 450 m, co-ord. 49°21′23″N, 16°20′00″E, 1982 not. V. Antonín (Fellner 1995, Kotlaba 2001).

Domašov, a spruce forest with mixed *Fagus* and *Abies*, *c.* 2 km NW of the village, on soil under *Picea* and *Abies*, alt. 470 m, 17 Oct. 1993 leg. J. Antonín, det. V. Antonín 93.411 (BRNM 576820; Bieberová 2000, Kotlaba 2001).

Olomučany, Olomučanský les, 27 Aug. 1975 leg. K. Kříž, det. V. Antonín (BRNM 289946).

Křtiny Arboretum (between the villages of Křtiny and Jedovnice, near Blansko), in litter under *Abies alba* close to a stump of *Abies alba*, alt. 450–500 m, co-ord. 49°19′18″N, 16°44′25″E, 2 Oct. 1984 leg. et det. A. Vágner (BRNM 457912; Bieberová 2000, Kotlaba 2001).

Moravian Karst, Blansko, Nový hrad castle, mixed forest (*Carpinus, Quercus, Larix*) on limestone, alt. *c.* 400 m, co-ord. 49°19′28″N, 16°38′32″E, 25 Oct. 1981 leg. P. Faltýsek and V. Antonín, det. V. Antonín, rev. H. Dörfelt (JE; Antonín 1982, Bieberová 2000).

Moravian Karst, Vilémovice near Macocha, Vývěry Punkvy National Nature Reserve, between Kateřinská jeskyně cave and Horní můstek (Macocha abyss), on the stump of a coniferous tree, co-ord. 49°21′56″N, 16°43′03″E, 20 Sept. 1983 leg. et det. A. Vágner (BRNM 462186). – Ibid., along the path to a part known as Chobot between the Suchý and Pustý žleb valleys, under *Berberis vulgaris, Fagus sylvatica* and *Picea abies*, alt. 420–500 m, co-ord. 49°21′52″N, 16°42′54″E, 27 Oct. 2004 leg. et det. A. Vágner (BRNM 691492, as *Oudemansiella melanotricha*). – Ibid., near the Macocha abyss, under *Carpinus, Picea* and *Quercus*, alt. 490 m, co-ord. 49°22′25″N, 16°43′50″E, 1 Aug. 2004 leg. et det. A. Vágner (BRNM 667712, as *Oudemansiella melanotricha*). – Ibid., in the vicinity of the upper Macocha cable-way station, on soil in a young beech stand, co-ord. 49°22′20″N, 16°43′39″E, alt. 490 m, 27 Oct. 2004 leg. et det. D. Dvořák 489/04 (BRNU). – Ibid., the vicinity of Macocha, along the path between Horní můstek and Dolní můstek (upper and lower view-point), on a coniferous stump, alt. 460–490 m, 22 Oct. 2005 leg. et det. D. Dvořák 438/05 (BRNU). – Ibid., Pustý žleb valley, ruins of Blansek Castle, mixed forest on ruins, under downed stem of *Abies alba*, alt. 460 m, co-ord. N 49°22′16″, E 16°43′22″, 7 Nov. 2004 leg. J. Běťák, det. D. Dvořák 605/04 (BRNU). – Ibid., Pustý žleb valley between Punkva caves and Skalní mlýn, near conifer stump (probably *Abies alba*), alt. 450 m, co-ord. N 49°22′20″, E 16°42′53″, 26 Aug. 2005 leg. et det. D. Dvořák 208/05 (BRNU). – ditto, 10 Nov. 2008 leg. et det. D. Dvořák (K).

Moravian Karst, Blansko-Arnoštov, Vývěry Punkvy National Nature Reserve, Punkevní údolí valley, at the base of a slope on the left bank of the Punkva river, mixed forest on a run of stone (*Fagus, Abies*), on soil, co-ord. 49°21′40″N, 16°41′25″E, 27 Aug. 2006 not. D. Dvořák.

Moravian Karst, Březina, U Výpustku Nature Reserve, south part of the reserve, beech forest, on root of a dead *Quercus* sp. (?), alt. 400–450 m, co-ord. 49°17′24″N, 16°43′29″E, 30 June 2009 leg. et det. D. Dvořák 120/09 (BRNU).

Moravian Karst, Adamov, Josefovské údolí valley (currently Býčí skála National Nature Reserve), right slope, near the Křtinský potok stream, alt. *c.* 350 m, 9 Oct. 1950 leg. et det. J. Špaček (BRNU 365496, as *Collybia longipes*; rev. 22 Aug. 2009 D. Dvořák).

Brno-Útěchov, Coufavá Nature Reserve, eastern part, apparently on soil in a fir-beech stand, alt. *c.* 430 m, co-ord. 49°17′40″N, 16°38′35″E, 21 Oct. 2009 leg. O. Nováček, det. D. Dvořák (BRNU).

Moravian Karst, Ochoz, near Brno, Zadní Hády Nature Reserve, *c.* 2 km E of the village, under *Carpinus* and *Quercus*, alt. 380–450 m, co-ord. 49°14′32″N, 16°42′12″E, 1 Sept. 1994 leg. et det. A. Vágner (BRNM 603040; Bieberová 2000, Kotlaba 2001).

Drahanská vrchovina hills, Vyškov distr., Březina military zone, Repešský žleb Valley, alt. 400–550 m, 9 Nov. 2005 leg. J. Běťák, det. D. Dvořák 395/05 (BRNU).

Veverská Bítýška (as Veveří Bítýška), alt. *c.* 320 m, Sept. 1952 leg. et det. K. Kříž and F. Šmarda (BRNM 325307, as *Collybia longipes*, rev. 13 Nov. 1985 V. Antonín). – Veverská Bítýška (as Veveří Bítýška), 7 Aug. 1952 leg. et det. K. Kříž and F. Šmarda (BRNM 325309, as *Collybia longipes*, rev. 13 Nov. 1985 V. Antonín). – Veverská Bítýška, near a stump of *Abies alba*, 17 July 1952 leg. et det. K. Kříž and F. Šmarda (BRNM 325294, as *Collybia longipes*, rev. 13 Nov. 1985 V. Antonín). – Veverská Bítýška, alt. *c.* 320 m, J. Kuthan 70/498 (BRA?; Dörfelt 1979, Kotlaba 2001). – Veverská Bítýška, mixed forest, apparently in the soil under *Larix decidua*, alt. 440 m, 22 Sept. 2001 leg. et det. Z. Bieberová 598 (BRNM).

Lažánky near Veverská Bítýška, site known as Babka, alt. 350 m, *Abieto-Piceetum*, restored stand: *Querceto-Carpinetum carici pilosae*, 19 Aug. 1961 leg. et det. F. Šmarda (BRNM 325303, as *Oudemansiella longipes*, rev. 13 Nov. 1985 V. Antonín). – Lažánky near Veverská Bítýška, *Abieto-Piceetum*, 17 Oct. 1960 leg. et det. F. Šmarda (BRNM 325296, as *Collybia longipes*, rev. 13 Nov. 1985 V. Antonín). – Lažánky near Veverská Bítýška, *Piceetum*, 15 Aug. 1962 leg. F. Valkoun, det. F. Šmarda (BRNM 313352, as *Hohenbuehelia longipes*, rev. 13 Nov. 1985 V. Antonín). – Veverská Bítýška, forest near Lažánky, 31 July 1962 leg. et det. F. Šmarda (BRNM 325295, as *Collybia longipes*, rev. 13 Nov. 1985 V. Antonín). – Lažánky, partly decayed stump of *Picea abies* covered with mosses, 1998 leg. et det. Z. Bieberová (Bieberová 2000, Kotlaba 2001, BRNM).

Xerula melanotricha is known from 36 localities (57 finds) in the Czech Republic (Fig. 2). All collections (with three exceptions, see below) are from the wood of



Fig. 1. *Xerula melanotricha*. Tesák Nature Reserve, 2 Sept. 2006; photo J. Burel.

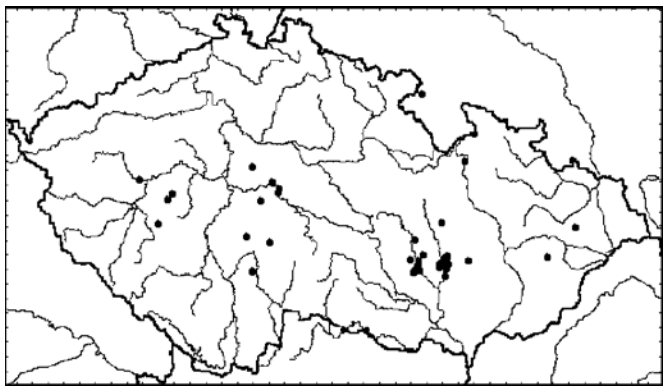

Fig. 2. Distribution map of *Xerula melanotricha* in the Czech Republic.

month	number of records	% of records
May	1	1.8
June	2	3.6
July	7	12.5
August	20	35.7
September	12	21.4
October	12	21.4
November	2	3.6

Table 1. Phenology of *Xerula melanotricha* in the Czech Republic.

coniferous trees. Finds on *Picea abies* and *Abies alba* were the most frequent (14 records on *Abies*, 11 on *Picea*); a coniferous tree was cited twice as a substratum. Three collections are aberrant:

1. On soil in a young beech stand (Vývěry Punkvy National Nature Reserve, leg. D. Dvořák, BRNU). The author personally knows this locality well. Old stumps of conifers (*Abies* or *Picea*) are also present there. Therefore there is a high degree of probability that the fungus was growing on coniferous wood.
2. Only broad-leaved trees (*Carpinus* and *Quercus*) are mentioned as growing at the locality of Zadní Hády Nature Reserve (leg. A. Vágner, BRNM 603040). The author also knows this locality personally. The most probable explanation is again the presence of an old stump (or stump remnants) of a coniferous tree there (there are scattered spruce here).
3. On the root of a dead *Quercus* sp. (U Výpustku Nature Reserve, leg. D. Dvořák, BRNU). The presence of *Picea* wood under the ground is, however, probable at this locality (D. Dvořák, pers. comm.).

According to the scale of naturalness of forest stands (Holec 2008), *Xerula melanotricha* has been found in near-natural forests (e.g. the Tesák Nature Reserve), man-influenced forests (e.g. Nedvědice, near Soběslav, Veverská Bítýška, Křtiny, localities near the Macocha in the Moravian Karst, etc.), as well as in man-made forests (e.g. Dolní Loučky, Jamné). Most localities may be considered man-influenced forests and *X. melanotricha* cannot therefore be considered a bio-indicative species of old-growth forest.

The fungus is a late summer and autumnal species usually growing from July to October (51 records, 90%) with the fructification peak from August to October (44 finds, 77.2%, see Table 1). It may occasionally be found in May and June or in November, but such collections are rather exceptional. In terms of altitude, most of the localities (30, 85.7%) may be classified as belonging to the colline belt (hilly country, alt. 200–500 m), only 5 of them (14.3%) were found in the submontane belt (alt. 500–800 m); for classification see Kotlaba 1994. It has not been recorded in other altitudinal belts.

Originally, Dörfelt (1979) described this fungus from the Velká Fatra Mts. (Slovakia) as growing on an *Abies alba* stump on limestone soil. Many localities in the Czech Republic have this soil type (e.g. Malovidy, Štramberk, Dolní Loučky, Moravian Karst). However, *X. melanotricha* has often been collected also on non-calcareous soils (e.g. Hostýnské vrchy Mts., Borotín). Therefore, this fungus is not strongly bound to calcareous soils.

These data do not fully agree with the ecological characterisation by Kotlaba (1995), who considered *Xerula melanotricha* a typical fungus of herb-rich beech, fir-beech and fir forests of the *Abietion* alliance and *Cephalanthero-Fagenion* and *Eu-Fagenion* suballiances, often on limestone soil. It definitely has a distinctly broader ecological valence, also growing in artificial spruce stands, and in stands on both calcareous and non-calcareous substrates.

Distribution and threat of *Xerula melanotricha* in Europe

Xerula melanotricha is widely distributed in Central, Southern and Western Europe; it has not been found in the Nordic countries to date (Vesterholt 2008). Except for the Czech Republic, it is known from the following countries: Austria (Kotlaba 2001, Krisai-Greilhuber 1999, Rücker 2002), Croatia (Tkalčec & Mešić 2002), France (Gerault 2005, Kotlaba 2001), Italy (Onofri 2005), Germany (e.g. Benkert *et al.* 1992, Dörfelt 1981, 1988), Greece (Dörfelt 1981), Liechtenstein (Kotlaba 2001), Poland (Ronikier 2003, Szczepka & Sokol 1986, Vesterholt 2008, Wojewoda 2003), Romania (Dörfelt 1981, Kotlaba 2001), Russia (Dörfelt 1981), Slovakia (Dörfelt 1981, Hagara 1989, Kotlaba 2001, Lizoň & Bacigálová 1998), Slovenia (Poler 1998), Spain (Gonzáles Cruz 2004), Switzerland (Breitenbach & Kränzlin 1993 Kotlaba 2001, Winkler 2009) and Turkey (Afyon *et al.* 2005, Kaşık *et al.* 2003, Yağiz *et al.* 2006). Outside Europe, it has been found in Algeria (Dörfelt 1981, Kotlaba 2001) and western Asia (Caucasus, Kotlaba 2001).

In addition to featuring as endangered in Czech Republic literature, this fungus is also included in the Red Lists of several other European countries, namely Austria (endangered species, Krisai-Greilhuber 1999), Germany (endangered species, Benkert *et al.* 1992), Poland (endangered species, Wojewoda & Ławrynowicz 2004), Slovakia (vulnerable species, Lizoň 2001) and Turkey (data-deficient species).

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