

## *Sabuloglossum arenarium* (*Geoglossaceae*) in the Czech Republic

TEREZA TEJKLOVÁ<sup>1\*</sup>, HELENA DECKEROVÁ<sup>2</sup>, JAN GAISLER<sup>3</sup>

<sup>1</sup>Museum of Eastern Bohemia, Eliščíno nábřeží 465, CZ-500 01 Hradec Králové, Czech Republic and Philosophical Faculty, University of Hradec Králové, Interdisciplinary Research Centre, Rokitanského 62, CZ-500 03 Hradec Králové, Czech Republic; t.tejklova@muzeumhk.cz

<sup>2</sup>O. Jeremiáše 1932/12, CZ-708 00 Ostrava-Poruba, Czech Republic; helena.decker@tiscali.cz

<sup>3</sup>Crop Research Institute, Grassland Research Station, Rolnická 6, CZ-460 01 Liberec, Czech Republic; jan.gaisler@volny.cz

\*corresponding author

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The authors found the rare geoglossoid fungus *Sabuloglossum arenarium* during field excursions in the Krkonoše Mts. (Giant Mountains) and Hrubý Jeseník Mts. in the autumn of 2014. The finds are the first records of this species in the Czech Republic. Its ascocarps grew in the subalpine zone in association with heath (*Calluna vulgaris*), cowberry (*Vaccinium vitis-idaea*), and bilberry (*Vaccinium myrtillus*), and close to another unusual fungus, *Clavaria argillacea*, in the trampled margin of tourist tracks. Macroscopic and microscopic measurements were made to identify the specimens and a comparison with data of other authors is presented.

**Key words:** fungi, earth-tongue, Ascomycota, Geoglossomycetes, mountains.

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Během terénních výzkumných exkurzí provedených na podzim 2014 v Krkonoších a v Hrubém Jeseníku našli autoři vzácnou geoglossoidní houbu *Sabuloglossum arenarium*. Tyto nálezy jsou prvními záznamy tohoto druhu v České republice. Plodnice se objevovaly v subalpinském pásmu v asociaci s vřesem (*Calluna vulgaris*) nebo brusnicemi (*Vaccinium vitis-idaea*, popř. *V. myrtillus*), a spolu s dalším vzácnějším druhem kyjankou hlínovou (*Clavaria argillacea*) na sešlapávaném okraji turistických cest. Vzoroky plodnic byly podrobeny makroskopickému a mikroskopickému studiu pro ověření determinace a je uvedeno porovnání s údaji ostatních autorů.

### INTRODUCTION

Geoglossoid fungi (*Geoglossum* Pers., *Glutinoglossum* Hustad, A.N. Mill., Dentinger & P.F. Cannon, *Hemileucoglossum* S. Arauzo, *Leucoglossum* S. Imai, *Microglossum* Gillet, *Nothomitra* Maas Geest., *Sabuloglossum* Hustad, A.N. Mill.,

Dentinger & P.F. Cannon, *Sarcoleotia* S. Ito & S. Imai, *Thuemenidium* Kuntze and *Trichoglossum* Boud.) are mostly inconspicuous species. These "earth-tongues" can grow in very different ecological conditions in meadows, pastures, peat bogs, gardens and forests. We have found them at various locations in lowlands, uplands and mountains. Most species are sensitive to environmental changes and in many cases their occurrence indicate relatively undisturbed conditions (Hustad et al. 2013). Often they grow together with other sensitive fungi of the *Entolomataceae*, *Hygrophoraceae* and *Clavariaceae* families (McHugh et al. 2001, Evans 2003, Newton et al. 2003). Because of their ecological requirements and sensitivity, many geoglossoid fungi are rare and endangered. Some species are listed in Red Lists of European countries (Hustad et al. 2013). Earth-tongues were not well studied in the Czech Republic until the last decade (e.g. Kříž & Skála 2006, Kučera & Gaisler 2012, Hustad et al. 2013, Hustad et al. 2014).

Interesting small fruitbodies of a geoglossoid species were found during field excursions in the Krkonoše Mts. and Hrubý Jeseník Mts. in autumn 2014. After microscopical observations, this fungus was identified as *Sabuloglossum arenarium*, a species which usually occurs in association with small shrubs of the *Ericaceae* family, especially *Empetrum nigrum* (e.g. Nitare 1982, Persson & Pleijel 2008, Ohenoja et al. 2010). These collections represent the first documented records of this fungus in the Czech Republic. It is a very important discovery in the conditions of Central Europe, where this species is very rare (Beenken & Horn 2008).

#### MATERIAL AND METHODS

Fresh material was observed for macro-morphological characterisation. The micro-morphological structures were studied in fresh and dry material under a Carl-Zeiss Primo Star light microscope (highest used total magnification 400×) in deionised water and in Melzer's reagent. Photos of microcharacters were made by means of a Canon PowerShot G10 camera with AxioVision release 4.8 software. Only some (3–4) ascocarps from each locality were studied because of the limited number of fruitbodies collected. The total number of studied ascocarps was eight. Micro-morphological parameters were measured in detail only for specimens from the Krkonoše Mts. Values of micro-morphological characters were calculated as the average of 30 measurements in fresh material (with minimal and maximal values in parentheses). For comparison, values studied in dry material were observed as well. Identification and nomenclature are based on Hustad et al. (2013).

Localities are geo-referenced and the coordinates given in the WGS 84 system. Specimens from the Krkonoše Mts. are deposited in HR (abbreviations of public

herbaria follow Thiers on-line), specimens from the Hrubý Jeseník Mts. are deposited in SUM and in the private herbarium of H. Deckerová (Ostrava).

## RESULTS

***Sabuloglossum arenarium*** (Rostr.) Hustad, A.N. Mill., Dentinger & P.F. Cannon  
Figs. 1–10

Synonymy: see Hustad et al. (2013).

Description of studied specimens. Ascocarps 10–40 mm high, 3–12 mm thick at apex, brownish-black, irregularly clavate, stipitate, scattered, solitary or caespitose. Fertile part 10–25 × 3–12 mm, black, smooth, often warped. Sterile part 5–15 × 2–4 mm, not markedly delimited from fertile part, cylindrical, relatively fragile, brownish black, dry when fresh, squamulose.

Asci 146 (120–175) × 15.2 (13–21) µm, in dry material 120 (105–140) × 12.6 (10–15) µm, narrowly clavate, 8-spored, apical pore J+ in Melzer's reagent.

Ascospores 32.2 (30–38) × 5.4 (4.2–5.8) µm, in dry material 31.6 (26–38) × 4.8 (3.6–5.7) µm, cylindrical, with rounded ends or slightly clavate, hyaline, aseptate, multiguttulate, usually slightly curved.

Paraphyses longer than asci, rather numerous, brownish, filiform, sparsely septate, straight or mostly irregularly curved, occasionally slightly branched, sometimes enlarged at apex to 5.4 (4–11) µm and 3.3–10.4 µm in fresh and dry material, respectively, not agglutinated.

### Specimens examined

Czech Republic. Bohemia. Krkonoše Mts., Špindleruv Mlýn, Labský důl valley, 700 m SE of Pančava waterfall, trampled margin of tourist track covered with small mosses (*Dicranella heteromalla*, *Oligotrichum hercynicum* and *Polytrichum* cf. *formosum*), close to *Festuca* sp. and *Vaccinium* spp., granite bedrock, 50°45'34" N, 15°33'13" E, alt. 1025 m, 19 Sept. 2014, leg. T. Tejklová, V. Samková, J. Doležal (HR 94300); *ibid.*, 24 Oct. 2014, leg. T. Tejklová, V. Samková, J. Gaisler, M. Novotný (HR 94302, HR 94303). – Vítkovice, Zlaté návrší ridge, 30 m WNW of Monument of Hanč and Vrbata, trampled margin of tourist track covered with small mosses and foliose liverworts, close to *Nardus stricta* grassland with *Calluna vulgaris* and *Pinus mugo*, granite bedrock, 50°45'09" N, 15°32'50" E, alt. 1416 m, 11 Oct. 2014, leg. J. Gaisler (HR 94301). – Moravia. Hrubý Jeseník Mts., Šerák-Keprník National Nature Reserve, saddle between Šerák and Keprník, trampled margin of tourist track covered with small mosses [*Ditrichum heteromallum*, *D.* cf. *lineare* (sterile) and *Pohlia nutans* subsp. *nutans*], gneiss bedrock, 50°11'01" N, 17°06'31" E, alt. 1300 m, 16 Sept. 2014, leg. and det. H. Deckerová (herb. priv. H. Deckerová 361/6435, duplicate SUM 11111).



**Fig. 1.** *Sabuloglossum arenarium*, saddle between Šerák and Keprník, Hrubý Jeseník Mts., Czech Republic, 16 Sept. 2014, leg. H. Deckerová (SUM 11111 and priv. herb. H. Deckerová 361/6435). Photo H. Deckerová.



**Fig. 2 (left), 3 (right).** *Sabuloglossum arenarium*, Zlaté návrší, 30 m WNW of Monument of Hanč and Vrbata, Krkonoše Mts., Czech Republic, 11 Oct. 2014, leg. J. Gaisler (HR 94301). Photo J. Gaisler.



**Fig. 4 (left), 5 (right).** *Sabuloglossum arenarium*, Labský důl, 700 m SE of Pančava waterfall, Krkonoše Mts., Czech Republic, 24 Oct. 2014, leg. T. Tejklová, V. Samková, J. Gaisler & M. Novotný (HR 94302). Photo J. Gaisler.



**Fig. 6 (left), 7 (right).** *Sabuloglossum arenarium*, Labský důl, 700 m SE of Pančava waterfall, Krkonoše Mts., Czech Republic, 24 Oct. 2014, leg. J. Gaisler (HR 94303). Photo J. Gaisler (Fig. 7 photographed ex situ).



**Fig. 8.** *Sabuloglossum arenarium* – asci with spores and paraphyses. Specimen from Zlaté návrší, Krkonoše Mts. (HR 94301). Scale bar = 20 µm. Photo J. Gaisler.



**Fig. 9 (left).** *Sabuloglossum arenarium* – spores. Specimen from Zlaté návrší, Krkonoše Mts. (HR 94301). Scale bar = 20 µm. Photo J. Gaisler. **Fig. 10 (right).** *Sabuloglossum arenarium* – asci with spores and paraphyses. Specimen from Labský důl, Krkonoše Mts. (HR 94303). Scale bar = 20 µm. Photo J. Gaisler.

## DISCUSSION

**Distribution and ecology**

This species has been recorded in Europe, Japan, the USA and Canada and the global distribution is very wide (Hustad et al. 2013). The European distribution of *Sabuloglossum arenarium* was summarised by Hustad et al. (2013), who reported data from Denmark, Germany, Greenland, Iceland, Netherlands, Norway, Sweden and the United Kingdom. Ohenoja et al. (2010) also examined a specimen from Finland. The distribution of *S. arenarium* in Central Europe is not sufficiently known. It was found in the Bavarian part of the Šumava Mts. in 2004 (Beenken & Horn 2008), which seems to be the nearest recorded locality to mentioned Czech ones. Our collections are the first ones for the Czech Republic and the species has not yet been recorded in Slovakia. The specimens of *S. arenarium* deposited in the herbarium SAV in Bratislava were collected in Poland and Estonia (V. Kučera, pers. comm.).

In North and West Europe, *Sabuloglossum arenarium* has often been reported from sand dunes predominantly in association with the dwarf shrub *Empetrum nigrum* (Ohenoja 2000, Persson & Pleijel 2008) and often together with *Clavaria argillacea* (Nitare 1982, Beenken & Horn 2008, Roobeek 2009, Ohenoja et al. 2010). Due to the differing climates of North and Central Europe, suitable conditions for the occurrence of these fungi in the Czech Republic are probably only found in mountain areas at altitudes above 1000 m. Shrubs of the family *Ericaceae*, such as *Calluna vulgaris*, *Vaccinium vitis-idaea* and *Vaccinium myrtillus*, were found on the Czech localities of *Sabuloglossum arenarium*, as well as the fungus *Clavaria argillacea*. *Empetrum nigrum* was not found here. These conditions and associated taxa are similar to the Bavarian locality of *S. arenarium*, the southernmost record of the species reported in Europe to date (Beenken & Horn 2008). *Sabuloglossum arenarium* was found on trampled margins of tourist tracks at the Czech sites, where probably special suitable conditions for development of ascocarps occurred. This fact has not yet been described in the studied literature, therefore our next observations will be focused on unaffected stands close to the study localities.

**Morphology**

The macroscopic characteristics of *Sabuloglossum arenarium* reported by various authors are largely identical (Mains 1955, Ohenoja et al. 2010, Hustad et al. 2013, etc.). Our measured microscopic characteristics are also relatively similar to the measurements of other authors (Beenken & Horn 2008, Ohenoja et al. 2010, Hustad et al. 2013). We only noticed small differences in ascus size and a more enlarged apical part of paraphyses in our specimens. Also Ohenoja (1995)

reported enlarged paraphyse tips, however no size was mentioned. Values of measurements in dry material were added to Tab. 1 for comparison with values measured in fresh material. The differences in ascus size are relatively large, therefore it is important to take into account the conditions under which this character is measured. Although Durand (1908) in his study described septate spores but Ohenoja (2010) rarely reported septate spores, in our specimens as well as in studies of other authors only aseptate spores were found. Kučera (pers. comm.) found septate spores in large collections of mature ascocarps. Nevertheless this species is relatively easy to identify by the microscopy as well as according to its specific ecological demands at Central European locations.

**Tab. 1.** Comparison of morphological and ecological data in different sources.

Author(s)	Ascocarps (mm)	Asci (µm)	Spores (µm)	Paraphyses (µm)	Associated plants	<i>Clavaria argillacea</i> presence
Durand (1908)	10–40 × ?	100–125 × 12–15	25–35 × 6			
Eckblad (1963)		130–160 × 25–35	17–37 × 3.5–5	3–4	<i>Empetrum</i>	
Nitare (1982)	10–50 × 5–20		17–40 × 3.5–6.5		<i>Empetrum</i> , <i>Calluna</i>	+
Ohenoja (1995)		130–160 × 10–12	25–40 × 4–6	enlarged tips	<i>Empetrum</i>	
Vesterholt & Petersen (2001)	10–35 × 7–15		28–36 × 4.5–7		<i>Empetrum</i>	
Beenken & Horn (2008)	10–15 × 2–7	120–140 × 15–18	23–35 × 4.5–6	3–5	<i>Calluna</i> , <i>Vaccinium</i>	+
Roobeek (2009)	10–20		21–45 × 5.8		<i>Empetrum</i> , <i>Calluna</i>	+
Ohenoja et al. (2010)	35–40 × ?	165–180 × 15–17	27–36 × 4–6	3–6	<i>Empetrum</i>	+
Hustad et al. (2013)	20–40 × 5–20	130–160 × 18–35	27–37 × 3.5–5	3–4	<i>Empetrum</i>	
Tejklová et al. (this paper)	10–40 × 3–12	120–175 × 13–21	30–38 × 4.2–5.8	4–11	<i>Calluna</i> , <i>Vaccinium</i>	+
Tejklová et al. – dry material		105–140 × 10–15	26–38 × 3.6–5.7	3.3–10.4		

## CONCLUSION

The new record of *Sabuloglossum arenarium* is an important find in Central Europe. This species demanding specific ecological conditions seems to be a very rare fungus in the Czech Republic. The species should therefore be included in at least the EN category of the prepared Red list of fungi of the Czech Republic.



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