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Scleroderma septentrionale, a new gasteromycete from North-European sand dunes

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A new species of the Sclerodermatales (Basidiomycota), *Scleroderma septentrionale* Jeppson, is described from sand dunes and sandy heaths in northern Europe. A table showing diagnostic characters in European species of *Scleroderma* sect. *Scleroderma* is presented.

Key words: Scleroderma septentrionale, Gasteromycetes, North Europe, taxonomy

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Introduction

Scleroderma Pers. is a gastroid genus with a worldwide distribution. Guzmán (1970) in his monograph of the genus divided it into three sections based on microcharacters in spores and hyphae. One of these sections, sect. *Scleroderma*, is characterized by spores showing a distinct reticulation and by having nodose-septate peridial hyphae. *Scleroderma bovista* Fr., *S. citrinum* Pers. and *S. meridionale* Demoulin & Malençon are well-known European representatives of this section.

In this paper a new species in the section *Scleroderma* is proposed, viz. *S. septentrionale*. The new taxon is a characteristic species met with on sand dunes and sandy heaths in northern Europe. It shows a more northerly distribution than any other species of the genus. Previous records of this taxon treat it as a sand form of either *S. aurantium* (= *S. citrinum*) or *S. bovista*.

Material and methods

The study is based on a total of approximately 80 collections preserved in the herbaria of H, LD, OULU, REYK, S, TUR, UME and UPS. The author's private herbarium is designated M.J. Drawings and descriptions were made from dried specimens. Microscopic studies were carried out in an ordinary light microscope and the samples were mounted in lactophenol. Spore sizes were measured excluding the spore wall ornamentation. The nomenclature of vascular plants is in accordance with Mossberg et al. (1992).

Scleroderma septentrionale Jeppson, n. sp. – Figs. 1–4

Scleroderma macrorhizon Wallroth sensu Guzmán (1970) pro parte
S. bovista Fr. sensu Andersson (1950) pro parte, Eriksson (1964), Rautavaara (1953)
S. aurantium Pers. sensu Arwidsson (1936)

Carposoma maturum subglobosum 20–60 mm diam., pseudostipite compacto vel fasciculato ad 80 × 30 mm. Peridium tenue, ad 1 mm latum, pallide ochraceum vel luteo-brunneum, in squamulas subtiles diffractum. Hyphae fibulatae. Dehiscentia apicalis irregularis. Gleba maturitate griseo-brunnea quandoque olivaceobrunnea. Sporae globosae vel subglobosae, (7–)9–11(15) µm diam., reticulatae. Carposoma maturum epigaeum vel semi-hypogaeum.

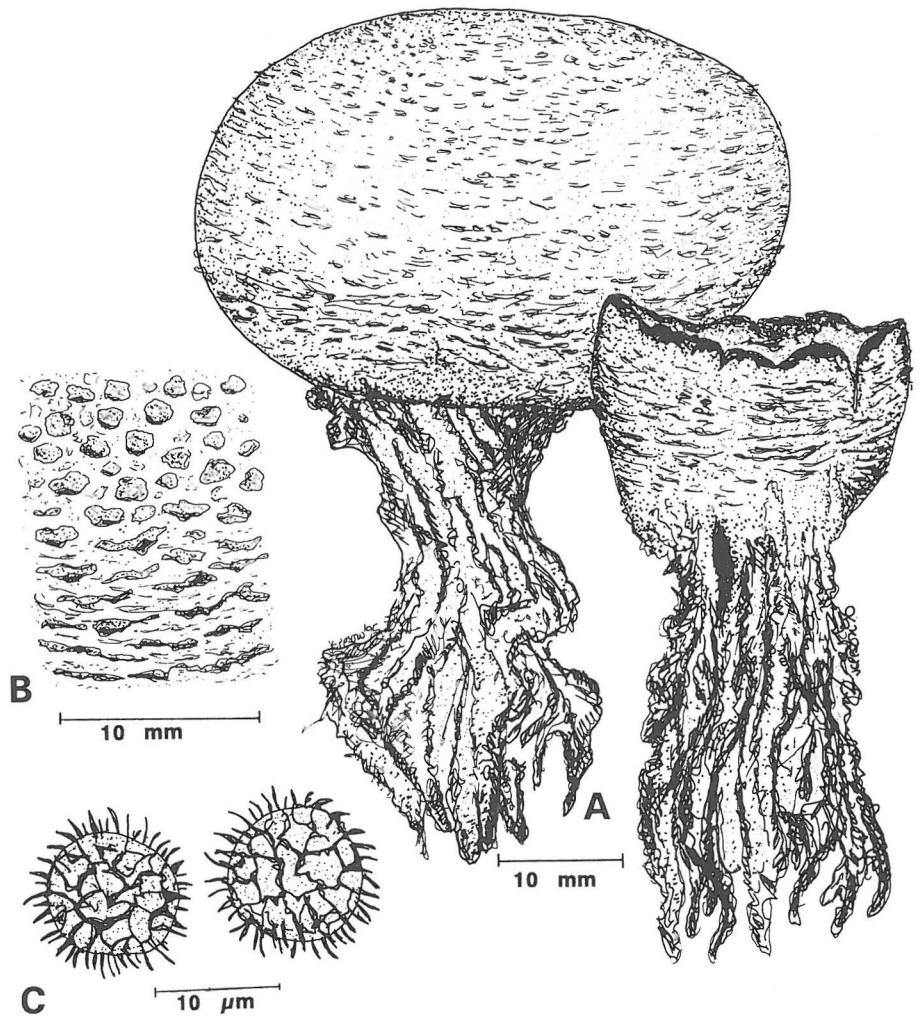

Fig. 1. *Scleroderma septentrionale*. A) Fruitbodies. B) Detail of peridium. C) Spores. (Sweden, Nb, Piteå, 10.IX.1986 *J. Nitare*, S).

In locis arenosis, praecipue in thiniis litoralibus Europae septentrionalis.

Holotypus: Finland, Oulun Pohjanmaa, Haukipudas, Isoniemi, Saukkoperä, 18.IX.1984 *T. Ulvinen, E. Ohenoja & K. Kalamees* (OULU).

Fruitbody subglobose, 20–60 mm in diametre. Twinned fruitbodies sometimes occur (Fig. 2 A, B, G). *Pseudostipe* prominent, 30–80 × 10–30 mm, usually widest at the base, compact-fascicular, incrusted with sand. *Peridium* pale ochraceous to yellowish brown with distinct minute, flattened, irregularly rounded scales, towards the base often arranged in concentric zones. Scales concolourous with or darker than the rest of the peridium. A smooth or minutely furfuraceous peridium may occur in very young fruitbodies. The peridium is thin (appr. 1 mm) but rather tough, at maturity irregularly opening in the top area; old fruitbodies become entirely cup-shaped. Peridial hyphae ± hyaline, thin-walled, 4–6 µm in diametre, with clamps. Mature *gleba* greyish brown, sometimes with olivaceous tinges. *Spores* globose-subglobose, (7–)9–11(–15) µm in diametre, brown, with a reticulate wall. The reticulum is complete. The spores vary greatly in size even in one and the same fruitbody (see below).

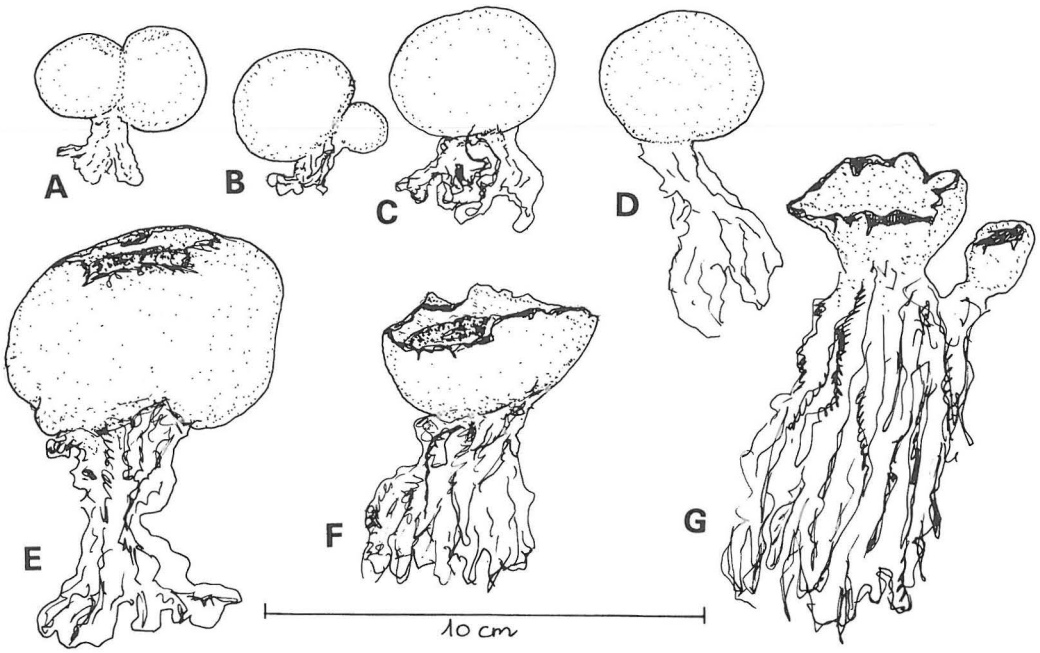

Fig. 2. *Scleroderma septentrionale*. Fruitbodies in different stages of development. (A–D. Finland, St, Pori, Yyteri, *M. Eriksson* (TUR; A) 6.VIII.1964, B) 30.VIII.1962, C) 4.IX.1964, D) 5.IX.1964), E) Finland, U, Hanko, Storviken, 2.IX.1965 *M. Eriksson* (TUR), F) Finland, V, Nauvo, Sandviken, 29.IX.1963 *M. Eriksson* (TUR). G) Finland, OP, Ii, Ulkokrunni, 5.IX.1965 *T. Ulvinen* (OULU).

Fig. 3. *Scleroderma septentrionale*. Holotypus. Photo P.I. Wåhleman.

Material studied: **Finland.** Varsinais-Suomi, Nauvo, Sandö, 29.IX.1962 *M. Eriksson* (TUR 156, 166, 184); Korppoo, Ängsö, 21.VIII.1963 *I. Kukkonen & O. Ravanko* (TUR 151). Uusimaa, Hanko, Storviken, 23.XII.1964, 2.IX.1965, Kolaviken, 22.VIII.1964, 18.IX.1970, Henriksberg, 11.IX.1964 *M. Eriksson* (14 specimens TUR); Helsinki, Vuosaari, south shore of Kallvikinniemi, 19.IX.1971 *L. Hämet-Ahti 2336a* (H). Satakunta, Pori, Yyteri, 1.X.1960, 28.VIII.1962, 30.VIII.1962, 2.IX.1962, 6.VIII.1964, 4.IX.1964, 5.IX.1964, 15.VIII.1965, 14.IX.1965, 14.X.1965, 31.VIII.1970 *M. Eriksson* (19 specimens TUR, OULU). Pohjois-Savo, Kuopio, Hietasalo, 1977 *L. Hakala* (TUR 307). Keski-Pohjanmaa, Kokkola, Laajalahti, 13.IX.1981 *R. Storbacka* (OULU); Kalajoki, 10.IX.1863 *M. Eriksson* (TUR 177, 186, OULU). Oulun Pohjanmaa, Haukipudas, Isoniemi, Saukkoperä, 12.10.1965 *T. Ulvinen* (OULU), 18.IX.1984 *T. Ulvinen, E. Ohenoja, K. Kalamees* (OULU, type); Oulunsalo, Koppana 18.IX.1963 *M. Eriksson* (TUR 161, 172, 189, OULU); Simo, Hepola, 21.IX.1963 *M. Eriksson* (TUR 146); Ii, Ulkokrunni, Pohjanharju, 5.IX.1965 *T. Ulvinen* (OULU). Perä-Pohjanmaa, Kemi, Ajos, 20.IX.1963 *M. Eriksson* (TUR 183, 185, 187, OULU), 22.IX.1984 *M. Kamula* (OULU). **Denmark.** Anholt, Ørkenen, 15.X.1991 *C. Lange* (C. Lange private herbarium). **Sweden.** Skåne, Löderup sn, Sandhammaren, 1946 *O. Andersson* (LD), 6.X.1946 *O. Andersson* (LD); Ystad, Saltsjöbad, 19– *O. Andersson* (LD). Uppland, Djurö sn, Sandhamn, 4.XI.1985 *J. Nitare* (S). Hälsingland, Hudiksvall, Hölick, 4.IX.1986 *J. Nitare* (S); Gnarp sn, Gnarp 4.IX.1986 *J. Nitare* (S), Moningssand, 4.IX.1986 *J. Nitare* (S). Ångermanland, Grundsunda sn, Saluböle, 7.IX.1986 *J. Nitare* (S); Härnösand, Hemsön, Arboretum Drafle, 20.IX.1970 *Å. Strid 14884 & O. Eriksson* (UME 26396). Västerbotten, Lövånger sn, Bjuröklubb, 9.IX.1986 *J. Nitare* (S), Nordingrå sn, Storsanden, 18.IX.1975 *O. Eriksson* (UME 26605a, b, colour slides), Obbolalandet, 20.VIII.1971 *L. Hjortsberg* (UME 26602). Norrbotten, Nederkalix sn, Båtskärsnäs, 11.IX.1986 *J. Nitare* (S), Båtskärsnäs, Frevisören, 2.IX.1972 *Å. Strid 10311* (UME, M.J.); Nedertorneå-Haparanda sn, Santasaari, 12.IX.1986 *J. Nitare* (S); Nedertorneå, Sandskäret, 22.VIII.1952 *E. Julin, Fungi Exs. Suecici 2258* (S, UPS); Piteå, Piteå havsbad, 19.IX.1986 *J. Nitare* (S), Piteå archipelago, Stor-Rebben, 3.IX.1930 *Th. Arwidsson* (S), Stenskär, IX.1930 *Th. Arwidsson* (S); Nederluleå, N of Kallax, IX.1970 *R. Keskküla* (S). **Iceland.** Suðvesturland, Gullbringusysla, Helgafell, 21.IX.1980 *Hörður Kristinsson & Pétur Sigurðsson* (REYK 45387).

Ecology and distribution

Scleroderma septentrionale is a psammophilous species found on sand dunes and sandy heaths along the coasts of North Europe (Fig. 6). There is a concentration of localities along the Baltic and Bothnian coasts of Finland and Sweden. Isolated occurrences are known from the island Anholt in Kattegatt (Denmark) and from Iceland. Most occurrences are in the close vicinity of the sea, which possibly has a positive influence by increasing the local humidity and maintaining mild and even temperatures during the autumn. There are only two records from inland localities, viz. from Finland, Pohjois-Savo, Kuopio, and Iceland, Helgafell (see list of specimens). In the latter case the locality is situated in the southwestern area of Iceland, where there is a strong maritime influence. As for the Kuopio locality, the site was a sandy lake shore with pine (L. Hakala, pers. comm.).

The distribution and ecological requirements of *S. septentrionale* could be compared with those of the ascomycete *Geoglossum arenarium* (Rostr.) Lloyd as presented by Nitare (1982). *G. arenarium* is a presumptive symbiont with *Empetrum* and is frequently encountered in the same localities as *S. septentrionale* (J. Nitare, pers. comm.).

The fruitbodies of *S. septentrionale* occur half buried in bare sand among *Arctostaphylos uva-ursi, Empetrum nigrum, Lathyrus japonicus* var. *maritimus, Leymus arenarius* and *Rumex acetosella*, in south Sweden also among *Ammophila arenaria.* In one locality (Anholt) the fruitbodies appeared among *Salix repens*. The general composition of the flora indicates rather low pH values. Scattered pine trees (*Pinus sylvestris*) seem to have been present in most of the localities and mycorrhiza was suspected already by Rautavaara (1953), who first recorded *S. septentrionale* (as *S. bovista*) from Finland. Eriksson (1964), who investigated the fungi on Finnish sand dunes, recorded it (as *S. bovista*) from several places and always in the root zones of the pine. Since *Pinus* is not indigenous in Iceland, the occurrence there may indicate symbiotic relations also with other plants (*Empetrum*?).

The northern distribution of this taxon was noted already by Arwidsson (1936), who first found it and regarded it as a sand form of *S. aurantium* (= *S. citrinum*). Andersson (1950) reported the same species as *S. bovista* from South Sweden but considered it a facultative sand fungus having a southern distribution more or less coinciding with that of *Quercus robur*. Rautavaara (1953) and Eriksson (1964) identified their findings on Finnish sand dunes as *S. bovista* referring to Andersson (1950). They both noted that Andersson was mistaken in his suggestion that *S. bovista* had a southern distribution in Fennoscandia (which it in fact has).

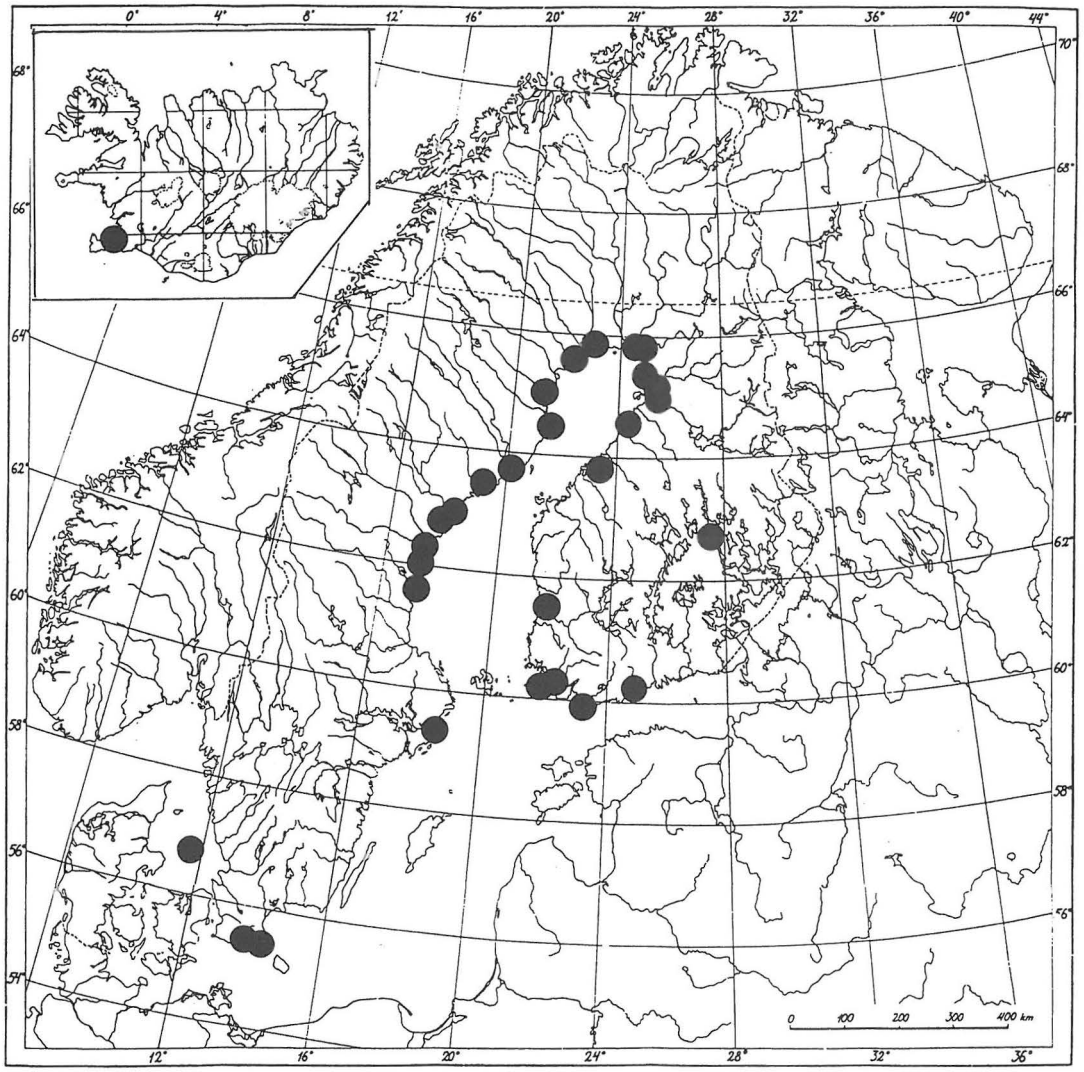

Fig.4. Known distribution of *Scleroderma septentrionale.*

There seem to be some reports from continental Europe which may relate to *S. septentrionale*. Records of *Scleroderma* from sand dunes of the Atlantic and North Sea coasts all seem to refer to *S. bovista* (or *S. meridionale* in southern areas), but Šebek (1953, 1964) reported findings on sand dunes in Bohemia of a taxon he identified as *S. aurantium* (Vaill.) Pers. var. *macrorhizum* Fr. According to his description it may be close to or even identical with *S. septentrionale*. Šebek's collections were not examined for this paper. In North America the occurrence of a large sand dune *Scleroderma* in the Great Lakes Region is noteworthy. This fungus was beautifully illustrated by Smith (1951) as a doubtful *S. aurantium* and was later (Smith & Smith 1973) reported as *S. macrorhizon* Wallroth based on Guzmán's interpretation of the latter. Later Demoulin (1974) found it to be identical with *S. meridionale*, a species described from the Mediterranean and Atlantic regions of South Europe and North Africa. In the light of the present studies a reinvestigation of the American samples of *S. meridionale* from the Great Lakes region is proposed.

Table 1. Diagnostic characters in *Scleroderma* sect. *Scleroderma*.

	Scleroderma citrinum	**Scleroderma bovista**	**Scleroderma septentrionale**	**Scleroderma meridionale**
pseudostipe	absent; fruitbody sessile	short – prominent; rhizomorphic – fasciculose	prominent; fasciculose – compact	prominent – compact
peridium consistency	thick, 1–4 mm though	thin, appr. 1 mm, fragile	thin, appr. 1 mm, fragile to tough	thick, >1 mm, tough
peridium colour	pale brown to yellowish	pale yellowish to greyish brown	pale brown to yellowish brown	pale brown to golden brown
peridium ornamentation	coarse scales all over	smooth, sometimes minute scales at apex	minute scales all over	furfuraceous
spores (µm)	(8)10–11(13) incomplete reticulum	(8)9–11(13) complete reticulum	(7)9–11(15) complete reticulum	(9)10–13(14) complete reticulum
dehiscence	apical, irregular	apical, irregular	apical, irregular	apical, irregular – stellate
ecology	on acid soil in woodland & heathland	woodlands, meadows, sand dunes; neutrophilic	on sand dunes and sandy heathland	forests on sandy soil, verges, clearings, sand dunes
distribution in Europe	temperate & hemiboreal; north to appr 62°	temperate & hemiboreal, isolated occurences in southern part of boreal zone; north to 61° (64° N on Norwegian coast)	hemiboreal – boreal, occasional records in temperate zone; north to 65°50'	Mediterranean & Atlantic region, north to 47°

Discussion

Material of a rooted *Scleroderma* matching the concept of *S. septentrionale* was distributed in Fungi Exsiccati Suecici (2258) with the following note: "It is with some doubt that this collection is distributed as *S. aurantium* but it seems to be only a luxuriant form caused by the habitat (sandy hose)".

Guzmán (1970) designated the specimen in FES as neotype of *Scleroderma macrorhizon* Wallroth and choose this name for any *Scleroderma* with a prominent pseudostipe and reticulate spores. Later Demoulin (1974) showed that the holotype of *S. macrorhizon*, which had been unknown to Guzmán, in fact belonged to typical *S. bovista*. This meant that Wallroth's epithet had to be rejected for the northern taxon. Fries (1829) described *S. vulgare* var. *macrorhizum*, which should also be taken into consideration. According to Demoulin (1974) there is, however, no authentic material at hand and the name has to be rejected as a *nomen dubium*. Subsequently, a new name had to be chosen for the sand dune *Scleroderma* of north Europe. The epithet *septentrionale* refers to its distribution in northerly areas, which makes it a unique member of the genus.

S. septentrionale is closely related to *S. bovista* and *S. citrinum* (see Table 1). It differs in the presence of a prominent pseudostipe and by having a thin and distinctly ornamented peridium. It also resembles *S. meridionale*, which, however, has a thick peridium with a furfuraceous surface. Since the sand dune *Scleroderma* of the Great Lakes Region was synonymized with *S. meridionale* by Demoulin (1974), material of

that species originating from the Mediterranean area was studied. It was found to deviate from *S. septentrionale* in having a much thicker and smooth-furfuraceous peridium with brighter colours as well as a more compact pseudostipe.

The prominent pseudostipe in *S. septentrionale* is an adaptation to the sandy habitat. *S. bovista* is usually provided with a rather short pseudostipe, which may, however, be rather prominent when the fungus is met with in sandy or gravelly places. The peridium in *S. bovista* is, however, ± smooth or merely cracked or minutely scaly at the top of the fruitbody. *S. citrinum* only rarely shows tendencies to form a short pseudostipe, also when growing in sandy situations. In *S. septentrionale* the size of the spores varies significantly even within a single specimen, a tendency which seems more pronounced than in the related species. The explanation is obscure. In one sample Demoulin (1974) suggested a disturbed maturation process caused by its very northern locality (65°N). This theory does not seem to hold true since *S. septentrionale* collected in the south of Scandinavia (where the climate is more favourable) shows the same variability. It must, however, be kept in mind that spore size is a well known problem in *Scleroderma*, the spores ripening and reaching their final dimension with the help of nursing hyphae after the autolysis of the basidia (Guzmán 1970).

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References

Andersson, O. 1950: Larger fungi on sandy grass heaths and sand dunes in Scandinavia. – Bot. Not. Suppl. 2(2):1–89.

Arwidsson, Th. 1936: Norrländska gasteromycetlokaler. – Bot. Not. 1936:532–538.

Demoulin, V. 1974: Scleroderma meridionale Demoulin et Malençon, the correct name for the large Scleroderma of Great Lakes sand dunes. – Michigan Bot. 13:68–72.

Eriksson, M. 1964: Larger fungi on dunes in Finland. – Rep. Kevo Subarctic Res. Stat. 1:149–154.

Fries, E. 1829: Systema mycologicum III. Lundæ.

Guzmán, G. 1970: Monografía del género Scleroderma Pers. emend Fr. (Fungi. Basidiomycetes). – Darwiniana 16:233–407.

Mossberg, B., Stenberg, L. & Ericsson, S. 1992: Den nordiska floran. Stockholm.

Nitare, J. 1982: Geoglossum arenarium, sandjordtunga – ekologi och utbredning i Sverige. – Svensk Bot. Tidskr. 76:349–357.

Rautavaara, T. 1953: Juuritryffeli (Scleroderma bovista Fr.) lentohiekassa Pohjois–Suomessa. – Karstenia 2:50.

Šebek, S. 1953: Monograph of the central European species of the genus Scleroderma Pers. – Sydowia 7:158–190.

Šebek, S. 1964: Břichatkovité houby písečné přesypové oblasti ve středním Polabi. – Česká Myk. 18:109–116.

Smith, A. H. 1951: Puffballs and their allies in Michigan. – 131 pp. Ann Arbor.

Smith, H. V. & Smith, A. H. 1973: How to know the non-gilled fleshy fungi. – 402 pp. Dubuque.

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