

## *Sarcosoma globosum* – an indicator of climate change?

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Ohenoja E., Kaukonen M., Ruotsalainen A. L.: *Sarcosoma globosum* – an indicator of climate change? Acta Mycol. 48 (1): 81–88, 2013.

Occurrence of a spring ascomycete, *Sarcosoma globosum* has increased in Finland during the last three decades. River banks and old spruce forests are its typical habitats. Some of its habitats are damaged or even destroyed, however, because of forestry and building of roads and houses. It is a care-demanding fungus on the Finnish Red List, according to the IUCN criteria, but its present status is being discussed.

**Key words:** Ascomycota, *Sarcosomataceae*, distribution, ecology, endangeredness

### INTRODUCTION

The genus *Sarcosoma* belongs to the ascomycete order Pezizales and to the family *Sarcosomataceae*, *S. globosum* (Schmidel) Casp. being the only species in the genus in the temperate areas. It occurs in southern and central Finland, usually in alluvial stands along rivers and brooks. It is rare and threatened in Europe and one of the 33 fungal species proposed to the Bern Convention (Dahlberg, Croneborg 2003). *S. globosum* is also found in the eastern parts of N. America.

### DESCRIPTION OF THE SPECIES

*Sarcosoma globosum* has big, sessile, roundish, barrel-like fruit bodies, 5–10 cm in diameter, dark brown-blackish, hymenium even, glossy, sterile part matt, velvety (Fig. 1a). Content of the fruit bodies is gelatinous. The genus name derives from Greek and means ‘fleshy body’. The fruit bodies turn flatter and more wrinkled when becoming older. Dry weight percentage of the fungus is about three.

*Asci* are 8-spored, 250–300 × 35–38 µm in size, tips not amyloid with iodine. Spores are hyaline, smooth, ellipsoid, 25–28 × 8–9 µm in size. *Paraphyses* are filiform,

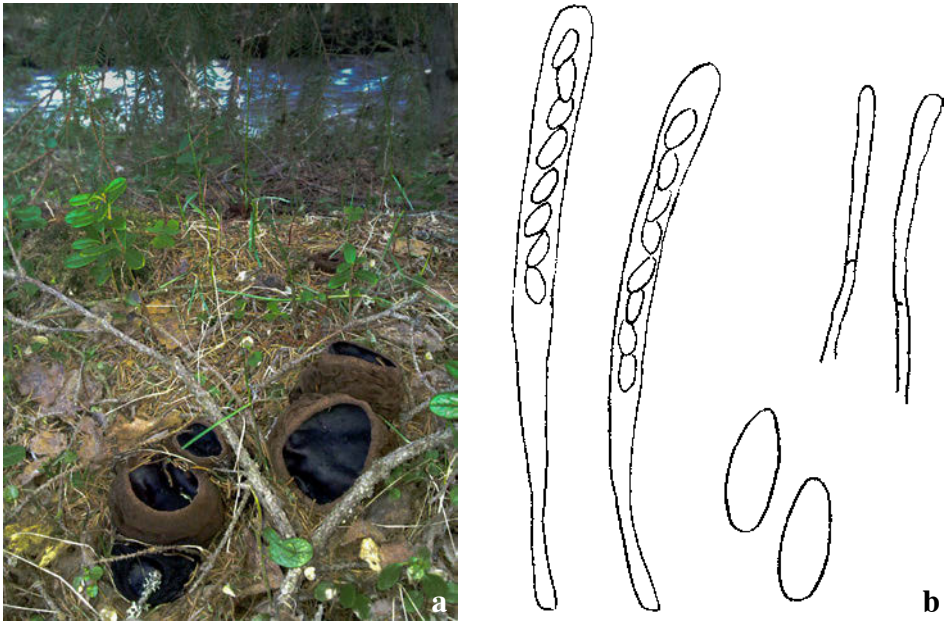


Fig. 1. *Sarcosoma globosum*: a – on bank of the brook Kalimeenoja in Oulu. Photo Lassi Kalleinen. 2012; b – microscopical characters (asci, spores and paraphyses) (Muhos 2.VI.1973 M. Ohenoja) Microsc. Esteri Ohenoja 2013.

brown, brittle, as long as the asci and 2.5-4.0  $\mu\text{m}$  wide (Fig. 1b). As for the way of living of *S. globosum*, it is supposed to be saprophytic.

#### ECOLOGY, PHENOLOGY AND DISTRIBUTION

Typical habitats of *Sarcosoma globosum* are the forests along rivers and brooks (Figs 1a, 2), often on alluvial shores, where the microclimate is favorable. The soil of flooded areas is rich in nutrients and moist also during dry springs. The fruit bodies often grow under aged spruces or pines among mosses and litter. *S. globosum* has been found in Finland both on calcareous and acid ground, though it is considered to benefit from lime (Martinsson, Nitare 1986, Tedebrand 1999). The plants and fungi reported in the vicinity of *S. globosum* are listed in Table 1.

*S. globosum* has been found in southern and central Finland the northernmost locality lying on the latitude of 66 degrees (Figs 3a-d, Tab. 2). History of the occurrence of the species in Finland has been presented by Kosonen (1988). First finds of *S. globosum* are from 1915 and 1916, the locality Rapolanharju (at Sääksmäki, Valkeakoski) being in southern Finland (Kivirikko 1916). This locality has not been continuously monitored, but it is protected, and the fungus was observed there e.g. in spring 1990. Kuopio has been a good area, too (Heikkilä, Vauras 1982). The northernmost locality in Finland, in Kuusamo, has lately been visited only occasionally, but Muhos, close to Oulu, has been monitored regularly since the first discovery in 1973.

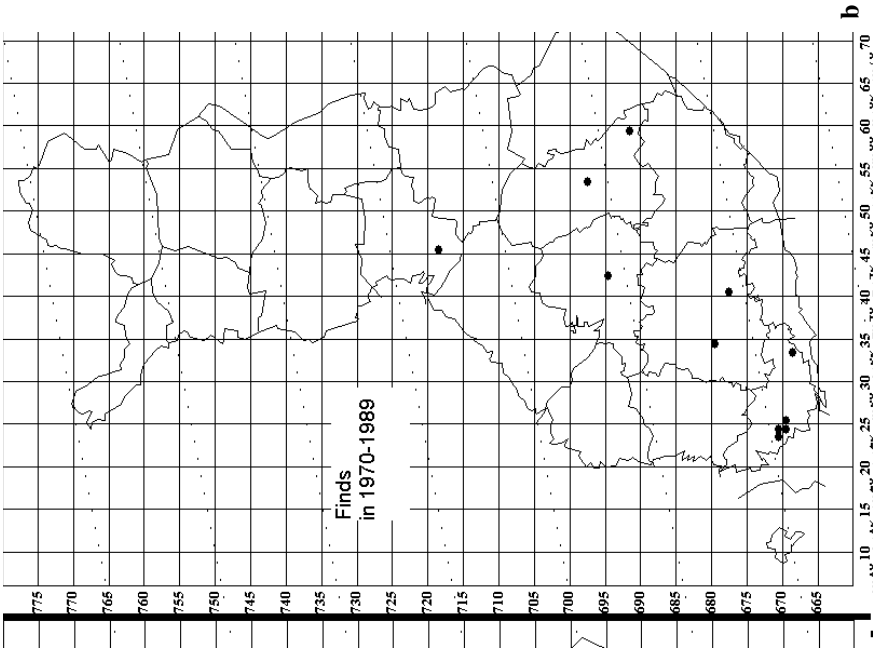


Fig. 2. Typical habitat of *Sarcosoma globosum* at Muhos. Photo Esteri Ohenoja 2012.

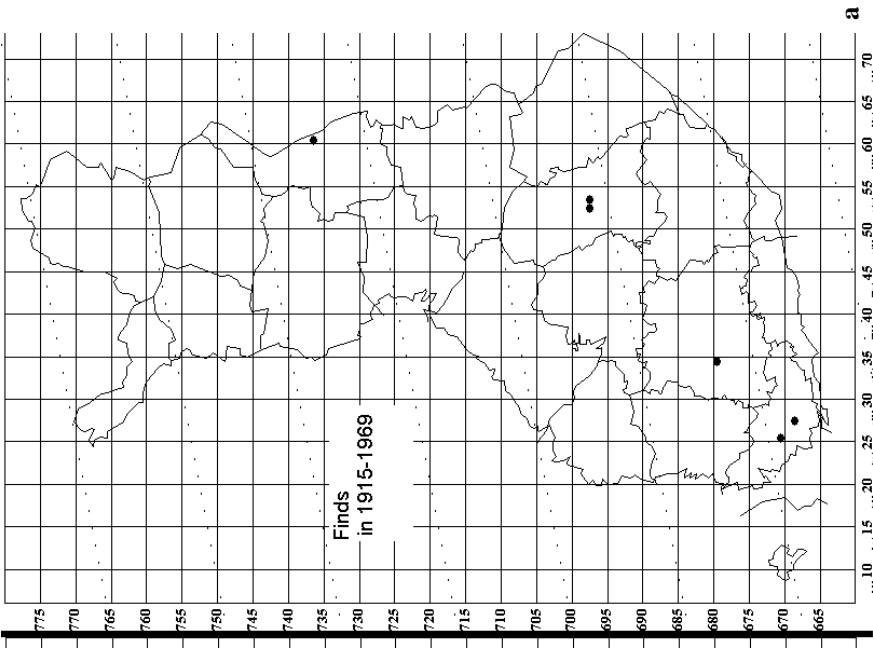
Table 1

Plants and fungi found in the closest neighbourhood of *Sarcosoma globosum* in Finland.  
The species are in an order of the observed frequency in the stands in question

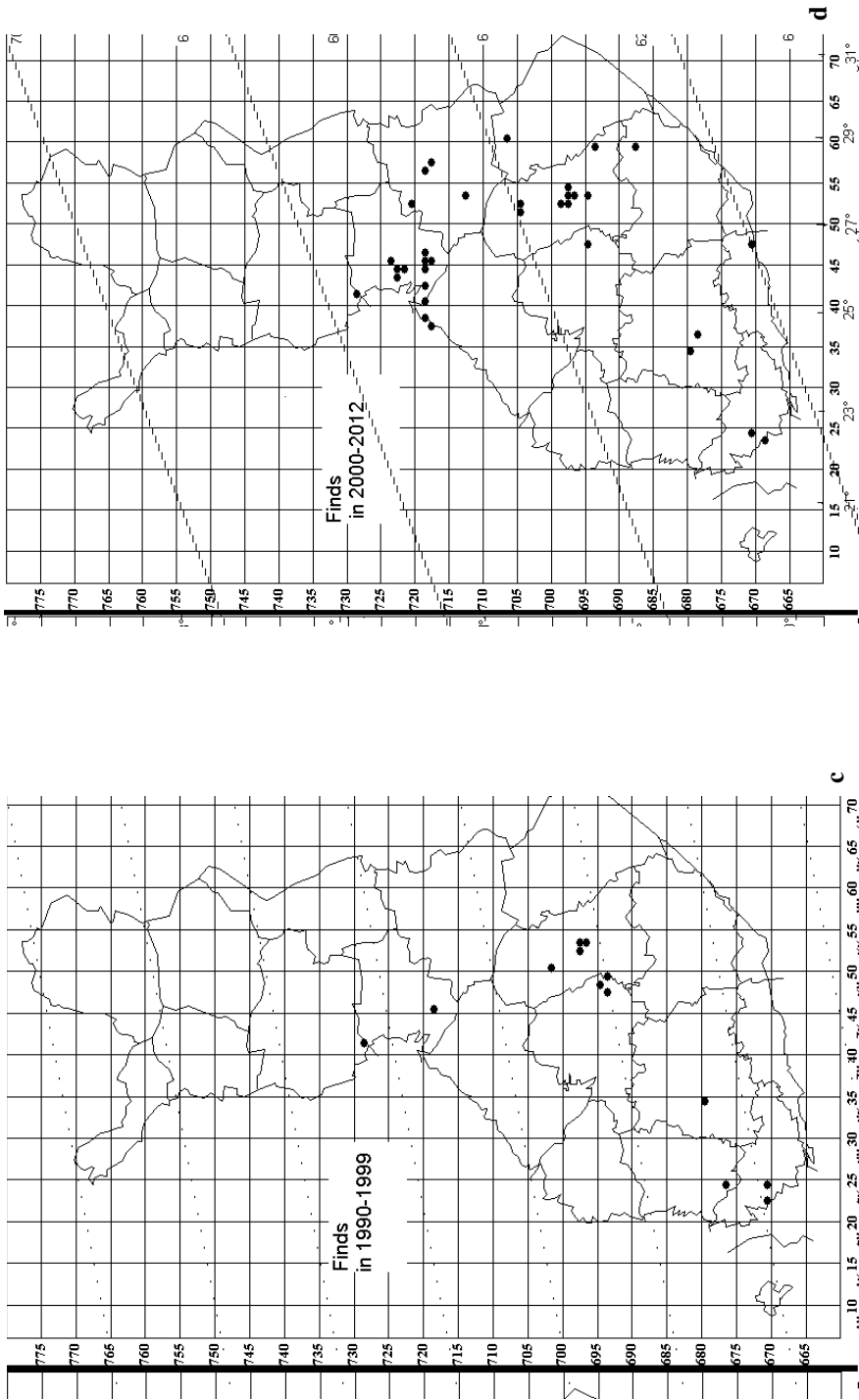
<b>Vascular plants</b>	<i>Silene dioica</i>
<i>Picea abies</i>	<i>Solidago virgaurea</i>
<i>Betula pubescens</i>	<i>Hieracium</i> sp.
<i>Sorbus aucuparia</i>	<i>Paris quadrifolia</i>
<i>Pinus sylvestris</i>	<i>Rubus saxatilis</i>
<i>Juniperus communis</i>	<i>Melica nutans</i>
<i>Rosa majalis</i>	<i>Elymus caninus</i>
<i>Prunus padus</i>	<i>Scirpus sylvaticus</i>
<i>Populus tremula</i>	<i>Poa nemoralis</i>
<i>Alnus incana</i>	<i>Diphasiastrum complanatum</i>
<i>Ribes spicatum</i>	<i>Equisetum arvense</i>
<i>Lonicera xylosteum</i>	<i>Matteuccia struthiopteris</i>
<i>Daphne mezereum</i>	
<i>Salix caprea</i>	<b>Mosses</b>
<i>Vaccinium vitis-idaea</i>	<i>Hylocomium splendens</i>
<i>Oxalis acetosella</i>	<i>Pleurozium schreberi</i>
<i>Linnaea borealis</i>	<i>Polytrichum commune</i>
<i>Orthilia secunda</i>	<i>Dicranum polysetum</i>
<i>Maianthemum bifolium</i>	<i>Rhytidiadelphus triquetrus</i>
<i>Luzula pilosa</i>	<i>Brachythecium curtum</i>
<i>Trientalis europaea</i>	<i>Rhodobryum roseum</i>
<i>Vaccinium myrtillus</i>	<i>Sphagnum</i> sp.
<i>Convallaria majalis</i>	
<i>Deschampsia flexuosa</i>	<b>Fungi</b>
<i>Equisetum sylvaticum</i>	<i>Microstoma protractum</i>
<i>Gymnocarpium dryopteris</i>	<i>Strobilurus esculentus</i>
<i>Vaccinium myrtillus</i>	<i>Auriscalpium vulgare</i>
<i>Empetrum nigrum</i> ssp. <i>hermaphroditum</i>	



**b**



**a**



Figs 3a-d. Finds of *Sarcosoma globosum* in 1915-2012 (Table 2). The grid on the maps is based on the uniform grid system used (27°E) in Finland. The areas on the map are the biological provinces.

Table 2  
The localities of *Sarcosoma globosum* in Finland

**Abbreviations:** 1b-4a forest vegetation zones (Rassi et al. 2010)

H Herbarium of the University of Helsinki, JYV Herbarium of the Jyväskylä University Museum, KUO Herbarium of Kuopio Natural History Museum, OULU Herbarium of the University of Oulu, TUR Herbarium of the University of Turku, TUR-A Herbarium of Åbo Akademi

<b>Hemiboreal, Oak zone (1b).</b> Lohja 22.4.1975 (H), 14.5.1987 (H); Parainen 27.5.1978 (TUR), 26.4.1989 (TUR), 29.4.1989 (TUR), 9.5.1989 (TUR-A), 8.4.1990 (TUR), 25.4.2000 (TUR), 25.12.2000 (TUR-A), 12.4.2001 (TUR), 20.4.2001 (TUR), 17.5.2001 (TUR), .5.2006 (TUR); Perniö 11.5.1961 (TUR); Piikkiö 13.-14.5.1954 (TUR), .3.1961 (H), 23.3.1961 (TUR), 18.4.1961 (TUR), 28.5.1961 (TUR), 8.5.1963 (TUR, OULU), 29.5.1967 (TUR); Rymättylä 14.4.1990 (TUR); Sauvo 9.4.1989 (TUR); Turku (Kakskerta) 14.5.1980 (TUR).
<b>Southern boreal, SW Finland and S Ostrobothnia (2a).</b> Hattula 20.5.2000 (TUR); Hämeenkoski (Koski) 28.5.1980 (OULU); Pyhtää 22.4.2001 (H); Säkyä 3.5.1998 (TUR); Valkeakoski (Sääksmäki) 4.6.1915 (litt.), 7.5.1916 (litt.), 12.6.1980 (H), 1.6.1982 (?), 1.5.1987 (?), 27.5.1987 (TUR), 21.5.1988 (TUR), 29.4.1990 (OULU), 24.5.1998 (H, TUR), 5.5.1998 (TUR), 19.4.2005 (H).
<b>Southern boreal, Lake district (2b).</b> Heinävesi 12.5.1986 (H), 3.5.2001 (H); Konnevesi 18.6.2008 (JYV); Kuopio 16.4.1950 (KUO), 9.5.1954 (H), 23.5.1954 (KUO), 23.5.1973 (KUO), 26.5.1962 (TUR), 22.5.1986 (KUO), 5.7.1994 (JYV), 5.6.1997 (TUR), 17.5.1999 (KUO); Maaninka 31.5.1998 (KUO); Rautalampi 1.5.1990 (litt.), 9.6.1991 (KUO); Savonlinna 6.6.2001 (H); 23.5.1992 (litt.); Äänekoski 15.6.1982 (OULU).
<b>Middle boreal, Ostrobothnia (3a).</b> Liminka 9.5.2012 (obs.); Muhos 2.6.1973 (OULU), 27.5.1988 (OULU), 24.5.1990 (OULU), 18.5.1993 (OULU), 28.5.1994 (OULU), 8.5.2010 (OULU), .6.2012 (obs.); Oulu 21.5.2005 (OULU), 22.5.2012 (obs.), 23.5.2012 (obs.); Oulu (Haukipudas) 20.5.2005 (OULU); Oulu (Kiiminki) 27.5.2005 (OULU); Revonlahti 8.5.2012 (obs.); Raahe 10.5.2012 (obs.); Tyrnävä 13.5.2012 (obs.).
<b>Middle boreal, N Karelia and Kainuu (3b).</b> Hyrynsalmi 30.5.2001 (OULU), 12.5.2005 (OULU); Kajaani 20.5.2008 (obs.), 25.5.2008 (obs.); Nurmes 29.5.2005 (TUR-A), 1.6.2005 (TUR-A); Puolanka 21.5.2005 (OULU).
<b>Middle boreal, SW Lapland (3c).</b> Simo .5.1999 (obs.), 15.5.2008 (OULU).
<b>Northern boreal, Kuusamo district (4a).</b> Kuusamo 19.6.1968 (H).
<b>RUSSIA Karelia onegensis (Kon).</b> Karhumäki 10.5.1943 (H).
<b>RUSSIA Karelia australis (Ka).</b> Viipuri 20.5.1891 (H).

There are over 80 collects and observations of *S. globosum* from Finland between 1915 and 2012. As for the phenology of the species (Tab. 2), it has been found in southern Finland in April-May, and in central Finland in May-June, the main fruiting time being in the southern half of the country somewhat earlier than in the North. The species was found in southwestern Finland once in December and in eastern Finland in November. In 1985 when *S. globosum* was abundant in Sweden (Martinsson, Nitare 1986) there was not a single find in Finland, but the springs 1998 and 1999, when the fungus was very abundant in Central Sweden (Tedebrand 1999) were good also in the southern part of Finland, and it was observed first time also in Simo, the north western most locality. The springs of 1990, 2001, 2005, 2008, and 2012 were good, especially in the northern part of the species' distribution. The amount of fruit bodies has been even hundreds at some localities. There has been information about this curious fungus e.g., in some newspapers, and this has apparently increased knowledge of its occurrence in the country.

## ENDANGEREDNESS

*Sarcosoma globosum* is, according to the criteria of IUCN, a care-demanding fungus species in Finland (Rassi et al. 2010). It is included in ten Red Lists of European countries (Dahlberg, Croneberg 2003). In Estonia it used to be very rare, but in 2005 and 2006 it appeared abundantly (Kullmann 2011). It is very rare in Norway, maybe because of the oceanic climate of the country, but in the semiarid, formerly pastured forests in Sweden it has been abundant (Tedebrand 1999). Now it is, however, somewhat declining. In Poland it is on the red list in the category of endangered species (Wojewoda, Ławrynowicz 2006). It is extinct from Slovakia, Germany and Lithuania, but in Latvia and Norway it has been found again. It is obvious, that it is increasing in Finland, but on the other hand it has lost habitats because of e.g. clearing of forest stands (Fig. 4) and the human impact on the riversides. A protection plan has been prepared for one area of occurrence at Muhos (Kaukonen, Ohenoja 1994), and that part of the river valley is now protected. Also some other Finnish localities are situated in nature reserves.

## DISCUSSION

The distribution of *Sarcosoma globosum* seems to be nemoral-boreal-montane. It always grows in same kind of habitats, characterized by the vicinity of rivers and brooks. Though the fungus can sometimes be very difficult to find when hiding deep in the moss carpet, it is so striking in characters, that people have noticed it and also informed museums and researchers about it. Why it seems to be more abundant now than before, the climate change with somewhat warmer winters and rainy springs could be one reason. Martinsson and Nitare wrote already in 1986 that cold winters with less snow are not favorable for the fruiting of the fungus. For instance, there was a mild winter preceding a good yield of *Sarcosoma* in Finland in spring 1961. The latest winters have also been rather warm, with, however, much snow. Based on the present knowledge, it would be appropriate to reevaluate the regional threat class of *S. globosum* on the Finnish red list of species.

**Acknowledgements.** The authors thank the curators of the herbaria of H, IISALMI, JYV, KUO, TUR, and TUR-A, and many other friends, too, for sending data and collects. Lassi Kalleinen is warmly thanked for the photo and technical help. We congratulate our colleague and friend Maria on her long standing, tough and productive mycological activity.

## REFERENCES

- Dahlberg A., Croneborg H. 2003. 33 threatened fungi in Europe. Complementary and revised information on candidates for listing in Appendix I of the Bern Convention. 82 pp.
- Heikkilä H., Vauras J. 1982. Kuopion lehtokeskuksen suursienistä. Savon Luonto 14: 58-68.
- Kaukonen M., Ohenoja E. 1994. Hytymäljakkään (*Sarcosoma globosum*) Muhoksen esiintymien suojelusuunnitelma. Oulun yliopiston kasvimuseo. 21 pp.
- Kivirikko K.E. 1916. *Bulgaria globosa*. Meddelelser Soc. Fauna Flora Fennica 42: 144-145.

- Kosonen L. 1988. Hytymaljakas (*Sarcosoma globosum*), silmälläpidettävä kevätsieni. (Summary: *Sarcosoma globosum* in Finland.) *Lutukka* 4 (1): 3-6.
- Kullmann B. 2011. Limatünnik Eestis. (In:) B. Kullmann, T. Liira, J., Sammul, M. (toim.). *Haruldused Eesti looduses. Eesti Looduseuurijate Seltsi aastaraamat* 86: 9-17.
- Martinsson K., Nitare, J. 1986. Bombmurklan, *Sarcosoma globosum*, en hotad svamp. *Svensk Bot. Tidskr.* 80: 169-184. Stockholm.
- Rassi P., Hyvärinen E., Juslén A., Mannerkoski I. (eds). 2010. The 2010 Red List of Finnish Species. *Ympäristöministeriö & Suomen ympäristökeskus*. Helsinki, 685 pp.
- Tedebrand J.-O. 1999. Bombmurklan (*Sarcosoma globosum* (J.C. Schmidt: Fr.) Rehm i Sverige. *Jordstjärnan* 20 (2): 25-42.
- Wojewoda W., Ławrynowicz M. 2006. Red list of the macrofungi in Poland. (In:) Z. Mirek, K. Zarzycki, W. Wojewoda, Z. Szeląg (eds). *Red list of plants and fungi in Poland*. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków: 53-70.