Studia bot. hung. 36, pp. 131–163, 2005

HUNGARIAN DISTRIBUTION OF THE LEGALLY PROTECTED MACROFUNGI SPECIES

I. SILLER[1], G. VASAS[2], F. PÁL-FÁM[3], Z. BRATEK[4], I. ZAGYVA[4] and L. FODOR[5]

[1]*Department of Botany, Faculty of Veterinary Sciences of the Szent István University*
H-1078 Budapest, István u. 2, Hungary; E-mail: Turcsanyine.Siller.Iren@aotk.szie.hu
[2]*Department of Botany, Hungarian Natural History Museum*
H-1097 Budapest, Könyves Kálmán krt. 40, Hungary; E-mail: vasas@bot.nhmus.hu
[3]*Department of Botany and Plant Production, University of Kaposvár*
H-7400 Kaposvár, Guba S. 40, Hungary; E-mail: pff3@hotmail.com
[4]*Department of Plant Physiology and Molecular Plant Biology, Eötvös Loránd University*
H-1117 Budapest, Pázmány Péter sétány 1/c, Hungary
E-mail: bratek@ludens.elte.hu, geastrum@axelero.hu
[5]*Ministry of Environment and Water*
Office of Nature Conservation, H-1121 Budapest, Költő u. 21, Hungary

The proposal for legal protection in Hungary compiled by the Hungarian Mycological Society includes thirty-five species of macrofungi (*Amanita vittadinii*, *Battarrea phalloides*, *Cantharellus melanoxeros*, *Cortinarius (Phl.) paracephalixus*, *Cortinarius (Phl.) praestans*, *Elaphomyces anthracinus*, *E. leveillei*, *E. maculatus*, *E. mutabilis*, *E. persooni*, *E. virgatosporus*, *Endoptychum agaricoides*, *Geastrum hungaricum*, *Gomphidius roseus*, *Gomphus clavatus*, *Gyrodon lividus*, *Hericium cirrhatum*, *Hericium erinaceus*, *Hygrocybe calyptriformis*, *Hypsizygus ulmarius*, *Lactarius helvus*, *Leccinum variicolor*, *Leucopaxillus macrocephalus*, *Phylloporus pelletieri*, *Polyporus tuberaster*, *Polyporus umbellatus*, *Pseudoboletus parasiticus*, *Rhodotus palmatus*, *Russula claroflava*, *Sarcodon scabrosus*, *Scutiger pescaprae*, *Squamanita schreieri*, *Strobilomyces strobilaceus*, *Tulostoma volvulatum*, *Volvariella bombycina*). The characterisation of these species is complemented with the discussion of distribution, existing Hungarian records and the reasons for which protection is needed and proposed.

Key words: distribution records, Hungary, protected species of macrofungi, red list of the Hungarian macrofungi

INTRODUCTION

Legal protection of macrofungi is a problem recently occupying the focus of interest of numerous mycologists worldwide. A gradual decline of macrofungi has been observed since 1960–70s (BAS 1978, ARNOLDS 1991, STEIGER 1976). This may be attributed to both natural, unfavourable weather patterns, and anthropogenic habitat disturbance and alteration, elimination of substrate lignum, use of pesticides, effects of toxic immission, etc. (WINTERHOFF 1984*a*, *b*, WINTERHOFF *et al.* 1984). The purpose of protection is first of all the salvage of endangered species from extinction, e.g. protecting rare and biogeographically valuable species, the type species (described in the respective country). Usually, as a first step red

lists have been compiled (ARNOLDS 1989, COURTECUISSE 1992), leading to subsequent proposals for species protection and conservation of sites of mycological interest (HERMANN and KUTHAN 1981). In some countries these efforts successfully led to legal protection for macrofungi (Bősze and FODOR 2005).

The need for protection of macrofungi was first voiced in Hungary by BABOS (1989) and RIMÓCZI (1992). Red lists were compiled soon after (SILLER and VASAS 1993, 1995*a*, *b*, RIMÓCZI 1997, RIMÓCZI *et al.* 1999). The latest proposal (2004) enlists thirty-five species of macrofungi compiled after a long process of negotiations and considerations between a subcommittee of the Hungarian Mycological Society and representatives of the Ministry of Environment and Water. A discussion forum was organised in November 2004. The present article contains a characterisation of the species, and a discussion of their distribution, known Hungarian records and the justification why protection is suggested. Nomenclature and taxonomy follow Index Fungorum (KIRK 2001).

METHODS

The species proposed for protection are characterised by the following criteria: properties of fruit-body; gills and hymenium; flesh; stem; life-strategy, occurrences in Hungary; and habitat; distribution and frequency; Hungarian red list category. Hungarian red list category 1 corresponds to the IUCN Critically Endangered (CR) category. Category 2 corresponds to the IUCN Endangered (EN) category. Category 3 corresponds to the IUCN Vulnerable (VU) category.

The species records represent those of the known Hungarian records (preparates or references to preparates of species only). Most of the specimens of the species proposed for protection are deposited in the herbarium of the Botanical Department of the Hungarian Natural History Museum (BP).

ENUMERATION

Amanita vittadinii (Moretti) Sacc.
(Agaricales, Pluteaceae)

Cap: 5–15 cm diameter, white, decorated with whitish, later greyish felt-like, rough scales. Skin occasionally with scale-like cracks in the middle part. Margin is crenulate.

Gills: free-standing, whitish when young, later becoming yellowish.

Stem: cylindrical, clavate at base or fusiformly tapering towards base. Under the fringed, filmy ring the whole surface of the stem is densely covered by rough, relinquishing scales often arranged in rows.

Flesh: thick, white in cap, in stem hard, greenish, its scent reminiscent of cauliflower, its taste is mild.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: from May to October, on salty and sandy pastures, in nitrophitic grassland communities. In moderately thermophilous, nutrient rich grasslands, pre-treated grasslands or abandoned agricultural fields, favouring neutral-basic or basic soils.

Distribution, frequency: Known from Europe and North Africa. In Europe very rare, mainly in Central and Western Europe. Occurs from the Apennines to the Mediterranean regions (GALLI 2001). In Hungary it is not rare in salty and sandy areas.

Hungarian red list category: 2.

Justification: Rare all over Europe, the most important populations are in Hungary.

Known Hungarian records: ALBERT (2002b): Budai-hegység: Pesthidegkút, (*Galio-Urticetum*); private collection of L. Albert: Jászberény. RIMÓCZI (1994): Szolnok, (*in populeto*), Vasszécsény (*Cynodonto-Lolietum*), Szany (*Lolio-Plantaginetum*), Hortobágy (*Festucetum pseudovinae*). BABOS (1989, 1982, 1999): Visegrádi-hegység: Leányfalu (*in prato*), Szentendre (*in prato*), Révfülöp, Szombathely (*in horto*), Kölesd (*in pascuo*), Martonvásár, Kunszentmiklós (*in saline pasture*), Tiszakürt, Szentes (*in prato*), Nagyiván (*Festucetum pseudovinae*), Tótkomlós, Nyíregyháza (*in prato salino*), Nyírbogdány. RIMÓCZI *et al.* (1997): Bátorligeti Ősláp. BP*: Jászapáti (*in pascuo*). Private collection of F. Pál-Fám: Bakony: Litke. Private collection of B. Dima: Budai-hegység: Pesthidegkút.

Battarrea phalloides (Dicks.) Pers.
(Agaricales, Tulostomataceae)

Fruit-body: originally found in the soil, spherical, covered by double veil, under the outer veil there is a gelatinous layer. Later the veil is broken and a long (often reaching 20 cm!), brown, squamulose stem is raising towards the soil surface, keeping a yellow-brown, brown, hirsute-fibrous, pruinose cap-like part. The ruptured veil remains as volva at the base of the stem.

Hymenium: situated inside the fruit-body, the spores are spread by the wind after the rupturing of the inner veil.

Flesh: woody, scent and taste is not typical.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: April–October, dry, sandy soil, in *Robinia* woods occupying its original habitat, often near wood-stacks.

Distribution, frequency: In Southern and Eastern Europe, rare all over Europe (JÜLICH 1984); until the 1990s not rare on the Hungarian Great Plain. However, during the last decade its population size has been decreasing considerably.

Hungarian red list category: 2.

Justification: The largest population of the species is supposed to be in Hungary, but its size has been strongly decreasing.

Known Hungarian records: BABOS (1999): Bugac: Ősborókás (*in Junipero-Populetum albae*), Csévharaszt (*in Junipero-Populetum albae*), Pálmonostora, Petőfiszállás: Szentkút, Alsópakony, Ásotthalom (*in solo arenoso*), Gyál, Felsőpakony, Heténygyháza (*in silva arenosa*), Kecskemét: Kisfái, Kecskemét: Nagynyír, Ópusztaszer: Hantháza. BP: Monor (*ad terram arenosam*), Fót, Tápiószecső, Pilis, Szeged, Farmos (*ad marginem robineti*), Dóc, Délegyháza (*ad marginem robineti*), Budapest: Pestszentlőrinc (*in robineto*), Budapest: Rákoshegy (*in robineto, solo arenoso*). Private collection of F. Pál-Fám: Fülöpháza. Private collection of B. Dima: Alsónémedi.

Cantharellus melanoxeros Desm.
(Cantharellales, Cantharellaceae)

Fruit-body: consists of cap-like and stem-like parts.

Cap: 2–5 cm diameter, fleshy, irregularly wavy edge, spreading, later becoming funnel-shaped, ochraceous yellow or ochraceous brown.

Hymenium: wrinkled, decurrent, forking, can be anatomising, rose or violet-grey.

Stem: cylindrical, can be pressed, similar but darker than the cap, blackening if damaged.

Flesh: creamy, blackening mainly under the surface and in the stem when cut, its flavour and scent is pleasant.

Life-strategy: mycorrhiza *(mainly with Fagus*, later *Quercus* sp.).

Occurrences in Hungary, habitats: From September to October, in beech and oak forests of acidic soil. Thermophilous species, producing its fruit-bodies in protected, sunny places on nutrient poor brown forest soil.

Distribution, frequency: Not rare in Southern Europe, but in Northern and Western Europe only a few records are known (KRIEGLSTEINER 2000). European endemism (DAHLBERG and CRONEBORG 2003).

Hungarian red list category: 1.

Justification: Rare all over Europe, even more rare in Hungary. The main reason of its retreating is the small and decreasing size of its habitat.

Known Hungarian records: LUKÁCS and KIRÁLY (1995): Őrség: Bajánsenye. BP: Őrség: Bajánsenye (*in silva mixta*). Private collection of F. Pál-Fám: Börzsöny: Királyrét (*Luzulo-Fagetum*). Private collection of B. Dima and L. Albert: Őrség: Fekete-tó (*Galio rotundifolio-Fagetum*), Heves–Borsodi-dombság: Tarnalelesz (*Luzulo-Fagetum*), Mátra: Parádsasvár (*Luzulo-Fagetum*), Börzsöny: Vár-hegy (*Luzulo-Fagetum*) (ALBERT and DIMA 2005).

Cortinarius paracephalixus Bohus
(Agaricales, Cortinariaceae)

Cap: 5–12 cm diameter, ochre, brown ochre, rust-yellow; surface slimy, slightly shiny when dry, the skin can be peeled off. The young fruit-body is entirely covered by a white, fibrous universal veil, the edge of the cap remains with white fibres for long.

Gills: decurrent with tooth; pale clay-coloured when young, becoming ochraceous brown when old.

Stem: clavate, whitish, later brown ochre, surface covered richly by white, then ochraceous brown veil, later breaking up forms small belts.

Flesh: whitish, ochre, more or less becoming red, then after several hours these places blackening; scent is reminiscent of corn silk.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: From September to November, in mixed deciduous forest of sandy soil, in gallery forests, first of all near White Poplar (*Populus alba*) (BOHUS 1976).

Distribution, frequency: European data are very limited (BREITENBACH and KRÄNZLIN 2000). Rare in Hungary, it may be regarded as a European endemism.

Hungarian red list category: 2.

Justification: In Europe it is only known from Hungary, therefore its legal protection is highly recommended.

Known Hungarian records: BABOS (1989, 1999): Horány (*in silva arenosa*), Bugac (*in Junipero-Populetum*), Fülöpháza (*in Junipero-Populetum*), Algyő. RIMÓCZI (1994): Jászberény (*in populeto*), Budakalász (*in populeto*), Bugac (*in populeto*), Fülöpháza (*Junipero-Populetum albae*). Private collection of L. Albert: Bátorliget, Alsónémedi, Kecskemét. Private collection of B. Dima: Budapest: Soroksár (under *Populus alba*) (ALBERT 2003), and Nyírség: Bátorliget.

Private collection of I. Iváncsik: Újszász: Szőrös-erdő, sub: *Populus canescens* (IVÁNCSIK 1994).

Cortinarius praestans (Cordier) Gillet
(Agaricales, Cortinariaceae)
(Syn.: *Cortinarius variecolor* (Pers.) Fr. var. *herculeanus* Fr.)

Cap: 10–20 cm in diameter, pale reddish brown, violet-chocolate brown, covered by violet universal veil when young, it remains as dots when old.

Gills: decurrent with tooth; violet-grey when young, later rusty clay-brown, their edges with fine teeth.

Stem: 10–25 cm long, 2–3 cm thick, slightly clavate at its base, with violet tint at the top, later whitish, ochraceous. The spider's web-like partial veil is well developed, pale violet, later tearing away from the cap margin and may be left as rings on the stem.

Flesh: thick, dense, whitish, pale violet at the top of the stem, its scent slightly reminiscent of *Boletus*, taste is mild.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: August–October, in deciduous forest of calcareous, acidic soil (mainly under *Fagus*, then *Tilia*, *Corylus*).

Distribution, frequency: Known from Europe and Asia (BREITENBACH and KRÄNZLIN 2000). Rare all over Europe, also in Hungary.

Hungarian red list category: 3.

Justification in Hungarian and at international level: Highly endangered because of its striking large size, edible feature and declining habitats. The habitat being old-growth deciduous forests of acidic soil; such forests are disappearing as a result of commercial forestry practices (e.g. logging).

Known Hungarian records: BABOS (1989): Mátra: Mátraháza (*Querco-Carpinetum*), Bakony: Bakonygyepes (*in Querco-Carpinetum*). RIMÓCZI (1994): Mátra: Parádsasvár (*Deschampsio-Fagetum subcarpaticum*), Bakony: Devecser, Széki-erdő (*Querco petraeae-Carpinetum pannonicum*). RIMÓCZI *et al.* (1997): Nyírség: Bátorliget. BP: Mátra: near "Pisztrángos-tó" (*Deschampsio flexuosae-Fagetum subcarpaticum*). Private collection of Albert, Dima and Németh: Mátra: near "Pisztrángos-tó".

Elaphomyces anthracinus Vittad.
(Elaphomycetales, Elaphomycetaceae)

Fruit-body: hypogeous, hard, globose or ovoid to pyriform, often depressed, up to 13 mm diam. Peridial surface brownish black, carbonaceous, appearing smooth to naked eye. Inner peridium whitish, later becoming grey.

Gleba: dingy white to grey, cottony at first, filled powdery mass of spores in mature specimens, sometimes with a central hollow.

Spore: globose, nearly black, ornamented with minute rods distributed densely and evenly, relatively small (15–19 ěm diam. excluding ornamentation).

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: In spite of over 100 years of work on truffles of the Carpatho-Pannonian region only few collections are known. It can be collected at all times of the year, under oaks, hornbeam and beech.

Distribution, frequency: Reported from several European countries and North America, but it is rare everywhere.

Hungarian red list category: 1.

Justification: It seems to be quite a rare species being difficult to distinguish macroscopically from the other rare *Elaphomyces* species with blackish surface. It is included in the red lists of several European countries.

Known Hungarian records: HOLLÓS (1911, 1933): Kecskemét: Nyírerdő (sub *Quercus robur*), Litke (Nógrád megye) (sub *Fagus sylvatica*). SZEMERE (1965): Királytelek (Nyírség, leg.: Ubrizsy, *Quercetum*), Somogy megye: Somogyfajsz (sub *Quercus*), Felsőtapazd-puszta, Bakony: Hárskút. BRATEK *et al.* (1999): Aggteleki-karszt: Bódvaszilas (silva mixta), Gerecse: Malom-völgy (*Carpino-Quercetum*).

Elaphomyces leveillei Vittad.
(Elaphomycetales, Elaphomycetaceae)

Fruit-body: hard and fragile, subglobose, often depressed at both sides, up to 3 cm diam., wrapped by a greenish yellow mycelial crust. Peridial surface dark blackish brown, carbonaceous, covered with small flat warts, with few persistent greenish yellow spots.

Gleba: when mature turned into blackish spora powder.

Spore: globose, covered by very fine, dense rods, 20–22.5 ěm diam.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: only two collections are known, *in deciduous woods, especially under Fagus sylvatica.*

Distribution, frequency: Known from some European countries, North America and Australia. Infrequent in Europe.

Hungarian red list category: 1.

Justification: Very rare throughout Europe and often included in red lists. Macroscopically easy to confuse with other rare black *Elaphomyces* species.

Known Hungarian records: HOLLÓS (1911): Fraknó (sub *Fagus sylvatica*). BRATEK *et al.* (1999): Mátra: Parádóhuta (*Deschampsio-Fagetum*).

Elaphomyces maculatus Vittad.
(Elaphomycetales, Elaphomycetaceae)

Fruit-body: subglobose, sometimes depressed, up to 22 mm diam., encrusted by a greenish later brown blackish mycelium. Peridium is nearly smooth, blackish with permanent verdigris large plaques.

Gleba: at maturity filled with blackish brown spore mass.

Spore: globose, brownish black, opaque at last, relatively large (28–35 ěm).

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: This fungus has been found to be locally abundant (Somogyfajsz), but the number of known habitats is very low in Hungary and Europe.

Distribution, frequency: So far not known outside Europe. Occurs only in a few countries and not frequent in any places.

Hungarian red list category: 1.

Justification: This species seems to be a European endemism. Macroscopically not easy to distinguish from the other rare black *Elaphomyces* species.

Known Hungarian records: HOLLÓS (1911): Litke (sub nom. *E. septatus*). SZEMERE (1965): Somogy megye: Somogyfajsz (Felsőkakpuszta, Kaszópuszta), Bakony: Eplény, Pénzesgyőr (sub *Fagus sylvatica*). BRATEK (unpubl.): Somogyi-dombság: Mesztegnyő (*Querco robori-Carpinetum*), Kóspallag (*Quercetum petraeae-cerris*).

Elaphomyces mutabilis Vittad.
(Elaphomycetales, Elaphomycetaceae)

Fruit-body: subglobose, up to hazelnut size, bluish black, wrapping whitish mycelial crust, with a soft cortex, becoming wrinkled after drying.

Gleba: bluish grey-black, at maturity consisting of powdery mass of spores.

Spore: globose, very small (7–15 ěm), brownish when mature, ornamented with small, dense rods.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: only one reported habitat, in deciduous wood.

Distribution, frequency: Known from Italy, France, Germany, Hungary and China.

Hungarian red list category: 1.

Justification: Very rare in Hungary and in Europe. Macroscopically easy to confuse with other rare black *Elaphomyces* species.

Known Hungarian records: SZEMERE (1965): Bize (sub *Quercus cerris*).

Elaphomyces persooni Vittad.
(Elaphomycetales, Elaphomycetaceae)

Fruit-body: globose-subglobose, 1–2 cm diam., hard and fragile, uniformly brown black, peridial surface ornamented with small verrucae.

Gleba: when mature light leaden grey, bluish grey, consisting of powdery mass of spores.

Spore: globose, hazel to sepia coloured, ornamented with a reticulum of polygonal meshes, numbering 6–8 along a diameter.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: Reported from a single site.

Distribution, frequency: Occurs only in Italy and Hungary. Rather rare species in deciduous or coniferous woods, in various seasons (MONTECCHI and SARASINI 2000).

Hungarian red list category: 1.

Justification: With only one record of this truffle from Hungary. This species is truly rare as well as being challenging to find. Macroscopically not easy to distinguish from other rare, black *Elaphomyces* species.

Known Hungarian records: BRATEK *et al.* (1992, 1999): Bakony: Uzsapuszta (*Carpino-Quercetum*, sub *Fagus sylvatica*).

Elaphomyces virgatosporus Hollós
(Elaphomycetales, Elaphomycetaceae)

Fruit-body: spherical or flattened, often pitted, depressed, hazelnut-walnut sized, 8–16 mm diam. Rind (peridium) coal-black, dull, finely verrucose, hard and fragile. In cross section the inner rind is white, dirty white, often more thin than the outer rind. The fruit-body formed in the soil, often deep in the soil, mostly at the border of humus and clay layers.

Gleba: cotton-like white at the beginning, then umber-brown when ripe.

Spore: brown, densely covered by parallel wavy ribs.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: during nearly the whole year, in *Querco-Carpinetum*, or under beech.

Distribution, frequency: majority of records originates from Hungary. It is reported from Sweden and the USA also.

Hungarian red list category: 1.

Justification: Its distribution is mainly restricted to the Carpathian Basin. The number of known sites is very low. Its natural habitats usually overstrained by game breeding. As it occurs together with valuable truffles (*Tuber aestivum*, *T. brumale*), occasionally truffle-pickers' soil-disturbance also damages its localities. According to Trappe (*pers. comm.*) *it is an ancient, relict species originating from ages prior to the continental drift.*

Known Hungarian records: HOLLÓS (1911, 1933): Litke (*Carpino-Fagetum*), Szekszárd: Kisbükk-erdő. BRATEK *et al.* (1992, 1999): Gerecse: Malomvölgy. BRATEK *et al.* (1999): Aggteleki-karszt: Szelcepuszta, Börzsöny: Kemence (*Querco-Carpinetum*), Kend (*Melittio-Fagetum*). Private collection of Z. Lukács: Budai-hegység (silva mixta with *Fagus sylvatica*).

Endoptychum agaricoides Czern.
(Agaricales, Agaricaceae)

Fruit-body: 2–12 cm high, 2–7(–20) cm in diameter. Conical, reminiscent of red pepper (paprika). Surface when young covered by white, later a more or less ochre-colour veil, which is tearing into radial lobes at the basis of fruit-body when ripe. Having a shorter or longer stem, continued as a twisted axis inside the fruit-body.

Inside the fruit-body: vertical plates divide it into chambers. Internal part is yellowish brown or green when young, later brown.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: March–November, on sandy steppes, pastures, *Robinia*-woods, *Robinio-Populetum*, at the edge of pine forests. Typical sandy steppe species.

Distribution, frequency: Very rare all over Europe, its main occurrence is in Central and Southern Europe (JÜLICH 1984). In Hungary it was regarded as relatively frequent until the 1980s. HOLLÓS and BABOS investigating fungi in the Hungarian Great Plain found it distinctly frequent. Its population size decreased drastically in the last 25 years. Its last record from Hungary originates from 1992 collection by RIMÓCZI (1994).

Hungarian red list category: 2.

Justification: Its Hungarian population size has been decreased drastically, as well as in other parts of Europe where it has been retreating due to spreading of agriculture, and transformation and elimination of its habitats. Endangered is also because of its spectacular appearance.

Known Hungarian records: BABOS (1989): Kajdacs, Vajta, Fácánkert (*in campis arenosis*), Alsótengelic (*in robineto, populeto*), Bikács-Nagydorog (*in loco graminoso*), Bölcske (*in paludosis*), Budapest: Pestszentlőrinc (*in robineto*), Tiszakürt (*in solo arenoso*), Hajdúhadház, Pamuk, Pilis hegység: Budakalász, Izbég, Bükk: Felsőtárkány (*in prato*). BABOS (1999): Bugac (*in pasture*), Izsák (*in sandy grassland*), Lakitelek: Tőserdő, Lászlófalva, Pálmonostora (*in pasture*), Petőfiszállás: Szentkút (*in pasture*), Ballószög, Csengele, Jászszentlászló, Kecskemét: Nyír, Kecskemét: Talfája, Kecskemét: Kisfái, Kecskemét: Urrét, Kunbaracs: Baracs-puszta, Kunpeszér, Ópusztaszer, Sükösd. BABOS (1982): Hortobágy. RIMÓCZI (1994): Nagykálló (*Festucetum pseudovinae*), Bugacpuszta (*Festucetum pseudovinae*), Hortobágy: Vámostanya (*Festucetum pseudovinae*). Private collection of L. Albert: Gyál. Private collection of B. Dima: Nyírség: Bátorliget.

Geastrum hungaricum Hollós
(Phallales, Geastraceae)

Exoperidium: usually splitting into 7–8 lobes, strongly hygroscopic, outside white, inside ochracous yellow, later brown. Its diameter is 8–21 mm when wet and spread, 2–10 mm when dry. It is the smallest earthstar of the world.

Endoperidium: spherical, sessile, without stalk, brown to grey, with grains (later smooth), apical peristome surrounded by a fibrous, sharp discus. Apophysis missing. Diameter 2–6 mm.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: fresh fruit-body from August to October, on dry, salty, sandy pastures, on sand between mosses and lichens. Dried fruit-bodies might remain through several years. Characteristic continental steppe element.

Distribution, frequency: Very rare in Europe. Outside Hungary also found in Slovakia, Bohemia and Germany (Eastern Germany) (JÜLICH 1984). Outside Europe, at present only known from Mongolia (DÖRFELT 1985).

Hungarian red list category: 1.

Justification: Rare all over Europe, however, the largest populations are supposed to be in Hungary.

Known Hungarian records: BABOS (1999): Süköśd. HOLLÓS (1901, 1903): Kecskemét: Nyír (*in sand dune, amongst mosses and lichens*), Nagykőrös: Csókás, Nagy-erdő. Private collection of I. Zagyva: Bugac-Bócsa (*Festucetum vaginatae*), Nagyiván (*Festucetum pseudovinae*), Csévharaszt (*Festucetum vaginatae*).

Gomphidius roseus (Fr.) Fr.
(Boletales, Gomphidiaceae)

Cap: 3–6 cm in diameter, becoming slightly funnel-shaped, its rim involute for long; rose, reddish coloured; surface sticky when wet, shiny when dry.

Gills: loose, thick, decurrent; white when young, then grey; covered by white arachnoid fibres when young, which are breaking later.

Stem: cylindrical, tapering downwards; whitish, often rose at base; upper part fibrous when young, a dark veil-zone coloured dark by spores is observed.

Flesh: whitish, rose under the skin of cap, colour is not changing; fruit-scented, with mild taste.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: September–October, under *Pinus*, on acidic soil, often together with *Suillus bovinus*.

Distribution, frequency: Known from Europe, North America, Asia and South Africa (KRIEGLSTEINER 2000). Infrequent in Europe, scattered in mountains. Probably it follows the distribution of *Suillus bovinus*. Very rare in Hungary; life conditions are suitable for its growth only at a few sites in the country.

Hungarian red list category: 2.

Justification: Rare in Europe. It has a striking habit, and also endangered because of its extreme habitat requirements (similar to those of *Suillus bovinus*).

Known Hungarian records: ALBERT (1999): Vendvidék: Felsőszölnök (*Genisto nervatae-Pinetum*). BABOS (1989): Őrség: Farkasfa: Fekete-tó (*in silva*

mixta), Vendvidék: Szakonyfalu (*in silva mixta*), Soproni-hegység: Nagykőhalom: Kecske-patak-völgye, Zempléni-hegység: Telkibánya: Nagykerek-hegy (*in pineto mixto*), Mátra: Mohos-hegy (*sub Pinus sylvestris*). RIMÓCZI (1994): Őrség: Farkasfa: Fekete-tó (*Querco petraeae-Carpinetum transdanubicum*), Őrség: Szalafő (*Querco petraeae-Carpinetum transdanubicum*). VASAS and LOCSMÁNDI (1995): Vendvidék: Szakonyfalu. Private collection of I. Siller: Őrség: Kétvölgy. Private collection of B. Dima: Őrség: Szalafő-Pityerszer, Vendvidék: Kétvölgy.

Gomphus clavatus (Pers.) Gray
(Phallales, Gomphaceae)

Fruit-body: consists of cap-like and stem-like parts, often more fruit-bodies growing together.

Cap: 6–12 cm diameter, convex when young, later flattening, finally becoming unevenly expanded, funnel-shaped. Margin wavy-wrinkled. Its colour at first violet, later ochraceous brown with lilac tint. Surface crumpled, wrinkled, with fine, velvety touch.

Hymenium: decurrent, thick, wrinkled, veiny, often anastomosing, lilac-violet when young, then with ochraceous brown tint.

Stem: short, tapering downwards, pale lilac, whitish at base.

Flesh: white, thick, tough. Scent is not obvious or pleasant, taste mild, slightly sour.

Life-strategy: mycorrhiza (under *Fagus sylvatica*, *Abies alba*, *Picea abies*).

Occurrences in Hungary, habitats: July–August, acidic deciduous woods, pine forests.

Distribution, frequency: Very rare in Hungary, and infrequent in other parts of Europe in montane, subalpine elevations, where it grows in mixed forests. Known from North America and Asia (KRIEGLSTEINER 2000).

Hungarian red list category: 1.

Justification: Endangered because of the decline and degradation of its habitat, eutrophication of forest soils, climatic change, inappropriate forestry practices. From the 1980s its populations apparently becoming extinct from several countries of Europe (KRIEGLSTEINER 2000). The striking edible mushroom of special colour draws people's attention. Listed in the proposal for protection of fungi in European level of the European Council for Conservation of Fungi (DAHLBERG and CRONEBORG 2003).

Known Hungarian records: ALBERT (1997): Mátra: Rákhalom (*Deschampsio-Fagetum*). BP: Visegrádi-hegység: Lom-hegy (*Luzulo-Fagetum*), Zemplé-

ni-hegység: Nagybózsva: Szőlőske-hegy (*Querco petraeae-Carpinetum*), Mátra: Nagylápafő (*Luzulo-Fagetum subcarpaticum*), Vendvidék: Felsőszölnök.

Gyrodon lividus (Bull.) Fr.
(Boletales, Paxillaceae)

Cap: 6–15 cm diameter, yellow to brownish red; surface slimy when wet, skin easy to peel.

Tubular part: long decurrent; yellow when young, then greenish yellow, finally greenish brown, becoming blue when wet; difficult to separate from flesh.

Stem: cylindrical, slim, slightly tapering at base, often curved; its colour same as that of the cap, ornamented more or less with longitudinal filaments.

Flesh: soft in cap, hard, filamentous, fibrous in stem; pale yellow, soon becoming blue, then rust-brown when cut; scent and taste is acidulent.

Life-strategy: mycorrhiza (under *Alnus* spp.).

Occurrences in Hungary, habitats: July–October, in wetlands, in fen-woods, under *Alnus*.

Distribution, frequency: Found but rare all over Europe, since its habitat, the wet, seminatural alder woods are declining. So far not known outside Europe (KRIEGLSTEINER 2000).

Hungarian red list category: 2.

Justification: Its habitats are in danger, therefore the distribution of the species is also declining. The diminution and desiccation of alder woods is the main threat for the fungus. The species is edible, fleshy and very attractive; however, because of its rarity, it should not be collected; collecting for any reason should be banned.

Known Hungarian records: BABOS (1989): Balatonszemes (*sub Alnus*), Nyírád (*sub Alnus*), Gyepükaján (*sub Alnus*), Lébény, Tengelic (*sub Alnus*), Alsógöd, Ócsa (*sub Alnus*), Mátra: Fényes-puszta (*sub Alnus*), Soproni-hegység: Sopron. Rimóczi (1994): Dabas (*sub Alnus*), Bakony: Farkasgyepü, Kövesd-patak (*sub Alnus*). RIMÓCZI *et al.* (1997): Bátorliget: Ősláp. Private collection of L. Albert: Bakony: Bakonygyepes. Private collection of B. Dima: Tata, Öreg-tó (ALBERT and DIMA 2005).

Hericium erinaceus (Bull.) Pers.
(Russulales, Hericiaceae)

Fruit-body: 10–25 cm thick, whitish when young, later yellowish grey, round, oval, bulbous, most often without stem. Surface filamentous, felty.

Hymenium: densely hanging, drooping, bent, whitish-yellowish, yellowish-brownish when aged, 2–5 cm long, spiny.

Flesh: whitish, tough, slightly fibrous, scent not characteristic, taste sweetish.

Life-strategy: parasitic and lignicolous saprobiont.

Occurrences in Hungary, habitats: undisturbed beech and oak forests with high air humidity, in the cracks and cavities of living, old or dead trunks, fallen logs and stumps.

Distribution, frequency: Holarctic, collin–eumontane. Widely distributed all over Europe (KRIEGLSTEINER 2000).

Hungarian red list category: 2.

Justification: Its protection is necessary because of the diminishing of old-growth forests. Highly endangered because of the decreasing amounts of dead trees (removed from the forests for various reasons). Mostly it is gathered and damaged because of its striking fruit-body. Also, because of its curative effects there is an increasing interest for collecting.

Known Hungarian records: RIMÓCZI (1994): Bükk: Vadkert (*Melittio-Fagetum subcarpaticum*). BABOS (1999): Kecskemét. PÁL-FÁM (2001): Mecsek: Parkerdő. Private collection of I. Siller: Bükk: Vár-hegy. BP: Budai-hegység: Hűvösvölgy: Vadaskert (*ad truncum Quercus*), Mátra: Mátrafüred (*ad truncum Quercus*).

Hygrocybe calyptriformis (Berk.) Fayod
(Agaricales, Tricholomataceae)

Cap: peaky, conical, 2–3 cm high and 2 cm wide. At first rose-red, later fading.

Gills: thin, at first red, later fading.

Stem: 2–3 cm long, slightly striped, whitish.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: in summer, subalpine, poor grasslands, pastures. Very rare.

Distribution, frequency: Known from Europe, North America, Northern Asia (Japan). Very rare species! It is reported from South–Southeastern, Western, Cen-

tral, and Northern Europe. In Central Europe with montane, subalpine distribution, in Switzerland it reaches 1,800 m above sea level.

Hungarian red list category: 2 (protection category at generic level).

Justification: The species is endangered both at international and national level. It is in latent danger because of its rarity, but in acute danger because of the fertilisation of pastures and change in land use (KRIEGLSTEINER 2001)! Throughout Europe, but mainly in Denmark, England and Germany *Hygrocybe* species have a great importance in nature conservancy (KRIEGLSTEINER 2001). Habitat declining and fertilising its habitats reached such a level that this aesthetically pleasing species (*Hygrocybe calyptriformis*) requires urgent protection. Listed among the proposed species for protection in Europe (DAHLBERG and CRONEBORG 2003) by the European Council for Conservation of Fungi.

Known Hungarian records: ZAGYVA (2000): Vendvidék: Kétvölgy (*Nardo-Callunetum*). Private collection of L. Albert: Vendvidék: Kétvölgy (*Nardo-Callunetum*) (ALBERT 2000). Private collection of L. Albert and B. Dima: Vendvidék: Kétvölgy (*Nardo-Callunetum*) (ALBERT and DIMA 2005).

Hypsizygus ulmarius (Bull.) Redhead
(Agaricales, Tricholomataceae)
(*Syn.*: *Lyophyllum ulmarium* (Bull.) Kühner)

Cap: 5–25 cm, hemispherical to expanded and flattened, may be depressed or slightly umbonate in the middle; edge involuted for long; surface marbled at the beginning, later smooth, shiny; cream or ochre, occasionally with yellow tints.

Gills: dense, whitish cream, decurrent.

Stem: 6–15 × 1–3 cm, cylindrical, in groups, may be curved, may be excentric, same colour as cap, with longitudinal filaments.

Flesh: white, fibrous, thick, with pleasant scent and taste, sometimes with distinct flour-smell.

Life-strategy: necrotrophic parasitic and saprobiont.

Occurrences in Hungary, habitats: from July to October, oak–ash–elm gallery forests and seminatural beech forests, however, it also occurs in more open sites, parklands and roadsides. On standing but decaying snags, thicker stumps, trunks. Its frequent substrates: *Fagus sylvatica*, *Ulmus*, *Populus* and *Quercus* species.

Distribution, frequency: Holarctic, lowland and montane species. Known in Northern Asia, North America and Europe. In Europe it is reported from Southern and Southeastern Europe (Italy, Romania), Western Europe (France, The Nether-

lands), Central Europe (Switzerland, Liechtenstein, Austria, Hungary, Germany), Eastern Europe (Bielorussia, Russia) and Northern Europe (KRIEGLSTEINER 2001).

Hungarian red list category: 2.

Justification: Endangered because of the diminishing of old-growth forests, because of the decreasing amount of dead trees (logs) of adequate thickness, as well as for its spectacular appearance, furthermore its collection for nutrition purposes. Further problem is the strong degradation, desiccation of gallery forests, which has contributed to the Elm disease throughout Europe, and also brought the lack of a common substrate of this species.

Known Hungarian records: BABOS (1989): Budapest: botanical garden of the Eötvös Loránd University (*Ulmus*). PÁL-FÁM and LUKÁCS (2002): Mecsek: Koszonya-tető (*Asperulo taurinae-Carpinetum*), Mecsek: Dömörkapu (*Asperulo taurinae-Carpinetum*), Börzsöny: Csóványos (*Fagetum*). SILLER (2004): Bükk: Őserdő (*Aconito-Fagetum*). LUKÁCS (2004 as *Lyophyllum ulmarium*): Zempléni-hegység: Jégbarlang, Budapest: Városliget.

Lactarius helvus (Fr.) Fr.
(Russulales, Russulaceae)

Cap: 4–15 cm in diameter, convex when young, later flattened, depressed in the middle, often becoming infundibuliform with time; yellowish red, flesh-red-ochraceous, leather-yellow when young, surface felty-fibrillous, dull, without zones.

Gills: slightly decurrent; yellowish white, later becoming reddish ochraceous.

Stem: 5–15 cm long, 1–3 cm thick, paler than cap, surface pubescent-pruinose, white fibrous or yellowish woolly at base.

Flesh: rigid, fragile, cream-yellow or pale reddish ochraceous, milk like water, not hot. Scent reminiscent of a Maggi spice (coumarin), becoming very intensive when dry.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: from August to October, mostly in wet forests with *Sphagnum* species, peat bogs, occasionally in acidic mixed forests with *Betula* or *Pinus*.

Distribution, frequency: montane species of northern distribution. In European high mountains (west or south); very rare in Hungary which is, the southern border of its distribution. Found also in North America, Northern Asia (Siberia) (KRIEGLSTEINER 2000).

Hungarian red list category: 1.

Justification: Its habitats, "acidic forests" with *Sphagnum*, have been depleting for various reasons: improper forest management and timber-extraction, decrease of water level and eutrophication of the peat bogs.

Known Hungarian records: BABOS (1989): Csaroda (*in sphagneto*), Csömör (*in sphagneto*), Törökbálint (*in silva mixta*), Szalafő (*in piceeto*), Kelemér: Mohos (*in sphagneto*). RIMÓCZI (1994): Kelemér (*Luzulo-Quercetum subcarpaticum*). Private collection of L. Albert and B. Dima: Mátra: Sirok: Nyírjes-tó (sub *Betula pubescens*).

Leccinum variicolor Watling
(Boletales, Boletaceae)

Cap: 5–10 cm in diameter, convex, greyish brown, mouse grey or near to blackish brown, covered by paler (whitish, ochraceous) patches. Surface uneven, felty. Margin involuted for long and most often paler.

Hymenium: whitish, cream, flesh brown when old. Its pores also whitish when young, then soon become dirty white, with ochraceous patches when pressed or old.

Stem: slim, slender, but thick enough, therefore seems to be robust. Surface pale grey, ornamented with tobacco grey scales. It takes a striking bluish grey colour.

Flesh: white, in cap soon becoming pink on cutting, in lower part of stem turning bluish green in spots. Scent, taste not too characteristic.

Life-strategy: mycorrhiza (with various species of *Betula*).

Occurrences in Hungary, habitats: September–October, in wet peat bogs, under *Betula* at the edge of fen woods.

Distribution, frequency: Recorded from North America, the Far East and Europe. Rather frequent in Northern Europe, rarer towards south and limited to peat bogs (KRIEGLSTEINER 2000).

Hungarian red list category: 2.

Justification: Endangered because of the global drying out of wetlands (KRIEGLSTEINER 2000). Similarly to other *Leccinum* species, it is edible (and thus collected).

Known Hungarian records: BABOS (1989): Őrség: Szalafő (*in silva mixta*), Bakony: Öcs, (*in sphagneto*), Uzsabánya, Kelemér: Nagy-Mohos (*in sphagneto*). RIMÓCZI (1994): Farkasfa: Fekete-tó (*in silva mixta*). VASAS and LOCSMÁNDI (1995): Farkasfa: Fekete-tó. ALBERT *et al.* (2004): Bakony: Öcs: Nagy-tó,

Kelemér: Kis-Mohos. Private collection of L. Albert: Őrség: Szalafő. Private collection of L. Albert and B. Dima: Mátra: Sirok, Nyírjes-tó.

Leucopaxillus macrocephalus (Schulzer) Bohus
(Agaricales, Tricholomataceae)

Cap: 10–20 cm in diameter, ochre, ochraceous brown; surface slightly pubescent, margin strongly involuted when young, filamentous, felty, later becoming crenulate.

Gills: decurrent with small tooth; whitish when young, then creamy, finally yellow, often with rusty patches.

Stem: thick, flattered, beet-like at base, radicant, often in groups; white when young, later somewhat paler than cap, surface hairy, filamentous.

Flesh: thick; whitish, in upper part of stem characteristic marbled; scent is reminiscent of corn-silk, taste slightly bitter.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: May–November, in oakwoods on roots of *Quercus* in singles or in groups. Mainly in warm, slightly open, seminatural oakwoods (BOHUS 1966).

Distribution, frequency: rare all over Europe, distributed in Southern and Central Europe. Occurs only in a few countries, Hungary, Italy, Slovenia, Austria (Steiermark) (MOSER 1983). In Hungary it is regarded relatively frequent (BABOS 1989), however, it appears to be in decline.

Hungarian red list category: 3.

Justification: The seminatural old-growth oak woods are becoming increasingly rare which poses danger for the survival of this species. Formerly known as being frequent (BABOS 1989), the past 20 years show a decline in Hungary. This large-size, spectacular macrofungus, (so far the biggest specimen was measured 1.75 kg) makes people tempted to collect it.

Known Hungarian records: BABOS (1989): Kópháza (*ad truncum vivum*), Csapod, Horpácsi-erdő (*in querceto*), Őrség: Szalafő (*in silva mixta*), Kőszegi-hegység: Gencsapáti, Pamuk (*immedate pr. truncum Quercus*), Mecsek: Pécs, Vértes: Bikol-puszta (*in querceto*), Csókakő: Bakony: Farkasgyepü (*Quercus* root), Bia (*in vicinitate Quercus*), Üröm (*in querceto*), Kamaraerdő, Törökbálint (*in silva mixta, cum Quercus*), Gödöllő: Tölgyes (*in querceto arenoso*), Börzsöny: Borbély-hegy, Esztergom, Barát-kút (*in silva frondosa*), Százhalombatta. RIMÓCZI (1994): Bakony: Farkasgyepü (*Querco petraeae-Carpinetum transdanubicum*), Soproni-hegység (*Querco petraeae-Carpinetum laitaicum*).

Phylloporus pelletieri (Lév.) Quél.
(Boletales, Boletaceae)
(Syn: *Phylloporus rhodoxanthus* (Schw.) Bres., *Paxillus paradoxus* (Kalchbr.) Cleland, *Xerocomus pelletieri* (Lév.) Bind.)

Cap: convex, then flattened, later flat, 3–8 cm in diameter, reddish, chestnut or dark brown. Surface velvety, becoming naked with age.

Gills: adnexed or slightly decurrent, golden yellow, anastomosing at stem, or rather cross-bars may be observed.

Stem: long, cylindrical, tapering at base, yellowish brown, surface pubescent, filamentous.

Flesh: yellow, ochraceous yellow, no colouration, taste mild, without considerable scent.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: June–October in acidic deciduous forests, mainly along paths, among scattered shrubs. Fruit-bodies not abundant, generally occur in singles.

Distribution, frequency: Widely distributed in America, in Europe distributed but missing from the northern region, also known from Asia. Not frequent, in some countries distinctly rare (KRIEGLSTEINER 2000).

Hungarian red list category: 2.

Justification: This species produces just a few fruit-bodies; it is endangered because its habitats are becoming more and more limited and degraded.

Known Hungarian records: BABOS (1989): Pamuk, Soproni-hegység: Sopron, Budai-hegység: Vastag-tanya, Budakeszi (*Luzulo-Quercetum*), Gödöllő: Tölgyes, Tarnalelesz, Bükk, Zempléni-hegység. RIMÓCZI (1994): Uzsapuszta (*Querco petraeae-Carpinetum pannonicum*), Tarnalelesz (*Melliti-Fagetum subcarpaticum*), Tarnalelesz (*Querco petraeae-Carpinetum pannonicum*). TÓTH (1999): Heves–Borsodi-dombság: Gyepes-völgy (*Melittio-* and *Aconito-Fagetum*). LUKÁCS *et al.* (2001): Őrség: Csöde (*Querco petraeae-Carpinetum*). Private collection of F. Pál-Fám: Börzsöny: (*Luzulo-Fagetum*). *BP: Tapolcai-medence: Szent György-hegy (in castaneeto*). Private collection of B. Dima: Tarnalelesz.

Polyporus tuberaster (Jacq.) Fr.
(Polyporales, Polyporaceae)
(Syn: *Polyporus forquignoni* Quél., *Polyporus lentus* Berk.)

Cap: 5–25 cm in diameter, flattened, round or kidney-shaped, may be funnel-shaped in the middle; surface scaled in circles, scales flattened onto surface, erect towards cap-margin; colour yellow to ochraceous brown with darker scales.

Hymenium: pored, slightly decurrent, colour pale yellow to yellowish brown.

Stem: most often central, seldom lateral, cylindrical, creamy, surface felty.

Flesh: soft, thick, whitish, of mushroom smell and taste.

Life-strategy: xylophagous, saprobiont (mainly on *Fagus*, *Quercus* spp. substrates)

Occurrences in Hungary, habitats: consists of 3 ecotypes: May–October, mostly on stumps or on branches near above soil, sometimes joined to wood in the soil with thick rhizomorph-like mycelium. Less frequently in Hungary (only 2 records) it develops from a large black sclerotium ("gombakő") lying deep in the soil. Occurs in protected, warm and well-lit forests, mainly in gallery forests, in *Querco-Carpinetum* mixed beech woods, in wet and nutrient-rich soil. Avoids closed forest.

Distribution, frequency: all over in Europe, Asia and North America. In Central Europe mostly on *Fagus*, and *Quercus*, however, production of sclerotium is not known in all sites. Sclerotium-production requires appropriate climatic and exogenic factors, since this is a thermofrequent species. In Mediterranean areas these conditions are more widely available than in oceanic, continental or cold climates.

Hungarian red list category: 3.

Justification: Endangered because of the lack of adequate amounts and quality of dead wood in consequence of present-day forest management, and because of the excellent qualities of this edible, rare species.

Known Hungarian records: VASAS and ALBERT (1987): Budai-hegység: Normafa (*ad truncum putr.*: *Fagus*), Vérteskozma, Zselicség (*ad truncum putr.*), Bükk: Létrás (*ad truncum putr.*), Bükk: Nagy-kerek-hegy (*ad truncum putr.*), Csapod: Horpácsi-erdő, Aggteleki-karszt: Trizs, Aggteleki-karszt: Rozsnyi-útibérc (*ad truncum putr.*), Zempléni-hegység: Makkoshotyka (*ad truncum putr.*), Bakony: Csesznek (*in fageto ad truncum putr.*), Gerecse: Tarján (*ad truncum putr.*). BP: Bakony: Zirc (*ad truncum putr.*), Aggteleki-karszt: Jósvafő, Tohonya-bérc (*ad truncum putr.*). Private collection of F. Pál-Fám: Bakony: Som-hegy (*Daphno laureolae-Fagetum*), Veszprém, Budapest: Kamara-erdő (*in Quercetum*). FODOR *et al.* (2001): Szigetköz: Derék-erdő (*Piptathero virescenti-*

Quercetum roboris). Private collection of F. Pál-Fám and L. Benedek: Börzsöny: Királyrét (*Luzulo-Fagetum*), Börzsöny: Királyrét (*Carici pilosae-Carpinetum*). SILLER (2004): Bükk: Őserdő (*Aconito-Fagetum*). Private collection of B. Dima: Budai-hegység: Nagykovácsi.

Polyporus umbellatus (Pers.) Fr.
(Polyporales, Polyporaceae)
(Syn.: *Dendropolyporus umbellatus* (Pers.) Jülich, *Grifola umbellata* (Pers.) Pilát)

Fruit-body: a group of fruit-bodies is formed. A specimen might be as high as 20–50 cm and might reach several kilograms in weight. After several branching of a common basis several hundreds (thousands) small cap is developing. The basis usually attached to a stump and continued in a blackish brown sclerotium in the soil.

Cap: each little cap is 1–4 cm wide, yellowish brown, greyish brown, round.

Hymenium: decurrent, built up of white tubes. Pores at first round, later multiangular (polygonal), tiny.

Flesh: white, fragile, with a pleasant flour-scent.

Life-strategy: causing white rot, parasitic and saprobiont.

Occurrences in Hungary, habitats: July–October, on stumps, roots of deciduous trees (most frequently *Quercus*, then *Acer*, *Carpinus*, *Fagus*, *Populus*), on strongly decayed wood. Seldom on coniferous trees (*Picea*, *Pinus*).

Distribution, frequency: Scattered in the Holarctic, temperate regions, but seldom found in deciduous forests (in regions of the oak-beech stands). Known from Asia, North America and Europe. In Europe it seems to be suboceanic, Central European. Very rare in Southern Europe (KRIEGLSTEINER 2000). Infrequent in all places recorded. It avoids the coniferous plantations and the managed, over-exploited forests. Hungarian records are underrepresented, the species is by all means very rare!

Hungarian red list category: 3.

Justification: Highly endangered species because of the depleting seminatural or old-growth forests, elimination of dead wood, and also because of its excellent qualities as an edible macrofungus.

Known Hungarian records: ALBERT (2002a): Mátra: Parádsasvár (*Luzulo-Fagetum*). Private collection of F. Pál-Fám: Dombóvár. BP: Budai-hegység: Nagykovácsi, Budai-hegység: Zsíros-hegy, Visegrádi-hegység: Lajosforrás, Soproni-hegység: Ágfalva (*ad truncum*), Zala megye: Dobron-hegy (*in fageto, ad*

terram), Bak (*in silva*), Vendvidék: Szakonyfalu, Soproni-hegység: Felső-Tödl (*ad truncum*), Mátra: Mátraszentimre.

Pseudoboletus parasiticus (Bull.) Šutara
(Boletales, Boletaceae)
(Syn.: *Xerocomus parasiticus* (Bull.) Quél.)

Cap: 2–5 cm diameter, yellow olivaceous brown; surface finely felty.

Tubular part: attached to the stem, with relatively wide pores; lemon yellow when young, later greenish yellow, finally greenish brown.

Stem: cylindrical, slightly tapering at the end, often curved; yellowish, surface granulose.

Flesh: hard when young, but soon becoming soft, whitish, cream-yellow, colour not changing when cut; no typical scent, taste is slightly sour (acidulent).

Life-strategy: earlier regarded as parasitic, recently considered rather a common association of mycorrhiza.

Occurrences in Hungary, habitats: August–October, grows on common earthball (*Scleroderma citrinum*) in highly acidic deciduous forest, therefore it is regarded as an indicator species of acidic soils.

Distribution, frequency: found all over Europe, but rare in its entire European range (KRIEGLSTEINER 2000). According to SINGER (1965) it occurs also in North America and Northern Africa.

Hungarian red list category: 3.

Justification: The highly acidic forests are scarce in our country, therefore the host species is also infrequent in Hungary. The species proposed for protection because its highly restricted habitats.

Known Hungarian records: BABOS (1989): Sopron: inter Rigó-forrás et Kecske-patak (*ad Scleroderma citrinum*), Baláta-tó, Mátra: Parádóhuta, Mohos-hegy. RIMÓCZI (1994): Uzsapuszta (*ad Scleroderma citrinum*), Soproni-hegység (*ad Scleroderma citrinum*).

Rhodotus palmatus (Bull.) Maire
(Agaricales, Tricholomataceae)

Cap: 3–7 cm in diameter, pink when young, later orange-rose, apricot-coloured, surface slightly pruinose, later marbled with a network pattern of wrinkles. Translucent because of a gelatinous layer under the skin.

Gills: free, decurrent, at first whitish, then orange-red.

Stem: central or excentric, colour similar or slightly paler than that of cap.

Flesh: in cap faint rose, in stem yellowish, yellowish-reddish. Substance (texture) characteristic rubbery. Scent fruit-like, taste bitter.

Life-strategy: lignicolous saprobiont.

Occurrences in Hungary, habitats: on dead deciduous tree trunks, branches. In groups, sometimes in dense clumps. Mainly in oak–ash–elm gallery forests in the milder areas (in lowland to hilly (collin) regions) on *Ulmus*, but also in rather wet beech forests on *Fagus*.

Distribution, frequency: Holarctic species, from Northern Asia to Europe, known also from North America (KRIEGLSTEINER 2001).

Hungarian red list category: 2.

Justification: The survival of this species is questioned because of the improper forest management practices, e.g. the clearing of dead wood. Beside its rarity, it has special ecological requirements (wet, decaying dead wood).

Known Hungarian records: BABOS (1989, 1999): Vaskút. SILLER (1999): Mátra: Kékes (*Aconito-Fagetum*). Private collection of I. Siller: Gemenc.

Russula claroflava Grove
(Russulales, Russulaceae)
(Syn.: *Russula flava* Romell)

Cap: 4–10 cm in diameter, at the beginning convex, then flattening, often depressed in the middle; unicoloured, golden yellow or rich yellowish orange, surface non-reflecting, dull.

Gills: decurrent; white when young, later ochraceous yellow, becoming greyish if cut or when old.

Stem: 3–6 cm long, 1–2 cm thick, of even thickness; white at first, then ochraceous, finally becoming grey.

Flesh: whitish, becoming grey, then black at the end if pressed, cut or old. Without characteristic scent, it taste is not hot.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: August–October, in acidic deciduous forests and *Sphagnum*-bogs.

Distribution, frequency: Holarctic, northern species. Known from North America, Northern Asia and Europe. In Europe very rare in Southern and Central Europe (KRIEGLSTEINER 2000).

Hungarian red list category: 3.

Justification: Edible species with striking habit. Endangered because of its habitats (peat bogs) are rare and limited, as well as the forestry management causes the diminishing of its habitats (highly acidic deciduous forests). The special ecological requirements (acido- and hygrophilous, calci- and nitrophobe species) strongly limit its survival (KRIEGLSTEINER 2000).

Known Hungarian records: VASAS *et al.* (1991): Kelemér: Kis-Mohos (*in sphagneto, sub Betula*), Barcs: "Ősborókás" (*sub Betula*). RIMÓCZI (1994): Salgóvár-hegy (*Querco petraeae-Carpinetum pannonicum*).

Sarcodon scabrosus (Fr.) P. Karst.
(Thelephorales, Bankeraceae)

Cap: 5–15–(20) cm, convex to flattening, middle part may be depressed; pale brown, greyish brown, chestnut brown, surface smooth, naked when young, later splitting into tiny, erect scales, spikes.

Hymenium: spiky, grey, then purple brown, with 0.3–0.5 cm long spikes.

Stem: 3–9 × 1–3 cm, cylindrical or thickening downwards, with elongated fibres and scales, rose-brown then dark brown, with bluish green tints at the base.

Flesh: soft, thick, white, blue-green at base, scent of flour, bitter.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: June–October, in acidic deciduous and coniferous forests.

Distribution, frequency: Rare, scattered throughout in entire Europe; also known from Asia and North America. In deciduous forests under *Fagus*, *Quercus* and *Castanea*, but in Scandinavia also under *Pinus*. In Europe it is found from Northern Italy through Croatia to Hungary and Bohemia, but also known from Austria, Switzerland, Germany, The Netherlands, England, the Scandinavian countries and Russia (KRIEGLSTEINER 2000).

Hungarian red list category: 2.

Justification: A declining species all over Europe, it is extinct in Germany since 1975, registered only at 2 spots recently (KRIEGLSTEINER 2000). All species of the genus are endangered because of air pollution and eutrophication in forests (VESTERHOLT *et al.* 2000). Its decline in Hungary shows in the small and decreasing size of its population. It would be important to preserve its still existing localities by leaving them intact.

Known Hungarian records: PÁL-FÁM (2001): Mecsek: Vasas (*Sorbo torminalis-Fagetum*). LUKÁCS *et al.* (2001): Vendvidék: Kétvölgy (*Vaccinio-Pinetum*, *Vaccinio-Piceetum* or *Vaccinio-Fagetum*). BP: Vendvidék: Szakonyfalu

(*Luzulo-Fagetum* and *Pino-Quercetum*). Private collection of I. Siller: Mátra: Vár-hegy (*Luzulo-Fagetum*). ALBERT and DIMA (2005): Mátra: Parádsasvár, Somhegy, Parádóhuta (*Luzulo-Fagetum*).

Scutiger oregonensis Murrill
(Polyporales, Albatrellaceae)
(Syn.: *Albatrellus pes-caprae* (Pers.) Pouzar, *Scutiger pes-caprae* (Pers.) Bond. et Singer)

Cap: 8–10 cm diameter irregular, lobate, convex, finely squamulose, reddish brown, blackish brown.

Pores: cream or yellowish, irregularly angular or round, decurrent.

Stem: often lateral, cylindrical and may be bulbous at base, surface finely squamulose, yellowish, orange-brownish.

Flesh: thick, fragile, soft, white. Scent pleasant, taste likes that of hazelnut.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: July–October, in singles or in small clusters in acidic, wet *Fagus*, *Abies* and *Picea* forests.

Distribution, frequency: rare submontane species all over Europe. Found also in Australia, East Asia and North America. In Europe from Mediterranean region through Central and Southern Europe it reaches Germany, The Netherlands and Denmark in the north. Missing from the European Atlantic states (western parts of France, Great Britain, Ireland, the Scandinavian countries, Finland, the Baltic States, Bielorussia, Ukraine). Rare in lowlands, scattered in hilly and montane areas, frequent in some places of the Alps and the Pyrenees and also found above 1,100 m (KRIEGLSTEINER 2000).

Hungarian red list category: 2.

Justification: Populations of *Scutiger* species are strongly declining all over Europe or totally extinct from numerous places. Threats are eutrophication, desiccation of soils and changes in forest management (KRIEGLSTEINER 2000). Its excellent qualities (edible) also make it closer to extinction.

Known Hungarian records: IGMÁNDY (1981): Bakony: Farkasgyepű, Mátra: Parádsasvár, Soproni-hegység, Vendvidék: Szakonyfalu, Zempléni-hegység: Telkibánya. PÁL-FÁM and LUKÁCS (2002): Mecsek: Mohosi-Kiskút (*Sorbo torminalis-Fagetum*). LUKÁCS (2002): Visegrádi-hegység: Tahi, Zempléni-hegység: Kőkapu, Vendvidék: Felsőszölnök. BP: Bakony: Farkasgyepü, Kövesd-patak (*Luzulo-Fagetum*), Mátra: Nagylápafő (*Luzulo-Fagetum subcarp. myrtilletosum*), Mátra: Mohos-hegy (*Deschampsio flexuosae-Fagetum subcarp. luzuletosum*),

Soproni-hegység, Vendvidék: Szakonyfalu (*Luzulo-Fagetum*), Zempléni-hegység: Nagykerek-hegy (*Luzulo-Quercetum subcarp. fagetosum*).

Squamanita schreieri Imbach
(Agaricales, Tricholomataceae)

Cap: 5–10 cm diameter, convex, later flattened, umbonate, colour ochraceous yellow, golden yellow, covered by numerous tiny, partly relinquishing scales.

Gills: white, decurrent with tooth.

Stem: colour similar with that of the cap, surface squamulose, strongly thickened like beet with white tuberculated, bulbous end, covered by yellow brown, brown floccose scales at the upper edge of the bulb.

Flesh: white, thick, scent pleasant, but not characteristic. Taste mild, hazelnut-like.

Life-strategy: mycoparasitic on various species of Agaricales (*Cystoderma, Galerina, Hebeloma sacchariolens*) according to recent studies (REDHEAD *et al.* 1994).

Occurrences in Hungary, habitats: June–October, on sand in catchment area forests, in groups or in smaller clusters. In Hungary found in oak wood and near *Pinus* trees.

Distribution, frequency: Known from Europe and Northern America, but very rare. A few European records show it from Italy, France, Switzerland, Germany (KRIEGLSTEINER 2001).

Hungarian red list category: 1.

Justification: Endangered in Europe and in Hungary as being close to extinction because of its special life-strategy (mycoparasite).

Known Hungarian records: BABOS (1989): Budai-hegység: Szépvölgy (*ad marginem pineti culti*). RIMÓCZI *et al.* (1997): Bátorliget: Ősláp. BP: Budai-hegység: Hármashatár-hegy (*in querceto*).

Strobilomyces strobilaceus (Scop.) Berk.
(Boletales, Boletaceae)

Fruit-body: with woolly scales, greyish black, black.

Hymenium: tubular, in the beginning pale grey, becoming brown, black with age or when pressed.

Stem: slender, woolly, pubescent, blackish.

Flesh: at first rose, then violet-black. Scent, taste not characteristic.

Life-strategy: mycorrhiza.

Occurrences in Hungary, habitats: June–October, in beech woods of acidic soil, in oak woods, in hornbeam-oak mixed forests. It prefers middle aged or old-growth forests, never found in plantations. It partners in mycorrhiza first of all *Fagus sylvatica*, then *Quercus* and *Pinus* species.

Distribution, frequency: found in the entire area of Europe, North and South America, Northern Africa, and Asia (KRIEGLSTEINER 2000).

Hungarian red list category: 3.

Justification: Endangered because of the depletion of the seminatural beech and oak woods with acidic soil and also for being an excellent edible species.

Known Hungarian records: BABOS (1989): Zempléni-hegység: Rostalló, Laczkó-hegy (*in fageto*), Visegrádi-hegység: Nyalkabérc: Gizella-telep (*in fageto*), Budai-hegység: Tök-hegy, Nagy-Szénás, Mátra: Vár-hegy, Mátrakeresztes, Mátraszentimre, Cseplye-völgy (*in querceto*), Szeleta, Őrség: Szalafő (*in silva mixta*). RIMÓCZI (1994): Erdőbénye, Szombathely, Tarnalelesz, Budakeszi, Bakony: Bakonygyepes. VASAS and LOCSMÁNDI (1995): Őrség: Szalafő (*in silva mixta*). Private collection of I. Siller: Őrség: Farkasfa: Fekete-tó. TÓTH (1999): Heves–Borsodi-dombság: Gyepes-völgy. Private collection of B. Dima: Bükk: Bükkszentlászló (*Luzulo-Fagetum*).

Tulostoma volvulatum I. G. Borshch.
(Agaricales, Tulostomataceae)

Fruit-body: consists of a spherical cap-like part a slim stem. The cap part is of 1–5 cm in diameter. Its outer cover is membranaceous, whitish, creamy, peeling with time, but the lower part often holding grains of sand, might remain. The inner cover (veil) is thin like paper, with age a more or less round, relatively large (2 mm) hole is opening on its top. The stem is fibrous, dense at first, later becoming tubular. Surface smooth at first, then becoming partly squamulose. At base a hard, often sand covered, pale ochraceous volva remains from the outer veil.

Hymenium: found inside the spherical cap-like part.

Flesh: in the cap part at first whitish, soft, then developing into a brownish powder, in the stem fibrous-filamentous.

Life-strategy: saprobiont.

Occurrences in Hungary, habitats: more or less during the whole year, on dry, sunny, sandy areas, sand steppes, among grass or on bare soil.

Distribution, frequency: In Europe only found in Hungary. Described from Middle Asia, Desert Kara-Kum. In India it is abundant on sandy, cultivated soils during the monsoon. Observed also in Northern Africa, as well as on the Central Asian steppes (JÜLICH 1984).

Hungarian red list category: 1.

Justification: In Europe only found, infrequently, in Hungary. Being a sandy steppe species, the increasing afforestation of sandy areas greatly limits its potential habitats.

Known Hungarian records: BABOS (1999): Bugac: Ősborókás, Csévharaszt (*in Junipero-Populetum*), Kéleshalom (*in Festucetum vaginatae stip.*). HOLLÓS (1903): Szikra-Alpár. KONECSNI (1971): Fülöpháza (*in Festucetum vaginatae stip.*).

Volvariella bombycina (Schaeff.) Singer
(Agaricales, Pluteaceae)

Cap: 8–20 cm in diameter, convex, then flattening, silver-whitish, silky, surface filamentous-pubescent (shaggy), ochraceous in the middle. Margin often ornamented with the remains of the veil.

Gills: white at first, later pink, free-standing.

Stem: silky, white, slightly yellowish and thickening downwards, easy to separate from cap. Base covered by a well-developed volva, which may be patchy outside with yellowish brown.

Flesh: white, fragile, with radish-scent, taste is pleasant.

Life-strategy: lignicolous saprobiont and parasitic.

Occurrences in Hungary, habitats: May–October, usually one by one (in singles), on living or decaying trunks, roots. According to KRIEGLSTEINER (2003) it is a thermophilous species occurring mostly in gallery forests, but also in man-made habitats (parks, cemeteries, riversides, etc.).

Distribution, frequency: Holarctic species known from Europe, Asia, North and South America, Southern Africa and Australia. In Europe it is distributed (scattered) in Southern and Central Europe (KRIEGLSTEINER 2003).

Hungarian red list category: 3.

Justification: Edible species of striking appearance, apparently endangered because of cutting down and clearing the forests with dead and old trees.

Known Hungarian records: BABOS (1989): Budapest, Pasaréti út, Németvölgyi út (*ad truncum putr.*), Budai-hegység: Sas-hegy (*ad truncum*), Budakeszi (*in acervo scobis*), Szárliget (*in acervo scobis*), Bakony: Bakonyszentlászló (*in*

acervo scobis), Szekszárd (*ad truncum Quercuum*), Martonvásár (*ad truncum putr.*), Sátor-hegység: Laczkó-hegy (*in Luzulo-Quercetum subcarp. fagetosum, ad trunc.*), Gödöllő (*ad linga putr.*), Börzsöny: Borsosberény (*ad truncum*), Mátra: Mátraháza: Som-hegy, Bükk: Pazsag (*ad truncum putr.*). HOLLÓS (1896, 1913): Lakitelek. RIMÓCZI (1994): Bakony: Kőris-hegy (*Phyllitidi-Aceretum*), Nyírkáta, Somoskő: Eresztvény (*Melittio-Fagetum*). PÁL-FÁM (2001): Pécs. SILLER (1999): Mátra: Kékes (*Aconito-Fagetum*). Private collection of I. Siller: Gödöllő.

CONCLUSIONS AND EPILOGUE

The 35 species of macrofungi gained legal protection in Hungary on 1 September 2005. In reality a greater number of species would deserve protection, however, we intended to provide sufficient information and justification and create a legal status for the most important ones. We do hope that following the initial steps a greater understanding of the importance of the macrofungi in the country's natural environment will lead to a greater level of protection. Hopefully, several other species may be gradually added in the future to the present list of macrofungi.

* * *

Acknowledgement – The authors are grateful for László Albert, Bálint Dima and Zoltán Lukács for placing their herbarium specimens at our disposal. One of the authors (Zoltán Bratek) expresses gratitude to the Research Grant Bolyai János for its support.

REFERENCES

ALBERT, L. (1997): Színes oldalak: Gomphus clavatus (Pers.) S. F. Gray. – *Mikol. Közlem. (Clusiana)* **36**(2–3): 59–64.

ALBERT, L. (1999): Színes oldalak: Gomphidius roseus (Fr.) Karst. – *Mikol. Közlem. (Clusiana)* **38**(1–3): 81–82.

ALBERT, L. (2000): Színes oldalak: Hygrocybe calyptriformis (Berk. et Br.) Fay. – *Mikol. Közl. (Clusiana)* **39**(1–2): 105–106.

ALBERT, L. (2002a): Színes oldalak: Polyporus umbellatus Pers.: Fr. – *Mikol. Közlem. (Clusiana)* **41**(1): 97–98.

ALBERT, L. (2002b): Színes oldalak: Amanita vittadinii (Moretti) Vittadini. – *Mikol. Közlem. (Clusiana)* **41**(2–3): 141–142.

ALBERT, L. (2003): Színes oldalak: Cortinarius paracephalixus Bohus. – *Mikol. Közlem. (Clusiana)* **42**(3): 61–62.

ALBERT, L. and DIMA, B. (2005): Ritka nagygombafajok (Basidiomycetes) előfordulása Magyarországon I. – *Mikol. Közlem. (Clusiana)* (in press)

ALBERT, L., ZÖLD-BALOGH, Á., BABOS, M. and BRATEK Z. (2004): A Kárpát-medence úszólápjainak jellemző kalapos gombái. – *Mikol. Közl. (Clusiana)* **43**(1–3): 61–74.

ARNOLDS, E. (1989): A preliminary red data list of macrofungi in the Netherlands. – *Persoonia* **14**: 77–125.

ARNOLDS, E. (1991): Decline of ectomycorrhizal fungi in Europe. – *Agriculture Ecosystems and Environment* **29**: 77–125.

BABOS, M. (1982): *Higher fungi of the Hortobágy.* – In: The flora of the Hortobágy National Park. – Akadémiai Kiadó, Budapest. pp. 63–90.

BABOS, M. (1989): Magyarország kalaposgombáinak (Agaricales s. l.) jegyzéke. – *Mikol. Közlem. (Clusiana)* **1–3:** 3–234.

BABOS, M. (1999): *Higher fungi (Basidiomycotina) of the Kiskunság National Park and its environs.* – In: The flora of the Kiskunság National Park. Vol. 2. Cryptogams. – Magyar Természettudományi Múzeum, Budapest, pp. 199–298.

BAS, C. (1978): Veranderingen in de Nederlandse paddestoelenflora. – *Coolia* **21**: 98–104.

BOHUS, G. (1966): Leucopaxillus-Arten in Ungarn. – *Fragmenta Botanica* **6**(1–4): 33–42.

BOHUS, G. (1976): Interessantere Cortinarius-Arten aus dem Karpaten-Becken, II. – *Annls hist.-nat. Mus. natn. Hung.* **68**: 51–52.

BŐSZE, SZ. and FODOR, L. (2005): A nagygombák védelmének helyzete az Európai Unió országaiban. – *Mikol. Közlem. (Clusiana)* (in press)

BRATEK, Z., KIRÁLY, I. and LÁNG, F. (1992): R-spectra of some hypogeous mushrooms. – *Micologia e Vegetazione Mediterranea* **7**(1): 95–102.

BRATEK, Z., ALBERT, L., BAGI, I., PÁLFY, B., TAKÁCS, T., RUDNÓY, SZ. and HALÁSZ, K. (1999): *New and rare hypogeous fungi of Carpathian basin.* – Actes du Ve Congrès International, Science et Culture de la Truffe et des autres Champignons Hypoges Comestibles. 4 au 6 mars 1999, Aix-en-Provence, France, Federation Française des Trufficulteurs, pp. 255–256.

BREITENBACH, J. and KRÄNZLIN, F. (2000): *Fungi of Switzerland.* Vol. 5. – Mykologia, Luzern.

COURTECUISSE, R. (1992): Les listes rouges de champignons. – *Bull. Soc. Mycol. Du Nord* **52**: 3–10.

DAHLBERG, A. and CRONEBORG, H. (2003): *33 threathened fungi in Europe.* – Complementary and revised information on candidates for listing in Appendix I of the Bern Convention. Tryckjouren/Uppsala AB.

DÖRFELT, H. (1985): *Die Erdsterne.* – Die Neue Brehm-Bücherei, Ziemsen Verlag, Wittenberg/Lutherstadt.

FODOR L., PÁL-FÁM, F. and RIMÓCZI, I. (2001): Adatok a Szigetköz nagygombáinak ismeretéhez. – *Mikol. Közlem. (Clusiana)* **40**(3): 47–58.

GALLI, R. (2001): *Le Amanite.* – Edinatura, Milano.

HERMANN, M. and KUTHAN, J. (1981): Zur Problematik des Naturschutzes Höherer Pilze. – *Mykol. Mitt.-Bl.* **25**: 8–13.

HOLLÓS, L. (1901): Adatok Magyarország földalatti gombáinak ismeretéhez. – *Term.tud. Közl.* **33** (Pótfüz. 61): 136–139.

HOLLÓS, L. (1903): *Magyarország Gasteromycetái.* – Franklin Társulat, Budapest, 194 pp.

HOLLÓS, L. (1911): *Magyarország földalatti gombái, szarvasgombaféléi.* – K. M. Természettudományi Társulat, Budapest, pp. 49–51.

HOLLÓS, L. (1913): Kecskemét vidékének gombái. – *Math. Term.tud. Közl.* **32**(3): 149–325.

HOLLÓS, L. (1933): Szekszárd vidékének gombái. – *Math. Term.tud. Közl.* **37**(2): 1–205.

HOLLÓS, L. (1896): *Növényzet.* – In: BAGI, L. *et al.* (eds): Kecskemét múltja és jelene. Kecskemét, pp. 77–147.

IGMÁNDY, Z. (1981): *Hazánk csövestaplói (Polyporaceae s. l.).* – Doktori értekezés (manuscript).

IVÁNCSIK, I. (1994): *Adatok Újszász környékének gombavilágáról.* – Tisza Klub, Szolnok, 20 pp.

JÜLICH, W. (1984): *Die Nichtblätterpilze*, Gallertpilze und Bauchpilze. – Kleine Kryptogamenflora II b/1., G. Fischer Verlag, Stuttgart, 626 pp.

KIRK, P. (ed.). (2001): The CABI Bioscience Database of Fungal Names (Funindex). http://www.indexfungorum.org /Names/Names.asp.

KONECSNI, I. (1971): Adatok a csévharaszti természetvédelmi terület és a közeli tölgyerdők kalaposgombához. – *Mikol. Közlem. (Clusiana)* **(1)**: 13–28.

KRIEGLSTEINER, G. J. (2000–2003): *Die Grosspilze Baden-Württembergs*. Band 1–4. – Ulmer Verlag, Stuttgart.

LUKÁCS, Z. (2002): Újabb adatok Magyarország nagygombavilágához I. – *Mikol. Közlem. (Clusiana)* **41**(2–3): 45–52.

LUKÁCS, Z. and KIRÁLY, I. (1995): Feketedő és vörösödő rókagombák Nyugat-Dunántúlról: Cantharellus melanoxeros Desm. és C. ianthinoxanthus (R. Maire) Kühner. – *Mikol. Közlem. (Clusiana)* **34**(2–3): 12–15.

LUKÁCS, Z., NYILAS, I., BATHÓ, A., GÁBOR, E. and POLGÁRI, J. (2001): Gombakutatások az Őrségben és a Zala megyei Csödén, ill. a szomszédos Vas megye néhány településének környékén. – *Mikol. Közlem. (Clusiana)* **40**(1–2): 77–88.

LUKÁCS, Z. (2004): Újabb adatok Magyarország nagygombavilágához II. – *Mikol. Közlem. (Clusiana)* **43**(1–3): 75–82.

MONTECCHI, A. and SARASINI, M. (2000): *Funghi ipogei d'Europa*. – Ass. Mic. Bres., Trento.

MOSER, M. (1983): *Die Röhrlinge und Blätterpilze*. – Kleine Krygtogamenflora Band IIb/2. G. Fischer Verlag, Stuttgart, New York, 252 pp.

PÁL-FÁM, F. (2001): A Mecsek-hegység nagygombái. – *Mikol. Közlem. (Clusiana)* **40**(1–2): 5–66.

PÁL-FÁM, F. and LUKÁCS, Z. (2002): A Mecsek hegység nagygombái 2. – *Mikol. Közlem. (Clusiana)* **41**(2–3): 35–44.

REDHEAD, S. A., AMMIRATI, J. F., WALKER, G. R., NORVELL, L. L. and PUCCIO, M. B. (1994): Squamanita contortipes, the Rosetta Stone of a mycoparasitic agaric genus. – *Can. J. Bot.* **72**: 1812–1924.

RIMÓCZI, I. (1992): *Adatok a magyarországi nagygombák vörös könyvének összeállításához*. – KÉE kiadványai. Lippay János tud. ülésszak, Budapest, pp. 244–247.

RIMÓCZI, I. (1994): Nagygombák cönológiai és ökológiai jellemzése. – *Mikol. Közlem. (Clusiana)* **33**(1–2): 5–180.

RIMÓCZI, I. (1997): Magyarország nagygombáinak természetvédelmi helyzete és Vörös Könyvének terve. – *Mikol. Közlem. (Clusiana)* **36**(2–3): 65–108.

RIMÓCZI, I., MÁTÉ, J. and LENTI, I. (1997): Osztott bazídiumú- és nem lemezes nagygombák a Bátorligeti-őslápon. – *Mikol. Közlem. (Clusiana)* **36**(2–3): 13–29.

RIMÓCZI, I., SILLER, I., VASAS, G., ALBERT, L., VETTER, J. and BRATEK, Z. (1999): Magyarország nagygombáinak javasolt Vörös Listája. – *Mikol. Közlem. (Clusiana)* **38**(1–3): 107–132.

SILLER, I. (1999): Ritka nagygombafajok a Kékes Észak erdőrezervátumban 1. – *Mikol. Közlem. (Clusiana)* **38**(1–2): 11–24.

SILLER, I. (2004): *Hazai montán bükkös erdőrezervátumok (Mátra: Kékes Észak, Bükk: Őserdő) nagygombái*. – PhD értekezés (kézirat).

SILLER, I. and VASAS, G. (1993): Védelemre javasolt magyarországi nagygombák. – *Mikol. Közlem. (Clusiana)* **32**(1–2): 75–80.

SILLER, I. and VASAS, G. (1995a): List of macrofungi proposed for protection in Hungary. – *Acta bot. hung.* **38**: 309–314. (1993–1994).

SILLER, I. and VASAS, G. (1995b): Red list of macrofungi in Hungary (revised edition). – *Studia bot. hung.* **26**: 7–14.

SINGER, R. (1965): *Die Pilze Mitteleuropas. Band V: Die Röhrlinge, Teil 1*. – Bad Heilbrunn, 132 pp.

STEIGER, A. (1976): Sollen unsere Pilze aussterben? Gedanken und Vorschlage zum Pilzschutz. – *Schweiz. Z. Pilzkde.* **54**: 18–22.

SZEMERE, L. (1965): *Die unterirdischen Pilze des Karpatenbeckens.* – Akadémiai Kiadó, Budapest.

TÓTH, B. (1999): Gombacönológiai vizsgálatok a Gyepes-völgyben (Heves-Borsodi dombság). – *Mikol. Közlem. (Clusiana)* **38**(1–3): 25–52.

VASAS, G. and ALBERT, L. (1987): Polyporus tuberaster (Pers.: Fr.) Fr. egy ritka gombafaj Magyarországon. – *Mikol. Közlem. (Clusiana)* **1987**(1): 51–63.

VASAS, G. and LOCSMÁNDI, CS. (1995): The macroscopic fungi (Basidiomycetes) of Őrség, Western Hungary. Natural History of Őrség Landscape Consevation Area I. – *Savaria, a Vas Megyei Múzeumok Értesítője* **22**(2): 265–294.

VASAS, G., LOCSMÁNDI, CS. and ALBERT, L. (1991): Über interessante Pilzfunde aus Ungarn, III. (Basidiomycetes, Agaricales). – *Annls hist.-nat. Mus. natn. hung.* **83**: 87–89.

VESTERHOLT, J., ASMAN, W. A. H. and CHRISTENSEN, M. (2000): Nitrogen deposition and decline of fungi on poor and sandy soils. – *Svampe* **42**: 53–60.

WINTERHOFF, W. (1984a): Ursachen des Artenrückganges. – *Beih. Veröff. Naturschutz Landschaftspflege Bad.-Württ.* **40**: 81–101.

WINTERHOFF, W. (1984b): Schutz von Grosspilzen. – *Beih. Veröff. Naturschutz Landschaftspflege Bad.-Württ.* **40**: 102–111.

WINTERHOFF, W., FINKENZELLER, X., GROSS, G., HAAS, H., KNOCH, D., KRIEGLSTEINER, G. J., LABER, D. and SCHWÖBEL, H. (1984c): Rote Liste der gefährdeten Grosspilze in Baden-Württemberg. – *Beih. Veröff. Naturschutz Landschaftspflege Bad.-Württ.* **40**: 5–20.

ZAGYVA, T. (2000): Szubalpin gyepek mikológiai felmérése az Őrségi Tájvédelmi Körzetben. – *Mikol. Közlem. (Clusiana)* **39**(1–2): 31–92.

(Received 19 May, 2005)