

Worldwide occurrence of psychoactive mushrooms – an update

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An update is given on the recorded psilocybin – and ibotenic acid containing mushrooms on a worldwide scale. Many new psilocybian species have been discovered during the last 15 years, including representatives of the genera *Psilocybe*, *Panaeolus*, *Inocybe*, *Gymnopilus* and *Pluteus*, whereas only *Amanita regalis* was identified as a new and potent source of ibotenic acid. Recreational use of psychoactive mushrooms has spread from the USA to Europe, but here, like anywhere else, it remains a marginal phenomenon. The mushrooms commonly used are limited to a few species: in Europe it is almost invariably *Psilocybe semilanceata*, whereas in the USA *Ps. cubensis*, is widely used. Locally, *Ps. stuntzii* and *Panaeolus subbalteatus* have also gained some popularity. Misuse in South America or Asia is virtually unknown, in spite of the easy availability of psychoactive fungi. The trade in “magic mushrooms” e.g. *Ps. cubensis* and *Copelandia cyanescens* on the Thai island of Koh Samui, or in Indonesian Bali only caters to European and American tourists. Finally, young people and members of the drug-using subculture in Australia and New Zealand have also become aware of the psychoactive fungi growing in their respective countries

Key words: Psychoactive mushrooms, psilocybin, ibotenic acid, recreational use

Stijve T. (1995): Současný stav výskytu psychoaktivních hub na světě. – Czech Mycol. 48: 11–19

Je podán přehled o současném výskytu hub obsahujících psilocybin a kyselinu ibotenovou. V posledních 15 letech bylo zjištěno mnoho druhů obsahujících psilocybin zahrnujících zástupce rodů *Psilocybe*, *Panaeolus*, *Inocybe*, *Gymnopilus* a *Pluteus*. Pouze *Amanita regalis* byla identifikována jako nový a silný zdroj kyseliny ibotenové. Rekreační užívání psychoaktivních hub se rozšířilo z USA do Evropy, ale zde, jakož i kdekoli jinde zůstávají psychoaktivní houby okrajovým fenoménem. Houby všeobecně užívané jsou omezeny na několik druhů: v Evropě je to většinou *Psilocybe semilanceata*, zatímco v USA je široce užívaná *Psilocybe cubensis*. Místně je populární *Ps. stuntzii* a *Panaeolus subbalteatus*. Zneužívání halucinogenních hub v Jižní Americe nebo Asii je prakticky neznámé, přestože jsou zde psychoaktivní houby snadno dostupné. Obchod s „kouzelnými houbami“ např. *Ps. cubensis* a *Copelandia cyanescens* na thajském ostrově Koh Samui (Kosamui) a indonéském Bali slouží k uspokojení turistů z Evropy a Ameriky. Mládež a členové komunit užívajících drogy v Austrálii a na Novém Zélandě jsou si vědomi, že i v jejich zemi rostou psychoaktivní houby.

The subject matter of this short review will be confined to mushrooms containing psilocybin and psilocin, and to those *Amanitaceae* that are characterised by isooxazole derivatives such as ibotenic acid. This excludes the *Russulaceae* and *Boletaceae* which are ritually used in New Guinea, but of which the active principle (if any) has not yet been isolated, and the *Pyrenomycetes* containing the well-known ergot alkaloids.

Already in 1978, Singer contributed a very good review article to the now classic CRC book on “Mushroom Poisoning” by Rumack and Salzman (Singer 1978). Singer listed then not less than 38 hallucinogenic *Psilocybe* species, mostly from

Mexico, Meso-America and the USA. In addition, he cited *Conocybe cyanopus*, and two *Coprinaceae*, *Copelandia cyanescens* and *Panaeolus subbalteatus* as hallucinogenic mushrooms, while reserving his opinion on a few blue-staining *Gymnopilus* in which the occurrence of psilocin/psilocybin had not yet been convincingly demonstrated.

As for psychoactive *Amanitae*, Singer mentioned of course *A. muscaria* and *A. pantherina* as species containing ibotenic acid and muscimol, but he rightly pointed out that this group of *Amanitae* is taxonomically rather complex, and that many varieties, on both sides of the Atlantic have not yet been studied in this respect. We may expect that appreciable progress has been made since 1978 and indeed, many more psychoactive mushrooms, especially psilocybian species have been discovered. Not long ago, a very useful index was published by Allen et al. (1992) who listed not less than 130 psilocybin-containing species from 12 genera, belonging to 6 families. These authors have considerably extended the afore-mentioned list by Singer (1978), and also that given in Guzman's monograph (Guzman 1983). Allen et al. (1992) pretend that 90 of the about 300 recognised *Psilocybe* sp. are hallucinogenic.

We have critically examined this by checking the evidence available in the literature, which yielded the following results: for 40 taxons we found reports on chemical analysis proving the presence of the indole alkaloids. For another 39 species no analysis was available, but the original papers and Guzman's monograph reported blueing tissues and/or hallucinogenic action. For seven species no such information could be found and an additional four were unknown in the literature.

This means that about 80 *Psilocybes* are psychoactive, but unfortunately this does not help much in the taxonomy!

Curiously enough, the number of hallucinogenic European *Psilocybes* has not increased since the early seventies. The ubiquitous *Ps. semilanceata* (Fr.) Kummer (Hofmann et al. 1963, Repke and Leslie 1977, Christiansen and Rasmussen 1982, Stijve 1984, Stijve and Kuyper 1985), also known as the Liberty Cap is still by far the most important. *Ps. bohémica* Šebek (Semerdžieva and Wurst 1986), *Ps. cyanescens* Wakefield (Benedict et al. 1962, Beug and Bigwood 1982) and *Ps. liniformans* Guzman et Bas (1977) are rare or, at least, not widely distributed.

On the other hand, many more psilocybin-containing mushrooms belonging to other genera have been described, especially by European authors. Quite unexpectedly, the hallucinogen turned up in the genus *Inocybe*, as was discovered by accident in Germany by Drewitz (1983) who described a curious case of poisoning by *Inocybe aeruginascens*, which was mistaken for edible *Marasmius oreades*. Soon afterwards, the presence of psilocybin and baeocystin was confirmed by chemical analysis (Stijve et al. 1985, Gartz and Drewitz 1985), and 4 other *Inocybe* species, mostly rare ones, were also found to contain those hallucinogens (Stijve and Kuyper 1985, Stijve et al. 1985).

In *Gymnopilus*, another genus belonging to the Cortinariaceae, several sp. have been suspected to contain psilocybin/psilocin (Hatfield and Valdes 1978), but this has only been confirmed for *G. purpuratus* (Cooke et Masee) Sing., an exotic species from South America and Australia, which was accidentally introduced into Germany during the 80ies (Kreisel and Lindequist 1988, Gartz 1989).

It is often thought that there are many hallucinogenic species among the *Panaeoloideae*. However, in Europe there is only *P. subbalteatus* (Berk. et Br.) Sacc., that has been unequivocally established to contain psilocybin in significant concentrations (Beug and Bigwood 1982, Ola'h 1968, Fiussello and Scurti Ceruti 1972, Stijve 1985).

In popular handbooks *Panaeolina foeniseeii* is said to be psychoactive, in spite of the negative reports that have been published during the last ten years (Beug and Bigwood 1982, Stijve et al. 1984, Allen and Merlin 1991). The error can be explained by confusion with *P. subbalteatus*, a taxon superficially resembling *P. foeniseeii*, and in the USA both mushrooms often grow together on well-manured lawns, which is not or seldom the case in Europe (Stijve 1987).

In the tropics there are a number of *Copelandia* sp. of which *C. cyanescens* (Berk. et Br.) Sing., also known as *Panaeolus cyanescens* (Berk. et Br.) Sacc. is the most widely distributed. This blue-staining mushroom is strongly hallucinogenic, because of its high psilocin content, which may exceed 1 percent on dry weight. It is interesting to note that collections from Hawaii also contain significant levels of psilocybin, whereas this compound is virtually absent in collections from Australia and Thailand (Stijve 1992).

Some uncertainty still exists about Ola'h's latent psilocybian species (Ola'h 1969), but it could well be that the phenomenon exists. Indeed, although *Panaeolus campanulatus* and *P. fimicola*, both from the USA and Europe, have generally been found not to contain any psilocybin, the presence of this compound was recently unquestionably established in collections of both *Panaeoli* from Southern Brazil (Stijve and de Meijer 1994).

Since 1981 we know that the genus *Pluteus* also comprises some taxons containing psilocin/psilocybin and some as yet unidentified tryptamine compounds (Saupe 1981, Stijve and Bonnard 1986, Stijve and de Meijer 1993). The most common species in Europe is the slightly greenish staining *Pluteus salicinus*. Another one, *Pl. nigroviridis* Babos is most rare (Stijve and Bonnard 1986). We recently demonstrated the presence of the hallucinogens in *Pl. glaucus* Sing. and in a closely related taxon, both collected in Southern Brazil (Stijve and de Meijer 1994).

Lately, Besl discovered in a hothouse of the botanical institute at Regensburg a new species of *Galerina*, that was described as *Galerina steglichii* spec. nov. This tiny mushroom had blueing tissues and was found to contain psilocybin (Besl 1994).

It is not unthinkable that psilocybin and related compounds will turn up in other mushrooms, but there have been erroneous reports on the subject, as

was pointed out by Stijve and Kuyper (Stijve and Kuyper 1988) *Mycena pura* and/or closely related taxons have been recognised as hallucinogenic (Heim 1963, Giacomoni 1984), but the active principle has not yet been isolated. Moreover, some exotic *Hydnaceae* such as *Sarcodon atroviridis* were found to contain not less than 4 unidentified tryptamine derivatives (Stijve 1993). On the other hand, a publication about a hallucinogenic *Lepiota* from Florida (Anonymous 1983) was in all probability a hoax. We can be brief about ibotenic acid – containing *Amanita* sp. Although Ott (1978) has claimed widespread recreational use of both *A. muscaria* and – *pantherina*, this is somewhat hard to believe. Indeed, ingestion of these mushrooms prompts mostly severe nausea, drooling, vomiting, whereas feelings of elevated mood and euphoria, followed by deep sleep and vivid dreams are far more rare.

Tab. 1 Ibotenic acid content of psychoactive *Amanita* species.

	Ibotenic acid determined as muscimol in percentage on dry weight
– <i>Amanita muscaria</i>	
ex Chamonix, Fr.	0.15
ex Lally, CH	0.16 – 0.22
ex Puidoux, CH	0.12
ex Paranã, Brazil	0.08 – 0.13
– <i>Amanita regalis</i>	
ex Gavle, Sweden	0.62 !!
– <i>Amanita pantherina</i>	
ex Gamburg, GFR	0.19
ex Puidoux, CH	0.31
ex Haute Savoie, Fr.	0.25

Few people who have tried it want to renew the experience (McDonald 1978). Chemical investigation of these mushrooms seems to have made little progress since Müller's and Eugster's discoveries (Müller and Eugster 1965, Good et al. 1965). The results of a limited survey carried out in our laboratory on the active principle in psychoactive *Amanita* species are given in table 1. It is noteworthy that

Amanita regalis, a stout variety of the fly agaric, was found to contain not less than 0,6 percent ibotenic acid, which is far more than ever reported for the other two *Amanitae* (Stijve 1982). This rare mushroom was said to have caused a pleasant delirium with a minimum of bodily discomfort. More collections should be analysed to check whether the high content is a distinguishing feature of *A. regalis*.

Modern recreational use of psilocybin-containing mushrooms both in the USA and Europe has been stimulated by popular and semi-scientific publications (Oss and Oeric 1976, Cooper 1980, Schreiber 1987, Stamets 1978). However, in spite of alarmist medical publications (Young et al. 1982, Jansen 1988) and lurid newspaper articles, the phenomenon remains marginal. Psilocin and psilocybin are not habit-forming and few individuals persist in using these mushrooms beyond the first experience of what is called a bad trip.

In Europe, from Italy to Finland (Semerdžieva and Nerud 1973, Christiansen et al. 1981, Michaelis 1977, Gartz 1993, Flammer and Horak 1983, Samorini and Festi 1988, Ohenoja et al.), it is invariably *Psilocybe semilanceata* that is used. There is indeed some selling of this dried mushroom (mostly at the equivalent of 2 – 3 Swiss francs/piece) in the big cities (Turberg 1984, Unsigned 1990), but it is really a minor street drug compared to heroin. The authorities in most European countries are aware of this. When the phenomenon reached Switzerland, the police used helicopters to chase the mushroom hunters on the alpine meadows. Now, some ten years later, such extreme measures have been abandoned, but the authorities still keep an eye on publications encouraging consumption of these fungi (Scheibler 1993).

Concerning recreational use of psilocybin mushrooms in the USA, the information contained in Jonathan Ott's article (Ott 1978) is still valid, although he exaggerates the number of species (21!) actually used for that purpose. The most widely used mushroom, gathered in the wild or cultivated (Stijve 1982) is *Psilocybe cubensis* (Earle) Sing., often called "golden tops", because of the golden yellow coloured pileus. *Psilocybe stuntzii* Guzman & Ott which was only discovered in the early seventies has also gained some popularity as has *Ps. cyanescens* Wakefield, which can also be grown both indoors and outdoors (Stamets and Chilton 1983). According to Ott, *Panaeolus subbalteatus* was commonly used in the Pacific Northwest 15 years ago. It could well be that its popularity has decreased now. In many persons it causes an upset stomach (Bigwood 1984). A recent report by Merlin and Allen (1993) discusses recreational use of *Copelandia (Panaeolus) cyanescens* in the Hawaiian islands.

Both *Ps. (sub) cubensis* and *Copelandia* sp. are sold to tourists in several resort areas of Thailand, notably on the islands Koh Samui and Koh Pha-ngan (Allen and Merlin 1992). Restaurants on these islands serve hallucinogenic omelettes, stews, soups, and even pizza's containing so-called "magic mushrooms", that is coprophilic *Ps.cubensis* grown in "farms" which mainly consist of well-manured rice paddies.

This practice is, of course, not without danger, because consumption of these dishes has sometimes induced bizarre and dangerous behaviour in tourists. Worse still, some restaurants serve omelettes containing more powerful synthetic hallucinogens, such as LSD! Similar practices using the same mushrooms are said to represent a minor tourist attraction on the Indonesian island of Bali (Hollander 1981).

There are no confirmed reports on abuse of psychoactive mushrooms in other Asian countries, even where legislation is absent. In Japan possession of such mushrooms is illegal, and one must even be cautious when transporting botanical specimens (Baumann 1990).

Gymnopilus spectabilis (Fr.) Sing. became first known as a hallucinogenic fungus in Japan (Romagnesi 1964). It is called there "Ohwaraitake", which means big laughter mushroom. It does not contain any psilocybin, but its active principle was recently characterised as a group of neurotoxic oligoisoprenoids (Tanaka et al. 1993).

We do not know anything about the possible use of psychoactive mushrooms in Africa, but the occurrence of those fungi there is more than likely. On the other hand, we are better informed about Australia and New Zealand, where the public at large has also become aware of psilocybian fungi growing in their respective countries (Shepherd and Hall 1973, Hall 1973). There is no evidence that the aboriginals were or are familiar with this kind of mushrooms. Recreational use seems to be limited to descendants of European immigrants who must have learned about the mind-altering effects by reading American literature. McCarthy (1971) has suggested that abuse of psychoactive fungi has been introduced by visiting American surfers at Australian beach resorts. Be this as it may, interest in hallucinogenic fungi was, as elsewhere, widely promoted by popular press articles describing the use of these mushrooms. Allen et al. mention that three agarics, *Psilocybe cubensis*, *Ps. subaeruginosa* Cleland, and *Copelandia cyanescens* are recreationally used in Australia (Allen et al. 1991), but the number of users is still small, and it is unlikely that hallucinogenic mushrooms will replace traditional stimulants.

Finally, it would seem that the "mushroom pandemic" (Pollock 1975) has not yet reached South America. Although psilocybin-containing fungi occur widely in countries like Argentina, Uruguay and Brazil (Guzman 1983, Stijve and de Meijer 1993) the local population is either unaware of and/or not interested in their psychoactive properties.

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