

A contribution to the ethnomycology and ethnobotany of Alpine psychoactive vegetals

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More than 20 species of psychoactive mushrooms grow on the Alpine region, mainly the isozaxolic *A. muscaria* and *A. pantherina*, and psilocybian species belonging to the genera *Psilocybe*, *Panaeolus*, *Inocybe* and *Pluteus*.

The ethnomycological studies evidenced the antiquity of the human relationship with psychoactive mushrooms in different area of the world, and recent data suggest the knowledge and use of these mushrooms in ritual-religious contexts among the old European and Alpine populations.

The study of Alpine psychotropic mycoflora is even more important for a suitable observation – in its ethnomycological, medical, sociological and legislative aspects – of the modern epidemical phenomenon concerning the use of psychoactive mushrooms as hallucinogenic drug by a specific young population. An update list of the Alpine psychoactive mushrooms is reported.

The study of Alpine psychoactive plants is more complex and fragmentary. The problems for long time discussed concerning the taxonomical identification of many "magic" plants are still unsolved, as with the visionary plants described by Pliny and Dioscorides, and the vegetal ingredients of the medieval witch potions and ointments.

A patient interdisciplinary work of collection and analysis of the numerous ethnobotanical and popular medicine data, together the modern biochemical, phytotherapeutic and psychopharmacological data could contribute to outline the "Alpine ethnopsychopharmacological complex".

Also concerning the psychoactive plants it is opportune to maintain updated ethnobotanical studies, for the appropriate observation of the modern use of these plants – first of all to the Solanaceae family – as hallucinogenic drugs.

THE ALPINE PSYCHOACTIVE MUSHROOMS

More than 150 species of psychoactive mushrooms widespread all over the world are so far known [1,2].

Amanita muscaria and *A. pantherina* are the main species of the isozaxolic group, producing the psychoactive alkaloids ibotenic acid and muscimol [3]. The most numerous and widespread group of psychoactive macromycetes is represented by the psilocybian mushrooms, which produce the indolic alkaloids psilocybin, psilocin, baeocystin [4,5]. A third group concerns the toxic mushrooms of the Clavicipitaceae family (mainly *Claviceps purpurea*, popularly known as ergot), which infect graminaceous plants, and low-mushrooms of the genera *Aspergillus* and *Penicillium*, all producing lysergic acid derivatives [6].

In Europe, starting by the times of the first reports of the presence of psilocybian hallucinogenic mushrooms [7,8], the number of the recognized species has considerably increased. I remind the recent discover of a new species – *Psilocybe hispanica* Guzmán – which grows on the Pyrenees at the altitude of 2300 m, and which was collected and used for years as hallucinogenic drug by young people [9].

In Table I (see page 64) is reported an updated list of the

psychoactive Basidiomycetes growing on the Alps. It is difficult to precisely quantify the number of the species, for the taxonomical uncertainties and modifications concerning someone of it. This is the case of *Psilocybe cyanescens*, a discussed species which centre-Europe taxonomies refer to the "P. cyanescens complex" or, involving two more species, to the "P. cyanescens-callosa-semilanceata complex" [10,11]. In the *Panaeolus* genus the difficulties to determine the number of the psychoactive species has been complicated by the recent taxonomical revision by E. Gerhardt [12], and this problem is particularly reflected on the European and Alpine species.

The presence of psilocybian alkaloids in *Psathyrella candolleana* (Fr. ex Fr.) Maire (Copriniaceae), *Gymnopilus spectabilis* (Fr.) A.H. Smith (Cortinariaceae), *Hygrocybe psittacina* (Schaeff. ex Fr.) Wünsche var. *psittacina* (Hygrophoraceae), and *Rickenella fibula* (Bull. ex Fr.) Raith (Tricholomataceae) previously reported [13], has not been confirmed through analysis on Swiss samples [14].

Not all mushrooms producing the psilocybian alkaloids may be considered hallucinogens. Some species of *Panaeolus* inconstantly produce these alkaloids and have been classified by G.M. Ola'h [15] as "psilocybian-latent" species. *Pan. foenisecii* is one of the most controversial species, relatively common all over the Alps till the altitude of 2500 m, and of which the numerous biochemical analysis,

involving Alpine samples too [16], revealed low (traces to 0.17% d.w.) or no concentrations of psilocybian alkaloids.

The strength of the effects of an hallucinogenic mushroom mostly depends by the concentration of its active compounds. Referring to the psilocybian mushrooms, P. Stamets [17] elaborated the following potency rating scale: <0.25 % d.w.: weakly active; 0.25-0.75 %: moderately active; 0.75-2.0 %: highly active; >2.0 %: extremely active.

The biochemical analysis of Alpine hallucinogenic mushrooms growing on the Italian side follow to be scarce. Apart the obsolete studies by N. Fiussello and coll. [18], the results of a single analysis on samples of *Psilocybe semilanceata* collected in the Turin Alps has been performed [19]. Biochemical assays developed on samples collected in central Europe showed a variability in the concentration of psilocybian alkaloids comprised from 0.1 to 1.7 % d.w. [20].

Concerning *A. muscaria* which grows in Italy, a single biochemical assay with the modern analytical techniques has been performed over samples collected in Piedmont, determining concentrations of 0.4 % muscimol and 1.0 % ibotenic acid in the fresh caps, while in the stipes these concentrations showed to be 4-5 times lower [21].

Amanita regalis is considered by some taxonomies as a simple variety of *A. muscaria*. It is a rare species, suspected to possess the same properties of its most common similar. The presence of the isoxazolic alkaloids has been recently confirmed on samples of this mushroom collected in Switzerland, with concentrations three times higher than those reported for *A. muscaria* [22].

Sporadically, tropical psilocybian species have been found in Europe, and may reach the Alps. This is the case of the recent finding in the neighbours of Bern (Switzerland) of a rich fructification of *Panaeolus bisporus* (Bert. & Mal.) Gerh., a species of the Morocco mountains. This finding has given the opportunity for a first biochemical essay over the species, which showed the presence of 0.4 % psilocin, confirming its potentialities as hallucinogenic drug [23].

The adventitious presence of tropical species is facilitated in the frequent case of dung habitat of the mushroom, following the import of herbivorous quadrupeds from tropical regions. In 1965 at Menton (France) a family was victim of a fortuitous psilocybian intoxication after consumed mushrooms collected from dung-material produced by foreign horses assigned to the Menton's racecourse. The species responsible for the intoxication was identified as *Copelandia cyanescens* Berk. & Br., which in its indigenous tropical regions grows on dung of many herbivorous quadrupeds [24].

Recently it has been surprisingly reported that young Polish people collect and use *Coprinus atramentarius* as hallucinogenic drug [25]. When absorbed together alcohol this mushroom induces the coprine-intoxication [26]. When eaten in absence of alcohol the young specimens are often considered edible. In Poland young people appear to eat 30-50 fresh carpophores to get hallucinogenic effects, without mixing with alcohol: a quantity hardly reached by people who collect the same mushroom for its edible properties, which could explain why its psychoactive properties were not yet been discovered.

The confirmation of the psychoactive properties of *C. atramentarius* could involve interesting historical and ethnomycological implications about the relationship of European man with this common mushroom. After all, doubt arises if among Polish young people the knowledge of its

hallucinogenic properties is a recent discovery or may belong to tradition knowledge.

ALPINE ETHNOMYCOLOGY

The archaeological and ethnographical data showed an antiquity of the human relationship with the hallucinogenic mushrooms reaching the Palaeolithic times. The most significant data concern old and modern American and African tribes, and don't lack those concerning the European populations [27,28].

In the extreme western side of the Alpine region, in the Vallées des Mervèilles (Mount Bego, Maritime Alps, France) a likely representation of *A. muscaria* has been identified (fig. 1), dated back to ca. 1800 BC and produced by an Indo-European Bronze Age population, inside a rich rock art produced in initiatory-religious contexts [29]. Previously, ethnomycological interpretations of Camunian (Valcamonica Valley,

Fig. 1 - Probable representation of *Amanita muscaria* in an Alpine prehistoric rock engraving (1800 BC, Vallées des Mervèilles, Mount Bego, Maritime Alps, France).



Italy) [30] and Scandinavian [31] rock art have been advanced.

The relationship of the old Alpine populations with mushrooms extend beyond the psychoactive and the edible species. I remind the important finding represented by the "Similaun's Man", dated back to 3000 BC, discovered at the Austria-Italy border. Among the objects associated to the mummy some pieces of polyporaceous mushrooms were identified, belonging to the species *Fomes fomentarius* (L.) Fr. - used as tinder -, and *Piptoporus betulinus* (Bull. ex Fr.) Karst [32,33]. This latter species is known for some time for its antibiotic properties [34].

Although the two species don't possess psychoactive pro-

perties – as initially wrongly reported by the popular press – the likely role of the second species as magic-therapeutic tool demonstrates the early attention of the Alpine man in front of the medicinal properties of mushrooms.

The continuity of a similar relationship could appear confirmed by the document discussed by R. Scotti [35], concerning a fresco of the Saint Brigida church, in Brembana Valley (Bergamo province, Italy), dated back to the XV century. It concerns a representation of Saint Onofrio in a peculiar edition of the Wild Man, a renown mythological figure of Alpine popular beliefs. In one hand the saint holds a rosary likely constituted by caps of an unidentified species of mushroom. The fresco has been realized during times of skin diseases epidemics (likely *Herpes* and *Vitiligo*), and the subject concerns these epidemics. Scotti has pointed out the therapeutic or magic-therapeutic role of the mushrooms hold by the saint.

We don't know documents which may attest a knowledge of psychoactive mushrooms in Europe during the early Middle Age, with the exception of the *De Vegetalibus* by Albertus Magnus, written in the XIII century, where the author gives a reference to mushrooms which induce mental illness. Carolus Clusius, in his *Rariorum plantarum historia* dated to 1601 reported about a mushroom which grows in Hungary and in Germany, possessing the characteristic, when eaten, to derange the mind.

Traces of knowledge of psychoactive mushrooms have been preserved in the popular names given to these mushrooms, as in the German word *narrenschwammen* ("foolish mushroom") given to the psilocybian mushrooms, and in the Basque term *sorgin zorrotz* ("whitch with the point") specifically given to *Psilocybe semilanceata* [5].

The old knowledge of these mushrooms let also traces in the popular sayings. In the Catalan language there exists a saying, "*estar tocat de bolet*" ("to be touched by the mushroom"), referred to somebody accomplishing foolish actions or saying foolish things. Nowadays the Catalans use this saying unaware of its original meaning; in the same manner in northern Italy the gatherers of edible mushrooms call the inedible mushrooms *funghi matti* ("mad mushrooms"), unaware of the generalization to which this concept has been subject during the times and that originally this term was used to indicate peculiar mushrooms, those "making foolish a man", that is the psychoactive ones.

In the Alps too a similar saying preserved, with the Austrian "*er hat verrückte Schwammerln gegessen*" ("he had eaten those mushrooms inducing madness"), always referring to somebody which makes or says foolish things. Together the Slavonic "*najeo se ljutih gljiva*" ("he had eaten enough foolish mushroom") and the Magyar "*bolondgombat erett*" ("he had eaten foolish mushrooms"), these popular sayings are significant traces of old knowledge of hallucinogenic mushrooms among the European populations [27].

Traces of this knowledge have also been found in modern times. J.M. Fericgla [36] determined a traditional use of *A. muscaria* in the Catalan region, on the Spanish side of the Pyrenees. His researches demonstrated that until the first decades of the XX century this mushroom was eaten for its inebriating properties in marginal rural environments (shepherds, coal merchants, isolated farmers), and occasionally follows to happens nowadays.

One more ethnographic trace has been individuated in a peculiar article written in 1880 by Dr. B. Grassi [37]. He reported a case of intentional intoxication with *A. muscaria* as substitute of wine by a farmer of the Milan province, and attested

the popular knowledge that this mushroom "induces people to sing".

The farmer had collected and eaten the mushroom for want of wine, a product which was rare and expensive at those times, due to the phyloxera parasite infesting the European vineyards. Grassi was excited by the idea to substitute *A. muscaria* with wine to satisfy the needs of the poor rural people; he performed a series of experiments with the mushroom on himself and on other people, to verify the levels of toxicity and the quantities. After this, he advertised the poor people about the use of this "nervous ailment" in substitution of wine, and supplied the local drugstore with dried preparations of the mushroom [38].

Concerning the use of psychoactive mushrooms in the traditional medicine, the data are generally scarce and null in the Alps, with the exception perhaps of the use of fly-agaric's cap as insecticide, for its renown properties to attract the flies. Khanty people of western Siberia employ this mushroom as topic application in case of snake bit [39]. In Germany homoeopathic preparations of *A. muscaria* are nowadays used in the treatment of tics, paresis of the bladder, epileptiform ailments, menopause flush, hyperhydrosis, mental weakness and Parkinson syndrome [40].

The only case known to the author of use of psilocybian mushrooms in the traditional medicine belongs to Transylvania (Hungry) and concerns the topic application of fresh carpophores of *P. semilanceata* in the treatment of warts [41].

THE MODERN USE OF ALPINE MUSHROOMS AS HALLUCINOGENIC DRUG

Starting from the 1960's in Europe and in northern America spread the use of psychoactive mushrooms as hallucinogenic drug ("magic mushrooms") [42,43]; a phenomenon with toxicological, sociological and legislative implications for which, although of lesser importance in front of the problems associated to the abuse of other drugs, it is appropriate to maintain an updated observation.

The Alpine region is the main source of supplying of psychoactive mushrooms for a wide population – mainly young people – of northern Italy, southern France, Switzerland, Austria, and Slovenia, which is possible to quantify to some thousands of people. The mushroom more commonly collected is *P. semilanceata*, called by the Italian users *funghetto*, in German language *Narrenschwammen*, *psilo* in French, and *liberty cap* in English. Other wild mushrooms collected for the drug use are: *A. muscaria*, *A. pantherina*, *Psilocybe bohemica*, *P. cyanescens*, *P. serbica*, *P. strictipes*, *Panaeolus subulatus* and by chance *Pluteus salicinus* and *Inocybe aeruginascens*.

Three types of toxicological problems reported and caused by these intentional psychotropic mycotoxicosis are recognizable: 1) erroneous identification of the mushroom collected, resulting in intoxications with species more toxic than the psychoactive ones; 2) intrinsic toxicity of the psychoactive mushrooms; 3) psychiatric complications caused by misuse and abuse of hallucinogenic drugs.

Maintaining an European observation, concerning the first type the survey is quite reduced. One case has been reported in Austria, where a young man was taken in hospital with a final phase of renal failure after eating carpophores of

Cortinarius orellanoides Hry. (Cortinariaceae) – containing the nephrotoxic cortinarines – which he had mistaken for *P. semilanceata* [44]; a confusion due more to irresponsibility of the young man in front of his ignorance in matter of mushrooms than to unlikely morphological similarities between the two species.

In the same habitat where *P. semilanceata* grows, the toxic species which could be mistaken with it because similarities of the morphologic macroscopic characteristics are *Galerina autumnalis* (Peck) Smith & Sing. (Cortinariaceae) and other congeners, producing amatoxins [45], and many species of *Mycena* and *Inocybe*, which produce muscarine. Species belonging to the genera *Conocybe*, *Coprinus*, *Hygrocybe* – apparently innocuous – may also be mistaken with species of *Psilocybe* and *Panaeolus*.

Concerning the intrinsic toxicity of hallucinogenic mushrooms, the pharmacological and epidemiological data show a relatively low toxicity on the human body. The number of fatalities concerning both the isoxazolic and the psilocybian mushrooms reported during the last 40 years in Europe is reduced to some unities, someone of which doubtful; as in the 1996 France fatal intoxication ascribed to the ingestion of *P. semilanceata* [46], doubted by other authors after a critical analysis of the case [47].

Following the ingestion of psilocybian mushrooms some renal failure [48,49], one accident of myocardial infarction [50], and an event of multifocal cerebral demyelination [51] have been reported. The presence of phenethylamine in *P. semilanceata* – recently reported [52] – brought to the hypothesis of a possible role of this compound in the adverse reactions with the mushroom, particularly tachycardia, a symptom hardly imputable to the psilocybian alkaloids.

In the most adverse physical reactions following the intentional ingestion of *A. muscaria* and overall *A. pantherina*, the mushrooms were eaten fresh. It is known that the dehydration process reduces the side effects of the isoxazolic mushrooms, particularly the gastro-enteric ailments, besides strengthening the psychoactive effects [3]. *A. pantherina* is generally 2-3 times more potent than *A. muscaria*, as has been confirmed on samples collected in the Alpine region [21,22], and it may induce more drastic side effects.

The third type of toxicological problems due to this modern "mycophily" is constituted by the psychiatric complications caused by abuse of psychedelic drugs like "magic mushrooms" are, which may induce psychotic or delirious or later depressant reactions. Many cases of this type have been reported in Europe during the last 30 years [42, 53,54], while many others have not been registered.

The collection, the trading and the use of psilocybian mushrooms – and not of the isoxazolic species – involve different legislative implications in the different countries which constitute the Alpine region. Generally, these mushrooms and their active principles psilocybin and psilocin are classified as illicit drugs.

Besides the wild species, in the black market psilocybian mushrooms produced from cultivation are available. In Europe the clandestine cultivations spread starting from the 1980's, and in the last decade they spread even more with the diffusion of simplified techniques for the homemade cultivation. *P. semilanceata* appear to be not suitable for cultivation, while the tropical *Psilocybe* (*Stropharia*) *cubensis* and *Copelandia cyanescens* are the most common species put in cultivation. Samples of these two latter species have been recently seized by Swiss customs at the border with Italy [55].

Dried psilocybian mushrooms are frequently preserved immersed in honey, as has been demonstrated by the recent seizure of pots with cultivated *P. cubensis* carpophores in honey by German customs at the border with Holland [56].

THE ALPINE PSYCHOACTIVE PLANTS

The ethnobotanical studies concerning the Alpine – and more generally European – psychoactive plants follow to be fragmentary and hampered by identification uncertainties of the involved species.

In the works by Classic Greek and Roman authors there are frequent references to plants with psychoactive properties, for which the lone popular name is reported, sometimes followed by an insufficient or even misleading "morphological" description.

The modern studies focalised on the identification of the "magic" plants described by Pliny (*Historia Naturalis*) and Dioscorides (*Materia Medica*), although praiseworthy, are based on unilateral etymologic [57], botanical [58,59] or historic-anthropological [60,61] approaches.

In the Classic and Medieval literature the objective knowledge is frequently amalgamated with local or exotic mythological traditions. Also the accumulation of mistakes by the copyists which for centuries transcribed the Classic works, does not facilitate the modern study of the old knowledge of the European populations concerning the psychotropic plants.

Besides *Papaver somniferum* L. – whose origins have been identified just in the Alpine region, with findings of fossilized poppies in neolithic and Bronze Age layers in Switzerland [62] –, and the renown hallucinogenic Solanaceous plants belonging to the genera *Atropa*, *Hyoscyamus*, *Mandragora* and *Datura*, the Alpine psychoactive flora is constituted by a number of other plants nowadays less known or unknown, which were discovered and later forgotten.

Indeed, not all the knowledge of the psychotropic flora accumulated during the archaic times have been preserved in the following times. This could be the case of *Epilobium angustifolium* L., identified with the plant called *onothera* by Classic authors [58]. Pliny reported that "taken together wine it induces gaiety" (*H.N.*, XXVI, 111), and Dioscorides that "the root decocted in water mitigates the wildness of animals and men" (*M.M.*, IV, 20). This let to suspect psychoactive properties of epilobium, which – although they don't find confirmation in the knowledge of centre-European popular medicine – should be confirmed by ethnographic data collected in Siberia. Kamchatka tribes obtain an inebriating brew with the root of this plant [63]; among the same tribes the absorption of *A. muscaria* too is frequently accompanied by an epilobium infusion [64].

The plant called by Classic authors *euripice* has been identified as a species of the genus *Juncus* [58]. Pliny (*N.H.*, XXI, 119) and Dioscorides (*M.M.*, IV, 54) reported that its seeds are somniferous and with high doses they induce a lethargic state. In the same passage Pliny reported that another species of rush, called *olosceno*, induce headache. From these data the suspect arises that in the past psychotropic properties were discovered, associated to the presence of mushrooms of the Clavicipitaceae family, infecting the spikes of Gramineae, Cyperaceae, Juncaceae and Bambusaceae and producing lysergic acid derivatives. Cases of traditional use of the psy-

choactive properties of the "spike-mushroom complex" are known in Peru [65], in India [66] and in other regions [5].

Moving from Classic to Medieval times, the ethnobotanical study of psychoactive plants is mainly focalised on the "flying-ointments" and potions of the "witches". The modern historic-anthropological studies tend to see the phenomenon of European medieval witchcraft as the evidence – codified by the Christian interpretation and tradition – of pre-Christian cults spread among the rural populations, including those of the Alpine region [67].

Modern authors unanimously recognize the presence of solanaceous hallucinogenic plants among the recipes' ingredients of the fly-ointments and potions handed down by the XVI century's writers (De Laguna, Cardanus, Della Porta, De Nynauld), while they appear to disagree on the identification of other vegetal ingredients reported in these recipes: *sium*, *apium*, *pentaphyllum*, *calamus* [68,69,70,71].

One more source for the ethnobotanical research is represented by the reports of the inquisitorial process for offences concerning witchcraft, preserved in the archives of broad areas of the Alpine region. I remind the process against a man living in Borno (Valtellina, Italy), dated to 1673, accused to profess magic arts, who confessed the use of two plants with opposite magical functions: the *radisc de malann* ("disease's root"), identified as aconite, veratrum or gentiana lutea, and the *erba tirella*, identified as *Orchis maculata* L. [72].

Traces of knowledge of the psychoactive flora preserved in modern popular medicine, but integrated studies on this concerning are not yet available. I remind the study by K. Lussi [73] about the recipes for aphrodisiac and love-magic philtres popularly hand down in Switzerland during the XVII-XIX centuries. A common recipe for the treatment of impotence provided for the topic application of an ointment obtained from nutmeg and root of *Geum urbanum* L. The root of this latter species produces eugenol, which likely possess stimulant properties [74].

It is author's opinion that the ethnobotanical study of Classic literary sources, deeds of the Medieval inquisitorial process, and popular traditions, focalised on the outline of the "Alpine ethnopsychopharmacological complex", still is fragmentary and lacking of deep interdisciplinary researches.

Concerning the modern use of the Alpine psychoactive plants as drugs, the phenomenon is reduced to occasional events centred on the absorption of solanaceous hallucinogenic plants, particularly *Datura stramonium* L. In 1988 in Alto Adige (Italy) a young man died following the intentional administration of stramonium; the death was due to loss of critical judgement of the reality, a characteristic peculiar to the anticholinergic drugs [75].

Besides the dangers due to the "delirogenic" effects of the solanaceous plants, problems caused by their deep toxicity may also appear. In Italy some recent acute intoxications with these plants have been reported in Varese [76] and in Tuscany [77].

BIBLIOGRAPHY

- [1] Guzmán G, Allen JW, Gartz J, 1998, A worldwide geographical distribution of the neurotropic fungi; an analysis and discussion, *Ann.Mus.Civ.Rovereto*, **1998**, *14*, 189-280.
- [2] Stijve T, Worldwide occurrence of psychoactive mushrooms – an update, *Czech.Mycol.*, **1995**, *8*, 11-19.
- [3] Festi F, *Funghi allucinogeni. Aspetti psicofisiologici e storici*, LXXXVI Pubblicazione del Mus.Civ. Rovereto, Rovereto, **1985**.
- [4] Samorini G, Sullo stato attuale della conoscenza dei Basidiomiceti psicotropi italiani, *Ann.Mus.Civ.Rovereto*, **1989**, *5*, 167-184.
- [5] Samorini G, Funghi allucinogeni italiani, *Ann.Mus.Civ.Rovereto*, **1993**, Suppl. 8, 125-150.
- [6] Samorini G, Neurotossicologia delle graminacee e dei loro patogeni vegetali. Un'introduzione, *Ann.Mus.Civ.Rovereto*, **1992**, *7*, 253-264.
- [7] Hofmann A, Heim R, Tschertner H, Présence de la psilocybine dans une espèce européenne d'Agarics, le *Psilocybe semilanceata* Fr., *Comp.Rend.Acad.Sci.*, **1963**, *257*, 10-12.
- [8] Semerdziewa M, Nerud F, Halluzinogene Pilze in der Tschechoslowakei, *Ceska Mykol.*, **1973**, *27*, 42-47.
- [9] Guzmán G, New species and new records of *Psilocybe* from Spain, the USA and Mexico, and a new case of poisoning by *Psilocybe barrerae*, *Doc.Mycol.*, **2000**, *29*, 41-52.
- [10] Krieglsteiner GJ, Studien zum *Psilocybe cyanescens*-Komplex in Europa, *Beitr.Kenn.Pilz.Mitteleur.*, **1984**, *1*, 61-94.
- [11] Krieglsteiner GJ, Studien zum *Psilocybe cyanescens-callosa-semilanceata*-Komplex in Europa, *Beitr.Kenn.Pilz.Mitteleur.*, **1986**, *2*, 57-72.
- [12] Gerhardt E, *Taxonomische Revision der Gattungen Panaeolus und Panaeolina (Fungi, Agaricales, Coprinaceae)*, Schweizerbartsche, Stuttgart, **1996**.
- [13] Gartz J, Nachweis von Tryptaminderivaten in Pilzen der Gattungen *Gerronema*, *Hygrocybe*, *Psathyrella* und *Inocybe*, *Biochem.Physiol.Pfl.*, **1986**, *181*, 275-278.
- [14] Stijve T, Kuyper TW, Absence of psilocybin in species of fungi previously reported to contain psilocybin and related tryptamine derivatives, *Persoonia*, **1988**, *13*, 463-465.
- [15] Ola'h GM, Etude chimiotaxinomique sur les *Panaeolus*. Recherches sur la présence des corps indoliques psychotropes dans ces champignons, *Comp.Rend.*, **1968**, *267*, 1369-1372.
- [16] Stijve T, Hischenhuber C, Ashley D, Occurrence of 5-Hydroxylated Indole Derivatives in *Panaeolina foenicicii* (Fr.) Kum. from Various Origin, *Zeit.Mykol.*, **1984**, *50*, 361-366.
- [17] Stamets P, *Psilocybin Mushrooms of the World*, Ten Speed, Berkeley, CA, **1996**.
- [18] Fiusello N, Ceruti Scurti J, Idrossi-indol derivati in Basidiomiceti. II. Psilocibina, psilocina e 5-idrossi-indol derivati in carpori di *Panaeolus* e generi affini, *Allionia*, **1972**, *18*, 85-89.
- [19] Calligaris F, Indagine sulle relazioni tra composizione chimica di funghi ad azione psicotropa e loro provenienza. Studio chemiometrico e cromatografico, *Ann.Mus.Civ.Rovereto*, **1998**, *12*, 219-242.
- [20] Stijve T, Kuyper TW, Occurrence of Psilocybin in Various Higher Fungi from Several European Countries, *Planta Medica*, **1985**, *5*, 385-387.
- [21] Gennaro MC, Giacosa D, Gioannini E, Angelino S, Hallucinogenic species in *Amanita muscaria*. Determination of Muscimol and Ibotenic Acid by Ion Interaction HPLC, *J. Liq. Chrom. & Rel. Technol.*, **1997**, *20*, 413-424.
- [22] Stijve T, De Koningsvliegczwm, *Amanita regalis* (Fr.) Micahel, de paddestoel van het jaar 2000, *AMK Mededelinge*, **2000**, *2*, 46-51.
- [23] Senn-Ivlet B, Nyffenegger B, Brenneisen R, *Panaeolus bisporus* – an adventitious fungus in central Europe, rich in psilocin, *Mycologist*, **1999**, *13*(4), 12-15.
- [24] Heim R, Hofmann A, Tschertner H, Sur une intoxication collective à syndrome psilocybinien causée en France par une *Copelandia*. *Comp.Rend.*, **1966**, *262*, 519-523.
- [25] Hucharz EJ, Braclik M, Kotulska A, *Coprinus*, a common European mushroom, is a previously unknown hallucinogenic plant, *Eur.J.Int.Med.*, **1999**, *10*, 61.
- [26] D'Antuono G, Tomasi R, *I funghi velenosi*, Edagricole,

- Bologna, 1988.
- [27] Wasson VP, Wasson RG, *Mushrooms, Russia and History*, Pantheon, New York, 1957, 2 vols.
- [28] Samorini G, New Data from the Ethnomycology of Psychoactive Mushrooms, *Int.J.Med.Mushr.*, 2001, 3, 257-278.
- [29] Samorini G, *Funghi allucinogeni. Studi etnomicologici*, Telesterion, Dozza, BO, 2002.
- [30] Samorini G, Sulla presenza di piante e funghi allucinogeni in Valcamonica, *Boll.Camuno St.Prest.*, 1988, 24, 132-136.
- [31] Kaplan RW, The sacred mushroom in Scandinavia, *Man*, 1975, 10, 72-79.
- [32] Pöder R, Peintner U, Pümpel T, Mykologische Untersuchungen an den Pilz-Beifunden der Gletschermumie vom Haulabjoch, in Höpfler F, Platzer W, Spindler K (Ed.), *Der Mann Im Eis*, Eingeverlag Univers., Innsbruck, 1992, 1, 313-320.
- [33] Sauter F, Stachelberger HW, Materialuntersuchungen an einem Begleitfund des "Mannes vom Hauslabjoch". Die "schwarze Masse" aus dem "Täschchen", in Höpfler F, Platzer W, Spindler K (Ed.), *Der Mann Im Eis*, Eingeverlag Univers., Innsbruck, 1992, 1, 442-453.
- [34] Pauletta G, Sull'attività antibiotica di un ceppo di *Polyporus betulinus* (Bull.) Fr., *Il Farmaco Ed.Sci.*, 1947, 2, 276-286.
- [35] Scotti R, *La figura di S.Onofrio affrescata nella chiesa di Santa Brigida*, Pro Loco di S. Brigida, BG, 2001.
- [36] Fericgla MJ, Las supervivencias culturales y el consumo actual de *Amanita muscaria* en Cataluña, *Ann.Mus.Civ.Rovereto*, 1993, suppl. 8, 245-256.
- [37] Grasso B, Il nostro Agarico Muscario sperimentato come alimento nervoso, *Gazz.Osp.Milano*, 1880, 1, 40-54.
- [38] Samorini G, A peculiar historic document concerning fly-agaric, *Eleusis J.Psychoact.Pl.Comp.*, 1996, 4, 3-16.
- [39] Saar M, Fungi in Khanty Folk Medicine, *J.Ethnopharm.*, 1991, 31, 175-179.
- [40] Waldschmidt E, Der Fliegenpilz als Heilmittel, *Integration*, 1992, 2/3, 67-68.
- [41] Zsigmond G, Les champignons dans la médecine populaire hongroise, *Bull.Soc.Myc.Fr.*, 1999, 115, 79-90.
- [42] Hyde C, Glancy G, Omerod P, Hall D, Taylor GS, Abuse of indigenous psilocybin mushrooms: a new fashion and some psychiatric complications, *Brit.J.Psychiat.*, 1978, 132, 602-604.
- [43] Supprrian T, Frey U, Supprrian R, Rösler M, Wanke K, Über den Gebrauch psychoaktiver Pilze als Rauschmittel, *Frotsch.Neurol.Psychiat.*, 2001, 69, 597-602.
- [44] Franz M, Regele H, Kirchmair M et al., Magic mushrooms: hope for a "cheap high" resulting in end-stage renal failure, *Nephrol.Dial.Transplant.*, 1996, 11, 2324-2327.
- [45] Gartz J, Das Hauptrisiko bei Verwendung psilocybinhaltiger Pilze - Verweschlung der Arten, 1995, *Jahrb.Transk.Med.Psychoter.*, 287-297.
- [46] Gerault A, Picart D, Intoxication mortelle à la suite de la consommation volontaire et en groupe de champignons hallucinogènes, *Bull.Soc.Myc.Fr.*, 1996, 112, 1-14.
- [47] Gartz J, Samorini G, Festi F, 1996, On the presumed fatality caused in France by ingestion of Liberty Caps, *Eleusis J.Psychoact.Pl.Comp.*, 1996, 6, 3-13.
- [48] Lindsay J, 1993, Renal Failure after eating "magic" mushrooms, *Can.Med.Ass.J.*, 1993, 148, 492.
- [49] Raff E, Hallora PF, Kjellstrand CM, Renal failure after eating "magic" mushrooms, *Can.Med.Ass.*, 1992, 147, 1339-1341.
- [50] Borowiak KS, Ciechanowski K, Waloszczyk P, Psilocybin Mushroom (*Psilocybe semilanceata*) Intoxication with Myocardial Infarction, *Clin.Toxicol.*, 1998, 36, 47-49.
- [51] Spengos K, Schwartz A, Hennerich M, Multifocal cerebral demyelination after magic mushroom abuse, *J.Neurol.*, 2000, 247, 224-225.
- [52] Beck O, Helander A, Karlson-Stiber C, Stephansson N, Presence of Phenethylamine in Hallucinogenic Psilocybe Mushroom: Possible Role in Adverse Reactions, *J.Anal.Toxicol.*, 1998, 22, 45-49.
- [53] Francis J, Murray VSG, Review of Enquires made to the NPIS Concerning Psilocybe Mushroom Ingestion, 1978-1981, *Human Toxicol.*, 1983, 2, 349-352.
- [54] Samorini G, Festi F, Le micotossicosi psicotrope volontarie in Europa: osservazione sui casi clinici, *Ann.Mus.Civ.Rovereto*, 1989, suppl. 4, 251-258.
- [55] Riva M, A funghi in dogana - Curiosando fra i funghi sequestrati / Pilzkunde am Zoll-Bestimmungsübungen an bechlagnahmenen Pilzen, *Schweiz.Zeit.Pilzkunde*, 2002, 80, 66-72.
- [56] Bogusz MJ, Maier R-D, Schäfer AT, Erkens M, Honey with *Psilocybe* mushrooms: a revival of a very old preparation on the drug market?, *Int.J.Legal Med.*, 1998, 111, 147-150.
- [57] Battisti C, Il sostrato mediterraneo nella fitonomia greco-latina, *Studi Etruschi*, 1960, 28, 349-384.
- [58] André J, *Le noms des plantes dans la Rome antique*, Les Belles Lettres, Paris, 1985.
- [59] Baumann H, *Greek wild flowers and plant lore in ancient Greece*, Herberet, London, 1993.
- [60] Martini MC, *Piante medicamentose e rituali magico-religiosi in Plinio*, Bulzoni, Roma, 1977.
- [61] Aliotta G, Piomelli D, Pollio A, 1994, Le piante narcotiche e psicotrope in Plinio e Dioscoride, *Ann.Mus.Civ.Rovereto*, 1994, 9, 99-114.
- [62] Merlin MD, *On the Trail of the Ancient Opium Poppy*, Ass. University, London & Toronto, 1984.
- [63] Maurizio A, *Geschichte der Gegoreenn getränke*, Neudruck, Berlin, 1933.
- [64] Brekhan II, Sam YA, Ethnopharmacologic Investigation of Some Psychoactive Drugs Used by Siberian and Far Eastern Minor Nationalities of USSR, in Efron DH et al. (Eds.), *Ethnopharmacologic Search for Psychoactive Drugs*, Public Health Service, Washington, 1967, 415.
- [65] Plowman TC, Leutchtman A, Blanet C, Clay K, Significance of the Fungus *Balansia cyperi* Infecting Medicinal Species of *Cyperus* (Cyperaceae) from Amazonia, *Econ.Bot.*, 1990, 44, 452-462.
- [66] Aaronson S, *Paspalum* spp. and *Claviceps paspali* in Ancient and Modern India, *J.Ethnopharm.*, 1988, 24, 345-348.
- [67] Ginzburg C, *Storia notturna. Una decifrazione del sabba*, Einaudi, Torino, 1989.
- [68] Harner MJ, The Role of Hallucinogenic Plants in European Witchcraft, in Harner MJ (Ed.), *Hallucinogens and Shamanism*, Oxford University, London, 1973, 125-150.
- [69] Piomelli D, Pollio A, *In upupa o strige. A Study in Renaissance Psychotropic Plant Ointment*, *Hist.Phil.Life Sci.*, 1994, 16, 241-273.
- [70] Tomei PE, L'uso delle specie vegetali nelle arti magiche, in Bosco G, Castelli P (cur.), *Stregoneria e streghe nell'Europa moderna*, Ministero Beni Culturali e Ambientali, Pisa, 1996, 207-210.
- [71] De Vries H, Über die sogenannten hexensalben, *Integration*, 1992, 1, 31-42.
- [72] Credaro V, *Stregoneria e botanica; identificazione dell'erba tirella con Orchis maculata L.*, *Boll.Soc.St.Valtell.*, 1990, 43, 115-118.
- [73] Lussi K, Die Anwendung von Nelkenwurz und Muskatnuss im alpenländischen Liebeszauber, *Jahrb.Ethnomed.Bewusstseinsf.*, 1997-98, 6-7, 169-183.
- [74] Rättsch C, *Enzyklopädie der psychoaktiven Pflanzen*, AT, Aarau, Switzerland, 1998.
- [75] Festi F, Aliotta G, 1989, Piante psicotrope spontanee o coltivate in Italia, *Ann.Mus.Civ.Rovereto*, 1989, 5, 135-166.
- [76] Brogginini M, Lorenzini ML, Reina A, Bottà V, Mezzetti MG, Intossicazione acuta da *Datura stramonium* in tossicodipendente, *Acta Anesth.It.*, 1987, 38, 639-643.
- [77] Soldati G, Piero A, Sindrome antimuscarinica, *Fed.Med.*, 1995, 7, 21-24.

Table 1 - Alpine psychoactive Basidiomycetes

Isoxazolic

Psilocybian

AMANITACEAE

- **Amanita muscaria* (L. ex Fr.) Hook. [F,I,Sw,A,SI]
- **A. pantherina* (DC. ex Fr.) Kumm. [F,I,Sw,A,SI]
- A. regalis* (Fr.) Michael¹ [F,I,Sw,A]

STROPHARIACEAE

- **Psilocybe bohemica* Sebek [A]
- **P. cyanescens* Walf. [F,I,Sw,A]
- **P. semilanceata* (Fr.) QuéL. [F,I,Sw,A,SI]
- **P. serbica* Mos. & Horak [A,SI]
- **P. strictipes* Sing. & Sm.² [F,I,Sw,A,SI]

COPRINACEAE

- Panaeolus bisporus* (Mal. & Bert.) Gerh.³ [Sw, advent.]
- **Pan. cyanescens* Berk. & Br.⁴ [F,Sw,A]
- Pan. fimicola* (Pers. ex Fr.) Gill.⁵ [F,I,Sw,A]
- Pan. foenisecti* (Pers. ex Fr.) Kühn.⁶ [F,I,Sw,A,SI]
- Pan. olivaceus* Möll.⁷ [A,Sw]
- Pan. papilionaceus* (Bull. ex Fr.) QuéL. var. *papilionaceus*⁸ [F,I,Sw,A,SI]
- **Pan. subbalteatus* (Berk. & Br.) Sacc.⁹ [F,I,Sw,A,SI]

CORTINARIACEAE

- **Inocybe aeruginascens* Babos [Sw,A]
- I. calamistrata* (Fr.) Gill. [I,Sw,A]
- I. coelestium* Kuyp. [Sw,A]
- I. corydalina* QuéL. var. *corydalina* [F,I,Sw,A]
- I. corydalina* QuéL. var. *erinaceomorpha* (Stangl & Vesel) Kuyp. [Sw]
- I. haemacta* Berk. & Br. [F,I,Sw,A]
- I. tricolor* Kühn. [Sw,A]

PLUTEACEAE

- **Pluteus salicinus* (Pers. ex Fr.) Kummer [F,I,Sw,A]

(?) *Coprinus atramentarius* Bull. ex Fr., Coprinaceae [F,I,Sw,A,SI]

A=Austria; F=France; I=Italy; SI=Slovenia; Sw=Switzerland

* Species nowadays collected on the Alpine region and used as hallucinogenic drugs.

¹ = *A. muscaria* var. *regalis* (Fr.) Bart.

² = *P. callosa* (Fr. ex Fr.) QuéL.

³ = *Copelandia bispora* (Mal. & Bert.) Sing. & Weeks

⁴ = *Copelandia cyanescens* (Berk. & Br.) Sing.

⁵ = *Pan. ater* (Lange) Kühn. & Rom.

⁶ = *Panaeolina foenisecti* (Pers. ex Fr.) Maire

⁷ = *Pan. castaneifolius* Murr.

⁸ = *Pan. campanulatus* (Fr.) QuéL.; *Pan. retirugis* (Fr.) QuéL.; *Pan. sphinctrinus* (Fr.) QuéL.

⁹ = *Pan. cinctulus* (Bolt.) Sacc. sensu Gerh.