

## Ectomycorrhizal fungi of Kashmir forests

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**Abstract.** All the macromycetes recorded in Kashmir and suspected to be mycorrhizal (77 taxa) are discussed in the context of the vegetational communities of Kashmir.

**Key words:** Conifers – Willows – Birch – Agarics – Boletes – Chanterelles – Clavarioid fungi

### Introduction

The State of Kashmir is highly agricultural with extensive paddy fields and associated crops. Natural woodland communities are found on the higher land which, however, have been considerably modified by man over the centuries. The Kashmir valley, which is the dominating physiognomic feature, has an area of 1 512 000 ha and is the result of the drainage of an extensive, ancient, former glacial lake. The surrounding mountains are of comparatively recent origin, being predominantly of Tertiary age and on the whole producing base-rich soils.

The valley is characterised by a Mediterranean climate but with two hot, dry periods, one in June and the other in the autumn; there is high precipitation in the cooler period, with temperatures in the winter plummeting to well below freezing. The high land encircling the valley rises to 5664 m and is clothed in snow for long periods of time.

The total area of Kashmir is 2335.2 ha of which 55% is forest, with a small proportion (76.64 ha) designated as wildlife sanctuaries and forest reserves. Game sanctuaries (43.8 ha) are mainly located at Datchigam, San-karacharya, Chumh Nai, Aija Jheel and Desu. Alpine pasture and grazing land covers about 308 ha. The forest areas in general are classified into those of commercial use, those uneconomic for felling and the alpine for-

ests. The major forest zones are at Kamroj, Langet, Sindh Jhelam valley, Pir Panjal. There are also plantations.

The potential ectomycorrhizal hosts in the natural communities belong to two families, the Pinaceae, particularly *Abies pindrow* (Royle) Spach, *Picea smithiana* (Wall.) Boiss. and *Pinus wallichiana* Jackson, and the Betulaceae. *Cedrus deodara* (Rox.) D. Don (Pinaceae) also occurs and is considered ectomycorrhizal. No short roots of any of these Kashmir plants have been examined microscopically (Table 1).

*Castanea sativa* Mill. (Fagaceae), a known ectotrophic phanerogam, has not been found consistently associated with any characteristic, macromycetes. It has naturalised in several areas or has been deliberately planted for food, as have *Juglans regia* L. and *Morus alba* L.

Arborescent members of the genus *Salix* have been planted extensively throughout Kashmir. Based on observations in Europe, it is considered that in wet places members of sect. *Vitalix* are predominantly endomycorrhizal, although typical members of ectomycorrhizal agarics have been found in Kashmir in plantations in association with *Salix alba* L. *Populus tremula* L. and its allies in *Populus* sect. *Leuce* are known to be ectomycorrhizal in Europe, although members of sect. *Aegerios* are frequently endotrophic (Harley and Harley 1987). *Populus nigra* L., which belongs to the latter section, is planted along many roads and ditches in lowland Kashmir, in areas highly modified by man; consequently few fungi, except *Agrocybe cylindrica* (DC.: Fr.) Mérat and *Pholiota destruens* (Brond.) Gillet, two lignicoles, are associated with this tree.

### Collecting sites

The areas to which most attention has been directed are the Gulmarg forests some 36 km from Srinagar, and the associated area of Tangmarg (2000 m above sea level), Pahlgam (= Pahalgam) at 2667 m to the northeast of Srinagar, and Sonamarg lying at 2500 m with its alpine forest of *Betula utilis* D. Don and alpine pasture. The

**Table 1.** Ectomycorrhizal fungi with suspected hosts. Herbarium material: Wat., Watling collections in Royal Botanic Garden, Edinburgh; A and RRL-MH, Abraham collections in Regional Research Laboratory, Sanat Nagar, Srinagar

Suspected mycorrhizal host	Associated fungus	Locality/accession number
Pinaceae		
<i>Cedrus deodara</i> <i>Viburnum</i> in vicinity also see under mixed communities	<i>Russula rubicunda</i>	Tangmarg; RRL-MH2
<i>Picea smithiana</i>	<i>Amanita ceciliae</i> <i>Amanita francheti</i> <i>Amanita pantherina</i> <i>Cantharellus cibarius</i>	Gulmarg; A-826; A-1986 Gulmarg; A-429 Gulmarg (no voucher), see text Gulmarg and Tangmarg Wat. 13002; RRL-MH6
Also associated with <i>Cedrus</i>	<i>Chroogomphus tomentosus</i>	Gulmarg; A-435
<i>Viburnum</i> in vicinity	<i>Chroogomphus vinicolor</i> <i>Cortinarius argutus</i> <i>Cortinarius kashmeriensis</i> <i>Gomphus brunneus</i> <i>Gomphus clavatus</i> <i>Hygrophorus pustulatus</i> <i>Inocybe fastigiata</i> <i>Lactarius deterrimus</i>	Gulmarg; A-43 Pahlgam; Wat. 12990 Gulmarg; Wat. 13069 Tangmarg Gulmarg; Wat. 13013; RRL-MH9 Voucher material in Herbarium Poona Pahlgam; Wat. 12970 Gulmarg and Tangmarg; Wat. 13074; RRL-MH5
	<i>Lactarius fuliginosus</i> <i>Russula densifolia</i> <i>Strobilomyces floccopus</i> <i>Tricholoma terreum</i>	Gulmarg; RRL-MH28 Gulmarg (no voucher) Gulmarg; A-2197 Gulmarg; RRL-MH5
<i>P. smithiana</i> intermixed with <i>Abies pindrow</i>	<i>Amanita excelsa</i>	Gulmarg; A-754
	<i>Amanita flavoconia</i> <i>Amanita fritillaria</i> <i>Clavariadelphus truncatus</i>	Gulmarg; A-880 Gulmarg; A-431 Tangmarg; Wat. 13052
<i>Pinus wallichiana</i>	<i>Amanita vaginata</i> <i>Floccularia albolanaripes</i> <i>Suillus plorans</i> <i>Suillus sibiricus</i> <i>Xerocomus bakshii</i>	Pahlgam; A-239; A-1578 Gulmarg; A-978 Pahlgam; Wat. 12981 Pahlgam; Wat. 12964, 12994 Gulmarg; A-460B
Mixed communities dominated by <i>P. smithiana</i> and <i>P. wallichiana</i> (for other general conifer stands see text); sparse <i>A. pindrow</i>	<i>Hygrophorus chrysodon</i>	Gulmarg, Tangmarg and Pahlgam Wat. 12993, 13016, 13026, 13038
	<i>Incobyte cf. appendiculata</i> <i>Incobyte friesii</i>	Tangmarg; Wat. 13023 Tangmarg; Wat. 13060
Accompanied by <i>Viburnum</i>	<i>Incobyte geophylla</i> <i>Lactarius scrobiculatus</i> <i>Lactarius subpurpureus</i> <i>Russula brevipes</i>	Tangmarg (no voucher) Tangmarg; Wat. 13033; RRL-MH4 Gulmarg (no voucher) Gulmarg and Tangmarg; Wat. 13054; RRL-MH1
	<i>Russula densifolia</i> <i>Russula firmula</i>	Sonamarg (no voucher) Tangmarg and Pahlgam; Wat. 13012, 13021
	<i>Russula nauseosa</i> (as <i>Russula xanthophaea</i> )	Pahlgam; Wat. 12971, 12975 Tangmarg; Wat. 12973, 13049; RRL-MH2
	<i>Tricholoma terreum</i>	Tangmarg (no voucher)
Betulaceae		
<i>Betula utilis</i>	<i>Amanita muscaria</i> <i>Cortinarius subfulgens</i> <i>Russula densifolia</i>	Sonamarg (no voucher) Sonamarg; Wat. 13008 Pahlgam and Sonamarg; RRL-MH3
Fagaceae		
? <i>Castanea sativa</i> (conifers in vicinity)	<i>Russula fragrantissima</i>	Pahlgam; Wat. 12995

Table 1 (continued)

Suspected mycorrhizal host	Associated fungus	Locality/accession number
Salicaceae <i>Salix alba</i>	<i>Amanita vaginata</i> <i>Cortinarius decipiens</i> <i>Inocybe geophylla</i> var. <i>geophylla</i> var. <i>lilacina</i> <i>Inocybe hygrophorus</i> <i>Inocybe maculata</i>	Sarband; Wat. 12987; RRL-AM1 Harwan; Wat. 13019 Harwan; Wat. 13020 Harwan (no voucher) Harwan; Wat. 13001, 13077 Harwan; Wat. 12982, 12991, 12996, 13004
	<i>Lactarius controversus</i> <i>Lactarius</i> aff. <i>uvidus</i> <i>Russula persicina</i> <i>Russula</i> cf. <i>sanguinea</i> <i>Russula</i> aff. <i>veterinosa</i>	Sarband; Wat. 12978; RRL-MH9 Sarband; Wat. 13000; RRL-MH8 Sarband; Wat. 12984 Sarband; Wat. 12985 Sarband; Wat. 12986, 13006

plantations around Harwan and the reserve at Dachigam were also studied.

The forests at Gulmarg and Tangmarg are dominated by *A. pindrow* intermixed with *P. wallichiana* and *P. smithiana*, and *B. utilis* in their upper limits, and at the latter site with a proportion of *C. deodara*. At Pahlgam, *Picea* and *Pinus* are again dominant with interspersed groups of *Abies*, *Juglans*, *Acer caesium* Wall. ex Brand., *Aesculus indica* Coleb. ex Cambess. and *Parrotiopsis jacquemontiana* (Decne.) Rehder. *Pinus* is not present in the community at Sonamarg.

#### List of suspected ectomycorrhizal fungi

##### Agaricaceae and Lepiotaceae

These are not generally considered to be mycorrhizal: 16 taxa are known. This includes unpublished data on specimens sent for identification to Edinburgh.

##### Amanitaceae

*Amanita ceciliae* (Berk. & Br.) Bas is widespread in Europe but is generally not known under this name; it is more familiar as *A. inaurata* Secretan, although this name is not valid, or *A. strangulata* Fr., although this name has been misinterpreted. This fungus was found at Gulmarg with *P. smithiana*, and constitutes the second record from India; the first was from Uttar Pradesh (Allahabad; Singh and Mehrotra 1974). It is closely related to *A. vaginata* q.v.

*A. citrina* (Schaeff.) S. F. Gray is a common member of the northern, temperate agaric flora; it is found in mixed woodlands with or without coniferous elements. This habitat preference is reflected in the two collections from Pahlgam.

*A. excelsa* (Fr.) Kummer is common in mixed woodlands in Europe and North America; this is the first record from India. It was found in mixed *A. pindrow* and *P. smithiana* at Pahlgam.

*A. flavoconia* Atkinson is a North American fungus not uncommon there in mixed woodland. This is the

first record from India and it was found at Gulmarg with *A. pindrow* and *P. smithiana*.

*A. francheti* (Boud.) Fayod is often considered to be a form of or a closely related taxon to *A. aspera* (Fr.) Hooker, indeed it is the correct name for this agaric, which is found in both coniferous and frondose woodland throughout the United States and Europe; it is probably more southern in Europe. This is the first record from India; it was found at Gulmarg with *P. smithiana*.

*A. fritillaria* (Berk.) Sacc. is already known from India, having been described from Assam by Berkeley (1852) and subsequently from Uttar Pradesh (Dehra Dun) by Bakshi (1974). It has also been recorded from the Singapore Botanic Garden and Bukit Timah (Corner and Bas 1962). The Kashmir collection thus extends its range even further. Its mycorrhizal hosts are potentially *A. pindrow* and *P. smithiana* under which it was growing.

*A. muscaria* L.: Fr.) Hooker has been recorded from under *B. utilis* at Sonamarg (Watling and Gregory 1980) but voucher material is lacking.

*A. pantherina* (DC.: Fr.) Secr. has been found in mixed coniferous woodland at Gulmarg and Pahlgam, although Watling and Gregory (1980) found it associated specifically with *P. smithiana*.

*A. rubescens* (Pers.: Fr.) S. F. Gray is very common in mixed woodlands in Europe and has been found associated with *A. pindrow* and *P. wallichiana* at Gulmarg. This species is not recorded for India by Manjula (1983).

*A. vaginata* (Bull.: Fr.) Vitt. is known from Pahlgam under *P. wallichiana* and in a coloured form from *Salix* plantations at Harwan (Watling and Gregory 1980); it is recorded from elsewhere in India (see Manjula 1983).

*A. vittadini* (Moretti) Vitt. is known from North Africa and Europe although it is rare in central and western parts. The Kashmir record extends the range considerably and emphasises within the genus *Amanita* the mixture of North American, South European and more boreal elements.

*A. vittadini* is a member of sg. *Lepidella* and apparently is the first member of the subgenus in India. Mem-

bers of the group generally grow in open grassy woodland or even on prairies and pampas. It appears that there is an area of research here to ascertain the mycorrhizal potential of *A. vittadini* and its allies. In Kashmir it has been found in shade under *Viburnum* in *Pinus* and *Abies* woodland.

#### *Bolbitiaceae*

These are saprotrophs with 17 species known, the majority of which are dealt with by Watling and Abraham (1986); Abraham and Kaul (1988); and Watling et al. (1988).

#### *Boletaceae*

Two members of the genus *Suillus*, *S. plorans* (Roll.) Singer and *S. sibiricus* Singer, have been found at Pahlgam, and *Strobilomyces floccopus* (Vahl.: Fr.) Karst. has been recorded by Murrill (1924, as *S. strobilaceus*). There is a wealth of bolete species in Kashmir but the taxa have as yet not been critically studied. They include all the major groups of boletes including *Tylopilus* sect. *Porphyrellus* (Gilbert) Smith & Thiers, *Chalciporus piperatus* (Bull.: Fr.) Singer, *Xerocomus bakshii* Singer & Singh and *Boletus* sect. *Edules*, represented probably by *B. edulis* Bull.: Fr. and *B. gigas* Berk. If correct *B. edulis* is a new record for India as is *C. piperatus*. *X. bakshii* was only previously known from experimental forestry plots at Dehra Dun, Uttar Pradesh (Singer and Singh 1971; Bakshi 1974).

#### *Cantharellaceae*

*Cantharellus cibarius* Fr. is widespread at Gulmarg with *P. smithiana* (Abraham et al. 1980).

#### *Clavariadelphaceae*

*Clavariadelphus truncatus* (Quél.) Donk is known from Tangmarg growing amongst conifer needles under *P. smithiana* and *A. pindrow* (Watling and Gregory 1980).

#### *Clavulinaceae*

*Clavulina cristata* (Fr.) Schroet. is recorded in a *Picea/Pinus* community at Upper Tangmarg.

#### *Coprinaceae*

These are saprotrophs with 18 species recorded for Kashmir (Watling, unpublished work).

#### *Cortinariaceae*

There are 63 members of this very large family known to occur in Kashmir with one represented by two colour varieties. There are at least five further unidentified taxa in the genus *Cortinarius* which have been located. Of the 39, about half are considered potentially ectomycorrhizal. Five *Cortinarii*, two species of *Hebeloma* and seven species of *Inocybe* have been dealt with by Watling and Gregory (1980) including a gasteroid member of *Cortinarius* sect. *Phlegmacium*, *C. kashmiriensis* Watling. At least one of these, *C. decipiens* (Pers.) Fr., and three of the genus *Inocybe* (*I. geophylla* (Sow.: Fr.) Kummer, *I. maculata* Boud. and *I. hygrophorus* Kühn.) were associated with *S. alba* at Harwan. To these can be added four further species all in the genus *Hebeloma* and kindly identified for S. P. A. by Dr. D. Pegler, Royal Botanic Gardens, Kew: *H. alpinum* Bruchet from Gulmarg, *H. testaceum* (Batsch: Fr.) Quél. from Sonamarg, *H. crustuliniforme* (Bull.: Fr.) Quél. from Gulmarg, and *H. pusillum* Lange from Sonamarg.

Also new are *Descolea pretiosa* Horak, described originally from coniferous forests, Himachal Pradesh (Horak 1971) and now found in Kashmir with *A. pindrow*, and *Cortinarius parafulmineus* R. Henry and *H. sinapi-zans* (Paulet: Fr.) Gillet, which have recently been recorded by Abraham (unpublished data). In total about 68 members of the family are known at present from Kashmir, although this number will undoubtedly rise.

#### *Crepidotaceae*

These are saprotrophs with two species known from Kashmir; see Watling and Gregory (1980).

#### *Gomphaceae*

*Gomphus brunneus* (Heinem.) Corner, originally described from Central Africa (as *Neurophyllum*, Heine-mann 1959) was collected at Tangmarg; although the basidiomata were very young they agreed in all essential details.

*G. clavatus* (Pers.: Fr.) S. F. Gray is known from under *P. smithiana* at Gulmarg (Watling and Gregory 1980).

*G. floccosus* (Schw.) Singer has recently been recorded from Gulmarg (Abraham and Kaul 1988).

#### *Gomphidiaceae*

*Chroogomphus tomentosus* (Murr.) O. K. Miller has been collected at Gulmarg; it was previously only known from North America.

*C. vinicolor* (Peck) O. K. Miller has been recorded in mixed conifer forest at Gulmarg amongst *Viburnum* shrubs with *P. smithiana*.

### Hygrophoraceae

Two species of ectomycorrhizal *Hygrophorus* [*H. chysodon* (Batsch: Fr.) Fr. and *H. pustulatus* (Pers.: Fr.) Fr.] are recorded by Watling and Gregory (1980). These same authors record *Hygrocybe psittacina* but it is not considered to be ectomycorrhizal.

### Pleurotaceae

These are saprotrophs, generally lignicolous; 10 taxa within this family are recorded for Kashmir.

### Pluteaceae

These are saprotrophs, generally lignicolous; seven taxa are known from the region.

### Paxillaceae

*Paxillus atrotomentosus* (Batsch: Fr.) Fr., recorded from Kashmir is primarily lignicolous.

*P. rubicundulus* P.D. Orton, has recently been recorded amongst grass and litter in plantations of *Populus* and *Salix* bordering rice fields at Magham-Narbal, Srinagar. In Europe it is associated with *Alnus*.

### Ramariaceae

*Ramaria aurea* (Fr.) Quél. is apparently widely distributed in Kashmir, having been found at Gulmarg, Tangmarg and Pahlgam; in the first locality it was in *Abies/Picea* forest with *C. deodara* intermixed.

Several collections of *R. formosa* (Fr.) Quél. have been made, especially in mixed conifer forest in Upper Tangmarg.

### Russulaceae

During a trip made by R. W. in 1978, 14 members of the family were recorded, the majority (9) in the genus *Russula*. It was impossible to equate with certainty some of the Kashmir material with either European or North American collections, and in one species several varietal names were employed to express the variation found. The species were: *Lactarius controversus* (Fr.: Fr.) Fr. with *S. alba*, *L. deterrimus* Gröger with *Picea*, *L. scrobiculatus* (Scop.: Fr.) Fr. with *Pinus* and *Picea*, *L. subpurpureus* Peck with conifers and *L. aff. uvidus* (Fr.: Fr.) Fr. with *Salix*; *Russula brevipes* Peck at various sites in Gulmarg/Tangmarg area, *R. densifolia* (Secr.) Gillet at Gulmarg and Sonamarg (Abraham et al. 1981), *R. firmula* J. Schaeffer at both Pahlgam and Tangmarg, *R. aff. fragrantissima* Romagn. possibly with *Castanea*, *R. persicina* Krombh. with *Salix*, *R. rubicunda* Quél. in mixed conifer forest, *R. cf. sanguinea* (Bull.: St Amans)

Fr. and *R. veteriosa* Fr. both with willow, and various variants of *R. nauseosa* (Pers.: Schw.) Fr. To this list, S. P. A. has added *Lactarius salmonicolor* Heim & Leclair from Tangmarg, *R. foetens* (Pers.: Fr.) Fr. and *R. quelletii* Fr. apud Quél., all from Gulmarg. To this list can also be added *L. fuliginosus* growing with *P. smithiana* at Gulmarg (Abraham and Kaul 1985).

### Schizophyllaceae

*Schizophyllum commune* Fr. This is a saprotroph with a single species known from Kashmir.

### Strophariaceae

These are saprotrophs with five species known from Kashmir.

### Tricholomataceae

This is a large family covering many different genera of white-spored agarics and exhibiting a whole spectrum of life forms; members at different ends of the spectrum often differ radically from each other. The family contains both mycorrhizal and non-mycorrhizal species. The latter in Kashmir number 33, leaving only 2 which are suspected of being ectomycorrhizal, viz. *Armillaria albolanaripes* Atk. recorded recently from Gulmarg with *P. wallichiana* and *Tricholoma terreum* (Schaeff.: Fr.) Kummer, also known with mixed conifers at Gulmarg (Watling and Gregory 1980; Abraham and Kaul 1985). It should be noted that *A. albolanaripes* is not a true member of the genus *Armillaria* and has been transferred to *Floccularia* in virtue of its amyloid basidiospores etc. [*Floccularia albolanaripes* (Atk.) Watling & Abraham Basionym: *Armillaria albolanaripes* Atk. in *Ann Mycol* 6: 54 (1908)].

*Tricholoma aurantiacum* (Schaeff.: Fr.) Rick has recently been added to the Indian list based on collections from Gulmarg, Pahlgam and Patinitop.

*T. sejunctum* (Sow.: Fr.) Quél. A collection close to this has been found a Batote in a pine plantation; in Europe this species is generally associated with wet birch woods.

### Discussion

In addition to the agarics and clavarioid fungi listed above, *Scleroderma verrucosum* (Vaill.) Pers. has been shown in Europe to be an important mycorrhizal fungus; it has been found at Sanat Nagar, Srinagar, in a poplar-willow plantation. The other gasteromycetes so far recorded from Kashmir are saprotrophs.

The understanding of the fungal flora of Kashmir is still in an exploratory stage and undoubtedly there are many more species to be recorded. Thus the ubiquitous *Laccaria laccata* (Scop.: Fr.) Berk., although known

**Table 2.** Number of suspected mycorrhizal species recorded for Kashmir with appropriate data for India (several other genera are found outside Kashmir)

Family	Kashmir	India
Amanitaceae	11	18
Boletaceae		
<i>Boletus</i>	2	3
<i>Strobilomyces</i>	1	1
<i>Suillus</i>	2	8
<i>Xerocomus</i>	1	3
other boletes	2	19
Cantharellaceae	1	3 (1 unnamed)
Clavariadelphaceae	1	5
Clavulinaceae	1	9
Cortinariaceae		
<i>Cortinarius</i>	7	12
<i>Hebeloma</i>	7	4
<i>Descolea</i>	1	1
<i>Inocybe</i>	8 (1 unnamed)	12
Gomphaceae ( <i>Gomphus</i> only)	3	3
Gomphidiaceae	2	2
Hygrophoraceae ( <i>Hygrophorus</i> )	2	3
Paxillaceae	1 (excluding lignicoles)	2
Ramariaceae	2	25
Russulaceae		
<i>Lactarius</i>	7	13
<i>Russula</i>	11	16
Tricholomataceae		
<i>Tricholoma</i>	3	5
<i>Floccularia</i>	1	1

from other areas of India, has not been recorded from Kashmir; surely it is not *absent*, just *not collected!* *Rozites*, represented in India by two species, might also be expected to occur in common with more familiar agarics. Undoubtedly, the fungi described above appear to be representative of large areas of Kashmir covered by mixed conifers; preliminary studies by S. P. A. in the Batote, Bholderwah and Patinitop forests show an ectomycorrhizal flora parallel to that of Gulmarg, Pahlgam etc.

Watling and Gregory (1980) recorded 119 taxa and their collections have been extended by Abraham et al. (1980, 1981, 1984, 1985). Of the 175 now recorded for Kashmir, 53 are suspected to be mycorrhizal. Manjula (1983) lists 583 species for the Indian agaric flora, although a few more have been added since by Sathe et al. (1980) and others. Of the approximately 650 species now known, about 22% occur in Kashmir and 33% of these are ectomycorrhizal. A compilation of the data is presented in Table 2.

Kashmir is a tourist attraction and many holiday resorts are located in the forest area. Intense pressure is exerted on these forests and because of the well-maintained road and track system, few are inaccessible. The felling of trees and overgrazing are commonplace in many areas and destruction by fire, both natural and man-made, has led to some soil exposure and subsequent erosion exacerbated by rain and melting snow; major landslips also occur. Legislation is in force to

eliminate indiscriminate felling and unauthorised grazing, but still the forests are under threat.

It is important, therefore, in view of the vital, fundamental association between macromycetes and trees, that an attempt be made to catalogue the organisms involved. It is the mycorrhizal relationship which ultimately gives the grandeur of the forests and, therefore, their aesthetic appeal and the commercial sources of timber. If these are to be improved and sustained, and the land protected against deleterious environmental effects, more effort is required to examine the ecosystem of these communities. In addition, some clues to the relationship between the flora of the Indian subcontinent and its neighbours can be ascertained by the study of the fungal flora (Watling 1978). Some connections have been currently suggested with Europe (S. P. Abraham et al., unpublished work), but with more and more information now available from other sources in India besides Kashmir, e.g. *Suillus* spp. (Natrajan and Raman 1983), some relationships might be made with North America. Attempts to make connections with the recent past can also be formulated, e.g. the part played by the Mogul invaders, and the age of the ethnomycology of the native peoples, and whether the latter traditions can be used to explore the use of mycorrhizal and non-mycorrhizal fungi as an untapped source of food.

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