Ethnomycological Study of Wild Edible and Medicinal Mushrooms in District Jammu, J&K, India

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Abstract

Background: Union Territory of Jammu and Kashmir (J&K) has a rich tradition of usage of wild edible mushrooms (WEM) for culinary and medicinal purposes. But very few studies, restricted to some regions of the Union Territory, have been conducted to enlist the WEM. District Jammu has never been explored for WEM. Moreover, the quantification of the traditional knowledge of WEM has not been carried out as yet in J&K. Therefore, the present study was conducted in Jammu district with aims of; enlisting the WEM and its usage, finding the most used WEM, and enumerating the consensus of usage for a species and associated knowledge.

Methods: Data of use reports was collected as per semi–structured questionnaire from 192 randomly selected informants. The cultural importance index (CI) and informant consensus factor (F_{ic}) were calculated on the basis of use reports. Analysis of variance was used to evaluate the significance of differences in the usage of WEM among the different informant categories.

Results: Results of the present study show that the locals were having the knowledge of fourteen fleshy fungi that are mainly utilized for culinary purposes. They also affirmed various medicinal values of some of these fungi. *Termitomyces* sp. (CI, 0.57) was the most important and diversely used species. *Termitomyces heimii*, *Termitomyces clypeatus* and *Termitomyces striatus* var*. annulatus* were the other frequently consumed species by the locals. More than 78.6% of these WEM were new records as culinary and medicinal for Jammu and Kashmir (UT). Agaricaceae and Lyophyllaceae were the largest families and *Termitomyces* (5 species) the most represented genera. Females, elders, and informants who have not attended schools were having significantly (*P<0.05*) higher information regarding WEM. The maximum consensus was recorded for the use of WEM as culinary with 596 citations and 0.98 F_{ic}, and the minimum homogeneity was found for their use in skin diseases (42 citations and 0.76 F_{ic}).

Conclusion: The inhabitants of district Jammu had good knowledge of WEM, but no documentation, lying of most of the information with elders and uneducated people, and destruction of forests and other natural habitats of WEM pose serious threat of losing this valuable information in near future. An ardent need is to educate locals regarding regionally available WEM. Further studies are recommended for developing protocols of cultivation of these WEM so that their future availability is ascertained along with creating income resources for the local population.

Introduction

The edible fleshy fungus growing in natural habitats and not cultivated is classified as wild edible mushroom (WEM). These species are a great source of proteins, fibres, minerals, and trace elements [1] apart from having low content of fats, low or negligible calories and cholesterol [2]. In addition to nutritional values, WEM have abundance of bioactive compounds like antibacterial, antidiabetic, anticancer, anticoagulant, antifungal, anti–HIV, antiinflammatory, antioxidant, antiparasitic, antiproliferative, antiviral, cytotoxic, hepatoprotective compounds, hypocholesterolemic, among others

[3–5]. Due to these nutritional and health benefits, WEM can be used as an important food to eradicate the menace of malnutrition from various African and Asian countries. FAO is also promoting the use of WEM for income generation and food security [6].

As many as 2000 species of edible fungi have been reported to be in use worldwide [7]. Boa [8] has reported 88 species as edible and medicinal, 249 species as food and medicinal and 133 species as medicinal only fungi i.e. a total of 470 medicinal fungi worldwide. In another estimate by Rai et al. [7] approximately 650 species of fungi have medicinal value. A total of 283 edible fungi have been recorded from India [9], besides 100 medicinal fungi [10]. Despite so many benefits, the use of WEM is not common in Indian societies due to; (i) incidences of food poisoning after the consumption of toxic fungi, (ii) some religious bindings as WEM are considered non–vegetarian food by some communities, (iii) urbanization and change in land use from forests to agriculture reducing the availability of WEM, and (iv) non–availability of local guide for the identification of edible and toxic fungi. The problem of identification of edible fungus can be solved by promoting the folk taxonomy of the WEM. Folk taxonomies are the outcome of social knowledge, interactions and dialects. It is the categorization of organisms on the basis of the conventional system of using vernacular names [11-13]. Mostly the vernacular names are based on some prominent features such as appearance, colour, habit, habitat, shape, size, smell, taste, utility as edible or poisonous [11, 12].

Ethnomycological studies on wild edible and medicinal mushrooms have been carried out in different parts of India [9, 10, 14-26], and the world, especially Africa [27-31], but such studies are rare in Jammu and Kashmir [2, 11-13, 32-35]. Quantitative analysis of traditional knowledge using cultural importance index [36] and factor informant consensus [37] has become increasingly popular in recent times. Basically these analyses show the extent of consensus among an ethnic community for a particular species or knowledge and the most used species. The present quantitative ethnomycological study is the first of its kind from Jammu and Kashmir.

Jammu is the winter capital of Jammu and Kashmir (Union Territory). The topography of most part of the district is undulating. Agriculture is the main occupation of approximately 60% of the population. The percentage of uncultivated and cultivated land area is 22.4% and 35.3%, respectively and the forest cover of district Jammu is merely 12.6% [38]. The forests are highly degraded and fragmented and the villagers usually visit them for the collection of fuelwood and non–wood forest products especially WEM. The present study was executed in district Jammu with aims of; (i) listing the traditional knowledge of wild edible and medicinal mushrooms, (ii) finding the most used WEM, and (iii) enumerating the consensus of usage for a species and associated knowledge. The outcome of this study will help in understanding the status of WEM and associated knowledge in Jammu district. This study can also lay the foundation for further studies on the nutritional aspects of the WEM, and their domestication and popularization to serve humanity, especially farmers and local populace, in generating income along with health benefits.

Material And Methods

Study area

Jammu is situated to the South of the great Himalayan range and North of the plains of Punjab (Fig. 1). Located at 32.73° N and 74.87° E and covering approximately 3,250 Km^2 area it comprises four tehsils *viz*. Akhnoor, Bishnah, Jammu, and Ranbir Singh Pura (R.S. Pura). Altitude of the district above sea level varies from 300–800m. The region has great variation in its temperature and precipitation with mean monthly temperature above 20° C. Situated in the subtropical part, the district has a markedly periodic climate as is characterized by a dry and increasingly hot season from April to June, a warm monsoon period from July and September and a dry and cold weather from October to December with slight winter rain during the months of January to March. The overall characteristics of Jammu forests is of dry, mixed deciduous or scrub type and the dominant vegetation of the forests comprises of *Acacia modesta*, *Aegle marmelos*, *Butea monosperma*, *Cassia fistula*, *Zizyphus mauritiana*, *Mallotus phillipensis*, *Diospyros montana*, *Grewia optiva*, *Pinus roxburghii*, *Premna barbata*, *Terminalia billerica*, *Adhatoda vasica*, *Flacourtia indica*, *Dodonaea viscosa*, *Capparis sepiaria*, *Woodfordia fruticosa*.

Methodology

Collection and identification of fungi

Systematic and periodic surveys of different locations of district Jammu were conducted, and careful field records were made for habitats, hosts, substrates, and photographs of collection sites and fruit bodies were taken for studying wild fleshy fungi. Macroscopic features were studied from fresh material and microscopic structures were observed in dried material by using 5% KOH and Congo Red. Micro–characters were observed with a Nikon E–400 microphotographic unit. Further identification and confirmation was done using pertinent keys, monographs and books [39-42]. Details of various mushroom species were taken from Ainsworth and Bisby's "Dictionary of Fungi" by Hawksworth et al. [43] and Kirk et al. [44]. Online websites like www.mycokey.com, www.mushroomexpert.com were also used for identification and related information. All the specimens were submitted to the herbarium of the Department of Botany, University of Jammu, Jammu, J&K, India.

Ethnomycological data collection

The ethnomycological study was carried between February 2014 and October 2018, and September 2020 and September 2021. The preliminary survey was carried out to find out about the persons who have the knowledge of local mushrooms. As per this detailed discussion and interactions during this survey a total of 423 persons between the age group of 25 and 87 yrs were selected randomly but only 192 inhabitants, having the knowledge of WEM, turned up to be the informants. These 192 informants (87 females and 105 males) were interviewed as per a semi–structured questionnaire. All informants were interviewed at least thrice for the collection of information regarding historical background, edibility status, traditional

usage, methods of preservation, commercial importance of fleshy fungi, and possible reasons for lower diversity of wild edible fungus in the region. All the interviews and discussions were conducted in different local dialects (*Dogri*, *Hindi* and *Poonchi*). The verification of the macrofungal species was done in the months of the rainy season and the informants were requested to escort us during the field visit to confirm the species and information thereof. The help of identified specimens and photographs already with us were also taken.

Data analysis

The data, collected through interviews, on the number of uses cited by the informants was analysed using Cultural importance index (CI) and factor informant consensus (F_{ic}). Cultural importance index (CI) was calculated as the sum total of use report (UR) for a species in culinary and medicinal use categories divided by number (192) of informants (N), and mathematically expressed as:

$$\mathrm{CI} = \sum_{u=u_i}^{u_{NC}} \sum_{i=i_1}^{i_N} UR_{ui} \; / \; N$$

where, the seven use-categories (*u*) are $u_{1\&2}$ and informants (*i*) are $i_{1\text{-}192}$. According to Tardio and Pardo-de-Santayana [36], CI accounts for the spread as well as versatility of uses. They further stated that CI is a better index than other indices because the maximum value of CI is the total number of uses in different use-categories.

To test homogeneity of information and knowledge sharing about the medicinal plants, the factor informant consensus (F_{ic}) was used [37]. The F_{ic} was calculated as:

$$F_{\mathrm{ic}} = \frac{\mathrm{n_{ur}} - \mathrm{n_t}}{\mathrm{n_{ur}} - 1}$$

where, n_{ur} refers to the total number of citations for a particular use category and n_t refers to the number of plants used for a particular use category. F_{ic} values are low (near 0) if there is no exchange of information about their use among informants, and approach one (1) if information is shared amongst informants [46-48].

Analysis of variance (ANOVA) was applied to compare the means of different attributes related to informants like gender, age and education with respect to the collection of WEM and traditional

beliefs. Fisher's LSD was applied as a multiple range test to compare the significant number of WEM collected by informants when the value of ANOVA was significant at $P < 0.05$.

Results And Discussion

Informants

Agriculture is the main source of livelihood and earning besides cattle rearing and poultry at small scale. Females help their male counterparts in different agricultural activities like sowing, harvesting and threshing of crops, and storage of grains. They also look after the cattle and along with their children take the livestock to the nearby forests or grazing lands for grazing every morning and generally collect firewood, non–wood forest products and WEM when they return home. The tradition of accompanying children during the collection of non–wood forest products and WEM also transmits vital information about these valuable resources to the next generation. Kumar and Sharma [11] and Bhatia et al. [48] have also reported similar traditions for females and children in other parts of Jammu and Kashmir.

A total of 192 informants, 45% females and 55% males, provided information about the wild edible mushrooms (WEM) of Jammu district. Most of these informants were above the age of 50 yrs (52%) and literate (68%). Females, elderly (>50 yrs age) and illiterate informants accounted for significantly ($P<0.05$) higher number of WEM (Table 1). A number of other studies in Jammu and Kashmir [11, 48, 49], India [15-26] and other countries [29, 30, 50] have also reported the higher role of Females, elderly and illiterate informants in the collection of non–wood forest products and WEM.

Ethnomycological diversity

Total fourteen species namely *Agaricus californicus* Peck, *Auricularia auricula-judae* (Bull.) Quel, *Calvatia bovista* (L.) Pers., *Coprinellus micaceus* (Bull.) Fr., *Geastrum saccatum* Fr., *Lepiota procera* (Scop.) Gray, *Leucoagaricus rhodocephalus* (Berk.) Pegler, *Morchella esculenta* (L.) Pers., *Podaxis pistillaris* (L.) Fr., *Termitomyces clypeatus* R. Heim, *Termitomyces eurrhizus* (Berk.) R. Heim, *Termitomyces heimii* Natarajan, *Termitomyces striatus* var. *annulatus* R. Heim, and *Termitomyce* sp. were being consumed by informants of district Jammu (Fig. 2a-m). Eleven species (78.6%) out of these WEM are new record for Jammu and Kashmir. As per the informants, reduction in forest areas (63% informants) is the prime reason for the lesser number of WEM in the study area (Fig. 3). Other reasons were; increasing agricultural fields (14.6% informants), lack of awareness about the local diversity of WEM amongst people (9.9% informants), and availability of fungal species in less quantities (6.8% informants). Besides, poor identification (7 informants) and non–documentation of edible and medicinal species of macrofungi (4 informants) have also been implicated in mushroom underutilization and some degree of inconsistencies in their usage. Kour [12], Akpaja et al. [27] and Teke et al. [29] has also reported anthropogenic disturbances, reduction in the forest area, and increasing urbanization as the major factors responsible for low diversity of macrofungus in their studies.

Agaricaceae with 5 genera and 5 species, and Lyophyllaceae with 1 genus and 5 species were the most important families, whereas the other three families were represented by one species each (Fig. 4). The higher use of members of Agaricaceae and Lyophyllaceae is in line with other studies [30, 51-53]. Higher percentage of these two families in most of the regional ethnomycology may be to their appealing taste and better income [11, 30] and/or easy to identify as edible and definite locations like termite mounds.

Termitomyces was the largest genera with 5 species (45.5%). The dominance of Termitomyces in the WEM is in accordance with most of the studies conducted in the tropical regions [29, 30, 50, 53-55] .

General perception of the local populace and folk taxonomy

As per most of the informants (>73.4%) thundering and lightning are the prime indicators of fruiting of WEM. Most of the elders (88.9%), having more than 50 yrs of age, believe that these natural phenomenons are responsible for bringing up WEM from the lap of mother earth. In the rainy season, they visit the termite mounds, wastelands, grazing lands and nearby forests, if present, after thundering and lightening (Table 2). Other workers [29, 30] have also reported thundering and lightning as an important indicator for mushroom hunting.

Another local perception regarding mushroom hunting is that while collecting wild edible fungus one should be silent to ensure that these mushrooms may appear in the next season at the same place. Kumar and Sharma [11] have reported that in the hilly tracks of Doda and Bhadarwah regions of Jammu and Kashmir, the tribes collect the mushrooms, especially morels, early in the morning.

Local people also broadly classified the use of white coloured mushrooms as edible while bright coloured mushrooms are considered poisonous. Some of the elderly informants said that they distinguish the edible fungus by their mild taste. These results are in line with Kumar and Sharma [11], Sagar et al. [16] and Sitotaw et al. [30] who have also reported colour of the mushroom as the prime indicator for identification of WEM.

In the present study, most of the local respondents did not come out with a good deal of descriptive vocabulary with respect to morphology, growth, and habit of macrofungi. As represented in table 3, there were some local names which were used for a group of fungi, e.g. agarics were commonly known as '*Chattri*', puffballs as '*Khucoon*', and earthstars as '*Zameeni Tare*'. Among agarics, *Termitomyces* species were particularly known as '*Khumb*', '*Tanna*', '*Sootree*' or '*Naadu*'. However, the knowledge related to the folk nomenclature was scarce and limited in the study area in comparison to the other mycophilic regions of the state like Bhaderwah, Kishtwar and Ladakh where people had developed rich ethnotaxonomic knowledge and experience in the utilization of the wild edible mushroom resources. Kumar and Sharma [11] have thrown light on 37 vernaculars indigenously used for 71 wild mushrooms from Bhadarwah region of Jammu and Kashmir while as Dorjey [13] reported 45 vernaculars used for various mushroom species in three areas of Ladakh. Kour [12] also recorded different vernacular names like '*Zameeni Tare*'

(*Astraeus hygrometricus*), '*Santri Chattri*' (*Leucoagaricus rubrotinctus*), '*Sootree*' (*Termitomyces heimii*) from Poonch district.

Cultural importance index (CI)

The highest CI was recorded for *Termitomyces* sp. (CI = 0.57). Other important edible mushrooms were *Termitomyces heimii* (CI, 0.48), *Termitomyces clypeatus* (CI, 0.44) and *Termitomyces striatus* var*. annulatus* (CI, 0.39) (Table 3). *Termitomyces* spp. has wide acceptability worldwide due to high concentration of proteins, vitamins and minerals [55-58], lower fat contents and carbohydrates [59] and an important source of income [60]. All these species grow on or around the termite mounds. As per Hindu religion, these termite mounds are sacred places where "*Naag Devta*" (snake deity) lives and people don't disturb them and offer water and milk, and *roat* (a traditional chapatti made up of wheat flour, *jaggery* and *desi ghee*) on every Sunday. Thus, a religious belief provides protection and good nourishment to the fungal mycelium. *Calvatia bovista* (CI, 0.24), with a very restricted distribution in the study area, was eaten only in the young stages as some of the people were of the opinion that its consumption in later stages could cause gastrointestinal problems since they were prone to insect infestation when extended fully (Table 2).

All these edible species have some medicinal value (Table 3). Eleven species each were good against skin problems and development of immunity, and eight species for heart ailments. In some other parts of India, *Termitomyces heimii* is used in treatment for cold, fever, and fungal infections [61] and as blood tonic [62], and *Termitomyces eurrhizus* is used for lowering hypertension and curing of rheumatic pains and diarrhea [63]. The fruiting bodies of *Podoxis pistillaria* are used against sunburn and the treatment of inflammation and skin diseases [64] and they also show antibacteria and antifungi activities [65, 66]. Edible and medicinal value of *Calvatia bovista*, *Geastrum saccatum*, *Leucoagaricus rhodocephalus* and *Morchella esculanta* has also been reported by researchers in other parts of the country and elsewhere in the world [8, 20, 28, 67-69].

Some of WEM viz. *Agaricus californicus* (CI_{gas}, 0.03), *Calvatia bovista* (CI_{gas}, 0.02) and *Termitomyces clypeatus* (CI_{gas}, 0.01) were reported to have gastrointestinal irritation or mild toxicity. Mild toxicity of these species has also been mentioned by few authors [8, 70, 71] but poisoning is restricted to gastrointestinal upset in a few individuals, a statement well supported by fewer citations in the present study.

Informant consensus factor

The maximum consensus was recorded for the use of fleshy fungus as culinary with 596 citations and 0.98 F_{ic} (Table 4), justifying their main utility as food. Similar findings have also been reported by Sitotaw et al. [30] in the community of district Menge of Ethiopia where WEM were utilized primarily for culinary purposes. The minimum homogeneity was found for immunity development (42 citations and 0.76 F_{ic}).

The high values of the informant consensus factor indicate greater homogeneity, and also show that informants share whatever knowledge lies with them about WEM [49].

Conclusions

This is the first-ever study to document the traditional knowledge of wild edible mushrooms (WEM) in district Jammu. Substantial information regarding the usage of wild mushrooms as food and medicine is available with the inhabitants of district Jammu. A total of eleven WEM from 5 families and 7 genera were reported by 50 informants. But there is a great risk of losing this valuable information in near future because females, elders and illiterate persons were having significantly higher information about WEM than others and all these sects of a society are the most vulnerable as far as storage and spread of information is concerned. In addition to this, reduction in natural habitats and no written record of WEM may also result in erosion of the traditional knowledge about these valuable treasures of nutrition. Although, accompanying children with mothers is a small ray of hope for maintaining perpetuity of knowledge regarding WEM, still we need to safeguard the natural habitats of mushrooms and popularize them as early as possible. As reported in other tropical regions of the world, *Termitomyces* was the most dominant genera of the present study. For the betterment of the society and to fulfill the requirements of both income generation and food security we need to focus our research on the domestication and cultivation of *Termitomyces* spp. A detailed investigation with respect to nutritional as well as medicinal aspects of these species is also required.

Declarations

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Authors' contributions

This study was designed by RS and YPS. The field work including survey was carried out by RS and SAJH. The data analysis was done by RKM. Identification of the mushrooms was done by SK. The manuscript writing was performed by RS, YPS and RKM. All authors have significantly contributed to this work and have read and agreed to the final manuscript.

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Availability of data and materials

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Ethics approval and consent to participate

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Consent for publication

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Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1

The collection of wild edible mushrooms (WEM) by informants

Attributes	Informants	No. of informants	No. of WEM	ANOVA	
				F–value	*P*–value
Gender	Female	87	$4.5^{a} \pm 3.2$	29.67	< 0.001
	Male	105	$3.3^{b} \pm 2.3$		
Age	up to 50yrs	93	$3.3^{b} \pm 2.0$	24.87	< 0.001
	>50 yrs	99	$4.4^{a} \pm 3.5$		
Education	Illiterate	61	$5.2^{a} \pm 1.5$	32.14	< 0.001
	1–8	79	$3.4^{b} \pm 1.2$		
	9–12	42	$3.0^{c} \pm 1.4$		
	>12	10	$2.9^{c} \pm 1.4$		

The values given in the table are mean ± SD. Fisher's LSD was applied as multiple-range test when ANOVA was found significant at $P < 0.05$. Similar alphabets in a column for an attribute show that the values do not vary significantly.

Table 2

The social belief regarding collection of wild edible mushrooms (WEM)

Attributes	Informants	Number	Mean number of WEM collected		ANOVA	
			Visits after lightening	Regular visits	F–value	P–value
Gender	Female	87	4.6	4.1	1.86	0.177^{ns}
	Male	105	3.5^{a}	2.8^{b}	5.71	0.019*
Age	up to 50yrs	93	3.3	3.2	0.08	0.781^{ns}
	>50 yrs	99	4.5^{a}	3.3^{b}	5.37	0.023*
Education	Illiterate	61	5.5^{a}	4.0^{b}	15.99	< 0.001**
	Literate	131	3.3	2.9	2.72	0.101^{ns}

The values given in the table are mean ± SD. Fisher's LSD was applied as multiple-range test when ANOVA was found significant at $P < 0.05$. Similar alphabets in a column for an attribute show that the values do not vary significantly. Ns, non-significant; * and **, $P < 0.05$ and 0.001, respectively.

Table 3

Ethnomycology and folk taxonomy of WEM of district Jammu

Scientific name	Family	Vaucher No.	Folk name	Fruiting	Uses (no. of informants cited the fungi for a use)	UR
Agaricus californicus Peck (Fig., 2a)	Agaricaceae	HBJU405	*Chatri*	Jul-Sep	Culinary (53); medicine (9); gastrointestinal disorders (6)	68
Auricularia auricula-judae (Bull.) Quel (Fig., 2b)	Auriculariaceae	HBJU420	-	Apr-Jun	Culinary (9); medicine (3)	12
Calvatia bovista (L.) Pers. (Fig., 2c)	Agaricaceae	HBJU407	*Khucoon*	Apr-Jun	Culinary (31); medicine (11); gastrointestinal disorders (3)	45
Coprinellus micaceus (Bull.) Fr. (Fig., 2d)	Agaricaceae	HBJU409	-	Jan-Jun	Culinary (13; medicine (3)	16
Geastrum saccatum Fr. (Fig., 2e)	Geastraceae	HBJU446	*Zameeni Tare*	Jul-Sep	Culinary (19); medicine (6)	25
Lepiota procera (Scop.) Gray (Fig., 2f)	Agaricaceae	HBJU415	-	Jul-Sep	Culinary (13); medicine (6)	19
Leucoagaricus rhodocephalus (Berk.) Pegler (Fig., 2g)	Agaricaceae	HBJU418	*Lal Chatri*	Jul-Sep	Culinary (47); medicine (11)	58
Morchella esculenta (L.) Pers. (Fig., 2h)	Morchellaceae	HBJU404	*Guchii*	Jul-Sep	Culinary (14); medicine (7)	21
Podaxis pistillaris (Peck) Hesler (Fig., 2i)	Strophariaceae	HBJU422	*Khumbhi*	Jul-Sep	Culinary (42); medicine (8)	50
Termitomyces clypeatus R. Heim (Fig., 2j)	Lyophyllaceae	HBJU427	*Khumb*	Jul-Sep	Culinary (72); medicine (10); gastrointestinal disorders (2)	84
Termitomyces eurrhizus (Berk.) R. Heim (Fig., 2k)	Lyophyllaceae	HBJU428	*Khumb*	Jul-Sep	Culinary (49); medicine (11)	60
Termitomyces heimii Natarajan (Fig., 2l)	Lyophyllaceae	HBJU429	*Naadu*	Jul-Sep	Culinary (83); medicine (10)	93
Termitomyces sp.	Lyophyllaceae	HBJU432	*Tanna*	Jul-Sep	Culinary (86); medicine (24)	110

Termitomyces striatus var. *annulatus* R. Heim (Fig., 2m)	Lyophyllaceae	HBJU431	*Sootree*	Jul-Sep	Culinary (65); medicine (10)	75

Table 4

Cultural importance index (CI) for WEM of Jammu

Name of the WEM	CI_{cul}	CI_{med}	CI_{gas}	CI_{total}
Agaricus californicus Peck	0.28	0.05	0.03	0.36
Auricularia auricula-judae (Bull.) Quel	0.05	0.02	-	0.06
Calvatia bovista (L.) Pers.	0.16	0.06	0.02	0.24
Coprinellus micaceus (Bull.) Fr.	0.07	0.02	-	0.08
Geastrum saccatum Fr.	0.10	0.03	-	0.13
Lepiota procera (Scop.) Gray	0.07	0.03	-	0.10
Leucoagaricus rhodocephalus (Berk.) Pegler	0.24	0.06	-	0.30
Morchella esculenta (L.) Pers.	0.07	0.04	-	0.11
Podaxis pistillaris (L.) Fr.	0.22	0.04	-	0.26
Termitomyces clypeatus R. Heim	0.38	0.05	0.01	0.44
Termitomyces eurrhizus (Berk.) R. Heim	0.26	0.06	-	0.31
Termitomyces heimii Natarajan	0.43	0.05	-	0.48
Termitomyces sp.	0.45	0.13	-	0.57
Termitomyces striatus var. *annulatus* R. Heim	0.34	0.05	-	0.39

CI_{cul}, CI_{med}, and CI_{gas} is cultural importance index of culinary, medicinal, and gastrointestinal disorders, respectively.

Table 5

Factor informant consensus (F_{ic}) of various use categories for fleshy fungi

Use category	n_{ur}	n_t	F_{ic}
Culinary	596	14	0.98
Gastrointestinal disease	12	3	0.82
Heart disease	37	8	0.81
Immunity development	49	11	0.79
Skin diseases	42	11	0.76

n_{ur} is number of use reports and n_t is the number of taxa

Figures

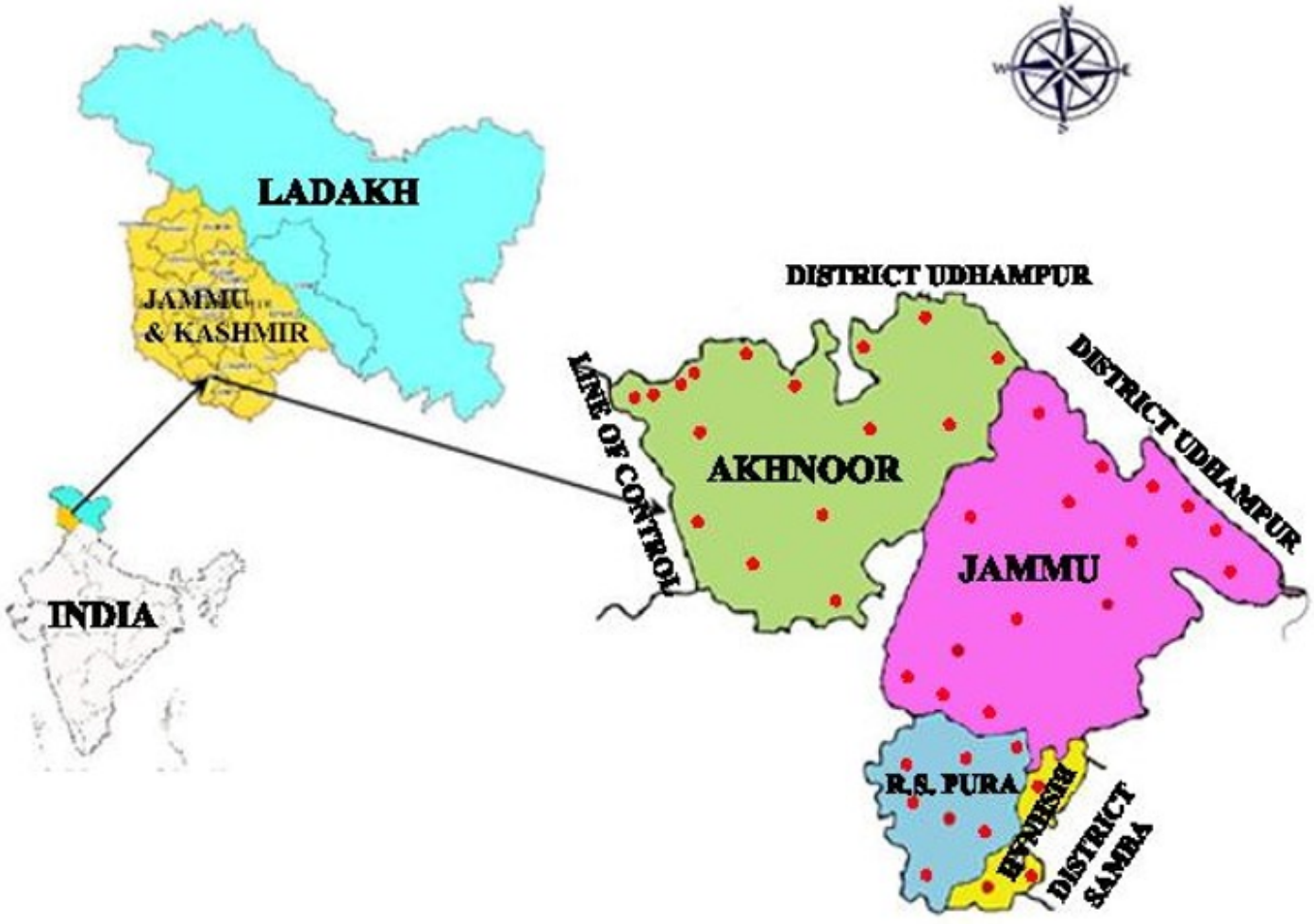

Figure 1

Location map of the study area and sampling points (•)

Figure 2

(a–m) (a) Fig. 2(a–m) (a) Agaricus californicus Peck, (b) Auricularia auricula-judae (Bull.) Quel, (c) Calvatia bovista (L.) Pers., (d) Coprinellus micaceus (Bull.) Fr., (e) Geastrum saccatum Fr., (f) Lepiota procera (Scop.) Gray, (g) Leucoagaricus rhodocephalus (Berk.) Pegler, (h) Morchella esculenta (L.) Pers., (i) Podaxis pistillaris (L.) Fr., (j) Termitomyces clypeatus R. Heim, (k) Termitomyces eurrhizus (Berk.) R. Heim, (l) Termitomyces heimii Natarajan, and (m) Termitomyces striatus var. annulatus R. Heim

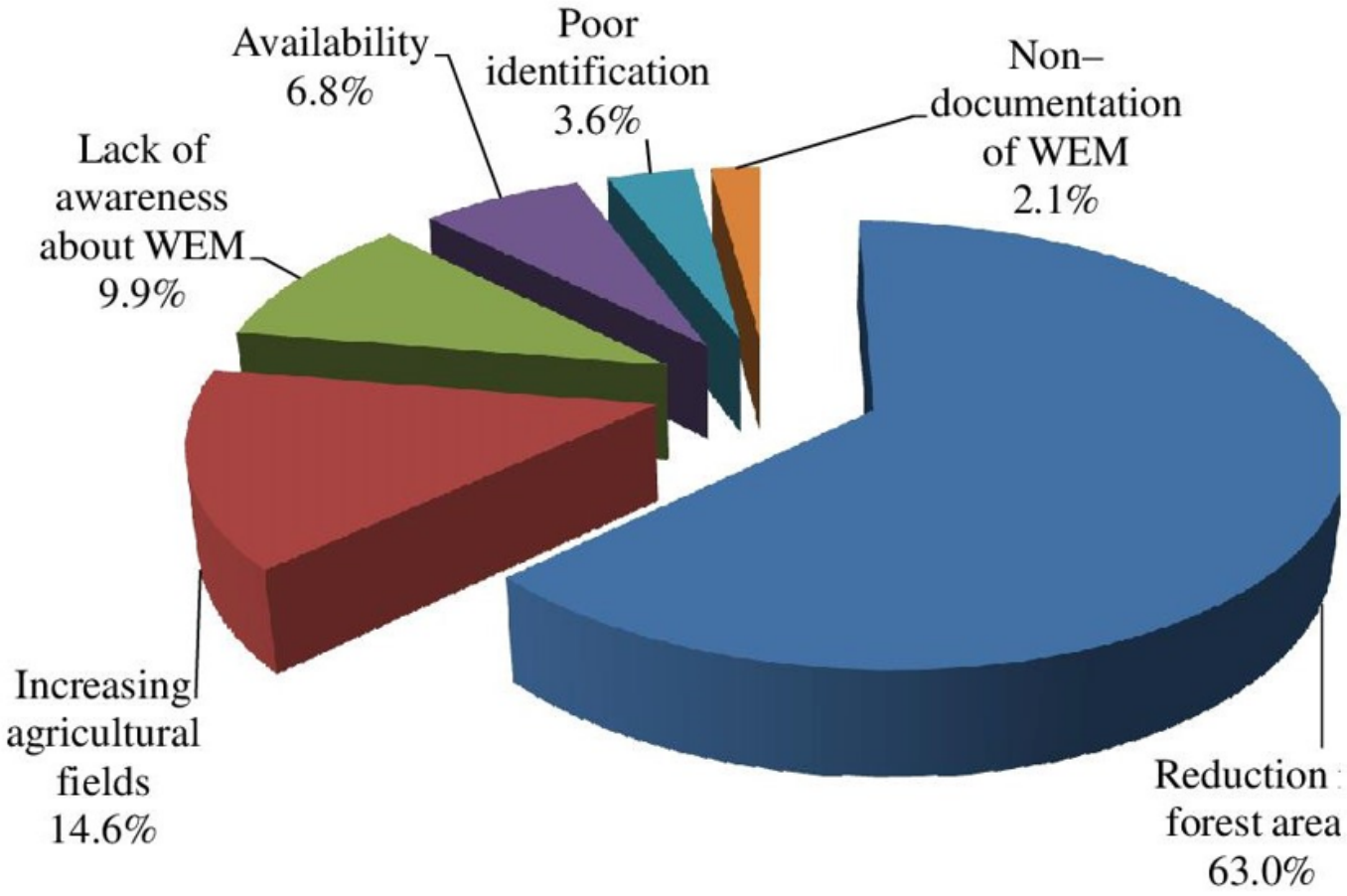

Figure 3

View points of the informants regarding the lesser number of WEM in the study area

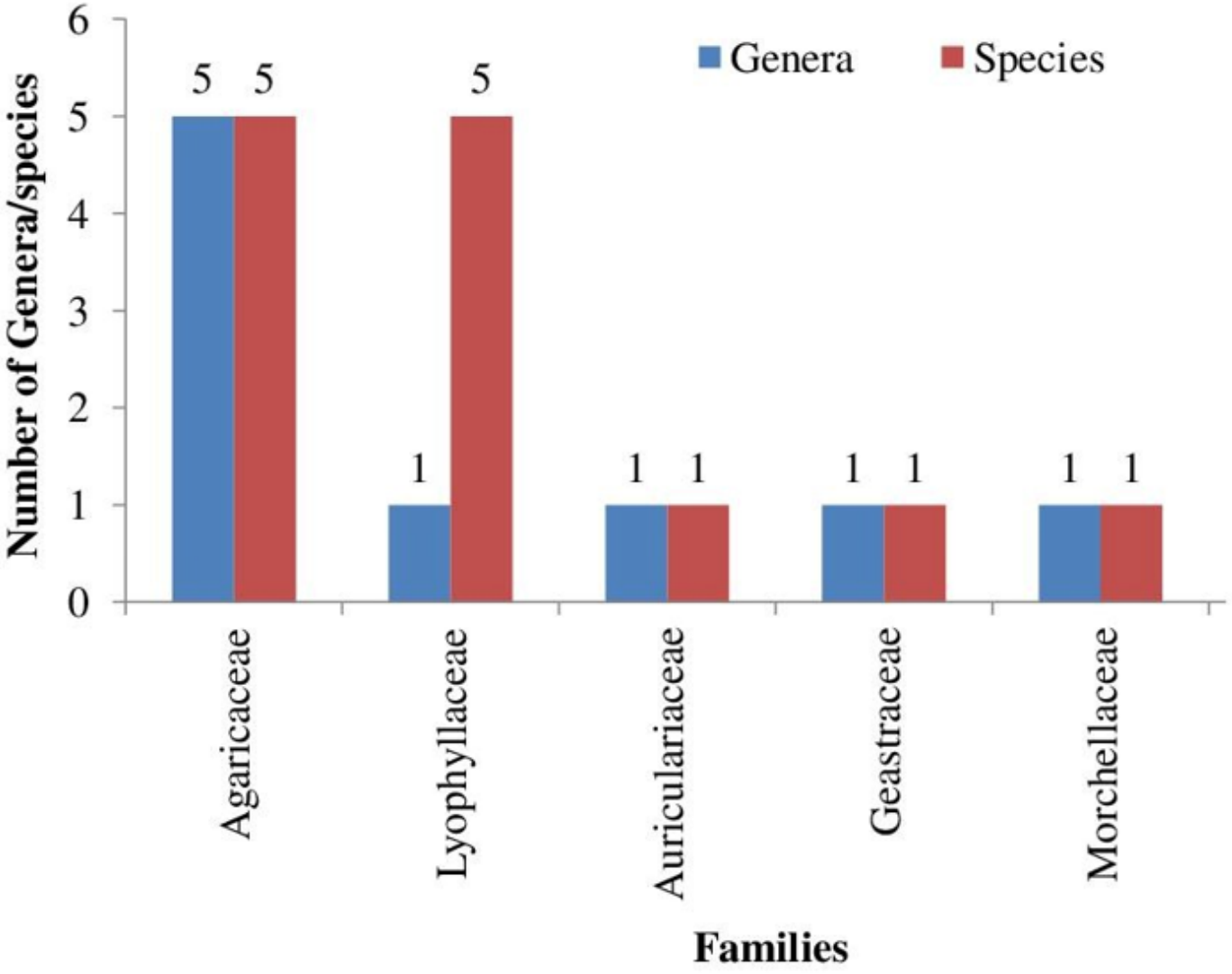

Figure 4

Number of genera and species in various families of fleshy fungi