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Exploration of wild medicinal mushroom species in Walayar valley, the Southern Western Ghats of Coimbatore District Tamil Nadu.

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Abstract

The present study explored the medicinal mushroom species used by the Irula tribal community in Walayar Valley, the southern Western Ghats of Coimbatore District, Tamil Nadu, India. The study was between May 2013 to August 2014 and reportson30medicinal mushroom species belonging to 23 genera in 13 families. The fungi occurred between 421 to 834m above m.s.l. Mushrooms were recorded in separate field data sheets, including binomial name, local name, medicinal uses and quantitative assessment of mushroom species collected per season per Kg based on information provided by the Irula community. These species included treatment of eight different illness categories. The study concludes their nutritional and medicinal potential, as well as ethno medicinal uses, which may have future pharmaceutical application.

Key words – Irula **–** medicinal mushroom **–** Walayar valley **–** Western Ghats

Introduction

Nature is a source of therapeutic agents and an impressive number of modern drugs have been isolated from natural resources, many of the drug isolations were based on traditional medicinal uses (Kinsalin et al. 2014). Mushrooms are spore–bearing, fleshy fruiting bodies of the fungi, that are typically produced above ground soil (Chandulal et al. 2013, Sharma & Atri 2014, Stadler & Hoffmeister 2015). They are widely consumed and are an edible and medical resource (Mortimer et al. 2012, Hilden et al. 2013, Thawthong et al. 2014, Bandara et al. 2015). Many mushrooms have therapeutic properties, such as antioxidant, antimicrobial, anticancer, cholesterol lowering and immuno stimulatory effects (Barros et al. 2007, Oyetayo 2009, Villares et al. 2012, Da Silva et al. 2012, De Silva 2012a, b, 2013, Lin et al. 2013, Liu 2014, Bandara et al. 2015, Benjarong et al. 2015) as they contain a variety of secondary metabolites, including phenolic compounds, polypeptides, triterpenes and steroids (Ziegenbein et al. 2006, Turkoglu et al. 2007, Dai et al. 2009, Liu et al. 2011, Luo et al. 2013, Thatoi & Singdevsachan 2014). Many genera of mushrooms are edible and are rich in essential nutrients, such as carbohydrates, and have a low fat and oil content, and contain proteins, vitamins, mineral, fibres and various amino acids (Fasidi & Kadiri 1990, Ziegenbein et al. 2006, Hyde et al. 2010, Rios et al. 2012, Jing Xu et al. 2014, Luangharn et al. 2014, Bandara et al. 2015).

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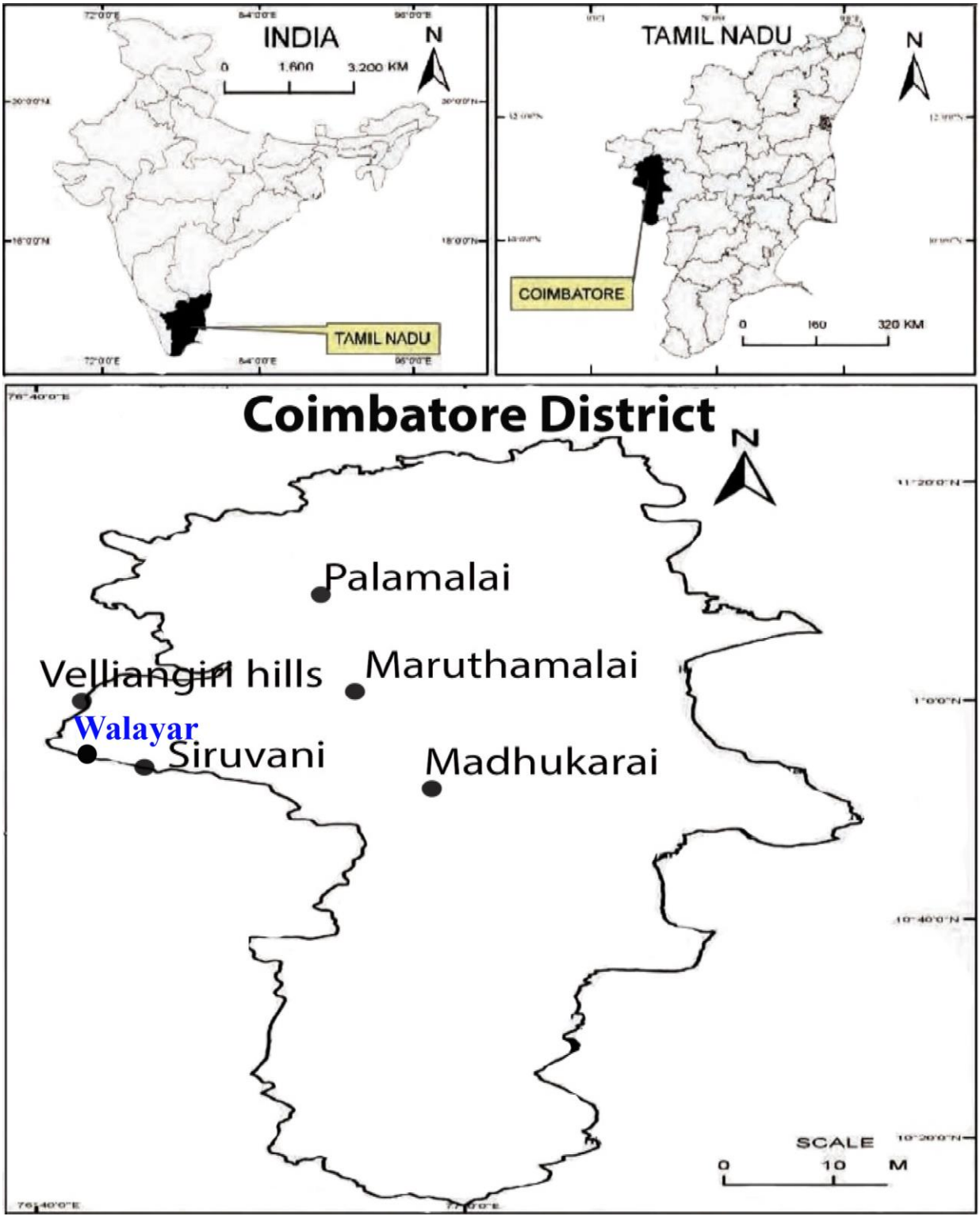


Figs 1 – Map showing the location of Walayar valley.

Walayar Valley, which is an important landscape situated in Tamil Nadu and Kerala parts of Western Ghats, harbours a rich variety of plants and edible mushrooms. The tribal community in this region, the Irula, use several edible mushrooms for their day–today life. The present study lists the edible mushroom species used by this group based on information provided by the indigenous tribal community.

Materials & Methods

Study Area

The geographical location of the Walayar Valley is 76°52'0"–76°52'21"E and 10°23'30"–10°23'52"N. It spreads in an area of ca.1100 ha both in Tamil Nadu and Kerala parts of Western Ghats (Fig. 1). The altitude of the valley lies between 410 and 892 m above m.s.l. The annual rainfall ranges between 2300 to 3200 mm for the past fifteen years. The vegetations are mostly moist deciduous and semi-evergreen forests (Champion & Seth 1968). The study was made in Tamil Nadu part of Western Ghats (ca. 550 ha).

Collection and identification of mushroom species

The mushroom species were collected in Walayar Valley during the period from May 2013 to August 2014. For their identification, taxonomic keys and descriptions were consulted (Gillman 1957). Descriptions of basidiomycetes were made according to their macro, micro and cultural features by using standard manual, The Manual of Soil Fungi (Ellis 1971).

Ailment categories

Eight ailment categories were grouped (Cook 1995) on basis of the information provided by the Irula healers of Walayar Valley (Table 1). They are gastro–intestinal ailments (GIA), dermatological infections/diseases (DID), respiratory system diseases (RSD), genito–urinary ailments (GUA), skeleto–muscular system disorders (SMSD), circulatory system/cardiovascular diseases (CSCD), endocrinal disorders (ED) and liver problems (LP).

Results& Discussion

Several naturally growing wild, medicinal mushrooms could be found in Walayar Valley. A total number of 30 mushroom species, belongs to 23 genera in 15 families was collected (Fig. 2). The detailed information about the botanical and common names of the mushroom species, family and habitat, medicinal uses with their reference, are presented in Table 2. Based on species contribution, the families *viz.*, Agaricaceae (5 species), Pleurotaceae (4 species), Polyporaceae (4 species), Tricholomataceae (3 species) and Lyophyllaceae (3 species) were dominant. The other families like Sclerodermataceae (2 species), Russulaceae (1 species), Hygrophoraceae (1 species), Ganodermataceae (1 species), Coriolaceae (1 species), Clavulinaceae (1 species), Lycoperdaceae (1 species), Pluteaceae (1 species), Auriculariaceae (1 species) and Marasmiaceae (1 species) were also present with less than 1 or 2 species. All these mushroom species are used as by the Irula tribal community in that region, whenever they are available. This wide diversity of mushroom species may be due to the existence of different types of vegetations and several microclimatic sites. Pushpa & Purushothama (2012) found that the presence of varied types of major communities naturally offer specific localities for taxonomically differing macrofungi.

The 30 species of medicinal mushroom fungi used by the Irula tribal community, that are classified as 8 different ailment categories (Cook 1995), and are already reported as edible elsewhere (Rajesh et al. 2013, Tapwal et al. 2013, Mohanan 2014) and no new report was made for these species in the present study. The tribal healers further informed that the medicinal mushroom species are collected at different months at various altitudes ranging between the 421 to 834m above m.s.l. and the quantitative of mushroom species collected per season/Kg are clearly recorded in this region (Table 3).This includes *Auricularia auricula, Agaricus augustus, A. bisporus, A. campestris, A. heterocystis, Bovista nigrescens, Clavulina rugosa, Clitocybe nuda, Coprinus* sp., *Ganoderma lucidum, Hygrocybe* sp., *Lentinus sajor–caju, Marasmius androsaceus, Melanoleuca grammopodia, Mycena galericulata, Pisolithus arhizus, Pleurotus ostreatus, P. sajor–caju, P. Sapidus, Russula fragilis, Scleroderma citrinum, Termitomyces heimii, T. microcarpus, Trametes versicolor* and *Volvariella speciosa*).

Table 1 Irulas ailments grouped by illness category (Cook 1995).

S. No.	Ailment categories	Biomedical terms	Tamil terms
1.	Circulatory system/ cardiovascular diseases (CSCD)	Cardiac disorders	Idhaya noi
		Blood purification	Rattha sutthigarippu
		Blood pressure/ hypertension	Rattha alutham
		Arteries problem	
		Improve immune system	Thamani thontharavu
			Noi ethirpu sakthi athigaripu
2.	Dermatological infections/diseases (DID)	Cuts	Vettukkayam
		Wound healing	Kaayam
		Skin diseases	Thol noi
		Sores	Pungal
3.	Endocrinal disorders (ED)	Diabetes	Sarkkarai/neerilivu noi
		Enhance insulin secretion	Kanaiya sueapu neer athigarika
		Kidney problem	Siruneeraga kal
		Urinary problem	Siruneeraga thontharavu
4.	Gastro–intestinal ailments (GIA)	Ulcer	Vayitru pun
		Digestion/indigestion	Geeranam/ageeranam
		Dysentery	Seedhabaethi
		Cholesterol	Kollupu
5.	Genito–urinary ailments (GUA)	Piles	Mula noi
6.	Liver problem (LP)	Liver problem	Kalliral noiku tanik
7.	Respiratory system diseases (RSD)	Cough	Irumal
8.	Skeleto–muscular system disorders (SMSD)	Rheumatism	Moottu vadham
		Arthritis	Kilvatam
		Tumor	Putru noi
		Swelling/inflammation/	Veekam
		Nervous problem	Narambu pathipu
		Depression	Mana alutham

Medical mycology is the traditional use of mushrooms. They have been used in medicine since the Neolithic and Paleolithic eras (Samorini 2001). Although mushrooms have been used in China as medicine since 100 A.D. (Gunde 1999), it was only in 1960 that scientists investigated the basic active principles of mushrooms which are health promoting. Mushrooms have been used in health care for treating simple and age old common diseases, such as skin diseases and pandemic diseases such as Cardiac disorders, cancer/tumour and liver problems. Interestingly, it was found out from the Irula tribal healers that certain species *viz.*, *Ganoderma lucidum*, *Lentinus tuberegium*, *Lycoperdon echinatum*, *Lentinus squarrosulus*, *Termitomyces heimii*, *Auricularia auricula*, *Termitomyces microcarpus* and *Pleurotus sajor–caju* are also used for the treatment of common ailments,such as fever, coughs and fungal infections.

Mushrooms are an important bioresource of novel secondary metabolites (Aletor 1995, Mattila et al. 2000, Deshmukh 2004, Kala 2009, Guillamon et al. 2010, Johnsy et al. 2011, Davidson et al. 2012, Sachan et al. 2013, Semwal et al. 2014, Qin et al. 2015). In India, alternative systems of medicine, utilize the curative properties of mushrooms. The secondary metabolites from these mushrooms are chemically diverse and possess a wide spectrum of biological activities (Rai et al. 2005). In India, several mushrooms have been reported as medicinal mushrooms, which have antioxidant, antimicrobial, anti–inflammatory activity with antitumor and other properties.

The ethnological aspects of mushrooms have also been reported by workers in different parts of India as well as worldwide (Harsh et al. 1993, Bulakh 2001, Bhosle et al. 2010, Bhaben et al. 2011, Davidson et al. 2012, Gogoi & Sarma 2012, Khaund & Joshi 2013, Kabita et al. 2014, Richter et al. 2015). Wild edible mushrooms have been reported from Manipur and Arunachal Pradesh of North East India (Sing & Sing 1993, Sing et al. 2002) whereas, from Assam, Baruah et al. (1971) reported a few basidiomycetous fungus of Sibsagar District. In central India, *Ganoderma lucidum* is used as herbal medicine by the Baiga tribes to cure asthma, *Agaricus sp.* is used in goiter treatment and *L. pusilum* in wound healing and also for controlling bleeding (Rai et al. 2005).

Table 2 Medicinal mushroom species used by the Irula tribal community for their ailments in Walayar Valley, the Western Ghats of Coimbatore district, Tamil Nadu.

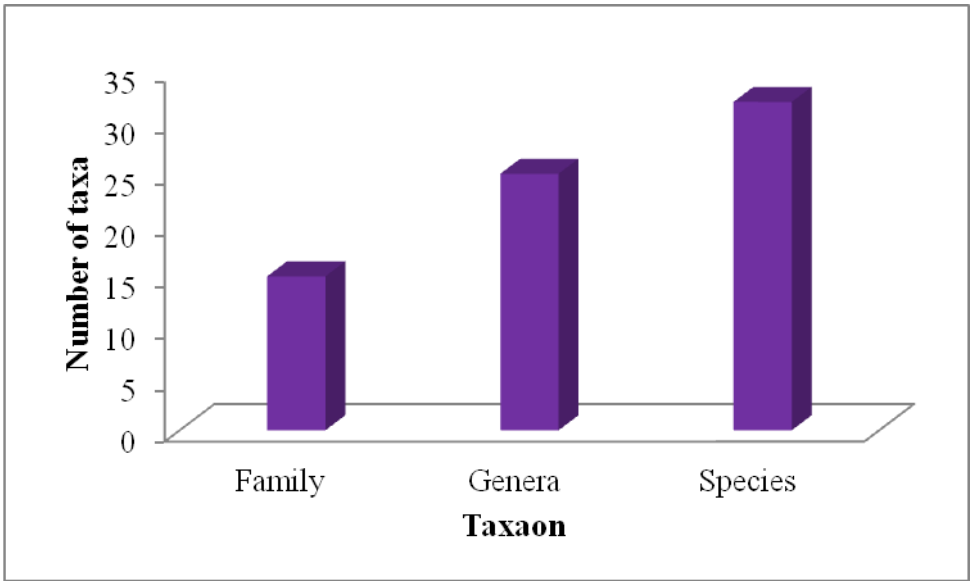
S. No.	Botanical Name	Common name	Family	Habitat of growth	Medicinal uses	Reference
1	*Auricularia auricular* (Bull.) J.	Jew's ear	Auriculariaceae	Upon wood of deciduous trees and shrubs	Cardiovascular diseases, diabetes and hypertension.	Yuan et al. 1998, Guillamon et al. 2010, Kabita et al. 2014.
2	*Agaricus augustus* Fr.	Not known	Agaricaceae	Deciduous woods	High cholesterol, arteries problem and ulcer.	Poongkode et al. 2001, Fortes et al. 2009.
3	*A. bisporus* (J.E.Lange) Emil J.	White button mushroom	Agaricaceae	Grassy places	Enhance insulin secretion.	Ahmad 1984a, Jagadish et al. 2009.
4	*A. campestris* L.	Meadow mushroom	Agaricaceae	Sides of pathways	Diabetes and ulcer.	Ewart et al. 1975, Ahmad et al. 1984a, b, Gray & Flatt 1998, Sun 2014.
5	*A. heterocystis* Heinem.	Not known	Agaricaceae	Grassy places	Antitumor, cholesterol and kidney problem.	Bankhead &Charles 2000, Ajith & Janardhanan 2007, Jagadish et al. 2009, De Silva et al. 2012b.
6	*Bovista nigrescens* Pers.	Brown puffball	Agaricaceae	Pastureland	Broken skin or wound and stop bleeding.	Densmore 1928, Chang & Miles 2004.
7	*Calocybe indica* Kuhner ex Donk.	Milky mushroom	Lyophyllaceae	Evergreen forests	Diabetes	Chang 1996, Sun 2014.
8	*Clavulina rugosa* (Fr.) Schroet.	Wrinkled coral fungus	Clavulinaceae	Rotten wood	Skin diseases	Chang and Mao 1995, Chang & Miles 2004.
9	*Clitocybe nuda* (Bull.) H.E.	Wood blewit	Tricholomataceae	Decaying leaf litter	Cardiovascular.	Guillamon et al.2010, Kabita et al. 2014.
10	*Coprinus* sp.	Not known	Agaricaceae	Buried wood or in grass.	Diabetes, circulatory disease, digestive disorders and piles.	Wasser 2002, Sun 2014.
11	*Daedaleopsis confragosa* (Bolton) J.	Blushing bracket	Polyporaceae	Tree trunk	Skin diseases	Kasuga et al.1995, Lindequist et al. 2005.
12	*Ganoderma lucidum* (Curtis) P.	Reishi	Ganodermataceae	Stumps of deciduous trees	Improve immune system, liver protection, lower blood pressure and inhibits cholesterol synthesis.	Komoda et al. 1989,Lin &Zhang 2004, Wang et al. 2007, Moradali et al. 2007, Sun & Zhou 2014.
13	*Hygrocybe* sp. (Schaeff.) P.	Not known	Hygrophoraceae	Tree trunks or logs.	Skin diseases	Ohtsuka et al. 1997, Chang & Miles 2004.
14	*Lentinus sajor–caju* (Fries) Fries.	White-rot	Polyporaceae	Dead wood	Lower cholesterol and	Ajith & Janardhanan 2007,

S. No.	Botanical Name	Common name	Family	Habitat of growth	Medicinal uses	Reference
		Fungus			anti-cancer agent.	Enman et al. 2007, De Silva et al. 2012b.
15	*L. squarrosulus* Mont.	Not known	Polyporaceae	Cashew nut tree	Antiulcer.	Mattila et al. 2000.
16	*L. tuberregium* (Fr.) Fr.	White-rot fungus	Polyporaceae	Dead wood	Cough, indigestion and dysentery.	Chang & Lee 2004.
17	*Lycoperdon echinatum* Pers.	Spiny puffball	Agaricaceae	Deciduous forests and grassy areas or woody debris	Wound healing	Mitchell & Perfect 1995; Chang & Miles 2004.
18	*Marasmius androsaceus* (L.) Fr.	Not known	Marasmiaceae	Deciduous hardwood trees	Blood purification, antiinflamatory, nerves problem and rheumatism.	Wasser &Weis 1999a, Yu et al. 2009.
19	*Melanoleuca grammopodia* Bull.	Not known	Tricholomataceae	Wood	Skin diseases	Mohamed & Dix 1988, Chang & Miles 2004.
20	*Mycena galericulata* (Scop.) Gray.	Common bonnet	Tricholomataceae	Submerged wood	Skin diseases	Mohamed & Dix 1988, Chang & Miles 2004.
21	*Pisolithus arhizus* (Scop.) Rauschert.	Dye makers puffball	Sclerodermataceae	Symbiotic with numerous trees	Skin diseases and wound healing.	Mohamed & Dix 1988, Chang & Miles 2004.
22	*Pleurotus ostreatus* (Jacq. ex Fr.) P.	Oyster, abalone	Pleurotaceae	On hardwood trees	Anticancer.	Yang et al. 2002, Ajith & Janardhanan 2007, Jedinak et al. 2010, De Silva et al. 2012b.
23	*P. sajor–caju* (Fr.) Singer.	Phoenix mushroom	Pleurotaceae	Hardwoods	Lower cholesterol.	Gunde & Cimerman 1995, Chang & Miles 2004.
24	*P. sapidus* Schulzer & Kalchbr.	Oyster or abalone	Pleurotaceae	On hardwood trees	Skin diseases and wound healing.	Thimal & Kluthe 1998, Chang & Miles 2004.
25	*Russula delica* (Pers.) Fr.	Fragile brittle gill	Russulaceae	Birch	Skin diseases and wound healing.	Turkoglu et al. 2007.
26	*Scleroderma citrinum* Pers.	Earth ball	Sclerodermataceae	Woods	Skin diseases and wound healing.	Wakefield & Elsie 1964, Chang & Miles 2004.
27	*Termitomyces heimii* Natarajan.	Ejova	Lyophyllaceae	White ant hill	Wound healing	Chandrawati et al. 2014.
28	*T. microcarpus* (Berk. & Broome) R.	Not known	Lyophyllaceae	Roots of bamboo stumps	Wound healing	Chandrawati et al. 2014.
29	*Trametes versicolor* (L.) Lloyd.	Turkey tail	Polyporaceae	Hardwood	Increase immune system and depression.	Coles & Toth 2005, Sun & Zhou 2014.
30	*Volvariella speciosa* (Fr.) Singer.	Rose-gilled grisette	Pluteaceae	Gardens and grassy fields	Antitumor	Mathew et al. 2008, De Silva et al. 2012b.

Table 3 Quantitative of edible and medicinal mushroom species are collected at different altitude from the study area of Walayar valley, Western Ghats of Tamil Nadu, India.

S. No.	Botanical Name	Available months	Altitude	Quantitative of mushroom species collected per season/Kg
1	*Auricularia auricula* (Bull.) J.	July – September	561	159
2	*Agaricus augustus* Fr.	July – September	568	198
3	*A. bisporus* (J.E.Lange) Emil J.	July – September	550	193
4	*A. campestris* L.	June – October	649	189
5	*A. heterocystis* Heinem.	June – October	523	178
6	*Bovista nigrescens* Pers.	August – September	731	166
7	*Calocybe indica* Kuhner ex Donk.	April– May and July – August	745	158
8	*Clavulina rugosa* (Fr.) Schroet.	July – August	745	169
9	*Clitocybe nuda* (Bull.) H.E.	July – August	654	198
10	*Coprinus* sp.	July – August	598	163
11	*Daedaleopsis confragosa* (Bolton) J.	April – May and July – August	823	142
12	*Ganoderma lucidum* (Curtis) P.	August – September	520	201
13	*Hygrocybe* sp. (Schaeff.) P.	July – August	533	193
14	*Lentinus sajor–caju* (Fries) Fries.	July – September	636	176
15	*L. squarrosulus* Mont.	July – September	641	188
16	*L. tuber–regium* (Fr.) Fr.	August – September	685	197
17	*Lycoperdon echinatum* Pers.	July – September	833	158
18	*Marasmius androsaceus* (L.) Fr.	August – September	789	172
19	*Melanoleuca grammopodia* Bull.	March – April and August – September	459	164
20	*Mycena galericulata* (Scop.) Gray.	March – April and August – September	490	139
21	*Pisolithus arhizus* (Scop.) Rauschert.	July – August	564	165
22	*Pleurotus ostreatus* (Jacq. ex Fr.) P.	August – September	426	154
23	*P. sajor–caju* (Fr.) Singer.	April – May and July – August	421	151
24	*P. sapidus* Schulzer & Kalchbr.	April – May and July – August	464	169
25	*Russula fragilis* (Pers.) Fr.	August – September	693	184
26	*Scleroderma citrinum* Pers.	July – September	712	183
27	*Termitomyces heimii* Natarajan.	August – September	834	187
28	*T. microcarpus* (Berk. & Broome) R.	July – September	819	194
29	*Trametes versicolor* (L.) Lloyd.	July – September	788	181
30	*Volvariella speciosa* (Fr.) Singer.	August – September	725	198

Sarma et al. (2010) reported that some Ethnic Tribes of Western Assam use wild edible mushrooms as food sources. Ethnic tribes such as Garos, Adivashis, Bodos and Rajbangshis of Western Assam consume at least seven species of mushrooms. According to Bhaben et al. (2011), the ethnic tribes of Nagaland, India also use wild edible mushrooms for food. Srivastava et al. (2011) conducted anethnobotanical survey for distribution and utilization of *Termitomyces* species in Gorakhpur forest division of Uttar Pradesh, India and reported that tribal people and forest dwellers use *Termitomyces* species as food and for medicinal purposes (not clearly known but used in malnutrition, weakness and their nutritional disorders). Traditional uses and medicinal potential of *Cordyceps sinensis* has been studied by Panda and Swain (2011) in Sikkim, India and it was found that most local folk healers/traditional healers use *Cordyceps* in their herbal medicine for the treatment of 21 ailments including cancer, bronchial asthma, bronchitis, TB, diabetes, cough and cold, erectile dysfunction, BHP, jaundice, and alcoholic hepatitis, among others. *Pleurotus sajor–*



Figs 2 – Taxonomic analysis of medicinal mushroom species in Walayar Valley, Coimbatore district, Tamil Nadu.

caju, *Termitomyces heimii*, *Termitomyces microcarpus*, *Volvariella volvaceae*, *Auricularia auriculata*, *Lentinus fusipes* and *Lentinus tuberegium*are also consumed by the Kaani tribes of Kanyakumari District in their different recipes (Sargunam et al. 2012). Recently, a survey has been conducted by Sachan et al. (2013) on indigenous knowledge of ethnic tribes from Similipal Biosphere Reserve, Odisha for utilization of wild mushrooms as food and medicine. All these studied medicinal mushrooms are used by several tribals living in the forests for their day-today life food as well as herbal medicinal purposes to cure malnutrition, weakness, and other nutritional disorders such as diarrhoea, high blood pressure, fever, and asthma (Sachan et al. 2013).

As the diversity of edible mushroom species is higher in this valley, it may be considered as potential landscape for wild mushrooms. These mushrooms have been used as ethnomedicines by tribals for treatment of various diseases. Many mushrooms still remain unreported and their nutritional as well as health benefits are unknown to us. If discovered, some of them may have high nutritional value and serve as valuable sources of bioactive compounds with many pharmaceutical applications. Therefore, species–specific cultivation technology should be developed for commercialization and hence conservation.

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