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J. Mycopathol. Res. 60(2) : 251-256 2022;
ISSN 0971-3719

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Four new records of Polypores to India

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Received : 11.02.2022

Accepted : 27.04.2022

Published : 27.06.2022

The present paper deals with the taxonomic study of polyporoid fungi in the Jammu division of Union Territory of Jammu and Kashmir. During the fungal forays some fascinating polypore specimens were collected in some districts of Jammu Division. The morphotaxonomic details and comparison with the published literature results into the identification of four polypore species i.e. *Dichomitus affixus*, *Donkiopora expansa*, *Sistotrema alboluteum* and *Trichaptum perrottetii*. All the four polypore species are described and illustrated as new records for India.

Key words: *Basidiomycota*, brown rot, North Western Himalaya, Poroid fungi, white rot

INTRODUCTION

Polyporoid fungi are an important group of wood-decaying fungi classified into various orders under phylum *Basidiomycota*. These fungi are characteristic in having annual to perennial macroscopic basidiocarps that range from resupinate to effused- reflexed to pileate to stipitate. These basidiocarps are unique in having poroid hymenophore with circular to angular to daedaleoid to lamellate to irregular pores. The colour of hymenial and abhymenial surfaces varies from whitish to some shades of yellow, orange, grey, violet, blue or red. Polyporaceae the major group of fungi involved in the decomposition of lignin and cellulose. However, few of these also have medicinal properties (Wachtel *et al.* 2011; Susannaand Narine 2016; Ján *et al.* 2016). The diverse vegetation and varied climatic conditions of Union Territory of Jammu and Kashmir have attracted the mycologists for exploration of the fungal diversity. The survey of literature revealed only 45 species of the polyporoid fungi so far reported from Jammu and Kashmir. The number of described species of these fungi from Jammu Division falls to 34 only.

Looking at the unique topography, climate and vegetation the present studies were taken up. During the exhaustive surveys carried out during the rainy season of 2014-2017 some interesting polyporoid specimens were collected from different districts of Jammu division. Presently, four polypore

species i.e. *Dichomitus affixus* (Corner) T. Hatt., *Donkiopora expansa* (Desm.) Kotl. & Pouzar, *Sistotrema alboluteum* (Bourdot & Galzin), Bondartsev & Singer and *Trichaptum perrottetii* (Lév.) Ryvardeen, are described as new to India.

MATERIAL AND METHODS

The polypores' basidiocarps were collected during the field surveys conducted in various localities of district Doda, Ramban, Kishtwar and Kathua of Jammu Division of Union Territory of Jammu and Kashmir in the rainy months (July–September) of years 2014-2017. These specimens were separated carefully from the substratum and details related to nature of the basidiocarp, mode of attachment, colour and nature of hymenial and abhymenial surface and margins were recorded. The microscopic features with reference to hyphal system, cystidia/cystidioles, basidia and basidiospores were studied by making crush mounts and cross section cutting of basidiocarp portions. These preparations were prepared in water, 3%/5%/10% KOH, 1% phloxine, 1% Congo red and 1% cotton blue (in distilled water/lactophenol). The cyanophilous and amyloid reaction of structures like hyphae, cystidia/cystidioles and basidiospores, were studied in 1% cotton blue (in distilled water/lactophenol) and Melzer's reagent (Iodine-0.5g, Potassium Iodide-1.5g, Chloral hydrate-20.0g and distilled water-20.0ml) respectively. The outline of the microscopic structures was drawn with the help of a camera lucida mounted on a compound microscope at 100X, 400X, and 1000X magnification. The specimens were identified on the

basis of comparison of the description with the literature and online repositories like Mycobank. The identified specimens were submitted to the Herbarium Department of Botany, Punjabi University, Patiala. The colour standards used are as per Kornerup and Wanscher (1978).

RESULTS AND DISCUSSION

Four polypore species spread over four genera, four families and three orders of *Agaricomycetes* (*Basidiomycota*) are described from Jammu division of Jammu and Kashmir.

1. *Dichomitus affixus* (Corner) T. Hatt., Mycoscience 43 (4): 307 (2002).

a" *Tyromyces affixus* Corner, Beihefte zur Nova Hedwigia 96: 157 (1989).

Basidiocarp annual, resupinate, up to 3mm in thickness; hymenial surface poroid, white when fresh, changing to pale yellowish on drying; margins adnate, entire, concolorous, sterile up to 2mm; subiculum homogenous, pale yellowish, up to 2mm in thickness; pores round to angular, 2-4 per mm; dissepiments entire, up to 50 µm thick; tube layer concolorous to the subiculum, up to 1 mm deep.

Hyphal System dimitic. Generative hyphae thin-walled, clamped, branched, up to 4.7 µm in width. Skeletal hyphae thick-walled, unbranched up to 7 µm in width. Basidia clavate, thin-walled, basally clamped, tetrasterigmate, 14-17.5 × 4.5-5.5 µm; sterigmata up to 2.5 µm long. Basidiospores hyaline, broadly ellipsoid, thin-walled, smooth, no reaction in cotton blue and Melzer's reagent, 6.1-8 × 5-6.5 µm (Fig. 1).

Material examined: Jammu and Kashmir, Kathua, Dyalachak, on angiospermous wood, Brij Bala, 11154 (PUN), September 10, 2015; Jammu, Talab-Tillo, on angiospermous wood, Brij Bala, 11153 (PUN), August 28, 2016.

Remarks: *Dichomitus affixus* is characterized by clamped generative hyphae and broadly ellipsoid basidiospores. It is being described first time from India. Earlier it is reported only from New Guinea (Mycobank, 2021).

2. *Donkioporia expansa* (Desm.) Kotl. & Pouzar, Persoonia 7: 214 (1973).

Change to = *Boletus expanses* Desm., Catalogue des Plantes Ommises dans la Botanographie

Belgique et dans les Flores du Nord de la France: 19 (1823).

Basidiome annual, resupinate, up to 4mm in thickness; hymenial surface poroid, white when fresh, changing to grayish brown on drying; margins concolorous, adnate, sterile up to 2mm; subiculum homogenous, white to pale yellowish, up to 2mm in thickness; pores round to angular, 2-3 per mm; dissepiments entire, up to 45 µm; tube layer concolorous to subiculum, up to 2mm deep.

Hyphal System trimitic. Generative hyphae thin- to thick-walled hyaline to pale-yellowish, clamped, branched up to 4.6 µm. Binding hyphae thick-walled branched up to 4.6 µm. Skeletal hyphae thick-walled, unbranched, up to 7 µm in width. Basidia thin-walled, sub-clavate, tetrasterigmate, 16-20 × 5-6 µm; sterigmata up to 3 µm long. Basidiospores hyaline, ellipsoid to broadly ellipsoid, thin-walled, smooth, no reaction in cotton blue and Melzer's reagent, 5-6.5 × 3.4-4 µm (Fig. 2).

Material examined: Jammu and Kashmir, Jammu, Bhaderwah, Shunushir, on *Cedrus deodara* stump, Brij Bala, 11155 (PUN), September 17, 2017; Kishtwar, Sinthon, on *Cedrus deodara*, Brij Bala, 11116 (PUN), August 23, 2017.

Notes: It is peculiar in having resupinate basidiome with trimitic hyphal system and ellipsoid to broadly ellipsoid basidiospores. Earlier it is reported from England, Czech Republic and North America (Ryvarden, 2014).

3. *Sistotrema alboluteum* (Bourdot & Galzin) Bondartsev & Singer, Annales Mycologici 39 (1): 47 (1941). a" *Poria albolutea* Bourdot & Galzin, Bulletin de la Société Mycologique de France 41: 217 (1925).

Basidiocarp annual, resupinate, effused, up to 3mm in thickness; hymenial surface poroid, white when fresh, changing to pale yellowish on drying; margins concolorous, adnate, sterile up to 1mm; subiculum homogenous, up to 1mm in thickness; pores round to angular to lacerate, 1-3 per mm; dissepiments entire, up to 65 µm in thickness; tube layer concolorous to the subiculum, up to 2 mm deep.

Hyphal System monomitic. Generative hyphae hyaline, thin-walled, clamped, branched, up to 5 µm in width. Basidia subclavate, thin-walled, basally clamped, tetrasterigmate, 18.2-24 × 9-12 µm; sterig-

Table 1: Taxa reported from the Jammu and Kashmir

Name of the species	Host	Order and family	Locality & Altitude (m)
<i>Antrodia lenis</i> (as <i>Poria lenis</i>)	Log of <i>Abies</i>	<i>Polyporales</i> , <i>Fomitopsidaceae</i>	Gulmarg, 3747
<i>A. serailis</i>	Gymnospermic log	<i>Polyporales</i> , <i>Fomitopsidaceae</i>	Pahalgam, 2740
<i>Bjerkandera adusta</i>	On stump under mixed forest	<i>Polyporales</i> , <i>Meruliaceae</i>	Batote, 1555
<i>Coltricia cinnamomea</i>	Log of <i>Cedrus deodara</i>	<i>Hymenochaetales</i> , <i>Hymenochaetaceae</i>	Patnitop, 2024 m
<i>C. perrenis</i>	Log of <i>Cedrus deodara</i>	<i>Hymenochaetales</i> , <i>Hymenochaetaceae</i>	Sonmarg, 2800
<i>Dadalea quercina</i>	On stump of <i>Quercus</i>	<i>Polyporales</i> , <i>Fomitopsidaceae</i>	Patnitop, 2024
<i>Dichomitus affixus</i>	Angiospermous wood	<i>Polyporales</i> , <i>Polyporaceae</i>	Kathua, 308
<i>Donkiporia expansa</i>	On stump of <i>Cedrus deodara</i>	<i>Polyporales</i> , <i>Polyporaceae</i>	Shunushir 2400
<i>Fomes fomentarius</i>	On coniferous log	<i>Polyporales</i> , <i>Polyporaceae</i>	Bhaderwah, 1613
<i>Fomitopsis rosea</i>	On coniferous log	<i>Polyporales</i> , <i>Polyporaceae</i>	Bhaderwah, 1613
<i>F. rufolaccata</i>	On log of <i>Abies pindrow</i> .	<i>Polyporales</i> , <i>Polyporaceae</i>	Gulmarg, 3747
<i>Ganoderma applanatum</i>	On angiospermous wood.	<i>Polyporales</i> , <i>Ganodermataceae</i>	Pahalgam, 2740
<i>G. lucidum</i>	Base of <i>Pinus excels</i>	<i>Polyporales</i> , <i>Ganodermataceae</i>	Batote, 1555
<i>G. resinaceum</i>	Base of <i>Platanus orientalis</i>	<i>Polyporales</i> , <i>Ganodermataceae</i>	Srinagar, 1585
<i>G. unguatum</i>	Base of <i>Quercus</i> ,	<i>Polyporales</i> , <i>Ganodermataceae</i>	Bhaderwah, 1613
<i>G. tornatum</i>	Unknown stump	<i>Polyporales</i> , <i>Ganodermataceae</i>	Pahalgam, 2740
<i>Gloeophyllum seiparium</i>	Log of <i>Cedrus deodara</i>	<i>Gloeophyllales</i> , <i>Gloeophyllaceae</i>	Pahalgam, 2740
<i>G. subferruginum</i>	Log of <i>Cedrus deodara</i>	<i>Gloeophyllales</i> , <i>Gloeophyllaceae</i>	Gulmarg, 3747
<i>G. odoratum</i>	Log of <i>Cedrus deodara</i>	<i>Gloeophyllales</i> , <i>Gloeophyllaceae</i>	Jai, 2400.
<i>Heterobasidion abetinum</i>	On log of <i>Abies</i>	<i>Russulales</i> , <i>Bondarzewiaceae</i>	Shunushir, 1613.
<i>Heterobasidion insularis</i>	On stump of <i>Pinus excels</i>	<i>Russulales</i> , <i>Bondarzewiaceae</i>	Batote, 1555
<i>Incrustoporia nivea</i>	Dead log of <i>Quercus</i>	<i>Polyporales</i> , <i>Polyporaceae</i>	Bhaderwah, 1613.
<i>Inonotus dryadeus</i>	Stump of <i>Abies</i>	<i>Hymenochaetales</i> , <i>Hymenochaetaceae</i>	Bhaderwah, 1613
<i>Irpex lacteus</i>	On log of <i>Cedrus deodara</i>	<i>Polyporales</i> , <i>Phanerochaetaceae</i>	Seoj, 2400.
<i>I. zonatus</i>	On log of <i>Cedrus deodara</i>	<i>Polyporales</i> , <i>Phanerochaetaceae</i>	Patnitop, 2024
<i>Junghuhnia collabens</i>	Unknown Stump	<i>Polyporales</i> , <i>Phanerochaetaceae</i>	Batote, 1555.

<i>Lenzites betulina</i>	On stump of <i>Q. incana</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Batote, 1555
<i>Mycoleptodonoides aitchisonii</i>	On stump of <i>Cedrus deodara</i>	<i>Polyporales,</i> <i>Phanerochaetaceae</i>	Gulmarg, 3747
<i>Osmoporus mexicanus</i>	On log of <i>C. deodara</i>	<i>Polyporales,</i> <i>Phanerochaetaceae</i>	Bhaderwah, 1613
<i>Onnia circinata</i>	Needles and Bark of <i>Pinus excels</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Batote, 1555
<i>Oxyporus corticola</i> (as <i>Poria corticola</i>)	On stump of <i>Abies</i> .	<i>Hymenochaetales,</i> <i>Schizoporaceae</i>	Gulmarg, 3747
<i>Oxyporus ravidus</i>	On log of <i>Cedrus deodara</i>	<i>Hymenochaetales,</i> <i>Schizoporaceae</i>	Shunushir, 2400
<i>Phaeolusschwentizii</i>	On base of <i>C. deodara</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Patnitop, 2024
<i>Phellinus caryophylli</i>	Stump under <i>Pinus excels</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Batote, 1555
<i>Phellinus contigus</i>	Stump under mixed forests.	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Bhaderwah, 1613
<i>Phellinus linteus</i>	Stump and Base of <i>Pinus excels</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Bhaderwah, 1613
<i>Phellinus robustus</i>	Stump of <i>Abies</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Gulmarg, 3747
<i>Phellinus sanfordii</i>	On angiospermic tree	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Bhaderwah, 1613
<i>Phellinus scropsus</i>	Stump of <i>Cedrus deodara</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Batote, 1555
<i>Ph. torulosus</i>	On stump of <i>Pinus excels</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Batote, 1555
<i>Porodaedalea pini</i>	Stump under <i>Pinus excels</i>	<i>Hymenochaetale,</i> <i>Hymenochaetaceae</i>	Batote, 1555
<i>Sistotrema alboluteum</i>	Stump under <i>Pinus excels</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Kathua, 308
<i>Trametes hirsutus</i> (as <i>Coriolus hirsutus</i>)	On stump under <i>Cedrus deodara</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Batote, 1555
<i>Trametes versicolor</i> (as <i>Coriolus versicolor</i>)	On stump of <i>Quercus</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Batote, 1555
<i>Trametes zonatus</i> (as <i>Coriolus zonatus</i>)	On twig of <i>Abies</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Batote, 1555
<i>Trichaptum abietinum</i> (as <i>Trichaptum abietinus</i>)	On trunk of <i>Berberis</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Batote, 1555
<i>T. venusta</i> (as <i>Trichaptum venustum</i>)	Stump of <i>Quercus</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Batote, 1555
<i>T. perttetoii</i>	Stump of <i>Cedrus deodara</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Shunushir, 2400
<i>Wrightoporia lenta</i> (<i>Poria lenta</i>)	On log of <i>Cedrus deodara</i>	<i>Polyporales,</i> <i>Polyporaceae</i>	Kishtwar, 1900 Bhaderwah, 1613

mata up to 3µm long. Basidio-spore-shyaline, globose, thin-walled, smooth, no reaction in cotton blue and Melzer's reagent, 4.6-6.3 × 4.6-5 µm (Fig.3). Collection examined: Jammu and Kashmir, Jammu, Bhaderwah, Chinta village, on decaying log of *Pinus* sp., Brij Bala 11159 (PUN), September 8, 2016; Kathua, Sukrala on decaying log of *Pinus* sp., Brij Bala, 11158 (PUN), September 27, 2017.

Remarks: *Sistotrema alboluteum* is characterized by resupinate, poroid basidiome with monomitic hyphal system and globose basidiospores. It is being recorded for the first time from India. The earlier reports of *S. alboluteum* are different parts of Europe (Mycobank, 2021).

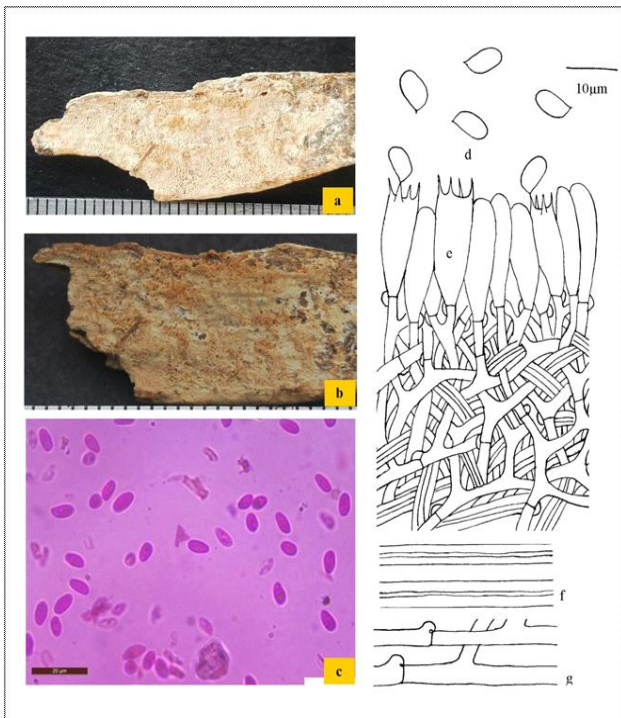


Fig. 1 : (a-g) *Dichomitus*: a-b. Basidiome showing hymenial surface (fresh and dry); c. Photomicrograph showing basidiospores; d. Basidiospores; e. Basidia; f. Skeletal hyphae; g. Generative hyphae.

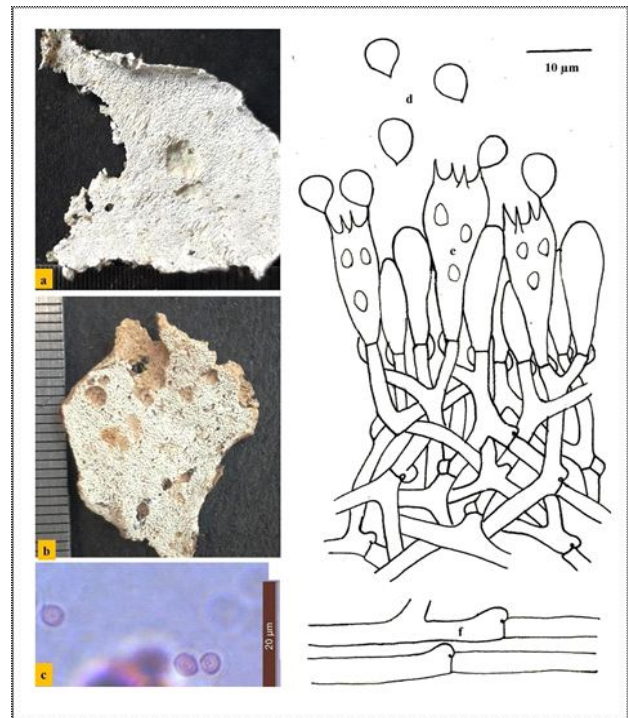


Fig. 3: (a-f) *Sistotrema alboluteum*: a-b. Basidiome showing hymenial surface (fresh and dry); c. Photomicrograph showing basidiospores; d. Basidiospores; e. Basidia; f. Generative hyphae.



Fig. 2 : (a-h) *Donkioporia expansa*: a-b. Basidiome showing hymenial surface (fresh and dry); c. Photomicrograph showing basidiospores; d. Basidiospores; e. Basidia; f. Skeletal hyphae; g. Binding hyphae; h. Generative hyphae

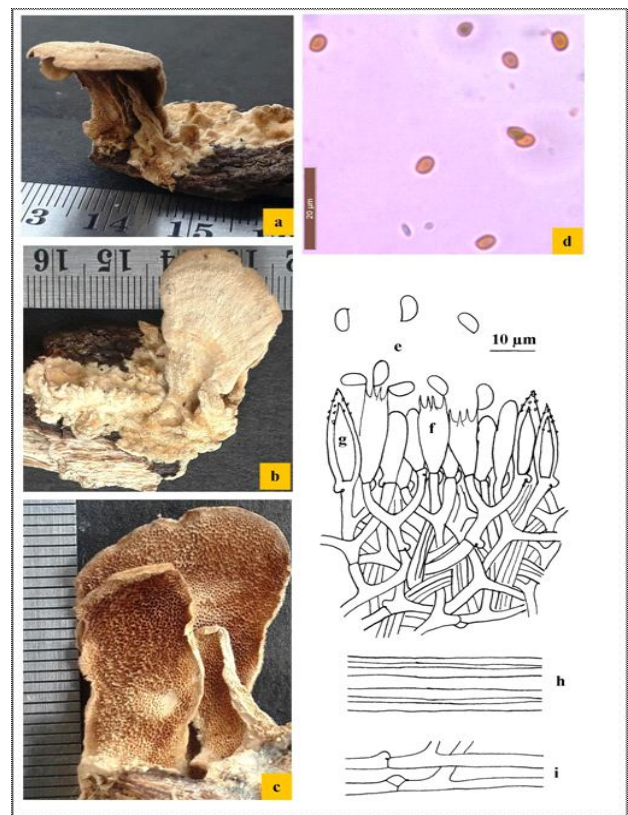


Fig. 4: (a-i) *Trichaptum perrottetii*: a. Basidiome showing mode of attachment; b-c. Basidiome showing abhymenial and hymenial surface; d. Photomicrograph showing basidiospores; e. Basidiospores; f. Basidia; g. Cystidia; h. Skeletal hyphae; i. Generative hyphae

4. *Trichaptum perrottetii* (Lév.) Ryvarden, Norwegian Journal of Botany 19: 237 (1972).
 a” *Trametes perrottetii* Lév., Annales des Sciences Naturelles Botanique 2: 195 (1844).

Basidiocarp annual, sessile, pileate, with narrow base, applanate, convex, at right angle to substrate; pilei up to 2.2×0.4×2.4 cm; abhymenial surface white when fresh, changing to grayish white, faintly concentrically zonate, hirsute; hymenial surface poroid, purplish brown when fresh, changing to brown on drying; pores round to angular, 2- 3 per mm; dissepiments up to 70 µm thin; margins concolorous, acute, entire, sterile up to 2mm on hymenial side; context, homogeneous, brownish orange, up to 2 mm in thickness; tube layer grayish red, up to 2mm deep.

Hyphal System dimitic. Generative hyphae hyaline, thin-walled, branched, clamped, up to 4 µm in width. Skeletal hyphae pale yellowish, thick-walled, aseptate unbranched, up to 5.5 µm in width. Cystidia subventricose, thin- to thick-walled, apically encrusted, originates in hymenium, 20-25×7-5 µm; projecting up to 10 µm from the hymenium. Basidia sub-clavate, clamped at the base, tetrasterigmate, 15-23.2×7-8 µm; sterigmata up to 3 µm in length. Basidiospores ellipsoid, hyaline, thin-walled, smooth, no reaction in cotton blue and Melzer’s reagent, 5-6 ×2 -3µm (Fig.4).

Material examined: Jammu and Kashmir, Doda, Shunushir, on *Cedrus deodara* branch, Brij Bala11161 (PUN), August 17, 2017.

Remarks: *Trichaptum perrottetii* is characterized by semicircular to elongated, shelf like pilei with hirsute abhymenial surface, abundant cystidia and ellipsoid basidiospores. Earlier it is reported from USA, Cuba, British Honduras, Guatemala, Costa Rica, Colombia, Brazil, French Guyana and Bolivia (Mycobank, 2021).

Earlier workers (Bala et al., 2020) reported 45 species of polyporoid fungi from Union Territory of Jammu and Kashmir (Table 1). These are

presently classified under 24 genera, 8 families and 4 orders of *Agaricomycetes* (*Basidiomycota*). In the present study one species each of the genera *Dichomitus*, *Donkioporia*, *Sistotrema* and *Trichaptum* has been described. Among these, genus *Donkioporia* is recorded for the first time from India and genus *Dichomitus* is new to Jammu and Kashmir. The present contribution adds four new records of the polyporoid fungi which take the number of polyporoid fungi from Jammu and Kashmir 45 to 49.

ACKNOWLEDGEMENT

The author is grateful to the Head, Department of Botany, Punjabi University Patiala, for providing necessary laboratory facilities and University Grants Commission, New Delhi for financial assistance under UGC DRS DSA-I programme.

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