

Diversity of the Genus *Stereum* Hill ex Pers. from District Sirmaur (Himachal Pradesh)Ramandeep Kaur¹, Maninder Kaur², Avneet Pal Singh^{3*} and Gurpaul Singh Dhingra³¹*Department of Botany, Baba Farid College, Bathinda - 151 001, Punjab, India.*²*PG Department of Botany, Dev Samaj College for Women, Ferozepur City - 152 002, Punjab, India.*³*Department of Botany, Punjabi University, Patiala - 147 002, Punjab, India.***Corresponding author Email: avneetbot@gmail.com; avneet@pbi.ac.in*

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ABSTRACT

Genus *Stereum* Hill ex Pers. is being described for the first time from district Sirmaur, Himachal Pradesh. Based on the morpho-taxonomic investigations, five species namely, *S. gausapatum*, *S. hirsutum*, *S. insignitum*, *S. ochraceoflavum* and *S. rugosum* have been described and illustrated. In addition to, all five species being new to Sirmaur district, two species, *Stereum insignitum* and *S. ochraceoflavum*, are described as new records for India.

Keywords: *Basidiomycota, Agaricomycetes, Himalaya, Wood rotting fungi, Taxonomy, Corticioid fungi*

INTRODUCTION

Genus *Stereum* (*Basidiomycota, Agaricomycetes, Russulales, Stereaceae*) is characteristic in having annual or perennial, macroscopic basidiocarps that range from resupinate, loosely adnate/effused to reflexed to pileate. In case of the reflexed and pileate forms, abhymenial surface varies from glabrous to colliculose through tomentose, hirsute or rugose. On the contrary, hymenial side is mostly smooth or tuberculate. The members of this genus are further characterized by monomitic or dimitic hyphal system with simple or nodose septate generative hyphae. The cystidial elements are generally present and the basidia are usually clavate to subclavate to tubular with four sterigmata. Basidiospores are quite diverse as far as their shape is concerned (narrowly ellipsoid to ellipsoid to cylindrical to allantoid). These are mostly thin-walled with smooth or ornamented surface and are stained in Melzer's reagent.

The members of the genus *Stereum* are distributed globally and have been described or documented from different parts of Africa, Asia, Australia, Europe, North America and Middle East (Tura *et al.*, 2008). Of the total 788 taxon names listed under the genus in Mycobank (2024), 696 names have been recognized as legitimate taxon names. The genus has been collected and described from different parts of India on the basis of sixteen species from time to time (Bagchee and Bakshi, 1954; Rattan, 1977; Natarajan and Kolandavelu, 1985; Sharma, 2012; Ranadive, 2013; Dhingra *et*

al., 2014). As far as Himachal Pradesh is concerned only seven species have been documented so far (Dhingra *et al.*, 2014).

During the field survey conducted in different parts of Sirmaur district of Himachal Pradesh in the monsoon season of 2016 and 2017, basidiocarp of the genus *Stereum* were collected. The morphology based examination of these specimens and their comparison with the literature (Bagchee and Bakshi, 1954; Rattan, 1977; Natarajan and Kolandavelu, 1998; Bernicchia and Gorjón, 2010; Sharma, 2012; Ranadive, 2013 and Dhingra *et al.*, 2014) divulged the identity of five species i.e. *S. gausapatum* (Fr.) Fr., *S. hirsutum* (Willd.) Pers., *S. insignitum* QuéL., *S. ochraceoflavum* (Schwein.) Sacc. and *S. rugosum* Pers. The genus is being described for the first time from Sirmaur district based on these five species. Among these, *Stereum insignitum* and *S. ochraceoflavum* are described as new records from India. All the specimens have been deposited at the herbarium of the Department of Botany, Punjabi University, Patiala (PUN). The color standards used are as per Methuen's Handbook of colours by Kornerup and Wanscher (1978). Taxonomic key to all the five species has also been given.

TAXONOMIC DESCRIPTIONS**Key to the species**

1. Hyphal system dimitic.....2
1. Hyphal system monomitic.....3

2. Basidiospores cylindrical, acanthophyses present.....*S. insignitum*

2. Basidiospores cylindrical to narrowly ellipsoid, acanthophyses absent.....*S. ochraceoflavum*

3. Abhymenial side glabrous to tomentose.....*S. gausapatum*

3. Abhymenial side not as above.....4

4. Abhymenial side hirsute.....*S. hirsutum*

4. Abhymenial side rugose.....*S. rugosum*

1. *Stereum gausapatum* (Fr.) Fr., *Hymenomyces* Europaei: 638, 1874.

– *Thelephora gausapata* Fr., *Elenchus Fungorum* 1: 171, 1828. **(Figures 1-7)**

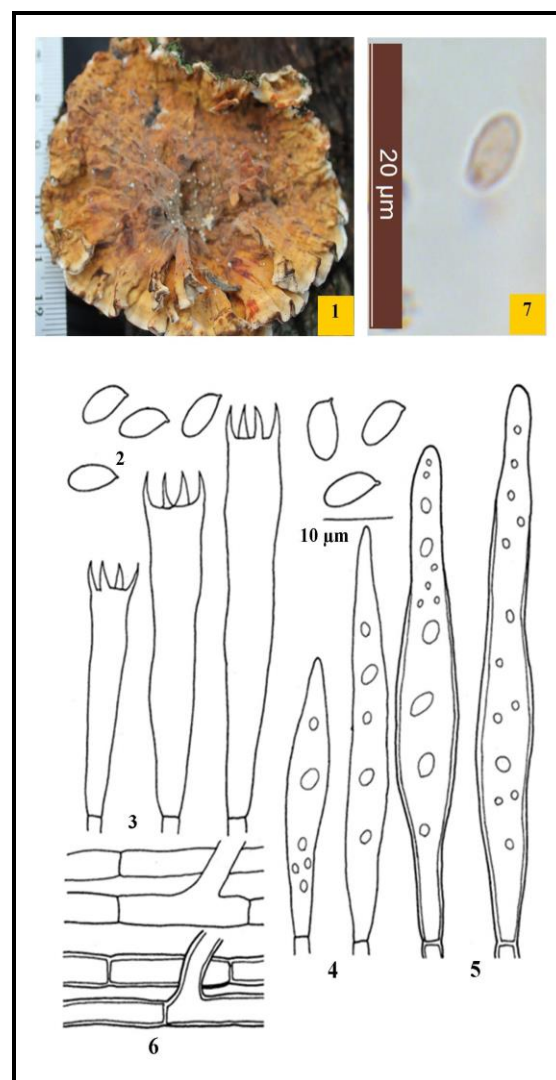
Basidiocarp resupinate, effused, adnate, reflexed to pileate, up to 910 µm thick in cross section, dimidiate; abhymenial side glabrous to tomentose, light brown to dark brown when collected, no prominent change on drying; hymenial side smooth to tuberculate, bleeds on bruising, orange white to greyish orange to brown to light brown when collected, no prominent change on drying; margins wavy to lobed, paler concolorous, occasionally indeterminate. Hyphal system monomitic. Generative hyphae septate, without clamps, up to 4.6 µm wide, thin- to thick-walled; usually parallel to substrate, less branched, loosely interwoven in subiculum: at right angles to substrate, more branched, compact in subhymenium.

Cystidial elements of two types: i. Cystidia tubular, 58–73 × 7.6–9 µm, thick-walled, except in apical portion, arising from the cortex, with oily contents; projecting up to 30 µm beyond the hymenium. ii. Acutocystidia numerous, with acute apical portion, 33–54 × 5.3–7 µm, without basal clamp; projecting up to 20 µm beyond the hymenium. Basidia clavate, 27–49 × 5–8 µm, four sterigmate, without basal clamp; sterigmata up to 4.5 µm long. Basidiospores subcylindrical to ellipsoid, 6.7–8 × 3.8–4.5 µm, smooth, thin-walled, positive to Melzer's reagent.

Sample studied – Himachal Pradesh: Sirmaur, Rajgarh, Nauradhar, on stump of *Quercus leucotrichophora*, Ramandeep and Avneet 11038 (PUN), September 12, 2016.

Remarks – This species grows in association with angiospermous hosts and is being described for the first time from the study area. Formerly in India, it

has been reported from Chamba and Kangra districts of Himachal Pradesh by Rattan (1977).



Figures 1-7: *Stereum gausapatum*. 1, Basidiocarp showing hymenial side; 2-4, Line diagrams showing outline of 2. basidiospores, 3. basidia, 4. Cystidia; 5, acutocystidia; 6, generative hyphae; 7, Photomicrograph showing a basidiospore.

2. *Stereum hirsutum* (Willd.) Pers., *Observationes Mycologicae* 2: 90, 1800.

– *Thelephora hirsuta* Willd., *Florae Berolinensis Prodrromus*: 397, 1787. **(Figures 8-14)**

Basidiocarp resupinate, effused, adnate, reflexed to pileate, up to 910 µm thick in cross section, dimidiate to broadly attached; abhymenial side hirsute, light brown to dark brown when collected, no prominent change on drying; hymenial side smooth to tuberculate, pale yellow to yellowish brown when collected, no prominent change on drying; margins acute, wavy to lobed, paler concolorous, occasionally indeterminate. Hyphal

system monomitic. Generative hyphae septate, without clamps, up to 5.7 μm wide, thin- to thick-walled; usually parallel to substrate, less branched, loosely interwoven in subiculum: at right angles to substrate, more branched, compact in subhymenium. Cystidial elements of two types: i. Cystidia tubular, 72–78 \times 6.5–9 μm , thick-walled, except in apical portion, arising from the cortex, with oily contents; projecting up to 32 μm beyond the hymenium. ii. Acutocystidia numerous, with acute apical portion, 20–35 \times 2.5–4 μm , without basal clamp; projecting up to 10 μm beyond the hymenium. Basidia clavate, 39–52 \times 6–7.2 μm , four sterigmate, without basal clamp; sterigmata up to 4.5 μm long. Basidiospores ellipsoid, 6.8–9.4 \times 3.5–4.5 μm , smooth, thin-walled, positive to Melzer's reagent.

Sample studied – Himachal Pradesh: Sirmaur, Shillai, on stump of *Cedrus deodara*, Ramandeep 11039 (PUN), September 3, 2017.



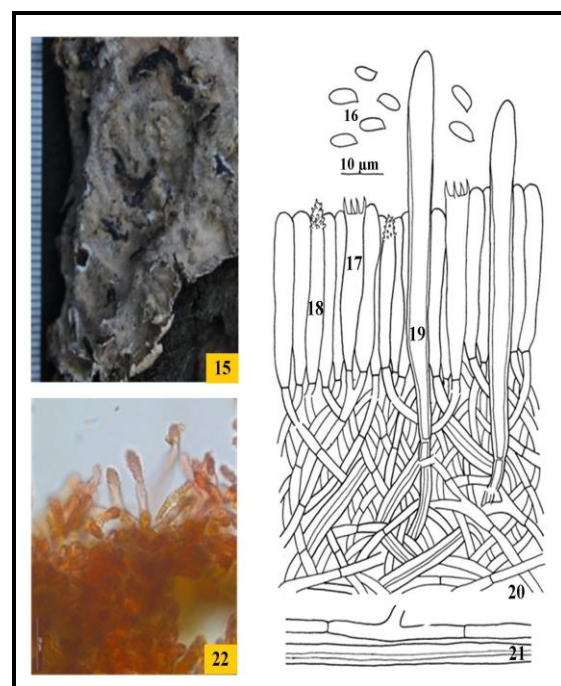
Figures 8-14: *Stereum hirsutum*. 8, Basidiocarp showing abhymenial side; 9, Basidiocarp showing hymenial side; 10-14, Line diagrams showing outline of 10. basidiospores, 11. basidia, 12. Cystidia, 13. acutocystidia and 14. generative hyphae.

Remarks – This species with hirsute abhymenial side is being described for the first time from the study area. Formerly in India, it has been reported from Uttarakhand by Lal Ji (2003) and Samita

(2014), from Chamba district of Himachal Pradesh by Rattan (1977), from Tamil Nadu by Natarajan and Kolandavelu (1998), from Jammu and Kashmir and Uttarakhand by Sharma (2012), from Chamba and Shimla districts of Himachal Pradesh by Kaur (2012) and Dhingra *et al.* (2014), from Maharashtra by Ranadive (2013), from Jammu and Kashmir by Jyoti (2017), Shimla district of Himachal Pradesh by Kaur (2018), and from Kangra district of Himachal Pradesh by Ritu (2019).

3. *Stereum insignitum* Quél., Comptes Rendus de l'Association Française pour l'Avancement des Sciences 18(2):513, 1890. **(Figures 15-22)**

Basidiocarp resupinate, effused, adnate, reflexed to pileate, up to 950 μm thick in cross section; abhymenial side tomentose to glabrous, brownish orange to greyish brown when collected, no prominent change on drying; hymenial side smooth to tuberculate, pale yellow to greyish yellow when collected, orange grey to greyish yellow on drying; margins wavy to lobed, paler concolorous, occasionally indeterminate.



Figures 15-22: *Stereum insignitum*. 15, Basidiocarp showing hymenial side; 16-21, Line diagrams showing outline of 16. basidiospores, 17. basidia, 18. acanthophyses, 19. pseudocystidia, 20. generative hyphae and 21. skeletal hyphae; 22. Photomicrograph showing acanthophyses.

Hypal system dimitic. Generative hyphae septate, without clamps, up to 4.7 μm wide, branched, thin-walled; less branched in subiculum; more branched

in subhymenium. Skeletal hyphae aseptate, up to 5 μm wide, unbranched, thick-walled. Both generative as well as skeletal hyphae usually parallel to substrate, intertwined, dominated by skeletal hyphae in subiculum and at right angles to substrate, compact, dominated by generative hyphae in subhymenium. Cystidial elements of two types: i. Pseudocystidia tubular, 71–104 \times 6.5–7.5 μm , thick-walled, except in apical portion, arising from the cortex, with oily contents; projecting up to 28 μm beyond the hymenium. ii. Acanthophyses numerous, with acute apical portion, 18–22 \times 2.8–3.2 μm , without basal clamp; projecting up to 8 μm beyond the hymenium. Basidia tubular, 20–38 \times 2.8–3.5 μm , four sterigmate, without basal clamp; sterigmata up to 5.5 μm long. Basidiospores subcylindrical, 4.7–7 \times 2.3–3.5 μm , smooth, thin-walled, positive to Melzer's reagent.

Sample studied – Himachal Pradesh: Sirmaur, Rajgarh, Nauradhar, on stump of *Quercus leucotrichophora*, Ramandeep and Avneet 11040 (PUN), September 12, 2016.

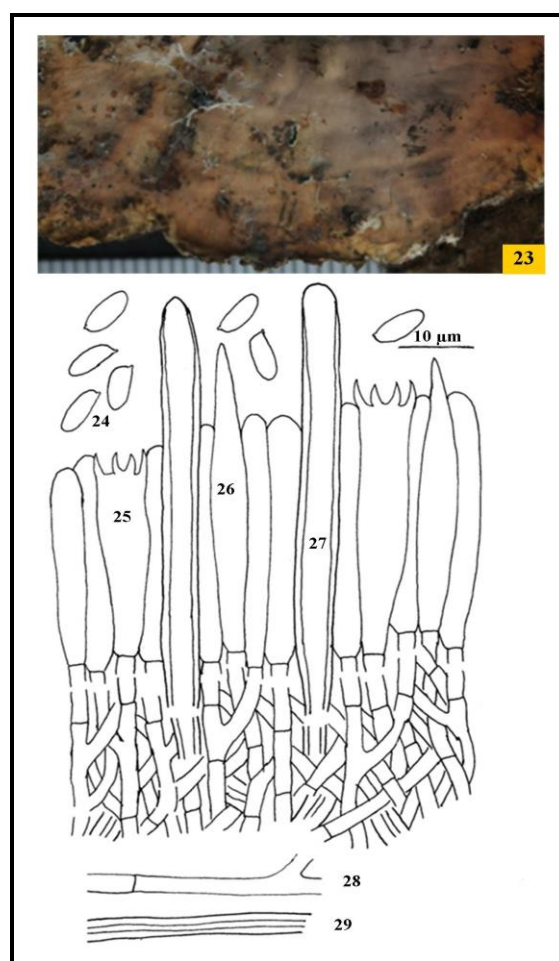
Remarks – This species with dimitic hyphal system and subcylindrical basidiospores is being described for the first time from India. Other former reports are from Austria, Bulgaria, Calabria, Czech Republic, Emilia–Romagna, France, Germany, Hungary, Italy, Lazio, Liguria, Piemonte, Romania, Russia, Spain, Slovenia, Toscana, Turkey and Ukraine (Mycobank, 2024).

4. *Stereum ochraceoflavum* (Schwein.) Sacc., Sylloge Fungorum 6: 576, 1888.

– *Thelephora ochraceoflava* Schwein., Syn. Fung. Amer. bor.: no. 649, 1831. **(Figures 23-29)**

Basidiocarp resupinate, effused, adnate, reflexed to pileate, up to 950 μm thick in cross section, dimidiate, usually in groups; abhymenial side tomentose to glabrous, pale yellow to greyish yellow when collected, no prominent change on drying; hymenial side smooth to tuberculate, pale yellow to greyish yellow to yellowish orange when collected, orange grey to greyish yellow on drying; margins wavy to lobed, paler concolorous, occasionally indeterminate. Hyphal system dimitic. Generative hyphae septate, without clamps, up to 2.8 μm wide, branched, thin-walled; less branched in subiculum; more branched in subhymenium. Skeletal hyphae aseptate, 4.7 μm wide, unbranched, thick-walled. Both generative as well as skeletal hyphae usually parallel to substrate, intertwined,

dominated by skeletal hyphae in subiculum and at right angles to substrate, compact, dominated by generative hyphae in subhymenium. Cystidial elements of two types: i. Pseudocystidia tubular, 50–70 \times 6.5–7.5 μm , thick-walled, except in apical portion, arising from the cortex, with oily contents; projecting up to 35 μm beyond the hymenium. ii. Acutocystidia numerous, with acute apical portion, 35–50 \times 4.7–6 μm , without basal clamp; projecting up to 15 μm beyond the hymenium. Basidia tubular, 27–39 \times 4.2–7.7 μm , four sterigmate, without basal clamp; sterigmata up to 5 μm long. Basidiospores cylindrical to narrowly ellipsoid, 6.5–7.7 \times 3–3.8 μm , smooth, thin-walled, positive to Melzer's reagent.



Figures 23-29: *Stereum ochraceoflavum*. 23, Basidiocarp showing hymenial side; 24-29, Line diagrams showing outline of 24, Basidiospores; 25, Basidia; 26, acutocystidia; 27, Pseudocystidia; 28, generative hyphae; 29, skeletal hyphae.

Sample studied – Himachal Pradesh: Sirmaur, Rajgarh, Nauradhar, on stump of *Cedrus deodara*, Ramandeep and Avneet 11041 (PUN), September 12, 2016.

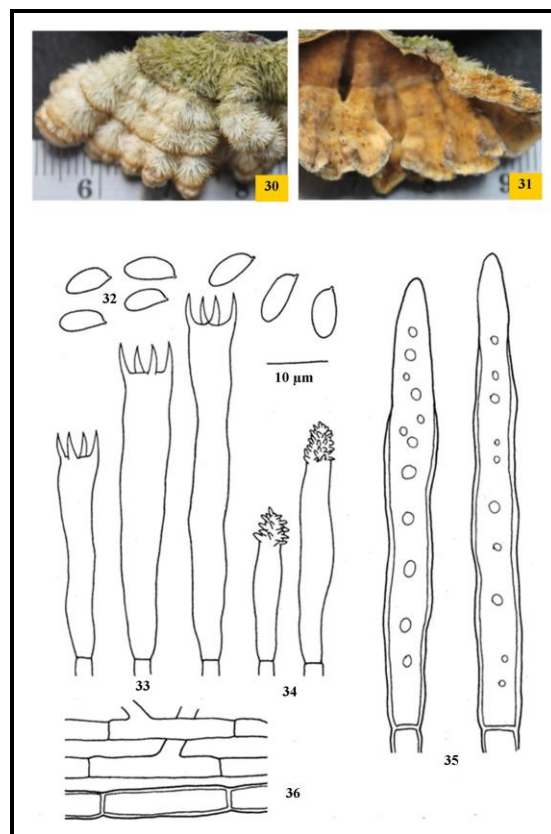
Remarks – This species with dimitic hyphal system and cylindrical to narrowly ellipsoid basidiospores is being described for the first time from India. Other former reports are from Alto-Adige, Belgium, Czech Republic, Emilia-Romagna, Estonia, France, Friuli Venezia-Giulia, Italy, Lazio, Liguria, Portugal, Russia, Spain, Slovenia, Switzerland, the Caucasus, Toscana, Turkey, Trentino Alto-Adige and Ukraine (Mycobank, 2024).

5. *Stereum rugosum* Pers., Neues Magazin für die Botanik 1: 110, 1794. (Figures 30-36)

Basidiocarp resupinate, effused, adnate, reflexed to pileate, up to 910 µm thick in cross section, usually dimidiate, laterally fused; abhymenial side rugose, occasionally zonate in peripheral region, brownish orange to greyish brown when collected, no prominent change on drying; hymenial side smooth to tuberculate, pale yellow to greyish yellow when collected, orange grey to greyish yellow on drying; margins wavy to lobed, paler concolorous, occasionally indeterminate. Hyphal system monomitic. Generative hyphae septate, without clamps, up to 5.6 µm wide, thin-walled; usually parallel to substrate, less branched, loosely interwoven in subiculum; at right angles to substrate, more branched, compact in subhymenium. Cystidial elements of two types: i. Cystidia tubular, 63–81 × 6–8.5 µm, thick-walled, except in apical portion, arising from the cortex, with oily contents; projecting up to 35 µm beyond the hymenium. ii. Acutocystidia numerous, with acute apical portion, 25–40 × 4.5–6 µm, without basal clamp; projecting up to 20 µm beyond the hymenium. Basidia clavate, 32–56 × 4.7–8 µm, four sterigmate, without basal clamp; sterigmata up to 5.7 µm long. Basidiospores cylindrical to ellipsoid, 6–9 × 2.4–4.2 µm, smooth, thin-walled, positive to Melzer's reagent.

Sample studied – Himachal Pradesh: Sirmaur, Shillai, on stump of *Cedrus deodara*, Ramandeep 11042 (PUN), September 3, 2017.

Remarks – This species with rugose abhymenial side is being described for the first time from the study area. Formerly in India, it has been reported as from Uttarakhand by Sharma (2012) and Samita (2014), from Shimla district of Himachal Pradesh by Kaur (2012) and Dhingra et al. (2014) and Kaur (2018), and from Chamba district of Himachal Pradesh by Poonam (2020).



Figures 30-36: *Stereum hirsutum*. 30-31. Basidiocarp showing abhymenial side (30) and hymenial side (31). 32-36. Line diagrams showing outline of 32. basidiospores, 33. basidia, 34. acutocystidia, 35. cystidia and 36. generative hyphae.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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