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The genus *Stereum* in Israel

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Abstract — A study of Israeli *Stereum* species diversity resulted in four species: *Stereum gausapatum*, *S. hirsutum*, *S. sanguinolentum*, and *S. subpileatum.* A new form, *S. hirsutum* f. *lobulatum,* is described from the species complex, and *S. gausapatum* and *S. sanguinolentum* are recorded as new species for Israeli mycobiota. Taxa are described and microstructural features are illustrated based on specimens collected from northern Israeli forests. Notes on host preference, morphological variability, distribution, and taxonomic relationships are provided. A key to Israeli *Stereum* species is given.

Key words—Mediterranean, stereoid fungi, polymorphism, taxonomy

Introduction

Its xerophilic habit makes the genus *Stereum* (*Stereaceae*, *Russulales*) a highly characteristic indicator for arid mycotas. This genus includes white-rot fungi inhabiting fallen or standing branches, trunks, and stumps representing a broadly diverse selection of broadleaved and coniferous trees. Their economic importance lies in their wood-destroying properties and carbon recycling of arid forest ecosystems (Overholts 1939, Woon & Jung 1999).

The stereoid morphotype covers annual to perennial, tough-leathery substipitate to resupinate fruitbodies with a more or less even hymenophore. Generically, the *Stereum* pileal covers are trichodermoid, often transforming to a fomitoid crust. The hymenium is variably colored, occasionally staining yellow-orange or red when injured. Cross-sections of the cream-colored context

reveal thin dark reddish deposits between the tomentum and fruitbody core. Russuloid pseudocystidia with refractive contents and weakly amyloid spores are characteristic at the microscopical level. The hyphal system is variously described as dimitic or monomitic, but most species have a pseudodimitic hyphal system dominated by thick-walled hyphae with living protoplasts. All hyphae are densely packed so that the fruitbodies are rather hard.

The concept of *Stereum*, adopted by Persoon (1794) and Fries (1838), was long used as an infrageneric division of *Thelephora* Ehrh. On the other hand, the concept of this union was rather broad. After generic separation and intensive microscopical studies, the concept of *Stereum* became increasingly narrow. Lentz (1955), Donk (1957), Boidin (1958a, b, 1959a, b, 1960), Pouzar (1959), Parmasto (1968), Welden (1971), and Chamuris (1988) segregated *Stereum* into smaller genera, thereby making the remaining genus a more homogeneous group. However, some of these segregate genera (e.g., *Haematostereum* Pouzar, *Xylobolus* P. Karst. emend. Boidin) have been "merged" into the core *Stereum* group, creating additional taxonomical problems. Some *Xylobolus* characteristics — such as amyloid binucleate basidiospores, hymenial acanthophysoid elements, and homothallism — are also basic generic characters for *Stereum,* suggesting that segregation of the genus has been premature.

Species concepts within *Stereum* are complicated by a lack of stable character patterns. Basidiocarp shape, type of tomentum, and presence of acanthohyphidia and conducting hyphae (Jülich & Stalpers 1980).

Modern molecular investigations place *Stereum* in the russuloid clade, which fully corresponds with microscopic evidence. Characteristics such as amyloid reactivity of the spore wall and the presence of gloeoplerous and lactiferous hyphae in most *Stereum* species are considered homologous with other russuloid taxa (Larsson & Larsson 2003, Larsson 2007).

The genus *Stereum* is distributed worldwide, with many widespread species following the distribution of their hosts from the boreal zone of Europe and North America into the arid areas of Africa, Asia, Australia, and the Middle East (Binyamini 1982, 1984; Breitenbach & Kränzlin 1986; Chamuris 1988; Ginns & Lefebvre 1993).

The history of *Stereum* research in Israel began with Binyamini (1982), who, in his fourth paper on Israeli lignicolous *Aphyllophorales*, recorded *Stereum hirsutum* and *Xylobolus subpileatus* (later described in Binyamini 1984) as species new to the area. *Stereum hirsutum,* considered a complex by many authors due to its great morphological variability, occurs on various hardwood substrata, shows a high ecological tolerance, and is also widespread in northern Israeli broadleaf forests. In contrast, *Stereum* (*Xylobolus*) *subpileatum* has been found only once growing on *Quercus calliprinos* in the Samarian forests. We have also found *Stereum gausapatum* inhabiting *Q. calliprinos* stumps in the

Israeli mountain forests of the Golan Heights. This species follows its host, usually oak, in Europe, Asia, Australia, and North America (Breitenbach & Kränzlin 1986). We present the first reports of *Stereum gausapatum* as well as the conifer-inhabiting *S. sanguinolentum* (found growing on fallen pine wood in the Golan Heights) for Israel below.

Material and methods

Fruitbody morphology was examined under light/dark field using a Carl Zeiss Axiostar 1122-100 microscope. Measurements were made using an immersion objective; 30 spores were measured for each specimen. The highest and lowest 5% spore measurements (given in parentheses) were excluded from each size variation range as outliers. Tissues were mounted in 10% potassium hydroxide (KOH) aqueous solution and Melzer's reagent for microscopical analyses. The material used in our analyses can be found in the herbarium of the Institute of Evolution, University of Haifa (Haifa, Israel, HAI). A map (Fig. 1) shows the Israeli distributions of each newly recorded species were distributed (Feinbrun-Dothan & Danin 1998).

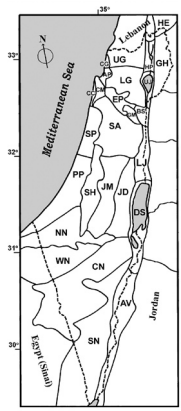


Fig. 1. Accepted abbreviations of nature regions of Israel: **AP** – Akko Plain; **AV** – Arava Valley; **BS** – Beit Shean Valley; **CC** – Carmel Coast; **CG** – Coast Galilee; **CM** – Carmel Mount; **CN** – Central Negev; **DS** – Dead Sea Area; **EP** – Esdraelon (Yizre'el) Plain; **GH** – Golan Heights; **GM** – Gilboa Mount; **HE** – Hermon Mount; **HP** – Hula Plain; **JD** – Judean Desert; **JM** – Judean Mts.; **LG** – Lower Galilee; **LJ** – Lower Jordan Valley; **NN** – Northern Negev; **PP** – Philistean Plain; **SA** – Samaria; **SH** – Shefela; **SN** – South Negev; **SP** – Sharon Plain; **UG** – Upper Galilee; **UJ** – Upper Jordan Valley; **WN** – Western Negev.

Taxonomic descriptions

Stereum gausapatum (Fr.) Fr., Hymenomyc. Eur.: 638, 1874. **Figs. 2–3**
≡ *Thelephora gausapata* Fr., Elench. Fung. 1: 171, 1828.

Basidiocarps annual, coriaceous, sessile to resupinate, normally effused-reflexed, 3–15 cm in extent, on vertical substratum found as imbricate dimidiate pilei merging into board-like patches. Abhymenial surface tomentose to strigose-hirsute; slightly zonate, rust-brownish with white-cream, and thin inflexed undulating margin. Hymenial surface even to somewhat tuberculate, cracking, brittle and pale-brown when fresh, but gray-brown when dry; when injured, fresh basidiome bruising red. Context thin, homogeneous, 0.5–1 mm. thick, cream-colored, in dry specimens without an evident deposit between tomentum and context.

Fig. 2. *Stereum gausapatum* growing on *Quercus calliprinos* stump in GH, Israel.
Scale bar = 1 cm (Photo V.F. Malysheva).

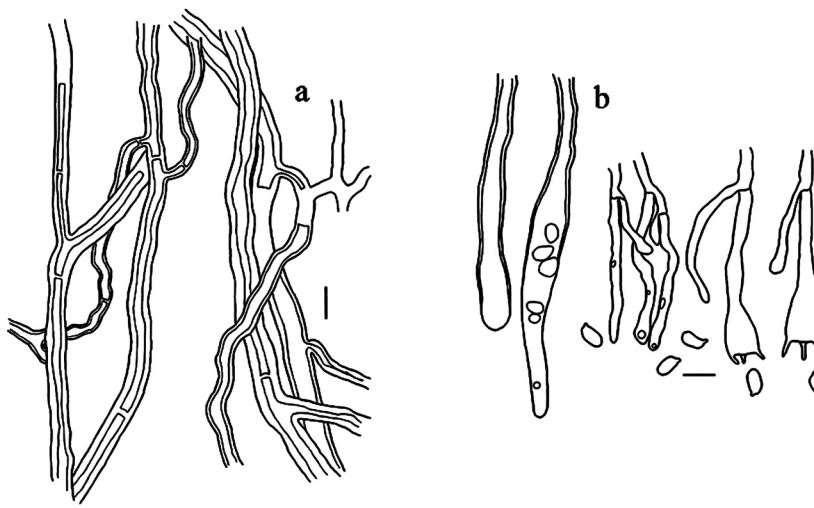


Fig. 3. Microscopic structures of *Stereum gausapatum*:
a – hyphae; b – hymenial fragment showing slenderly thick-walled pseudocystidia among cylindrical basidioles, basidia, and basidiospores.
Scale bar = 10 μm.

Hyphal system pseudodimitic. Subhymenial hyphae strongly interwoven, thus individual hyphae hardly seen, while contextual hyphae are somewhat loose. Generative hyphae septate, thin- to slightly thick-walled, 2–4 µm diam, branched and hyaline. Pseudoskeletal hyphae thick-walled, hyaline to yellowish with oily contents inside, slenderly branched, 4–8 (mostly 4–5) µm diam. Conducting hyphae similar, but without septation, with chrysescent contents. Cystidia not seen, but cystidia-like hyphal ends (pseudocystidia) numerous, cylindrical to subcylindrical, thin- to slightly thick-walled, 2–7 µm wide (with basal inside walls 1–1.5 µm thick), but apically thin-walled, with brownish oily contents. Basidioles cylindrical, thin-walled, 2–3 µm diam, projecting up to 10 µm above hymenium. Basidia narrowly clavate to clavate, 43–55 × 6–10 µm, 4-spored, without a basal clamp. Basidiospores ellipsoid-cylindrical, hyaline, smooth, thin-walled, (6–)6.5–7.9 × 3–3.8 µm, amyloid.

Found growing on *Quercus calliprinos* in the North of Israel (Fig. 4).

General distribution and habitat. *Stereum gausapatum* occurs mostly in oak zones on *Quercus*, *Castanea,* and *Carpinus* species. Basidiomata develop on dead stems, rotten stumps, logs, or trunks. Associated with a white rot (Ginns & Lefebvre 1993). Its general distribution according to our knowledge includes: Europe (Austria, Belgium, Denmark, Estonia, France, Germany, Georgia, Greece, Norway, Portugal, Russia, Spain, Sweden, Ukraine); Middle East (Israel, Turkey), Asia (Azerbaijan, Japan, South Korea); North America (Mexico, USA); South America (Panama).

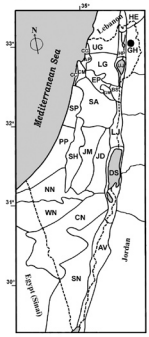


Fig. 4. Distribution of *Stereum gausapatum* in Israel.

Note. *Stereum gausapatum* was considered one of the "bleeders", along with *S. sanguinolentum* and *S. rugosum* Pers. and therefore placed into *Haematostereum* by Pouzar (1959). The bleeding reaction in fresh specimens appears upon hymenial surface injury and is caused by inner-colored exudates of the numerous pseudocystidia present in the hymenium of these species (Fig. 17). Due to this particular fact, *S. gausapatum* can be confused with *S. rugosum*, which when bruised also stains red and in addition shares the same habitat, however differs by its stratified perennial hymenium, larger spores, and presence of acanthohyphidia. Other species sharing a common habitat with *S. gausapatum,* are *S. hirsutum* and *S. ostrea* (Blume & T. Nees) Fr. In the field, *S. gausapatum* can be distinguished from *S. ostrea* by densely hirsute and thicker pilei (Overholts 1939), but, microscopically, *S. gausapatum* does not possess acanthohyphidia. In Israel, *S. gausapatum* may be confused with specimens belonging to *S. hirsutum*-complex because they share the same habitat, have similar spore sizes, and, in some specimens, turn red when injured during their

active growth phase. However, *S. hirsutum* has thick-walled pseudocystidia and usually acute hyphidia, while the pseudocystidia in *S. gausapatum* have rather thin walls: less than 1.5 µm in diam. (Chamuris 1985, 1988). According to Jülich & Stalpers (1980), within *S. gausapatum*, the dimension of the spores given by European authors is always larger than those given by American authors.

Specimens examined: **ISRAEL. GH**, Massada Forest, *Quercus calliprinos* forest, on *Quercus* stump, 07.03.2007, leg. & det. D. Țura, I. Zmitrovich et V. Malysheva (HAI 0114).

Stereum hirsutum (Willd.) Pers., Observ. Mycol. 2: 90, 1800 ('1799'). **Figs. 5–9**
≡ *Thelephora hirsuta* Willd., Fl. Berol. Prodr.: 397, 1787.

Basidiocarps annual to perennial, usually sessile to effused-reflexed with narrow to broadly prostrate base or totally resupinate and several centimeters in extent. Pilei semicircular, dimidiate or flabelliform to irregular, often umbonate, up to 70 × 50 × 1–2 mm; membranous-elastic when fresh and ceraceo-coriaceous when dry. When broadly attached, in most cases with confluent pilei, the single pilei have an imbricate arrangement. Abhymenial surface hirsute to hispid, yellow-ochraceous or grayish-white, in older specimens often covered by green algae or with a reddish-brown cutis exposed towards the attachment zone, more or less zonate. When zonate, usually with narrow dark bands alternating with wider and lighter colored ones (zonation in some specimens may be more prominent towards margin, where cutis is visible as a narrow glabrous band). Margin wavy, sometimes radiately plicate, thinning outwards, usually whitish-cream to gray. Hymenial surface smooth to slightly tuberculate, often with radial concentric ridges; light-yellow to orange-grayish, when old hymenium turns gray, in some specimens growth may continue on the same-aged basidiocarp; thus, sometimes marginal hymenium appear to be thicker and lighter in color. Context thin, whitish-cream; in cross section, with a very thin red-brownish deposit between tomentum and context, barely observable in some specimens.

Hyphal system pseudodimitic. Generative hyphae simple septate, thin-walled, mostly 2–3µm diam, branched and hyaline; pseudoskeletal hyphae thick-walled, rarely septate, 4–8 µm diam, unbranched to slightly branched, with oil-drops and pale yellowish contents in KOH. Cystidia not seen, but cystidia-like hyphal ends (pseudocystidia) present. Pseudocystidia abundant, cylindrical to subcylindrical, sometimes medially inflated, thick-walled, except an apical part with basal wall 3–4 µm thick. Hyphidia acuminate, mostly cylindrical, thin- to slightly thick-walled, 2–3 µm in diam. Basidia slenderly-clavate, 25–35 × 3.5–4 µm, 4-spored, without a basal clamp. Basidiospores ellipsoid-cylindrical, hyaline, thin-walled, even, often with internal oil-drops, 4–6.5(–7) × 3–3.5 µm, amyloid.

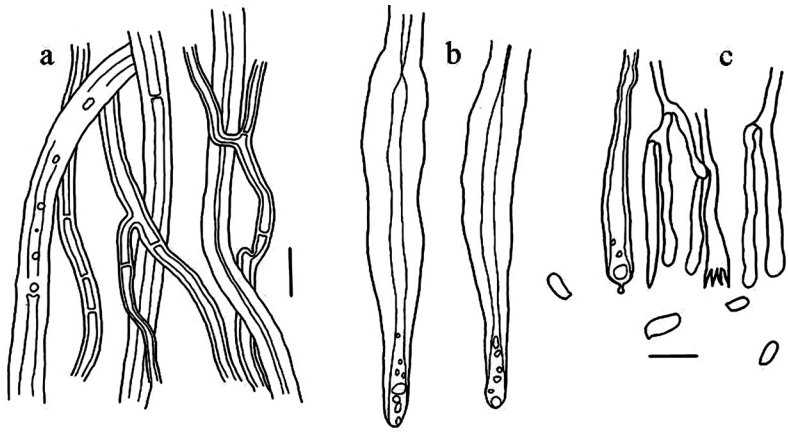


Fig. 5. Microscopic structures of *Stereum hirsutum*:
a – hyphae; b – thick-walled pseudocystidia; c – hymenial fragment showing pseudocystidia among acute-cylindrical hyphidia, basidia, and basidiospores.
Scale bar = 10 μm.

General distribution and habitat. The species within the *Stereum hirsutum*-complex are generally known to grow on bark and wood of trunks, twigs, or stumps of a wide range of dead or living deciduous trees. According to present-day knowledge, the members of this complex are widespread and common in several countries: Europe (Austria, Croatia, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Macedonia, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, UK, Ukraine); Middle East (Israel, Turkey); East Asia (Mongolia, Japan, South Korea); North America (Canada, USA); South America (Colombia, Costa Rica, Dominican Republic, Venezuela); Southern Hemisphere (Australia, New Zealand); Africa (Morocco, Tanzania); Greater Antilles (Jamaica).

Note. Some authors treat *Stereum hirsutum* as a complex that shares a common or similar inner structure but exhibits different morphological forms; other authors find "reliable" taxonomic features to split this complex into separate species. However, some specimens, depending on biotic and abiotic factors of their habitat in various geographic biomes, show some stable morphotypes.

During its active growth, hymenium in some fruitbodies turns yellow-orange to red when bruised; thus, in the field, they might be confused with *S. rugosum* and *S. gausapatum*. Therefore, careful morphological examination is needed. Because of its multiplicity of forms, according to Breitenbach & Kränzlin (1986), old specimens of *S. hirsutum* can be confused with *S. ochraceoflavum* (Schwein.) Fr. Although both species share the same substrata, *S. ochraceoflavum*

preferentially colonizes twigs and clippings, while *S. hirsutum* colonizes trunks, crevices, and thick branches and thus apparently produces thicker fruitbodies.

Chamuris (1988) cites the following important stable characters for the North American *S. hirsutum* (all also found in Israeli examined specimens): the presence of cutis, broad substratum preference, mostly acuminate hyphidia, thick-walled pseudocystidia with basal wall thickness ≥ 2 μm wide, and conducting hyphae with yellow contents that turn brownish-orange in Melzer's reagent.

Stereum hirsutum is one of the most common hardwood-inhabiting species in Israel. The variable morphologies exhibited by the species in northern Israeli forests are compared in Table 1.

Table 1. Fruitbody variability in *Stereum hirsutum*-complex in Israel

Morphotypes	Basic characteristics
Strongly plicate, actively growing type HAI 0141 (Fig. 6)	**fruitbodies** strongly plicate, imbricate, narrowly to sessile attached; **abhymenial surface** tomentose-strigose ocher-pale brownish, towards attachment zone covered by green algae or with a glabrous reddish brown cutis; **hymenium** even, with radially concentric ridges, yellowish-orange. Note: The yellow to reddish bruising hymenium (sometimes, when fresh) suggests an actively growing basidiocarp; usually, in such cases, the abhymenial and hymenial surfaces show lighter colors compared to aged fruitbodies (Fig. 7).
Aged fruitbody type HAI 0119 (Fig. 7)	**fruitbodies** narrowly attached to sessile, dimidiate, flabelliform; **abhymenial surface** white-gray, zonate, tomentose-strigose, with cream- colored margin and often glabrous, blackish-brown cutis towards attachment zone; **hymenial surface** yellow-orange to gray, smooth. Note: the hard, dry fruitbodies, the glabrous, brown-blackish visible cutis, often covered by green algae and the presence of grayish color on hymenial and abhymenial surfaces resemble the main features of aged fruitbodies.
Uneven hymenophore type HAI 0138 (Fig. 8)	**fruitbodies** effused-reflexed, narrowly attached, confluent; **abhymenial surface** zonate, mated-strigose, grayish; **hymenial surface** even-tuberculate beset with minute, irregular, lighter colored folds, which actually resemble small, rising individual pileoli with light-colored patches on a grayish background. Note: only two samples with this type of deviant hymenial surface, were found in Israel in different localities.
Tomentose abhymenial surface type HAI 0137 (Fig. 9)	**fruitbodies** imbricate, broadly to narrowly attached in appearance, 90 × 17 × 1 mm thick, confluent; an individual pilei with its own attachment point; **abhymenial surface** tomentose, tomentum entirely covering the upper surface including short stipe, zonate; **hymenial surface** even, light yellowish-orange to grayish towards attachment point. Note: the soft tomentum covering the entire upper surface and the warm light colors make this specimen highly distinguishable from the other samples of *Stereum* that we found.

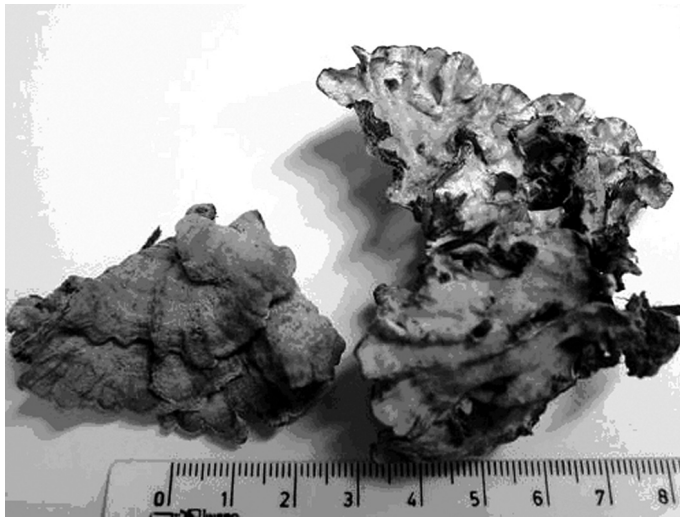


Fig. 6. *Stereum hirsutum* fruitbody: strongly plicate, actively growing type (explanation in Table 1). Scale bar = 1 cm.

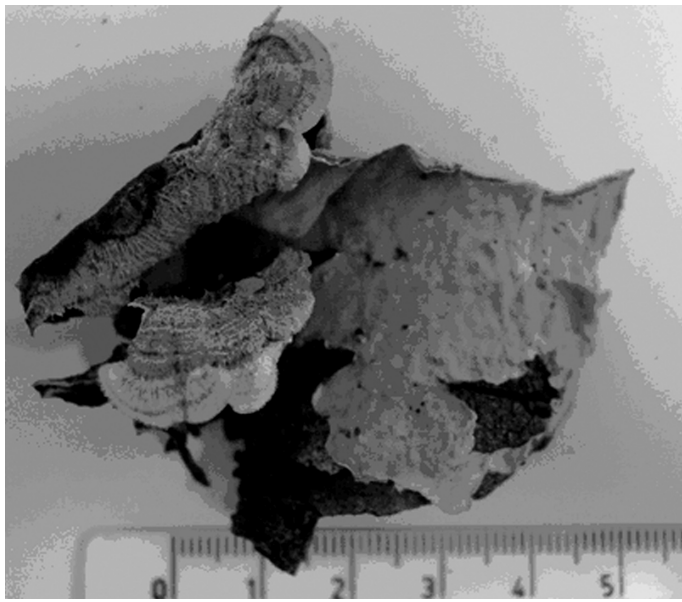


Fig. 7. *Stereum hirsutum* fruitbody: aged fruitbody type (explanation in Table 1). Scale bar = 1 cm.

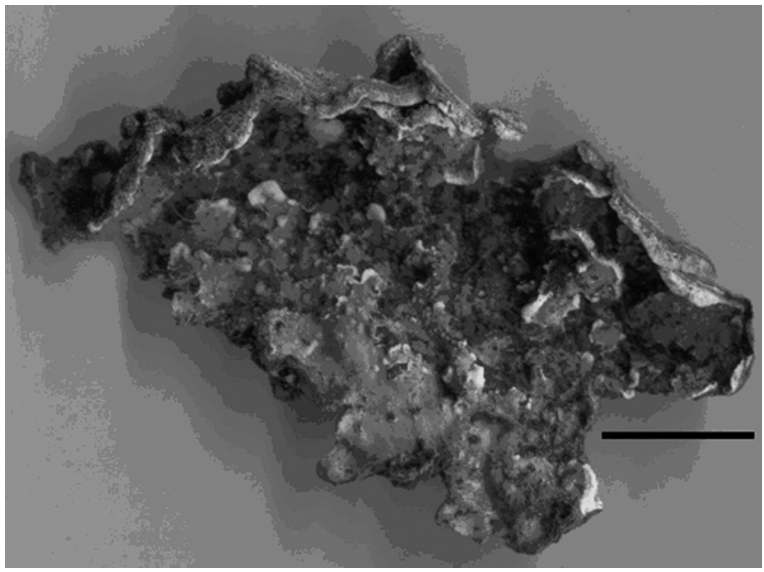


Fig. 8. *Stereum hirsutum* fruitbody: uneven hymenophore type(explanation in Table 1). Scale bar = 1 cm.

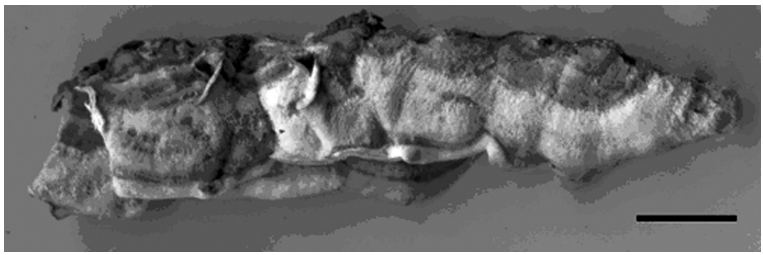
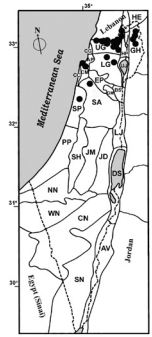


Fig. 9. *Stereum hirsutum* fruitbody: tomentose abhymenial surface type (explanation in Table 1). Scale bar = 1 cm.

Chamuris (1988) suggests that *S. subtomentosum* Pouzar gradually merges into *S. hirsutum*. Indeed, in boreal areas, specimens characterized by applanate symmetrical pilei with dull-colored hymenium can be found, but the presence or absence of a strigose abhymenial surface greatly complicates species attribution. However, as Israeli materials, despite their variability, do not include *S. subtomentosum*-like morphotypes, this taxon may be considered absent in Israel.

The *S. hirsutum* species complex is widely distributed in North Israel (Fig. 10).

Fig. 10. Distribution of *Stereum hirsutum*-complex in Israel.



Many Israeli specimens of *S. hirsutum* exhibit longitudinally expanded lobate processes, a very interesting feature that is seen elsewhere only in *S. ostrea* (incl. *S. lobatum*) and *S. insignitum* Quél. Its strigose pilei with a black line under the tomentum and the absence of acanthohyphidia, confirms the identification of the Israeli material as *S. hirsutum*, yielding an ecotype parallel to *S. ostrea* and *S. insignitum*. As this pattern is very distinguishable, we propose a new form for this polymorphic species:

Stereum hirsutum* f. *lobulatum Ţura, Zmitr. & Wasser, **f. nov.** **Figs. 11–12**

Mycobank MB 506905

Basidiomata stereoidea, perennia, basi angustata, lobulata, elongata, ad marginem undulata et confluenta. Superficio strigosa, zonata et undulata, basi cinerascens, ad marginem ochraceo-flava. Hymenium laeve, sed radiately costatum, basi cineraceo-flavum, ad marginem subvitellinum. Structura microscopica quod in typus. Sporae 5.5–7.5 × 2.5–3.0 µm.

Holotype: **ISRAEL. UG**, Savsufa Forest, *Quercus calliprinos* forest, on oak stump, 11.02.2008, leg. D. Ţura, det. D. Ţura et I. Zmitrovich (HAI 0193).

Basidiocarps perennial, usually sessile with narrow base, 1–2.5 cm wide and 1.5–3.5 cm long; pilei flabelliform to irregular, regularly lobate, confluent both in basal and marginal parts. Abhymenial surface hirsute to hispid, grayish at the base and yellow-ochraceous at margin, regularly zonate, radiately plicate. Hymenial surface basically smooth but with radial concentric ridges along fruitbody growth axes, light-yellow to orange-grayish. Context thin, pale cream; in cross-section with a very thin cinnamomeous deposit between tomentum and context.

The microstructure is the same as in all other specimens of *S. hirsutum* studied; acanthohyphidia absent. Spores 5.5–7.5 × 2.5–3.0 µm.

Note. Such a specific lobulate and subfasciate habit has not been described for *Stereum hirsutum*, at least not in well-known monographs (Eriksson et al. 1984, Davydkina 1980, Chamuris 1988, Duhem 2007). Chamuris (1988), who noted possibly undulate or plicate fruitbody forms, did not mention deeply crenate lobules in his monograph.

All lobulate forms of this fungus were found in subxerophilic mountain oak forests (Upper Galilee, Golan Heights). In such extreme conditions, the fungal morphogenetic spectra are enriched by strange "marginal" forms. Some of these (e.g., *Byssomerulius corium* var. *halieensis* Zmitr. et al., *Peniophora*

Fig. 11. *Stereum hirsutum* f. *lobulatum* fruitbodies variability.

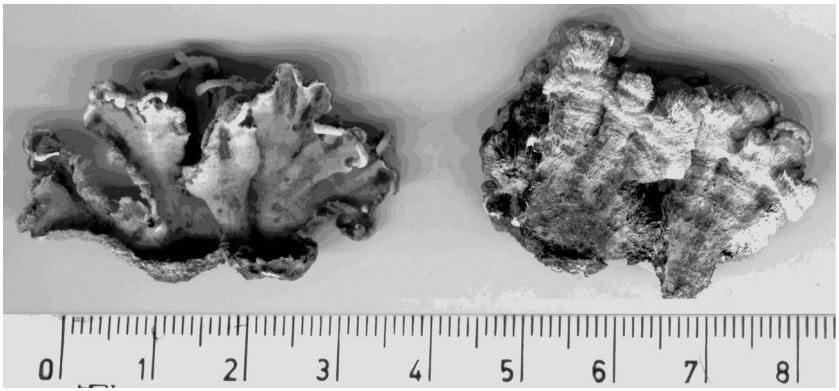


Fig. 12. A large-scale view of fruitbody cluster of *Stereum hirsutum* f. *lobulatum*.

quercina f. *merulioides* Ţura et al.) have been described earlier so as to highlight the variability range of these species (Zmitrovich et al. 2006, Ţura et al. 2007).

These formations are very important for an internal differentiation of the species because over time reproductive barriers may occur within such ecotypic subpopulations that may lead to eventual speciation.

Specimens examined: **ISRAEL. UG**, Mt. Meron National Park, on *Pinus*?, 27.12.2000, leg. S. Reshetnikov, det. S. P. Wasser (HAI 0115); ?, Harshad Harbaim, on branch of dead oak, 1.02.2001, leg. S. Reshetnikov, det. S. P. Wasser (HAI 0116); ?, Harshad Harbaim, on *Quercus* stump, 24.02.2001, leg. I. Tovbin, det. S.P. Wasser (HAI 0117); **UG**, Salsufer Forest, on *Q. calliprinos* wood, 19.11.2006, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0118); **UG**, Bar'am Forest, *Q. calliprinos* forest, on *Quercus* stump, 16.12.2006, leg. D. Ţura, det. D. Ţura, I. Zmitrovich et V. Malysheva (HAI 0119); **GH**, Massada Forest, *Q. calliprinos* forest, on broadleaf wood, 26.11.2006, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0120); **LG**, Oshaya Forest, mixed *Pinus* and *Quercus* wood, on *Quercus* stump, 16.12.2006, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0121); **UG**, Nahal Keziv, mixed hardwood forest, on *Quercus* stand, 20.12.2006, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0122); **MC**, Muhraqua, *Q. calliprinos* forest, on *Quercus* stump, 24.12.2006, D. Ţura, I. Zmitrovich et V. Malysheva (HAI 0123); **GH**, Qazrin, mixed forest, on *Cupressus* stump, 09.01.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0124); **GH**, Massada Forest, *Q. calliprinos* forest, on broadleaf wood, 09.01.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0125); **MC**, Mt. Carmel Natural Park, mixed *Quercus* and *Pinus* forest, on *Quercus* branches, 12.01.2007, leg. S. Zohar, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0126); **UG**, Even Menahem, *Quercus* forest, on hardwood stump, 22.01.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0127); **UG**, Hanita Forest, *Q. calliprinos* forest, on branches of *Q. calliprinos,* 31.01.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0128); **LG,** Lavi Forest, mixed *Pinus* and *Quercus* forest, on oak twig, 04.02.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0129); **UG**, Kiryat Shmona, *Eucalyptus* wood, on hardwood twigs, 11.02.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0130); **SA**, Reihan Forest, mixed *Pinus* and *Quercus* wood, on hardwood twigs, 19.02.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0131); **UG**, Kiryat Shmona, *Eucalyptus* wood, on hardwood stump, 20.02.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0132); **UG**, Banias Park, mixed broadleaf trees, 20.02.2007, leg. Yair Ur, det. D. Ţura, I. Zmitrovich et V. Malysheva (HAI 0133); **UG**, Sde Eliezer, on *Eucalyptus* tree, 21.02.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0134); **GH**, Massada Forest, *Q. calliprinos* forest, on oak stump, 07.03.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0135); **UG**, Kiryat Shmona, *Eucalyptus* wood, on hardwood stump, 07.03.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0136); **LG**, near Kabul, mixed hardwood forest, on *Eucalyptus* stump, 07.03.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich et V. Malysheva (HAI 0137); **UG**, Mt. Meron, *Q. calliprinos* forest, on *Quercus* stump, 09.03.2007, leg. & det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0138); **UG**, Bar'am Forest, *Q. calliprinos* forest, on *Quercus* stump, 09.03.2007, leg. D. Ţura, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0139); **SP**, Ben Shemen Forest, mixed broadleaf trees, on ?, 16.03.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0140); **UG**, Canyon Agam, *Quercus* forest, on *Quercus* stump, 17.03.2007, leg. Zohar S., det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0141); **GH**, Hanita Forest, *Q. calliprinos* forest, on branches of *Q. calliprinos,* 20.03.2007, leg. Y. Ur, det. D. Ţura, I. Zmitrovich & V. Malysheva (HAI 0142).

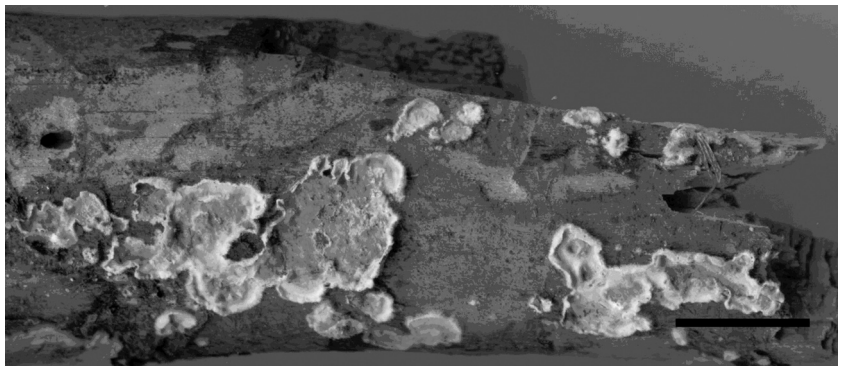


Fig. 13. Dry fruitbodies of *Stereum sanguinolentum* on fallen pine wood. Scale bar = 1 cm.

Stereum sanguinolentum (Alb. & Schwein.) Fr., Epicr. Syst. Mycol.: 549, 1838.

Figs. 13–15

≡ *Thelephora sanguinolenta* Alb. & Schwein., Consp. Fung. Lusat.: 274, 1805.

Basidiocarps annual, hard-coriaceous, resupinate, totally prostrate with free margins 3–4 mm wide, in appearance as several small, hardly separable, round-ovoid patches scattered on wood substratum, confluent and expanding up to 5 cm in length. Abhymenial surface strigose-tomentose, easily zonate, white-cream, with thin inflexed margin. Hymenial surface even to tuberculate, grayish-brown with violaceous tinge mostly in the central part of

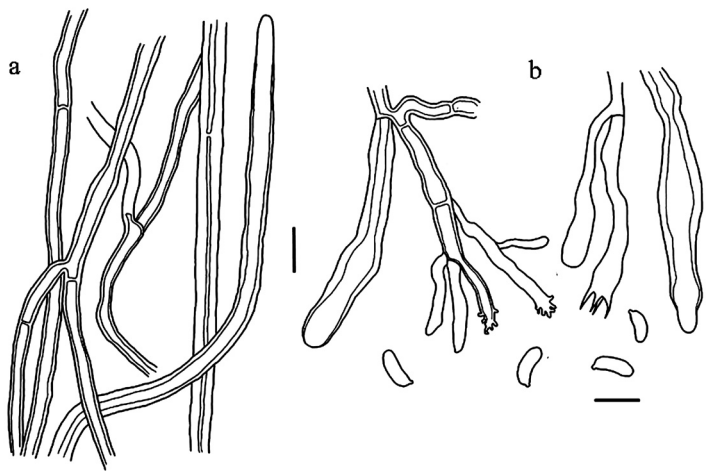


Fig. 14. Microscopic structures of *Stereum sanguinolentum*: a – hyphae; b – hymenial fragment showing slender thick-walled pseudocystidia among acanthohyphidia, basidia, and basidiospores. Scale bar = 10 μm.

the patches, color becoming gradually lighter towards the undulating margin. Hymenophore of dried specimens bleeding when bruised. Context thin, light-colored, 0.5–1 mm thick, in cross-section a reddish-brown thin deposit is seen (barely observable without magnifier).

Hyphal system pseudodimitic. Generative hyphae simple-septate, hyaline, thin- to thick-walled, 3–4 µm diam, branched; pseudoskeletal hyphae thick-walled, rarely septate, 3–6 µm diam. Conducting hyphae of the same dimensions, but without septa and with oil-rich brown contents, occur in subhymenial and medullar tissues. Cystidia not seen but cystidia-like hyphal ends (pseudocystidia) present. Pseudocystidia cylindrical to subcylindrical, some with an inflated middle part up to 13 µm in diam., and narrow base; with basal walls 1.5–2 µm thick and brownish oily contents. Acanthohyphidia abundant, cylindrical, tapering towards apex, thin-walled, 20–30 × 3–4 µm in diam. Basidia cylindrical to narrowly clavate, 25–55 × 3–10 µm, 4-spored, without a basal clamp. Basidiospores ellipsoid to cylindrical, hyaline, smooth, thin-walled, (6–)7–10(–10.5) × (2–) 2.5–3(–3.5) µm, amyloid.

The species was found inhabiting pine wood in North of Israel (Fig. 15).

General distribution and habitat. Being associated with a white rot, *Stereum sanguinolentum* is a very affective and fast colonizer of newly dead or wounded conifer sapwood, probably the most important fungus involved in "wound rot of spruce" (Schmidt 2006, Calderoni et al. 2003). Many authors reported this species as parasitized by jelly fungus *Tremella encephala* Pers. According to our knowledge, the general distribution of *Stereum sanguinolentum* includes: Europe (Austria, Czech Republic, Denmark, Finland, France, Georgia, Germany, Iceland, the Netherlands, Norway, Portugal, Romania, Russia, Slovenia, Spain, Sweden, UK, Ukraine); Middle East (Israel); East Asia (Japan, Mongolia, South Korea); North America (Canada, USA); Other (Faeroe Islands).

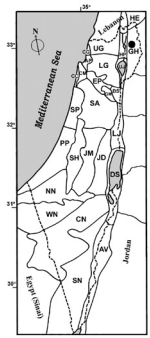


Fig. 15. Distribution of *Stereum sanguinolentum* in Israel.

Note. A notable difference distinguishing *S. sanguinolentum* from other similar species in the field is its coniferous substrate. Due to its red staining reaction when bruised, *S. sanguinolentum* might be confused with *S. rugosum*, *S. gausapatum*, and representatives of the *S. hirsutum*-complex. Diagnostic differences are: substratum, spore size, and presence of colored conducting hyphae. Jülich & Stalpers (1980) reports that although acanthohyphidia are mentioned in descriptions of American specimens, they are never reported for European material. The studied Israeli material is characterized by numerous acanthohyphidia.

Specimen examined: **ISRAEL. GH**, near Mt. Baron, *Pinus* forest, on pine fallen wood, 26.11.2006, leg. D. Țura, det. D. Țura, I. Zmitrovich et V. Malysheva (HAI 0143).

Stereum subpileatum Berk. & M.A. Curtis, Hook. J. Bot. Kew Gard. Misc. 1: 238, 1849. Fig. 16

≡ *Xylobolus subpileatus* (Berk. & M.A. Curtis) Boidin, Rev. Mycol. 23: 341, 1958.

"Sporophore effused-reflexed, attached by the umbos, small, 1–1.5 cm long and up to 1.5 mm thick; pileus tomentose, grayish-orange to light brown or brown, somewhat zonate; margin brownish; hymenial surface light orange, smooth or somewhat pubescent. Context pale-orange. Hyphal system trimitic; skeletal hyphae thick-walled, 4–7 µm wide. Cystidia cylindric, thick-walled, encrusted, 5–7 µm wide. Basidia 20–40 × 3–5 µm, with 4 sterigmata; spores cylindric, 4–4.5 × 2–2.5 µm, hyaline, smooth" (Binyamini 1982).

The hyphal system of this species can be characterized as pseudodimitic to subdimitic (pseudoskeletal hyphae in older parts lose their plasmatic contents). Some sclerified elements are actually branched similar to "trimitic" polypore elements, a condition also observed in other *Stereum* species.

General distribution and habitat. Associated with white pocket rot, *Stereum subpileatum* occurs on living hardwood substrata, mainly oak. Its general distribution includes Europe (Austria, Macedonia, Russia, Spain); Middle East (Israel); East Asia (China, Japan, Nepal); North America (Canada, Cuba, Mexico, USA); South America (Colombia, Costa-Rica, Venezuela).

Note. According to Binyamini (1982), this species was found in Israel only once, in Samaria (Fig. 16), and differs from other Israeli *Stereum* species by widely effused, hard, perennial fruitbodies with cylindrical encrusted cystidia, and by the hard cover of small pilei (see also Chamuris 1988, Jülich & Stalpers 1980). Microscopically, *Stereum subpileatum* is highly similar to *S. frustulatum* (Pers.) Fr. (both considered conspecific by Welden, 1971). In many handbooks the two species have been treated as separate species belonging to the genus *Xylobolus*. However, we prefer another solution (see Introduction).

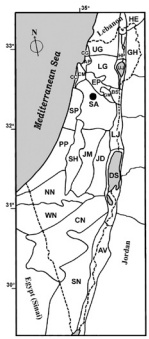


Fig. 16. Distribution of *Stereum subpileatum* in Israel.

Key to Israeli species of *Stereum*

1a. Acanthohyphidia absent 2

1b. Acanthohyphidia present 3

2a. Basidioles cylindrical. Pseudocystidia basal walls equal/less than 1.5 μm thick. Abhymenial surface condensed, subtomentose to nude. Hymenium bleeding when bruised, with crysescent conducting hyphae) . . . . ***S. gausapatum***

2b. Basidioles acuminate-cylindrical. Pseudocystidia thick-walled, basal walls usually more than 2 μm thick. Abhymenial surface hirsute-tomentose. Hymenium when injured, in basidiocarps with active growth, sometimes staining yellow-orange-red, but without conducting hyphae . . . . . ***S. hirsutum***

3a. Basidiocarps annual, tough-coriaceous, not deeply cracking. Hymenium bleeding when injured, with abundant conducting hyphae. Pseudocystidia basal walls 1.5–2 μm wide. Basidiospores (6–)7–10(–10.5) × 2.5–3(–3.5) μm . . . . . ***S. sanguinolentum***

3b. Basidiocarps perennial, hard-corneous, with deeply cracked multistratose hymenium. Hymenium not bleeding when injured, without conducting hyphae. Basidiospores 4–4.5 × 2–2.5 μm . . . . . ***S. subpileatum***

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