Taxonomy of Trechispora farinacea and proposed synonyms I. Species with a grandinioid or hydnoid hymenophore

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Trechispora farinacea (Corticiaceae, Basidiomycotina) is currently interpreted as a widespread and morphologically variable taxon. Type collections for *T. farinacea* and for names of seven other species with grandinioid or hydnoid hymenophores were studied. These names have by various authors been proposed as synonyms of *T. farinacea*. The type collections were found to represent three species different from *T. farinacea*. The differences observed in light microscope are further supported by ultrastructure of spores and crystal deposits as seen in SEM. The new combinations *Trechispora araneosa, T. nivea* and *T. stevensonii* are proposed. Epitypes for *Hydnum farinaceum* and *Odontia nivea* are selected.

Key words: Basidiomycotina, Corticiaceae, Trechispora, crystals, SEM.

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Introduction

Liberta (1973) monographed the genus *Trechispora* P. Karst. (Corticiaceae, Basidiomycotina) and his treatment has since then been the main source for determining species of that genus. During a floristic treatment of the Nordic flora of Corticiaceae (Hjortstam et al. 1988), it became evident that the species concept used by Liberta was too broad and that several good species were lumped together. A project was set out to re-evaluate certain species and species groups within *Trechispora* and some related genera. In Larsson (1994) the results of a study of species with poroid hymenophores were reported. In the present part of the project *Trechispora farinacea* (Pers.:Fr.) Liberta and the species suggested as identical to *T. farinacea* are re-examined.

Liberta listed five names as synonyms of *T. farinacea* viz. *Odontia nivea* Pers., *Hypochnus sphaerosporus* Maire, *Corticium submutabile* Höhn. & Litsch., *Tomentella araneosa* Höhn. & Litsch., and *Cristella caucasica* Parmasto. Later Maas-Geesteranus (1974) added *Hydnum stevensonii* Berk. & Broome to the same synonomy and Jülich (1975) contributed *Odontia microspora* Rick and *Odontia serrata* Rick. Eriksson & Ryvarden (1975) claimed that *Hydnum mucidum* Pers. was a synonym and finally Jülich (1984) reduced *Corticium stellulatum* Bourdot & Galzin to the same category.

Material and methods

This study is mainly based on material preserved in the herbarium of Gothenburg (GB) and on my own collections made during the study. In addition, collections from the herbaria of UPS, S, O, C, and H have been revised. Moreover, collections from the private herbaria of G. Gilles (France), K. Hauerslev (Denmark), E. Høgholen (Norway), E.

Table 1. *Diagnostic characters for described species*

Group *Trechispora*	I *araneosa*	II *farinacea*	III *nivea*	IV *stevensonii*
Hymenophore	grandinioid	grandinioid	hydnoid	hydnoid
Aculei	irregular	irregular	tapering	cylindrical
Colour	light yellowish	light ochraceous	whitish	whitish
Fimbriate margin	not seen	rare	common	rare
Hyphal walls	thin	thin	slightly thickened	thin
Tramal hyphae	short-celled	short-celled	long-celled	long-celled
Hyphal width	4–8 mm	3–7 mm	ca 3 mm	3–3.5 mm
Spore length	5–56.5 mm	3.5–4 mm	3–4 mm	4–4.5 mm
Length of spore aculei	0.7 mm	0.3–0.5 mm	to 0.3 mm	0.5 mm
Crystals	always present	often lacking	always present	uncommon
Crystal form	butterfly	varying	druses	rhomboid
Anamorph	absent	absent	absent	present

Martini (Switzerland), and Å. Strid (Sweden), have been examined. No attempt was made to revise all specimens determined as *Trechispora farinacea* in the Nordic herbaria, neither was there any attempt to make a world-wide revision to match Liberta's treatment of the group. Data on type material and other collections studied are listed with each species description below. Acronyms for herbaria follow Holmgren et al. (1990). Specimens without a herbarium notation are preserved in GB.

List of specimens examined are presented after each species description. For *Trechispora farinacea* s.s. and *T. stevensonii* (Berk. & Broome) K. H. Larss. only selected specimens are listed.

Methods used for light microscopy and SEM are those given by Larsson (1994).

Definitions

Aculei are used as a general term for processes on a surface, be it of a spore or of a hymenium. *Aculeate* is here defined as having blunt processes with length to breadth ratio larger than 1. *Verrucose* is defined as having blunt processes with a length to breadth ratio less than or equal to 1. A *cord* is a linear bundle of hyphae with little internal differentiation. Cords differ from rhizomorphs by the absence of vessel hyphae. The *ventral* side of a spore is turned inwards when still attached to the sterigma. The opposite side is called *dorsal*. *Trama* is used for the central parts of hymenophoral aculei. A true trama is derived from subicular hyphae.

Results and discussion

On the basis of macromorphology, micromorphology and ultrastructure grandinioid/hydnoid specimens in the Nordic herbaria conforming to the prevailing concept of *T. farinacea* could be sorted into four groups. Their main characteristics are summarized in Table 1.

The possibility of using crystal morphology in species delimitation was discussed by Larsson (1994). For the three poroid species earlier grouped as *T. mollusca* (Pers.:Fr.) Liberta, I showed that crystal morphology was the best diagnostic character. If crystals are to serve this purpose, they must appear regularly in the specimens. For two of the groups in Table 1, crystals are a constant feature and can thus aid the identification.

SEM studies show distinct differences in spore morphology between the four groups. However, in the light microscope only group I with larger spores could be unambiguously separated when spore characters were used.

A comparison of the composition of the hymenial aculei between groups I and II, on the one hand, and groups III and IV on the other, showed

that it was fundamentally different. The former groups have aculei formed by the repeated branching from one row of short-celled, wide hyphae (Figs 1B, 3C). When branching, either new rows of such hyphae, or shorter ones supporting the basidia, can be formed. No true trama is formed and all hyphae in the aculei are subhymenial. Aculei formed in this way can grow in several directions and be of very unequal length. From the beginning they grow well separated but with age they tend to coalesce. Some aculei acquire a coralloid form.

The other two groups have distinctly shaped, conical to cylindrical aculei. They have a true trama formed by parallel, moderately branched hyphae of more or less the same width as the hyphae in the subiculum, to which layer they also belong (figs 7C, 10C).

All four groups are fairly easy to recognize under a lens. This observation is of interest for the discussion on nomenclature below.

Nomenclature

Specimens in group I are similar to the type of *Tomentella araneosa*. The other groups are discussed in detail below.

The first mycologist who had more than a passing interest to corticiaceous fungi was Persoon. Three of the names given by him are of importance to the discussion here. These are *Odontia nivea*, *Hydnum farinaceum* and *H. mucidum*. All three names were adopted by Fries (1821) and have thus been sanctioned according to ICBN (Greuter et al. 1994).

Persoon's descriptions are here cited in full:

Hydnum farinaceum: effusum pallidum, margine byssinum, subulis acutis tenuissimus. Supra ligna arida crescens, farinae stratae subsimile, margine byssoideo loco natali arcte adhaeret.

Odontia nivea: late effusa alba, margine byssino tubulis confertis brevibus integris. tab. 4. fig. 6. 7. (Passim intra trunc. putr.).

Hydnum mucidum: effusum glabrum albidum, subulis elongatis confertis. Hydnum mucidum, effusum album, aculeis teretibus integerrimis. Gmel. Syst. Nat. Linn. 2. p. 1440. Hab. intra truncos mucidos, rarius. 2–3 vnc. latum, sub lente quidem subtomentosum est, sed non villosum.

For *H. farinaceum*, Donk (1957) selected a neotype from Persoon's herbarium. It consists of three small pieces of wood glued to the sheet. Only fragments of hymenium remain and most parts are severely degraded. It is possible to observe aculei but they are not sufficiently well preserved to be of help in identification. Under the microscope, spores, some basidia, and shrunken hyphae can be seen. All tissue is densely filled with crystals. The spores are subglobose to broadly ellipsoid and aculeate. Group I has too large spores to fit *H. farinaceum* but group II–IV are all possible candidates to be named *farinacea*.

The protologue states that *H. farinaceum* is a species which is not white but pallid, which probably means a bleached white, in other words light ochraceous. The protologue further tells us that the aculei are very small, looking almost like a coating of flour on the substrate. These characters best fit group II.

It is clear that the neotype (L910.256–1393 (L)) is no longer sufficient for a safe identification of *H. farinaceum*, with the stricter species delimitation introduced here. I have studied other collections referred to as *H. farinaceum* in herb. Persoon. However, neither of them was found to be suitable as a neotype. The problem can be solved by the selection of an epitype (Greuter et al. 1994).

Epitype for *Hydnum farinaceum* Pers. **Sweden.** Västergötland, Flo par.: Hunneberg, Jonstorpsmossen Nature Reserve, 28 Aug. 1986, Karl-Henrik Larsson 6337 (GB; isoepitypes in L, K and BPI).

The description of *Hydnum niveum* is accompanied by two drawings. According to the caption, they illustrate the same specimen in two different magnifications. No authentic material of this species is known and the illustration should therefore be regarded as a holotype for *Hydnum niveum* Pers. (Neues Mag. Bot. (Ed. Römer), Zürich, Tafel IV figs. 6–7 (1794)).

The protologue states that *H. niveum* is white and has short, entire aculei growing close together. The drawings show a basidioma which is

clearly hydnoid and has a distinct margin with radially growing, cord-like mycelium.

Both groups III and IV, with their white and hydnoid basidiomata, correspond to the protologue of *H. niveum*. However, the fimbriate margin seen in the holotype is only characteristic of group III. Also in this case, the selection of an epitype is needed to give the name *nivea* an unequivocal interpretation.

Epitype for *Hydnum niveum* Pers. **Denmark.** Sjælland. Rørvig: at Dybesø, on ?*Alnus*, 19 Oct. 1975, K. Hauerslev (C)

Lundell & Nannfeldt (1953) regarded *H. niveum* as identical to *H. farinaceum*. They based their interpretation on a collection determined by E. Fries and preserved in herb. Fries (UPS). This specimen is easily identified and conforms with *H. farinaceum* as it has been redefined here.

Eriksson & Ryvarden (1975) state that *Hydnum mucidum* Pers. is identical to *T. farinacea s. l.* Their opinion is based on authentic material in Persoon's herbarium (L) which they selected as lectotype. Unfortunately, no such collection could, on request, be located in Leiden. Until this collection reappears, the identity of *H. mucidum* must remain unsolved. However, it is very tempting to connect group IV with this Persoonian name. The protologue describes a species with terete, that is more or less conical, aculei. Fries' interpretation of this name is *Dentipellis fragilis* which is rather similar to group IV but with much longer aculei. I have chosen to let this remain a matter for speculation and instead selected the name *Hydnum stevensonii* for group IV.

Description of species

Trechispora araneosa (Höhn. & Litsch.) K. H. Larss. **comb. nov.** (Figs 1–2)

Tomentella araneosa Höhn. & Litsch. Sitzungsber. K. Akad. Wiss. Wien Math.-nat. Kl. 116 (I): 830 (1907).

Holotype. **Austria.** Sattelberg bei Pressbaum, on *Pinus*, 31 Aug. 1906 F. von Höhnel & V. Litschauer (FH!).

Basidiomata resupinate, effuse, loosely attached to the substratum, soft and fragile, thin. *Hymenophore* at first arachnoid to byssoid and more or less minutely tufted, with age densely granular to grandinioid, always strongly porose, greyish white or, more commonly, yellowish white. *Margin* thinning out, arachnoid, concolorous. *Hyphal system* monomitic; all hyphae thin-walled, colourless and clamped. *Cords* frequent in the subiculum, also extending over the surrounding substratum, white, byssoid, with straight, frequently anastomosing, rarely encrusted, 2–3(–3.5) µm wide hyphae, surrounded by somewhat broader, richly encrusted and more branched hyphae giving the cords their byssoid appearance. *Subicular hyphae* straight, 3–5 µm wide, often encrusted, growing in parallel with the substratum and forming a very thin, only a few hyphae thick, tissue. *Subhymenium* composed of short-celled, richly branched hyphae, branching at more or less right angles from the subiculum, of varying width but usually 4–6(–8) µm, more or less isodiametric, triangular or inflated, only faintly encrusted. Central hyphae of aculei different, heavily encrusted, generally wider and longer than the other subhymenial hyphae and measuring 5–7(–10) µm in width, richly branched, more or less inflated, towards the apex of aculei narrowing into long, septate, hyphal ends giving the aculei a tomentose appearance. *Basidia* short-cylindrical, often slightly constricted, sometimes pedunculate 10–14(–18) × 4–6(–7) µm, with four, 4–7 µm long, curved sterigmata and with a basal clamp. *Basidiospores* ellipsoidal, densely aculeate, 5–6.5 × 4–5 µm inclusive of the 0.7 µm long spines, slightly thick-walled and with smooth and dense contents, not or only weakly cyanophilous. *Crystals* very common, appearing on the subicular hyphae and the central hyphae of the aculei, when complete having the form of a butterfly, or a bow-tie, but often only incomplete crystals are seen.

Habitat and ecology. Fruitbodies are formed on strongly decayed wood or on debris lying on the ground, usually in deciduous or mixed forests with a herb-rich ground-layer. Fruitbodies have been found on *Abies, Alnus, Fagus, Picea, Pinus, Pseudotsuga, Quercus*, and on mosses

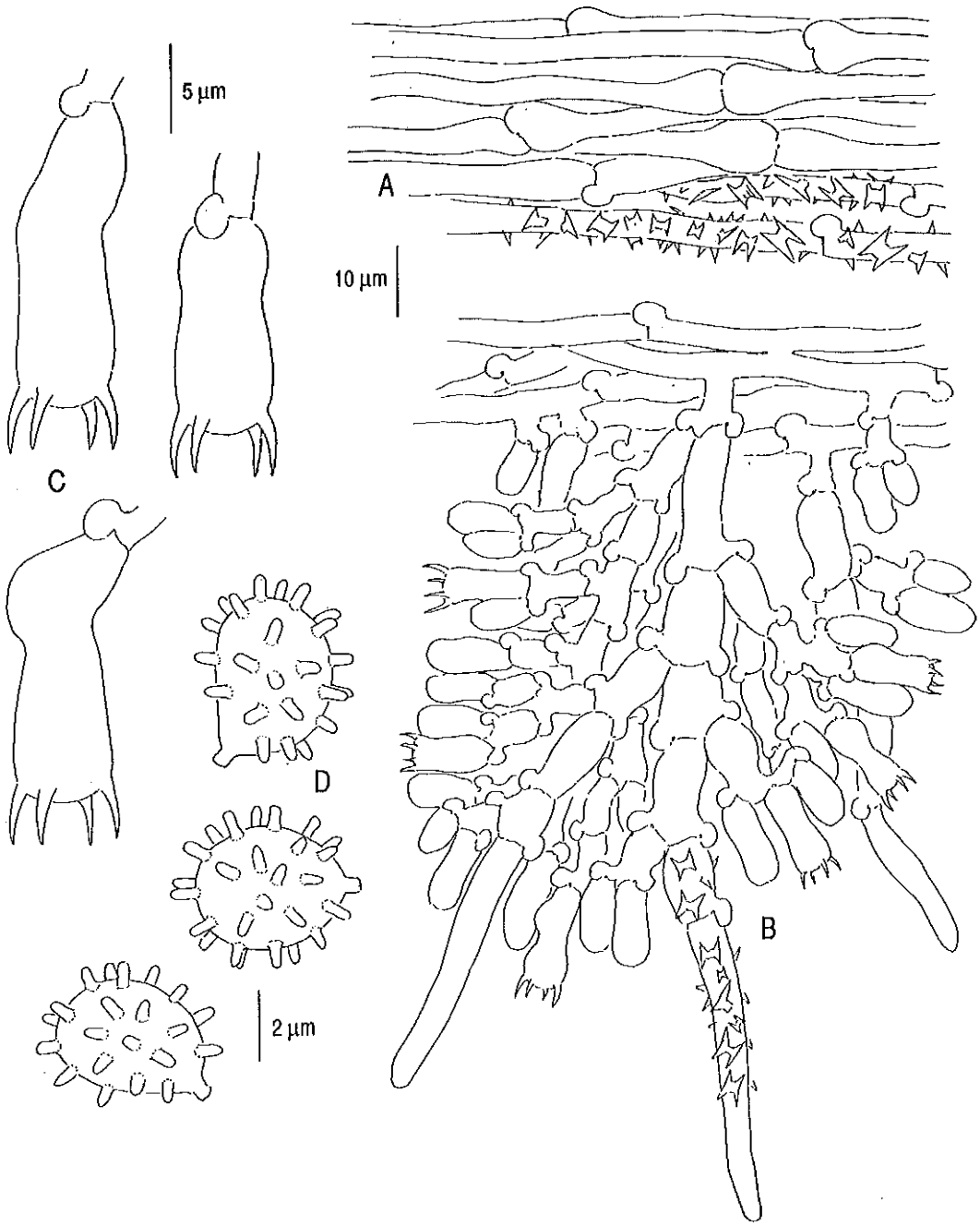

Fig. 1. *Trechispora araneosa*. A) hyphae from cord in subiculum. B) section from hydnoid part of hymenophore. C) basidia. D) basidiospores (Larsson 6291).

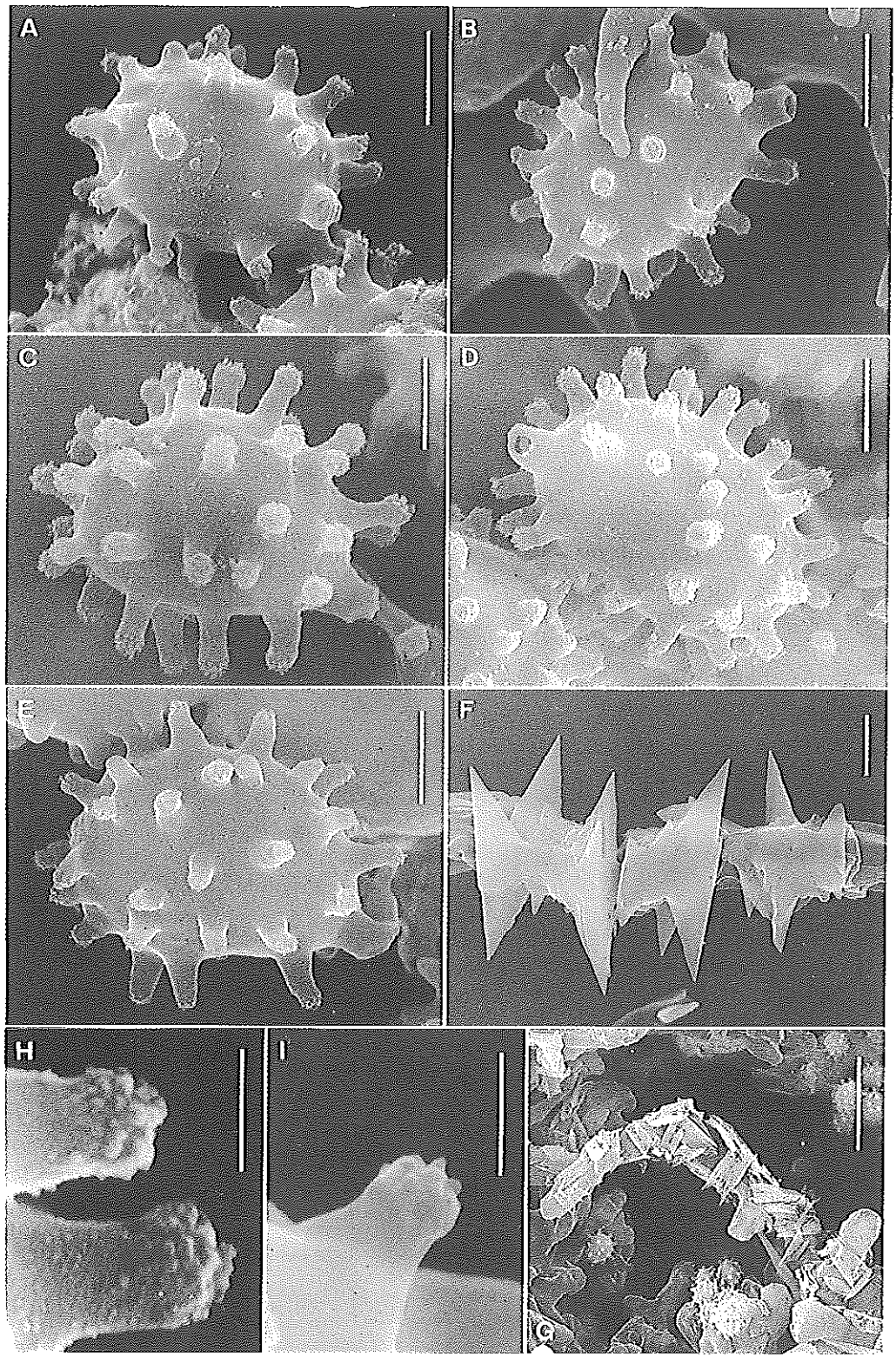

Fig. 2. SEM of spores and crystals of *Trechispora araneosa*. A, D) ventral view. B, E) side view. C) dorsal view. F–G) crystals. H-I) apices of aculei. A–B) Larsson 6308, fresh specimen. C-E, G–H) Larsson 5937, fresh specimen. F, I) type specimen, dry. A–E) bar = 1 µm. F) bar = 2 µm. G) bar = 10 µm. H–I) bar = 0.3 µm.

Distribution. In Northern Europe there are collections only from the southwestern area, mainly from Denmark but also from three adjacent provinces in Sweden viz. Skåne, Halland and Västergötland. Other known finds indicate that this is a nemoral species, widely distributed in central Europe.

Additional collections studied. **Austria**. Steiermark, 1981 Hallenberg 4223. **Canada**. British Columbia, 1967 Eriksson 7544; 1988 Hallenberg 10804. **Denmark**. Jylland, 1968 Hauerslev 3150 (C); 1951 Christiansen 2419 (C); 1952 Nannfeldt (UPS); Sjælland, 1950 Christiansen 1498 (C); 1949 Christiansen 542 (C), 590 (UPS); 1966 Hauerslev (C); 1976 Hauerslev 5292 (C); 1950 Christiansen 1533 (C); 1954 Hauerslev 26 (C); Oct. 1966 Hauerslev (C); 1973 Hauerslev 4699 (C); 1966 Hauerslev 2556 (C); 1955 Hauerslev 1206 (C); 1960 Hauerslev 2579 (C); 1970 Hauerslev 3617 (C); 1970 Hauerslev 3600 (C); 1950 Christiansen 1510 (C); Mön, 1961 Hauerslev 1546 (C); Frillesvig Sep. 1961 Hauerslev 1528 (C). **France**. ?, Sep. 1924 Gilbert (Bourdot 37895; *Corticium Gilbertii* Bourdot in herb.) (PC); Landes, 1990 Gilles 1857; 1990 Gilles 2031, 2035. **Poland**. Bialystok, 1973 Hallenberg & Larsson 1238; Kielce, 1973 Hallenberg & Larsson 1390, 1395, 1501, 1503, 1526, 1536, 1538, 1607, 1624; Lublin, Oct. 1963 Bòlazy. **Sweden**. Skåne, 1946 Eriksson 747 (UPS), 934 (UPS); 1946 Eriksson 944 (UPS); 1975 Hallenberg 1222; Halland, 1982 Larsson 3475; 1986 Larsson 6291, 6302, 6308; Västergötland, 1985 Larsson 5937; Dec. 1985 Larsson; 1978 Larsson 2305.

Bourdot & Galzin (1928) made the combination to *Corticium* but did apparently not see any authentic material. They concluded (p. 513) that "Le *T. araneosa* v. Höhn. et L. para"t être, d'après la description, une forme intermédiaire entre *Corticium sphaerosporum* R. Maire et *C. fastidiosum* Fr., très voisine de ce dernier". In Bourdot's herbarium (PC) only one collection of *T. araneosa* was found. It is labelled *Corticium Gilbertii* (in box 25 bis), an unpublished herbarium name.

The *Cristella* sp. (Christiansen 1960:99) proved to be this species. Larsen (1974), who monographed *Tomentella*, did not take a stand regarding *Tomentella araneosa* but only noted that "this species should be referred to a position in or near *Trechispora*".

There are several other species with spore dimensions that approach those of *T. araneosa*. Of these *T. fastidiosa* (Pers.: Fr.) Liberta differs by the smooth and membranaceous hymenophore and the crystals which are formed as aggregates of bipyramids. *T. praefocata* (Bourdot & Galzin) Liberta also differs by the hymenophore and crystals. The hymenophore is smooth but not membranaceous and the crystals are acicular. Besides, the aculei on the spores are longer than in either *T. araneosa* and *T. fastidiosa*. The species that most closely resembles *T. araneosa* is *Odontia verruculosa* G. Cunn. The latter differs by slightly smaller spores and the crystals which are formed as rhomboidal plates. *Odontia verruculosa* will be covered in detail in a forthcoming paper.

The apices of spore aculei have an ornamentation of tubercles only visible in SEM and best seen when preparations are made from fresh material (Figs 2 A–D, H–I). This is a most peculiar characteristic that occurs also in other species in *Trechispora*, for example in *T. hymenocystis* (Berk. & Broome) K.H. Larss. (Larsson 1994).

The "butterfly"-crystals have not been observed in any other species of *Trechispora*. The calcium contents of hyphal tissue was investigated by use of energy-dispersive X-ray microanalysis. The analysis showed that the concentration of calcium was highest in the crystals. This is in accordance with investigations of other species in *Trechispora* (Larsson 1994). Presumably most crystals occurring on hyphae and cystidia in species in the Corticiaceae are formed by calciumoxalate (Keller 1985).

Trechispora farinacea (Pers.: Fr.) Liberta, Taxon 15: 318 (1966). (Figs 3–5, 6A)

Hydnum farinaceum Pers., Syn. Meth. Fung. p. 562 (1801) – *Hydnum farinaceum* Pers.: Fr., Syst. Mycol. 1: 419 (1821). Neotype: France. Prope Parisios (L 910.256–1393!)

Syn: *Grandinia stimulispora* Cejp, Hedwigia 66: 267–68 (1926). Lectotype (sel. here): Bohemia occidentalis, pagus Hurky prope oppidulum Rokycany, arboris basis abscisa *Alnus*, Aug. 1925, leg. K. Cejp (PRC!).

Basidiomata resupinate, effuse, usually growing closely attached to the substratum but easily separable, without being pellicular. *Margin* usually not differentiated, more rarely seen as a white, narrow

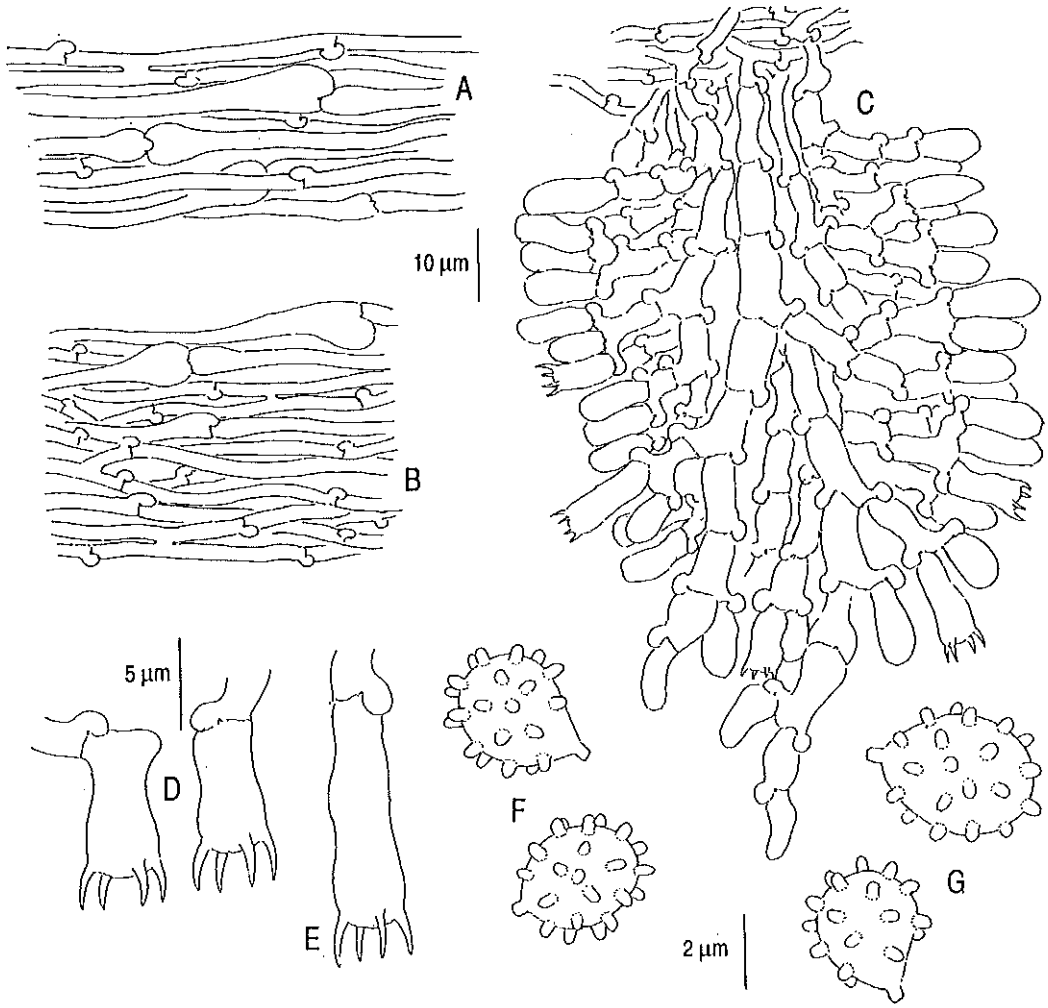

Fig. 3. *Trechispora farinacea*. A) hyphae from cord in substratum. B) hyphae from subiculum. C) section from hydnoid part of hymenophore. D, E) basidia. F, G) basidiospores. A, D) Larsson 5956. B, G) Larsson 5941. C, E, F) Larsson 6337.

strip of byssoid mats and short cords. *Hymenophore* sometimes smooth but usually farinaceous to grandinioid or nearly hydnoid, light ochraceous or greyish; spines irregular in growth, of unequal form and often coalescing or even being coralliform, blunt. *Hyphal system* monomitic; all hyphae with clamps. *Cords* mainly occurring in the substratum, with straight, anastomosing, thin-walled, 2–3.5 µm wide hyphae, with ampullate septa reaching 7 µm in width. *Subiculum* almost lacking, usually only a few cells thick, with hyphae of the same type as in the cords. *Subhymenium* varying from thin to thick, making up the hymenial configuration with its granules and spines, composed entirely of richly branched, short-celled, isodiametric, conical or irregular hyphae which are broadest in the centre of the granules and there reaching 7 µm in width; all hyphae in a spine

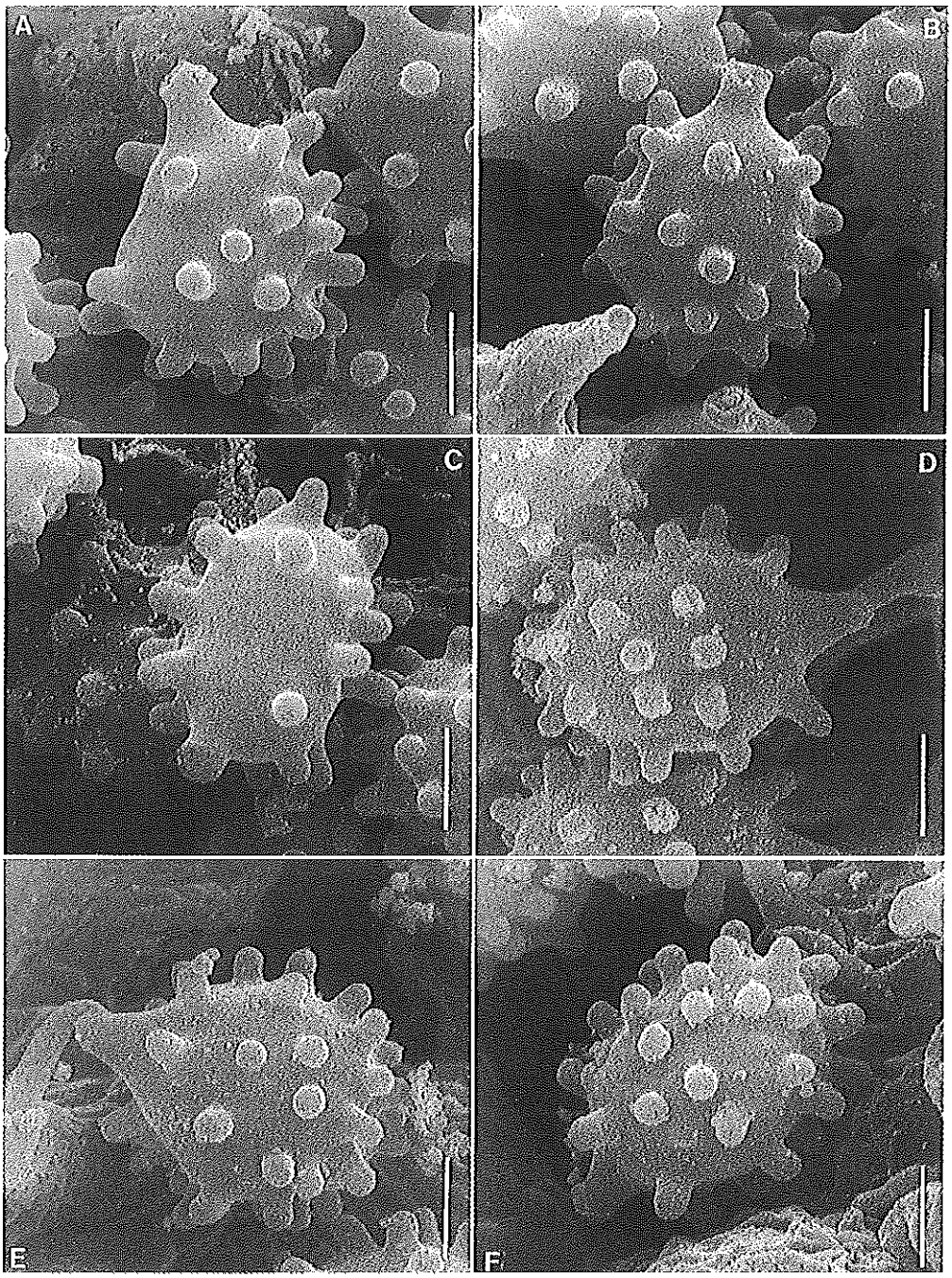

Fig. 4. SEM of spores of *Trechispora farinacea*. A, E) lateral view. B, F) dorsal view. C–D) ventral view. A–C) Larsson 6303, fresh specimen. D–F) Larsson 6385, fresh specimen. Bar = 1 µm.

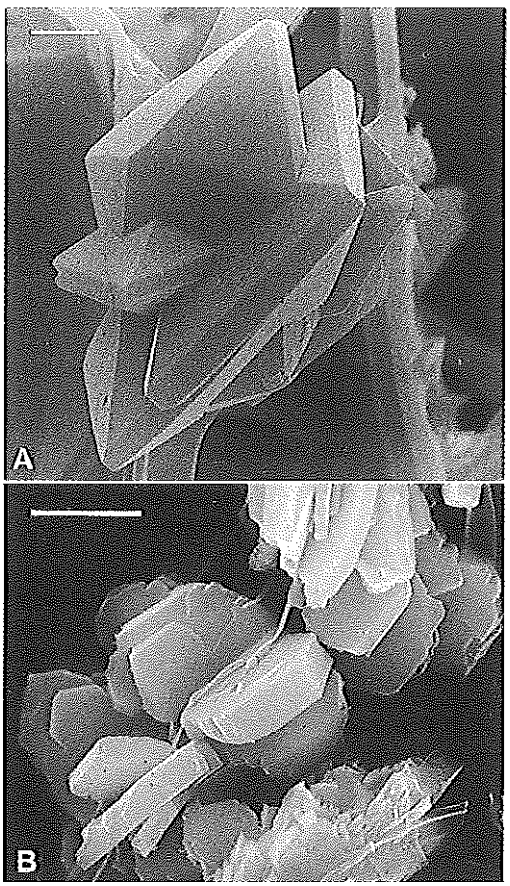

Fig. 5. SEM of crystals in *Trechispora farinacea*. A) Larsson 5941. B) Larsson 6385. A) bar = 2 µm. B) bar = 5 µm.

emerging from one or a few, central rows of hyphae which extend beyond the apex of the spine with a short, blunt, undulating hyphal end. *Basidia* cylindrical or slightly conical to pedunculate, often with a slight median constriction, 10–15 × 4.5–5 µm, with four curved sterigmata up to 5 µm long and with a basal clamp. *Basidiospores* subglobose to broadly ellipsoidal, aculeate, 3.5–4 × 3–3.5 µm inclusive of the 0.3–0.5 µm long spines, not or only weakly cyanophilous. *Crystals* occurring irregularly, often frequent on cords in the substratum and sometimes also abundant in the basidioma tissue, of varying form and seen as prisms or aggregated lanceolate to rhomboidal plates.

Habitat and ecology. T. farinacea grows mainly on dead wood but also on other debris of all kinds. Known substrates include a wide variety of conifers and angiosperm trees. In Northern Europe collections are made in all kinds of forests and no preferences can be detected.

Distribution. T. farinacea is found all over the north temperate region. In this study more than 800 specimens were examined, about 500 of them from Sweden. The selection below was designed to reflect the geographical distribution of studied collections.

Selected specimens studied. **Austria.** Steiermark, 1981 Hallenberg 4295. **Canada.** British Columbia, 1982 Hallenberg 6813; Quebec, 1982 Hallenberg 6507. **Denmark.** Sjælland, Aug. 1978 Hallenberg. **Finland.** Lapland, 1962 Eriksson 1056; Etelä-Häme, 1984 Larsson 5242. **Germany.** Hessen, 1983 Larsson 4797. **Italy.** Bologna, 1984 Ryvarden 22299 (O). **Norway.** Hedmark, 1986 Larsson 6517; 1986 Larsson 6468, 6498. **Poland.** Kraków, 1973 Larsson 2895. **Romania.** Neamt, 1983 Hallenberg 7990. **Spain.** Alava, 1980 Moreno & Manjón 5512. **Sweden.** Halland, 1986 Larsson 6297, 6303; Hälsingland, 1944 Eriksson 203; Lappland, 1958 Eriksson 8350; 1982 Larsson 2703; Skåne, 1946 Eriksson 919 (UPS); Småland, Femsjö E. Fries (as *Hydnum niveum* (UPS); Västergötland, 1970 Hjortstam 5141; 1971 Larsson 253; 1981 Larsson 2590; 1982 Larsson 3033; 1985 Larsson 594; 1986 Larsson 6385. **Switzerland.** Ticino, 1986 Martini 870. **USA.** Great Smoky Mountains Nat. Park 1983 Jung 589-2.

Grandinia stimulispora Cejp is a synonym. Two collections were cited in the protologue. The oldest of them should serve as lectotype.

Specimens with a completely smooth hymenophore and a spore morphology similar to that of *T. farinacea* are sometimes found. Such specimens can not be safely classified as belonging to *T. farinacea*.

Trechispora nivea (Pers.) K. H. Larss. **comb. nov.** (Figs 7–9)

Odontia nivea Pers., Neues Mag. Bot. (Ed. Römer) p. 110 (1794). – *Hydnum niveum* (Pers.) Pers., Syn. Meth. Fung. p. 563 (1801). – *Hydnum niveum* (Pers.: Fr) Pers., Syst. mycol. 1: 419–20 (1821).

Syn.: *Hydnum hypoleucum* Berk. & Broome, J. Linn. Soc. (Bot.) 14: 60 (1873). **Sri Lanka.** Nov. 1867 T(hwaites) No. 179B (K!) LECTOTYPE of *Hydnum hypoleucum*. – *Hydnum cohaerens* Berk. & M. A. Curtis apud Cooke in Grevillea 20: 1 (1891). **Venezuela.** No 133 (K!) HOLOTYPE of *Hydnum cohaerens*. – *Odontia serrata* Rick, Egatea 17: 276 (1932). **Brazil.** Rio Grande do Sul, 1930 Rick 130 (K!) LECTOTYPE of *Odontia serrata*. – *Odontia microspora* Rick, Egatea 18: 39 (1933). **Brazil.** Rio Grande do Sul, 1930 Rick 91 (K!) LECTOTYPE of *Odontia microspora*.

Basidiomata resupinate, effuse, easily separable from the substratum but not pellicular, soft and fragile, white to light ochraceous. *Hymenophore* densely hydnoid; spines narrow, nearly cylindrical, with blunt and somewhat tufted apices, up to 1 mm long, initially forming ridges and flattened veins giving young areas of the basidioma a subporoid appearance; smooth areas fertile, arachnoid to byssoid. *Margin* thinning out, often forming radiating hyphal mats and cord-like structures, white. *Hyphal system* monomitic; all septa with clamps. *Cords* with straight, anastomosing, slightly thick-walled, 1.5–3 µm wide hyphae, with ampullate septa up to 6 µm wide. *Subiculum* with hyphae similar to those in the cords, often provided with small bladders, projections or irregular wall thickenings resulting from swelling of the hyphal wall and from the initiation of crystal-chambers, usually encrusted. *Trama* in spines with mainly straight, frequently branching, slightly thick-walled hyphae, mainly 3 µm wide, often with irregular wall thickness, usually encrusted. *Subhymenium* with short-celled, richly branched, cylindrical to slightly inflated or irregular, thin-walled, mainly 3 µm wide hyphae. *Basidia* cylindrical with a slight median constriction, 8-15 × 4–5 µm, with four, rather straight sterigmata up to 3 µm long and with a basal clamp. *Basidiospores* subglobose to broadly ellipsoidal, ventrally flattened, verrucose with low to medium-sized warts, 3–4 × 2.5–3.5 µm inclusive of the up to 0.3 µm high warts, not or only weakly cyanophilous. *Crystals* usually present, bipyramidic, aggregated.

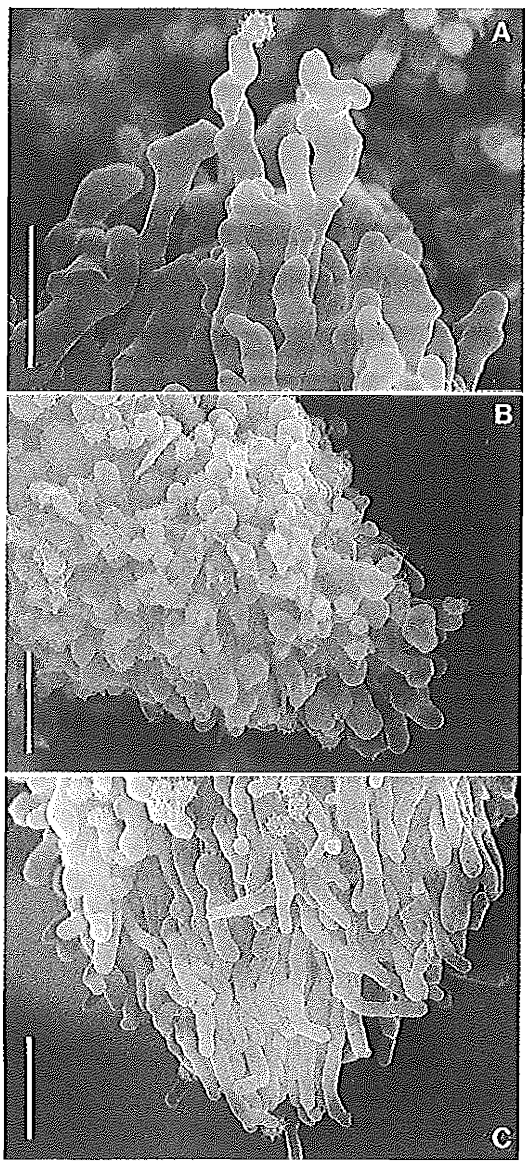

Fig. 6 A–B. SEM of the apices of hymenophoral spines in *Trechispora farinacea*. Larsson 5941, fresh specimen. Fig. 6 C. SEM of apex of hymenophoral spine in *T. stevensonii*. Larsson 6401, fresh specimen. Bar = 10 µm.

Habitat and ecology. T. nivea grows on dead wood from a variety of lignoses. The following genera are noted as substrate: *Abies, Acer, Alnus, Betula, Buxus, Coffea, Fagus, Laurus, Musanga, Picea, Pinus, Populus, Quercus, Raphia, Sabal, Sorbus, Tilia*, and *Ulmus*. Some finds are made

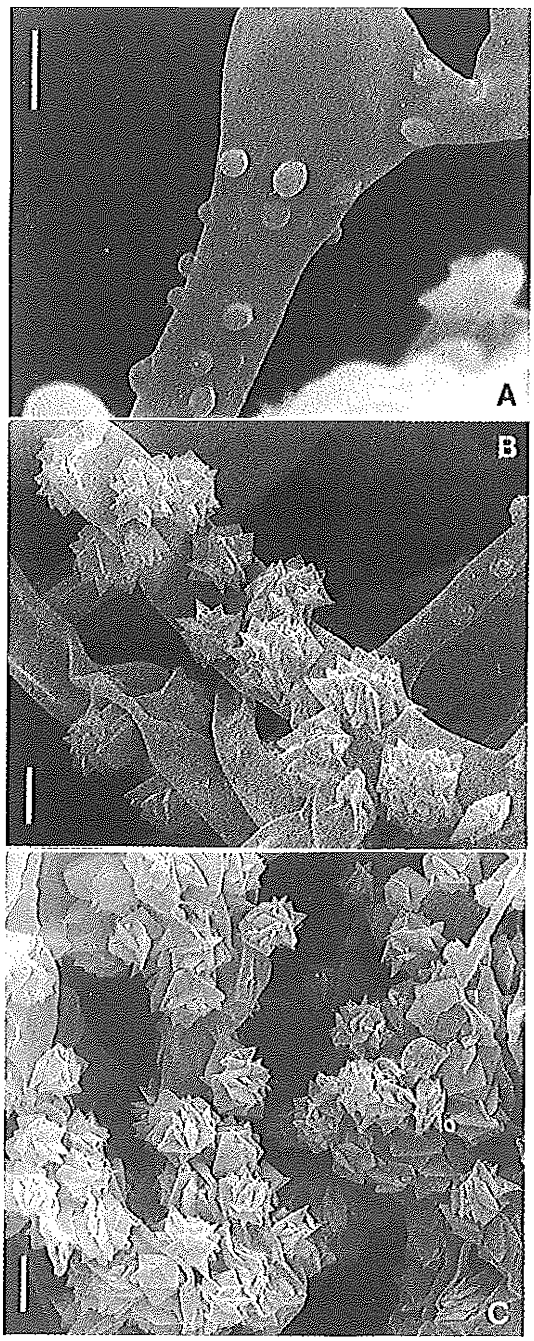

Fig. 9 A. SEM of subicular hypha of *Trechispora nivea*, N. Hallenberg 1701, rehydrated specimen. Figs 9 B–C. SEM of crystals in *Trechispora nivea*. B) J. Eriksson 8967. C) J. Eriksson 7002. Bar = 2 µm.

on dead basidiomata of polypores, and on mosses. In Northern Europe *T. nivea* seems to favour deciduous forests and wood from angiosperm species.

Distribution. This species is the most widespread of any *Trechispora*. Its distribution is world-wide and covers tropical as well as temperate, nemoral and boreal regions extending into the subalpine birch forest of northernmost Sweden.

Additional specimens studied. **Argentina**. Misiones, 1982 Ryvarden 20065. **Australia**. New South Wales, 1983 Coveny 143(1983) (O), 186(1983) (O). **Austria**. Steiermark, 1976 Michelitsch; Nieder-Österreich, 1907 Höhnel (S). 1962 da Costa Neto SP70545; São Paulo, 1969 B. Skvortzow, SP106958, SP107220, SP107258; 1969 Sounus SP107280; 1973 Bononi SP112186; 1982 Bononi SP177293; 1987 Pegler, Hjortstam, Ryvarden, Hjm16437 (SP213803). **Canada**. Quebec, 1967 Eriksson 7001, 7002, 8998; 1969 Eriksson 9069. **Canary Islands**. Gran Canaria, 1987 Beltháń & Rodriguez-Armas TFCMIC5811. Tenerife, 1989 Hallenberg 11171. **Central African Republic**. Lobaye, 1965 Boidin LY 530; 1967 Boidin LY 6001. **Chile**. Juan Fernandez Islands, 1916 Skottsberg (S). **Czecho-Slovakia**. Sep. 1928. Pilát. **Denmark**. Sjælland, 1959, Hauerslev (C); 1950 Christiansen MPC 777 (C); 1951 Christiansen MPC 2473 (C); Sep. 1954 Hauerslev (C); May 1960 Hauerslev (C); July 1961 Hauerslev (C); June 1966 Hauerslev (C); Oct. 1975 Hauerslev (EPITYPE, C). **Ethiopia**. Arsi, 1973 L. Ryvarden 8857 (O). **Finland**. Åland, Sep. 1971 Haeggström (H); Varsinais-Suomi, 1987 Kotiranta 6659, 6661 (H); Uusimaa, May 1966 Alanko (H). **France**. Ain, 1990 Boidin (ex herb. G. Gilles, GG 1942), 2380; Landes, 1991 Gilles 2412; Var, 1991 David (ex herb. G. Gilles 2346). **Germany**. Dresden, Magnus (S); Hewnhut, Sep. 1973 Doll. **Iran**. Mazanderan, 1976, Hallenberg 1589, 1701; 1978 Hallenberg 2040, 2174, 2447, 2619. **Italy**. Latina, 1984 Ryvarden 22465; 1984 Larsson 5512. **Norway**. Akershus, 1918 Romell 9195 (S); Mohn Jenssen. **Poland**. Kielce, 1973 Hallenberg & Larsson 1491; Krak—w, 1973 Hallenberg & Larsson 2275. **Republic of China**. 1989 Wu 890714–17. **Reunion**. 1987 Boidin LY12314. **Romania**. Neamt, 1985 Hallenberg 9082. **Sweden**. Lappland, 1960 Eriksson 8767; Skåne, May 1974 Sunhede; 1946 Eriksson 908, 911, 928b (UPS); Uppland, 1929 Lundell 1401; Oct. 1949 Haglund & Rydberg (S); Oct. 1949 Haglund & Rydberg (S); 1912 Romell 4920; 1913 Romell 4997 (S); 1921 Romell 5486 (S); 1923 Romell 5546 (S); Oct. 1981 Strid; Västerbotten, 1970 Strid 6772 (S); 1971 Strid 8921 (S); Västmanland, 1975 Hallenberg 1039; Öland, 1982 Sunhede 7426. **Switzerland**. Ticino, 1986 Zenone (ex herb. E. Martini 768). **Tanzania**. Arusha,

1973 Ryvarden 9999 (O). **USA.** Florida, Sep. 1954 Cain (S). **Zimbabwe.** Manica Land, 1986 Ryvarden 23771 (O).

T. nivea has characteristics very close to those of *T. mollusca* (Pers.: Fr.) Liberta. The main difference is a hydnoid instead of a poroid hymenophore. The two species also show different distribution patterns. Whether these differences justify the separation of two species cannot be solved in this study.

Trechispora stevensonii (Berk. & Broome) K. H. Larss. **comb. nov.** (Figs 6C, 10–11)

Hydnum stevensonii Berk. & Broome, Ann. & Mag. Nat. Hist. IV 15: 31 (1875).

Holotype. **United Kingdom.** Scotland, Glamis: Mar. 1874, J. Stevenson (K!).

Syn.: *Grandinia farinacea* (Pers.: Fr.) Bourdot & Galzin f. *sorediosa* Bourdot & Galzin, Hym. de France p. 412–13 (1928). – *Osteomorpha fragilis* Arnaud ex Watling & W. B. Kendr., Naturalist 104: 1–2 (1979).

Basidiomata resupinate, effuse, soft and fragile, adnate or pellicular and always easily separable from the substratum. *Hymenophore* smooth to hydnoid, in smooth areas arachnoid; spines crowded, conical, up to 0.7 mm long, fragile, in young stage as low ridges growing in a reticulate manner, white, bluish white to ochraceous. *Margin* white, abrupt or thinning out in byssoid hyphal mats, sometimes with cords. *Hyphal system* monomitic; all hyphae with clamps. *Cords* occurring in the subiculum and in the substratum, with thin-walled, straight, anastomosing, 2–3 µm wide hyphae, with ampullate septa up to 10 µm wide, sometimes difficult to find. *Subiculum* thin, composed of the same type of hyphae as in the cords but lacking ampullate septa, having shorter cells and branching more frequently. *Trama* with thin-walled, straight, parallel, 3–3.5 µm wide hyphae with 10–30 µm long cells, forming a sterile tuft with somewhat narrower hyphae at the apex of the spines. *Subhymenium* composed of short-celled, richly branched, cylindrical or slightly inflated to irregular hyphae. *Basidia* cylindrical to subclavate, often with a slight median constriction, 10–20 × 4–4.5 µm, with four, up to 5 µm long, sterigmata and with a basal clamp. *Basidiospores* ellipsoidal, aculeate, 4–4.5 × 3–3.5 µm inclusive of the 0.5 µm long spines, with a prominent hilar appendix, in a few collections reaching 5.5 µm and having a tendency to be ventrally concave, not or only weakly cyanophilous. *Anamorph* forming white cushions, mainly at the margin of the basidioma but also at a distance from the basidioma, 0.3–1.0 mm wide, coalescing. *Conidia* formed by fragmentation of straight, short-celled hyphae; hyphae breaking off at the clamped septa, giving the conidia a characteristic, irregular and very variable form. *Crystals* not common. When seen they are usually flat and basically rhomboidal.

Habitat and ecology. T. stevensonii grows on much decayed wood of a wide range of broad-leaved species but is also collected on *Picea, Pinus* and *Abies*. In Northern Europe it is most common in fertile, moist biotopes.

Distribution. T. stevensonii is mainly collected in boreal and nemoral areas of both the Northern and the Southern Hemisphere. There are also a few collections from mountainous areas (above 1000 m) in the tropics.

Selected specimens studied. **Argentina.** Tierra del Fuego, 1982 Ryvarden 19400 (O). **Australia.** New South Wales, 1982 Coveny 60(1982) (O). **Austria.** Steiermark, 1981 Hallenberg 4522. **Canada.** British Columbia, 1982 Hallenberg 7226; Ontario, 1982 Hallenberg 6451. **Denmark.** Sjælland, 1980 Jeppson 1954. **Finland.** Uusimaa, 1988 Kotiranta 6766 (H); Kuusamo, 1978 Ryvarden 17314 (O). **France.** Landes, 1989 Gilles 1679. **Germany.** Dec. 1965 Doll. **Iran.** Mazanderan, 1976 Hallenberg 1471. **Italy.** Ferrara, 1984 Ryvarden 22189 (O). **Kenya.** Eastern, 1973 Ryvarden 8924 (O). **Reunion.** 1984 Boidin LY12702. **Norway.** Hedmark, 1986 Larsson 6490; Nordland, Aug. 1988 Ryvarden (O). **Poland.** Bialystok, 1973 Hallenberg & Larsson 729. **Republic of China.** Aug. 1988 Wu 880824–37. **Romania.** Covasna, 1985 Hallenberg 9349. **Spain.** Navarra, 1986 Hallenberg 9728. **Sweden.** Halland, 1986 Larsson 6300; Lappland, 1960 Eriksson 8922; Skåne, 1946 Eriksson 971 (UPS); Småland, 1929 Nannfeldt 3393 (UPS, GB).; Uppland, May 1946 Eriksson (UPS). Västergötland, 1985 Larsson 5938, 5978; 1986 Larsson 6279, 6401; Ångermanland, 1970 Hjortstam 4366.

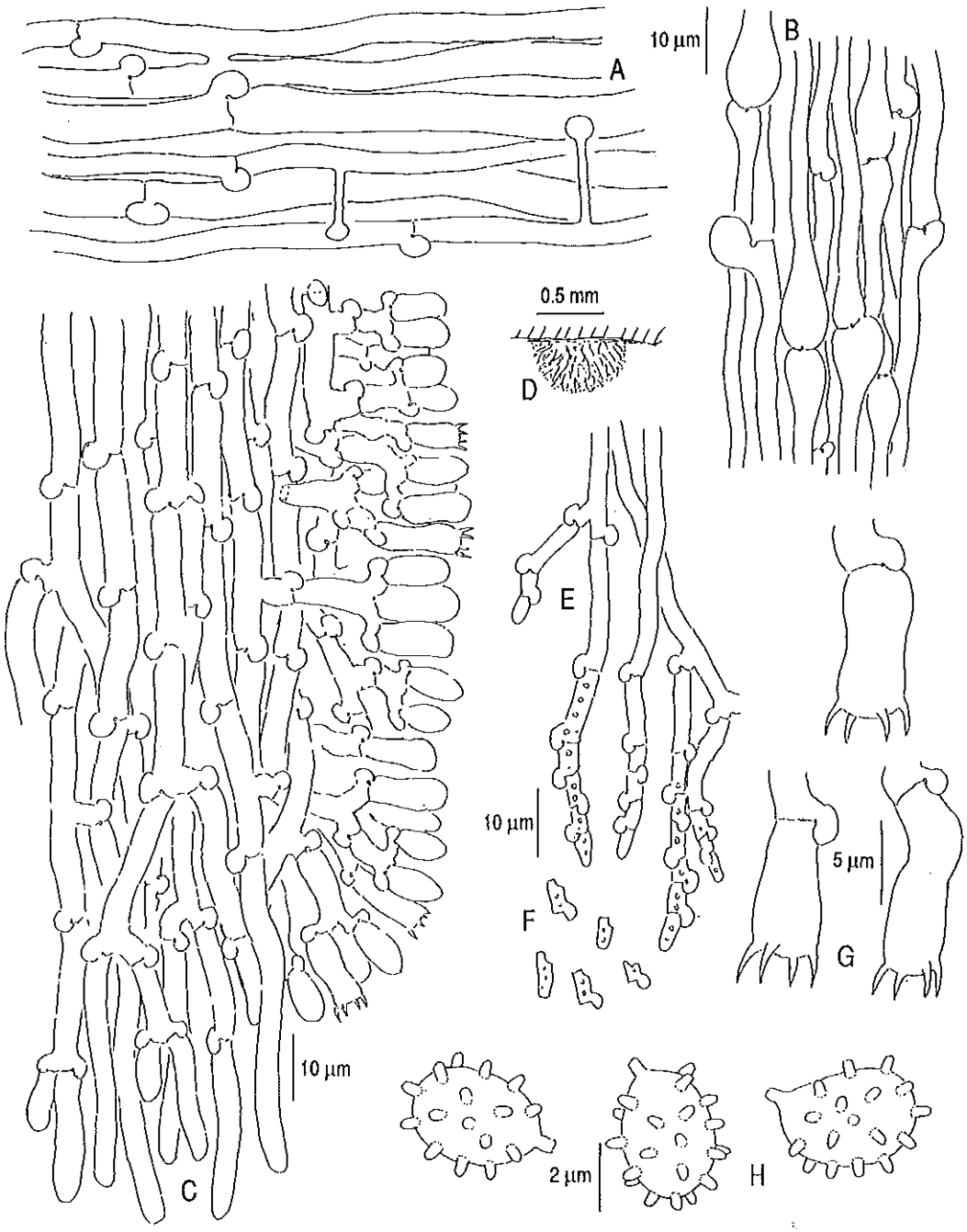

Fig. 10. *Trechispora stevensonii*. A) hyphae in subiculum. B) hyphae in cord in subiculum. C) section through apex of spine. D) section through anamorph. E) conidiogenous hyphae. F) arthroconidia. G) basidia. H) basidiospores. A, C–H) Larsson 5938. B) Larsson 6279.

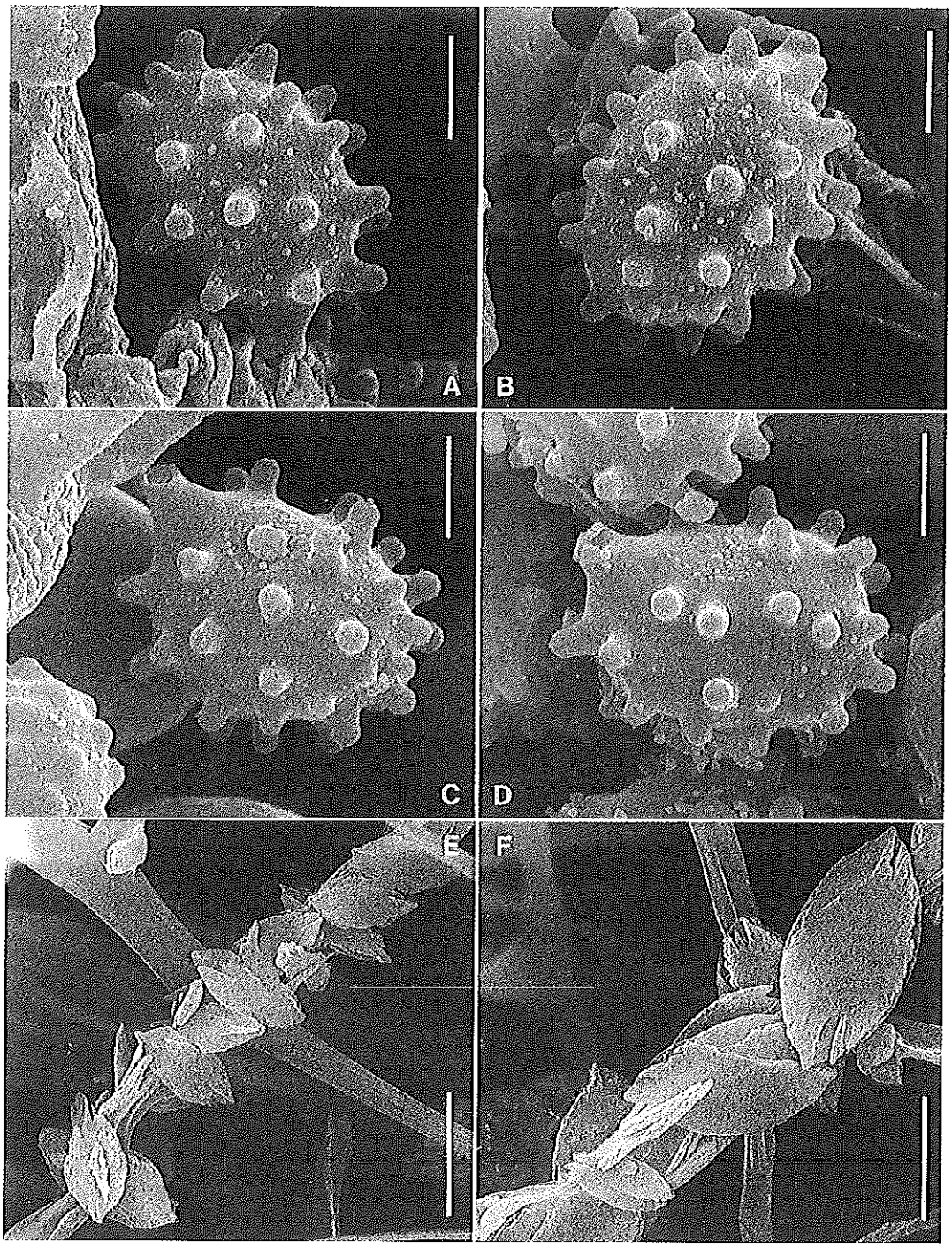

Fig. 11 A–D. SEM of fresh spores of *Trechispora stevensonii*. A) lateral view. B) dorsal view. C–D) ventral view. Larsson 5942. Fig. 11 E–F) SEM of crystals of *T. stevensonii*. Larsson 6279. A–D) bar = 1 µm. E–F) bar = 5 µm.

The type is in good condition and shows all essential characteristics like the hydnoid hymenophore with teeth emerging from a smooth, thin, fertile tissue, the thin-walled, parallel 2.5–4.5 µm wide hyphae in the spines and the ellipsoid, aculeate 4–5.5 × 3–3.5 µm large spores. The anamorph is lacking, but its presence is not necessary for a reliable determination.

Some collections of *T. stevensonii*, not cited in the specimen list, have an entirely smooth, very thin and arachnoid hymenophore but show the typical conidia (Leg. Larsson 1973, 5972, 6244, 6266, 6406, 6461, 6464, 6571). They were all growing on very decayed wood and usually in sheltered places, more or less deep into the ground under logs. Fertile areas are small and fragmented and in most cases the anamorph is dominating. Spores from two of these smooth collections were studied in SEM. Small differences in spore length and ornamentation can be traced, but are insufficient for the separation of a new taxon. If conidia are lacking, such collections can be difficult to classify.

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