

Key to the species of *Scutellinia* subgen. *Geneosperma* (Rifai) comb. et stat. nov. (Discomycetes, Pezizales, Pyronemataceae)

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Moravec J. (1997): Key to the species of *Scutellinia* subgen. *Geneosperma* (Rifai) comb. et stat. nov. (Discomycetes, Pezizales, Pyronemataceae). – *Czech Mycol.* 50: 85–97

Geneosperma Rifai (1968), originally created as a monotypic genus with the type species *Geneosperma geneosporum* (Berk.) Rifai [= *Scutellinia geneospora* (Berk.) O. Kuntze, based on *Peziza geneospora* Berk.], is newly combined here and given the new status of a subgenus of the genus *Scutellinia*, subgen. *Geneosperma* (Rifai) comb. et stat. nov.. Besides the type species, the subgenus also comprises two other recently described species, *Scutellinia laevispora* (Korf et Zhuang) comb. nov. (basonym: *Geneosperma laevisporum* Korf et Zhuang 1986), and *Scutellinia totaranuiensis* J. Moravec (1996). *Geneospora* was synonymized with *Scutellinia* by Korf (1972, 1973) but later re-evaluated as a good genus again by Korf and Zhuang (1986), and recently recombined by T. Schumacher (1990) to the rank of section of the genus *Scutellinia*, sect. *Geneospermae* (Rifai) T. Schumacher. The three species have been studied including the ascospore characteristic by using SEM photomicrographs. Despite the peculiar nature of their ascospores well delimiting *Geneosperma* (the ascospores are embedded in a hyaline, membranous sheath which surrounds them in the form of follicles tapering to the apiculi on the ascospore poles), these three species share all other basic features which characterize the genus *Scutellinia*. Therefore, the author keeps the infrageneric conception of *Geneosperma* but simultaneously prefers its subgeneric position proposed here, which better than its rank of a mere section respects the distinction of the ascospores. On the epispore of ascospores of *S. laevispora* (a species originally described as smooth spored) peculiar pulvinate cyanophilic tubercles have been observed and verified by SEM. The ascospore character is discussed. A key to the three so far known species of the subgenus *Geneosperma* and illustrations including SEM of ascospores accompany the paper.

Key words: *Scutellinia* subgen. *Geneosperma* (Rifai) comb. et stat. nov., *Scutellinia laevispora* (Korf et Zhuang) comb. nov., *S. geneospora*, *S. totaranuiensis*, folliculate ascospores, taxonomy.

Moravec J. (1997): Klíč k určení druhů *Scutellinia* subgen. *Geneosperma* (Rifai) comb. et stat. nov. (Discomycetes, Pezizales, Pyronemataceae). – *Czech Mycol.* 50: 85–97

Geneosperma Rifai (1968), původně vystavený jako monotypický rod s typovým druhem *Geneosperma geneosporum* (Berk.) Rifai [= *Scutellinia geneospora* (Berk.) O. Kuntze, založeném na *Peziza geneospora* Berk.], je zde zařazen do rodu *Scutellinia* s novým statutem podrodu, subgen. *Geneosperma* (Rifai) comb. et stat. nov.. Tento podrod zahrnuje kromě typového druhu další dva nedávno popsané druhy, *Scutellinia laevispora* (Korf et Zhuang) comb. nov. (basonym: *Geneosperma laevisporum* Korf et Zhuang 1986), a *Scutellinia totaranuiensis* J. Moravec (1996). Jméno *Geneosperma* bylo pokládáno za synonymum *Scutellinia* (Korf 1972, 1973), později opět přehodnoceno jako jméno pro opodstatněný rod (Korf and Zhuang 1986), a nedávno T. Schumacher (1990) přeřadil *Geneosperma* do hodnoty sekce rodu *Scutellinia*, sect. *Geneospermae* (Rifai) T. Schumacher. Jmenované druhy byly detailně studovány včetně použití SEM fotomikrografie askospor. Navzdory podivuhodné charakteristice askospor, která dobře vymezuje podrod *Geneosperma* (ornamentované askospory obalené průsvitným blanitým vakem vytvářejícím přívěsky na pólech), tyto 3 druhy sdílejí ostatní hlavní znaky, které charakterizují rod *Scutellinia*. Proto se autor přidržuje vnitrorodového pojetí *Geneosperma* a zároveň upřednostňuje její zde stanovené pojetí v hodnotě podrodu, který lépe zhodnocuje vyjimečnou charakteristiku askospor než v pozici pouhé sekce. Zvláštní cyanofilní polštářkovité

tuberkule na episporu askospor *S. laevispora* (původně popsáné jako druh hladkovýtrusý) byly pozorovány a ověřeny použitím SEM. Charakteristika askospor je diskutována. Klíč k určení tří dosud známých druhů podrodu *Geneosperma* a ilustrace včetně SEM askospor doplňují příspěvek.

The coarsely ornamented ascospores of *Scutellinia geneospora* (Berk.) O. Kuntze (1891), surrounded by a peculiar hyaline, cyanophilic membranous follicle-like sheath which envelopes the warts of the ornamentation and forms conspicuous apiculi on the ascospore poles, are unique in operculate discomycetes as the membranous sheath develops across the epiplasmic interfaces, so that the eight portions of ascus epiplasm are deposited on the ascospore wall within the follicles. This outstanding character led Rifai (1968) to create a new genus *Geneosperma* Rifai.

Thus the genus originally accommodated the single species *Geneosperma geneosporum* (Berk.) Rifai [= *Scutellinia geneospora* (Berk.) O. Kuntze – basionym: *Peziza geneospora* Berk., Hook, J. Bot. 3: 203, 1851].

The monotypic genus was not commonly accepted and was considered a synonym of *Scutellinia* (Cooke) Lambotte by Korf (1972, 1973). Later, Korf and Zhuang (1986) described the new species *Geneosperma laevisporum* Korf et Zhuang (1986) based on a collection from New Zealand, and simultaneously reconsidered the synonymy of *Geneosperma* with *Scutellinia*. They again recognized *Geneosperma* as a good genus after the second species was found and extended the originally monotypic genus. Korf et Zhuang (1986) also discussed in greater detail the character of the foliulate ascospores and their delimitation within the asci, and in accordance with Rifai (1968), considered it a leading characteristic which separates the two genera from each other. Recently, Schumacher (1990) recombined *Geneosperma* and stated it to be a mere section of the genus *Scutellinia* sect. *Geneospermae* (Rifai) T. Schumacher (1990). He obviously overlooked Korf and Zhuang's paper with the description of *G. laevisporum*, cited above, and thus maintained only the single (type) species of the section in his monograph of the genus *Scutellinia*. Similarly, when I described a new species of *Scutellinia* from New Zealand under the name *Scutellinia totaranuiensis* J. Moravec (1996), and compared the new species with *Scutellinia geneosperma* based on my examination of the type material (K), I had no idea of the existence of *G. laevisporum*, as I had neither seen the paper by Korf and Zhuang (1986). After the paper and the type material of *G. laevisporum* was sent to me by courtesy of Prof. Korf, Ithaca, I have re-examined and compared all these three closely related species undoubtedly belonging to the genus *Scutellinia* (Cooke) Lambotte, but differing by the remarkable ascospore sheath. In spite of the peculiar characteristic of their ascospores, these three species possess all other basic features which characterize the genus *Scutellinia*, especially the same shape and colour of the apothecia

and their identical structure, and the same type of apothecial hairs. Therefore, I consider *Geneospora* congeneric with *Scutellinia*, but at the same time I believe that *Geneospora*, due to the unique nature of its ascospores, deserves a higher position within the genus than Schumacher's concept of it at the rank of a mere section, and that the subgeneric status better respects its unique distinction. Consequently, *Geneospora* is newly combined here and classified as a subgenus of the genus *Scutellinia*:

Family **Pyronemataceae** Corda emend. Korf (1972)

subfamily **Scutellinioideae** Clements emend. Korf (1972)

tribe **Scutellinieae** (Clements) Pant in Pant et Tewari emend. Korf (1972)

genus ***Scutellinia*** (Cooke) Lambotte (1887)

Scutellinia subgenus ***Geneosperma*** (Rifai) comb. et stat. nov.

Basionym: *Geneosperma* Rifai, Verh. Koninkl. Nederl. Akad. Wetensch. Afd. Nat. 57 (3): 102, 1968.

Species typica: *Peziza geneospora* Berkeley, Hook. J. Bot. 3: 203, 1851, = *Geneosperma geneosporum* (Berk.) Rifai, Verh. Koninkl. Nederl. Akad. Wetensch. Afd. Nat. 57 (3): 102, 1968. = *Scutellinia geneospora* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 869, 1891.

Species ceterae: *Scutellinia laevispora* (Korf et Zhuang) J. Mor.; *Scutellinia totaranuiensis* J. Mor..

Characteristics of the subgenus *Geneosperma*: The species of this subgenus possess features which characterize the genus *Scutellinia*: apothecia discoid with an orange red hymenium, on the outside and on the margin covered by rigid, brownish, septate, thick-walled hairs which are long or very short, straight or curved, mostly acuminate above and with a bifurcate to multifurcate rooting base. Excipulum clearly differentiated (the ectal excipulum of a textura globulosa-angularis, the medullary excipulum of a textura intricata). Asci operculate, eight-spored. Ascospores ellipsoid, biguttulate or multiguttulate, with a cyanophilic sculpture being ornamented by large cyanophilic warts, crests or tubercles, - but the subgenus is delimited by a peculiar character of the ascospores - they are enveloped by a hyaline, membranous outermost follicular sheath which forms apiculi on the ascospore poles, as the ascospores are embedded in the ascus within the follicles.

Such an ascospore character is quite unique in operculate discomycetes. The follicle-like apiculate sheath in the subgen. *Geneosperma* differs well from the delicate and easily separable and mostly ornamented outermost perisporial sheath which is present on ascospores of *Scutellinia* sect. *Pseudocheilymeniae* Svr. and sect. *Minutae* Svr. and all species of the genus *Cheilymenia* as proved by SEM [compare J. Moravec (1990)].

The subgenus comprises three up to now known species:

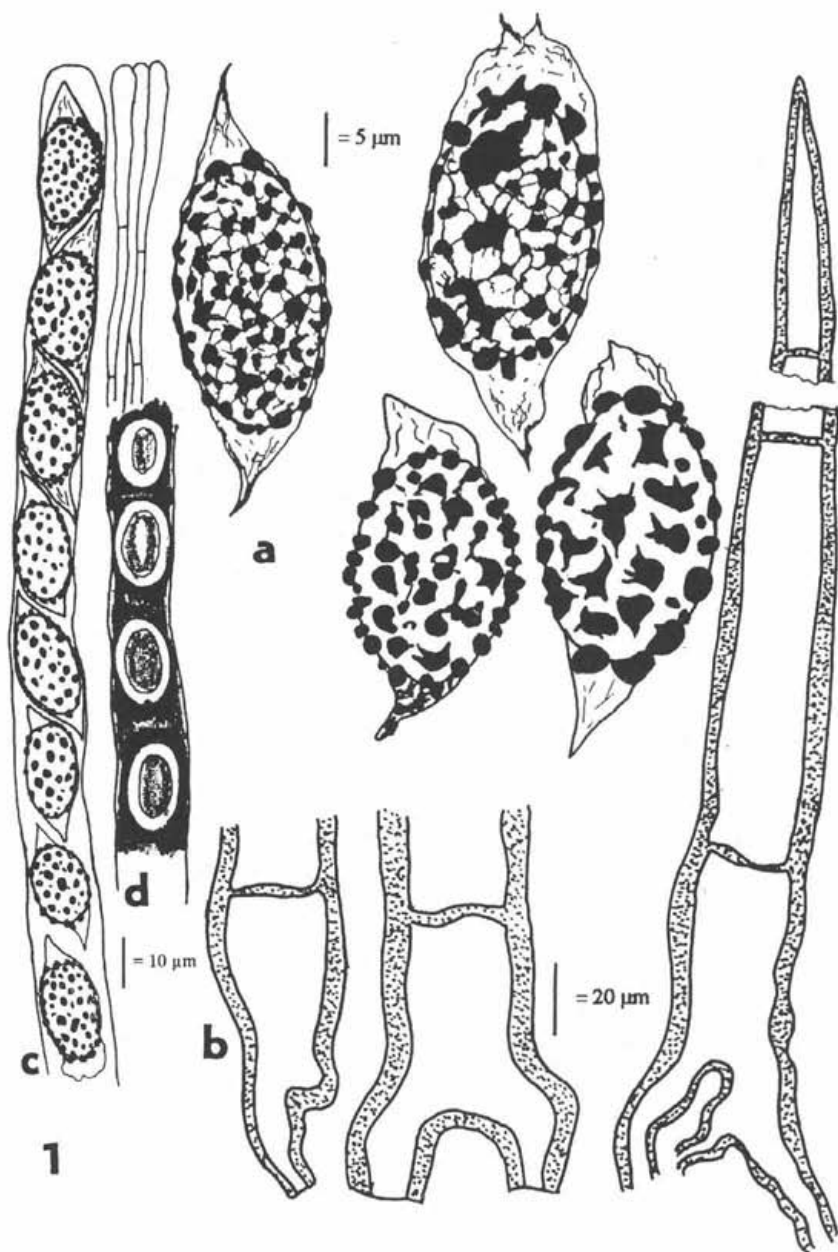


Fig. 1. *Scutellinia (Geneosperma) geneospora*: a. Ascospores (oil immersion + CB); b. Hairs; c. Ascus and upper parts of paraphyses; d. Part of ascus with immature ascospores surrounded by epiplasm.

1. *Scutellinia geneospora* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 869, 1991.

Basionym: *Peziza geneospora* Berkeley, Hook. J. Bot. 3: 203, 1851,

≡ *Lachnea geneospora* (Berk.) Saccardo, Syll. fung. 8: 178, 1889,

≡ *Geneosperma geneosporum* (Berk.) Rifai, Verh. Koninkl. Nederl. Akad.

Wetensch. Afd. Nat. 57 (3): 102, 1968. (inaccurately written "geneospora" by Rifai)

= *Lachnea appendiculata* P. Hennings, Warburg, Monsunia 1:35, 1900,

≡ *Humaria appendiculata* (P. Henn.) Boedijn, Sydowia 5: 212, 1951,

= *Lachnea fleischeriana* P. Hennings, Warburg, Monsunia 1:35, 1900,

≡ *Ciliaria fleischeriana* (P. Henn.) Overeem, Icon. Fung. mal. Hft. 9: 1, 1925,

= *Lachnea foliculata* Höhnelt, Sber. Akad. Wiss. Wien, Math. - nat. Kl., 1, 117: 396, 1909.

The type species of the subgenus, *S. geneospora*, is distinguished by large discoid apothecia (4-12 mm diam.), on the outside covered by stiff, brownish hairs which are denser, longer and larger on the margin of the apothecia. The marginal hairs of the type specimen (K) are rigid, pointed above, septate, thick-walled (the walls 3.5-7.5 μm thick) and measure 400-955 \times 25-45 μm , mostly with bifurcate, rarely simple or trifurcate rooting base. Ascospores ellipsoid, multiguttulate, coarsely ornamented by mostly irregular warts and crests and enveloped by a hyaline membranous sheath which is tightly adpressed to the ornament and therefore hardly or not visible on the outline of mature ascospores but can be seen on the ascospore poles projecting there in a form of transparent apiculi. Ascospores of the type specimen (18-) 21-24.5 (-25.5) \times 12-15 (-16) μm (excluding the ornamentation and apiculi), according to my measurement. Paraphyses slightly enlarged above, those of the type material cohered together.

Habitat and distribution: on decayed wood in forested mountains of East Asia: India, Japan, Indonesia (Java) and China. Its distribution is discussed and mapped by Korf and Zhuang (1986).

Material examined: Holotype of *Peziza geneospora* Berkeley, India, Sinchul, Hooker fil., (K ex herbarium Berkeley).

Illustrations: Rifai (1968), Korf and Zhuang (1986), T. Schumacher (1990) - SEM, J. Moravec (1996) - SEM, and Fig. 1 and SEM Fig. 6 of this paper.

2. *Scutellinia laevispora* (Korf et Zhuang) comb. nov.

Basionym: *Geneosperma laevisporum* Korf et Zhuang, Acta Mycologica Sinica Suppl. 1: 91, 1986;

Appearance and character of the ascospores of *S. laevispora* represent the most peculiar feature within the subgenus, well distinguishing the species. Even if

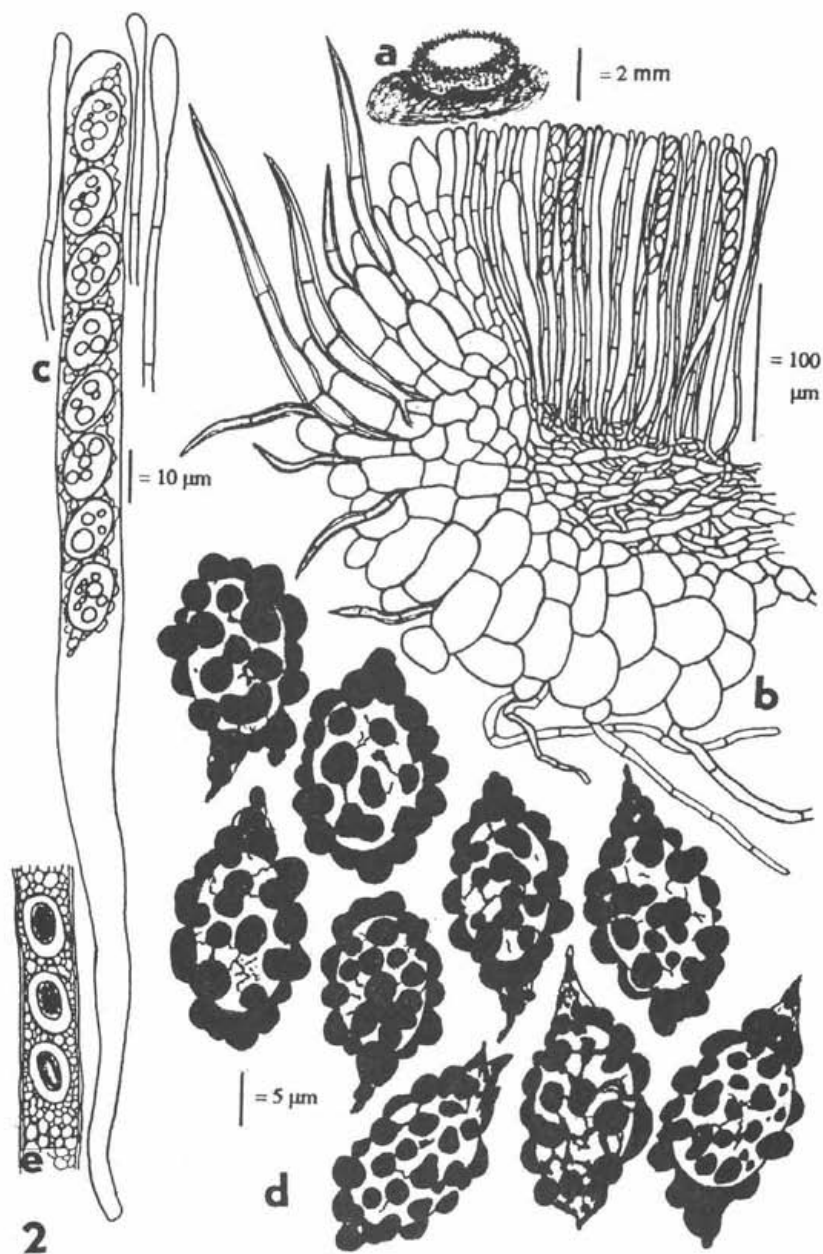


Fig. 2. *Scutellinia* (*Geneosperma*) *totaravuiensis*: a. Apothecium; b. Section of the marginal part of the apothecium; c. Ascus and paraphyses; d. Ascospores (oil immersion + CB); e. Part of ascus with immature ascospores surrounded by pustules of epiplasm.

the authors (Korf and Zhuang 1986) described the ascospores as smooth (the etymology of the Latin epithet "laevisporum"), my examination of the isotype material (CUP) has revealed that the ascospore wall (episporium) is in reality covered by pulvinate cyanophilic tubercles. However, these tubercles may be overlooked when the ascospores are observed under an optical microscope, as they are so large that often only few pustules cover the whole spore wall of the small and conspicuously elongate-ellipsoid biguttulate ascospores, or the tubercles confluent and form one amorphous thick cyanophilic substance. For that reason, this structure was probably considered portions of an "extra-sporal substance" by the authors, and indeed, the tubercles are hardly seen as they often merge with the strongly cyanophilic substance within the follicular sheath. Moreover, it appears that on a certain number of ascospores, the tubercles are distributed only on two facing sides. The sheath develops in the early stage of the asci. The cytoplasm surrounding the immature ascospores is then transparent, whilst the portions of the epiplasm in the form of irregular tubercles of strongly cyanophilic substance are deposited on the ascospores later forming the tuberculate episporium. It is interesting however, that when the sheath is crashed (by pressure of the cover glass) the tubercles of the episporium remain inside the sheath together with a compact cyanophilic matter whilst the released ascospores peeled out of the sheath (and also from the episporium) are almost smooth on their endospore wall. The tubercles are well seen on the SEM microphotographs where the sculptured ascospores appear as situated in the centre of the large sheath which surrounds the ascospores, and the pustules are seen due to the tightly adpressed membrane, but seemingly as if situated on the surface of the sheath. This is obviously caused by the fact that the follicular sheath is strongly flattened on the two facing sides of the ascospores and so adpressed on the tubercles which cover the internal wall. Therefore, also under the light microscope, when it is seen from the upper flat side, we can see the sculpture through the membrane adpressed on the inner wall of the ascospore which is placed in the centre of the extremely large sheath whilst the space between the outlining membrane of the sheath and the inner wall is very wide. However, the same sheath in its lateral perspective appears narrow as it is adpressed on the two sides of the ascospore, and we can then see the tubercles on the ascospore sides and seemingly, since it is adpressed there, simultaneously on the flattened sides of the sheath. Naturally, on the SEM photographs, the sheath appears to be opaque as the samples are coated by an ultra thin layer of gold. The flat shape of the sheath, which somewhat resembles the shape of seeds of *Ailanthus*, probably arose when the ascospores were delimited in the ascus at first arranged laterally and adpressed to one another having the appendages of the follicles bent along the walls of the ascus and thus later shaped into the spine-like and often hook-like simple or doubled (furcate) projections. The bifurcate

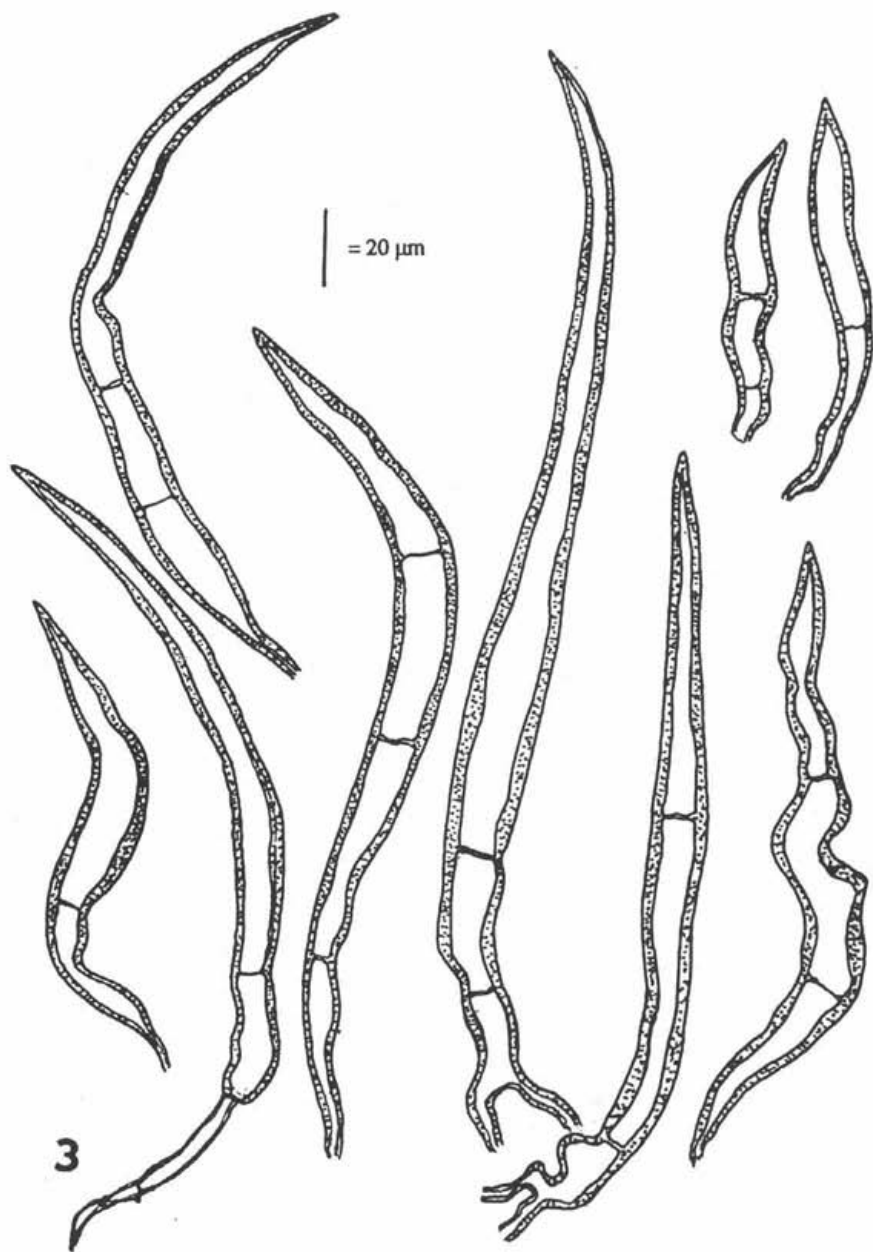


Fig. 3. *Scutellinia (Geneosperma) totaranuiensis*: Hairs.

projections originated when the projection of an adjoining ascospore penetrated into the sheath appendage and split its shape.

I have come to this conclusion on the above discussed features by using the combination of the observation both under the optical microscope and SEM, which is necessary for a better understanding of the ascospore character. However, I am fully aware that the explanation cannot be definitive as there are so many peculiarities which cannot be sufficiently explained.

Korf and Zhuang (1986) discussed the delimitation of ascospores in the ascus and supposed that probably all of the ascus epiplasm is enclosed within the follicular sheaths and concluded that we hardly know how there can be a sufficient build-up of pressure within the ascus for ascospore discharge. I also agree with their opinion that the peculiar ascospore character deserves a further examination by transmission electron microscopy (TEM) which can better explain the ascospore character discussed above.

The apothecia of *S. laevispora* are 3-5 mm in diam. when dried, the colour of fresh apothecia is unknown - the hymenium of the dried apothecia is orange, the apothecial hairs are long but not so wide as in *S. geneospora*, 150-1250 × 17-38 μm, brown, septate, often forked above into two or three arms, or occasionally even stellate, acuminate or blunt above, straight or curved, rigid or flexible, with a mostly simple attenuate base. Asci operculate, eight-spored. The ascospores (their character detailed above) are narrow-ellipsoid, 15-18 × 6.5-9.1 μm (excluding the ornamentation and sheath), and the membranous follicle-like sheath which surrounds them is very large (28-45 × 10-16 μm). Paraphyses not or slightly enlarged above.

Habitat and distribution: on decaying wood, known only from the type collection.

Material examined: New Zealand (South Island), Westland Nat. Park, 8. IV. 1983 leg. G. J. Samuels and all. (Isotype CUP 6177).

Illustrations: Korf and Zhuang (1986) and Figs 4-5 and SEM Figs. 9-11 of this paper.

3. *Scutellinia totaranuiensis* J. Moravec, Mycotaxon 58: 233, 1996.

For detailed description and illustrations see also J. Moravec (1996).

S. totaranuiensis differs from the two other species especially by small (2-5 mm diam. when fresh) apothecia, on the outside and on the margin densely covered by extremely short both excipular and marginal apothecial hairs. The hairs measure 60-270(-285) × 12-21 μm, are rigid, straight or often curved, acuminate above and often narrowing towards the base; the base is bifurcate consisting of short and narrow roots, or simple and truncate. Occasionally the hairs are attenuated below into a subacute "secondary hair" (resembling "bicuspidate"

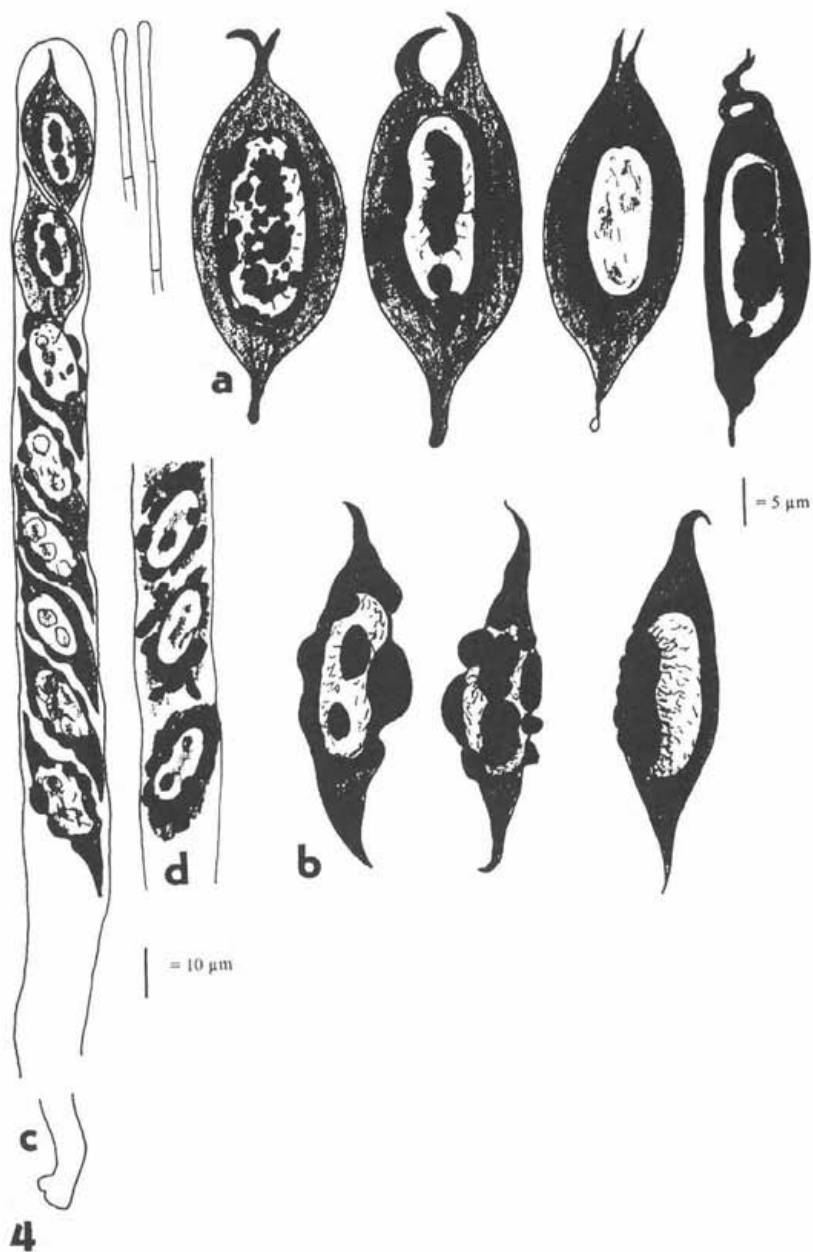


Fig. 4. *Scutellinia (Geneosperma) laevispora*: a. Ascospores (oil immersion + CB); b. Ascospores in a lateral and sublateral perspective; c. Ascus and paraphyses; d. Part of ascus with immature ascospores surrounded by epiplasm.

hairs which characterize the genus *Trichophaeopsis*). Also the ascospores clearly differ as they are wide-ellipsoid, $13.5-16.5 (-17.6) \times 7.5-10.5 (-11) \mu\text{m}$ (measured excluding the sculpture and apiculi) - and thus they are much smaller than the ascospores of *S. geneospora* - multiguttulate, ornamented by large, cyanophilic, mostly rounded warts and tubercles, coated by an outermost membranous sheath which is mostly tightly adpressed on the tubercles and copies their shape, and thus visible only as appendages on the ascospore poles, and the tubercles are usually situated and densely arranged also inside the irregular appendages. This ascospore appearance and characteristics well differentiate *S. totaranuiensis* also from *S. laevispora*. A certain difference is also found in the development of the ascospore sheaths in the asci, as the cyanophilic tubercles are largely present in the form of the epiplasm surrounding immature ascospores and are well seen in yet very immature asci before the apiculate sheaths, which later close the ascospores, are developed.

In other features, especially due to the very short apothecial hairs, *S. totaranuiensis* is also close to certain other species of the large genus *Scutellinia*, and therefore, I also compared it to a few other species, in particular *Scutellinia phymatodeus* S. C. Kaushal et R. Kaushal and *Scutellinia pseudotrechispora* (Schröt.) Le Gal (see J. Moravec 1996).

Habitat and distribution: On soil. Known only from the type collection.

Material examined: New Zealand (South Island), Totaranui near Takaka, on moist clayey-sandy soil on a path through a sea-side forest, 6. III. 1993 leg. J. Moravec. The holotype BRNM 599298, isotypes CUP, WELTU, J. Mor.).

Illustrations: J. Moravec (1966), and Fig. 2 and Figs 7-8 of this paper.

A KEY OF THE SPECIES OF SCUTELLINIA SUBGEN. GENEOSPERMA

Species of an appearance and other features common for other species of the genus *Scutellinia*, but differing by ascospores embedded within a membranous follicle, being surrounded by it in the form of hyaline, outermost sheath which forms appendages on the ascospore poles
 *Scutellinia* subgen. *Geneosperma*

1 a. - apothecia growing on soil; marginal hairs short (up to $280 \mu\text{m}$). Ascospores wide ellipsoid, $13.5-17.6 \times 7.5-11 \mu\text{m}$, (excluding the ornamentation and apiculi), coarsely ornamented by mostly rounded warts and tubercles; the outermost membranous sheath adpressed on the ornamented spore walls proper and so seen mostly as the apiculate appendages on the ascospore poles; the cyanophilic tubercles often present also inside the appendages *S. totaranuiensis*

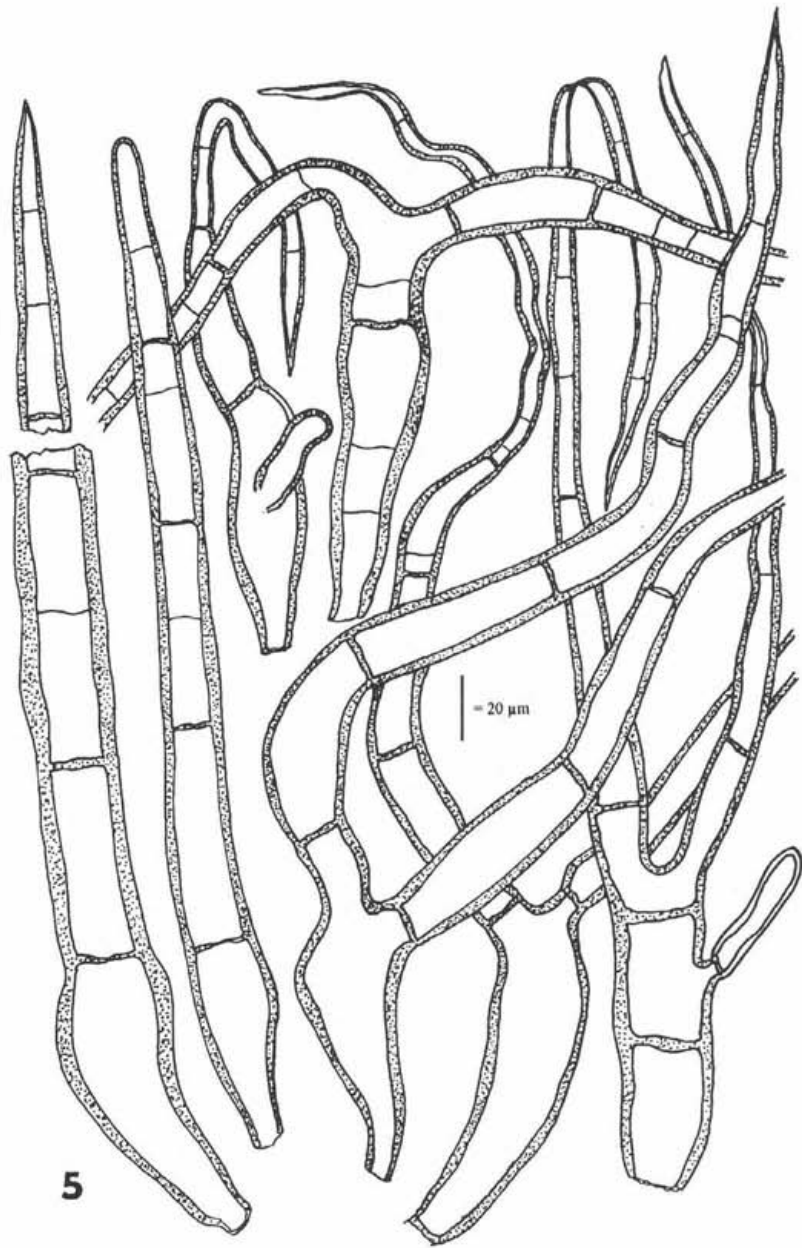
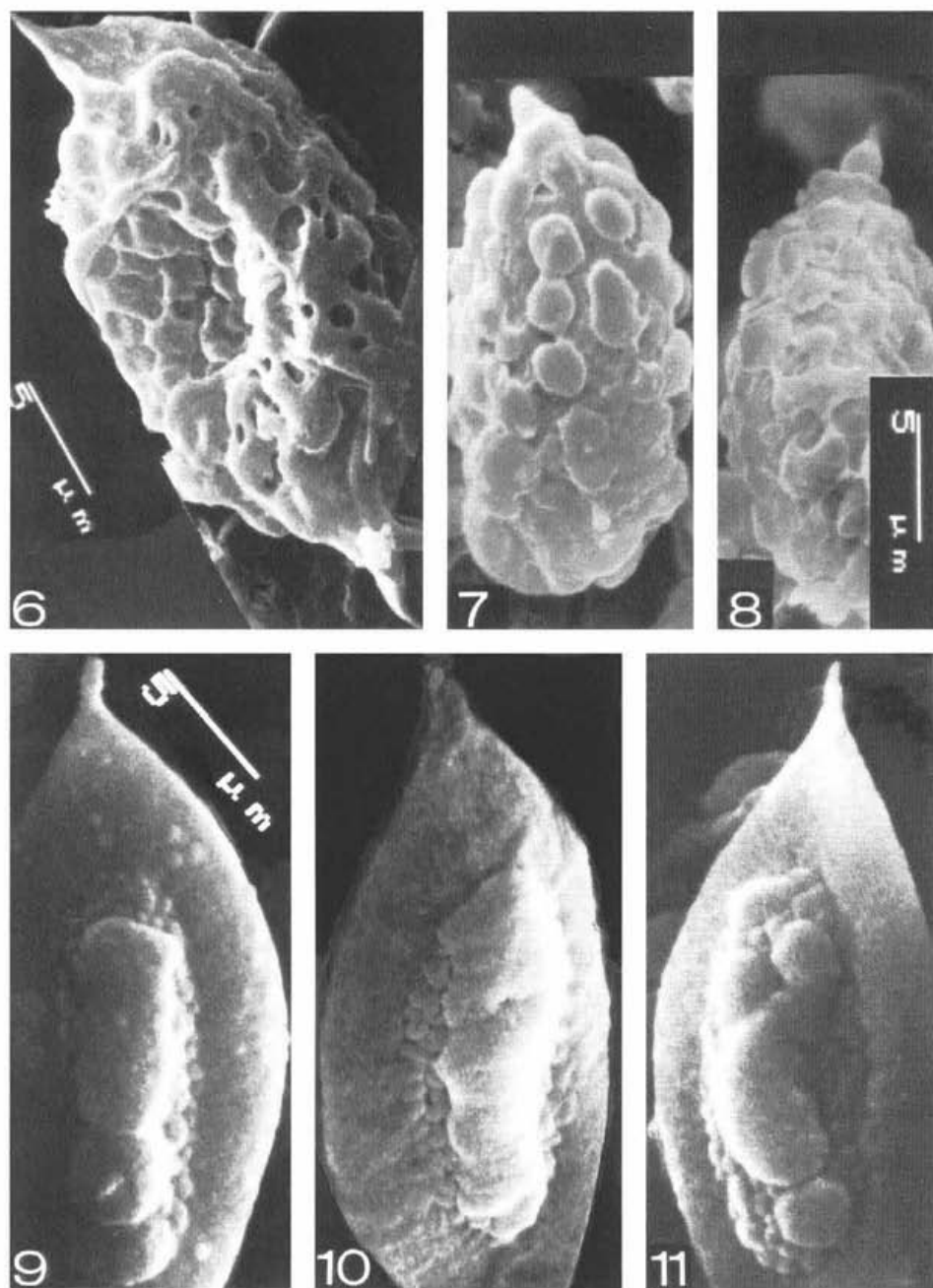


Fig. 5. *Scutellinia (Geneosperma) laevispora*: Hairs.



Figs 6-11. SEM of ascospores: **6.** *Scutellinia (Geneosperma) geneospora*; **7-8.** *Scutellinia (Geneosperma) totaranuiensis*; **9-11.** *Scutellinia (Geneosperma) laevispora*.

- 1 b. - apothecia growing on decayed wood; marginal hairs long, (up to more than 800 μm) 2
- 2 a. - ascospores large, 18-25.5 \times 12-16 μm (excluding the ornamentation and apiculi), ornamented by mostly irregular warts and crests; the outermost sheath addressed on the warts and usually seen as empty and transparent appendages on the ascospore poles *S. geneospora*
- 2 b. - ascospores narrow ellipsoid, 15-18 \times 6.5-9.1 μm (excluding the outermost sheath), covered by only several large pulvinate cyanophilic tubercles or confluent pigment, surrounded by a very large, (28-45 \times 10-16 μm)! fusiform, flattened sheath protruding on the ascospore poles in the form of the thin and sharp apiculi; viewed from the upper flat side, the space between the ascospore and the membrane of the outermost sheath is conspicuously wide, giving the ascospores a smooth appearance; *S. laevispora*

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