

New discoveries in Asian pannariaceous lichens

Per M. JØRGENSEN

Abstract: New collections from inner China have revealed further species in the genus *Fuscopannaria*: two new species, *Fuscopannaria cyanogranulosa* P. M. Jørg. and *Fuscopannaria obtegens* P. M. Jørg. are described and *Fuscopannaria subgemmascens* Upreti & Divakar is reported as new to Sichuan. A key to the sorediate species of the region is provided. The first fertile specimen of *Krosowia gemmascens* has been discovered, much further west than previously known, showing the genus to be related most closely to *Fuscopannaria* despite its gelatinous, homoiomerous thallus. Some collections from the Mulu region in Borneo have added to our knowledge of the difficult lowland taxa of *Parmeliella*, two of which proved to be new: *Parmeliella plumosella* P. M. Jørg. and *Parmeliella polydactyla* P. M. Jørg. & Coppins, both being quite unusual in containing “violet” *Nostoc* as cyanobiont. There is a surprising number of Asian collections with brightly coloured medullas: red-orange material has been named several times and is correctly referred to as *Parmeliella endomilta* Vain. The specimens with a yellow medulla are named *Parmeliella endolutea* P. M. Jørg., nom. nov. A key to the brightly coloured species of *Parmeliella* concentrated in SE Asia is given. A new corticolous *Protopannaria* has been discovered in Sichuan, and is described as *P. corticola* P. M. Jørg.

Key words: Borneo, China, *Fuscopannaria*, *Krosowia*, new species, *Parmeliella*, *Protopannaria*

Introduction

The lichens of the family *Pannariaceae* in Asia have recently been treated in several regional papers (Jørgensen 2000*a, b*, 2002*a, b*; Jørgensen & Kashiwadani 2001; Jørgensen & Sipman 2002, 2006; Upreti *et al.* 2005). Subsequently, collectors have sent me more material that has widened the knowledge of the family in Asia, some genera of which appear to have an evolutionary centre in SE Asia. This present paper summarizes recent discoveries in *Fuscopannaria*, *Krosowia*, *Parmeliella* and *Protopannaria* among this material. The methods are the same as in the previous papers and the material is that cited in each section.

Fuscopannaria, two new species and a new record

The steadily increasing number of species described in this genus has been a surprise to

me (Jørgensen 2005). After my study of the American taxa (Jørgensen 2001*a*), where the Pacific region proved to be particularly species-rich, to find an even greater variation in SE Asia was unexpected. Nearly every collection sent to me from the region contained new species or new records. Two new species are described and a new record is reported here from a recent package of specimens from inner China sent by W. Obermayer, Graz.

Fuscopannaria cyanogranulata P. M. Jørg. sp. nov.

Fuscopannariae sorediatae similis, sed thallo fulvo sorediis punctiformibus et apotheciis convexis sine marginibus thallinis.

Typus: China, Xizang, SE Tibet, Tsangpo tributary, Nangxian-Mainling, Liung Chu, eastern branch (Camp 14—High Camp), 4050 m, 14 August 1994, G. Miehe & U. Wündisch 94-176-29/15 (GZU—holotypus).

(Fig. 1A)

Thallus to 3 cm diam., small-squamulose, of rounded, shallowly incised, pale brown

Per M. Jørgensen: Botanical Museum, University of Bergen, Allégt. 41, N-5007 Bergen, Norway.

squamules, 2–3 mm diam. broad and *c.* 150 µm thick, with marginal, punctiform, bluish soralia with bluish granular structures on the edges, becoming confluent with age.

Apothecia rare to 1 mm diam., convex with brown disc and whitish proper exciple soon disappearing, to 30 µm wide, without a thalline margin. *Hymenium* I+ blue-green turning red-brown. *Asci* subcylindrical with amyloid internal ring-structure, 8-spored. *Ascospores* simple, colourless, citriform, 25–30 × 10–15 µm including a distinct, uneven exospore.

Pycnidia not observed.

Chemistry. Fatty acids and terpenoids as in most species of the genus (Jørgensen 1991).

Notes. When describing *Fuscopannaria coeruleascens* (Jørgensen 2000b), I included with some doubt a specimen from Nepal and remarked at the time that fertile material would be necessary to resolve the matter. Fertile material now available clearly shows that the Himalayan material belongs to a different and undescribed species. *Fuscopannaria coeruleascens* differs from the *F. cyanogranulata* by its apothecia with a distinct thalline margin and by its smaller and broader spores with an indistinct exospore. It has a much more southern distribution in Asia than the new species, being confined to the montane regions of New Guinea, Borneo, Sri Lanka and southern India,

As the sorediate species of *Fuscopannaria* are now becoming better known and proving to be as complex in SE Asia as in Pacific North America, a key to the SE Asian species is presented below (p. 241) to assist in their identification.

Habitat and distribution. *Fuscopannaria cyanogranulata* appears to be a corticolous species of the upper *Abies* forests of eastern Himalaya, at an altitude of about 4000 m.

Specimens examined. **Nepal:** *Khumbu:* South of Kunde, 4000 m, 9 ix 1962, *J. Poelt* (M).—**China:** *Xizang:* SE Tibet, Tsangpo tributary, Nanxian-Mainling, Lilung Chu, eastern branch, 1994, *U. Wündisch & G. Miehe* 94-176-29/16 (GZU).

***Fuscopannaria obtegens* P. M. Jørg.
sp. nov.**

Fuscopannaria dispersae similis, sed thallo squamulis dichotome divisis, imbricato; apothecia convexa, sine margine thalino, proliferantes, sporis subglobosis.

Typus: China, *Xizang*, SE Tibet, Gyala Peri W, Upper Bong Chu (Lang Chu), E of Pass Nyingchi-Dongjuk, 4430 m, 28 August 1994, *U. Wündisch & G. Miehe* 94-231-36/26 (GZU—holotypus).

(Fig. 1C)

Thallus spreading widely, made up of imbricating brown squamules to 2 mm diam., dichotomously branched with tongue-like, white-tipped apices, to 150 µm thick, resting on a conspicuous mat of blackish rhizohyphae.

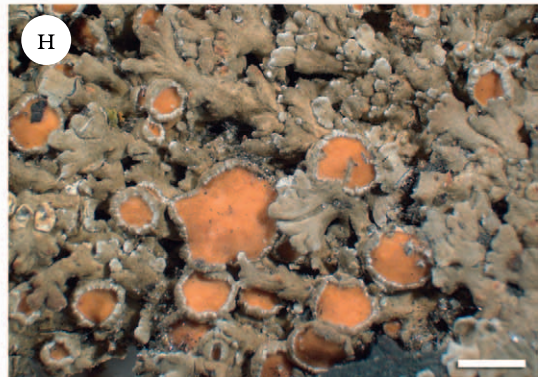
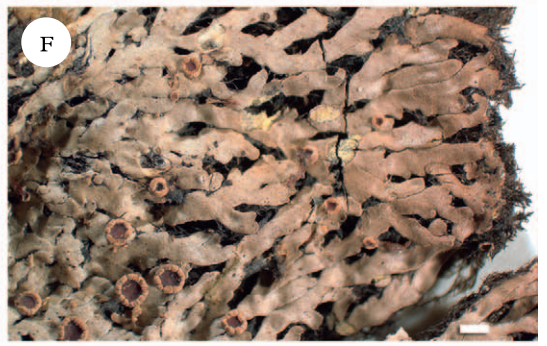
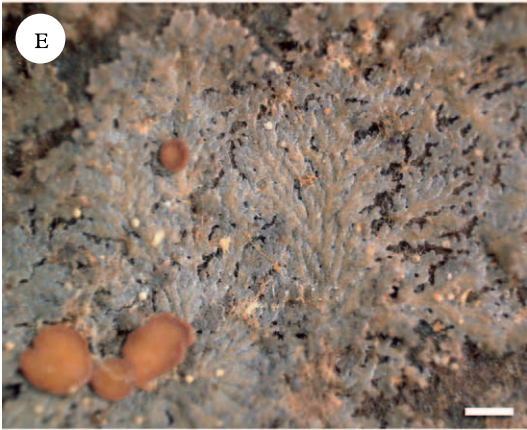
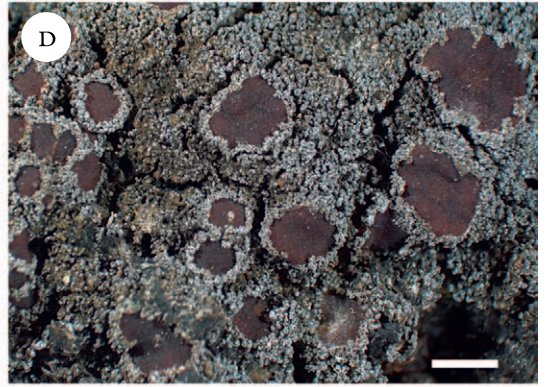
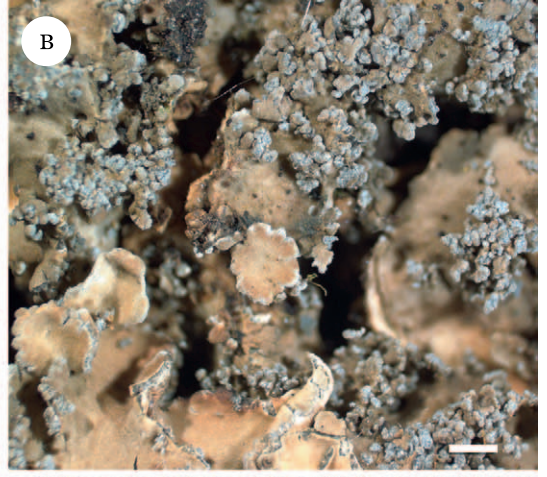
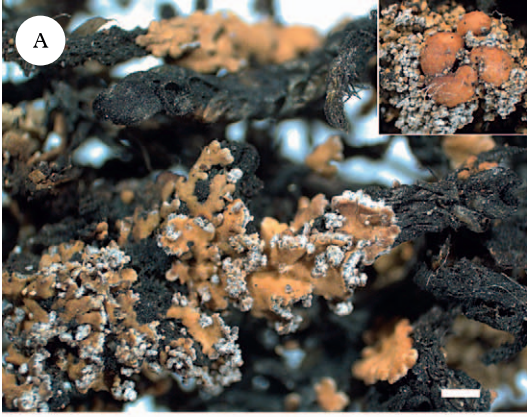
Apothecia common to 1 mm diam., convex without thalline margin, but with visible whitish proper exciple (about 40 µm wide), often proliferating and occurring in clusters, disc brown. *Hymenium* I+ blue-green, changing to red-brown. *Ascospores* subglobose, 10–12 µm diam., with indistinct exospore.

Pycnidia not observed.

Chemistry. Contains fatty acids and terpenoids (TLC), the latter visible as needle-like crystals in herbarium specimens (see Jørgensen 1991).

Notes. This new species is very characteristic with its crustose appearance covering large areas of the trunks on which it grows. These large areas appear black because of the well-developed blackish rhizohyphal mat, similar to that of corticolous specimens of *Parmeliella triptophylla* (Ach.) Müll. Arg.,

FIG. 1. Morphology of Asian Pannariaceae. A–C *Fuscopannaria*; A, *F. cyanogranulata* (holotype GZU); B, *F. subgemmascens*, Sichuan (*W. Obermayer* s.n. GZU); C, *F. obtegens* (holotype GZU); D, *Kroschia gemmascens*, fertile specimen (GZU); E–G *Parmeliella*; E, *P. plumosella* (holotype E); F, *P. endolutea*, Borneo (E); G, *P. polydactyla* (holotype E); H, *Protopannaria corticola* (holotype GZU). Scales: A–H=1 mm.



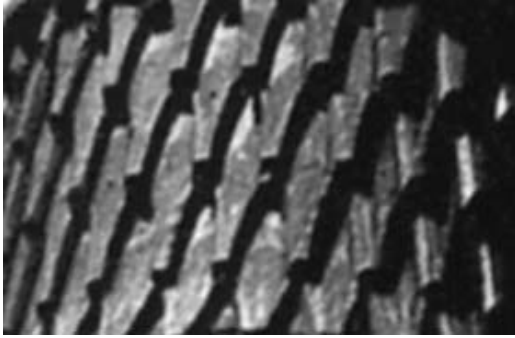


FIG. 2. Part of the roof of Fantoft Stavkirke, Bergen.

which is not known from this region. The only somewhat similar and probably closely related species known from the area is *Fuscopannaria dispersa* P. M. Jørg. (Jørgensen 2000a) which has dispersed, elegantly incised squamules, while *F. obtegens* has strongly imbricating squamules that are dichotomously divided, giving the thallus an impression of a tiled roof (particularly like the ones seen on stave churches in Norway, Fig. 2). In addition, the frequently proliferating apothecia are without a thalline margin and contain smaller subglobose spores.

Habitat and distribution. Known only from the rich type collection, which was made from stems in a grazed *Juniper* forest near the upper forest limit at 4430 m, on a south-facing slope, indicating that it might be a species of the upper coniferous forests in the region.

***Fuscopannaria subgemmascens* Upreti & Divakar**

This species is recorded here for the first time from China.

(Fig. 1B)

Specimen examined. **China:** *Sichuan:* Henguan Shan, Daxue Shan, in area of Hailouglou Station, 29 vii 2000, Obermayer (GZU).

***Kroswia* found with apothecia**

The genus was recently described (Jørgensen 2002b) from sterile material and

placed in the *Pannariaceae*, despite its gelatinous, homoiomerous thalli that had led earlier lichenologists to include it in *Physma* (*Collema*).

Fertile material of *Kroswia gemmascens* (Nyl.) P. M. Jørg. has now been found in collections from inner China, which supplements the description and extends the distribution of the genus. The specimens show apothecia typical of the *Pannariaceae* and look superficially rather like *Pannaria conoplea* (Ach.) Bory, but have a distinct gelatinous texture.

(Fig. 1D)

Apothecia with secondarily developed thalline margin (Henssen 1969), covered in gymnidia (see Jørgensen & Kashiwadani 2001). **Apothecial disc** dark brown, plane and somewhat lobed; in section showing a suppressed/poorly developed proper exciple (to 15 µm wide); **subhymenium** well-developed, 100–120 µm wide, made up of intricate, closely interwoven hyphae. **Hymenium** 250–300 µm high, I+ blue-green, rapidly turning red-brown, with simple, thin (c. 1.5 µm), septate paraphyses which are enlarged apically and there covered in an external brown pigment. **Asci** narrowly cylindrical, 200–250 × 7.5–12.5 µm, rather thin-walled, apically enlarged with internal amyloid ring-structure. **Ascospores** 8 per ascus, pale brown, globose, 10–15 µm diam., without a distinct exospore.

Notes. The apothecial characters clearly confirm the position of *Kroswia* in the *Pannariaceae*, but contradict my former assumption that it was closely related to gelatinous *Pannaria* species, such as *P. santessonii* Swinscow & Krog. The characters of the hymenium and the chemistry of the thallus certainly place it close to *Fuscopannaria*, but it differs not only in its thallus organization but also in the brownish spores, a unique character in the family.

Distribution. Previously known only from south-eastern Japan and eastern China

(Jørgensen 2002*b*), the new discovery extends the distribution area greatly westwards and into the Asian continent.

Specimens examined. **China:** *Sichuan:* SE Tibetan fringe mountains (=Hengduan Shan), Daxue Shan, 57 km S of Kangding, Gongga Shan, Hailougou glacier and forest park, surrounding area of Hailougou Station, 2940–3130 m, 2000, *W. Obermayer* 08680 (GZU). *Xizang:* Tibet, Nyainqentanglha Shan, 370 km E of Lhasa, 55 km NNE of Nyingchi river valley, at the west side of Gyala Peri, 2500 m, 1994, *W. Obermayer* 10628 (GZU).

Parmeliella, notes on some material from Mulu, Borneo

Among material collected mainly by B. J. Coppins (Edinburgh) during the Royal Geographic Society Mulu expedition in Borneo in 1977–78, there are some particularly interesting collections which add to our knowledge of this difficult genus in this region. They belong in the difficult lowland species complexes that were not included in the treatment of the New Guinea *Pannariaceae* (Jørgensen & Sipman 2006). Some are new species or need new names.

Parmeliella endolutea P. M. Jørg. stat. & nom. nov.

Pannaria stylophora var. *lutea* Herre, *Bryologist* 54: 283 (1951); type: Philippines, Luzon, Prov. Rizal, Mt. Irid, A. W. Herre (LAM—holotype!)

(Fig. 1F)

Notes. To date this taxon has been known only from the type collection which was clearly characterized in the original description, although it has been poorly known and understood until now. The Mulu material shows some variation in the presence and development of isidia, but this appears, just as in the case of *Parmeliella flavida* P. M. Jørg., not to be of great taxonomic importance (Jørgensen & Sipman 2006). While the presence of apothecia is variable, they are often present and show that this species belongs to the *Parmeliella mariana* (Fr.) P. M. Jørg. & D. Galloway complex with a distinct thalline margin and asci with

internal amyloid ring-structures (Jørgensen 2003). *Parmeliella endolutea* clearly differs from *P. flavida* in that it is only the medulla which is (strongly) yellow, not the thallus itself. I have therefore given it a new name to reflect the realities, as allowed by the ICBN (Art. 11.2), rather than merely making a new combination. As commented upon previously (Jørgensen 2003) there appears to be a concentration of species in the *Pannariaceae* and the *Coccocarpiaceae* in this region with yellow/orange pigments, which have not been precisely identified as they are nearly insoluble in acetone (J. A. Elix pers. comm.). This concentration of species appears to be the result of some common evolutionary factor, a matter needing further study.

One of these species, *Parmeliella endomilta* Vain. (syn. *Parmeliella endoferruginea* Aptroot) often occurs together with *P. endolutea*. It is quite clear that these two are distinct species, and not chemical variants of the same taxon. *Parmeliella endomilta* has a browner more skin-like thallus and different, citriform spores.

These brightly coloured *Parmeliella* species are often confused and a key to them is presented below (p. 242).

Specimens examined (of *P. endolutea*). **Sarawak:** Gunong Mulu National Park, 4th Division, Baram Park, valley of Ulu Jerneh (Hidden valley), c. 500 m, 1978, B. Coppins 5256, 5258 (E); Long Pala, Limestone Hill, c. 2 km E of base camp, S. side of Sungei Melinau Paku, 70–300m, 1978, B. Coppins 5431, 5432, 5434(E).

Specimens examined (of *P. endomilta*). **Sarawak:** Gunong Mulu National Park, 4th Division, Baram Distr., valley of Ulu Jerneh (Hidden valley), 500 m, 1978, B. Coppins 5257; *ibid.*, 1978, B. Coppins 5317 (E).

Parmeliella plumosella P. M. Jørg. sp. nov.

Parmeliellae philippinae similis, sed thallo delicate plumoso diviso, et sporis curtis.

Typus: Borneo, Sarawak, Gunong Mulu National Park, 4th Division, Baram distr., valley of Ulu Jerneh, 7 April 1978, B. Coppins 5266 (E—holotypus).

(Fig. 1E)

Thallus subcrustaceous composed of closely appressed, featherlike divided, grey-brown squamules, forming effuse colonies to 5 cm diam. surrounded by a crustaceous black prothallus; in section 50–75 µm thick, with cellular upper cortex, 15–25 µm thick, underneath packed with perpendicular chains of the cyanobiont, a “violet” *Nostoc*, individual cells 3–5 µm diam. No lower cortex, but a few horizontal hyphae which merge into the prothallus.

Apothecia common, to 1.5 mm diam., brown, often convex and becoming irregular with pale proper exciple, to 25 µm wide, soon becoming excluded. *Subhymenium* paraplectenchymatous, brownish, 30–50 µm wide. *Hymenium* 50–70 µm high, I+ bright blue. *Asci* subcylindrical, to 50 × 7–10 µm, with internal blue ring-structure, 8-spored. *Ascospores* simple, colourless, ellipsoid, 12–14 × 5–6 µm, smooth, without distinct exospore.

Pycnidia not observed.

Chemistry. No substances detected by TLC

Notes. This is a most delicate species, on smooth bark appearing as a bluish film which on closer inspection proves to have featherlike squamules. In section these squamules appear basically to be an aggregation of a “violet” *Nostoc* protected by a cellular hyphal “roof” (the cortex of the lichen).

Parmeliella plumosella appears to be a lowland “cousin” of *Parmeliella philippina*, differing both in thallus morphology and shorter spores.

Habitat and distribution. *Parmeliella plumosella* is as yet known only from lowland Borneo, where it is locally common in the forest, but may prove to have a wider distribution in the lowland forests of SE Asia, which are lichenologically poorly known.

Specimens examined. **Sarawak:** Gunung Mulu National Park, 4th division, Baram Distr, Long Pala, 65 m, 1978, *B. Coppins* 5419 (E); along alluvial plot, S side of Sungei Melinau, c. 2 km ESE of National Parks Hut, 65 m, 1978, *B. Coppins* 5416 (E); Ulu Sungei

Jerneh, 500 m, 1978, *B. Coppins* 5259 (E).—**Sabah,** Mt. Silam, SW of Lahad Dahu, east coast, 1963, *Z. Iwatsuki* 5603 (TNS).

***Parmeliella polydactyla* P. M. Jørg. & Coppins sp. nov.**

Thallus squamulosus; squamis digitiformes divisis, “digitis” erosis, deorsum curvatis, sine acidis lichenosis. *Apothecia* ignota.

Typus: Sarawak, Gunung Mulu National Park, 4th Division, Baram distr., W side of Sungei Melinau, near Lobang Angin (cave of the winds), 100 m, 12 April 1978, *B. Coppins* 5338 (E—holotypus).

(Fig. 1G)

Thallus squamulose, squamules scattered on an effuse distinct blackish mat of rhizohyphae (up to 10 cm diam.), central ones to 2–3 mm wide, digitately divided, each of the brown “fingers” eroded marginally and bent downwards, 50–75 µm, thick with cellular cortex 10–15 µm and a loose medullary layer beneath enclosing packets of a “violet” *Nostoc*, individual cells 3–5 µm diam. Lower cortex absent, and the visible lower surface appears cottony with bluish dots, representing the *Nostoc* glomerules. Towards the margin of the colonies there is a tendency to form flat, elongated (to 5 mm) marginal squamules with torn, eroded margins.

Apothecia and *pycnidia* unknown.

Chemistry. No substances detected by TLC.

Notes. An outstanding species, unlike any known in this genus, characterized by its finger-like, brittle protuberances which sometimes appear eroded and lace-like; they certainly function as dispersal units. In this character it resembles *Pannaria fimbriata* P. M. Jørg., a gelatinous species of the forest floor in Queensland (Jørgensen 2001c).

The thin, brittle thallus with a “violet” cyanobiont shows some similarity with the likewise exceptional *Parmeliella palmatula* P. M. Jørg. from Queensland in Australia. They appear to represent a most distinctive paleotropical part of the genus, possibly needing some kind of taxonomic recognition, but unfortunately at present not known with fully developed apothecia.

Habitat and distribution. As yet known only from the Mulu region in Borneo, and probably quite rare since B. J. Coppins, who was aware of its distinctness in the field, did not collect it elsewhere. It may therefore be a local taxon being restricted to these dark forests.

Additional specimen examined. **Sarawak:** Mulu National Park, Melinau Gorge Park, 1975, B. L. Burt 8292 (E).

A new, corticolous species in *Protopannaria*

Among the material collected by W. Obermayer in Sichuan, a most characteristic species of the genus *Protopannaria* was discovered. It has no name, and is described below.

Protopannaria corticola P. M. Jørg. sp. nov.

Protopannariae pezizoidi similis, sed thallo corticola, melius evoluto, squamuloso, sporis minutis et glabris.

Typus: China, Sichuan, SE-Tibetan fringe Mountains (=Hengduan Shan), Daxue Shan, 57 km S of Kangding, Gongga Shan, Hailougou glacier and forest park, NW of Hailougou station, lateral margin area of glacier, 2980–3150 m, 28 July 2000, W. Obermayer 08893 (GZU—holotypus).

(Fig. 1H)

Thallus squamulose, 2–3 cm diam., greenish grey, mostly with white-pruinose margins, otherwise smooth, nearly shiny and corneous, 200–300 µm thick with a cellular upper cortex, 40–50 µm wide; no lower cortex, the medullary hyphae gradually merging into the richly developed blackish rhizohyphae. Cyanobiont *Nostoc* in clusters, individual cells 5–6 µm.

Apothecia common, sessile, to 2 mm broad with prominent, crenulate, white-rimmed

thalline margin and orange-brown, flat disc, internally with reduced proper exciple, to 25 µm wide. *Hymenium* resting on a distinct, pale brownish subhymenium of intricately interwoven hyphae, to 100 µm wide; the hymenium itself 150–200 µm high, I+ dingy blue. *Asci* subcylindrical, 100–130 × 10–15 µm, without internal amyloid apical structures, 8-spored. *Ascospores* colourless, simple, broadly ellipsoid, 12–15 × 7–10 µm, smooth, without visible exospore.

Pycnidia not observed.

Chemistry. No substances detected by TLC.

Notes. A most characteristic species, somewhat reminiscent of *Protopannaria pezizoides* (Weber) P. M. Jørg. & Ekman, because of its large orange-brown apothecia, but with a clearly different, better developed thallus and smaller, smooth spores in addition to the unusual habitat (see below).

Habitat and distribution. As yet known only from the type locality where it grows on *Rhododendron* and *Salix* in a montane forest.

The discovery of this apparently first, genuinely corticolous species of the genus in the Himalayas is of considerable phytogeographical interest. This small, bipolar genus (6 species) which has most species (4) in the subantarctic region (Jørgensen 2001b) is basically a genus of species growing on mosses, debris or turf, or occasionally found on rotting bark of trees in damp habitats.

Additional specimens examined. **China:** Sichuan: Hengdu, Daxue Shan, Hailougou glacier and forest park, surrounding area of Hailougou Station, 2940–3130 m, 2000, W. Obermayer 08589, 08597 p.p. (GZU).

Key to sorediate species of *Fuscopannaria* in SE Asia

- 1 Thallus subfoliose, of radiating squamules up to 3 cm diam. with distinct marginal lobes 2
- Thallus small-squamulose, individual squamules up to 3 mm diam., indistinctly lobed 5

- 2(1) Thallus partly pruinose with true marginal soralia, often capitate; boreal (Kamtchatka, Sakhalin) **F. ahlneri (P. M. Jørg.) P. M. Jørg.**
Thallus not pruinose, without true soralia; mostly subtropical to warm-temperate 3
- 3(2) Thallus with marginal gymnidia; temperate (India, Sichuan)
. **F. subgemmascens Upreti & Divkar**
Thallus with soredia-like margins formed by scars of dislocated lobules 4
- 4(3) Photobiont green, no lichen acids; Himalayan
. **F. granulifera P. M. Jørg. & Upreti**
Photobiont blue-green, with terpenoids and fatty acids; subtropical (S. India, Thailand, S. Korea) **F. siamensis P. M. Jørg. & P. Wolseley**
- 5(1) Squamules with gymnidia; subtropical **F. coeruleascens P. M. Jørg.**
Squamules with farinose or granular soredia; temperate 6
- 6(5) Soralia farinose, labriform on the “frosted” margins of the thallus; warm-temperate (Japan) **F. sorediata P. M. Jørg.**
Soralia granular on the margins of the the uniformly coloured thallus; cold-temperate 7
- 7(6) Thallus shiny grey- to red-brown with confluent isidioid soralia; boreal (Hokkaido-Ural) **F. confusa (P. M. Jørg.) P. M. Jørg.**
Thallus dull pale brown (fawn) with punctiform soralia; Himalaya
. **F. cyanogranulata P. M. Jørg.**

Key to the brightly coloured species of *Parmeliella* in East Asia

- 1 Thallus with a yellowish hue, medulla not coloured (Philippines, New Guinea) **P. flavida P. M. Jørg.**
Thallus grey-brown with strongly coloured medulla 2
- 2(1) Thallus greyish with citrine yellow medulla, lobes discrete, sometimes with isidia, spores shorter than 15 µm (Philippines, Borneo, New Guinea)
. **P. endolutea P. M. Jørg.**
Thallus brownish with orange medulla, lobes confluent, sometimes lobulate, spores longer than 15 µm (widespread in the paleotropics, see Jørgensen & Sipman 2006) **P. endomilta Vain.**

I am above all indebted to my friends Brian Coppins (Edinburgh) and Walter Obermayer (Graz) for putting their interesting collections at my disposal. Brian Coppins also most kindly made useful comments on the manuscript. In preparing this paper and in the study of the material, I have been generously supported by Mr Jan Berge, Mrs A. Botnen, Mrs B. Helle and Dr T. Tønsberg, all working in my department in Bergen. Jack Elix (Canberra) has kindly tried to identify the yellow pigments. To all of them my most sincere thanks.

REFERENCES

- Henssen, A. (1969) Die Entstehung des Thallusrandes bei den Pannariaceen (Lichenes). *Berichte der Deutschen Botanischen Gesellschaft* **82**: 235–248.
- Jørgensen, P. M. (1991) On some Fennoscandian *Pannaria* species. *Annales Botanici Fennici* **28**: 87–91.
- Jørgensen, P. M. (2000a) Notes on some East-Asian species of the lichen genus *Fuscopannaria*. *Journal of the Hattori Botanical Laboratory* **89**: 247–259.
- Jørgensen, P. M. (2000b) On the sorediate counterparts of the lichen *Fuscopannaria leucosticta*. *Bryologist* **103**: 104–107.
- Jørgensen, P. M. (2001a) Survey of the lichen family Pannariaceae on the American continent, North of Mexico. *Bryologist* **103**: 670–704.
- Jørgensen, P. M. (2001b) Studies in the lichen family Pannariaceae X. The lichen genus *Protopannaria* in the subantarctic islands. *Cryptogamie, Mycologie* **22**: 67–72.

- Jørgensen, P. M. (2001c) New species and records of the lichen family Pannariaceae from Australia. *Bibliotheca Lichenologica* **78**: 109–139.
- Jørgensen, P. M. (2002a) Further notes on Asian species of the lichen genus *Fuscopannaria*. *Journal of the Hattori Botanical Laboratory* **91**: 225–229.
- Jørgensen, P. M. (2002b) *Krosowia*, a new genus in the Pannariaceae (lichenized ascomycetes). *Lichenologist* **34**: 297–303.
- Jørgensen, P. M. (2003) Notes on some misunderstood, subtropical *Parmeliella* species. *Bryologist* **106**: 121–129.
- Jørgensen, P. M. (2005) Additions to the Pannariaceae of North America. *Bryologist* **108**: 255–258.
- Jørgensen, P. M. & Kashiwadani, H. (2001) New or misunderstood Japanese *Pannaria* species. *Journal of Japanese Botany* **76**: 1–10.
- Jørgensen, P. M. & Sipman, H. J. M. (2002) The lichen genus *Erioderma* in South-east Asia. *Annales Botanici Fennici* **39**: 201–211.
- Jørgensen, P. M. & Sipman, H. J. M. (2006) The lichen family Pannariaceae in the montane regions of New Guinea. *Journal of the Hattori Botanical Laboratory* **100**: 695–720.
- Upreti, D. K., Divakar, P. K. & Nayaka, S. (2005) Notes on Indian pannariaceous lichens. *Nova Hedwigia* **81**: 97–114.

Accepted for publication 5 February 2007