

The lichen genus *Tuckneraria* Randlane & Thell — a new segregate in the Parmeliaceae

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The new lichen genus *Tuckneraria* Randlane & Thell is described. The separation from *Nephromopsis* is based mainly on anatomical characters in the reproductive structures, such as shape and size of ascospores and structures of exciple and ascus, but also on morphological characters — thallus surface features and the presence of cilia. The genus *Tuckneraria* includes the three species *T. laureri* (Kremp.) Randlane & Thell, *T. laxa* (Zahlbr.) Randlane & Thell, *T. pseudocomplicata* (Asah.) Randlane & Saag and the newly described *T. ahtii* Randlane & Saag. *Nephromopsis nipponensis* (Asahina) M.J.Lai is considered synonymous with *Tuckneraria pseudocomplicata*.

Key words: lichenized Ascomycotina, *Nephromopsis*, Parmeliaceae, *Tuckermannopsis*, *Tuckneraria*

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INTRODUCTION

The generic complex comprising *Cetrariopsis*–*Cetrellopsis*–*Nephromopsis* (Ascomycotina, Parmeliaceae) has so far not been monographed on a worldwide basis. The species within these rare Asiatic genera are poorly known and have been referred to during the last few decades only in some local floristic studies (Rassadina 1971, Golubkova 1981, Awasthi 1982, Park 1990, Kurokawa 1991), with the exception of a significant paper on cetrarioid lichens of East Asia (Lai 1980). A team of researchers is now carrying out a detailed study of this group and the present paper is the first report of the project.

Until recently, the genus *Nephromopsis* Müll.Arg. has been delimited mainly on the basis of morphological and chemical characters (Lai 1980, Randlane & Saag 1991, 1992) such as loosely attached foliose thallus; the tendency of marginal apothecia to be situated on the lower surface; the presence of laminal pseudocyphellae over the lower cortex; the occurrence of pycnidia, frequently on emergent projections, marginally and/or laminally; the complex of secondary compounds including usnic acid, fatty acids, orcinol depsides and depsidones and anthraquinones. However, anatomical studies of ascocarps clearly demonstrate that species

treated under this genus vary significantly in their shape of ascospores, ascus type and excipular structure. As the division of species into groups based on anatomical qualities is also correlated with morphological characters, the segregation of a new genus is fully justified.

MATERIAL AND METHODS

About 250 herbarium specimens from B, DUKE, FH, GZU, H, KW, LD, M, MB, S, TAIM, TNS, TU, UPS, US, the majority of them belonging to *T. laureri* (Kremp.) Randlane & Thell, were studied. Chemical analyses according to the standardized TLC methods (Culberson 1972, 1974) were carried out in Tartu University. The acetone extracts were run in solvent systems B, C and G (Culberson et al. 1981). After spraying with 10% sulphuric acid, the plates were air dried and then heated at about 100–120°C for up to 15 min.

Anatomy of ascocarps and conidiomata was examined at the University of Lund. Sections were made with a Kryomat, Leitz freezing microtome and stained in lactophenol cottonblue. After pretreatment with 10% KOH solution, asci were squashed in a 0.3% Lugol's solution. The characters were studied with a Zeiss Axioscope light microscope, and photomicrographs made with a Zeiss M 35 W camera.

TAXONOMY

Tuckneraria Randlane & Thell, *gen. nova*

Thallus foliaceus, mediocris (ad 7 cm latus), pallide flavescens, virescens vel glaucus; laciniae oblongae aut suborbiculares; partim ascendentes; marginibus interdum ciliatis; margine sorediata aut soredia desunt. Superficies inferior pallida, fusca vel nigra; pseudocyphellata; rhizinata. Apothecia marginalia, orbicularia vel reniformia, ad 10 mm lata; sporae 8-nae, subglobose, 5–7 × 4–5 µm; asci 30–50 × 10–14 µm. Pycnidia marginalia, papillaria vel spinuliformia; conidia 4–5 × 1–1.5 µm, extremis nonnihil inflatis.

Type species: *Tuckneraria pseudocomplicata* (Asahina) Randlane & Saag

Thallus foliose, medium (to 7 cm broad), smooth or only slightly rugose; light yellow, yellowish-green or yellowish-grey, +/- loosely attached to the substratum; lobes elongate or rounded, with ascending margins and numerous or occasional marginal cilia; with or without marginal soredia; lower surface whitish, light to dark brown or black; white or light brown, usually small and plain pseudocyphellae situated on lower cortex; rhizines simple, at times long and numerous; both cortices paraplectenchymatous; cortical hyphae strongly gelatinized.

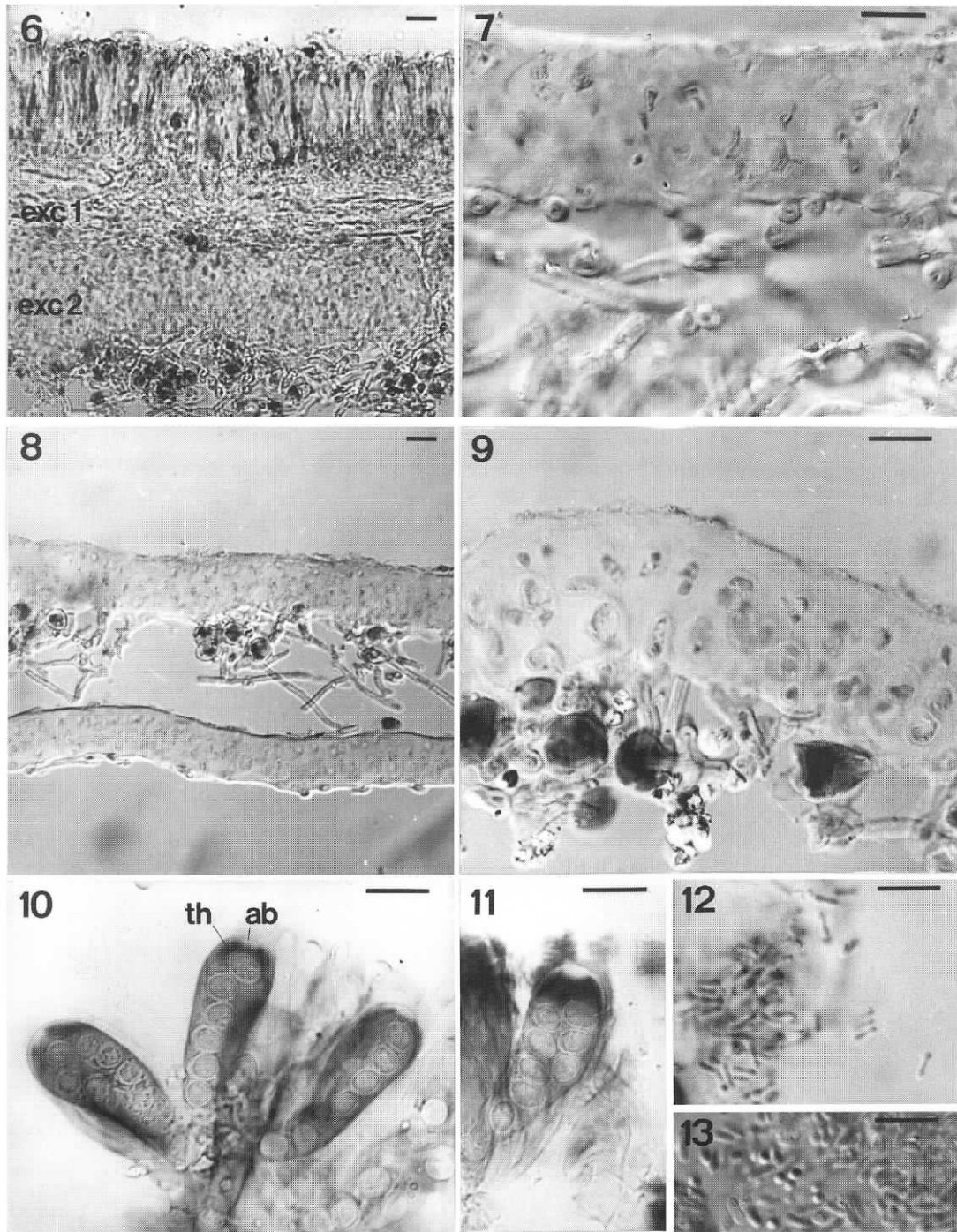
Apothecia marginal, disc brown, rounded or reniform, to 10 mm in diameter, facing up- or downwards; exciple 2-layered; ascospores simple, globose - subglobose, 5–7 × 4–5 µm, 8 per ascus; asci 30–50 × 10–14 µm, clavate, spores arranged +/- uniseriately; asci *Tuckermannopsis*-type (Kärnefelt et al. 1992) with rather small tholus, very broad ocular chamber and broad axial body (2.5–4 µm). Pycnidia on marginal (occasionally laminal on both surfaces) emergent projections; pycnoconidia bifusiform, 4–5 × 1–1.5 µm.

Chemical constituents: usnic acid +/- in the cortex; lichesterinic- and protolichesterinic-type fatty acids, caperatic acid and orcinol depsidones (physodic, conphysodic, alectoronic, collatolic acids) in the medulla.

The name for the new genus is compiled from the names of the related lichen genera *Tuckermannopsis* and *Nephromopsis*, combining them with *Cetraria*. The species within *Tuckneraria* are morphologically reminiscent of the species in *Nephromopsis* but in ascocarp anatomy more like *Tuckermannopsis*. These two genera are probably the most closely related entities to the new genus. Still, there are certain differences even in the morphological characters between *Nephromopsis* and *Tuckneraria* (Figs. 1–5): the thallus of the species within *Nephromopsis* is usually coriaceous, thick and often strongly

Figs. 1–5. Morphology of the genus *Tuckneraria*. — 1: *T. ahtii*, part of the frequently ciliated thallus, China, Yunnan, Handel-Mazetti 660 (US). — 2: *T. laureri*, showing the sorediate margin and the marginal apothecium, Austria, Stubai Alpen, 1958 Steiner (LD). — 3: *T. pseudocomplicata*, part of the ciliated thallus; Japan, Shikoku, Awa, Fujikawa 29560 (TNS). — 4: *T. laxa*, characterized by the same type of cilia; Taiwan, Miaoli Co., Lai 7770 (TAIM). — 5: Lobes of the same specimen with marginal pycnidia and cilia. Scale in Figs. 1, 2, 4 = 1 cm, in Figs. 3, 5 = 1 mm. p = pycnidia, s = soredia.





reticulated or rugose; the lobes are usually rounded, not elongate; the marginal cilia are absent; pseudocyphellae on the lower surface are large, well delimited, either on special outgrowths or concave. In *Tuckneraria* cortical hyphae are always strongly gelatinized (Figs. 7–9). The ascospores of these two genera essentially differ, being ellipsoid in *Nephromopsis* and subglobose in *Tuckneraria*, while the anatomical characters of exciple (Fig. 8) and asci (Figs. 6, 10, 11) present similarities as well as differences (Table 1). Pycnoconidia are bifusiform ($5 \times 1\text{--}1.5 \mu\text{m}$) in both genera (Figs. 12, 13). Secondary chemistry of *Nephromopsis* and *Tuckneraria* is similar: both have usnic acid in the cortex; both have lichesterinic- and protolichesterinic-type fatty acids and occasionally caperatic acid in the medulla together with the orcinol depsidones physodic and conphysodic acids; a few *Nephromopsis* species also contain orcinol de-pside olivetoric acid and the anthraquinone en-docrocin or secalonic acid, none of which are present in *Tuckneraria*.

The best characters for the separation of *Tuckneraria* from *Nephromopsis* are the general habit of the thallus and the ascospore shape. Species within *Tuckermannopsis* are easily separated from both genera by their lack of pseudocyphellae on the lower cortex.

The genus *Tuckneraria* includes 4 species growing on deciduous and coniferous trees mainly in eastern and south-eastern Asia.

Tuckneraria ahtii Randlane & Saag, *spec. nova*

Thallus foliaceus, laciniae 4–10 mm latae; marginibus interdum ciliatis; superficies superior virescens vel fuscescenti-flavens. Superficies infe-

rior pallide fusca, in centro fere nigra, pseudocyphellata; rhizinae fuscae, ad 5 mm longae. Apothecia marginalia, ad 8 mm longa et 5 mm lata; ascosporae subgloboseae, $5\text{--}7 \times 4\text{--}5 \mu\text{m}$; asci clavati, $30\text{--}50 \times 10\text{--}14 \mu\text{m}$. Pycnidia marginalia, papillaria vel spinuliformia; conidia $5 \times 1\text{--}1.5 \mu\text{m}$ recta, extremis nonnihil inflatis. Acidum usnicum +/- in cortice superiore; acidum lichesteranicum et protolichesteranicum in medulla.

Type: China. Prov. Yunnan, Lijiang County, Mt. Yulongshan, lower central E slope, Ganheba, 3 200–3 300 m, $27^{\circ}06'N$, $100^{\circ}14'E$, on *Abies*, 23 April 1987, *Teuvo Ahti*, *Jian-Bin Chen & Li-Song Wang*, 46 649 (H, holotype; TU, isotype).

Thallus foliose, upper surface pale glaucous or yellowish-brown, lower surface light to dark brown or almost black in central parts. Lobes rounded at the tips but usually elongate in general habit, 4 to 10 mm wide, bearing conspicuous black marginal pycnidial projections and sometimes also numerous or occasional pale or brown cilia (Fig. 1). Pseudocyphellae on lower cortex plain, white or light brown, infrequent on some specimens. Rhizines brown, simple, sometimes very long, to 5 mm, and numerous.

Apothecia marginal, with oblong or reniform brown disc, to 8×5 mm; ascospores subglobose, $5\text{--}7 \times 4\text{--}5 \mu\text{m}$; asci $30\text{--}50 \times 10\text{--}14 \mu\text{m}$, narrowly clavate; axial body $2.5\text{--}4 \mu\text{m}$. Pycnidia on emergent projections, usually marginal and numerous, some laminal pycnidial projections may be present on both surfaces (on the lower cortex growing out from rim of pseudocyphellae); pycnoconidia bifusiform, $5 \times 1\text{--}1.5 \mu\text{m}$ (Fig. 12).

Chemistry: usnic acid present or absent in the cortex; lichesterinic- and protolichesterinic-

Figs. 6–13. Anatomy of the genus *Tuckneraria*. — 6: Cross section of an apothecium of *T. pseudocomplicata*, showing the two layered exciple. Japan, Honshu, *Tagawa* 319 (US). — 7: Upper cortex of *T. laureri*; Austria, Tirolia, *Zahlbruckner* 463 (LD). — 8: *T. laxa*, cross-section of thallus with strongly gelatinized hyphae; Taiwan, Miaoli Co., *Lai* 7770 (TAIM). — 9: Upper cortex of *T. pseudocomplicata* with strongly gelatinized cortical hyphae; Japan, Honshu, *Tagawa* 319 (US). — 10: Asci of *T. laureri*, with a small tholus and a rather broad axial body; *Zahlbruckner* 463 (LD). — 11: Asci of *T. ahtii*; China, Xizang, *Zong Yu-chen & Liao Yin-shang* 307 (LD). — 12: Pycnoconidia of *T. ahtii*; Nepal, Himalayas, *Miehe* 11836 (GZU). — 13: Pycnoconidia of *T. laureri*, Austria, Stubai Alpen, *Steiner* 1958 (LD). Scale = 10 μm ; exc 1 = upper excipular layer, exc 2 = lower excipular layer, th = tholus, ab = axial body.

Table 1. Comparison of characters of *Tuckneraria* with those of the related genera *Nephromopsis* and *Tuckermannopsis*.

	<i>Nephromopsis</i>	<i>Tuckneraria</i>	<i>Tuckermannopsis</i> s. str.
Thallus	foliose, coriaceous	foliose, paper thin	foliose, paper thin
Lobe shape	rounded	rounded to elongate	elongate
Lower surface	rugose or reticulated	+/- smooth	smooth
Marginal cilia	absent	present	present
Pseudocyphellae on lower surface	large, distinct	small, indistinct	absent
Exciple	3-layered	2-layered	2-layered
Asci	30–70 x 9–14 µm	30–50 x 10–14 µm	25–40 x 8–15 µm
Ascospores	ellipsoid, 5–10 x 2.5–5 µm	subglobose, 5–7 x 4–5 µm	globose, 3.5–5 x 3.5–5 µm
Axial body	2–4 µm	2.5–4 µm	3–4 µm
Cortical substances	usnic acid	usnic acid	atranorin
Medullary substances			
a) fatty acids	present	present	present
b) secalonic acids	present	absent	absent
c) orcinol depsides & depsidones	olivetoric or physodic acid	alectoronic, collatolic, physodic acid	alectoronic, collatolic, olivetoric or physodic acid

type fatty acids always present in medulla, while caperatic acid is an accessory substance.

Distribution: China, Nepal, Taiwan.

Specimens of this lichen species have usually been erroneously identified as *Nephromopsis delavayi* Hue, even though several characters do not correspond with the original description of *N. delavayi* (Hue 1899–1900). The most important character is the shape and size of the ascospores: *N. delavayi* has ellipsoid ascospores (7–11 x 4–5 µm) and therefore probably belongs to the genus *Nephromopsis*, while the ascospores of the species described here are subglobose (5–7 x 4–5 µm). Other characters such as the size and reticulation of the thallus, absence of cilia and the apothecial measurements highlight the essential differences between these two entities. According to Lai (1980), the type material of *N. delavayi* contains secalonic acid and is morphologically identical with *Nephromopsis ornata* (Müll.Arg.) Hue. We are in agreement

about the synonymy of *N. delavayi* with *N. ornata* proposed by Lai but propound here a new species, *Tuckneraria ahtii*, to include the specimens that in many herbaria have been wrongly determined as *N. delavayi*. Teuvo Ahti collected wonderful material from China, Yunnan, and it was in the Helsinki herbarium in 1992 that we first began to speculate about the new species.

Specimens examined — China. Prov. Yunnan, Mt. Yulongshan near Lijiang, 3 450–3 500 m, *Handel-Mazzetti* 3563 (US, FH), Lijiang County, Mt. Ndaza Ko, 4 000 m, *Rock (Zahlbruckner-Redinger)*: Lich. Rar. Exs. 31 S); Lijiang County, Yangtze watershed, eastern slopes of Lijiang Snow Range, *Rock 11 773* (UPS); Prov. Xizang, 3 300 m, *Zong Yu-chen & Liao Yin-shang* 307. Nepal. Langtang area, Pamdang Karpo, 4 620 m, *Miehe 13 056f* (GZU), Langschisa Glacier, 4 090 m, 4 400 m, 4 480 m, 4 530 m *Miehe 11 725b, 13 846, 12 424, 11 835* (GZU), Dupku, Helambu, 4 090 m, *Miehe 7396e* (GZU), Pangtang, 4 300 m, *Miehe 2284* (GZU). Taiwan. Prov. Taichung, Mt. Armashan, *Lai 6860* (TAIM).

Tuckneraria laureri* (Kremp.) Randle & Thell, *comb. nova

Cetraria laureri Kremp., Flora 34: 673. 1851. — *Nephromopsis laureri* (Kremp.) Kurok., J. Jap. Bot. 66: 156. 1991.

Cetraria complicata Laurer in Fr., Lichenogr. Eur. Ref.: 459. 1831 (nomen nudum).

Cetraria straminea Kremp. ex Schwend. in Nägeli, Beitr. Wiss. Bot. 2: 154. 1860; syn. nov.

Thallus light yellow on upper surface, white to pale brown on lower surface. Lobes rounded, up to 5 mm broad, ascending in the margins, bearing marginal soredia (sometimes almost isidia-like structures) and scattered cilia (Fig. 2). Pseudocyphellae on lower cortex white, plain, rounded or irregular, often surrounded by a light brown line, at times absent from some specimens. Rhizines scattered.

Apothecia very rare, marginal, with brown disc and sorediose thalline margin; ascospores subglobose, 5–6 × 4–4.5 µm; asci clavate, 35–45 × 10–12 µm (Fig. 10); axial body 2.5 µm. Pycnidia on marginal emergent projections; pycnoconidia bifusiform, 5 × 1–1.5 µm (Fig. 13).

Chemistry: usnic acid in the cortex; lichensterinic- and protolichensterinic-type fatty acids in the medulla. Medulla Pd–, K–, C–, KC–.

Distribution: montane forests of Central Europe (the Alps, the Carpathians); Asia (Russia, China, Mongolia, Japan, Nepal); South America (Venezuela, Colombia).

T. laureri is the only sorediate taxon within the *Cetrariopsis*–*Nephromopsis*–*Tuckneraria* complex, thus representing a 'secondary' species. In accordance with the 'species-pairs' theory (Poelt 1970), it is the most widely distributed of all other — 'primary' — species discussed here, growing widely in Eurasia and found also in the northern part of South America. Because of its superficial morphological similarity (yellowish thallus, marginal soredia) to the North American and European lichen *Tuckermannopsis oakesiana* (Tuck.) Hale, it has sometimes been confused with it. However, *Tuckneraria laureri* and *Tuckermannopsis oakesiana* cannot be phylogenetically closely related because of essential differences in their reproductive structures and secondary chemistry. The present generic position of the former species is not satisfactory either, but this problem will be discussed in a future paper.

More than 170 specimens were examined from different parts of the whole distribution area.

Selected specimens examined — Austria. Steiermark, See-Eben, 1 400 m, *Poelt* (GZU); Tirol, Allgäu, 1 720 m, *Schauer* (M). Germany. Salzburg, Radstadt, 1 320 m, *Schauer* (M); Oberbayern, Garmisch, 1 280 m, *Schauer* (M). Italy. Tirol, Bolzano, *Hausmann* (Erbar. Crittog. Ital., 464; M, S). Yugoslavia. Alpes Julia, Pokljuka, Rudno Polje, 1 800 m, *Vězda*, Lich. Sel. Exs. 847 (LD, S). Romania. Hunedoara, Retezat Mts., 45°23'N 22°49'E, 1 450–1 550 m, *Moberg 10 765* (UPS). Ukraine. Zakarpatska region, district Rahivska, Velikii Bichkiv, 800 m, *Makarevich 8261* (KW). China. Sikang, Kangting, Chungo Valley, Yara, 4 050 m, *Smith 14 011* (UPS). Japan. Honshu, Prov. Shinano, Mt. Takeshi-mine, 1 700 m, *Kashiwadani 15 043* (TNS). Mongolia. Ara-Khangai region. Zenkher district, Suvruga ridge, 2 200 m, *Biazrov 714* (LD). Nepal. Langtang area, Dubku Helambu, 4 090 m, *Miehe 7396e* (GZU). Russia. Irkutsk region, Hamar-Daban Mt. Range, Bolshaya Osinovka, *Trass 1031* (TU); Habarovsk region, Badzhal Mt. Range, Urmi, *Randle 208* (TU). Colombia. Risaralda, volcano Santa Rosa, 4°49'N, 75°28'W, 4 130 m, *Wolf 1172* (B). Venezuela. Merida, Apartaderos, 8°45'N, 70°45'W, 3 500 m, *Kalb* (LD).

Tuckneraria laxa* (Zahlbr.) Randle & Thell, *comb. nova

Nephromopsis ciliaris (Ach.) Hae var. *laxa* Zahlbr., Fedde, Repert. 33: 61. 1933. — *Nephromopsis laxa* (Zahlbr.) M.Sato, J. Jap. Bot. 14: 783. 1938. — *Cetraria laxa* (Zahlbr.) Sato, Parmeliales (I), in Nakai et Honda, Nova Flora Japonica 5: 51. 1939.

Cetraria daibuensis Räsänen, J. Jap. Bot. 16: 85. 1940. — *Nephromopsis daibuensis* (Räsänen) Räsänen, Kuopion Luonnon Yst. Yhd. Julk. B 2(6): 47. 1952.

Thallus pale yellow on both surfaces, lobes elongate and narrow (up to 2 mm broad) with abundant marginal cilia, yellowish-brown or darker brown to black at the tips. Pseudocyphellae on lower cortex in the form of tiny, white, plain spots. Rhizines scattered, simple or occasionally branched.

Apothecia very rare, marginal, with a brown rounded disc; ascospores subglobose, 5 × 4 µm; asci clavate, 40–45 × 12–13 µm; axial body 3 µm. Pycnidia marginal, on +/- emergent projections. Pycnoconidia not seen.

Chemistry: usnic acid in the cortex; lichensterinic- and protolichensterinic-type fatty acids in the medulla. Medulla Pd–, K–, C–, KC–.

Distribution: endemic to Taiwan.

This species stands somewhat alone in the genus due to its highly characteristic morphology (uniformly pale colour of the thallus on both surfaces, narrow and elongate lobes, abundant marginal cilia, extremely small pseudocyphellae) (Figs. 4, 5). Evidently its distribution is restricted to the island of Taiwan. However, the presence of pseudocyphellae on the lower cortex and marginal position of apothecia in *T. laxa*, as well as the anatomical structures of the asci and thallus (Fig. 6), clearly place it in *Tuckneraria*.

Specimens examined — Taiwan. Nimandaira, Mt. Arisan, Asahina, (H). Miaoli County, Mt. Dapachienshan, Lai 7770 (TAIM). Hua-lien County, Shyu-lin village, 2 700 m, Koponen 18 024 (H).

***Tuckneraria pseudocomplicata* (Asah.)
Randlane & Saag, comb. nova**

Cetraria pseudocomplicata Asahina, J. Jap. Bot. 12: 804, 1936. — *Nephromopsis pseudocomplicata* (Asahina) M.J. Lai, Quart. J. Taiwan Mus. 33: 224, 1980.

Cetraria rhytidocarpa Mont. & Bosch f. *nipponensis* Asah., J. Jap. Bot. 24: 228, 1954; syn. nov.

Nephromopsis nipponensis (Asahina) M.J. Lai, Quart. J. Taiwan Mus. 33: 223, 1980.

Thallus greenish on upper and white or light brown on lower surface. Lobes rounded, to 7 mm broad, bearing scattered marginal cilia (Fig. 3). Pseudocyphellae on lower cortex not numerous; in the form of rounded or irregular white, small, plain patches, often with light brown margins. Rhizines pale, simple, long (to 3 mm). Apothecia marginal, rounded or reniform, to 6 mm in diameter, with reddish-brown disc; exciple 2-layered (Fig. 6); ascospores subglobose, 5–6 × 4–5 µm; asci clavate, 30–35 × 12–14 µm; axial body 3.5 µm. Pycnidia numerous, situated on marginal emergent projections; pycnoconidia bifusiform, 5 × 1–1.5 µm.

Chemistry: usnic acid present or absent in the cortex; as for the medullary compounds, two different chemotypes can be distinguished. The first chemotype, formerly *Nephromopsis pseudocomplicata*, contains aleatoronic acids (α and β forms) as the major, and α -collatolic acid as a minor substance in the medulla; lichesterinic- and protolichesterinic-type fatty acids may occur rarely. The second chemotype,

formerly *Nephromopsis nipponensis*, contains equally constantly orcinol depsidones physodic and conphysodic acids as well as lichesterinic- and protolichesterinic-type fatty acids. Both chemo-types respond similarly to medullary colour tests: Pd–, K–, C–, KC+ red and no morphological or anatomical differences.

Distribution: Eastern Asia (Sakhalin island, Japan, Taiwan).

T. pseudocomplicata is chosen to be the type species of the new genus because of its supposed central position in this group of taxa. It evidently has some affinities to all the species in *Tuckneraria*. Its chemical diversity can be interpreted in terms of evolutionary potential.

About 60 specimens were examined from Japan and Taiwan.

Selected specimens examined — The first chemotype with aleatoronic acids. Japan. Prov. Suruga, Mt. Fuji, Culberson & Culberson 10 805, 10 807 (US), Lake Saiko, Culberson & Culberson 10 803 (M); Prov. Yamanashi, Adzumazawa, Mitomimura, 2 300 m, Omura 395 (US); Prov. Shinano, Mt. Tadesina, Kurokawa 51 747 (M), Mt. Yatsugatake, Kurokawa 58 303 (TAIM); Honshu, Prov. Nara, Mt. Odaigakara, Tagawa 319, Komagatake, Faurie 6759, Taiwan. Taitung County, Yakou, 2 750 m, Lai 9484 (US) — besides aleatoronic acids also lichesterinic- and protolichesterinic-type fatty acids.

The second chemotype with physodic, conphysodic, lichesterinic and protolichesterinic acids. Japan. Prov. Kai, Mt. Yatsu-ga-take, Asahina (lectotype of *Cetraria rhytidocarpa* f. *nipponensis*; DUKE); Prov. Musashi, Mt. Kumatori, 1 900 m, Shibuichi, 4533 (Kurokawa: Lich. Rar. Crit. Exs. 153; H, LD, M, TAIM, TU); Prov. Musashi, Tiibu, Mt. Ryogami, Kurokawa 55 0573-b (M); Prov. Hida, Mt. Ontake, Asahina, Lich. Jap. Exs. 56, (H); Honshu, Koponen (H).

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