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Lichen genera *Alectoria*, *Bryoria* and *Sulcaria* from India and Nepal

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&

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RÉSUMÉ

AWASTHI, G. & D. D. AWASTHI (1985). Les genres lichéniques *Alectoria*, *Bryoria* et *Sulcaria* en Inde et au Népal. *Candollea* 40: 305-320. En anglais, résumé français.

Cet article traite d'études morphotaxonomiques détaillées d'une espèce unique d'*Alectoria* Ach. s. str. de quatorze espèces de *Bryoria* Brodo & Hawksw., et de deux espèces de *Sulcaria* Bystr. réparties dans les régions himalayennes de l'Inde et du Népal. *Bryoria levis* Awas. et *B. nepalensis* sont des espèces nouvelles décrites ici.

ABSTRACT

AWASTHI, G. & D. D. AWASTHI (1985). Lichen genera *Alectoria*, *Bryoria* and *Sulcaria* from India and Nepal. *Candollea* 40: 305-320. In English, French abstract.

The paper deals with the detailed morpho-taxonomic studies of the single species of *Alectoria* Ach. s. str., fourteen species of *Bryoria* Brodo & Hawksw., and two species of *Sulcaria* Bystr. distributed in the Himalayan region of India and Nepal. *Bryoria levis* Awas. and *B. nepalensis* Awas. are described as new species.

Introduction

Regional investigations on the genus *Alectoria* Ach. s. lat. by several workers (MOTYKA, 1964; BYSTREK, 1969, 1971 and HAWKSWORTH, 1970, 1972) ultimately culminated in the recognition of its three segregate genera *Alectoria* Ach. s. str., *Bryoria* Brodo & Hawksw. and *Sulcaria* Bystr. (BRODO & HAWKSWORTH, 1977). These three genera are represented by a total of 17 species in the Himalayan region of India and Nepal. Information of taxonomic significance is given under each species treated.

In general, the cortex in all the taxa is typically composed of compact, longitudinally disposed hyphae and appears prosoplectenchymatous in transverse sections of thallus mounted in water or in cotton blue. But, addition of K solution to the sections tends to separate or disperse the hyphae from each other (except sometimes as in *Bryoria nitidula*) indicating an imperfect fusion of hyphal walls. Unless soredia are present, the breaks or openings in the cortex are referred to pseudocyphellae.

Materials and methods

The investigations presented in this paper are based on the specimens preserved in the herbaria of: Botany Department, Lucknow University (LWU); Botanical Museum, Helsinki University (H); Botanische Staatssammlung, München (M); University of Uppsala (UPS); Central National herbarium, Botanical Survey of India (CAL) and the personal herbarium of D. D. Awasthi (Awas.). The usual methods used in lichenology have been adopted. The thin layer chromatography (TLC) observations are based on the methods suggested by CULBERSON (1972), and WALKER & JAMES (1980) by the use of the solvent A (toluene/benzene, 1-4 dioxan and acetic acid) on glass plates coated by silica gel in the laboratory.

Key to the genera

- 1a. Thallus cortex longitudinally furrowed and with transverse bands, spore simple, hyaline becoming 1-3 septate and brown at maturity **Sulcaria**
- 1b. Thallus not furrowed 2
- 2a. Thallus yellow to greenish yellow, if thallus fertile, spores brownish, simple, 20-45 μm long **Alectoria**
- 2b. Thallus grey, grey brown to brown black, spores hyaline, simple, 4-15 μm long **Bryoria**

Genus **Alectoria** Ach. s. str. Brodo & Hawksw., Opera Bot. 42: 56. 1977.

A single species is known from alpine Himalayas in Nepal.

Alectoria ochroleuca (Hoffm.) Mass., Sched. Crit. Lich. Ital.: 47. 1855.

= *Usnea ochroleuca* Hoffm., Descr. Adumbr. Pl. Lich. 2(1): 7. 1791. Type not seen.

Thallus terricolous, erect to decumbent, up to 8 cm tall, pale yellow to yellow; branching anisotomic dichotomous; branches up to 2 mm in diam., tapering and brown black apically; surface dull to shining; pseudocyphellae sparse to dense, white, raised, oblong to elongate; isidia and soredia absent. Cortex 80-120 μm thick; medullary hyphae superficially granulated, 6-10(14) μm thick. Apothecia absent. TLC: usnic acid and an undetermined bluish spot at Rf value 0.56.

Specimens examined

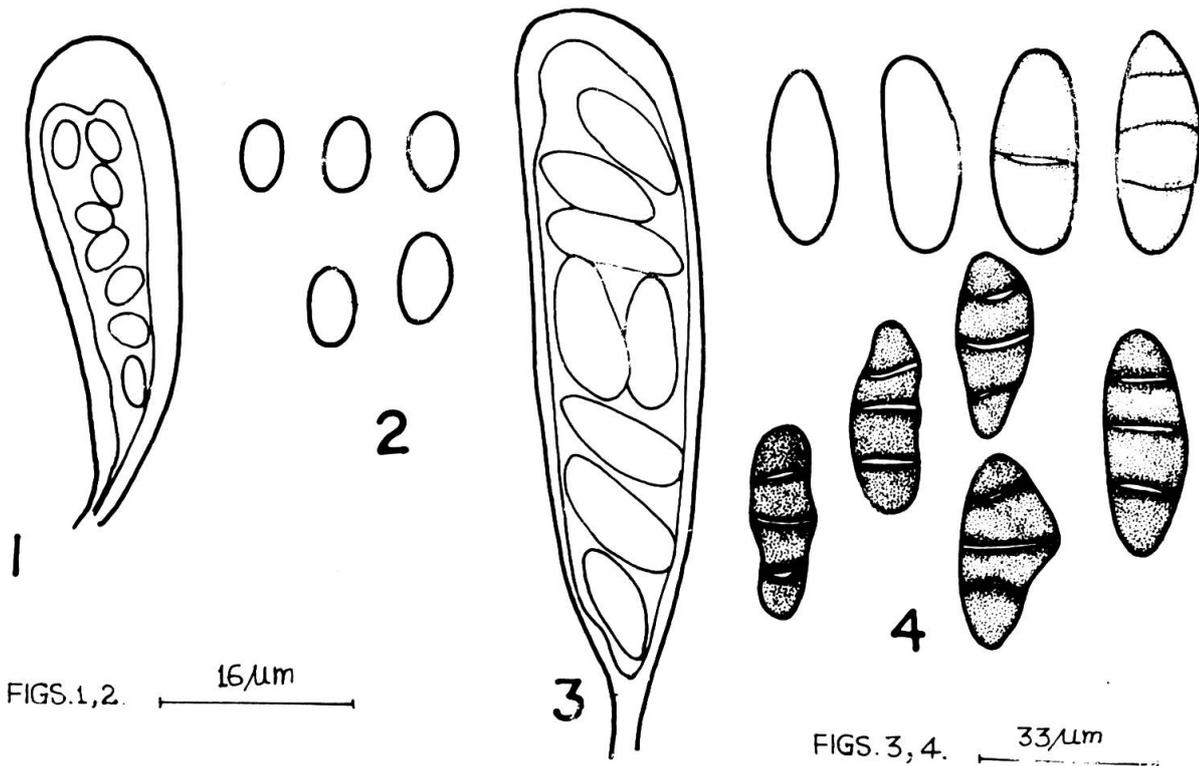
Nepal: Solukhumbu, Ama Dablam, alt. 4600 m, on soil, Shrestha 10c, comm. Sharma (Awas.); Mahalangur Himal, Khumbu, Hohe W Lobuche, alt. ca. 5100 m, *Poelt L 809, L 811* (M); det. Bystrek, 1966.

Genus **Bryoria** Brodo & Hawksw., Opera Bot. 42: 78. 1977

The following key pertains to the 16 species that are reported to occur in the area under treatment. Our observations on the occurrence of the two taxa, *B. asiatica* and *B. nadvornikiana*, are given at the end.

Key to the species

- 1a. Thallus sorediate, soralia with tufts of isidioid spinules 2
- 1b. Thallus esorediate 9
- 2a. Medulla P+ orange red (fumarprotocetraric acid) 3
- 2b. Medulla P—, no lichen product 8
- 3b. Soralia broader than the branch 4
- 3b. Soralia narrower than the branch 6
- 4a. Thallus erect, black, up to 4 cm tall, main branches ca. 0.6 mm in diam., soralia ca. 1.5 \times 1 mm, medulla K— **11. B. poeltii**
- 4b. Thallus pendulous to subpendulous, medulla K+ yellow 5
- 5a. Thallus pendulous, pale yellow to brown, soralia sometimes broader than the branch, soredia white; psoromic acid **5. B. implexa**
- 5b. Thallus subpendulous, brown to black, soralia usually broader than the branch, soredia greenish white; barbatolic acid [**B. nadvornikiana**]
- 6a. Medulla K+ yellow to red 7
- 6b. Medulla K—, thallus erect, up to 3 cm tall, branching isotomic dichotomous, main branches up to 0.5 mm in diam. **3. B. furcellata**



Figs 1 & 2. — *Bryoria nepalensis* Awas.

1. Ascus with spores; 2. Spores.

Figs. 3 & 4. — *Sulcaria sulcata* (Lév.) Bystr. ex Brodo & Hawks.

3. Ascus with spores; 4. Spores.

- 7a. Thallus erect to pendulous, branching anisotomic dichotomous, branches twisted, up to 1 mm in diam. 10. **B. perspinosa**
- 7b. Thallus pendulous, branching isotomic dichotomous, main branches up to 0.3 mm in diam., soralia elongate, narrow slit-like 5. **B. implexa**
- 8a. Soralia turning brown black, branching anisotomic dichotomous, lax, main branches up to 0.5 mm in diam., thallus more or less pendulous, fertile 14. **B. variabilis**
- 8b. Soralia white, thallus erect, branching isotomic dichotomous to anisotomic dichotomous, main branches up to 1 mm in diam., sterile 12. **B. smithii**
- 9a. Medulla P+ orange red (fumarprotocetraric acid) 10
- 9b. Medulla P—, no lichen product 14
- 10a. Thallus more or less erect, up to 8 cm tall 11
- 10b. Thallus pendulous, more than 10 cm long 12
- 11a. Thallus basally black, apically brown, branches lax, divergent, lateral spinules perpendicular, dense 1. **B. bicolor**
- 11b. Thallus brown black throughout, branches bushy, stiff, stout 9. **B. nitidula**
- 12a. Branching isotomic dichotomous, smooth, lateral spinules absent 7. **B. levis**
- 12b. Branching anisotomic dichotomous, lateral spinules present 13
- 13a. Thallus ca. 20 cm long, generally grey brown to blackish, branches more or less stiff, lateral spinules dense, thallus sterile 4. **B. himalayana**
- 13b. Thallus ca. 10 cm long, bony white to pale brown, somewhat delicate, apothecia lateral and branch bent at apothecium 6. **B. lactinea**

- 14a. Thallus pseudocyphellate 15
 14b. Thallus non-pseudocyphellate 16
 15a. Thallus erect, ca. 8 cm tall, dark brown to black, main branches up to 0.3 mm in diam., lateral spinules present **13. B. tenuis**
 15b. Thallus pendulous, up to 15 cm long, greenish brown, main branches up to 0.7 mm in diam., branching isotomic dichotomous, lateral spinules absent or rare, thallus fertile **8. B. nepalensis**
 16a. Thallus erect, up to 10 cm tall, brown black, branches lax, divergent, main branch up to 1 mm in diam., with longitudinal depressions, lateral spinules numerous, perpendicular, thallus fertile **2. B. confusa**
 16b. Thallus elongate, pendulous, up to 35 cm long, brown to black, main branches 0.5 mm in diam., branching isotomic to anisotomic dichotomous with acute angles, lateral spinules sparse to dense **[B. asiatica]**

1. Bryoria bicolor (Ehrh.) Brodo & Hawksw., Opera Bot. 42: 99. 1977.

= *Lichen bicolor* Ehrh., Beit. Naturk. 3: 82. 1788.

= *Alectoria bicolor* (Ehrh.) Nyl., Acta Soc. Linn. Bordeaux 21: 291. 1856. Type not seen.

Thallus corticolous, terricolous or saxicolous, erect, 4(7) cm tall, black in lower part and pale to dark brown in upper part; branching isotomic dichotomous and divergent to anisotomic dichotomous and acute; branches ca. 0.5 mm in diam., apically tapering; lateral spinules perpendicular; pseudocyphellae usually distinct towards apices of branches, white or brownish; isidia and soredia absent. Cortex 60-100 μ m thick; medullary hyphae smooth. Apothecia absent. TLC: fumarprotocetraric acid.

Bryoria bicolor is widely distributed in the northern hemisphere. It is distinguished by its colour, pseudocyphellae and fumarprotocetraric acid. It is close to *B. nitidula* which, however, differs in anisotomic dichotomous branches black throughout.

Specimens examined

India, Sikkim: near Chhangu, alt. ca. 3300 m, on stones among mosses, *Awasthi 45* (Awas.); Jongri, alt. ca. 3900 m, *Bose 60.134* (Awas.). Uttar Pradesh: Almora district, Dhakuri ridge, alt. ca. 2850 m, on trees, *Awasthi & Awasthi 648A* (Awas.). West Bengal: Darjeeling district, below Sandakhpoo, alt. ca. 3300 m, on twigs of shrubs, *Awasthi & Agarwal 67.357* (LWU). **Nepal**: E. Nepal, Topkegola, near Sajupokhari, alt. ca. 4500 m, on ground among mosses, *Awasthi 2408* (Awas.); Mewakhola valley, alt. 3450 m, *Awasthi 2277* (Awas.).

2. Bryoria confusa (Awas.) Brodo & Hawksw., Opera Bot. 42: 155. 1977.

= *Alectoria confusa* Awas., Proc. Indian Acad. Sci. 72B: 152. 1970. Type collection: E. Nepal, Mewakhola valley, alt. ca. 3450 m, 1953, *Awasthi 2278* (holotype: Awas.!) (Fig. 5).

Thallus corticolous, erect, up to 10 cm tall, dark brown to blackish near base, paler brown towards apices; branching anisotomic dichotomous; branches up to 1 mm in diam., tapering; surface with depressions; lateral spinules short, numerous, perpendicular to axis; pseudocyphellae, isidia and soredia absent. Apothecia generally present, lateral, up to 1 mm in diam., spores 10-12 \times 4-6 μ m. TLC: no lichen product.

The taxon has been discussed in detail earlier (Awasthi l.c. and JØRGENSEN, 1972). It is distinguished by absence of pseudocyphellae, isidia, soredia and lichen products. It is distributed eastwards to China and Taiwan from the Himalayas.

Specimens examined

India, Arunachal Pradesh: Parila, alt. ca. 2745 m, on twigs, *Panigrahi 6397A* (Awas.); Senge Dzung, alt. 3690 m, on *Rhododendron*, *Rao 7709* (Awas.). West Bengal: Darjeeling district, near

Batasi, alt. ca. 2100 m, on branches of trees, *Awasthi* 43 (Awas.); Sandakhpoo, alt. ca. 3000 m, on branches of *Rhododendron*, *Awasthi* 2406 (Awas.). **Nepal:** E. Nepal, Mewakhola valley, alt. 3450 m, on tree, *Awasthi* 2273, 2278 (Awas.).

3. *Bryoria furcellata* (Fr.) Brodo & Hawksw., Opera Bot. 42: 103. 1977.

= *Cetraria furcellata* Fr., Syst. Orb. Veget. 1: 283. 1825. Type not seen.

Thallus corticolous, rarely saxicolous, erect, ca. 3 cm tall, black near base and pale brown upwards; branching isotomic dichotomous, branches up to 0.5 mm in diam., tapering; lateral spinules numerous, at right angles to axis; thallus pseudocyphellate and sorediate; soralia fissural, narrower than the branch, slightly raised with tufts of isidioid spinules. Cortex 70-110 μm thick; medullary hyphae smooth. Apothecia absent. TLC: fumarprotocetraric acid.

Bryoria furcellata is distinguished by the presence of fissural soralia with tufts of isidioid spinules and fumarprotocetraric acid. It is close to *B. poeltii* in all these characters but the soralia of the latter are much broader than the branches.

Specimen examined

Nepal: Himalaya, Vorhimalaya, Okhaldunga, *Abies-Rhododendron* Wald um Thodung bei etwa 3000 m, *Poelt* L 773 (M).

4. *Bryoria himalayana* (Mot.) Brodo & Hawksw., Opera Bot. 42: 155. 1977 (not "himalayensis" as erroneously stated).

= *Alectoria himalayana* Mot., Fragm. Florist. Geobot. 6: 450. 1960. Type collection: Himalaya, Sikkim, *T. Thomson* 299 (isotypes: CAL & M!) (Fig. 6).

Thallus corticolous, pendulous, up to 20 cm long, grey brown to blackish; branching anisotomic dichotomous and divergent; branches up to 0.8 mm in diam., tapering, terete, sometimes slightly flattened; lateral spinules numerous, short or long, at right angles to axis; pseudocyphellae sparse, narrow streak-like and elongate; isidia and soredia absent. Cortex 60-100 μm thick; medullary hyphae smooth, 2-4(8) μm thick. apothecia absent. TLC: fumarprotocetraric acid and an undertermined grey spot at Rf value 0.53.

Bryoria himalayana is distinguished by pendulous, brown-black, sparsely pseudocyphellate thallus with profuse lateral spinules and presence of fumarprotocetraric acid. The taxon is so far known from the Himalayas (India, Nepal, Bhutan) only.

Specimens examined

India, Sikkim: *T. Thomson* 299 (CAL & M); same locality, *T. Thomson* 298, 300 (CAL). West Bengal: Darjeeling district, near Sandakhpoo, alt. ca. 3000 m, on trees, *Awasthi* 46, 80 (Awas.); same locality, on twigs of shrubs, *Awasthi & Agarwal* 67.409 (LWU); Sandakhpoo to Phalut, alt. 3600 m, on *Rhododendron* trees, associated with *Usnea*, *Awasthi & Agarwal* 67.434B (LWU); near Tongloo Dakbunglow, alt. ca. 3300 m, on branches of shrubs and small trees of *Viburnum*, *Awasthi & Agarwal* 67.533 (LWU). **Nepal:** Himalaya, Vorhimalaya, Ostnepal, *Abies-Rhododendron* Bergwald, Jumbesi, Östlich, *Poelt* L 781 (M); Östlich über Ringmo, *Poelt* L 785 (M); Lamjura, alt. ca. 3500 m, *Poelt* L 776 (M); *Rhododendron* Bergwald, Tanga, alt. ca. 4000 m, *Poelt* L 786 (M); Khumbu, Felsige Hänge südlich-Khumzung, 3900-4000 m, über Gneis, *Poelt* L 787 (M).

5. *Bryoria implexa* (Hoffm.) Brodo & Hawksw., Opera Bot. 42: 121. 1977.

= *Usnea implexa* Hoffm., Deutsch. Fl. 2: 134. 1796.

= *Alectoria implexa* (Hoffm.) Nyl., Lich. Scand.: 72. 1861. Type not seen.

Thallus terricolous, ca. 6 cm tall, pale brown to dark brown, blackish in apices; branching isotomic dichotomous; branches up to 0.3 mm in diam., tapering, somewhat twisted and sometimes flattened; surface slightly pruinose; lateral spinules minute to long; pseudocyphellae absent; soralia scarce, fissural, elongate slit like, sometimes broader than the branch; isidioid spinules absent. Apothecia absent. TLC: psoromic acid and thamnolic acid.

Specimen examined

India, Uttar Pradesh: Uttarkashi district, Gomukh area, right bank, 5th moraine, alt. ca. 3780 m, on soil, *Awasthi & Singh 8531B* (Awas.); separated from a mixture of *B. smithii*.

6. *Bryopria lactinea* (Nyl.) Brodo & Hawksw., Opera Bot. 42: 155. 1977.

= *Alectoria lactinea* Nyl., Lich. Jap.: 23. 1890. Type collection: Japonia, Itjigome, 1879, Almqvist (holotype: H-NYL 35.882!) (Figs. 7 & 8).

Thallus corticolous, pendulous, ca. 10 cm long, bony white to pale brown; branching anisotomic dichotomous; branches up to 0.5 mm in diam., terete, sometimes slightly flattened, tapering apically; surface smooth, shiny; lateral spinules more or less perpendicular; pseudocypbellae very sparse, elongate, slitlike; isidia and soredia absent. Cortex 40-70 μ m thick. Apothecia lateral, sessile (a single apothecium in the type specimen), 1.5-2 mm in diam., branch knee like bent or duplicated by bending at the apothecium (indicated by arrow in Fig. 7) disc light brown, smooth, convex. Spores vide Nylander 8-10 \times 3-4.5 μ m (the single apothecium in type specimen partially already cut has not been cut again), spores in Nepal specimen elongate ellipsoid, 6-10 \times 2-4 μ m. TLC: fumarprotocetraric acid and an undetermined grey spot at Rf value 0.53. NYLANDER (1890) has stated "Thallus extus K (Cacl) + (fugaciter violacee reagens, intus —)", but we have found the thallus KC—.

Bryoria lactinea is distinguished by bony white to brownish fertile thallus, bent at the apothecium and presence of fumarprotocetraric acid. The taxon is very close to *B. himalayana*. The whitish branches of the latter are difficult to distinguish from *B. lactinea*. The two are kept as distinct taxa for the present by maintaining a difference between the two by shorter (10 cm), more or less delicate, bony white, fertile thallus in *B. lactinea* and longer (20 cm), more or less stiff, grey brown, sterile thallus in *B. himalayana*. *B. lactinea* known from Japan is now also known from the Himalayas.

Specimens examined

Nepal: E. Nepal, Mewakhola valley, alt. 3300-3450 m, on trees, *Awasthi 2275* (fertile) 2276 (sterile) (Awas.). **Japan**: Japonia, Itjigome *Almqvist* (H-NYL 35882).

7. *Bryoria levis* Awas. sp. nov.

Corticola. Thallus ca. 7 cm longus, brunneus. Rami primarii 0.5 mm crassi, isodichotome divergentes, leves, teretes. Ramuli laterales nulli. Pseudocypbellae sparsae. Soredia isidiaque desunt. Apothecia ignota. Thallus continet acidum fumarprotocetraricum.

Type collection: Nepal, E. Nepal, Mewakhola Valley, alt. 3450 m, on trees, 28.5.1953, D. *Awasthi 2274* (holotype: Awas., Fig. 9).

Thallus corticolous, ca. 7 cm tall, pendulous, yellowish brown to light chestnut brown, shining; branching isotomic dichotomous for the greater part, slightly anisotomic dichotomous in the apical region; branches divergent, or axils acute in younger branches; main branches up to 0.5 mm in diam., terete, tapering; surface smooth; lateral spinules absent. Thallus very sparsely pseudocypbellate; pseudocypbellae minute, elongate, slit-like; isidia and soredia absent. Cortex 80-120 μ m thick; algal stratum discontinuous, 30-50 μ m thick; medulla arachnoid, medullary hyphae 4-6(10) μ m thick, smooth. apothecia absent. Cortex and medulla K + yellowish, C—, KC—, P + orange. TLC: fumarprotocetraric acid and an undetermined grey spot at Rf value 0.53.

The taxon is distinctive in the yellowish brown to brown, smooth thallus, isotomic dichotomous branches lacking lateral spinules and presence of fumarprotocetraric acid. It does not seem to be related to any of the species known.

Specimens examined

India, Sikkim: Karponang, alt. 3000 m, on branches of tree, *Awasthi 44* (Awas.). **Nepal**: E. Nepal, Mewakhola valley, alt. 3450 m, on trees, *Awasthi 2274* (Awas.).

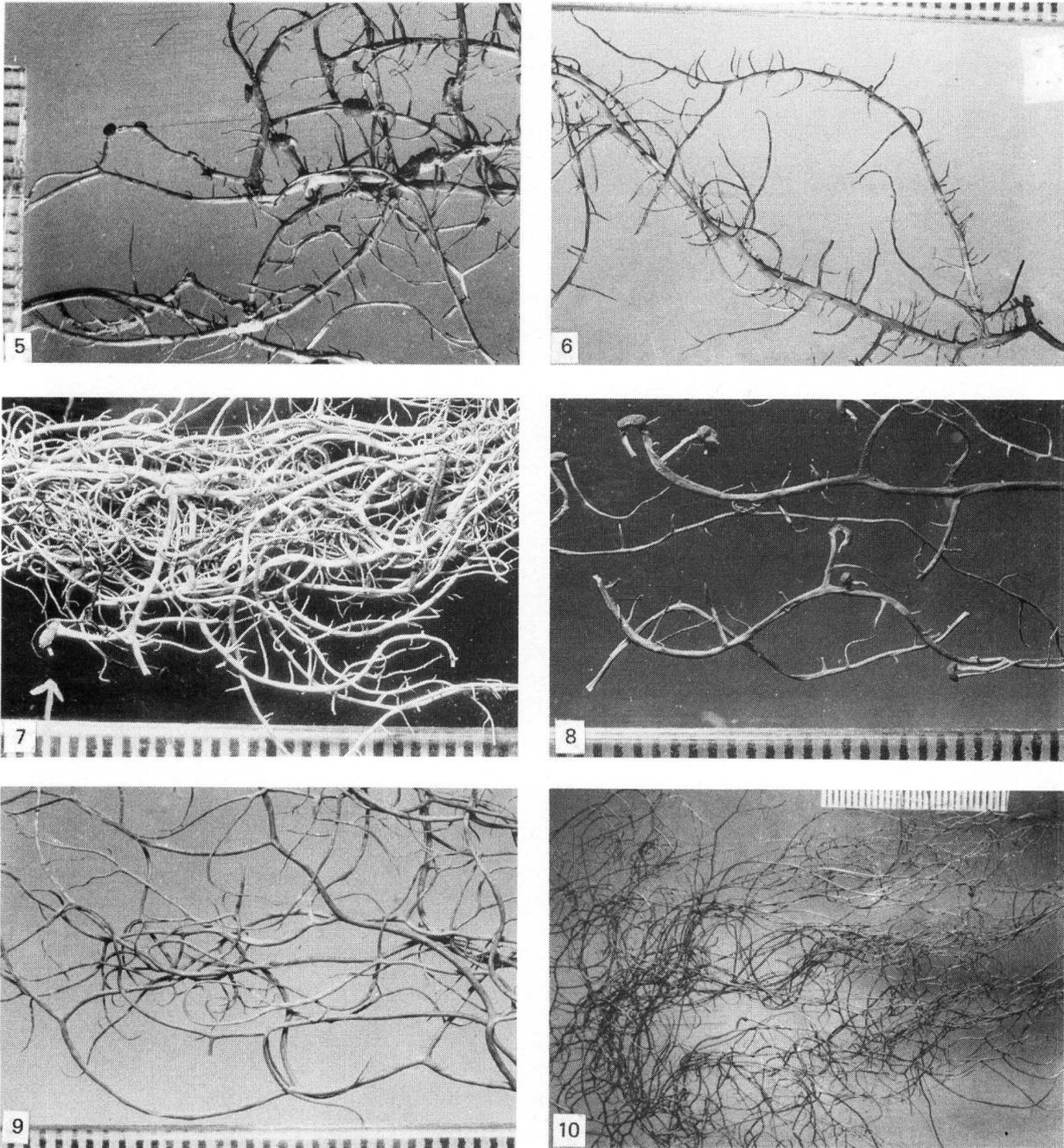


Fig. 5. — Part of holotype of *Bryoria confusa* (Awas.) Brodo & Hawksw.; *Awasthi 2278* (Awas.) (scale: 1 mm).

Fig. 6. — A branch of isotype of *Bryoria himalayana* (Mot.) Brodo & Hawksw.; *Thomson 299* (M) (scale: 1 mm).

Fig. 7. — Holotype of *Bryoria lactinea* (Nyl.) Brodo & Hawksw.; *Almquist* s.n. (H-NYL 35 882). White arrow indicates apothecium with bent branch (scale: 1 mm).

Fig. 8. — *Bryoria lactinea* (Nyl.) Brodo & Hawksw.; *Awasthi 2275* (Awas.) (scale: 1 mm).

Fig. 9. — Holotype of *Bryoria levis* Awas; *Awasthi 2274* (Awas.) (scale: 1 mm).

Figs. 10. — Holotype of *Bryoria nepalensis* Awas.; *Poelt L 799* (M) (scale: 1 mm).

8. *Bryoria nepalensis* Awas. sp. nov.

Corticola. Thallus subpendulus vel pendulus, ca. 15 cm longus, aeneo-brunneus ad interdum brunneo-niger. Rami primarii isodichotomiter divergentes, teretes, attenuati, ca. 0.5 (0.7) mm crassi. Ramuli laterales rari vel nulli. Pseudocyphellae sparsae, elongatae. Soredia isidiaque desunt. Apothecia lateralia, ad 1 mm lata, sessilia. Asci octospori, sporis simplicibus incoloratis, $6-8 \times 4 \mu\text{m}$ metientibus.

Type collection: Nepal-Himalaya, Khumbu, *Abies-Rhododendron* Wald südlich Kunde, 3900-4000 m, 9.10.1962, *J. Poelt L 799* (holotype: M, Figs. 10 & 11).

Thallus corticolous, up to 15 cm long, decumbent to pendulous, black near base and intermittently black for short distance, otherwise cervine brown, cylindrical, not twisted; branching typically isotomic dichotomous, rarely anisotomic dichotomous; main branches divergent, lax, ca. 0.5(0.7) mm in diam., terete, tapering; surface smooth, shiny; lateral spinules rarely present or absent; pseudocyphellae sparse, narrow, slit like and elongate, concolorous to thallus or rarely white; isidia, soredia and isidioid spinules absent. Cortex 80-140 μm thick; algal stratum discontinuous, 20-40 μm thick; medulla arachnoid, medullary hyphae 2-4 μm thick, smooth. Apothecia lateral, up to 1 mm in diam., sessile, slightly constricted at base; disc concave to convex, brown to dark brown, epruinose. Epithecium light brown; hymenium colourless, 50-60(80) μm high, I + blue, then turning black; hypothecium colourless, 80-90 μm thick; asci 8 spored, ca. $50 \times 20 \mu\text{m}$ in size; spores colourless, simple, oval, $6-8 \times 4 \mu\text{m}$ (Figs. 1 & 2); paraphyses branched and anastomosed. Cortex and medulla K— C— KC—, P—. TLC: no lichen product.

The holotype specimen of *B. nepalensis* had been annotated as *Alectoria jubata* (L.) Ach. by Bystrek in 1966. But as indicated by BRODO & HAWKSWORTH (1977, p. 150) the lectotype of *A. jubata* (L.) Ach. is extremely squashed and may correspond to *A. proluxa* (an illegitimate name) or to *A. fremontii*. Thus it has a dubious taxonomic validity and is therefore to be rejected under Art. 69. The specimen under reference is not similar to *Bryoria fremontii* (Tuck.) Brodo & Hawksw. which is characterised by sorediate, foveolate thallus and presence of vulpinic acid.

The new taxon, *B. nepalensis*, is distinguished by the subpendulous to pendulous, isotomic dichotomously branched thallus with sparse slit-like pseudocyphellae, absence of soredia and the lichen products. It is close to *B. confusa* in the absence of lichen products, but the two have different growth forms, and *B. confusa* lacks pseudocyphellae. *B. nepalensis* is known from the type collection only.

9. *Bryoria nitidula* (Th. Fr.) Brodo & Hawksw., Opera Bot. 42: 107. 1977.

= *Bryopogon jubatum* var. *nitidulum* Th. Fr., Nova Acta Reg. Soc. Sci. Upsal. Ser. 3, 3: 25. 1860. Type not seen.

Thallus corticolous, erect, 5-8 cm tall, dark brown to black throughout, more or less bushy; branching anisotomic dichotomous; branches 0.25-0.5 mm in diam., terete, sometimes flattened, tapering; surface smooth; lateral spinules perpendicular; pseudocyphellae sparse; isidia and soredia absent. Cortex 70-130 μm thick, partially pigmented to non pigmented in apical region, but brown pigmented in basal region, where the hyphae do not separate in K in T. S.; medullary hyphae uneven in thickness, (2)4-6(10) μm thick, smooth. Apothecia unknown. TLC: fumarprotocetraric acid.

Bryoria nitidula resembles *B. bicolor* which, however, is black towards base and brownish in apical region, and the main branches are isotomic dichotomous. The taxon is distributed in the arctic and subarctic regions of northern hemisphere.

Specimen examined

Nepal: E. Nepal, Topkegola, near Sajupokhari, alt. ca. 3900 m, on twigs of shrubs, *Awasthi 2340* (Awas.).

10. *Bryoria perspinosa* (Bystr.) Brodo & Hawksw., Opera Bot. 42: 155. 1977.

= *Alectoria perspinosa* Bystr., Khumbu Himal 6(1): 21. 1969. Type collection: Nepal, Himalaya, Vorhimalaya, Ostnepal, *Abies-Rhododendron* Bergwald, Östlich Jumbesi, 1962, *Poelt L 778* (isotype: M!) (Figs. 12 & 13).

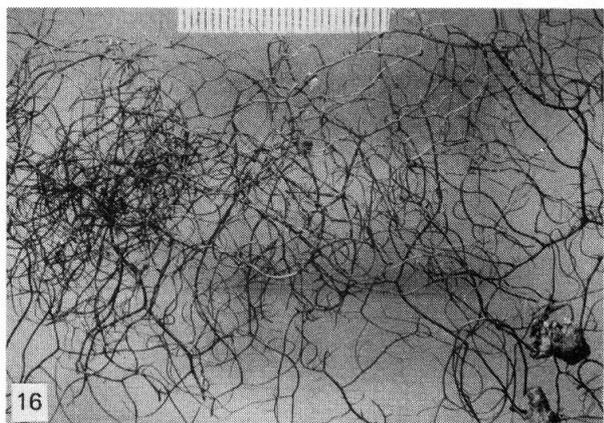
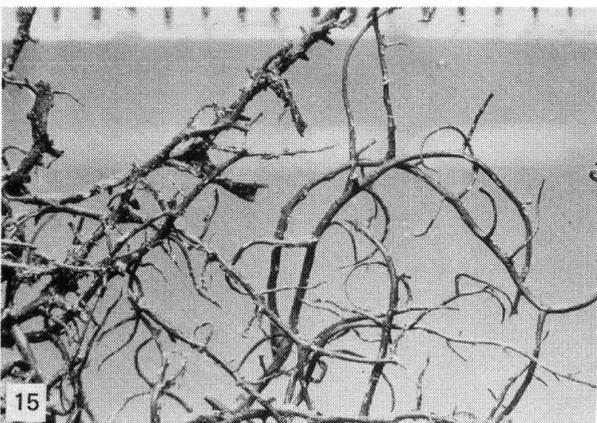
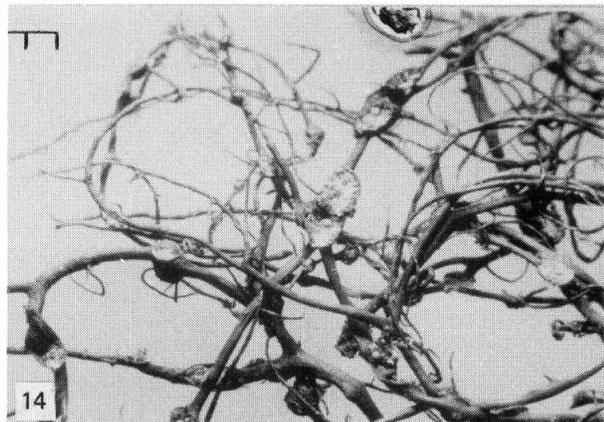
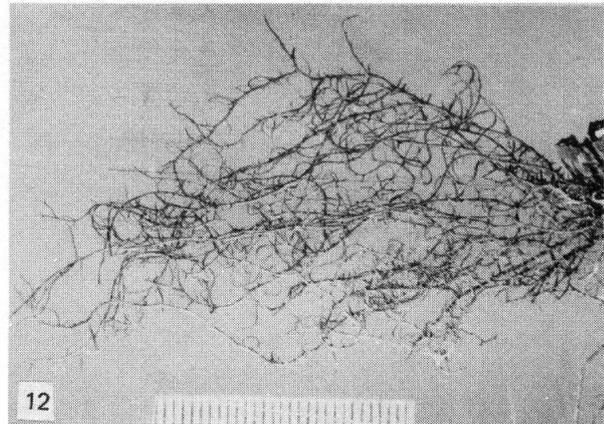
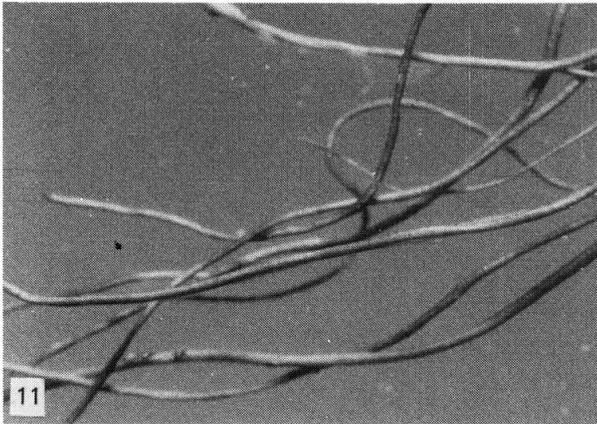


Fig. 11. — Holotype of *Bryoria nepalensis* Awas.; *Poelt L 799* (M) (scale: 1 mm).
 Figs. 12 & 13. — Isotype of *Bryoria perspinosa* (Bystr.) Brodo & Hawksw.; *Poelt L 778* (M) (scale: 1 mm).
 Fig. 14. — Isotype of *Bryoria poeltii* (Bystr.) Brodo & Hawksw.; *Poelt L 805* (M) (scale: 1 mm).
 Fig. 15. — *Bryoria smithii* (DR.) Brodo & Hawksw.; *Awasthi s.n.* (Awas.) (scale: 1 mm).
 Fig. 16. — Isotype of *Bryoria variabilis* (Bystr.) Brodo & Hawksw.; *Poelt L 798* (M) (scale: 1 mm).

Thallus corticolous, erect to pendulous, up to 8 cm long, pale brown, dark brown to blackish brown; branching anisotomic dichotomous, several main branches arise from the base, main branches up to 1 mm in diam. at base, terete, sometimes flattened and twisted, tapering; lateral spinules numerous, perpendicular to main axis, dense, short or elongate; surface of branches smooth with white, raised, oblong-elongate or slit-like pseudocyphellae and soralia, the latter with tufts of isidioid spinules. Cortex 80-130 μm thick. Apothecia absent. Medulla and soralia P + orange red. TLC: fumarprotocetraric acid and an undetermined grey spot at Rf value 0.54.

While describing *Alectoria perspinosa*, BYSTREK (1969, p. 21) mentioned "Medulla K ope sensim, distincte lutescit dein rubrofuscus tingitur. Medulla P intense rubescens, C non colorat. KC medullam intense rubro colorat," but in framing the key he (Bystrek, l.c., p. 19) placed this taxon under the group "Lager KC und C + gelb oder rot". We have found the medulla of isotype specimen K + yellow-red, C—, P + orange red, corresponding to the protologue.

The species is distributed in the Himalayan region and in China.

Specimens examined

India, Arunachal Pradesh: 2 miles from Senge Dzong rest house, alt. 3360 m, on dead bark of *Rhododendron*, Rao 7672 (Awas.). **Nepal**: Himalaya, Vorhimalaya, Ostnepal, *Abies-Rhododendron* Bergwald, Östlich Jumbesi, *Poelt L 778* (M).

11. *Bryoria poeltii* (Bystr.) Brodo & Hawksw., Opera Bot. 42: 155. 1977.

= *Alectoria poeltii* Bystr., Khumbu Himal 6(1): 20. 1969. Type collection: Nepal, Himalaya, Mahalangur Himal, Khumbu, Bibre, 1962, *Poelt L 805* (isotype: M!) (Fig. 14).

Thallus erect, up to 4 cm tall, black; branching anisotomic dichotomous; branches up to 0.6 mm in diam., more or less terete, tapering; surface smooth; lateral spinules perpendicular to the main axis; pseudocyphellae absent; soralia lateral, fissural, broader than the branch, ellipsoid to more or less ovoid or rounded, up to 1.5 \times 1 mm, with tufts of isidioid spinules (spinules absent in young soralia), soredia white, granular. Cortex 20-60 μm thick. Apothecia absent. Medulla and soralia P + yellow-red. TLC: fumarprotocetraric acid.

Bryoria poeltii is characterised by anisotomic dichotomous branching, soralia much broader than the branch, beset with tufts of isidioid spinules, and fumarprotocetraric acid. *B. poeltii* is known from Nepal Himalaya and China.

Specimen examined

Nepal: Himalaya, Mahalangur Himal, Khumbu, Bibre, *Poelt L 805* (M).

12. *Bryoria smithii* (DR.) Brodo & Hawksw., Opera Bot. 42: 152. 1977.

= *Alectoria smithii* DR., Ark. Bot. 20a(11): 15. 1926. Type not seen (Fig. 15).

Thallus corticolous, sometimes terricolous, ca. 7 cm tall, basally blackish brown to black, paler towards apices; branching isotomic dichotomous to anisotomic dichotomous; branches 0.2-0.5(1) mm in diam., more or less terete, tapering; lateral spinules sparse in primary branches, but numerous, perpendicular in secondary branches; thallus surface smooth, pseudocyphellate and sorediate; soralia white, abundant, elongate, fissural, narrower than the branch, tufts of small isidioid spinules in older soralia (breaks in cortex lacking soredia considered as pseudocyphellae). Cortex 40-80 μm thick. Apothecia unknown. TLC: no lichen product.

Bryoria smithii is characterised by isotomic to anisotomic dichotomous branching, fissural soralia with tufts of isidioid spinules, and absence of lichen products. This species is close to *B. variabilis* which, however, is distinguished by more or less pendulous habit, anisotomic arcuate branches, soralia later turning brown black, and presence of apothecia. *B. furcellata* and *B. poeltii* are close to *B. smithii* in general habit, but both of them have fumarprotocetraric acid. The species is distributed in Europe, Himalaya, China and extends through Malaysia to Hawaii Islands.

Specimens examined

India, Uttar Pradesh: Almora district, Loharkhet to Dhakuri, alt. ca. 2400 m, on twigs of *Rhododendron*, *Awasthi* 7563 (Awas.); near Dhakuri ridge, alt. ca. 2850 m, on twigs of shrubs, *Awasthi & Awasthi* 648B (Awas.); same locality, *Awasthi* 7602 (Awas.); Uttarkashi district, Gomukh area, alt. ca. 3750 m, on ground, *Awasthi & Singh* 8531A, 8589, 8594 (Awas.); on way to Gomukh from Gangotri, alt. ca. 3420 m, on bark, *Awasthi & Singh* 8338 (Awas.). West Bengal: Darjeeling district, Tiger hill, Senchal lake area, alt. ca. 2250-2400 m, *Awasthi* s.n. (Awas.). **Nepal**: E. Nepal, Thaparma to Pheriche, alt. 4511 m, on *Rhododendron*, *Rao* 13.768 (Awas.).

13. *Bryoria tenuis* (Dahl) Brodo & Hawksw., Opera Bot. 42: 112. 1977.

= *Alectoria tenuis* Dahl, Meddl. Grönl. 150(2): 144. 1950. Type not seen.

Thallus terricolous, up to 8 cm tall, dark brown to black near base, brown or pale brown or pale yellow brown towards apices; branching isotomic dichotomous to anisotomic dichotomous, branches up to 0.3 mm in diam., terete, slightly tapering; lateral spinules minute, perpendicular to the axis; thallus surface smooth; pseudocyphellae white, fissural, slightly raised; isidia, soredia and isidioid spinules absent. Cortex 56-80 µm thick. Apothecia absent. TLC: no lichen product.

The taxon is close to *Bryoria bicolor*, but has a stiff texture, with more of blackness, and lacks fumarprotocetraric acid [Brodo & Hawksworth (l.c.) have reported forms with or without fumarprotocetraric acid.] It is also close to *B. nitidula* which, however, has thicker branches and fumarprotocetraric acid. The species is reported to be distributed mainly in the Oceanic areas of Europe, America while, this find in the Himalayas is interesting.

Specimens examined:

India, Uttar Pradesh: Uttarkashi district, Gomukh area, alt. ca. 3650 m, on ground, *Awasthi & Singh* 8593 (Awas.). West Bengal: Darjeeling district on way Batasi to Palmajua, alt. ca. 2250 m, *Bose* 60.71 (Awas.).

14. *Bryoria variabilis* (Bystr.) Brodo & Hawksw., Opera Bot. 42: 156. 1977.

= *Alectoria variabilis* Bystr., Khumbu Himal 6(1): 22. 1969. Type collection: Nepal Himalaya, Khumbu, *Abies-Rhododendron* Wald, südlich Kunde, 3900-4000 m, an *Abies* Rinde, 1962, *Poelt* L 798 (isotype: M!) (Fig. 16).

Thallus corticolous; erect or pendulous, up to 10 cm long, blackish near base, brown towards apices; branching anisotomic dichotomous; main branches usually diverging, arcuate, up to 0.5 mm in diam., terete, tapering; lateral spinules sparse to numerous, short or elongate, perpendicular to the axis; thallus surface smooth, pseudocyphellate and sorediate; soralia fissural, turning brown black, with tufts of isidioid spinules. Cortex 50-80 µm thick. Apothecia lateral, up to 1 mm in diam., constricted at base, disc concave to convex, orange yellow to brown, epruinose. Asci 8 spored; spores uniseriate in the ascus, oval, 6-8 × 4-6 µm; paraphyses branched and anastomosed. TLC: no lichen product.

Bryoria variabilis is distinguished by anisotomic dichotomous branching, fissural soralia with tufts of isidioid spinules, presence of apothecia and lack of lichen products. It resembles *B. smithii* in the presence of soralia with isidioid spinules and absence of lichen products, but the two differ in growth form and nature of branching. The taxon is known from the type collection only.

Specimen examined

Nepal: Himalaya, Khumbu, *Abies-Rhododendron* Wald, südlich Kunde, 3900-4000 m, an *Abies* Rinde, *Poelt* L 798 (M).

Observations on *Bryoria asiatica* and *B. nadvornikiana*: DU RIETZ (1926) reported the occurrence of *Alectoria asiatica* DR. [= *Bryoria asiatica* (DR.) Brodo & Hawksw.] in Himalayas based on a specimen collected by *Hook. & Thomson* 1739 at UPS. Recently JØRGENSEN (1972, p. 197) pointed out that a part of this specimen is *Alectoria perspinosa* Bystr. [= *Bryoria perspinosa*

(Bystr.) Brodo & Hawksw.], but he has not stated to which taxon the other part of the specimen belongs. It is not possible to comment on that aspect as that part of specimen has not been examined. The isotype specimen of *Bryoria asiatica* (China, Prov. Sze-Chúan, reg. bor. occid., zwischen Tsagogomba und Tamba, auf *Picea*, *Juniperus* und *Rhododendron* 4000 m.s.m., 2.10.1922, *H. Smith 5018* at UPS) was examined and the following description is based on that.

Thallus corticolous, pendulous, ca. 35 cm long, grey brown, dark brown to black, irrespective of the basal or apical region; branching mostly isotomic dichotomous near base and anisotomic dichotomous towards apices, acute; branches 0.25-0.5 mm in diam., more or less terete, sometimes flattened at the dichotomies, tapering; lateral spinules dense or sparse, more or less perpendicular to the axis; surface smooth, without depressions; pseudocyphellae, isidia and soredia absent. Apothecia absent. TLC: no lichen product.

In spite of fairly exhaustive collections that were examined from the Himalayas, there was no specimen that resembled the isotype of *B. asiatica*. It can thus be concluded that probably the taxon does not occur in the Himalayas.

BYSTREK (1969, p. 20) has reported the occurrence of *Alectoria nadvornikiana* var. *spinulosa* (Ahlner) Mot. from Nepal (Khumbu Himal, an *Abies-Rhododendron* Wald, südlich Kunde, 3800-3900 m, an *Abies* collected by Poelt). The taxon has been synonymized under *Bryoria nadvornikiana* (Gyeln.) Brodo & Hawksw. by BRODO & HAWKSWORTH (1977, p. 122). That specimen has not been examined and thus comments are not possible, but in our collections no specimen similar to *B. nadvornikiana* was found.

Genus *Sulcaria* Bystr.

Ann. Univ. Mariae Curie — Sklodowska, C. 26: 275. 1971; Brodo & Hawksw., Opera Bot. 42: 146. 1977.

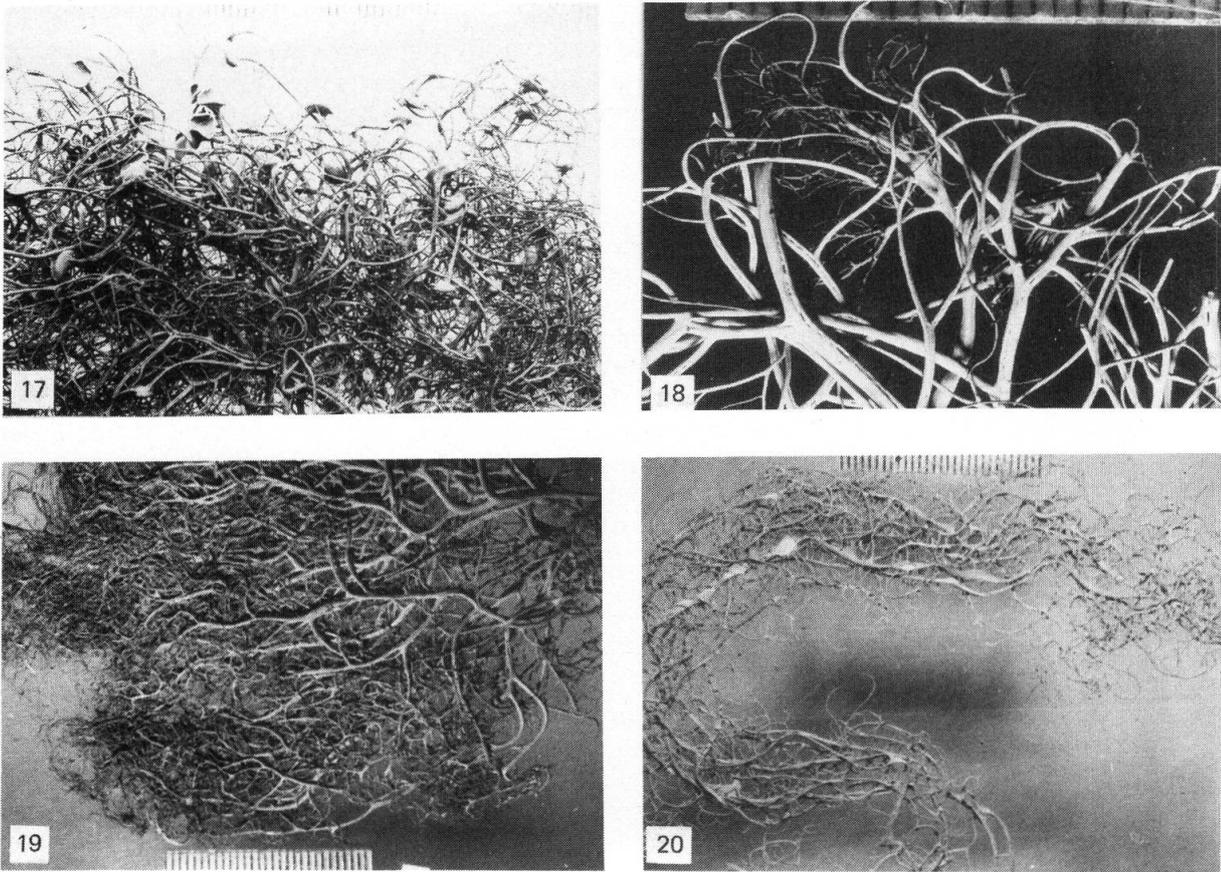
Three species of the genus are known from the World till now, two of which are from the Himalayas. *Sulcaria sulcata* is the only taxon known in the fertile condition.

Key to the species

- 1a. Thallus ashy grey to grey brown, branches more or less rounded; P + deep yellow (Psoromic acid) **1. *S. sulcata***
 1b. Thallus yellowish grey to grey green, primary branch flattened; P + orange [vulpinic acid, virensic acid (\pm) and pulvinic acid (\pm)] **2. *S. virens***

- 1. *Sulcaria sulcata*** (Lév. apud Jacquem.) Bystr. ex Brodo & Hawksw., Opera Bot. 42: 156. 1977.
 = *Sulcaria sulcata* Bystr., Ann. Univ. Mariae Curie-Sklodowska, C, 26: 276. 1971; nom. inval.
 = *Cornicularia sulcata* Lév. in Jacquem., Voy. Inde Bot. 179, tab. 180, fig. 3, 1841-1844. Type not seen.
 = *Alectoria sulcata* (Lév.) Nyl., Mem. Soc. Imp. Sci. Nat. Cherbourg 5: 98. 1857.
 = *Alectoria spinosa* Tayl. in Hook. Lond. J. Bot. 6: 118. 1847. Type not seen.
 = *Alectoria sulcata* f. *ciliata* Hue, Nouv. Arch. Mus. Ser. 4, 1: 91. 1899. Type not seen.
 = *Alectoria sulcata* f. *indica* Gyeln., Ann. Crypt. Exot. 4: 173. 1931. Type not seen.
 = *Alectoria sulcata* var. *barbata* Hawksw., Taxon 19(2): 242. 1970. Type not seen.
 = *Sulcaria sulcata* var. *barbata* (Hawksw.) Hawksw. in Brodo & Hawksw., Opera Bot. 42: 156. 1977 (Figs. 17-19).

Thallus corticolous, attached by a basal disc, erect or sometimes pendulous, up to 8(12) cm tall, and up to 3 mm thick at base; branches more or less cylindrical, primary branches isotomic dichotomous, becoming anisotomic dichotomous and tapering towards apices, sometimes anastomosed; surface pale brown in basal region, brown or brown black towards apices; smooth except along the longitudinally furrowed pseudocyphellate side (to be considered as the lower side); furrows more or less scalariform due to the presence of transverse bands of cortex, narrow slit-like to sometimes much widened giving a dorsiventral appearance to the branch. In fertile specimens, branches stiff and lax, gradually tapering still remaining stiff to the apices, but in sterile forms



Figs. 17-19. — *Sulcaria sulcata* (Lév.) Bystr. ex Brodo & Hawksw.

17. A typical fertile thallus; *Awasthi 84* (Awas.); **18.** Development of dense thin branches at apex of one of the thick branches; *Awasthi 2284* (Awas.); **19.** The morphotype with apical dense, brown and capillaceous branches; *Awasthi 82* (Awas.) (scale: 1 mm).

Fig. 20. — *Sulcaria virens* (Tayl.) Bystr. ex Brodo & Hawksw.; *Awasthi 939* (Awas.) (scale: 1 mm).

there is development of brown black dichotomously branched numerous, narrow hair like branches in the apical region. Intermediate forms connecting the fertile and sterile forms sometimes present. Isidia and soredia absent. Cortex 50-150(200) μm thick. Apothecia lateral, often appearing geniculate due to death of distal branch, up to 8 mm in diam., disc concave to plane, greyish white pruinose to epruinose brown. Hymenium colourless, 120-148 μm high; hypothecium pale yellow; 55-66 μm thick. Asci 8 spored, arrested bitunicate, 90-130 \times 30-40 μm ; spores initially simple, colourless to pale yellow, becoming 1-3 septate and brownish at maturity, ellipsoid, 36-50 \times 12-16 μm , thin walled (Figs. 3 & 4). Though the simple, colourless to pale yellow spores are frequently seen, the 1-3 septate, brownish spores are rarely present and then often they also appear to be more or less in a shrivelled condition in comparison to the hyaline simple spores. It is likely that either the spores get shrivelled after they become mature with septa and brown colour or the shrivelled condition is the result of imperfect development. Paraphysoides branched and anastomosed. TLC: atranorin and psoromic acid.

The taxon is distinguished by thick robust thallus with furrows on one side and the P + deep yellow colour. It is widely distributed in the Himalayas and extends eastwards in Asia.

GYELNIK (1935, p. 250) described *Alectoria sulcata* f. *indica* Gyeln. as "thallus sterilis, usque ad 10 cm longus, erectus, ramulis divaricatis numerosissimis, tenuibus instructus". HAWKSWORTH (1970) described *A. sulcata* var. *barbata* Hawksw. as "Planta ut in *Alectoria sulcata* (Lév.) Nyl. var. *sulcata*, sed differt in ramis terminalibus qui sunt subdichotomiter produfi intricati ramosi. Ramis terminales, capillaces rare crassiores quam 0.08 mm". Both these above

descriptions distinctly pertain to the same type of thallus, though we have not seen their type specimens. Hawksworth has indicated that the var. *barbata* is generally sterile, rarely fertile. On the basis of the following observations they have been synonymized with the species. In the several Himalayan specimens examined, it has been observed that the typically profusely fertile specimens are less repeatedly branched, while, with the decrease in the number of apothecia there is a denser branching of the thallus apically. In one of the specimens (*Awasthi 2284*, Fig. 18) this type of branching is present in one of the major branches, while, other branches remain thick though without apothecia.

It was observed by one of us (DDA) at Sandakhpoo (in Darjeeling district) where *Sulcaria sulcata* is common that the fertile specimens occur in more or less sheltered places, whereas the apically profusely branched specimens grow in upper branches of trees exposed to strong wind currents. It is likely that the development of repeated finer branches is an ecological adaptation. With decrease or absence of fertility, the minute finer branches may act as effective vegetative propagules. More field study is needed to substantiate this view.

HUE (1899) had described *Alectoria sulcata* f. *ciliata* Hue from India, and had distinguished it as "variat apicibus omnino denigratis at que margine apotheciorum ciliis 1-9 mm longis oranto. Haec posterior variotio f. *ciliata* dici potest" The type is referred to "In super in India", probably at PC, has not been examined. We have not come across any specimen with ciliate apothecia.

Specimens examined

India, Arunachal Pradesh: Parila, alt. ca. 2745 m, on twigs, *Panigrahi 6396* (Awas.). Sikkim: alt. ca. 3000 m, on trees, *Awasthi 85* (Awas.); same locality, *T. Thomson 276* (CAL). Uttar Pradesh: Almora district, Loharkhet to Dhakuri, alt. ca. 2400 m, *Awasthi & Awasthi 614, 645* (Awas.); Chamoli district, Chopta to Tungnath, on bark of fallen tree branches, *Dange 76.609, 76.610, 76.658* (LWU); Dehradun district, Chakrata hills, Deoban, alt. ca. 2760 m, on bark of tree, *Awasthi & Joshi 76.155* (LWU). West Bengal: Darjeeling district, Sandakhpoo, alt. 3150-3300 m, on branches of *Rhododendron*, *Awasthi 82, 83, 84* (Awas.); same locality, alt. ca. 3570 m, on tree trunks, *Awasthi & Agarwal 67.386* (LWU); Sandakhpoo to Phalut, alt. 3300-3600 m, on tree trunks of *Rhododendron*, *Awasthi & Agarwal 67.507* (LWU); same locality, *Bose 60.143* (Awas.); 2 miles below Sandakhpoo, alt. 3000 m, on shrubs, *Awasthi & Agarwal 67.330* (LWU); Tiger Hill, alt. 2250-2550 m, *Bose 6012* (Awas.); near Tongloo Dakbunglow, alt. ca. 3300 m, on twigs of shrubs, *Awasthi & Agarwal 67.529, 67.539* (LWU). **Nepal**: E. Nepal, Mewakhola valley, alt. 3300 m, on trees, *Awasthi 2284* (Awas.); near Ethung, alt. 2400 m, on trees, and twigs of shrubs, *Awasthi 2119* (Awas.); Pokhari to Ethung, alt. 2700 m, on trees, *Awasthi 2137* (Awas.); ascent to Sandakhpoo (India) from Nepal side, alt. 3000-3300 m, on shrubs and trees, *Awasthi 2466, 2471* (Awas.); Chamtang, alt. ca. 4200 m, *Banerjee 1402* (Awas.); Shete to Jambosi, alt. 2971 m, on *Quercus* tree, *Rao 13679* (Awas.).

2. *Sulcaria virens* (Tayl.) Bystr. ex Brodo & Hawksw., Opera Bot. 42: 154. 1977.

- = *Sulcaria virens* (Tayl.) Bystr. Ann. Univ. Mariae Curie-Sklodowska, C, 26: 276. 1971 nom. inval.
- = *Alectoria virens* Tayl., Hook. Lond. J. Bot. 6: 188. 1847. Type collection: India, Sheopore, 1821, Wallich (Holotype: FH-seen in 1962).
- = *Alectoria virens* var. *decolorans* Asah. in Hara, Fl. E. Himal: 604. 1966. Type collection: India, (West Bengal), Darjeeling, Phalut, 1960, Togashi (holotype: TNS, not seen).
- = *Sulcaria virens* f. *decolorans* (Asah.) Hawksw. in Brodo & Hawksw., Opera Bot. 42: 156. 1977 (Fig. 20).

Thallus corticolous, pendulous, up to 25(40) cm long, greyish yellow to yellowish green to grey green; densely branched and branches elongated; the primary branch in the well developed specimens almost 2 mm wide, flattened, dorsiventral with a wide, more or less continuous furrow (pseudocypbella) on the lower side, secondary and further branches narrower, ca. 1 mm or less, more or less cylindrical except at dichotomy, often twisted, usually with narrow slit like furrow almost continuous or rarely with transverse bands of cortex giving a scalariform appearance; branching anisotomic dichotomous; surface smooth, faintly pruinose; lateral spinules sometimes pre-

sent, short, hook-like. Isidia and soredia absent. Cortex 50-100 µm thick. Apothecia unknown. TLC: vulpinic acid with or without virensic and pulvinic acids.

Sulcaria virens is distinguished by greyish yellow to yellowish grey green thallus with furrowed pseudocyphellae and presence of vulpinic acid with or without virensic and pulvinic acids. The taxon is distributed in the temperate and alpine Himalayas and extends to China and Japan.

S. virens f. *decolorans* (Asah.) Hawksw. as *Alectoria* was referred by HAWKSWORTH (1971) to differ in the greyish brown colour. There is no difference chemically and consequently its recognition as a forma seems unjustified as such colour differences are quite often seen in other taxa of lichens.

Specimens examined

1. Specimens with vulpinic, virensic and pulvinic acids; **India**, Arunachal Pradesh: Bomdila to Rahung, hanging from tree trunk, *Rao 7359* (Awas.). Uttar Pradesh: Dehradun district, Chakrata, alt. ca. 2100 m, on trees, *Seshadri A 29* (Awas.); Chakrata division, near Mundali, alt. 2550 m, on trees, *Awasthi 939* (Awas.); Chamoli district (previously part of Garhwal district), Kukinkhal, 3 miles up Wan, on way to Roopkund, alt. ca. 3000 m, on *Rhododendron*, Swami Pranavanand (4024 in Hb. Awas.); Pithoragarh district, Narayanashram, on coniferous trees, leg? comm. *Appa Rao AVN-I* (Awas.); Uttarkashi district, below Jamnotri, alt. 2700 m, hanging from trees, *Awasthi 876* (Awas.). **Nepal**: E. Nepal, ascent to Sandakhpoo (India) from Nepal side, alt. ca. 3000-3300 m, on branches of *Viburnum* and *Berberis*, *Awasthi 2462* (Awas.); Mewakhol valley, alt. 3300-3600 m, on trees, *Awasthi 2270* (Awas.), duplicate has been reported as f. *decolorans* with vulpinic and virensic acids by HAWKSWORTH (1971), but we have found all the three acids.

2. Specimens with vulpinic acid only; **India**, Sikkim: near Karponang, alt. ca. 2550 m, on twigs of trees, *Awasthi 58* (Awas.); Jongri, alt. 3900 m, *Bose 60.133* (Awas.).

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