

ON NEW LICHENS FROM THE HIMALAYAS—I

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INTRODUCTION

DURING the last few years the author has made extensive collections of Lichens from various parts of India. These have been supplemented by many other collections presented to the author, noteworthy among which is the one by Prof. O. A. Höeg. Notes on some of these collections have already been published by Awasthi (1953, 1954) and Höeg (1953). This extensive collection of Indian Lichens in the author's herbarium, upto now, comprises about 2,500 specimens, which have been serially numbered along with about 1,000 identified foreign lichens received on exchange or as gift.

The Indian collection is under careful investigation by the author. During the course of study, several species have been discovered which do not conform to any of the species known so far. After a thorough examination of these specimens and comparison with the related species they have been regarded as new species. These have also been confirmed by the Swedish Lichenologist, Dr. A. H. Magnusson, whose critical remarks (in correspondence) over the different species have been incorporated in the paper.

The present paper and its series are intended to include only those species which have been found or will be found as new to Science, from the Himalayan region.

METHOD

The usual methods with which the Lichenologists are familiar have been adopted for the investigations. The anatomical details have been studied in free-hand sections in water as mounting medium. Treatment and reactions with the well-known chemical reagents used in Lichenology have also been tried, the abbreviations of which, used in the text, stand as follows:

KOH or K = aqueous solution of Potassium hydroxide; Cl = aqueous solution of Calcium hypochlorite; K (Cl) = K immediately followed by Cl; I = aqueous solution of Iodine (in a little Potassium iodide); Pd =

alcoholic solution of Paraphenylenediamine; + = positive reaction
 - = negative reaction and \pm = more or less.

1. *Cetraria pallida* Awasthi sp. nov.

Thallus suberectus vel erectus, irregulariter divisus, glaucus vel flavescens-albidus, laciniae applanatae, concavae vel semicanaliculatae, marginibus leviter undulatis, tenuiter fusco-atris, fibrillis atris rare instructae, superficie laevigato pseudocyphellis atromarginatis \pm dense ornatae. Sterilis. Medulla Pd—.

Habitat.—On ground among mosses.

Locality.—E. Nepal; Topkegola, Thagalabhanjyang (in the main Himalayan range), altitude 13,500–14,000 ft.; coll. D. D. Awasthi; 29–5–1953; No. 2347 in Herb. author; Plate X, Fig. 1; TYPE.

Thallus suberect to erect, 2–3 (3.5) cm. tall, irregularly to subdichotomously lacinate, laciniae irregular in outline, 2–6 mm. broad, appanate concave to semicanaliculate on the upper side, somewhat undulate marginally; margin irregular, brown black lined occasionally with brown black fibrils; fibrils 0.1–0.2 mm. long and 0.1 mm. thick. Thallus above lightly greenish pale to pale, smooth, \pm faintly scrobiculate; below shining pale, occasionally brownish, with roundish brown black margined white specks (pseudocyphellae), on an average about 0.5 mm. in diameter, sometimes the pseudocyphellae confluent and appear as long streaks; the basal part of the laciniae rarely reticulately ridged. No soredia and isidia.

Thallus 200–250 μ thick, plectenchymatously corticated, cortices of almost equal thickness (35–40 μ) on both the sides, cells somewhat indistinguishable on the exterior but 2–4 μ in size inwards; algal zone 30–40 μ thick with green (Protococcus) cells of average 10–12 μ in size; medulla white; medullary hyphae 4–5 μ thick, moderately thick-walled (lumina 1.5–2 μ .) Upper cortex K + yellow; Cl—. Medulla K—, Cl—, K (Cl) + yellow. Pd—.

Thallus sterile.

“Belongs to subsection *Pseudocyphellatae* Räs. and is related to *C. straminea* Vain., from the Philippines, but this species has broad ascendant lobes and grows on trees” (A. H. Magnusson).

2. *Cetraria nepalensis* Awasthi sp. nov.

Laciniae thalli subsolitariae, erectae, elongatae, subdichotome ramosae, supra castaneae, laevigatae, nitidiusculae, concavae vel subplanae, subtus pal-

lidiores, marginibus pycnidiis podicellatis, minutis instructæ, ad basin atro-fibrillosæ, pseudocyphellis deficientibus. Sterilis. Medulla K (Cl)—, Pd—.

Habitat.—On ground among mosses.

Locality.—E. Nepal, Topkegola, towards Thagalabhanjyang (in the main Himalayan range), altitude 15,000 ft.; coll.: D. D. Awasthi; 29-5-1953; No. 2373 in Herb. author; Plate X, Fig. 2; TYPE.

Thallus erect, 2-4 cm. tall, subdichotomously branched, laciniae † uniformly 2-3 (4) mm. broad, variously applanate concave to semicanaliculate on the upper side, margin somewhat undulate, minutely black dentate in the apical and black fibrillate in the basal parts; dents on an average 0.1 mm. in size and fibrils 0.25×0.1 mm. in size with pycnidia at the tips. Thallus above chestnutbrown; below usually lighter pale brown to concolorous as the upper side, both sides smooth shining; basal decaying parts of the laciniae yellowish. No soredia, isidia and pseudocyphellæ.

Thallus thickest in the middle (160-200 μ) and gradually thinning outwards in the margin to 120-100 μ ; plectenchymatous cortex of almost equal thickness (35-40 μ) on both the sides; cortex externally brownish, gradually lighter to colourless inwards, cells roundish, fairly large, 6-8 μ in size; algal zone 25-30 μ thick, algal cells green (Protococcus) upto 12 μ in size; medulla white, medullary hyphæ 4-5 μ thick, thick-walled and superficially finely granular. Upper cortex K —, Cl—, I—. Medulla K —, Cl—, K—, (Cl)—, Pd—.

Thallus sterile.

“Approaches certain specimens of *Cetraria delisei* var. *fastigiata* Del. in habitus but medulla in *nepalensis* K (Cl)—” (A. H. Magnusson).

3. *Physcia askotensis* Awasthi sp. nov.

Thallus suborbicularis, ambitu lobatus, glaucescenti-albus, lobis adpressis brevibus, subapplanatis vel subundulatis, inciso-crenatis, interdum leviter pruinosis, thallus subtus pallidus rhizinis pallidis instructus, cortice superiore KOH + flavo, medulla KOH immutata. Apothecia in centro crebra, majuscula, sessilia, disco fusco-atro vel atro, plano, margine prominenti flexuoso cincto. Hypothecium pallidum. Sporæ 8-næ ovali-ellipsoideæ, obscuratæ, uniseptatæ, pariete crasso.

Habitat.—On bark of tree trunk of *Alnus nepalensis*.

Locality.—N.W. Himalayas, Kumaon, Almora District, Askote, near village Sunkote, altitude 4,500 ft.; coll.: D. D. Awasthi; 2-5-1955; No. 3319

in Herb. author; Plate X, Fig. 3; TYPE; also from the same locality and habitat collected on 21-6-1954; No. 2687 in Herb. author; Para type.

Thallus foliose, suborbicular, Type *ca.* 10 cm. in size, but observed growing to larger dimensions than this, adpressed, lacinate lobate; lobes plane to irregularly undulated, 4-10 mm. broad, ascendent and somewhat imbricated along the margins, incised crenate, apex scarcely ascending. Thallus above glaucous white, pruinose, peripherally smooth and gradually minutely ridged reticulated to tubercled inwards (centrally); below light pale to greyish pale, rhizinose upto the margin; rhizinæ pale to greyish pale, branched, upto 1 mm. long and 0.1 mm. thick at the base, loosely adherent to the bark and thus thallus easily separable. No soredia and isidia.

Thallus 160-200 μ thick in the marginal lobes, paraplectenchymatously corticated on both the sides; upper cortex 25-35 μ thick, cells thin-walled, roundish to subangular 5-8 μ in size; algal zone 25-30 μ thick, algal cells green (Protococcus) upto 10 μ in size, roundish; medulla colourless of loosely interwoven hyphæ; hyphæ 4-4.5 μ thick, thick-walled (lumen 1 μ); lower cortex of almost the same thickness as the upper, paraplectenchymatous with somewhat thickened amorphous walls, cells 4-12 μ in size, irregular to roundish, larger cells towards medulla. Upper cortex K + yellow, Cl-, K (Cl) + yellow, I-. Medulla K-, Cl-, K (Cl)-, I-, Pd-.

Apothecia in the central part of the thallus, numerous, sessile, concave when young, plane to scarcely reflexed later, rounded to somewhat irregular in outline, usually mature ones upto 1.5 mm. in diameter; disc dark brown to black pruinose or not; margin prominent, flexuose and pruinose, rarely cracked. Thecium (hymenium) 90-120 μ thick, light brownish for about 10 μ in the upper part, I + blue, hypothecium pale, Asci clavate, 85-90 \times 30-35 μ in size, 8-spored; spores biserially arranged, oval-ellipsoid, 2-celled, immature colourless, mature brown, thick-walled, ends rounded obtuse to acute, 24-32 \times 10-13 μ in size, lumina of the spore cells varying, usually 6-7 μ in size.

“ This species seems to be nearly akin to *Ph. biziana* (Mass.) Zahlbr. on account of the broad, pruinose laciniae, the negative KOH-reaction in the medulla and the shape and arrangement of the apothecia, but is well distinguished in the smaller spores. The resemblance to the sterile *Ph. biziana* var. *aipolioides* Nadv. in his exsiccates No. 25 is rather great ” (A. H. Magnusson).

4. *Physcia melanotricha* Awasthi sp. nov.

Thallus foliaceus, suborbicularis, obscure cinereofuscus vel fusco-ater, laciniatus, siccus, fragilis, humidis coriaceus, laciniae sublineares, discretæ, profunde canaliculatæ, marginibus undulatis, superne lævigatæ, subtus atræ, dense atrofibrillosæ, reagentibus immutatæ. Cortex superior paraplectenchymatice cellulosus. Sterilis.

Habitat.—On water dipped wet sandy soil along with mosses and grasses.

Locality.—E. Nepal, near Topkegola, above the banks of Sajupokhari (*Saju* = proper name, *pokhari* = lake) in the main Himalayan range, altitude 14,500–15,000 ft.; coll.: D. D. Awasthi; 30-5-1953; No. 2410 in Herb. author; Plate X, Fig. 4; TYPE.

Thallus foliose suborbicular, 4–5 cm. in size, lacinate, subascending; laciniae repeatedly subdichotomously branched, imbricated or superposed; almost uniformly 1.5–2 mm. (2.5–3.5 mm. before division) broad, apically narrower (upto 1 mm.); laciniae canaliculate upto the apical end, even the smallest lobules concave on the upper side; margin smooth to minutely irregular. Thallus leathery coriaceous when wet and brittle in dry state; laciniae in herbarium specimens sometimes twisted by about 180° exposing the under-side up. Thallus above smooth, dark greyish brown to brownish black, usually apical parts lighter in colour; below black, densely beset with black, branched hirsute and rough-surfaced rhizinae of about 1 mm. length and 0.1 mm. thick at the base. No soredia and isidia.

Laciniae 200–250 μ thick in the middle and thinner (100–80 μ) marginally; upper side paraplectenchymatously corticated; cortex 16–20 μ thick; cells roundish to subangular, thin-walled and 4–6 μ in size; algal zone 20–25 μ thick, algal cells green (Protococcus) upto 10 μ in size; medulla white of compact and conglutinated longitudinally disposed hyphae (in transverse section the medulla often partly falsely appearing as paraplectenchymatous); medullary hyphae 4 μ thick, thick-walled, (lumen 1 μ), smooth; under cortex \pm plectenchymatous brown black and 5–8 μ thick. Upper cortex K—; Cl—, I—. Medulla K—, Cl—, K (Cl)—, Pd—.

Thallus sterile

“Belongs to *lithotea* group” (Magnusson).

The name—*melanotricha*—to this new species has been given on a suggestion from Dr. Magnusson.

5. *Physcia endococcina* (Korb.) Th. Fr. var. *latiloba* H. Magn. nov. var.

A Typo differt lobi thalli breves latique (2–5 mm.).

Habitat.—On bark of tree or on stones.

Locality.—N.W. Himalayas, Almora District, Askote, below village Sunkote, altitude 4,500 ft. (on bark of *Alnus nepalensis*); coll.: D. D. Awasthi; 2–6–1955; No. 3318 in Herb. author; Plate X, Fig. 5: TYPE; also from the same locality and habitat dated 21–6–1954 (No. 2699). From localities near about Askote—on bark of *Pyrus Pashia* (No. 3302), on *Sapium insigne* (No. 3303), and over stone (No. 3301).

Distribution.—"Found also in Hawaiian Islands. The corticolous type seen from U. S. A., Maryland and Maine"—(A. H. Magnusson).

Thallus orbicular when small in even substratum and becoming sub-orbicular in larger dimensions, upto 10 cm. in diameter, adpressed, laciniate; laciniae upto 5 mm. broad, crenate, dissected, ascending imbricate marginally. Thallus above ashy grey to greyish brown, smooth, no soredia and isidia; below black rhizinose; rhizinæ upto the margin, black, dense, and upto 2 mm. long.

Thallus about 200 μ thick, corticated on both the sides, upper cortex 40–45 μ thick, paraplectenchymatous, cells thin-walled, roundish to sub-angular, 6–8 μ in size; algal cells green, medulla yellowish in the upper about $\frac{1}{3}$ – $\frac{1}{4}$ region and coccineus in the lower $\frac{2}{3}$ – $\frac{3}{4}$ region, medullary hyphae 3.5–4 μ thick, thin-walled; lower cortex 20–25 μ thick, dark brown to brown black, cells roundish to somewhat elongated, 8–12 μ in size. Upper cortex K + yellowish, Cl–. Medulla K + violet (due to the interaction the violet colour is also driven out of the medulla), Cl + dark violet to violet brown.

Apothecia numerous, crowded in the central part, superficial, sessile, beset with about 1 mm. long black cilia at the base, receptacle attaining a size of about 1.5 mm. in diameter, with prominent thalline margin; disc brown black to black, concave in young stages, plane later. Thecium (hymenium) about 100 μ thick, I + blue, epithecium yellowish; hypothecium yellowish, medulla coccineus. Asci club-shaped, 8 spored; spores brown 2-celled, oval ellipsoid, placodioid, thick-walled, 22–30 \times 12–15 μ in size; paraphyses slender, simple, tip swollen.

6. *Anaptychia himalayensis* Awasthi sp. nov.

Thallus suborbicularis, laciniatus, cinereo-albus vel glauco-cinereus, laciniae partim horizontales, \pm imbricatæ, plerumque apicibus adscendentes,

partim suberectæ, lobis crenatis et varie tuberculosi, lævigatis, haud sorediosis, pycnidiis obscuris verruciformibus sæpe ornatis. Rhizinæ marginales obscuræ sæpe visibiles. Cortex KOH + flavus, I + cærulescens, hyphæ corticales longitudinaliter \pm parallelæ. Apothecia numerosa, superficialia vel alte podicellata, majuscula, disco fusco pruinoso, immerso, margine alte prominente, laciniato. Spores 8-næ, fuscæ, diblastæ, placodiomorphæ, majusculæ.

Habitat.—Over stone in subshady place.

Locality.—N.W. Himalayas, Almora District, Askote, below village Naret, altitude 4,000–4,500 ft.; coll.: D. D. Awasthi; 28–5–1954; No. 2653 in Herb. author; Plate XI, Fig. 3: TYPE.

Thallus suborbicular, upto 4.5 cm. in size, adpressed, horizontal to apically partly subascending; laciniae subdichotomously branched 1–2 mm. broad, convex on the upper side, imbricate to compactly interlocked with each other (chiefly in the central part) by the marginal cilia, apically subascending and bearing superficial to subterminal podicellate apothecia; often the horizontal part of thallus superposed by the dense, suberect lobes, secondary in nature of development, lobes small, 1–2 mm. broad, entire or crenate and divided; laciniae and lobes with black pycnidial dots and often variously tubercled with pycnidial protuberances; laciniae margin ciliate; cilia branched basally concolorous to the thallus and distally brown. Thallus above greyish white to glaucous grey, smooth waxy to scarcely pruinose in the marginal lobes; below white farinose, without rhizinæ. No soredia and isidia. Thallus usually has a brownish scum of *Scytonema* alga covering the marginal grooves in the central part.

Thallus corticated (pseudocortex) on the upper side and along the margins by longitudinally \pm parallel hyphæ, thickness varies from 40–300 μ due to irregular reticulations in the inner outline of the cortex, the algal zone discontinuous, algal cells 12–15 μ in size, green (Protococcus), occur in groups in the grooves of the cortex, sometimes groups of algal cells as islands within the tissue of cortex; medulla thin of loosely interwoven superficially densely granular hyphæ. No lower cortex. Cortex K + yellow, Cl–, K (Cl) + yellow, I + violet blue to blue; medulla K–, Cl–, I–, Pd + orange yellow.

Apothecia numerous, superficial to subterminal on horizontal or suberect laciniae, mature podicellate, suberect to erect peltate, upto 8 mm. in diameter; disc brown pruinose with an inner rim-like faintly orange-coloured margin, medullary in origin, and an outer proliferated thalline margin with 1–3 mm. long lobules, farinose on the inner and corticated

on the outer side, the lobules marginally ciliate, cilia of the same nature as in thallus. Apothecia arise as globular structures on the thallus with eciliate inflexed lobules in young stages; and later are plane to somewhat reflexed with ciliate lobules. Thecium (hymenium) 180–200 μ thick, brownish in the upper part and colourless inwards, I + blue, hypothecium yellowish in thin sections, brownish otherwise. Asci club-shaped, 120–140 \times 20–25 μ in size, 8-spored; spores brown, oval ellipsoid, 2-celled, somewhat constricted at the septum, placodioid, thick-walled, 32–40 \times 16–20 μ in size; paraphyses slender, simple, upto 2 μ thick.

This species is closely related to *A. podocarpa* (Bél.) Mass., but can easily be distinguished by its habitat, the habit of lacinia, the I + blue or violet blue reaction of the cortex, the ciliate lobulate margin of apothecia and the smaller spores.

7. *Anaptychia pellucida* Awasthi sp. nov.

Thallus fruticulosus, rosulatus, cinereo-albus vel obscure cinereus, lacinia subdichotome lobata, convexa, basi subangusta, superne latiores, fibrillis atris marginalibus vel superficialibus ornata, subtus albidæ, farinosa vel reticulatim subnervosa. Cortex superior KOH—, I + cærulescens, hyphae longitudinaliter directæ. Apothecia breviter podicellata, margine elevato crenato haud fibrilloso, disco obscure fusco, leviter pruinoso vel nudo. Sporæ magna, 8-na, obscuræ, placodiomorphæ, maculis pellucidis (cellulis indistinctis) instructæ.

Habitat.—On twigs of a shrub.

Locality.—E. Himalayas, Darjeeling, Tiger Hill, altitude 8,000 ft.; coll.: D. D. Awasthi; 10–10–1954; No. 3136 in Herb. author; Plate XI, Figs. 1 & 2: TYPE.

Thallus fruticulose, 4–6 cm. in size, rosulate, fixed to the substratum (twig) only centrally, subdichotomously branched, laciniate; lacinia convex on the upper side by curving inwards of the margins, narrow basally and broad flattened upto 5 mm. upwards. Thallus above glaucous-ashy-white to dark grey or blackish, smooth to occasionally minutely brown black tubercled; tubercles pycnidial in nature, simple or confluent; thallus below white farinose and minutely reticulately nervose; fibrils along the margin and on the upper side, black, branched, thyrsoid, intricately and hirsute upto 3 mm. long and 0.2–0.3 mm. thick at the base. No soredia and isidia.

Thallus corticated (pseudocortex) on the upper side and along the margins by longitudinally running thick-walled hyphae, uppermost layer o

the cortex lightly brown, inner outline irregular and greatly reticulated, thus thickness varying between 40–275 μ , and often continuous upto the lower surface without any cover of medulla (these thick parts represent the superficially nervose reticulations); algal zone discontinuous, algal cells green (Protococcus) in irregular patches located in the concavities formed by the reticulated inner side of the cortex; algal cells 10–14 μ in size; medulla present and thin covering only the groups of algal cells; no lower cortex. Cortex K—, Cl—, K (Cl)—, I + violet blue to blue (upper surface yellowish); medulla K + scarcely yellowish Cl—, I—, Pd + yellow.

Apothecia superficial to subterminal, shortly podicellate, 2–3 mm. in diameter, disc dark brown, scarcely pruinose to nude; the margin thalline, entire in young stages and thin crenate later, without any fibrils; cortex of the receptacle 120–150 μ thick, I + deep blue. Thecium 260–300 μ thick, light brownish for about 40 μ in the upper part and colourless inwards, I + blue; hypothecium colourless in thin and yellowish in thick sections, I + light orange. Asci large, clavate to irregular (due to bulging spores) about 215 \times 60 μ in size, 8-spored; spores large, ellipsoid, brown, 2-celled, placodioid with many globular pellucid areas towards the two ends (illusively globularly celled), 60–72 \times 24–28 μ in size; paraphyses slender, simple, 2 μ thick. Pycnoconidia straight 3–4 \times 1 μ and somewhat narrower in the middle region.

“ Related to *A. podocarpa* but spores larger and in spots pellucid ” (A. H. Magnusson). It can also be distinguished by the I + blue reaction in the cortex. It shows similarity to *A. comosa* in the presence of cilia on the upper surface but spores in *comosa* are much smaller.

The two preceding species of Anaptychia—*A. himalayensis* and *A. pellucida*—have shown an interesting reaction when treated with iodine solution. The cortical region in both of these develops a violet blue to blue colour by this treatment. The colouration is much pronounced in the cortical region of the apothecia. The only other Anaptychia with “a positive I-reaction, however, is recorded by Vainio in *A. obscurata* var. *serpens*” (Magnusson). Thus these two can easily be distinguished from the rest of the Anaptychia by this reaction:—Cortex I + blue.

8. *Peccania Höegii* Awasthi sp. nov.

Thallus effusus, subfruticulosus, olivæo-ater, partes thalli erectæ, breves, subcontiguæ vel approximatae, teretes, superne crassiores, partes fertiles apice dilatatae, apothecium unicum ferentes, disco concavo, cinereo-

suffuso, margine tumido atro cincto, algas cæruleo-virides minutas, glomeratas includente. Hypothecium pallidum, indistinctum. Paraphyses conglomeratae, granulis obscuris nubilatae, thecium inde indistincte visum. Asci rare evoluti, sporae 8-nae, simplices, ellipsoideae.

Habitat.—On hard chalky soil over stone (or boulders).

Locality.—N.W. Himalayas, Kangra District, Spiti Valley, Kaze, altitude 12,000 ft.; coll.: O. A. Höeg; 9-8-1952; No. 1653 in Herb. author; Plate XI, Figs. 4, 5 & 6: TYPE. Also from Kangra District, Pin River Valley, 1 mile south of Sangam, altitude 12,800 ft.; coll.: O. A. Höeg; 6-8-1952; No. 1629 in Herb. author.

Thallus effuse, black, subfruticulose, consisting of the vertical thallus parts 0.6-1 mm. high, club-shaped, contiguous in groups or more or less isolated; at least top black, otherwise more or less suffused by greyish earthy particles. The hyphae of the thallus densely traversing as deep as 2 mm. within the chalky soil, and are thick-walled, septate and 4-5 μ thick. Thallus in section yellowish brown and amorphous in the outermost 4-5 μ thick region, followed inwards by the gonidial zone of 80-100 μ thickness. Algal cells blue green 4-6 μ in size, and in well demarcated groups within a mucilaginous (?) type of substratum (matrix); medulla of dense hyphae almost vertically disposed.

Apothecia apical on a 0.12 mm. thick erect stalk, about 0.8-1 mm. high; disc at first closed, open later, widening to about 0.6 mm. with concave mostly suffused rounded disc and turgid, black margin; KOH + yellow. Algal cells blue green present in the margin and in the stalk. Apothecial margin upto 160 μ broad, upper surface dark brown in water, laterally 100 μ thick with numerous blue green algae 4-6 μ in diameter, in small dense groups. Thecium 80 (100) μ thick, I + blue, nubilated and dark from black brown spots between or on the paraphyses. Hypothecium paler brown, I-. Asci clavate, 45-60 \times 12-15 μ , 8-spored, very rarely mature; spores not seen released outside the ascus, as observed within the ascus simple, colourless, oval ellipsoid, 10-12 \times 6-8 μ in size. Paraphyses simple, 1 μ thick.

It is a minute lichen, interesting in having peculiar brown black nubilations in the thecium, a structure "never seen in any other lichen" (Magnusson). The specimen has been named after its collector, Prof. O. A. Höeg (Norway).

SUMMARY

The paper deals with 7 new species and one new variety of lichens from the Himalayan region. They are *Cetraria pallida* Awasthi, *C. nepalensis*

