

REVISION OF THE LICHEN GENUS *Buellia* De Not. (FAMILY PHYSCIACEAE) FROM INDIA

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ABSTRACT

The paper reports seventeen species of the lichen genus *Buellia* De Not., from India along with a key for identification of different Indian species. Out of these, nine species, *Buellia aggedians* (Stirt.) Zahlbr., *B. betulinoides* Schubert & Klement, *B. inornata* (Stirt.) Zahlbr., *B. lauricassiae* (Fèe) Müll. Arg., Müller, *B. manipurensis* Singh and Singh, *B. meghalayensis* S. Singh and D. D. Awasthi, *B. morehensis* Singh and Singh, *B. montana* Magn., and *B. palmiensis* S. Singh and D. D. Awasthi are reported as endemic species for Indian lichen flora.

KEYWORDS: *Buellia*, Lichen, Key, Endemic species and Distribution

During the course of revisionary studies on the lichen family Physciaceae under “Flora of India” project, several lichen specimens collected earlier from Eastern, North-Eastern, Western and Southern regions of India have been investigated. The lichen genus *Buellia* De Not., is characterized by thallus crustose, continuous, rimose areolate, granulose or verrucose, rarely sorediate or isidiate, hypothallus mostly as a black or brownish line along the margin or in between the thalli, rarely absent. Thallus thin or moderately thick, cortex not well differentiated phycobiontic cells spherical to ellipsoidal, green, ± uniformly distributed. Apothecia immersed, adnate or sessile, round or rarely angular or irregular, margin indistinct or prominent, disc black, plane slightly or strongly convex, epruinose or rarely pruinose, exciple thin or moderately thick, dark brown to black or dark brown on outer side and pale brown or hyaline on inner side or completely pallid, epithecium brown to dark brown or olive brown, hymenium hyaline, with or without oil globules, hypothecium hyaline to pale brown, internal stipe distinct or indistinct, pallid, reddish brown or dark brown, asci clavate, 8-spored or occasionally 12-16 spored, ascospores brown, 2-celled, ellipsoid, rarely ovoid, straight or curved, unconstructed or constricted at septum and not surrounded by a gelatinous halo, spore wall uniformly or unevenly thickened, surface smooth or ornamented, paraphyses simple to branched, apically swollen and brown (Awasthi, 1988; Singh and Singh, 1982; Singh and Awasthi, 1981).

MATERIALS AND METHODS

This study is based on consultation of herbarium materials that are preserved in different lichen herbarium at Agharkar Mycological Herbarium (AMH), Agharkar

Research Institute, Pune; National Botanical Research Institute, Lucknow (LWG); Botanical Survey of India, Eastern Circle, Shillong (ASSAM). Central National Herbarium (CNH), Botanical Survey of India, Kolkata (CAL). The materials were brought on loan from the above lichen herbariums to Botanical Survey of India, Central Circle, Allahabad (BSA).

The specimens were investigated morphologically, anatomically and chemically. The colour tests were performed with the usual reagents i.e. K (5% Potassium hydroxide), C (aqueous solution of hypochlorite) and PD (Paraphenylene diamine). Lichen substances were investigated with thin layer chromatography (TLC) in solution A (180 toluene: 60 dioxane: 8 acetic acid) using the technique of Culberson (1972) and Walker and James (1980).

Key to the Indian species of genus *Buellia*

- | | |
|--|---------------------|
| 1a. Thallus saxicolous..... | 2 |
| 1b. Thallus corticolous..... | 9 |
| 2a. Spore wall ornamented on surface..... | 3 |
| 2b. Spore wall smooth on surface..... | 8 |
| 3a. Thallus K ⁺ yellow or yellow red..... | 4 |
| 3b. Thallus K ⁻ | 7 |
| 4a. Thallus surface smooth..... | 5 |
| 4b. Thallus surface rough..... | 6 |
| 5a. Thallus glaucous white to grey, areolate, deeply fissured, hypothallus absent, K ⁺ red, PD ⁺ yellow..... | <i>B. ceylensis</i> |

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- 5b. Thallus yellowish, grey to ashy grey, deeply fissured, hypothallus black line along the margin, K⁺ yellow, PD⁺ deep yellow.....*B. meghalayensis*
- 6a. Thallus greyish brown, cracked to areolate, hypothallus dark brown, thick, 2-4 celled ascospore, K⁺ yellow to reddish brown, PD⁺ deep yellow.....*B. manipurensis*
- 6b. Thallus grey to grey brown, verruculose, hypothallus indistinct but blackish at its junction, K⁺ red, PD⁺ yellow.....*B. morehensis*
- 7a. Thallus dull brownish, grey, subsquamulose, rough, hypothallus absent, K⁻, PD⁻*B. palniensis*
- 7b. Thallus brownish grey, rough, hypothallus indistinct, mischoblastiomorphic type of ascospore, K⁺ yellowish, PD⁻*B. posthabita*
- 8a. Spore wall ornamented on surface.....10
- 8b. Spore wall smooth on surface.....15
- 9a. Thallus K⁺ yellow or yellow to red.....11
- 9b. Thallus K⁻13
- 10a. Thallus rough, greyish white to grey granulose to verruculose, mischoblastiomorphic type of ascospore, K⁺ yellow turning red, PD⁺ yellow.....*B. inornata*
- 10b. Thallus smooth.....12
- 11a. Thallus whitish grey to glaucous white, subverruculose to granulose, deeply fissured, K⁺ yellow, PD⁺ yellow.....*B. punctata*
- 11b. Thallus whitish grey to grey, weakly fissured, K⁺ yellow, PD⁻*B. montana*
- 12a. Thallus smooth, sorediate, soredia dull whitish, farinose.....*B. betulinoides*
- 12b. Thallus rough, soredia absent.....14
- 13a. Thallus glaucous white to greyish white, subsquamulose, weakly fissured, K⁻*B. curtisii*
- 13b. Thallus greyish brown to grey, subverruculose, weakly fissured, placodiomorphic type of ascospore, K⁻*B. placodiomorpha*
- 14a. Thallus smooth, greyish white to grey, weakly fissured, K⁺ yellowish, PD⁻*B. aggreadians*

- 14b. Thallus rough.....16
- 15a. Thallus grey to brownish grey, deeply fissured, K⁺ yellow turning red, PD⁺ yellow- orange.....*B. disciformis*
- 15b. Thallus whitish grey to grey, verruculose to granulose, weakly fissured, K⁺ yellow turning red, PD⁻*B. glaucotheca*
- 16a. Thallus greyish white, subverruculose, weakly fissured, 6-celled, 3-transversely and 2- longitudinal septate, submuriform of ascospore, K⁺ yellow, PD⁻*B. alboatra*
- 16b. Thallus glaucous grey to grey, verruculose, weakly fissured, 4-celled, 3-transversely septate ascospore, K⁺ yellow turning red, PD⁺ yellow-orange.....*B. lauricassiae*

RESULTS AND DISCUSSION

Taxonomic Descriptions

Buellia aggreadians (Stirt.) Zahlbr., Cat. Lich. Univ., 7: 333, 1931; *Lecidea aggreadians* Stirt., Proc. Phil. Soc., Glasgow, 11: 313, 1879.

Type: India; Neilgherries (Nilgiri), on bark of tree, G. Watt, s. n. (BM), (not seen).

Thallus corticolous, crustaceous, 2-3 cm across, whitish grey to grey, verruculose, surface smooth, weakly fissured, epruinose, hypothallus black delimiting line along the margin, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5 mm diameter, disc black, plane to convex, covered with dense pruina, oil globules present, epithecium brown 24 µm thick, hymenium hyaline, 96-108 µm high, insert with oil globules, hypothecium dark brown 108-120 µm thick, exciple dark brown 60-84 µm thick, asci 8-spored, clavate, 60-72 x 12-18 µm, ascospores brown, 2-celled, ellipsoid, 15-28 x 6-9 µm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K⁺ yellowish, C⁺ reddish to red, KC⁺ red, PD⁻

Remark: *Buellia aggreadians* resembles *B. glaucotheca* (Fée) Malme and *B. epimarta* (Nyl.) Malm, which are distinguished by different thallus reactions and absence of oil globules in hymenium.

Distribution: India (Tamil Nadu and West Bengal).

CHANDRA: REVISION OF THE LICHEN GENUS *Buellia* De Not. (FAMILY PHYSICIACEAE) FROM INDIA

Specimens examined: West Bengal, 24-Parganas, Saptagram, Birati, 16.9.1966, K. N. Roychowdhury 395 (CAL); Woodlands, alt. 4500 ft., 16.9.1967, C. G. Dharne & K. N. Roychowdhury 1341 (CAL); Galla road side, 12.2.1970, K. N. Roychowdhury 1690 (CAL).

***Buellia alboatra* (Hoffm.) Th. Fr., Fries 91: 1861; *Lichen alboatra* Hoffm., 30: 1784; *Lichen corticola* Acharius, nom. Superfl., 131: 1795; *Abacina alboatra* (Hoffm.) Norman, 236: 1853; *Diplotomma alboatrum* (Hoffm.) Flotow, 380, 382: 1850; *Rhizocarpon alboatrum* (Hoffm.) Anzi, 92: 1860.**

Type: Germany, (Arnold, Lich. Mon 55: UPS), (not seen).

Thallus corticolous, crustaceous, 2-3 cm across, whitish grey, subverruculose to granulose, areolate, surface rough, weakly fissured, epruinose, hypothallus indistinct, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5 mm diameter, disc black, plane to convex, slightly pruinose, oil globules absent, epithecium pale brown 24-36 μm thick; hymenium hyaline 84-108 μm high, hypothecium dark brown 84-96 μm thick; exciple dark brown 60-72 μm thick; asci 8-spored, clavate, 60-72 x 12-18 μm , ascospores brown, 6-celled, 3-transversely and 2-longitudinal septate, submuriform, 15-24 x 6-12 μm in size, wall uniformly thickened, surface smooth, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^+ yellowish, C^- , KC^- , PD^-

Remark: *B. alboatra* is distinguished by 6-celled, 3-transversely and 2-longitudinal septate and submuriform of ascospores and K^+ yellow thalli.

Distribution: India (Manipur); Europe, North America, Africa, Australia and New Zealand.

Specimens examined: Manipur, Litan, Sakkibung, alt. ca. 3500-4000 ft., 14.11.1976, K. P. Singh 54912 (CAL).

***Buellia betulinoidea* Schubert & Klement, Nova Hedwigia, 11 (1-4): 66, 1966.**

Type: India; Jammu & Kashmir, Batote, alt. 1600 m., on Cedrus (Hb. Klement), (not seen).

Thallus corticolous, crustaceous, 2-3 cm across, greyish brown, subverruculose to granulose, surface smooth, weakly fissured, epruinose, sorediate, soredia dull whitish, farinose, hypothallus absent. Apothecia sessile, immersed, 0.2-1.0 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium pale brown 24 μm thick, hymenium hyaline 84-96 μm high,

hypothecium dark brown 84-96 μm thick, exciple brown on outer and pallid on inner side, 48-60 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 15-24 x 6-9 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^- , C^- , KC^- , PD^-

Remark: *B. betulinoidea* is distinguished by presence of dull whitish farinose, soredia on the thalli.

Distribution: India (Manipur and Tamil Nadu).

Specimens examined: Manipur, Saraikong, Litan, alt. ca. 3600 ft., 9.11.1976, K. P. Singh 54782 (CAL); Karang, Kabru lakha area, alt. ca. 4000-5000 ft., 1.11. 1976, K. P. Singh 55044 (CAL).

Buellia ceylanensis Zahlbr., Zahlbr. Apud Reehinger, Deuschrift. Math. Naturv. Class Kais. Acad. Wiss Wien, 18: 31, 1911; Awasthi & Singh, Geophytology, 1(2): 101, 1972.

Type: Ceylon (Sri Lanka), near Kandy, on quartz, Rachinger 2768, (W), (not seen).

Thallus corticolous, crustaceous, 3-4 cm cross, grey to greyish brown, areolate, surface smooth, deeply fissured, bright, epruinose, hypothallus indistinct, isidia and soredia absent. Apothecia sessile, immersed, 0.2-1.0 mm diameter, disc black, plane to convex, slightly pruinose, oil globules absent, epithecium brown 24 μm thick, hymenium hyaline 72-84 μm thick, hypothecium pale brown 60-72 μm thick, exciple dark brown on outer side and pallid on inner side 72-96 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 18-24 x 6-12 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, septate, branched, globose at tips.

Chemistry: Thallus K^+ red, C^- , KC^- , PD^+ deep yellow.

Remark: *B. ceylanensis* resembles *B. meghalayensis* but the latter is distinguished by K^+ red thalli and larger spore size.

Distribution: India (Manipur and Tamil Nadu); Ceylon

Specimens examined: Manipur, Mao, alt. 6200ft., 5.6.1979, K. P. Singh 550368 (CAL).

***Buellia curtisii* (Tuck.) Imsh. In Brodo, Lichens of Long Island, New York; 253, 1968. *Gyrostomum curtisii* Tuck. Am. J. Arts Sci. 2(25): 430, 1858.**

Type: North Carolina, Trunks, Dr. Curtis (not seen).

CHANDRA: REVISION OF THE LICHEN GENUS *Buellia* De Not. (FAMILY PHYSCIACEAE) FROM INDIA

Thallus corticolous, crustaceous, 3-4 cm across, glaucous white to greyish white, verruculose, subsquamulose, surface rough, weakly fissured, epruinose, hypothallus indistinct, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 24 µm thick, hymenium hyaline 84-96 µm high, hypothecium pale brown 96-108 µm thick, exciple brown on outer and pallid on inner side 36-45 µm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 15-28 x 6-9 µm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, septate, branched, globose at tips.

Chemistry: Thallus K⁺ yellow to red brown, C⁻, KC⁻, PD⁺ deep yellow to reddish.

Remark: *B. curtisii* resembles *B. stilligiana* which is distinguished by dark brown exciple, giving red crystals in K solution and presence of zeorin in the thalli.

Distribution: India (Manipur); North America.

Specimens examined: Manipur, Karang, Kabru-Lakha area, alt. 3500 ft., 14.6.1979, K. P. Singh 55083 (CAL); Ukhrul, Carnation Avenue, alt. ca. 5500 ft., 4.11.1976, K. P. Singh 55149 (CAL).

Buellia disciformis (Fr.) Mudd., *Man. Brit. Lich.* 1861. Sheard, *Lichenologist*, 2: 239, 1964. *Lecidea parasema* var. *disciformis* Fr., *Nov. Sched. Critic.* 9, 1826.

Type: Stirp. Crypt. Vog. Rhem., Maugeot et Nestler 745 (UPS), (not seen).

Thallus corticolous, crustaceous, 4-5 cm across, grey to brownish grey, subverruculose, surface smooth, deeply fissured, epruinose, hypothallus dark brown to black delimiting line around the thallus, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5 mm diameter, disc black, plane to convex, epruinose, oil globules present, epithecium brown 24 µm thick, hymenium hyaline 72-84 µm high, inserted with oil globules, hypothecium dark brown 96-120 µm thick, exciple dark brown 36-72 µm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 15-28 x 6-9 µm in size, wall uniformly thickened, surface smooth, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K⁺ yellow to red, C⁻, KC⁻, PD⁺ yellow-orange.

Remark: *B. disciformis* is distinguished by different thallus reactions K⁺ yellow turning red, PD⁺ yellow-orange and presence of oil globules in hymenium.

Distribution: India (Manipur and West Bengal).

Specimens examined: Manipur, Ukhrul, on way to Tori, alt. 3500-4000 ft., 7.11.1976, K. P. Singh 54717 (CAL); West Bengal, 24-Paragnas, Chowngda (Halera), 27.11.1970, K. N. Roychowdhury 1409, 1429 (CAL).

Buellia glaucotheca (Fée.) Malme, *Ark. Bot.* 21 A (14): 20, 1927. Imsh., *Farlowia*, 4: 491, 1955. *Lecidea glaucotheca* Fée., *Suppl. Essai. Crypt. Ecorc. Office*, 109, 1837.

Type: Habitat in corticibus Cinchonae Condamineae, Humbold & Bonpland, (not seen).

Thallus corticolous, crustaceous, 1-2 cm across, whitish to dusty grey, verruculose to granulose, surface bright, rough, weakly fissured, epruinose, hypothallus black delimiting line around the thallus, isidia and soredia absent. Apothecia sessile, immersed, 0.2-1.0 mm diameter, disc black, plane to convex, covered with white pruina, margin black, oil globules absent, epithecium brown 24 µm thick, hymenium hyaline 84-96 µm high, hypothecium dark brown, K⁺ red, 108-120 µm thick, exciple brown to dark brown 48-72 µm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 18-27 x 6-9 µm in size, wall uniformly thickened, surface smooth, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K⁺ yellow turning red, C⁻, KC⁻, PD⁺ deep yellow.

Remark: *B. glaucotheca* resembles *B. aggregians*, which is distinguished by K⁺ red thallus and hymenium interspersed with oil globules.

Distribution: India (Manipur and Tamil Nadu); Cuba, Jamaica, South America and West Indies.

Specimens examined: Manipur, Mapith hill, range peak, alt. ca. 4500-5500 ft., 19.11.1976, K. P. Singh 54948 (CAL).

Buellia inornata (Stirt.) Zahlbr., *Cat. Lich. Univ.*, 7: 369, 1931. *Lecidea inornata* Stirt., *Proc. Phil. Soc. Glasgow*, 3: 185, 1881.

Type: India; Assam, A. Watt s. n. ex Hb. Stirton, (BM), (not seen).

Thallus corticolous, crustaceous, 3-4 cm across, whitish grey to grey, verruculose to granulose, surface

CHANDRA: REVISION OF THE LICHEN GENUS *Buellia* De Not. (FAMILY PHYSICIACEAE) FROM INDIA

rough, weakly fissured, epruinose, hypothallus brownish black delimiting line along the margin, isidia and soredia absent. Apothecia sessile, immersed, 0.2-1.0 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 24 μm thick, hymenium hyaline 108-120 μm high, hypothecium dark brown to black, 108-120 μm thick, exciple brown to dark brown 60-84 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, mischoblastiomorphic, 15-24 x 6-9 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^+ yellow turning red, C^- , KC^- , PD^+ deep yellow.

Remark: *B. inornata* is an endemic species, widely distributed in India. In external morphology and chemistry, this taxon closely resembles *B. lauricassiae* (Fèe) Müll. Arg., but the latter possesses 4-celled ascospores.

Distribution: India (Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Manipur, Tamil Nadu, Uttarakhand and West Bengal).

Specimens examined: Manipur, Tegnopal, alt. 5000 ft., 21.6.1979, K. P. Singh 550914 (CAL).

***Buellia lauricassiae* (Fèe) Müll. Arg., Müller, 85: 1887. *Lecidea lauricassiae* Fèe, 101: 1837. *Mannia lauricassiae* (Fèe) Trevisan, 77: 1857. *Diplotomma lauricassiae* (Fèe) Szatala, 123: 1932. *Cratiria lauricassiae* (Fèe) Marbach, 160: 2000.**

Type: India; West Bengal, Kolkata, Seebpore, Kurz (UPS), (not seen).

Thallus corticolous, crustaceous, 3-4.5 cm across, glaucous grey to grey, verruculose to granulose, surface rough, weakly fissured, epruinose, hypothallus dark brown to black delimiting line along the margin, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5(1.0) mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 24-36 μm thick, hymenium hyaline 78-92 μm high, hypothecium dark brown, 120-144 μm thick, exciple brown to dark brown 48-72 μm thick, asci 8-spored, unitunicate, ascospores brown, 4-celled, 3-transversely septate, 15-27 x 6-12 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^+ yellow turning red, C^- , KC^- , PD^+ deep yellow.

Remark: *B. lauricassiae* resembles *B. inornata* in external morphology and chemistry but it is distinguished by possesses 4-celled, 3-transversely septate ascospores.

Distribution: India (Andhra Pradesh, Manipur and West Bengal).

Specimens examined: Manipur, Churachandpur, Singhat area, alt. ca. 4500 ft., 14.6.1979, K. P. Singh 550679, 550676 (CAL); West Bengal, 24-Paragnas, Saptagram, 3.10.1966, K. N. Roychowdhury 366 (CAL).

***Buellia manipurensis* Singh and Singh, Geophytology, 12 (1): 129, 1982.**

Type: India; Manipur, Korong, Mao, on the way to Rubinimiah on rocks, alt. ca. 1960 m., June 5, 1979, K. P. Singh 550372 (CAL), (not seen).

Thallus saxicolous, crustaceous, 3-4 cm across, greyish brown, cracked to areolate, surface smooth, epruinose, hypothallus dark brown, thick delimiting line along the margin, isidia and soredia absent. Apothecia sessile, immersed, 0.3-1.5 mm diameter, disc dark brown, plane to convex, margin indistinct, epruinose, oil globules absent, epithecium brown 18-24 μm thick, hymenium hyaline 72-85 μm high, hypothecium dark brown, 60-96 μm thick, exciple dark brown along outer side and pale brown towards inner side 40-60 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-4-celled, straight to curved, constricted at septa, 18-27 x 6-10 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^+ yellow to reddish brown, C^- , KC^- , PD^+ deep yellow.

Remark: *B. manipurensis* resembles *B. nubile* in the nature of thallus reactions but the latter has smaller ascospores (10-12 x 4-5 μm) in size.

Distribution: India (Manipur).

Specimens examined: Manipur, Korang-Monjong hill, alt. ca. 3500-4000 ft., 1.11.1976, K. P. Singh 55016 (CAL); Churachandpur, Singhat area, alt. ca. 4500 ft., 14.6.1979, K. P. Singh 550681 (CAL).

***Buellia meghalayensis* S. Singh and D. D. Awasthi, Biol. Mem. 6 (2): 187. 1981.**

CHANDRA: REVISION OF THE LICHEN GENUS *Buellia* De Not. (FAMILY PHYSCIACEAE) FROM INDIA

Type: India: Meghalaya, Mawsmai area, 7 Km. from Cherrapunji, alt. ca. 1000 m., Awasthi 7985 (AWAS), (not seen).

Thallus saxicolous, crustaceous, 2-3 cm across, yellowish grey to ashy grey, cracked to areolate, surface smooth, deeply fissured, epruinose, hypothallus black, delimiting line along the margin, isidia and soredia absent. Apothecia sessile, immersed, 0.5-1.0 mm diameter, disc black, plane to convex, slightly pruinose, margin indistinct, oil globules absent, epithecium brown 24-36 μm thick, hymenium hyaline 84-96 μm high, hypothecium dark brown 96-120 μm thick, exciple dark brown along outer side and pale brown towards inner side 60-72 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, slightly curved, 18-27 x 6-12 μm in size, wall uniformly thickened, surface smooth, paraphyses hyaline, septate, branched, globose at tips.

Chemistry: Thallus K^+ yellow, C^- , KC^- , PD^+ deep yellow.

Remark: *B. meghalayensis* shows some resemblance to *B. substigmaea* but the latter is distinguished by pinkish purple reaction by HNO_3 in exciple, smooth ascospore surface and presence of atranorin and norstictic acid only.

Distribution: India (Manipur and Meghalaya).

Specimens examined: Manipur, Ukhrul, Shiroy hills, 10.6.1979 K. P. Singh 550573, (CAL).

***Buellia morehensis* Singh and Singh, Geophytology, 12 (1): 128. 1982.**

Type: India, Manipur, Tegnopal, Moreh, on bark of tree, alt. ca. 1050 m., June 18, 1979 K. P. Singh 550855 (CAL), (not seen).

Thallus corticolous, crustaceous, 3-4 cm across, yellowish grey to grey brown, verruculose, verrucae prominent, epruinose, hypothallus indistinct but blackish at its junction with other thallus, isidia and soredia absent. Apothecia sessile to subsessile, immersed, 0.5-1.2 mm diameter, disc black, plane to convex, epruinose, margin indistinct, oil globules absent, epithecium brown 24 μm thick, hymenium hyaline 84-96 μm high, hypothecium dark brown 108-120 μm thick, exciple dark brown along outer side and pale brown towards inner side 40-70 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 18-27 x 6-9 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^+ red, C^- , KC^- , PD^+ yellow.

Remark: *B. morehensis* resembles *B. granularis* Müll. Arg., *B. inornata* (Stirt.) Zahlbr. and *B. stillingiana* Stein. In external morphology. It differs from the first two taxa in ascospores morphology and from *B. stillingiana* in the colour of exciple and chemistry.

Distribution: India (Manipur).

Specimens examined: Manipur, Tegnopal, alt. ca. 5000-6000 ft., 21.6.1979, K. P. Singh 550954 (CAL); Ukhrul-Hundung, alt. ca. 4700 ft., 5.11.1976, K. P. Singh 55200 (CAL).

***Buellia montana* Magn., Bot. Notiser, 2: 199. 1954.**

Type: India, Uttarakhand, Naini Tal, China peak, alt. 7000 ft., on bark, 1949, P. N. Mehra (not traceable in UPS in litt. Where Magnusson's herbarium is now located), (not seen).

Thallus corticolous, crustaceous, 1-2 cm across, dusty to brownish grey, subverruculose, surface smooth, weakly fissured, epruinose, hypothallus absent, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 18-24 μm thick, hymenium hyaline 72-96 μm high, hypothecium dark brown 60-96 μm thick, exciple dark brown along outer side and pale brown towards inner side 48-60 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 18-27 x 6-9 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^- , C^- , KC^- , PD^- .

Remark: *B. montana* resembles *B. zahlbruckneri* but the latter has a discontinuous, verruculose white thallus, which is K^+ yellowish. It also shows some resemblance with *Buellia punctata*, which can be distinguished from the former by \pm evanescent thallus and smaller (9-16 μm) ascospores.

Distribution: India (Himachal Pradesh, Manipur and Uttarakhand).

Specimens examined: Manipur, Toribari, alt. ca. 3500-4000ft., 1.6.1979, K. P. Singh 550035(CAL).

***Buellia palniensis* S. Singh and D. D. Awasthi, Biol. Mem., 6 (2): 188. 1981.**

Type: India: Tamil Nadu, Palni hills, Hill view, below Perumalmalai, alt. ca. 1300 m., on rock, Awasthi & Singh, 70.442 (LWU), (not seen).

Thallus corticolous, crustaceous, 2-3 cm across, dull, brownish grey, areolate, surface smooth, deeply fissured, epruinose, hypothallus indistinct, isidia and soredia absent. Apothecia sessile, immersed, 0.5-1.0 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 18-24 μm thick, hymenium hyaline 60-72 μm high, hypothecium dark brown 96-108 μm thick, exciple dark brown along outer side and pale brown towards inner side 48-60 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 18-24 x 6-12 μm in size, wall uniformly thickened, surface smooth, paraphyses hyaline, septate, branched, globose at tips.

Chemistry: Thallus K^+ yellow, C^- , KC^- , PD^- .

Remark: *B. palniensis* shows some resemblance with *B. sororioides* and *B. subSORORIoides* but the latter two are distinguished by K^+ yellow to red and PD^+ yellow thalli.

Distribution: India (Manipur and Tamil Nadu).

Specimens examined: Manipur, Ukhrul, Shiroy hills, alt. 9000ft., 20.6.1979, K. P. Singh 550576 (CAL); Gungbi, alt. ca. 5500ft., 5.11.1976, K. P. Singh 55174 (CAL).

***Buellia placodimorpha* Vain., Etud. Lich. Bresil, 1: 172, 1890. Imshaug, Farlowia, 4: 498, 1955.**

Type: Brazil, ad corticem arbores prope Septiba in civ. Minarum, VAINIO 473 (TUR- VAIN), (not seen).

Thallus corticolous, crustaceous, 2-3 cm across, greyish brown to grey, subverruculose to evanescent, surface rough, weakly fissured, epruinose, hypothallus brownish black delimiting line along the margin, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 12 μm thick, hymenium hyaline 72-84 μm high, hypothecium dark brown 96-108 μm thick, exciple dark brown on outer margin and hyaline to brownish towards inner side 48-60 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, polarilocular, placodimorphic, 15-27 x 6-12 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, septate, branched, globose at tips.

Chemistry: Thallus K^- , C^- , KC^- , PD^- .

Remark: *B. placodimorpha* is distinguished by 2-celled, polarilocular and placodimorphic type of ascospores. It resembles *B. placodimorphoids* but the latter is distinguished by K^+ yellow thalli.

Distribution: India (Manipur and Uttarakhand), Brazil and West Indies.

Specimens examined: Manipur, Tegnopal, alt. 5000ft., 21.6.1979, K. P. Singh 550921 (CAL); Toribari, alt. ca. 3500-4000 ft., 1.6.1979, K. P. Singh 550047 (CAL).

***Buellia posthabita* (Nyl.) Zahlbr., Cat. Lich. Univ. 7: 390, 1931. Imshaug, Farlowia, 4: 499, 1955. *Lecidea posthabita* Nyl., Lich. Nov. Zeland., 111, 1888.**

Type: Nova Granata, Honda, 1861, Lindig, s. n. (H-NYL.), (not seen).

Thallus saxicolous, crustaceous, 2-3 cm across, brownish grey, subverruculose, surface rough, weakly fissured, epruinose, hypothallus indistinct, isidia and soredia absent. Apothecia sessile, immersed, 0.2-0.5 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium pale brown 24-36 μm thick, hymenium hyaline 96-108 μm high, hypothecium colourless to light brown 84-96 μm thick, exciple dark brown on outer side and pallid on inner side 60-84 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, mischoblastiomorphic type, 24-27 x 12-15 μm in size, wall uniformly thickened, surface smooth, paraphyses hyaline, simple, branched, globose at tips.

Chemistry: Thallus K^+ yellowish, C^- , KC^- , PD^- .

Remark: *B. posthabita* is distinguished by hypothallus indistinct and mischoblastiomorphic type of ascospores.

Distribution: India (Manipur), Nova Granata and West Indies.

Specimens examined: Manipur, Litan Sakkibung, alt. ca. 3500-4000 ft., 14.11.1979, K. P. Singh 54897 (CAL).

***Buellia punctata* (Hoffm.) Mass., Reicerch. Auton. Lich., 165, 1852. Sheard, Lichenologist, 2: 243, 1964. *Verrucaria punctata* Hoffm. Deutsch. Fl., 192, 1796.**

Type: Massachusetts, Willey, (not seen).

Thallus corticolous, crustaceous, 3-4 cm across, whitish grey to glaucous white, subverruculose to granulose, surface smooth, weakly fissured, epruinose, hypothallus absent, isidia and soredia absent. Apothecia

CHANDRA: REVISION OF THE LICHEN GENUS *Buellia* De Not. (FAMILY PHYSICIACEAE) FROM INDIA

sessile, immersed, 0.2-1.0 mm diameter, disc black, plane to convex, epruinose, oil globules absent, epithecium brown 18-24 μm thick, hymenium hyaline 60-72 μm high, hypothecium dark brown 96-108 μm thick, exciple dark brown long outer side and pale brown towards inner side 48-72 μm thick, asci 8-spored, unitunicate, ascospores brown, 2-celled, ellipsoid, 15-24 x 6-9 μm in size, wall uniformly thickened, surface ornamented, paraphyses hyaline, simple, globose at tips.

Chemistry: Thallus K^+ yellow, C^- , KC^- , PD^- .

Remark: *B. punctata* resembles *B. montana* but the latter is distinguished by a smooth thallus and larger (18-27 μm) ascospores. This is cosmopolitan in distribution.

Distribution: India (Himachal Pradesh, Jammu & Kashmir, Manipur and West Bengal).

Specimens examined: Manipur, Tegnopal, alt. 5000 ft., 21.6.1979, K. P. Singh 550905 (CAL); West Bengal, 24-Paraganas, Diamond harbour, 3.1.1972, K. N. Roychowdhury 2649 (CAL); Tongloo, alt. 10074 ft., 1.6.1966, K. N. Roychowdhury 54 (CAL).

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