

OBSERVATIONS ON SOME TAXA OF THE LICHEN GENUS *ANTHRACOTHECIUM*

AJAY SINGH

National Botanical Research Institute, Rana Pratap Marg, Lucknow 226 001, India

Abstract

A critical study of the type material of 27 species of *Anthracothecium* has resulted in the reduction of their identity to nine species.

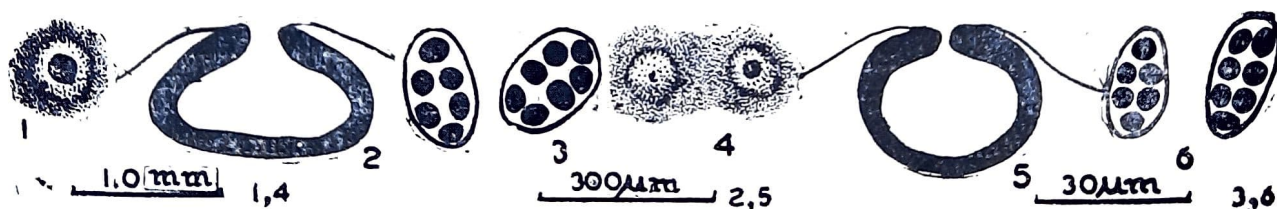
In connection with the monographic studies of *Anthracothecium*, a genus comprising over 100 species, as recorded by Zahlbruckner (1922-40) and Lamb (1963), type specimens of about 50 species were examined. Several of them have been found to exhibit minor differences of characters, not worthy of creating independent species, but fitting rather, within the variation range of some earlier instituted species. Such a situation has necessitated the consideration for their synonymization as detailed in this paper. The basic important characters for typification of the *Anthracothecium* species are: the nature of thalline verrucae containing ascocarps, morphology of ascocarps, nature of the nucleus, asci, and ascospores, that have been suitably illustrated.

1. *Anthracothecium confine* (Nyl) Müll. Arg., *Linnaea*, **63** : 45.1880.-*Verrucaria confinis* Nyl. Expos. synopt. Pyrenocarp., p. 49. 1858.
Lectotype—Guyana Gallica, Melinin s.n. (H-NYL no. 1097).

Figs. 1-3

- syn. *Anthracothecium albescens* (Nyl.) Müll. Arg., *Linnaea*, **63** : 45. 1880.-*Verrucaria albescens* Nyl., Expos. synopt. Pyrenocarp., p. 50. 1858.
Lectotype—Guyana britannica, Nylander 216 (H-NYL no. 1286).

Figs. 4-6



Figs. 1-6. 1-3. *Anthracothecium confine*. 1. Ascocarp (dorsal view); 2. Vertical section of ascocarp; 3. Spores. 4-6. *Anthracothecium albescens*.

Thallus corticolous, hypophloedal, whitish, grey, yellowish or evanescent, smooth or rough, K-, C-, KC-, P-, with or without black border. Ascocarps verruca-forming, solitary, 0.3-0.5 mm in diameter, 200—300 μ m high, convex to hemispherical, lower part or sometimes whole embedded in thalline verrucae, embedded part concolous with thal-

lus, the upper part in the former case covered with corticiform layer of thallus, whitish or dull black, sometimes a small part around ostiole naked, black and nitidous; excipuloid tissue black and carbonaceous, \pm uniformly thick all-round, round to somewhat flat at bottom; nucleus I+ wine red, without oil globules; paraphysoid threads simple; asci cylindrical to clavate, 8-spored, $50-105 \times 12-25 \mu\text{m}$; spores uni- or biseriata in ascus, brown, ellipsoid, muriform, cells arranged in 3-4 transverse tiers with 1-3 cells in each, $10-22 \times 6-14 \mu\text{m}$.

Remarks—Nylander (1858) characterized *Verrucaria confinis* by its ascocarps as, "apothecia verruculis thallinis prominulis inclusa, (latit. fere 0.5 millim.)". Actually the ascocarps are smaller (0.3-0.4 mm in diameter). For *Verrucaria albescens*, Nylander (1958) observed, "perithecium (latit. 0.25 rarius adtingente) infra attenuato (inde interdum quasi dimidiatim nigo)". Nylander further stated, "Satis facile distincte a *V. confini* apotheciis suffusis (nec quidem ostiolo determinate denudato), plerumque minoribus". The ascocarps in this specimen, however, are of the same size and morphology as those of *V. confinis*. The difference in the thalline covering over the ascocarp, the character employed by Nylander (1958) to differentiate them from each other is indistinct. The two taxa, therefore, are conspecific, and *V. confinis* Nyl. being diagnosed earlier in the same work, gets priority.

2. *Anthracothecium depressum* Müll. Arg., *Flora*, **66** : 245, 1883.

Lectotype—Brazil; near Apiahy, Puiggari 362 (G). Puiggari s.n. (Syntype : G).

Figs. 7-9

syn. *Anthracothecium goniostomum* Müll. Arg., *Flora*, **66** : 246, 1883.

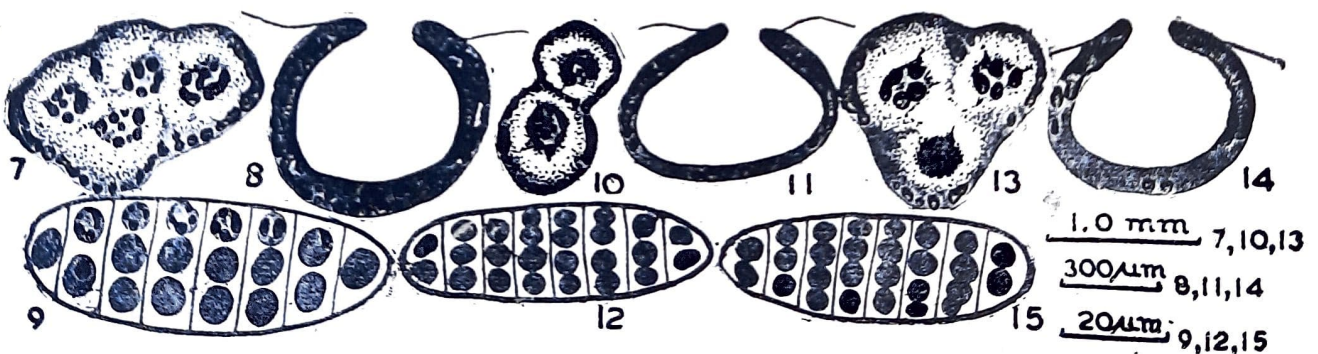
Lectotype—Brazil; Apiahy region, near Xiririca, Puiggari 143 (G).

Figs. 10-12

syn. *Anthracothecium amphitropum* Müll. Arg., *Flora*, **66** : 246, 1883.

Lectotype—Brazil; near Apiahy, Puiggari 1059 (G). Puiggari 2162 (Syntype:G).

Figs. 13-15



Figs. 7-15. 7-9. *Anthracothecium depressum*, 7. Four fertile thalline verrucae (dorsal view); 8. Vertical section of ascocarp; 9. Spores. 10-12. *Anthracothecium goniostomum*, 10. Two fertile thalline verrucae (dorsal view); 11. Vertical section of ascocarp; 12. Spore. 13-15. *Anthracothecium amphitropum*, 13. Three fertile thalline verrucae (dorsal view); 14. Vertical section of ascocarp; 15. Spore.

Thallus corticolous, hypophloedal, buff, ochre to yellow-brown, smooth, verrucose (verrucae always associated with ascocarps, and hence referred to as fertile thalline ver-

rucae), K-, C-, KC-, P-, not or partly surrounded by black line; fertile thalline verrucae solitary or up to 15 coalescing in linear or irregular fashion, without forming stroma, 0.8-2.5 mm across, concave, flat or concave at top, forming slightly discernible to prominently raised rim around ostiole, or the upper exposed black part of ascocarp, producing oculate condition. Ascocarps one or rarely two in each verruca, 0.6-0.8 mm in diameter, 300-700 μm high, immersed in thalline verruca, only a small part around ostiole naked, black and nitidous, ostioles situated in shallow pits at verrucal top; excipuloïd tissue black and carbonaceous, with moderate deposition of colourless crystals, not spreading laterally but rarely shield-like expansion visible at top, bottom, round or flat; nucleus I+ wine red, without oil globules; paraphysoid threads simple; asci clavate, (6-) 8-spored, 170-290 \times 40-55 μm ; spores uni- or biseriata in ascus, brown, oblong-ellipsoid, multi-celled muriform, cells arranged in 8-10 transverse tiers with 1-4 cells in each and with 7-8 primary septa, 42-85 \times 18-35 μm .

Remarks—Müll. Arg. (1883) characterised *Anthracotheccium depressum* as, “verrucae circ. 1½ mm latae, monocarpicae, pro parte subseriatim irregulariter confluentes; depresso-hemisphaericae, cum thallo concolores, crasse thalline, vertice perithecio nigro-denudato planiusculo late depresso-oculatae.”. Müll. Arg. (l.c.) recognized *Anthracotheccium goniostomum* on characters, “verrucae fructigera 1-1½ mm latae, solitariae et 2-4 natim concretae,, conico-hemisphaericae; perithecia. imo apice. denudata unde verrucae late oculatae, osculum de supra visum ambitu angulosum, plano-convexum, nigrum, opacum, centro obscure fusco-mamillatum.” In the third, \pm identical species, *Anthracotheccium amphitropum*, Müll. Arg. (l.c.) observed, “apothecia in verrucis 1-1½ mm latis solitarius v. hinc inde seriatim v. irregulariter concretis cum thallo concoloribus late apertis solitaria, perithecio fusco-nigra, completa leviter depresso-globosa, evoluta 2/3 altitudinis v. paullo profundius in verrucam immersa, 4/5 mm lata, parte nuda late pyramidali-hemisphaerica fere depresso-hemisphaerica, vertice obsoleta mamillate oreque minute umbilicata”.

The three species have been found to conform to each other to the basic characters of the ascocarps and spores and hence are placed in the same taxon, as *Anthracotheccium depressum* for its earlier appearance than the two in the same work. Malme (1929), though realized close similarity between the three species, preferred yet, not to disturb their identity.

3. *Anthracotheccium globiferum* (Eschw.) Müll. Arg., *Flora*, **67** : 666. 1884.-*Verrucaria globifera* Eschw. apud Mart., *Flora Brasil. I.*, p. 131. 1833.
Lectotype—Brazil ; Para, Leg ? (G).

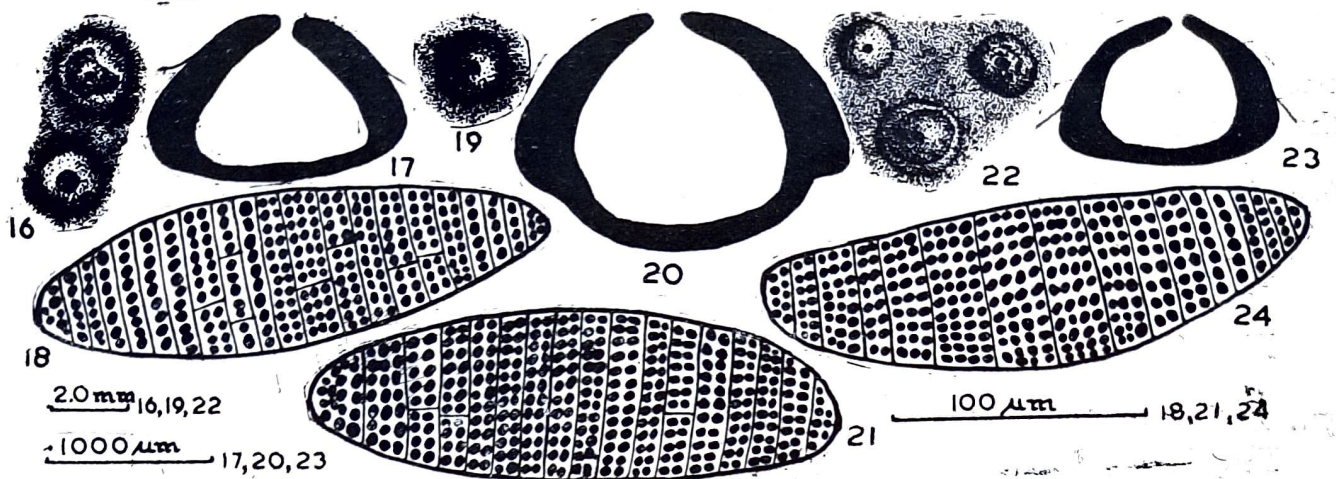
Figs. 16-18

- syn. *Anthracotheccium epapillatum* (Nyl.) Müll. Arg., *Linnaea*, **63** : 44. 1880-*Verrucaria epapillata* Nyl., *Expos. synopt. Pyrenocarp.*, p. 43, 1858.
Lectotype—Sri Lanka (Ceylon); no precise locality, Hooker & Thomsou 2226 (H-NYL no. 4).

Figs. 19-21

- syn. *Anthracotheccium paraguayense* Malme, *Ark. Bot.*, **22A**(11) : 36. 1929.
Lectotype—Brazil; Matto Grosso, Corumba, Malme s. n. (S).

Figs. 22-24



Figs. 16-24. 16-18. *Anthracothecium globiferum*, 16. Ascocarps (dorsal view); 17. Vertical section of ascocarp; 18. Spore. 19-21. *Anthracothecium epapillatum*; 19. Ascocarp (dorsal view); 20. Vertical section of ascocarp; 21. Spore. 22-24. *Anthracothecium paraguayense*. 22. Ascocarps (dorsal view). 23. Vertical section of ascocarp; 24. Spore.

Thallus corticolous, hypophloedal, grey, cream-coloured, buff, ochre, yellow-brown to brown, smooth to nitidous, K-, C-, KC-, P-, with or without black border line. Ascocarps verruca-forming, one or a few (up to 6) included in each verruca without forming stroma, 0.8-2.0 mm in diameter, 700-1300 μm high, convex to hemispherical, \pm completely embedded in thalline verrucae, or upper half part to whole covered with corticiform layer of thallus, or naked, of thalline colour or dull black or black and nitidous respectively (more than one condition present in the same specimen), ostioles indistinct, to umblicate; excipuloid tissue black and carbonaceous, with or without deposition of colourless crystals, generally broader at sides than at top and bottom; nucleus I+wine red with abundant oil globules; paraphysoid threads simple; asci clavate, 2-4(-rarely more)-spored, 200-360 \times 40-80 μm ; spores brown, oblong-ellipsoid, multi-celled muriform, cells arranged in numerous (ca. 35) transverse tiers, up to 13 cells in each, with 7-24 primary septa, 120-220 \times 30-90 μm .

Remarks—Müll. Arg. (1884) re-examined the type of *Verrucaria globifera* and described its fertile parts as, "apothecia Circ. 1 mm lata v. demum paullo majora, circiter semiimmersa, praeter partem superiorum demum latiuscule emergentum et denudatum thalldice corticata, superne conico-hemisphaerica, demum superne nitidula, nunc rotundato-obtusa umbilicata, perithecium globosum, basi completum et undique subaequicrassum; sporae in ascis geminae, superpositae, 120-150 μ longae, 30-40 μ latae, utrinque obtuse, demum crebre parenchymatice divisae et rufo-fuscae". Müll. Arg. (1984) further pointed out, "Proximum est ceylonico *Anthracothecium epapillato* a quo thalli colore et forma perithecii differt". Regarding *Verrucaria epapillatum*, Nylander (1858) did not give any distinguishing feature of this species in the protologue, nor indicated its affinity to any other taxon. The difference, however, that seems to lie in the perithecial form, as seen in the two protologues are non-existent according to my observations. For *Anthracothecium paraguayense*, Malme (1929) traced its relationship as follows: "Ab *A. duplicante* (Nyl.) jam apotheciis sporisque majoribus et his aliter septatis dignota est. *A. globiferum* (Eschw.) Müll. Arg., caju specimen vidi perexiguum, crusta obscura, apo-

theciis forte magis denudatis et sporis ex icone inedita brevioribus recedere videtur". The thallus of *A. globiferum* is not obscure and the naked condition of its ascocarp is also discernible in the type of *A. paraguayense*.

Except the thallus colour, a variable character, all other characters in the three species tally. *A. epapillatum* and *A. paraguayense*, therefore, should be treated as synonyms of the oldest epithet, *A. globiferum*.

4. *Anthracothecium leucostomum* (Ach.) Malme, *Ark. Bot.*, **22A** (11) : 32. 1929.-*Pyrenula leucostoma* Ach., *Gesellsch. Naturforsch. Freunde Berlin Magazin*, **6** : 19, 1814.
Type—Not seen.

Figs. 25-27

- syn. *Anthracothecium libricolum* (Fée) Müll. Arg., *Linnaea*, **63** : 43. 1880.-*Pyrenula libricola* Fée, *Suppl. Éssai Crypt. Ecorc. Officin.*, p. 82, 1873.
Type—Not seen.

- syn. *Anthracothecium paramerum* (Nyl.) Müll. Arg., *Nuovo G. bot. ital.*, **23** : 278. 1891.-*Verrucaria paramera* Nyl. apud Crombie, *J. Linn. Soc., Bot.*, **16** : 227, 1877.
Lectotype—Admiralty Island, Mosley s. n. (H-NYL no. 50).

Figs. 28-30

- syn. *Anthracothecium submucosum* (Vainio) Zahlbr., *Catal. lich. univ.*, VIII : 123. 1932.-*Bottaria submucosa* Vainio, *Ann. Acad. Sci. fenn. ser. A*, **15**(6) 327, 1920.
Lectotype—The Philippines; Luzon, Province of Laguna, ad corticem arboris, Robinson s. n. (TUR).

Figs. 31-33

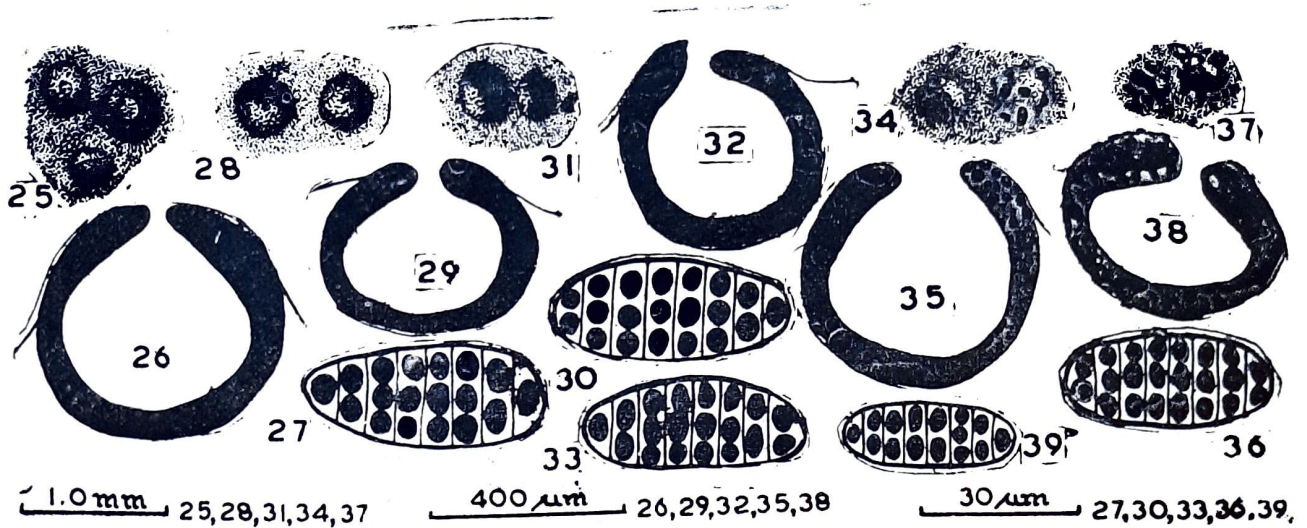
- syn. *Anthracothecium erythrinae* (Vainio) Zahlbr., *Catal. lich. univ.*, VIII : 121. 1932.-*Bottaria erythrinae* Vainio, *Ann. Acad. Sci. fenn., ser. A.*, **15**(6) : 328, 1920.
Lectotype—The Philippines; Luzon, Los Banos, on *Erythrina indica*, Baker s. n. (TUR).

Figs. 34-36

- syn. *Anthracothecium albidopallesces* (Vainio) Zahlbr., *Catal. lich. univ.*, VIII : 121. 1932.-*Bottaria albidopallens* Vainio, *Ann. Acad. Sci. fenn., ser. A.*, **15**(6) : 328, 1920.
Lectotype—The Philippines; Luzon, Manila and vicinity, ad corticem arboris, Dec. 1912, Merrill s. n. (TUR).

Figs. 37-39

Thallus corticolous, hypophoedal, glaucous, straw-coloured, buff, ochre, yellow-brown or brown, smooth, K-, C-, KC-, P-, with or without black border line. Ascocarps verruca-forming, solitary or a few (up to 5) crowded together without forming stroma, 0.3-0.7 mm in diameter, 300-600 μ m high, immersed when young emergent later, convex to hemispherical, completely covered with and concolorous to thallus except around ostiole, or upper part up to the half or sometimes even more becoming naked and black, ostioles indistinct or like pale dots or depressions; excipuloid tissue black and carbonaceous, with moderate deposition of colourless crystals, not spreading laterally;



Figs. 25-39. 25-27. *Anthracothecium leucostomum*, 25. Ascocarps (dorsal view); 26. Vertical section of ascocarp; 27. Spore. 28-30. *Anthracothecium paramerum*, 28. Ascocarps (dorsal view.); 29. Vertical section of ascocarp; 30. Spore. 31-33. *Anthracothecium submucosum*, 31. Ascocarps (dorsal view); 32. Vertical section of ascocarp. 33. Spore. 34-36. *Anthracothecium erythrinae*, 34. Ascocarps (dorsal view); 35. Vertical section of ascocarp; 36. Spore. 37-39. *Anthracothecium albidopallens*, 37. Ascocarps (dorsal view); 38. Vertical section of ascocarp. 39. Spore.

nucleus I+ wine red, without oil globules; paraphysoid threads simple; asci clavate, 8-spored, 110-200 × 25-45 μm; spores biseriate in ascus, brown, ellipsoid, multi-celled, muriform, cells arranged in 8(-10) transverse tiers, with 1-3 cells in each and with 7 primary septa, 20-46 × 11-19 μm.

Remarks—Malme (1929) made a new combination, *Anthracothecium leucostomum* based on the material of *Pyrenula leucostoma* Ach. and synonymised *Anthracothecium libricolum* (Fée) Müll. Arg., a common pantropical species with it.

On examination of the type material of several species belonging to the *Anthracothecium leucostomum*-complex by me, it was realized that the identity of some taxa needs revision. The following table presents a comparative account of the ascocarp and spore measurements in *A. leucostomum* and some other taxa of this complex that have been merged with this species.

Species	Ascocarp diameter	Spore length
<i>A. leucostomum</i>	0.5 mm	(22—)27—35(—43) μm (Malme, 1929)
<i>A. libricolum</i>	—	0.034—0.045 millim (Nylander, 1858)
	0.3—0.2(—0.4) millim	0.028—0.044 millim (Vainio, 1915)
<i>A. paramerum</i>	0.5—0.7 millim.	0.024—0.034 millim (Nylander, 1978)
		0.024—0.040 millim (Nylander, 1900)
		0.038—0.046 millim (Nylander, 1900)
<i>A. submucosum</i>	0.35—0.6 mm	0.028—0.044 mm (Vainio, 1920)
<i>A. erythrinae</i>	0.4—0.5 mm	0.027—0.038 mm (Vainio, 1920)
<i>A. albidopallens</i>	0.3—0.35 mm	0.020—0.032 mm (Vainio, 1920)

The comparative morphology of ascocarps and spores is shown in their respective figures, indicating thereby, close similarity between these species.

5. *Anthracothecium macrosporum* (Hepp) Müll. Arg., *Linnaea*, 63 : 44, 1880.-*Verrucaria macrospora* Hepp apud Zolling., System. Verzeichn. Indische. Archip. Gesamm. Pflanzen. p. 9. 1854.

Lectotype—Java, Zolling 147 (G).

Figs. 40-42

- syn. *Anthracothecium andamanicum* (Nyl.) Müll. Arg., *Linnaea*, 63 : 44. 1880.-*Verrucaria andamanica* Nyl., *Bull. Soc. linn. Normandie*, ser. 2, 7 : 178, 1873.

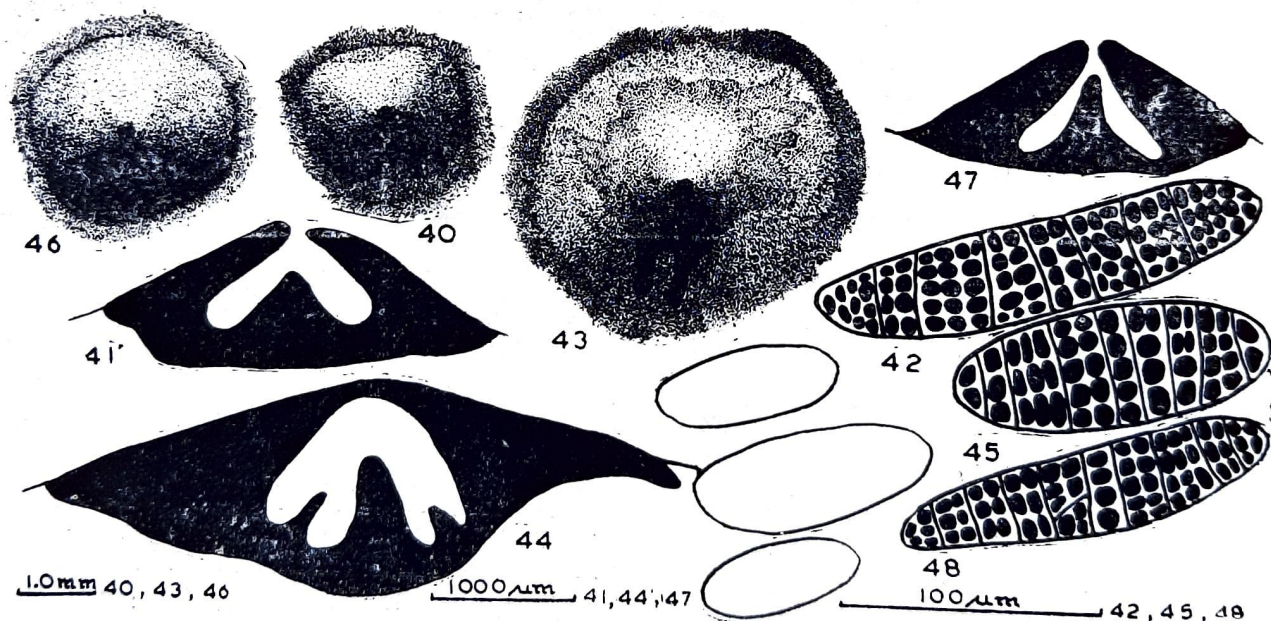
Lectotype—India ; Andaman Islands, Kurz 99 (H-NYL no. 10631).

Figs. 43-45

- syn. *Anthracothecium columellatum* (Vainio) Zahlbr., *Catal. lich. univ.*, VIII : 121. 1932.-*Pottaria columellata* Vainio, *Ann. Acad. Sci. fenn.*, ser. A., 15(6) : 325, 1920.

Lectotype—The Philippines; Palwan, Taytay, on *Pongamia mitis*, seashore, Fenix 15635 (TUR). Syntype : Same locality, Merrill 9032 (TUR).

Figs. 46-48



Figs. 40-43. 40-42. *Anthracothecium macrosporum*, 40. Ascocarp (dorsal view), 41. Vertical section of ascocarp, 42. Spores. 43-45. *Anthracothecium andamanicum*, 43. Ascocarp (dorsal view), 44. Vertical section of ascocarp, 45. Spores. 46-48. *Anthracothecium columellatum*, 46. Ascocarp (dorsal view), 47. Vertical section of ascocarp, 48. Spores.

Thallus evanescent, cream-coloured, buff, ochre, yellow-brown to brown, hypophloedal, smooth, K-, C-, KC-, P-, hypothallus indistinct. Ascocarps verruca-forming, solitary, sometimes up to 5 coalescing without forming stroma, 2.0-5.0 mm in diameter, 1200-1800 µm high, generally completely naked and black or sometimes nitidous or partly to completely covered with thallus, covered part coloured like thallus, sometimes covered with corticiform layer of thallus and dull black, convex to conico-depres-

sed, ostioles prominent, umblicate; excipuloid tissue black and carbonaceous, broadly spreading laterally, with a prominent central columella arising from the bottom with smooth and circular outline or with buttress-like outgrowths, or sometimes a number of thin columellas coalescing, forming a single central column, or remaining separate in form of a few thin and separate pillars; nucleus I+ wine red, without oil globules; paraphysoid threads simple; asci 2-4 (-more)-spored, $260-360 \times 45-90 \mu\text{m}$; spores brown, oblong-ellipsoid or ellipsoid, multi-celled muriform, cells arranged in (15-)25-32 transverse tiers with up to 7 cells in each, and with (3-)-7-12 primary septa, $60-170 \times 25-33 \mu\text{m}$.

Remarks—*Verrucaria andamanica* (= *Anthracothecium andamanicum* (Nyl.) Müll Arg.) described by Nylander (1873) from Andaman Islands, India resembles well with *A. macrosporum*, except that the ascocarps of the former are larger. Likewise, the lectotype and the syntype of *Bottaria columellata* exhibit \pm the same characteristic features as that of *Anthracothecium macrosporum*. Patwardhan and Makhija (1980) rightly synonymized *A. columellatum* with *A. macrosporum*.

6. *Anthracothecium ochrotropum* (Nyl.) Zahlbr., Catal. lich. univ., I : 465, 1922.-*Verrucaria denudata* f. *ochrotropa* Nyl., Bull. Soc. linn. Normandie, ser 2. 2 : 90, 1868.

Lectotype—Nova Caledonia, Lifu, Deplanche s. n. (H-NYL no. 1090).

Figs. 49-51

syn. *Anthracothecium subochraceum* (Nyl.) Zahlbr., Catal. lich. univ., I : 468, 1922.-*Verrucaria*

Albescens ssp. *subochracea* Nyl. apud Crombie, J. Linn. Soc. Lond. Bot., 16 : 227, 1877.

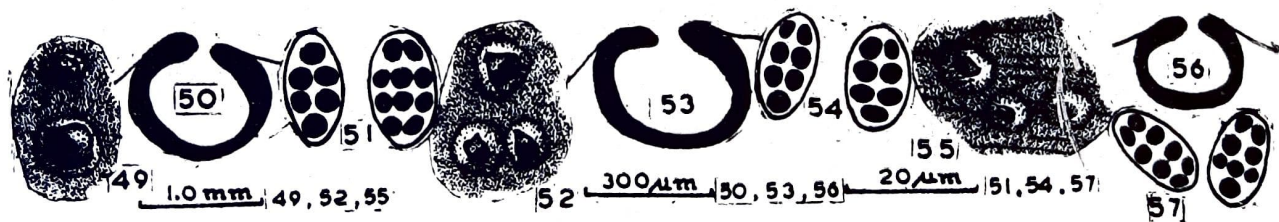
Lectotype—Admiralty Island (Challenger Expedition) Moseley s.n. (H-NYL no. 4070).

Figs. 52-54

syn. *Anthracothecium ochroxanthum* Müll. Arg., Nuovo G. bot. ital., 23 : 279, 1891.

Lectotype—Insula Victoria, inter Singapore et Sarawak, Pictet s.n. (G).

Figs. 55-57



Figs. 49-57. *Anthracothecium ochrotropum*, 49. Ascocarps (dorsal view), 50. Vertical section of ascocarp, 51. Spores. 52-54. *Anthracothecium subochraceum*, 52. Ascocarps (dorsal view), 53. Vertical section of ascocarp, 54. Spores. 55-57. *Anthracothecium ochroxanthum*. 55. Ascocarps (dorsal view). 56. Vertical section of ascocarp. 57. Spores.

Thallus corticolous, epi- or hypophloedal, grey throughout or with yellow to orange, faint to bright patches, yellowish-grey, ochre, yellow-brown or orange, smooth to rough, K+ purple (yellow or orange parts only, sometimes so faintly around the ascocarps only), C-, KC-, P-, with or without black border line. Ascocarps verruca-forming, solitary or up to 5 grouped together without forming stroma, 0.2-0.4 mm in diameter, ca. $300 \mu\text{m}$ high,

immersed to emergent, in latter case convex to hemispherical, partly to completely covered with corticiform layer, dark brown to black, or upper major part naked, black and nitidous, ostioles indistinct; excipuloid tissue black and carbonaceous, not spreading laterally; nucleus I+wine red, without oil globules; paraphysoid threads simple; asci cylindrical to clavate, 8-spored, $46-100 \times 11-26 \mu\text{m}$; spores uni- or biseriate in ascus, brown, ellipsoid, muriform, cells arranged in 3-5 transverse tiers, with 1-3 cells in each, $10-20 \times 7-12 \mu\text{m}$.

Remarks—Nylander (apud Crombie, 1878) distinguished *Verrucaria albescens* *subochracea from *V. albescens* by subochraceous colour of its thallus. He did not mention the colour reaction of thallus with K. On investigating the lectotype of *V. albescens* *subochracea, I discovered that this taxon conforms in all the taxonomic details to *Anthracothecium ochrotropum*. Another species, *Anthracothecium ochroxanthum*, recognized by Müll. Arg. (1891a), shows likewise, affinity with *A. ochrotropum*. All the three taxa are thus conspecific.

7. *Anthracothecium oculatum* Müll. Arg., *Giorn. bot. ital.*, 23 : 404, 1891.

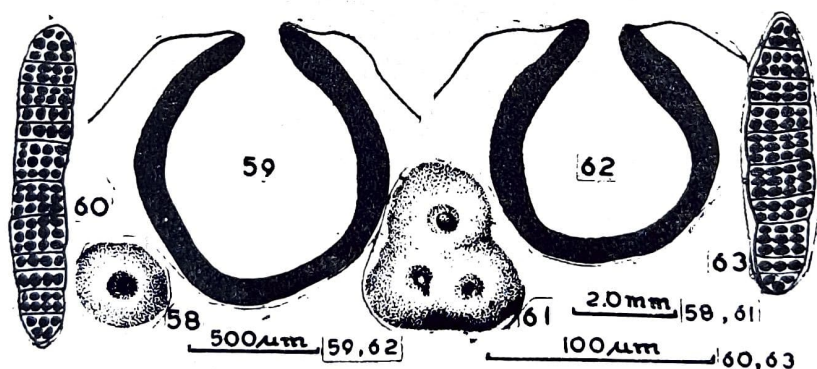
Lectotype—Australia; Brisbane, Bailey 509 (G).

Figs. 58-60

syn. *Anthracothecium mulleri* Patw. & Makhija, *Kavaka*, 8 : 25, 1980.

Holotype—India; Kerala, Cardamom hills, Devicolam, Prabhu 76.762 (AMH).

Figs. 61-63



Figs. 58-63. 58-60. *Anthracothecium oculatum*. 58. Single fertile thalline verruca (dorsal view), 59. Vertical section of ascocarp, 60. Spore. 61-63. *Anthracothecium mulleri*, 61. Three fertile thalline verrucae. (dorsal view), 62. Vertical section of ascocarp, 63. Spore.

Thallus corticolous, hypophloedal, buff, grey or brownish, smooth, densely verrucose, verruca always associated with ascocarps, K-, C-, KC-, P-, thalline verruca solitary or irregularly crowded, 1-3-carpous, 1.5-3.0 mm across. Ascocarps up to 2.0 mm in diameter, ca. $1500 \mu\text{m}$ high, \pm completely embedded in thalline verrucae and hence of thalline colour, externally visible from above as depressed black dots or minute black areas around ostioles giving rise to oculate condition, or sometimes the upper up to 1/3 part becoming naked and black, ostioles indistinct, or pale punctate; excipuloid tissue black and carbonaceous, not to slightly thickened at sides, with or without moderate deposition of colourless crystals; nucleus I+wine red, without oil globules; paraphysoid threads simple; asci clavate, 2-4(-5)-spored, $200-270 \times 35-55 \mu\text{m}$; spores brown, oblong-ellipsoid, multi-celled muriform, cells arranged in 14-27 transverse tiers, with up to 6

cells in each and with 6-14 transverse and 1-2 longitudinal primary septa, not to slightly constricted at a few or all the primary septa, (55-)90-155 × 20-35 μm .

Remarks—From the comparison of protologues of *Anthracothecium oculatum* Müll. Arg. (1891b) and *A. mulleri* Patw. & Makhija (1980), and by the examination of their type specimens by me, it is clear that the two taxa show the presence of \pm the same basic taxonomic characters. Both of them thus represent one and the same taxon.

8. *Anthracothecium parvinucleum* (G. Meyer & Flotow) Zahlbr., Catal. lich. univ., I : 466, 1922.-*Verrucaria parvinuclea* G. Meyer & Flotow. *Nova Acta Caesar. Leop. Carol.*, **19** : Suppl. 231, 1843.

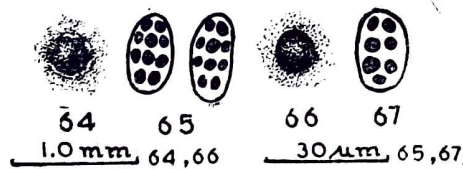
Type—Not seen.

Figs. 64-65

- syn. *Anthracothecium canallae-albae* (Nyl.) Müll. Arg., *Linnaea*, **63** : 45, 1880.-*Verrucaria canallae-albae* Nyl., Expos. synopt. Pyrenocarp. p. 51, 1858.

Lectotype—America meridionali, leg ? (H-NYL no. 1230).

Figs. 66-67



Figs. 64-67. 64-65. *Anthracothecium parvinucleum*, 64. Ascocarp (dorsal view), 65. Spores. 66-67. *Anthracothecium canallae-albae*, 66. Ascocarp (dorsal view), 67. Spore.

Thallus corticolous, hypophloedal, whitish-grey, grey or evanescent, smooth or rough, K-, C-, KC-, P-, with or without black border line. Ascocarps solitary 0.25-0.5 mm in diameter, ca. 250 μm high, \pm immersed to emergent; convex to hemispherical, naked, black, opaque or nitidous, ostioles indistinct, or like pale depressions; excipuloid tissue black and carbonaceous, not spreading; nucleus I+ wine red, without oil globules; paraphysoid threads simple; asci clavate or occasionally cylindrical, 8-spored, 58-95 × 10-19 μm ; spores uni- or sometimes biseriata in ascus, brown, ellipsoid, muriform, cells arranged in 3-4 transverse tiers with 1-3 cells in each, 9-20 × 5-12 μm .

Remarks—*Anthracothecium parvinucleum* is a common pantropical species and can easily be recognized by its grey thallus, small (0.25-0.5 mm diameter), naked and black ascocarps and small (9-20 × 5-12 μm) spores, with cells arranged in 3-4 transverse tiers. The type specimen of *A. canallae-albae* is poor, containing two ascocarps only. To leave the specimen intact, I did not section the ascocarp. Outwardly it resembles to the description of *A. parvinucleum*. The ascocarp is 0.25 mm in diameter (size not given in protologue by Nylander, 1858) and is naked and black. The figure of spore provided on the sheet, perhaps by Nylander himself, and its description in the protologue, conforms in all respects to that of *A. parvinucleum*. In the protologue of *Verrucaria canallae-albae*, Nylander (1958) observed, "...Affinits (quoad sporas) *V. denudata* (a qua fortasse non specie differt)". *A. canallae-albae*, thus does not justify its separate identity and must be merged with *A. parvinucleum*.

9. *Anthracotheceium seminudum* Müll. Arg., *Nuovo G. bot. ital.*, 23 : 278, 1891.
Lectotype—Ins. Victoria, inter Singapore et Sarawak, Pictet, L. Vict. n. 13 (G).

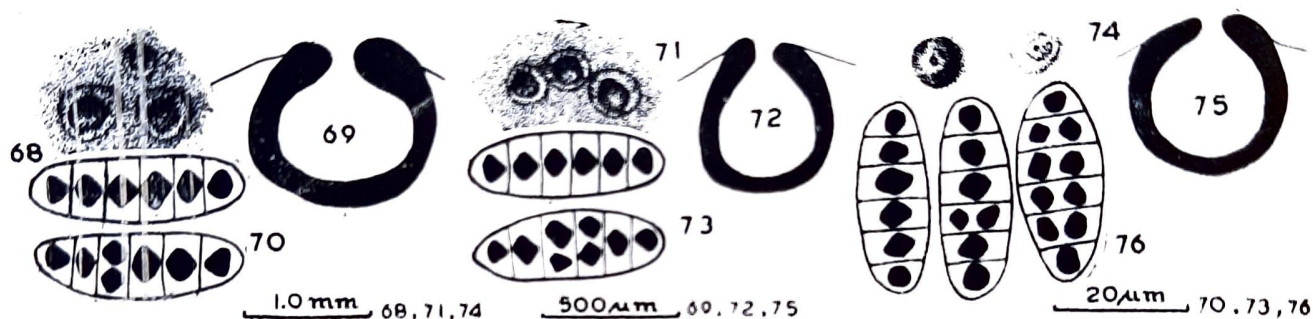
Figs. 68-70

- syn. *Anthracotheceium hexamerum* Müll. Arg., *Nuovo G. bot. ital.*, 23 : 279, 1891.
Lectotype—Ins. Victoria, inter Singapore et Sarawak. Pictet L. Vict. n. 14 (G).

Figs. 71-73

- syn. *Anthracotheceium gibberulosum* (Vainio) Zahlbr., *Catal. lich. univ.*, VIII : 122, 1932.-
Bottaria gibberulosa Vainio, *Ann. Acad. Sci. fenn.*, ser. A, 15(6) : 329, 1920.
Holotype—The Philippines; Luzon, Manila and vicinity, on *Hibiscus tiliaceus* L.,
 Merill 8522 (TUR).

Figs. 74-76



Figs. 68-76. 68-70. *Anthracotheceium seminudum*, 6P. Ascocarp (dorsal view), 69. Vertical section of ascocarp, 70. Spores. 71-73. *Anthracotheceium hexamerum*, 71. Ascocarp (dorsal view), 72. Vertical section of ascocarp, 73. Spores. 74-76. *Anthracotheceium gibberulosum*, 74. Ascocarp (dorsal view), 75. B Vertical section of ascocarp. 76. Spores.

Thallus corticolous, hypophloedal, ochre, yellow-brown or greenish, smooth, K-, C-, KC-, P-, without or with a faint to distinct brownish to black border line. Ascocarps solitary, 0.25-0.4 mm in diameter, 250-350 μ m high, immersed, later emerging and convex, covered with corticiform layer of thallus, or naked, black opaque to somewhat nitidous, ostioles indistinct or umblicate; excipuloid tissue black and carbonaceous, not spreading, with or without moderate deposition of colourless crystals; nucleus I+ wine red, without oil globules; paraphysoid theards simple; asci clavate, 8-spored, 90-125 \times 22-27 μ m; spores biscriate in ascus, brown, oblong-ellipsoid, transversely septate to submuriform, with 5 primary septa (6 celled) and 2 cells in 1-2 -(4) median cells of some of the spores, 22-32 \times 7-12 μ m.

Remarks—Müll. Arg. (1891a) described two \pm identical taxa as *Anthracotheceium seminudum* and *A. hexamerum*, observing about the latter as, "specim ut in *A. seminudo* Müll. Arg." Müll. Arg. (l.c.) separated the two species solely on the basis of the thalline covering over ascocarps. In case of *A. seminudum* he reported, "supra emersa nuda" and in *A. hexamerum* as, "undique superne thallino-valata". On examination of the types by me, this difference was found to be inconsistent as both the characters are present in both the specimens to a greater or lesser degree and thus the two pertain to the same taxon. *A. seminudum* being described earlier in the same work gets priority over *A. hexamerum*. Another taxon, *Bottaria gibberulosa*, that was described by Vainio (1920) shows close simi-

larity with *Anthracothecium seminudum* in the characters of thallus, ascocarps and their contents. The thallus of *Bottaria gibberulosa* (= *Anthracothecium gibberulosum*) is neither epiphloedal nor gibbous, as observed by Vainio (1920). It should, therefore, be merged with *A. seminudum*.

Acknowledgements

I express my sense of gratitude to the Directors of AMH, BM, G, H, S and TUR for sending type material on loan for my study; to Dr D. D. Awasthi for his critical comments; to Shri S. S. Rana for his help in preparation of plates; and to the Director, National Botanical Research Institute, Lucknow for providing facilities for this work.

References

- CROMBIE, J. M. (1878). The lichens of the "Challenger" expedition. *J. Linn. Soc. (Bot)*, **16** : 211-231.
- LAMB, I. M. (1963). *Index Nominum Lichenum*. The Ronald Press Company, New York.
- MALME, G. O. A. (1929). Pyrenulae et Anthracothecae Herbarii Regnelliani. *Ark. Bot.*, **22A**(11) : 1-40.
- MÜLL. ARG., J. (1883). Lichenologische Beiträge XVIII. *Flora* **66**. Regensburg.
- MÜLL. ARG., J. (1884). Revisio Lichenum Eschweillerianorum. *Flora*, **67** : 1-17. Regensburg.
- MÜLL. ARG., J. (1891a). Lichenes Victoryenses, a cl. Camillo Pictet genevensi, in insula Victory, inter Singapore et Borneo sita, ad cortices lecti. *Nuovo G. bot. ital.*, **23**(2) : 276-279.
- MÜLL. ARG., J. (1891b). Lichenes Brisbanenses, a cl. F. M. Bailey. *Government Botanist*, prope Brisbane (Queensland) in Australia orientali lecti. *Nuovo G. bot. ital.*, **23**(3) : 385-404.
- NYLANDER, W. (1858). *Exposito synoptica Pyrenocarporum*. pp. 1-88. St. Pierre 13.
- NYLANDER, W. (1868). Synopsis Lichenum Novae Caledoniae. *Bull. Soc. linn. Normandie*, ser. 2, **2** : 1-101.
- NYLANDER, W. (1873). Lichenes Insularum Andaman. *Bull. Soc. linn. Normandie*, ser. 2, **7** : 162-183.
- NYLANDER, W. (1900). Lichenes Ceylonenses. *Acta Soc. Sci. fenn.*, **26**(10) : 1-26.
- PATWARDHAN, P. G. & MAKHIJA, U. (1980). The genus *Anthracothecium* Hampe ex Massal. in the Western Ghats, south western India. *Kavaka*, **8** : 17-27.
- VAINIO, E. A. (1915). Additamenta ad Lichenographiam Antillarum illustrandam. *Soumal Tiedeakat. Toim. (Ann. Acad. Sci. fenn.)* ser. A, **6**(7) : 1-226.
- VAINIO, E. A. (1920). Lichenes Insularum Philippinarum III. *Soumal. Tiedeakat. Toim. (Ann. Acad. Sci. fenn.)* ser. A, **15**(6) : 1-368.
- ZAHLBRUCKNER, A. (1922-1940). *Catalogus lichenum universalis*, Vols. I-X. Leipzig.