

The lichen genus *Coccocarpia* from the Andaman and Nicobar Islands, India

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Abstract: Seven species of *Coccocarpia* are reported from the Andaman Islands and two from the Nicobar Islands. These include four species new to India and to the Andaman Islands, viz. *C. glaucina*, *C. cf. myriocarpa*, *C. sp. 1* and *C. sp. 2*, and two species new to the Nicobar Islands, viz. *C. erythroxyli* and *C. palmicola*. A key to all nine species of *Coccocarpia* known from India is presented and information on morphology, chemistry and distribution given.

Introduction

The lichen genus *Coccocarpia* Persoon (Family Coccocarpiaceae), comprising 23 species at world level (Arvidsson, 1982; Marcano *et al.* 1995), is mainly distributed in tropical and subtropical regions. It is characterised by: thallus small to medium-sized, foliose, rarely dwarf-fruticose, lobate, dorsiventral, rhizinate, heteromerous; hyphae of upper cortex, medulla, and lower cortex periclinial, arranged in the length direction of the lobes; hyphal cells \pm rectangular; phycobiont *Scytonema*; apothecia biatorine, with no visible proper margin, adnate or sessile, often \pm irregular in outline, in many species with hairs projecting from the margins; occurring in moist and warm habitats.

Arvidsson (1982) reported five species of *Coccocarpia* from India, viz. *C. erythrocardia* (Müll. Arg.) L. Arvidss., *C. erythroxyli* (Spreng.) Swinsc. & Krog, *C. palmicola* (Spreng.) L. Arvidss. & D. Gall., *C. pellita* (Ach.) Müll. Arg. emend. R. Sant. and *C. rottleri* (Ach.) L. Arvidss. Evidently by some inadvertence the two species *C. erythrocardia* and *C. rottleri* were not mentioned by Awasthi (1985) in his revision of "Lichen genus *Coccocarpia* from India and Nepal" and consequently in his "Key to the Macrolichens of India" (1988).

In the course of an investigation of the lichen flora of the Andaman and Nicobar Islands, 23 *Coccocarpia* specimens were collected, which appeared to belong to 6 species. These include four species new to India, viz. *C. glaucina*, *C. cf.*

myriocarpa, *C. sp. 1* and *C. sp. 2*, which raise the number of species known from this country to nine. They are also new to the Andaman Islands and raise the number of species known from these Islands to eight. Two species, *C. erythroxyli* and *C. palmicola*, were found on the Nicobar Islands, the first report of the genus from this archipelago.

A key to all 9 species presently known from India, and notes on their distribution, morphology and chemistry are presented below. For species not represented in our material, characters were taken from Arvidsson (1982).

Ecology and distribution

The Andaman Islands are said to be continental fragments and form a part of a lofty range of submarine mountains *ca.* 1100 km long running from Cape Negrais in the Arakan Yomah range of Burma, through Sumatra and Java to the Lesser Sunda Islands. They are composed of two groups of islands lying in the Bay of Bengal and situated between 13° 41' and 10° 30' North latitudes and 92° 11' and 93° 07' East longitudes. The climate is warm and humid. The Islands are subjected to both the south-west and the north-east monsoon. The dry or hot season comprises the months of January to April while the rest of the year forms the rainy season. The Nicobar group of Islands is of volcanic origin and lies between 6° 40' and 9° 30' North latitudes and 92° 30' and 94° 10' East longitudes. There is practically no dry season in the South-Nicobar Islands.

The vegetation is typically of tropical nature. As these islands are separated from the Indian mainland by a considerable stretch of sea (*ca.* 1200 km from the eastern coast of India), the islands exhibit remarkable differences in the constituents of their flora from that of the mainland.

The lichen flora is dominated by crustose, corticolous species belonging to the pyrenocarps and the Graphidaceae. Macrolichens are of rare occurrence in the Andaman and Nicobar Islands. *Coccocarpia* is among them and is relatively frequent among bryophytes on shady tree trunks

in the forests. Associated lichens are *Arthothelium*, *Cryptothecia*, *Leptogium*, *Pannaria*, pyrenolichens and graphids.

Materials and methods

The specimens were examined with a stereomicroscope and a light microscope. Sections of the thalli and apothecia were stained with Lugol's solution. All sections were examined with lactophenol as mounting medium. TLC was done by the standard method (Culberson & Kristinsson, 1970) using solvent systems benzene-dioxane-acetic acid (180:45:5) and hexane-diethylether-formic acid (130:80:20). All specimens were observed under UV light (365 nm).

Key to the Indian species of *Coccocarpia*

- 1a** Thallus lobes usually less than 1.0 mm wide, pruinose; thallus minute, dwarf foliose; lobes always flattened, narrow, bluish-grey, narrowly to broadly flabellate, linear-curved, 0.3-0.6(-0.9) mm wide, covered with accessory lobules; ascospores globose.....
.....*C. rottleri* (Ach.) L. Arvidss.
- 1b** Thallus lobes usually more than 1.0 mm wide, epruinose; thallus whitish-grey to plumbeous-grey, bluish-green, brownish or black.....**2**
- 2a** Medulla orange-red; lobes adjacent or imbricate, more rarely discrete, cuneate or flabellate to broadly flabellate, 1.5-8.0 mm wide, plane or slightly convex to concave with deflexed margins without concentric ridges; isidia terete, laminal, rarely marginal; rhizines almost always black; apothecia up to 4.0 mm in diam., reddish-brown to black.....
.....*C. erythrocardia*
- 2b** Medulla white or creamish.....**3**
- 3a** Thallus without isidia.....**4**
- 3b** Thallus with isidia.....**6**

Taxonomical part

- 4a** Thallus dwarf-foliose; lower surface always pale yellow with invariably white rhizines.....*Coccocarpia* sp. 1
- 4b** Thallus foliose; lobes usually broadly flabellate, not or weakly branched, contiguous or imbricate, ± loosely attached, apices round.....5
- 5a** Lobes 1-6 mm wide; apothecia 1-4(-9) mm in diam., ± irregular, ± adnate, usually flattened, with or without exciple hairs.....*C. erythroxyli*
- 5b** Lobes 0.5-3 mm wide, with round apices and long interspaces, lobulate, with black, large, marginal pycnidia; thallus pale whitish-grey, adpressed; lower surface pale brown to dark brown, with black rhizines; only apothecial initials observed which are less than 1.0 mm in diam, round, black.....*C. cf. myriocarpa*
- 6a** Isidia distinctly flattened, squamiform to microphylline.....*C. pellita*
- 6b** Isidia terete, ± branched coralloid.....7
- 7a** Lobes 0.5-3.5 mm wide, plane or slightly convex, rarely slightly concave, margins deflexed; isidia mostly laminal, concolorous with the thallus, granular to terete, coralloid.....*C. palmicola*
- 7b** Lobes strongly canaliculate, margins upcurled.....8
- 8a** Thallus whitish-grey to plumbeous-grey, flabellate, apices rounded, entire or incised lobulate, 1-3 mm wide; upper surface glossy, with concentric rings and radiating lines, epruinose; isidia marginal; lower surface pale-creamish with black rhizines; pycnidia marginal*C. glaucina*
- 8b** Thallus blackish-grey, loosely attached, lobate; isidia laminal; lower surface black with black rhizines.....*Coccocarpia* sp. 2

1. *Coccocarpia erythrocardia* (Müll. Arg.) L. Arvidss. *Opera Bot.* 67: 55, 1982.

= *Coccocarpia pellita* var. *erythrocardia* Müll. Arg. *Flora* 65: 322, 1882.

Remarks: According to Arvidsson (1982), this is a characteristic species which can be easily recognized by its orange-red (K+) medulla, and by its usually isidiate lobes. A similar taxon, *Coccocarpia endoferruginea*, also has a red medulla, but it is K-ve.

Coccocarpia erythrocardia has been recorded by Arvidsson (1982) from the Andaman Islands [Andaman Island: Port Blair, 29.11.1890, E.H. Man (BM)]. We have not found this species during the course of our extensive exploration of Andaman Islands.

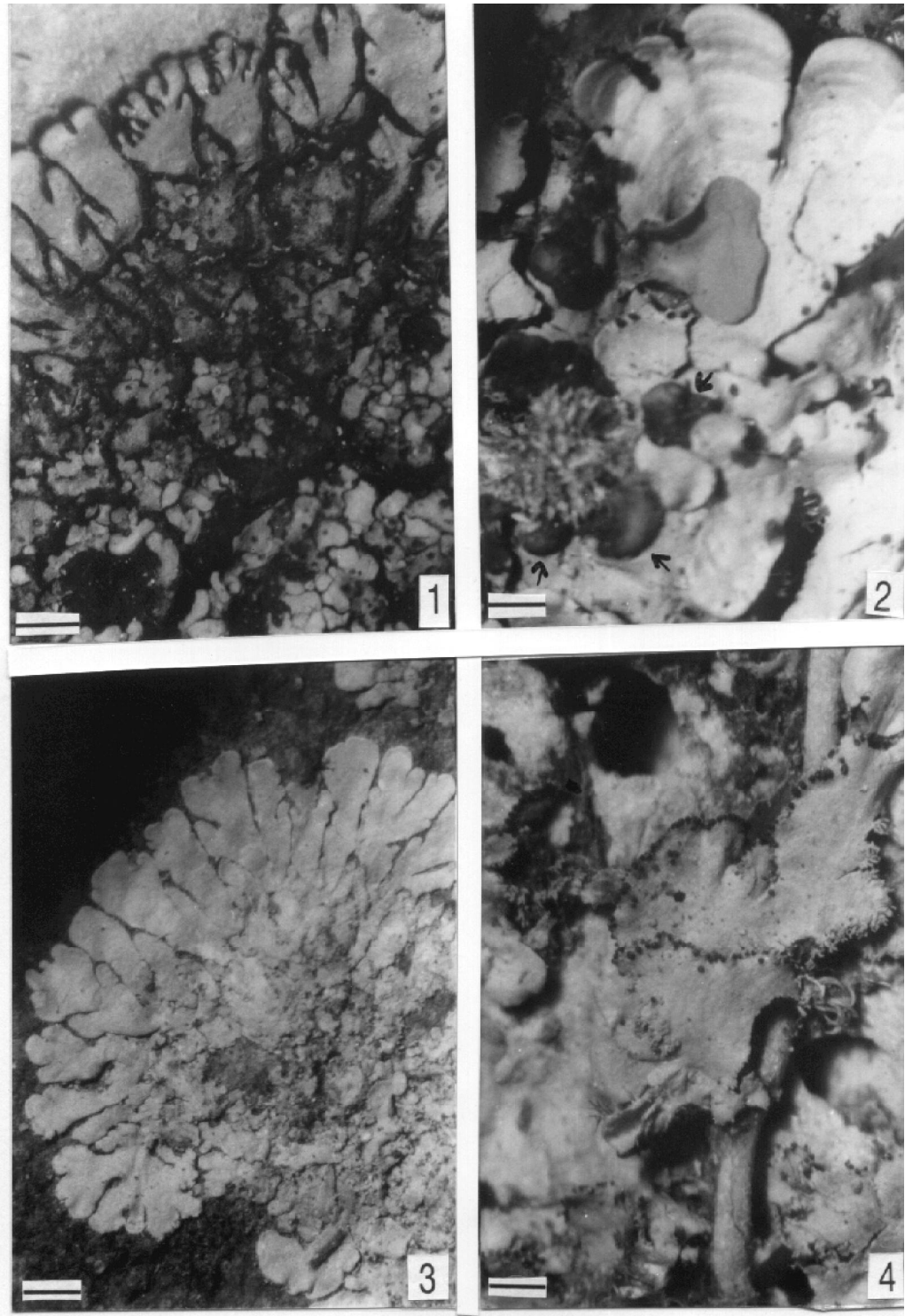
2. *Coccocarpia erythroxyli* (Spreng.) Swinsc. & Krog *Norw. J. Bot.* 23: 256, 1926. Arvidsson, *Opera Bot.* 67: 57, 1982. [Figs 1, 2]

= *Lecidea erythroxyli* Spreng. *Kungl. Vetensk. Acad. Nya Handl.* I: 47, 1820.

Remarks: *Coccocarpia erythroxyli* is one of the most variable and widely distributed species of *Coccocarpia* in India. It is highly variable in colour of lobes, size of apothecia, 0.8-3 mm broad, and colour of apothecia, black to orange.

It is reported here for the first time from the Nicobar Islands. In India, this species has been previously known from the Andaman Islands, Assam, Karnataka, Kerala, Maharashtra, Tamil Nadu and Uttar Pradesh (Arvidsson, 1982).

Specimens examined: **Middle Andaman:** Betapur Range, Pitcher Nala, M.B. Nagarkar & P.K. Sethy, 85.2410 [AMH]. **North Andaman:** Diglipur Range, Sitapur, in moist deciduous forest, P.K. Sethy & P.G. Patwardhan, 86.11 [AMH] (with black apothecia); M.B. Nagarkar & P.G. Patwardhan, 86.37, 86.42, 86.47, 86.92, 86.147 and 86.148 [AMH]. **Nicobar Islands:** Great Nicobar, Campbell Bay, Beach forest, P.G. Patwardhan & P.K. Sethy, 87.161, 87.164 [AMH]; Shompen hut, East-West road of Campbell Bay, in Evergreen forest, P.K. Sethy &



Figs 1-4. 1. *Coccocarpia erythroxyli* - Thallus with black apothecia [86.11-AMH]. 2. *Coccocarpia erythroxyli* - Lobes with distinct concentric rings [85.2410-AMH]; note the apothecia (arrow). 3. *Coccocarpia glaucina* - Thallus with elongate lobes [85.2174-AMH]. 4. *Coccocarpia glaucina* - Lobes with marginal isidia and pycnidia [85.1090-AMH]. Scale = 1mm

M.B. Nagarkar, 87.234 [AMH]; Campbell Bay to Laful Bay, P.K. Sethy & P.G. Patwardhan, 87.92 [AMH]. Car Nicobar, Kimus, M.B. Nagarkar & P.K. Sethy, 86.779 [AMH].

3. *Coccocarpia glaucina* Krempelh. *Nuovo Giorn. Bot. Ital.* 7: 14, 1875. Arvidsson, *Opera Bot.* 67: 68, 1982. [Figs 3,4]

Remarks: *Coccocarpia glaucina* is a corticolous species usually overgrowing mosses. It has a rather restricted distribution in South-East Asia, from Malacca in the west to the Philippines and the Samoa archipelago in the east. This may indicate a wider Pacific distribution (Arvidsson, 1982). It is reported here for the first time from India.

Specimens examined: **Middle Andaman:** Guitar Island, Long Island Range, P.K. Sethy & M.B. Nagarkar, 85.2174, 85.2175 [AMH]. **South Andaman:** Alexanderia Island, Wandoor, P.K. Sethy & M.B. Nagarkar, 85.1090 [AMH].

4. *Coccocarpia* cf. *myriocarpa* L. Arvidss. *Opera Bot.* 67: 70, 1982. [Figs 5, 6]

Thallus foliose, lobate. Lobes leaden-grey to bluish-green, somewhat darker when wet, 0.8-4 mm wide; apices of lobes round, flabellate, incised, weakly branched. Upper surface smooth, epruinose, non-isidiate, glossy, with concentric rings and radiating lines; accessory lobules present at the central part of the thallus. Lower surface pale yellowish to black with dense black rhizines. Thallus 40-80 μm thick. Upper cortex colourless, 8-10 μm thick, made up of 2-3 layers of cells. Algal layer 30-40 μm thick. Medulla colourless. Lower cortex distinct, hyaline, 10-12 μm thick, made up of 2-3 layers of paraplectenchymatous cells.

Apothecial initials seen. Asci and ascospores not observed.

Pycnidia small, black, immersed but present also along the lamina.

Chemistry: Upper cortex K-, C-, KC-, Pd-, and UV-. No lichen substances detected by TLC.

Remarks: The material examined has a rather similar morphology to the *Coccocarpia myriocarpa* which is known only from Tanzania (savannah zone of tropical East Africa). Since the material at hand does not have mature apothecia, it is only provisionally identified.

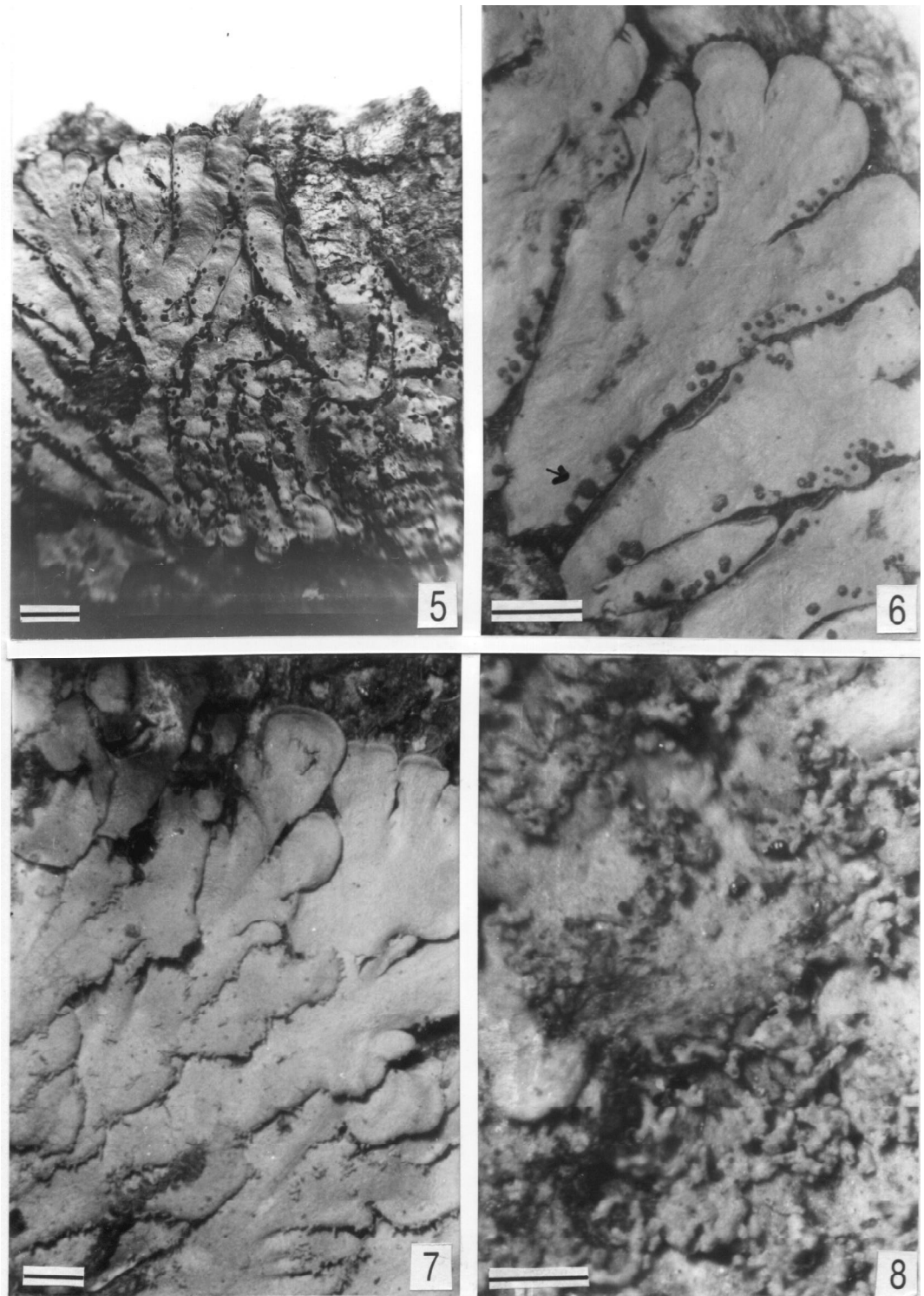
Specimens examined: **South Andaman:** Tirur, P.K. Sethy & P.G. Patwardhan, 85.6 [AMH]; Baratang Island, Nilambur forest, Guest house, P.G. Patwardhan & P.K. Sethy, 85.478 [AMH].

5. *Coccocarpia palmicola* (Spreng.) L. Arvidss. & D. Gall. *Bot. Notiser* 132: 242, 1979. Arvidsson, *Opera Bot.* 67: 72, 1982. [Figs 7, 8] = *Lecidea palmicola* Spreng. *Kungl. Vetensk. Acad. Nya Handl.* I: 46, 1820.

Remarks: *Coccocarpia palmicola* is distinguished by its grey to brownish-black, laminal, simple, granular, terete to coralloid branched isidia.

This species primarily occurs in tropical regions in corticolous habitats. It is one of the most frequently collected species of *Coccocarpia* and has been collected in dry deciduous, moist deciduous and evergreen forests of the Andaman and Nicobar Islands. In India, it was previously known from the Andaman Islands, Assam, Karnataka, Kerala, Maharashtra, Tamil Nadu and Uttar Pradesh (Arvidsson, 1982). It is being reported for the first time from the Nicobar Islands.

Specimens examined: **Middle Andaman:** Betapur Range, Pitcher Nala, P.K. Sethy & P.G. Patwardhan, 85.2448 [AMH], Interview Island, in beach & moist deciduous forest, P.K. Sethy & P.G. Patwardhan, 85.2918, 85.2927 [AMH]. **North Andaman:** On way to Lamia bay from Kalipur, South east of Aerial bay in mixed forest, M.B. Nagarkar & P.K. Sethy, 86.445 [AMH]. Milangram, Diglipur Range in evergreen forest, P.K. Sethy & P.G. Patwardhan, 86.325, 86.362 [AMH]. **South Andaman:** Chidya Tapu, P.G. Patwardhan & M.B. Nagarkar, 85.54 [AMH]. **Nicobar Islands:** Great Nicobar, Campbell bay to Laful Bay, P.K. Sethy & M.B. Nagarkar, 87.74



Figs 5-8. 5. *Coccocarpia* cf. *myriocarpa* - Lobes with apothecial initials along margins and pycnidia [85.478-AMH]; scale = 2 mm. 6. *Coccocarpia* cf. *myriocarpa* - Note apothecial initials (at arrow) [85.478-AMH]. 7. *Coccocarpia palmicola* - Lobes with terete isidia [87.74-AMH]. 8. *Coccocarpia palmicola* - Thallus with numerous isidia [85.2927-AMH]. Fig. 6-8, scale =

[AMH]; Kamorta, P.G. Patwardhan & M.B. Nagarkar, 87.297 [AMH]; Car Nicobar, Malacca, P.G. Patwardhan & M. B. Nagarkar.

6. *Coccocarpia pellita* (Ach.) Müll. Arg. emend. R. Sant. *Symb. Bot Ups.* 12(1): 420, 1952. Arvidsson, *Opera Bot.* 67: 76, 1982. = *Parmelia pellita* Ach. *Lichenographia Universalis*, p 468, 1810.

Remarks: *Coccocarpia pellita* is reported by Arvidsson (1982) from Andaman Islands, Kerala, Tamil Nadu, and Uttar Pradesh. It was also recorded from West Bengal by Awasthi (1985). However, it is absent from our collections from the Andaman Islands.

7. *Coccocarpia* sp. 1 [Figs 9, 10]

Thallus ± orbicular, dwarf-foliose, lobate, ± loosely attached to the substratum. Lobes grey when dry, somewhat darker when wet, 0.5-1.5 mm wide, plane or slightly concave, imbricate, almost round with entire margins. Accessory lobules present. Upper surface ± smooth, epruinose, not isidiate. Radiating lines in the upper cortex usually visible. Lower surface whitish brown, buff coloured. Rhizines distinctly white, often projecting beyond the margins. Thallus 45-85 µm thick. Upper cortex colourless, 8.5-12.5 µm thick, made up of 2-3 layers of paraplectenchymatous cells covered with an epicortex. Algal layer 20-30 µm thick. Medulla hyaline, 20-30 µm thick. Lower cortex distinct, hyaline, 12-16 µm thick, consisting of 2-3 layers of periclinal, parallel hyphae, running in lengthwise direction.

Apothecia absent.

Pycnidia rarely present, laminal, globose, with black ostiole.

Chemistry: Upper cortex K-, C-, KC-, Pd-, and UV-. No lichen substances detected by TLC.

Remarks: This species of *Coccocarpia* is distinguished by its dwarf-foliose, grey, non-isidiate thallus with almost round, imbricate lobes with lower surface always pale brown to buff coloured and moderately covered with

invariably white rhizines, and thus differs from *C. erythroxyli* in having short lobes and white rhizines.

Since we have only a single specimen of this species, we prefer to keep the species unnamed until more material can be studied.

Specimens examined: **South Andaman**: Port Mount, P.K. Sethy & P.G. Patwardhan, 85.23 [AMH].

8. *Coccocarpia* sp. 2 [Figs 11, 12]

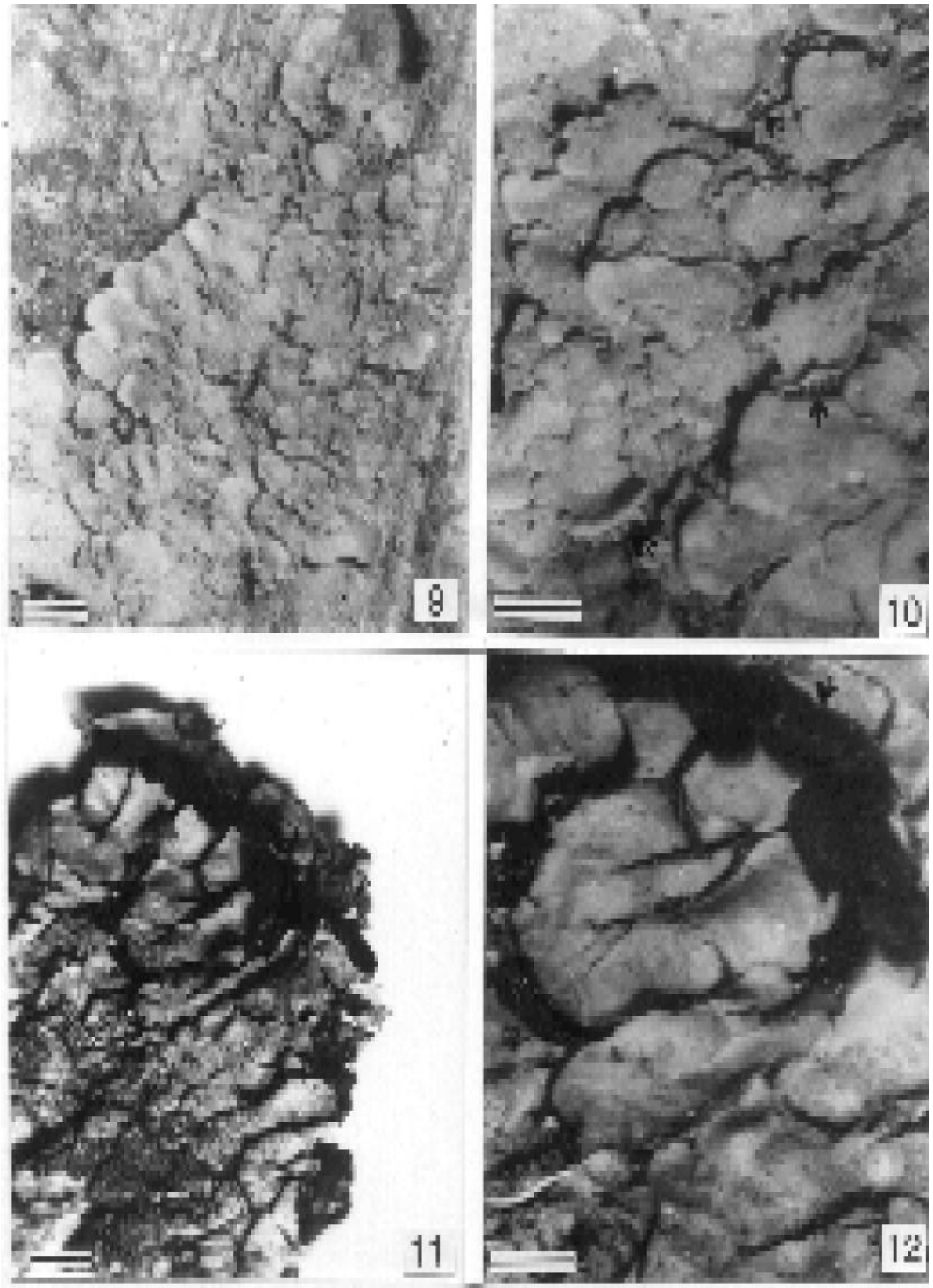
Thallus ± irregular, foliose, dark grey, ± loosely attached, lobate. Lobes flattened, canaliculate, distinctly upcurled with thick mat of projecting, black rhizines, 0.5-3 mm wide. Apices of lobes round, imbricate. Margins of lobes entire or incised. Accessory lobules sparsely present. Upper surface with distinct, transverse, concentric ridges, slightly glossy, epruinose. Radiating lines in the upper cortex usually visible at higher magnification. Lobes isidiate, isidia distinctly laminal, dense in the central part of thallus, concolorous to distinctly black, granular to terete, coralloid. Lower surface distinctly black, covered with thick, black, branched rhizines. Thallus 100-150 µm thick. Upper cortex colourless, 8-12 µm thick, composed of 2-3 layers of periclinal hyphae with rectangular cells. Epicortex not seen. Algal layer 33-42 µm thick. Medulla hyaline, 42-46 µm thick. Lower cortex colourless, 8-12 µm thick, composed of 2-3 layers of periclinal, parallel hyphae, running in lengthwise direction.

Apothecia absent.

Pycnidia laminal, punctate, slightly emergent, black, with ostiole.

Chemistry: Upper cortex K-, C-, KC-, P-, UV-. No lichen substances present.

Remarks: The present species of *Coccocarpia* is distinguished by its slate-grey, loosely attached, lobate, canaliculate thallus with upcurled margins and 0.5-3 mm broad, rounded lobes, with black lower surface covered with a thick mat of black rhizines projecting beyond the margins, and laminal isidia, dense in the central part, concolorous to often slightly darker (almost



Figs 9-12. **9.** *Coccocarpia* sp. 1 - Dwarf-foliose thallus with numerous accessory lobes [85.423-AMH]. **10.** *Coccocarpia* sp. 1 - same specimen; note white rhizines (at arrow). **11.** *Coccocarpia* sp. 2 - Lobes with distinctly black, thick rhizines forming a mat and with numerous isidia [85.552-AMH]; scale = 2 mm. **12.** *Coccocarpia* sp. 2 - same specimen in close-up; note thick mat (at arrow). Fig. 9, 10, 12, scale = 1mm.

black), granular to terete.

Coccocarpia glaucina seems to be the most closely related species which has very distinctly canaliculate thallus, a pale lower side and marginal isidia.

Specimens examined: **South Andaman:** Baratang Island, on the way to and around Wrafter's creek, P.K. Sethy & P.G. Patwardhan, 85.552 [AMH].

Acknowledgments

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