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Revision of the lichen genus *Dirinaria* (Tuck.) Clem., from India

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Abstract

The paper reports seven species of the lichen genus Dirinaria (Tuck.) Clem. from India along with a key for identification of different Indian species. Out of these, one species, Dirinaria confusa Awasthi is reported as new record for Indian lichen flora.

Keywords- *Dirinaria*, lichens, key, new record, India

Introduction

Six species of the lichen genus *Dirinaria* (Tuck.) Clem., have been investigated from India by Awasthi (1975) and Risbud and Patwardhan (1989). Tuckerman (1877) placed it in a new section *Dirinaria* of the genus *Pyxine* while, Clements (1909) proposed a new generic status to *Dirinaria* and to segregated from the genus *Physcia* and *Pyxine* on the basis of thalline exciple and black hypothecium. It is characterized by foliose, heteromerous, corticated on both surfaces, upper cortex paraplectenchymatous, lower cortex prosoplectenchymatous of thallus, photobiont a green alga, *Trebouxia*, rhizines lacking or small black precursors of rhizines sparsely present; apothecia lecanorine, black, hypothecium dark brown to black, asci 8-spored, 1-septate, ellipsoid, thick walled, brown to dark brown, *Physcia* type of ascospores, atranorin always present (Awasthi, 1988; Swinscow and Krog, 1978). The present study reported one new record to Indian lichen flora and provides information on present status of the dealt taxa and their distribution in India and also given a detail taxonomic description with key for easy identification of different Indian species of the studied taxa.

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) and 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). The micro crystallography was carried out in G. A. W. solution (glycerol, ethanol, water in 1:1:1 proportion) using Asahina's micro chemical techniques as

enumerated by Hale (1974 c). 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 Indian species

- 1a. Thallus with soredia or isidia, divaricatic or sekikaic acid present.....2
- 1b. Thallus without soredia or isidia, divaricatic or sekikaic acid present.....6
- 2a. Thallus sorediate, sekikaic acid present.....*D. consimilis*
- 2b. Thallus sorediate or isidiate, divaricatic acid present.....3
- 3a. Thallus sorediate, divaricatic acid present.....4
- 3b. Thallus isidiate, divaricatic acid present.....5
- 4a. Lobes confluent and flabellate at periphery.....*D. applanata*
- 4b. Lobes discrete and truncate at periphery.....*D. picta*
- 5a. Isidia dense, papilliform to piliform.....*D. papillulifera*
- 5b. Isidia coralloid, apically crateriform and produce coarse granular soredia.....*D. aegialita*
- 6a. Divaricatic acid present.....*D. confluens*
- 6b. Sekikaic acid present.....*D. confusa*

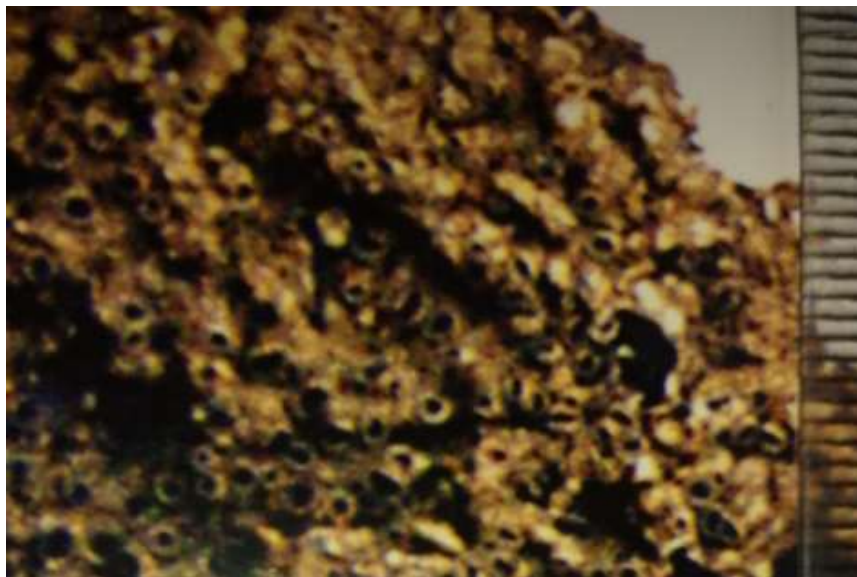


Fig.1 . *Dirinaria confusa* Awasthi

Taxonomic description

Dirinaria confusa Awasthi, Biblioth. Lichenol. 2: 56. 1975. (Fig. 1)

Type: Mexico, Blanco District, Bonn, on bark of various trees, mostly cedar, 1850, C. Wright: 55 (Lectotype: FH). (not seen).

This species can be easily characterized by its glaucous white to grey, loosely attached to substratum, non sorediate and non isidiate, foliose thallus, presence of sekikaic acid and atranorin, corticated on

both surfaces, lower surface black with minute rhizines, black apothecia with reddish brown to dark brown lentiform hypothecium and 1-septate, ellipsoid, brown to dark brown, *Physcia* type of ascospores. In external morphology, this species resembles *Dirinaria confluens* (Fr.) Awasthi but the later species differs in presence of sekikaic acid in medulla of the lobes in G.A.W. solution. It is widely distributed in South and S. E. United States, Central and South America and also known from Formosa. In India, it grows in moist exposed conditions on bark of trees and rocks in tropical and subtropical forests.

Selected specimens examined: INDIA: Arunachal Pradesh; Debang Valley, Athuli-Gunli foot track, alt. 950-1150 m., 15.1.1987, Singh 8024; Everest point alt. 1050 m., 31.12.1982, Singh 2512; East Kameng, Seppa, Bana road, alt. 550 m., 11.4.1999, Singh 9986; West Kameng, Dirang, Yang forest, alt. 1625-1800 m., 5.5.1982, Singh 1882; Hapoli-ziro road, 24.9.1981, Singh 479; Namdapha, 20.2.1981, Singh 177; Tamen road, 3 km from ziro, 23.9.1981, Singh 368 (ASSAM).

Dirinaria aegialita (Afz. in Ach.) Moore, The Bryologist 71: 248, 1968; *Parmelia aegialita* Afz. in Ach. Meth. Lich. 191:1803; Awasthi, Biblioth. Lichenol. 2:64-68, 1975.

Thallus foliose, heteromerous, 3-4 cm across, suborbicular, adpressed to substratum, glaucous white, grey to dark grey in central part, lobes 153-220 µm thick, lacinulate, laciniae radiating, subdichotomously to irregularly branched 0.5-1.5 mm broad, epruinose or rarely pruinose at the apices, isidiate-soresiate, isidia coralloid, apically crateriform and produce coarse granular soredia, medulla greyish white 88-103 µm thick, upper cortex paraplectenchymatous 29-44 µm thick, lower surface black, corticated, lower cortex prosoplectenchymatous 29-44 µm thick, rhizines very minute; apothecia not seen.

Chemistry: Thallus K⁺ yellow, medulla K⁻, KC⁻, C⁻, PD⁻; atranorin present (TLC), crystals of sekikaic acid absent and divaricatic acid present in GAW.

Remark: *Dirinaria aegialita* is closely related to *Dirinaria papillulifera* in external morphology and presence of divaricatic acid in medulla of the lobes but is distinguished by coralloid crateriform isidia modified into coarse granular soredia.

Distribution: INDIA (Arunachal Pradesh, Assam, Andaman Islands, Bihar, Kerala, Madhya Pradesh, Meghalaya, Tamil Nadu, Uttarakhand and West Bengal), Ceylon, Formosa, Indonesia, Philippines, Vietnam, Africa, South America and Pacific Ocean.

Selected specimens examined: Arunachal Pradesh; Tirap district, Deomali, 25.2.1982, Singh 838; West Kameng district, Dirang Rama Chug forest, alt. 1700-1900 m., 6.5.1982, Singh 1984 (ASSAM). Assam; Gauhati, near Kamakhya temple, 16.12.1975, Awasthi 8046 (LWU-LWG), North Cachar hills district, Haflong, 1.8.2005, Upreti & Jayshree 05-002989 (LWG). Andaman Islands; North Andaman, Sitapur, Diglipur Range, 2.1.1986, Patwardhan 86.61, 86.71, 86.83, 86.111, 86.126, 86.125, 86.158, 86.193, 86.211 (AMH). Bihar; Paschim Champaran district, Dom hills, South Gadhi, 19.2.1995, Upreti & Tandon 213225 (LWG). Kerala; Calicut district, University of Calicut, University campus, 6.5.1979, Awasthi, Upreti & Misra 79. 784 (LWU-LWG). Madhya Pradesh; Hosangabad district, Pachmarhi, near Apsrabihar falls, alt., 1080 m., 18.1.1980, Upreti & Misra 08.131; Chhindwara district, Parasia Sonapipri, 9 Km away from Parasia, alt., 1000 m., 20.1.1980, Upreti & Misra 80.156, 80.166, 80.167, 80.191 (LWG). Meghalaya; West Khasi hills, Sonapahar, 15th Km on Tura road, 10.7.1984, Singh 6905 (ASSAM). Tamil Nadu; Meghamalai (Periyar Tiger Reserve border) Sinamanoor forest range, alt., 1000 m., 21.3.1999, Nayaka 67 (LWG). Uttarakhand; Almora district, 2 miles beyond Kapkote to Loharkhet, 7.6.1970, Awasthi (LWU-LWG). West Bengal; 24-Parganas,

Sandeshkhali, 10.8.1973 Roychowdhury 3141; Bakkhali forest, 21.7.1973, Roychowdhury 2952; Dhanakhali canal area (Sunderbans), 23.4.1972 Roychowdhury 2033 (CAL).

Dirinaria applanata (F'ee) Awasthi, in Awasthi & Agarwal, J. Indian Bot. Soc. 49: 135. 1970; Awasthi, Biblioth. Lichenol. 2: 78. 1975; *Parmelia applanata* F'ee, Essai Crypt. Ecorc. Officin. 126, tab, fig 2. 1824; *Anaptychia applanata* Mass. Memoir. Lichenogr. 40. 1853; *Physcia applanata* (F'ee) Zahlbr., Cat. Lich. Univ. 7: 581. 1931.

Thallus saxicolous or corticolous, foliose, heteromorous 4-6 cm across, suborbicular, adpressed to substratum, yellowish grey to grey, lobes 191-220 μm thick; lacinulate, laciniae dichotomously to irregularly branched, 1-2 mm broad, some times densely primrose or epruinose, rounded, flabellate apices, distinctly discrete at periphery region and centripetally longitudinally, plicate-rugose, sorediate, soredia globose, capitates 0.5-1.5 mm diam., laminal, isidia absent, medulla greyish white 117-132 μm thick, upper cortex paraplectenchymatous 29-44 μm thick, lower surface black, corticated, lower cortex prosoplectenchymatous 29-44 μm thick rhizines simple, very minute. Apothecia laminal, sessile to scarcely corticated at the base 0.5-1.0 mm diam., disc concave, dark brown, slightly pruinose, margin entire to crenulate, epithecium light brown 14 μm thick, hymenium hyaline 103 μm high, hypothecium dark brown 88-103 μm thick, thalline exciple 136-181 μm thick, asci 8-spored, 1-septate, ellipsoid, brown, 11-18 x 5-7 μm , ascospores.

Chemistry: Thallus K^+ yellow, medulla K^- , KC^- , C^- , PD^- ; atranorin present (TLC), crystals of sekikaic acid absent and divaricatic acid present in GAW.

Remark: *Dirinaria applanata* is closely related to *Dirinaria consimilis* in external morphology but is distinguished by presence of divaricatic acid in medulla of the lobes. It is also resembles to *Dirinaria picta* in presence of divaricatic acid and capitates soredia but differs from flabellate lobes margin.

Distribution: INDIA (Arunachal Pradesh, Andaman Islands, Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Mizoram, Orissa, Tamil Nadu and Uttar Pradesh); China, Formosa, Indonesia, Japan, Malaysia, Philippines, Vietnam, Africa, North and South America, Australia and Pacific Ocean.

Selected specimens examined: Arunachal Pradesh; Lohit district, Wamsai, near Peyong village, alt., 180 m., 30.12.1983, Singh 4169; Lower Subansari, on the way of Yayali to Tago hydal, 19.3.2000, Singh 10323, 10358, 10386, 10375, 10313; West Kameng, Rupa on the way of Shergaon, alt., 1500-1700 m., 27.4.1982, Singh 1569 (ASSAM). Andaman Islands; South Andaman, Wright Myo, 21.12.1986, Patwardhan 86.729, 86.730, 86.731 (AMH). Andhra Pradesh; Vishakhapatnam, 3 Km above Simhachalam near microwave station, 9.3.1986, Awasthi, Mathur & Srivastava 86.332 (LWU-LWG). Karnataka; Bangalore Lalbagh Garden, 28.4.1979, Awasthi, Upreti & Misra 79.69, 79.41, 79.57 (LWU-LWG). Kerala; Calicut, University campus, 6.5.1979, Awasthi, Upreti & Misra 79.756 (LWU-LWG). Madhya Pradesh; Chhindwara district; Parasia sonapiri, 9 km away from Parasia; alt. ca 1000m., 20.1.1980, Upreti & Misra 80.166 (LWU-LWG). Meghalaya; West Khasi hills, Nongstain, 11.7.1984, Singh 6927 (ASSAM). Mizoram; Aizawl district, May 1990, Singh 10214 (ASSAM). Orissa; Jharruguda district, Bagdihi Ban ki village forest, 24.12.1993, Upreti 213016 (LWG). Tamil Nadu; Palni hills, Shambaganur, in pear orchards, alt. ca 6000 ft., 14.12.1970, Singh 70.851; Nilgiri hills, on way from Kilkotagiri to Konada, alt. ca 6000 ft., 1.1.1971, Awasthi & Singh 71.54 (LWU-LWG). Uttar Pradesh; Lucknow district, Mehmood Nagar, 6 km before Malihabad, alt. 138 m., 2.3.2006, Nayaka 06.003583 (LWG).

Dirinaria consimilis (Stirt) Awasthi, J. Indian Bot. Soc. 49: 135. 1970; *Physcia consimilis* Stirt. Proc. Phil. Soc. Glasgow, 11: 310. 1879; *Pyxine consimilis* Stirt. Trans. and Proc. New Zealand Instit. 30: 395. 1898; Zahlbr. Cat. Lich. Univ. 7: 571. 1931.

Thallus saxicolous or corticolous, foliose, heteromorous 5-6 cm across, suborbicular, spreading, adpressed to substratum, glaucous grey, lobes 162-220 μ m thick; lacinulate, laciniae radiating, subdichotomously to subpinnately branched, 0.5-1 mm broad, imbricate to confluent at periphery, apices flabellate to spatulate, faintly pruinose in apical parts otherwise epruinose, sorediate, soredia capitate, granular, isidia absent, medulla greyish white 83-103 μ m thick, upper cortex paraplectenchymatous 29-44 μ m thick, lower surface black, pale brown at the apices, corticated, lower cortex prosoplectenchymatous 29-44 μ m thick, rhizines minute. Apothecia laminal, sessile to scarcely corticated at the base 0.5-1.0 mm diam., disc concave, dark brown to black, slightly pruinose, margin entire to crenulate, epithecium colourless to pale brown 22 μ m thick, hymenium hyaline 73-88 μ m high, hypothecium dark brown 132-147 μ m thick, thalline exciple 136-181 μ m thick, asci 8-spored, 1-septate, ellipsoid, brown, 15-22 x 7-9 μ m, ascospores.

Chemistry: Thallus K^+ yellow, medulla K^- , KC^+ , C^- , PD^- ; atranorin present (TLC), crystals of sekikaic acid present and divaricatic acid absent in GAW.

Remark: *Dirinaria consimilis* is closely related to *Dirinaria applanata* and *Dirinaria picta* in external appearance but is distinguished by presence of sekikaic acid in medulla of the lobes.

Distribution: INDIA (Arunachal Pradesh, Andaman Islands, Bihar, Kerala, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Orissa, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal); Burma, Indonesia, Thailand, Nepal, Vietnam, Africa and South America.

Selected specimens examined: Arunachal Pradesh; East Siang, Yinkiong, Shermer forest, alt. 500-950 m., 7.1.1983, Singh 2774; West Kameng, Rupa on the way of Shergaon, alt. 1500-1700 m., 27.4.1982, Singh 1447, 1538 (ASSAM). Andaman Islands; Bamboo flats, 14.4.1961, Saran 88263 (LWG). Bihar; Paschim Champaran district, Ram Nagar, Chamguru Bangeria area, 18.2.1995, Upreti & Tandon 213214, 213220 (LWG). Kerala; Mallapuram district, Calicut University campus 24.1.1975, Singh & Ranjan 102446 (LWU-LWG). Madhya Pradesh; Satana district, Raigaon, June 1978, A. Singh 73.105, 73.116 (LWG). Manipur; Imphal, Manipur University campus, 13.7.2000, Upreti 20. 2130791B (LWG); Saraikong litan, alt. ca 3600 ft., 9.11.1976, Singh 54746, 54770, 54791 (CAL). Meghalaya; West Khasi hills, near Sonapahar, 11.7.1984, Singh 6934; West Garo hills, Ghaghmara-William bagar road near Revak, 6.7.1984, Singh 6784, 6789 (ASSAM). Mizoram; Aizawl district, May 1990, Singh 10203, 10234, 10256, 10267 (ASSAM). Orissa; Jharruguda district, on the way to Beghdidi village, 22.12.1993, Upreti (LWG). Tamil Nadu; Palni hills, on way from perumalmai to oothu near Malaiyar, alt. ca 4000 ft., 20.12.1970, Singh 70.1163; Madras IIT campus, 26.4.1979, Awasthi, Upreti and Misra 79.4 (LWU-LWG). Uttar Pradesh; Lucknow district, 5 km ahead of Kakori towards Malihabad, alt. 138 m., 2.3.2006, Nayaka 06.003588 (LWG). Uttarakhand; Almora district, Askote above village Barakote, alt. 5500 ft., 23.6.1954, Awasthi 2694 (LWU-LWG); Uttarkashi district, Dhanpur-Dharsu, alt. 1050 m., 14.9.1977, A. Singh 75318 (LWG). West Bengal; Darjeeling district, Rangit river valley, near the bridge, alt. ca 2000 ft., 8.3.1967, Awasthi and Agarwal 67.184 (LWU-LWG); 24- Parganas, Hingalganj, 20.6.1971, Roychowdhury 1733; Katakhal, 11.4.1972, Roychowdhury 1886; I. B. G. Howrah, 1.11.1967, Roychowdhury 665 (CAL).

Dirinaria confluens (Fr.) Awasthi, Biblioth. Lichenol. 2: 28. 1975; *Parmelia confluens* Fries, Syst. Orb. Veget. Part I, 284. 1825; *Physcia confluens* Nyl. Synop. Lich. 1: 430. 1860. *Dimelaena confluens* Trev. Atti. Soc. Ital. Sci. Natur. Milano. 11: 623. 1868.

Thallus saxicolous or corticolous, foliose, heteromerous 4-6 cm across, spreading, adpressed to substratum, glaucous grey, lobes 176-250 µm thick; lacinulate, laciniae subdichotomously branched, 0.5-1.5 mm broad, confluent rounded, flabellate at apices centripetally distinct plicate-rugose, epruinose, soredia and isidia absent, medulla greyish white 88-117 µm thick, upper cortex paraplectenchymatous 29-44 µm thick, lower surface black, corticated, lower cortex prosoplectenchymatous 44-58 µm thick, rhizines minute. Apothecia laminal, sessile 1.0-1.5 mm diam., disc concave, dark brown to black, slightly pruinose, margin entire to crenulate, epithecium pale brown 14 µm thick, hymenium hyaline 103 µm high, hypothecium dark brown 120-137 µm thick, thalline exciple 136-181 µm thick, asci 8-spored, 1-septate, ellipsoid, brown, 15-18 x 7-9 µm thick, ascospores.

Chemistry: Thallus K⁺ yellow, medulla K⁻, KC⁻, C⁻, PD⁻; atranorin present (TLC), crystals of sekikaic acid absent and divaricatic acid present in GAW.

Remark: *Dirinaria confluens* is closely related to *Dirinaria confusa* in external morphology but is distinguished by presence of divaricatic acid in medulla of the lobes.

Distribution: India (Arunachal Pradesh, Andaman Islands, Goa, Karnataka, Kerala, Madhya Pradesh, Mizoram, Orissa, Tamil Nadu, Uttarakhand and West Bengal); Ceylon, Indonesia, Nepal, Africa, America and Australia.

Selected specimens examined: Arunachal Pradesh; West Kameng, Rupa on the way of Shergaon, alt. 1500-1700 m., 27.4.1982, Singh 1570; Rupa-Bomdila foot track, alt. 1500-1700 m., 25.4.1982, 1305, 1418 (ASSAM). Andaman Islands; South Andaman, Bamboo flat 14.4.1961, Saran and Parthy 88267 (LWG); Middle Andaman, Parlob Jig Island, on beach 23.12.1985, Patwardhan 85.2283, 85.2284, 85.2288, 85.2289 (AMH). Goa; Goa University area, Bambali, 29.6.2004, Upreti, Chatterjee and Divaker 04.004378 (LWG). Karnataka; Tumkur district, near Tiptur, 1.5.1979, Awasthi, Upreti and Misra 79.286 (LWU-LWG). Kerala; Jaukki district, Munnar, Mattupatty, Indo-Swiss Project area, alt. ca 1600-1700 m., 25.3.1985, Awasthi, Tiwari and Mathur 85.185 (LWU-LWG). Madhya Pradesh; Shahdol district, Amarkantak Kapil Sangamgaon 2 km from Amarkantak town, alt. ca 1060 m., 28.1.1980, Upreti and Misra 80.366 (LWU-LWG). Mizoram; Aizwal district, May 1990, Singh 10233 (ASSAM). Orissa; Gangam district, on way to Seranga 3.3.1986, Awasthi, Mathur and Srivastava 86.114 (LWU-LWG). Tamil Nadu; Palni hills, Perumalmalai area, on way to perumal peak, alt. 5000-7500 ft., 17.10.1970, Singh 70.1076; Kodaikanal, near the pillar rocks, alt. ca 7500 ft., 3.1.1970, Awasthi and Singh 70.220, 70.250 (LWU-LWG). Uttarakhand; Pithoragarh district, Sukhidak Shymala Tal, alt. 1200 m., 24.1.1993, Upreti 21281 (LWG). West Bengal; 24- Parganas, Kalitala (Sunderbans), 13.8.1974, Roychowdhury 3557; Bakkhali forest, 29.7.1973, Roychowdhury 2950; I.B.G. Howrah, 6.9.1976, Roychowdhury 621 (CAL).

Dirinaria picta (Sw.) Elem. et Shear, The Genera of Fungi, 323, 1931; *Lichen pictus* Sw. Nova Gen. et Spec. Plant. 146. 1788; *Parmelia picta* Ach. Meth. Lich. 211:1803; Lichenogr. Univers. 480. 1810; *Physcia picta* Nyl. Memoir. Soc. Imp. Sci. Nat. Cherbourg. 3:175.1855; and Synopsis Meth. Lich. 1: 430:1886; Zahlbr. Cat. Lich. Univers. 7:582.1931; *Pyxine picta* Tuck. Synop. North Amer. Lich. 1:79.1882.

Thallus saxicolous or corticolous, foliose, heteromorous, 4-5 cm across, suborbicular, closely adpressed to substratum, glaucous grey to pale, lobes 191-250 μm thick, lacinulate, laciniae radiating, stellately, pinnatifid to subdichotomously branched 1.0-1.5 mm broad, discrete in the peripheral, apices acute, rounded to spatulate not flabellate confluent, plane to scarcely convex, sorediate, soredia laminal, globose, capitate, farinose, 0.7-1.0 mm diam., isidia absent, medulla greyish white 117-132 μm thick, upper cortex paraplectenchymatous 29-44 μm thick, lower surface black, corticated, lower cortex prosoplectenchymatous 29-44 μm thick, rhizines minute. Apothecia laminal, sessile to scarcely constricted at base, 0.5-1.5 mm diam., disc concave, dark brown to black, epruinose, margin entire to crenulate, epithecium brown 14-22 μm thick, hymenium hyaline 88-103 μm high, hypothecium dark brown 88-103 μm thick, thalline exciple 136-181 μm thick, asci 8-spored, 1-septate, ellipsoid, brown, 15-22 x 7-9 μm , ascospores.

Chemistry: Thallus K^+ yellow, medulla K^- , KC^- , C^- , PD^- ; atranorin present (TLC), crystals of sekikaic acid absent and divaricatic acid present in GAW.

Remark: *Dirinaria picta* is closely related to *Dirinaria appanata* in presence of divaricatic acid and capitate soredia but is distinguished by the presence of stellate radiate lobes.

Distribution: INDIA (Arunachal Pradesh, Andaman Islands, Meghalaya, Mizoram, Tamil Nadu and West Bengal); Burma, Ceylon, China, Indonesia, Malaysia, Okinawa, Philippines, Vietnam, Africa, North and South America and Pacific Ocean.

Selected specimens examined: Arunachal Pradesh; East Kameng, Khalang reserve forest, Sejnsa, alt. 200 m., 16.4.1999, Singh 10159, 10113, 10115; Lower Subansari, on the way of Yayali to Tago hydal, 19.3.2000, Singh 10311, 10353, 10361 (ASSAM). Andaman Islands; North Andaman, Milamgram, Diglipur range, 3.1.1986, Patwardhan 86.327, 86.328, 86.329 (AMH). Meghalaya; Mairang-Meghalaya, 15.3.1982, Singh 2301, 2325 (ASSAM). Mizoram; Lunglai forest, Dengtang forest, 3.10.1988, Singh 8958 (ASSAM). Tamil Nadu; Palni hills, Kodaikanal, near shoal, alt. ca. 6000 ft., 13.12.1970, Singh 70.811; on the way to near shoal, alt. ca 6500 ft., 13.10.1970, Singh 70.804 (LWU-LWG). West Bengal; Darjeeling district, Oodlabari, Ghis beet forest, alt. ca 1000 ft., 19.2.1966, Awasthi & Agarwal 66.7, 66.10, 66.88 (LWU-LWG); 24-Parganas, Hingalgaon, 2.7.1971, Roychowdhury 1862 (CAL).

Dirinaria papillulifera (Nyl.) Awasthi, The Bryologist, 67:369.1964. *Physcia papillulifera* Nyl. Acta Sc. Sci. Fenn. 26 (IV): 9.1900.

Thallus saxicolous or corticolous, foliose, heteromorous, 3-5 cm across, suborbicular, closely adpressed to almost-adglutinated to substratum, glaucous white to grey, lobes 265 μm thick, lacinulate, laciniae radiating, subpinnately to subdichotomously branched 1.0-1.5 mm broad, discrete at the periphery, rounded to flabellate, centripetally imbricate to confluent longitudinally plicate-rugose, slightly pruinose or epruinose, isidiate, isidia develop as minute papillae, later become elongate filiform, densely crowded, simple to branched at the base, soredia absent, medulla greyish white 132 μm thick, upper cortex paraplectenchymatous 44 μm thick, lower surface black, corticated, lower cortex prosoplectenchymatous 73 μm thick, rhizines minute; apothecia not seen.

Chemistry: Thallus K^+ yellow, medulla K^- , KC^- , C^- , PD^- ; atranorin present (TLC), crystals of sekikaic acid absent and divaricatic acid present in GAW.

Remark: *Dirinaria papillulifera* is closely related to *Dirinaria aegialita* in external morphology and presence of divaricatic acid in medulla of the lobes but is distinguished by papilliform to piliform isidia.

Distribution: India (Arunachal Pradesh, Assam, Andaman Islands, Andhra Pradesh, Kerala, Orissa, Sikkim, Tamil Nadu and West Bengal); Ceylon, Indonesia, West Indies, North and South America.

Selected specimens examined: Arunachal Pradesh; Upper Subansari, on the way of lake to Nuk basti, 28.3.2000, Singh 10715; West Siang, Barpu basti foot track, alt. 800 m., 29.12.1982, Singh 2405 (ASSAM). Assam; Gauhati, near Kamakhya temple, 16.12.1975, Awasthi 8067 (LWU-LWG). Andaman Islands; South Andaman, Shol Bay, near Wright Myo, 20.12.1986, Patwardhan 86.677 (AMH). Andhra Pradesh; Vishakhapatnam, Simhachalam area in cashew plantation (forest), 6.3.1986, Awasthi, Mathur & Srivastava 86.237, 86.251 (LWU-LWG). Kerala; Quilon, Tanmalai area, on way to Aryankan, 25.11.1973, Singh 73.179 (LWU-LWG). Orissa; Khurda district, in Barunai hill area near Khurda, 27.2.1986, Awasthi, Mathur & Srivastava 86.004 (LWU-LWG). Sikkim; North Sikkim, Kabi before Mangam, alt. 1660 m., 11.8.2004, Upreti, Chatterjee & Divakar 04-003725 (LWG). Tamil Nadu; on the way of Kodaikanal Brijam lake, 17.10.1985, Patwardhan & Nagarkar 85.1659, 85.1660 (AMH). West Bengal; 24-Parganas, Kalitala (Sunderbans), 26.4.1972, Roychowdhury 2064 (CAL).

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