Lichens on mangrove plants in Andaman Islands, India

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Twenty-nine species of lichens are reported on mangrove plants in the Andaman Islands. Fourteen species are new records to Andaman Islands, including five new records to India.

Key words – Lichenized fungi – new records – taxonomy

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Introduction

The Andaman Islands attracted the attention of floristic botanists as early as 1791 (Thothatri 1962) but lichens were not collected from these islands until 1867 by Dr. Kurz of the Royal Botanical Garden, Calcutta. The area has been thoroughly explored by the Indian lichenologists (P.G. Patwardhan, Urmila Makhija and P.P. Sethy of Agharkar Research Insitutute, Pune; Ajay Singh and D.K.Upreti of National Botanical Research Institute, Lucknow during 1980-1988) and many collections were made and results published in various scattered publications (Singh & Sinha 2010).

From the botanical point of view the Andaman Islands have a special position in the Indian subcontinent for their interesting flora. The islands are continental fragments and form 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 13^0 41' and 10^0 30' North and 92^0 11' and 93^0 7' East. The land area of the entire group of 205 islands is about 6330 km^2. The main group consists of North, Middle and South Andaman.

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 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), they exhibit remarkable differences in the constituents of their flora from that of the mainland vegetation. There are a large number of Malaysian elements due to proximity, besides their own elements that are endemic taxa due to insular position.

The vegetation of the islands is classified under six types (Thothatri 1962):

1. Mangrove forest (confined to creeks)
2. Beach forest (on the coast and extending somewhat inland)
3. Deciduous forest
4. Evergreen forest at lower elevations
5. Moist evergreen forest at higher elevations
6. Vegetation in the cleared areas

Fig. A Foliose lichens on tree trunks of mangrove plants Mayabander, North Andaman

Fig. B Lichen communities on mangroves Kalipur, North Andaman

Fig. C Embankments of stilt roots of Rhizophora mucronata - Andaman

Fig. D Creek in Kadamtala, South Andaman

For the current research project, mangrove forests of Andaman Islands were selected as a less explored habitat for lichens. The intertidal or tidal areas of mangroves offer a unique type of ecosystem, which is considered as the most productive ecosystem of the world. Mangroves constitutes about 14 million hectares in the world and 656,000 hectares in Indian subcontinent. They are restricted to the coastal areas and confined to creeks in different islands of Andaman. The mangrove vegetation exceeds 22.5 % of the total forest cover. Ever increasing population pressure, pollutant discharges from industries, oil refineries, tanneries, urban areas, etc. has turned mangrove forests into a vulnerable and fragile ecosystem. During the past three decades the mangrove flora and mangrove ecosystem has received much attention from the scientific communities (Naskar & Mandal 1999).

The epiphytic lichens of these special habitats are poorly known. In this context the lichen flora on the mangroves (Figs. A-D) in Andaman Islands has been explored, specifically in North Andaman: Kalipur, Diglipur, Aerial Bay, Laxmipur, Kalighat, Ramnagar, South Andaman: Manjeri, Chidiyatapu, Wandoor, and Middle Andaman: Yerrata, Rangat, Baratang Island, Kadamtala and Mayabandar.

It has been observed that crustose lichen species are abundant on the bark of mangroves with fewer foliose lichens; fructicose lichens were not observed during this study. The lichens were found on mangrove genera *Sonneratia*, *Avicennia*, *Xylocarpus*, *Rhizophora* and *Brugeria*. The earlier works on lichens from Andaman were mainly from trees of deciduous and evergreen forests. The present work is the first comprehensive work of on the mangrove plants in Andaman. Twenty-nine species are identified including five new records to India. Illustrations of new records are given. Distribution of lichen species in lichenogeographic regions of India is given in Table 1.

Methods

The specimens were collected from Andaman Islands during consecutive years 2007 in November-December) and 2008 in March. 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. Chemical constituents were identified by thin-layer chromatography using methods standardized for lichen products (Culberson & Kristinsson 1970, Culberson 1972, White & James 1985) with the solvent systems benzene-dioxane-acetic acid (180:45:5), hexane-ethyl ether-formic acid (130:80:20), and toluene-ethyl acetate-formic acid (139:83:8). Specimens were identified using literature (Nylander 1963, Divakar and Upreti 2005, Lücking et al. 2009, Rivas Plata et al. 2010)) and by comparison with types and protologues. All examined specimens are deposited in Ajrekar Mycological Herbarium (AMH).

The species

◊ New record to Andaman; • New record to India

• ***Anisomeridium ambiguum*** (Zahlbr.) R.C. Harris**,** in Egan, Bryologist 90: 163, 1987. (Monoblastiaceae) Fig. 1
= *Arthopyrenia ambigua* Zahlbr., Cat. Lich. Univ. 10: 73, 1935.

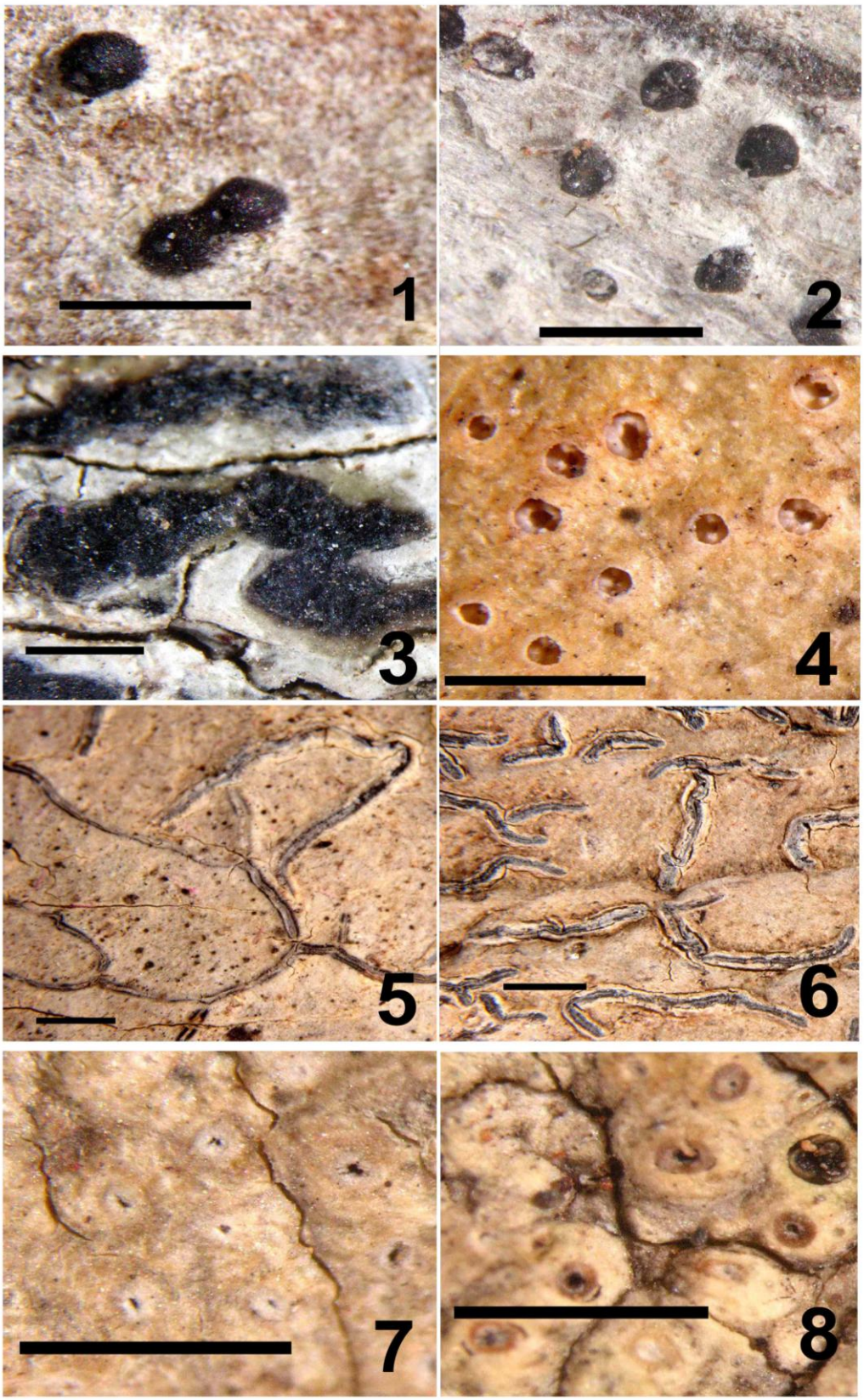
Distribution – India (Andaman Islands); Pantropical.

Anisomeridium complanatum (Makhija & Patw.) R.C. Harris, More Florida Lichens, Incl. 10 ¢ Tour Pyrenol. (New York): 145, 1995. (Monoblastiaceae)
= *Ditremis complanata* Makhija & Patw., Biovigyanam 16: 15, 1990.

Distribution – India (Andaman & Nicobar Islands, Karnataka, Kerala and Tamil Nadu), Endemic.

◊***Anisomeridium flavopallidum*** (Makhija & Patw.) R.C. Harris, More Florida Lichens, Incl. 10 ¢ Tour Pyrenol. (New York): 146, 1995. (Monoblastiaceae) Fig. 2
= *Ditremis flavopallida* Makhija & Patw. Biovigyanam 16: 16, 1990.

Distribution – India (Maharashtra) Endemic.



Figs 1–8 – Habit **1** *Anisomeridium ambiguum*. **2** *Anisomeridium flavopallidum*. **3** *Arthonia pellea*. **4** *Chapsa phlyctidioides*. **5** *Graphis dendrogramma*. **6** *Graphis renschiana*. **7** *Leucodecton biokense*. **8** *Leucodecton fissurinum*. Bars = 1 mm

◊***Arthonia pellaea*** Leighton, Transact. Linn. Soc. London. 27: 180, 1869. (Arthoniaceae) Fig. 3

Distribution – India (Karnataka); Ceylon.

• ***Chapsa phlyctidioides*** (Müll. Arg.) Mangold, Aust. Syst. Bot. 21: 221, 2008. (Thelotremataceae) Fig. 4
= *Ocellularia phlyctidiodes* Müll. Arg., Hedwigia 32: 130, 1893.

Distribution – India (Andaman Islands); Eurasia-Tropical Asia, N. America incl. Mexico, Oceania-Australia

Coccocarpia palmicola (Spreng.) Arv. & D.J. Galloway, Bot. Not. 132: 242, 1979. (Coccocarpiaceae)
= *Lecidea palmicola* Spreng., Kongl. Vetensk. Acad. Nya Handl. 1: 46. 1820.

Distribution – India (Andaman, Nicobar Islands, Arunachal Pradesh, Assam, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Sikkim, Tamil Nadu, Uttarakhand, West Bengal); Bhutan, tropical and subtropical regions of the world.

Diorygma junghuhnii (Mont & Bosch) Kalb, Staiger & Elix, Symb. Bot. Upsal. 34: 157, 2004. (Graphidaceae)
= *Ustalia junghuhnii* Mont. & Bosch, in Jungh., Pl. Jungh. 4: 477, 1855.

Distribution – India (Andaman, Nicobar Islands, Assam, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Nagaland, Sikkim, and Tamil Nadu); Australia, Brazil, Guatemala, Indonesia, New Caledonia, Paraguay, Philippines, Solomon Islands, Tahiti and Thailand.

Dirinaria aegialita (Afzel. in Ach.) Moore, Bryologist 71: 248, 1968. (Physciaceae**)**
= *Parmelia aegialita* Afzelius in Acharius, Meth. Lich.: 191, 1803.

Distribution – India (Andaman Islands, Kerala, Tamil Nadu); S.E. Asia, Africa, S. America and Pacific Oceanic Islands.

Dirinaria applanata (Fee) D.D. Awasthi, in Awasthi & Agarwal, J. Indian Bot. Soc. 49: 135. 1970. (Physciaceae)
= *Parmelia applanata* Fee, Essai Crypt. Ecorc. Offic. : 126, 1824

Distribution – India (Andaman Islands, Karnataka, Maharashtra. Nagaland, Tamil Nadu, Uttaranchal. West Bengal); widely distributed in tropical to subtropical regions of the world.

Dirinaria picta (Sw.) Schaer ex Clem, in Clements& Shear, Gen. Fungi: 323, 1931. (Physciaceae) **=** *Lichen pictus* Sw., Prodr.: 146, 1788**.**

Distribution – India (Andaman, Nicobar Islands, Arunachal Pradesh, Assam, Lakshadweep, Tamil Nadu, Uttarpradesh and West Bengal); Australasia, Pacific region, Africa, America.

Dyplolabia afzelii (Ach.) A. Massal., Neagen. Lich.: 6, 1854. (Graphidaceae) = *Graphis afzelii*Ach., Syn. Meth. Lich.: 85, 1814.

Distribution – India (Andaman, Nicobar Islands, Arunachal Pradesh, Assam, Kerala, Maharashtra, Meghalaya, Nagaland, Tamil Nadu); Australia, Brazil, Cuba, Dominica, Indonesia, Mexico, and Sri Lanka.

◊***Graphis dendrogramma*** Nyl., J. Linn. Soc. Bot. 16: 226, 1878. (Graphidaceae) Fig. 5

Distribution – India (Arunachal Pradesh, Kerala, Sikkim and West Bengal); Costa Rica, Malayasia and Sri Lanka.

• ***Graphis renschiana*** (Müll. Arg.) Stizenberg., Bericht. über die Thätigk. St. Gallisch. Naturw. Gesellsch.: 184, 1891. (Graphidaceae) Fig. 6
= *Graphina renschiana* Müll. Arg., Flora, Jena 68(28): 512, 1885.

Distribution – India (Andaman Islands); Madagascar, Pantropical

Graphis subdisserpens Nyl., Bull. Soc. Linn. Normandie, ser. 2, 7: 175, 1873. (Graphidaceae**)**

Distribution – India (Andaman, Nicobar Islands, Arunachal Pradesh); Insula Labouan and Thailand.

Table 1 Distribution of lichen species in lichenogeographic regions of India (Singh et al 2004)

Species	1	2	3	4	5	6	7	8	9
Anisomeridium ambiguum •								+	
Anisomeridium complanatum						+		+	
Anisomeridium flavopallidum ◊						+		+	
Arthonia pellaea ◊						+		+	
Chapsa phlyctidioides •								+	
Coccocarpia palmicola		+			+	+		+	
Diorygma junghuhnii		+				+		+	
Dirinaria aegialita						+		+	
Dirinaria applanata	+	+		+		+		+	
Dirinaria picta		+		+		+		+	+
Dyplolabia afzelii		+				+		+	
Graphis dendrogramma ◊		+		+		+		+	
Graphis renschiana •								+	
Graphis subdisserpens		+						+	
Hemithecium scariosum								+	
Leucodecton biokense •								+	
Leucodecton compunctellum						+		+	
Leucodecton fissurinum ◊						+		+	
Leucodecton tarmugliense								+	
Megalotremis biocellata •								+	
Myriotrema norstictideum ◊		+		+		+		+	
Parmeliella macrospora								+	
Parmotrema disparile ◊						+		+	
Parmotrema ravum ◊	+	+				+		+	
Pyrenula mastophhoriza								+	
Relicina abstruse ◊						+		+	
Stirtonia ramosa								+	
Thecaria sp.								+	
Tylophoron protrudens ◊	+			+		+		+	

◊ = New record to Andaman; • = New to India including Andaman

1= Western Himalaya; **2** = Eastern Himalaya; **3** = Western Dry Region; **4** = Gangetic Plains; **5** = Central India; **6** = Western Ghats; **7** = Eastern Ghats & Deccan Plateau; **8** = Andaman & Nicobar Islands; **9** = Lakshadweep

Hemithecium scariosum Makhija & Adaw., Mycotaxon 91: 350, 2005. (Graphidaceae)

Distribution – India (Andaman, Nicobar Islands). Endemic.

• ***Leucodecton biokense*** A. Frisch, Biblioth. Lichenol. 92: 153, 2006. (Thelotremataceae) Fig. 7

Distribution–India (Andaman Islands); Africa.

Leucodecton compunctellum (Nyl.) A. Frisch, Biblioth. Lichenol. 92: 155, 2006. (Thelotremataceae)

= *Thlotrema compunctellum* Nyl., Bull. Soc. Linn. Normandie, ser. 2, 2: 77, 1868.

Distribution – India (Andaman, Nicobar Islands, Kerala); Australia, New Caledonia, Sri Lanka, West Indies, and Africa.

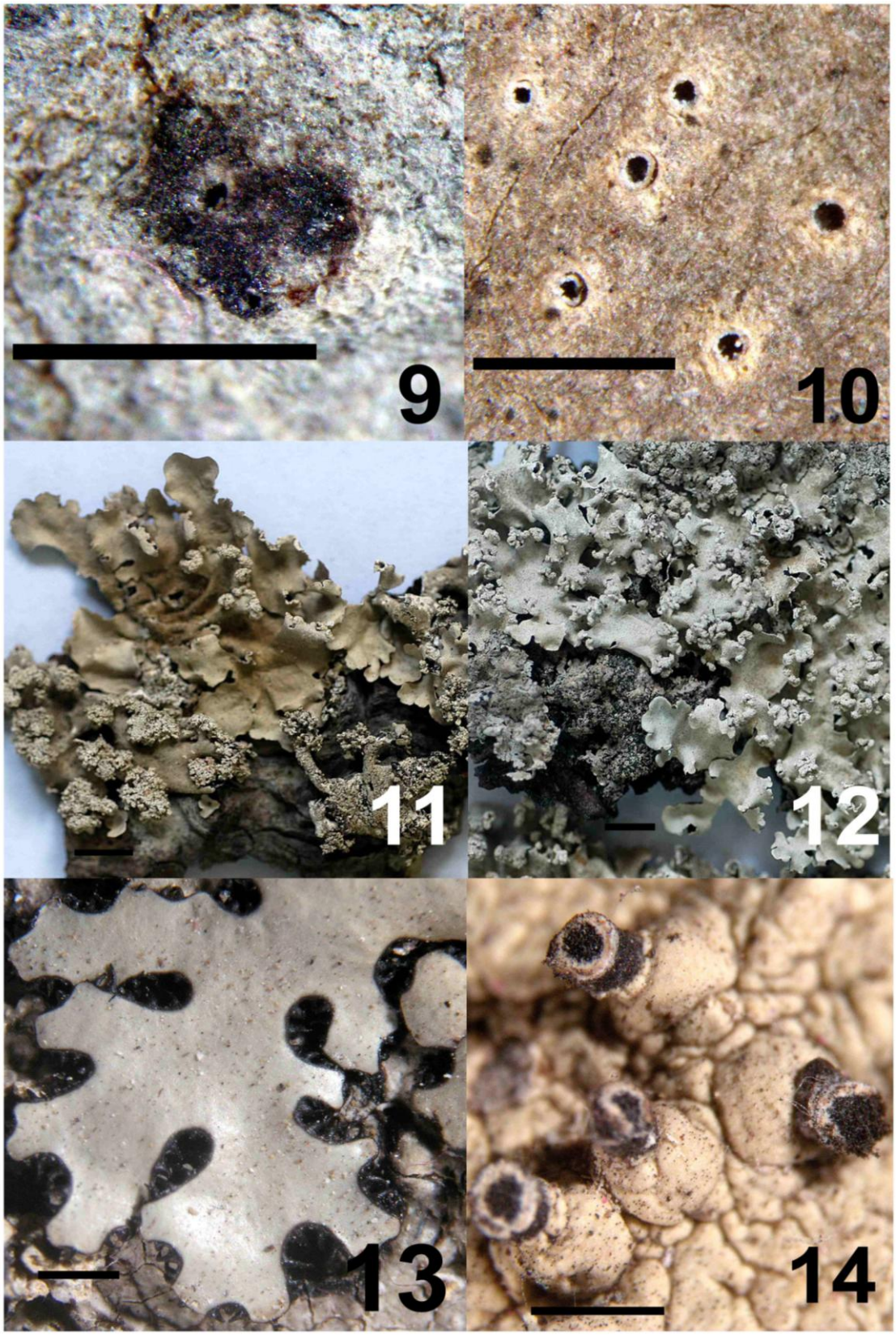
◊***Leucodecton fissurinum*** (Hale) A. Frisch, Biblioth. Lichenol. 92: 156, 2006. (Thelotremataceae) Fig. 8

= *Myriortrema fissurinum* Hale, Bull. Br. Mus. Nat . Hist., Bot. 8: 279, 1981.

Distribution – India (Karnataka, Kerala and Tamil Nadu); Africa and Sri Lanka.

Leucodecton tarmugliense (Sethy, Nagarkar & Patw.) Frisch, Biblioth. Lichenol. 92: 155, 2006. (Thelotremataceae)

= *Leptotrema tarmugliense* Sethy,



Figs 9–14 – Habit **9** *Megalotremis biocellata*. **10** *Myriotrema norstictideum*. **11** *Parmotrema disparile*. **12** *Parmotrema ravum*. **13** *Relicina abstruse*. **14** *Tylophoron protrudens*. 9, 10, 13, 14 Bars = 1 mm; 11–12 Bars = 5 mm.

Nagarkar & Patw., Mycotaxon 28: 192, 1987.

Distribution – India (Andaman, Nicobar Islands). Endemic.

• ***Megalotremis biocellata*** Aptroot, Biblthca Lichenol. 44: 125, 1991. (Trypetheliaceae)Fig. 9

Distribution –India (Andaman Islands); Costa Rica, Australia.

◊***Myriotrema norstictideum*** (Patw. & Nagarkar) D.D. Awasthi, Biblioth. Lichenol. 40: 3 1991. (Thelotremataceae) Fig. 10
= *Lepotrema norstictideum* Patw. & Nagarkar, Biovignyam 6: 5, 1980.

Distribution–India (Assam, Meghalaya, Tamil Nadu and West Bengal). Endemic.

◊***Parmotrema disparile*** (Nyl.) Hale, Phytologia 28: 336, 1974. (Parmeliaceae).
Fig. 11
=*Parmelia disparalis* Nyl., Syn. Lich. 1(2): 381, 1860

Distribution – India (Tamil Nadu) and Mexico; Africa

◊***Parmotrema ravum*** (Krog. & Swinscow) Sérus., in Vězda, Lich. Sel Exs. Fasc. 75 No. 1857, 1983. (Parmeliaceae) Fig. 12
=*Parmelia rava* Krog & Swinscow, Bull. Br. Mus. (Nat. Hist.) Bot. 9: 207, 1981.

Distribution – India (Arunachal Pradesh, Kerala, Manipur, Nagaland, Tamil Nadu, Uttarakhand); Nepal and Africa.

Parmeliella macrospora Makhija & Adaw., Mycotaxon 71: 332, 1999. (Parmeliaceae**)**

Distribution – India (Andaman, Nicobar Islands). Endemic.

Pyrenula mastophhoriza (Nyl.) Zahlbr., Cat. Lich. Univers. 1: 439, 1922. (Pyrenulaceae).
= *Verucaria mastophoriza* Nyl., Bull. Soc. linn. Normandie, sér. 2, 7: 180, 1873.

Distribution – India (Andaman & Nicobar Islands). Endemic.

◊***Relicina abstrusa*** (Vain.) Hale, Phytologia 28: 484, 1974. (Parmeliaceae) Fig. 13
= *Parmelia abstrusa* Vain., Acta Soc. Faun. Fl. Fenn. 7(7): 64. 1890.

Distribution – India (Karnataka and Kerala); Indonesia, Japan, Malaya, Philippines, and Taiwan. Central, South and North America.

Stirtonia ramosa Makhija & Patw. *Biovigyanam* 13(2): 49, 1987. (Arthoniaceae-unsettled position)

Distribution – India (Andaman, Nicobar Islands). Endemic.

Thecaria sp. (Graphidaceae)

◊***Tylophoron protrudens*** Nyl., Ber. Tät. St Gall. Naturw. Ges. 20: 279, 1862 [1861-62] Lecanorales Fig. 14

Distribution – India (Kerala, Orissa, Uttarakhand and West Bengal); Nepal. Pantropical.

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References

Culberson CF. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. Journal of Chromatography 72, 113–125.

Culberson CF, Kristinsson H. 1970. A standardized method for the identification of lichen products. Journal of Chromatography 46, 85–93.

Divakar PK, Upreti DK. 2005. Parmelioid Lichens in India (A revisionary study). Bishen Singh Mahendra Pal Singh, Dehra Dun, p. 1–488.

Lücking R, Archer A, Aptroot A. 2009. A world-wide key to the genus *Graphis* (*Ostropales: Graphidaceae*). Lichenologist 41: 363–452.

Naskar KR, Mandal RN. 1999. Ecology and biodiversity of Indian mangroves 1, 3-348. Dehradun, India, Milton Book Company.

Nylander WL. 1873. Lichenes Insularum Andaman. Bulletin Society. Linn. Normandie, ser. 2, 7, 162–183. 1874.

Rivas Plata E, Lücking R, Sipman HJM, Mangold A, Kalb K, Lumbsch H. 2010. A world-wide key to the thelotremoid *Graphidaceae*, excluding the *Ocellularia-Myriotrema-Stegobolus* clade. Lichenologist 42, 139–186.

Singh KP, Sinha GP. 2010 – Indian Lichens An Annotated Checklist. Government of India. Botanical Survey of India. Shiv Offset Press, Dehra Dun. 1–571.

Singh, KP, Sinha GP, Bujarbarua P. 2004. Endemic lichens of India. Geophytology 33, 1–16.

Thothatri, K. 1962. Contributions to the flora of the Andaman and Nicobar Islands. Bulletein. Botanical. Survey. India 4 (1-4), 281–296.

White FJ, James PW. 1985. A new guide to microchemical techniques for the identification of lichen substances. Bulletin British Lichen Society. 57(Suppl.), 1–41.