



The Angiospermic Phytodiversity of Chilka Lagoon, the Pride of Odisha, India: A Review

Sachidananda Padhy¹ and Santosh Kumar Dash²

Vedic Science Research Centre, Bhaba Nagar, 1st Lane, Berhampur 760 004, Odisha, India
E-mail: ¹<sachi_padhy@rediffmail.com>, ²<santoshdash64@gmail.com>

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ABSTRACT Chilka is the largest estuarine water body at the East-Coast of Peninsular India, in Odisha state. This communication presents an account of 153 Angiosperm plants reported from the Chilka lagoon, its islands and shore line facing the Bay of Bengal. This study also adds three new species of Pteridophytes to the recorded list so far of South Odisha, vide earlier reports. Protection majors necessary to conserve the environment of Chilka, is discussed.

INTRODUCTION

Chilka is the pride of our nation as Asia's biggest saline water lake of about five thousand years old. From time immemorial the flora, fauna and bountiful natural beauty of this wide voluminous lagoon has inspired philosophers, poets and naturalists to keep it as the center of attraction of their creative thoughts. This largest water body at the east coast of Peninsular India in Odisha state, is situated on 19° 54' N and 85° 06' - 85° 35' E. This wetland is an estuarine lake connected to the Bay of Bengal (Fig. 1). The total watershed area of the lake is approximately 3,000 square kilometers with water spread area ranging between about 1165 in rainy season to 906 square kilometers in winter. It provides more than 6000 hectares of suitable area for aqua culture which amounts to nineteen percent of the total available brackish water resources of the state. It is a unique natural environment and a nursery ground, as well for commercial cultivation of prawn, crabs and transitional fishes (marine and fresh water).

The biological wealth of the lake includes about 160 fish species, 150 bird species, 2 species of crabs and variety of other wildlife and plant species. It is a shelter place for bare headed Geese, Rosy pelican, Flamingos, Brahiming duck in large flocks and Dolphins at the mouth

of the estuary. It provides excellent habitat for the migratory waterfowl belonging to Siberian – Kazakhstan and from the Palearctic regions beyond Himalayas in Central and Northern Asia. About 65 species of Waterfowls were reported to be sighted in the lagoon area. The Chilka Lake has been declared as a bird sanctuary since 1973 and in 1979 as a hot-spot for 'Conservation of the wetland' bearing an International acclaim.

The scenic beauty of hilly forests inside the lake are outstanding. The lagoon is studded with a number of emerald green islands, with colourful names such as Honeymoon Island, Breakfast Island, Kalijai (a pilgrimage island spot) and Nalbana - a pasture swamp for the cattle and also a natural landing site for hundreds and thousands of migratory birds, as well. The other islands boarding upon the Bay of Bengal contain villages and hamlets, each with its own unique comeliness. One can enjoy the bountiful natural beauty of Chilka while on a trip in East Coast Railways.

The Lagoon has a cyclic terms of sweet versus saline water for six months term in each year. The lake is connected with the Bay of Bengal with its meeting place entitled 'Maggarmukh mouth'. Saline water rush into the lake through this mouth during high tides. The lake assumes by this a saline water ecosystem from January to the end of June. In July the rainy season starts and eight tributary rivers of Puri district (namely: Daya, Nuna, Ratnachira, Bhargavi, Kania, Malaguni, Dhanua and Salia) connected around Chilka along with ten water channels of Ganjam district, pour their waters into the lake. The flood

Address for correspondence:

Sachidananda Padhy
Vedic Science Research Centre,
Bhaba Nagar-1st Lane, Berhampur 760 001,
Dist. Ganjam, Odisha, India
E-mail: sachi_padhy@rediffmail.com

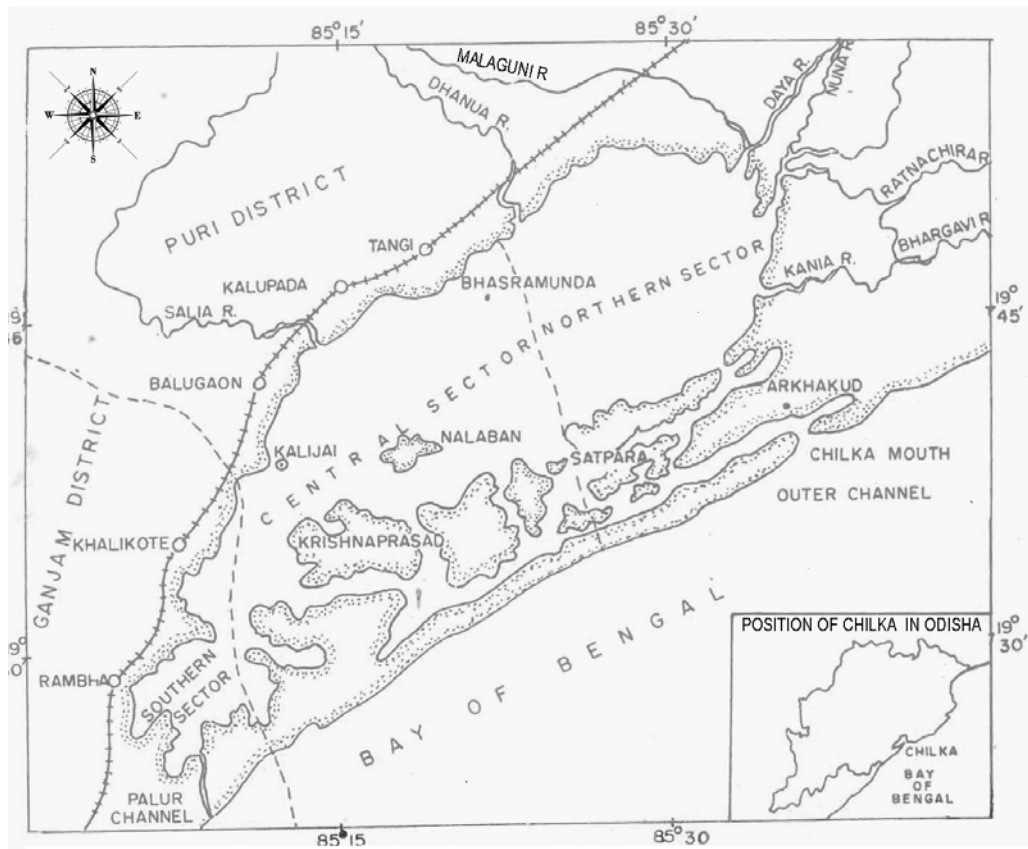


Fig. 1. Chilka Lake

waters push out the same volume of saline waters of the lake through the Maggarmukh mouth back to the Bay of Bengal. The lake thus turns into a sweet water ecosystem from July to December. This intermittent change of sweet - saline environment in a year alternatively favours and/or disfavours the growth of some of the members of the biodiversity. The biota which tolerate both sweet and saline environment remain unaffected by such natural changes. The rest of them along with weeds die during the transition period creating insipid foul smell and pollute the environment inadvertently for some time.

Research on Chilka was initiated by the Zoological Survey of India as early as 1914. More than 200 references on the flora, fauna, fisheries, hydrography, ecology, conservation and development of Chilka Lagoon are available (Rao et al. 1988). In the meantime many studies and researches are being carried out to find out the

environmental aspects of the lake. The Orissa Environmental Society (OES) with the support of the DST, Government of India had organized a national level conference in 1986. The conference suggested to minimize the damage to Chilka environment. This communication is aimed to focus on the Angiospermic Phytodiversity (Table 1) of Chilka Lagoon, as reflected in the OES Conference with latest updated information status (Champion and Seth 1968; Haines 1921-1925; Misra 1998; Mooney 1950; Narayanswami and Carter 1920; Padhy et al. 2016; Panda and Pattnaik 1985, 1988; Panigrahi 1983, 1988; Pattnaik 1973; Paul et al. 1980).

RESULTS AND DISCUSSION

Hundred years (1920-2018) of research on Angiospermic phytodiversity of Chilka lake is presented in Table 1.

Table 1: List of plants in alphabetical order collected/reported from Chilka Lagoon, its islands and the shore line facing the Bay of Bengal, Odisha.

Odia vernacular names in parenthesis are incorporated as far as possible against each scientific description at length.

Fl: flowering; Fr: fruiting.

S. No.	List of Plants : Scientific names/ (Family)/ Features/ (Local-Odia Name)
1	<i>Abrus precatorius</i> L. (Fabaceae). Scarce.(Kaincha/Gunja)
2	<i>Acacia intsia</i> Willd. (Mimosaceae). Dominant prickly climber; Fl: Sep; Fr : Dec.
3	<i>Acanthus illicifolius</i> L. (Acanthaceae). (Harikusa/ Harakancha)
4	<i>Aeluropus lagopoides</i> (L.)Trin. ex Thw.). (Poaceae). In the brackish alluvium along creeks with long wiry roots.
5	<i>Aerva lanata</i> (L.) Juss. ex Sch. (Amaranthaceae). Growing on wall at edges of ponds; edaphic variation among island flora.(Paunsia / Lopanga arka)
6	<i>Aeschynomene aspera</i> L. (Fabaceae) Creeping species with superficial floating branches, stem aeranchymatous used as pith materials in fishing nets. (Sola)
7	<i>Aganosma caryophyllata</i> Wall. Roxb. G. Don (Apocynaceae). Flowers sweet, very fragrant, latex bearing, throughout rainy seasons; fruits follicles, dehisce in April (Malati).
8	<i>Albizia odoratissima</i> (L.f.) Benth. (Mimosaceae). Tree in sandy area in Cassipourea thickets. Scarce.(Kala Sirissa / Tinia)
9	<i>Allophylus cabbe</i> (L.) Rau. (Sapindaceae).Fl. Pink, Fr. Orange red, round. (Khandakoli /Kantakura /Patanai)
10	<i>Alphonsea sclerocarpa</i> Thwaites (Annonaceae). A common tree in the island.
11	<i>Alternanthera sessilis</i> (L.) R. Br. (Amaranthaceae). In pockets of sandy alluvium on the rocky beach.
12	<i>Annona squamosa</i> L. (Annonaceae) The Custard Apple, <i>Ata</i> . Sweet sop, Excellent fruit in September; flowering May onwards. Has naturalized; an inhabitant of tropical America.
13	<i>Asparagus racemosus</i> Willd. (Liliaceae). Growing on <i>Canthium parviflorum</i> ; scarce.
14	<i>Atlantia malabarica</i> (Rafin.) Tanaka (Rutaceae). Scarce. (Jambira / Araguni).
15	<i>Azadirachta Indica</i> A. Juss. (Meliaceae). Trees, abundant. Fl.: April-August; Fr.: June on wards. (Nimba/Nima/Limba)
16	<i>Azima tetraacantha</i> Lam. (Salvadoraceae). Spiny creeper growing over sandy areas with zigzag angular stems. Scarce. (Dumuduma).
17	<i>Bambusa bambos</i> (L.)Voss. (=B. <i>arundinacea</i> Retz.) (Poaceae). Common. (Kanika / Kanta Baunsha)
18	<i>Barringtonia acutangula</i> (L.) Gaertn. (Barringtoniaceae). Single tree at edge of lake. Fl.: – June – October, Scarce.(Hinjala)
19	<i>Blumea lacera</i> L. (Asteraceae). Sticky scented herbs; springing up during December. (Pokasunga)
20	<i>Boerhaavia diffusa</i> L. (Nyctaginaceae). Common weed, among stones at edges of lake during rains; or also, on bare stony ground trailing over bushes under grown beneath; in all seasons; fruits sticky, leaves orbicular. (Atikapodi/Puruni)
21	<i>Bulbostylis barbata</i> (Rottb.)Clarke, var. <i>pulchella</i> Thw. (Cyperaceae). Growing among rocks at edge of ponds. (Mukulikorei)
22	<i>Calotropis acia</i> Buch-Ham. (Asclepiadaceae). Scarce-solitary plants on rocks edges of lake; good fodder for deer's and grasshoppers. (Aakanda)
23	<i>Calotropis gigantea</i> R. Br. (Asclepiadaceae). Giant milk weed. (Arakha)
24	<i>Canavalia gladiata</i> (Jacq.) DC. (Fabaceae). Climbers. Fl.: end of rainy season. Beans and seeds edible. Sword bean (Mahukanka)
25	<i>Canavalia virosa</i> (Roxb.) Wt. & Arn. (Fabaceae). Hedge climbers. Fl.: towards end of rainy season. Seeds bitter; but fodder for caterpillars. (Mohra Simba)
26	<i>Canthium parviflorum</i> Lam. (Rubiaceae). Large suffruticose bushes in mixed thickets, reduced to small under shrubs in scrubby rocky places. Leaves cooked with rice and eaten during famine. Common fodder for deer. Fl. & Fr. : Sept, or more profusely from April to June. (Tuturi/Totadi)
27	<i>Capparis brevispina</i> DC. (Capparaceae). Common shrubs, leaves destroyed by insects and deer, stems with out-growths. Fl. & Fr. June on wards. (Lepura / Nephuda)
28	<i>Capparis roxburghii</i> DC. (Capparaceae). Large hispidous creepers with red fruits growing over trees at island edges and occasionally in inland. Fl. October- April. (Handiphuta)
29	<i>Capparis sepiaria</i> L. (Capparaceae). Large weedy thorny climbers overwhelming <i>Azadirachta indica</i> in mixed thickets. Fl.: April.(Hudipi/ Kau thantia/ Kantikapali)
30	<i>Caralluma adscendens</i> R. Br. An (Asclepiadaceae). Erect leafless herb in small patches on open stony places. Common.

Table 1: Contd...

S. No.	List of Plants : Scientific names/ (Family)/ Features/ (Local-Odia Name)
31	<i>Cassipourea ceylanica</i> (Gardn.) Alston (Rhizophoraceae) [= Weihea ceyanica (Gardn.) Baill.] Fl. : April, Fr. (capsules) – June.
32	<i>Combretum latifolium</i> BI. (=C. <i>extensum</i> Roxb.) (Combretaceae). Overwhelming climbers, common in mixed thicket. Towards end of rains sends out long vegetative shoots. Fl. December to April and seeds ripen in April.
33	<i>Cayratia carnos</i> a (Lam.) Gagnep. (Vitaceae). Fruits like wood-apple, gets violet after ripening, Fr. Juice acidic. (Khatua / Atyamlaparnee)
34	<i>Careus</i> sp. (Cactaceae). Columnar cactus, runs wild. Flowers in hot weather and rains.
35	<i>Cipadessa fruticosa</i> BI. (Meliaceae). A bushy shrub or small tree.
36	<i>Cissampelos pariera</i> L. var. <i>hirsute</i> (DC.) Forman, (Menispermaceae). Creepers on <i>Opuntia</i> sp. Fl: in rainy season.(Akanabindi)
37	<i>Cissus quadrangularis</i> L. (Vitaceae). Very common climbers on every kind of trees and shrubs, especially on <i>Ficus</i> sp. springs up readily in deep shade on stony ground. Stems characteristic fleshy, Fl.: beginning of June on wards. (Hadabhanga)
38	<i>Cissus viitiginea</i> L. (Vitaceae). Growing over trees in jungle. Fl: throughout rainy season. Flowers very attractive to butterflies.(Jangali Angur)
39	<i>Clerodendrum inerme</i> (L.) Gaertn. (Verbenaceae). Very common; but, sporadic with quadrangular stem, Flowers white lowly scented. (Genguti / Phulajahri)
40	<i>Coldenia procumbens</i> L. (Boraginaceae). Seasonal herbs, forming flat mats on sandy beach; grows up between December and April and dies off before June. (Gandhuri lata)
41	<i>Commelina benghalensis</i> L. (Commelinaceae). Wet land weeds, branched ascending, soft herbaceous.(Kanisira)
42	<i>Crataeva magna</i> (Lour.) DC. (= <i>C. trifoliata</i> Roxb.) (Capparaceae) Common trees at marginal zones. Fl: September in winter months. Petals turned pale yellow through passing of time; Fr: scarlet when ripe in July. (Varuna)
43	<i>Cressa cretica</i> L. (Convolvulaceae). Shore species growing up only when shore gets exposed. Fl: April, dies of hot weather. (Rudrabanti / Dahana)
44	<i>Crotalaria pallida</i> Aiton (=C. <i>striata</i> DC.) (Fabaceae). Herbaceous shrub; common in cleared places towards end of rainy season; dies at end of winter. (Jhunjhunuka)
45	<i>Cryptolepis sinensis</i> (Lour.) Merr. (= <i>C. elegans</i> Wall. (Asclepiadaceae). Common creepers in mixed thickets, flowers pale greenish yellow. (Basakhapuri)
46	<i>Cyanotis cristata</i> (L.)D. Don (Commelinaceae). Found in shades of brick or rock walls. Prostrate creeping herbs with blue flowers. (Kena)
47	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae). Common on alluvial soil. (Duba Ghasa)
48	<i>Cyperus compressus</i> L. (Cyperaceae). Growing on sandy shore near upper flood level. (Ghasa?)
49	<i>C. cuspidatus</i> Kunth var. <i>angustifolia</i> Clarke. (Cyperaceae). Growing among rocks or among the herbaceous growth along a footpath.(Mutha)
50	<i>C. corymbosus</i> Rottb. (Cyperaceae). Between rocks in water near edge of pond; Fl: April and again from July to October. (Kuitia ghasa)
51	<i>C. dubius</i> Rottb.(= <i>Mariscus dregeanus</i> Kunth.) (Cyperaceae). Rare, nuts dorsally compressed, present in all spikelets; nuts dorsally compressed. (Benua benta)
52	<i>Dalbergia monosperma</i> Dalz. (Fabaceae). Overwhelming creeper with small leaves. Fl: March - April.
53	<i>Datura metel</i> L. (Solanaceae). Very common annual to biennial herbs exhibiting considerable variations in colour of flowers and stamens – deeply tinged with purple. (Dudura)
54	<i>Derris trifoliolata</i> Lour. (=D. <i>scandens</i> Benth.) (Fabaceae). Large climbing shrubs, with flowers rosy white; Fl: Rainy season. (Kotia / Swarnalata)
55	<i>Ducrosticgts cuberea</i> Wt. & Arn. (Fabaceae). Small trees, scarce. Proximal part of the inflorescence mauve colored distal part bright yellow.
56	<i>Dioscorea oppositifolia</i> L. (Dioscoreaceae).Common on thickets of <i>Cassipourea ceylanica</i> (Gardon.) Alston. Mostly found in wet zones as evergreen climbers, stem tuber offers nutritional status used by locals. (Pani alu/ Pithala kanda)
57	<i>Dioscorea sativa</i> L. (Dioscoreaceae). Climbing on <i>Glycosmis pentaphylla</i> thickets.
58	<i>Eclipta prostrata</i> (L.) L. (Asteraceae). Wet land weeds at edges over stones. (Bhrungaraja / Kesudura)
59	<i>Eleusine aegyptiaca</i> Desf. (Poaceae). On loose stony soil. Seeds used as source of cereals by locals. (Mandia)
60	<i>Eragrostis interrupta</i> P. Beauv. (Poaceae). Scarce; weeds on footpath.(Ghasa)
61	<i>E. tenella</i> Roem. et Schult. var. <i>breviculmis</i> Stapf. (Poaceae). Scarce, weeds on foot path. (Ghasa)
62	<i>E. tenella</i> var. <i>plumose</i> Stapf. (Poaceae). On the edge of well and on barren stony ground. (Ghasa)
63	<i>Eugenia rothii</i> Panigr. (= <i>E. bracteata</i> Roxb.). (Myrtaceae). Gigantic shrub like small trees in sandy area, Fl: April. (Sagarbatua)

Table 1: Contd...

S. No.	List of Plants : Scientific names/ (Family)/ Features/ (Local-Odia Name)
64	<i>Euphorbia antiquorum</i> L. (Euphorbiaceae). Trees on rocks. Fl: December; Fr: April. (Tikanta Siju)
65	<i>Euphorbia ligularia</i> Roxb. (= <i>E. nerifolia</i> L.) (Euphorbiaceae). Small trees. Fl: December; Fr: April. (Trikona- /Tina- Siju)
66	<i>Euphorbia thymifolia</i> L. (Euphorbiaceae). Sporadic weeds. (Patra Siju)
67	<i>Evolvulus alsinoides</i> (L.) L. (Convolvulaceae). Scarce; weed on paths occur in December.(Krushna ankaranti / Neela Bichhamalia)
68	<i>Excoecaria agallocha</i> L.(Euphorbiaceae). Scarce; occur in gravel edges of lake amongst <i>Azadirachta</i> and <i>Crataeva</i> and mangrove ever green vegetation. (Gaugua)
69	<i>Ficus arnottiana</i> (Miq.) Miq. (Moraceae). Large tree; figs dull purple when fully ripe. (Parasa Pippali)
70	<i>F. benghalensis</i> L. (Moraceae). Commonest indigenous species, but now dying out. Figs red when ripe. (Bara / Bata)
71	<i>F. geniculata</i> Kurz (Moraceae). Large trees; scarce.
72	<i>F. lambertiana</i> Miq. (Moraceae). Large trees, common with coriaceous leaves with broad base; often without adventitious roots; figs when ripe white flushed with red purple and dotted when young.
73	<i>F. microcarpa</i> L.f. (= <i>F. retusa</i> auct. non L.) (Moraceae). Large trees: common. (Jida)
74	<i>F. religiosa</i> L. (Moraceae). Trees, uncommon occurrence. Leaves with long petioles; peduncles hairy in fruits. (Asswatha)
75	<i>F. tinctoria</i> Forst. f. Subsp. <i>globosa</i> (Bl.) Corner (Moraceae). Epiphytic on Banyan and other Ficus sp. Figs bright yellow when ripe.(Udabara giranga)
76	<i>F. tinctoria</i> Frost. Ssp. <i>parasitica</i> (Willd.) Corner (Moraceae). Large trees with branches growing upright. At least on the upper part leaves dark green and glossy, but scabrid; figs bright orange-yellow. (Kotasanijiranga)
77	<i>Fimbristylis dichotoma</i> (L.) Vahl. (Cyperaceae). In sandy fore shore. (Badasuanli)
78	<i>Glinus oppositifolius</i> (L.) DC. (<i>Mollugo spigula</i> L.) (Aizoaceae). On damp rock edges of pond. Fl.,Fr: Rainy to winter seasons. (Pita Saga)
79	<i>Gloriosa superba</i> L. (Liliaceae). Scarce. Important medicinal for family-planning. Rich source of alkaloid Diosogenin. Annual herbs with perinnated rhizomes. (Agnisikha/ Kuradhia phula / Langalangalia)
80	<i>Glycosmis pentaphylla</i> (Retz.) DC. (Rutaceae). Common shrubs. Fl: all seasons. Leaves up to 24 cm long, leaflets serrate, inflorescence to 8 cm long. (Chaul-dubuduba)
81	<i>G. mauritiana</i> (Lam.) Tanaka (Rutaceae). Smaller species with leaves to 8 cm long, leaflets entire and inflorescences to 8 cm long. (Chauladhua)
82	<i>Grewia orientalis</i> L. (Tiliaceae). In thickets.
83	<i>Gymnema sylvestre</i> (Retz.) R. Br. Ex Schultes. Common large woody climber. (Mendhee / Gudamari)
84	<i>Haophila balfouri</i> Solered. (Hydrocharitaceae). Known as sea-grass, floats on brackish water, associated with <i>Potamogeton</i> & <i>Najas</i> spp.
85	<i>H. evalis</i> Hook. f. (Hydrocharitaceae). Known as sea-grass, floats on the brackish water, associated with <i>Potamogeton</i> & <i>Najas</i> spp.
86	<i>Hedyotis corymbosa</i> (L.) Lam. (= <i>Oldenlandia corymbosa</i> L.) (Rubiaceae). Grow on edges of pond, very common, abundant. (Gharpodia)
87	<i>Hedyotis</i> sp. (= <i>Oldenlandia herbaceal</i> (L.) Roxb. (Rubiaceae). Abundant and indigenous on stony grounds, edges of path and open spaces.
88	<i>Hedyotis</i> sp. (= <i>Oldenlandia nudicaulis</i> Roth.) (Rubiaceae). On stony grounds under shade bushes.
89	<i>Helicteres isora</i> L. (Sterculiaceae). Common mod size trees. Fruits capsule, spirally twisted. (Modimodikia)
90	<i>Heliotropium currassivium</i> (Boraginaceae). (Hati sundha?)
91	<i>Hemigyrosa canescens</i> Thw. (= <i>Lepisanthes</i> sp.) (Sapindaceae). Mango tree like, Fl: April; Fr: May- June.
92	<i>Hybanthus enneaspermus</i> (L.) Muel. (Violaceae). On edge of well; typical. Flowers in rains. (Madanmast)
93	<i>Indigofera linifolia</i> L. var. <i>campbelli</i> (Baker) Ramaya (Fabaceae). Scarce.
94	<i>Ipomoea pescaprae</i> Roth. (Convolvulaceae). Scarce. On sandy foreshore. (Kansari- Lai / Lata)
95	<i>Ipomoea sepiaria</i> Koen. (Convolvulaceae). On bushes near shore edges of lake. (Musakani)
96	<i>Jatropha heterophylla</i> L. (Euphorbiaceae). Common both in surrounding jungle and in open areas. Exotic species from Brazil.
97	<i>Justicia diffusa</i> Willd. var. <i>prostrata</i> Roxb. (Acanthaceae). Very variable; well luxuriant vegetation, spreading and rooting at nodes; eaten by deer and also growing in clumps on bare stony soil. Fl: all seasons.

Table 1: Contd...

S. No.	List of Plants : Scientific names/ (Family)/ Features/ (Local-Odia Name)
98	<i>Lannaea coromandelica</i> (Houtt.) Mer. (Anacardiaceae). Large tree common in sandy area on north side. Fl: April on branches without leaves. (Maee)
99	<i>Leptadenia reticulata</i> (Retz.) Wt. et Arn. (Asclepiadaceae). Common creeper with small greenish white flowers. Fl: throughout rainy season. (Mendhi)
100	<i>Lindernia ciliata</i> (Colsm.) Pennell. (= <i>Bonnaya brachiata</i> Link. & Otto. (Scrophulariaceae). Wet rocky edges of pond in rains, herbs up to 25 cm, stems quadrangular with leaves subsessile. (Khetakura)
101	<i>Lindernia crustacean</i> (L.) F. V. Mueller (Scrophulariaceae). Growing in shade of bushes <i>crustacean</i> on stony ground and at edge of pond.
102	<i>Lindernia hirsute</i> (Benth.) (Scrophulariaceae). In shade of bushes and fig trees.
103	<i>Lipocarpha senegalensis</i> (Lam.) T. Durand et H. Durand (Cyperaceae). At edges of footpath. (Mutha)
104	<i>Ludwigia asdcendens</i> (L.) Hara. (Onagraceae). Adventitious roots bearing aquatics with floating white sacs over nodes. (Jalajali / Panitagar)
105	<i>Lycopersicon lycopersicum</i> (L.) Karslen (= <i>L. esculentam</i> Miller). (Solanaceae). Barkuda. Cultivated and becoming established in the island. (Tomato)
106	<i>Manilkara hexandra</i> (Roxb.) Dab. (= <i>Mimusops hexandra</i> Roxb.) (Sapotaceae). Growing among rock at edges of lake. Scarce. (Kshirakoli)
107	<i>Morinda tomentosa</i> Heyne ex Roth (M. tinctoria Roxb.) (Rubiaceae). A common large tree in thickets.
108	<i>Mollugo pentaphylla</i> L. (Aizoaceae). On the edge of well; on stony ground in shade or on bare rocky soil, with long tap root. (Pita goma)
109	<i>Najas foveolate</i> A. Br. Ex Magam. (Najadaceae). Floating on water mass.
110	<i>N. graminea</i> Del. (Najadaceae). Form mats or float about in water mass.
111	<i>Neptunia natans</i> (L. f.) Druce. (= <i>N. oleracea</i> Lour.) (Mimosaceae). Floating submerged aquatics. (Pani Lajakuli)
112	<i>Opuntia stricta</i> (Haw.) Haw. var. <i>dillenii</i> Benson (Cactaceae). Flowers orange coloured with pink tinged. Fl: April. (Saptafeni)
113	<i>Opuntia vulgaris</i> Mill. (Cactaceae). Flowers bright yellow, outer petals stained with scarlet spines growing singly are larger and less easily detached. (Nagafeni)
114	<i>Panicum tripheron</i> Schult. (Poaceae). On bare stony ground; chiefly in rainy season. (Ghasa)
115	<i>Peromphis malabarica</i> (Rubiaceae). Shrubs with white flowers and red berries. Flowering: June.
116	<i>Phragmites karka</i> Trin. (Poaceae). Grown in swamps; good fodder for buffaloes; almost exhausted. (Santra / Nai ghasa)
117	<i>Phyla nodiflora</i> (L.) Greene. (Verbenaceae). On beach. Fl: April. (Langli ghasa)
118	<i>Plecosperrum spinosum</i> (Willd.) Trecul. (Moraceae). Creepers with strong spines; in mixed thickets, climbing on <i>Azadirachta indica</i> . (Banabanaka)
119	<i>Plumbago zeylanica</i> L. (Plumbaginaceae). Scarce. Seen as hill side vegetation. (Sweta Chitaparu)
120	<i>Polycarpaea corymbosa</i> (L.) Lam. (Caryophyllaceae). Growing up only in dry weather. Scarce. (Sana jatajatia)
121	<i>Pongamia pinnata</i> (L.) Pierre. (Fabaceae). Small trees growing almost around islands spaces within high water level; hardly found in interior zones. Fl: April on wards; Fr: round about.
122	<i>Portulaca grandiflora</i> L. var. <i>meridian</i> (I) V. Narayanswami (Portulacaceae). Growing among stones at edges and on top of walls; also on stones near shore of lake. Fl: June onwards. (Duludulia)
123	<i>Potamogeton pectinatus</i> L. (Potamogetonaceae). Common, submerged weeds, rooting in alluvium substratum or gets detached and floats. Abundant.
124	<i>Premna latifolia</i> Roxb. (Verbenaceae). Common plant in mixed thickets, often reaching considerable size. Fl: April onwards. (Gandhana)
125	<i>P. corymbosa</i> (Burm. f.) Rottl. & Wt. (Verbenaceae). Plant remains green when dry. Its flowers have strong small. (Bhoota bairee / Agnibathu)
126	<i>P. latifolia</i> Roxb. var. <i>cuneata</i> Clarke (Verbenaceae). Tree, common in sandy areas.
127	<i>P. wightiana</i> Schauer. (Verbenaceae). Scandent shrubs; flowers with peculiar aroma attractive to butterflies.
128	<i>Prosopis cineraria</i> (L.) Druce. (Mimosaceae). Spiniscent gigantic shrubs in nearby landscapes with pendulous branches covered by gray barks. (Sami)
129	<i>Reissantia indica</i> (Willd.) Halle (<i>Hippocratia indica</i> Willd.) (Hippocratiaceae). Overwhelming creepers, very common; Fl: Sept-June.
130	<i>Rungia pectinata</i> (L.) Nees (Scrophulariaceae). On dry ground from December to April. Seasonal herbs.
131	<i>Ruppia rostellata</i> Koch (Ruppiaceae).

Table 1: Contd...

S. No.	List of Plants : Scientific names/ (Family)/ Features/ (Local-Odia Name)
132	<i>Salicornia brachiata</i> Roxb. (Chenopodiaceae). All these grow on brackish alluvium in creeks of lagoon.
133	<i>Salvadora persica</i> L. (Salvadoraceae). Small trees growing only among rocks at edge of lake. Trunk thick, distorted and twisted. Leaves bright green. Fruits ripen in April. (Pilu / Tabata)
134	<i>Sarcostemma acidum</i> (Roxb.) Voigt. (Asclepiadaceae). Trailing leafless shrub common on prickly pear. Flowering in rains; also ripe fruits seen then. (Soma?)
135	<i>Schoenoplectus littoralis</i> (Schrader) Palla. (= <i>Scirpus littoralis</i> Schrader) (Cyperaceae). Shallow submerged aquatics. (Sipala)
136	<i>Sesuvium portulacastrum</i> L. (Aizoaceae). On brackish alluvium along creeks; common in field bunds of Gopalpur in Chilka Lake.
137	<i>Sida acuta</i> Burm. f. (Malvaceae). Woody annual herbs. (Paharaa gachha)
138	<i>S. cordifolia</i> L. (Malvaceae). Quite common, but always eaten up by the deer. Fl. & Fr: end rainy seasons. (Bisiripi)
139	<i>S. Rhombifolia</i> L. (Malvaceae) Herbs, annual, woody. Fl: Fr: Winter (Bajramoolee)
140	<i>Solonum trilobatum</i> L. (Solanaceae). Scandent spiniscent shrubs, scarce in <i>Glycosmis</i> thickets. (Ankuree)
141	<i>Strychnos nux-vomica</i> L. (Loganiaceae). Fairly common tree in mixed thickets. Fl: & Fr: Apr. onwards. (Kochila)
142	<i>Suaeda Maritima Dumort.</i> (Chenopodiaceae). Grown on brackish alluvium in creeks of lagoon. Herbs: 20-35 cm high. (Giria saga / Harmita)
143	<i>S. nudiflora</i> Moq. (Chenopodiaceae). Grown on brackish alluvium in the creeks of the lagoon. (Nihnia)
144	<i>Symphorema involucratum</i> Roxb. . (Verbenaceae). Overwhelming creepers; Fl: April.
145	<i>Tamarindus indica</i> L. (Fabaceae). Trees in small islands. (Tentuli / Kayan)
146	<i>Tephrosia purpurea</i> (L.) Pers. (Fabaceae). Most abundant in places cleared of jungle from June to Sept. (Kolathia)
147	<i>Tinospora cordifolia</i> Miers. (Menispermaceae). Creepers on large <i>Ficus</i> trees. (Gulchi / Amruta-ballee)
148	<i>Toddalia asiatica</i> (L.) Lam. var. <i>gracilis</i> Gamble. (Rutaceae). Climbing shrubs. (Tundapoda)
149	<i>Tridax procumbens</i> L. (Asteraceae). On steps leading to the pond- a weak straggling herb (Beesalyakarani).
150	<i>Vernonia cinerea</i> (L.) Less. (Asteraceae). Very variable herbs found flowering in all seasons. (Biranchi)
151	<i>Walsura piscida</i> Roxb. (Meliaceae). Small tree in mixed thickets. Fl: Oct; Fr: April. (Mundika?)
152	<i>W. temata</i> Roxb. (Meliaceae).
153	<i>Zizyphus oenoplia</i> Mill. Rhamnaceae). Barkuda. Thorny climbing shrubs, common in mixed thickets. Fl: August – September. (Kanteikoli)

Most of the species as reported in Table 1 are from Barkuda Island which is situated towards the South-Western extremity of the lake. It is less than half a square mile in area, only 1.6 to 3 km away from the mainland. The physical structure of the island is very simple, the whole area is rocky and stony with scanty red soil cover. The vegetation of Barkuda Island consists mainly of large trees, shrubs and thick stoloniferous creepers. There are no epiphytes, no tall grasses, reeds or bamboos; no palms, no screw pines, aroids or orchids. Similarly, few parasites, ferns, mosses or liverworts are available. The greater part of the island is occupied by a fig-jungle dominated by the Banyan (*Ficus benghalensis*) trees.

Chilka is intimately associated with the south part of Odisha from geographical, ecological and

commercial point of view. Recently a brief review on the Pteridophyta diversity of South Odisha was reported (Padhy et al. 2016), which included 46 species. Four species of Pteridophytes: *Selaginella tenera* spring, *Hemionites arifolia* Burm.f, *Adiantum incisum* Forsk and *Cheilanthes tenuifolia* Sw were reported from Barkuda area of Chilka (Panigrahi 1988), out of which the former three were new additions to the south Odisha list, published by Padhy et al. (2016). Information about the flora of the shores and other islands of Chilka are meager. These islands are of several kinds, differing greatly in information on vegetation. However, one can recognize at least five types amongst them, as:

1. The outer channel of the lake-system, often consists of submerged aquatics like sedges and grasses.

2. The largest island, 'Nalabana', is in fact a flat mud bank, remains swampy ever since.
3. The small conical hills, such as Gantasila and others add to the scenery of the Chilka with vegetation coverage.
4. A large number of islands are low and undulating, consists of alluvium very close to the shore. These become frequently peninsulas as the water of the channel dry up. These islands are mostly inhabited by fishermen.
5. The fifth type islands are Barkuda and chherikuda which are studied in detail (Narayanswami and Carter 1920).

Similarly, depending upon the local habit condition, the vegetation of Chilka lake and its adjoining regions can be divided into three broad categories (Panda and Pattnaik 1988); such as:

(a) Aquatic Vegetation

The depth of water, salinity and nature of substratum, to a large extent responsible for the distribution and abundance of aquatic plant communities in the environment of Lake Chilka.

(b) Littoral Scrub Jungles

The mangroves which were once plentiful towards the margin of the lake and its uninhabited islands (at that time) like Badakuda, Sanakuda, Cherikuda and Ghantasila etc., are no more found due to ruthless cutting and destruction in the past by the present natives for various purposes. The only vegetation now extent are the littoral scrub jungles along the rocky faces representing the remnants of one time dominant tidal swamp forests. These are resultant of the dry condition due to poor soil substratum entangled with strong sea wind and huge biotic interference of several categories. The vegetation is completely devoid of arborous species of mangroves; still some of their associates can be observed in the denuded ecological conditions.

(c) Sand-dunes and Psammophytic Condition

The scorching sun, shifting sands and salt laden wind on the beaches near the lake support an interesting psammophytic vegetation. The stretch of land lying in between Bay of Bengal and Chilka lake has been planted with *Casuarina equisetifolia*, which exhibit luxuriant growth and acquired adequate natural regeneration.

A comparison of the list of species reported by previous workers and those occurring today, a considerable change in the pattern of vegetation and its species composition can be marked along the year. Moreover, the existing vegetation is prone to human interferences of various kinds and magnitudes. The introduction of exotic species, expansion of agricultural land, pisciculture, navigation, tourism, naval exercises are directly and indirectly responsible for the ecological distress of the lagoon. Development of some projects, architectural complexes, established industries and many others are likely to come up in future are bound to have some impact on the quality of the environment. The mouth of the lake 'Magarmukh' is getting narrower resulting in poor inflow of sea water and the lake bed (substratum) is rising up gradually with the deposition of silt brought down by eight rivers and ten water channels. All this change of environment has a serious impact on the aquatic lifeforms that is, flora and fauna and on the overall ecosystem. The population of fishes, crabs, dolphins, water-snakes in the lake water and the black-bucks, deers, feral-cattle of the islands have reduced with a decline of the arrival of migratory birds. Even a deletion of mosquito fauna is recorded (Dash et al. 1988).

Penaeus monodon, the jumbo tiger prawn, is one of the major species in Chilka (Mohanty 1984). Being one of the fastest growing prawn, it is the most suitable species for brackish water aquaculture and is widely cultured in various parts of India (Rajyalakshmi 1980). Besides prawns, four most marketable fishes like *Lates calcarifer*, *Mugil cephalus*, *Etropolis suratensis* and *Chanos chanos* have been known to adopt to a wide range of salinity conditions. However, sudden fluctuation of salinity in the lagoon cause severe stress on these species (Ravichandran et al. 1980). Similarly, four species of Mysidaceae: *Rhopalophthalmus egregius* Hensen, *Macropis orientalis* W.M.T, *Potamomysis assimilis* W.M.T and *Gastrosaccus muticus* W.M.T are observed in Chilka. The mysids are one of the important natural food items for prawn and many brackish water fishes. They are also a source of food for the local fisherman and also a source of raw material for preparation of suitable food for larval feeding in the modern prawn hatcheries. The concentration of Mysids sharply decrease with the increase of water turbidity. During monsoon, with the discharge of turbid flood water

into the lagoon through the rivers and canals, the abundance of Mysids suddenly decline. Their population also falls down when the mean water temperature increase beyond 30^o C (Patnaik 1988). The above are the few study index, to focus on the decline of biodiversity of Chilka due to disturbance of environment.

CONCLUSION

Lake Chilka, the pride of Odisha state, has been exposed ever since to lot of anthropogenic activities on various grounds and hence prone to change in its biota especially of its phytodiversity. Research on it, is a continuing process and since long there is very little of addition in this regard. A base line contribution on it, is indexed and reviewed further, the present paper being the review outcome of about one hundred years of research pertains to its phytodiversity. Moreover, there is constraints in identifying species with updated references and the present contribution updates the floristic records on the lake along with latest nomenclatural revision of the species inhabiting there in.

RECOMMENDATIONS

For the eco-development of the area, coordinated research project to enunciate study on the flora, fauna, soil, geology, water quality and fishery be initiated for time to time. Anthropogenic activities like vulnerable sports should be strictly regulated. Shooting and trapping of birds and poaching of wild animals must be strictly forbidden. Fishing should be confined to demarcated zones. Naval exercises and training activities of the Naval Training Centre should be confined to a limited area. The mouth of the rivers connecting the lake and the mouth of the lake opened to Bay of Bengal should be reclaimed from sand and silt. The barren rocks and islands must be planted to check soil erosion and provide shelter and breeding ground for the birds. In addition to all above, adequate protection should be given to degraded littoral forests for natural regeneration and establishment in order to conserve the ecology and environment of Chilka Lagoon. Very recently, the Government of Odisha has decided to avoid movement of the noise causing motor launches inside the Chilka, certainly a welcome step to avoid sound pollution in that area, causing a break of ecolog-

ical homeostasis between the flora and fauna of the lake.

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REFERENCES

- Dash AP, Tripathy N, Hazra RK 1988. Mosquito fauna of Chilka lake area. In: SN Patro (Ed.): *Chilka the Pride of Our Wet Land Heritage*. Bhubaneswar: Orissa Environmental Society, pp. 58-62.
- Champion HG, Seth SK 1968. *A Revised Survey of the Forest Types of India*. Delhi: Government of India Publications, pp. 1-404.
- Haines HH 1921-1925. *The Botany of Bihar and Orissa – 6 Parts*. London.
- Misra MK 1998. *Udvida Sangraha*. Berhampur: Manojmalini Misra.
- Mohanty SK 1984. Prospects and Strategy for the Development of Brackish Water Prawn Culture in Orissa. *Souvenir Seminar on Aquaculture*, 11-12 February, Cuttack, pp. 42-55.
- Mooney HF 1950. *Supplement to the Botany of Bihar and Orissa*. Ranchi: Catholic Press.
- Narayanswami V, Carter HG 1922. Systematic list of the plants of Barkuda. *Mem Asiat Soc Beng*, 7(4): 289-319.
- Padhy R, Dash SK, Padhy S 2016. Pteridophyta diversity of South Odisha, India, with special reference to medico folklore claims: A brief review. *J Biodiversity*, 7(1): 25-32.
- Panda PC, Pattnaik SN 1985. Flora of Chilka lake and its environs. *Proc Orissa Bot Soc*, 10: 11-12.
- Panda PC, Pattnaik SN 1988. A contribution to the flora and vegetation of Chilka wildlife sanctuary, Orissa. In: SN Patro (Ed.): *Chilka the Pride of Our Wet Land Heritage*. Bhubaneswar: Orissa Environmental Society, pp. 81-85.
- Panigrahi G 1983. Vegetational Types of Orissa – Survey. *Souv Sixth All India Botanical Conference*. Utkal University, Bhubaneswar, pp. 43-48.
- Panigrahi G 1988. Vegetation and flora of the Chilka lagoon. In: SN Patro (Ed.): *Chilka the Pride of Our Wetland Heritage*. Bhubaneswar: Orissa Environmental Society, pp. 63-80.
- Patnaik S 1973. A study of the aquatic plants of Chilka lake. *Proc Nat Acad Sci Ind*, 43(B): 53-65.
- Patnaik PN 1988. Some observations on the occurrence of Mysids in the Chilka Lagoon. In: SN Patro (Ed.): *Chilka the Pride of Our Wetland Heritage*. Bhubaneswar Orissa Environment Society, pp. 54-57.
- Paul SR, Balapur KM, Rizvi SAR 1980. Additional notes on the flora of Orissa. *Ind Jour Forestry*, 3(3): 275-276.

- Rajyalakshmi T 1980. Food and feeding habits of prawns in hatchery and intensive rearing systems. *Proc Indian Nat Sci Acad*, 346(I): 72-89.
- Rao KVR, Mohanty SK, Rao PV 1988. Bibliography on Chilka lagoon. In: SN Patro (Ed.): *Chilka the Pride of Our Wetland Heritage*. Bhubaneswar: Orissa Environment Society, pp. 104-119.
- Ravichandran P, Rajyalakshmi T, Pillai SM 1980. Growth of *Penaeus monodon* in pens in Chilka lagoon and its ecological significance. In: SN Patro (Ed.): *Chilka the Pride of Our Wetland Heritage*. Bhubaneswar: Orissa Environment Society, pp. 44-53.

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