

Floristic composition of aquatic angiosperms in different wetlands of Pudukkottai district of Tamil Nadu, India

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ABSTRACT

Floristic survey was carried out during 2012-2015 in the different wetlands of Pudukkottai district of Tamil Nadu, India. During this survey 144 species of angiosperms belonging to 92 Genera and 43 families were documented. Dominant families were Cyperaceae with 23 species followed by Poaceae (16), Plantaginaceae (8), Lythraceae and Commelinaceae (7 each), Hydrocharitaceae (6), Acanthaceae, Leguminosae, Linderniaceae and Araceae (5 each). Morpho-ecologic group were anchored emergent 70%, wetland 13%, free floating and floating leave anchored 6% each and submerged/submerged anchored 5%.

Keywords: Aquatic angiosperms, Emergent anchored, Wetlands, Pudukkottai

INTRODUCTION

Aquatic plants are important components of many water ecosystems. True aquatic or hydrophytes are found permanently in wet places, but others known as emergent aquatics or seasonal aquatics are more amphibious and may tolerate seasonal drying. Aquatic plants integrate temporal, spatial, chemical, physical and biological qualities of their ecosystem [1]. Generally aquatic macrophytes are herbaceous and very occasionally shrubby in nature. Most of these aquatic plants can grow very fast and directly or indirectly interfere to the human activities [2].

Worldwide there are more than 100 families of vascular aquatic plants about 7.5% of dicotyledonous and 11% of monocotyledonous. They are structurally different from mesophytes and xerophytes by having less developed protective and conductive tissues [3]. Aquatic plants are of various types, some emergent and rooted on the bottom and others submerged. Still others are free-floating, and some are rooted on the bank of the impoundments, adapting semi-aquatic habitat [4] such habitat includes banks of canals, rivers, periphery of water bodies which are mostly in earthen dams, and partly in masonry dams, drainage ditches and water ponds near villages, that may be called semi-aquatic but more appropriately referred to as emergent aquatic [5]. Studies on aquatic and marshland plants of India are well documented by many authors that include [6], [7], [8], [9], [10], [11]. The present study aims at documenting the aquatic and marshland plants wealth of Pudukkottai district of Tamil Nadu.

MATERIALS AND METHODS

Study area

The present study was carried out in the Pudukkottai district of Tamil Nadu, India. The district lies between 78.25' and 79.15' of the Eastern longitude and between 9.50' and 10.40' of the Northern latitude and total area of 4663 Sq. Km. with a coast line of 39 Km. It is bounded by Tiruchirappalli district in the North and West, Sivaganga district in the south, Bay of Bengal in the East and Thanjavur district in the North East.

Topographically this district may be broadly classified as coastal region and interior plains region. The coastal region, which stretches from north to south, has small townships and villages like Kattumavadi, Manamelkudi, Kottaipattinam, Mimisal etc. of east coast. The interior plain region contains hillocks, river and large number of wetlands such as seasonal and perennial ponds and puddles it is a main resource of irrigation and drinking purposes. The wetlands showing the richness of hydrophytes it provides a food and shelter for fishes, frogs, tortoise and other aquatic fauna, wintering and staging ground for a number of migratory waterfowls and breeding ground for resident birds.

Floristic survey

An extensive field survey was conducted during the year 2012-2015 on various regions of Pudukkottai district of Tamil Nadu. The plant specimens were collected at various seasons and at different reproductive stages (Flower either Fruit or both) from their natural habitats. The collected specimens are taxonomically identified with the help of various published regional floras [8, 12, 13, 14, 15, 16, 17] and the doubtful specimens were cross checked with previous deposited specimens at MH, Botanical Survey of India, Southern circle, Coimbatore. Plants with their correct nomenclature were arranged alphabetically, family name followed by APG III classification [18].

RESULTS AND DISCUSSION

In the present study, a total number of 144 species belonging to 92 genera and 43 families were identified during this survey. Cyperaceae was the most common and dominant family with 23 species, followed by Poaceae (16), Plantaginaceae (8), Lythraceae and Commelinaceae (7 each), Hydrocharitaceae (6), Acanthaceae, Leguminosae, Linderniaceae and Araceae (5 each). Thirty three families were represented below 5 species (Table 1). The five adaptations of hydrophytes of the district can be classified depending upon their nature, habit, conduct with water, soil, air and light. Free floating hydrophytes such as *Eichhornia crassipes*, *Lemna perpusilla*, *Nymphoides indica* (Figure 1.) and *Neptunea oleracea* they are commonly seen in stagnant water bodies such species typically float on water surface with extensive root system. Submerged hydrophytes like *Blyxa octandra*, *Hydrilla verticillata*, *Vallisneria natans* and *Najas indica* in generally the foliage are entirely submerged conduct with soil but the reproductive part is slightly over the water. Fixed floating hydrophytes such as *Nymphaea nouchali*, *N. pubescens*, *N. rubra* and *Nelumbo nucifera* are contact with soil, water and air. Amphibious hydrophytes are commonly occurring on exposed and adopted to sustain both aquatic and terrestrial modes of life such as *Periscaria glabra*, *Cyperus iria*. Marshy and wetland hydrophytes *Typha angustifolia*, *Utricularia polygaloides*, *Bergia ammannioides*, *B. capensis*, *Fimbristylis quiquangularis* and *Crotalaria quinquefolia* are occur in moist rice fields, bank of water bodies, marshy and wet areas, large number of herbaceous taxa included vegetation of such habitats. Seagrasses have always been fascinating being the only angiosperms to become so successful marine environment [19]. In tropical seagrasses such as *Syringodium isoetifolium*, *Cymodocea serrulata* and mangrove plants like *Avicennia marina* and *Pemphis acidula* collect in the coastal region.

Among the five morpho-ecologic groups emergent anchored 70%, free floating and floating leave anchored 6% each submerged/submerged anchored 5% and wetland 13% (Figure 2.) in this district.

Figure 1. Aquatic angiosperms in different adaptations



a. Nymphoides indica (L.) Kuntze *b. Ottelia alismoides* (L.) Pers. *c. Nymphaea rubra* Roxb. ex Andrews *d. Bergia capensis* L. *e. Cymodocea serrulata* (R.Br.) Asch. & Magnus *f. Avicennia marina* (Forssk.) Veirh.

Figure2. Distribution of various life forms in aquatic condition

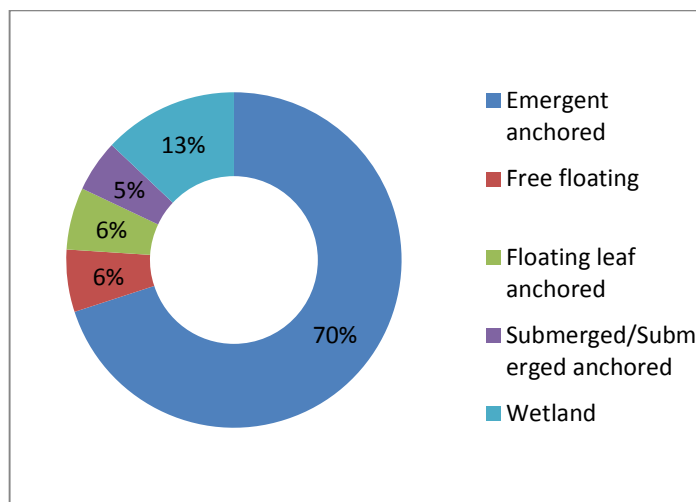


Table1. Enumeration of aquatic angiosperms from Pudukkottai district of Tamil Nadu, India

SNo	BOTANICAL NAME	FAMILY	GROW HABIT
1	<i>Acanthus ilicifolius</i> L.	Acanthaceae	Emergent anchored
2	<i>Aeschynomene aspera</i> L.	Leguminosae	Emergent anchored
3	<i>Aeschynomene indica</i> L.	Leguminosae	Emergent anchored
4	<i>Alternanthera paronychioides</i> A.St.-Hil.	Amaranthaceae	Emergent anchored
5	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Amaranthaceae	Emergent anchored
6	<i>Ammannia baccifera</i> L.	Lythraceae	Emergent anchored
7	<i>Ammannia octandra</i> L.f.	Lythraceae	Emergent anchored
8	<i>Aponogeton crispus</i> Thunb.	Aponogetonaceae	Floating leaved anchored
9	<i>Aponogeton natans</i> (L.) Engl. & K.Krause	Aponogetonaceae	Floating leaved anchored
10	<i>Arundo donax</i> L.	Poaceae	Emergent anchored
11	<i>Avicennia marina</i> (Forssk.) Veirh.	Acanthaceae	Emergent anchored
12	<i>Bacopa floribunda</i> (R.Br.) Wettst.	Plantaginaceae	Emergent anchored
13	<i>Bacopa monnieri</i> (L.) Wettst.	Plantaginaceae	Emergent anchored
14	<i>Barringtonia acutangula</i> (L.) Gaertn.	Lecythidaceae	Emergent anchored
15	<i>Bergia ammannioides</i> Roxb. ex Roth	Elatinaceae	Emergent anchored
16	<i>Bergia capensis</i> L.	Elatinaceae	Emergent anchored
17	<i>Blyxa octandra</i> (Roxb.) Planch. ex Thwaites	Hydrocharitaceae	Submerged anchored
18	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Emergent anchored
19	<i>Centranthera tranquebarica</i> (Spreng.) Merr.	Orobanchaceae	Emergent anchored
20	<i>Chlorophytum laxum</i> R.Br.	Asparagaceae	Wetland
21	<i>Commelina diffusa</i> Burm.f.	Commelinaceae	Wetland
22	<i>Crotalaria quinquefolia</i> L.	Leguminosae	Emergent anchored
23	<i>Cyanothis axillaris</i> (L.) D.Don ex Sweet	Commelinaceae	Emergent anchored
24	<i>Cyanothis cristata</i> (L.) D.Don	Commelinaceae	Emergent anchored
25	<i>Cyanothis tuberosa</i> (Roxb.) Schult. & Schult.f.	Commelinaceae	Wetland
26	<i>Cymodocea serrulata</i> (R.Br.) Asch. & Magnus	Cymodoceaceae	Free floating
27	<i>Cyperus compressus</i> L.	Cyperaceae	Emergent anchored
28	<i>Cyperus dubius</i> Rottb.	Cyperaceae	Emergent anchored
29	<i>Cyperus exaltatus</i> Retz.	Cyperaceae	Emergent anchored
30	<i>Cyperus iria</i> L.	Cyperaceae	Emergent anchored
31	<i>Cyperus squarrosus</i> L.	Cyperaceae	Emergent anchored
32	<i>Dentella repens</i> (L.) J.R.Forst. & G.Forst.	Rubiaceae	Wetland
33	<i>Diplacrum caricinum</i> R.Br.	Cyperaceae	Emergent anchored
34	<i>Dopatrium junceum</i> (Roxb.) Buch.-Ham. ex Benth.	Plantaginaceae	Emergent anchored
35	<i>Dopatrium lobelioides</i> (Retz.) Benth.	Plantaginaceae	Emergent anchored
36	<i>Dopatrium nudicaule</i> (Willd.) Benth.	Plantaginaceae	Emergent anchored
37	<i>Drosera burmanni</i> Vahl	Droseraceae	Wetland
38	<i>Drosera indica</i> L.	Droseraceae	Wetland
39	<i>Echinochloa colona</i> (L.) Link	Poaceae	Emergent anchored
40	<i>Eclipta prostrata</i> (L.) L.	Compositae	Emergent anchored

41	<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae	Free floating
42	<i>Eleocharis atropurpurea</i> (Retz.) J.Presl & C.Presl	Cyperaceae	Emergent anchored
43	<i>Eleocharis geniculata</i> (L.) Roem. & Schult.	Cyperaceae	Emergent anchored
44	<i>Enicostema axillare</i> (Poir. ex Lam.) A.Raynal	Gentianaceae	Emergent anchored
45	<i>Epaltes divaricata</i> (L.) Cass.	Compositae	Emergent anchored
46	<i>Eragrostis gangetica</i> (Roxb.) Steud.	Poaceae	Emergent anchored
47	<i>Eragrostis uniolooides</i> (Retz.) Nees ex Steud.	Poaceae	Emergent anchored
48	<i>Eriocaulon cinereum</i> R.Br.	Eriocaulaceae	Emergent anchored
49	<i>Eriocaulon quinquangulare</i> L.	Eriocaulaceae	Emergent anchored
50	<i>Eriochloa procera</i> (Retz.) C.E.Hubb.	Poaceae	Emergent anchored
51	<i>Fimbristylis argentea</i> (Rottb.) Vahl	Cyperaceae	Emergent anchored
52	<i>Fimbristylis bisumbellata</i> (Forssk.) Bubani	Cyperaceae	Emergent anchored
53	<i>Fimbristylis cinnamometorum</i> (Vahl) Kunth	Cyperaceae	Emergent anchored
54	<i>Fimbristylis cymosa</i> R.Br.	Cyperaceae	Emergent anchored
55	<i>Fimbristylis dichotoma</i> (L.) Vahl	Cyperaceae	Emergent anchored
56	<i>Fimbristylis dipsacea</i> (Rottb.) C.B.Clarke	Cyperaceae	Emergent anchored
57	<i>Fimbristylis falcata</i> (Vahl) Kunth	Cyperaceae	Emergent anchored
58	<i>Fimbristylis ovata</i> (Burm.f.) J.Kern	Cyperaceae	Emergent anchored
59	<i>Fimbristylis polytrichoides</i> (Retz.) Vahl	Cyperaceae	Emergent anchored
60	<i>Fimbristylis quiquangularis</i> (Vahl) Kunth	Cyperaceae	Emergent anchored
61	<i>Fimbristylis schoenoides</i> (Retz.) Vahl	Cyperaceae	Emergent anchored
62	<i>Fuirena uncinata</i> (Willd.) Kunth	Cyperaceae	Emergent anchored
63	<i>Glossostigma diandrum</i> (L.) Kuntze	Phrymaceae	Wetland
64	<i>Halodule pinifolia</i> (Miki) Hartog	Cymodoceaceae	Emergent anchored
65	<i>Halosarcia indica</i> (Willd.) Paul G.Wilson	Amaranthaceae	Emergent anchored
66	<i>Hoppea dichotoma</i> Willd.	Gentianaceae	Wetland
67	<i>Hoppea fastigiata</i> (Griseb.) C.B.Clarke	Gentianaceae	Wetland
68	<i>Hydrilla verticillata</i> (L.f.) Royle	Hydrocharitaceae	Submerged anchored
69	<i>Hydrolea zeylanica</i> (L.) Vahl	Hydroleaceae	Emergent anchored
70	<i>Hygrophila auriculata</i> (Schumach.) Heine	Acanthaceae	Emergent anchored
71	<i>Hygrophila madurensis</i> (N.P.Balakr. & Subram.) Karthik. & Moorthy	Acanthaceae	Emergent anchored
72	<i>Iphigenia indica</i> (L.) A.Gray ex Kunth	Colchicaceae	Wetland
73	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	Floating leaved anchored
74	<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	Emergent anchored
75	<i>Ipomoea coptica</i> (L.) Roth ex Roem. & Schult.	Convolvulaceae	Emergent anchored
76	<i>Iseilema laxum</i> Hack.	Poaceae	Wetland
77	<i>Lemna perpusilla</i> Torr.	Araceae	Free floating
78	<i>Leptochloa fusca</i> (L.) Kunth	Poaceae	Emergent anchored
79	<i>Leptochloa neesii</i> (Thwaites) Benth.	Poaceae	Emergent anchored
80	<i>Linnophila indica</i> (L.) Druce	Plantaginaceae	Emergent anchored
81	<i>Linnophila repens</i> (Benth.) Benth.	Plantaginaceae	Emergent anchored
82	<i>Lindernia antipoda</i> (L.) Alston	Linderniaceae	Emergent anchored
83	<i>Lindernia crustacea</i> (L.) F.Muell.	Linderniaceae	Emergent anchored
84	<i>Lindernia hyssopoides</i> (L.) Haines	Linderniaceae	Emergent anchored
85	<i>Lindernia oppositifolia</i> (L.) Mukerjee	Linderniaceae	Emergent anchored
86	<i>Lindernia parviflora</i> (Roxb.) Haines	Linderniaceae	Emergent anchored
87	<i>Lobelia alsinoides</i> Lam.	Campanulaceae	Wetland
88	<i>Ludwigia adscendens</i> (L.) H.Hara	Onograceae	Floating leaved emergent
89	<i>Ludwigia hyssopifolia</i> (G.Don) Exell	Onograceae	Emergent anchored
90	<i>Ludwigia Perennis</i> L.	Onograceae	Emergent anchored
91	<i>Lumnitzera racemosa</i> Willd.	Combretaceae	Emergent anchored
92	<i>Microcarpaea minima</i> (K.D. Koenig ex Retz.) Merr.	Plantaginaceae	Wetland
93	<i>Monochoria vaginalis</i> (Burm.f.) C.Presl	Pontederiaceae	Free floating
94	<i>Murdannia dimorpha</i> (Dalzell) G.Bruckn.	Commelinaceae	Emergent anchored
95	<i>Murdannia nudiflora</i> (L.) Brenan	Commelinaceae	Emergent anchored
96	<i>Murdannia spirata</i> (L.) G.Bruckn.	Commelinaceae	Emergent anchored
97	<i>Najas indica</i> (Willd.) Cham.	Hydrocharitaceae	Submerged anchored
98	<i>Nechamandra alternifolia</i> (Roxb. & Wight) Thwaites	Hydrocharitaceae	Submerged
99	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Floating leaved anchored
100	<i>Neptunia oleracea</i> Lour.	Leguminosae	Free floating
101	<i>Nesaea brevipes</i> Koehne	Lythraceae	Emergent anchored
102	<i>Nymphaea nouchali</i> Burm.f.	Nymphaeaceae	Floating leaved anchored
103	<i>Nymphaea pubescens</i> Willd.	Nymphaeaceae	Floating leaved anchored
104	<i>Nymphaea rubra</i> Roxb. ex Andrews	Nymphaeaceae	Floating leaved anchored
105	<i>Nymphoides indica</i> (L.) Kuntze	Menyanthaceae	Free floating
106	<i>Oryza sativa</i> L.	Poaceae	Emergent anchored

107	<i>Ottelia alismoides</i> (L.) Pers.	Hydrocharitaceae	Submerged anchored
108	<i>Pandanus odorifer</i> (Forssk.) Kuntze	Pandanaceae	Wetland
109	<i>Panicum repens</i> L.	Poaceae	Emergent anchored
110	<i>Parkinsonia aculeata</i> L.	Leguminosae	Emergent anchored
111	<i>Paspalidium flavidum</i> (Retz.) A.Camus	Poaceae	Emergent anchored
112	<i>Paspalidium geminatum</i> (Forssk.) Stapf	Poaceae	Emergent anchored
113	<i>Paspalum scrobiculatum</i> L.	Poaceae	Emergent anchored
114	<i>Pemphis acidula</i> J.R. Forst. & G. Forst.	Lythraceae	Emergent anchored
115	<i>Persicaria glabra</i> (Willd.) M.Gomez	Polygonaceae	Emergent anchored
116	<i>Phyla nodiflora</i> (L.) Greene	Verbinaceae	Emergent anchored
117	<i>Pistia stratiotes</i> L.	Araceae	Free floating
118	<i>Platostoma menthoides</i> (L.) A.J.Paton	Lamiaceae	Emergent anchored
119	<i>Polygonum plebeium</i> R.Br.	Polygonaceae	Emergent anchored
120	<i>Pseudoraphis spinescens</i> (R.Br.) Vickery	Poaceae	Emergent anchored
121	<i>Pycreus pumilus</i> (L.) Nees	Cyperaceae	Emergent anchored
122	<i>Rotala densiflora</i> (Roth) Koehne	Lythraceae	Emergent anchored
123	<i>Rotala mexicana</i> Schtdl. & Cham.	Lythraceae	Emergent anchored
124	<i>Rotala verticillaris</i> L.	Lythraceae	Emergent anchored
125	<i>Rungia pectinata</i> (L.) Nees	Acanthaceae	Emergent anchored
126	<i>Saccharum spontaneum</i> L.	Poaceae	Emergent anchored
127	<i>Sacciolepis indica</i> (L.) Chase	Poaceae	Emergent anchored
128	<i>Schoenoplectiella articulata</i> (L.) Lye	Cyperaceae	Emergent anchored
129	<i>Schoenoplectiella lateriflora</i> (G.F.Gmel.) Lye	Cyperaceae	Emergent anchored
130	<i>Sphenoclea zeylanica</i> Gaertn.	Sphenocleaceae	Emergent anchored
131	<i>Spirodela polyrrhiza</i> (L.) Schleid.	Araceae	Free floating
132	<i>Suaeda maritima</i> (L.) Dumort.	Amaranthaceae	Emergent anchored
133	<i>Syringodium isoetifolium</i> (Asch.) Dandy	Cymodoceaceae	Submerged
134	<i>Theriophonum minutum</i> (Willd.) Baill.	Araceae	Wetland
135	<i>Typha angustifolia</i> L.	Typhaceae	Emergent anchored
136	<i>Utricularia bifida</i> L.	Lentibulariaceae	Wetland
137	<i>Utricularia caerulea</i> L.	Lentibulariaceae	Wetland
138	<i>Utricularia hirta</i> Klein ex Link	Lentibulariaceae	Wetland
139	<i>Utricularia polygaloides</i> Edgew.	Lentibulariaceae	Wetland
140	<i>Vahlia dichotoma</i> (Murray) Kuntze	Vahliaceae	Emergent anchored
141	<i>Vahlia digyna</i> (Retz.) Kuntze	Vahliaceae	Emergent anchored
142	<i>Vallisneria natans</i> (Lour.) H.Hara	Hydrocharitaceae	Submerged anchored
143	<i>Wolffia globosa</i> (Roxb.) Hartog & Plas	Araceae	Free floating
144	<i>Xyris pauciflora</i> Willd.	Xyridaceae	Emergent anchored

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REFERENCES

- [1] Lacoul P, Freedman B, Environ Rev, **2006**, 14: 89-136.
- [2] Naskar K, *Aquatic and semi-aquatic plants of the lower Ganga delta*, Daya publishing house, Delhi, **1990**.
- [3] Les DH, Schneider EL, In: Rudall PJ, Cribb PJ, Cutler DF, Humphries CJ, (Ed), *The Nymphaeales, Alismatidae, and the theory of an aquatic monocotyledon origin. Monocotyledons: Systematics and Evolution*, Royal Botanic Gardens, Kew, **1995**, pp 23-24.
- [4] Ahmad N, Younis, *Aquatic plants of Lahore, Pakistan association for advancement sciences*, 14-shah jamal colony, Lahore -12, **1979**, pp 14-20.
- [5] Marwat SK, Usman K, Shah R, Shahn A, Khan EA, *Pak J Bot*, **2013**, 45(SI): 279-288.
- [6] Biswas K, Calder C, *Handbook of common and marsh plants of India and Burma*, Bishen Singh & Mahendra Pal Singh, Dehradun, **1937**.
- [7] Deb DB, *Bull Bot Soc Beng*, **1957**, 29 (2): 155-170.
- [8] Subramnyam K, *Aquatic angiosperms (Botanical monograph no.3)*, New Delhi: CSIR, **1962**.
- [9] Kachroo P, *Aquatic Biology in India*, Bishen Singh & Mahendra Pal Singh, Dehradun, **1984**.
- [10] Lavania GS, Paliwal SC, Gopal B, In: Brij Gopal (Ed.), *Aquatic vegetation of the Indian subcontinent. Ecology and Management of aquatic vegetation in the Indian subcontinent*, Kluwer Academic Publishers, Dordrecht Boston/London, **1990**, pp 29-76.
- [11] Cook CDK, *Aquatic and wetland plants of India*, Oxford University press, **1996**.

- [12] Hooker JD, *Flora of British India* (Vol. 1-7), Ashford: Reeve and company, **1872-1879**,
[13] Gamble JS, Fischer CEC, *Flora of the Presidency of Madras* (Vol. 1-3), London: Adlord and sons Ltd, **1915-1935**.
[14] Matthew KM, *The flora of the Tamilnadu Carnatic*, Volume 1-3, The Rapinat herbarium, St. Joseph's College, Tiruchirappalli, **1983**.
[15] Matthew KM, *Flora of the Palni Hills*, Volume 1-3, The Rapinat herbarium, St. Joseph's College, Tiruchirappalli, **1999**.
[16] Henry AN, Nair NC, *The flora of Tamil Nadu* (3 Vols.), Coimbatore: Botanical Survey of India, **1983-1989**.
[17] Kabeer KAA, Nair VJ, *Flora of Tamil Nadu-Grasses*, Coimbatore: Botanical Survey of India, **2009**.
[18] APG III, *Journal of the Linnean Society*, **2009**, 16: 105-121.
[19] Ramamurthy K, Balakrishnan NP, Ravikumar K, Ganesan R, *Flora of India series 4 Seagrasses of Coromandel Coast India*, Coimbatore: Botanical Survey of India, **1992**.