



Aquatic Plant Diversity of Ponds in Thrissur District, Kerala, India

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Abstract: The analysis of aquatic plant diversity was conducted in twenty ponds of Thrissur district, Kerala, during April 2014 to March 2016. During the period of study, 41 macrophytes were identified which comes under 35 genera belonging to 24 families including Pteridophytes. 46.3% of total plant species that were recorded fall into the category of marshy, followed by 19.5% submerged hydrophytes, 12.2% emergent hydrophytes, 12.2% free floating hydrophytes and 9.8% attached floating hydrophytes. The diverse plant family is Poaceae followed by Hydrocharitaceae, Onagraceae and Asteraceae.

Keywords: Aquatic plants, Macrophytes, Thrissur, Pteridophytes, Poaceae, Hydrocharitaceae, Onagraceae, Asteraceae

The macrophytes play a vital role in healthy aquatic ecosystems and serve as primary producers of oxygen through photosynthesis. These plants supply a wide variety of nesting habitats for aquatic organisms. They provide a substrate for epiphytic algae and shelter for many invertebrates, aid in nutrient cycling to and from the sediments and help to stabilize river and stream banks. The macroscopic flora includes the aquatic Angiosperms (flowering plants) and Pteridophytes (ferns). The macrophytes constitutes a diverse assemblage of taxonomic groups and are classified into four categories based on their habit of growth namely free floating, attached floating, submerged and emergent (Kumar 2015). Majority of the ponds in India are shallow and perennial freshwater bodies. Algae in deep waters dominate the aquatic biota and macrophytes dominate in the shallow waters. The macrophytes are the major contributors of pond productivity. The aquatic macro-vegetation plays an important role in maintaining ecological balance (Bhagyaleena and Gopalan 2012). The eutrophic water bodies are characterized by the presence of aquatic plants (Bronmark and Hansson 2017). The increased number of macro vegetation indicates the eutrophic condition of the reservoirs (Reju et al 2015). The macrophytes produce additional amount of nutrients and that pollute the water after their death (Tewari and Mittal 2020). The water quality of the freshwater bodies is rapidly declining (Nandal et al 2020). The aquatic plants in the freshwater habitats of India were reported by Cook (1996). The baseline data on biodiversity is essential for the conservation and management strategies of wetland and aquatic habitats (Ravi et al 2020). In Kerala the systematic reports regarding the freshwater ecology, limnology and conservation biology of ponds was insufficient.

MATERIAL AND METHODS

The present work was conducted in twenty ponds ($P_1 - P_{20}$) of Thrissur district, Kerala, during April 2014 to March 2016 (Table 1). The twigs of plants were collected periodically with flowers and fruits. The habit, morphology and floristic characters are recorded during the time of collection. The plants collected were identified with the help of floras (Manilal and Sivarajan 1982, Gamble and Fischer 1915 – 1936, Sreekumar and Nair 1991).

RESULTS AND DISCUSSION

During the period of study, 41 macrophytes were identified which comes under 35 genera belonging to 24 families including Pteridophytes (Table 2 and Plate 1). The 46.3% of total plant species that were recorded fall into the category of marshy land, followed by 19.5% submerged hydrophytes, 12.2% emergent hydrophytes, 12.2% free floating hydrophytes and 9.8% attached floating hydrophytes (Fig. 1). The diverse family is Poaceae followed by Hydrocharitaceae, Onagraceae and Asteraceae (Table 2). The free floating hydrophytes found in the ponds of Thrissur district are *Eichhornia crassipes* (Mart.) Solms, *Lemna perpusilla* Torrey, *Pistia stratiotes* L., *Azolla pinnata* R. Br. and *Salvinia molesta* D. Mitch. The rooted plants with floating leaves are *Nymphaea nouchali* Burm. f., *Nymphaea rubra* Roxb. ex Salisb., *Nymphoides hydrophylla* (Lour.) O. Ktze. and *Nymphoides indica* (L.) O. Ktze. The prominent growth of the floating plants will not allow light to pass through the water and the growth of the microphytes are inhibited. The rooted submerged plants found in the ponds are *Ottelia alismoides* (L.) Pers., *Utricularia aurea* Lour., *Cabomba caroliniana* Gray., *Hydrilla verticillata* (L. f.) Royle, *Ceratophyllum*

Table 1. GPS locations of the ponds studied

Pond No.	Name of the pond	GPS location
P ₁	Pond at Christ College campus, Irinjalakuda	10°21'23.4"N 76°12'44.1"E
P ₂	Njourikulam, Irinjalakuda	10°20'53.1"N 76°12'48.3"E
P ₃	Andanikulam, Irinjalakuda	10°18'56.2"N 76°13'12.5"E
P ₄	Marathampully pond, Irinjalakuda	10°20'29.8"N 76°12'55.0"E
P ₅	Pallikulam, Thrissur	10°31'17.5"N 76°13'20.4"E
P ₆	Ayyanpadi pond, Edamuttam	10°22'32.7"N 76°08'10.3"E
P ₇	Pond at Edamuttam	10°22'29.1"N 76°07'33.1"E
P ₈	Kothakulam pond, Valapad	10°23'40.7"N 76°06'58.5"E
P ₉	Kuttankulam, Irinjalakuda	10°20'48.3"N 76°12'10.0"E
P ₁₀	Temple pond, Kodungallur	10°13'38.0"N 76°11'52.2"E
P ₁₁	Temple pond, Guruvayur	10°35'44.3"N 76°02'21.3"E
P ₁₂	Vadakechira temple pond, Thrissur	10°31'46.1"N 76°12'57.9"E
P ₁₃	Pond at Kaduppassery, Velukkara Panchayath	10°18'59.8"N 76°15'15.5"E
P ₁₄	Oomenkulam, Irinjalakuda	10°20'26.5"N 76°13'06.9"E
P ₁₅	Velathikulam, Muriyad Panchayath	10°21'07.4"N 76°13'49.2"E
P ₁₆	Ayyappankavu kulam, Cheloor, Irinjalakuda	10°20'22.6"N 76°11'40.2"E
P ₁₇	Kottamkulam, Thalikulam	10°26'07.7"N 76°05'49.1"E
P ₁₈	Narayanamangalam temple pond, Palakkal	10°28'12.1"N 76°13'14.4"E
P ₁₉	Pallikulam, Koratty	10°16'10.3"N 76°20'39.9"E
P ₂₀	Mudichira, Muriyad Panchayath	10°21'12.3"N 76°14'00.6"E



Plate 1. 1. *Alternanthera philoxeroides* (Mart.) Griseb.; 2. *Cabomba caroliniana* Gray.; 3. *Ceratophyllum demersum* L.; 4. *Eclipta prostrata* L.; 5. *Eichhornia crassipes* (Mart.) Solms.; 6. *Ipomoea aquatica* Forssk.; 7. *Hydrilla verticillata* (L. f.) Royle; 8. *Lemna perpusilla* Torrey; 9. *Limnocharis flava* (L.) Buch.; 10. *Limnophila aquatica* (Roxb.) Alston; 11. *Ludwigia adscendens* (L.) Hara.; 12. *Monochoria vaginalis* (Burm. f.) Presl; 13. *Ottelia alismoides* (L.) Pers.; 14. *Nymphaea nouchali* Burm. f.; 15. *Nymphaea rubra* Roxb. ex Salisb.; 16. *Pistia stratiotes* L.; 17. *Vallisneria natans* (Lour.) Hara.; 18. *Nymphoides indica* (L.) O. Ktze.; 19. *Nymphoides hydrophylla* (Lour.) O. Ktze.; 20. *Utricularia aurea* Lour.; 21. *Ceratopteris thalictroides* (L.) Brongn.; 22. *Azolla pinnata* R. Br.; 23. *Salvinia molesta* D. Mitch.; 24. *Marsilea minuta* L.

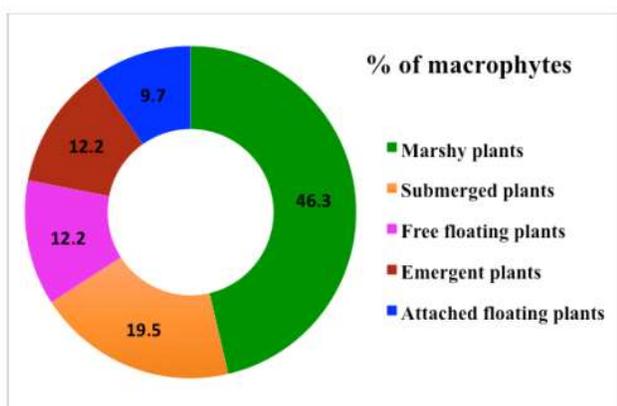


Fig. 1. Distribution of macrophytes in the ponds of Thrissur district

demersum L., *Najas graminea* Del. and *Najas indica* (Willd.) Cham. The *Cyperus pilosus* Vahl., *Cyperus compressus* L. and *Eragrostis uniolooides* (Retz.) Nees ex Steud were found to be dominant during dry season of the year in the marshy areas of the ponds.

The macrophytes have capacity to improve the water quality by absorbing nutrients, with their effective root system. At the same time death and decay of the macrophytes increases nutrient concentration and it leads to the eutrophication. *Eichhornia crassipes* (Mart.) Solms

Table 2. Distribution of macrophytes in the ponds of Thrissur district, Kerala

Name of species	Family name	Habit	Pond No:
<i>Alternanthera philoxeroides</i> (Mart.) Grisb.	Amaranthaceae	M	P ₁₃ , P ₁₄
<i>Cabomba caroliniana</i> Gray.	Cabombaceae	S	P ₁₃
<i>Ceratophyllum demersum</i> L.	Ceratophyllaceae	S	P ₁
<i>Colocasia esculenta</i> (L.) Schott	Araceae	E	P ₁₃ , P ₂₀
<i>Cyperus compressus</i> L.	Cyperaceae	M	P ₁ , P ₂ , P ₃ , P ₁₃ , P ₁₅ , P ₁₆ , P ₁₇ , P ₂₀
<i>Cyperus pilosus</i> Vahl.	Cyperaceae	M	P ₁ , P ₁₅ , P ₁₇ , P ₂₀
<i>Echinochloa colona</i> (L.) Link.	Poaceae	M	P ₂
<i>Eclipta prostrata</i> (L.) L.	Asteraceae	M	P ₁ , P ₁₃ , P ₂₀
<i>Eichhornia crassipes</i> (Mart.) Solms.	Pontederiaceae	FF	P ₆ , P ₁₃
<i>Eragrostis unioides</i> (Retz.) Nees ex Steud	Poaceae	M	P ₄ , P ₁₃ , P ₁₅ , P ₂₀
<i>Hydrilla verticillata</i> (L. f.) Royle	Hydrocharitaceae	S	P ₁ , P ₂ , P ₆ , P ₁₃ , P ₁₄ , P ₁₈
<i>Hygrophila schulli</i> (Buch - Ham) M.R. & S.M. Almeida	Acanthaceae	E	P ₂ , P ₆ , P ₁₃ , P ₂₀
<i>Hygroryza aristata</i> (Retz.) Nees ex Wight & Arn.	Poaceae	E	P ₁₃ , P ₁₅
<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	M	P ₆ , P ₁₃
<i>Lemna perpusilla</i> Torrey	Lemnaceae	FF	P ₇ , P ₁₅
<i>Limnocharis flava</i> (L.) Buch.	Alismataceae	E	P ₆ , P ₁₃
<i>Limnophila aquatica</i> (Roxb.) Alston	Scrophulariaceae	E	P ₁₃
<i>Ludwigia adscendens</i> (L.) Hara.	Onagraceae	M	P ₂
<i>Ludwigia hyssopifolia</i> (G. Don) Exell	Onagraceae	M	P ₁₃ , P ₁₅
<i>Ludwigia perennis</i> L.	Onagraceae	M	P ₂ , P ₄ , P ₆ , P ₁₂ , P ₁₃ , P ₁₅
<i>Monochoria vaginalis</i> (Burm. F.) Presl	Pontederiaceae	M	P ₁ , P ₂ , P ₄
<i>Najas graminea</i> Del.	Najadaceae	S	P ₁
<i>Najas indica</i> (Willd.) Cham.	Najadaceae	S	P ₁
<i>Nymphaea nouchali</i> Burm. F.	Nymphaeaceae	AF	P ₂ , P ₈ , P ₁₀ , P ₁₁ , P ₁₄
<i>Nymphaea rubra</i> Roxb. Ex Salisb.	Nymphaeaceae	AF	P ₅ , P ₆
<i>Nymphoides hydrophylla</i> (Lour.) O. Ktze.	Menyanthaceae	AF	P ₂
<i>Nymphoides indica</i> (L.) O. Ktze.	Menyanthaceae	AF	P ₂
<i>Ottelia alismoides</i> (L.) Pers.	Hydrocharitaceae	S	P ₆
<i>Panicum repens</i> L.	Poaceae	M	P ₂ , P ₃ , P ₉ , P ₁₃ , P ₁₄ , P ₁₅ , P ₁₆ , P ₂₀
<i>Paspalum scrobiculatum</i> L.	Poaceae	M	P ₁₃ , P ₂₀
<i>Pistia stratiotes</i> L.	Araceae	FF	P ₁₇
<i>Persicaria barbata</i> (L.) Hara var. <i>barbata</i> Joseph	Polygonaceae	M	P ₁₃
<i>Sacciolepis interrupta</i> (Willd.) Stapf.	Poaceae	M	P ₉
<i>Spilanthes ciliata</i> HBK	Asteraceae	M	P ₁₃
<i>Utricularia aurea</i> Lour.	Lentibulariaceae	S	P ₁ , P ₁₃
<i>Vallisneria natans</i> (Lour.) Hara	Hydrocharitaceae	S	P ₁₃
<i>Wedelia chinensis</i> (Osbeck) Merr	Asteraceae	M	P ₁₃
<i>Azolla pinnata</i> R. Br.	Azollaceae	FF	P ₁₃
<i>Ceratopteris thalictroides</i> (L.) Brongn.	Parkeriaceae	M	P ₄ , P ₆ , P ₁₃ , P ₁₄ , P ₁₅ , P ₁₇ , P ₂₀
<i>Marsilea minuta</i> L.	Marsileaceae	M	P ₄ , P ₆ , P ₁₃ , P ₂₀
<i>Salvinia molesta</i> D. Mitch.	Salviniaceae	FF	P ₁ , P ₂ , P ₄ , P ₁₂ , P ₁₃ , P ₁₉

AF – Attached floating; E – Emergent; FF – Free floating; M – Marshy; S – Submerged

Hydrilla verticillata (L.f.) Royle are capable in improving water quality by reducing nutrient concentration. The macrophytes such as *Hydrilla*, *Ceratophyllum* and *Eichhornia* grown in ponds have the ability to maintain water quality (Pradeep and Dwivedi 2016). Some Pteridophytes such as *Azolla pinnata* R. Br., *Ceratopteris thalictroides* (L.) Brongn., *Marsilea minuta* L. and *Salvinia molesta* D. Mitch. were also found abundant in the perennial ponds studied (Table 2). Aquatic macrophytes act as microhabitat for the fauna of wetlands due to the diversity of growth forms which outcomes in a greater niche modification (Malaiya 2015). It is very important to conserve the natural ecosystems that are deteriorating at an alarming rate otherwise the remnants will significantly lose their ability to sustain the present biological diversity (Gupta et al 2020).

CONCLUSION

This assessment on the macrophytes in the perennial ponds of Thrissur district, Kerala is a comprehensive floristic analysis of the aquatic flora. During the investigation 41 macrophytes were reported which comes under 35 genera belonging to 24 families including Pteridophytes. This report will be useful for analyzing the biodiversity of the macrophytes in the ponds of Kerala. The ponds promote abundance and high richness of aquatic plants and enhance regional biodiversity. The aquatic macro-vegetation plays a significant role in maintaining ecological balance by nutrient recycling. The ponds that are not periodically cleaned showed more diversity of macrophytes.

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