Section A-Research paper

Aquatic Weeds in the Ponds of Kanyakumari District ,Tamilnadu, India.

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Abstarct:

The present study was conducted to find out aquatic weeds in the ponds of Kanyakumari district, Tamilnadu, India during the year 2020 to 2021. A total of 101 plant species belonging to 37 families and 49 genera were documented. Out of 101 species, about 46 Emergent Weeds followed by Submerged weeds (14), Free floating weeds (22) Rooted floating weeds (12), Temporary water situation weeds (7 species). The dominant aquatic weeds were *Eichhornia crassipes, Ipomoea carnea*, *Pistia stratiotes*, and *Salvinia molesta.* The invasive aquatic weeds were *Eichhornia crassipes, Ipomoea carnea, Pistia stratiotes, Trapa natans*, *Typha angustifolia.* The medicinal uses of aquatic weeds were *Eichhornia crassipes, Hydrilla verticillata, Ipomoea aquatica, Nelumbo nucifera, Typha angustifolia.* A number of weeds such as *Nelumpo nucifera, Ipomoea aquatica, Trapa natans, Typha angustifolia* are reported to have been used for edible use. Various recommendations and measures have been suggested to improve the biodiversity of aquatic weeds of the study areas.

Key Words: Aquatic weeds, Agriculture, Biodiversity, Dominant, Emergent, Floating, Submerged, Medicinal

Introduction:

The term aquatic weeds refers to a large variety of aquatic plants, ranging from large filamentous algae to emergent reeds and cattails, which interfere with one or the other use of the water resources in a water body (river, lake, reservoir, fish pond or paddy field). An aquatic weed is an unscrupulous growth of a plant that influences adverse physical demand or biological effects on a water body with its resultant economic and aesthetic losses (Gupta, 1979).

Aquatic weeds also pose significant threat to wetlands and related agricultural systems. Wetlands are generally rich in nutrients, have shallow water and normally support extensive

growth of a large variety of macrophytes. These macrophytes provide shelter, food, nesting and breeding sites for most of the waterfowls, fishes and also other aquatic biota. Hence they cannot be always considered as weeds. It is only when some plant species start growing in such large proportions that they reduce or eliminate the growth of other desirable plants affecting other biota and their normal utilization of the wetland, they become weeds. In most cases, such weed species are not the normal components of the wetland and often introduced from other areas (Chandran, 2009).

Weed menace is one of the persistent environmental problems faced globally. Even the most developed nations like USA and UK spend huge sum of resources not to eradicate but just to keep the spread of weed's under control. Rest of the nations throughout the world also continue with their efforts to control the weeds, especially the aquatic and wetland weeds, as they became major environmental nuisance for the water resources (Abbasi *et al*., 1988)

Aquatic weeds change the flavor appearance and taste of drinking water. Aquatic weeds are a menace to fisheries too. Aquatic weeds on decomposition give offensive odors and pollute the atmosphere. Aquatic weeds also hamper transportation through the water. Weeds cause quicker wear and tear to farm implements Lancer and Krake (2002).

Aquatic weeds are those unwanted plants growing in water and complete at least a part of their life cycle in water (Jay Varshney 2008). Aquatic weeds also remove phosphorus, nitrogen and other elements from the water column. Floating weeds causes other problems as well. Dense populations reduce the penetration of light and oxygen through the water column, and mosquitoes find breeding grounds in the stagnant water held by the rosette of plant. Water hyacinth is arguably the nation's worst floating weed, and managers throughout the southern eastern continue to battle this noxious species. The submerged weed hydrilla (*Hydrilla verticillata*) which has been called the world's 'worst weed' was also introduced intentionally as an aquarium plant in the 1950s. (Lyn G Getfys 2014) noxious weed cause a number of problems in aquatic ecosystems it crowds out native plants to form monocultures, which are poor habitat for aquatic wildlife and fish. Many herbicides are used to control submerged, emerged and floating aquatic weeds (Frank 1963). Aquatic weeds change the flavor appearance and taste of drinking water. Aquatic weeds are a menace to fisheries too. Aquatic weeds on decomposition give offensive odors and pollute the atmosphere. Aquatic weeds also hamper transportation through the water. Weeds cause quicker wear and tear to farm implements. The presence of weeds around our living and working places makes the surroundings dull (Lidia Lancar,2002)

Materials and Methods:

Study area:

The Kanyakumari district region is blessed with a good number of fresh water ponds and dams harbouring a great variety of aquatic weeds. The present survey was carried out in select ponds of Kanyakumari district, Tamilnadu, India. The district lies between 77^{o} 07'-77^{o} 35 E, 08^{o} 35'-08^{o} 35'N, and it occupies an area of about 1672 sq.Km. A total of 40 ponds of Kanyakumari district were selected randomly The name of the ponds were Puthukulam, Ulavankulam, Parayadikulam, Nullikulam, Thayanankulam, Nedunkulam, Devikulam, Venkattukulam,

Chenkulam, Vallikulam, Kadayalmathukulam, Kurunkalloorkulam, Karamankulam,pasikulam, Upoorikulam, Palakulam, Alankulam, Kakachankulam, Edappurukulam, Perunkulam, Ettiyarkulam, Sasthankulam, Kottarakonathukulam, Chanikulam, Udappukulam, Pottakulam, Kaavikulam,Vanniyarkulam, Kanchirankulam, Annuvalthikulam, Puttakulam, Amalakulam, Kattukulam, Pachikulam, Kattikulam and Madathukulam.(Plate.1,2; Annexure:1)

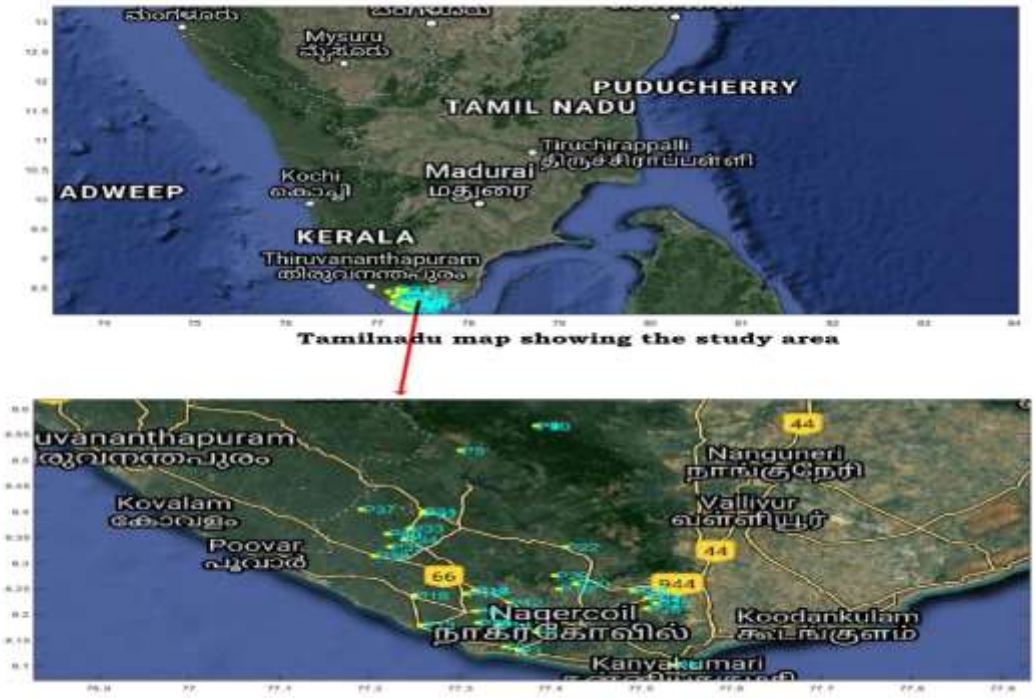

Plate :1. Map Showing selected ponds in Kanyakumari District

Floristic study:

Frequent and regular field visits have been made in the study area with a view of document aquatic weed flora. Field surveys have been carried out in study area during 2020 to 2021, covering different seasons. During field trips voucher specimens of every species was collected in flowering and fruiting stages and detailed field notes were prepared on the spot. Special emphasize was given on data pertaining to habit, habitat association with other species. Collection and preservation were made as per the procedure given by (Jain and Rao, 1977), (Nayar *et al*., 2014). Initially identification was provisionally done by using (Gamble- Fischer 1915-1936), (Charles Bryson *et al.,* 2009) Available monographs and relevant literature were also consulted for the same. The specimens were then poisoned with Mercuric Chloride in alcohol. Further process of pressing, mounting and labeling were done following the instructions given by (Jain and Rao, 1977). The mounted specimens were deposited in the Herbarium of Botany Department and Research Centre N.M.C.College Marthandam.

Plate :2 Type of Weed infestation in ponds of Kanyakumari District

Result and Discussion

The Present study 101 plant species 49 genera belonging to 17 families were identified from the ponds. A total of 101 plant species belonging to 37 families and 49 genera were documented perennials comprised about 71% of the aquatic weeds in the study and annuals comprised 23% remaining are throughout the year. The family Potamogetonaceae, Poaceae has (6 species each) Salviniaceae has 5 species, Pontedericeae, Nymphaceae (4 species each) Typhaceae, Onagraceae (3 species each)Alismataceae Amaranthaceae, Characeae, Cyperaceae, Asteraceae, Hydrocharitaceae, Convolvulaceae, Araceae (2 species each) remaining 18 families are monospecific. (Figure.1). Out of 101 species, about 46 Emergent Weeds followed by Submerged weeds (14), Free floating weeds (22) Rooted floating weeds (12), Temporary water situation weeds (7 species). The dominant aquatic weeds were *Eichhornia crassipes, Ipomoea carnea, Pistia stratiotes,* and *Salvinia molesta.* The invasive aquatic weeds were *Eichhornia crassipes, Ipomoea carnea, Pistia stratiotes, Trapa natans* and *Typha angustifolia.* The medicinal uses of aquatic weeds were *Eichhornia crassipes, Hydrilla verticillata, Ipomoea aquatica, Nelumbo nucifera* and *Typha angustifolia.* A number of weeds such as *Nelumpo nucifera, Ipomoea aquatica, Trapa natans* and *Typha angustifolia* are reported to have been used for edible use (Plate.3).

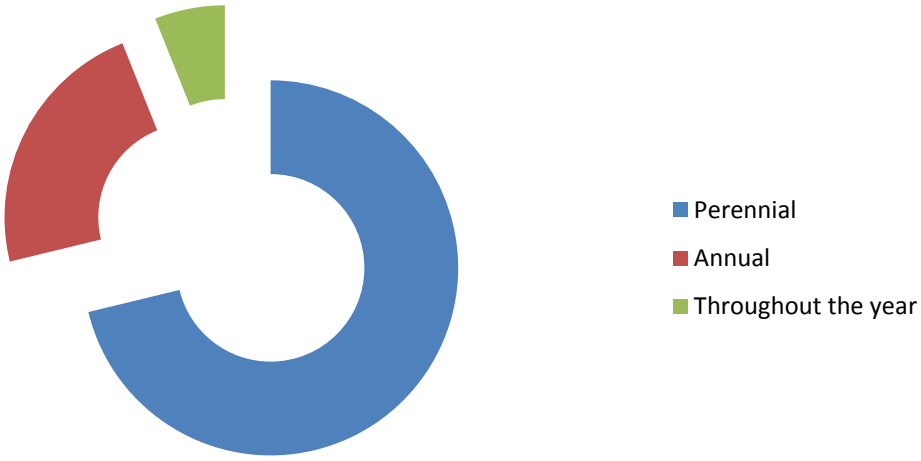

Figure: 1. Habitatwise distribution of the aquatic weeds in the study area.

Water hyacinth (*Eichhornia crassipes*) and *Ipomoea carnea* are the two major problem weeds that are invading these ponds vigorously. *Ipomoea carnea* invades the edges and shallow are whereas the water hyacinth is spreading over a wider area. Together, these species are playing a major role in degrading and altering the natural habitat available to the aquatic ponds. (Labrada 1996) reported 140 aquatic weeds. *Eichhornia crassipes, Salvinia molesta, Nymphaea stellata, Nelumpo nucifera, Hydrilla verticillata, Vallisneria spriralis, Typha angustata, Chara, Nitella, Ipomoea* sps..etc. *Salvinia molesta, Hydrilla verticillata* and *Pistia stratiotes* are primary aquatic weeds of the world (Gopal and Sharma 1981). (Siddhwartha *et al.,* 2015) reported 10 weed species .Among 3 common groups weeds, four species of floating, four species of emergent and two species of submerged. Recently *Alternanthera philoxeroides* has become a growing menace in water bodies in India (Susilkumar 2004).

Plate:3 Aquatic Weeds of the Study area

Conclusion:

In the present investigation total of 101 plant species belonging to 37 families and 49 genera were

recorded. The dominant aquatic weeds were *Eichhornia crassipes, Ipomoea carnea, Pistia stratiotes,* and *Salvinia molesta.* Aquatic ecosystems are threatened globally due to their widespread resources which are utilized for human use. Immediate steps are to be taken for their conservation and sustainable utilization and various recommendations and measures have been suggested to improve the biodiversity of aquatic weeds of the study areas.

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Table 1: Aquatic weeds in the study area

Name	Type	Family	Life cycle
Alisma plantago L.	Emergent amphibious hydrophyte	Alismataceae	Perennial
Ammania octandra L.F	Emergent amphibious hydrophyte	Lythraceae	Annual
Aponogeton natans (L.) Engl. &K.Krause	Free floating hydrophyte	Aponogetonaceae	Annual
Azolla filiculoides Lam.	Free floating hydrophyte	Salviniaceae	Annual
Azolla imbricata Waxai.	Free floating hydrophyte	Salviniaceae	Annual
Azolla pinnata R.Br.	Free floating hydrophyte	Salviniaceae	Annual
Bergia capensis L.	Emergent amphibious hydrophyte	Elatinaceae	Perennial
Ceratophyllum demersum L.	Free floating hydrophyte	Ceratophyllaceae	Annual
Chara zeylanica L.	Submerged hydrophyte	Characeae	Perennial
Commelina paludosa Blume.	Emergent amphibious hydrophyte	Commelinaceae	Perennial
Cyperus arenarius Retz.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Cyperus articulatus L.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Cyperus bulbosus Vahl.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Cyperus exaltatus Retz.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Cyperus squarrosus L.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Eichhornia crassipes (Mart.)Syn.	Free floating hydrophyte	Pontedericeae	Perennial
Eleocharis geniculata (L.)Roem.&Schult	Emergent amphibious hydrophyte	Cyperaceae	Annual or perennial
Elodea canadensis Michx.	Rooted Submerged hyrophyte	Hydrocharitaceae	Perennial
Eragrostis pilosa (L.)P.Beauv	Emergent amphibious	Poaceae	Perennial

	hydrophyte		
Eragrostis riparia (Willd.)Nees	Emergent amphibious hydrophyte	Poaceae	Perennial
Eriocaulon thwaitesii Korn	Emergent amphibious hydrophyte	Eriocaulaceae	Perennial
Eriochloa procera (Retz.) C.E.Hubb	Emergent amphibious hydrophyte	Poaceae	Perennial
Fimbristylis aestivalis Vahl.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Fimbristylis argentea (Rottb.)vahl	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Fimbristylis cymosa R.Br.	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Fimbristylis dipsacea (Rottb.)C.B.Clarke	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Fimbristylis ferruginea (L.)Vahl	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Fimbristylis quinquangularis (Vahl)Kunth	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Hydrilla verticillata Royle.	Rooted Submerged hyrophyte	Hydrocharitaceae	Perennial
Hydrocera triflora (L.)Wight &Arn.	Emergent amphibious hydrophyte	Balsaminaceae	Perennial
Hydrocharis morsus-ranae L.	Floating hydrophyte	Hydrocharitaceae	Annual
Hydrocotyle umbellata L.	Floating hydrophyte	Hydrocotylaceae	Perennial
Ipomoea aquatica Jacq.	Rooted floating hydrophyte	Convolvulaceae	Throughout the year
Jussiacea repens L.	Floating hydrophyte	Onagraceae	Perennial
Lemna minor L.	Free floating hydrophyte	Araceae	Perennial
Lemna perpusilla Torr.	Free floating hydrophyte	Araceae	Perennial
Leptochoa panicea (Retz.)Ohwi	Emergent amphibious hydrophyte	Poaceae	Perennial
Limnophila heterophylla (Roxb.)Benth	Submerged suspended hydrophyte	Plantaginceae	Perennial
Limnophila indica (L.)Druce.	Emergent amphibious hydrophyte	Plantaginceae	Perennial
Lindernia hyssopoides (L.)Haines	Emergent amphibious hydrophyte	Linderniaceae	Annual

Ludwigia adscendens (L.)H.Hara.	Rooted Submerged hyrophyte	Onagraceae	Perennial
Ludwigia parviflora L.	Floating hydrophyte	Onagraceae	Perennial
Marsilea minuta L.	Temporary water situation hydrophyte	Marsileaceae	Throughout the year
Meteranthera limosa (SW)Wild.	Temporary water situation hydrophyte	Pontedericeae	Perennial
Monochoria vaginalis Presi.	Temporary water situation hydrophyte	Pontedericeae	Annual
Myriophyllum spicatum L.	Rooted Submerged hyrophyte	Holorhagaceae	Perennial
Najas graminea Delile.	Submerged hydrophyte	Hydrocharitaceae	Perennial
Najas minor All.	Submerged hydrophyte	Najadaceae	Annual
Nelumpo alba L.	Rooted floating hydrophyte	Nymphaceae	Perennial
Nelumpo nucifera G.	Rooted floating hydrophyte	Nymphaceae	Perennial
Neptunia oleraceae Lour.	Floating hydrophyte	Fabaceae	Perennial
Nitella hyalina C.Agardh	Submerged hydrophyte	Characeae	Perennial
Nuphar lutea L.	Rooted floating hydrophyte	Nymphaceae	Perennial
Nymphaea alba L.	Rooted Submerged hyrophyte	Nymphaceae	Perennial
Nymphaea pubescens Willd.	Floating hydrophyte	Nymphaceae	Annual
Nymphoides hydrophylla (Lour.)Kuntze	Emergent amphibious hydrophyte	Menyanthaceae	Perennial
Nymphoides indica (L.)Kuntze.	Floating hydrophyte	Menyanthaceae	Perennial
Ottelia alismoides (L.)Pers.	Submerged hydrophyte	Hydrocharitaceae	Perennial
Panicum maximum Jacq.	Emergent amphibious hydrophyte	Poaceae	Perennial
Panicum perpurascens Raddi.	Temporary water situation hydrophyte	Poaceae	Perennial
Parkinsonia aculeata L.	Emergent amphibious hydrophyte	Fabaceae	Perennial
Paspalidium flavidium (Retz.) A.Camus	Emergent amphibious hydrophyte	Poaceae	Throughout the year
Paspalum distichum L.	Emergent amphibious hydrophyte	Poaceae	Perennial
Paspalum fluitans Kunth.	Temporary water situation hydrophyte	Poaceae	Perennial
*Persicaria amphibia (*L.)Gray	Free floating hydrophyte	Polygonaceae	Perennial

Phragmites australis (Cav.)Trin. Ex Steud.	Emergent amphibious hydrophyte	Poaceae	Perennial
Phragmites communis Trin	Emergent amphibious hydrophyte	Poaceae	Perennial
Phragmites karka (Retz.)Trin.ex Steud.	Emergent amphibious hydrophyte	Poaceae	Perennial
Pistia stratiotes L.	Free floating hydrophyte	Araceae	Perennial
Polygonum glabrum Willd.	Emergent amphibious hydrophyte	Polygonaceae	Perennial
Pontederia cordata L.	Emergent amphibious hydrophyte	Pontedericeae	Perennial
Potamogeton crispus L.	Rooted Submerged hyrophyte	Potamogetonaceae	Perennial
Potamogeton natans L.	Submerged hydrophyte	Potamogetonaceae	Perennial
Potamogeton nodosus L.	Submerged hydrophyte	Potamogetonaceae	Perennial
Potamogeton pusillus L.	Submerged hydrophyte	Potamogetonaceae	Perennial
Pycreus flavescens (L.) P.Beauv.ex.Rchb	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Rhynchosia minima (L.)DC.	Emergent amphibious hydrophyte	Fabaceae	Perennial
Rhynchospora corymbosa (L.)Britton	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Sacciolepis indica (L.) Chase	Emergent amphibious hydrophyte	Poaceae	Perennial
Sagittaria guayanensis kunth.	Rooted floating hydrophyte	Alismataceae	Perennial
Salvinia auriculata (Mitch)Syn.	Free floating hydrophyte	Salvinaceae	Annual
Salvinia molesta D.Mitch	Free floating hydrophyte	Salvinaceae	Annual
Salvinia natans (L.)All.	Free floating hydrophyte	Salvinaceae	Annual
Schoenoplectiella articulata (L.) Lye	Emergent amphibious hydrophyte	Cyperaceae	Perennial
Spirodela polyhiza (L.)Schlcid.	Free floatin7g hydrophyte	Araceae	Perennial
Spirogyra porticalis Link,C.G.Nees	Submerged hydrophyte	Chloraphyceae	Annual
Sporobolus indicus (L.)Rr.	Emergent amphibious hydrophyte	Poaceae	Perennial
Stuckenia pectinata (L.)Boerner.	Submerged hydrophyte	Potamogetonaceae	Perennial

Trapa bispinosa Roxb.	Floating hydrophyte	Trapaceae	Perennial
Trapa natans L.	Emergent amphibious hydrophyte	Trapaceae	Perennial
Typha latifolia L.	Emergent amphibious hydrophyte	Typhaceae	Perennial
Typha angustata L.	Emergent amphibious hydrophyte	Typhaceae	Perennial
Typha orientalis C.Presl.	Emergent amphibious hydrophyte	Typhaceae	Perennial
Utricular stellaris L.f	Submerged suspended hydrophyte	Lentibulariac**eae**	Annual
Utricularia aurea Lour.	Submerged suspended hydrophyte	Lentibulariaceae	Annual
Utricularia flexuosa Vahl.	Rooted Submerged hyrophyte	Lentibulariaceae	Perennial
Vallisneria natans (Lour.)H.Hara	Submerged hydrophyte	Hydrocharitaceae	Perennial
Vallisneria spiralis L.	Submerged hydrophyte	Hydrocharitaceae	Perennial
Waltheria indica L.	Emergent amphibious hydrophyte	Malvaceae	Perennial
Wolffia globasa (Roxb)Hartog &Plas	Floating hydrophyte	Araceae	Perennial
Zannichellia palustris L.	Rooted floating hydrophyte	Zannichelliaceae	Perennial

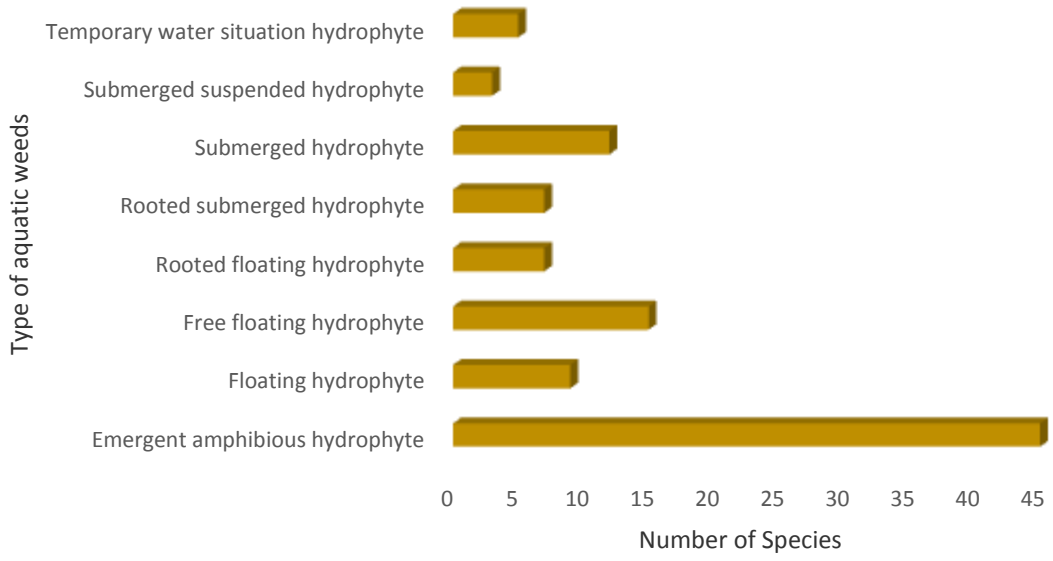

Fig .2. Type of aquatic weeds in the study area

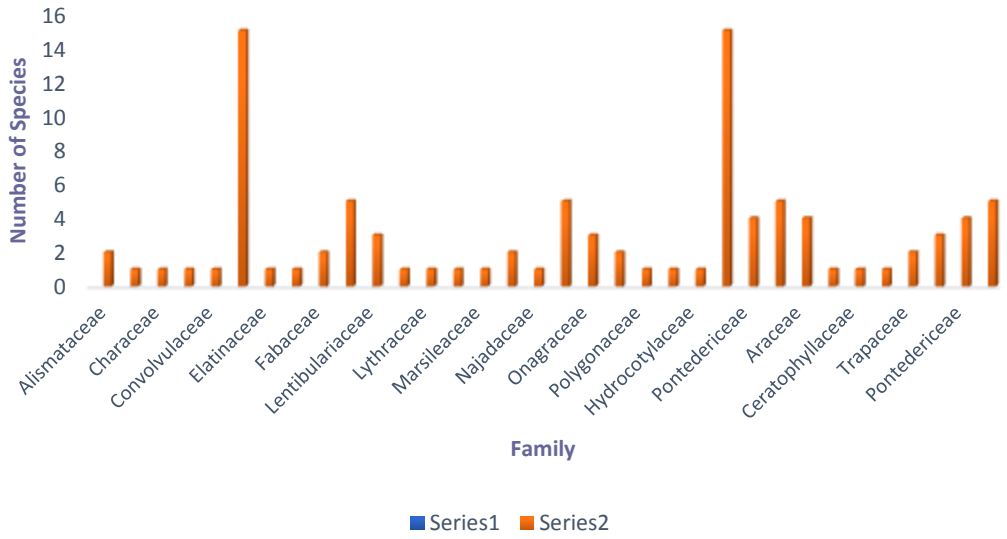

Fig 3: Familes of the aquatic weeds in the study area.

Water hyacinth (*Eichhornia crassipes*) and *Ipomoea carnea* are the two major problem weeds that are invading these ponds vigorously. *Ipomoea carnea* invades the edges and shallow are whereas the water hyacinth is spreading over a wider area. Together, these species are playing a major role in degrading and altering the natural habitat available to the aquatic ponds. (Labrada 1996) reported 140 aquatic weeds. *Eichhornia crassipes, Salvinia molesta, Nymphaea stellata, Nelumpo nucifera, Hydrilla verticillata, Vallisneria spriralis, Typha angustata, Chara, Nitella, Ipomoea* sps..etc. *Salvinia molesta, Hydrilla verticillata* and *Pistia stratiotes* are primary aquatic weeds of the world (Gopal and Sharma 1981). (Siddhwartha *et al.*, 2015) reported 10 weed species .Among 3 common groups weeds, 4 species of floating, 4 species of emergent and 2 species of submerged. Recently *Alternanthera philoxeroides* has become a growing menace in water bodies in India (Susilkumar 2004).

Conclusion:

In the present investigation total of 101 plant species belonging to 37 families and 49 genera were recorded. The dominant aquatic weeds were *Eichhornia crassipe, Ipomoea carnea, Pistia stratiotes,* and *Salvinia molesta.* Aquatic ecosystems are threatened globally due to their widespread resources which are utilized for human use. Immediate steps are to be taken for their conservation and sustainable utilization and various recommendations and measures have been suggested to improve the biodiversity of aquatic weeds of the study areas.

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Annexure:1 Location of Ponds Selected for Present Investigation

S.No	Taluk	Site	Locality	Latitude	Longitude
1	Agastheeswaram	P1	Ochenkulam	8.1659° N	77.3833° E
2		P2	Nagakuzhikulam	8.1366° N	77.3497° E
3		P3	Nadakulam	8.12909° N	77.3640° E
4		P4	Pammalkulam	8.5659° N	77.3833°E

5		P5	Zillikulam	8.5186° N	77.3000 °E
6		P6	Karumpattukulam	8.1009° N	77.5362° E
7		P7	Kadankulam	8.1009° N	77.5362° E
8		P8	Nallikulam	8.2059° N	77.3159° E
9		P9	Nullikulam	8.5659° N	77.3833° E
10		P10	Ananthankulam	8.5659° N	77.3833° E
11	Kalkulam	P11	Chekkaravilaikulam	8.1832° N	77.3192° E
12		P12	Thayankulam	8.2225° N	77.3535° E
13		P13	Periyarkulam	8.1786° N	77.2561° E
14		P14	Chittankulam	8.1774° N	77.3410° E
15		P15	Kuzhikulam	8.2396° N	77.3066° E
16	Killiyoor	P16	Chirukulam	8.2489° N	77.4086° E
17		P17	Manchadikulam	8.2456° N	77.3156° E
18		P18	Narakkulam	8.2370° N	77.2493° E
19		P19	Pottakulam	8.2456° N	77.3156° E
20		P20	Karukuzhikulam	8.18312° N	77.3192° E

21		P21	Vilavacherikulam	8.2312° N	77.5060° E
22		P22	Chekkadikulam	8.3301° N	77.4161° E
23		P23	Puthukulam	8.2454° N	77.4903° E
24		P24	Kattukulam	8.2312° N	77.5060° E
25		P25	Periakulam	8.2211º N	77.5162 º E
26		P26	Krishnakulam	8.2111º N	77.5062º E
27		P27	Uthukulam	8.2312° N	77.5060° E
28		P28	Malayankulam	8.2454 N	77.4903 E
29		P29	Pottanerikulam	8.2749 N	77.4042 E
30		P30	Udayankulam	8.2595 N	77.4272 E
31	Thiruvattar	P31	Puthukulam	8.3997° N	77.2586° E
32		P32	Puliyorkulam	8.3949° N	77.2580° E
33		P33	Kotturukulam	8.3662° N	77.2434° E
34		P34	Devikulam	8.3446° N	77.2376° E
35		P35	Palakkulam	8.3310° N	77.2219° E
36	Vilavancode	P36	Kakachankulam	8.3560° N	77.2190° E
37		P37	Edappurukulam	8.4033° N	77.1902° E

38		P38	Perunkulam	8.3129° N	77.2048° E
39		P39	Nedunkulam	8.3129° N	77.2048° E
40		P40	Thattankulam	8.3560° N	77.2190° E