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A SURVEY OF USEFUL AQUATIC MACROPHYTES, AND ITS BIOLOGICAL SPECTRUM IN KURANDIKULAM, MELASANKARANKUZHI, KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

This paper pen down the survey of useful aquatic macrophytes, and its biological spectrum inKurandikulam, Melasankarankuzhi, Kanyakumari District, Tamil Nadu, India.

Keywords: Aquatic macrophytes, Biological spectrum, Kanyakumari.

1. INTRODUCTION

Plants are vital to the function of aquatic ecosystems for their role in providing food, oxygen and habitat for other organisms. Aquatic macrophytes respond to the changes in water quality and have been used as bioindicator of pollution (Tripathi and Shukla, 1991) and are frequently used to reduce different kinds of pollutants from polluted water. The growth of aquatic plants or macrophytes in aquatic ecosysystem has an important influence on both the structure and the processes that occur in the stream habitat. Studies on aquatic macrophytes are in its initial phase in South India and it requires immediate attention (Gopal and Zutchi, 1998; Udayakumar and Doss, 2010). Rivers, soil moisture and relatively shallow groundwater basins are the principal sources of water for human (Srivastava*et al.,* 2008). One percent of the world's surface is covered by various fresh water habitats including the ponds (Gleick, 1996). They support life of 7 % of the estimated 1.8 million described species. Aquatic macrophytes can be used as a tool in the determination of pollution and nutrient level (Melzer, 1999) water quality and lake condition (Clayton and Edwards, 2006) trophic status of lakes (Palmer *et al.,* 1992), pollutant degradation (Mccutchen and Scgnoor, 2003) and decontaminate waste water (Nahlik and Mitsch, 2006). Urbanisation, industrialisation and bursting human population are the major threats to the fresh water ecosystem. In the present study, an attempt has been made to investigate the qualitative aspects of the macrophytes of Kurandikulam, Thoppur, kanyakumari District. Moreover, the present study is the first attempt to document the macrophytic diversity of the Thoppur, Kanyakumari District.

2. METHODOLOGY

2.1. Study Area:

The study area Kurandikulam is located in Melasankarankuzhipanchayat. This pond is situated in northern part of the Melasankarankuzhi. The villages like, Kurandi, Vadalivilai, Kothavilai are surrounding this pond. Most of the people are coolies. Around 2000 people are depends this pond for their domestic purposes. Due to the anthropogenic activities, this pond area is shrined day by day.

An extensive floristic survey was conducted during the year June 2012 – November 2012. The plant specimens were collected to prepare herbarium specimens and authenticate their correct identities. The collected specimens were identified taxonomically with the help of available monographs, taxonomic revisions and floras (Gamble and Fischer, 1915-1935; Mohanan and Henry, 1994; Santhapu and Henry, 1994) and collected specimens were cross checked for correct identification at the Herbarium of Tropical Botanical Garden and Research Institute, Trivandrum, Kerala and Department of Botany, S.T. Hindu College, Nagercoil.

3. RESULTS AND DISCUSSION

In the present study, altogether 65 macrophytic species were recorded and species were grouped under different categories i.e, Marginal (30 species), sub-merged (9 species), floating (7 species) and emergent (19 species) recorded in the present study were distributed over genera and families. Dicots (37 species) were dominant (19 families) and covered 57% of the total number of macrophytic species. Monocots (28 species) (9 families) were next to dicots and covered 43% of the total plants. Algae, Bryophytes and Pteridophytes were poor in distribution and were represented by three species each. Scientific names and habitat status are given in Table-1. Table-2 depicts the family wise distribution of genus and species and their percent composition and Table-3

depicts the summary of Taxonomic data and Table – 4 showed the habitat status (number wise) their uses in Table-5. Life form classification and the Biological spectrum of the identified plants were showed in Table 6, 7.

From the present study, it was evident that study area was clearly dominated by dicotyledons followed by the Monocots, but Algae, Bryophytes and Pteridophytes contributed only three species each.Out of 65 species, the family Cyperaceae had contributed 7 species and their percentage composition is 10.6%. Asteraceae, Euphorbiaceae, Lamiaceae, Hydrocharitaceae and Charophyceae had 3 species and their percentage composition is 4.5%. Convolvulaceae, Caesalpiniaceae, Poaceae, Salviniaceae, Polytrichaceae had two species and their percentage composition is 3%. Boraginaceae, Capparaceae, Nelumbonaceae, Nymphaceae, Onagraceae, Papaveraceae, Sapindaceae, Scrophulariaceae, Araceae, Ceratophyllaceae, Lemnaceae, Postederiaceae, Potamogetonaceae, had one species each and their percentage composition 1.5%. The diverse type of macrophytic forms recorded from the study area indicates that the selected area is very rich in plant diversity particularly in submerged and emergent species. *EichhorniaCrassipes*(free floating),*Hydrillaverticillata* (submerged) and *Cynodondactylon* (marginal) *Cyperusrotundus* (emergent), *Commelinabenghalensis* (emergent), *Acalyphaindica*(marginal) and *Tridaxprocumbens* (marginal) were the dominant species in the study area. The growth of both submerged and emergent species was governed to some extent by the magnitude and duration of water depth. Most of submerged species like *Utricullariastellaris, Ceratophyllumdemersum, Potamogetonmalanius, Hydrillaverticillata*and *Nitella* species grew luxuriantly in shallow water as light and nutrients are available in plenty.Rooted floating leaved plant like*Lemna minor, Azollapinnata, Salvinianatans* and *Marchantia*also favoured this study area. Emergent like *Alternantherasessilis, Scopariadulcis, Marsileaquadrifolia*and *Ipomeaaquatica* were recorded from continuously water logged area of the study area. Some of the emergent like *Ecliptaalba, Euphorbia hirta* and *Cyperusiria* were found on dry area near the study area.

In the present study, the Raunkiar's system of life form classification has been followed.The identified plants were categories as Phanerophytes, Chamaephytes, Hemicryptophytes, Geophytes and Cryptophytes. Presently observed species include 7.69% Chamaephytes which showed -38.31 deviation from normal biological spectrum; 15.38% phanerophytes and showed deviation of +6.38; 6.15% Cryptophytes and exhibits a deviation of +0.15%; 3.07% Hemi cryptophytes with a deviation of -22.93%; 67.69% Therophytes and the deviation from normal biological spectrum is +54.69(Table -7). There are five plant species belongs to Chamaephytes (*Polygonumglabrum*, *P. barbarum*, *Charazeylanica*, *C. Nitzii and Nitella hyaline*). Forty four plant species belongs to Therophytes, ten species belongs to Phanerophytes, four belongs to Cryptophytes and two plants belongs to Hemicryptophytes (*Ipomeaaquatica* and *Hydrillaverticillata*) Table -6.

Aquatic weeds are classified according to various habitats which form their eco-environment and become conducive for their growth, reproduction and dissemination. In the present study, some of the identified plants are called as aquatic weeds. They are *Nelumbonucifera, Ipomeaaquatica*(Rooted floating weed), *Cyperusrotundus, Commelinabenghalensis* (emergent weeds), *Cynodondactylon, Hydrillaverticillata, Azollapinnata* (Free floating weeds). These aquatic weeds interface with the static and flow water system. They cause tremendous loss of water from water bodies. Diffuse growth of these weeds provides an ideal habitat for the development of mosquitoes causing malaria and some other diseases. These weeds also serve as vectors for disease causing organisms and can greatly reduce the aesthetic value of water bodies from a recreational point of view. Our study area is enriched with small fishes that are due to the presence of aquatic weeds, because they provide continuous supply of phytoplankton.

The vegetation of the various plant species were classified after Raunkiar's life forms classifications as modified by Ellengberg and Muller-Dombois (1967) and Muller-Dombois and Ellemberg (1974).The form, habitat and nature of cotyledons, life form of occurrence of each species were studied in the field. The biological spectrum for the area has been compared with the Raunkiar;s Spectrum (Raunkiar's 1934, Muller Dombois and Ellemberg 1974).

Comparison of the presently prepared life form spectrum with that of the Raunkiar's normal biological spectrum of world revealed that therophytes were most (67.69%) higher than the normal spectrum and other life forms like phanerophytes (15.38%) and Cryptophytes (6.15%) are higher than the normal spectrum. Chamaephytes (7.69%) and Hemicrypotophytes (3.07%) were found less than the normal spectrum. Therophytes

were recorded five times higher than the normal spectrum and they are the indicators of amount of biotic influence on the vegetation and develop especially in the area where vegetation has been disturbed by overgrazing (Singh and Ambasht, 1975). Barucha and Dave (1994) stressed that higher Therophytes are indicators of the magnitude of influence of man and animals on the habitat Saxena and Singh (1982) prepared the biological spectrum for Himalayan vegetation across different altitudes. According to Asri (2003) therophytes are the indicators of dry conditions and also attributed to human activities. Abd EL-Ghani and Abdel-Khalik (2006) noted that the increase in grazing pressure throughout the southern Mediterranean ecosystems leads to the occupation of the under stories by invasive therophytes and indicates hyperdegradition. Kapoor and Singh (1990) also gave a detailed account of the life forms pattern in the temperature grass lands of Shimla hills, Himachal Pradesh.

The Biological spectrum of study area showed divergence when compared with Raunkiar's normal spectrum depicting the thero-phanerophytic (Therophytes -67.69%; Phanerophytes -15.38%) plant climate of the region. The preponderance of therophytes in the area may be due to the reason that the therophytes are the ephemerals, which survive adverse seasons in the form of seeds and predominantly found in extremes of dry, hot or cold, conditions.

Grasses are widespread than any other family of flowering plants of the world and represented by 10,000 species 261 genera (Karthikeyan, 2005). As in the case of any aquatic ecosystem, monocots dominate the vegetation having more species diversity in contrast to terrestrial habitats. But in this study, dicots are dominant than the monocots. Even though dicots are dominant Poaceae (Grasses), Cyperaceae (sedges), Hydrocharitaceae and Commelinaceae with 2, 7, 3 and 2 species respectively dominated the study area.

Cyperaceae with its wide range of distribution and habit adaptability found a place even in the Pre-Linnaean contribution. An analysis has revealed that most of the species of Cyperaceae belongs to Penninsularindia, while *Kallingabrevifolius, cyperusrotundus, Pycreuspunilis, Maricuscompaitus* etc., are cosmopolitan and *Cyperuscompressus, C. iria, Fimbristylisdichotoma*are pantropical, the rest are more or less restricted in distribution, and show a strong affinity to the flora of Tamil Nadu, India, South east Asia and China.

Several species of *Cyperus* and *Fimbristylis* are frequently found as weed and they have a very wide range of distribution in the tropics of India. The present study agrees with the finding of Rao and Varma (1982) that these plants are in the wide range of distribution.

Geographic distribution of terrestrial plant species is often limited by climatic factors, by competition with species that perform better under their local environment and by the reduced reproductive success of range limit populations (Garcia *et al* ., 2000). Moreover high proportion of widely distributed taxa among the aquatic plants may be due to uniformity of the aquatic environment, widespread clonally, high phenotypic plasticity, ecological factors and climate in particular. These factors are known to constrain the distribution of plant species, resulting in large vegetation zones (Walter, 1973). It can be argued that the rest of the species down come from the neighbouring phyto-geographical domains. Jordan (2001) point out that geographical barriers and patterns of long – distance dispersal are often referred to as contributes to the distribution of aquatic flora.

The utilization of aquatic associated macrophytes at a sustainable basis can only succeed if the surface water and aquatic ecosystems are properly managed. Surface water and wetlands, and consequently aquatic plants are constantly threatened by a number of factors which include: drainage of wetlands for crop production, stream channelization and flood control, housing development, solid waste and nutrient loading from domestic sewage and agricultural runoff. The domestic sewage and industrial waste adversely affect the quality of water and consequently the flora and fauna of the water bodies (Verma, 2002). The human activities alter the structure of surface water and give a selective advantage to one, or a few species which develop a large population, 'crowd' out other species and lower the total community productivity.

Aquatic plants are especially sensitive to changes (increases in nutrient concentration and to organic pollutants. The physico-chemical characteristics have been found to exert influences on the biological production in water bodies (Kaushik*et al.,* 2002). The aquatic weeds, which are a common sight in any aquatic system, become a menace for water bodies. In many places de-weeding is a big programme, so in such a situation, if we can harness the potential of the weeds for better

utility in indigenous medicine we can conserve the diversity of macrophytic plant population.

The present study indicates that the studied areas are very rich in flora biodiversity and indigenous knowledge. The local people are dependent on these species not only for domestic uses (especially food, manure, raw-materials), but also to cure various diseases. According to collected information, only small quantities of some species are collected and sell in market. However, there are possibilities to enhance the income of the local communities, if properly managed the habitats and potential species in an integrated manner with the involvement of local people in planning and management of the resources. So it is recommended to initiate the activities, such as inventory of useful species, habitat characteristics, identification of potential species for various economic uses and formulation and implementation of plan of actions taking consideration of the needs of people and sustainable management of the wetlands.

When questioned about the changing status of the existing plants, our respondents mentioned that the alien and invasive species are spreading very fast in the water bodies impacting on the growth of the native species. Some species, especially species of*Nelumbo, Nymphoides* and *Trapa* are declined in abundance during the last decade. Priority should be focused on the conservation of the valuable native species and their habitats with the integrated management measures.

4. CONCLUSION

The present trend of uses of plant diversity in the study area indicated that the uses of plants and traditional practices will continue to play a significant role in the socio-cultural life of these village communities. But the trend of decline of the abundance of some very useful native species, increase of unsustainable anthropogenic practices and encroachments and spreading of invasive species show that action for conservation is urgently needed. Therefore, priority should be given to implement conservation activities with integrated approach for sustainable development.

Table 1. List of aquatic macrophytic species identified in the study area (Kurandikulam, Melasankarankuzhi, Kanyakumari District).

S. No	Botanical Name	Habitat Status
	ANGIOSPERMS DICOTYLEDONS	
	AMARANTHACEAE	
1	*Achyranthesaspera*Linn.	Marginal
2	*Alternantherasessilis*Linn.	Emergent
3	*Amaranthusspinosus*Linn.	Marginal
4	*Digeramuricata*L.	Marginal
5	*Gomphrenacelosioides*Mart.	Marginal
	ASTERACEAE	
6	*Tridaxprocumbens*Linn.	Marginal
7	*Partheniumhysterophorus*Linn.	Marginal
8	*Eclipta alba* Hassk.	Emerrgent
	BORAGINACEAE	
9	*Heliotropiumindicum*Linn.	Marginal
	CONVOLVULACEAE	
10	*Ipomoea aquatica*Forsk.	Emergent
11	*Convolvulus arvensis*Linn.	Margianl
	CAESALPINIACEAE	
12	*Cassia occidentalis*Linn.	Marginal
13	*Cassia tora*Linn.	Marginal
	CAPPARACEAE	
14	*Cleome viscosa*Linn.	Marginal
	EUPHORBIACEAE	
15	*Euphorbia hirta*Linn.	Marginal
16	*Phyllanthus simplex* Rertz.	Marginal
17	*Acalyphaindica*Linn.	Marginal
	LAMIACEAE	
18	*Ocimum sanctum* Linn.	Marginal
19	*Anisomelesmalabarica*Linn.	Marginal
20	*Leucasaspera (*willd.) Spreng.	Marginal
	MALAVACEAE	
21	*Sidarhombifolia*Linn.	Marginal
22	*Abutilon indicum (*Linn*).*	Marginal
	NELUMBONACEAE	
23	*NelumbonuciferaGaertn.* Fruct.	Floating
	NYMPHAEACEAE	
24	*Nymphaeastellata*Willd.	Floating
	LENTIBULARIACEAE	
25	*Utricullariastellaris*linn.	Submerged
	ONAGRACEAE	
26	*Ludwigiahyssopifolia (*G.Don)	Floating
	PAPAVERACEAE	
27	*Argemonemexicana*Linn.	Marginal
	POLYGONACEAE	
28	*Polygonumgrabrum*Willd.	Emergent
29	*Polygonumbarbatum*Linn.	Emergent
	SOLANACEAE	
30	*Solanumnigrum*Linn.	Marginal
31	*Solanumxanthocarpum*schrad.	Marginal
32	*Datura metal* L.	Marginal
33	*Physalis minima* Linn.	Marginal

	SAPINDACEAE	
34	*Cardiospermumhalicacabum*Linn.	Marginal
	SCORPHULARIACEAE	
35	*Scopariadulcis*linn.	Emergent
	RUBIACEAE	
36	*Lantana camara*Linn.	Marginal
37	*Clerodendrumviscosum*Vent.	Marginal
	MONOCOTYLEDONS-ARACEAE	
38	*Colocasiaesculenta*Linn.	Marginal
	CERATOPHYLLACEAE	
39	*Ceratophyllumdemersum*Linn.	Submerged
	CYPERACEAE	
40	*Maricuscompaitus*Retzius	Emergent
41	*Pycreuspunilis*L.	Emergent
42	*Fimbristylisdichotoma*L	Emergent
43	*Cyperuscompressus*Linn.	Emergent
44	*Cyperusrotundus*Linn.	Emergent
45	*Cyperusiria*Linn.	Emergent
46	*Kallingabrevifolia*Rott ball.	Emergent
	COMMENLINACEAE	
47	*Commelinabenghalensis*Linn.	Emergent
48	*Commenlinanudiflora*Linn.	Emergent
	LEMNACEAE	
49	*Lemna minor* Linn.	Floating
	HYDROCHARITACEAE	
50	*Hydrillaverticillata*Linn.	Submerged
51	*Otteliaalsinoides*Linn.	Submerged
52	*Vallisnariaspiralis*Linn.	Submerged
	PONTEDERIACEAE	
53	*Potamogetonmalaianus*Miquel	Submerged
	POACEAE	
54	*Cynodondactylon*Linn.	Marginal
55	*Chlorisbarbata*L.	Marginal
	THALLOPHYTA (ALGAE)	
	CHAROPHYCEAE	
56	*Charazeylanica*Willd	Submerged
57	*Charanitzii*Schw.	Submerged
58	*Nitella hyaline* Agardh	Submerged
	PTERIDOPHYTA-SALVINACEAE	
59	*Azollapinnata*R. brown	Floating
60	*Salvinianatans*Linn.	Floating
	MARSILEACEAE	
61	*Marsileaquadrifolia*Linn.	Emergent
	SELAGINELLACEAE	
62	*Selaginella*species	Emergent
	MARCHANTIACEAE	
63	*Marchantia*species	Floating
	POLYTRICHACEAE	
64	*Polytrichum commune*	Emergent
65	*Polytrichumjuniperinum*	Emergent

Table 2, Family wise distribution of aquatic macrophytes in the study area (Erattaikulam, Thoopur, Kanyakumari District).

S. No	Family	No. of species	No. of genus	% Composition
1	Amaranthaceae	5	5	7.6%
2	Araceae	1	1	1.5%
3	Asteraceae	3	3	4.5%
4	Boraginaceae	1	1	1.5%
5	Caesalpiniaceae	2	1	3.0%
6	Capparaceae	1	1	1.5%
7	Ceratophyllaceae	1	1	1.5%
8	Charophyceae	3	2	3.0%
9	Commelinaceae	2	1	3.0%
10	Convolvulaceae	2	2	3.0%
11	Cyperaceae	7	5	10.6%
12	Euphorbiaceae	3	3	4.5%
13	Hydrocharitaceae	3	3	4.5%
14	Lamiaceae	3	3	4.5%
14	Lemnaceae	1	1	1.5%
16	Lentibulariaceae	1	1	1.5%
17	Malvaceae	1	1	1.5%
18	Marchantiaceae	1	1	1.5%
19	Marsileaceae	1	1	1.5%
20	Nelumbonaeceae	1	1	1.5%
21	Nymphaeaceae	1	1	1.5%
22	Onagraceae	1	1	1.5%
23	Papaveraceae	1	1	1.5%
24	Poaceae	2	2	3.0%
25	Polygonaceae	2	1	3%
26	Polytrichaceae	2	1	3.0%
27	Pontederiaceae	1	1	1.5%
28	Potamogetonaceae	1	1	1.5%
29	Rubiaceae	2	2	3%
30	Salviniaceae	2	2	3.0%
31	Sapindaceae	1	1	1.5%
32	Scrophulariaceae	1	1	1.5%
33	Selaginellaceae	1	1	1.5%
34	Solanaceae	4	3	6.0%

Table 3. Taxonomic data of aquatic macrophytes of study area.

	D	M	A	P	B	Total
Families	19	9	1	3	2	34
Genera	33	16	2	4	2	62
Species	36	19	3	4	3	65

D – Dicots; M- Monocots; A – Algae; P - Pteridophytes; B- Bryophytes.

Table 4. Habitat status of the identified plants in the area.

Habitats	Marginal	Floating	Emergent	Total
Number of plants	30	7	19	65

Table 5. Identified plants in the study area and its uses

S.No	Name of the plants	Uses
1	*Alternantherasessilis*(L.)DC.	Whole plant used in conditions of kapha and pitta, burning sensation, leprosy, skin disease, dysepesia, haemorrhoids and fever. Leaf used in bone fracture, eye complaints, bite of rabid dog, snakebite and night blind.
2	*Ceratophyllumdemersum*L	Whole plant used as a cooling agent and scorpion sting.
3	*Commelinabenghalensis*L.	The plant is useful to treat bedsores, breast sores and pimples. It is also used to control Haemorrhages.
4	*CynodondactylonPers*	Leaf juice drunk to relieve body pain. Leaf juice mixed with lime applied to cure inflammation.
5	*Cyperusrotundus*L.	Root used in bowl complaints, diuretic, jaundice, sores and wound. Bulb used in dysentery.
6	*Ecliptaprostrata*L.	The whole plant is used to treat jaundice, liver and spleen complaints, malaria, anti-fertility, ulcers and wounds. Roots used as an antidote to snakebite. Plant is squeezed and boiled with coconut oil, applied on the scalp is a good medicine for preventing hair loss and dandruff.
7	*Ipomoea aquatica*forsk	Leaf juice used as a mild purgative and blood purifier.
8	*Ludwigiahyssopifolia*(G.Don).	Leaves used to cure cuts, wounds and sores.
9	*Marsileaquadrifolia*L.	Whole plant is useful in psychopathy, opthalmis, diarrhoea, cough, bronchitis, leprosy, skin diseases, dyspesia, haemmorrhoides, fever and insomnia.
10	*NelumbonuciferaGaetn*	Whole plant is given in hyperdipsia, chloera, diarrhoea, helminthiasis, vomiting and cardiac debility, flowers used as a cardio tonic in fever and diseases of liver. Rhizome used in treatment of piles. Seeds used as cooling medicine for skin diseases.
11	*Nymphaeastellata*wild.	Whole plant used as cardio tonic.
12	*Polygonumglabrum*wild.	Plants used as a febrifuge and the infusion of leaves in colic pain.
13	*Vallisneriaspiralis*L.	Whole plant is used as a stomachic and for leucorrhoea.
14	*Eichhorniacrassipes*(Mart.) Solms	The whole plant used as manure and for fattening pigs.
15	*Hydrillaverticillata*(L.F.)	It is eaten by some fishes and it is a good oxygenator. It is suitable for aquaria.
16	*Otteliaalsinoides*(L.) Pers.	The fruits are eaten by children. The petioles and blades are used as vegetables.
17	*Polygonumbarbatum*L.	The root is used as an astringent and cooling remedy. The leaves and stalks is said to be used as a stimulating wash for ulcers.
18	*Utricula riastellaris*L.	Ecologically the plant is a good oxygenator of water and is used by fishes for food.
19	*Vallisneriaspiralis*L.	Ecologically the plant is a good oxygenator of water and is used by fish for food.

Table 6. Life form classification of the aquatic macrophytic species from the study area.

Life Forms	Name of the Plants	No.of Species	% Composition
Chamaephytes (CH)	*Polygonumglabrum,* P.*barbatum, Charazeylanica,* C.*Nitzii, Nitella hyaline.*	5	7.69
Phanerophytes (P)	*Utricularia*stellaris*, Azollapinnata, Salvinianatans, Ceratophyllumdemersum, Marsileaquadrifolia, Lemna minor, Marchantia*species*, Nelumbonucifera, Nymphaeastellata, Ludwigiahyssopifolia.*	10	15.38
Cryptophytes (C)	*Vallisneriaspiralis, Colacasiaesculenta, Potamogetonmalaianus, Otteliaalsinoides.*	4	6.15
Therophytes (T)	*Alternantherasessilis, Eclipta alba, Commelinabenghalensis,* C*. nudiflora, Cyperuscompressus,* C.*rotundus,* C*. iria, Maricuscampaitus, Pycreuspunilis, Kallingabrevifolia, Achyranthusaspera, Amaranthusspinosus, Digeramuricata, Gomphrenacelosioides, Tridaxprocumbens, Partheniumhysterophorus, Heliotropiumindicum, Convolvulus alsinoides, Cassia tora, Cassia occidentalis, Cleome viscosa, Euphorbia hirta, Phyllanthus simplex, Acalyphaindica, Ocimum sanctum, Anisomelesmalabarica, Leucasaspera, Sidarhombifolia, Abutilon indicum, Argemonemexicana, Solanumnigrum,* S*. xanthocarpum, Datura metal, Cardiospermumhalicacabum, Lantana camera, Cleorodendrumviscosum, Cynodondactylon, Chlorisbarbata, Polytrichum commune,* P.*juniperinum, Selaginella*sp*, Physalis minima, Scopariadulcis.*	44	67.69
Hemicryptophytes (H)	*Ipomoea aquatica, Hydrillaverticillata.*	2	3.07

Table 7. Biological spectrum (%) of all life forms found in the study area.

Life Form Classes	No. of Species	Life forms (%) Present study	Raunkiar's normal spectrum and composition (%)	Deviation of Normal Spectrum
Ch	5	7.69	46	-38.31
P_H	10	15.38	9	46.38
C	4	6.15	6	+0.15
H	2	3.07	26	-22.93
Th	44	67.69	13	+54.69
Total	65	100	100	

Ch - Chamaephytes; C - Cryptophytes; H - Hemicryptophytes; Th – Therophytes; P-Phanerophytes

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