



Limnological studies of Hirehonnalli lake, Kalghatgi taluk, Dharwad district, Karnataka

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Abstract

Limnological studies at Hirehonnalli lake reports phytoplanktons recorded highest during summer season and less during rainy rainy season. Recorded 60 phytoplanktons in that Bacillariophyceae is dominant. Angiosperms recorded 96 species, in that Fabaceae, Asteraceae, Solanaceae, Euphorbiaceae, Amaranthaceae, Convolvulaceae, Boraginaceae, Acanthaceae and Malvaceae are the dominant families. Hirehonnallilake water is not good for drinking as per the above results from our study. Seasonal various with physiochemical parameters like Temperature, pH, TDS, Total alkalinity, Dissolve Oxygen, Chemical Oxygen Demand were conducted monthly from January to July which includes winter, rainy and summer seasons. Some major tests were conducted once at the seasons during winter, summer and rainy seasons like Total hardness, Calcium hardness and Magnesium hardness.

Keywords: Angiosperm diversity, Hirehonnalli lake, Physiochemical parameters, Phytoplanktons.

Introduction

Limnology, the study of freshwater systems, has been gaining importance lately. Understanding the physical, chemical, and biological aspects of water, along with the morphology and catchment areas of inland water bodies, helps in utilizing these habitats for irrigation and fishery purposes. Water, in its various forms like oceans, rivers, lakes, clouds, rain, and snow, is crucial for all life on Earth(Prasad, *et al.*, 2017).Phytoplankton are

essential microorganisms in aquatic environments, playing a vital role in maintaining the stability and functioning of aquatic ecosystems. As primary producers, they form the base of the food chain, converting inorganic substances into organic matter through photosynthesis, providing energy for the entire ecosystem (Shengnan, *et al.*, 2024).Study of phytoplankton community in Bhalki tank,

Karnataka, India they focused on how different physico-chemical factors, like nutrients, limiting elements, sewage influx, and runoff from nearby fields, affected various groups of algae. The changes in water chemistry due to sewage and runoff had a big impact on the abundance of Cyanophyceae, Chlorophyceae, Euglenophyceae, and Bacillariophyceae. Factors such as temperature, pH, calcium, magnesium, chlorine, silicon, sulfate, total solids, and organic matter (Siddamallayya, 2007). The study on the periodicity of phytoplankton in Guthal Lake of Mandya from June 2014 to May 2015 correlated 18 physicochemical parameters with four groups of planktonic populations. The phytoplankton communities in the lake respond to variations in the water's physicochemical conditions throughout the year. They are crucial for assessing the overall health and productivity of the lake ecosystem (Mahadev, *et al.*, 2016). Limnological Studies in Ponds and Lakes of Dharwad reported Physio-chemical complexes, distribution and periodicity of phytoplankton from Yemmekeri pond, Railway pond, Kelgeri lake and Nuggikeri lake situated in dharwar (Hosmani, 1975). Hydrobiological studies in ponds and lakes of Dharwad reported concentration of Phytoplanktons of Railway gate pond, Nuggikeri Lake and Hirekeri lake. In this Nuggikeri lake records the highest phytoplankton concentration. Recorded Psycho-chemical parameters (Mulgund, 1982). The study on the potential of different classes of algae like Cyanophyceae, Chlorophyceae, Bacillariophyceae, and Euglenineae in Nakane Lake, Dhule district. In Maharashtra, the study involved analyzing the algal and physicochemical properties of the water (Khairnar, *et al.*, 2022). The study of phytoplankton diversity of the Gogi lake ecosystem Yadgir District, Karnataka. Reported twenty-one phytoplankton species categorized into four classes: Bacillariophyceae (8 species), Chlorophyceae (7 species), Cyanophyceae (5 species), and Charophyceae (1 species). These species are further classified into twelve families, with Fragilariaceae (4 species), Bacillariaceae (3 species), Zygnemataceae (3 species) (Bhaskar, *et al.*, 2015). Essential water quality factors such as

pH, temperature, TDS, DO, BOD, total hardness, calcium, magnesium, and salinity were analyzed. The evaluation of pollution levels in the water samples was done by comparing the measured values of these physicochemical parameters with the WHO's recommended standards for drinking water (Anil Kumar, *et al.*, 2020). Studies on the Physio-Chemical Parameters of Mailapur Reservoir at Yadgir District, Karnataka State reports concludes that the Mailapur reservoirs were good in water quality, high ecological status and useful for the fish production (Basawarajeshwari, 2019).

Materials and Methods

Study area: The Hirehonnalli lake is situated in Hirehonne halli village. This is about 8km away from sub-district headquarter Kalghatgi (Tehsildar office) and 27km away from district headquarter Dharwad (Fig. 1). The total area of this lake is 20 acres. It is situated at DMS15°14'41.8"N 75°00'07.9"E. As the lake records 550 m altitude above sea level. Lake is surrounded by farms for agriculture purpose, also constructed canals around the lake for Agriculture usage. It is primarily used as a source of irrigation and secondary for fishery purpose. In this way lake is characterized by submerged vegetation in absence noted to decline in water level during summer and some anthropogenic activities.

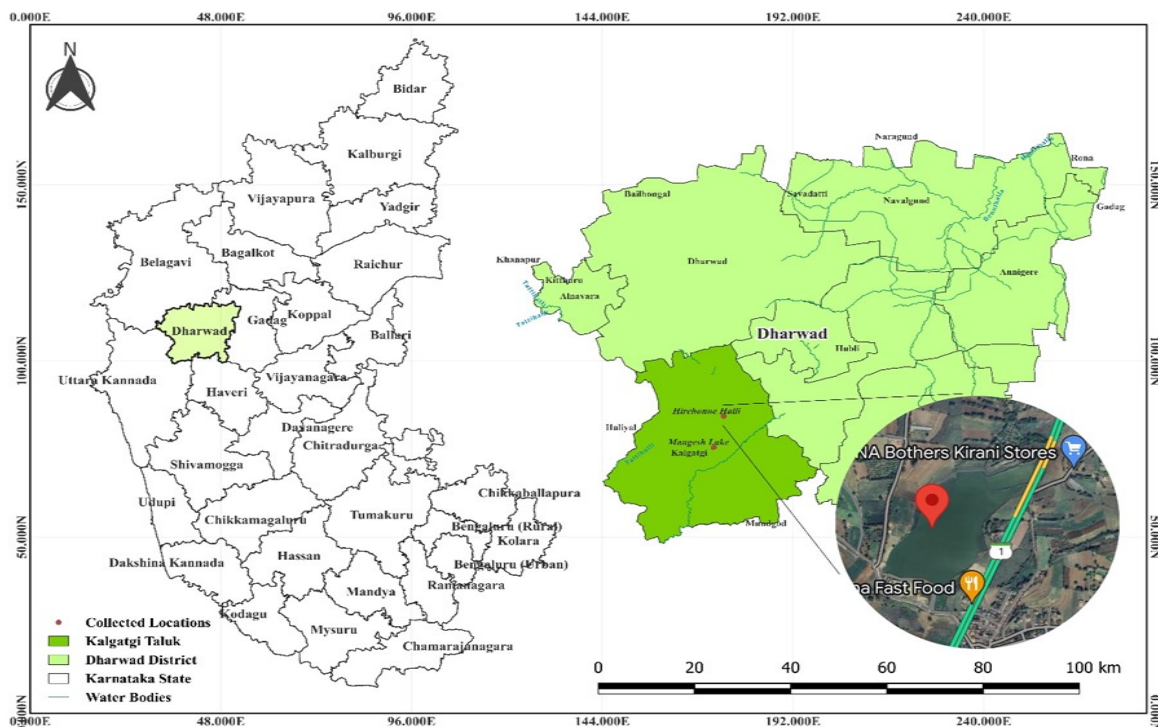


Fig.1:Map of study Area showing Hirehonne halli Lake

Collection of Samples: Samples were collected in three forms i.e. Water sample, and Phytoplankton. Water sample was collected monthly once for Physiochemical tests. Phytoplankton samples were also collected monthly at morning hours (8-10 am) once to assess the diversity and documentation.

Identification of phytoplankton: An Introduction to Phytoplanktons: Diversity and Ecology (Ruma Pal & Avik Kumar, 2013). Training Manual on Phytoplankton Identification Taxonomy (Gopinathan, *et al.*, 2010) Phytoplankton identification and water quality monitoring along the fish-cage belt at Magat dam reservoir, Philippines (Francis & Jonathan, 2016). Freshwater Algae Identification and Use as Bioindicators (Edward B. G. & S. C. David, 2010).

Physio-chemical Parameters:

Physio-chemical Parameters were conducted minor tests for monthly and some major tests for two seasons with following standard methods:

Chemical Oxygen Demand (Champika, 1993); Total Alkinity Test (APHA test, 1992); Dissolved Oxygen test (Winkler method); Electrochemical Conductivity: This has been conducted in Shilpa Biologicals Pvt. Ltd.; Chloride Test (Mohr’s test); Determination of Total Hardness by Volumetric (EDTA) Method (FSSAI, 2015); Determination of Calcium by Volumetric Method (FSSAI, 2015); Determination of Magnesium by Calculation Method (FSSAI, 2015); Determination of Chlorophyll content in a given sample by UV spectrophotometric method (Aminot & Franscico, 2000).

Results

Phytoplanktons were recorded highest during summer season (Table 1 & Fig. 2-5). Total Classes of phytoplanktons (Table-2) in Hirehonnehalli lake are Bacillariophyceae (22), Chlorophyceae (13), Cyanophyceae (13), Euglenophyceae (6), Zygnematophyceae (3), Trebouxiophyceae (1), Coscinodiscophyceae (1), Peranemia (1).

Table 1: Phytoplanktons in Hirehonnalli Lake

Sl. No.	Scientific name	Class	Family
1	<i>Achnanthes Sp.</i>	Bacillariophyceae	Achnanthaceae
2	<i>Amphora sp.</i>	Bacillariophyceae	Catenulaceae
3	<i>Anabaena sp.</i>	Cyanophyceae	Nostocaceae
4	<i>Anomoeoneis sp.</i>	Bacillariophyceae	Anomoeoneidaceae
5	<i>Arthrospira platensis</i> Gomont	Cyanophyceae	Microcoleaceae
6	<i>Asterococcus superbus</i> (Cienkowski) Scherffel	Chlorophyceae	Palmellosidaceae
7	<i>Aulacoseira sp.</i>	Coccosinodiscophyceae	Aulacoseiraceae
8	<i>Chlamydocapsa planctonica</i> (West & G.S.West) Fott	Chlorophyceae	Palmellopsidaceae
9	<i>Chlorella vulgaris</i> Beijerinck	Trebouxiophyceae	Chlorellariceae
10	<i>Chlorococcum humicola</i> (Nägeli) Rabenhorst	Chlorophyceae	Chlorococcaceae
11	<i>Chroococcus sp.</i>	Cyanophyceae	Chroococcaceae
12	<i>Chroococcus sp.</i>	Cyanophyceae	Chroococcaceae
13	<i>Closterium moniliferum var. minus</i> H.Alten	Zygnematophyceae	Closteriaceae
14	<i>Cocconeis placentula</i> Ehrenberg	Bacillariophyceae	Cocconeidaceae
15	<i>Desmodesmus intermedius</i> (Chodat) E.Hegewald	Chlorophyceae	Scenedesmaceae
16	<i>Desmodesmus maximus</i> (West & G.S.West) Hegewald	Chlorophyceae	Scenedesmaceae
17	<i>Desmodesmus sp.</i>	Chlorophyceae	Scenedesmaceae
18	<i>Euglena acus</i> (OF.Müller) Ehrenberg	Euglenophyceae	Euglenaceae
19	<i>Euglena gracilis</i> G.A.Klebs	Euglenophyceae	Euglenaceae
20	<i>Gomphonema micropus</i> Kützing	Bacillariophyceae	Gomphonemataceae
21	<i>Gyrosigma acuminatum</i> (Kützing) Rabenhorst	Bacillariophyceae	Naviculaceae
22	<i>Gyrosigma kuetzingii</i> (Grunow) Cleve	Bacillariophyceae	Naviculaceae
23	<i>Kirchneriella lunaris</i> (Kirchner) Möbius	Chlorophyceae	Selenastraceae
24	<i>Lepocinclis acus</i> (O.F.Müller) B.Marin & Melkonian	Euglenophyceae	Phacaceae
25	<i>Lepocinclis ovum</i> (Ehrenberg) Lemmermann	Euglenophyceae	Phacaceae
26	<i>Mastogloia sp.</i>	Bacillariophyceae	Mastogloiaceae
27	<i>Merismopodia sp.</i>	Cyanophyceae	Merismopediaceae
28	<i>Microcystis aeruginosa</i> (Kützing) Kützing	Cyanophyceae	Microcystaceae
29	<i>Microcystis novacekii</i> (Komárek) Compère	Cyanophyceae	Microcystaceae
30	<i>Monoraphidium contortum</i> (Thuret) Komárková-Legnerová	Chlorophyceae	Selenastraceae
31	<i>Monoraphidium griffithii</i> (Berkeley) Komárková- Legnerová	Cyanophyceae	Selenastraceae
32	<i>Navicula cryptocephala f. veneta</i> (Kützing) Hustedt	Bacillariophyceae	Naviculaceae
33	<i>Navicula germainii</i> J. H. Wallace	Bacillariophyceae	Naviculaceae

34	<i>Navicula gregaria</i> Donkin	Bacillariophyceae	Naviculaceae
35	<i>Navicula</i> sp.	Bacillariophyceae	Naviculaceae
36	<i>Navicula viridis</i> (Nitzsch) Ehrenberg	Bacillariophyceae	Naviculaceae
37	<i>Neidium affine</i> (Ehrenberg) Pfitzer	Bacillariophyceae	Neidiaceae
38	<i>Nitzschia acicularis</i> (Kützing) W.Smith	Bacillariophyceae	Bacillariaceae
39	<i>Nitzschia elongata</i> Hantzsch, nom. illeg.	Bacillariophyceae	Bacillariaceae
40	<i>Nitzschia palea</i> (Kützing) W.Smith	Bacillariophyceae	Bacillariaceae
41	<i>Nitzschia recta</i> Hantzsch ex Rabenhorst	Bacillariophyceae	Bacillariaceae
42	<i>Nitzschia umbonata</i> (Ehrenberg) Lange-Bertalot	Bacillariophyceae	Bacillariaceae
43	<i>Oscillatoria limosa</i> C.Agardh ex Gomont	Cyanophyceae	Oscillatoriaceae
44	<i>Oscillatoria nigra</i> Vaucher ex Gomont	Cyanophyceae	Oscillatoriaceae
45	<i>Pectinodesmus pectinatus</i> (Meyen) E.Hegewald, M.Wolf, ...	Chlorophyceae	Scenedesmaceae
46	<i>Peranema inflexum</i> Skuja	Peranemia	Peranemataceae
47	<i>Phacus acuminatus</i> Drezepolski	Euglenophyceae	Phacaceae
48	<i>Phaculus longicauda</i> (Ehrenberg) Dujardin	Euglenophyceae	Phacaceae
49	<i>Phormidium microtomum</i> Skuja	Cyanophyceae	Oscillatoriaceae
50	<i>Pinnularia rabenhorstii</i> (Grunow) Krammer	Bacillariophyceae	Pinnulariaceae
51	<i>Pleurosigma</i> sp.	Bacillariophyceae	Pleurosigmataceae
52	<i>Scenedesmus dimorphus</i> (Turpin) Kützing	Chlorophyceae	Scenedesmaceae
53	<i>Spirogyra porticalis</i> (O.F.Müller) Dumortier	Zygnematophyceae	Spirogyraceae
54	<i>Spirogyra</i> sp.	Zygnematophyceae	Spirogyraceae
55	<i>Spirulina</i> sp.	Cyanophyceae	Spirulinaceae
56	<i>Synechocystis crassa</i> Woronichin	Cyanophyceae	Microcystaceae
57	<i>Synedra gracilis</i> Kützing	Bacillariophyceae	Fragilarceae
58	<i>Tetradesmus major</i> f. <i>lunatus</i> (Korshikov) Fott & Komárek	Chlorophyceae	Scenedesmaceae
59	<i>Tetraedron minimum</i> (A.Braun) Hansgirg	Chlorophyceae	Hydrodictyaceae
60	<i>Tetraedron</i> sp.	Chlorophyceae	Chlorophyceae

Table.2: Phytoplankton Classes from Hirehonnalli Lake

Class	No. of species
Bacillariophyceae	22
Chlorophyceae	13
Cyanophyceae	13
Euglenophyceae	6
Zygnematophyceae	3
Trebouxiophyceae	1
Coccolithophyceae	1
Peranemia	1
Total	60

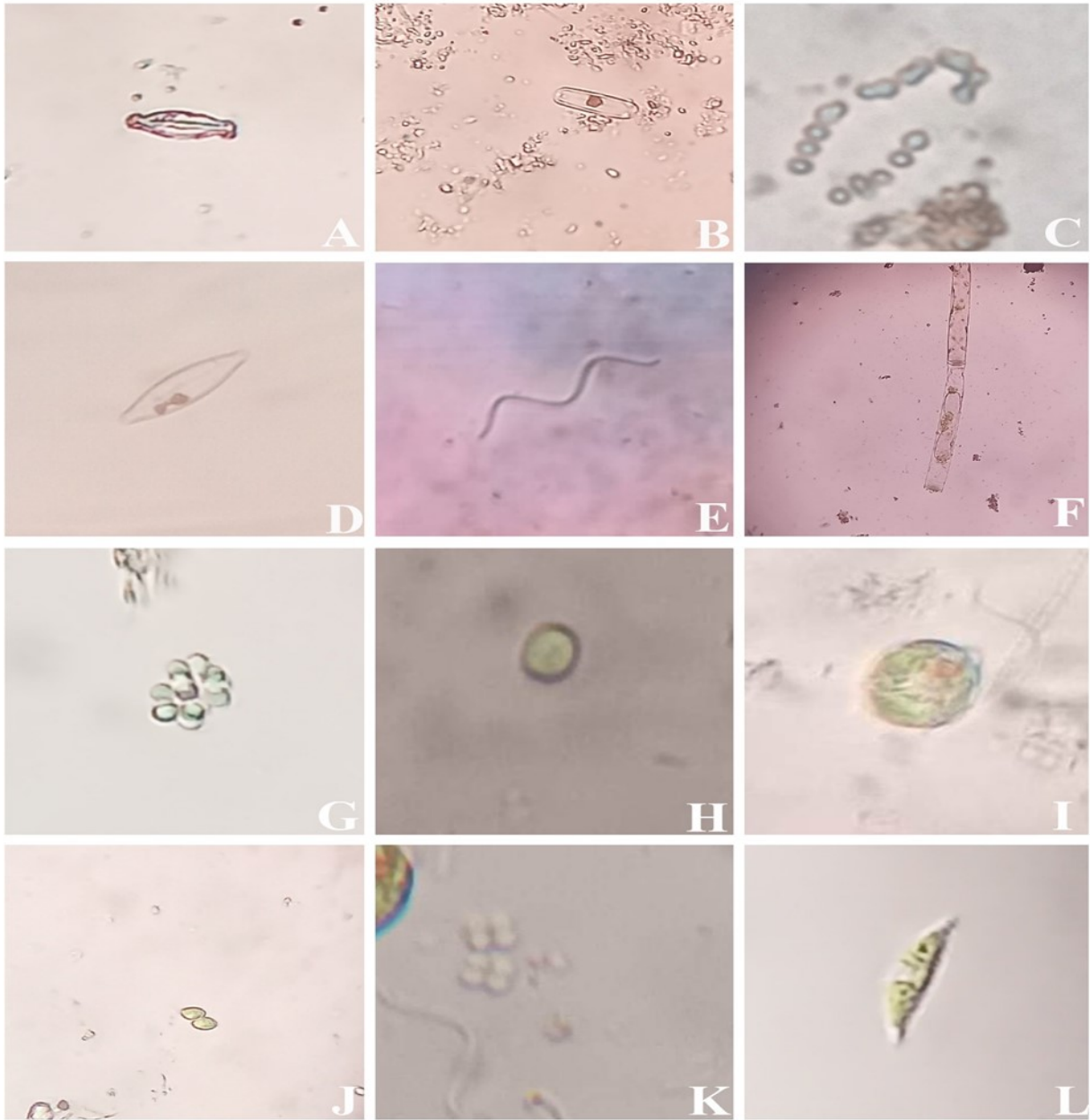


Fig. 2:A.*Achnanthes* sp.; B.*Amphora* sp.; C. *Anabaena* sp.; D.*Anomoeoneis* sp.; E.*arthrospira platensis*; F.*Aulacoseira* sp.; G.*Chlamydocapsa planctonica*; H.*Chlorella vulgaris*; I.*Chlorococcum humicola*; J.*Chroococcus* sp.; K.*Chroococcus* sp.; L.*Closterium moniliferum*.

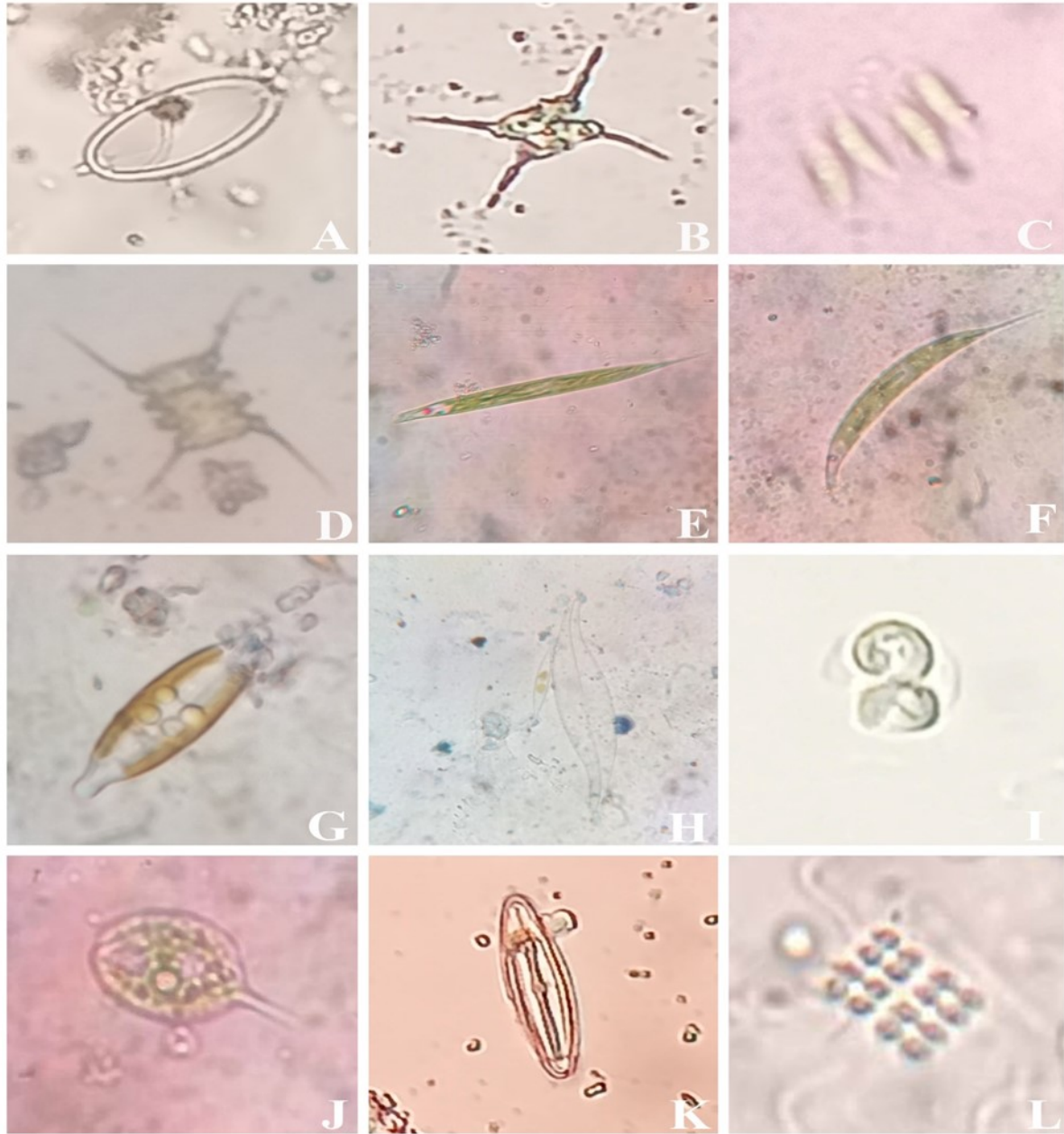


Fig. 3:A. *Cocconiesplacentula*; B.*Desmodesmus* sp.; C. *Desmodesmusintermedius*; D. *Desmodesmus maximus*; E. *Euglena acus*; F.*Euglena gracilis*; G. *Gomphonema micropus*; H. *Gyrosigma acuminatum*; I. *Kirchneriella lunaris*; J. *Lepocinclis ovum*; K. *Mastogloia sp.*; L. *Merismopodia sp.*

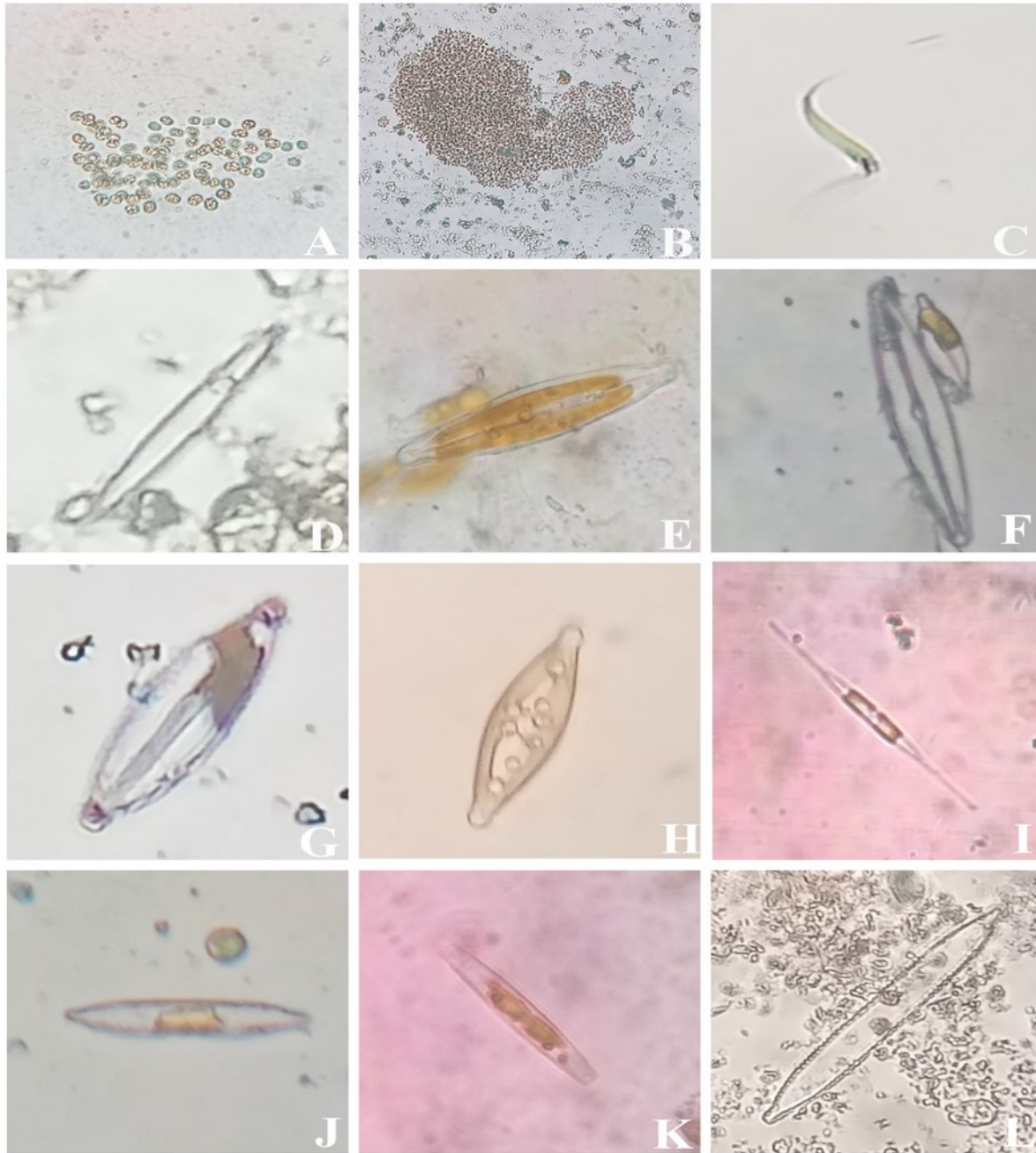


Fig. 4: **A.** *Microcystis aeruginosa*; **B.** *Microcystis novacekii*; **C.** *Monoraphidium contortum*; **D.** *monoraphidium griffithii*; **E.** *navicula cryptocephala*; **F.** *Navicula germanii*; **G.** *Navicula* sp.; **H.** *Neidium affine*; **I.** *Nitzschia acicularis*; **J.** *Nitzschia elongata*; **K.** *Nitzschia palea*; **L.** *Nitzschia umbonata*.

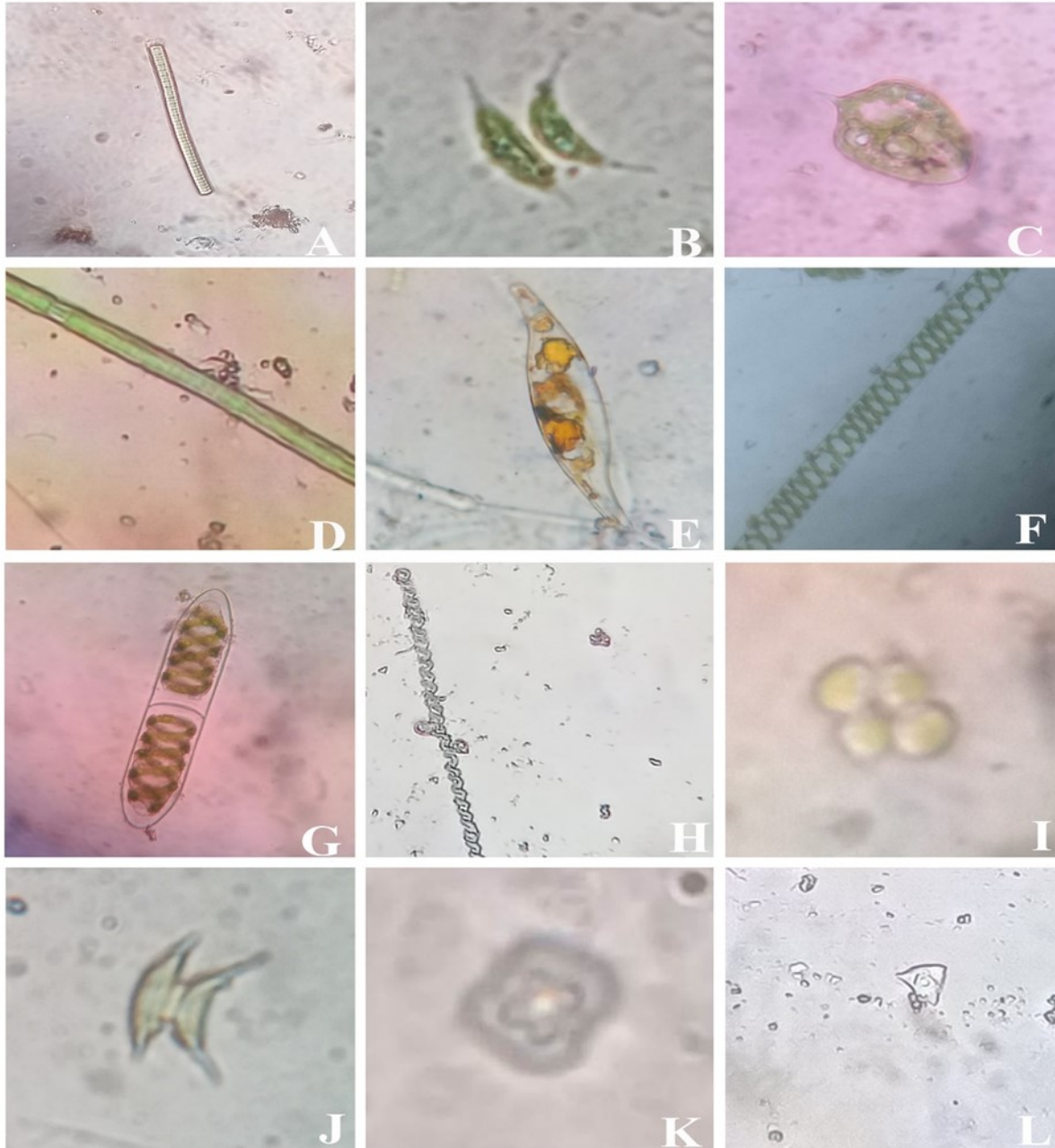


Fig. 5: A. *Oscillatoria limosa*; B. *Pectinodesmus pectinatus*; C. *Phacus acuminatus*; D. *Phormidium microtomum*; E. *Pleurosigma* sp.; F. *Spirogyra porticalis*; G. *Spirogyra* sp.; H. *Spirulina* sp.; I. *Synechocystis crassa*; J. *Tetrademus major*; K. *Tetraedron minimum*; L. *Tetraedron* sp.

The highest content of chlorophyll from phytoplanktons in summer season. Bacillariophyceae members influences the presence of high DO, TDS, Phosphate and BOD are matching with Thirugnanamoorthy & Selvaraju, 2009. This lake records the same with high DO, TDS and Phosphate with high number

of Bacillariophyceae members studied by the earlier workers.

Angiosperm survey was conducted monthly two times during period of January to July 2024 consisting 3 season (Winter, Summer and Rainy season). Recorded 96 species of Angiosperms (Fig. 6-12).

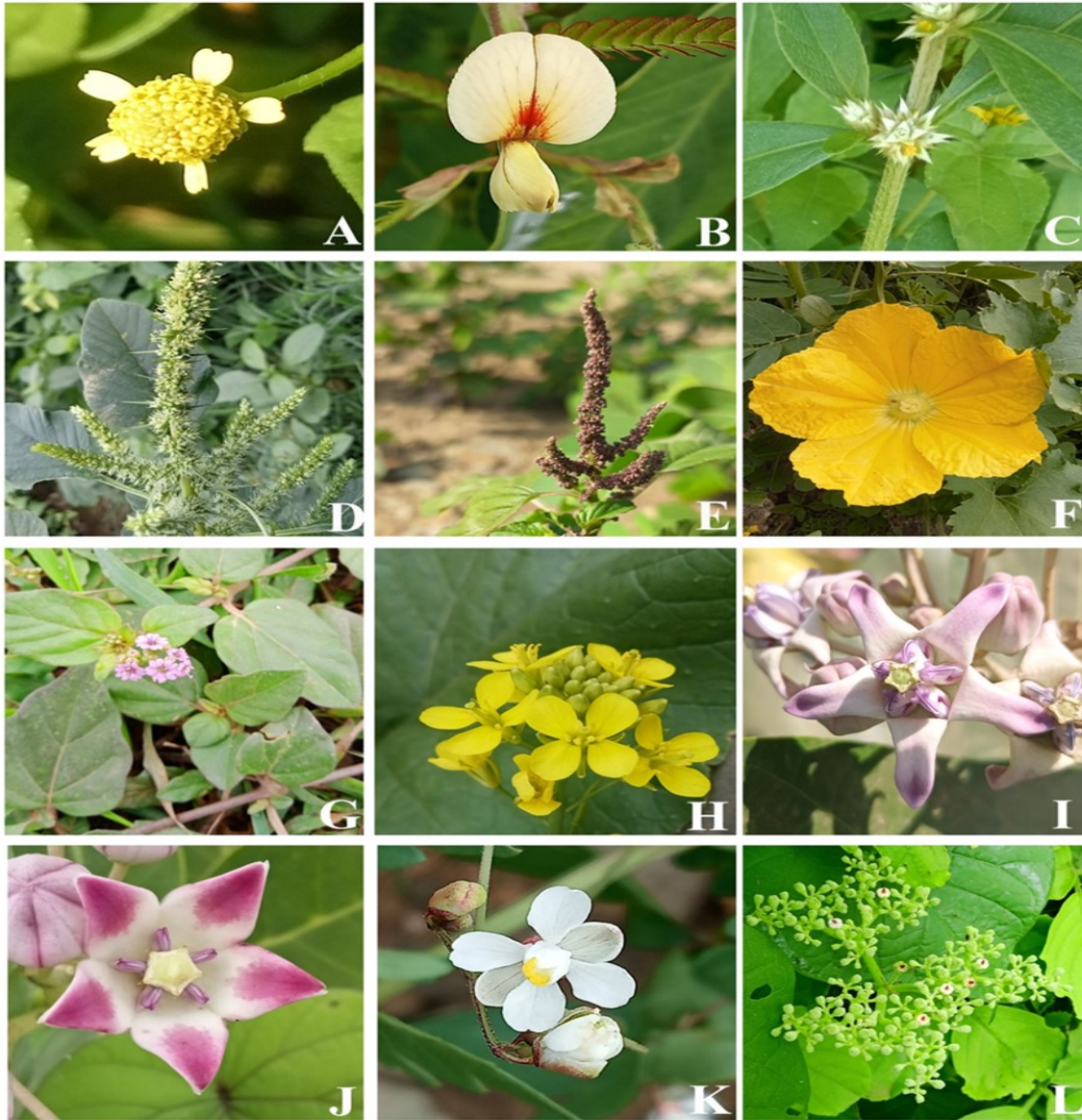


Fig. 6: **A.** *Acmella radicans*; **B.** *Aeschynomene indica*; **C.** *Alternanthera ficoidea*; **D.** *Amaranthus spinosus*; **E.** *Amaranthus viridis*; **F.** *Benincasa hispida*; **G.** *Boerhavia defuse*; **H.** *Brasica juncea*; **I.** *Calotropis gigantean*; **J.** *Calotropis procera*; **J.** *Chrozophora rottleri*; **K.** *Cardiospermum halicacabum*; **L.** *Causonis trifolia*.



Fig. 7: A.*Chloris virgata*;B. *Chromolena odoreta*; C. *Chrozophora rotteleri*; D. *Cleome viscosa*; E. *Clitoria ternatea*; F. *Coccinia grandis*; G. *Coldenia procumbens*; H. *Commelina benghalensis*; I. *Commelina forskaolii*;J. *Corchorus trilocularis*;K. *Cucumis sativus*;L. *Cyanthillium cinereum*.

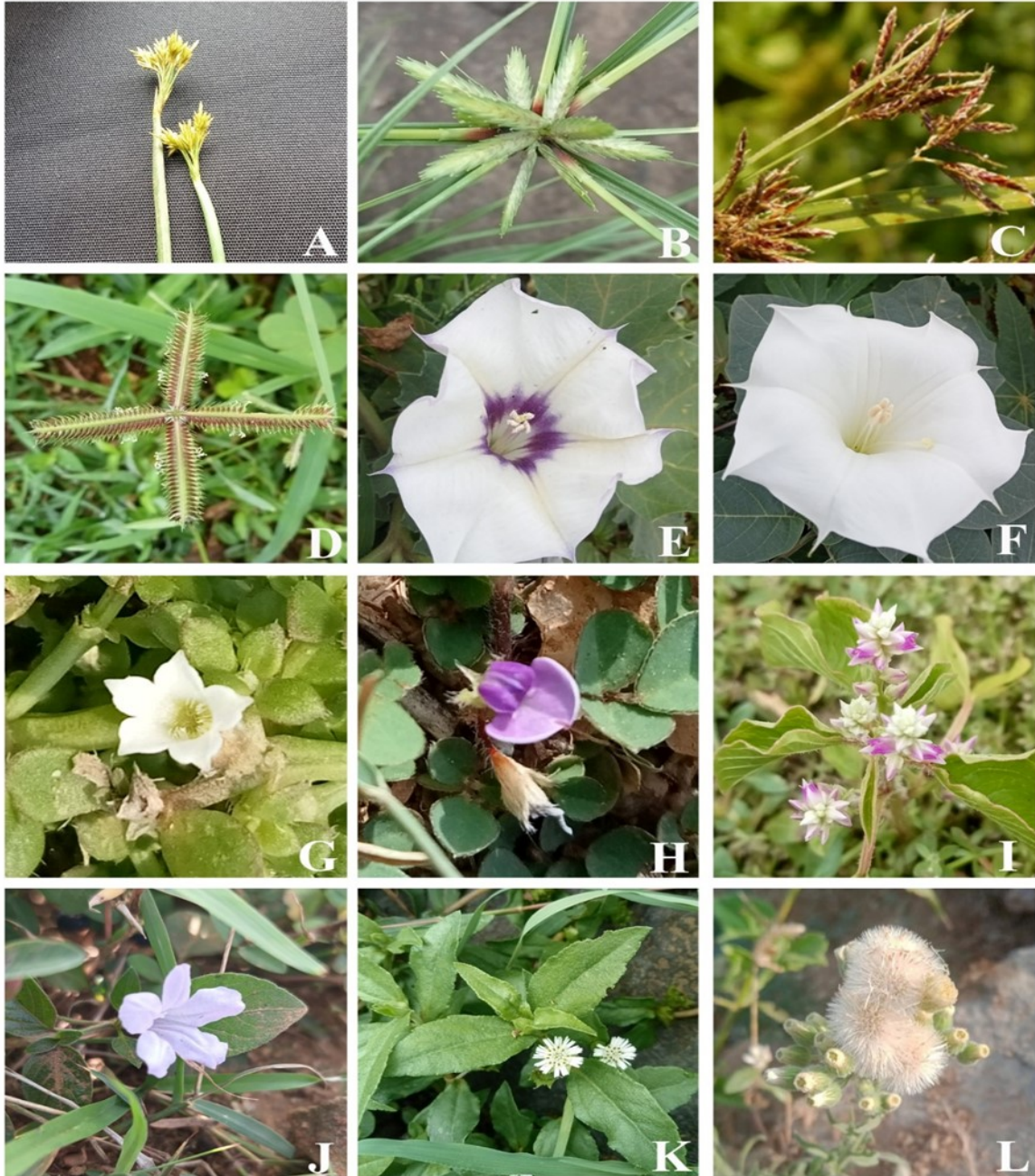


Fig. 8: **A.***Cyperus articulatus*; **B.** *Cyperus compressus*; **C.** *Cyperus rotundus*; **D.** *Dactyloctenium aegyptium*; **E.** *Datura discolor*; **F.** *Datura ferox*; **G.** *Dentella repens*; **H.** *Desmodium triflorum*; **I.** *Digera muricata*; **J.** *Dipteracanthus prostratus*; **K.** *Eclipta prostrata*; **L.** *Erigeron bonariensis*.



Fig. 9: A.*Euphorbia heterophylla*; B. *Euphorbia hirta*; C. *Euphorbia hypericifolia*; D. *Euphorbia serpens*; E. *Euploca ovalifolia*; F. *Flueggea leucopyrus*; G. *Glycine soja*; H. *Gomphrena serrata*; I. *Grangea maderaspatana*; J. *Heliotropium indicum*; K. *Hygrophilla auriculata*; L. *Indigofera linnaei*.

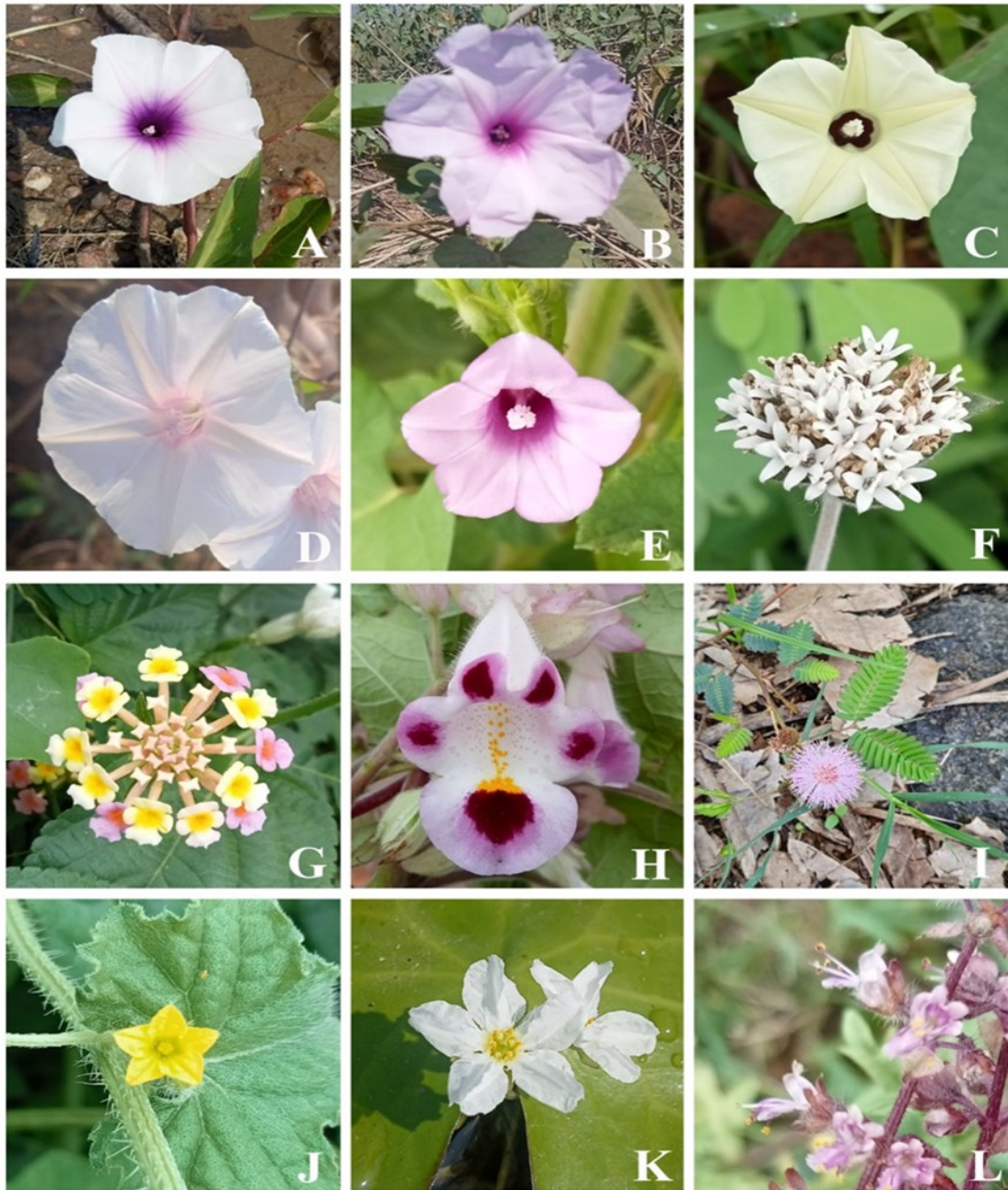


Fig. 10: A.*Ipomea aquatica*; B. *Ipomoea carnea*; C. *Ipomea obscura*; D. *Ipomea sagittifolia*; E. *Ipomea triloba*; F. *Lagascea mollis*; G. *Lantana camera*; H. *Martynia annua*; I. *Mimosa pudica*;J. *Mukia maderaspatana*;K. *Nymphoides hydrophillum*;L. *Ocimum basilicum*.



Fig. 11: **A.***Oxalis corniculata*; **B.***Parthenium hysterophorus*; **C.** *Pergularia daemia*; **D.***Phyla nodiflora*; **E.***Phyllanthus reticulatus*; **F.***Physalis angulata*; **G.***Physalis minima*; **H.***Plumbago zeylanica*; **I.***Polygonum plebium*; **J.***Portulaca oleracea*; **K.***Ricinus communis*; **L.***Ruellia tuberosa*.



Fig.12: A.*Senna obtusifolia*; B.*Senna occidentalis*; C.*Senna uniflora*; D.*Sesamum indicum*; E.*Sida cordifolia*; F.*Solanum diphyllum*; G.*Solanum incanum*; H.*Solanum lycopersicum*; I.*Solanum melongina*; J.*Trianthema portulacastrum*; K.*Trichodesma indicum*; L.*Vachellia nilotica*.

Habit wise distribution of angiosperms is divided into trees (6) herbs (62), shrubs (13), climbers (11) and aquatic (2). (Table-3)

Table.3: Habit Wise distribution of Plants from Hirehonnalli Lake

Tree	6
Shrub	15
Herbs	62
Climbers	11
Aquatic	2
Total	96

Dominant nine families are reported in Fabaceae (13), Asteraceae (10), Solanaceae (8), Euphorbiaceae (6), Amaranthaceae (5), Convolvulaceae (5), Boraginaceae (5), Acanthaceae (5), Malvaceae (3) (Table 4).

Table. 4: Dominant families of Angiosperms in Hirehonnalli Lake

Family	Number of species
Fabaceae	13
Asteraceae	10
Solanaceae	8
Euphorbiaceae	6
Amaranthaceae	5
Convolvulaceae	5
Boraginaceae	5
Acanthaceae	5
Malvaceae	3

Recorded 96 plant species in Hirehonnalli lake, in that 55 are native to India other 41 species are alien species (Table-5).

Table. 5: List of plant species collected from Herehonnalli Lake

Sl no.	Scientific name	Family	Common name	Vernacular name	Flowering season	Nativity to India
1	<i>Acmella radicans</i> (Jacq.) R.K.Jansen	Asteraceae	Toothache plant	buzz buttons	April-July	-
2	<i>Aeschynomene indica</i> L.	Fabaceae	Budda pea	Diya siyambala	Jun-Sep	+
3	<i>Alternanthera ficoidea</i> (L.) P.Beauv.	Amaranthaceae	Sanguinaria	Joy weed	Mar-May	-
4	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Spiny Amaranth	Kanta Chaulai	Apr-Dec	-
5	<i>Amaranthus viridis</i> L.	Amaranthaceae	Slender amaranth	Chaulayi	April-July	-
6	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Neem Tree	Bevin mara	Mar-May	-
7	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Hog weed	Punarnava	April-July	+
8	<i>Boerhavia erecta</i> L.	Nyctaginaceae	Erect spiderling	Pandhari Punarnava	Apr-July	-
9	<i>Calotropis gigantea</i> (L.)W.T.Aiton	Apocynaceae	Crown flower	Eruku	Jan-Dec	+
10	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Apocynaceae	Giant milkweed	bili aekkada gida	Mar-Aug	+
11	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	Heart pea	Lataphatkari	June-Aug	+
12	<i>Causonis trifolia</i> (L.) Mabb. & J.Wen	Vitaceae	Three-Leaved Wild Vine	fox-grape,	June-Aug	+
13	<i>Chloris virgata</i> Sw.	Poaceae	Feather finger grass	Witpluim chloris	Sept-Dec	-
14	<i>Chromolena odoreta</i> (L.)	Asteraceae	Siam weed	Triffed Weeds	Jan-July	-
15	<i>Chrozophora rottileri</i> (Geisler) Spreng.	Euphorbiaceae	Suryavarti	Subali	April-July	+
16	<i>Cleome viscosa</i> L.	Cleomaceae	Tick weed	Bagra	March-July	+
17	<i>Clitoria ternatea</i> L.	Fabaceae	Butterfly pea,	Shanku pushpi	Jan-Dec	-
18	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Gourd Tindora	Bhimb	Mar-Dec	+
19	<i>Coldenia procumbens</i> L.	Boraginaceae	Tripungi	Creeping Coldenia	Apr- may	+
20	<i>Commelina benghalensis</i> L.	Commelinaceae	Tropical spiderwort	Kanshira	June-Oct	+
21	<i>Commelina forskoolii</i> Vahl	Commelinaceae	Forsskal's Dayflower	Kanpet	Jun-Aug	+
22	<i>Corchorus trilocularis</i> L.	Malvaceae	Wild jute	Ennepundi gida	May-Dec	+
23	<i>Croton bonplandianus</i> Baill .	Euphorbiaceae	Ban tulsi	Kala Bhangra	Jan-Dec	+
24	<i>Cucumis sativus</i> L.	Curcubitaceae	Cucumber	Kakadi	Apr -may	+

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25	<i>Cyanthillium cinereum</i> (L.) H.Rob.	Asteraceae	Little Ironweed		Feb-July	+
26	<i>Cyperus articulatus</i> L.	Cyperaceae	Priprioca	jointed flatsedge	Mar-July	+
27	<i>Cyperus compressus</i> Krock.	Cyperaceae	Annual sedge,	hedgehog sedge	July-Oct	+
28	<i>Cyperus rotundus</i> L.	Cyperaceae	Nut grass	Java grass	June-Aug	+
29	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Boraginaceae	Crowfoot Grass	Kadu ragi hullu	Jun-Sep	+
30	<i>Datura discolor</i> Bernh.	Solanaceae	Desert thorn-apple	Jimsonweed	Mar-May	-
31	<i>Datura ferox</i> L.	Solanaceae	Angel's trumpets	Thorn aaple	Jan-July	-
32	<i>Dentella repensk</i> Var. Repens	Rubiaceae	Creeping lickstoop	Creeping dentella	Mar-May	+
33	<i>Desmodium triflorum</i> (L.) DC.	Fabaceae	Tropical trefoil	Kodalia	April-July	+
34	<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	False Amaranth	Lata Mouri	Jun-Sep	+
35	<i>Dipteracanthus prostratus</i> (Poir.) Nees	Acanthaceae	Bell weed	Velipadakkam	April-July	+
36	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	Bhringraj	False daisy	Jan-Dec	-
37	<i>Erigeron bonariensis</i> L.	Asteraceae	Flax-leaf fleabane	Wavy leaf fleabane	Jan-July	+
38	<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	Lesser Green Poinsettia	Milkweed,	Feb-Aug	-
39	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Asthama plant	Garden spuge	Jan-Dec	+
40	<i>Euphorbia serpens</i> Kunth	Euphorbiaceae	Creeping Spurge		June-Aug	-
41	<i>Euploca ovalifolia</i> (Forssk.) Diane & Hilger	Boraginaceae	Salt heliotrope		April-July	
42	<i>Ficus religiosa</i> L.	Moraceae	Peepul tree	Ashvattha tree	Nov-Feb	+
43	<i>Flueggea leucopyrus</i> Willd.	Phyllanthaceae	Bushweed	Panduphali	Apr-July	+
44	<i>Gomphrena serrata</i> L.	Amaranthaceae	Perpetua		Apr-July	-
45	<i>Grangea maderaspatana</i> (L.)Poir.	Asteraceae	Carpet Nelampala	Namuti	Mar-May	+
46	<i>Heliotropium indicum</i> L.	Boraginaceae	Indian Heliotrope	Chelubaalada gida	July-Jan	-
47	<i>Hygrophilla auriculata</i> (Schumach.)Heine	Acanthaceae	Swamp weed	Gokulakanta	Jan-Aug	-
48	<i>Indigofera linnaei</i> Ali	Fabaceae	Nine-leaved indigo	Kennegilu	Jun-Sep	+
49	<i>Ipomea aquatica</i> Forssk.	Convolvulaceae	Water spinach	Kalami	Jan-July	-
50	<i>Ipomea carnea</i> Jacq.	Convolvulaceae	Pink morning glory	Bkkina hejje balli	Feb-July	-
51	<i>Ipomea obscura</i> (L.)Ker Gael.	Convolvulaceae	Wild petunia	kokkita	Mar-Aug	-

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52	<i>Ipomea sagittifolia</i> Burm.f.	Convolvulaceae	Purple heart glory	Bindweed	Jan-july	-
53	<i>Ipomea triloba</i> L.	Convolvulaceae	littlebell	Aiea morning glory	Feb-Oct	-
54	<i>Lagascea mollis</i> Cav.	Asteraceae	Silk Leaf	Jarvad	Aug-Mar	-
55	<i>Lantana camera</i> L.	Verbinaceae	Lantana	Gubon gu -phul	Feb-Nov	-
56	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Thumbai	Thumbe gida	Jan-Dec	+
57	<i>Mangifera indica</i> L.	Anacardiaceae	Mango	Mavina mara	Mar-May	+
58	<i>Martynia annua</i> L.	Martyniaceae	Tiger's claw	Vinchu	Jun-Aug	-
59	<i>Mimosa pudica</i> L.	Fabaceae	Touch me not	Chuimui	Mar-Nov	+
60	<i>Momordica charantia</i> L.	Cucurbitaceae	Bitter Melon	Karela	Jan-Dec	+
61	<i>Nymphoides hydrophyllum</i> (Lour.)	Menyanthaceae	Crested floating heart	Panikola pan-seuli	Jan-Feb	=
62	<i>Ocimum basilicum</i> L.	Lamiaceae	Basil	Ram tulsi	May- July	+
63	<i>Oxalis corniculata</i> L.	Oxalidaceae	Creeping woodsorrel,	Amrit Sak	Mar-Oct	+
64	<i>Parthenium hysterophorus</i> L.	Asteraceae	Famine weed	Whitetop weed	April-July	+
65	<i>Pergularia daemia</i> (Forssk.) Chiov.	Apocynaceae	Uttran	Bilehatthi Balli	Jan-Dec	+
66	<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	Turkey tangle frogfruit	Jal buti	May- apr	+
67	<i>Phyllanthus reticulatus</i> Poir.	Phyllanthaceae	Black-Honey Shrub	Karihuli	Jan-Dec	+
68	<i>Physalis angulata</i> L.	Solanaceae	Baloon cherry	Njodinjotta	June-August	-
69	<i>Physalis minima</i> L.	Solanaceae	Bladder cherry	Little gooseberry	April-July	+
70	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Ceylon leadwort	Chitra	Jan-Dec	+
71	<i>Polygonum plebium</i> R.Br.	Polygonaceae	Small knotweed	machechi	April-July	=
72	<i>Portulaca oleracea</i> L.	Portulacaceae	Garden purslane	Little howeed	April-July	+
73	<i>Ricinus communis</i> L.	Euphorbiaceae	Castor oil plant	castor bean	June-Aug	-
74	<i>Ruelia tuberosa</i> L.	Acanthaceae	Waterkanon	jurbula gadda	April-July	=
75	<i>Rungia pectinata</i> (L.)Nees	Acanthaceae	Comb rungia	Comb Rungia	Jan-Feb	-
76	<i>Senna obtusifolia</i> (L.)H.S.Irwin&Barneby	Fabaceae	Wild senna	Cofee weed	Feb-April	-
77	<i>Senna occidentalis</i>	Fabaceae	Ant bush	Kasondi	April-July	-
78	<i>Senna</i> sp.	Fabaceae				+
79	<i>Senna uniflora</i> (Mill.)	Fabaceae	One leaf senna	Oneleaf senna	jan-aug	-
80	<i>Sesamum indicum</i> L.	Pedaliaceae	Sesame	Til	April-July	+

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81	<i>Sida cordifolia</i> L.	Malvaceae	Velluppan	Kisangi	Jan-Dec	+
82	<i>Sida cordifolia</i> L.	Malvaceae	Flannel Weed	Chikana	Jan-Dec	+
83	<i>Solanum diphyllum</i> L.	Solanaceae	Twoleaf nightshade	Tomatillo	Mar-Oct	-
84	<i>Solanum lycopersicum</i> L.	Solanaceae	Tomato	Tamati	March-May	-
85	<i>Solanum melongena</i> L.	Solanaceae	Egg plant	Brinjal	Jan-Dec	+
86	<i>Solanum nigrum</i> L.	Solanaceae	European black nightshade	Mokoi	Mar-July	+
87	<i>Sonchus wightianus</i> DC.	Astraceae	Bitter sowthistle	sowthistle	June-July	+
88	<i>Stylosanthes fruticosa</i> (Retz.) Alston	Fabaceae	Shrubby pencil	wild lucerne	June-Aug	+
89	<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae	Nodeweed	Mudianpacha	June-August	-
90	<i>Syzygium jambos</i> (L.) Alston	Myrtaceae	Rose aapple	Nerale hannu	Mar-May	-
91	<i>Tamarindus indica</i> L.	Fabaceae	Tamarind	Assam java		-
92	<i>Thunbergia alata</i> Bojer ex Sims	Acanthaceae	Black-eyed Susan vine		Jun-Aug	-
93	<i>Trianthema portulacastrum</i> L.	Aizoaceae	Giant Pigweed	Sabuni	Apr-Dec	+
94	<i>Trichodesma indicum</i> (L.) Sm.	Boraginaceae	Indian Borage	Chota Kalpa	Aug-Nov	+
95	<i>Tridax procubens</i> L.	Asteraceae	Coat buttons	savanthi sanna gida	Jan-Dec	-
96	<i>Vachellia nilotica</i> (L.) P.J.H.Hurter & Mabb.	Fabaceae	Acacia nilotica	thorn mimosa,	Jun-Oct	+

Physiochemical parameters like Temperature, PH, TDS, Total alkalinity, Carbonates, Hydro carbonates, Dissolved oxygen, Chlorides, Chemical Oxygen Demand were conducted monthly from January to July which includes winter, summer and rainy seasons. Some major tests were conducted in winter, summer and rainy season. Tests include Chlorophyll (Chlorophyll a, Chlorophyll b, Total chlorophyll) content form phytoplanktons. Calcium hardness, Total hardness, Magnesium hardness.

Physiochemical parameters of during three seasons include Temperature (Winter-27⁰C,

Summer-33⁰C & Rainy-22⁰C), PH (Winter-8.26, Summer-8.8 & Rainy-8.4), TDS(Winter-794 in ppm, Summer-762 in ppm & Rainy-708 in ppm), Total alkalinity (Winter-40 mg/ml, Summer-35 mg/ml & Rainy-33 mg/ml), Carbonates (Winter-20 mg/ml, Summer-15 mg/ml & Rainy-10 mg/ml), Hydro carbonates (Winter-20 mg/ml, Summer-17 mg/ml & Rainy-23 mg/ml), Dissolved oxygen(Winter-4.0 mg/ml, Summer-8.8 mg/ml & Rainy-8.6 mg/ml), Chlorides (Winter-13.5 mg/ml, Summer-13.5 mg/ml & Rainy-12.35 mg/ml), Chemical Oxygen Demand (Winter-24 mg/ml, Summer-26 mg/ml & Rainy-20.5 mg/ml). (Table-6)

Table-6: Data showing the tests conducted regularly (Hirehonnalli Lake)

Physiochemical parameters	January	February	March	April	May	June	July
Date	29th Jan	13th Feb	18th March	24-Apr	24th May	15h June	8th Julu
Temperature ⁰ C	25	29	33	32	32	22	23
PH	8.26	8.49	8.79	8.87	8.99	8.56	8.33
TDS in ppm	800	788	725	800	722	701	712
Total Alkality	50	30	35	40	30	30	35
CO32-mg/ml	30	10	10	20	10	10	10
HCO ₃ mg/ml	20	20	15	20	20	20	25
DO mg/ml	3.6	4.4	6.4	9.6	8.8	8.7	8.5
Chloride mg/ml	10.6	17.7	15.9	14.2	10.65	12.8	12.1
COD mg/ml	18	30	27	31	17	20	21

Some **major tests** were conducted during **winter season** records Hardness (216 mg/ml as CaCO₃), Total hardness (216.06 mg/ml), calcium (76.15 mg/ml), calcium hardness (190.14 mg/ml), Magnesium (6.35 mg/ml), Magnesium Hardness (6.3 mg/ml).

Some **major tests** were conducted during **summer season** records hardness (232 mg/ml as CaCO₃), Total hardness (232.23 mg/ml), calcium (82.56 mg/ml), calcium hardness (206 mg/ml), Magnesium (6.35 mg/ml), Magnesium Hardness (6.34 mg/ml). Chlorophyll test were carried out using UV spectrophotometer absorbance. Chlorophyll “a” (25.67 mg/ml), Chlorophyll “b”

(8.01 mg/ml), Total chlorophyll content (33.68 mg/ml) & Total chlorophyll content in phytoplankton (134.72 mg/ml) (Table-7).

Some **major tests** were conducted during **rainy season** records hardness (204 mg/ml as CaCO₃), Total hardness (204.06 mg/ml), calcium (72.94 mg/ml), calcium hardness (182.13 mg/ml), Magnesium (5.35 mg/ml), Magnesium Hardness (5.33 mg/ml). Chlorophyll test were carried out using UV spectrophotometer absorbance. Chlorophyll “a” (23.88 mg/ml), Chlorophyll “b” (5.79 mg/ml), Total chlorophyll content (29.67 mg/ml) & Total chlorophyll content in phytoplankton (118.67 mg/ml) (Table-7).

Table-7: Data showing the three seasonal (Winter, Summer & Rain) observations.

Seasonal Parameters	Winter(Jan-Feb)	Summer(Mar-May)	Rainy(Jun-Jul)
Hardness mg/ml as CaCO ₃	216	232	204
Total Hardness in mg	216.06	232.23	204.06
Calcium mg/ml	76.15	82.56	72.94
Calcium Hardness mg/ml	190.14	206	182.13
Magnesium mg/ml	6.35	6.35	5.35
Magnesium Hardness mg/ml	6.3	6.34	5.33
Chlorophyll a mg/ml		25.67	23.88
Chlorophyll b mg/ml		8.01	5.79
Total chlorophyll content mg/ml		33.68	29.67
Total chlorophyll content in phytoplankton mg/ml		134.72	118.67

Soil Sample Analysis and Water Analysis in ICAR Science Centre, Dharwad reported that water and soil are test results are good for the

Growth of plants and not fit for drinking. Hirehonnalli lake has black soil and pH is 7.88 slightly basic in nature (Table-8).

Table-8: Soil and Water Analysis (Hirehonnalli Lake) in ICAR Science Centre, Dharwad

Soil	
Parameters	
Soil color	Black
pH	7.88
Electric conductivity (S/m)	11.56
Organic Carbon mg/ L	0.46
Mineralization Nitrogen	85.5
P ₂ O ₅ per acre	13.5
K ₂ O per acre	212
Ca per 100gm	23.5
Mg per 100gm	13.5
Available Sulphur	0.28
Zn mg per Kg	0.41
Cu mg per Kg	0.56
Fe mg per Kg	4.56
Mn mg per Kg	5.61
Water	
pH	7.12
Electric conductivity(S/m)	0.28

Conclusion

The water is fit for agriculture but not for drinking due to high phytoplanktons in the presence of K, Ca and Mg. Soil is dug out for various uses during summer season. Washing clothes and cattles is common in all seasons. Fishing is done during February to June when water becomes less. Fishes include Katla, Kannadi, Miragal, Rahoo, Gaskarp, Murgod, Chillapilli. Soil of lake is black and It is good for plants diversity.

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