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Acquainting algal flora of Guru Nanak College campus, Chennai, Tamil Nadu, India.

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Abstract:

Algae are ancient group of organisms occurring in a wide range of habitats. The algal periodicity and succession pattern varies markedly and are influenced by various factors. Extensive survey has been carried out covering several places of Guru Nanak College campus during October 2016 to September 2017 to explore the algal flora. A total number of thirty three species were documented under four different classes namely Chlorophyceae, Bacillariophyceae Euglenophyceae and Cyanophyceae in which Chlorophyceae was found to be dominant. Variety of algal species occurs in nature that serves as an efficient tool for the betterment of mankind.

Key words: Cyanophyceae, Chlorophyceae, Bacillariophyceae, Euglenophyceae, Guru Nanak College.

Introduction:

Algae can be variously described as they are “Simplest plants in plant Kingdom” (Chapman 1962), “chlorophyll bearing organisms which are thalloid” (Prescott, 1969) “simple plants with autotrophic mode of nutrition” (Smith, 1955) “displays a spectrum of photosynthetic pigments and evolve oxygen during photosynthesis” (Singh, 1974). They are considered to be aquatic, oxygen-evolving photosynthetic autotrophs that are unicellular, colonial and constructed of filaments or composed of simple tissues (Guiry 2012). They are ubiquitous in nature, and can be found in various habitats. Algae are mostly aquatic (fresh water and marine) also occur in terrestrial environment, however they can be found in extreme environment on earth including snow, desert soils and hot springs (Lee, 2008). Apart from this they can also inhabit on surfaces of plants – epiphytic; leaves – epiphyllous; bark – corticolous; animals – epizoic; rock – lithophyte; metals – epimetallous (Schlichting 1975).

Algae serve as a primary producer in all the aquatic based food chain (Browder *et al.* 1994). They perform roughly 50% of the photosynthesis on this planet (John, 1994) and thus are instrumental in supporting the biosphere in terms of reducing global warming. They are more efficient in converting solar energy by the utilization of photosynthetic machinery for the production of biomass which can be used as a source of food, feed, chemicals and energy (Vonshak, 1990). According to Dagget (2008) algal biodiesel can be considered as the only renewable fuel option under development suitable for aviation. They are also one of the major sources for many consumables and microalgae in particular has been considered as a vital source of vitamins, minerals, proteins, polyunsaturated fatty acids (PUFA), antioxidants, etc. (Pulz and Gross, 2004) which are essential to mankind. Documenting basic patterns of biodiversity is fundamental for conservation and management action (Villasenor *et al*., 2007).

Sister Maloney (1943) was pioneer who reported algal flora of college campus. She documented 135 species and varieties of algae from 10 different station in Catholic college campus of Oklahoma. Esteemed professor G.S. Venkataraman (1957) has made similar initiatives of reporting algal flora in relation with the working environment (Banaras Hindu University). Later Emeritus Professor N. Anand (2011) has explored fresh water algae of the University of Madras (Guindy campus). Similarly Nainesh and Sumesh, 2013 (**Gujarat** University Campus), Supriya and Meena, 2014 (Shivaji University Campus, **Maharashtra**), Ambika and Krishnamurthy, 2016 (Kuvempu University, **Karnataka**), Mary, 2016 (Osmania University, **Hyderabad**), Bindumole *et. al.,* 2011 (Kasaragod Govt. College, **Kerala**) and Elumalai *et. al*. 2014 (Presidency College, **Tamil Nadu**) have documented campus flora of algae across the Nation.

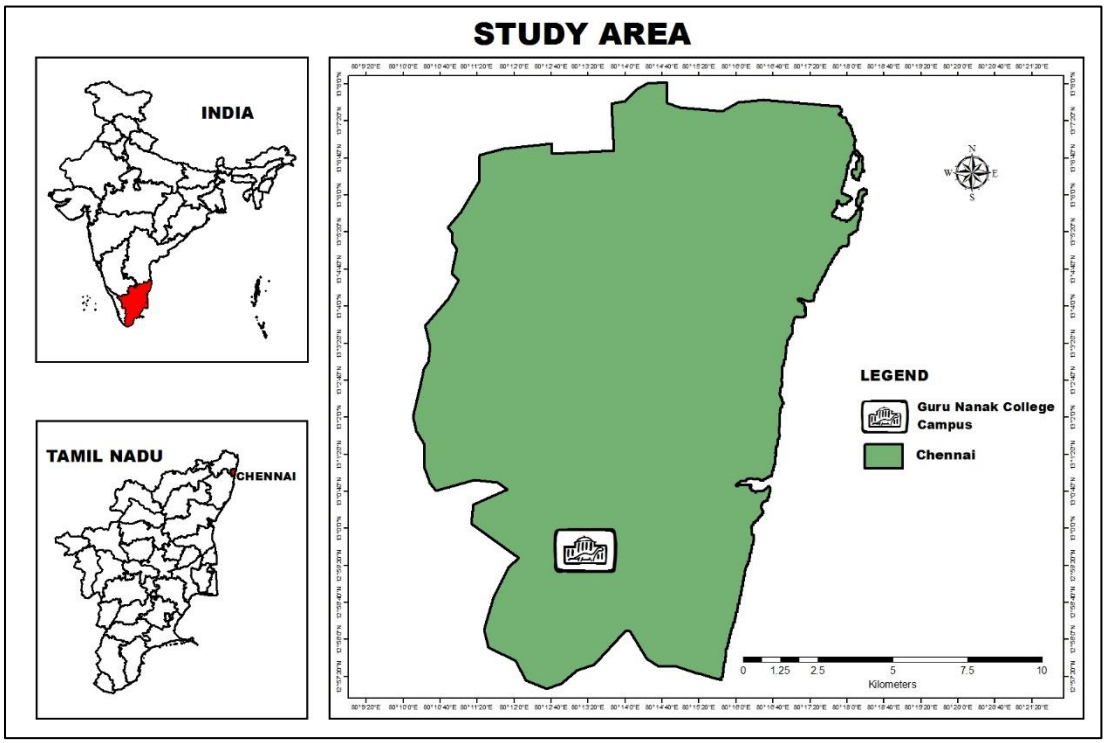
"Charity begins at home" – The first priority of man is the needs of his own family and friends. In the same way it has been proposed to study the algal flora of Guru Nanak College, Chennai.

Materials & Method:

Guru Nanak College (**Fig.1**) was established in 1971 to mark the 500th birthday of Guru Nanak Devji located near Raj Bhavan, Guindy, Chennai, the Capital city of Tamil Nadu State, India **(Map 1)**. Tucked in the Guindy Reserve forest on the Velachery Road, the college in the salubrious campus is far from the din and bustle of the city. The lush greenery is the pride of the college. A beautiful Sikh temple in the Gurudwara adds sanctity to the campus. The present work is an extensive study made to investigate the algal population over a period of twelve months (October 2016 to September 2017). Samples were collected from various habitats of College campus (**Plate I**) such as stagnant water, moist and dry soil, walls of well, surroundings of water tanks, plastered walls, cemented floor, and small stones. The collected samples were brought to the laboratory for live culture and a portion was preserved in 4% formalin for further studies. Observation and documentation of the algae was done using HOVERLABS Research Microscopic Unit. Identification was done using standard books, monographs and various published research articles (Anand 1998; Desikachary 1959, 1986; Krishnamurthy 1954, 2000; Philipose 1967, 1988).

Fig. 1 – Study area (Entrance) – Guru Nanak College, Chennai

Map 1 Showing Study area.



The location map of the study area was created using the GIS software ArcGIS 10.3 Version 10.3.0.4322 © 1999 – 2012 Esri Inc.

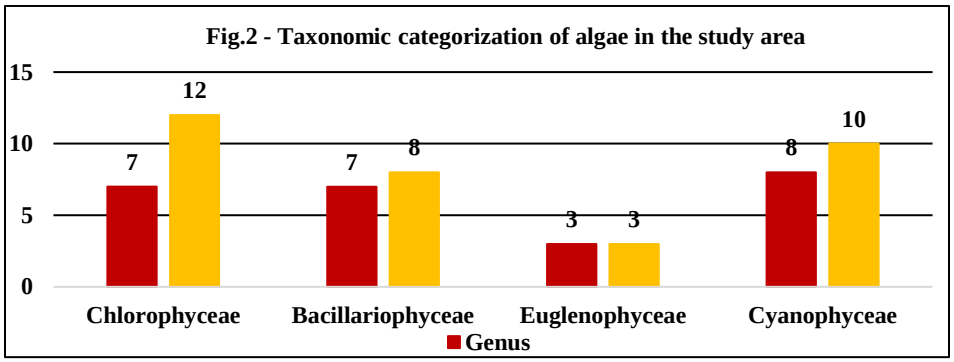
Result & Discussions:

The algae that were encountered in the present investigation of Guru Nanak College campus falls into four classes such as Chlorophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae with a total number of thirty three species belonging to twenty five genera (**Table 1**) indicating greater diversity. It was observed that class Chlorophyceae and Bacillariophyceae reported with 7 genera each, whereas they reported with 12 and 8 species respectively. Similarly Cyanophyceae documented with 8 genera and 10 species from the study area (**Fig.2**). Furtherly the dominant class was found to be Chlorophyceae – 36.33% followed by Cyanophyceae – 30.32%, Bacillariophyceae – 24.26% and Euglenophyceae – 9.10% (**Fig. 3**). The abundant species from the study area were given in **Plate II**.

Table 1 – Algal Flora of Guru Nanak College Campus

S. No	Name of the Species	S. No	Name of the Species
Chlorophyceae		**Bacillariophyceae**	
1	*Gonium pectorale*	**18**	*Rhopalodia gibba*
2	*Pediastrum simplex*	**19**	*Nitzschia obtusa*
3	*Scenedesmus acuminatus*	**20**	*Surirella nervosa*
4	*Scenedesmus dimorphus*	**Euglenophyceae**	
5	*Scenedesmus incrassatulus*	**21**	*Euglena sociablis*
6	*Scenedesmus obliqus*	**22**	*Lepocincilis glabra*
7	*Scenedesmus quadricauda*	**23**	*Phacus longicauda*
8	*Ulothrix variabilis*	**Cyanophyceae**	
9	*Microspora stagnorum*	**24**	*Aphanocapsa banaresense*
10	*Spirogyra jogensis*	**25**	*Gloeocapsa decorticans*

11	*Spirogyra verruculosa*	**26**	*Synechocystis aquatilis*
12	*Cosmarium cyllicum*	**27**	*Lyngbya hieronymusii*
Bacillariophyceae		**28**	*Oscillatoria rubescens*
13	*Craticula cuspidata*	**29**	*Oscillatoria perornata*
14	*Tabellaria fenstrata*	**30**	*Oscillatoria vizagapatensis*
15	*Pinnularia lundii*	**31**	*Phormidium cebennense*
16	*Pinnularia platycephala*	**32**	*Anabaena fertilissima*
17	*Amphora elliptica*	**33**	*Nostoc carnaeum*



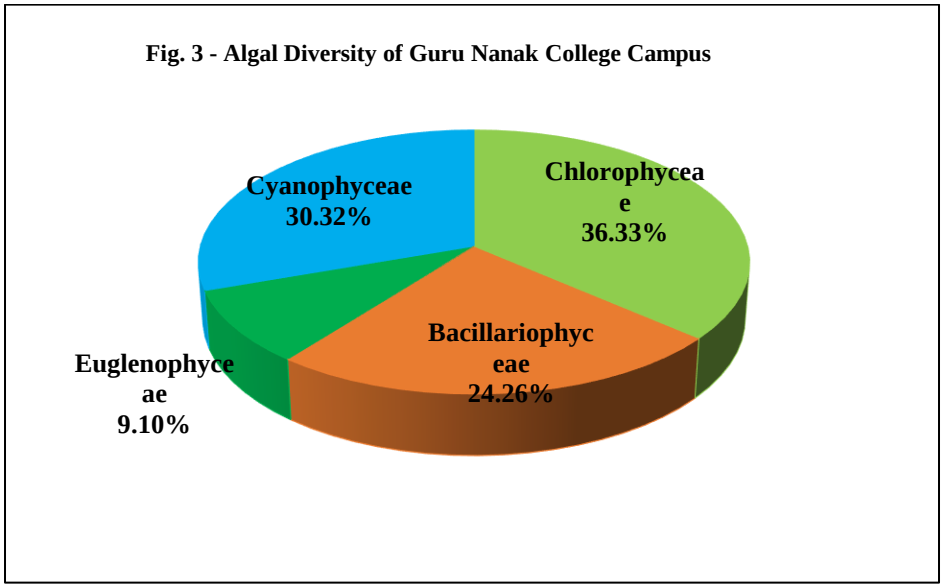
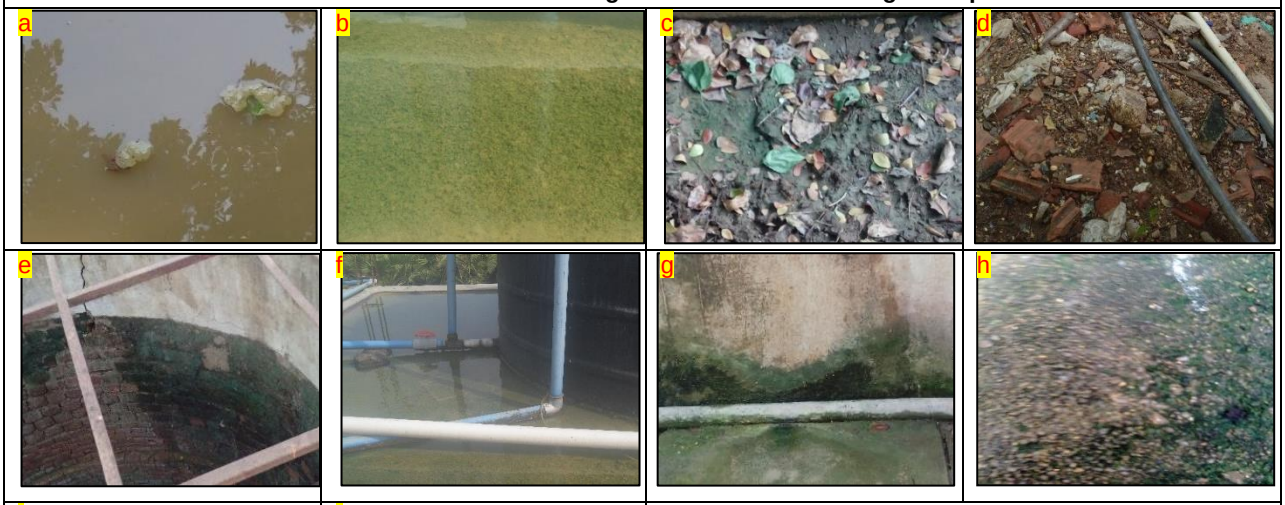
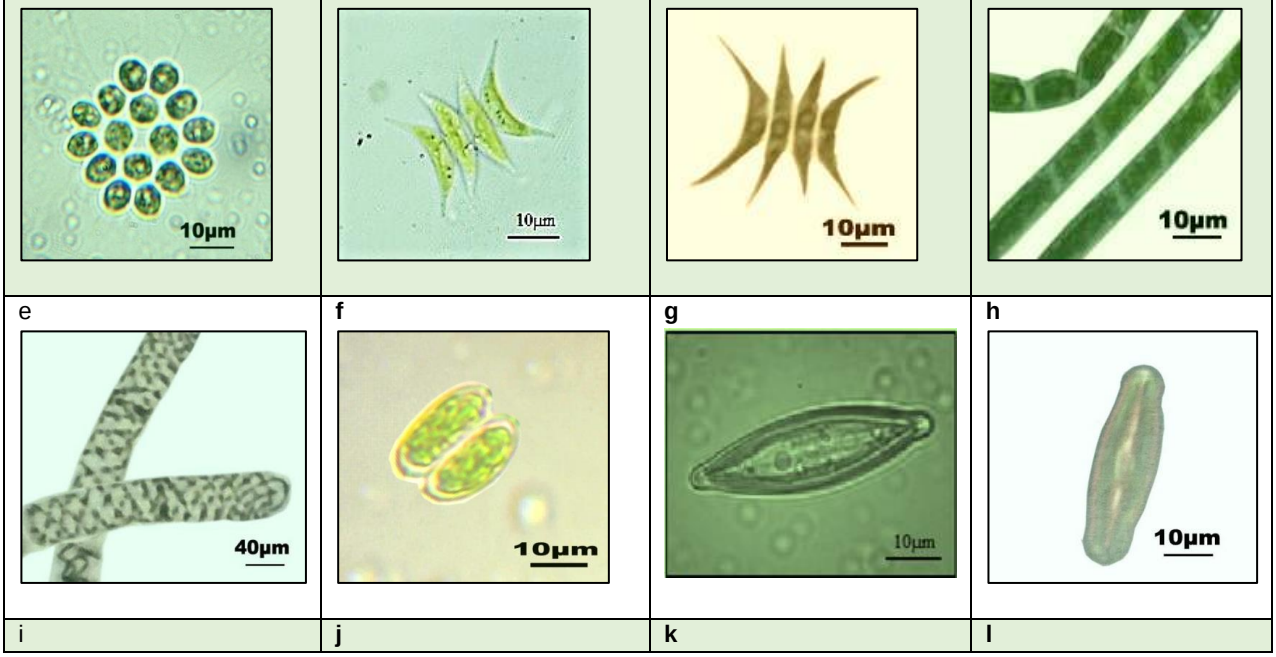


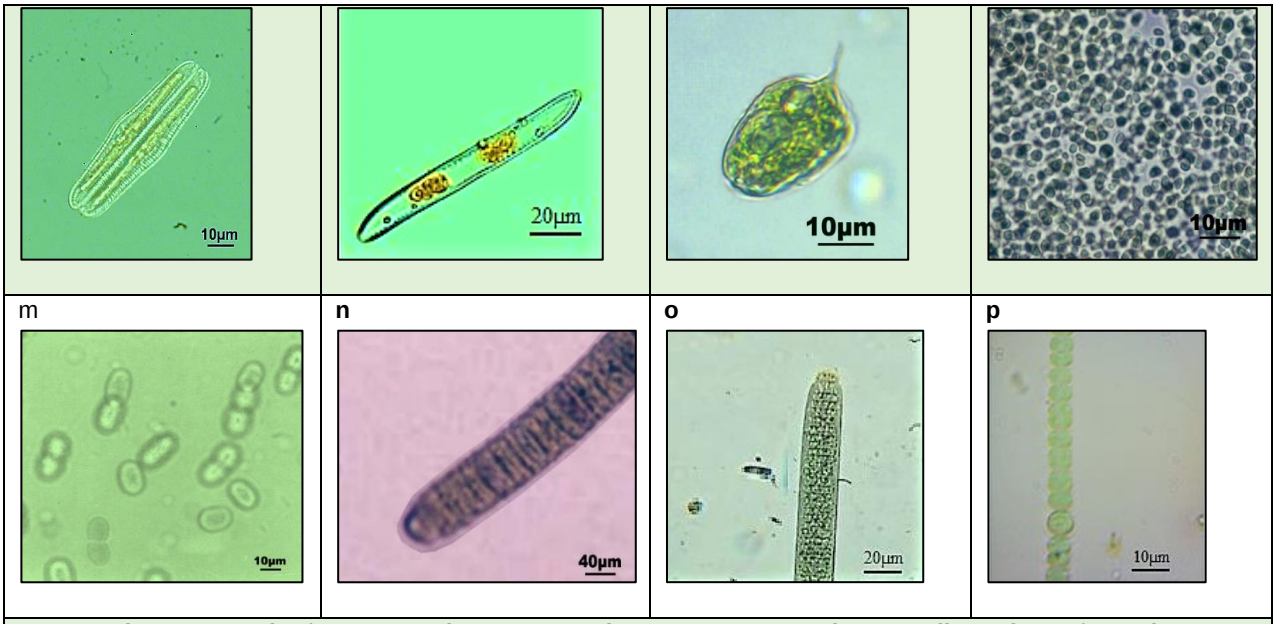
Plate I – Various habitats of algae in Guru Nanak College Campus.



a & **b** – Stagnant water, **c** & **d** – Moist and dry soil, **e** – Walls of well, **f** – Surroundings of water tanks, **g** – Plastered walls, **h** & **i** – Cemented floor, **j** – Small stones.

Plate II – Algal Diversity of Guru Nanak College Campus.





a **– *Gonium pectorale***, b **– *Scenedesmus acuminatus***, c **– *Scenedesmus dimorphus,*** d **– *Microspora stagnorum***, e **– *Spirogyra verruculosa***, f **– *Cosmarium cyllicum***, g **– *Craticula cuspidate***, h **– *Pinnularia lundii***, i **– *Rhopalodia gibba***, j **- *Nitzschia obtusa,*** k **– *Phacus longicauda,*** l **– *Aphanocapsa banaresense,*** m **– *Gloeocapsa decorticans***, n **– *Oscillatoria perornata***, o **– *Oscillatoria vizagapatensis***, p **– *Anabaena fertilissima*.**

Fritch (1935) has coined the term Chlorophyceae which literally means green algae. In the present study class Chlorophyceae was recorded with the genera such as *Gonium, Pediastrum, Scenedesmus, Ulothrix, Microspora, Spirogyra* and *Cosmarium* (**Fig. 4a**). According to Palmer (1980) Chlorophyceae plays an important role in fresh water ecosystem as most of the members are found to be ecologically important. The members of this class play as a chief source for food chain and oxygen for both freshwater and marine environment (Sharma, 1986).

Cyanophyceae was recorded with eight genera with ten species. The genera include *Aphanocapsa, Gloeocapsa, Synechocystis, Lyngbya, Oscillatoria, Phormidium, Anabaena* and *Nostoc* (**Fig. 4d**). Cyanobacteria constituted the largest group in microalgae (Geitler, 1932) which are evolved as a group of organisms about 2,000 million years ago (Bisby, 1995). They are incredible ecosystem engineers and can fix atmospheric nitrogen, contributing greatly to the global nitrogen budget (Karl *et al.* 2002).

Diatoms (Bacillariophyceae) are comparatively recently evolved organisms which originate 200 million years ago (Medlin *et al.,* 1997). In the present study *Craticula, Tabellaria, Pinnularia, Amphora, Rhopalodia, Nitzschia* and *Surirella* were the genera documented in Bacillariophyceae (**Fig. 4b**). Diatoms have long been lauded for their use as powerful and reliable environmental indicators (Lowe, 1974). The productions of high-energy lipid reserves make diatoms a highly desirable food source for many aquatic heterotrophs (Ahlgren *et al.,* 1990).

Euglenophyceae are free-swimming algal flagellates found in a variety of freshwater and marine environments (Sandra and Carlos, 2009). In the present study least number of genera such as *Euglena, Lepocincilis* and *Phacus* were reported in this class (**Fig. 4c**). Euglenophyceae serve as an excellent bio-indicator of environmental changes, not only by their presence or absence, but also by measuring the cellular changes that occur in various environmental conditions (Hosmani, 2012).

From the investigation it could be concluded that Guru Nanak College campus facilitates ambient environment for the growth of diverse algal species. Documenting biodiversity forms the fundamental and also helpful in the conservation and management actions for future studies. Only very few resources has been utilized so far in

agriculture, medicine, food and so on. Most of the potential algae are available in plenty which has wide spectrum of benefits.

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Distribution of algal species from the study area

Fig. 4a

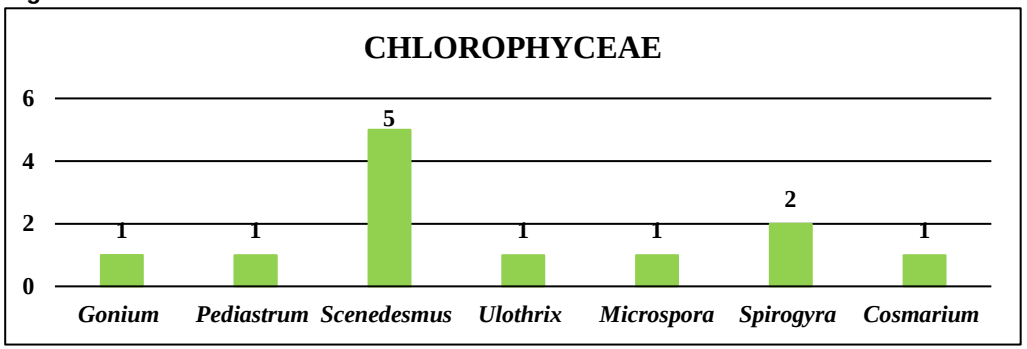

Fig. 4b

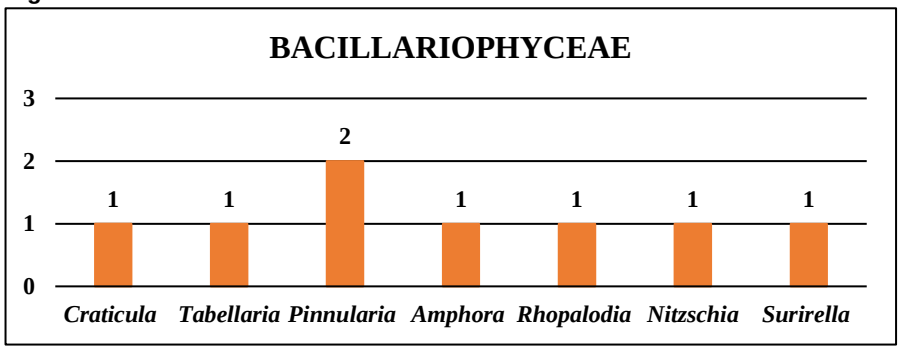

Fig. 4c

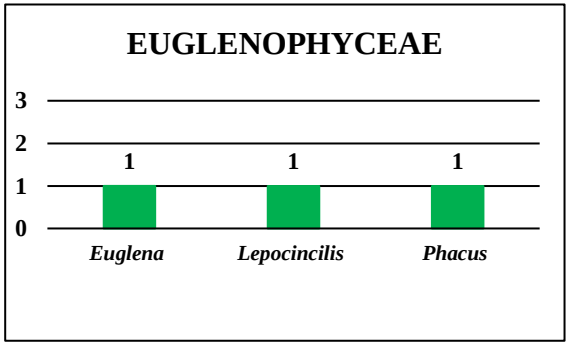

Fig. 4d