

ALGAL DIVERSITY ON AND AROUND *LODOICEA MALDIVICA* (J.E.GMEL.) PRES. (DOUBLE COCONUT) IN AJC BOSE INDIAN BOTANIC GARDEN, HOWRAH

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ABSTRACT

38 algal taxa belonging to 6 Classes viz. Cyanophyceae (15), Xanthophyceae (2), Chrysophyceae (2), Bacillariophyceae (10), Euglenophyceae (2) and Chlorophyceae (7) were recorded between July October, 2010 from *Lodoicea maldivica* (J. E. Gmel.) Pres. (Double Coconut) and its surrounding area in the Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIG), Howrah. This is the first report on algae on and around this interesting palm.

Keywords : Algae, Diversity, Double Coconut Palm.

INTRODUCTION

The term “algae” merely refers to aquatic organism capable of photosynthesis and so applies to several groups which photosynthesize and manufacture their own food except a few forms of Cyanobacteria which get sufficient supply of energy in the form of glucose. The first primitive form of life called as prokaryotes may have originated c. 3.5 billion years ago, whereas blue-green algae performing photosynthesis originated c. 3.0 billion years ago (Cassidy, 2009) and were predominant even during Precambrian era (Schopf, 1975, 1994, 1996). Later on, eukaryotic algal forms also evolved at different time period and in transition also recorded from semi-aquatic (swamp and marshy land) to terrestrial habitat and even on different objects and thus widely called as ubiquitous. Taxonomically, algae has been classified into 11 Class pertaining to Cyanophyceae, Xanthophyceae, Cryptophyceae, Chrysophyceae, Dinophyceae, Bacillariophyceae, Euglenophyceae, Chlorophyceae, Chloromonodineae, Phaeophyceae and Rhodophyceae (Fritsch, 1935, 1945).

Lodoicea maldivica (J.E.Gmel.) Pres. (Arecaceae), a very important and interesting rare giant palm listed in Red Data Book was planted during 1894 at the centre of an octagonal metallic enclosure in AJC Bose Indian Botanic Garden, Howrah. The microclimatic conditions provided not only helped this plant in its survival but they also helped other microscopic forms like algae to thrive on soil, pebbles, boulders and stones. The presence of diverse algal forms tempted the authors to study the same in detail as no one studied it earlier. However, few studies on other palm species like *Oreodoxa regia* have been carried out by Biswas (1932) and Kamat and Harankhedkar (1976), on *Cocos nucifera* by Brühl and Biswas (1923) and Kamat (1963a) whereas Rao (1937, 1938), Banerji (1938), Kamat (1963b, 1967, 1968, 1972, 1974), Kamat and Harankhedkar (1976) and Gupta (2008) recorded algal forms from different tree species belonging to Angiosperm and Gymnosperm. Besides, algal forms have also been recorded from acid bogs and alkaline soils by Prasad and Srivastava (1968), Prasad & al. (1978) and from fertile and desert soils by Holsinger (1935), Gonzalves and Gangla (1949), Pandey (1965), Prasad and Srivastava (1968), Bharati and Bongale (1975), Bongale and Bharati (1980, 1984), Goyal & al. (1984), Bongale (1986, 1987a, b, c), Angadi (1990), Shakuntala (1990), Suseela and Goyal (1994), Singh & al. (1995) and Singh and Srivastava (2002).

MATERIAL AND METHODS

The Large Palm House- an octagonal metallic enclosure in the Acharya Jagadish Chandra Bose Indian Botanic Garden is selected as sampling site for collection of samples of algae growing on a rare palm tree, listed in Red Data Book i.e. *Lodoicea maldivica* (J.E.Gmel.) Pres. as well as on soil, pebbles, boulders and stones (**Fig. 1**) from July to October, 2010. Before a fortnight from date of collection of samples, the climatic

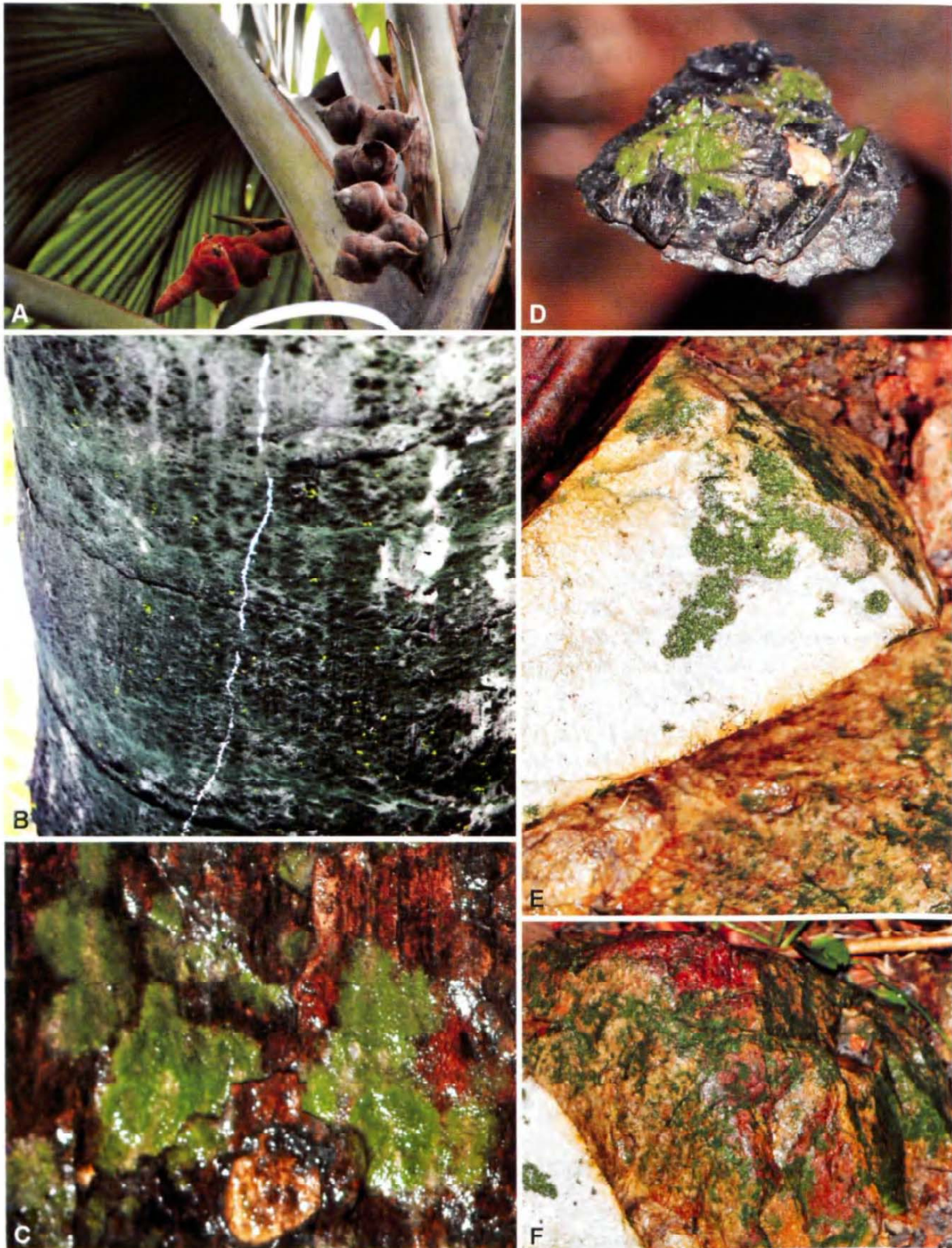


Fig.1 Samples Collected from different parts of *Lodoicea maldivica* (J.E.Gmel.) Pres. **A.** From upper region and from flower; **B.** From middle region bluish-greenish algal patch on tree trunk; **C.** From lower region green algal patch on tree trunk; **D - F.** Algal patches on Pebble, Boulder and Stone respectively.

data like temperature, rainfall and relative humidity including sunrise, sunset were collected. Initially, before a fortnight from collection of samples, the climatic condition was found mostly cloudy and bright sunshine was limited for few days. The temperature ranged from 25.4 °C to 30.4 °C, rainfall nil to 74.0 mm and relative humidity from 59% to 98%. The procedure adopted for collection of samples from different parts of the tree and surrounding area is briefly described as follows :

Samples from different level of tree trunk like upper, middle and lower portion including petiole and flower, soil and pebble / boulder / stone lying around the precious tree were collected by gently scraping green and bluish-green algal patches by sterilized scalpel and forceps and collected in 15 ml screw cap glass Borosil specimen vial and brought to the laboratory. Further added double distilled water to make the volume 10 ml in each vial and preserved the specimens by adding 2 to 4 drops of 4% Formalin. All specimens were observed under Leica DM 2500 Microscope using Leica QWin V 3.2 Image Processing and Analysis Software. The photomicrographs were taken by using Leica DFC 500 digital camera attached with the microscope. The specimens were identified consulting standard monographs, books and proceedings of Geitler (1932), Tiffany and Britton (1952), Desikachary (1959), Prescott (1982), Starmach (1985), Kant and Gupta (1998), Komárek and Anagnostidis (1998, 2005), Bertalot and Genkal (1999), Kristiansen and Preisig (2007) and Karmmer and Bertalot (2008a, b). The above studied specimens are maintained in the Ecology Section, Central National Herbarium, Botanical Survey of India (CAL).

RESULT AND DISCUSSION

During study, altogether 38 algal species were recorded from *Lodoicea maldivica* (J.E.Gmel.) Pres. as well as from soil and pebbles / boulders / stones existing around. The recorded 38 algal forms belong to the Class Cyanophyceae (15), Bacillariophyceae (10), Chlorophyceae (7) and 2 each to the Class Xanthophyceae, Euglenophyceae and Chrysophyceae (Table 1 & 2, Fig. 5). The recorded number of algal species is 4 and 9 times more than earlier reports from other plant species by Kamat and Harankhedkar (1976) and Gupta (2008) respectively.

However, out of 38 species reported from *Lodoicea maldivica* (J.E.Gmel.) Pres., only 6 species namely *Chroococcus minutus* (Kütz.) Nägeli, *Oscillatoria tenuis* C. Agardh ex Gomont, *Scytonema ocellatum* Lyngb. ex Bornet & Flahault, *Chlorococcum humicola* (Nägeli) Rabenh., *Chlorella vulgaris* Beij. and *Protococcus viridis* C. Agardh have also been reported earlier by the Brühl and Biswas (1923), Biswas (1932), Kamat (1972) and Gupta (2008) from tree trunk (bark) of other plant species. The quantitative occurrence of such a high number of algal species on *Lodoicea maldivica* (J. E. Gmel.) Pres. and surrounding area is amazing which may be due to moist and suitable environmental conditions facilitated for most part of the year within the enclosure as a result of two different climbers i.e. *Antigonon leptopus* Hook. & Arn. and *Porana paniculata* Roxb. While studying vertical profile of algae (Class-wise) on tree trunk at upper, middle and lower portion, maximum 7 Cyanophycean forms were recorded at middle zone (Table 1) possibly due to compactness of leaf scar which may have facilitated to lodge maximum soil and mineral contents generated due to dead cells of earlier grown algal forms which may helped in holding sufficient moisture / water content for longer time period followed by 5 and 3 species at lower and upper part respectively. Maximum 5 Bacillariophycean forms were recorded at lower zone possibly due to existence of maximum patches of other algal forms. Maximum 3 Chlorophycean forms were recorded from the upper portion possibly due to maximum exposure of sunlight and relative humidity followed by lower zone. Besides, 2 species each were recorded from petiole and flower, 3 species from soil and 6 species from pebbles / boulders / stones belonging to different Classes. During the study some of the species recorded are common on more than one substratum like- *Lyngbya contorta* Lemmerm. from middle part of the tree trunk and stone around the tree, *Fragilaria construens* (Ehrenb.) Grunow from upper part of the tree trunk as well as soil around the tree, *Chlorococcum humicola* (Nägeli) Rabenh. from stone around the tree and lower part of the tree trunk. Besides this, *Chlorella vulgaris* Beij. is reported from almost all part of the Palm viz. lower part of the tree trunk, stone around the tree, leaf scarp, flower, bryophyte near tree. In addition to that, some of species confined in particular area

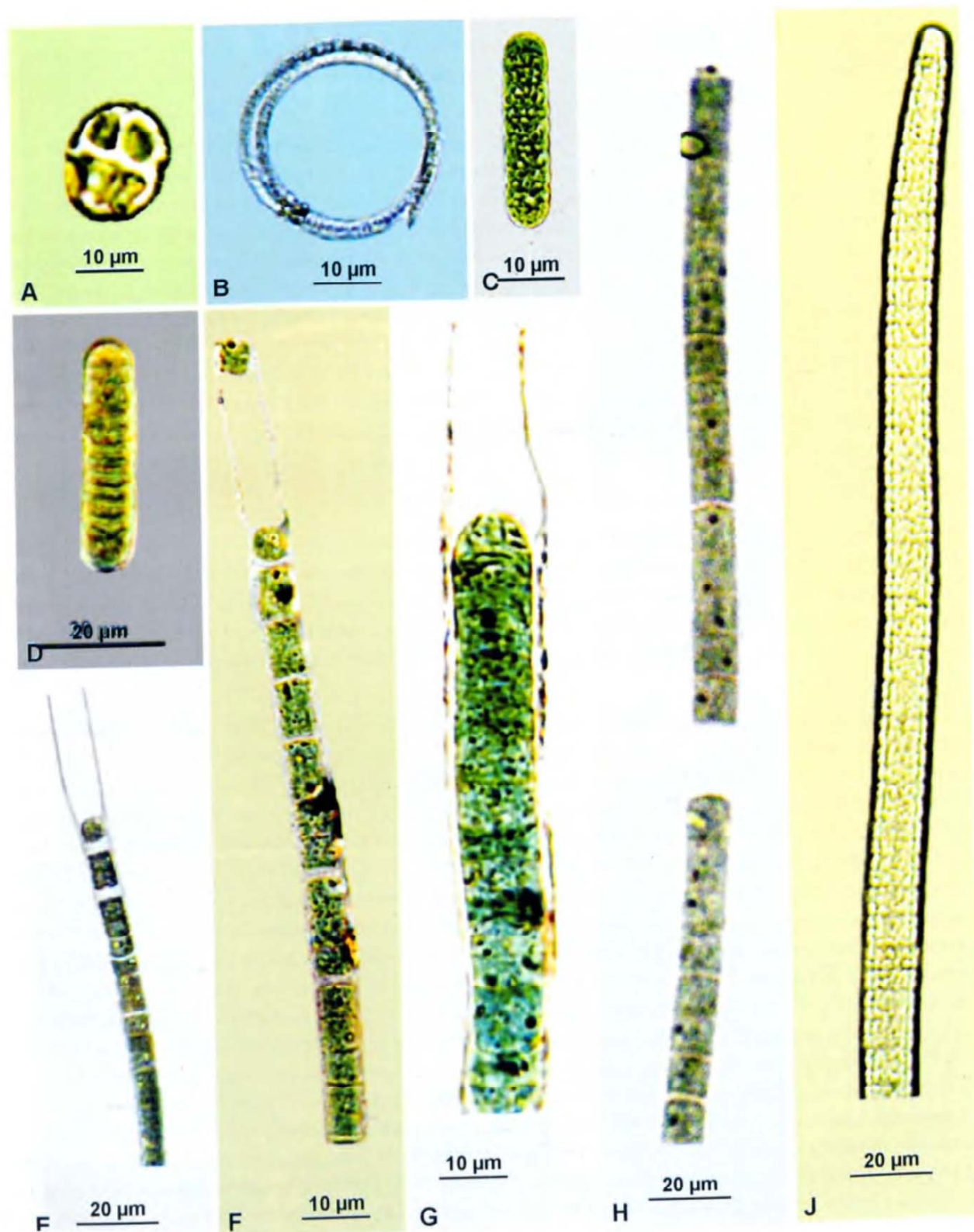


Fig. 2 Cyanophyceae from *Lodoicea maldivica* (J.E.Gmel.) Pres. and its surrounding area: **A.** *Chroococcus minutus* (Kütz.) Nägeli; **B.** *Lyngbya contorta* Lemmerm.; **C.** *Oscillatoria perornata* Skuja; **D.** *Lyngbya majuscula* var. *chakiaense* C.B.Rao; **E.** *Lyngbya mesotricha* Skuja; **F.** *Phormidium purpurascens* (Kütz.) Gomont; **G.** *Lyngbya martensiana* Menegh. ex Gomont; **H.** *Phormidium calcicola* N.L.Gardner & J. *Oscillatoria tenuis* C.Agardh ex Gomont.

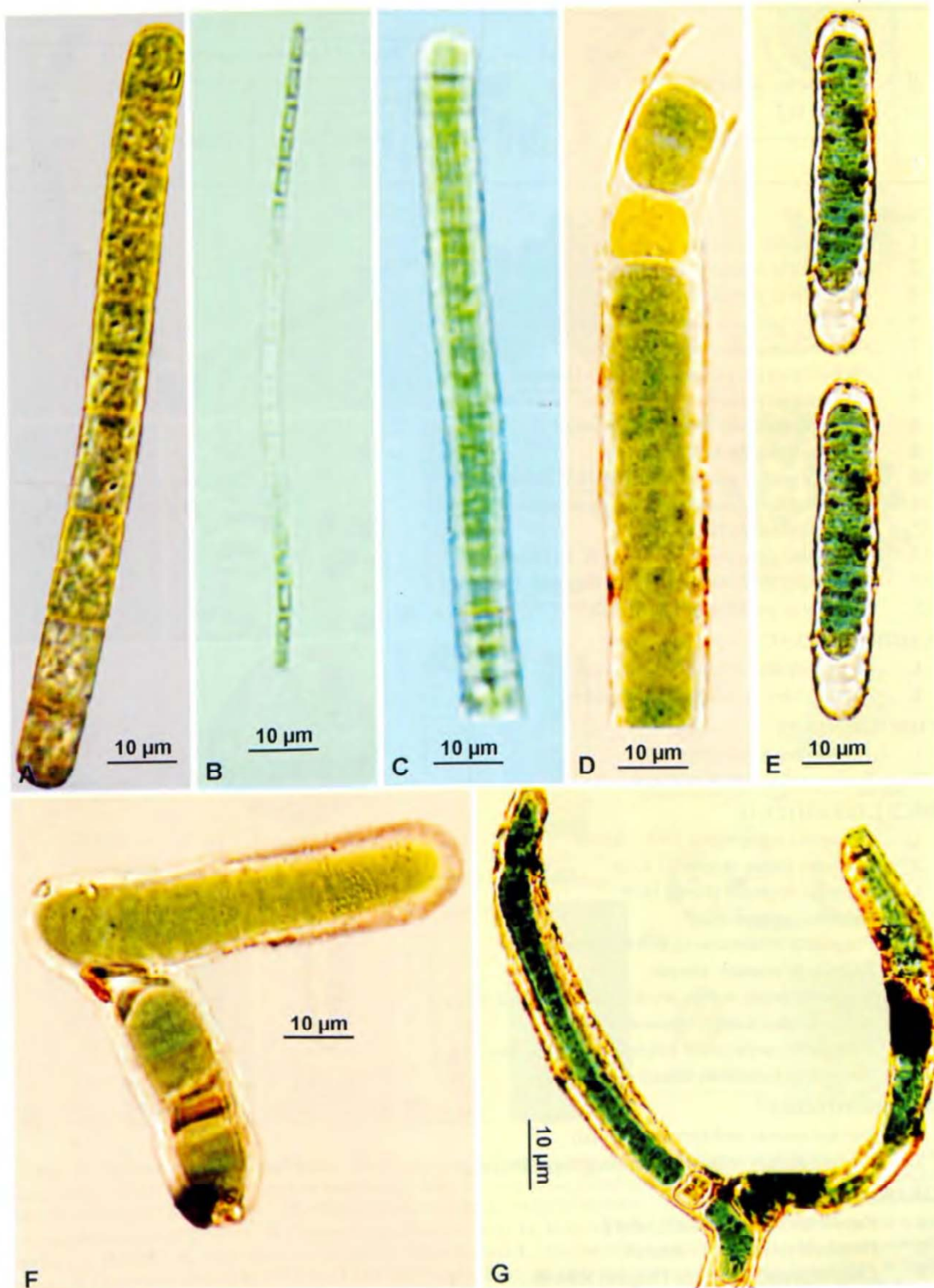


Fig. 3 Cyanophyceae from *Lodoicea maldivica* (J.E.Gmel.) Pres.: **A.** *Phormidium retzii* (C.Agardh) Kütz. ex Gomont; **B.** *Phormidium tenue* (Menegh.) Gomont; **C.** *Oscillatoria limosa* C.Agardh ex Gomont; **D.** *Scytonema ocellatum* Lyngb. ex Bornet & Flahault; **E.** *Scytonema pseudopunctatum* Skuja; **F.** *Scytonema guyanense* var. *minus* N.L.Gardner & **G.** *Scytonema pseudopunctatum* Skuja.

Table 1. Occurrence of Algae on and around *Lodoicea maldivica* (J.E.Gmel.) Pres. (Double Coconut) in AJCBIBG, Howrah

S. No.	Name of the Algae	Habitat						
		Parts of <i>Lodoicea maldivica</i>					Soil	Stones
		Tree Trunk			Petiole	Flower		
		Lower part	Middle part	Upper part				

CYANOPHYCEAE

1. *Chroococcus minutus* (Kütz.) Nägeli +
2. *Oscillatoria limosa* C. Agardh ex Gomont +
3. *Oscillatoria perornata* Skuja +
4. *Oscillatoria tenuis* C. Agardh ex Gomont +
5. *Phormidium calcicola* N. L. Gardner +
6. *Phormidium purpurascens* (Kütz.) Gomont +
7. *Phormidium retzii* (C. Agardh) Kütz. ex Gomont +
8. *Phormidium tenue* (Menegh.) Gomont +
9. *Lyngbya contorta* Lemmerm. +
10. *Lyngbya majuscula* var. *chakiaense* C.B.Rao +
11. *Lyngbya martensiana* Menegh. ex Gomont +
12. *Lyngbya mesotricha* Skuja +
13. *Scytonema guyanense* var. *minus* N. L. Gardner +
14. *Scytonema ocellatum* Lyngb. ex Bornet & Flahault +
15. *Scytonema pseudopunctatum* Skuja +

XANTHOPHYCEAE

1. *Meringosphaera spinosa* Prescott +
2. *Monallantus brevicylindrus* Pascher +

CHRYSOPHYCEAE

1. *Apistonema expansum* Geitler +
2. *Synura splendida* Korshikov +

BACILLARIOPHYCEAE

1. *Cyclotella trichonidea* Econ.-Amilli +
2. *Melosira italica* (Ehrenb.) Kütz. +
3. *Diatoma hyemalis* (Roth) Heib +
4. *Diatoma vulgare* Bory +
5. *Fragilaria construens* (Ehrenb.) Grunow +
6. *Fragilaria pinnata* Ehrenb. +
7. *Diploneis ovalis* subsp. *arctica* Lange-Bert. & Genkal +
8. *Navicula slesvicensis* Grunow +
9. *Pinnularia curticostrata* Krammer & Lange-Bert. +
10. *Pinnularia humilis* Krammer & Lange-Bert. +

EUGLENOPHYCEAE

1. *Trachelomonas pulcherrima* Playfair +
2. *Trachelomonas volvocina* var. *compressa* Drezep. +

CHLOROPHYCEAE

1. *Pandorina mora* (F. Muell.) Bory +
2. *Protococcus viridis* C. Agardh +
3. *Chlorococcum humicola* (Nägeli) Rabenh. +
4. *Chlorella vulgaris* Beij. +
5. *Treubaria setigera* (W. Archer) G. M. Sm. +
6. *Crucigenia quadrata* Morren +
7. *Crucigenia rectangularis* (Nägeli) Gay +

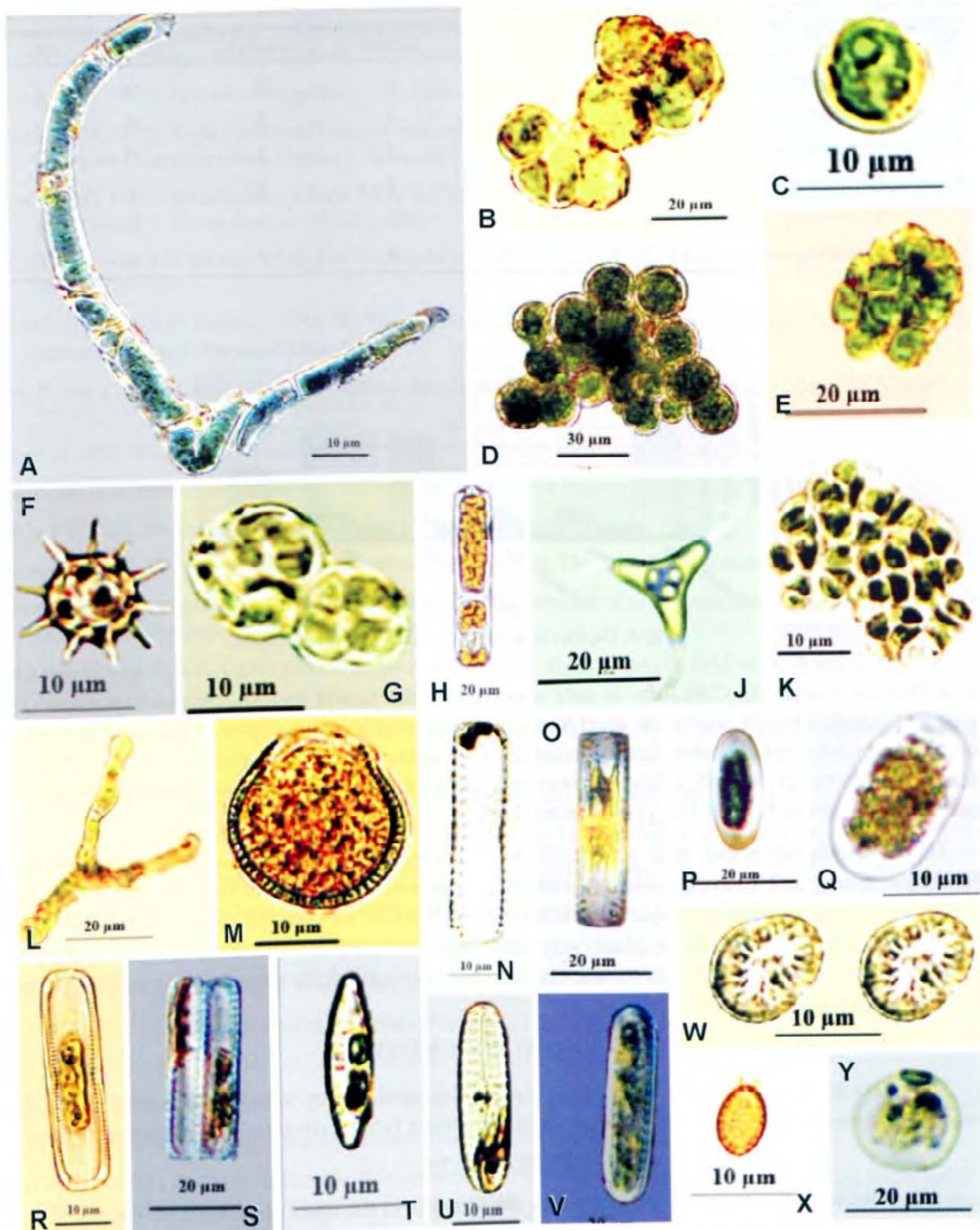


Fig. 4 Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae and Euglenophyceae from *Lodoicea maldivica* (J.E.Gmel.) Pres. and its surrounding area : **A.** *Scytonema pseudopunctatum* Skuja; **B.** *Protococcus viridis* C. Agardh; **C.** *Chlorella vulgaris* Beij.; **D.** *Chlorococcum humicola* (Nägeli) Rabenh.; **E.** *Pandorina mora* (F. Muell.) Bory; **F.** *Meringosphaera spinosa* Prescott; **G.** *Crucigenia quadrata* Morren; **H.** *Melosira italica* (Ehrenb.) Kütz.; **J.** *Treubaria setigera* (W. Archer) G. M. Sm.; **K.** *Crucigenia rectangularis* (Nägeli) Gay; **L.** *Apistonema expansum* Geitler; **M.** *Synura splendida* Korshikov; **N.** *Diatoma hyemalis* (Roth) Heib; **O.** *Diatoma vulgare* Bory; **P.** *Diploneis ovalis* subsp. *arctica* Lange-Bert. & Genkal; **Q.** *Monallantus brevicylindrus* Pascher; **R.** *Fragilaria construens* (Ehrenb.) Grunow; **S.** *Fragilaria pinnata* Ehrenb.; **T.** *Navicula slesvicensis* Grunow; **U.** *Pinnularia curticostata* Krammer & Lange-Bert.; **V.** *Pinnularia humilis* Krammer & Lange-Bert.; **W.** *Cyclotella trichonidea* Econ.-Amilli; **X.** *Trachelomonas pulcherrima* Playfair; **Y.** *Trachelomonas volvocina* var. *compressa* Dreze.

Table 2. Algae recorded from on and around *Lodoicea maldivica* (J.E.Gmel.) Pres. (Double Coconut) in AJCBIBG, Howrah.

Sl. No.	Class	Order	Family	Genus	species	subsp.	var.
1.	Cyanophyceae	2	3	6	13	0	2
2.	Xanthophyceae	1	1	1	2	0	0
3.	Chrysophyceae	2	2	2	2	0	0
4.	Bacillariophyceae	5	7	8	9	1	0
5.	Euglenophyceae	1	1	1	1	0	1
6.	Chlorophyceae	3	5	6	7	0	0

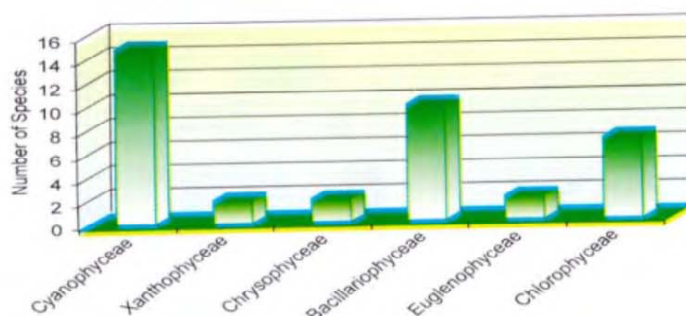


Fig. 5. Number of Algae recorded from different classes.

such as *Protococcus viridis* C.Agardh is only observed on the flower and *Apistonema expansum* Geitler only on leaf petiole. Overall, maximum algal forms were recorded from lower part of the tree trunk followed by upper and middle part probably due to presence of adequate quantity of nutrients, humus and moisture contents. The occurrence of such a large number of algal forms on *Lodoicea maldivica* (J.E.Gmel.) Pres., conserved in the garden for last 116 years is remarkable.

The algal infestation and their genetic stock on and around *Lodoicea maldivica* (J.E.Gmel.) Pres. studied is fascinating and is having applied significance. This is an unique type of finding reported for the first time from a rare slow growing palm species which supported such a vast diversity of algal forms belonging to six Classes on almost all part of the plant body from base to tip of the tree. The outcome of the present investigation is preliminary and needs further detailed study to establish the association as well as succession of different algal forms.

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प्रतिभा गुप्ता

सार संक्षेप

प्रस्तुत शोधपत्र में आचार्य जगदीशचन्द्र बोस भारतीय वनस्पति उद्यान (ए.जे.सी.बो.भा.व.उ.), हावड़ा में अवस्थित लोडोसिया मालद्वीविका (जे. ई. गेमेल.) प्रेस. पर एवं उसके आस-पास शैवाल का अध्ययन जुलाई से अक्टूबर, 2010 के मध्य किया गया एवं कुल 38 शैवाल प्राप्त हुए जो कि 6 वर्गों से सम्बद्ध हैं-सायनोफाइसी(15), जेन्थोफाइसी(2), क्राइसोफाइसी(2), बेसीलेरियोफाइसी(10), युग्लीनोफाइसी(2) एवं क्लोरोफाइसी(7)। लोडोसिया मालद्वीविका (जे. ई. गेमेल.) प्रेस. पर एवं उसके आस-पास पाये जाने वाले शैवालों का यह प्रथम अध्ययन है।