

# STUDY OF DIVERSITY AMONG THE GENUS *PHACUS* DUJARDIN, [1841] FROM DISTRICT NASHIK, [M.S.] INDIA.

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## Abstract

The present investigation reveals the 24 taxa of *Phacus*. These are collected from 29 fresh water sites of various parts of Nashik and its tahsils during the years 2009-2013. *Phacus* is found mostly in small fresh water pools rich in organic matter grow luxuriantly in such waters imparting its colour to the water body. The bright grass green, red or mix of green and red scums which are indicators of presence of *Phacus* species. This Paper consist the images and description of identified taxa. Among these *Phacus pusillus* and *P. stokesii* var. minor are new to India. *Phacus acuminates* var. *drezeplorskii* is also little known and appear as first report for Maharashtra. Rests are first time explored from this region. This enriches the algal flora of Nashik.

Key words –Diversity, Euglenoide, *Phacus*, Fresh water, Nashik.

## INTRODUCTION:

Algae are a primitive group of autotrophic organisms. These are occurs in every kind of habitats as water [ as lakes, ponds, pools, paddles, rivers and oceans. ] land, air and can survive even in the extremities of the environmental conditions and global in occurrence. They are the most ancient of the organisms thriving from Pre-Cambrian period and today has successfully established almost in variety of habitat. They are ubiquitous in their distribution. They are one of the most successful and important part of the aquatic food chains in the form of primary producers of organic matter in nature, thus, playing a major role as a basic constituent of a living community.

On the basis of size and thallus nature algae are as two type's macroalgae and microalgae. Macroalgae are large and multicellular organisms and Microalgae are microscopic, single-celled or colonial. In current era algae especially microalgae has unique status due to its extensive use worldwide. In aquatic ecosystem Microalgae play important role in nutrient cycling, fixing inorganic carbon into organic molecules and evolved oxygen. so its need to explored the microalgae and enrich the biodiversity.

The unicellular green euglenoids in the lentic ecosystem from Nashik District has still ignore so these are unrecorded, therefore its urgent need to explore the flora to understand the taxonomy and diversity among genus *Phacus* of Nashik. *Phacus* Dujardin 1841 is a morphologically distinctive photosynthesis euglenoid. It is most known euglenoids after the euglena in the water samples. This Phytoplankton is unicellular, uniflagellate rigid and compressed cell with a true cell wall. Most of the euglenoide not have true cell wall except *Phacus*. It is being very flat and leaf-shaped dorsiventral flat, often with ridges, folds or grooves running helically or longitudinally, with a long posterior spine. Some species have become shaped like flattened spinning tops, twisted into flat corkscrews eg. *Phacus inflexus*. It is also having single flagella; eyespot and flagella swelling are present. Eyespot is sometime absent. The periplast ornamented with striae, punctate, or denticulations that lie in longitudinal or in spiral series. Chloroplasts small or large, flat, discoid and numerous, with or without pyrenoids. Paramylon typically deposited as a few large granules [often rings] together with many small ones.

*Phacus* is belonging to family Euglenaceae. The taxa are found in shallow and stagnant or slow flowing waters, as moist soil, ditches, puddles, ponds. The plants were collected and identified in live conditions only so as to observe its motility, number of flagella and other details with treatment of dilute iodine. The genus *Phacus* is widely distributed with species like *P. agilis*, *P. anamola*, *P. brachyketron*; *P. caudatus*, *P. pyrum*, and *P. radricula* are common. These organisms flourish well at temperatures above 25°C .

**MATERIAL AND METHODS:**

The study is based on field, laboratory work and literature surveys, Samples were collected during Jan.2009 to Dec.2013. Collection were made with help of phytoplankton net and manually. Algal samples were preserved in 4% formalin. For the detailed studies of algae, Photomicrography has been done under Labmade electric microscope with digital camera.

**Collection of algal samples:**

The collections of algae from various habitats are made during the period from 2009-2013. The algae are collected by hand or with a knife, forceps etc. including part or entire substrates. They are also collected from stones in fast flowing water, aquatic plants, on dam walls and from any floating objects. Algae are also obtained by simply squeezing bryophytes and other aquatics. The phytoplanktons are collected by using a fine mesh phytoplankton net, with 25-30 $\mu$  pores. Sufficient quantity of sample is concentrated by simply scooping a jar through the water for several times.

**Storage and preservation of samples:**

The algal samples are collected in bottles, jars or plastic bags of different sizes with some water from the collection sites. After collection the containers are kept open. Algae can be kept alive for short periods for one or two days in open petridishes, in a cool place with reduced light for their continuous growth and further observations.

For long term storage samples are preserved in preservative solutions, dried or as permanent microscope mounts. Samples are preserved in commercial formations like 4 % formalin and FAA.

The observations are based on living materials which are essential for its identification. The simplest method is to prepare a cavity glass slide by placing a drop of sample on to the slide with cover slip carefully over it and avoiding any air bubbles and observing the specimen under lower magnification of microscope. Observations are made more sequentially at under 4 x, 10x, 40x, 100 x magnification. India ink is also used to observe the flagella of motile organisms. This technique is also very useful for observing sheaths of individual cells or of mucilaginous organisms.

**Measurements:**

The measurements of the specimens are taken and used for its identification and subsequent classification. The metric units cm, mm, and  $\mu$  are utilized. Stage and eyepiece micrometers are used for measuring the length and breadth of the organism.

**Microphotographs:**

The microphotographs are taken by camera by using "Lobo"- Trinocular microscope unit. Sony Cyber Shot DSC-W80 camera is used for all microphotographs.

**Identification:**

The identification of algae was done by using standard monographs and research papers.

**RESULT AND DISCUSSION -**

Division	Euglenophyta
Class	Euglenophyceae
Order	Euglenales
Family	Euglenaceae

**Genus- *Phacus* Dujardin, 1841:**

Prescott -1951; 395.

Phytoplankton, unicellular, uniflagellate rigid, compressed cells, naked being very flat and leaf-shaped, often with ridges, folds or grooves running helically or longitudinally, with a long posterior spine, shaped like flattened spinning tops, twisted into flat corkscrews. Flagella, eyespot and flagella swelling are present. The periplast ornamented with striae, punctate, or denticulations that lie in longitudinal or in spiral series. Chloroplasts small or large, flat, discoid and numerous, with or without pyrenoids. Paramylon typically deposited as a few large granules [often rings] together with many small ones.

***Phacus acuminatus*** A. Stokes, 1885:

Pl.-1

Prescott -1951; 396: Pl. - 88, Fig.- 4.

Cells suborbicular in outline with greatest width below middle, very thin, shallow dorsal furrow extending half to  $\frac{3}{4}$  cell length, a short blunt extension at posterior end, incision at anterior end, chloroplasts numerous, parietal rings like disc with 1-2 ring like paramylon bodies, pellicle longitudinally striated; flagellum approximately length of cell. Cells 20-25 $\mu$  wide and 20-36.9 $\mu$  long.

Habitat- Waghera Dam [04/04/2009], Pimpalgaon Bhor [14/09/2010], Harsool [9/9/2012].

Distribution- Maharashtra [Kamat and Freitas, 1976; Jawale *et al*, 2003; Kamat, 1974], Tamilnadu [Mahendrapurumal and Anand, 2009; Mayakkannam, 2010].

***Phacus acuminates* var. *drezepolskii*, Skvortzow, 1928:**

Pl. - 1

Prescott - 1951; 397: Pl. - 88, Fig.-17, 18.

Cells bigger in size, ellipsoid or ovoid with short, sharp tail produced posteriorly or the cell margins convolute to form a tail. Periplast longitudinally striated paramylon bodies 2, large discs, one in the centre and other near the tail. Cells 10-15 $\mu$  in dia., 21-24 $\mu$  long and tail 1.65-3.3 $\mu$  long. Previously recorded in Karnataka [1983] only. It seems to be first report Maharashtra.

Habitat –Tapovan [22/06/2012], Dental College [22/06/2012].

Distribution - Karnataka [Hosmani and Bharati, 1983], Queensland [Day *et al.* 1995].

***Phacus agilis* Skuja, 1926:**

Pl. - 1

Philipose -1967; 522: Pg. - 519, Fig. - 16a-b.

Cells like a coffee bean and elongate-ellipsoid, four-cornered, anterior end slightly narrowed, posterior end narrowed and obtuse with a knob-like tail in line with the longitudinal axis, pellicle with fine slightly spiral striae. Flagellum about body length. Paramylum two, lateral. Cells 13.2 $\mu$  long and 8.25 $\mu$  in dia.

The given specimen is similar as the type specimen of Philipose. It is smaller than the type specimen.

Habitat-Waghera Dam[04/04/2009], Pimpalgaon Bhor [14/09/2010], Peint-Surgana [12/08/2009], Pimpri Trimbak [18/09/2009], Niphad [10/6/2009], Salher [11/07/2009], Nasardi bridge [30/04/2010], Tapovan [22/06/2012], Dental College [22/06/2012].

Distribution-Andhra Pradesh [Suxena, 1972], Gujarat [Patel and Waghodekar, 1981], Maharashtra [Jawale *et al.*, 2003; 2005; Kumawat *et al.*, 2007].

Spain [Alvarez Cobelas 1984], Israel [Stupina *et al.* 2000], Britain [Wolowski, 2002, Whitton *et al.* 2003], Romania [Caraus, 2002], China [Hu and Wei, 2006].

***Phacus anamola* Fritsch and rich., 1930:**

Pl. - 1.

Philipose- 1983; 525: Pg. - 519, Fig. - 22 a-d.

Cell in two unequal halves with one of the halves in the form of a wing. Cell longer than broad and winged in apical view; end broadly rounded with the hind end broadened and with a short bent tail, pellicular striae longitudinal to slightly spiral. Paramylum two, disc-like and unequal in size, one in each half of the cell and other in the other part of the cell. Cells 29.7-33 $\mu$  long, 23.5 $\mu$  dia. and with tail 1.8-2.1 $\mu$  long. The given specimen is similar as the type specimen by Philipose [1983].

Habitat- Niphad [10/06/2009], Salher [11/07/2009], Ozar [27/02/2012], Dental College [22/06/2012].

Distribution- W. Bengal [Kacharoo, 1960], Maharashtra [Kamat and Freitas 1976; Ashtekar, 1982], Gujarat [Patel and Waghodekar, 1981; Kumawat *et al.* 2007].

***Phacus brachycentron* Pochmann, 1942:**

Pl. - 1.

Philipose -1983; 523:Pg.519, F.-18, 18a.

Cells ovoid, slightly asymmetrical, narrowed gradually posteriorly to a long, straight or bent, finely pointed tail. Paramylum 2-3, when 3, two central concentric and one eccentric to central one, when two one slightly lateral and second eccentric to the first. Eyespot small and disc like. Cells 14.8-26.4 $\mu$  long, 13.2-23.1 $\mu$  in dia. Chloroplast numerous, ovoid.

It is cosmopolitan but not a common species. The type species is described by Pochmann and Indian species is alike as a type species.

Habitat– Ghodegaon [18/08/2011], Dugarwadi [10/06/2012], Dental College [22/06/2012].

Distribution – Andhra Pradesh [Suxena, 1955], Maharashtra [Kamat, 1968; Kamat and Freitas 1976; Ashtekar, 1982; Jawale *et al.*, 2003], Rajasthan[Trivedi, 1982]; Tamilnadu [Mayakkannam, 2010].Brazil [Alves-da-Silva and Menezes 2010], Sierra Leone [Alfinito 2011].

***Phacus caudatus* Hubner, 1886:**

Pl. - 1

Philipose- 1967; 530: Pg. - 527, Fig. - 32 a-c.

Cells 19.8 -29.7 $\mu$  long, 10.5-18.5 $\mu$  dia. and tail 3.3 $\mu$  long. Ovoid-pyriform, spirally twisted and asymmetrical produced posteriorly to form a straight short, caudus, anteriorly and broadly rounded, periplast longitudinally striated. Chloroplast numerous, small and discoid. Two paramylum discs or rings of unequal size, lying along the longitudinal axis with the larger one in the middle or just above and the smaller one near the tail.

Habitat- Karanjwan Dam [15/10/2009], Kashyapi Dam [28/10/2010], Anjeneri [02/07/2012].

Distribution- Andhra Pradesh [Suxena 1955], Gujarat [Kamat 1961-62; Patel and Waghodekar, 1981], Maharashtra [Kamat, 1963, 1964, 1968, 1975; Deore, 1978; Jawale *et al.*, 2003; Gore and Sanap, 2009], Uttar Pradesh [Hortobagyi, 1969], Karnataka [Bharati and Hosmani, 1973; Hosmani, 2008].

The given specimen is similar as the type specimen by Philipose [1967] except it is smaller than the type specimen.

***Phacus circumflexus* Pochmann, 1914:**

Pl. - 1

John- 2002; 164:Pl.39 Fig.-N.

Cell broadly oval, slightly twisted, with one rib folded, posterior end with long, straight tail piece. Pellicle with spirally arranged striations. Flagellum length is as cell length or less. Chloroplast numerous without pyrenoid. Paramylon bodies two, central one larger than the posterior. Cell 72.6 $\mu$  long and 33 $\mu$  in dia. Rare in occurrence.

Habitat –Dugarwadi [10/06/2012], Tapovan [22/06/2012].

Distribution – Andhra Pradesh [Suxena, 1955], Maharashtra [Kamat, 1975], Karnataka [Hosmani, 2008], Burma [Skvortzov, 1937].

***Phacus curvicauda* Swirenko, 1915:**

Pl. - 1

Philipose- 1967; 524: Pg.-519, Fig. - 20 a-c.

Cell broadly ovoid or nearly spherical, sub orbicular in outline, dorso-ventrally grooved. The anterior end slightly narrow, the hind end slightly broadened and bearing at its tip a short tail which is turned slightly towards one side; apical groove of variable length ranging from about 1/3 to nearly the full length of the cell. Pellicular striae longitudinal, a flagellum two-times longer than the body length. Chloroplast numerous and discoid, two disc-shaped paramylon. Cells with tail [30.03] 36.3-39.6 $\mu$  long, 21.45-26.89 $\mu$  dia. and tail 1.65-4.95 $\mu$  long. It is cosmopolitan and common species.

Habitat- Peint-Surgana [12/08/2009], Pimpri Trimbak [18/09/2009], Niphad [10/06/2009], Salher [11/07/2009], Nasardi Bridge [30/04/2010], Tapovan [22/06/2012], Kumbharwadi [28/07/2012].

Distribution- Andhra Pradesh [Suxena, 1955], Maharashtra [Kamat, 1963, 1964, 1975, Kamat and Freitas, 1976; Deore, 1978; Ashtekar 1982; Jawale *et al.*, 2003; Jadhav, 2014], Himachal Pradesh [Kamat, 1968a], Uttar Pradesh [Hortobagyi, 1969; 1948], Karnataka [Bharati and Hosmani, 1973], Gujarat [Patel and Waghodekar, 1981] Karnataka [Hosmani, 2008].

Popova and safonova [1976]

***Phacus inflexus* [I. Kisselev] Pochmann, 1942:**

Pl. - 1

Philipose- 1983; 523.

= *Phacus inflexus* [I. Kisselev] Pochmann 1942.

= *Euglena inflexa* I. Kisselev 1931.

= *Phacus inflexus* var. *minor* Bourrelly and Manguin 1952.

Cell usually strongly twisted with inwardly curved dorsal side, looking like a sickle in side view, posterior end with a short tail lying against the dorsal side and drawn out from a dorsal hump, pellicular striae delicate and spiral, paramylum two, one large and the other small, ovoid to discoid or elongate and rod-like; larger one usually on the dorsal side; Chloroplast discoid and numerous, eye-spot small, flagellum as the body length. Cells [13.5] 19.4-26.4 $\mu$  long and [6.3] 7-9.9 $\mu$  broad. The given specimen is alike as the type specimen by Philipose [1983] except it is larger in size.

Habitat- Niphad [10/06/2009], Salher [1/07/2009], Peint-Surgana [12/08/2009], Pimpri, Trimbak [18/09/2009], Nasardi bridge [30/04/2010], Ghodegaon [18/08/2011], Dugarwadi [10/06/2012], Tapovan [22/06/2012].

Distribution- Gujarat [Patel and Waghodekar, 1981], Tamilnadu [Mahendrapuram and Anand, 2009; Mayakkannam, 2010].

***Phacus landekiensis* Stawinski, 1969:**

Pl. - 1

Cell body 37 $\mu$  long, 27 $\mu$  wide highly flattened, pellicle firm, body form constant. Chloroplasts small, discoid, pyrenoids absent, flat, leaf-shaped.

Habitat- Niphad [10/06/2009], Salher [11/07/2009], Waghera Dam [04/04/09], Peint-Surgana [12/08/2009], Pimpri Trimbak [18/09/2009], Nasardi bridge [30/04/2010], Pimpalgaon Bhor [14/9/2010], Dugarwadi [10/06/2012], Rajurgaon [04/06/2011], Ghodegaon [18/08/2011], Tapovan [22/06/2012].

***Phacus longicauda* [Ehrenberg] Dujardin, 1841:**

Pl. - 1.

Prescott, 1951; 400: Pl.-87, F.-1

Cells 46.2 - 52.4 $\mu$  broad, 92.4 - 99 $\mu$  long with tail, 66 $\mu$  long without tail, broadly ovoid to pyriform, tapering gradually posteriorly to form a long, straight, sharply pointed caudus, anteriorly broadly rounded. Periplast longitudinally striated. Flagellum shorter than the cells in length. Paramylum body in the form of a single circulate plate. Rather common in Nasardi pond.

Habitat- Nasardi Bridge [30/04/2010], Ozar [27/02/2012].

Distribution- Kashmir [Bhatia, 1930], Gujarat [Kamat, 1961], Maharashtra [Kamat, 1964, 1968, 1973a, 1974; Kamat and Freitas, 1976, Deore, 1978; Jawale *et al.*, 2003; Kumawat *et al* 2007; Gore and Sanap, 2009], Kerala [Suxena *et al* 1973].

***Phacus longicauda* [Ehr.] Dujardi var. *torta* Lemmermann, 1910 .**

Pl. - 1

John, 2002; 164:

Cell broadly ovoid, slightly twisted at posterior part with one rim folded, terminating in a long sharp tail, chloroplast numerous, disc shaped, paramylon bodies ring like and large, pellicle longitudinally striated, flagellum smaller than the cell length. Cell 33 - 52.8 $\mu$  long, 33-36.3 $\mu$  in dia. and tail 19.8-26.4 $\mu$  long. Rare in occurrence

Habitat- In ponds and puddles of Jadhav wadi [20/01/2011], Trimbakeshwar [21/01/2012].

***Phacus menson* Pochmann, 1942:**

Pl. - 1

Philipose, 1983; 533:Pg.-527, Fig.-35a-d

Cell elongated ellipsoidal or oval, entire lateral margins, anterior end rounded, tail at posterior side. Pellicle with longitudinal striae and transverse striae among them. Chromatophore smalls, discoid, many. Paramylon two,

equal rings, one at the centre, other towards the tail. Cells 49. 2 -51.5 $\mu$  in dia., 49.5-72.2 $\mu$  long and tail 26.4-36.3 $\mu$  long.

Habitat- Benze Farm [18/8/2011], Gangapur Farm [25/01/2012], Dindori [30/03/12].

Distribution- Maharashtra [Deore, 1978], Karnataka [Hosmani and Bharati, 1983]

***Phacus orbicularis* K. Hübner, 1886:**

Pl. - 1

Prescott -1951; 401: Pl.-87, Fig. -10.

= *Phacus orbicularis* var. *undulata* Skvortzov 1917.

= *Phacus pleuronectes* var. *australis* Playfair 1921.

= *Phacus platalea* Drezepolski 1925.

= *Phacus ovoidea* Roll 1925.

= *Phacus zingeri* Roll 1925.

= *Phacus orbicularis* var. *caudata* Skvortzov 1928.

= *Phacus pleuronectes* var. *marginata* Skvortzov 1928.

= *Phacus orbicularis* var. *cingeri* [Roll] Svirenko 1938.

= *Phacus undulatus* [Skvortzov] Pochmann 1942.

= *Phacus orbicularis* f. *communis* Popova 1947.

= *Phacus orbicularis* f. *cingeri* [Roll] Safonova 1976.

= *Phacus cingeri* Roll 1925; Skuja 1949.

Cell orbicular, in side view dorsal side convex and ventral side nearly flat or slightly convex, posterior end with a short tail, bent at an angle to the cell or curved, flagellum as long as body, pellicle longitudinally striated, frequently with transverse striae between the longitudinal ones, apical furrow reaching up to the middle, paramylon two, disc shape, one large and central and the other small overlapping the former eccentrically. Cells excluding tail 55-63 $\mu$  in dia. and 40-53 $\mu$  long. It is cosmopolitan and very common species.

Habitat - Dugarwadi [10/06/2012], Ashawadi [11/10/2012].

Distribution- Maharashtra [Gonzales and Joshi, 1946; Kamat 1964, 1968, 1975; Ashtekar, 1982; Jawale *et al.*, 2003; 2005; Narkhede, 2006; Kumawat *et al.*, 2007], Andhra Pradesh [Suxena, 1955], Himachal Pradesh [Kamat, 1968a], Kerala [Suxena *et al.*, 1973].

Popova and safonova, [1976].

***Phacus orbicularis* var. *zmudae* Namyslawski, 1921:**

Pl. - 1

Prescott - 1951; 401: Pl.-88, Fig.-10.

Cells orbicular, produced posteriorly to form a short caudus obliquely turned to the left [as seen in ventral view], periplast longitudinally striated. Paramylon bodies two, one large and central and the small overlapping the former eccentrically. Cells 26.4-27 $\mu$  in dia., 29.7-30.5 $\mu$  long. Rare in occurrence.

Habitat – NandurMadhameshwar [29/02/2012], Anjeneri [5/07/2012].

***Phacus onyx* Pochmann, 1942:**

Pl. - 1

Philipose- 1967; 533: Pg.-538, Fig.-34A.

Cell slightly asymmetrical and less trapezoidal with the posterior end abrupt and with a sharply curved tail, anterior end narrower, one or both margins of cell with a notch, pellicle with longitudinal striae paramylon a single large disc [or ring] and rarely two smaller ones. Cell with tail 29.7-39.6 $\mu$  long, 26.1-26.4 $\mu$  dia. and tail 8.24-10 $\mu$  long. The given specimen agrees all characters as the type specimen of Philipose [1983]. Some smaller dimension forms than the type specimen, rest of the characters are agreed.

Habitat- Niphad [10/06/2009], Salher [11/07/2009], Peint-Surgana [12/08/2009], Pimpri, Trimbak [18/09/2009], Nasardi bridge [30/04/2010], Ghodegaon [18/08/2011], Dugarwadi [10/06/2012], Tapovan [22/06/2012].

Distribution- Andhra Pradesh [Suxena, 1955], Maharashtra [Kamat, 1963; Kamat and Freitas, 1976; Ashtekar 1982; Jawale *et al.*, 2003; 2005; Vanjari and Kumawat, 2007; Kumawat, *et al.*, 2007].

***Phacus pyrum* [Ehrenberg] W. Archer, 1871:**

Pl. - 1

Prescott-1951; 402: Pl.-88, Fig.-22.

Cells ovoid, narrowed gradually posteriorly to a long, straight, finely pointed tail. Broadly rounded anteriorly, but with 02 papillae between which the flagellum emerges, periplast spirally ribbed, paramylon bodies 02 ring-like plates, laterally situated. Cells 16.5-19.1 $\mu$  in dia., 26.4-29.7 $\mu$  long.

Habitat – Waghera Dam [04/04/2009], Peint-Surgana [12/08/2009], PimpriTrimbak [18/09/2009], Nasardi bridge [30/04/2010], Pimpalgaon Bhor [14/09/2010], Ozarkhed [30/03/2012], Tapovan [22/06/2012].

Distribution –Maharashtra [Jawale *et al.*, 2003; 2005; Vanjari and Kumawat, 2007], Karnataka [Kumawat *et al.* 2007; Hosmani 2008].

***Phacus pusillus* Lemmermann, 1910:**

Pl. - 1

John, 2002; 167:Pl.38 Fig.-Q, R.

=*Phacus alatus* G.A.Klebs, 1886.

=*Phacus parvulus* var. *pusillus* [Lemmermann] Popowa, 1955.

Cells 6.6-7 $\mu$  wide, 11.55-13.2 $\mu$  long, ovoid to elongate, oval to flattened, dorsiventral with a wide furrow running full length of cell, slightly twisted, anterior end rounded, posterior end is slightly narrowed, pellicle

slightly, Chloroplast parietal, small numerous disc shaped, Paramylon bodies one, ring shaped. Rare in occurrence. It seems a first report of the alga from this locality and Maharashtra.

Habitat–Karanjwan Dam [15/10/2009], Kashyapi Dam [28/10/2010], Harsool [14/02/2011], Sakur [10/05/2011], Anandwali [9/02/2011], Benze Farm [18/8/2011], Nandur Madhameshwar [29/2/2012].

Distribution- Britain [Wolowski 2002, Whitton *et al.* 2003, John, Whitton and Brook 2011], Romania [Caraus, 2002, 2012], Spain [Alvarez Cobelas 1984], Brazil [Alves-da-Silva and Menezes, 2010], Israel [Stupina *et al.* 2000], Taiwan [Shao 2003-2014].

***Phacus radricula* [Playfair] Pochmann :** Pl. - 1

Huber-Pastalozzi-1955:233:

Cells 13.2-19.8 $\mu$  broad, 26.4 -29.7 $\mu$  long and tail 9.9 $\mu$  long. Cell ovoid, narrowed gradually posteriorly to a long, straight, finely pointed caudus. Broadly rounded anteriorly, with two papillae. Flagellum arises between these two papillae. Periplast spirally ribbed, paramylum bodies 2, ring like plates, laterally situated.

Habitat- Niphad [10/06/2009], Salher [11/07/2009], Ozar [22/03/2011].

Distribution- Maharashtra [Deore, 1978; Jawale, *et al.*, 2005; Kumawat, *et al.* 2007]

***Phacus ranula* Pochmann, 1942:** Pl. - 1

Huber –Pestalozzi, 1955:227

Cells 47-50 $\mu$  broad, 77-80 $\mu$  long, ellipsoidal, with the posterior short and somewhat bent caudus, periplast longitudinally striate, paramylum bodies large. It is apparently a cosmopolitan but not common species. Conforti [1991] describe var. minor based on small size cells but species occur in Nashik is larger size reported.

Habitat- Dugaon [12/02/2009], Vani [12/03/2009], Niphad [10/06/2009], Salher [11/07/ 2009], Someshwar [7/09/2012].

Distribution- Maharashtra [Deore, 1978], West Bengal [Pal and Santra, 1984].

***Phacus ranula* var. *brevicaudatus* Philipose:** Pl. - 2

Philipose- 1983; 535: Pg.-537, Fig.-36 c-d.

The tail shorter and nearly straight, not twisted, stouter; lateral margins of cell either or sometimes with a notch; transverse striae present; paramylum four to numerous, ring-like, disc-like and of variable size; eye-spot distinct. Flagellum not observed; cell without tail 72.6 $\mu$  long, including tail 108.9 $\mu$ , 57.75 $\mu$  in dia. and tail 33 $\mu$  long.

Habitat- Ozar [22/3/2011].

Distribution- Maharashtra [Deore, 1978; Kumawat, *et al.* 2007]

Singapore [Pham *et al.* 2011], Arkansas [Smith 2010].

***Phacus stokesii* var. *minor* Lemmermann, 1901:** Pl. - 1

John-2002; 168:Pl.38 Fig.-L.

Cell ovoid or broadly ovoid with broad longitudinal furrow at the middle, anterior broadly rounded posterior slightly pointed, tail short. Pellicle with longitudinal striae. Paramylon a single, large, disc-shaped. Chloroplast parietal, numerous, disc shaped, eye spot distinct, cup shape. Flagella long. Cell 13.2-16.5 $\mu$  long, 8.25-13.2 $\mu$  broad, tail 1.65 $\mu$  long. It seems a first report of the alga from this locality and Maharashtra.

Habitat – NandurMadhameshwar [29/02/2012], Ozarkhed Dam [30/03/2012].

Distribution- Queensland [Day *et al.* 1995], Britain [Wolowski 2002, Whitton *et al.* 2003], China [Hu and Wei 2006], Brazil [Alves-da-Silva and Menezes 2010], Brazil [Alves-da-Silva and Menezes, 2010], Sierra Leone [Alfinito, 2011], Poland [Zakrys *et al.* 2013].

***Phacus tortus* [Lemmermann] Skvortzov, 1928:** Pl. - 1

Huber -Pestalozzi, 1955:225

=*Phacus longicauda* var. *tortus* Lemmermann 1976.

Cells broadly spindle shape, anterior end conically rounded, tapering and spirally twisted in posterior region to form long, straight tail. Tail long as half the cell length. Chloroplast parietal, paramylum bodies 1-2, circular plate likes. Periplast with spiral striations, flagellum long, eyespot distinct. Cells 49.5- 66 $\mu$  in dia., 55-90 $\mu$  long with cauda and caudae 26. 4 $\mu$  long.

Habitat- Dugaon [12/02/2009], Vani [12/03/2009], Karanjwan Dam [15/10/2009], Kashyapi Dam [28/10/2010], Gangapur Dam [1/02/2011], Ghodegaon [18/08/2011], Dugarwadi [10/06/2012], Someshwar [7/09/2012].

Distribution- Maharashtra [Kamat, 1963, 1964, 1975; Deore, 1978; Jawale *et al.*, 2003, 2005; Narkhede, 2006; Vanjari and Kumawat, 2007], Uttar Pradesh [Hortobagyi, 1969] Karnataka [Hosmani 2008], Tamilnadu [Mayakkannam, 2010].

***Phacus wettsteineinii* Drezepolski, 1925:** PP. -2

Philipose- 1967; 521: Pg.-519, Fig.-14 a, b.

Cell 16.5 long, 6.6- 8.25 $\mu$  broad. Cell elongate-oval with both ends rounded and a sharp point at the hind end. Periplast longitudinally striated, chloroplast big, round or disc- like, two rounded disc shape paramylum. The present specimen is agree with the type specimen describe by Philipose [1967]. It is reported as solo report in Maharashtra only [Deore, 1978],

Habitat- Niphad [10/06/2009], Salher [11/07/2009], Nasardi Bridge [30/04/2010], Ghodegaon [18/08/2011], Dugarwadi [10/06/2012], Tapovan [22/06/2012].

Distribution- Maharashtra [Deore, 1978], Romania [Caraus 2002, 2012].

## CONCLUSION –

The Present investigation shows 28 –taxa. These are collected from the stagnant fresh water, pond, pools, puddles etc. Eutrophic water supports rich microalgae- euglenoid -*Phacus*. All these taxa are first record for the Nashik region. Among these *Phacus pusillus* and *P. stokesii* var. *minor* are reported new for India and *P. acuminatus* var. *drezepolskii* is a little known and appear as a first report from Maharashtra. Size and Shape variation was sometimes observed in naturally occurring fresh water wet lands. eg. *Phacus elegans*. variation also seen in different sites and also within the single taxa type. Such kind of observations are matches with the Confetti [1998], reported morphological variations due to different level of organic content. As per Confetti [1998] observations the presence of enormous paramylon bodies in *Phacus* and *Euglena* could be used as a good environmental bioindicator.

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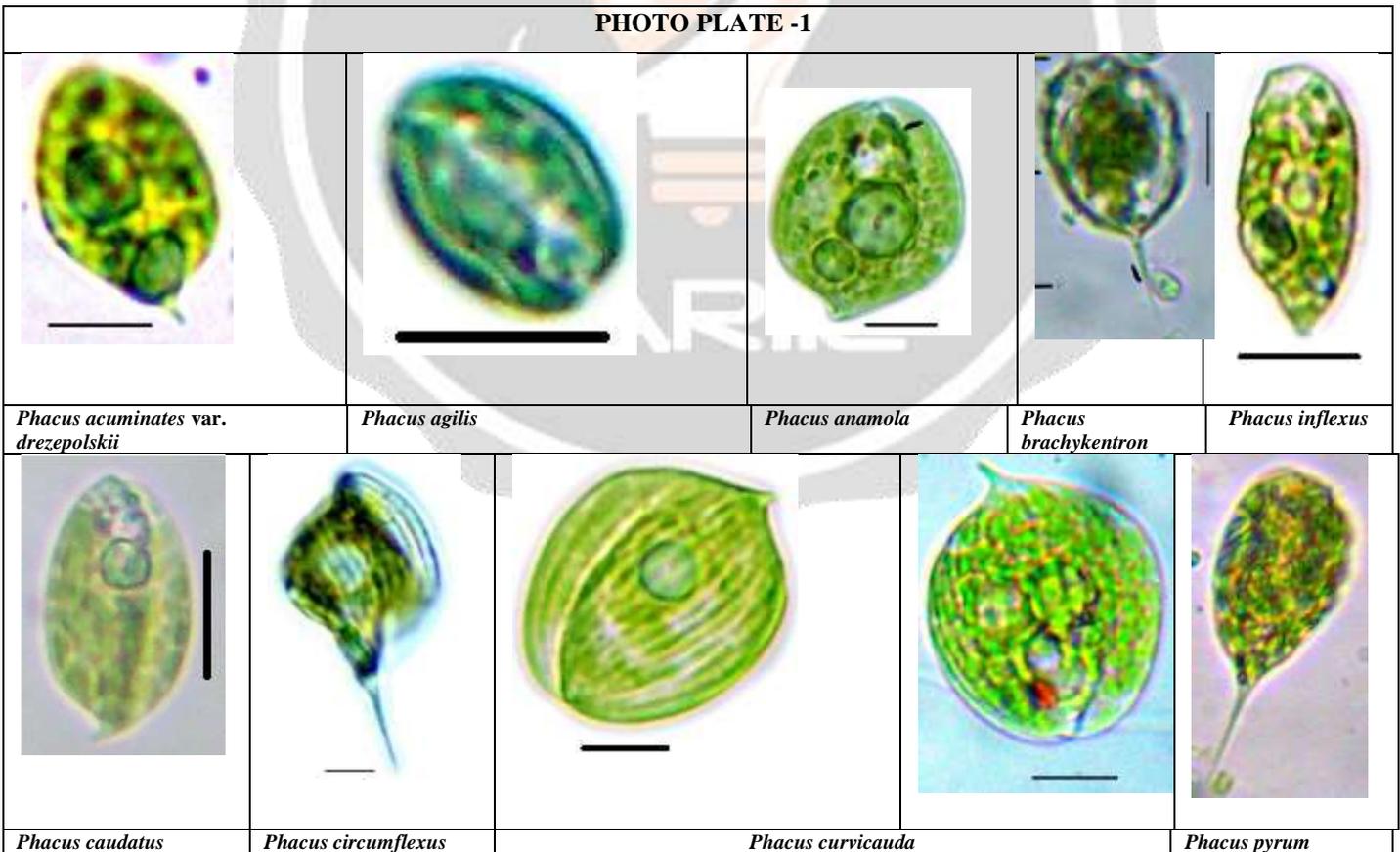
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\*Originals not seen.

**PHOTO PLATE -1**



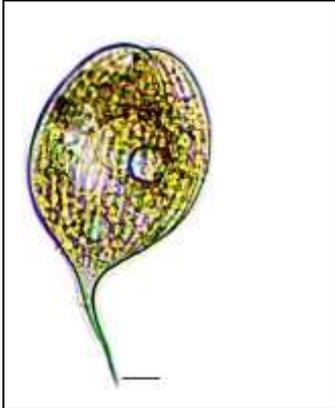
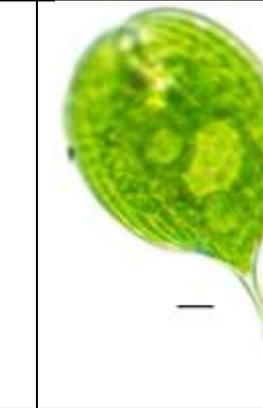
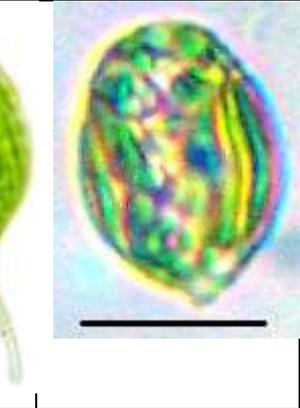
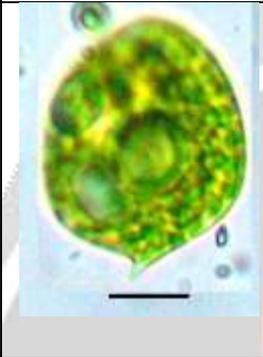
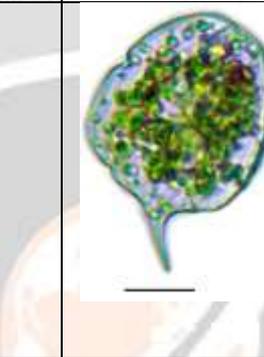
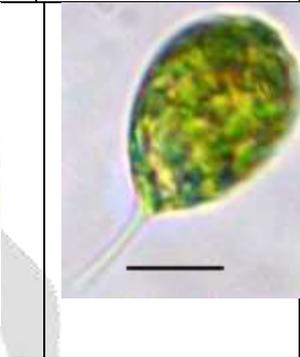
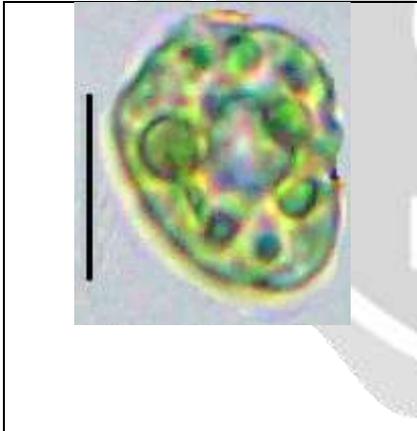
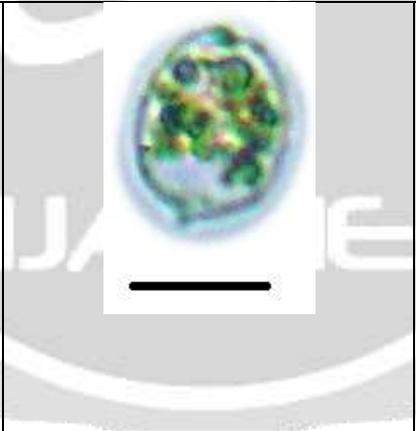
				
<i>Phacus longicauda</i>	<i>Phacus longicauda var. torta</i>	<i>Phacus tortus</i>	<i>Phacus menson</i>	<i>Phacus stokesii var. minor</i>
				
<i>Phacus orbicularis</i>	<i>Phacus orbicularis var. zmutdae</i>	<i>Phacus onyx</i>	<i>Phacus pusillus</i>	<i>Phacus radícula</i>

PHOTO PLATE -2

		
<i>Phacus landekiensis</i>	<i>Phacus wettsteineinii</i>	<i>Phacus ranula var. brevicaudatus</i>
Each scale is 10µ in length		