

## Research Article

# Euglenozoan diversity in Pobitora Wildlife Sanctuary, a unique wetland habitat for Rhinos and migratory birds

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## ABSTRACT

Pobitora, the renowned Wildlife Sanctuary of Northeast India for highest density of Greater One Horned Rhinoceros houses a varied forms of phytoplankton in its unique aquatic habitats. The Sanctuary is situated within a thickly populated village in the Brahmaputra floodplain of the region and experiences with recurrence of flood every year and, subsequent increase of organic matter in the water bodies. Euglenozoan diversity, which is considered as one of the indicators of organic pollution, was enumerated in the Sanctuary which revealed a total of 124 euglenozoa species under 6 orders, 7 families and 13 genera. Among the different genera *Trachelomonas* Ehrenberg, 1834 with 36 species was recorded to be the dominant genus followed by *Phacus* Dujardin, 1841 (34), *Euglena* Ehrenberg 1830 (28), *Lepocinclis* Perty, 1849 (16), *Strombomonas* Deflandre, 1930 (2) respectively. The genera *Euglenocapsa* F. Steinecke, 1932, *Cryptoglena skujai* Marin and Melkonian, *Sphenomonas* F. Stein, 1878, *Peranemopsis* Lackey, 1940, *Petalomonas* F. Stein 1859, *Entosiphon* F. Stein, 1874, *Rhabdomonas* Fresenius, 1858, *Heteronema* Dujardin, 1841 were recorded with only one species each. Out of which, a total of 107 species were reported for the first time from Northeast India. As the euglenoids are one of the indicators of organic pollution, the current data will undoubtedly serve as a boarding area for scientific monitoring and augmenting future management plan of the Sanctuary.

**Key words:** Euglenozoa, diversity, taxonomic enumeration, Pobitora wildlife Sanctuary, Protected area, Northeast India

## INTRODUCTION

Photosynthetic euglenozoa commonly known as Euglenoids are the groups of unicellular, free-living eukaryotic microorganisms belonging to the Kingdom Protista (Smith, 2016). Morphologically, they are flagellated single-celled organisms having plastids inside, a distinctive cytoskeleton consisting of proteinaceous pellicle supported by many microtubules, and a membrane-bound storage structure known as a paramylon bodies (Bicudo and Menezes, 2016). They are primarily propelled by swimming (Leander *et al.*, 2017) with the help of the flagella which are being exerted by the simultaneous alternation of shape of the cell. In natural state, the euglenoids therefore look like an elongated or spiral spindle (Karnkowska *et al.*, 2013). The proteinaceous pellicle layer provides protection and support to the cells during its forward and backward movement (Murulidhara and Murthy, 2018) which always put hinderance in microscopic examinations of the euglenoid cells.

Till now, A total of 3000 Euglenoid species has been documented throughout the globe and another 1000 species are yet to be either identified or explored (Guiry, 2012). Majority are reported from organically polluted environment or found to see abundant in the water bodies where organic matter content are on the higher levels, hence freshwater Euglenoids are considered as indicator of organic contamination or pollution (Khan and Tisha, 2020).

The Northeastern Region of India, the "gateway" for majority of India's flora and fauna due to its complex biogeography and rich ecosystem diversity

(Jain and Das, 2022) accommodates around 18 National Parks and 58 Wildlife Sanctuaries. Pobitora WLS, renowned for housing the nation's highest density of Greater One Horned Rhinoceros is one of them due to its unique aquatic habitats (around 14.61% of the total coverage) suitable for one horned rhinoceros and as many as 375 number of residents and migratory birds (Areendran *et al.*, 2021).

The Pobitora WLS is experienced with recurrence of flood every year which make the area suitable for high growth of algal flora. As it is a known fact that positioning at the base level of trophic structure of any food web, algae provide food supplement to zooplanktons and fishes, and finally to the top carnivores. However, presence of a few pollutions indicator algal species viz. members of Euglenoids (Murulidhara and Murthy, 2018; Ajayan *et al.*, 2020), a group under free floating algae is a matter of concern considering the health of the water bodies which are not only the feeding and breeding ground of a good number of migratory birds but also are the sites of wallowing of great one horned rhinoceros. Blooms caused due to high growth of Euglenoid taxa might deplete the Dissolved Oxygen level and bringing changes in the phytoplankton diversity (Mandal *et al.*, 2022) resulting fish mortality due to release of toxins by the Euglenoids (Zimba *et al.*, 2004; Boyd and Tucker, 2014) leading to hamper the food web in those water bodies. Euglenoids toxins may sometime inhibit mammalian tissue growth too (Zimba *et al.*, 2017), though no report has so far been available on impact of algal toxins on rhino. Keeping in mind the highest density of rhinos and regular visit of migratory birds in great number to

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the Pobitora WLS and simultaneous growth of the euglenoids in the waterbodies, the present endeavour was therefore taken to explore and document the Euglenozoan diversity in the Pobitora Wildlife Sanctuary of Northeast India for better management of the WLS in days to come.

## MATERIAL AND METHODS

### Study Area

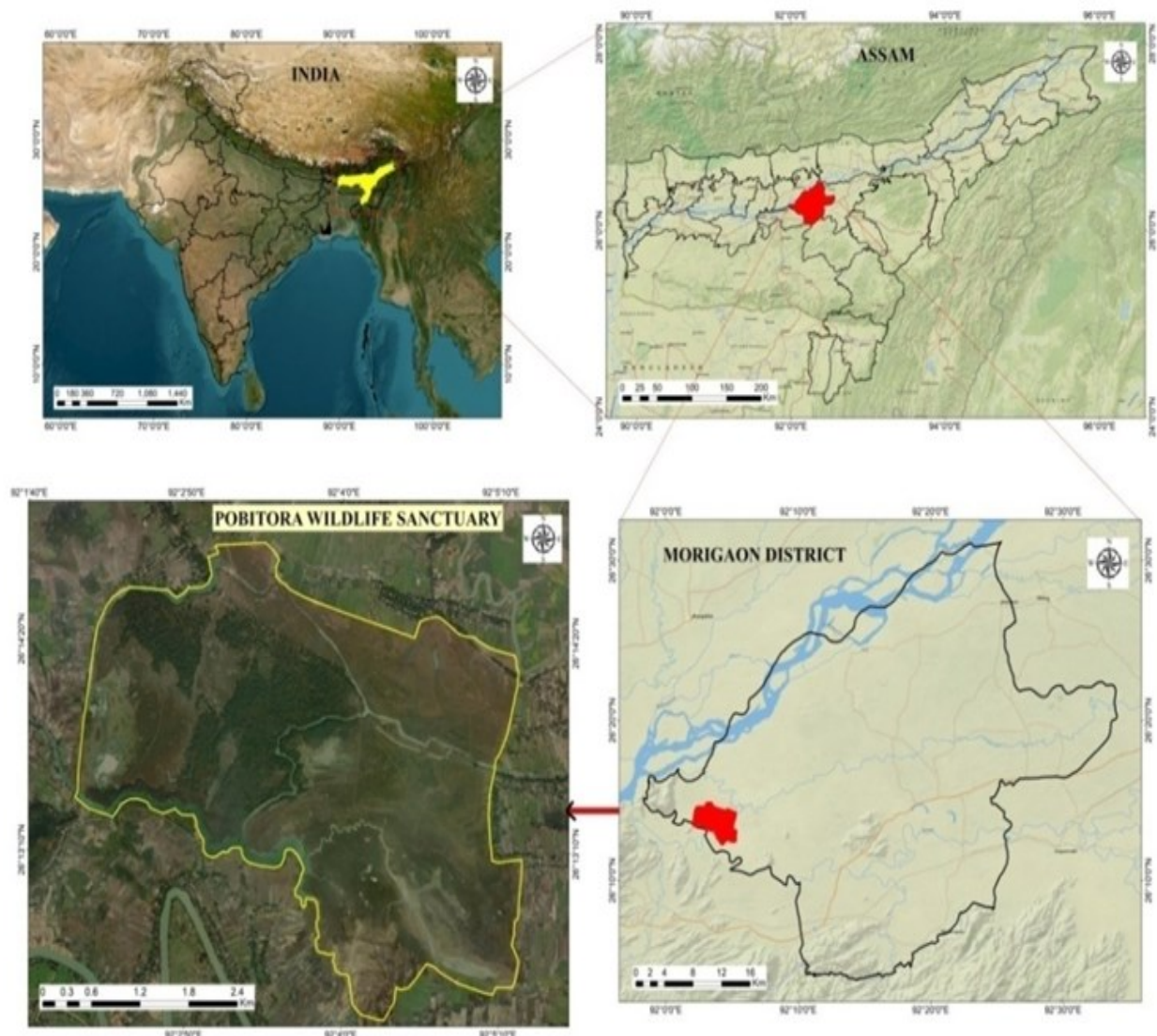
About 30 kilometres to the east of Assam's capital city Guwahati on the south of the mighty river Brahmaputra, Pobitora Wildlife Sanctuary is placed. The area is under Mayang Civic Circle of Morigaon district (Assam), originally known as the Mayang Kingdom or the "land of black magic". Spreading around 38.81 km<sup>2</sup>, the sanctuary is located between latitudes 26°12'N to 26°16'48"N and longitudes 91°58'48"E to 92°05'24"E (Borgohain *et al.*, 2014). The entire Sanctuary is under Brahmaputra flood plain and experiences yearly flooding at least for 4 to 5 months. Besides having enormous ephemeral, the Sanctuary also houses many perennial water bodies which are locally known as 'beels'.

### Sampling

Euglenoid sampling was done fortnightly in the morning from 6am to 8am and in the evening just before dusk in the same sites for one and half years from January 2020 to May 2022. 20 litres of water from each study sites were collected and allowed to pass through a plankton net of mesh size 45 µm. The filtrate residue was then immediately transferred to sampling bottles of 20 ml size pre-rinsed with sample water which were then diluted, packed, and carried to Plant Ecology Laboratory of the Department of Botany, Gauhati University.

### Observation and identification

The fresh euglenoid samples were then observed using Euromex Delphi-X Microscope with Image Viewer Software at magnifications of 40X or 60X and rest portions were preserved in Lugol's solution for future study. The samples are later identified by consulting widely used publications and monographs of John *et al.*, (2005), Ahmed *et al.*, (2009), Yamagishi (2010), Das and Adhikary (2014) and taxonomically updated following Algaebase, the most versatile online taxonomic algal database (Guiry and Guiry, 2023).



**Figure 1.** Location of sampling sites in Pobitora Wildlife Sanctuary

## RESULTS

From the exploration made for one and half years within the Pobitora WLS, altogether 124 euglenozoa species were identified and documented. Amongst them, with 36 species, *Trachelomonas* Ehrenberg 1834 was the most dominant genus followed by *Phacus* Dujardin, 1841 (34 species), *Euglena* Ehrenberg 1830 (28 species), *Lepocinclis* Perty, 1849 (16 species), *Strombomonas* Deflandre, 1930 (2 species). The genera *Euglenocapsa* F. Steinecke, 1932, *Cryptoglana skujai* Marin and Melkonian, *Sphenomonas* F. Stein, 1878, *Peranemopsis* Lackey, 1940, *Petalomonas* F. Stein, 1859, *Entosiphon* F. Stein, 1874, *Rhabdomonas* Fresenius, 1858, *Heteronema* Dujardin, 1841 were recorded with only one species each. A complete list of the species is appended with their systematic position here below along with the digital microphotographs of the first reported taxa from Northeast India as Photoplates (Figure:2-6).

### Order: Euglenales

#### Family: Euglenaceae

#### Genus: *Trachelomonas* Ehrenberg 1834

**1. *Trachelomonas mirabilis* Swirensko var. *obesa* (Messikommer) Conrad 1952 (Figure:2.A1)**  
Yamagishi, 2010, p.90, pl.42, f.11

The size of the tests is fusiform, with narrowly rounded ends. flagellum apertures have long, broad, and cylindrical collars with a circle of spines surrounding the mouth. 20µm in diameter, 28 µm length when the collar is removed, and 5 µm long collars.

Voucher No.: Pobitora 77  
New to North- East.

**2. *Trachelomonas armata* var. *longispina* Playfair 1915:25, pl.IV[4]:fig.20 (Figure:2.A2)**  
Yamagishi, 2010, p.77, pl.37, f.4

Broad and ovoid tests; flagellum apertures lack a collar and are encircled by round and short spines; the wall is covered with brownish layer all over, with long, strong spines at the posterior ends; the diameter and length of the tests are 32 and 44 µm, respectively.

Voucher No.: Pobitora 16  
New to North- East

**3. *Trachelomonas pavlovskoensis* (Polijanski) Popov var. *ellipsoidea* Popova**  
Yamagishi, 2010, p.91, pl.43, f.1,2

Long and ellipsoid tests, with narrowly rounded anterior and posterior ends, flagellum apertures with long, cylindrical collars, and densely punctate walls; Tests are 24 µm in diameter, 32 µm long without the collar; collars are around 6 µm long.

Voucher No.: Pobitora 56  
Previously reported from North – East: Deepor Beel Wildlife Sanctaury, Assam (Boruah *et al.*, 2020)

**4. *Trachelomonas hispida* var. *punctata* Lemmermann 1905:165 20(Figure:2. A3)**  
Yamagishi, 2010, p.87, pl.41, f.7

Tests are oval, with rounded anterior and posterior ends and no collar. The lateral sides are slightly enlarged, and the wall is densely punctate. tests 24 µm in length and 18 µm in diameter.

Voucher No.: Pobitora 56  
New to North- East.

**5. *Trachelomonas crebea* Kellicott 1887:189, fig.3 (Figure:2. A4)**

Ahmed *et al.*, 2009, p.326

Lorica yellow and brown in color, regularly ellipsoid, irregularly punctate, flagellar pore encircled by a wide cylindrical collar 3 µm broad, Lorica with collar 26 µm long, 15 µm broad.

Voucher No.: Pobitora 38  
New to North- East.

**6. *Trachelomonas lacustris* Drezepolski 1925:217, fig.67 (Figure:2.A5)**

Ahmed *et al.*, 2009, p.338

Lorica cylindrical, with almost parallel lateral borders and broadly rounded anterior and posterior ends, coarsely punctate. Flagellum aperture with a collar. numerous chloroplasts, and the presence of pyrenoid; Tests 24 µm in diameter, 33 µm long without collar ;collars 5 µm long.

Voucher No.: Pobitora 71  
New to North- East.

**7. *Trachelomonas pulcherrima* var. *minor* Playfair 1915:14, pl.I[1]:figs 37,38 (Figure:2.A6)**

Ahmed *et al.*, 2009, p.352

Lorica is oblong, tiny, light brown in colour, smooth-walled, and has a low-collared flagellum opening. Lorica is 17.5 µm long and 7.0 µm wide.

Voucher No.: Pobitora 35.  
New to North- East.

**8. *Trachelomonas similis* A. Stokes 1890 :76, fig.12 (Figure:2.A7)**

John *et al.*, 2005, p.174, pl. 42, f. Z

The lorica is broadly ellipsoidal or ovoid, 17 µm wide, and 23 µm long; walls are smoothly punctate, apical pore is encircled by a well-developed collar 4.5 µm wide and 3.5 µm high. Each cell contains several chloroplasts.

Voucher No.: Pobitora 35  
New to North- East.

**9. *Trachelomonas cervicula* A. Stokes 1890 :75, fig.11 (Figure:2.A8)**

John *et al.*, 2005, p.173, pl.43, f. E.

Lorica 26 µm wide, 22 µm long, spherical; walls smooth or lightly punctate, golden or reddish-brown; apical pore surrounded by a low, flat ring with a cylindrical canal extending inwards to lorica cavity, 5 µm wide, 9 µm long; flagellum 1.5 µm longer than lorica; chloroplasts numerous, plate-shaped, and devoid of pyrenoids.

Voucher No.: Pobitora 99  
New to North- East.

**10. *Trachelomonas derephora* (W. Conrad) Oye 1927:171 (Figure:2.A9)**

Yamagishi, 2010, p.84, pl.40, f.14.

Globose shaped tests: flagellum apertures with a short, cylindrical collar encircled by thickening of the wall at the base; thick, smooth wall; tests 21 µm across.

Voucher No.: Pobitora 99.  
New to North- East.

**11. *Trachelomonas hispida* var. *hispida* (Perty) F. Stein 1878 :expl.pl.XXII[22]; Figs 20-34**

Yamagishi, 2010, p.87, pl.41, f.3.

Tests have large ellipsoid shapes, broadly rounded

anterior and posterior ends, and virtually straight lateral sides in the middle. Flagellum apertures lack collars, the wall of which is coarsely punctate throughout and densely covered in tiny spines; tests 43 µm long and 23 µm wide.

Voucher No.: Pobitora 25

Previously reported from North –East :Wokha,Nagaland (Das &Adhikary,2012)

**12.*Trachelomonas oblonga* var. *truncata* Lemmermann 1899:344 (Figure:2. A10)**

Yamagishi, 2010, p.91, pl.42, f.13.

Tests are cylindrical and oblong, with rounded anterior and posterior ends, collarless flagellum apertures, approximately straight lateral sides, and smooth walls. tests 16 µm long and 11 µm wide.

Voucher No.: Pobitora 54

New to North- East.

**13.*Trachelomonas lemmermannii* var. *lemmermannii* Woloszynska 1912:696, fig.19 D (as ‘Lemmermanni’) (Figure:2.A11)**

Yamagishi, 2010, p.206., pl.42, f.4.

Tests are cylindric, with punctate walls, anterior ends that are truncately rounded without collars, and posterior ends that narrow into a broad, conical apex. tests with a 16 µm diameter and 30 µm length.

New to North- East.

**14.*Trachelomonas verrucosavar. macrotuberculata* Grandori 1935 (Figure:2.A12)**

Yamagishi, 2010, p.100., pl.46, f.8.

The tests are globose and thick walled, with broad flagellum apertures and a low collar. The tests have a diameter of 24 µm.

Voucher No.: Pobitora 77

New to North- East.

**15.*Trachelomonas curta* var. *tubigera* (Deflandre) Balech 1944:239 (Figure:2. A13)**

Yamagishi, 2010, p.83., pl.39, f.5.

flagellum apertures with a cylindric collar extending inward to the test chamber; compressed globose tests; thick, smooth wall; tests 22 µm long and 28 µm wide.

Voucher No.: Pobitora 33

New to North- East.

**16.*Trachelomonas reinhardii* Svirenko 1916:90,126, pl.1: fig.9,10(as ‘reinhardi’)**

Yamagishi, 2010, p.94., pl.43, f.13.

Tests are large and globose, with broadly rounded anterior and narrowly rounded posterior ends that can have a truncate flattened centre. Flagellum apertures with a broad cylindric collar and a slightly atypical mouth; extensive punctation across the wall; Tests are 23 µm length without the collar, 22 µm in diameter, and have 2 µm long collars.

Voucher No.: Pobitora 42

Previously reported from North – East: Deepor Beel Wildlife Sanctuary, Assam (Boruah *et al.*,2020)

**17.*Trachelomonas cylindrica* Ehrenberg 1834 (Figure:2. A14)**

John *et al.*,2005, p.174, pl.42, f. A.

Lorica is 7.5 µm wide, 14.5 µm long, broad, cylindrical, with practically straight and parallel sides; walls are smooth, light brown; and the apical pore is thickened

at the rim and lacks a collar.

Voucher No.: Pobitora 77

New to North- East.

**18.*Trachelomonas robusta* Swirenkovar. *robusta* (Figure:2. A15)**

Yamagishi, 2010, p.94., pl.44, f.4

Tests are cylindric, with a flagellum aperture that lacks a collar, anterior end is narrowly rounded with a truncately flattened apex, posterior ends that are widely rounded, and lateral sides that are coarsely covered in short, blunt spines. Tests are 18 µm in diameter and 25 µm long.

Voucher No.: Pobitora 11

New to North- East.

**19.*Trachelomonas bernardii* Woloszynskaf. *major* Deflandre (Figure:2. A16)**

Yamagishi, 2010, p.79, pl.38, f.13

Tests with smooth walls, flagellum apertures without collars, compressed and globose, round in top view, ellipsoid with angular sides; tests 25 µm long and 33 µm in diameter.

Voucher No.: Pobitora 37

New to North- East.

**20.*Trachelomonas intermedia* Dangeard var. *intermedia* (Figure:2.A17)**

Yamagishi, 2010, p.88, pl.41, f.6

Tests are subglobose, with broadly rounded anterior and posterior ends and coarsely punctate walls. tests 22 µm long and 17 µm wide.

Voucher No.: Pobitora 113.

New to North- East.

**21.*Trachelomonas pavlovskoensis* (Poljanski) Popova var. *pavlovskoensis* (Figure:2.A18)**

Yamagishi, 2010, p.91, pl.38, f.13

Large, broad, and elliptic tests with rounded ends; flagellum apertures with a short collar; Tests measuring 50 µm in length.

Voucher No.: Pobitora 92

New to North- East.

**22.*Trachelomonas hispida* var. *acuminata* Deflandre 1926 :651 ,pl.17,figs 214 ,215bis,222 (Figure:2. A19)**

Yamagishi, 2010, p.87, pl.41, f.8

Tests broad and ellipsoid; anterior ends broadly rounded, without a collar; posterior ends narrowed and slightly, conically produced; wall punctate all over and with scattered short spines; tests 25 µm in diameter, 30 µm long.

Voucher No.: Pobitora 65

New to North- East.

**23.*Trachelomonas oblonga* Lemmermann var. *oblonga* (Figure:2. A20)**

Yamagishi, 2010, p.91, pl.42, f.14

Tests are rectangular, with broad, rounded anterior and posterior ends, collarless flagellum openings, and smooth lateral sides. tests 19 µm long and 14 µm wide.

Voucher No.: Pobitora 35

New to North- East

**24.*Trachelomonas curta* Da Chunha var. *curta* (Figure:2. A21)**

Yamagishi, 2010, p.82, pl.39, f.12

The flagellum apertures lack a collar but are surrounded by thickened rim. The tests are compressed and globose, round in top view and ellipsoid in lateral view. The tests are 22 µm in diameter and 15 µm long.

Voucher No.:Pobitora 25  
New to North- East.

**25. *Trachelomonas raciborskii* Woloszynska var. *incerta* Drezepolski (Figure:2.A22)**  
Yamagishi, 2010, p.94,pl.43, f.15

Tests are broad and ellipsoid, with extensively rounded anterior and posterior ends and approximately straight and parallel lateral sides: flagellum openings devoid of a collar; wall is heavily punctate throughout and only has small spines at the anterior and posterior ends; tests 30 µm long and 23 µm in diameter.

Voucher No.:Pobitora 21.  
New to North- East.

**26. *Trachelomonas intermedia* Dangeard (Figure:2.A23)**

John *et al.*, 2005, p.176, pl.43, f. X

Lorica is 25 µm long, 20 µm wide, and has an apical pore is 3 µm in diameter and is surrounded by a ring-like thickening. The flagellum is 2 times longer than the lorica and has countabechloroplasts, each of which has a pyrenoid.

Voucher No.:Pobitora 34  
New to North- East

**27. *Trachelomonaas guttata* Middelhoek 1951:231,pl.I [1]:figs 1,2 (Figure:2.A24)**

Yamagishi, 2010, p.86,pl.41, f.4

Tests are large and ellipsoid; the anterior and posterior ends are broadly rounded without collars, and the wall is micropunct to shallowly scrobiculate. tests are 29 µm long and 22 µm wide.

Voucher No.:Pobitora 63  
New to North- East

**28. *Trachelomonas bernardinensis* var. *africana* Deflandre 1926 (Figure:2.A25)**

Yamagishi, 2010, p.79,pl.39, f.1

Tests are broad ellipsoid, with narrowed anterior ends, flaring mouth flagellum apertures, and narrower posterior ends with a long, slender cauda. The wall is minutely scrobiculate, and the tests are 21 µm in diameter and 43 µm long, including the collar and cauda.

Voucher No.:Pobitora 25  
New to North- East.

**29. *Trachelomonas granulosa* Playfair var. *granulosa* (Figure:3.B1)**

Yamagishi, 2010, p.86,pl.41, f.9

Tests are large and oval shape, narrowly rounded anterior ends without collars, and broadly rounded posterior ends. tests 28 µm long and 24 µm broad.

New to North- East.

**30. *Trachelomonas pulcherrima* Playfair var. *pulcherrima* (Figure:3.B2)**

Yamagishi, 2010, p.93,pl.43, f.10

Tests are long and spherical, with almost parallel lateral edges, generally rounded anterior and posterior ends, and flagellum apertures with or without a low collar.

Tests 26 µm long and 12µm in diameter; to a some extent rough walls.

Voucher No.:Pobitora 63  
New to North- East.

**31. *Trachelomonas dubia* Swirenko emend. Deflandre var. *dubia* (Figure:3.B3)**

Yamagishi, 2010, p.84,pl.40, f.12

Tests are cylindrical, with rounded posterior ends and large, conically constricted anterior ends, and a thin cylindrical collar around the flagellum apertures. a smooth wall tests measure 26 µm long with the collar and 14 µm in diameter.

Voucher No.:Pobitora 23  
New to North- East.

**32. *Trachelomonas robusta* Svrenko 914:636,pl.19:fig.17 (Figure:3.B4)**

John *et al.*, 2005, p.174, pl.42, f. K

Lorica 25 µm wide, 32 µm long, ellipsoidal to broadly ovoid; walls occasionally smooth or punctate, yellowish brown; apical pore encircled by a circle of spines; chloroplasts 8 µm in each cell; only rarely with strong spines.

Voucher No.:Pobitora 17.  
New to North- East.

**33. *Trachelomonas allia* Drezeporski var. *allia* (Figure:3.B5)**

Yamagishi, 2010, p.76,pl.38, f.4

Tests with large spheroid shapes, broadly rounded anterior and posterior ends, straight sides, flagellum apertures without collars, walls coated with minute puncta and short spines; Tests are 35 µm long and 19 µm in diameter.

Voucher No.:Pobitora 17  
New to North- East.

**34. *Trachelomonas elliptica* (Playfair) Deflandre 1927:286 (Figure:3.B6)**

Yamagishi, 2010, p.85,pl.40, f.6

Tests are thin ellipsoid, with smooth walls, anterior ends that are conically rounded, and posterior ends that are conically narrowed into a blunt apex. Flagellum apertures have cylindrical, short collars that are somewhat narrowed at the base. Tests 25 µm length overall, with a diameter of 11 µm.

Voucher No.:Pobitora 07  
New to North- East.

**35. *Trachelomonas volvocinavar punctata* Playfair 1915:9,pl.I[1]:fig.2 (Figure:3.B7)**

Yamagishi, 2010, p.100,pl.46, f.4

Tests are subglobose; the wall is coarsely punctate; flagellum apertures are ring-shaped but without a collar. tests with a 22 µm diameter.

Voucher No.:Pobitora 63  
New to North- East.

**36. *Trachelomonas raciborskii* var. *incerta* Drezepolski 1925:221,fig.55 (Figure:3.B8)**

Yamagishi, 2010, p.94,pl.43, f.15

Tests are broad and ellipsoid, with extensively rounded anterior and posterior ends and approximately straight and parallel lateral sides: flagellum openings devoid of a collar; wall is heavily punctate throughout and only has small spines at the anterior and posterior ends; tests 30

µm long and 23 µm in diameter.

Voucher No.:Pobitora 21

New to North- East

**Genus:***Euglenocapsa*F. Steinecke,1932

**37.***Euglenocapsa ochracea*F.Steinecke 1932:592,fig.2 (Figure:3.B9)

Ahmed *et al.*, 2009, p.352

Cells that are circular to slightly oval, barely pigmented, and 8 µm long and 5.5 µm broad. Near the cell wall, many disc-shaped chloroplasts are still present. similar to the euglena's vacuole system. 22 µm flagellum. Pyrenoid is not present.

Voucher No.:Pobitora 37

New to North- East.

**Genus :***Euglena* Ehrenberg 1830

**38.***Euglena acus* var. *minor* Hansgirg 1893:173 (Figure:3.B10)

Yamagishi, 2010, p.37.,pl.15, f.2.

Cells are long and fusiform, with truncate anterior ends and tapered posterior ends that resemble a long spine. Paramylon bodies are numerous and long rod-shaped, measuring 6.5 µm in diameter and 65 µm long when the cauda is added.

Voucher No.:Pobitora 11

New to North- East

**39.***Euglena oxyuris* Schmarदार. *charkowiensis* (Swirensko)Chu (Figure:3.B11)

Yamagishi, 2010, p.38.,pl.16, f.1.

Cells are cylinder-shaped, twisted, and have a keel-like fold on the dorsal side; the anterior ends are rounded and somewhat oblique; the posterior ends taper into a narrow, long, pointed cauda; there are two big, broad ring-like paramylon bodies; and the cells are 25 µm in diameter and 125 µm long.

Voucher No.:Pobitora 27

New to North- East

**40.***Euglena acus* Ehrenberg var. *acus* (Figure:3.B12)

Yamagishi, 2010, p.37.,pl.15, f.1.

Cells are long and fusiform, with truncate anterior ends and tapered posterior ends that create a long cauda that resembles a spine. Paramylon bodies are many and long rod-shaped; cells are 7 µm in diameter and 90 µm long, including the cauda.

Voucher No.:Pobitora 19

New to North- East

**41.***Euglena acus* (O.F. Muller)Ehrenberg 1830

John *et al.*, 2005, p.148, pl.34, f. A

Cells are 7 µm in width and 52 µm in length. They are needle-shaped, elongate spindle-shaped, occasionally twisted, and occasionally take on an S-shape. The anterior end is narrowed and apically truncate, while the posterior end tapers to a long, fine point. the eyespot is small, situated at the canal's end, and there is no euglenoid movement; the pellicle is delicately striated; the chloroplasts are small, numerous, peripheral, disc-like, and without pyrenoids; the paramylon bodies are numerous, long, rod-shaped; the flagellum is short—about one-third cell length; swims straight ahead quite quickly while turning gently and there are no visible cysts.

Voucher No.:Pobitora 63

Previously reported from North – East :Oil Refinery Guwahati, Assam (Baruah *et al.*,2009).

**42.***Euglena viridis* (O.F. Muller)Ehrenberg 1830:39 Das and Adhikary,2014,p.189,pl.15,fig.1.

Cells are roughly spindle-shaped, with a broad anterior end, a midsection that is wider than the middle, and a narrow posterior end. They are 39 µm long and 18.6 µm wide. ovoid paramylon bodies.

Voucher No.:Pobitora 11

Previously reported from North East :Wokha,Nagaland (Das &Adhikary,2012)

**43.***Euglena gracilis*G.A.Klebs 1883

Das and Adhikary,2014,p.187,pl.14,fig.17.

Cells are 39 µm long and 18.6 µm wide in the middle, with a widely spindle-shaped anterior end, broader middle, and tapering to a narrow posterior end. ovoid paramylon bodies.

Voucher No.:Pobitora 27

Previously reported from North East :Wokha,Nagaland (Das &Adhikary,2012)

**44.***Euglena desesfo. intermedia* G.A. Klebs 1883 (Figure:3.B13)

John *et al.*,2005, p.151, pl.37, f.K.

Cells 18 µm wide and 84 µm long, cylindrical, with a blunt front end and a tapered back end; very slightly striated, hard to distinguish striae on pellicle; without pyrenoids, with disc-shaped chloroplasts, paramylon bodies are rod-shaped and abundant, or with short, brick-shaped bodies that have depressed cores; a flagellum that is only around one-sixth the length of a cell; a noticeable, purplish eyespot; the euglenoid moves, typically in a slow, continuous squirming motion, occasionally settling on a slide by the tip of its rear end and swaying on it.

Voucher No.:Pobitora 33

New to North- East

**45.***Euglena desesfo. klebsii*(Lemmermann) T.G.Popova 1966 (Figure:3.B14)

John *et al.*,2005, p.151, pl.37, f.L,M.

Cells 8 µm wide, 54 µm long, cylindrical; anterior end slightly narrowed, rounded at apex; posterior end narrowing to a short, rounded tail piece; flagellum about one sixth cell length pellicle finely striated, chloroplasts numerous,disc shaped, without pyrenoids; paramylon bodies short, rod-shaped, euglenoid movement occurs.

Voucher No.:Pobitora 21

New to North- East

**46.***Euglena oxyuris*Schmarदार var *minima* Bourrelly (Figure:3.B15)

Yamagishi, 2010, p.180,pl.16, f.4

Cells are cylindrical, twisted, and have a keel-like fold on the dorsal side. The anterior ends are rounded and somewhat oblique, and the posterior ends taper into a narrow, long, pointed cauda. There are two huge, broad ring-like paramylon bodies, each measuring 15 µm in diameter and 86 µm in length.

Voucher No.:Pobitora 27

New to North- East

**47.***Euglena clavata* Skuja 1948:189,190,pl.XXII [22]:figs 2-5 (Figure:4.C1)

Ahmed *et al.*, 2009, p.238

Clavate cells with an obliquely truncated anterior end and a tailpiece that is clearly defined. Flagellum twice as



long as the body. 99.2 µm long and 15.6 µm wide cell. Very weakly yet spirally striated, stiff, chloroplast-containing pellicle, unevenly lobbed plates with pyrenoid sheaths are positioned in clusters on the body's two halves. Cysts do not form in cells, which are both highly and weakly metabolic.

Voucher No.:Pobitora 97

New to North- East

**48. *Euglena sociabilis* P.A.Dangeard 1902:182, fig.15 (Figure:4.C2)**

Ahmed *et al.*, 2009, p.256

Fusiform cells having brief posterior processes and marginal metabolic activity. Flagellum that is longer than the body. Cell 70 µm long and 7 µm wide. Swimming actively, crawling when startled, and never securing with the posterior tip. Fine striations on the pellicles. On each face of the chloroplast are 10 elongate, strongly lobed, double encased pyrenoid chloroplasts. Each chloroplast has one pyrenoid, and the cysts are spherical with what appears to be a sticky wall.

Voucher No.:Pobitora 19

New to North- East

**49. *Euglena geniculata* Dujardin 1841:362, pl.V[5]:figs 15,16**

Yamagishi, 2010, p.151, pl.37, f.C

Cells are bluntly spindle-shaped, 56.5 µm long and 10.4 µm wide, with rounded anterior ends and pointed tail pieces. They are also grouped in two stars and contain paramylon bodies.

Voucher No.:Pobitora 37

Previously reported from North – East : Akhaura pond, Agartala, Tripura. (Das & Adhikary, 2012)

**50. *Euglena proxima* P.A.Dangeard 1902:154, fig.6 A-F**

John *et al.*, 2005, p.155, pl.35, f.B.

Spindle-shaped cells that are 25 µm broad and 55 µm long, with an anterior end that is slightly bluntly truncate and a posterior end that tapers to a short, hyaline tail-piece; pellicle groups; euglenoid movement occurs; cells occasionally twist.

Voucher No.:Pobitora 16

Previously reported from North – East : Jor pukhuri, Dimapur, Nagaland. (Das & Adhikary, 2012)

**51. *Euglena flava* P.A.Dangeard 1902:180, fig.14 (Figure:4.C3)**

Ahmed *et al.*, 2009, p.241

Cells are spindle-shaped with rounded anterior ends, yellowish-green in colour, and culminate in a tail piece that is colourless. Cells are 14.3 µm in width and 44.3 µm length. Pellicle with faint striae. Chloroplasts are discoid, oriented parallel to the surface, and have numerous chloroplasts. End views resemble bands. Thin-walled, metabolic pyrenoid 4 cyst.

Voucher No.:Pobitora 19

New to North- East.

**52. *Euglena chlamydomphora* Mainx 1928:342, fig (Figure:4.C4)**

John *et al.*, 2005, p.152, pl.35, f.I, J

Cells when swimming freely, are spindle-shaped, 9 µm broad, and 32.2 µm long, with a rounded anterior end and a narrowing posterior end. Euglenoid movement is erratic, and its shape can occasionally shift to one that is roughly cylindrical. Numerous, disc-shaped, and lacking

pyrenoids chloroplasts Numerous, tiny, ellipsoidal, or oblong paramylon bodies Flagellum as long as the cell.

Voucher No.:Pobitora 98

New to North- East.

**53. *Euglena elastica* Prescott 1944:365, pl.3:figs 25-27 (Figure:4.C5)**

John *et al.*, 2005, p.157, pl.37, f.N

Cells are 9.5 µm wide and 76 µm long, typically spindle-shaped with an abruptly narrowing anterior end and a narrow, rounded posterior end. The pellicle is smooth. The paramylon bodies are short and rod-like, numerous, scattered throughout the cell, and the flagellum is about two-thirds of the cell length. The euglenoid movement is violent and occasionally greatly bulging.

Voucher No.:Pobitora 29

New to North- East.

**54. *Euglena gaumei* Alorge & Lefevre var. *gaumei* (Figure:4.C6)**

Yamagishi, 2010, p.180, pl.16, f.2

Cylindric cells with two rod-shaped paramylon bodies; anterior ends that are somewhat narrowed and rounded; posterior ends that abruptly narrow into a long, thin cauda. Cells are 10 µm in diameter and 55 µm long, including the cauda.

Voucher No.:Pobitora 11

New to North- East.

**55. *Euglena repulsans* J.Schiller 1952:367, fig.3 a-e (Figure:4.C7)**

John *et al.*, 2005, p.152, pl.35, f.K, M

Cells that are 20 µm wide and 60 µm long, spindle-shaped, with a tapered posterior end when floating freely; pellicle thin and smooth; around 10 oblong chloroplasts without pyrenoids in each cell; small, ellipsoidal paramylon bodies; a flagellum that is as long as the cell; a small, crimson eyespot; and swift, violent euglenoid movement.

Voucher No.:Pobitora 27

New to North- East.

**56. *Euglena oxyuris* var. *charkowiensis* (Svirenko) Chu 1946 (Figure:4.C8)**

Yamagishi, 2010, p.180, pl.16, f.1

Cells are 125 µm in length and 25 µm in diameter. They are cylindrical, twisted, and have a keel-like fold on the dorsal side. The anterior ends are rounded and somewhat inclined, and the posterior ends taper into a narrow, long, pointed cauda.

Voucher No.:Pobitora 39

New to North- East.

**57. *Euglena splendens* P.A.Dangeard 1902:165, fig.9, pl.III[3]:figs 1-6 (Figure:4.C9)**

Ahmed *et al.*, 2009, p.256

Cells have an oval shape with a conical posterior end; in their rarely expanded state, they seem cylindro-fusiform. When irritated, they almost turn spherical, but the posterior point does not fully vanish. 63.5 µm wide. 68.6 µm long cells. Granular paramylon.

Voucher No.:Pobitora 97

New to North- East.

**58. *Euglena contabrica* .G.Pringsheim 1956 (Figure:4.C10)**

John *et al.*, 2005, p.150, pl.37, f.E, F

Cells are 25 µm wide, 54 µm long, spindle-shaped, twice attenuated towards the back, and cylindrical in the centre; there is euglenoid movement; many, band-like chloroplasts spreading from a centre that are frequently identified by a collection of paramylon bodies. When viewed from above, paramylon bodies on the cell surface form pseudopodium like processes and are surrounded by colourless, roundish sacks that are grouped in spirals. Pellicle delicately striated, flagellum twice the length of the cell, eye spot relatively large, and observation of the palmelloid stage.

Voucher No.:Pobitora 18  
New to North- East.

**59. *Euglena tripteris* (Dujardin) Diesing 1850 (Figure:4.C11)**

Yamagishi, 2010, p.179, pl.15, f.4

Cylindric cells that are typically metabolically twisted and swollen into spirals have anterior ends that are narrowly rounded and posterior ends that gradually taper into massive, rod-shaped paramylon bodies. Cylindric cells are 8 µm in diameter and can expand to 20 µm in diameter; they are 70 µm long when the cauda is included.

Voucher No.:Pobitora 29  
New to North- East.

**60. *Euglena sanguinea* Ehrenberg 1832:71, pl.I [1]:fig.IV[4]**

John *et al.*, 2005, p.154, pl.36, f.J

Cells are 90 µm long and 22 µm wide, elongate cylindrical shaped, with rounded anterior and posterior ends and a noticeably striated pellicle. The chloroplasts are numerous, dissected, and radially distributed, with arms extending to the cell periphery. Each has a double - sheathed pyrenoid, whose green colour is occasionally covered by granules of the red pigment haematochrome; paramylon bodies, which can range in shape from spherical to ovoid or have other shapes; flagellums, which are typically 1.5 times longer than cells; eyespots, which are fairly large and clearly visible near the base of the canal; Euglenoid swimming is extremely energetic and strikingly aggressive.

Voucher No.:Pobitora 15.  
Previously reported from North – East :Jor pukhuri, Dimapur, Nagaland. (Das & Adhikary, 2012)

**61. *Euglena cuneata* E.G.Pringsheim 1956 (Figure:4.C12)**

John *et al.*, 2005, p.150, pl.37, f.G,H

Cells smaller, Cells are 45 µm long and 12 µm wide; broadly cylindrical, rounded at anterior and narrowed at posterior end, chloroplast bands radially arranged around centre, densely packed, sometimes becoming wider and forked before their arms reach cell periphery, rim parallel to striae at periphery; pellicle spirally striated flagellum twice cell length; eyespot relatively large.

Voucher No.:Pobitora 13  
New to North- East.

**62. *Euglena limnophila* Lemmermann var. *swirenkoi* (Arnoldi) T.G.Popova 1955:170, pl.68:figs 8-15 (Figure:4.C13)**

John *et al.*, 2005, p.149, pl.34, f.D,E

Chloroplasts are numerous, small disc-shaped, without pyrenoids; paramylon bodies are ring-like or rod-

**59. *Euglena tripteris* (Dujardin) Diesing 1850 (Figure:4.C11)**

Yamagishi, 2010, p.179, pl.15, f.4

Cylindric cells that are typically metabolically twisted and swollen into spirals have anterior ends that are narrowly rounded and posterior ends that gradually taper into massive, rod-shaped paramylon bodies. Cylindric cells are 8 µm in diameter and can expand to 20 µm in diameter; they are 70 µm long when the cauda is included.

Voucher No.:Pobitora 29  
New to North- East.

**60. *Euglena sanguinea* Ehrenberg 1832:71, pl.I [1]:fig.IV[4]**

John *et al.*, 2005, p.154, pl.36, f.J

Cells are 90 µm long and 22 µm wide, elongate cylindrical shaped, with rounded anterior and posterior ends and a noticeably striated pellicle. The chloroplasts are numerous, dissected, and radially distributed, with arms extending to the cell periphery. Each has a double - sheathed pyrenoid, whose green colour is occasionally covered by granules of the red pigment haematochrome; paramylon bodies, which can range in shape from spherical to ovoid or have other shapes; flagellums, which are typically 1.5 times longer than cells; eyespots, which are fairly large and clearly visible near the base of the canal; Euglenoid swimming is extremely energetic and strikingly aggressive.

Voucher No.:Pobitora 15.  
Previously reported from North – East :Jor pukhuri, Dimapur, Nagaland. (Das & Adhikary, 2012)

**61. *Euglena cuneata* E.G.Pringsheim 1956 (Figure:4.C12)**

John *et al.*, 2005, p.150, pl.37, f.G,H

Cells smaller, Cells are 45 µm long and 12 µm wide; broadly cylindrical, rounded at anterior and narrowed at posterior end, chloroplast bands radially arranged around centre, densely packed, sometimes becoming wider and forked before their arms reach cell periphery, rim parallel to striae at periphery; pellicle spirally striated flagellum twice cell length; eyespot relatively large.

Voucher No.:Pobitora 13  
New to North- East.

**62. *Euglena limnophila* Lemmermann var. *swirenkoi* (Arnoldi) T.G.Popova 1955:170, pl.68:figs 8-15 (Figure:4.C13)**

John *et al.*, 2005, p.149, pl.34, f.D,E

Chloroplasts are numerous, small disc-shaped, without pyrenoids; paramylon bodies are ring-like or rod-shaped, numerous; cells are 7.5 µm wide and 48 µm long, broadly spindle-shaped, occasionally bent; anterior end apically truncate; posterior end tapering to a sharp tail-piece; and Flagellum shorter than the length of the cell; tiny eyespot towards the end of canal.

Voucher No.:Pobitora 29  
New to North- East.

**63. *Euglena spirogyra* Ehrenberg var. *spirogyra* (Figure:4.C14)**

Yamagishi, 2010, p.38, pl.15, f.5

Large fusiform cells that are more or less flattened and twisted; anterior ends that are slightly oblique and



rounded; posterior ends that taper into long spines; periplast that is spirally striated with a row of brown warts; two paramylon bodies that are large ring-like plates; Cells are 15 µm in diameter and 125 µm long with the cauda.

New to North- East.

**64. *Euglena gaumei* Allorge & Lefevre var. *minor* Allorge (Figure:4.C15)**

Yamagishi, 2010, p.180, pl.6, f.3

Long ovoid cells with lateral sides that undulate in accordance with euglenoid movement, anterior ends that are narrowed and have truncated apices, posterior ends that are broadly rounded and abruptly narrow into a long, thin, sharp cauda, two large rod-like or long ring-like plates for the paramylon bodies, and cells that are 7 µm in diameter and 45 µm long, including the cauda.

Voucher No.:Pobitora19

New to North- East

**65. *Euglena polymorpha* P.A.Dangeard 1902:175, figs 12,13; pl.III[3]:figs 7-10**

John *et al.*, 2005, p.155, pl.36, f.C,D

Cells 20 µm wide, 80 µm long, almost spherical, ovoid to pear-shaped and gradually narrowing to a short, blunt, conical tail-piece; pellicle noticeably spirally striated; chloroplasts 12 plate or disc like with lacinate margins; each with a double sheathed pyrenoid; paramylon bodies small; flagellum twice cell length.

Previously reported from North – East :Kaziranga National Park, Assam. (Yasmin *et al.*, 2015)

**Genus : *Cryptoglena* Ehrenberg, 1831**

**66. *Cryptoglena skujai* Marin and Melkonian**

Das and Adhikary, 2014, p.199, pl.16, fig.4.

Cells have a coffee-bean form, a longitudinal groove along the length of the ventral surface, a slight dip at the anterior end, parietal chloroplasts, and two paramylon bodies. 2, cells 18 µm long and 10.6 µm wide, watch glass-shaped and positioned in opposition to the lateral margins of the cell.

Voucher No.:Pobitora 29

Previously reported from North – East :Jor pukhuri, Dimapur, Nagaland. (Das & Adhikary, 2012)

**Family: Phacaceae**

**Genus: *Phacus* Dujardin, 1841, nom. et typ. cons.**

**67. *Phacus mammillatus* Philipose 1984:526, figs 24 a-c (Figure:4.C16)**

Yamagishi, 2010, p.55, pl.25, f.4

Cell bodies with longitudinal furrows extending on dorsal and ventral face, dividing into distinct but dissimilar halves; asymmetric pyriform in top view; anterior ends asymmetrically narrowed, rounded, and bilobed; posterior ends truncately rounded and slightly concave at the centre, with a small papilla-like cauda at end ; lateral sides asymmetrical; one side nearly straight and the other broadly Three paramylon bodies, each with cells that are 29 µm in diameter and 32 µm long.

Voucher No.:Pobitora 15

New to North- East

**68. *Phacus hamatus* Pochmann 1942:182, fig.86 1-f (Figure:4.C17)**

Yamagishi, 2010, p.53, pl.24, f.2

Asymmetrically shaped ovoid cells with anterior ends that are narrowly rounded and shallowly bilobed and

posterior ends that are broadly rounded with a thin cauda that curves inward; Two circular ring shaped paramylon bodies ; cells are 35 µm in diameter and 44 µm long (without the cauda) and caudae are 10 µm long.

Voucher No.:Pobitora 23

New to North- East

**69. *Phacus pyrum* (Ehrenberg) W.Archer 1871 :99 (Figure:4.C18)**

John *et al.*, 2005, p.166, pl.40, f.K,L

Cells 15 µm wide and 36 µm long, ovoid, possibly slightly flattened; anterior end broadly rounded and gradually narrowing at posterior end to a long, straight, and finely pointed tail-piece; pellicle faintly spirally ribbed; paramylon ring like disc shaped bodies, laterally positioned; occasionally paramylon of several smaller disc-shaped bodies: Small, many, disc shaped chloroplasts that are about 1.5 times the length of the cell; flagellum that appears between two papillae.

Voucher No.:Pobitora 97

New to North- East

**70. *Phacus helikoides* Pochmann var. *helikoides* (Figure:4.C19)**

Yamagishi, 2010, p.53, pl.24, f.8

Tests are oval; cells are 54 µm in diameter and 70 µm long when the cauda is included; cells are broad fusiform and twisted throughout their entire length; anterior ends are formed into truncate, bilobed apices; posterior ends that taper into a spirally twisted, long, straight cauda.

Voucher No.:Pobitora 17

New to North- East

**71. *Phacus triqueter* (Ehrenberg) Dujardin var. *triqueter* (Figure:5.D1)**

Yamagishi, 2010, p.62, pl.30, f.2

Cells are broad and ovoid, but not perfectly symmetrical; lateral sides are slightly swollen; they are typically the broadest below the median line; the dorsal surface has a high longitudinal ridge; in apical view, it is low and triangular; the anterior and posterior ends are narrowly rounded; the caudae are thin, long, and inwardly curved; Two huge circular plates known as paramylon bodies; cells are 45 µm in diameter and 37 µm length without the cauda; caudae are 13 µm long.

Voucher No.:Pobitora 39

New to North- East

**72. *Phacus orbicularis* Hubner 1886:5, fig.1 (Figure:5.D2)**

John *et al.*, 2005, p.166, pl.40, f.C,D

Cells are broad ovoid in shape, 39 µm wide, and 50 µm long. The anterior end is gently rounded and the posterior end is broadly rounded with a short curved tail-piece. The flagellum is the same length as the cell, the apical groove is almost the complete length of the cell, the pellicle is generally longitudinally and transversely striated, and there are short transverse striae present.

Voucher No.:Pobitora 15

New to North- East

**73. *Phacus ovalis* Skvortzov 1958:165, pl.3, fig.33 (Figure:5.D3)**

Yamagishi, 2010, p.58, pl.27, f.3

Large, long oval cells with increasingly rounded and constricted anterior ends and larger posterior ends that

abruptly taper into long, thin caudae: 2, ring-shaped or circular paramylon bodies; cells 42  $\mu\text{m}$  in diameter and 87  $\mu\text{m}$  long, including the cauda; caudae 20  $\mu\text{m}$  long.

Voucher No.:Pobitora 53  
New to North- East

**74. *Phacus pomiformis* (Conrad) Pochmann 1942 (Figure:5.D4)**

Yamagishi, 2010, p.58,pl.27, f.5

The periplast is longitudinally striated with a row of granules running along the striae, and the cells are broad ovoid and pomiformis; the anterior ends are somewhat constricted and truncately rounded with a prominent, central papilla; and the posterior ends are broadly rounded. Two dish-shaped paramylon bodies with cells that are 20  $\mu\text{m}$  in diameter and 21  $\mu\text{m}$  long, with caudae that are 5  $\mu\text{m}$  long, are present.

Voucher No.:Pobitora 58  
New to North- East

**75. *Phacus undulatus* (Skvortsov) Pochmann var. *undulatus* (Figure:5.D5)**

Yamagishi, 2010, p.63,pl.30, f.7

Broad ovoid cells with narrowly rounded, bilobed anterior ends, rounded posterior ends, and few irregular notches on the lateral edges. Paramylon bodies are a single, circular plate: measuring 30  $\mu\text{m}$  in diameter, 32  $\mu\text{m}$  without the cauda, and 5  $\mu\text{m}$  in length.

Voucher No.:Pobitora 17  
New to North- East

**76. *Phacus psuedonordstedtii* Pochmann var. *psuedonordstedtii* (Figure:5.D6)**

Yamagishi, 2010, p.58,pl.27, f.6

Broad and ellipsoid cells with truncately rounded anterior ends and conically rounded posterior ends that generate a thin cauda; two paramylon bodies, lying dish-like along the lateral borders; periplast spirally striated; cells 13  $\mu\text{m}$  in diameter, 23  $\mu\text{m}$  long without the cauda; caudae 10  $\mu\text{m}$  long.

Voucher No.:Pobitora 52  
New to North- East

**77. *Phacus circulatus* Pochmann 1942:177,fig.77**

Das and Adhikary,2014,p.193,pl.15,fig.6.

Cells with a broadly orbicular shape and two sizable paramylon bodies measure 38.8  $\mu\text{m}$  in length and 31  $\mu\text{m}$  in broad. The anterior end is somewhat narrowed and the posterior end is broadly rounded.

Voucher No.:Pobitora 73  
Previously reported from North – East :Deepor Beel Wildlife Sanctaury ,Assam (Boruah *et al.*,2020)

**78. *Phacus acuminatus* var. *parvulus* Weik (Figure:5.D7)**

Yamagishi, 2010, p.47,pl.21, f.4

Cells ovoid with narrowly rounded, bilobed anterior ends and large, sharply rounded posterior ends with a short cauda and extensively tapering base: cells are 17  $\mu\text{m}$  in diameter and 20  $\mu\text{m}$  long with the cauda have uneven lateral sides with one side that is practically straight and the other side is widely swollen.

Voucher No.:Pobitora 33  
New to North- East

**79. *Phacus pseudonordstedtii* var. *miniscula* (Conrad) Huber-Pestalozzi(Figure:5.D8)**

Yamagishi, 2010, p.58, pl.27, f.7

Cells are ovoid to ellipsoid in shape, with narrowly rounded anterior and conical posterior ends, and spirally striated periplast. two disc shaped paramylon bodies that are resting along the sides; cells 10  $\mu\text{m}$  in diameter, 16  $\mu\text{m}$  long without the cauda; caudae 8  $\mu\text{m}$  long.

Voucher No.:Pobitora 03  
New to North- East

**80. *Phacus circumflex* Pochmann 1942:206,fig.119 a-f (Figure:5.D9)**

Yamagishi, 2010, p.50, pl.22, f.5

Broad ovoid to ellipsoid cells with twisted upper lateral margins, anterior ends formed, and posterior ends conically tapering into a cauda; lengthy and straight caudae; circular plates found on paramylon bodies 2; cells 34  $\mu\text{m}$  in diameter, 42  $\mu\text{m}$  long without the cauda; caudae 35  $\mu\text{m}$  long.

Voucher No.:Pobitora 44  
New to North- East

**81. *Phacus onyx* Pochmann var. *onyx* (Figure:5.D10)**

Yamagishi, 2010, p.57, pl.27, f.1

Cells are generally oval; anterior ends are narrowly rounded; posterior ends are widely rounded, with a cauda; caudae are short and slightly curved inward; lateral sides are broadly swollen, but one side has a notch and two bulges; there are two paramylon bodies; cells are 22  $\mu\text{m}$  in diameter and 30  $\mu\text{m}$  long; the cauda is 5  $\mu\text{m}$  long.

Voucher No.:Pobitora 85  
New to North- East

**82. *Phacus anomalus* F.E.Fritsch & M.F.Rich 1929:73,fig.24 H-N**

Yamagishi, 2010, p.48, pl.21, f.7

Asymmetric ovoid cells with two distinct but differing halves, one half large and thick and the other slightly smaller and thinner; one face with a broad deep furrow and the other with a shallow one extending totally; asymmetric pyriform cells from the top view; Cells are 18  $\mu\text{m}$  in diameter and 25  $\mu\text{m}$  long, with constricted, asymmetrically rounded anterior ends and broad, truncately rounded posterior ends with a small, short broad cauda.

Voucher No.:Pobitora 76  
Previously reported from North – East :Deepor Beel Wildlife Sanctaury ,Assam (Boruah *et al.*,2020)

**83. *Phacus mariae* Deflandre 1928**

Yamagishi, 2010, p.56, pl.26, f.4

Cells are long, trapezoid, with rounded corners and a high longitudinal ridge on the dorsal face; anterior ends are widely rounded and shallowly bilobed; posterior ends are truncately rounded and have a thin, straight cauda; paramylon bodies are two; each cell is a circular plate and measures 22  $\mu\text{m}$  in diameter and 25  $\mu\text{m}$  in length, with caudae that are 5  $\mu\text{m}$  long.

Voucher No.:Pobitora 22  
Previously reported from North – East :Deepor Beel Wildlife Sanctaury ,Assam (Boruah *et al.*,2020)

**84. *Phacus curvicauda* Svirenko var. *curvicauda* (Figure:5.D11)**

Yamagishi, 2010, p.51, pl.23, f.6

Suborbicular cells have anterior ends that are thin and rounded, and posterior ends that are rounded with a curved, short cauda. Two circular or ring-shaped paramylon bodies with cells that are 25 µm in diameter and 30 µm long.

Voucher No.:Pobitora 03  
New to North- East

**85.*Phacus pleuronectes* (O.F.Muller)Nitzsch ex Dujardin 1841:336,pl.5:fig.5 a,b**

Yamagishi, 2010, p.58, pl.27, f.4

Cells are generally oval, with large, abruptly rounded posterior ends and a cauda that is obliquely curved at the anterior and posterior ends, respectively. Two ring-shaped or circular paramylon bodies with cells that are 35 µm in diameter and 40 µm long without the cauda and caudae are 5 µm long.

Voucher No.:Pobitora 57  
Previously reported from North – East :Deepor Beel Wildlife Sanctaury ,Assam (Boruah *et al.*,2020)

**86.*Phacus acuminatus* var. *javana* (Pochmann) Huber-Pestalozzi 1955:193,fig.226 (as ‘javana’) (Figure:5.D12)**

Yamagishi, 2010, p.47, pl.21, f.3

Cells are triangular-ovoid in shape, with a high median longitudinal ridge on the dorsal face, anterior ends that are rounded and bilobed, and posterior ends that are abruptly rounded with a short cauda and a broadly tapering base;cells 23 µm in diameter, 25 µm long

Voucher No.:Pobitora 33  
New to North- East

**87.*Phacusacuminatus*A.Stokesvar.*acuminatus* (Figure:5.D13)**

Yamagishi, 2010, p.47, pl.21, f.1

Cells are subcircular, with anterior ends that are narrowly rounded and posterior ends that are broadly rounded with a cauda. The paramylon bodies are two circular plates, and the cells are 25 µm in diameter and 35 µm long, including the cauda.

Voucher No.:Pobitora 19  
New to North- East.

**88.*Phacus triquerter* (Ehrenberg) Dujardin 1841:338 (as ‘triquetera’) (Figure:5.D14)**

John *et al.*,2005, p.163, pl.39, f.D

Cells are generally oval, slightly asymmetrical, 25 µm wide by 49 µm long, and significantly concave to convex.the back abruptly narrows to a long, thin, pointed, and curled tail-piece; the front end is broadly rounded. The pellicle is longitudinally striated; the cell is triangular in cross-section and has a little hollow on the ventral surface; the chloroplasts are disc-shaped; the paramylon 2 bodies are ring-shaped; and the flagellum is the same length as the cell.

Voucher No.:Pobitora 27  
New to North- East.

**89.*Phacus agilis* Skuja 1926:39,40,fig.2:4 (Figure:5.D15)**

Yamagishi, 2010, p.48, pl.21, f.5

Cells are shaped like coffee beans and have a longitudinal furrow running down the middle of the dorsal face, narrowly rounded anterior ends, and truncately rounded posterior ends with a small, low nipple-like cauda. There are two paramylon bodies, which are lateral shell-

like structures. Cells are 13 µm in diameter and 17 µm long.

Voucher No.:Pobitora 43  
New to North- East.

**90.*Phacus raciborskii* Drezepolskif. *raciborskii* (Figure:5.D16)**

Yamagishi, 2010, p.59, pl.28, f.4

Cells are long wedge-shaped, folded along the longitudinal axis, and slightly spirally twisted. The anterior ends are rounded, while the posterior ends taper into a curving cauda. There are two paramylon bodies, each with a ring-like or circular plate. Cells are 8 µm in diameter in lateral view, and 33 µm long when the cauda is added.

Voucher No.:Pobitora 11  
New to North- East

**91.*Phacus tricarinatus* Prowse 1962:170,fi (Figure:5.D17)**

Yamagishi, 2010, p.62, pl.30, f.5

Cells are small, quadrate broad-ovoid, symmetrical, with smooth lateral sides and a slight swelling at the base. The dorsal face has a high longitudinal ridge, and the top view reveals triradiate cells with deep concave sides. The anterior ends are flat and shallowly bilobed, while the posterior ends are broadly rounded with a short, thin cauda; paramylon bodies 2,circular plate Cells are 15 µm in diameter and 17 µm long.

Voucher No.:Pobitora 57  
New to North- East

**92.*Phacus pusillus* Lemmermann 1910:514 (Figure:5.D18)**

John *et al.*, 2005, p.160, pl.38, f.Q,R

Cells are 8.5 µm wide and 21 µm long, ovoid, flattened dorsiventrally with a wide furrow running the full length of the cell, slightly twisted, anterior end rounded; posterior end slightly narrowed; pellicle spirally striated; chloroplasts parietal, small, numerous, disc-shaped; paranmylon bodies 2, ring-shaped; flagellum same length as cell; eyespot noticeable

Voucher No.:Pobitora 17  
New to North- East

**93.*Phacus monilatus* var.*suecicus* Lemmermann 1904:125,PL.I[1]:fig.15 (as ‘suecicus) (Figure:5.D19)**

John *et al.*,2005, p.166, pl.400, f.P

Cells are 25 µm wide and 31 µm long, ovoid in shape, and have a small, prominent papilla at the apex. The posterior end narrows to a long, sharp, straight, or slightly curved tail-piece. The pellicle is longitudinally striated with rows of small granules, occasionally with alternate lines of small or large granules, and the number of rows is variable. paramylon has two sizable bodies that resemble discs or crescents; Flagellum shorter than cell; eyespot small; chloroplasts small, many, and disc shaped.

Voucher No.:Pobitora 45  
New to North- East

**94.*Phacus circulate* Pocvar.*circulatus*1942:177,fig.77 (Figure:5.D20)**

Yamagishi, 2010, p.50, pl.22, f.6

Circular plate like paramylon bodies. Cells are approximately round, slightly constricted at the anterior ends,

and broadly rounded at the posterior ends with a short, curved cauda. Cells are 27 µm in diameter and 26 µm long without the cauda. Caudae are 3.5 µm long.

Voucher No.:Pobitora 31  
New to North- East

**95. *Phacus contortus* var. *complicatus* Bourrelly 1952:177, pl. XXII [22]: figs 278-285 (Figure:5.D21)**  
Ahmed *et al.*, 2009, p.281

Cells contorted, twisted, posterior caudus bluntly pointed, straight. Paramylon 2, roundish oblong. Pellicle striations parallel. Cells 33 µm long, 15 µm broad.

Voucher No.:Pobitora 29  
New to North- East

**96. *Phacus dangeardii* Lemmermann 1910:513 (as 'Dangeardii')**  
Yamagishi, 2010, p.51, pl.23, f.2

Cells are 20 µm in length and 13 µm in diameter. They are broad ellipsoid, with rounded and bilobed anterior ends, rounded posterior ends; paramylon bodies of ring-like plate.

Voucher No.:Pobitora 89  
Previously reported from North – East :Deepor Beel Wildlife Sanctaury, Assam (Boruah *et al.*, 2020)

**97. *Phacus oscillans* G.A.Klebs 1883:313, pl.3:fig.6 (Figure:5.D22)**  
John *et al.*, 2005, p.160, pl.38, f.A,B

Cells are 13 µm wide, 33 µm long; cells oval shaped ; anterior end with 2 lobes (one higher than other), posterior end narrowing slightly with a short blunt projection; lateral edges fold downwards to form a broad, shallow, ventral groove, pellicle spirally striated; chloroplasts parietal, small, numerous, crowded and disc-shaped, paramylon of 2 ring-shaped bodies, 4.5 µm in diameter, in about centre of cell; flagellum same length as cell.

Voucher No.:Pobitora 35  
New to North- East

**98. *Phacus parvulus* G.A.Klebs 1883:313, pl.3:fig.5 (Figure:6.E1)**  
John *et al.*, 2005, p.160, pl.38, f.P

Cells 16 µm long, 7.6 µm wide, wedge shaped ; anterior end rounded and obliquely truncate; posterior end slightly tapering to a small and bluntly rounded short extension; pellicle spirally striated ; chloroplasts numerous ,small, paramylon a single ring shaped body located in cell centre; flagellum equal to cell length ; eyespot visible .

Voucher No.:Pobitora 37  
New to North- East

**99. *Phacus suecicus* (Lemmermann) Lemmermann var. *suecicus* (Figure:6.E2)**  
Yamagishi, 2010, p.61, pl.29, f.3

Cells are broadly ovoid; posterior ends are widely rounded with a cauda that is slightly curved; their anterior ends are somewhat narrower and truncately rounded with a conspicuous, median papilla. Cells are 19 µm in diameter, 36 µm length without the cauda, and 6 µm long caudae. The periplast is longitudinally striated and has a row of granules. There are two paramylon bodies, which are parietal and huge dish-like, laying along the lateral edges.

Voucher No.:Pobitora 57

New to North- East

**100. *Phacusalatus* G.A.Klebs 1883:312 var. *latviensis* Skvortsov 1928 (Figure:6.E3)**  
John *et al.*, 2005, p.163, pl.39, f.E,F

Cells 19 µm wide and 35 µm long, broadly oval divided into two unequal halves, wing like in appearance, with a strong posterior end and a curving tail piece, longitudinally striated pellicle, disc shaped chloroplasts, large paramylon bodies, 2 in each cell, flagellum length of the cell.

New to North- East

**Genus: *Lepocinclis* Perty, 1849, nom. cons.**

**101. *Lepocinclis acicularis* France var. *acicularis* (Figure:6.E4)**  
Yamagishi, 2010, p.40, pl.18, f.4

Cells fusiform; anterior ends narrowed and truncate; posterior ends narrowed and produced, with a short, straight cauda; 9 µm in diameter, 23 µm long with the cauda.

Voucher No.:Pobitora 10  
New to North- East

**102. *Lepocinclis salina* Fritsch var. *pachyderma* (Deflandre) Conrad 1935:59 (Figure:6.E5)**  
Yamagishi, 2010, p.45, pl.20, f.6

Broad oval cells with many, tiny granular paramylon bodies ; Cells 19 µm in diameter, 25 µm long.

Voucher No.:Pobitora 19  
New to North- East

**103. *Lepocinclis ovum* var. *palatna* 1910:483, 505, fig.13 (Figure:6.E6)**  
Yamagishi, 2010, p.44, pl.19, f.11

Cells are generally ovoid, with narrowly rounded, shallowly bilobed anterior ends and widely rounded, truncate posterior ends with papillate cauda; Two paramylon bodies, ring-shaped plates with cells that are 25 µm long and 25 µm in diameter.

Voucher No.:Pobitora 29  
New to North- East

**104. *Lepocinclis marssonii* Lemmermann 1905:151, pl.IV[4]:fig.9 (Figure:6.E7)**  
Yamagishi, 2010, p.42, pl.19, f.3

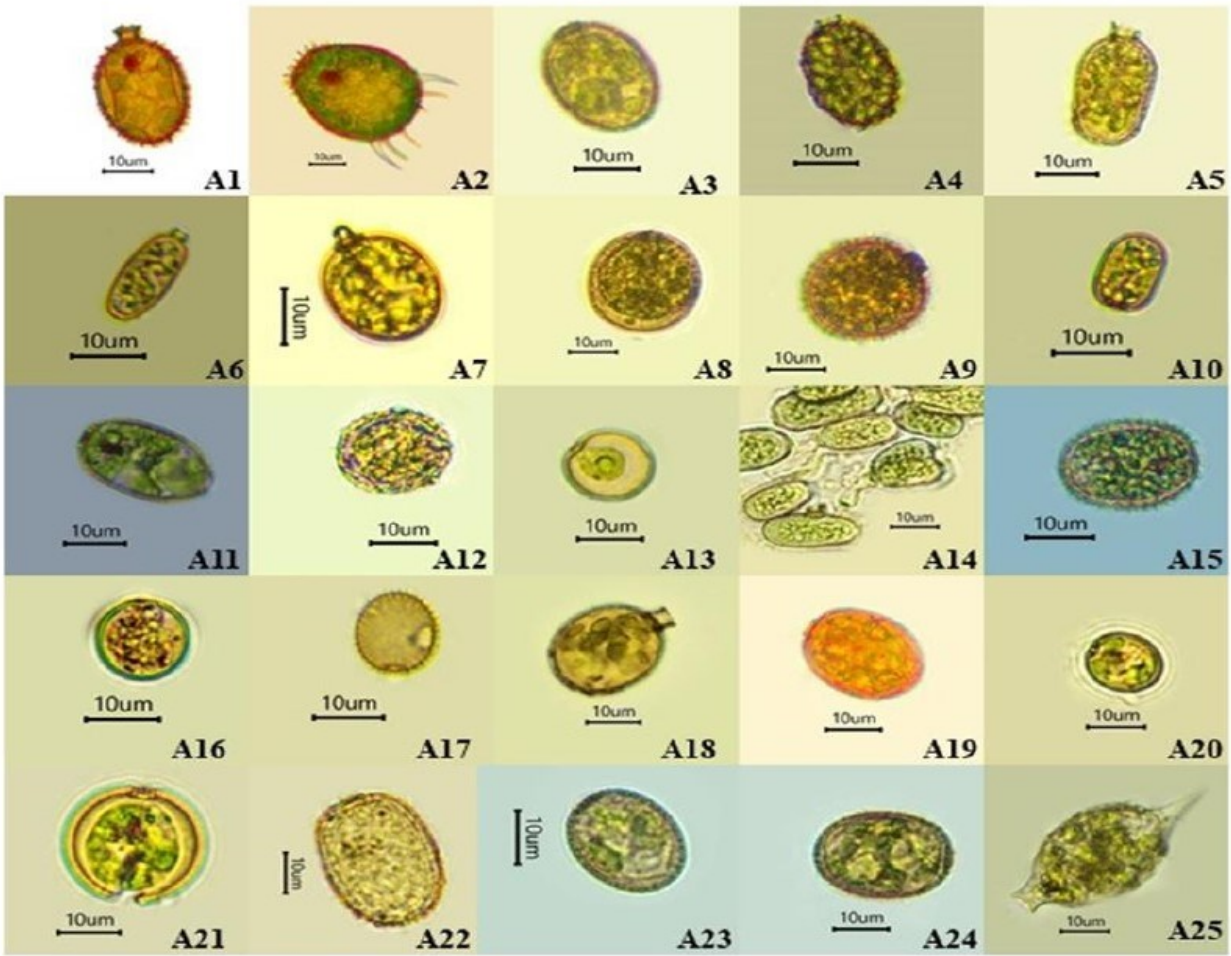
Long fusiform cells, two ring-like paramylon bodies, anterior ends that are truncate and bi papillated with a neck-like constriction, posterior ends are narrower and protrude into the cauda ; cells are 13 µm in diameter and 35 µm long, including the cauda.

Voucher No.:Pobitora 83  
New to North- East

**105. *Lepocinclis acuta* Prescott 1949:89, pl.1:figs 10,1 (Figure:6.E8)**  
Das and Adhikary, 2014, p.196, pl.15, fig.16.

Cells are club-shaped, 33 µm long and 13.3 µm wide, somewhat constricted at the anterior end, stretched into a sharp cauda at the posterior end, right-handed striated on the pellicle, and have two plate shaped paramylon bodies.

Voucher No.:Pobitora 43  
New to North- East



**Figure:2** A1.*Trachelomonas mirabilis* var. *obesa* A2.*Trachelomonas armata* var. *longispina* A3.*Trachelomonas hispida* var. *punctata* A4.*Trachelomonas crebea* A5.*Trachelomonas lacustris* A6.*Trachelomonas pulcherrima* var. *minor* A7.*Trachelomonas similis* A8.*Trachelomonas cervicula* A9.*Trachelomonas derephora* A10. *Trachelomonas oblonga* var. *truncata* A11.*Trachelomonas lemmermannii* var. *Lemmermannii* A12.*Trachelomonas verrucosa* var. *macrotuberculata* A13. *Trachelomonas curta* var. *tubigera* A14. *Trachelomonas cylindrica* A15.*Trachelomonus robusta* var. *robusta* A16. *Trachelomonas bernardii* f.*major* A17. *Trachelomonas intermedia* Dangeard var. *intermedia* A18. *Trachelomonas pavlovskoensis* var. *pavlovskoensis* A19. *Trachelomonas hispida* var. *acuminata* A20. *Trachelomonas oblonga* Lemmermann var. *oblonga* A21. *Trachelomonas curta* var. *curta* A22. *Trachelomonas raciborskii* Woloszynska var. *incerta* A23. *Trachelomonas intermedia* A24. *Trachelomonaas guttata* A25. *Trachelomonas bernardinensis* var. *africana*

106. *Lepocinclis ovum* var. *verrucosum* Prowse 1958:154,fig.2s(as ‘verrucosum’) ( Figure:6.E9)  
Yamagishi, 2010, p.184, pl.20, f.2

Cells are oblong, with anterior ends that are truncately rounded and posterior ends that gradually narrow into a long, straight cauda. The periplast is spirally striated, with noticeable spiral rows of minute verrucae along the striae. There are two paramylon bodies, each with a ring-like plate; cells 24 µm in diameter, 55 µm long with the cauda.

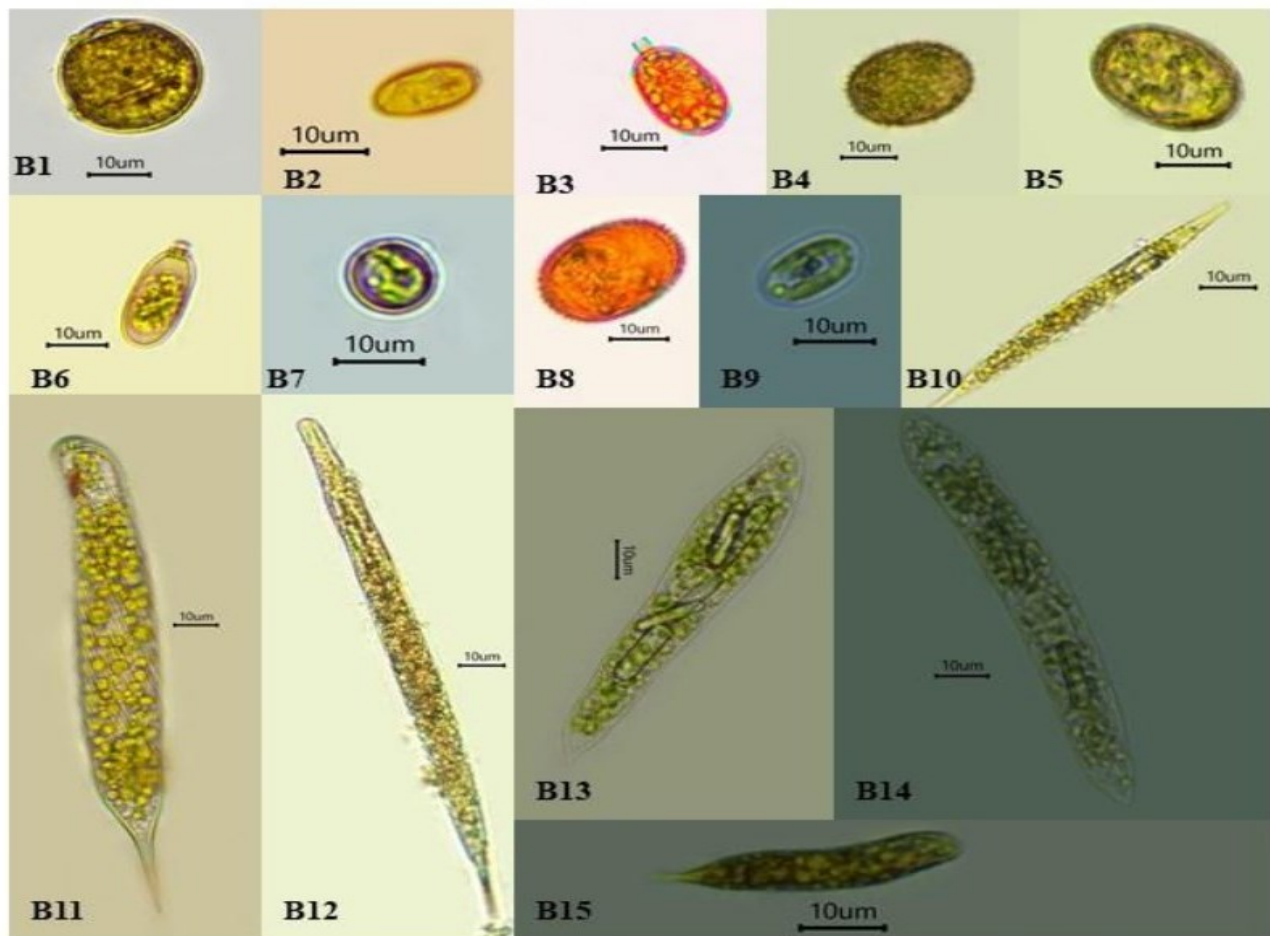
Voucher No.:Pobitora 44  
New to North- East

107. *Lepocinclis salina* var. *papulosa* W. Conrad 1934 (Figure:6.E10)  
Yamagishi, 2010, p.45, pl.20, f.5

Cells are broad cylindrical ovoid, with anterior ends that are shallowly bilobed and have one side that is slightly protruded; posterior ends that are broadly rounded, with or without a short obtuse, papillate cauda; lateral sides that are nearly straight and parallel at the midregion; paramylon bodies that are numerous and rod-like; and cells are 33 µm in diameter and 48 µm long.

Voucher No.:Pobitora 17  
New to North- East





**Figure:3** B1.*Trachelomonas granulosa* var.*granulosa* B2.*Trachelomonas pulcherrima* var. *pulcherrima* B3.*Trachelomonas dubia* var. *dubia* B4.*Trachelomonas robusta* B5. *Trachelomonas allia* var. *allia* B6.*Trachelomonas elliptica* B7.*Trachelomonas volvocina* var. *punctata* B8.*Trachelomonas raciborskii* var. *incerta* B9.*Euglenocapsa ochracea* B10.*Euglena acus* var. *minor* B11.*Euglena oxyuris* var. *charkowiensis* B12.*Euglena acus* var. *acus* B13.*Euglena deses* fo. *intermedia* B14.*Euglena deses* fo. *klebsii* B15. *Euglena oxyuris* var. *minima*

**108. *Lepocinclis gracilicauda* Deflandre var. *gracilicauda* (Figure:6.E11)**

Yamagishi, 2010, p.42, pl.18, f.12

Broad ellipsoid cells with broadly rounded ends: posterior ends with a straight, long, slender cauda; 18  $\mu\text{m}$  in diameter, 27  $\mu\text{m}$  long; caudae 9  $\mu\text{m}$  long.

Voucher No.:Pobitora 72

New to North- East

**109.*Lepocinclis playfairiana* (Deflandre)Deflandre 1932:227(as 'Playfairiana') (Figure:6.E12)**

Ahmed *et al.*, 2009, p.269

Cells are generally oval, with a short caudus and an anteriorly sharply rounded L. lateral to apex connection of the goblet and flagellum. Smooth and fine periplast. Two rings, either circular or oval: Paramylon. 32.4  $\mu\text{m}$  long and 27  $\mu\text{m}$  wide cells

Voucher No.:Pobitora 35

New to North- East

**110.*Lepocinclis ovum* (Ehrenberg) Lemmermann 1901 (Figure:6.E13)**

John *et al.*, 2005, p.159, pl.38, f.C

Cells are broadly oval and measure 25  $\mu\text{m}$  in width and 38  $\mu\text{m}$  in length. The front end is rounded, and the posterior end has a short, blunt tail piece that is about 6  $\mu\text{m}$  long. a spiral-shaped pellicle with left-handed striae; Paramylon represents two rings, one on each side of the cell; When swimming, the flagellum is as long as the cell and is pointed posteriorly; the eyespot is frequently extremely small.

Voucher No.:Pobitora 03

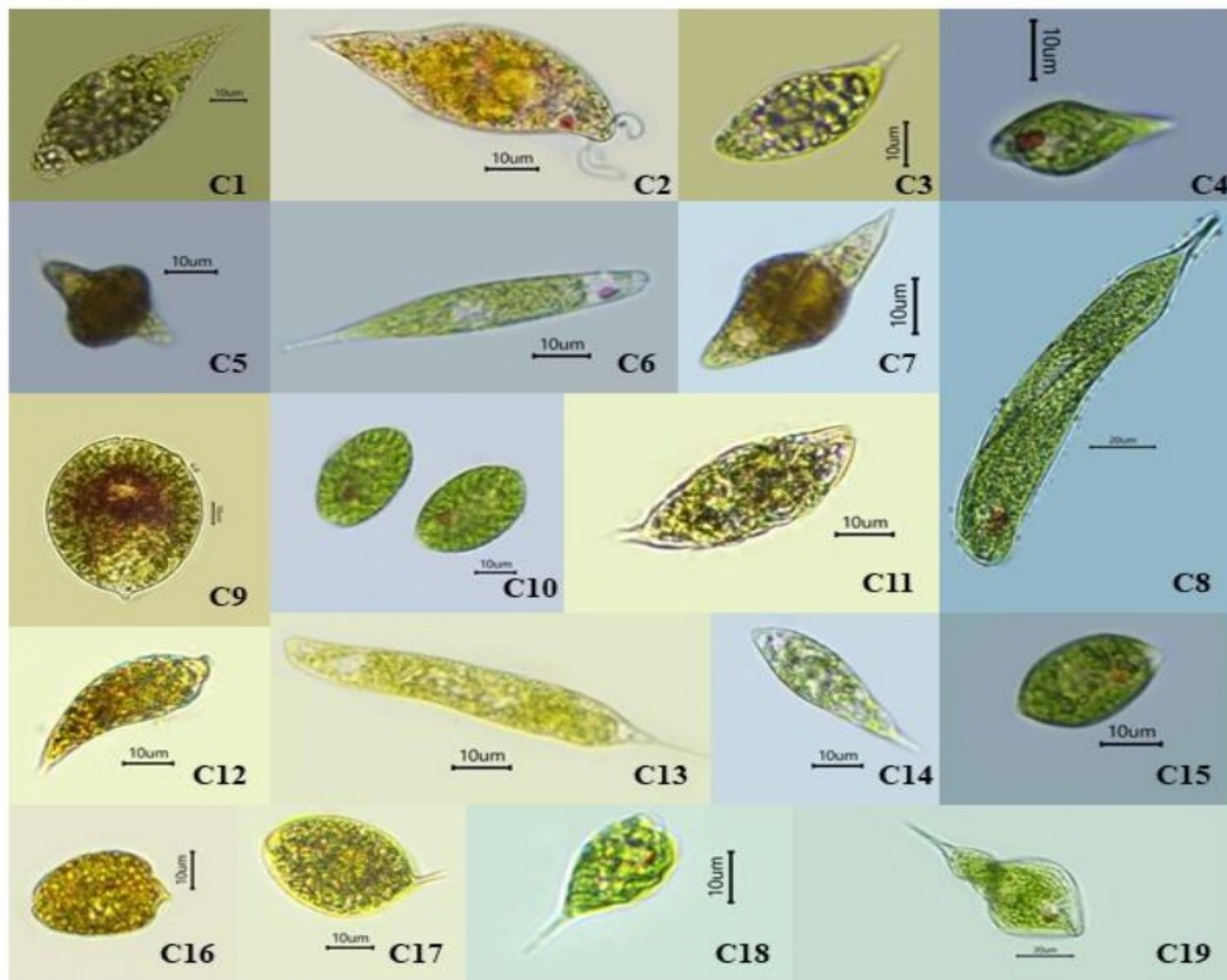
New to North- East

**111.*Lepocinclis ovum* var.*dimidio - minor* (Deflandre) Conrad 1935:42(Figure:6.E14)**

Yamagishi, 2010, p.43, pl.19, f.7

Cells are broad ovoid, 13  $\mu\text{m}$  in diameter, and 21  $\mu\text{m}$  long (including the cauda) with a short, thin cauda that resembles a nipple.





**Figure:4** C1. *Euglena clavata* C2. *Euglena sociabilis* C3. *Euglena flava* C4. *Euglena chlamydophora* C5. *Euglena elastica* C6. *Euglena gaumei* var. *gaumei* C7. *Euglena repulsans* C8. *Euglena oxyuris* var. *charkoviensis* C9. *Euglena splendens* C10. *Euglena contabrica* C11. *Euglena tripteris* C12. *Euglena cuneata* C13. *Euglena linnophila* var. *swirenkoi* C14. *Euglena spirogyra* var. *spirogyra* C15. *Euglena gaumei* var. *minor* C16. *Phacus mammillatus* C17. *Phacus hamatus* C18. *Phacus pyriformis* C19. *Phacus helicoides* var. *helicoides*

Voucher No.:Pobitora 33  
New to North- East

**112. *Lepocinclis hungpanchiaensis* S.P.Chu 1936: 280,fig.13**

Yamagishi, 2010, p.42, pl.19, f.4

Fusiform cells with narrowly rounded posterior ends that form a short, thin cauda and anterior ends that are bilobed at one side directly below the end; Two paramylon bodies, each with a ring-shaped plate with cells that measure 23 µm in diameter and 45 µm in length, cauda included.

Voucher No.:Pobitora 13

Previously reported from North – East :Deepor Beel Wildlife Sanctaury ,Assam (Boruah *et al.*,2020)

**113. *Lepocinclis wangii* S.P.Chu var. *wangii* (Figure:6.E15)**

Yamagishi, 2010, p.46, pl.20, f.8

Cells fusiform; anterior ends conically narrowed and bilobed, one side produced into a beak-like process; posterior ends gradually narrowed into a long, thin cauda; cells 28 µm in diameter, 55 µm long with the cauda.

Voucher No.:Pobitora 33  
New to North- East

**114. *Lepocinclis spirogyroides* Marin and Melkonian (Figure:6.E16)**

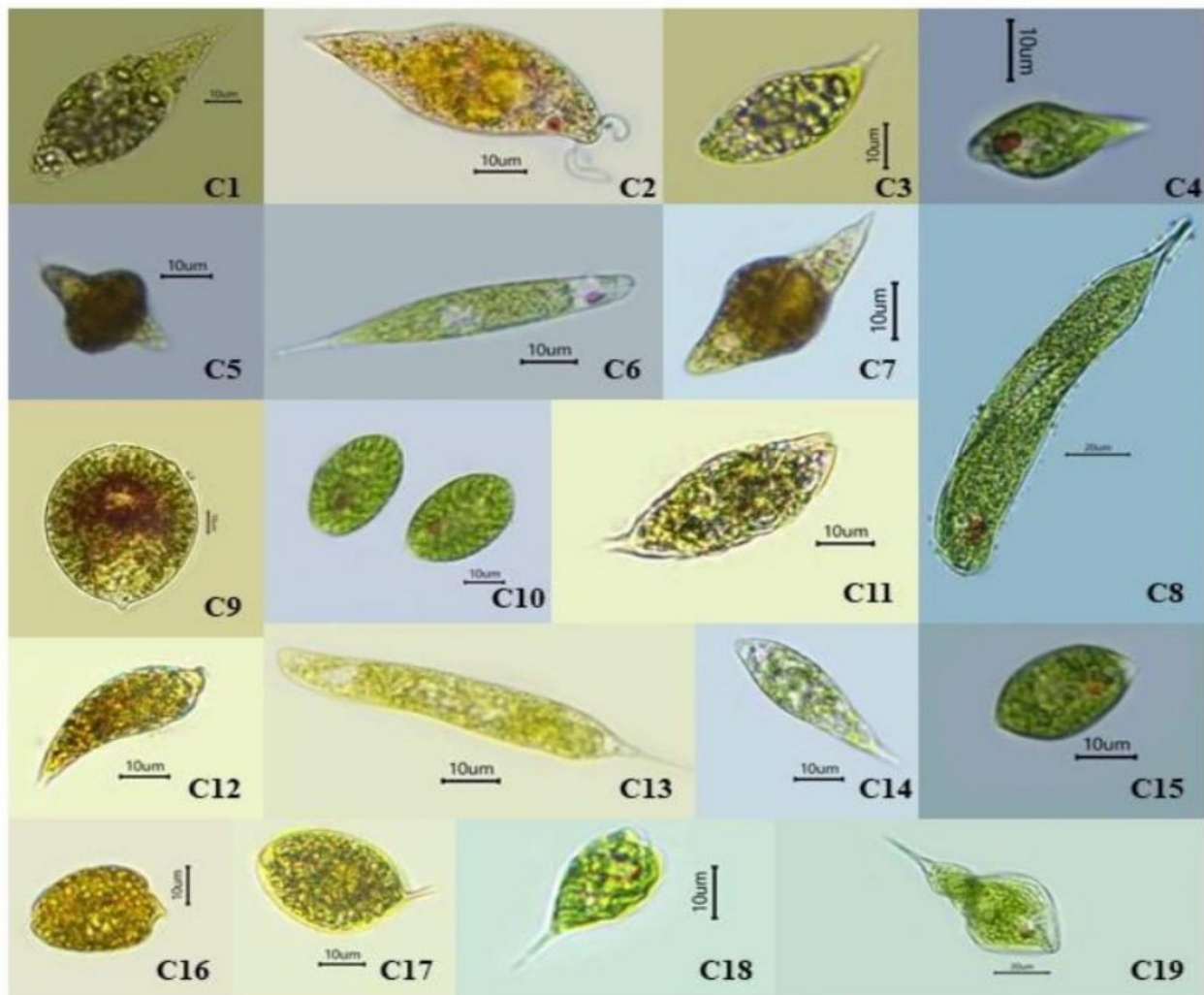
Das and Adhikary,2014,p.198,pl.16,fig.2.

A cell with a spindle shape, a pellicle with helical striation and shiny granules, and many disc-shaped chloroplasts that are 103 µm long and 14 µm wide.

Voucher No.:Pobitora 43  
New to North- East

**115. *Lepocinclis ovum* var. *australis* Playfair 1921: 126,fig.3b,c (Figure:6.E17)**

Yamagishi, 2010, p.43, pl.9, f.6;



**Figure:4** C1. *Euglena clavata* C2. *Euglena sociabilis* C3. *Euglena flava* C4. *Euglena chlamydophora* C5. *Euglena elastica* C6. *Euglena gaumei* var. *gaumei* C7. *Euglena repulsans* C8. *Euglena oxyuris* var. *charkowiensis* C9. *Euglena splendens* C10. *Euglena contabrica* C11. *Euglena tripteris* C12. *Euglena cuneata* C13. *Euglena linnophila* var. *swirenkoi* C14. *Euglena spirogyra* var. *spirogyra* C15. *Euglena gaumei* var. *minor* C16. *Phacus manmillatus* C17. *Phacus hamatus* C18. *Phacus pyrum* C19. *Phacus helikoides* var. *helikoides*

In the face view, cells are clearly short and oblong in shape with rounded corners; their anterior ends are broadly rounded and occasionally shallowly bilobed; their posterior ends have a small, nipple-shaped cauda their paramylon bodies have two rings-like plates; and Lengths are 20 µm in diameter and 25µm long, respectively.

Voucher No.:Pobitora 29

New to North- East

**116.***Lepocinclis pseudo- ovum* Conrad var. *pseudo ovum*(Figure:6.E18)

Yamagishi, 2010, p.44, pl.20, f.1

Cells ovoid; anterior ends broadly rounded; posterior ends narrowly rounded with a long, straight cauda with a basal nodule; Paramylon bodies two, ring-shaped plates; Cells are 21 µm in diameter and 45 µm long,

including the cauda.

Voucher No.:Pobitora 73

New to North- East

**Genus:***Strombomonas* Deflandre,1930

**117.***Strombomonas australica* (Playfair)Deflandre 1930 var. *australica*(Figure:6.E19)

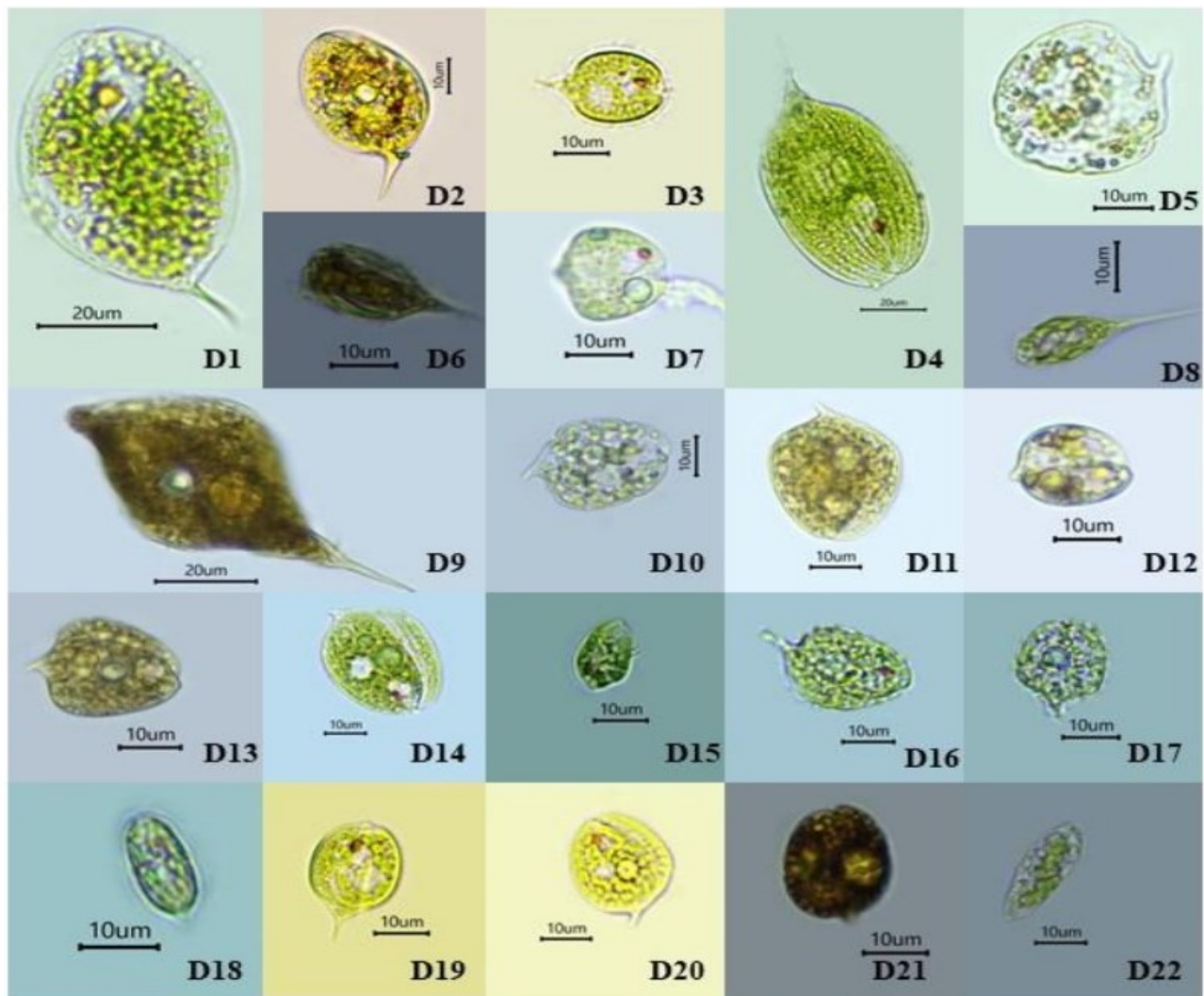
Yamagishi, 2010, p.64, pl.32, f.2

Long, thin fusiform tests; anterior ends narrowed gradually into a long, cylindric neck with a slightly flared and serrated mouth; posterior ends narrowed gradually into a long cauda; walls rough, with thick granules; tests 18 µm wide, 76 µm long with the neck and cauda.

Voucher No.:Pobitora 33

New to North- East





**Figure:5** D1. *Phacus triqueter* var. *triqueter* D2. *Phacus orbicularis* D3. *Phacus ovalis* D4. *Phacus pomiformis* D5. *Phacus undulatus* var. *undulatus* D6. *Phacus psuedonordstedtii* var. *psuedonordstedtii* D7. *Phacus acuminatus* var. *parvulus* D8. *Phacus pseudonordstedtii* var. *miniscula* D9. *Phacus circumflex* D10. *Phacus onyx* var. *onyx* D11. *Phacus curvicauda* var. *curvicauda* D12. *Phacus acuminatus* var. *javana* D13. *Phacus acuminatus* var. *acuminatus* D14. *Phacus triquerter* D15. *Phacus agilis* D16. *Phacus raciborskii* f. *raciborskii* D17. *Phacus tricarinatus* D18. *Phacus pusillus* D19. *Phacus monilatus* var. *suecicus* D20. *Phacus circulatus* var. *circulatus*. D21. *Phacus contortus* var. *complicatus* D22. *Phacus oscillans*

118. *Strombomonas napiformis* (Playfair) Deflandre  
1930:590 (Figure:6.E20)  
Yamagishi, 2010, p.182, pl.34, f.1

Tests are obovoid, with conically constricted posterior ends and a long, thin cauda. The anterior ends are broadly rounded with a short, broad cylindrical neck and a smooth mouth. Wall smooth or slightly rough; tests 33 µm length, including the neck and cauda, and 23 µm in diameter.

Voucher No.: Pobitora 31  
New to North- East

Order: Petalomonadida  
Family: Sphenomonadidae  
Genus: *Sphenomonas* F. Stein, 1878

119. *Sphenomonas quadrangularis* var. *cruciformis*  
Playfair (Figure:6.E21)  
Yamagishi, 2010, p.182, pl.18, f.2

Cells are long ovoid in face view, square cruciform in top view, and have slightly concave sides. The anterior ends are narrower and conically formed, while the posterior ends are broadly rounded, periplast rigid and have four elevated, longitudinal granulated ridges. Cells are 12.5 µm wide and 21 µm length.

Voucher No.: Pobitora 56

New to North- East

Genus: *Petalomonas* F. Stein, 1859

120. *Petalomonas angusta* (Klebs) Lemmermann  
1910:551 (Figure:6.E22)

Yamagishi, 2010, p.181, pl.17, f.8

Ovoid cells with a median longitudinal furrow on the dorsal face ;cells are 20 µm wide and 32 µm long, with anterior ends that are constrained and somewhat truncate and posterior ends that are broadly rounded.

Voucher No.:Pobitora 65

New to North- East

**Order:Entosiphonida**

**Family:Entosiphonidae**

**Genus:Entosiphon F.Stein,1874**

**121. *Entosiphon ovatus* A.Stokes 1885:440,pl.XV [15]:fig.12 (Figure:6.E23)**

Yamagishi, 2010, p.103, pl.17, f.2

Cells are ellipsoid, with broad, rounded posterior ends and somewhat narrowed and rounded anterior ends. The cytoplasm is granular, and the pharyngeal rod is long and extends the whole length of the cell; Cells 12 µm wide and 23 µm length .

Voucher No.:Pobitora 49

New to North- East

**Order:Peranemida**

**Family:Peranemidae**

**Genus: *Peranemopsis* lackey,1940**

**122. *Peranemopsis limax* (Christen )J.Larsen 1987:601 (Figure:6.E24)**

Yamagishi, 2010, p.104, pl.17, f.6

The majority of cells are long and oval; they feature gradually narrowed anterior ends with an obliquely truncate apex, broad rounded posterior ends, metamorphosing periplasts, granular cytoplasm, and many circular paramylon bodies. The average cell is 17 µm wide and 38 µm long.

Voucher No.:Pobitora 92

New to North- East

**Order:Natomonadida**

**Family:Astasiidae**

**Genus:*Rhabdomonas* Fresenius,1858**

**123. *Rhabdomonas incurva* Fresenius 1858:230,pl.X [10]:figs 46,47 (Figure:6.E25)**

Yamagishi, 2010, p.45, pl.16, f.8

Cell is 8 µm wide and 24 µm long;They resemble beans because they are thick, slightly cylindrical in shape, and thin on the face. There are little longitudinal striae in the periplast.

Voucher No.:Pobitora 73

New to North- East.

**Order:Anisonemida**

**Family:Anisonemidae**

**Genus: *Heteronema* Dujardin,1841**

**124. *Heteronema globiferum* (Ehrenberg) F. Stein 1878 :expl.pl.XXIII [23]:figs 54-56(as 'globiferum') (Figure:6.E26)**

Yamagishi, 2010, p.45, pl.17, f.4

The periplast is spirally striated, Cell is ovoid ,the anterior ends protrude conically into the truncated apex, the rear ends are broadly rounded, frequently elongated, and the paramylon bodies feature numerous tiny ellipsoidal granules;Cells are 33 µm long and 31 µm wide.

Voucher No.:Pobitora 71

New to North- East.

## DISCUSSION

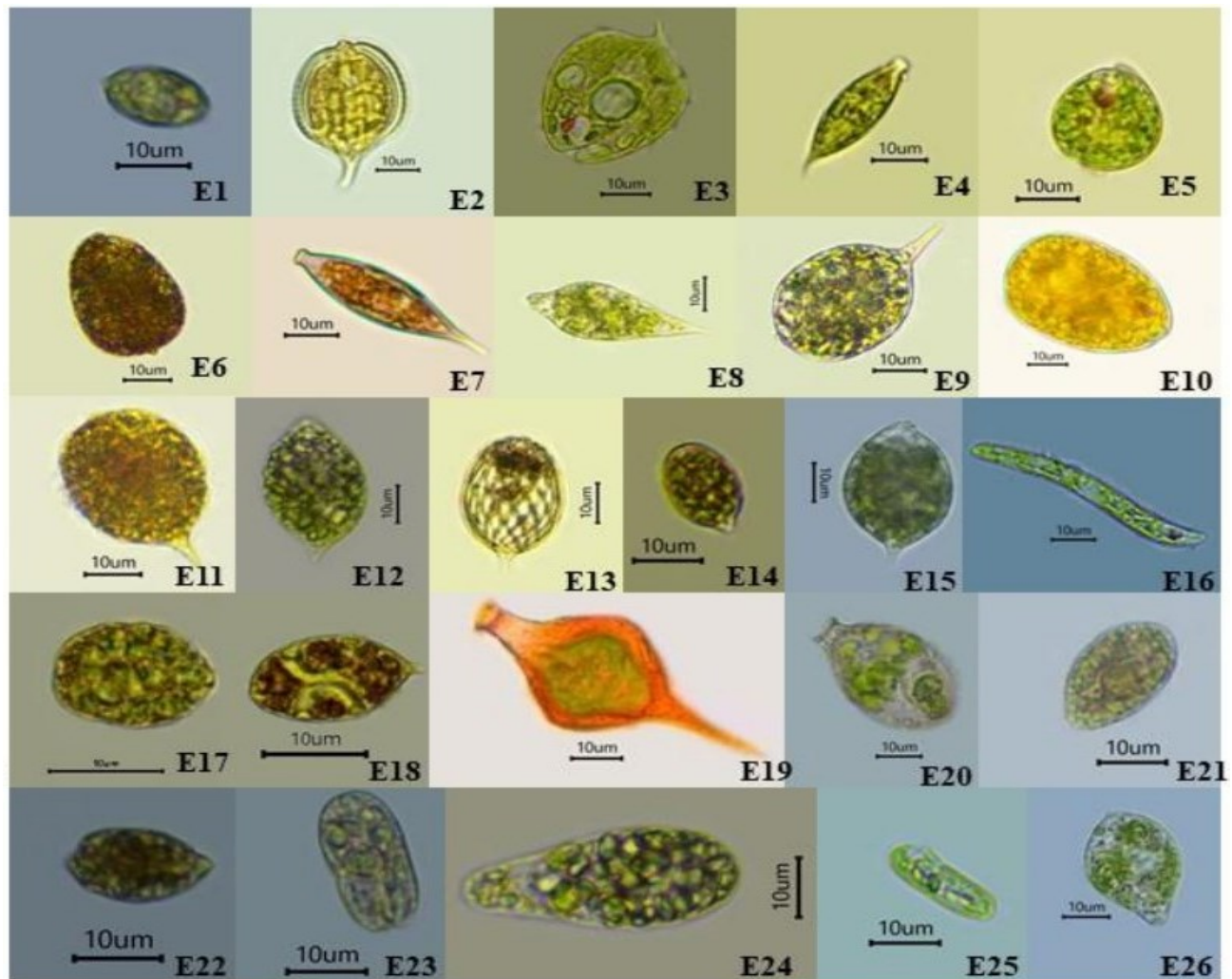
The current endeavor revealed a total of 124 Euglenoids species from the different waterbodies of Pobitora Wildlife Sanctuary. Out of which, a total of 107 euglenozoa species were recorded for the first time from North East India. Among the different genera, percentage contribution of *Trachelomonas* Ehrenberg,1834 was the highest (29.03%) followed by *Phacus* Dujardin,1841 (27.41%), *Euglena* Ehrenberg 1830 (22.58%), *Lepocinclis* Perty,1849(12.90%). Out of the 124 taxa,*Euglena acus* Ehrenberg var. *acus*,*Phacus oscillans* G.A.Klebs 1883 were uniformly available throughout the year in almost all the waterbodies. Overall euglenoids diversity was higher during the winter months within the Sanctuary in contrast to summer months when *Lepocinclis gracilicauda* Deflandre var. *gracilicauda*, *Lepocinclis wangii* S.P.Chu var. *wangii*, *Phacus suecicus*(Lemmermann) Lemmermann var. *suecicus* were outnumbered the others which may be attributed to dilution of water and concomitant reduction in organic matter content (OMC) due to influence of flood. Post flood decomposition of weeds and other biotic remains usually enhance the OMC in each and every water body of the Sanctuary. The droppings and pellets of winter migratory birds and, rhinos too contribute in the process. It is to be noted that the above mentioned three euglenoid species escape with the receding of flood water which may be due to subsequent increase of OMC and pH in water. Another interesting point to be noted here that more species of euglenoids were reported towards the boundary of the Pobitora WLS where in so that appropriate action could be taken to conserve the great one horned rhinoceros and to protect the migratory birds visiting the Sanctuary from any type of possible threat in future.

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**Figure:6** E1. *Phacus parvulus* E2. *Phacus suecicus* var. *suecicus* E3. *Phacus alatus* E4. *Lepocinclis acicularis* var. *acicularis* E5. *Lepocinclis salina* var. *pachyderma* E6. *Lepocinclis ovum* var. *palatina* E7. *Lepocinclis marssonii* E8. *Lepocinclis acuta* E9. *Lepocinclis ovum* var. *verrucosum* E10. *Lepocinclis salina* var. *papulosa* E11. *Lepocinclis gracilicauda* var. *gracilicauda* E12. *Lepocinclis playfairiana* E13. *Lepocinclis ovum* E14. *Lepocinclis ovum* var. *dimidio - minor* E15. *Lepocinclis wangii* E16. *Lepocinclis spirogyroides* E17. *Lepocinclis ovum* var. *australis* E18. *Lepocinclis pseudo-ovum* var. *pseudo ovum* E19. *Strombomonas australica* var. *australiana* E20. *Strombomonas napiformis* E21. *Sphenomonas quadrangularis* var. *cruciformis* E22. *Petalomonas angusta* E23. *Entosiphon ovatus* E24. *Peranemopsis limax* E25. *Rhabdomonas incurva* E26. *Heteronema globiferum*

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