

STUDY OF EUGLENOIDS—*COLACIUM* EHR., *KHAWKINEA* JOHN ET McKIBBEN, *ASTASIA* EHR. AND *MENOIDIUM* PERTY, FROM GUJARAT

V. H. WAGHODEKAR* & R. J. PATEL

Department of Biosciences, Sardar Patel University, Vallabh Vidyanagar 388 120, India

Abstract

The paper deals with systematic account of 22 taxa belonging to 4 genera: *Colacium*, *Khawkinea*, *Astasia* and *Menoidium* collected from different localities of Gujarat. *Colacium* and *Khawkinea* are reported for the first time from India. Out of these, 14 taxa, viz., *Colacium vesiculosum* f. *cyclopicola*, *C. gojdicsae*, *C. mucronatum*, *Khawkinea quartana*, *Astasia applanata*, *A. breviciliata*, *A. dangeardii* var. *parva*, *A. kathemerias*, *A. longa*, *A. parva*, *A. pygmaea*, *A. torta*, *A. variabilis* and *Menoidium minimum* are new to Indian Euglenoids and are the first records from Gujarat.

Introduction

From the literature, it seems that about 260 taxa of Euglenoids belonging to 16 genera have been reported from different parts of India. Though many phycologists have worked on Indian Euglenoids, the entire Gujarat State remains unexplored except the work of Kamat (1962) who collected 28 taxa of Euglenoids belonging to 3 genera, *Euglena*, *Lepocinclis* and *Phacus* from Ahmedabad only. Recently Patel and Waghodekar (1981) described 23 taxa of *Phacus* from Gujarat.

During the study of Euglenoids of Gujarat, the authors collected about 350 taxa belonging to 20 genera. Out of these 22 taxa belonging to four genera, *Colacium* Ehr., *Khawkinea* John & McKibben, *Astasia* Ehr. emend. Duj. and *Menoidium* Perty are described for the first time from Gujarat. *Khawkinea*, *Astasia* and *Menoidium* are the colourless Euglenoids. Two genera, *Colacium* and *Khawkinea* are the first records from India. Three species of *Colacium*, 1 of *Khawkinea*, 9 of *Astasia* and 1 of *Menoidium* are the additions to the Indian Euglenoids.

Material and methods

The survey of Euglenoids was started in September, 1977 and continued till May, 1980. The collections were made infrequently and at irregular intervals, from road-side ditches, rice-fields, pools, puddles, sewage water, permanent ponds, lakes, tanks and stagnant waters in rivers from all parts of Gujarat from September to May. The collection comprises green, red and colourless Euglenoids. The materials were preserved in 3% formaldehyde.

The Euglenoids were identified with the help of relevant monographs by Huber-Pestalozzi (1955), Leedale (1967), Asaul (1975), Popova and Safonova (1976) and available publications. The numbers in the brackets at the end of the description of each taxa

*Present address : Department of Biology, D. N. Mahavidyalaya, Faizpur, District, Jalgaon, Maharashtra, India.

indicate the numbers given to the bottles which have been deposited in the department of Biosciences, Sarcar Patel University, Vallabh Vidyanagar.

Systematic Description

Genus *COLACIUM* Ehrenberg

Colacium gojdicsae (Prescott) H. P.

Text-fig. 3

Cell fusiform to sub-cylindrical; truncated at anterior end; posterior end attenuated and somewhat produced into caudus like process. Pellicle apparently smooth. Chromatophores many, irregular discs with pyrenoids. Paramylum many small rods, scattered. Flagellum body length. Stigma brown-red, small, oval. Nucleus posterior. Highly metabolic, $29.6-30.6 \times 11.2-14.7 \mu\text{m}$.

Habitat—Rare; Vallabh Vidyanagar, August, 1978 (No. 4562); Surat, September, 1979 (No. 4661).

Colacium mucronatum Bourr. et. Chand.

Text-fig. 1

Cell solitary, oval enclosed in cell-wall. Cuticle finely striated. Cell when metabolic cystome showing U-shape. Chromatophores large, oval discs, with central sheathed pyrenoids. Paramylum small rods. Stigma small, oval. Nucleus posterior to middle of cell. $25.8 \times 18.6 \mu\text{m}$.

Habitat—Rare; puddle, Vallabh Vidyanagar, November, 1977 (No. 4522).

The present form agrees with the species described by Huber-Pestalozzi (1955) and Leedale (1967) except in being solitary and not as epiphytic or in dendroid colonies. Present material is metabolic showing cytosome and stigma clearly.

Colacium vesciculosum Ehr. f. *cyclopicola* (Glickh.) Popova

Text-fig. 2

Cell fusiform to ovoid, encased in a firm cell-wall. Cell solitary, attached to insect larva. Chromatophores many, Large, ovoid discs, without pyrenoids. Paramylum few, small rods. Nucleus just posterior to middle. $2.4 \times 11.5 \mu\text{m}$.

Habitat—Very rare taxon; pond Uttarsanda, March, 1979 (No. 4630).

Genus *KHAWKINEA* John. et McKibben

Khawkinea quartana (Moroff.) John et McKibben

Text-fig. 4

Cell elongate oval; narrowing anteriorly, bilabiate; posteriorly tapering into a tail-like-process. Pellicle spirally striated. Paramylum scattered oval granules, sometimes irregular in shape. Flagellum more than the body length. Stigma oval, close to reservoir. Nucleus posterior half of the cell. Metabolic, $33.2-60 \times 11-23.4 \mu\text{m}$.

Habitat—Pond, Harni, September, 1977 (No. 4508), May, 1979 (No. 4657); Vallabh Vidyanagar, June, 1978 (No. 4545); puddle Junagadh, March, 1979 (No. 4634).

Genus *ASTASIA* Ehr. emend. Duj.



Text-fig. 1-34

Astasia applanata Pringsh.

Text-fig. 19

Cell oval to fusiform in outline, anterior half broader with a papilla-like projection; posterior half drawn out into a tail-like process with rounded or blunt-tip. Pellicle spirally striated. Paramylum oval, many. Flagellum slightly more than the body length. Nucleus central. $39-47 \times 14.2 \times 15.3 \mu\text{m}$.

Habitat—Rare species, Anand, May, 1978 (No. 4543); Vallabh Vidyanagar, June, 1978 (No. 4545).

Astasia braviciliata Matv.

Text-fig. 16

Cell fusiform in outline; anteriorly narrowing into a short or elongated neck; posterior end with a short, blunt caudus. Pellicle apparently smooth. Paramylum many, oval granules. Flagellum $1/3$ the body length. Nucleus central, $42.2 \times 26.4 \mu\text{m}$.

Habitat—Rare species, puddle, Maninagar, Ahmedabad, September, 1978 (No. 4564).

Astasia dangeardii Lemm. var. *parva* Pringsh.

Text-figs. 12, 14

Cell fusiform, narrowing at both the ends; posterior half drawn into a short, blunt process. Pellicle faintly spirally striated. Paramylum many, oval granules. Flagellum about the body length or slightly more. Nucleus in posterior half of the cell, $31.3-37 \times 10.4-14.2 \mu\text{m}$.

Habitat—Vallabh Vidyanagar, April, 1978 (No. 4538); pond Pavi-Jetpur, November, 1978 (No. 4595); pond Shejvi, January, 1979 (No. 4610).

Astasia elongata Skv.

Text-fig. 17

Cell elongated-oval, rounded at the posterior end; anterior end slightly narrowed and bilabiate. Cytoplasm granular. Pellicle apparently smooth. Paramylum many, small, granules. Flagellum about the body length. Nucleus in posterior half of the body, $30.2 \times 9.8 \mu\text{m}$.

Habitat—Rare species, Uttarsanda, March, 1979 (No. 4627).

Astasia inflata Duj. f. *fusiformis* (Skuja) Popova

Text-fig. 24

Cell fusiform; anterior end truncated, bilabiate with reservoir; posterior end triangular and pointed. Pellicle finely spirally striated. Paramylum small rods or discs, irre-

Text-fig. 1—1. *Colacium mucronatum* Bourr. et Chad.; 2. *C. vesiculosum* Ehr. f. *cyclopicola* (Glickh) Popova; 3. *C. gojdicsae* (Prescott) H. P.; 4. *Rhawkinia quartana* (Moroff.) John. et McKibben; 5-19, 24, 25. *Astasia* Ehr. emend. Duj.; 5-6. *A. klebsii* Lemm.; 7. *A. torta* Pringsh.; 8, 9. *A. longa* Pringsh.; 10, 15. *A. kathemerios* Skuja; 11. *A. ovalis* H.-P.; 12, 14. *A. dangeardii* var. *parva* Pringsh.; 13. *A. parva* Pringsh.; 16. *A. braviciliata* Matv.; 17. *A. elongata* Skv.; 18. *A. variabilis* Skv.; 19. *A. applanata* Pringsh.; 24. *A. inflata* f. *fusiformis* (Skuja) Popova; 25. *A. pygmaea* Skueja; 20, 23, 26-34. *Menoidium* Perty; 20, 26, 30, 32, 34. *M. pellucidum* Perty; 21-23. *M. cultellus* Pringsh.; 27. *M. minimum* Matv.; 28, 29. *M. gracile* Playf.; 31. *M. falcatum* Zach.
(All scale bars— $20 \mu\text{m}$; Bars; A-Figs. 15-16; B-Figs. 1-9, 12-14, 17-34; C-Figs. 10-11.)

gularly distributed. Flagellum about the body length or slightly more. Nucleus large, spherical, in posterior wider half part of the cell, $35.1-42.1 \times 11-17.7 \mu\text{m}$.

Habitat—Rare taxon; Dahod, December, 1977 (No. 4529); fish-pond, Lingda, April, 1978 (No. 4539).

Astasia Kathemerios Sküija

Text figs. 10, 15

Cell ovate, broader towards the anterior end; posteriorly narrowed into a short tail. Pellicle with indistinct striae. Paramylum bodies many (upto 15) ovoid or rods, in the wider part of cell. Flagellum about $2/3$ the body length, Nucleus central. $18.3-26 \times 7-10 \mu\text{m}$.

Habitat—Pond Vyara, March, 1978 (No. 4537); puddle, Vallabh Vidyanagar, May, 1978 (No. 4541).

Astasia klebsii Lemm.

Text-figs. 5, 6

Cell fusiform to spindle-shaped; posterior half of body drawn out into a long tail like process. Pellicle spirally striated, striae very faint or indistinct. Paramylum bodies many, ovoid, bluish, in the wider anterior half of the cell. Flagellum nearly the body length. Nucleus median or in posterior half of the cell. Metabolic. $36.4-55.1 \times 11.3-17.2 \mu\text{m}$.

Habitat—Pond, Harni, September, 1977 (No. 4508); puddle, Surat, September, 1977 (No. 4661).

Astasia longa Pringsh.

Text-figs. 8, 9

Cell elongated; narrowed posteriorly ending into a short tail piece; anteriorly bilabiate. Pellicle spirally striated. Cytoplasm slightly granular, having many small oval, paramylum granules, scattered throughout the cell. Nucleus nearly central, $62.7-63.7 \times 14.5-16 \mu\text{m}$.

Habitat—Rare species, Boriavi, June, 1978 (No. 4549); puddle, Kheda, February, 1979 (No. 4618).

Astasia ovalis H. P.

Text-fig. 11

Cell broadly oval, generally inversely oval with rounded ends. Membrane thin and smooth. Paramylum few, oval, flat in additions to many small oval granules. Flagellum about the body length. Nucleus spherical, posterior. Metabolic, $12.8-13.5 \times 9.4 \mu\text{m}$.

Habitat—Rare species, puddle, Anand, May, 1978 (No. 4543).

Astasia parva Pringsh.

Text-fig. 13

Cell ovoid or dumb-bell shaped; anterior end slightly broader. Pellicle faintly, spirally striated. Paramylum small, rod-shaped, 6-10. Nucleus central, $21.7 \times 9 \mu\text{m}$.

Habitat—Rare species, pond Uttarsanda, December, 1977 (No. 4524).

Astasia pygmae Skuja

Text-fig. 25

Cell oblong, oval; rounded anteriorly; posterior end with a short protrusion or papilla. Pellicle spirally striated. Paramylum oval granules, 4-10 in number. Flagellum slightly more than the body length. Nucleus slightly posterior to the middle, $11.5-16.1 \times 10-10.7 \mu\text{m}$.

Habitat—Rare species, cement cistern, Hadgude, May, 1979 (No. 4643); Gamdi, August, 1979 (No. 4650).

Astasia torta Pringsh.

Text-fig. 7

Cell spindle-shaped, cylindrical, anterior part of the cell broader with slightly produced, narrowly truncated anterior end; posterior end narrowing, somewhat spirally twisted with short, acute, tail. Pellicle finely spirally striated. Paramylum oval many. Flagellum $1/2-2/3$ the body length. Nucleus nearly central. $36.4 \times 11 \mu\text{m}$.

Habitat—Rare species, pond Harni, September, 1977 (No. 4508).

Remarks—Present form is closely related to *A. klebsii* Lemm. and *A. curvata* Klebs but it differs from *A. klebsii* in having ribbon like shape, not more curved and less broad anterior end and from *A. curvata* in having less length and less curved body. Present species has the characters in between *A. klebsii* and *A. curvata* (Pringsheim, 1942; Huber-Pestalozzi, 1955).

Astasia variabilis Skv.

Text-fig. 18

Cell small, oval; rounded at both ends. Periplast apparently smooth. Cytoplasm clear with 10-15 oval paramylum granules. Flagellum about the body length, $18 \times 11.7 \mu\text{m}$.

Habitat—Very rare species, pond Shejvi, January, 1979 (No. 4610).

Genus *MENOIDIUM* Perty*Menoidium cultellus* Pringsh.

Text-figs. 21-23

Cells cylindric-elliptic, flattened, generally distinctly curved to one side, convex side more curved; anterior end narrowed into a neck, terminating obliquely often with 2 pointed lips; posterior end broadly rounded with a knob-like swelling or capitate. Sometimes on concave side, deep notch present near the mid-region. Cytoplasm granular. Pellicle apparently smooth or delicately longitudinally striated. Paramylum 2-3 large cylinders with many small rods. Flagellum $1/2$ the body length. Nucleus central, circular. $29.3-51 \times 8-10.4 \mu\text{m}$.

Habitat—Pond, Pavi-Jetpur, November, 1978 (No. 4596); Pond Godhra, February, 1979 (No. 4621); Junagadh, March, 1979 (No. 4635).

Menoidium falcatus Zach.

Text-fig. 31

Cell sickle-shaped, elongated, cylindrical; anterior end narrowed into a neck, ending obliquely with 2 pointed lips; posterior end tapering and pointed. Cell curved on one side. Cytoplasm granular. Pellicle apparently smooth. Paramylum 2 large and few small thin rods. Flagellum nearly the body length. Nucleus central, $75 \times 8.5 \mu\text{m}$.

Habitat—Very rare species; pond, Godhra, February, 1979 (No. 4621).

The plants from Andhra Pradesh are more longer than those of Gujarat ones (Suxena, 1955-110— $120 \times 12-14 \mu\text{m}$). It is agreeable with that described by earlier workers (Forest, 1954; Huber-Pestalozzi, 1955; Asaul, 1975; Popova & Safonova, 1976).

Menoidium gracile Playf.

Text-figs. 28, 29

Cell cylindrical-elongated, flattened, slightly curved to one side; anterior end narrowed to a neck ending obliquely; posterior end bluntly ended. Pellicle longitudinally striated. Cytoplasm slightly granular, with 2 large cylinders and many small paramylum rods. Flagellum about 1/2 the body length. Nucleus central. $52.5-56.8 \mu\text{m}$.

Habitat—Pond, Shejvi, January, 1979 (No. 4609).

Menoidium minimum Matv.

Text-fig. 27

Cell broadly cylindrical, flattened, curved on one side; anterior end slightly narrowed, rounded and truncated; posterior end with a short curved point. Pellicle fairly rigid, apparently smooth. Cytoplasm granular. Paramylum few, squarish rods with few small ones. Flagellum about 1/2 the body length. Nucleus central, $16.4 \times 4.7 \mu\text{m}$.

Habitat—Very rare species ; pond, Uttarsanda, December 1977 (No. 4524).

Menoidium pellucidum Perty

Text-figs. 20, 26, 30, 32-34

Cells cylindrical-elliptic in shape, very flat, distinctly curved to one side, convex side more curved; anterior end narrowed to a neck-like end, often terminating obliquely in two pointed lips; posterior end slightly narrowed and rounded. Pellicle longitudinally striated. Cytoplasm granular to hyaline with 1-2 large cylinders and many small rods of paramylum. Flagellum 1/2 the body length. Nucleus central, spherical, $39.8-55.7 \times 8-11.3 \mu\text{m}$.

Habitat—Widely distributed (Nos. 4572, 4596, 4620, 4621, 4635, 4649).

Acknowledgements

One of the authors (VHW) is grateful to the University Grants Commission, New Delhi for awarding Teacher Fellowship under faculty improvement Programme.

References

- ASAUL, Z. I. (1975). *Euglenophyta of the Ukrainian, R. S. R.*, pp 480, Naukova Dumka Kiev.
- FOREST, H. S. (1954). *Handbook of Algae*, pp. 467. Univ. Tennessee Press, Knoxville.
- HUBER-PESTALOZZI, G. (1955). Die Binnengesasser von Prof. Dr. August Thienemann. (Band XVI, Teil 1-4). *Das Phytoplankton des Susswassers. Systematik und Biologie Euglenophyceen*, pp. 606. Jenna.
- KAMAT, N. D. (1962). The Euglenophyceae of Ahmedabad, India. *J. Univ. Bombay*, **30** : 15-21.
- KAMAT, N. D. (1963). The algae of Kohlapur, India. *Hydrobiologia*, **22** : 209-305.
- KAMAT, N. D. (1974). Algae of Marathwada, Maharashtra. *Phykos*, **13** : 22-32.

- KAMAT, N. D. (1975). Algae of Vidarbha, Maharashtra. *J. Bombay nat. Hist. Soc.*, **72** : 450-476.
- LEEDALE, G. F. (1967). *Euglenoid Flagellates* XIII, pp. 242, Prantice-Hall, Inc., Englewood Cliffs. N. J.
- NAIDU, K. V. (1962). Studies on the Fresh water Protozoa of South India-1. Euglenoidina. *Jour. zool. Soc. India*, **14** : 88-92.
- PATEL, R. J. & WAGHODEKAR, V. H. (1981). The Euglenophyceae of Gujarat-India. I. Genus *Phacus* Dujardin. *Phykos*, **20** : 24-33.
- POPOVA, T. G. & SAFONOVA, T. A. (1976). *Flora Plantarum Cryptogamarum URSS*. Vol. IX. *Euglenophyta*. Fasc 2, 288 pp., 45 pl. Nauka, Leninopoli McML., XXVI.
- PRINGSHEIM, E. G. (1942). Contributions to our knowledge of saprophytic algae and flagellates III. *Astasia Distigma*, *Menoidium* and *Rhabdomonas*. *New Phytol.*, **41** : 171-205.
- SEENAYYA, G. (1971). Ecological studies in the plankton of certain freshwater ponds at Hyderabad-India. II. Phytoplankton-I. *Hydrobiologia*, **37** : 55-88.
- SEENAYYA, G. (1972). Ecological studies in the plankton of certain freshwater ponds at Hyderabad-India. Phytoplankton 2. *Hydrobiologia*, **39** : 247-271.
- SINGH, V. P. & P. N. SUXENA (1969). Preliminary studies on algal succession in raw and stabilized sewage. *Hydrobiologia*, **34** : 503-512.
- SUXENA, M. R. (1955). Fresh-water Eugleneae from Hyderabad, India. *J. Indian bot. Soc.* **34** : 429-450.