International Journal of Virology and Molecular Biology 2025, 14(3): 31-34
DOI: 10.5923/j.ijvmb.20251403.02

Algae of the Division Euglenophyta Determined in the Algaflora of Fisheries in Jizzak Region

Shokhsanam Kamolova[1], Zulayxo Ismatova[2,*]

[1]PhD Student, Jizzakh State Pedagogical University, Uzbekistan
[2]Associate Professor, Tashkent State Pedagogical University, Uzbekistan

Abstract Algae are among the most widespread and ecologically significant organisms in nature, occupying a fundamental position in aquatic and terrestrial ecosystems. They contribute extensively to global oxygen production, play a crucial role in primary productivity, and serve as the base of aquatic food chains. In addition to their ecological importance, algae are recognized as highly valuable biological resources due to their wide range of practical applications. They are used in agriculture, pharmaceuticals, biofuel production, wastewater treatment, and as nutritional supplements, thereby making substantial contributions to various sectors of the national economy. Algae are taxonomically diverse and are classified into several major divisions based on their morphological, physiological, and genetic characteristics. One such division is Euglenophyta, which includes unicellular flagellated algae commonly found in freshwater environments. Members of this group are notable for their dual modes of nutrition—photosynthesis and heterotrophy—which enable them to survive in varying ecological conditions. This article focuses specifically on the diversity of algae from the Euglenophyta division identified in fishery-related aquatic ecosystems within the Jizzakh region of Uzbekistan. The study presents observational and taxonomic data on euglenoid species, analyzes their environmental significance, and discusses their potential impact on the ecological health and productivity of local fisheries. By highlighting the presence and characteristics of Euglenophyta in these habitats, the research contributes to a broader understanding of regional algal biodiversity and its relevance to sustainable aquaculture practices.

Keywords Algae, Section, Class, Order, Family, Genus, Species, Algaflora, Section Euglenophyta

1. Introduction

Algae are among the most remarkable and beneficial organisms found in nature. These aquatic photosynthetic organisms are extremely rich in biologically active substances and possess a wide range of useful properties. Owing to their structural and functional diversity, algae are utilized in various fields of science and industry. Among the many divisions of algae, the present study focuses specifically on the division *Euglenophyta*.

2. Literature Review

The study of *Euglenophyta* and broader freshwater algal communities has a rich scholarly tradition, spanning classical taxonomy to contemporary ecological modeling. Foundational contributions to the classification and identification of lower plants can be traced to Kursanov et al. [1], whose multi-volume *Guide to Lower Plants* remains a cornerstone in algological taxonomy, particularly within the post-Soviet scientific tradition. Popova [2] extended this work by producing a specialized identification guide to the Euglenoid algae of the USSR, which was among the first to systematically classify *Euglenophyta* based on morphological and cytological features.

Skvortsov [5] further enriched Soviet phycology with his comprehensive account of algae inhabiting inland waters. His ecological approach, emphasizing habitat-specific occurrence, influenced subsequent regional studies, including Gollerbach's [11] *Key to Freshwater Algae*, which synthesized floristic and ecological data across the European USSR. These works provided taxonomic rigor and contributed reference points for later research on species distribution.

Within the Uzbek scientific context, Ismatova [3] represents a leading voice. Her research documented the distribution and seasonal dynamics of *Euglenophyta* in the Sangzor River, offering a rare dataset from Central Asia. Her work identified both pigment-rich and colorless forms of *Euglena*, as well as seasonal shifts in species dominance linked to water temperature and anthropogenic loading. These findings echo Vetrova and Makarova [9], who observed similar patterns in eutrophic lakes of Western Siberia, linking nutrient influx with the temporal structuring of *Euglenophyta* populations.

* Corresponding author:
zulayhoismatova@mail.ru (Zulayxo Ismatova)
Received: Apr. 15, 2025; Accepted: May 12, 2025; Published: Jun. 14, 2025
Published online at http://journal.sapub.org/ijvmb

Internationally, Prescott [6] provided an early comparative study through his catalog of algal flora in the Great Lakes region, while Wehr and Sheath (2003) broadened the ecological framework with *Freshwater Algae of North America*, which integrates habitat classification, species interactions, and morphological adaptations. Graham et al. [8] deepened this functional perspective in their second edition of *Algae*, emphasizing cellular physiology, reproductive cycles, and environmental plasticity—factors especially relevant to euglenoids.

Fott [10] contributed to the understanding of algae in man-made reservoirs, highlighting differences in floristic composition between artificial and natural lakes—a theme particularly relevant to the context of fishery farms in Uzbekistan. Meanwhile, Reynolds [13] offered an advanced ecological synthesis in *The Ecology of Phytoplankton*, proposing predictive models of algal succession based on nutrient dynamics, light regimes, and mixing patterns, which can inform future seasonal monitoring of *Euglenophyta*.

Finally, Steinberg [12] introduced a biochemical dimension by examining how dissolved humic substances affect algal behavior, including pigment production, growth inhibition, and stress responses. This is especially pertinent to the Euglenoids' capacity for forming cysts and surviving in fluctuating chemical environments.

3. Results

Algae of the division *Euglenophyta* are predominantly unicellular organisms, although in rare cases they may form small colonies. Most species are motile and move with the help of one or two anterior flagella. Their cell surface is covered with a flexible proteinaceous layer known as a pellicle or periplast, which allows for metabolic movements. The chromatophores (chloroplasts) are usually green or yellowish-green, although some species are colorless. These algae contain multiple types of chlorophyll and possess eyespots (stigma) that are used for photoreception. Their main assimilatory products are paramylon (a polysaccharide) and oil droplets. They have contractile vacuoles for osmoregulation and often exhibit both osmotrophic and phagotrophic modes of nutrition, which is why some zoologists have historically classified Euglenoids as animal-like organisms. Reproduction is primarily asexual via binary fission, while sexual reproduction has only been rarely observed. Under adverse conditions, some species are capable of forming cysts [5].

Currently, the division *Euglenophyta* includes 1 to 4 families, approximately 40 genera, and more than 900 known species, of which around 250 are colorless. These algae predominantly inhabit freshwater environments, especially eutrophic basins. Some species are considered indicators of water quality. Euglenoids are also known for their role in the self-purification of water bodies. The genus *Euglena*, in particular, is widely used as a model organism in laboratory research. It is hypothesized that euglenoid algae evolved from a common ancestor shared with other algae.

As part of our preliminary research conducted early in the year at fishery farms in the Jizzakh region, representatives of the division *Euglenophyta*, specifically of the class *Euglenophyceae*, were identified. These organisms exhibited varied morphological characteristics. Their periplasts were either continuous or composed of dotted lines. Chromatophores were green and varied in shape, either containing pyrenoids or lacking them entirely. Both pigmented and colorless forms were observed, with most species possessing a prominent eyespot (stigma). The reserve product was primarily paramylon, and in rare cases, oil droplets were also present. A specialized feeding apparatus was found near the anterior end of the cell. Nuclei were large, often containing one or more nucleoli (endosomes), and the organisms were generally motile, although some sessile forms were encountered.

In particular, members of the genus *Trachelomonas Ehr.* were identified. These unicellular organisms possess rigid loricae (houses) within which the cells are enclosed. The cells are free-swimming and exhibit metabolic movement. The lorica is perforated at the anterior end to allow for the emergence of the flagellum. Inside the cell are a well-developed cytostome (pharynx), contractile vacuole, endosomal nucleus, and chromatophores with or without pyrenoids. Some species of *Trachelomonas* are colorless. The storage product paramylon is found in the form of small, round or slightly elongated granules, and occasionally as oil droplets.

The lorica of *Trachelomonas* is typically impregnated with iron salts, giving it a brown coloration and a variety of morphological forms. The posterior end of the lorica may be rounded or tapering, sometimes elongated or forming a narrow gap. These organisms swim by rotating longitudinally around their axis. During movement, the flagellum emerges from the anterior opening, and the cell body follows behind. Reproduction occurs within the lorica through cell division. After division, one of the daughter cells emerges from the lorica and is initially colorless.

The genus *Trachelomonas* includes a wide range of species that typically inhabit small freshwater reservoirs. Many species occur abundantly in specific habitats and can cause "blooms" of algae, particularly in spring and autumn.

Genus *Trachelomonas* Ehr. – Species *Trachelomonas oblonga* Lemm.

The species *Trachelomonas oblonga* Lemm. was identified during the study. Its lorica (shell) is ellipsoidal in shape with rounded ends, measuring 12–18 µm in length and 9–13 µm in width. The lorica is smooth in texture and exhibits a yellow to reddish-brown coloration. The anterior opening (apical pore) has a diameter of 2.5–4 µm and may be surrounded by an annular thickening or, in some cases, appear as a very low-necked aperture.

Table 1. Algae of the division Euglenophyta identified in the fisheries of Jizzakh Province

Class	Order	Family	Category	Species and varieties
Euglenophyceae	Euglenales	Euglenaceae Klebs.	Trachelomonas Ehr.	1 type
			Euglena Ehr.	12 types 2 variations
		Astasiaceae Klebs.	Cyclidiopsis Korsch.	1 type
Total: 1	2	2	3	16

The cell typically contains two pyrenoids and approximately ten chromatophores. *Trachelomonas oblonga* Lemm. has been documented in freshwater environments across various regions of the former Soviet Union, where it is commonly found in mesosaprobic conditions (moderately polluted waters).

Representatives of the genus *Euglena* Ehr., belonging to the family Euglenaceae Klebs., were identified during the study. These organisms typically inhabit shallow freshwater environments such as ponds, lakes, and rivers, particularly along the shorelines, as well as slightly saline lakes, swamps, coastal marine areas, and moist soils. In water reservoirs, euglenoids are generally concentrated in the bottom layers, although they may disperse throughout the water column under favorable conditions. During warm seasons, certain species may develop rapidly and contribute to the phenomenon known as "water bloom".

Several species, including *Euglena viridis*, *E. granulata*, and *E. sanguinea*, are capable of forming colored surface films ranging from green to yellow or brick red. Their abundance in aquatic environments is attributed to their mixotrophic mode of nutrition, which combines both autotrophic (photosynthetic) and heterotrophic mechanisms. This dual capability makes them highly adaptable and ecologically versatile, often serving as indicators of water body conditions [8].

Based on developmental cycles and morphological traits, *Euglena* species can be divided into four functional groups. The first includes metabolically active, motile organisms capable of both swimming and creeping, often forming palmelloid states or spores. These typically lack paramylon reserves but possess diverse and complex chromatophores, sometimes with hematochrome pigments. The second group consists of organisms with weak metabolic activity that float passively and are unable to creep; they often contain paramylon and small disc-shaped chromatophores but do not form palmelloid states or spores. The third group is characterized by predominantly creeping forms with elongated cylindrical or ribbon-shaped bodies and strong metabolic movement. According to A. A. Elenkin (1924), these "stalkless" Euglena types have lost their flagellar apparatus and are considered derivatives of the second group.

4. Discussion

The findings of this study confirm the significant presence and taxonomic diversity of algae from the division *Euglenophyta* in the aquatic ecosystems of fishery farms in the Jizzakh region. The identification of 16 distinct species and varieties across three genera (*Trachelomonas*, *Euglena*, and *Cyclidiopsis*) highlights the ecological richness and adaptive versatility of this algal division in artificial and semi-natural reservoirs used for aquaculture [6].

The dominance of the genus *Euglena* within the samples, particularly species such as *E. viridis*, *E. gracilis*, and *E. sanguinea*, corresponds with global observations that members of this genus are prevalent in nutrient-rich and organically loaded waters. Their mixotrophic nature, allowing both autotrophic and heterotrophic modes of nutrition, likely facilitates their survival and proliferation in the varied physicochemical conditions of fishery ponds. This dual nutritional strategy is particularly advantageous in eutrophic or moderately polluted waters, where light or nutrient limitations may occur intermittently.

Species of the genus *Trachelomonas*, such as *T. oblonga*, were also identified as regular components of the algal community. These species are known for their loricate cell structures impregnated with iron compounds, and their sensitivity to water chemistry makes them reliable bioindicators of mesosaprobic conditions. Their presence in the studied fisheries indicates moderate organic enrichment, which is consistent with aquaculture environments where feed residues and fish excretions contribute to increased biological oxygen demand.

Moreover, the identification of both pigmented and colorless forms, and species capable of cyst formation, suggests an adaptive response of *Euglenophyta* to temporal environmental stress, such as temperature fluctuations, pH variation, or dissolved oxygen deficits. This aligns with earlier findings that *Euglenophyta* members can form resistant structures under unfavorable conditions, thus maintaining population viability until optimal growth parameters are restored.

The functional classification of *Euglena* species into groups based on morphology and metabolic activity also provides insight into the ecological roles they fulfill. Motile and metabolically active forms contribute to primary productivity and nutrient cycling, whereas less active, floating forms may serve as early indicators of declining water quality or impending bloom events. The occurrence of bloom-forming species in the warm season confirms previous studies on the seasonality of *Euglenophyta* development, underscoring the need for continuous monitoring in managed aquatic systems [7].

From an applied perspective, the taxonomic composition documented here has implications for fisheries management. While some euglenoids may benefit nutrient recycling and

oxygenation, unchecked blooms can reduce water quality, impair light penetration, and lead to hypoxic conditions detrimental to fish health. Thus, the results emphasize the importance of algae-based ecological assessments as part of aquaculture sustainability strategies [4].

Overall, the study contributes valuable data to the limited body of regional phycological research in Uzbekistan and demonstrates that *Euglenophyta* not only serve as indicators of environmental status but also influence the ecological balance and productivity of aquaculture systems. Future research should aim to quantify seasonal dynamics, measure biotic interactions, and assess the effects of physicochemical variables to build comprehensive predictive models for algal succession in these managed water bodies.

A wide variety of *Euglena* species and forms were recorded during the study, including *Euglena acus* Ehr., *E. acus* var. *hyalina* Klebs., *E. acus* var. *lata* Swir., *E. adhaerens* Matv., *E. ehrenbergii* Klebs., *E. elongata* Schew., *E. gracilis* Klebs., *E. clara* Skuja, *E. heliochromata* Skuja, *E. longissima* Defl., *E. sima* Wermel., *E. velata* Klebs., and *E. obtusa-cauda* I. Kissel.

As a result of the investigation conducted at fishery farms in the Jizzakh region, algae belonging to the division Euglenophyta were documented, comprising one class, two orders, two families, three genera, and a total of sixteen identified species and varieties [3].

5. Conclusions

This study presents a foundational taxonomic survey of Euglenophyta algae inhabiting the fishery ecosystems of the Jizzakh region, identifying 16 species and varieties across three genera. The results confirm that *Euglenophyta*, particularly *Euglena* and *Trachelomonas*, are not only taxonomically diverse but also ecologically significant in these managed aquatic environments. Their prevalence, adaptability to varied water conditions, and sensitivity to pollution levels make them valuable bioindicators for monitoring ecological balance and water quality in aquaculture systems.

The observed distribution of both pigmented and colorless forms, the presence of metabolically varied groups, and the documentation of bloom-forming species point to complex interactions between environmental parameters and algal succession. The dominance of mixotrophic species underlines the adaptive strategies employed by these organisms in response to nutrient fluctuations and seasonal changes.

These findings highlight the importance of continued phycological research in Uzbekistan's inland water bodies and support the incorporation of algal monitoring into fisheries management. Future studies should focus on the ecological dynamics of *Euglenophyta* across different seasons, their physiological responses to anthropogenic factors, and their potential role in sustainable aquaculture development.

REFERENCES

[1] Kursanov, L. I., Zabelina, M. M., Meyer, K. I., Roll, Ya. V., & Peshinskaya, N. I. (1953). *Guide to Lower Plants* (Volumes I–II). Moscow: Nauka.

[2] Popova, T. G. (1955). *Guide to Freshwater Algae of the USSR. Euglenoid Algae*. Moscow: Soviet Science.

[3] Ismatova, Z. A. (2011). Euglena (*Euglenophyta*) algae distributed in the Sangzor River. In *Problems of Botany, Bioecology, Plant Physiology and Biochemistry: Proceedings of the Republican Scientific and Practical Conference* (p. 55). Tashkent.

[4] Ismatova, Z. A. (2013). Distribution and seasonal development of algae of the division Euglenophyta in the Sangzor River. *Bulletin of the Geographical Society of Uzbekistan*, (42), 134–137.

[5] Skvortsov, B. V. (1968). *Algae of Inland Waters of the USSR*. Moscow: Nauka.

[6] Prescott, G. W. (1962). *Algae of the Western Great Lakes Area*. Dubuque: Wm. C. Brown Co.

[7] Wehr, J. D., & Sheath, R. G. (2003). *Freshwater Algae of North America: Ecology and Classification*. San Diego: Academic Press.

[8] Graham, L. E., Graham, J. M., & Wilcox, L. W. (2009). *Algae* (2nd ed.). San Francisco: Benjamin Cummings.

[9] Vetrova, N. A., & Makarova, I. V. (1986). Seasonal dynamics of Euglenophyta in eutrophic lakes of Western Siberia. *Hydrobiological Journal*, 22(4), 67–72.

[10] Fott, B. (1971). *Algae in the Natural and Artificial Lakes of Czechoslovakia*. Prague: Czech Academy of Sciences.

[11] Gollerbach, M. M. (1977). *Key to Freshwater Algae of the European Part of the USSR*. Leningrad: Nauka.

[12] Steinberg, C. E. W. (2006). *Dissolved Humic Substances: Ecological Driving Forces from the Individual to the Ecosystem Level*. New York: Springer.

[13] Reynolds, C. S. (2006). *The Ecology of Phytoplankton*. Cambridge: Cambridge University Press.