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# DISTRIBUTION OF INDICATOR–SAPROBIC ALGAE IN THE SOUTHERN FERGANA CANAL AND THEIR IMPORTANCE IN ASSESSING WATER ECOLOGICAL STATUS

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**Abstract**
Algological investigations conducted in the Southern Fergana Canal during 2021–2025 revealed that 101 out of 344 identified algal species and intraspecific taxa were indicator–saprobic algae (94 species, 6 varieties, and 1 form). Taxonomic analysis showed that these indicator–saprobic algae belong to 4 divisions, 8 classes, 9 orders, 15 families, and 34 genera. Indicator–saprobic algae accounted for 29.4% of the total algoflora recorded in the canal, demonstrating their high diagnostic value for assessing organic pollution and ecological water quality.

**Keywords**: Southern Fergana Canal; algoflora; indicator–saprobic algae; xenosaprobic; xeno-oligosaprobic; oligosaprobic; β-mesosaprobic; α-mesosaprobic; polysaprobic.

## Introduction

At present, a variety of biological methods are used to analyze polluted waters and assess their quality. In algological studies, particular attention is paid to the degree of organic pollution (saprobity) of water bodies, as well as to the secondary and tertiary products formed as a result of organic matter decomposition.

In determining saprobic characteristics, the classical system developed by R. Kolkwitz and M. Marsson remains relevant to this day. It should be noted that this system was subsequently refined and expanded by R. Pantle and G. Buck, as well as by V. Sládeček, which significantly enhanced its applicability for assessing water quality.

Numerous researchers have emphasized that the investigation of species composition and intraspecific diversity of indicator–saprobic algae, along with the analysis of their spatial and temporal distribution dynamics, provides a reliable basis for evaluating water quality and assessing the ecological and sanitary status of aquatic ecosystems.

## Results and Discussion

Algological studies conducted in the canal during 2021–2025 revealed that, out of 344 recorded algal species and intraspecific taxa, 101 were indicator–saprobic algae (94 species, 6 varieties, and 1 form). Systematic analysis showed that the identified indicator–saprobic algae belong to 4 divisions, 8 classes, 9 orders, 15 families, and 34 genera. Indicator–saprobic algae accounted for 29.4% of the total algal taxa recorded in the canal.

Among the indicator–saprobic algae, 9 taxa belonged to the division Cyanophyta (8.91%; 8 species and 1 form), 84 taxa to Bacillariophyta (83.17%; 78 species and 6 varieties), 4 taxa to Euglenophyta (3.96%; 4 species), and 4 taxa to Chlorophyta (3.96%; 4 species). (1-diagramma)

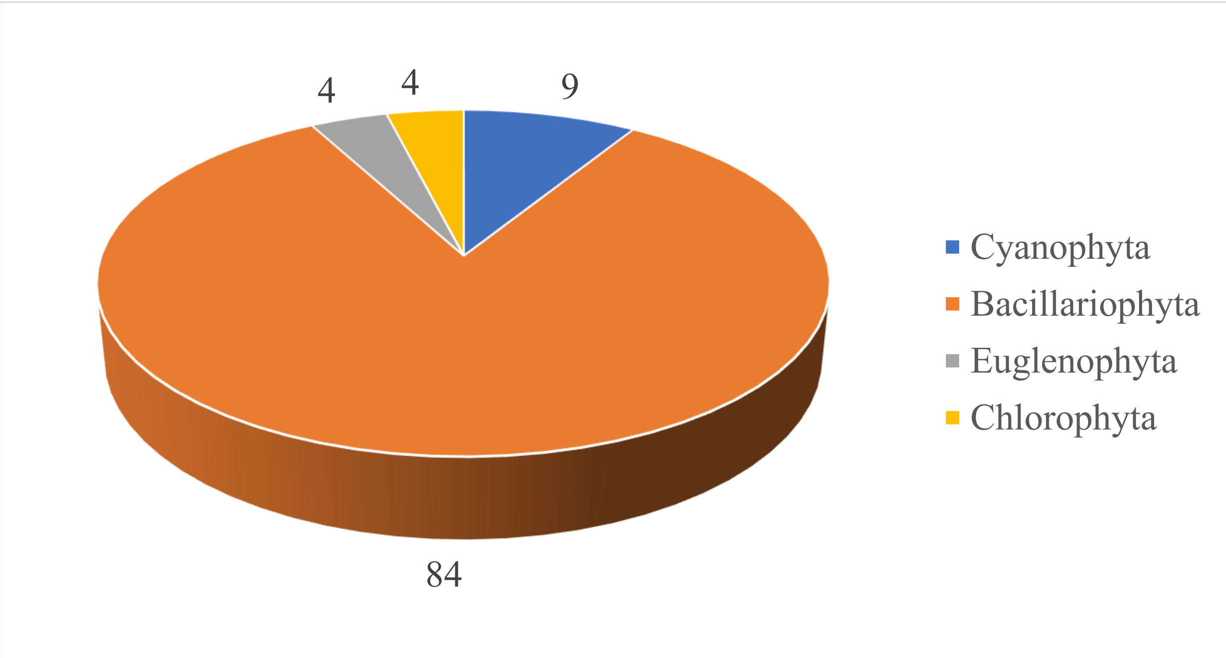


Figure 1. Abundance of indicator–saprobic algae in the Southern Fergana Canal.

Analysis of the identified taxa by saprobity revealed that the assemblage included 6 xenosaprobic taxa (5 species and 1 variety; 5.94%), 7 xeno-oligosaprobic taxa (6 species and 1 variety; 6.93%), 8 oligosaprobic taxa (8 species; 7.93%), 37 β-mesosaprobic taxa (36 species and 1 variety; 36.63%), 12 α-mesosaprobic taxa (1

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species and 1 variety; 11.88%), and 2 polysaprobic taxa (1 species and 1 variety; 1.98%). In addition, taxa with transitional saprobic characteristics were recorded, including 5 xeno-α-mesosaprobic taxa (5 species; 4.95%), 1 xeno-β-mesosaprobic taxon (1 species; 0.99%), 17 oligosaprobic–β-mesosaprobic taxa (15 species, 1 variety, and 1 form; 16.83%), and 6 β-α-mesosaprobic taxa (6 species; 5.94%).

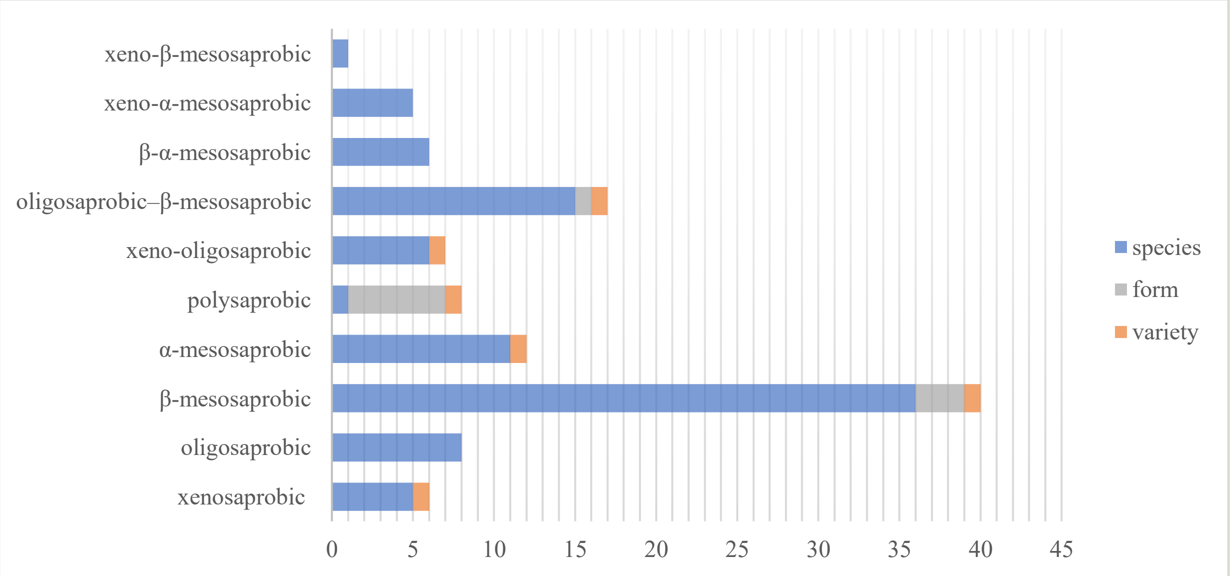


Figure 2. Distribution of indicator–saprobic algae species across saprobity groups in the Southern Fergana Canal.

Systematic analysis of indicator–saprobic algae belonging to the division Cyanophyta within the algoflora showed that 9 out of the 48 algal species and intraspecific taxa recorded in the canal were assigned to this division. These taxa belong to the order Chroococcales of the class Chroococcophyceae and to the order Oscillatoriales of the class Hormogoniophyceae. Notably, the only form-level taxon identified among indicator–saprobic algae was also assigned to this division (Oscillatoria limnetica f. brevis Nygaard), which is of particular significance.

Among the indicator–saprobic cyanobacterial taxa, 1 taxon belonged to the β–α-mesosaprobic group (*Merismopedia tenuissima* Lemmermann), 3 taxa to the α-mesosaprobic group (*Oscillatoria formosa* Bory ex Gomont, *O. fragilis* Böcher, *O. tenuis* C. Agardh ex Gomont), 1 taxon to the β-mesosaprobic group (*Oscillatoria amphibia* C. Agardh ex Gomont), 1 taxon to the oligosaprobic group (*Gloeocapsa turgida* (Kützing) Hollerbach), 1 taxon to the xenosaprobic group (*Phormidium*

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*incrustatum* Gomont), and 2 taxa to the oligosaprobic–β-mesosaprobic group (*Microcystis pulverea* (H.C. Wood) Forti and *Oscillatoria limnetica* f. *brevis* Nygaard).

Table 1. Taxonomic analysis of indicator–saprobic algae in the Southern Fergana Canal (2021–2025).

| № | Algal division | Taxonomic units (n) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Class | Order | Family | Genus | Species | Variety | Form | Total species and intraspecific taxa | Relative proportion of species and intraspecific taxa (%) |
| 1 | ***Cyanophyta*** | 2 | 2 | 4 | 5 | 8 | - | 1 | 9 | **8,91** |
| 2 | ***Chrysophyta*** | - | - | - | - | - | - | - | - | - |
| 3 | ***Bacillariophyta*** | 2 | 3 | 7 | 23 | 78 | 6 | - | 84 | **83,17** |
| 4 | ***Euglenophyta*** | 1 | 1 | 1 | 3 | 4 | - | - | 4 | **3,96** |
| 5 | ***Pyrrophyta*** | - | - | - | - | - | - | - | - | - |
| 6 | ***Chlorophyta*** | 3 | 3 | 3 | 3 | 4 | - | - | 4 | **3,96** |
| | **Total:** | **8** | **9** | **15** | **34** | **94** | **6** | **1** | **101** | **100** |

Among representatives of the division Euglenophyta, *Trachelomonas volvocina* (Ehrenberg) Ehrenberg was assigned to the oligosaprobic–β-mesosaprobic group, *Euglena variabilis* G.A. Klebs to the β–α-mesosaprobic group, while *Trachelomonas oblonga* Lemmermann and *Phacus parvulus* G.A. Klebs were classified as β-mesosaprobic taxa.

Within the division Chlorophyta, *Cladophora glomerata* (Linnaeus) Kützing and *Cladophora fracta* (O.F. Müller ex Vahl) Kützing were assigned to the β-mesosaprobic group, *Ulothrix zonata* (F. Weber & Mohr) Kützing to the oligosaprobic group, and *Pedinomonas major* Korshikov to the polysaprobic group.

A total of 84 species and intraspecific taxa of the division Bacillariophyta were identified as indicator–saprobic algae. Importantly, all xeno-oligosaprobic, xeno-α-mesosaprobic, and xeno-β-mesosaprobic taxa recorded in the canal belonged

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exclusively to this division. The Bacillariophyta assemblage comprised 5 xenosaprobic, 6 oligosaprobic, 32 β-mesosaprobic, 9 α-mesosaprobic, and 1 polysaprobic taxa. In addition, transitional saprobic groups were represented by 7 xeno-oligosaprobic, 14 oligosaprobic–β-mesosaprobic, 5 xeno-α-mesosaprobic, 1 xeno-β-mesosaprobic, and 4 β–α-mesosaprobic taxa, as revealed by the study. (Figure 3.)

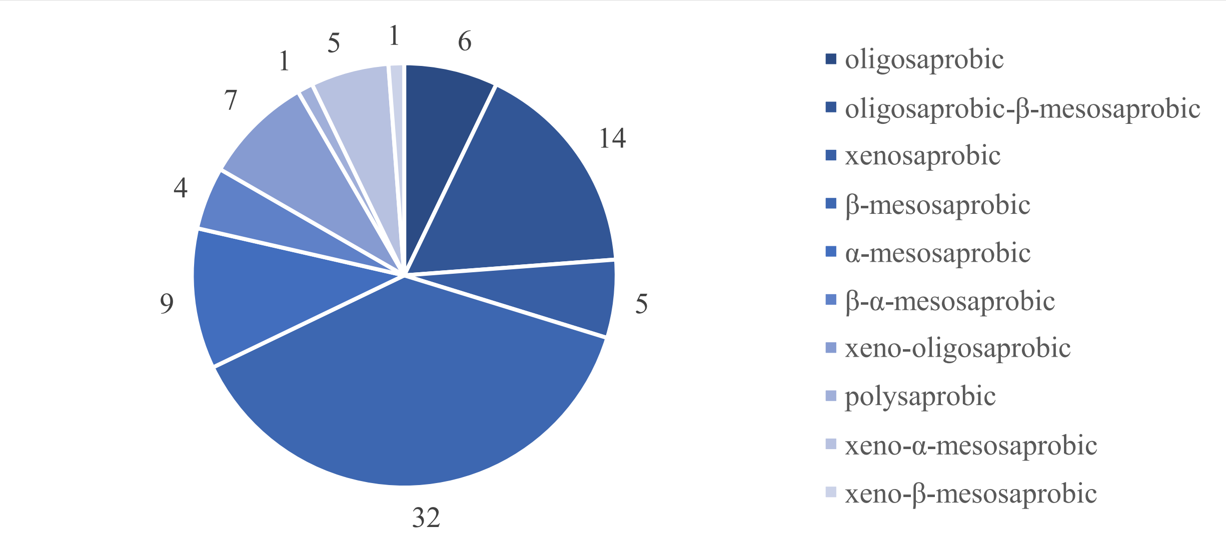


Figure 3. Classification of *Bacillariophyta* taxa according to saprobity groups.

All variety-level taxa recorded among the indicator–saprobic algae identified in the canal belonged exclusively to the division Bacillariophyta. These included *Diatoma hyemalis* var. *mesodon* (Ehrenberg) Kirchner (xenosaprobic), *Synedra ulna* var. *oxyrhynchus* (Kützing) O'Meara (polysaprobic), *Cocconeis disculus* var. *diminuta* (Pantocsek) Sheshukova-Poretskaya (xeno-oligosaprobic), *Navicula cryptocephala* var. *veneta* (Kützing) Rabenhorst (α-mesosaprobic), *Amphora ovalis* var. *gracilis* (Ehrenberg) Van Heurck (oligosaprobic–β-mesosaprobic), and *Surirella robusta* var. *splendida* (Ehrenberg) Van Heurck (β-mesosaprobic).

Indicator–saprobic algae of this division were distributed among the following genera: Melosira (5), Cyclotella (3), Stephanodiscus (2), Tabellaria (1), Meridion (1), Diatoma (4), Fragilaria (5), Ceratoneis (1), Synedra (9), Asterionella (1), Cocconeis (3), Achnanthes (3), Rhoicosphenia (1), Stauroneis (1), Navicula (11), Gyrosigma (2), Amphora (4), Cymbella (6), Bacillaria (1), Nitzschia (10), Cymatopleura (2), and Surirella (3).

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During the winter season, despite a decrease in air temperature, low water turbidity and high light penetration resulted in the identification of 57 indicator–saprobic algal species and intraspecific taxa. Among these, 3 taxa were oligosaprobic, 11 oligosaprobic–β-mesosaprobic, 4 xenosaprobic, 6 xeno-oligosaprobic, 4 xeno-α-mesosaprobic, 1 xeno-β-mesosaprobic, 2 β–α-mesosaprobic, 6 α-mesosaprobic, and 20 β-mesosaprobic. All winter-recorded indicator–saprobic algae belonged to the division Bacillariophyta, comprising 2 classes, 3 orders, 6 families, and 21 genera.

In spring, an increase in air temperature and, consequently, water temperature led to higher species diversity. A total of 60 species and intraspecific taxa of Bacillariophyta, belonging to 2 classes, 3 orders, 7 families, and 21 genera, were recorded as spring indicator–saprobic algae. These taxa were distributed across eight saprobity groups: 4 xenosaprobic, 6 xeno-oligosaprobic, 2 oligosaprobic, 10 oligosaprobic–β-mesosaprobic, 5 xeno-α-mesosaprobic, 23 β-mesosaprobic, 3 β–α-mesosaprobic, and 7 α-mesosaprobic taxa.

During the summer season, when air temperatures reached their highest values, increased water turbidity resulted in a reduction in species diversity. In total, 55 species and intraspecific taxa were identified, including 3 variety-level taxa. 9 taxa (four species and one variety) were recorded exclusively during the summer period. The summer assemblage comprised 4 xenosaprobic, 5 xeno-oligosaprobic, 5 xeno-α-mesosaprobic, 3 oligosaprobic, 8 oligosaprobic–β-mesosaprobic, 19 β-mesosaprobic, 4 β–α-mesosaprobic, 6 α-mesosaprobic, and 1 polysaprobic taxon.

Seasonally recorded variety-level taxa included the polysaprobic *Synedra ulna* var. *oxyrhynchus* (Kützing) O'Meara, the xenosaprobic *Diatoma hyemalis* var. *mesodon* (Ehrenberg) Kirchner, and the xeno-oligosaprobic *Cocconeis disculus* var. *diminuta* (Pantocsek) Sheshukova-Poretskaya.

In autumn, decreasing air temperature and reduced solar radiation led to lower water temperatures; however, favorable conditions for indicator–saprobic algae resulted in higher diversity compared to other seasons. A total of 67 species and intraspecific taxa of indicator–saprobic algae were recorded. These taxa belonged to 4 divisions, 7 classes, 8 orders, 11 families, and 26 genera and were distributed across the following saprobity zones: 3 xenosaprobic, 6 xeno-oligosaprobic, 5 xeno-α-mesosaprobic, 3 oligosaprobic, 13 oligosaprobic–β-mesosaprobic, 25 β-mesosaprobic, 5 β–α-mesosaprobic, 6 α-mesosaprobic, and 1 polysaprobic taxon.

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Season-specific variety-level indicator–saprobic algae included *Diatoma hyemalis* var. *mesodon* (Ehrenberg) Kirchner (x), *Cocconeis disculus* var. diminuta (Pantocsek) Sheshukova-Poretskaya (x–o), *Navicula cryptocephala* var. *veneta* (Kützing) Rabenhorst (α), and *Amphora ovalis* var. *gracilis* (Ehrenberg) Van Heurck (o–β), while the only form-level taxon, *Oscillatoria limnetica* f. *brevis* Nygaard (o–β). The form-level representative belonged to Cyanophyta, while the variety-level representatives belonged to Bacillariophyta.

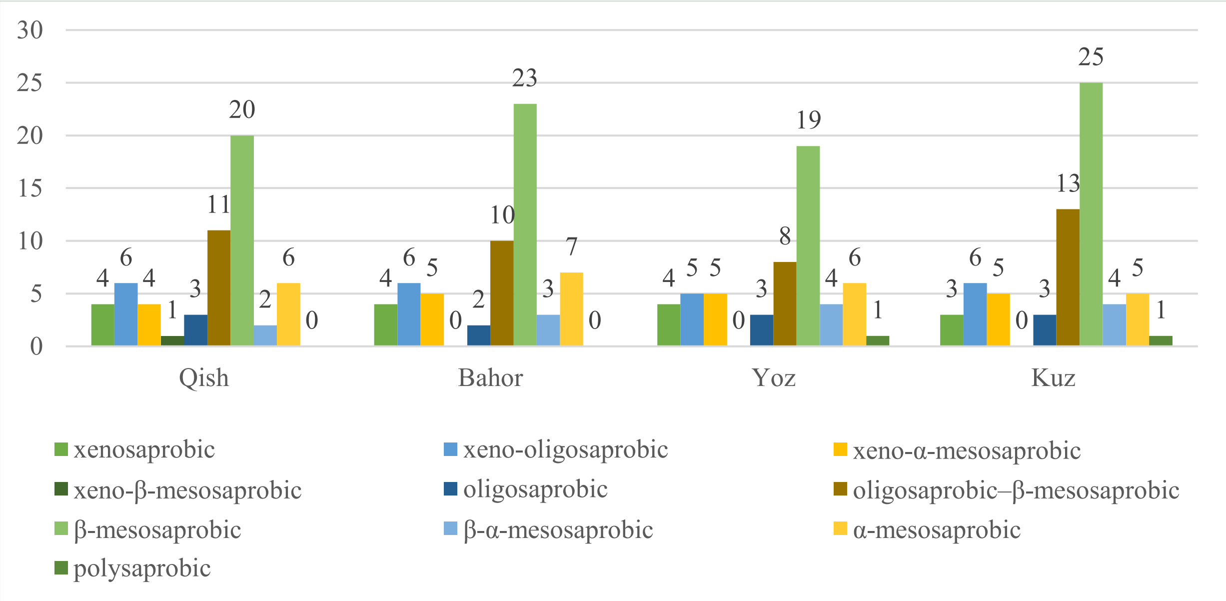


Figure 4. Seasonal diversity of saprobity groups throughout the year.

Indicator algae recorded exclusively in autumn included *Asterionella formosa* Hassall and *Gomphonema intricatum* Kützing (both oligosaprobic), *Nitzschia dissipata* (Kützing) Rabenhorst (oligosaprobic–β-mesosaprobic), *Synedra vaucheriae* (Kützing) Kützing (β-mesosaprobic), and the Chlorophyta *Pedinomonas major* Korshikov (polysaprobic).

Notably, only members of Bacillariophyta and Chlorophyta represented polysaprobic taxa characteristic of the most heavily polluted zones, whereas no polysaprobic taxa were observed among Euglenophyta or Cyanophyta.

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## Conclusion

The results indicate that the level of biological pollution in the Southern Fergana Canal is moderate to high. The presence of oligosaprobic, β-mesosaprobic, α-mesosaprobic, polysaprobic, and transitional indicator taxa confirms that the canal water is organically polluted and exhibits eutrophic conditions. At the same time, the occurrence of certain clean-water indicator species suggests that partial recovery (self-purification) processes are taking place within this aquatic system. The seasonal occurrence and developmental patterns of indicator–saprobic algae were analyzed, taking into account the similarity coefficients of indicator assemblages across different seasons.

## References

1. Yuldashova, M. (2025). Biodiversity and ecology of the algoflora of selected water bodies of the Fergana Valley. Doctoral dissertation (DSc), Tashkent, Uzbekistan, pp. 162–183.
2. Yuldashova, M. P. (2019). Algoflora of the Shohimardonsoy–Margilonsoy river system. PhD dissertation abstract, Namangan, Uzbekistan, 44 p.
3. Ergasheva, X. E. (2017). Algoflora of the Andijan Reservoir. PhD dissertation abstract, Tashkent, Uzbekistan, 44 p.
4. Yuldashova, M., & Tolqinov, A. (2024). Seasonal development of the algoflora of the Southern Fergana Canal in 2023–2024. Scientific Bulletin of Fergana State University, Supplement, No. 6, Fergana, pp. 72–75.
5. Yuldashova, M., & Tolqinov, A. (2023). Seasonal development of the algoflora of the South Fergana Canal in 2023–2024. International Journal of Biological Engineering and Agriculture, 2(12), December.
6. Tolqinov, A. (2025a). Distribution patterns of indicator–saprobic algae along the Southern Fergana Canal. In Proceedings of the Republican Scientific–Practical Conference "Modern Agrobiotechnologies for Maintaining, Restoring and Increasing the Fertility of Irrigated Soils of the Mirzachul Oasis" (pp. 386–389). Gulistan, Uzbekistan.
7. Tolqinov, A. (2025b). Distribution of indicator–saprobic algae in the Southern Fergana Canal and their significance in assessing the ecological status of water. In Proceedings of the Republican Scientific–Practical Conference "Modern Agrobiotechnologies for Maintaining, Restoring and Increasing the Fertility of Irrigated Soils of the Mirzachul Oasis" (pp. 389–393). Gulistan, Uzbekistan.