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A specific diversity and taxonomic structure of phytoplankton in water bodies of Iran

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In phytoplankton of water bodies of Iran 738 species (826 infraspecific taxa) from 8 divisions of algae are revealed, including Cyanophyta – 114 (126), Euglenophyta – 85 (101), Chrysophyta – 19 (24), Xanthophyta – 41 (43), Bacillariophyta – 173 (194), Dinophyta – 34 (40), Cryptophyta – 9 (9), Chlorophyta – 263 (289). The taxonomic structure of phytoplankton was analyzed; data were presented about distributions of specific structure in spectra of leading families and genera.

Key words: *phytoplankton, taxonomic structure, polytypic water bodies, Iran.*

Introduction

Phytoplankton is a leading ecological group in the majority of continental water bodies. Algae of plankton play important role in a life of a water body, saturated water with oxygen, producing primary organic substance. Moreover it participates actively in processes of sewage purification. At the same time phytoplankton of polytypic water bodies of Iran (rivers, lakes, swamps, ponds and reservoirs) is investigated insufficiently. At present time, there isn't enough data about specific diversity of phytoplankton in water bodies of Iran. In addition, a lot of water bodies in this country are not investigated on algological point of view.

We carried out the systematic algofloristic study of polytypic water bodies of Iran since 2000 year (Zarei Darki, 2004a).

The purpose of this work is the analysis of a specific diversity and taxonomic structure of phytoplankton of Iran water bodies.

Materials and methods

The materials for present study were collected by the author from the 122 water bodies of Iran, which are described in publications (Zarei Darki, 2004b; Zarei Darki, 2002; Dogadina et al., 2002, 2007).

Samples collection and identification followed by standard approaches to study algae (Algae, 1989).

Results and discussion

In phytoplankton of polytypic Iran water bodies 738 species (826 inf. taxa) were found, which included nomenclature of species (tab. 1). It makes 57,0% of total specific diversity of the continental algal flora in Iran water bodies, investigated on algological point of view presently.

Table 1.

Taxonomic spectrum of phytoplankton in Iran's water bodies

Taxa	Species		Infraspecific taxa	
	abs. num	%	abs. num	%
Cyanophyta	114	15,45	126	15,25
Euglenophyta	85	11,52	101	12,23
Chrysophyta	19	2,57	24	2,91
Xanthophyta	41	5,56	43	5,21
Bacillariophyta	173	23,44	194	23,49
Dinophyta	34	4,61	40	4,84
Cryptophyta	9	1,22	9	1,09
Chlorophyta	263	35,64	289	34,99
Total	**738**	**100**	**826**	**100**

The richest species division of algae is Chlorophyta – 289 taxa, that makes 75% of total green algae found in algal flora of Iran. Representatives of genera *Dunaliella* Teod., *Chlamydomonas* Ehr., *Oocystis* A. Br., *Scenedesmus* Meyen were typical plankters. The usual species, observed in all researched water

bodies, were: *Carteria klebsii* (Dang.) Fr., *Schroederia setigera* (Schröd.) Lemm., *Pediastrum boryanum* (Turp.) Menegh., *P. duplex* Meyen, *Oocystis submarina* Lagerh., *Monoraphidium griffithii* (Berk.) Kom.-Legn., *Kirchneriella intermedia* Korsch. var. *major* Korsch., *Hyaloraphidium arcuatum* Korsch., *Coelastrum microporum* Näg. Typically benthic forms: *Cosmarium angulosum* Bréb., *C. granatum* Bréb. got during extremely abundant in samples of a plankton.

Division Bacillariophyta with 173 species (194 inf. taxa) is according to number of this species, which registered in samples of plankton on the second place. Typically the planktonic forms of diatoms concerned with genera *Aulacoseira* Thw., *Cyclotella* Kütz., *Stephanodiscus* Ehr., *Astrionella* Hass., *Fragilaria* Lyngb., *Synedra* Ehr. So the observed species frequently were: *Cyclotella distinguenda* Hust., *Stephanodiscus astraea* (Ehr.) Grun., *S. hantzschii* Grun., *Melosira varians* Ag., *Fragilaria capucina* Desm., *F. construens* (Ehr.) Hust. f. *subsalina* (Hust.) Hust., *F. pinnata* Ehr., *Eunotia arcus* Ehr., *Achnanthes exigua* Grun, *A. minutissima* Kütz., *Asterionella formosa* Hass. (Zarei, 2006).

In the rivers, in structure of potamoplankton facultative planktonic diatoms forms, erected by the stream from the bottom or epiphytes come off from a substratum are almost usual: *Diatoma anceps* (Ehr.) Kirchn., *Cymbella amphicephala* Näg., *Gomphonema acuminatum* Ehr., *Navicula atomus* (Kütz.) Grun., *Pinnularia gibba* Ehr., *Stenopterobia curvula* (W. Sm.) Kram., *Surirella angustata* Kütz., etc.

More over 114 (126 inf. taxa) species of plankton were presented by blue-green algae. In fact, planktonic forms of Cyanophyta belong to genera *Synechocystis* Sauv., *Synechococcus* Näg., *Rhabdoderma* Schmidle et Laut., *Merismopedia* (Meyen) Elenk., *Microcystis* (Kütz.) Elenk., *Aphanothece* (Näg.) Elenk., *Gloeocapsa* (Kütz.) Hollerb. In plankton of several water bodies species *Synechocystis salina* Wisl., *Microcystis pulverea* (Wood) Fortt were extremely abundant.

The majority of representatives of Euglenophyta are typical plankters. Species *Trachelomonas hispida* (Perty) Stein emend. Defl., *T. volvocina* Ehr., *Strombomonas acuminata* (Schmarda) Defl., *Euglena gracilis* Klebs, *E. oxyuris* Schmarda, *Phacus acuminatus* Stokes, *Cryptoglena pigra* Ehr. were found more often than others in phytoplankton of water bodies of Iran (Dogadina et al., 2003).

Yellow-green algae (Xanthophyta) were represented in all ecological groups equally. In plankton 43 taxa of Xanthophyta have been revealed. So, they were passive plankters in overwhelming majority. Especially there were species *Trachychloron chlorallantoides* Pasch., *Goniochloris parvula* Pasch. The majority of representatives of dinophytes, golden and cryptophytes algae were represented by typical planktonic forms, that living in thickness of water in riverside of water bodies. So it is interesting to note *Dinobryon divergens* Imhof, *D. sociale* Ehr. var. *americanum* (Brunnth.) Bachm., *Gymnodinium purpureum* Skuja, *G. uberrimum* (Allman) Kof. et Swezy, *Peridiniopsis penardiforme* (Lind.) Bourr., *Chroomonas acuta* Uterm., *Cryptomonas borealis* Skuja, *C. marssonii* Skuja – the most mass and typical representatives of phytoplankton which investigated in water bodies.

Also, we did interesting algofloristic finds in water bodies of Iran. Here we carry the species, which observe rarely in individual specimens or any water body. Phytoplankton has many species such as *Rhabdoderma lineare* Schmidle et Laut. em. Hollerb. f. *unicellulare* Hollerb., *Merismopedia testacea* (Näg.) Elenk., *Lepocinclis glabra* Dreź. var. *raciborskii* Dreź., *Phacus setosus* France, *Arachnochloris striata* Pasch., *Heterodesmus bichloris* Ettl, *Diplopsalis acuta* (Apstein) Entz, *Chroomonas longicaudata* Korsch., *Raciborskiella salina* Wislouch, *Lobomonas monstrosa* Korsch., *Pseudocarteria peterhofiensis* (Kisselev) Ettl, *Tetrachlorella alternans* (G. Sm.) Korsch., *Elakatothrix pseudogelatinosa* Korsch. (Dogadina et al., 2007).

Interesting results at study of algal flora of water bodies ensue from use of methods of the comparative floristics that developed for the “higher” plants. It is known, that the spectrums of leading families and genera determine "face" of flora and represent typological features of water bodies. In addition, these spectrums reflect effect of factors on water body (Gorbulin, 2004). We attempted to analysis the spectrums of leading families and genera of phytoplankton at investigated water bodies that consider leading genera spectrum of one ecological group (Safonova, 1983).

There are 464 taxa in structure of ten leading families of phytoplankton which include 56,17% of total specific diversity of this ecological group in the investigated water bodies of Iran. First top places in the spectrum of leading families are occupied by Euglenaceae in compliance with some of taxa. Also, active participation of this group based on formation of kernel of phytoplankton is proved by presence of three genera of euglenophytes algae at spectrum of leading genera in which one genus is included in a top part of a spectrum: *Euglena* Ehr. (second position), *Phacus* Duj. (8th position), *Trachelomonas* (10th position) (tab. 2). Thus Euglenophyta occupied only 4th place in taxonomic spectrum (tab. 1).

In our opinion, the following can explain position of Euglenaceae in formation of a specific diversity of phytoplankton in investigated water bodies. The spectrums of leading families and genera did not involve few specific families and genera, such as planktonic forms. Besides majority of euglenophytes algae are planktonic forms, as they present in all samples of plankton (both net and settling). Finally, significant number of species of Euglenaceae, wide circulation in polytypic water bodies, and their presence in generic

spectrum of three largest genera of euglenophytes algae are evidence of high level of organic pollution in studied water bodies.

Table 2.

The spectrum of leading families and genera in plankton of water bodies of Iran

Position	Families	num. of inf. taxa	% in flora	Position	Genera	num. of inf. taxa	% in flora
1	Euglenaceae	97	11,74	**1**	*Cosmarium*	37	4,48
2	Naviculaceae	81	9,81	**2**	*Euglena*	33	4
3	Oscillatoriaceae	58	7,02	**3**	*Navicula*	32	3,87
4	Desmidiaceae	47	5,69	**4**	*Oscillatoria*	27	3,27
5	Scenedesmaceae	37	4,48	**5**	*Nitzschia*	27	3,27
6	Fragilariaceae	36	4,36	**6**	*Scenedesmus*	26	3,15
7	Bacillariaceae	31	3,75	**7**	*Fragilaria*	24	2,91
8	Chlamydomonadaceae	28	3,39	**8**	*Phacus*	23	2,78
9	Chlorellaceae	28	3,39	**9**	*Closterium*	21	2,54
10	Peridiniaceae	21	2,54	**10**	*Trachelomonas*	15	1,82
	Total	**464**	**56,17**		***Total***	**265**	**32,09**

Except Euglenaceae, four families (Scenedesmaceae, Chlamydomonadaceae, Chlorellaceae, Peridiniaceae) and one genera (*Scenedesmus*) are typical plankters in the spectrum (tab. 2).

The high positions of families Oscillatoriaceae, Desmidiaceae and genera *Cosmarium*, *Oscillatoria*, *Closterium* which unite benthic forms and live in benthonic layers of water or at the bottom, pay to itself attention. In planktonic samples such forms often get accidentally. They are raised by stream or stir of water at the bottom during sampling in a coastal zone or on shallow section. Also, it can come from representatives of periphyton abundantly.

As a whole, the veritable planktonic forms make less than half of the species composition in spectrums of leading families and genera (48,25%). Prevalence of facultative planktonic forms can be attributed to the high number of the samples collected from the rivers.

The conclusion

In phytoplankton of water bodies of Iran were found 826 species and infraspecific taxa of algae that make 57% of total specific diversity of algal flora in continental water bodies of this country. Veritable planktonic forms make 48,25% of the species composition from 10 leading families and genera. In a spectrum of families predominating position of Euglenaceae is evidence of high level of organic pollution in investigated water bodies.

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Видове різноманіття та систематична структура фітопланктону водоймищ Ірану
Б.Зареі Даркі, Т.В.Догадіна

У фітопланктоні водоймищ Ірану виявлено 738 видів (826 внутрішньовидових таксонів) з 8 відділів водоростей, у тому числі: Cyanophyta – 114 (126), Euglenophyta – 85 (101), Chrysophyta – 19 (24), Xanthophyta – 41 (43), Bacillariophyta – 173 (194), Dinophyta – 34 (40), Cryptophyta – 9 (9), Chlorophyta – 263 (289). Проаналізована систематична структура фітопланктону, наведено дані щодо розподілу видового складу провідних родин і родів.

Ключові слова: *фітопланктон, систематична структура, різнотипні водоймища, Іран.*

Видовое разнообразие и систематическая структура фитопланктона водоемов Ирана
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В фитопланктоне водоемов Ирана обнаружено 738 видов (826 внутривидовых таксона) из 8 отделов водорослей, в том числе: Cyanophyta – 114 (126), Euglenophyta – 85 (101), Chrysophyta – 19 (24), Xanthophyta – 41 (43), Bacillariophyta – 173 (194), Dinophyta – 34 (40), Cryptophyta – 9 (9), Chlorophyta – 263 (289). Проанализирована систематическая структура фитопланктона, приведены данные по распределению видового состава в спектрах ведущих семейств и родов.

Ключевые слова: *фитопланктон, систематическая структура, разнотипные водоемы, Иран.*

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