Caspian J. Env. Sci. 2010, Vol. 8 No.2 pp. 127~139

CJES
Caspian Journal of Environmental Sciences

[Research]

An overview of the rotifers of the family Notommatidae (Rotifera: Monogononta: Ploima) from Iran

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ABSTRACT

The diversity and distribution of the rotifers family Notommatidae was studied in the northwest, the south and the southwest of Iran. In total, 29 species were identified, of which, 25 are new records for the country. New records include the following species: *Cephalodella forficata, C. cf. mus, C. vittata, C. ventripes, C. lepida, C. inquilina, C. gibboides, C. tincaformis , C. obvia, C. sterea, C. physalis, C. gracilis, Eosphora najas, E. Ehrenberg, E. therina, E. anthadis, Eothina elongate, Monommata actices, Notommata pygma, N. glyphura, N. diasema, N. brachyota, Resticula nyssa, R. melandocusa* and *Pleurotrocha atlantica*. Spatial and temporal patterns of the species diversity were evaluated. Descriptions are provided for all the identified species in detail. Biogeography and environmental conditions favorable for identified species were referred. A great richness of rotifers in aquatic environments is generally found in regions where vegetation predominates, either in aquatic or in the ecotone zone between aquatic and terrestrial environments.

Keywords: *Rotifer, Notommatidae, Environmental factors.*

INTRODUCTION

The phylum Rotifera is a relatively small group of microscopic, aquatic or semi-aquatic invertebrates, encompassing just over 1800 named species of unsegmented, bilaterally symmetrical, pseudocoelmates (Wallace *et al.,* 2006). The phylum is currently divided into two classes of Pararotatoria and Eurotatoria, with the latter having two subclasses of Bdelloidae and Monogononta. Monogononta comprises 29 families (Segers, 2002), in which family Notommatidae is probably one of the most difficult rotifer groups for determination. Notommatidae includes some genera with the largest number of species, e.g. 190 species of the genus *Cephalodella* (De Smet, 1998a). Identification of the family should be made by using both external criteria and detailed inspection of trophi structure. The virgate trophi of Notommatidae are of the major importance for identification (Nogrady *et al.*, 1995). The family Notommatidae is divided into two subfamilies, based on the presence of a wreath of bulbous glands between stomach and intestine (Tetrasiphoninae, with two genera) or its absence (Notommatinae, with 19 genera) (Nogrady *et al.,* 1995). Currently accepted genera in the family are as follows: *Cephalodella* (Bory de Saint-Vincent, 1826), *Dorystoma* (Harring and Myers, 1922), *Drilophaga* (Vejdovsky, 1883), *Enteroplea* (Ehrenberg, 1830), *Eosphora* (Ehrenberg, 1930), *Eothinia* (Harring and Myers, 1922), *Metadiaschiza* (Rousselet, 1976), *Monommata* (Bartsch, 1870), *Notommata* (Ehrenberg, 1930), *Paracephalodella* (Berzins, 1976), *Pleurotrocha* (Ehrenberg, 1930), *Pseudoharringia* (Fadeew, 1925), *Resticula* (Harring and Myers, 1924), *Rousselettia* (Harring, 1914), *Sphyrias* (Harring, 1913), *Taphrocampa* (Gosse, 1851) and *Tylotrocha* (Harring and Myers, 1922) (Segers, 2007).

In recent years, there has been an increased interest in the rotifer fauna, especially of non investigated habitats of the entire world (e.g. Segers and Shiel, 2003; Morales and Gutierres, 2004; Sharma and Sharma, 2005; De Smet, 2006; De Smet and Chernyshev, 2006). However, the knowledge on the Iranian rotifers is limited and only a few valid reports are available (e.g. Löffler, 1961). This study provides data on the diversity of the rotifer family Notommatidae in geographically-different regions of Iran and their association with some environmental variables.

MATERIALS AND METHODS

Samples were obtained from scattered locations in three different provinces of Iran: West Azarbaijan in Northwest, Khoozestan in Southwest and Hormozgan in South (Fig. 1 and Table 1). Sampling was carried out at 28 sites over a period of one year starting in November 2007. For the sites located at West Azarbaijan, sampling was performed in different seasons.

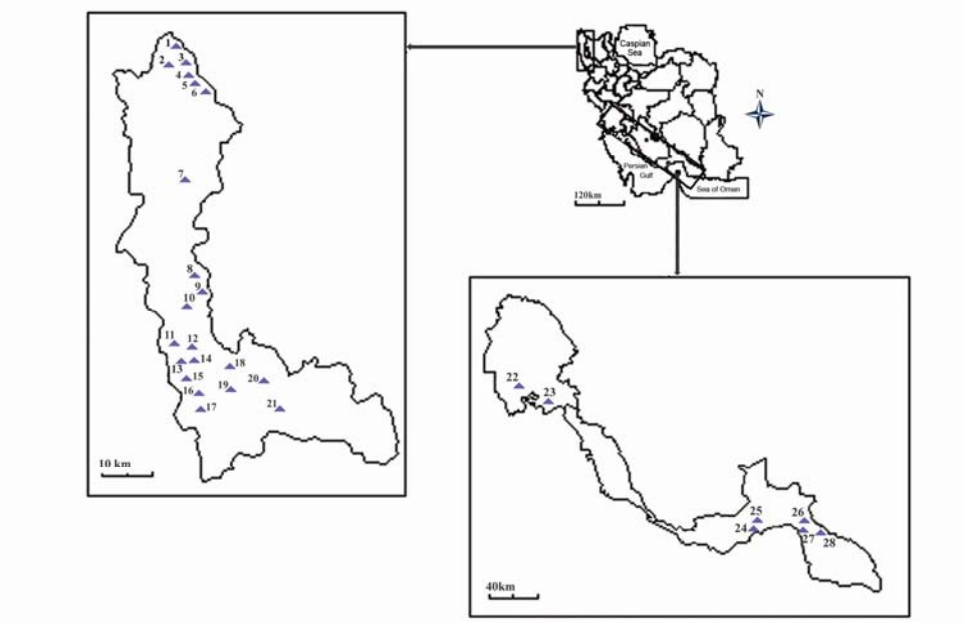

Fig 1. Map of Iran, the position of studied areas and the distribution of sampling sites, numbers 1- 28.

Planktonic rotifers were collected by filtering an approximate volume of 40 liters of water from the littoral zone through 30 µm mesh plankton net. Aquatic plants and algae of each water body were collected to be analyzed epiphytic rotifers. Rotifer resting eggs were isolated from the collected surface sediments by using the sucrose floatation technique recommended by Scott Mills (personal communication). This was especially helpful to recover rotifers during the seasonal drought or freezing of the waters. A saturated sucrose solution was made by mixing and stirring an equal proportion of sugar and tap water. Approximately 500 g of the sediment was added to an adequate volume of the solution and disturbed for a few minutes, followed by an overnight settlement for a complete floatation of the deposited resting eggs. The supernatant including the floating eggs was rinsed through a column filter ended to a mesh size of 50 µm. The final residue was transferred to a Petri dish containing water with a salinity of 8-10 g l^{-1}. The resting eggs were incubated at 25 ˚C under continuous light to allow their hatching (Garcia-Roger *et al.,* 2006).

At each sampling occasion, the following environmental variables were measured *in situ*: dissolved oxygen (DO), temperature, pH and salinity. Live specimens were identified to the lowest taxonomic level possible by the aid of

Table 1. List and general descriptions of the sampling sites

Site no.	Local name	City	Location	Position	System type
1	Boralan	Poldasht	NW	N 39°41′17″ E 44°33′39″	permanent lagoon
2	Aghgul	Makoo	NW	N 39°32′16″ E 44°45′39″	permanent lagoon
3	Shatloo	Makoo	NW	N 39°36′15″ E 44°42′39″	temporary pond
4	Bohloolkandi	Poldasht	NW	N 39°26′17″ E 44°56′39″	temporary pond
5	Shahid Kazemi	Poldasht	NW	N 39°24′16″ E 45°00′39″	temporary pond
6	Haajjamaal	Poldasht	NW	N 39°11′18″ E 45°05′39″	wetland
7	Shahrake zaareaan	Khoy	NW	N 38°54′17″ E 45°04′64″	small pool
8	Zanbil	Urmia	NW	N 37°44′59″ E 45°14′44″	contiguous pools
9	Eskeleh	Urmia	NW	N 37°36′50″ E 45°16′03″	sinkholes
10	Golamarz	Urmia	NW	N 37°37′24″ E 45°08′58″	permanent pond
11	Gardeshaaneh	Oshnoviyeh	NW	N 37°06′35″ E 45°08′85″	artificial pond
12	Bijanabad	Oshnoviyeh	NW	N 37°05′35″ E 45°10′64″	artificial pond
13	Qezenabad	Oshnoviyeh	NW	N 37°02′68″ E 45°08′48″	temporary pond
14	Khanlar	Oshnoviyeh	NW	N 37°02′62″ E 45°10′15″	pool
15	Cheshmehgul	Oshnoviyeh	NW	N 37°08′30″ E 45°13′26″	artificial pond
16	Alkabad	Oshnoviyeh	NW	N 37°03′06″ E 45° 02′50″	fountain
17	Kanimotor	Piranshahr	NW	N 36°48′21″ E 45°13′71″	fountain
18	Seyrangul	Naqadeh	NW	N 36° 50′17″ E 45°34′10″	permanent lagoon
19	Usofkand	Mahabad	NW	N 37° 07′09″ E 45° 48′08″	permanent lagoon
20	Kaanibrazan	Mahabad	NW	N 37° 01′52″ E 45° 45′43″	permanent lagoon
21	Qubibabaali	Mahabad	NW	N 36° 57′23″ E 45° 53′11″	permanent lagoon
22	Karoon	Ahvaz	SW	N 31° 20′21″ E 48° 40′22″	river side
23	Kianpars	Ahvaz	SW	N 31° 20′28″ E 48° 42′45″	river- side pond
24	Estambik	Bandar Abbas	S	N 27°14′06″ E 56° 15′32″	artificial pond
25	Poleshoor	Bandar Abbas	S	N 27° 21′00″ E 56° 28′12″	river
26	Minab dam	Minab	S	N 27° 10′30″ E 57° 06′36″	river
27	Tiaab	Minab	S	N 27° 06′36″ E 56° 49′48″	permanent lagoon
28	Jooy mahal	Minab	S	N 26° 56′24″ E 57° 09′00″	river

NW: northwest Iran; SW: southwest Iran; S: south Iran

standard identification keys following Koste (1978) and Nogrady et al. (1995). Trophi were prepared by dissolving the animals in diluted sodium hypochlorite, as proposed by De Smet (1998b), and were examined for detailed identification by using an Olympus microscope equipped with camera. For *Cephaledella*, the trophi were marked as to be belonging to one of the six types described in Nogrady et al. (1995). The studied rotifers were considered as "planktonic", "epiphytic" or those "hatched" from the collected resting eggs.

RESULTS AND DISCUSSION

In our study on Rotifera of some regions of Iran (unpublished), Nottomatidae was among the three richest rotifer families. In this study a total of 29 species belonging to seven genera of the family Notommatidae were identified (Table 2). *Cephalodella* was the most diverse genus presented with 16 species. Number of species in the other genera were as follow: *Notommata*, 4 species, *Eosphora*, 4 species, *Eotinia* and *Resticula*, 2 species each, *Pleurotrocha* and *Monommata*, one species each. Illustrations of some of the observed species are presented in figures 2 and 3. The images for the remaining identified species are not included because of the low quality or scarcity of the specimens. In a study performed earlier, Löffler (1961) reported 4 species of the genus *Cephalodella*, namely *C. catellina, C. gibba, C. forficula* and *C. stenoroosi* from different locations of Iran. Recently, Hakimzadeh (2007) identified the latter species from some water bodies of Tehran province, Iran, together with the introduction of a new species, *Pleurotrocha petromyzon*.

Figure 4 shows the relative diversity of the identified genera. Five genera, *Eosphora, Eotinia, Resticula, Pleurotrocha* and *Monommata* are being reported for the first time from Iran. There was an apparent skew in the distribution and occurrence of the genera in different localities, e.g. *Cephalodella* frequently observed in all studied sites. This may be because some genera such as *Cephalodella* have a wide range of environmental preference than the other notommatids. Such skewed distributional pattern for the family Notommatidae was noted in some of the previous reports (Sarma and Manuel, 1998; Ejsmont-Karabin and Kuczyńska-Kippen, 2001; Kaya and Altindag, 2009). Most of the identified species, in this study, were observed rarely or occasionally. Only six species, *Cephalodella gibba, C. forficula, C. catellina*, *C. stenroosi*, *C. forficata* and *Eosphora najas* were relatively abundant, i.e. observed in all sites with high population density reaching up to 2763 ind. l^{-1} for *C. catellina* at site 3.

Among the total identified notommatids, 14 species (46.6 %) were exclusively planktonic, while 6 species (20 %) were considered to be entirely epiphytic. Two species (6.6 %) were identified after their resting eggs were hatched. Five species (17 %) were observed in both epiphytic and planktonic samples. Three species, *C. gibba, C. catellina* and *E. najas* were observed in all investigated groups, i.e. in planktonic, epiphytic and hatched samples (Table 2).

Among the three studied provinces, West Azarbaijan hosted the highest diversity of Notommatidae (25 species), while only 5 notommatid species were encountered in the southern provinces, i.e. Khoozestan and Hormozgan. This may be caused by more sampling sites and the higher sampling frequency in the former territory. Among the investigated sites in West Azarbaijan, site 11 in an artificial dammed river, hosted the highest number of notommatid rotifers (8 species). Further, the occurrence of 7 species in site 8, which in fact comprises small adjacent oligotrophic-ponds, was an interesting observation. This may suggest that these rotifers could be of typical isolated waters which are not supplied by exotic nutrients.

Rotifers like other planktonic organisms are influenced by a variety of physical, chemical and biological factors (Pociecha and Wilk-Woźniak, 2007). The studied water bodies in which members of the family Notommatidae were observed, had salinity between 0 and 41 g l^{-1}, water temperature between 2 and 34 ˚C, pH between 7 and 10

and DO between 2 and 23.5 mg l^{-1}. The highest species richness (5-8 species each) was recorded at the study sites (8, 11, 13 and 14) with a relatively low salinity (2-8 g l^{-1}). As predicted, the water temperature was higher in southern provinces, which together with relatively high salinity in most of the waters could be responsible for lower number (3-4 species each) of observed Notommatidae.

Table 2. List of the identified notommatid rotifer species from different sampling locations in Iran Numbers correspond to the number of sites in figure 1.

Phylum: Rotifera Class: Eurotatoria Subclass: Monogononta Order: Ploima Family: Notommatidae	Category	Location
Genus: *Cephalodella*		
**C. catellina* (Muller,1786)	P, E, H	all sites
C. forficata (Ehrenberg,1832)	P	8
**C. forficula* (Ehrenberg,1832)	P, E	11,13,15,17
**C. gibba* (Ehrenberg,1832)	P, E, H	all sites
C. gibboides (Wulfert,1950)	P, E	8,18, 19
C. gracilis gracilis (Ehrenberg,1832)	E	11
C. inquilina (Myers,1924)	P	23
C. lepida (Myers,1934)	P	11
C. cf. mus (Wulfer,1956)	E	13
C. obvia (Donner,1950)	E	17
C. physalis (Myers,1924)	P	23
**C. stenroosi* (Wulfert,1937)	P, E	4,6,11,18
C. sterea (Gosse,1887)	P, E	7,15, 21
C. tincaformis (Koste and Bottger, 1992)	P	14
C. ventripes (Dixon-Nuttall,1901)	P	13
C. vittata (Kutikova,1985)	P	14
Genus: *Eosphora*		
E. anthadis (Harring and Myers,1922)	H	20
E. ehrenbergi (Ehrenberg,1832)	P, E	8, 16, 20
E. najas (Ehrenberg,1830)	P, E, H	all sites
E. therina (Harring and Myers,1922)	P	26
Genus: *Eothinia*		
E. elongata (Ehrenberg,1832)	H	8
Genus: *Monommata*		
M. actices (Myers,1930)	E	16
Genus: *Notommata*		
N. diasema (Myers,1936)	P	11
N. brachyota (Ehrenberg,1832)	P	14
N. glyphura (Wulfert,1935)	E	19
N. pygmaea (Harring and Myers, 1922)	P	15
Genus: *Pleurotrocha*		
P. atlantica (Myers,1936)	P	25
Genus: *Resticula*		
R. nyssa (Harring and Myers, 1924)	P	15
R. melandocus (Gosse,1887)	P	10

P: planktonic, E: epiphytic, H: hatched from resting eggs.
* reported by Löffler (1961) and Hakimzadeh (2007)

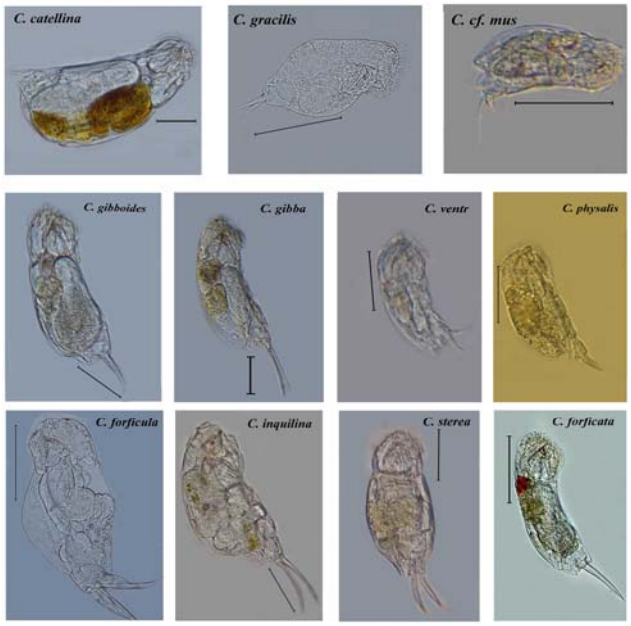

Fig 2. Light microscopic view of the identified rotifers of the genus *Cephalodella* (40-100x magnification). Scale bar, 50 µm.

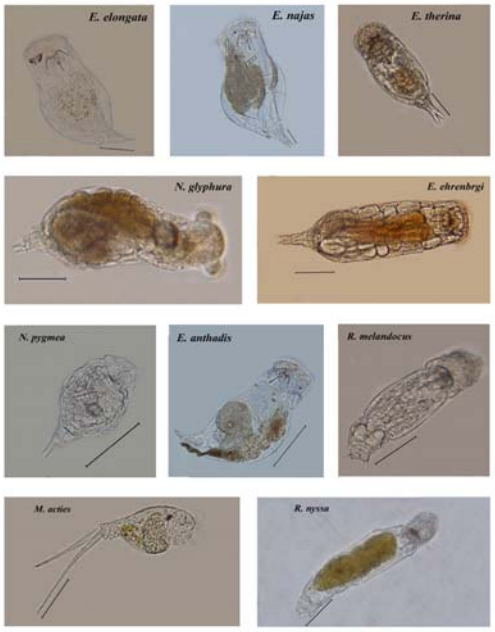

Fig 3. Light microscopic view of some of the identified rotifers of the genera *Eothinia*, *Eosphora, Monommata, Notommata,* and *Resticula* (40-100x magnification). Scale bar, 50 µm.

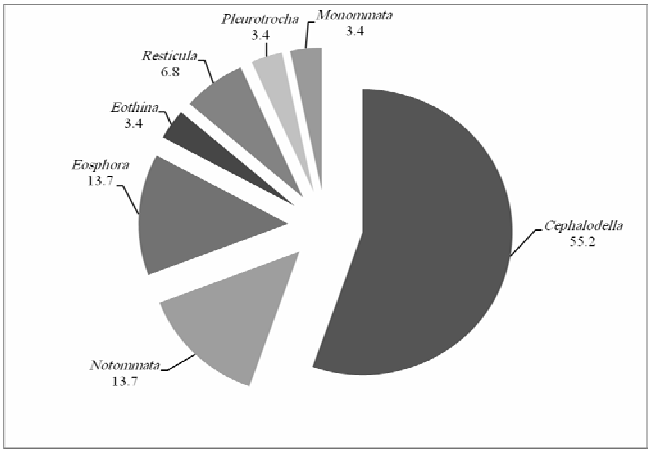

Fig 4. Relative frequency of different genera in the observed rotifers of the family notommatidae from Iran

All of the investigated sites had neutral to alkaline waters. pH is related to many other variables in freshwaters that are correlated with zooplankton distribution, and it is known that rotifers exhibit a very wide range of pH tolerance (Yildiz *et al*., 2007). However, Bł¸edzki and Ellison (2003) suggested that pH affects production, abundance and species richness of rotifers. Berzins and Pejler (1989) found some correlations between pH of water, level of eutrophication and the distribution of planktonic, periphytic and benthic rotifers. However, this study does not attest the occurrence of non-planktonic and planktonic rotifers at lower and higher pH values, respectively, as found by the latter authors.

The other important factors which may have led to higher rotifer diversity in some waters were the presence of the phytoplankton and macrophyte communities and also animal garble. A greater richness of rotifers in aquatic environments is generally found in areas where vegetation predominates, either in aquatic or in the

ecotone zone between aquatic and terrestrial environments. Aquatic macrophytes could favor a greater diversity of habitats for shelter and food (Nogrady, 1993). Most of the studied sites supporting higher diversity and density of rotifers were covered by submerged or emerged aquatic plants such as *Nasturtium officinale*, *Phragmites* sp., *Juncus* sp. *Lemna minor* and also filamentous green algae. Emergent and submerged microphytes have important role in the community composition of rotifers by providing numerous microhabitats (Bonecker *et al*., 1998; Martínez *et al.,* 2000).

To make a comparison between the diversity of the rotifers on the seasonal basis, spring was the season with highest diversity including the highest number of species (19 species), whereas, the number of identified notommatid species were lower in other seasons: summer, autumn and winter were 10, 8 and 6, respectively (Fig. 5). The highest species richness during the spring could be due to lowered water salinity caused by seasonal rainfall and rise in the level of inflowing waters, and also increased water temperature, which provide appropriate conditions for planktonic blooms.

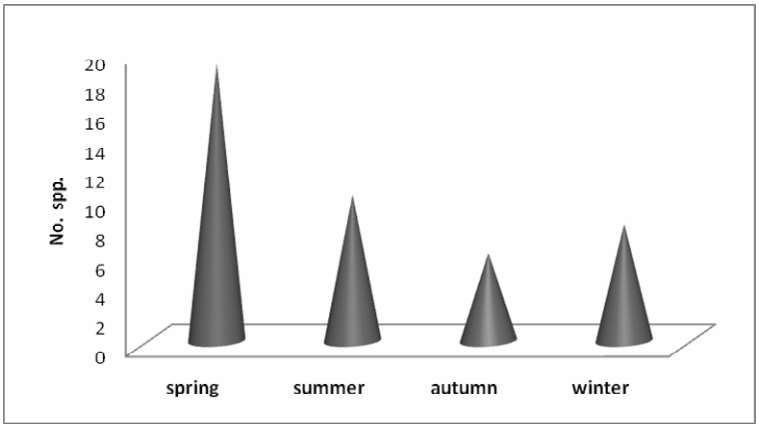

Fig 5. The temporal diversity of notommatid rotifers from Iran, as denoted by the number of species (No. spp.) observed in different seasons.

Morphological and ecological notes on the identified taxa

Cephalodell catellina (Muller, 1786)

Body short; lorica flexible with wide lateral sulci separating indistinct lorica plates; foot short, tail is overhanging; toes short, straight, thin, conical; two separate red frontal eyespots (Jordi de Manuel, 2000); type C trophus (Nogrady *et al*., 1995).

This species was found as both planktonic and epiphytic. It seems to be a cosmopolitan element (De Smet, 2001) and was found in all seasons in the littoral waters of all the study sites, being fresh or brackish in nature (salinities 0-10 g l^{-1}), and with a neutral to alkaline pH (7-9.3).

C. forficata (Ehrenberg, 1832)

Body elongate, slender, slightly compressed laterally; neck well marked; lorica plates distinct, sulci narrow; foot and tail small; toes widely spaced at base, short, stout, taper to acute tips; eyespot absent; type B trophus (Nogrady *et al*., 1995) .

This species was observed in the water column of a small natural pond (site 8) in spring. The water had a temperature of 24 °C, pH of 7 and salinity of 10 g l^{-1}.

C. forficula (Ehrenberg, 1832)

Body elongate, spin-shaped, with slight constriction at neck; head large; integument flexible, without lorica plates; toes short, stout, recurved, about one-fifth of the total body length; toes have a distinctive transverse spicule row (2-4) on the dorsal median surface, terminating in a long spine; single frontal eyespot (Jordi de Manuel, 2000); type D trophus (Nogrady *et al*., 1995).

This species was found as both planktonic and epiphytic in the littoral waters of 4 sites in all the seasons, mostly in spring and summer. The water salinity ranged from 2 to 10 g l^{-1}, temperature was 6.5-26 °C, pH was

7-9 and DO was 8-11 mg l^{-1}.

C. gibba (Ehrenberg, 1832)

Body slightly elongated, gibbous, laterally compressed with a thin lorica; sulsi widen slightly posteriorly; toes relatively long, slender; single frontal eyespot present; type B trophus (Nogrady *et al.,* 1995).

This species was found in all sampling sites in three seasons of spring, summer and winter and in wide ranges of physico-chemical conditions including salinity ranges of 0-41 g l^{-1}.

C. gibboides (Wulfert 1950)

Body slightly elongate; lorica firm with distinct plates; sulci somewhat widen and well visible even on the head – lorica; corona oblique but not very convex; tail covers the foot and has a longitudinal notch; double frontal eyespots (Segers, 1997); type B trophus (Nogrady *et al.,* 1995).

This species was found in three sites located in the northwest of Iran at a salinity range of 7-10 g l^{-1}, temperature 12-28 °C and pH 7.5-9.2. It was found as both planktonic and epiphytic and in oligo as well as eutrophic waters.

C. gracilis gracilis (Ehrenberg, 1832)

Body rather short but slim, laterally compressed and slightly gibbous dorsally; head relatively short, broad and convex interiorly; neck well marked; lorica thin and flexible, but plates fairly distinct; foot conical and rather short; toes short, fairly slender, very slightly recurved dorsally; corona oblique and strongly convex without projecting lips; eyespot frontal (http://www.nies.go.jp/chiiki1/protoz/morpho/rotifera); type A trophus (Nogrady *et al.,* 1995).

This taxon was found as epiphytic in a semi-natural dammed river (site 11) in spring. As vegetation was rare in the place and the system has a riverine origin, it can be supposed that this rotifer could be found as plankton as well. Water salinity was 10 g l^{-1}, temperature 24 °C, DO 2 mg l^{-1} and pH 7.

C. inquilina (Myers, 1924)

Body moderately elongate; head short and broad; neck well marked; foot large and very broad at the base; tail very small; toes long, slender, nearly straight; corona decidedly oblique and strongly convex without projecting lips; eyespot absent (http://www.nies.go.jp/chiiki1/protoz/morpho/rotifera); type B trophus (Nogrady *et al.,* 1995).

This planktonic species was isolated from a riverine ecosystem in southwest of Iran, where the salinity was 4.5 g l^{-1}, temperature was 30 °C, pH was 8.2 and DO was 8 mg l^{-1}.

C. lepida (Myers, 1934)

Body slender, head along; lorica flexible but plates well defined; foot and tail small, toes long, slender; corona oblique; lips present but no beak, no eyespot (Nogrady *et al.,* 1995).

This species was recorded at a flavio-lacustrine body of water in spring, in which the temperature was 17.5 °C, pH 8.8, DO 23.5 mg l^{-1} and salinity zero.

C. cf. mus (Wulfer, 1956)

Body very small, stout, round and bulbous; head short, dorsally two small auricles are visible; lorica well defined; sulci wide but it does not cover the foot; foot very short; tail well separated, toes soft; corona oblique, convex with lips; cervical eyespot; type A trophus (Nogrady *et al.,* 1995).

This species was found as epiphytic from a eutrophic body of water where aquatic vegetation was dominant and exposure to livestock manure was probable. The measure of the water parameters were as follows: temperature 9 °C, pH 7.8, salinity 4 g l^{-1} and DO 22.5 mg l^{-1}.

C. obvia (Donner, 1950)

Body cylindrical; lateral sulci parallel; foot short, tail covers foot; toes uniformly tapered; corona strongly convex; two frontal eyespots (Nogrady *et al.,* 1995).

This species was found as epiphytic in a eutrophic shallow pool in spring. The pool was covered by intense macrophyte vegetations including *Lemnea* and *Juncus*. The water salinity was about zero; temperature was 18 °C, DO 9.2 mg l^{-1} and pH 8.6.

C. physalis (Myers, 1924)

Body very short, stout and gibbous dorsally; head very large and obliquely truncate anteriorly; lorica quite firm, lateral cleft wide; foot very short and stout; tail small and knob- like; the toes are blade-shaped, decurved and have acute tips; corona strongly oblique with small beak; the

eyespot is at the posterior end (http://www.nies.go.jp/chiiki1/protoz/morpho/rotifera); type A trophus (Nogrady *et al.*, 1995).

This species was found in the littoral zone of a lotic habitat in southwest Iran, where the emergent plants mostly *Phragmites commonis* were dominant. The water salinity was 4.5 g l^{-1}, temperature 34 °C, pH 8.5 and DO was 12 mg l^{-1}.

C. stenroosi (Wulfert, 1937)

Body stout, cylindrical and powerful; the trunk divided into an upper larger and a lower segment; lorica rigid; sulci narrow terminally; head short, laterally compressed; foot short, conical; toes stout, thick, decurved dorsally, with a dorsal lump or dull tooth in the middle, tapering to a common sharp tip; eyespot absent; type D trophus (Nogrady *et al.*, 1995).

This species was recorded from 4 sites all located in northwest Iran. It was found to be as both planktonic and epiphytic. The habitats of this species include oligo and mesotrophic waters with low to moderate vegetation density. The water temperature ranged 2-18 °C, pH 7- 9.3, DO 1.7-23.5 mg l^{-1} and salinity 0-10 g l^{-1}.

C. sterea (Gosse, 1887)

Body fusiform; head large; lorica firm, plated; foot large and robust; tail extends beyond distal end of foot; toes short, stout, slightly recurved posteriorly, may have somewhat undulate margins; two red frontal eyespots in single capsule (Segers, 1997); type B trophus (Nogrady *et al.*, 1995).

Planktonic and epiphytic specimens of this species were found in 3 scattered sites in West Azarbaijan. The salinity was 0-13 g l^{-1}, temperature was 2-23 °C and pH was 7- 9.3.

C. tincaformis (Koste and Bottger, 1992)

Body elongate, laterally compressed; abdomen slightly bulbous; tail distinct, extending beyond foot; plates and sulci distinct; toes short, one third of total body length; paired frontal eyespots in single capsule (Nogrady *et al.*, 1995).

This species was found as planktonic in a highly eutrophic pool affected by household and animal wastes and with a muddy bed. Water salinity was 0.5 g l^{-1}, temperature was 14.5 °C, pH was 8.5 and DO was 18.5 mg l^{-1}.

C. ventripes (Dixon-Nuttall, 1901)

Body short, stocky, gibbous dorsally, oval in back view; dorsal lorica may extend beyond distal end of the foot; plates and sulci distinct; dorsal sulcus a distinct V shaped groove; foot ventral, small; toes short and stout, decurved ventrally; corona with prominent lips; double cervical eye; type A trophus (Nogrady *et al.*, 1995).

This species was identified from the water column of a single site in winter. This site was a eutrophic pond highly occupied by macrophytes such as *Phragmites* and *Thypha*. Water salinity was 4 g l^{-1}, temperature 8.5 °C, DO 22.2 mg l^{-1} and pH 7.8.

C. vittata (Kutikova, 1985)

Body cylindrical with straight ventral lorica, slightly gibbous; lorica distinct; lateral sulcus narrow; head large, not oblique, strongly convex; no lips; foot small; tail wide but does not cover foot; toes uniformly tapered, decurved ventrally; type B trophus (Nogrady *et al.*, 1995).

Similar to *C. tincaformis,* this species was also sampled from site 14, a eutrophic pond with heavy influx of household and livestock wastes. The water had salinity of zero, temperature 17.5 °C, pH 7.5 and DO 5.64 mg l^{-1}.

Eosphora ehrenbergi (Ehrenberg, 1832)

Body robust with indistinct folds; abdomen terminally rounded with small tail; foot double jointed; toes short, conical; cerebral eyespot present; living specimens are brownish (Segers, 1997).

This species was identified as planktonic and epiphytic from three sites located in the central and southern parts of West Azarbaijan. The sites include diverse ecological systems located at considerably different altitudes. Water salinity ranged 1-10 g l^{-1}, temperature 13-27 °C, pH 7.5-8.7 and DO 1.5 -18.5 mg l^{-1}.

E. najas (Ehrenberg, 1830)

Body robust, ovoid; head and neck folds distinct, collar like; integument firm; tail small with three lobes; foot indistinctly three segmented; toes straight, slender; one cerebral eyespot at anterior end of ganglion (Dhanapathi, 1975).

This species is considered as to be a cosmopolitan taxon (De Smet, 2001). It was

found in all of the sampling sites as epiphytic or planktonic. It was also recovered from the deposited resting eggs. Thus, this taxon could be regarded as tolerant to various environmental conditions.

E. therina (Harring and Myers, 1922)

Body broad, very robust and extremely transparent; head not separated but a fold between neck and trunk is present; foot three jointed, tapering; toes small with a minute claw, cervical eyespot large (Koste and Hollowday, 1993).

This species was isolated from a lotic system in south Iran, where the water salinity was 6 g l^{-1}, temperature 25 °C and DO 14 mg l^{-1}.

E. anthadis (Harring and Myers, 1922)

Body robust; head wide, trapezoidal; integument transparent and soft; foot segmented; toes short and wide; dorsal outline of the pair is hemispherical with small claws; no eyespot (Nogrady *et al.,* 1995).

This species was identified after its resting eggs were hatched from the collected sediments of a shallow seasonal wetland in West Azarbaijan in winter.

Eothinia elongata (Ehrenberg, 1832)

Body cylindrical, slightly gibbous; transverse folds indistinct; longitudinal folds marked; lobed tail extremely transparent, sluggish; corona frontal only, foot glands the length of the foot; right salivary gland huge (Nogrady *et al.,* 1995).

This species was identified after its resting eggs, collected from the littoral area of site 8 in spring, were hatched. At the time of sampling, water had a salinity of 10 g l^{-1}, temperature 22.5 °C, DO 1.7 mg l^{-1} and pH 7.5.

Monommata actices (Myers, 1930)

Body slender, cylindrical, tapering to the foot; head separated from trunk by dorsal wrinkles and folds of integument which is striated; the single dorsal antenna is tubular and retractile; the lateral antennae are in the position of the lumber spots; corona oblique; trophus small; no constriction between stomach and intestine; food glands, bladder and retrocerebral sac small; eyespot at posterior end of ganglion (Segers, 1997).

This epiphytic rotifer was found in a mountainous, oligotrophic, shallow pond in summer. The pond is located 1908 m above sea level and its littoral area was occupied by emerged aquatic plants. The water had a salinity of 0 g l^{-1}, temperature 31 °C, DO 6.9 mg l^{-1} and pH 7.9.

Notommata brachyota (Ehrenberg, 1832)

Body slender and pseudosegmented; small auricles bulging corona; rudimentary foot carrying two short toes but without tail (Nogrady *et al.,* 1995).

The characteristics of the sampling place of this planktonic rotifer have been explained for *C. tincaformis* and *C. vittata*. This species was found in winter. The water had a salinity of 0 g l^{-1}, temperature 17.5 °C, DO 5.64 mg l^{-1} and pH 7.5.

N. diasema (Myers, 1936)

Body stout, cylindrical, transparent and variable; tail small, one lobed; foot two jointed, long; toes long with slender tip (Nogrady *et al.,* 1995).

This rotifer was found as a free-living plankton in a semi-lotic water system in winter. Its habitat had a salinity of 0 g l^{-1}, temperature17.5 °C,DO 23.5 mg l^{-1} and pH 8.8.

N. glyphura (Wulfert, 1935)

Large non-loricate predatory species; toes two short and slender (Sarma, 1996).

This species was identified as an epiphytic rotifer from a mesotrophic shallow wetland in spring. The water temperature was 20 °C, pH 8.8 and salinity 0 g l^{-1}.

N. pygmaea (Harring and Myers, 1922)

Body stout, spindle shaped; foot has two joints and two short toes abruptly reduced to slender tips (Nogrady *et al.,* 1995).

This rotifer was sampled from an artificial reservoir in spring. The water was supplied by a hilltop fountain and its temperature was 17.5 °C, pH 10, salinity 2 g l^{-1} and DO 11.5 mg l^{-1}.

Pleurotrocha atlantica (Myers, 1936)

Body sturdy and transparent; head and neck well separated; large square tail; foot fluted, with two short conical toes; large red cervical eyespot (Nogrady *et al.,* 1995).

This species was sampled from a shallow river flown in south of Iran, where the salinity of water was 15 g l^{-1}, temperature 27 °C and pH 7.9. The water had a low oxygen concentration of 3 mg l^{-1}.

Resticula nyssa (Harring and Myers, 1924)
Body vermiform, striated and psedosegmented; corona ventral with small rostrum; small broad tail; foot 3 segmented; toes bulbous with claw; eyespot present (Nogrady *et al*., 1995).
This species was sampled at the same site as *N. pygmaea* was in spring. The water had a temperature of 17.5 °C, pH 10, salinity 2 g l^{-1} and DO 11.5 mg l^{-1}.
R. melandocus (Gosse, 1887)
Body variable, fusiform, with longitudinal striae; foot 4 segmented; toes bulbous at base, curved; corona frontal with ciliary wreath and two small auricle-like locomotory cilia; eyespot just a dark granular mass (Nogrady *et al.,* 1995).

This species was found in the water column of a deep and mesotrophic permanent pond in northwest of the country. The water had a temperature of 22 °C, pH 8.5, salinity 5 g l^{-1} and DO 2.1 mg l^{-1}.

ACKNOWLEDGEMENT

I would like to thank Dr. Hendrik Segers for his useful notes on the identification. Thanks are also due to Mr. Davood Alizadeh for his kind help with sampling, Ms. Avin Dadfar for her assistance in drawings and Ms. Esmat Khaleqsefat for her contribution to the manuscript preparation. This study was funded by Urmia University under a research project coded 007/A/86.

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(Received: Dec. 15-2009, Accepted: May 20-2010)

شناسایی و معرفی روتیفرهای خانواده Notommatidae (Rotifera: Monogononta: Ploima) در ایران

ر. ملک‌زاده ویایه

چکیده

روتیفرها گروه مهمی از بی مهره گان آبزی هستند که در حدود ۲۰۰۰ گونه از آنها در سراسر جهان شناسایی شده اند. در این بررسی تنوع و پراکنش روتیفرهای خانواده Notommatidae در برخی از مناطق شمال غرب، جنوب و جنوب غرب ایران مورد مطالعه قرار گرفته است. در مجموع، ۲۹ گونه از روتیفرهای متعلق به خانواده Notommatidae شناسایی شدند، که در بین آنها ۲۵ گونه برای نخستین بار از ایران گزارش می شوند. گونه های جدید عبارتند از: *Cephalodella forficata*، *C. cf. mus*، *C. vittata*، *C. ventripes* ، *C. lepida*، *C. inquilina*، *C. gibboides* ، *C. tincaformis* ، *C. obvia* ، *C. sterea* ، *C. physalis* ، *C. gracilis* ، *Eosphora najas* ، *E. ehrenberg* ، *E. therina* ، *E. anthadis* ، *Eothina elongate* ، *Monommata actices* ، *Notommata pygma* ، *N. glyphura* ، *N. diasema* ، *N. brachyota* ، *Resticula nyssa* ، *R. melandocusa* و *Pleurotrocha atlantica*. اختصاصات ریخت شناختی گونه ها و نیز پراکنش مکانی و فصلی روتیفرهای مورد بررسی توصیف شده اند و در مورد جغرافیای زیستی و شرایط محیطی محل زیست گونه‌های شناسایی شده بحث شده است. نتایج حاصل از این بررسی و مطالعات مشابه می توانند به شناخت تنوع زیستی روتیفرهای مناطق مختلف کشور کمک کنند و در مطالعه روابط زیستی و غذایی اکوسیستم‌های آبی مورد استفاده قرار گیرند.