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Monogonont rotifers (Rotifera: Monogononta) from Northern Apennine lakes: new and rare taxa for Italy

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SUMMARY - *Monogonont rotifers (Rotifera: Monogononta) from Northern Apennine lakes: new and rare taxa for Italy* - Thirteen new or rare taxa of monogonont rotifers for the Italian fauna were found in zooplankton samples collected in permanent Northern Apennine lakes (some of which are part of the LTER Network) during a limnological survey carried out in the open water season of 2007 and 2008. The water bodies, located at altitudes ranging between 1241 and 1731 m a.s.l., are all of glacial or glacial-tectonic origin and generally ice-covered from November to May. Ten of the hereby reported taxa are new for Italy, among them a putative new species of the genus *Pleurata*, whilst the remaining 3 taxa were previously recorded only occasionally. Four genera (*Bryceella, Eothinia, Erignatha* and *Pleurata*) have not been reported from Italy before. For each taxon, data on distribution and ecology derived from the literature are also given. Our results show that even biotic communities that have been extensively monitored can still provide interesting novelties, thus emphasizing the importance of detailed taxonomic studies that also take into account the microscopic components of biodiversity.

RIASSUNTO - *Rotiferi monogononti dei laghi dell'Appennino Settentrionale: taxa nuovi e rari per l'Italia* - Si riportano 13 taxa di rotiferi monogononti nuovi o rari per la fauna italiana rinvenuti in campioni di zooplancton prelevati in laghi permanenti dell'Appennino Settentrionale (alcuni dei quali sono parte della rete LTER-Italia) nel corso di una campagna limnologica condotta durante la stagione delle acque aperte nel biennio 2007-2008. I corpi idrici, situati a quote comprese tra 1241 e 1731 m s.l.m., sono tutti di origine glaciale o tettonico-glaciale e presentano una copertura ghiacciata che permane generalmente da novembre a maggio. Dei 13 taxa qui riportati, dieci rappresentano nuovi record per la fauna italiana, tra i quali è da rimarcare il ritrovamento di una probabile nuova specie assegnata al genere *Pleurata*, mentre per i restanti tre taxa si hanno soltanto segnalazioni occasionali nel nostro paese. Quattro generi (*Bryceella, Eothinia, Erignatha* e *Pleurata*) sono nuovi per l'Italia. Vengono inoltre fornite informazioni, tratte dalla letteratura, sulla distribuzione e le caratteristiche ecologiche di ciascun taxon. Questi risultati mostrano come anche ambienti le cui comunità sono state a lungo studiate possono ancora riservare novità di un certo interesse, sottolineando così l'importanza di ricerche più dettagliate e attente anche alle componenti meno "appariscenti" della biodiversità acquatica.

Key words: Rotifera, Monogononta, biodiversity, taxonomy, new records, Northern Apennine lakes
Parole chiave: Rotifera, Monogononta, biodiversità, tassonomia, nuove segnalazioni, laghi dell'Appennino Settentrionale

1. INTRODUCTION

The phylum Rotifera is a group of tiny pseudocoelomate metazoans widely distributed in all types of freshwater habitats. It comprises about 2030 known species, divided into three main groups, the Seisonidea (exclusively marine), the Bdelloidea and the Monogononta. The Monogononta is the largest and most diverse group, with approximately 1600 species-level taxa of benthic, free swimming and sessile forms (Segers 2007; 2008). Thanks to their opportunism, adaptability and fast reproductive rates, rotifers can be a very important component of planktonic communities of both lotic and lentic ecosystems, representing a critical link in freshwater food webs. Most of the known species are free-living and suspension-feeders on microalgae, bacteria or detritus, some are obligate or occasional predators and very few are parasitic (Wallace *et al*. 2006). Despite their broad distribution and diversity, only c. 200 species or species-groups of freshwater monogonont rotifers, belonging to 46 genera in 20 families, are reported in the most updated version of the Checklist of the Italian Fauna, around 94% of which are recorded in Northern Italy (Braioni & Ricci 1995). Subsequent works (Fontaneto & Melone 2003; Rossetti *et al*. 2003; Fontaneto *et al*. 2004; Fontaneto *et al*. 2008; Rossetti *et al*. 2009) contributed to the addition of new records to this inventory, which nonetheless remains incomplete, given the still unsatisfactory present knowledge on the taxonomy, distribution and ecology of this group. Here we present a list of monogonont rotifers that were found in 13 Northern Apennine lakes during a limnological survey conducted in 2007 and 2008 and which are either rare or new for Italy.

2. MATERIAL AND METHODS

Thirteen permanent lakes located in the Northern Ap-

Tab. 1 - Location and habitat features of Northern Apennine lakes examined in this study. H: height above sea level; S: surface area; Z_{max}: maximum depth.
Tab. 1 - Localizzazione geografica e principali caratteristiche dei laghi dell'Appennino Settentrionale analizzati in questo studio. H: altezza sul livello del mare; S: area superficiale; Z_{max}: profondità massima.

lake	code	H (m)	S (ha)	Z_{max} (m)	lat N	long E	habitat type	trophic state
Ballano	BAL	1341	7.3	19.0	44° 22' 07"	10° 06' 01"	natural, dammed for hydroelectric purposes	oligo-mesotrophic
Compione Inferiore	COI	1647	0.47	2.9	44° 21' 44"	10° 04' 33"	natural	oligo-mesotrophic
Compione Superiore	COS	1686	0.18	2.0	44° 21' 40"	10° 04' 30"	natural	oligo-mesotrophic
Gemio Inferiore	GEI	1339	3.25	7.4	44° 23' 08"	10° 02' 58"	natural, level raised with a concrete sill	eutrophic
Gemio Superiore	GES	1355	3.57	5.6	44° 23' 20"	10° 02' 49"	natural, level raised with a concrete sill	eutrophic
Palo	PAL	1508	0.87	5.6	44° 21' 22"	10° 06' 50"	natural	oligotrophic
Pradaccio	PRA	1362	3.80	4.0	44° 23' 35"	10° 01' 18"	natural, level raised with a concrete sill	oligo-mesotrophic
Santo Parmense	SAP	1507	8.16	22.5	44° 24' 06"	10° 00' 38"	natural	oligo-mesotrophic
Scuro Parmense	SCP	1527	1.16	10.4	44° 23' 53"	10° 02' 42"	natural	oligotrophic
Sillara Inferiore	SII	1731	1.14	10.0	44° 21' 56"	10° 04' 03"	natural	oligotrophic
Squincio	SQU	1241	3.11	3.0	44° 21' 11"	10° 08' 10"	natural, level raised with a concrete sill	eutrophic
Verdarolo	VDL	1390	1.13	3.0	44° 21' 31"	10° 07' 22"	natural	eutrophic
Verde	VER	1507	5.96	24.0	44° 21' 43"	10° 05' 20"	natural, dammed for hydroelectric purposes	mesotrophic

ennines at altitudes ranging between 1241 and 1731 m a.s.l. were included in a limnological survey carried out during the open water season of 2007 and 2008 (Tab. 1). All of them are of glacial or glacial-tectonic origin, and the watershed lithology is dominated by silico-clastic arenites. Lakes deeper than 6-7 m are dimictic and generally ice-covered from November to May. The zooplankton communities of these lakes were previously analysed in several studies carried out by the Department of Environmental Sciences, University of Parma (e.g., Rossetti *et al*. 2006; Tavernini *et al*. 2009).

In 10 water bodies qualitative zooplankton samples were collected from the shore twice a year, immediately after the spring thaw and in late autumn, by means of a 50 μm net. In three lakes (Scuro Parmense, Santo Parmense and Gemio Inferiore), both qualitative and quantitative samples were collected monthly by vertical hauls from the maximum depth using a 50 μm net with a diameter of 25 cm. All samples were immediately fixed with a 4% buffered formalin solution. Taxonomic analysis of rotifer taxa was done under a compound microscope considering the morphology of their body (although many specimens were contracted because of the formalin fixation) and trophi, these latter extracted by adding a small volume of a sodium hypoclorite solution to dissolve the soft tissues. For species identification, the following keys were used: Ruttner-Kolisko (1974), Koste (1978), Braioni & Gelmini (1983), Nogrady *et al*. (1995), Segers (1995), De Smet (1996) and De Smet & Pourriot (1997).

3. RESULTS AND DISCUSSION

A total of 66 rotifer taxa (data not shown) were identified, of which 10 represent new records for Italy, whilst three had never or only occasionally been reported in Northern Italy before (Tab. 2). Four genera, *Bryceella, Eothinia, Erignatha* and *Pleurata* are new for Italy. All the hereby reported known species had already been recorded in the Palearctic region (Segers 2007). The specimens assigned to the genus *Pleurata* probably belong to a hitherto unknown species, which will be formally described elsewhere.

Short notes on the distribution in the study area (lake codes as in table 1 and ecology of each taxon, as drawn from the literature, are reported below.

Beauchampiella eudactylota (Gosse, 1886). It is the only known species of the genus *Beauchampiella*. A single specimen was found in July 2007 in GEI. It is the first record for continental Italy, since it was previously known only from Sardinia (Braioni & Ricci 1995). It is a warm stenotherm and cosmopolitan species, often found in bogs and periphyton of shallow waters (Koste 1978).

Lecane lauterborni Hauer, 1924. A single specimen of *Lecane lauterborni* was found in May 2007 in PRA. This species can be found between submerged mosses (especially *Sphagnum*) (Segers 1995).

Tab. 2 - Taxonomic account and global distribution of the rotifer taxa reported in this study (*Afr*: Afrotropical region; *Aus*: Australian region; *Nea*: Nearctic region; *Neo*: Neotropical region; *Ori*: Oriental region; *Pac*: Pacific region; *Pal*: Palearctic region; according to Segers, 2002; 2007). Asterisks indicate new records for the Italian fauna.
*Tab. 2 - Inquadramento tassonomico e distribuzione globale dei taxa di rotiferi riportati in questo lavoro (*Afr*: regione Afrotropicale;* Aus*: regione Australiana;* Nea*: regione Neartica;* Neo*: regione Neotropicale;* Ori*: regione Orientale;* Pac*: regione Pacifica;* Pal*: regione Paleartica; secondo Segers, 2002; 2007). Gli asterischi indicano le nuove segnalazioni per la fauna italiana.*

Family	Species	Distribution
Euchlanidae	*Beauchampiella eudactylota* (Gosse, 1886)	Afr, Aus, Nea, Neo, Ori, Pal
Lecanidae	**Lecane lauterborni* Hauer, 1924	Nea, Neo, Pac, Pal
Proalidae	**Bryceella stylata* (Milne, 1886)	Nea, Pac, Pal
	**Proales* cfr. *gigantea* (Glascott, 1893)	Aus, Nea, Pal
	Proalinopsis caudatus (Collins, 1873)	Afr, Aus, Nea, Pal
Ituridae	**Itura myersi* Wulfert, 1935	Aus, Nea, Neo, Ori, Pal
Notommatidae	**Cephalodella stenroosi* Wulfert, 1937	Neo, Pal
	**Eothinia elongata* (Ehrenberg, 1832)	Afr, Aus, Nea, Neo, Ori, Pal
	Notommata cfr. *pachyura* (Gosse, 1886)	Afr, Aus, Nea, Neo, Ori, Pal
	**Pleurata* sp.	
	**Resticula nyssa* Harring & Myers, 1924	Aus, Nea, Pal
	**Taphrocampa annulosa* Gosse, 1851	Afr, Aus, Nea, Neo, Ori, Pal
Dicranophoridae	**Erignatha clastopis* (Gosse, 1886)	Aus, Nea, Neo, Pal

Bryceella stylata (Milne, 1886). The genus *Bryceella* includes only two known species. Three specimens of *B. stylata* were collected in April 2007 from SII. This species is common in moor and acid waters between *Sphagnum*, in leaf litter and tree holes, more frequently in the cold season. It feeds on small diatoms (De Smet 1996).

Proales cfr. *gigantea* (Glascott, 1893). A single specimen of *Proales* cfr. *gigantea* was found in April 2007 in VER. The genus *Proales* comprises 44 known species, of which *P. gigantea* is a particularly interesting member, since it is a parasite of the eggs of several freshwater gastropods, feeding on the fluid surrounding the embryo and laying its eggs inside the snail egg. It has also been observed parasitizing chironomids eggs (De Smet 1996).

Proalinopsis caudatus (Collins, 1873). Six named species and three *species inquirendae* belong to the genus *Proalinopsis*, of which a few individuals identified as *P. caudatus* were found in different lakes: in spring 2007 from COI and GEI, in autumn 2007 from GES, PAL and VDL. This species had already been recorded in a previous survey in 2003 in two of the study lakes (GES and VDL) and only in two other sites in Piedmont, Northern Italy (Fontaneto & Melone 2003). It is described as a cosmopolitan species, living in *Sphagnum* bogs and in periphyton and epibenthos of acid waters (De Smet 1996).

Itura myersi Wulfert, 1935. The genus *Itura* comprises six known species, of which only *Itura* gr. *aurita* had been previously recorded in Italy. Two individuals of *I. myersi* were found in April 2007 in COS. It is a benthic-periphytic species often found in ponds, fens and also slightly brackish waters (De Smet & Pourriot 1997).

Cephalodella stenroosi Wulfert, 1937. Over 160 species are globally included in the genus *Cephalodella*. Specimens assigned to the species *C. stenroosi* were found in spring 2007 in VER and in autumn 2007 in PAL and BAL. It is considered a benthic species (Nogrady *et al*. 1995).

Eothinia elongata (Ehrenberg, 1832). The genus *Eothinia* consists of six named species. A few specimens of *E. elongata* were occasionally found in July and August 2007 and in September 2008 in GEI, and in July 2007 in SCP. It is a carnivore rotifer, feeding in particular on bdelloids (Nogrady *et al*. 1995).

Notommata cfr. *pachyura* (Gosse, 1886). A single specimen of *Notommata* cfr. *pachyura* was collected in September 2008 in GEI. Like the other c. 50 species known for this genus, *N. pachyura* is a benthic rotifer. It is acidophil and although being an occasional predator, it normally feeds on desmids (Nogrady *et al*. 1995). This is the second record for Italy of this cosmopolitan species, previously found in Piedmont (Fontaneto & Melone 2003).

Pleurata sp. The relatively recently established genus *Pleurata* (see Nogrady *et al*. 1995) comprises seven named species, none of which seems to correspond to the individuals found during this survey in SQU (spring 2007), SAP (May, June and July 2007), and SCP; in the latter lake, the population reached density of c. 2 ind L^{-1} in June and July 2007. This taxon had been reported in SCP in previous surveys, but it had been incorrectly identified as *Cephalodella* sp. Further analyses are underway to confirm its status as a new species.

Resticula nyssa Harring & Myers, 1924. Of the seven species belonging to the genus *Resticula*, only one (*R. gelida*) had been reported in Italy so far. In GEI (May and November 2007), SAP (May 2007) and GES and BAL (autumn 2007) a few individuals of *R. nyssa* were found, a rare but cosmopolitan, typically acidophil species (Nogrady *et al*. 1995).

Taphrocampa annulosa Gosse, 1851. The genus *Taphrocampa* comprises only four known species. *T. selenura,* recently found in two sites in Piedmont (Fontaneto & Melone 2003), is the only species of this genus previously reported for the Italian fauna. In GEI and GES (May and June 2007), SAP (July and August 2007) and in SCP (June 2007), a few specimens of *T. annulosa* were collected, a cosmopolitan species generally living among detritus (Nogrady *et al*. 1995).

Erignatha clastopis (Gosse, 1886). This species, belonging to a genus comprising six known species, was found in May in GEI, GES, VDL and PRA. Only in PRA, a few specimens were also found in November. It is a periphytic species, generally found in weedy ponds, lakes and swamps and feeding mainly on green algae (De Smet & Pourriot 1997).

4. CONCLUSIONS

Our results show that even biotic communities that have been extensively monitored for years, like those of the lakes included in this study, can still provide interesting novelties in terms of biodiversity when accurate taxonomic analyses are carried out. This emphasizes the importance of more detailed taxonomic studies that also take into account the microscopic components of biodiversity, which nonetheless can play a significant role in the functioning of aquatic ecosystems.

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