

Rotifera (Monogononta) diversity in subtropical waters of Argentina

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Keywords : Rotifera, Neotropical region, shallow lakes, littoral area, acid waters, new records, new species.

The rotifer fauna of twenty five localities (mainly shallow lakes) from Corrientes, Argentina was studied. 136 taxa were identified, 20 of which, from the genera *Lecane*, *Lepadella*, *Ploesoma*, *Ptygura*, *Squatinella*, *Testudinella* and *Trichocerca* are new to the Argentine fauna. Most of these are (sub)tropical in distribution, and 8 % are endemic to South America. *Ploesoma africana* Wulfert, *Ptygura kostei* n.sp., *Testudinella brevicaudata* Yamamoto and *Trichocerca vernalis* Hauer are recorded from the Neotropical region for the first time. The rotiferan species richness of this area, is remarkable. The highest diversity was recorded from vegetated lakes, with acid waters, where one locality yielded 56 species.

Diversité des Rotifères (Monogononta) dans les eaux subtropicales d'Argentine

Mots clés : Rotifères, Neotropis, lacs peu profonds, zone littorale, eaux acides, nouvelles récoltes, espèce nouvelle.

La faune des Rotifères de 25 lacs peu profonds de la région de Corrientes (Argentine) a été étudiée. 136 taxa ont été recensés dont 20 nouveaux pour la faune d'Argentine : ils appartiennent aux genres *Lecane*, *Lepadella*, *Ploesoma*, *Ptygura*, *Squatinella*, *Testudinella* et *Trichocerca*. La majorité a une distribution subtropicale, cosmopolite et 8% sont endémiques d'Amérique du Sud. *Ploesoma africana* Wulfert, *Ptygura kostei* n.sp., *Testudinella brevicaudata* Yamamoto et *Trichocerca vernalis* Hauer sont citées par la première fois dans la région néotropicale. C'est dans les lacs acides avec végétation littorale qu'on a observé la plus grande diversité : 56 espèces ont été dénombrées dans une seule station.

1. Introduction

The rotifer fauna of Argentina is partially documented. Nearly 300 species have been recorded from this country which is as large as 4.025.696 km² (Jose de Paggi 1990). Argentina extends over a large latitudinal range (from 22° to 56°S) besides with large altitudinal variations. Consequently there exists a great diversity of climates and environments, so one can expect a very high diversity of rotifers. Biogeographically the Argentine territory is included into two large subregions: Guyana-Brazilian and Andean-Patagonian. Up to now, the largest number of rotifers has been recorded from the Guyana-Brazilian area which is rich in

lentic waters and floodplain rivers. Nevertheless there are many unexplored areas in this subregion and most investigations were based on pelagic samples only. The vegetated littoral zones have been relatively little studied, so few representatives of littoral genera appear in the rotifer list from Argentina.

In the present paper the rotifer fauna of a hitherto unknown area of Guyana-Brazilian subregion is analyzed.

2. Study site and methods

The area is located in the northeast of Argentina, Corrientes province, in a subtropical band between 28° and 30.5° S, near the Paraná river. It is very rich in wetlands, rivers, streams and shallow lakes (< 5 m) mainly formed by eolic action during a dry period in the Holocene (Iriando 1981). These lakes have sandy bottoms and transparent waters, most of them are densely vegetated.

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Fifty eight samples were collected during late spring (4 to 10 December 1992) in 25 water bodies, including shallow lakes («lagunas»), pools and rivers (Table 1). The number of samples by locality were in relation to the size of water bodies (see Table 1). These were taken in open waters and among the littoral vegetation. In the rivers, samples were also taken in lateral swamps. Samples were collected with a 50 µm mesh cone net and preserved in the field in 4 % formalin. The sampling method was qualitative. The physical and chemical parameters were measured directly in the field : transparency (Secchi disk), temperature (mercury thermometer), pH (Hellige comparator), conductivity (conductivity meters) and oxygen content (oxygen meters) (Table 1).

3. Results

The area under consideration comprises three geographical groups of water bodies (Fig. 1): Group I with pH values ranging from 6 to 8.6, without vegetation or with *Potamogeton*, *Cabomba*, *Ludwigia* ; group II water bodies with pH 5.8 to 6.1, with a dense macro-

phyte growth, mainly consisting of *Myriophyllum*, *Egeria*, *Hydrocotyle*, *Nymphoides*, *Azolla* and *Salvinia* ; group III pH 7.2 to 8.4 without vegetation, except the localities 18 (with *Potamogeton*) 21 (*Azolla*, *Salvinia*, *Pistia*), and 22 (covered by *Elodea*). The water temperature ranged from 25° to 34°C. Group I and II are in a lowland wetland area, group III is on higher elevation.

136 taxa, belonging to 37 genera were identified from 25 water bodies, however the total is incomplete because some unidentifiable taxa were found, twenty species are new records for Argentina and four species are new to the Neotropical region.

The total number of rotifer species traced in the samples at each site varied from 2 (Laguna Mula) to 56 (Laguna El pacu).

3.1. New records and selected species: taxonomic comments and distribution in the Neotropical region

Twenty species of the genera *Lecane*, *Lepadella*, *Ptygura*, *Ploesoma*, *Squatinella*, *Testudinella*, *Trichocerca*, were recorded for the first time from Argentina (Table 2).

Table 1. List of localities and values of temperature (°C), transparency (m), pH, conductivity (µS/cm), samples and species numbers, respectively (* vegetated water bodies).

Tableau 1. Liste des localités, température (°C), transparence (m), pH, conductivité (µS/cm), nombre d'échantillons et nombre d'espèces (* localités avec végétation).

	Temp.	Secchi.	pH	Cond.	NR. Samples	NR. Species
1 Santa Lucía River*	25.0		6.0	99	3	29
2 Laguna* Caragatay	25.0	0.06	6.0	385	2	17
3 L. El Varillar	26.0	0.06	6.1	397	2	3
4 L. La Cruz	25.0	1.22	6.0	122	2	15
5 L. Soto*	27.5	0.45	8.6	153	4	20
6 L. Pago de los deseos*	29.8	1.20	7.4	52.5	3	9
7 L. Duna*	30.0	0.82	7.8	87.4	3	22
8 L. Mula	30.0	0.52	8.4	157	1	2
9 Sarandí Stream*	30.0	0.10	6.0	1013	4	21
10 L. Pistia	30.0	0.60	6.0	1846	2	10
11 L. Junco*	29.0	0.64	6.1	34	4	51
12 L. El Pacú*	29.5	0.50	6.0	93	3	56
13 L. Concepción	25.0	0.69	5.8	32	2	40
14 L. Timbocito*	30.0	-	-	25	2	25
15 Farm Pond	27.2	0.16	7.4	41	1	11
16 Avalos Stream	29.5	0.80	8.4	417	1	14
17 Stream near Mercedes	27.2	-	7.8	387	1	12
18 Farm Pond La Cantera*	28.0	-	7.2	111	2	20
19 Stream in C. Cuatía	23.5	-	7.2	103	1	3
20 Laguna La Cantera	27.0	-	7.8	61.3	1	7
21 Swamp (Mocoretá)*	26.0	1.55	7.4	550	2	37
22 Farm Pond in Sauce*	26.0	-	7.9	242	2	22
23 Guayquiraró River	27.0	-	7.2	166	1	14
24 Farm Pond in Sauce	28.5	-	7.4	84	1	7
25 Feliciano River	28.5	-	7.8	1250	1	14

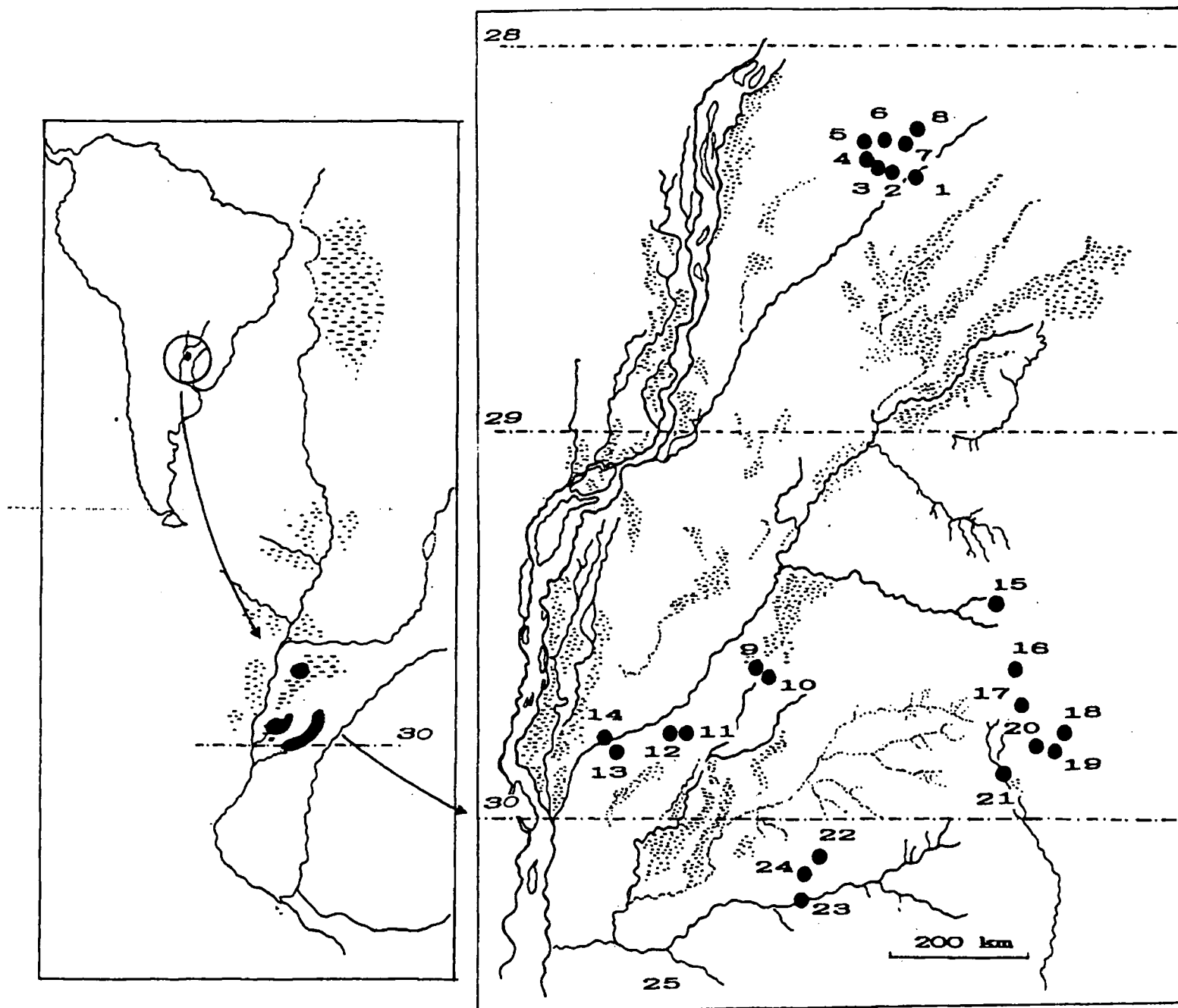


Fig. 1. Geographical localization of the study area and sampling sites (group I : 1-8, group II : 9-14, group III : 15-25).

Fig. 1. Localisation géographique de la zone d'étude et sites de récolte des rotifères (groupe I : 1-8, II : 9-14, III : 15-25).

Some of the recorded taxa are cosmopolitan as *Lepadella cristata* (Rousselet, 1893) (Figs. 2 a,b), widely distributed in Neotropical region, principally in acid waters (Koste 1972a, 1986, Koste & Robertson 1990, Koste & Böttger 1992, Schmid Araya 1991), *Testudinella incisa* (Ternetz, 1892) (Fig. 3) and *Testudinella parva* (Ternetz, 1892) (Fig. 4) both recorded previously from Neotropis (Koste & Jose de Paggi 1982). The following species are interesting:

**Lecane amazonica* (Murray, 1913) (Fig. 5) (syn. *L. murrayi* Hauer, 1965, after Segers 1993)

According to Koste (1972a) and Koste & Böttger (1992) this species prefers acid or slightly acid waters and warm temperatures. In this study it was found in Laguna Junco (pH 6.1, 29°C). Up-to-now *L. amazonica* was recorded only from South America: Brazil and Ecuador (Thomasson 1971, Koste & Robertson 1990, Koste & Böttger 1992).

**Lecane braziliensis* Segers, 1993 (Fig. 6)

This is the first record of the species outside Brazil. It was described from Roraima, Brazil (Segers et al. 1993a). In Argentina it has been previously found in a

Table 2. List of rotifer taxa. Numbers refer to the localities (Table 1) (* new record set to Argentina, ** new record to the Neotropical Region).
 Tableau 2. Liste des espèces récoltées. Les nombres correspondent aux localités du tableau 1 (* espèces nouvelles pour l'Argentine, ** espèces nouvelles pour la région néotropicale).

<i>Anuraeopsis fissa</i> (Gosse), 12-14	<i>L. hamata</i> (Stokes), 1, 4, 5, 9, 11-14, 18, 21, 23
<i>A. navicula</i> Rousselet, 12, 14, 20, 22, 23	<i>L. hastata</i> (Murray), 18
<i>Ascomorpha ecaudis</i> (Perty), 9, 23	<i>L. hornemanni</i> (Ehrenberg), 5, 7, 11, 13, 15, 18, 22
<i>Asplanchna intermedia</i> (Hudson), 2, 14, 25	<i>L. leontina</i> (Turner), 1, 4, 7, 9, 11, 12, 21-23
<i>Brachionus angularis</i> Gosse, 13, 14, 16, 25	<i>L. ludwigii</i> (Eckstein), 6, 13, 21
<i>B. bidentatus</i> Anderson, 2, 9, 11, 12, 15	* <i>L. ludwigii</i> (Eckstein) f. <i>marshi</i> Haring, 11
<i>B. caudatus</i> Barrois & Daday, 12, 17	<i>L. ludwigii</i> (Eckstein) f. <i>ohioensis</i> (Herrick), 5, 9, 11, 12, 23
<i>B. c.</i> Barrois & Daday f. <i>austrogenitus</i> Ahlstrom, 12, 14, 23	<i>L. luna</i> O.F.Muller, 2, 4, 5
<i>B. c.</i> Barrois & Daday, f. <i>personatus</i> Ahlstrom, 12, 21, 23, 25	<i>L. lunaris</i> (Ehrenberg), 1, 3, 4, 7, 11-14, 22
<i>B. chelonis</i> Ahlstrom, 14	* <i>L. marchantaria</i> Koste & Robertson, 5
<i>B. dolabratus</i> Haring, 14, 20	<i>L. monostyla</i> (Daday), 4, 11-13
<i>B. falcatus</i> Zacharias, 7, 15	<i>L. nana</i> (Murray), 2
<i>B. havanaensis</i> Rousselet, 5, 11, 12	<i>L. obtusa</i> (Murray), 5, 21-23
<i>B. quadridentatus</i> (Hermann), 2, 11-13, 17, 21, 23, 25	<i>L. papuana</i> (Murray), 11, 14, 22, 23
<i>B. zahniseri</i> Ahlstrom, 1	<i>L. proiecta</i> Hauer, 11
<i>Cephalodella catellina</i> (O.F.Muller), 11, 15	<i>L. pyriformis</i> (Daday), 2, 5, 11, 12, 13, 16, 21, 23
<i>B. mucronata</i> Myers, 13	<i>L. quadridentata</i> (Ehrenberg), 2, 11, 12
<i>Collotheca cf. coronatta</i> (Cubitt), 9, 11, 13	<i>L. rhytida</i> Haring & Myers, 12, 21
<i>Colurella uncinata</i> (O.F.Muller), 5, 12, 14	<i>L. scutata</i> (Haring & Myers), 11-13
<i>Conochilus coenobasis</i> Skorikov, 6, 11-13, 20, 25	<i>L. signifera</i> (Jennings) f. <i>ploenensis</i> (Voigt), 4, 11, 13
<i>C. unicornis</i> Rousselet, 12, 13	<i>L. stenroosi</i> (Meissner), 21
<i>Dicranophorus cf. hauerianus</i> Wiszniewski, 12, 13	<i>L. stichaea</i> Haring, 4
<i>Dipleuchlanis propatula</i> (Gosse), 21	<i>L. tenuiseta</i> Haring, 21
<i>Epiphanes clavulata</i> (Ehrenberg), 22	<i>L. ungulata</i> (Gosse), 1, 7, 12, 21, 22
<i>Euchlanis dilatata</i> (Ehrenberg), 11-13, 16	<i>Lepadella acuminata</i> (Ehrenberg), 25
<i>E. incisa</i> Carlin, 1, 2, 7, 11, 12	* <i>L. biloba</i> (Hauer), 1, 21
<i>Filinia longiseta</i> (Ehrenberg), 9, 14, 16, 17, 20	<i>L. costata</i> Wulfert, 11
<i>F. opoliensis</i> (Zacharias), 3, 8, 15, 16, 21, 24	* <i>L. cristata</i> (Rousselet), 22
<i>F. terminalis</i> (Plate), 11-14, 23	* <i>L. donneri</i> Koste, 1, 7
<i>F. pejleri</i> Hutchinson, 25	* <i>L. ehrenbergi</i> (Perty), 7
<i>Hexarthra intermedia braziliensis</i> (Hauer), 3, 5, 15, 17, 25	* <i>L. elongata</i> Koste, 13, 14
<i>H. mira</i> (Hudson), 24	<i>L. ovalis</i> (O.F.Muller), 1, 2, 13, 18, 23
<i>Horaella thomassoni</i> Koste, 11, 12	<i>L. patella</i> (O.F.Muller), 1, 2, 5, 11-13, 14, 23
<i>Keratella americana</i> Carlin, 5, 12	<i>L. rhomboides</i> (Gosse), 2, 10, 12, 13
<i>K. cochlearis</i> (Gosse), 1, 5, 7, 9, 11-13, 15, 17, 23-25	<i>Lophocharis salpina</i> (Ehrenberg), 1, 21
<i>K. lenzi</i> (Hauer), 9, 11-14, 21, 23, 24	<i>Macrochaetus longipes</i> Myers, 9, 10, 13
<i>K. tecta</i> (Gosse), 5, 6, 9, 11, 12	<i>M. sericus</i> (Thorpe), 2, 6, 11, 12, 16, 21
<i>K. tropica</i> (Apstein), 9, 13, 17, 21, 25	<i>Monommata longiseta</i> (O.F.M.), 9, 11
<i>Lecane aculeata</i> (Jakubski), 2, 5, 10, 21	<i>Mytilina bisulcata</i> (Lucks), 1, 12, 22
* <i>L. amazonica</i> (Murray), 18	<i>M. mucronata</i> (O.F.Muller), 23
* <i>L. braziliensis</i> Segers, 6	<i>M. ventralis</i> (Ehrenberg), 5, 7, 9, 11, 12, 16
<i>L. bulla</i> (Gosse), 1, 2, 5, 6, 7, 10-16, 18, 19, 21-23	<i>Notommata copeus</i> Ehrenberg, 12
<i>L. closterocerca</i> (Schmarda), 4, 9, 10-12, 18, 21-23	<i>Plationus patulus</i> (O.F.Muller), 4, 7, 10-12, 16, 18, 21-23, 25
<i>L. cornuta</i> (Muller), 1, 4, 7, 13, 14, 18, 21-23	<i>Platyias quadricornis</i> (Ehrenberg), 1, 21
<i>L. crepida</i> Haring, 7, 12, 13, 18	<i>P. leloupi</i> (Gillard), 11
<i>L. crepida</i> Haring f. <i>longidactyla</i> (Koste), 14, 16, 22	** <i>Ploesoma africana</i> Wulfert, 11
<i>L. curvicornis</i> (Murray), 4, 5, 7, 22	<i>Pompholix complanata</i> Gosse, 9, 12, 15, 17
<i>L. decipiens</i> (Daday), 1, 11, 12, 18	<i>Polyarthra dolichoptera</i> Idelson, 17, 19, 22, 25
<i>L. doryssa</i> (Haring), 4	<i>P. vulgaris</i> Carlin, 1, 6, 9, 11-17, 21, 23, 24
<i>L. elsa</i> Hauer, 4, 7, 11, 24	** <i>Ptygura kostei</i> n. sp., 21
<i>L. elegans</i> Haring, 13	<i>P. libera</i> Myers, 11
<i>L. flexilis</i> Haring, 5, 11	<i>Scaridium longicaudum</i> (O.F.Muller), 1, 9, 14
<i>L. furcata</i> (Murray), 1, 7	* <i>Squatinella bifurca</i> (Bolton), 13, 21
<i>L. halyclista</i> Haring & Myers, 1, 12, 21	* <i>S. leydigi</i> Zacharias, 1
	* <i>S. lamellaris</i> (Muller), 12

Table 1. Continued.

Tableau 1. Suite.

<i>Testudinella ahlstromi</i> Hauer, 9, 10, 11, 18, 21	* <i>T. hollaerti</i> De Smet, 18
** <i>T. brevicaudata</i> Yamamoto, 6	<i>T. insignis</i> (Herrick), 11, 13, 14
* <i>T. incisa</i> (Ternetz), 1, 7	<i>T. longiseta</i> (Schrank), 12
<i>T. mucronata</i> (Gosse), 12, 21, 22, 23	<i>T. porcellus</i> (Gosse), 12, 22
* <i>T. ohlei</i> Koste, 1, 11, 12	<i>T. pusilla</i> (Lauterborn), 12
* <i>T. parva</i> (Ternetz), 4, 11, 21	<i>T. rattus</i> (O.F. Muller), 5
<i>T. patina</i> (Hermann), 1, 6, 7, 9, 10-13, 16-18, 22, 23, 25	<i>T. similis</i> (Wierzejski), 1, 12, 23
<i>T. patina</i> (Hermann) f. <i>intermedia</i> Anderson, 22	<i>T. stylata</i> (Gosse), 13
<i>T. tridentata</i> Smirnov, 22	<i>T. tigris</i> (O.F. Muller), 12
<i>Trichocerca bicristata</i> (Gosse), 2, 7, 9, 11, 12, 14, 22	** <i>T. vernalis</i> (Hauer), 2
<i>T. brachyura</i> (Gosse), 13	<i>Trichotria tetractis</i> (Ehrenberg), 1, 11, 12, 18
<i>T. braziliensis</i> (Murray), 1	<i>Tripleuchlanis plicata</i> Levander, 16, 21
<i>T. cylindrica</i> (Imhof), 12	<i>Wolga spinifera</i> (Western), 11, 17, 2
<i>T. elongata</i> (Gosse), 11	

rice field in Corrientes near the region now studied (Martinez & José de Paggi, unpubl.) here it is recorded from Pago de los deseos Lake. *Lecane braziliensis* was found in waters with low conductivity (72 $\mu\text{S}/\text{cm}$ in the rice field and 52.5 $\mu\text{S}/\text{cm}$ in Pago de los deseos).

* *Lecane decipiens* (Murray, 1913) (Fig. 7)

This is a relatively common species in South and Central America (Segers 1995), however it is the second record in Argentina (Modenutti & Claps 1988, not illustrated). Many records of this taxon are misidentified as *L. hamata* (Segers 1996) but *L. decipiens* can readily be distinguished because it has the head margin coincident and convex, and the dorsal plate ending in a small transverse fold. Few individuals were found in three localities.

* *Lecane hornemanni* (Ehrenberg, 1834)
(Figs. 8 a-c)

So far, the single Argentine record of this species was from Lake Hess, eastern Patagonia (Thomasson 1963). However, the presence of this common tropical and subtropical species in an Andean lake should be confirmed. This species was frequently found during this study. Recently, Segers (1995) synonymized *L. nodosa* Hauer, 1938 with *L. hornemanni*. This author stated that there are no significant differences between them, because the knobby hemispheres surface of the lorica of *L. nodosa* could be a fixation artefact. In this study the both forms were found: typical form with smooth lorica (Fig. 8a) in three localities (Duna, Soto, Tajamar; pH: 7.4 to 8.6) and individuals with knobby hemispheres, smallest, (Figs. 8b-c) in two localities (La Cruz, Junco, pH 6.00 to 6.10). The later form was recorded from Brazil as *L. nodosa*, in waters with pH 5.2-6.0 (Brandorf et al. 1982) and from Australia, in

water with pH 6.3 (Koste & Shiel 1990). This difference in ecological conditions of the habitat, is noticeable.

L. hornemanni has been recorded from Brazil, Venezuela, Panama, Antilles (Koste & José de Paggi, 1982).

* *Lecane ludwigii* (Eckstein, 1883) f. *marshi* Haring, 1914 (Fig. 9)

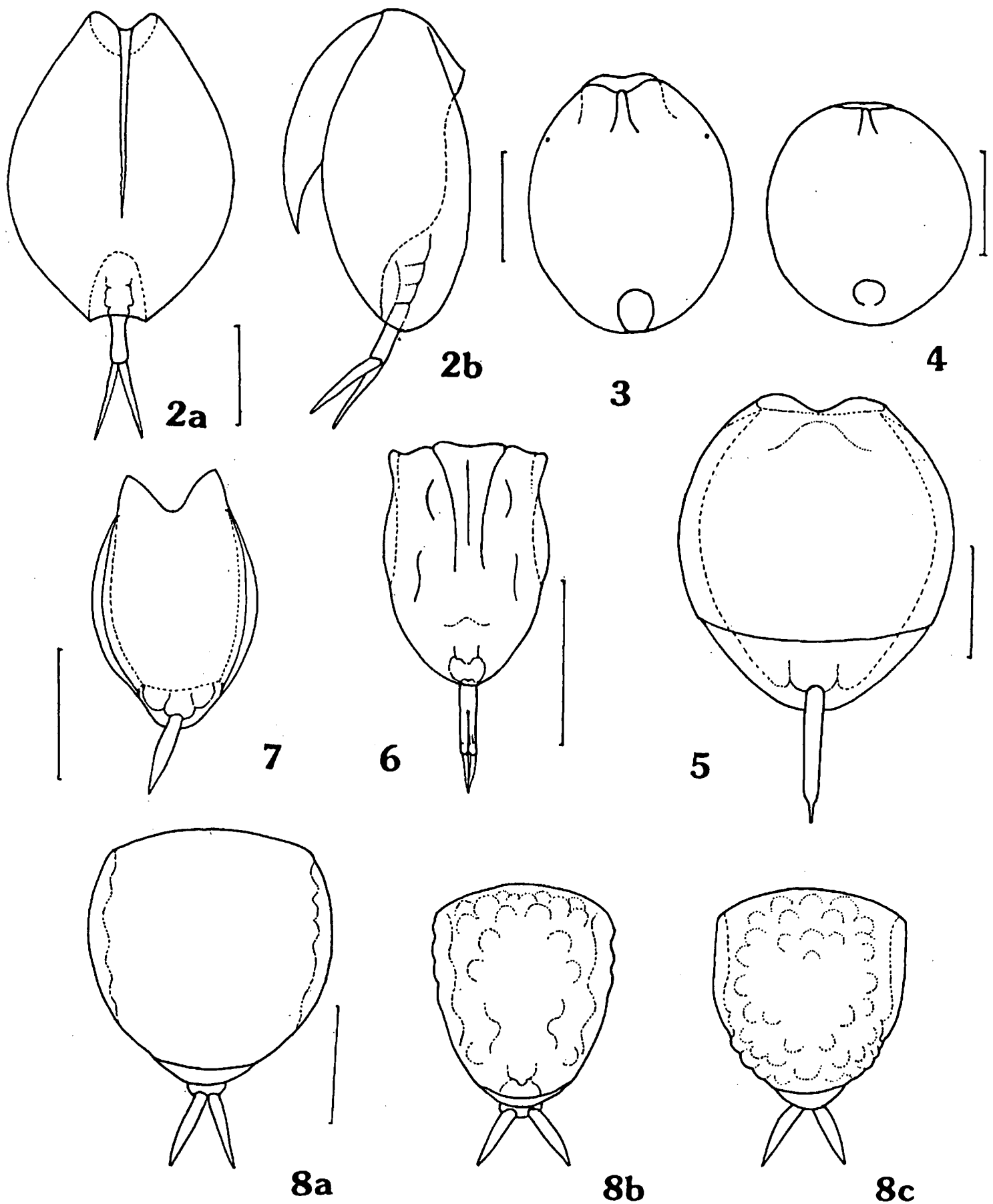
Segers (1995) synonymized *L. ohioensis* with *L. ludwigii* on the basis of the great variability in the shape of the posterior projection of the foot plate. In the group of synonymized taxa, *L. ludwigii* f. *marshi* shows an unusual and different variant in the frontal spines (long, slender and curved as a hook), but the other features agree with *L. ludwigii*.

L. ludwigii f. *marshi* (only three individuals) and *L. ludwigii* f. *ohioensis* (Fig. 10) were both found coexisting in Laguna Junco without intermediate forms. Besides of the difference in shape, they differ in the size, f. *ohioensis* is smaller than f. *marshi* (lorica length 105 and 130 μm , respectively). A more profound taxonomic analysis, principally at the population level, appears necessary to determine the status of this species and its morphological variants.

L. ludwigii f. *marshi* is not common, it was originally described from Panama canal zone and later found in China too (Haring & Myers 1926).

* *Lecane marchantaria* Koste & Robertson, 1983 (Fig. 11)

The species is characterized by the egg shaped lorica, with the ventral anterior margin more deeply concave than the dorsal margin. Only known from South America: Brazil and Peru (Koste & Robertson 1983, Koste 1988). In this study it was found in Laguna Soto (pH 8.6).



Figs. 2-8. 2 a-b. *Lepadella cristata*; a: dorsal; b: lateral. 3. *Testudinella incisa*, ventral. 4. *T. parva*, ventral. 5. *Lecane amazonica*, ventral view. 6. *L. braziliensis*, dorsal. 7. *L. decipiens*, ventral. 8. a-c. *L. hornemanni*, dorsal; (a: Laguna Soto; b: L. La Cruz; c: L. Junco). Scales 50 μ m.

Figs. 2-8. 2 a-b. *Lepadella cristata*; a: vue dorsale, b: vue latérale. 3. *Testudinella incisa*, vue ventrale. 4. *T. parva*, vue ventrale. 5. *Lecane amazonica*, vue ventrale. 6. *L. braziliensis*, vue dorsale. 7. *L. decipiens*, vue ventrale. 8 a-c. *L. hornemanni*, vue dorsale; (a : Laguna Soto; b: La Cruz; c: L. Junco). Echelles : 50 μ m.

* *Lepadella biloba* Hauer, 1958 (Fig. 12)

This species was alternatively considered as a form, later a subspecies of *L. patella* Hauer and recently Segers & De Meester (1994) elevated the taxon to full species rank. It was previously found in Bolivia (Segers et al. 1994).

* *Lepadella donneri* Koste, 1972 (Fig. 13)

This species, known only from the Neotropis, is easily distinguished by the lateral sulci in the anterior half of the lorica. It was recorded from Brazil, Peru and Ecuador (Koste 1972a, 1988, Koste & Böttger 1992).

* *Lepadella ehrenbergi* (Perty, 1850) (Fig. 14)

It resembles *L. bicornis* Vassist & Battish, 1971, but the latter species is characterized by its equal toes. In the Neotropical region *L. ehrenbergi* was pointed out in species lists from Venezuela and Brazil (Hauer 1956, Brandorff et al. 1982). The only illustrated records correspond in fact to *L. bicornis* (Koste 1974b).

* *L. elongata* Koste, 1992 (Fig. 15)

(syn.: *L. quadricarinata* f. *procera* Klement, 1959, *L. acuminata* after Koste, 1972)

On the basis of the absence of four ribs over the foot opening and lorica outline, Koste (in Koste & Böttger 1992) described it as a new species. *L. elongata* has an elongated lorica outline, narrow posterior region and deep pedal notch. In South America, recorded from Brazil and Ecuador (Koste & Böttger 1992, Segers & Dumont 1995). *L. elongata* was found in acid waters (pH 5.8, Laguna Concepción).

* *Squatinella bifurca* (Bolton, 1884) (Fig. 16)

Body cylindrical, with two spines in median line of posterior lorica. The species was found between submerged macrophytes, in the littoral of Laguna Concepción. Though cosmopolitan, *S. bifurca* was recorded previously only from Amazonas, Corumba River (Koste 1972a).

* *Squatinella lamellaris* (Muller, 1786) f. *mutica* (Ehrenberg, 1838) (Figs. 17 a,b) (syn.: *S. mutica* Ehrenberg 1832, after Segers et al. 1991)

Caudal margin of the lorica semicircular, foot with three pseudo segments, without spine on the last foot pseudo-segment. In acid waters, widespread in distribution and common in Neotropis too, recorded as *S. mutica* from Amazonas, Ecuador, Jamaica (Koste 1974a, Koste & Böttger 1992, Koste et al. 1993).

Squatinella leydigi Zacharias, 1886 (Figs. 18 a,b)

Body oval, the dorsal lorica has ribs similar to those described by Pejler (1962) and a long spine. Foot with two pseudo-segments.

S. leydigi is an inhabitant of acid waters (Koste 1978). Few individuals were found in a sample from the banks of River Santa Lucia, between *Myriophyllum*, pH 6.0. In the Neotropical region this species was previously recorded from Ecuador (Koste & Böttger 1992, in a species list).

* *Testudinella ohlei* Koste, 1972a (Fig. 19)

The specimens found in El pacu (pH 6.0) are slightly smaller than those originally described by Koste (1972). This rotifer, restricted to the Neotropis, was described from Brazilian acid waters and recorded also from Ecuador (Koste & Böttger, 1992)

* *Trichocerca hollaerti* De Smet, 1990 (Figs. 20 a-c)

This species resembles *T. lophoesa*. Both species share a well developed keel with striated area running up to the caudal end. However, they can be identified by the trophi (Segers & Sarma 1993). *T. hollaerti* was described from Africa (De Smet 1990). Segers & Sarma (1993) founded it in Brazil.

3.2. New records from Neotropical Region: descriptions and notes on their distribution

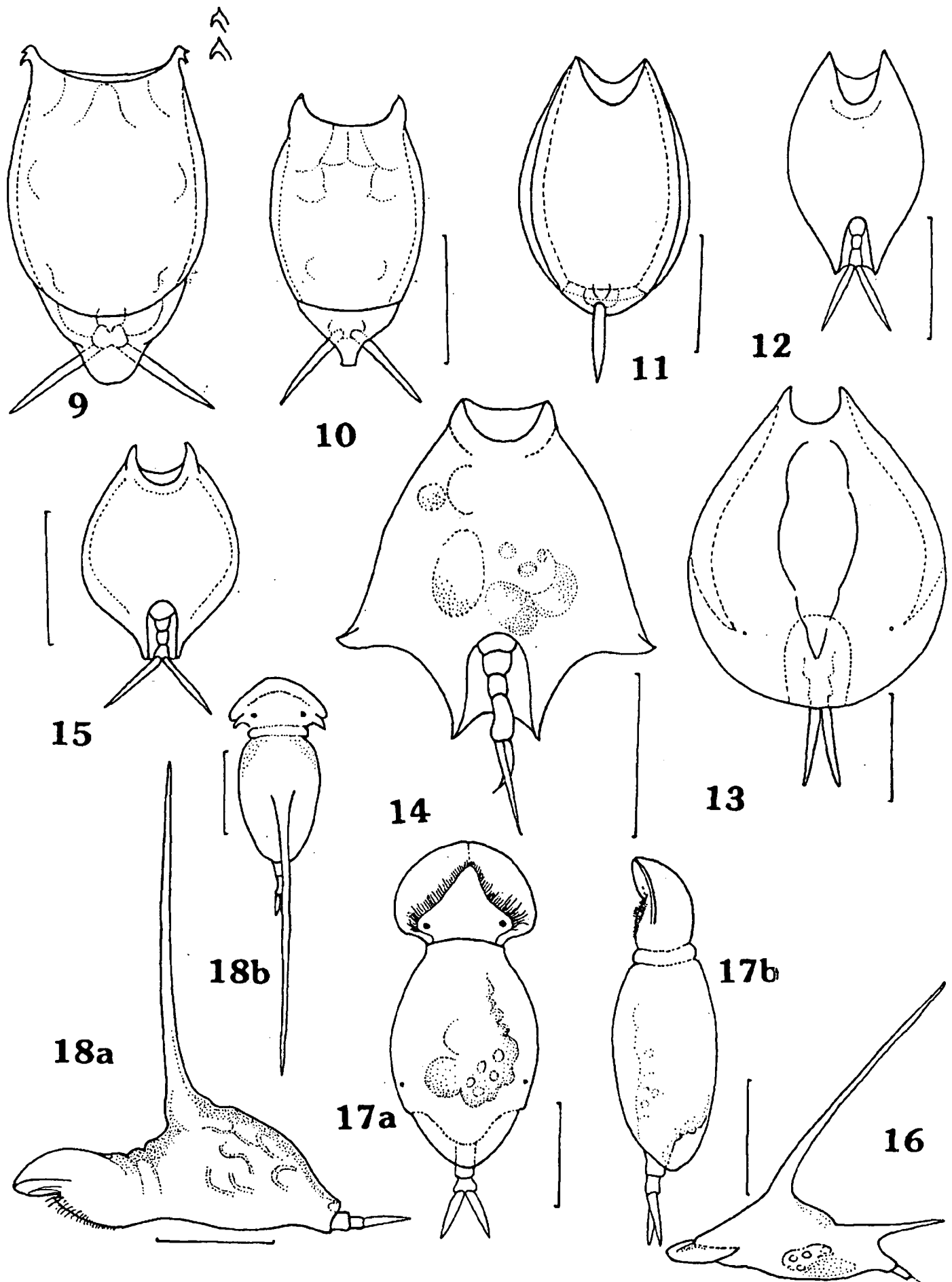
Ploesoma africana, *Ptygura kostei*, *Testudinella brevicaudata* and *Trichocerca vernalis* are new records. *Trichocerca vernalis* Hauer, 1936 (Figs. 21 a,b) is a cosmopolitan taxon (Shiel & Koste 1992).

• *Ploesoma africana* Wulfert, 1965 (Figs. 22 a-d)

Ploesoma africana was described as a dimorphic species, which is appreciable principally in the lateral view. The Argentine specimens correspond to the «A» form in the description of Wulfert (1965). Wulfert's record includes figures and a description, but no measurements were provided. Variability in size was recorded, but the lorica ornamentation appears to be constant in the Argentine specimens. The possible synonymy of *P. africana* with *P. lenticulare* was suggested by Koste (1978). *P. africana* is distinguished from *P. lenticulare* by its occipital margin, having lateral truncate projections and by the dorsal lorica being very narrow. The specimens from Laguna Junco are different from those of *P. lenticulare* and *P. truncata* found in other localities of Argentina (Figs. 23, 24). Nevertheless, the variability in the genus requires a more intensive investigation, there are only few illustrated record of the species, and there are no reports on intrapopulational variability. It is suggested to retain the taxa as different species until further studies are made.

Measurements: body length 160-250, dorsal lorica width 74-95 μm .

Ecology and Distribution: a small population was found in Laguna Junco. *P. africana* was recorded only



Figs. 9-18. 9. *L. ludwigii* f. *marshi*, dorsal. 10. *L. ludwigii* f. *ohioensis*, dorsal. 11. *L. marchantaria*, ventral. 12. *Lepadella biloba*, ventral. 13. *L. donneri*, dorsal. 14. *L. ehrenbergi*, ventral. 15. *L. elongata*, ventral. 16. *Squatinella bifurca*, lateral. 17 a-b. *S. lamellaris*; a: dorsal, b: lateral. 18. a-b. *S. leydigi*; a: lateral, b: dorsal. Scales 50 μ m.

Figs. 9-18. 9. *L. ludwigii* f. *marshi*, vue dorsale. 10. *L. ludwigii* f. *ohioensis*, vue dorsale. 11. *L. marchantaria*, vue ventrale. 12. *Lepadella biloba*, vue ventrale. 13. *L. donneri*, vue dorsale. 14. *L. ehrenbergi*, vue ventrale. 15. *L. elongata*, vue ventrale. 16. *Squatinella bifurca*, vue latérale. 17 a-b. *S. lamellaris*; a: vue dorsale, b: vue latérale. 18. a-b. *S. leydigi*; a: vue latérale, b: vue dorsale. Echelles : 50 μ m.

from Africa (Wulfert, 1965). Neotropical *Ploesoma* include *P. lenticulare*, *P. truncata* and *P. hudsoni*.

• *Ptygura kostei* n.sp. (Figs. 25 a,b)

Synonyms: *Ptygura elsteri* f. *thailandis* Koste 1975, p. 50, Figs. 3 a-c, 6,8

Ptygura elsteri f. *thailandis* De Smet, 1989

Ptygura elsteri f. *thailandis* Segers et al. 1993, p. 66.

Type locality: Mocoreta River swamp, Corrientes Province, Argentina.

Material examined: female holotype deposited in the Museo de Ciencias Naturales B.Rivadavia, B.Aires (Nr.33993); two female paratypes in the Instituto Nacional de Limnología (INALI, S/6795).

Diagnosis

P. kostei is distinguished by the hooks on the dorsal side of the neck. It has four smooth robust hooks, which are slightly incurved. *P. kostei* resembles *P. elsteri* but it is easily distinguished for having four hooks almost similar in size. In *P. elsteri*, in dorsal view the median hooks are smaller and the lateral hooks have small teeth on the inner side (Figs. 26 a,b).

Description

Female

Sessile animal, without tube, peduncle not visible. Slender, tube-shaped body with soft cuticle, long foot with a small attachment disc. Minute ventral antennae. The most important morphological characteristic of the species are four hooks on the neck, under the corona, in lateral view curved downwards. In contracted specimens the hooks are as long as 25-30% of the total length. Because of the body contraction of most of the studied specimens, the shape of the corona is not well defined and cannot be described.

Measurements: contracted body: 100-110 µm, median hook: 26 µm, lateral hook: 28 µm.

Male: unknown.

Distribution: *Ptygura kostei* is known from the type locality; few contracted individuals were found in waters of pH 7.4 in a swamp, between *Salvinia* and *Azolla*. Koste (1975) found it on *Eichhornia* in water with pH 7.9 in Thailand. Besides, the species has been recorded from Africa (De Smet 1989, Segers et al. 1993b). Probably, *P. kostei* is a tropicopolitan species.

Etymology: this new species is dedicated to Dr. W.Koste, in honour of his contribution to the knowledge of the Southamerican rotifer fauna and for his encouragements to students and colleagues of this continent.

Comments: the species was described from Thailand by Koste (1975) as an infraspecific taxon, *P. elsteri* f. *thailandis*; this, and *P. elsteri* were found together in the same sample by him. Intermediate forms were not described by Koste and neither found in the Argentine material. The structure of dorsal process seems to be a valid character for the diagnosis of *Ptygura* species. In this genus, there are groups of species with different types of hooks or spines as *P. furcillata*, *P. melicerta*, *P. mucicola*, *P. elsteri* and *P. linguata*.

• *Testudinella brevicaudata* Yamamoto, 1951 (Fig. 27)

The specimens found correspond with the description of Koste & Tobias (1987): both anterior margin shape and foot aperture being situated at the posterior end of ventral lorica.

Measurements: lorica length 128 µm, lorica width 100 µm.

Ecology and distribution: *T. brevicaudata* was described from Japan and recorded from Africa by Koste & Tobias (1987). It was found in Pago de los deseos, a shallow, densely vegetated pond, pH 7.4.

4. Discussion

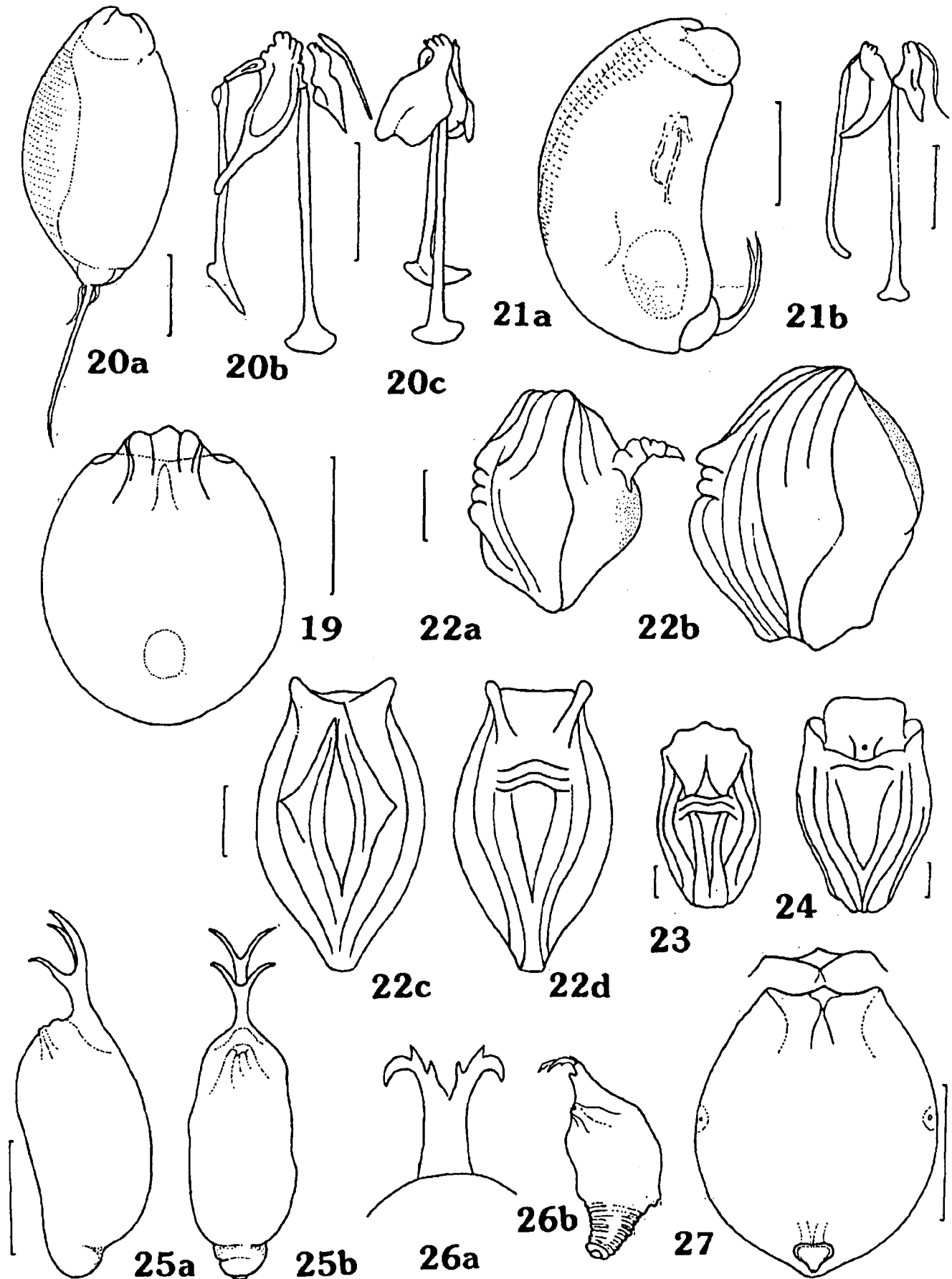
The area dealt with in this study has a noticeable rich rotifer fauna, and a clear relationship between rotifer richness and habitat heterogeneity was observed.

Most of the recorded taxa are littoral, only 30 % of them are planktonic, and all new records for Argentina or Neotropical region are littoral indeed.

There is a far higher number of species in lakes with higher development and diversity of the macrophytes (group II) than in those belonging to the groups I and III. The mean richness of these groups of habitats was 33, 14, and 15 respectively. The highest numbers of species (56 and 51) were recorded in Lake Concepción and Lake Junco, respectively, both with dense submerged and floating macrophyte growth, such as *Myriophyllum*, *Egeria*, *Nymphoides*, *Azolla* and *Salvinia*. On the other hand, the lowest number of species (2) was found in Lake La Mula, a man-made water-body without macrophytes.

The rotifer fauna of the studied region is at all not homogenous and its faunistic affinity is relatively low. The value of the Index of Biotic Dispersion (Koch 1957) was only 10 %.

Many of the species are confined to a restricted number of biotopes. Only 4 species (*Testudinella patina*, *Polyarthra vulgaris*, *Keratella cochlearis*, *Lecane bul-*



Figs. 19-27. 19. *Testudinella ohlei*, dorsal. 20 a-c. *Trichocerca hollaerti*; a: lateral, b-c: trophi. 21 a-b. *T. vernalis*; a: lateral, b: trophi. 22 a-d. *Ploesoma africana*; a-b: lateral, c: ventral; d: dorsal. 23. *P. lenticulare*, dorsal (Colastine Riber). 24. *P. truncata*, dorsal (Parana River). 25 a-b. *Ptygura kostei*, contracted; a: ventral, b: lateral. 26 a-b. *P. elsteri* (after Koste 1972b, 1974b); a: hooks, b: lateral; 27. *Testudinella brevicaudata*, ventral. Scales 50 μ m; trophi 25 μ m.

Figs. 19-27. 19. *Testudinella ohlei*, vue dorsale. 20 a-c. *Trichocerca hollaerti*; a: vue latérale, b-c: trophi. 21 a-b. *T. vernalis*; a: vue latérale, b: trophi. 22 a-d. *Ploesoma africana*; a-b: vues latérales, c: vue ventrale; d: vue dorsale. 23. *P. lenticulare*, vue dorsale (Colastine Rivière). 24. *P. truncata*, vue dorsale (Parana Riber). 25 a-b. *Ptygura kostei*, contracté; a: vue ventrale, b: vue latérale. 26 a-b. *P. elsteri* d'après Koste 1972b, 1974b); a: crochets, b: vue latérale; 27. *Testudinella brevicaudata*, vue ventrale. Echelles : 50 μ m; trophi 25 μ m.

la) of the 136 species recorded occur in 50% of the water bodies. Conversely, 85% of the species were recorded from less than 25% of the localities and 68 taxa in only one or two water bodies.

The most diverse genera were *Lecane* (29%) and *Trichocerca* (11%). In recent studies, Segers & Sarma (1993) and Segers et al. (1993b) founded a similar composition in littoral-associated rotifer assemblages in Brazil and Africa. Some species with restricted distribution to Brazil were found in Argentina as *L. braziliensis*, *L. amazonica* and *L. marchantaria*. Species with a tropical and subtropical distribution were recorded as *Lecane aculeata*, *L. crepida*, *L. hornemanni*, *L. monostyla*, *L. papuana*, *L. dorissa* and *Trichocerca hollaerti*. Other species known as rare in distribution were recorded for the second time in Argentina, *L. rhytida* and *L. halyclista*.

The genus *Testudinella* was also well represented in vegetated lakes mainly in acid waters. Four taxa of this genus were found coexisting in a farm pond (locality 22).

The *Brachionus* species are mainly restricted to the tropics and subtropics, with a high number of endemics in South America (Green 1972, Dumont 1983). However the diversity of *Brachionus* in Corrientes was relatively low in comparison to similar latitude of Argentina (Jose de Paggi & Koste 1988) probably because of the dominance of slightly acid waters.

Most of the 136 species of rotifer found in the studied area are cosmopolitan and tropicopolitan; 11 (8%) of them are presently known as endemic to the Neotropical region: *Brachionus dolabratus*, *B. havanaensis*, *B. zahniseri*, *Horaella thomassoni*, *Keratella americana*, *Lecane amazonica*, *L. braziliensis*, *L. marchantaria*, *L. proietta*, *Lepadella donneri* and *Testudinella ohlei*

It seems that the acidity of waters in tropical and subtropical areas does not affect negatively the richness of the rotifer fauna, on the contrary the high rotifer richness of Amazonian and Australian acid waters (Brandorff et al. 1982, Koste & Shiel 1986) is well known. The high rotifer diversity of the slightly acid waters of Lakes Concepción and El Junco, was previously not recorded from other biotopes in Argentina. The rotifer diversity of this region is higher than that in other Argentine subtropical areas, at the same latitude (Jose de Paggi 1989). In the northwestern region of Argentina, 87 rotifer taxa were recorded from 51 localities and the highest species number by biotope was 27. These biotopes, in arid and semi-arid climate, have alkaline waters (pH 7.5 - 8.9) in contrast with those in Corrientes.

There is a remarkable similarity between the rotifer faunas from Corrientes and from Amazonian «black waters». Similar environmental conditions seem to have allowed the extension of some Amazonian species to the South, besides the studied region had a tropical climate between 1400- 800 years before present (Iriondo 1995). Many of the present records are the southernmost ones of many species belonging to the genera *Lecane*, *Testudinella*, *Trichocerca* and *Lepadella*. On the other hand, South America rotifer fauna have some affinities with the Africa fauna (Segers & Sarma 1993, Segers et al. 1993) the record of *P. africana* contributes to this hypothesis.

This study shows the state of our knowledge: samples from a comparatively small area with 25 localities, result in 20 new rotifers for a country and 4 new records for Neotropis, besides, rare species or recorded in only one opportunity from Neotropis (*L. ludwigii* f. *marshi*, *S. bifurca*, *S. leydigi*) are found. The tropical and subtropical region of South America is dominated by rivers and associated floodplains, wetlands and shallow lakes, the largest basins of the continent: Amazonas, Orinoco and Parana are located mainly in this region. The area covered by wetlands in South America is > 800.000 km² (Neiff et al. 1994). Taking that into account, the extension of habitats for rotifers is huge. More intensive studies on rotifer fauna of this region are needed and could contribute for a better knowledge of the distribution patterns of the species and its biogeography at world level.

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References

- Brandorf G., Koste W. & Smirnov N.N. 1982. — The composition and structure of Rotiferan and Crustacean communities of the lower Rio Nhamunda, Amazonas, Brazil. *Stud. Neotrop. Fauna Environ.*, 17: 69-121.
- De Smet W.H. 1989. — Contribution to the rotifer fauna of the Bas-Zaire. 1. The rotifers from some small ponds and a river. *Biol. Jb. Dodonaea*, 56: 115-131.
- De Smet W.H. 1990. — Contribution to the rotifer fauna of the Bas-Zaire. 2. Species composition and seasonal abundance of rotifers in a shallow pond. *Biol. Jb. Dodonaea*, 57: 62-77.
- Dumont H.J. 1983. — Biogeography of rotifers. *Hydrobiologia*, 104: 19-30.
- Green J. 1972. — Latitudinal variation in associations of planktonic Rotifera. *J. Zool. Lanit*, 167: 31-39.
- Harring H.K. & Myers F.J. 1926. — The Rotifer Fauna of Wisconsin. III A revision of the genera *Lecane* and *Monostyla*. *Trans. Wisconsin Acad. Sci., Arts and Letters*, 22: 315-423.
- Hauer J. 1956. — Rotatorien aus Venezuela und Kolombien. *Ergebnisse der deutschen Limnol. Venezuela-Expedition 1952* 1: 277-314.

- Iriondo M.H. 1981. — Antigüedad del último cambio climático en el Litoral. *Ecologia*, 6:5-8.
- Iriondo M.H. & Krohling D.M. 1995. — El sistema eólico pampeano. *Com. Mus. Prov. Cs. Naturales*, 5: 1-68.
- Jose de Paggi S. 1989. — Rotíferos de algunas provincias del Noroeste argentino. *Rev. Hydrobiol. trop.*, 22: 223-238.
- Jose de Paggi S. 1990. — Ecological and biogeographical remarks on the rotifer fauna of Argentina. *Rev. Hydrobiol. trop.*, 23: 297-311.
- Jose de Paggi, S. & Koste W. 1988. — Rotifera from Saladillo River basin (Santa Fe Province, Argentina). *Hydrobiologia*, 157: 13-20.
- Koch L.F. 1957. — Index of biotal dispersity. *Ecology*, 38: 145-148.
- Koste W. 1972a. — Rotatorien aus Gewässern Amazoniens. *Amazoniana* 3: 258-505.
- Koste W. 1972b. — Über ein sessiles Rädertier aus Amazonien, *Ptygura elsteri* n.sp mit Bemerkungen zur Taxonomie des Artkomplexes *Ptygura melicerta* (Ehrenberg 1832). *Int. Revue ges. Hydrobiol.*, 57(6): 875-882.
- Koste W. 1974a. — Rotatorien aus einem Ufersee des unteren Rio Tapajos, dem Lago Paroni (Amazonien). *Gewässer und Abwasser*, 53/54: 43-68.
- Koste W. 1974b. — Zur Kenntnis der Rotatorienfauna der «schwimmenden Wiese» einer Uferlagune in der Varzea Amazoniens, Brasilien. *Amazoniana* 5(1): 25-59.
- Koste W. 1975. — Über den Rotatorienbestand einer Mikrobiozönose in einem tropischen aquatischen Saumbiotop, der *Eichhornia crassipes* Zone im Litoral des Bung-Borapet, einem Stausee in Zentralthailand. *Gewässer und Abwasser*, 57/58: 43-58.
- Koste W. 1978. — *Rotatoria. Die Rädertiere Mitteleuropas*. Borntraeger, Berlin, 2 Vols: 673 p, 234 platten.
- Koste W. 1986. — Über die Rotatorienfauna in Gewässern südöstlich von Concepcion, Paraguay, Sudamerika. *Osnabrücker naturwiss. Mitt.*, 12: 129-155.
- Koste W. 1988. — Über die Rotatorien einiger Stillgewässer in der Umgebung der Biologischen Station Panguana im tropischen Regenwald in Peru. *Amazoniana*, 10: 303-325.
- Koste W. & Bottger K. 1992. — Rotatorien aus Gewässern Ecuadors II. *Amazoniana*, 12: 263-303.
- Koste W., Janetzky W. & E. Vareschi. 1993. — Zur Kenntnis der limnischen Rotatorienfauna Jamaikas (Rotatoria: Aschelminthes) Teil I. *Osnabrücker naturwiss. Mitt.*, 19: 103-149.
- Koste W. & Jose de Paggi S. 1982. — Rotifera of the Superorder Monogononta recorded from Neotropis. *Gewässer und Abwasser*, 68/69: 71-102.
- Koste W. & Robertson B. 1983. — Taxonomic studies on the Rotifera (Phylum Aschelminthes) from a Central Amazonian varzea lake, Lago Camaleao (Ilha de Marchantaria, Rio Solimoes, Amazonas, Brazil). *Amazoniana* 8: 225-254.
- Koste W. & Robertson B. 1990. — Taxonomic studies of the Rotifera from shallow waters on the island of Maraca, Roraima, Brazil. *Amazoniana*, 11 (2): 185-200.
- Koste W. & Shiel R.J. 1986. — New Rotifera (Aschelminthes) from Tasmania. *Trans. R. Soc. S. Aust.*, 110(3): 93-109.
- Koste W. & Shiel R. 1990. — Rotifera from Australian inland waters V. Lecanidae (Rotifera: Monogononta). *Trans. R. Soc. S. Aust.*, 114: 1-36.
- Koste W. & Tobias W. 1987. — Zur Rädertierfauna des Sankarani Stausees im Einzugsgebiet des Niger, Republik Mali, Westafrika (Aschelminthes, Rotatoria). *Arch. Hydrobiol.*, 108: 499-515.
- Modenutti B.E. & M.C.Claps. 1988. — Monogononta Rotifers from plankton and periphyton of pampasic lotic environments (Argentina). *Limnologica*, 19: 167-175.
- Neiff J.J., Iriondo M.H. & Carignan R. 1994. — Large tropical South American wetlands. *Proceedings of International Workshop on Ecology and Management of Aquatic-Terrestrial ecotones*: 156-165.
- Pejler B. 1962. — On the taxonomy and ecology of benthic and periphytic Rotatoria. Investigations in Northern Swedish Lapland. *Zool.Bidr. Uppsala*, 33: 327-422.
- Schmid Araya J.M. 1991. — Distributional aspects of Rotifera in Central and South Chile. *Arch. Hydrobiol.*, 120: 481-493.
- Segers H. 1993. — Rotifera of some lakes in the floodplain of the River Niger (Imo State, Nigeria). New species and other taxonomic considerations. *Hydrobiologia*, 250: 39-61.
- Segers H. 1995. — The Lecanidae (Monogononta), In Dumont, H. (ed) *Guides to the Identification of the Microinvertebrates of the Continental Waters of the World*. The Hague, SPB Academic Publishing: 226 p.
- Segers H. 1996. — The biogeography of littoral *Lecane* Rotifera. *Hydrobiologia*, 323:169-197.
- Segers H., Ajayi A.O., Chiambeng G.Y., Chuah H.P., Del Castillo M., Directo M.G., Luzuriaga de Cruz M., Moreno L., Oliveira-Neto A & Retnaning Widyastuti. Y. 1991. — Fourteen Rotifers species new to the Belgian Fauna with nomenclatural and taxonomical remarks on some *Squatinella* species. *Belg. J.Zool.*, 121: 193-201.
- Segers H. & De Meester L. 1994. — The Rotifera of Papua New Guinea, with the description of a new *Scaridium* Ehrenberg 1830. *Arch. Hydrobiol.*, 131: 111-125.
- Segers H., Dos Santos Silva E.N. & Oliveira Neto A.L. 1993. — New and rare species of *Lecane* and *Lepadella* (Rotifera: Lecanidae: Colurellidae) from Brazil. *Belg. J. Zool.*, 123: 113-121.
- Segers H. & Dumont H.J. 1995. — 102+ rotifer species (Rotifera: Monogononta) in Broa reservoir (SP., Brazil) on 26 August 1994, with the description of three new species. *Hydrobiologia*, 316: 183-197.
- Segers H., Meneses L. & Del Castillo M. 1994. — Rotifera (Monogononta) from Lake Kothia, a high altitude lake in the Bolivian Andes. *Arch. Hydrobiol.*, 132: 227-236.
- Segers H., Nwadiaro C. & Dumont H.J. 1993. — Rotifera of some lakes in the floodplain of the River Niger (Imo State, Nigeria). II. Faunal composition and diversity. *Hydrobiologia*, 250: 63-71.
- Segers H. & Sarma S.S.S. 1993. — Notes on some new or little known Rotifera from Brazil. *Rev. Hydrobiol. trop.*, 26 (3): 175-185.
- Segers H., Sarma S.S.S., Kakkassery F.K. & Nayar C.K.G. 1994. — New records of Rotifera from India. *Hydrobiologia*, 287: 251-258.
- Shiel R.J. & Koste W. 1992. — Rotifera from Australian inland waters. VIII Trichocercidae (Monogononta). *Trans. R. Soc. S. Aust.*, 116: 1-27.
- Thomasson K. 1963. — Araucarian lakes. Plankton studies in North Patagonia with notes on terrestrial vegetation. *Acta Phytogeogr. Suec.*, 47: 139 p.
- Thomasson K. 1971. — Amazonian algae. *Mem. Inst. r. Sci.Nat. Belg.*, ser 2,86: 53 p.
- Wulfert K. 1965. — Rädertiere aus einigen afrikanischen Gewässern. *Limnologica*, 3: 347-366.