Free-living Platyhelminthes of the Pacaya-Samiria National Reserve, a Peruvian Amazon floodplain

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Abstract

Twenty-one free-living species of turbellaria (Platyhelminthes) were found in the Pacaya-Samiria National Reserve (Loreto, Peru), a Peruvian Amazon floodplain. The total 21 observed taxa comprise five species of Catenulida, two species of Macrostomida, two species of "Lecithoepitheliata", 10 species of Rhabdocoela and two species of Tricladida. Most of the species are cosmopolitan and occur in freshwater habitats worldwide. Of the species collected, only *Mesostoma ehrenbergi* was previously known from this region, whereas five species of Rhabdocoela were only recently described from the Pacaya-Samiria Reserve. Some morphological, distributional and ecological remarks are provided.

Key words: "Turbellaria", Amazon floodplain, free-living Platyhelminthes, distribution, Peru, Pacaya-Samiria Reserve

Introduction

Little is known about the microturbellarians from the Neotropical Region in general and South America in particular. The known microturbellarian fauna comprises 48 species of Catenulida, 9 species of Macrostomida, 2 species of "Lecitoepitheliata", 1 species of Prolecitophora, 4 species of Proseriata, 68 species of Rhabdocoela and 37 species of Tricladida (Kenk, 1974; Kawakatsu & Rovasio, 1992; Moretto, 1996; Damborenea & Cannon, 2001; Amato *et al*., 2003; Amato & Amato, 2005; Noreña *et al*., 2003, 2005a, 2005c; Brusa, 2006; Damborenea *et al*., 2005; Gamo & Leal-Zanchet, 2005; Sluys *et al*., 2005).

The Pacaya-Samiria National Reserve, situated within the Amazon River Floodplain, is characterized by the high diversity of its aquatic fauna, especially fishes (Albert & Crampton, 2003a, b; Crampton *et al*., 2003, 2004; Lovejoy *et al*., 2006). However, little is known about its microfauna. This area is characterised by monomodal flood pulses, flooding environments and heterogeneous macrophyte communities. The floodplain comprises swamps, lakes and seasonally inundated forests.

An expedition to this Reserve was carried out during the dry season (September 2002, UCAMARA Project). The primary goal of the expedition was to analyze the communities associated with macrophytes, both floating meadows and lake-shore macrophytes. During this trip, the free-living turbellarians associated with macrophytes were studied. Recently, five species were described for this reserve: *Gieysztoria chiqchi* Damborenea, Brusa & Noreña, 2005, *G. kasasapa* Damborenea, Brusa & Noreña, 2005 and *G. sasa* Damborenea, Brusa & Noreña, 2005, *Sergia calae* Noreña, Damborenea & Escobedo, 2006, and *Mesostoma ucamara* Noreña, Damborenea & Escobedo, 2006 (Damborenea *et al*., 2005; Noreña *et al*., 2006).

This study presents the species of turbellarians collected in a Peruvian Amazon floodplain (Pacaya-Samiria National Reserve) and compares their distribution with worldwide records from the literature.

Material and methods

The samples were collected from the vegetation of flooded areas with 125 and 160 µm mesh nets. The entire plants (roots and leaves) were rinsed within the net and returned to the water. Occasionally, the nets were dragged several times through the abundant littoral floating plant community (*e.g*. *Pistia* sp., *Eichhornia* sp., *Azolla* sp.). Specimens belonging to other invertebrate groups, such as Hydroidea, Oligochaeta, Acari, Gastropoda, Nematoda, Cladocera, Copepoda, Conchostraca, Amphipoda, Rotifera and Diptera Chironomidae were also captured during sampling. Most of these represent food sources for the turbellarian species.

The material was transported to the laboratory-ship, where the worms were studied alive under stereo-microscope. Some specimens were fixed in polyvinyl-lactophenol (whole-mounts) for the study of hard structures (stylets), and some were fixed in Bouin´s solution for histological studies.

The fixated worms were dehydrated and embedded in paraplast wax. Four µm thick sections were stained with Azan (Romeis, 1989), or hematoxylin and eosin, and mounted in DPX or Synthetic Canada Balsam.

The material studied has been deposited in the Invertebrate Collection of Museo Nacional de Ciencias Naturales (MNCN: 4.01/46; 4.01/47) (Madrid, Spain) and in the Invertebrate Zoology Collection of Museo de La Plata, Argentina (MLP: 5426-5444, 5489, 5492, 5495).

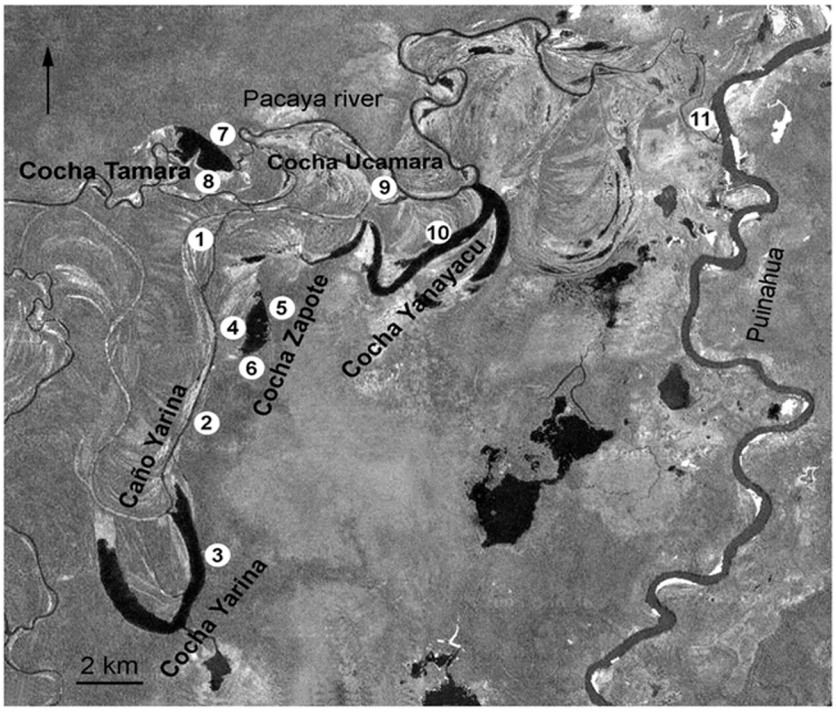

FIGURE 1. Air photograph from the research area. The white spots are the sampled sites (numbers correspond to the sampling localities mentioned in the Material & Methods).

Research area

The Pacaya-Samiria National Reserve is delimited by the Marañón and Ucayali Rivers, in a Peruvian Amazon floodplain (Fig. 1). It is an extensive flood area with (1) main beds, (2) numerous secondary beds connected by a net of channels or "caños", (3) abandoned sectors of river beds (half-moon floodplain lakes) or "cochas", and (4) ponds of different sizes and depths that may transform into (5) marshy areas. All of these lotic and lentic environments have muddy and very dark sediments. Shore vegetation consists mainly of *Scirpus* sp., *Polygonum* sp. ("tabaco lagarto"), *Panicum* sp. and the free floating *Pistia stratiotes* ("repollito"), *Eichhornia* sp. ("camalote"), *Salvinia herzogii* and *Nymphaea* sp. Table 1 shows the vegetation found at each sample site.

Localities (September 16–23, 2002) (Fig. 1)

Site 1. "Caño" Yarina (09-15-02) (5º17'36"S, 74º29'54"W). The samples were obtained from within the floating shore vegetation while aboard the boat. Acidic, transparent but dark waters.

Site 2. Security Station 2 (09-16-02) (5º21'28"S, 74º30'29"W). Small branch or channel of the "caño" Yarina covered with abundant floating vegetation ("zapacaya"). Dark, transparent and acidic waters.

Site 3. "Caño" Yarina and "Cocha" Yarina, Pacaya River (09-17-02) (5º24'42"S, 74º30'23"W). The "caño" Yarina is a secondary branch of the Pacaya River. The "cocha" Yarina, shaped like a half moon, is an abandoned bend of the Pacaya River, connected to the "caño" Yarina by a channel. Bottom with whitish and spongy mud. Depth: 1–0.50 m in the sampling area. Abundant floating and free-floating vegetation.

Site 4. Pools and swamps in the channel running between the "cocha" Zapote and the "caño" Yarina (09-19-02) (5º20'16"S, 74º29'40"W). Pools with little water, dark mud and covered with detritus and dead vegetation. Depth: about 0.30 m in the sampling area, and more than 0.50 m of swampy mud. Abundant shore and free-floating vegetation.

Site 5. "Cocha" Zapote (09-19-02) (5º20'16"S, 74º29'40"W). Bottom comprising dark and soft mud, covered with detritus and dead vegetation. Depth: 1.50 m in the sampling area. Abundant floating and free-floating vegetation. The "cocha" Zapote becomes completely isolated from the river during the dry season.

Site 6. Connection channel of the "Cocha" Zapote (09-19 to 20-02) (5º20'16"S, 74º29'40"W). Pool near the "cocha" and inside the connection channel. The pool was marshy, covered with floating vegetation and surrounded by tropical forest. Bottom comprising dark, soft mud and filled with detritus and dead vegetation. Depth: 1.50 m in the sampling area. The abundant vegetation forms a floating meadow that covers almost the whole surface of the pool.

Site 7. "Caño" Yarina in the Security Station 2 (09-21-02) (5º16'28"S, 74º29'55"W). Abundant vegetation in the form of floating meadows.

TABLE 1. Tabular compostion of the Turbellaria within the Pacaya-Samiria research area (* = presence), number of taxa in each sample and the vegetation found.

Species	**Sample sites**										
	1	2	3	4	5	6	7	8	9	10	11
CATENULIDA Stenostomidae											
1. *Stenostomum grande*			*				*		*		
2. *Stenostomum bicaudatum*			*								
3. *Stenostomum paraguayense*			*				*		*		
4. *Stenostomum* sp.1			*	*		*	*				*
5. *Stenostomum* sp.2			*			*	*				
MACROSTOMIDA Macrostomidae											
6. *Macrostomum tuba*				*		*					
7. *Macrostomum johni*			*			*				*	
"LECITHOEPITHELIATA" Prorhynchidae											
8. *Prorhynchus stagnalis*	*										
9. *Geocentrophora cf. applanata*								*			
RHABDOCOELA Dalyelliidae											
10. *Gieysztoria chiqchi*	*	*	*			*	*		*		
11. *Gieysztoria kasasapa*		*				*					
12. *Gieysztoria sasa*			*			*	*		*		
13. *Sergia calae*				*							
Temnocephalidae											
14. *Temnocephala lutzi*										*	
Typhloplanidae											
15. *Mesostoma ehrenbergi*							*		*	*	
16. *Mesostoma ucamara*			*					*			
17. *Bothromesostoma evelinae*			*						*		
18. *Olisthanella truncula*			*								
Polycystididae											
19. *Gyratrix hermaphroditus*			*	*					*		
TRICLADIDA Dugesiidae											
20. *Girardia* cf. *tigrina*			*	*		*					
Planariidae											
21. *Phagocata* sp.	*		*	*		*			*		
Total number of taxa	3	2	14	6	0	9	7	2	8	3	1

to be continued...

Table 1 (continued)

Species	Sample sites										
	1	2	3	4	5	6	7	8	9	10	11
Shore and floating vegetation											
Eichornia sp.	●	●	●	●	●	●	●	●	●		
Pistia sp.	●		●	●	●	●	●	●		●	
Salvinia sp.	●						●	●	●	●	
Nymphaea sp.						●	●				
Polygonum sp.			●					●			
Scirpus sp.					●				●	●	●
Azolla sp.				●	●						
Paspalum sp.	●	●									

Site 8. “Cocha” Tamara (09-21-02) (5º 16' 28”S, 74º 29' 55”W). Shore covered with abundant vegetation. Dark, soft mud bottom, with detritus and dead vegetation. Depth: 1.50 m in the sampling areas.

Site 9. “Cocha” Ucamara (09-22-02) (5º16'55”S, 74º25'45”W). Near the “cocha” Yanayacu. Small lake or pond, connected directly to the Pacaya River. The bottom of the “cocha” is dark and soft mud, covered with detritus. Abundant vegetation. Depth: approximately 1 m in the sampling area.

Site 10. “Cocha” Yanayacu (09-22-02) (5º17'46”S, 74º25'33”W). Yanayacu is one of the largest “cochas” of the Reserve. The bottom is fine, muddy, with very light silt, and fine grain sand. Dark and deep water. Vegetation formed primarily by floating species. Depth: 1 m in the sampling area.

Site 11. Puinahua Channel (09-23-02) (5º16'12”S, 74º21'27”W). Secondary branch of the Pacaya river. Bottom whitish with muddy sediment. Scarce vegetation. Depth: 1 m in the sampling area.

Results and discussion

Microturbellarians were captured in 10 of 11 sampling sites (Table 1). *Eichhornia* sp., *Pistia* sp. and *Salvinia* sp. were the most frequent species in the vegetation. No relationship was found between the type of the vegetation and the taxa found. Twenty-one taxa were identified, 16 of them at species level. Of the remaining five species, two resemble known species, but identification is not completely positive. These species are designated as “cf”. The other three taxa could only be determined to genus level.

Faunistic and biological remarks

Five *Stenostomum* species (Catenulida) were found in the study area, two of which were identified at genus level only due to low number of specimens. The three species identified (*Stenostomum grande* Child, 1902; *S. paraguayense* (Martin, 1908) Luther 1908 and *S. bicaudatum* Kenner, 1888) were determined while alive and had previously been described for South America (Martin, 1908; Marcus, 1945; Van Der Land, 1970; Noreña-Janssen, 1995; Gamo & Leal-Zanchet, 2004). However, this is the first record of these species for the Peruvian Amazon basin (Tables 1 and 2). The morphological characteristics observed, such as light refracting bodies and pharyngeal glands, correspond to those given by Marcus (1945) and Noreña *et al*. (2005b). They were found mainly in littoral areas with rich detritic bottoms and abundant vegetation (Table 1). *Stenostomum* species are characteristic inhabitants of still, lenitic waters (ponds or lagoons) near the littoral zone of rivers, but also occur in benthic areas (Marcus, 1945). They are well-known predators of invertebrates such as small Crustacea, Oligochaeta and larvae of insects.

Several specimens of the genus *Macrostomun* (Macrostomida) were captured in the Pacaya-Samiria Reserve. Many of these were sexually immature, preventing identification to species level. Nevertheless, two species (*Macrostomum tuba* Graff, 1882 and *M. johni* Young, 1972) were identified during this study and represent the first record of the taxon *Macrostomum* for the Amazon basin (Table 1). The morphology of the stylet is similar to that described by Gamo & Leal-Zanchet (2004) for Brazilian specimens.

Macrostomum johni was first described for freshwater environments of North Wales (United Kingdom) among stones and vegetation beds during the winter months (December to February) (Young, 1972). Recently, *M. johni* was captured in Rio Grande do Sul, Brazil, in a small artificial pond during autumn (Gamo & Leal-Zanchet, 2004). In the present study, *M. johni* was captured in aquatic vegetation (*e.g*. *Scirpus* sp, *Eichhornia* sp., *Pistia* sp. and *Salvinia* sp., Table 1) during spring. These results demonstrate that *M. johni* is a eurythermic or thermoplastic species.

Specimens of the taxon Prorhynchidae (“Lecithoepitheliata”) were found only at two sampling sites, among the roots of floating vegetation in the “caño” Yarina and “cocha” Ucamara, both localities with rich vegetation (Table 1). *Prorhynchus stagnalis* Schultze, 1851 and *Geocentrophora* cf. *applanata* (Kennel, 1888) Steinböck 1927 were recognized by external features in live specimens. The *Geocentrophora* specimen was whitish, with a yellow hue in the midbody. The lack of detailed observations of the stylet precludes its identification to species. The live *P. stagnalis* specimens collected in this work were approximately 2 mm long, with whitish coloration that became denser and greyish in the intestinal region, with small dark pigment granules concentrated on the lateral body.

Within the Dalyelliidae (Rhabdocoela), three species of *Gieysztoria* (*G. chiqchi* Damborenea, Brusa & Noreña 2005, *G. sasa* Damborenea, Brusa & Noreña 2005 and *G. kasasapa* Damborenea, Brusa & Noreña 2005) have been described for the Pacaya-Samiria Reserve (Damborenea *et al*., 2005). They inhabit the free-floating and floating

aquatic plants in lotic and lentic environments. *G. chiqchi* was the most abundant species in several samples, and was associated with different types of vegetation (Table 1). Another species of dalyellids, *Sergia calae*, also recently described from the Reserve (Noreña *et al.*, 2006) was captured only in marshy pools covered with abundant dead and floating vegetation.

Ten species of *Temnocephala* (Rhabdocoela, Temnocephalidae) have been described from Brazil (Damborenea & Cannon, 2001; Amato *et al*., 2003; Amato & Amato, 2005). Within the research area, *Temnocephala lutzi* (Fig. 2) Monticelli, 1913 was collected from the gill cavities of *Trichodactylus* sp. crabs captured in "cocha" Yanayacu (Table 1). The stylet morphology of the studied specimens agrees with the description given by Amato *et al.* (2005). The stylet length is 126 µm, which is shorter than the 130–140 µm mentioned by Pereira & Cuocolo (1941) but longer than the 87–109 µm given by Amato *et al.* (2005). The introvert has small spines and a slightly bent distal end, similar to that described by Amato *et al.* (2005). This species had already been recorded in the Brazilian Amazon floodplain (see Damborenea, 1994).

Four species that belong to the taxon Typhloplanidae (Rhabdocoela), namely *Mesostoma ehrenbergi* (Focke, 1836) Oersted 1844, *M. ucamara* Noreña, Damborenea & Escobedo 2006, *Bothromesostoma evelinae* Marcus 1946 and *Olisthanella truncula* (Schmidt, 1858) Graff 1913 (Fig. 3) were collected in seven of the eleven sampling sites (Table 1). *M. ucamara* was described and characterized for the first time for this Reserve (Noreña *et al.*, 2006). *Mesostoma ehrenbergi*, *M. ucamara* and *Bothromesostoma evelinae* are typical inhabitants of the upper water-layers of the submerged phytal zones, while *Olisthanella truncula* was found near the bottom, among the roots and leaves of aquatic vegetation, in agreement with its photophobic behaviour described by Luther (1960).

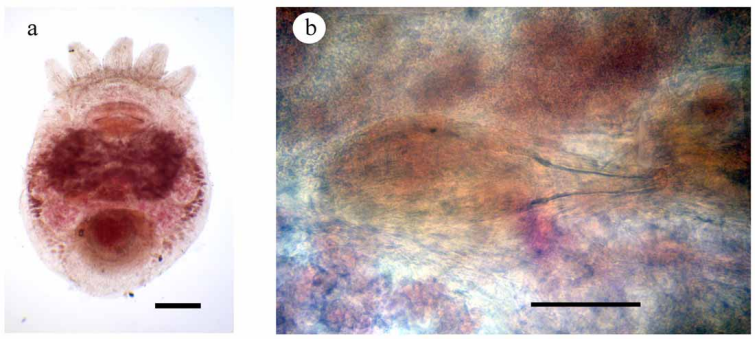

FIGURE 2. Microphotographs of *Temnocephala lutzi*. **a**: whole mount, scale bar 400 µm, **b**: detail of the stylet, scale bar 100 µm.

The *M. ehrenbergi* specimens collected were 1–1.5 mm long, transparent and with extremely branched whitish vitellaria. Some specimens had small darker pigment spots in the posterior body, as was described for Argentinean specimens by Noreña & Faubel

(1992). The *Olisthanella truncula* specimens were 1 mm long and amber colored with darker longitudinal stripes on the body and two black round eyes, better defined than in European species. *Bothromesostoma evelinae* specimens (0.8–2mm long) were dark brown dorsally and ventrally had a yellow edge that became paler toward the body margins. The internal anatomy of these specimens did not differ from previous descriptions of these species from Europe or South America (Figs. 3).

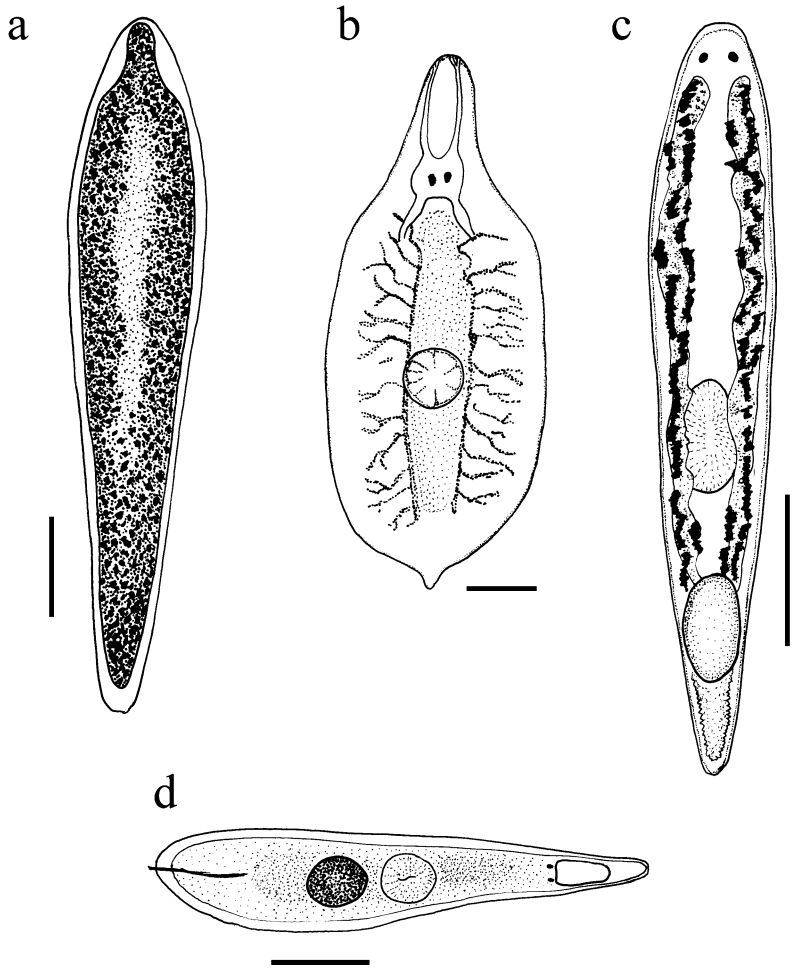

FIGURE 3. Dorsal view of live specimens. **a**: *Bothromesostoma evelinae.* **b**: *Mesostoma ehrenbergi.* **c**: *Olisthanella truncula*. **d**: *Gyratrix hermaphroditus*. Scale bars a–c: 200 µm, scale bar d: 100 µm.

The freshwater populations of *Gyratrix hermaphroditus* Ehrenberg, 1831 (Rhabdocoela, Polycystid-idae) live among the root system of diverse floating aquatic plants and exploit the mobility of these plants (floating meadows) for dispersal (Noreña-Janssen, 1995). This taxon is a well-known species complex, consisting of a number of sibling species (L´Hardy, 1986; Puccinelli & Curini-Galletti, 1987; Curini-Galletti &

Puccinelli, 1989, 1990, 1998; Curini-Galletti & Puccinelli, 1990; Artois & Schockaert, 2001), with an exceptional ability to adapt to different (limnetic, brackish, marine) environments (Reuter, 1961). The specimens collected in the Reserve were 0.5 mm long and 0.2 mm wide, with eyes posterior to the proboscis and one spherical egg behind the pharynx (Fig. 3).

Girardia cf. *tigrina* (Dugesiidae) and *Phagocata* sp. (Planariidae) (Fig. 4), both belonging to the Tricladida, were found at several sampling sites (Table 1). The identification of both species is tentative and based on external features. Sagittally-sectioned series were made in order to identify the species, but the collected individuals were immature. This is the first record for both taxa in the Amazon basin.

All the free-living Platyhelminthes found in Pacaya-Samiria are well-known swimming predators that occur in the aquatic vegetation (floating meadows, etc). The Amazon floodplain forest is flooded to a depth of several metres for 5–7 months each year. This pattern has persisted for at least 1 million years (Iron & Adis, 1979). Freshwater invertebrates, particularly the turbellarians, might use the flood pulses to colonize new areas, and therefore as an avenue for distribution (Noreña-Janssen, 1995). Most of the species reported in this work (*e.g.* species of Typhloplanidae, Dalyelliidae and Polycystididae) form resistant (or dormant) eggs. This type of egg has been noted as tolerant of dry and cold periods (Luther, 1904; Rieger *et al*., 1991). The conditions in the Amazon floodplain are unlike the European rivers and the formation of dormant eggs is related to the change of habitat (*e.g.* from lenitic to lotic) as the species spread, and perhaps to the dry periods associated with low water levels.

Studies about the life cycles of floodplain turbellarians are very scarce. The life cycles are apparently univoltine or bivoltine, and cosmopolitan species, such as *Mesostoma ehrenbergi* and *Gyratrix hermaphroditus*, show polyvoltine life-cycles, as seen in the European populations (Noreña-Janssen, 1995).

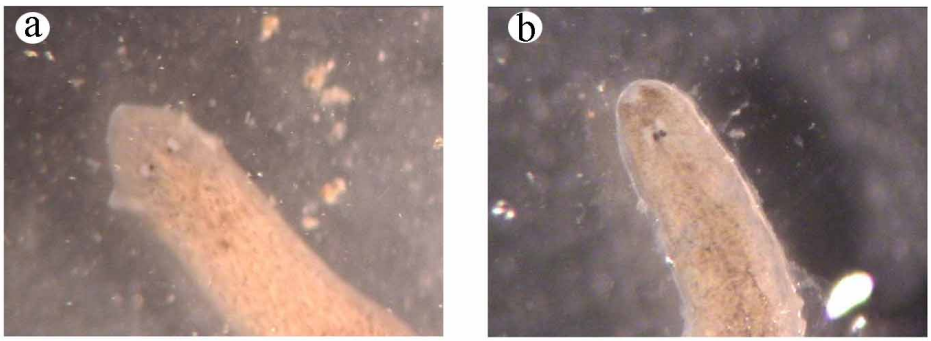

FIGURE 4. Microphotograps of live triclads. **a**: *Girardia* cf. *tigrina*, **b**: *Phagocata* sp. Photographed by Daniel H. Shain.

Biogeographic remarks

Several recent studies of freshwater turbellarian from the Southern Hemisphere reveal the occurrence of a high diversity of species, with many species only known from this Hemisphere (Therriault & Kolasa, 1999; Hartenstein & Dwine, 2000; Hochberg & Cannon, 2001, 2002; Brusa *et al.*, 2003; Artois *et al.*, 2004; Gamo & Leal-Zanchet, 2004; Hochberg, 2004; Noreña *et al.*, 2004, 2005a, 2005b, 2005c; Willems *et al.*, 2004, 2005a, 2005b). However, this group is still poorly understood for South America, and especially for Peru.

Surprisingly, most of the species identified (76%) in the current study in the Peruvian Amazon basin, which is a very ecologically distinctive region, are well known (Table 1). Eight taxa identified in this study are cosmopolitan: *Stenostomum grande, Macrostomum tuba, Prorhynchus stagnalis, Geocentrophora* cf. *applanata, Mesostoma ehrenbergi, Olisthanella truncula, Gyratrix hermaphroditus* and *Girardia* cf. *tigrina*, occurring in Europe, Africa and Asia and therefore widely distributed (Table 2). These are ecologically tolerant species, mostly occurring in great abundance, a prerequisite for widespread distribution through floating meadows, drift wood or the production of dormant-resistant eggs (Karling *et al.*, 1972). Nevertheless, Australian studies demonstrate that the dispersal of *G. hermaphroditus* may be affected by ecological and physical barriers, as well as by silt type or substratum (Curini-Galletti & Puccinelli, 1998). In the Amazon floodplain, the main physical barriers are the “várzeas” or “albardones” (embankments) in periods of low water level; these obstacles are overcome during the high water level season. Therefore, wide distribution could be expected for the aquatic Amazon species.

Nevertheless, the cosmopolitan distribution of *M. tuba* (Table 2) is somewhat questionable because it has been found mainly in artificial ponds and botanical gardens in Europe and North America (Luther, 1960).

Four species: *Stenostomum bicaudatum, S. paraguayense, Temnocephala lutzi* and *Bothromesostoma evelinae*, are restricted to South and Central America (Table 2). In the case of the positively identified *Stenostomum* species, it is worth noting that both species show “comparable” external features (*e.g.* they form zooid chains, have anterior sensory ciliary pits, and a simple pharynx that is extremely dilatable during prey capture) to *Microstomum lineare* (Müller, 1773) Örsted, 1843 (Macrostomida), and occupy lentic (*S. bicaudatum*) and lotic (*S. paraguayense*) environments, which are part of the ecological niche of *M. lineare* in other latitudes.

Temnocephala lutzi was only known from Brazil (Table 2), and this is the first record of this species for the Peruvian Amazon floodplain.

Bothromesostoma evelinae shows the same degree of adaptation and ecological behaviour as the European species *Bothromesostoma personatum* (Schmidt, 1848) Braun 1885, but these species have clearly different distribution patterns.

TABLE 2. Distribution of species of Turbellaria found in the Pacaya-Samiria Reserve, Loreto, Peru. The distribution outside South America is after Tyler *et al*. (2005), and Faubel (2004).

Species	South/ Central America	North America
Stenostomum grande	Argentina, Brazil, Surinam (Norea *et al*., 2003, 2005a; Gamo & Leal-Zanchet, 2004)	United States (Nuttycombe & Waters, 1938)
Stenostomum bicaudatum	Trinidad, Brazil, Surinam, Argentina, (Norea *et al*., 2003, 2005a; Gamo & Leal-Zanchet, 2004)	United States (Nuttycombe & Waters, 1938)
Stenostomum paraguayense	Paraguay, Brazil, Surinam, Argentina (Norea *et al*., 2003, 2005a)	
Macrostomum tuba	Brazil (Luther, 1960; Norea *et al*., 2003; Gamo & Leal-Zanchet, 2004), Venezuela (Hyman, 1955)	United States (Hyman, 1936)
Macrostomum johni	Brazil (Gamo & Leal-Zanchet, 2004)	
Prorhynchus stagnalis	Brazil (Norea *et al*., 2003)	United State (Kolasa *et al*., 1987)
Geocentrophora cf. applanata	Trinidad, Brazil (Graff, 1913; Marcus, 1944)	United States (Tyler *et al*., 2005)
Gieysztoria chiqchi	Peru (Damborenea *et al*., 2005)	
Gieysztoria kasasapa	Peru (Damborenea *et al*., 2005)	
Gieysztoria sasa	Peru (Damborenea *et al*., 2005)	
Sergia calae	Peru (Norea *et al*., 2006)	
Temnocephala lutzi	Brazil (Pereira & Cuocolo, 1941; Damborenea, 1994)	
Mesostoma ehrenbergi	Brazil, Argentina (Norea *et al*., 2003). Peru (Beauchamp, 1939)	United States (Graff, 1913)
Mesostoma ucamara	Peru (Norea *et al*., 2006)	
Bothromesostoma evelinae	Brazil, Uruguay, Argentina (Norea *et al*., 2003) Peru (Norea *et al*., 2006)	
Olisthanella truncula	Peru (Norea *et al*., 2006)	
Gyratrix hermaphroditus	Brazil, Argentina (Tyler *et al*., 2005; Norea *et al*., 2003)	Bermuda Islands, United States (Karling, 1978; Kolasa *et al*., 1987)
Girardia **cf.** *tigrina*	Brazil, Uruguay (Sluys *et al*., 2005)	Canada and United States (Sluys *et al*., 2005)
Phagocata sp.		

continued.

TABLE 2 (continued).

Species	Europe	Other continents
Stenostomum grande	Finland, Russia, Poland	
Stenostomum bicaudatum		
Stenostomum paraguayense		
Macrostomum tuba	Russia, Czech Republic, Austria, Bulgaria, France, Italy; Ukraine, Germany, Poland, Sweden, Spain, Finland, Romania.	Kenya, Uganda, Japan
Macrostomum johni	United Kingdom	
Prorhynchus stagnalis	Switzerland, Germany, Russia, United Kingdom, Sweden, Belgium, Austria, Azores, Bulgaria, Estonia, Faeroe I., Finland, France, Hungary, Italy, Macedonia, Poland, Spain, Switzerland, Ukraine.	Kenya, Siberia, Japan
Geocentrophora cf. applanata	United Kingdom (Young, 1970)	
Gieysztoria chiqchi		
Gieysztoria kasasapa		
Gieysztoria sasa		
Sergia calae		
Temnocephala lutzi		
Mesostoma ehrenbergi	Switzerland, Germany, Russia, United Kingdom, Sweden, Belgium, Austria, Finland, Ireland, Denmark, Netherlands, France, Italy, Hungary, Bulgaria, Czech Rep., Estonia, Spain, Ukraine.	Australia
Mesostoma ucamara		
Bothromesostoma evelinae		
Olisthanella truncula	Switzerland, Germany, Russia, Czech Rep., Finland, Italy, Macedonia, Poland, Spain, Ukraine, France, Austria, Hungary	Africa, Japan
Gyratrix hermaphroditus	Switzerland, Germany, Russia, Hungary, Bosnia Herzegovina, United Kingdom, Ireland, Sweden, Romania, Greenland, Spain, Poland, Czech Rep., Finland, Italy, Ukraine, Denmark, Estonia, Latvia.	Somalia, Kenya Turkey, Antarctica
Girardia **cf.** *tigrina*	Spain, Netherlands, Poland, Italy, Germany, France, Belgium, Austria.	Japan, Australia
Phagocata sp.	Europe	Armenia

Another five species have been described for this region, namely *Gieysztoria chiqchi*, G. *kasasapa*, *G. sasa*, *Sergia calae* and *Mesostoma ucamara* (Damborenea *et al.*, 2005, Noreña *et al*., 2006). The genus *Gieystoria* is well represented and distributed in South America (as it is in the rest of the world), with high degree of speciation. This taxon comprises approximately 73 species, and 24 of them are described only for South America. The genus *Sergia* could be considered as cosmopolitan (Europe, Africa and South America), but its species are endemic to different areas: *Sergia sergia* (Beklemischev, 1918) Nassonov 1923 was found only in Russia, *Sergia mancala* Marcus & Marcus, 1957 only in Africa and *Sergia calae* in Peru. A similar pattern occurs in genus *Mesostoma* within the *Mesostoma lingua*-group (Noreña & Faubel, 1992). The taxon is distributed worldwide, but specific representatives of this species-complex occur in particular regions. On the contrary, *Mesostoma ehrenbergi* is cosmopolitan, and the populations differ only in their pigmentation pattern.

More studies in the Neotropical region are needed in order to establish biogeographical models of distribution, and thanks to the newly published data, these are feasible goals for the near future. The study of microturbellarians in South America will increase the knowledge about the diversity of the group in this region, and therefore contribute to the collection of data necessary for reliable biogeographical and kinship analyses.

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