ACTA BIOLÓGICA COLOMBIANA

Research article

Diversity of aquatic and semi-aquatic Heteroptera (Insecta) assemblages from two urban rivers in Northwestern Argentina

Diversidad del ensamble de Heteroptera (Insecta) acuáticos y semiacuáticos de dos ríos urbanos del Noroeste Argentino

Graciela Cecilia Gomez[1] https://orcid.org/0000-0002-1280-6293

Eugenia Fernanda Contreras[2] https://orcid.org/0009-0003-9827-1326

[1]Universidad Nacional de Jujuy-CONICET, Avenida Bolivia 1661, San Salvador de Jujuy, Jujuy, Argentina

[2]Universidad Nacional de Jujuy-CONICET, Avenida Bolivia 1661, San Salvador de Jujuy, Jujuy, Argentina

* ***For correspondence:*** gracielagomez@inbial.unju.edu.ar

Received: 5 September 2024. **Revised**: 11 july 2025. **Accepted**: 05 August 2025

Associate Editor: Allan Henry Smith Pardo

Citation: Gomez, G. C., and Contreras, E. F. (2025). Diversity of aquatic and semi-aquatic heteroptera (Insecta) assemblages from two urban rivers in Northwestern Argentina. *Acta Biol. Colomb.*, *30*(3), XX-XX https://doi.org/10.15446/abc.v30n3.116492

ABSTRACT

In Argentina, studies on aquatic Heteroptera have been conducted in the northwestern, northeastern, Pampean, Cuyo, and Patagonian regions, most of which have been carried out in protected areas. In the province of Jujuy, these insects have been poorly studied in urban environments; therefore, the objective of this study was to assess the diversity and abundance of aquatic and semi-aquatic Heteroptera from two urban rivers in San Salvador de Jujuy (Jujuy Province, Argentina). Three sampling sites were selected on the Xibi-Xibi and Río Grande rivers, and two sampling campaigns were conducted during the dry and wet seasons of 2021. Heteroptera were collected using a Surber net. A list of the taxa present in the area is provided, including five genera belonging to four families. The aquatic and semi-aquatic Heteroptera assemblages of the Xibi-Xibi and Río Grande rivers were similar in terms of diversity. However, significant temporal differences were observed, with the rainy season exhibiting greater diversity than the dry season. The genus *Rhagovelia* was the most abundant in both rivers, while *Ambrysus* and *Nerthra* were exclusive to the Xibi-Xibi and Río Grande rivers, respectively. This represents the first contribution to the knowledge of aquatic and semi-aquatic Heteroptera in urban environments of San Salvador de Jujuy.

Keywords: Aquatic true bugs, Gelastocoridae, Jujuy, Naucoridae, Vellidae.

RESUMEN

En Argentina existen estudios referidos a heterópteros acuáticos en las regiones Noroeste, Noreste, Pampeana, Cuyo y Patagonia, la mayoría de ellos desarrollados en áreas protegidas. En la provincia de Jujuy, estos insectos han sido poco estudiados en ambientes urbanos, por lo cual, el objetivo del trabajo fue conocer la diversidad y abundancia de los heterópteros acuáticos y semiacuáticos de dos ríos urbanos de San Salvador de Jujuy (provincia de Jujuy, Argentina). Se seleccionaron tres sitios de muestreo en los ríos Xibi-Xibi y Río Grande y se realizaron dos campañas de muestreo en las temporadas seca y lluviosa del 2021. Para la colecta de heterópteros se utilizó red Surber. Se presenta una lista de los taxones presentes en el área que incluye cinco géneros pertenecientes a cuatro familias. Los ensambles de heterópteros acuáticos y semiacuáticos de los ríos Xibi-Xibi y Río Grande son similares en términos de diversidad. Sin embargo, a nivel temporal se encontraron diferencias significativas, siendo la temporada lluviosa más diversa que la temporada seca. El género *Rhagovelia* fue el más abundante en ambos ríos, mientras que *Ambrysus* y *Nerthra* fueron exclusivos del río Xibi-Xibi y Río Grande, respectivamente. Se realiza el primer aporte al conocimiento de chinches acuáticas y semiacuáticas de ambientes urbanos de San Salvador de Jujuy.

Palabras clave: Chinches acuáticas, Jujuy, Vellidae, Gelastocoridae, Naucoridae.

INTRODUCTION

The insects commonly known as water bugs belong to the order Hemiptera (suborder Heteroptera). Based on their habitat, two types can be recognized: semi-aquatic (infraorder Gerromorpha), which inhabit the surface film of water, and truly aquatic (infraorder Nepomorpha), which live below the water surface (Mazzucconi *et al*., 2009; Melo, 2009).

Heteroptera species are a significant component of aquatic insect communities and can be found in a diverse range of environments, including natural lentic, lotic, coastal, oceanic, and phytotelmata habitats, with an altitude range from 0 to 4700 m s.n.m. (Bachmann, 1998; Mazzucconi *et al*., 2009; Melo, 2009).

Aquatic and semi-aquatic Heteroptera inhabit all continents except Antarctica, with the greatest diversity found in the Neotropical and Oriental regions, which host 1289 and 1103 species, respectively (Melo, 2009). In South America, this fauna includes six families, 43 genera, and approximately 380 species of Gerromorpha, and ten families, 39 genera, and about 510 species of Nepomorpha (Mazzucconi *et al*., 2009).

In Argentina, there are several studies on the fauna of aquatic and semi-aquatic heteropterans, most of which were developed in protected areas. Melo (2009) studied the diversity of aquatic and semi-aquatic Heteroptera in Patagonia, and found that 40 % of the species recorded in protected natural areas are exclusive to the region.

On the other hand, in the Pampean region, the studies by Kanopko *et al*. (2009) are noteworthy for their compilation of a list of Heteroptera species present in the water bodies of Ernesto Tornquist Provincial Park (Buenos Aires Province). Additionally, Torres *et al.*

(2007) provided data on the diversity and distribution of aquatic beetles and Heteroptera in El Palmar National Park, located in Entre Ríos Province.

In the Cuyo region, Scheibler *et al.* (2016) assessed the altitudinal and temporal variation of Heteroptera assemblages in mountain wetlands of Mendoza, where they found a simplified community structure and low species richness.

In the Northeast region, the contributions of López Ruf *et al.* (2003) are notable for their presentation of a list of aquatic and semi-aquatic Heteroptera species found in Mburucuyá National Park, in Corrientes Province. Additionally, Mazzucconi *et al.* (2008) published a list of Gerromorpha and Nepomorpha species from Salto Encantado Provincial Park in the Cuñá Pirú Valley, Misiones Province.

In the Northwestern region of the country, knowledge of aquatic and semi-aquatic Heteroptera is limited to the province of Jujuy. Torres *et al.* (2008) presented a list of Heteroptera species associated with aquatic environments in Calilegua National Park. On the other hand, studies conducted by Gomez *et al.* (2022) in the rivers of the Rio Grande basin confirmed variations in the composition of the aquatic and semi-aquatic Heteroptera assemblage along an altitudinal gradient ranging from 736 to 3,693 m s.n.m. The main collector in this basin is the Río Grande, and one of its tributaries is the Xibi-Xibi; both rivers have stretches that flow through the city of San Salvador de Jujuy.

Different studies document that in urban environments, environmental factors such as the presence of multiple potential hosts, climatic conditions, urban warming, air flows, pollution, and daily fluctuations can interact (Posada and Ramos-Montaño, 2012; Meineke *et al*., 2013).

Arthropods, and insects in particular, remain a relatively poorly understood group in urban settings (McIntyre, 2000). The composition of Heteroptera assemblages associated with the urban sectors of the Río Grande and Xibi-Xibi rivers has not yet been studied. Previous research on these rivers has focused on the general macroinvertebrate community structure (Gomez, 2025), but specific studies on Heteroptera composition remain lacking. The objective of this study was to determine the diversity and abundance of aquatic and semi-aquatic Heteroptera in two urban rivers in San Salvador de Jujuy (Jujuy Province, Argentina).

MATERIALS AND METHODS

Study area

Corresponds to the Yungas province, located on the eastern slopes of the Andes, between 300 and 3500 m s. n. m. The climate is very humid due to abundant rainfall and fog, which almost continuously covers the mountains. In the Argentine portion of the Yungas province, three districts have been recognized: Transition Forests (350-600 m s. n. m.), Montane Rainforests (500-1500 m s. n. m.), and Upper Montane Forests (1200-2500 m s. n. m.) (Arana *et al*., 2021).

Two urban rivers that cross the city of San Salvador de Jujuy (Jujuy Province, Argentina) were selected: the Río Grande and the Xibi-Xibi. The Río Grande is the main collector of the eponymous basin; it originates in the Tres Cruces locality (3707 m s. n. m.) and flows in a north-south direction until it reaches the Reyes river, covering an approximate distance of 120 km. From there, it changes course towards the east, south of the Sierras de Zapla (800 m s. n. m.) (Paleari, 1986). The Xibi-Xibi river extends for 10 km and is a tributary of the Río

Grande. A section of the Xibi-Xibi river is protected by the Xibi-Xibi Municipal Nature Reserve, which features an urban landscape and contains a small fraction of riverside vegetation, surrounded by retaining walls and crossed by bridges (Zamar, 2017).

Sampling

Three sampling sites were selected along the Xibi-Xibi and Río Grande rivers, following an altitudinal and urbanization gradient that increased downstream (Table 1). Two sampling campaigns were conducted during the dry (October-November) and wet (March) seasons of 2021. In the first campaign, samples were collected at two sites in the Río Grande, resulting in a total of five sampling events.

To collect Heteroptera specimens, quantitative samples were taken at six sites (three replicates per site using a Surber net with a 0.09 m^2 aperture and 250 µm mesh) during both the dry and wet seasons (n = 33 samples). The collected material was transferred to labeled jars and preserved in 96 % ethanol.

Identification and preservation of the specimens

The Heteroptera specimens obtained in the field were sorted and quantified under a stereoscopic magnifier (Nikon SMZ 800) and preserved in 70 % ethanol. Identification at the genus level was performed using the keys of Mazzucconi *et al*. (2009) and Heckman (2011). The specimens were deposited in the Entomological Collection "Dra. Lilia Estela Neder" at Instituto de Biología de la Altura (INBIAL-EN) of Universidad Nacional de Jujuy.

Data analysis

To perform the analysis, an abundance matrix of the genera from the Río Grande and Xibi-Xibi rivers was created. Abundances were expressed as the total number of individuals present (absolute abundance). To estimate and compare the diversity of Heteroptera in both rivers and during the two hydrological periods, Hill numbers (qD) were used, considering q values from 0 to 2, with a 95 % confidence interval. The qD values can be interpreted as effective numbers of genera, where q = 0 corresponds to genus richness, q = 1 corresponds to the exponential of Shannon's entropy, and q = 2 corresponds to the inverse of the Simpson index. The results were presented as a continuous function of the parameter q (Chao *et al*., 2014; Chao and Jost, 2015).

Non-metric multidimensional scaling (NMDS) analysis was employed to visualize similarities in Heteroptera assemblage structure between sites and hydrological periods. Additionally, rank-abundance curves were created to compare the fauna of the Río Grande with that of the Xibi-Xibi. For all statistical analyses, R software version 4.3.2 was used.

RESULTS

Structure and diversity of aquatic and semi-aquatic Heteroptera at temporal and spatial scales

A total of 101 Heteroptera individuals, representing four families and five genera, were collected (Table 2). The relative abundances of the Heteroptera families present in both rivers were as follows: Veliidae (95%), Hebridae (3%), Gelastocoridae (1%) y Naucoridae (1%).

In the diversity profiles of the Xibi-Xibi and Río Grande rivers (Figure 2A), the confidence intervals overlap, indicating that there is no significant difference in diversity values for orders 0, 1, and 2.

On the other hand, based on the temporal diversity profile (Figure 2B), no differences in richness (q=0) were observed between hydrological seasons. However, for the diversity measure of order 1 (q=1), it was found that the rainy season was 1.8 times more diverse than the dry season. The diversity of order 2 (q=2) exhibited a similar pattern, with the rainy season being 1.7 times more diverse than the dry season.

In the non-metric multidimensional scaling (NMDS) ordination analysis (Figure 3), it was observed that the Río Grande river, during the dry season, was characterized by *Hebrus* sp. in the upper reach (RG12), *Rhagovelia* sp. in the middle reach (RG22), and *Nerthra* sp., in the lower reach (RG32). Conversely, the Xibi-Xibi river, during the dry season, was characterized by *Ambrysus* sp. in the upper reach (XX12) and by *Microvelia* sp. in the middle (XX22) and lower reaches (XX32). Furthermore, during the rainy season, the Xibi-Xibi river was predominantly characterized by *Rhagovelia* sp. in the upper (XX11) and middle reaches (XX21).

The rank-abundance curves (Figure 4) show that the Xibi-Xibi river has higher evenness than the Río Grande, as evidenced by its gentler slope compared to the steeper curve of the latter.

The assemblages of both rivers were dominated by *Rhagovelia* sp. (Xibi-Xibi: 77 %; Río Grande: 91 %). On the other hand, *Rhagovelia* sp., *Microvelia* sp., and *Hebrus* sp. were

genera common in both rivers, while *Ambrysus* sp. and *Nerthra* sp. were recorded only in the Xibi-Xibi and Río Grande rivers, respectively.

DISCUSSION

In the urban rivers Xibi-Xibi and Río Grande, four families of aquatic and semi-aquatic bugs were recorded, with Veliidae being the most abundant, representing 95 % of the community. This result is consistent with other studies conducted in the Río Grande basin (Jujuy, Argentina), where Veliidae was reported as the most numerous family, though with a lower relative abundance value (55 %) (Gomez *et al*., 2022). The success of this family in Heteroptera assemblages may be attributed to its ability to occupy a wide range of habitats, including permanent, temporary, natural, and artificial water bodies (Mazzucconi *et al*., 2009; Schuh and Weirauch, 2020), as well as to its gregarious behavior (Andersen, 1982). The remaining families (Hebridae, Gelastocoridae, Naucoridae) had very low abundance (1 to 3 %), consistent with the records of Gomez *et al.* (2022) in the Yungas ecoregion of Jujuy province.

Based on the diversity profile, assemblage diversity was similar between rivers at the spatial scale, whereas at the temporal scale it was significantly higher during the rainy season. Likely linked to seasonal hydrological changes that modify the composition and density of aquatic invertebrate communities (Tejerina and Molineri, 2007; Moya *et al*., 2009; Mesa, 2010).

On the other hand, the rank-abundance curves showed that the genus *Rhagovelia* Mayr, 1865 dominated the assemblages in both the Río Grande and Xibi-Xibi rivers. These water bodies, which belong to the Yungas ecoregion, are characterized by thick sediments, turbulent

waters, and lush riparian vegetation (Gomez and Molineri, 2022; Gomez *et al*., 2022). *Rhagovelia* species inhabit streams in jungle areas with moderate to rapid currents and move through the water using their middle legs (via tarsal feathery fans) as oars (Bachmann, 1998; Mazzucconi *et al*., 2009).

The other common genera in both rivers were *Microvelia* Westwood (1834) and *Hebrus* Curtis, 1879. According to studies by Bachmann (1998) and Mazzucconi *et al.* (2009), species of both genera typically inhabit the surface of lentic environments with vegetated margins, slow-flowing streams, emerging plants, and rocks, as well as sandy and muddy banks. In contrast to these findings, this study recorded *Microvelia* sp. and *Hebrus* sp. in fast-flowing mountain rivers. It is possible that the specimens collected were drifting from the banks or from backwater areas. In Jujuy Province, previous records of *Microvelia* and *Hebrus* are associated with the Xibi-Xibi river near site XX1, where urbanization begins, and with the Río Grande river in a section downstream of the city of San Salvador de Jujuy (Gomez *et al*., 2022). Likewise, Torres *et al*. (2008) cite the following species for Calilegua National Park: *Hebrus* sp., *Microvelia* sp., *M. longipes* Uhler 1984, *M. mimula* White 1879, and *M. hungerfordi* McKinstry 1937.

The only genus recorded exclusively in Río Grande was *Nerthra* Say, 1832, which was found only in the lower reaches during the dry season (RG32). Bachmann (1998) and Gomez *et al*. (2022) indicate that species of this genus are typically found on banks with fine sediments in both lentic and lotic environments, where water accumulates. In Jujuy Province, Gomez *et al*. (2022) reported *Nerthra* in a section of the Río Grande river corresponding to a semi-arid environment in the Prepuna region (locality of Tumbaya). In contrast, this study recorded

Nerthra sp. in bodies of water in jungle environments, thus expanding its distribution to the Yungas ecoregion.

On the other hand, the Xibi-Xibi river presented a single exclusive genus: *Ambrysus* Stål (1862). Its distribution is restricted to South America, with nine species recorded in Argentina (López Ruf, 2008). All of these species are benthic inhabitants of lotic environments, including streams and mountain rivers with stony bottoms, clear waters, and low current speeds (Bachmann, 1998; López Ruf, 2008; Mazzucconi *et al*., 2009). In Jujuy Province, *Ambrysus* records are associated with the Xibi-Xibi and Yala rivers (Gomez *et al*., 2022) and water bodies in Calilegua National Park: *Ambrysus gemignanii* De Carlo 1950 and *Ambrysus kolla* López Ruf 2004 (Torres *et al.*, 2008).

CONCLUSIONS

This study enhances our understanding of aquatic and semi-aquatic Heteroptera in Argentina and represents the first significant contribution to the knowledge of these insects in the urban environments of San Salvador de Jujuy (Jujuy Province). The results reveal that the Xibi-Xibi and Río Grande rivers exhibit similar diversity of aquatic and semi-aquatic Heteroptera. However, notable temporal variation was observed, with significantly higher values during the wet season than in the dry season. This research establishes a baseline for future ecological studies on aquatic and semi-aquatic Heteroptera in urban areas of northwestern Argentina.

AUTHOR CONTRIBUTIONS

GCG: conception, design, data collection, analysis, and writing of the document; EFC: conception and writing of the document.

ACKNOWLEDGMENTS

This manuscript was supported by the SECTER-UNJu grant (F/009). We also thank Jose Manuel Segovia for creating the map.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

REFERENCES

Andersen, E. A. (1982). *The semiaquatic bugs (Hemiptera, Gerromorpha). Phylogeny, adaptations, biogeography and classification*. Entomonograph, Scandinavian Science Press Ldt. https://doi.org/10.1163/9789004631267

Arana, M. D., Natale, E., Ferretti, N., Romano, G., Oggero, A., Martínez, G., Posadas, P. and Morrone J. (2021). *Esquema biogeográfico de la República Argentina*. Opera Lilloana.

Bachmann, A. O. (1998). Heteroptera acuáticos. In J. J. Morrone and S. Coscarón (Ed.), *Biodiversidad de artrópodos argentinos. Una perspectiva biotaxonómica*(pp. 163-180).. Ediciones Sur.

Chao A., Gotelli, N. J., Hsieh, T. C., Sander, E. L., Ma, K. H., Colwell, R. K. and Ellison, A. M. (2014). Rarefaction and extrapolation with Hill numbers: A framework for

sampling and estimation in species diversity studies. *Ecological Monographs*, *84*(1), 45-67. https://doi.org/10.1890/13-0133.1

Chao, A. and Jost, L. (2015). Estimating diversity and entropy profiles via discovery rates of new species. *Methods in Ecology and Evolution*, *6*(8), 873-882. https://doi.org/10.1111/2041-210X.12349

Gomez, G. C., Contreras, E. F. and Torrejon, S. E. (2022). Diversity of the Heteroptera (Insecta: Hemiptera) aquatic and semi-aquatic assemblage of the Río Grande basin (Jujuy-Argentina) in an altitudinal and temporal gradient. *Revista de la Sociedad Entomológica Argentina*, *81*(2), 29-38. https://doi.org/10.25085/rsea.810203

Gomez, G. C. and Molineri, C. (2022). Water quality assessment along a heterogeneous basin (Río Grande, Jujuy, Argentina). *Ecología Austral*, *32*(1), 1-8. https://doi.org/10.25260/EA.22.32.1.0.1704

Gomez, G. C. (2025). Comparative study of the macroinvertebrate assemblages of two urban rivers of Jujuy, Argentina. *Anais Academia Brasileira da Ciências*, *97*(4), e20231359. https://doi.org/10.1590/0001-3765202520231359

Heckman, C. W. (2011). *Encyclopedia of South American aquatic insects: Hemiptera - Heteroptera, Illustrated keys to known families, genera, and species in South America*. Springer. https://doi.org/10.1007/978-94-007-0705-4

Kanopko, S., Mazzucconi, S., López Ruf, M. and Bachmann, A. (2009). Los heterópteros acuáticos y semiacuáticos del Parque Provincial Ernesto Tornquist (Provincia de Buenos Aires, República Argentina). *Revista de la Sociedad Entomológica Argentina*, *68*(3-4), 271-282.

López Ruf, M. L., Mazzucconi, S. A. and Bachmann, A. O. (2003). Heteroptera acuáticos y semiacuáticos del Parque Nacional Mburucuyá (Provincia de Corrientes, Argentina). *Revista de la Sociedad Entomológica Argentina*, *62*(1-2), 65-71.

López Ruf, M. L. (2008). Naucoridae. In L. Claps, G. Debandi and S. Roig-Juñet (Ed.), *Biodiversidad de artrópodos argentinos*(pp. 201-2079). Sociedad Entomológica Argentina.

Mazzucconi, S.. A, López Ruf, M. and Bachmann, A. O. (2008). Gerromorpha y Nepomorpha (Insecta: Heteroptera) del Parque Provincial Salto Encantado del Valle del Cuñá Pirú, Provincia de Misiones, Argentina. *Lundiana*, *9*(1), 57-66. https://doi.org/10.35699/2675-5327.2008.23215

Mazzucconi, S., López Ruf, M. and Bachmann, A. (2009). Hemiptera-Heteroptera: Gerromorpha y Nepomorpha. In E. Domínguez and H. Fernández (Ed), *Macroinvertebrados bentónicos sudamericanos*(pp. 167-231). Fundación Miguel Lillo.

McIntyre, N. 2000. Ecology of urban arthropods: a review and call to action. *Annals of the Entomological Society of America*, *94*(4), 825-835. https://doi.org/10.1603/0013-8746(2000)093[0825:EOUAAR]2.0.CO;2

Meineke, E. K., Dunn, R. R., Sexton, J. O. and Franks, S. D. (2013). Urban warming drives insects pest abundance on Street tres. *PloS One*, *8*(3), e59687. https://doi.org/10.1371/journal.pone.0059687

Melo, M. C. (2009). Biodiversidad de Heteroptera (Hemiptera) acuáticas y semiacuáticas de la Patagonia argentina. *Revista de la Sociedad Entomológica Argentina*, *68*(1-2), 177-185.

Mesa, L. M. (2010). Effect of spates and land use on macroinvertebrate community in Neotropical Andean streams. *Hydrobiologia, 641*(1), 85-95. https://doi.org/10.1007/s10750-009-0059-4

Moya, N, Gibon, F. M., Obendorff, T., Rosales, C. and Domínguez, E. (2009). Comparación de las comunidades de macroinvertebrados acuáticos en ríos intermitentes y permanentes del altiplano boliviano: implicancias para el futuro cambio climático. *Ecología Aplicada, 8*(2), 105-114. https://doi.org/10.21704/rea.v8i1-2.387

Paleari, A. (1986). Diccionario geográfico de la provincia de Jujuy. Instituto Geográfico Militar.

Posada, R. H. and Ramos-Montaño, C. (2012). Efecto de la precipitación en la distribución de insectos plaga y síntomas de enfermedades en el arbolado urbano de Bogotá. Primer Congreso latinoamericano de ecología urbana (p. 14).

Scheibler, E. E., Melo, M. C., Montemayor, S. I. and Scollo, A. M. (2016). Abundance, richness, seasonal and altitudinal dynamics of aquatic true bugs (Heteroptera) in mountain wetlands of Argentina. *Wetlands, 36*, 265-274. https://doi.org/10.1007/s13157-016-0735-x

Schuh, R. T. and Weirauch, C. (2020). *True Bugs of The World (Hemiptera: Heteroptera): Classification and Natural History* . Siri Scientific Pres.

Tejerina, E. G. and Molineri, C. (2007). Comunidades de Chironomidae (Diptera) en arroyos de montaña del NOA: comparación entre Yungas y Monte. *Revista de la Sociedad Entomológica Argentina., 66*(3-4), 169-177.

Torres, P. L. M., Mazzucconi, S. A. and Michat, M. C. (2007). Los coleópteros y heterópteros acuáticos del Parque Nacional El Palmar (Provincia de Entre Ríos, Argentina): lista

faunística, diversidad y distribución. *Revista de la Sociedad Entomológica Argentina*, *66*(3-4), 127-153.

Torres, P. L. M., Mazzucconi, S. A., Michat, M. C. and Bachmann, A. O. (2008). Los coleópteros y heterópteros acuáticos del Parque Nacional Calilegua (Provincia de Jujuy, Argentina). *Revista de la Sociedad Entomológica Argentina, 67*(1-2), 127–144.

Zamar, Z. (2017). *Recuperación paisajística ambiental y puesta en valor del río Xibi Xibi*. [Tesis de maestría]. Universidad Nacional de Córdoba.

Table 1. Sampling sites.

Site	Code	Latitude-longitude	Altitude (m s.n.m.	Site	Code	Latitude-longitude	Altitude (m s.n.m.)
Xibi-Xibi 1	XX1	24º11’36” S 65º19’36” W	1325	Río Grande 1	RG1	24º10’33” S 65º19’12” W	1276
Xibi-Xibi 2	XX2	24º11’21” S 65º18’23” W	1280	Río Grande 2	RG2	24º10’30” S 65º18’33” W	1265
Xibi-Xibi 3	XX3	24º11’21” S 65º17’50” W	1259	Río Grande 3	RG3	24º11’11” S 65º16’51” W	1224

Table 2. Total abundance of aquatic and semi-aquatic Heteroptera from two urban rivers (Jujuy, Argentina) collected during the dry and wet seasons of 2021. Sites with no collected Heteroptera specimens were excluded. The first two letters and the first number indicate the site (see Table 1), while the second number indicates the season (1 = wet, 2 = dry).

Family	**Taxon**	**Codes**	**XX11**	**XX12**	**XX21**	**XX22**	**XX32**	**RG12**	**RG22**	**RG32**
Veliidae	*Rhagovelia* sp.	Rhag	30	6	12	0	3	0	18	14
	Microvelia sp.	Micr	0	2	1	1	8	0	1	0
Hebridae	*Hebrus* sp.	Hebr	0	1	1	0	0	1	0	0
Gelastocoridae	*Nerthra* sp.	Nert	0	0	0	0	0	0	0	1
Naucoridae	*Ambrysus* sp.	Ambr	0	1	0	0	0	0	0	0

Figure 1. Map of San Salvador de Jujuy city (Jujuy Province, Argentine) with site locations. Codes for the sites are the same showed in Table 1.

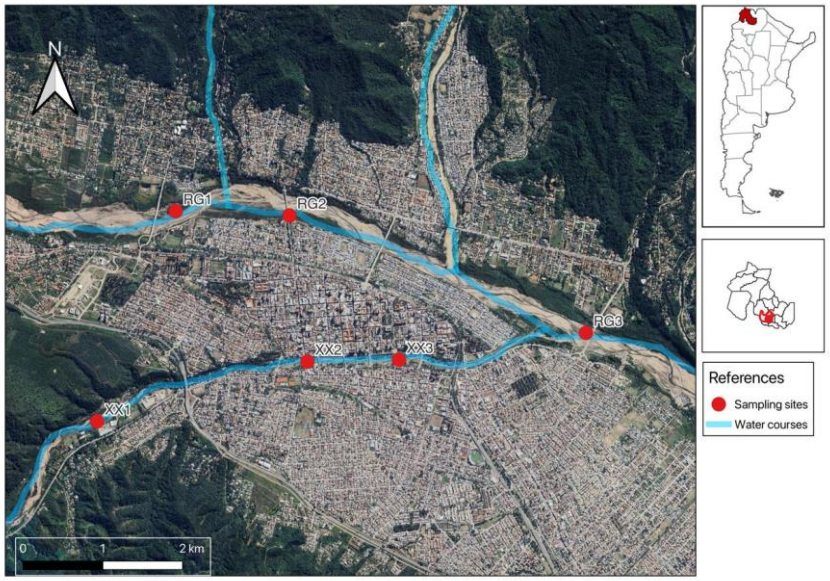

Figure 2. Diversity profiles of Heteroptera genera from the Xibi-Xibi and Río Grande rivers, based on Hill numbers (the shaded area represents the 95 % confidence interval). a) Spatial scale, b) Temporal scale.

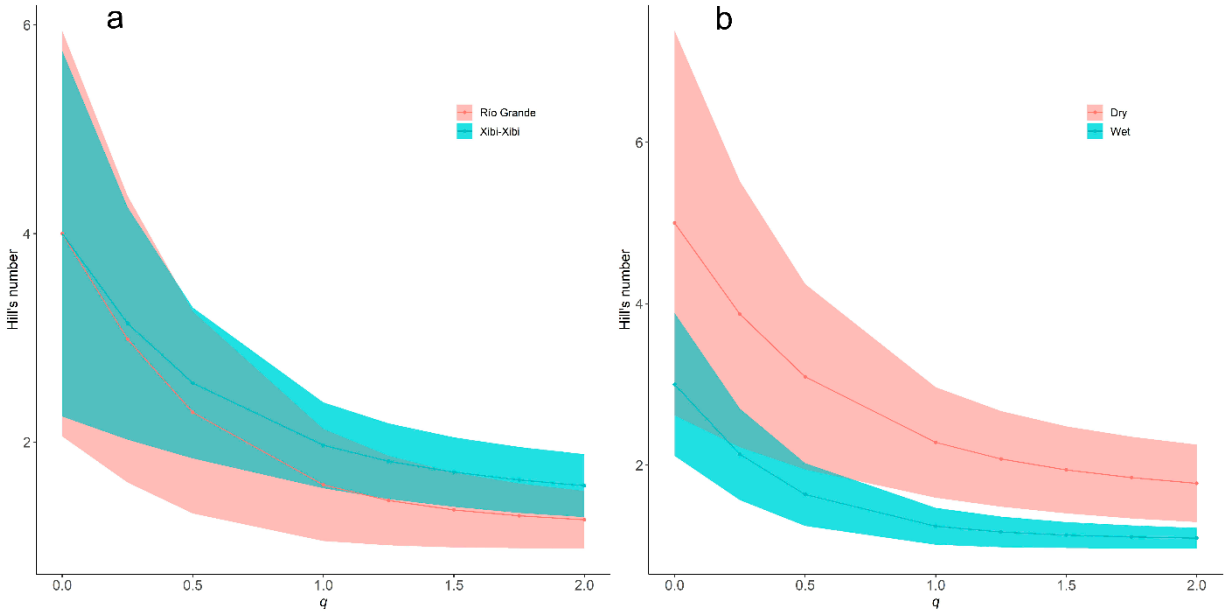

Figure 3. Non-metric multidimensional scaling (NMDS) ordination of the two urban rivers (Jujuy, Argentina) based on the total abundance of Heteroptera during the wet and dry seasons. Codes for the taxa are listed in Table 1.

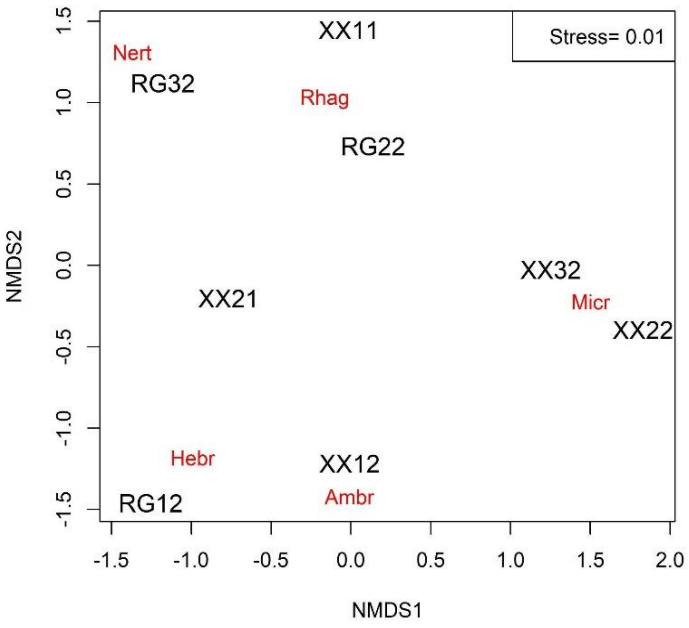

Figure 4. Rank-abundance curves of aquatic and semi-aquatic Heteroptera present in two urban rivers of San Salvador de Jujuy (Jujuy, Argentina). Codes for the taxa are listed in Table 1.