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Geographical distribution note of the species of *Paracymus* Thomson, 1867, from Venezuela (Coleoptera: Hydrophilidae: Hydrophilinae)

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ABSTRACT

This research presents the geographical distribution of 50 species of *Paracymus* (Coleoptera: Hydrophilidae) inhabiting Venezuela, within a subregion, two biogeographical domains, and four provinces, following the Neotropical regionalization. The spatial distribution of these species represented on an attached map, which shows an extract of the Neotropical region from northern South America.

Key words: Hydrophilidae, Neotropical, *Paracymus*, neotropical regionalization, geographical distribution.

Nota distributiva geográfica de las especies de *Paracymus* Thomson, 1867, de Venezuela (Coleoptera: Hydrophilidae: Hydrophilinae)

RESUMEN

Esta investigación presenta la distribución geográfica de 50 species de *Paracymus* (Coleoptera: Hydrophilidae) que habitan en Venezuela, dentro de una subregión, dos

dominios biogeográficos y cuatro provincias, siguiendo el marco de regionalización neotropical. La distribución espacial de estas especies se representa en un mapa adjunto, que constituye una extracción de la región Neotropical del norte de Sudamérica.

Palabras clave: Hydrophilidae, neotropical, *Paracymus*; regionalización neotropical, distribución geográfica.

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INTRODUCTION

The geographic distribution of *Paracymus* species in Venezuela categorizes geographic areas in terms of their biota (Escalante 2009); this is an essential tool for understanding the distribution of terrestrial biodiversity. By categorizing geographic areas based on their characteristic biota, a hierarchy is established that facilitates the analysis of the interrelationships between species and their respective environments.

The primary objective of this research was to represent the distribution of the 50 species belonging to the genus *Paracymus* in Venezuela, identifying the distribution of species throughout the Pacific and Brazilian Boreal domains, as well as in the biogeographic provinces of La Guajira (states of Mérida, Táchira, Trujillo, and Zulia), Venezuela (states of Aragua, Anzoátegui, Carabobo, Capital District, Falcón, Miranda, Sucre), Sabana (states of Lara, Portuguesa, Cojedes, Guárico, Anzoátegui, Monagas, Barinas, Apure), and Pantepuy (states of Bolívar and Amazonas), reflecting the remarkable environmental heterogeneity of the Venezuelan territory. In short, this study contributes to our knowledge of the biodiversity of aquatic beetles in the country and highlights the importance of considering biogeographical divisions when designing effective conservation strategies.

MATERIALS AND METHODS

This research uses the geographical context within the Neotropical region proposed in Morrone (2014) and Morrone *et al*. (2022) without standardizing a biogeographic study, it only embeds the fundamental hierarchical division such as subregions, domains, provinces, and districts, superimposed on the geographic regions in Venezuela, based on previous works such as those by Ebach *et al*. (2008) and Escalante (2009).

The type material examined in this research was deposited in the collection of the Arthropod Museum of the Universidad del Zulia, located in Maracaibo, Zulia State, Venezuela. The biogeographic distribution framework for this study is the Neotropical regionalization proposed by Morrone (2014) and Morrone *et al.* (2022). Based on this proposal, a list was drawn up and included in a geographical map of Venezuela (Fig. 1) in order to visualize the distribution of species of the genus *Paracymus* in the Venezuelan biogeographic units corresponding to the Brazilian subregion.

These units comprise the Pacific domain, which includes the provinces of La Guajira (Maracaibo district), Venezuela, and Sabana, and the Brazilian Boreal domain, province of Pantepuy. The resulting map is an adaptation of Figure 12 presented in Morrone (2014: 24). The distribution of species is presented as a hierarchically organized list, following the biogeographic classification established in the regionalization of the Neotropical region of northern South America, proposed by Morrone (2014) and Morrone *et al.* (2022). This map of Venezuela (Fig. 1) is superimposed and adapted as a modification of Morrone (2014), allowing the visualization of the distribution of species in the different biogeographic areas of northern South America.

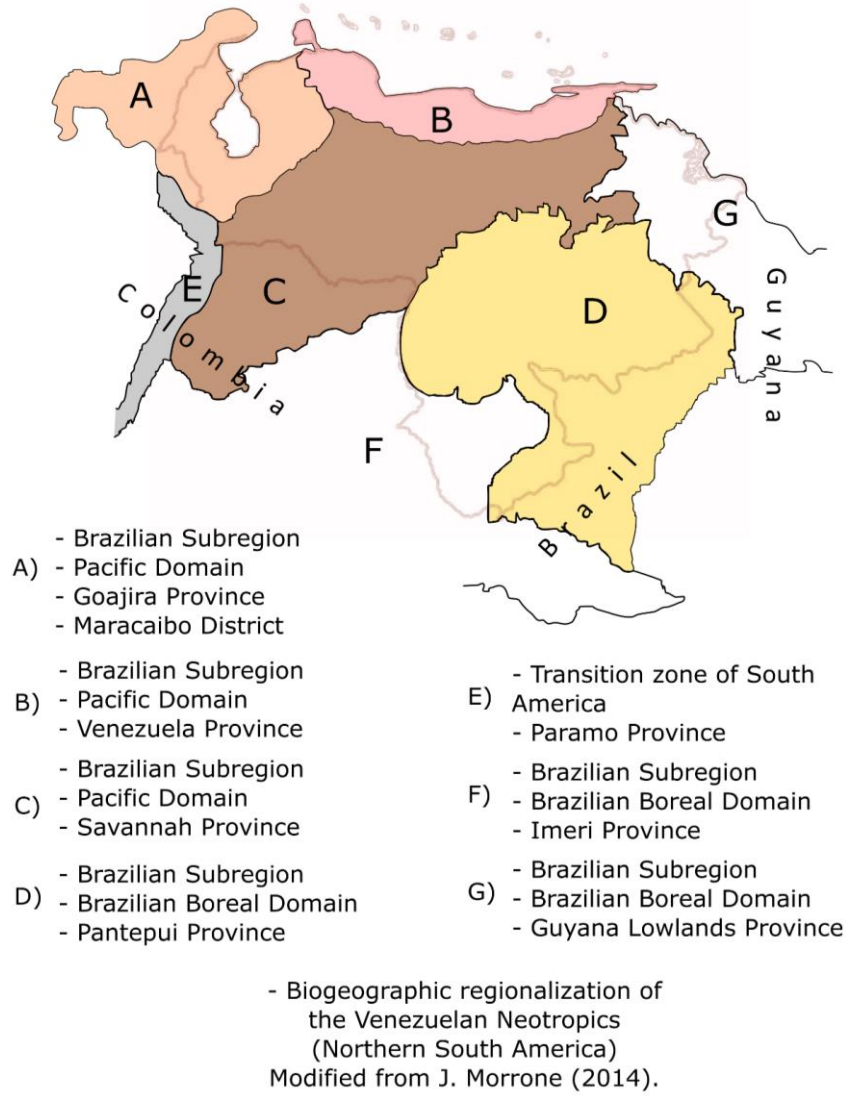

Figure 1. Biogeographic regionalization of the genus *Paracymus* in Venezuelan (Northern South America) modified from Morrone (2014).

RESULTS

Neotropical Region Sclater (1858)
Brazilian Subregion Blyth 1871: 428

Brazilian Subregion A
Pacific Domain Cabrera and Willink1973: 52
Guajira Province Cabrera and Willink1973: 46.
Maracaibo District Müller1973
Zulia State: Lake Maracaibo Depression.

Paracymus (*Paracymus*) *ailuzus* García y Jiménez, 2022c: 169 - Zulia.
Paracymus (*Escotadus*) *anacolinae* García y Jiménez, 2022c: 173 - Zulia.
Paracymus (*Escotadus*) *barrosi* García, 2022b: 74 - Zulia.
Paracymus (*Escotadus*) *botanicus* García, 2024: 23 - Zulia.
Paracymus (*Escotadus*) *burronegrus* García, 2021b: 30 - Zulia.
Paracymus (*Paracymus*) *ceuta* García, 2022b: 44 - Zulia.
Paracymus (*Escotadus*) *magnum* García, 2022b: 48 – Zulia.
Paracymus (*Escotadus*) *lagoxidacius* García, 2022a: 81 - Zulia.
Paracymus (*Escotadus*) *maracaiboensis* García, 2022b: 48 - Zulia.
Paracymus (*Escotadus*) *pallidecius* García, 2024: 25 - Zulia.
Paracymus (*Escotadus*) *tuberiasus* García, 2022a: 87 - Zulia.
Paracymus (*Escotadus*) *zulianorum* García, 2022b: 51 - Zulia.
Paracymus (*Escotadus*) *zulianus* García, 2021b: 37 - Zulia.
Paracymus (*Lineolu*) *chorroelindius* García, 2022b: 55 - Táchira.
Paracymus (*Paracymus*) *lara* García, 2021a: 202 - Lara.

Brazilian Subregion B
Pacific Domain Cabrera and Willink 1973: 52
Province of Venezuela Cabrera and Willink 1973: 56
State of Sucre: Araya Peninsula.

Paracymus (*Escotadus*) *acostae* García y Jiménez-Ramos, 2020: 105 - Sucre.
Paracymus (*Escotadus*) *aitanae* García y Jiménez-Ramos, 2020: 109 - Sucre.
Paracymus (*Escotadus*) *balkei* García y Jiménez-Ramos, 2020: 110 - Sucre.

Paracymus (*Escotadus*) *marinus* García y Jiménez-Ramos, 2020: 114 - Sucre.
Paracymus (*Escotadus*) *ramosae* García y Jiménez-Ramos, 2020: 118 - Sucre.
Paracymus (*Paracymus*) *mercedesae* García y Jiménez-Ramos, 2020: 119 - Sucre
Paracymus (*Escotadus*) *solarys* García y Jiménez-Ramos, 2020: 120 – Sucre.

Brazilian Subregion C
Pacific Domain Cabrera and Willink 1973: 52
Sabana Province Orfila 1941: 86
Llanos Region in the states of Apure and Guárico

Paracymus (*Lineolu*) *arcuatus* García, 2022b: 53 - Guárico
Paracymus (*Escotadus*) *benettii* García, 2021b: 29 - Guárico.
Paracymus (*Lineolu*) *convexus* García, 2022b: 56 - Apure.
Paracymus (*Lineolu*) *fannyae* García, 2022b: 48 - Apure, Guárico.
Paracymus (*Paracymus*) *insularis* Wooldridge, 1973: 119 - Apure, Guárico.
Paracymus (*Lineolu*) *hemisphaericum* García, 2022b: 59 - Guárico.
Paracymus (*Lineolu*) *lisethae* García, 2022b: 61 - Guárico.
Paracymus (*Paracymus*) *limbatus* Wooldridge, 1973: 120 - Apure, Guárico.
Paracymus (*Paracymus*) *melvae* García, 2021a: 203 - Apure.
Paracymus (*Paracymus*) *ovalus* García, 2022a: 85 - Apure.
Paracymus (*Escotadus*) *venezuelae* García, 2022a: 90 - Apure.
Paracymus (*Escotadus*) *gilsoni* García, 2022a: 77 - Apure.
Paracymus (*Escotadus*) *sandovali* García, 2024: 27 - Apure.
Paracymus (*Paracymus*) *yaruro* García, 2021a: 210 - Apure.

Brazilian Subregion D
Boreal Brazilian Domain Clarke 1892: 381
Province Pantepui Mayr and Phelps 1967: 276
State of Amazonas

*P*aracymus (*Escotadus*) *gavilanensis* García y Jiménez, 2022c: 176 - Amazonas.
*P*aracymus (*Escotadus*) *gavilanus* García y Jiménez, 2022c: 179 - Amazonas.
Paracymus (*Escotadus*) *jirehae* García y Jiménez, 2022c: 182 - Amazonas.
Paracymus (*Escotadus*) *liliae* García y Jiménez, 2022c: 185 - Amazonas.
Paracymus (*Escotadus*) *pemonus* García, 2021a: 31 - Amazonas.
Paracymus (*Paracymus*) *petiti* García, 2021a: 207 (Amazonas.

Paracymus (*Paracymus*) *piaroa* García, 2021a: 205 - Amazonas.
Paracymus (*Escotadus*) *samariapus* García, 2021b: 32 – Amazonas
Paracymus (*Lineolu*) *sanozamaus* García, 2022b: 62 – Amazonas.
Paracymus (*Escotadus*) *surensis* García, 2024: 30 - Amazonas.
Paracymus (*Escotadus*) *toboganensis* García, 2024: 32 - Amazonas.
Paracymus (*Escotadus*) *torresi* García, 2024: 34- Amazonas.
Paracymus (*Escotadus*) *yanomami* García, 2021b: 35 - Amazonas.

DISCUSSION

Paracymus species have a particular geographical distribution in Venezuela, currently concentrated in four main biogeographical provinces (Morrone *et al.* 2022, Morrone 2014): Goajira, Venezuela, Sabana, and Pantepuy. This distribution pattern reflects a complex interaction of historical, geological, and ecological factors that have shaped the evolution and dispersion of species in this genus.

The Pantepui Province, with 13 species, emerges as a center of diversity for the *Paracymus* genus in Venezuela. This region has a diversity of aquatic habitats, providing a wide range of ecological niches. The geological stability of the region and the presence of geographical barriers, such as the Orinoco River, may have limited its distribution, as Pérez-Hernández (1989) points out that this river has acted as a biogeographical barrier, which, as it moved to its current course, modified the distribution of certain species (Pérez-Hernández and Lew 2001).

The Sabana Province. With its extensive floodplains and mighty rivers, this province is home to 14 species of *Paracymus*. The connectivity between the aquatic systems of the Llanos facilitates dispersal, but there is a possibility that geographical barriers, such as the Orinoco and Apure rivers, limit distribution.

The Goajira Province. It includes the Lake Maracaibo depression and the Andean highlands of Venezuela, with their high diversity of aquatic habitats, and is home to 16 species of *Paracymus*, making it the province with the greatest species richness for this

genus. The environmental heterogeneity of this region, with its lakes, rivers, lagoons and wetlands, favors species diversification. In addition, the geological history of the region, marked by changes in sea level and the formation of geographical barriers, may have played an important role in the evolution of these beetles.

The Venezuela Province. With seven species, the Araya Peninsula has less diversity of *Paracymus* compared to the other provinces. However, its strategic location between the Caribbean Sea and the Llanos makes it a biogeographic transition zone. The presence of salt flats and coastal lagoons may have favored the adaptation of some species to saline conditions. This research represents a preliminary study of the distribution of the genus *Paracymus* in Venezuela, as new species are discovered every year, offering a different perspective in each of the provinces involved.

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