



# Corrections and comments on MARTINS-SILVA (2022) “Checklist of Aquatic Heteroptera genera (Insecta: Hemiptera) from Brazilian Savanna (Cerrado Biome), with family and genera identification key”

Felipe Ferraz Figueiredo Moreira<sup>1</sup>, Carla Fernanda Burguez Floriano<sup>1</sup>,  
Fabiano Stefanello<sup>2</sup> & Higor Daniel Duarte Rodrigues<sup>1</sup>

1. Instituto Oswaldo Cruz, Fundação Oswaldo Cruz, Rio de Janeiro, Rio de Janeiro, Brazil. 2. Universidade Estadual do Maranhão, Caxias, Maranhão, Brazil.

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**Abstract.** Recently, MARTINS-SILVA (2022) published the article entitled “Checklist of Aquatic Heteroptera genera (Insecta: Hemiptera) from Brazilian Savanna (Cerrado Biome), with family and genera identification key”. The paper provides information on which genera of aquatic Heteroptera would occur in the *Cerrado* biome and an identification key to families and genera, based on specimens deposited in the Aquatic Invertebrates Collection of the University of Brasília, Brazil. However, it presents many problems, including misidentifications, lack of care with references, scientific names and taxonomic authorities, and poor grammar, syntax and spelling. Here, we express our concern about this paper and provide identification corrections for specimens figured in it whenever possible.

**Keywords:** Hexapoda; inventory; misidentifications; taxonomy; water bugs.

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### ✉ Corresponding author:

Higor Daniel Duarte Rodrigues  
✉ [higorddr@gmail.com](mailto:higorddr@gmail.com)

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Recently, MARTINS-SILVA (2022) published a checklist of the water bug (Insecta: Hemiptera: Heteroptera: Gerromorpha & Nepomorpha) genera occurring in the Brazilian Savanna (*Cerrado* biome), including an identification key to families and genera. The objective of the study was to provide information on which genera of aquatic Heteroptera would occur in the biome, based on specimens deposited in the Aquatic Invertebrates Collection of the University of Brasília, Brazil. These specimens have been collected in three Brazilian states (Goiás, Mato Grosso, and Minas Gerais) and the Federal District. The author identified five families and 12 genera of Gerromorpha, and seven families and 19 genera of Nepomorpha.

Faunistic inventories are important and useful to assess the biodiversity of different regions. The data generated can be used, for example, in predictive analyses and in helping decision makers establish and manage conservation areas. These faunistic studies, in general, consist of a simple list of species found in a given locality or region, without a deep taxonomic treatment, and may or may not contain other notes, such as biological or behavioral observations (PAPAVERO 1994). The article by MARTINS-SILVA (2022) could have been an important contribution to better understand the distribution patterns of water bugs in central Brazil. However, it presents many problems, including misidentifications, lack of care in finding and following a broad scope of references, errors in citing scientific names and taxonomic authorities, and poor grammar, syntax and spelling.

## RESULTS AND DISCUSSION

**What is a checklist in taxonomy and why produce one?** According to PAPAVERO (1994), checklist articles are indexes to certain biological groups that gather the names of all contained taxa and list the most important bibliographic references. In turn, WINSTON (1999) considers checklists to be any study that merely lists species, containing or not a discussion, synonym lists, geographic distributions, or descriptive information. Such lists help broaden the knowledge on species distributions, diminishing the Wallacean shortfall (LOMOLINO 2004), and provide a baseline for biogeographic studies and the conservation of biodiversity. MARTINS-SILVA (2022) does not fit perfectly in PAPAVERO'S (1994) or WINSTON'S (1999) concepts, and the necessity of such a checklist is questionable.

MOREIRA *et al.* (2011) published a much more complete and well-prepared list of the species of water bugs recorded from the whole country, providing a general account of taxa, known geographic distributions, notes (taxonomic and others), graphics and tables, a thorough discussion, and dozens of the most important references. After that, with the establishment of the Taxonomic Catalog of the Brazilian Fauna (BOEGER *et al.* 2022) in 2015, such information is regularly updated by specialists and freely available to all sorts of users. Therefore, if a landmark publication that is not completely outdated and a free source of

updated information on all species of water bugs from Brazil are available, why would it be necessary to publish a checklist of the fauna from three Brazilian states plus the Federal District at the generic level?

Additionally, any taxonomic work, including checklists, should only be produced after a careful survey of the literature, from classic studies to recently published articles. MARTINS-SILVA (2022) did not follow this principle and used outdated classifications for Corixoidea and Naucoridae (Nepomorpha). Micronectidae, once considered a subfamily of Corixidae, is treated as a separate family since NIESER (2002), which was corroborated in recent phylogenetic studies (e.g., WANG et al. 2021) but ignored by MARTINS-SILVA (2022). Naucoridae classification has also gone through many changes recently, both at subfamily and generic levels (SITES 2022), all of which were disregarded by MARTINS-SILVA (2022).

**Are identification keys always useful?** Keys to species are a good starting point for a taxonomist's work by aiding in the identification of specimens based on a summary of diagnostic features available for a given set of taxa. However, for many groups of animals, especially for insects that depend on the examination of genital features for a proper identification, keys to species can be misleading or difficult to follow by non-specialists. That is why many articles that are developed by non-taxonomists rely on specimens identified only to family or genera, which is faster and easier to be accomplished. Keys focused on these taxonomic levels can thus be very important for researchers developing studies on ecology or biomonitoring, for example, which is a good reason to produce them. Unfortunately, this is not the case of the key provided by MARTINS-SILVA (2022). It contains many crass errors, including the impossibility of reaching couplets 3 and 23. Furthermore, it does not direct to any illustrations and includes uninformative (e.g., "short antennae" vs. "long antennae") or simply erroneous characters or terminology (e.g., "hemierlytra", "outer membrane", "long rostrum reaching the outer coxae", "beveled eyes on the back"). Ultimately, it can only lead to errors when used by readers that are unaware of such problems.

On the other hand, well-prepared keys to families and genera can be found, for example, in PANIZZI & GRAZIA (2015), who provided a very extensive review of the Neotropical true bug (Heteroptera) fauna. More recently, the freshwater Hexapoda from the Neotropics also received attention from HAMADA et al. (2018). This book is dedicated to provide extensively illustrated keys to genera developed by dozens of specialists in the local fauna. With these two publications alone, most minimally trained students or researchers can have an overview of the Neotropical fauna and a good chance of attaining proper specimen identifications. By deepening the studies on the references therein provided, one can even start to specialize in one or a few taxa.

**Identifications and new records provided by MARTINS-SILVA (2022).** The author identified 31 genera of Gerromorpha and Nepomorpha, however, representatives of only 18 genera have been figured. Out of these specimens, all identified at the generic level, eight are nymphs. Immature stages are undescribed for most Neotropical water bugs, with a few exceptions (e.g., some gerrids (KONOPKO & MAZZUCCONI 2011), belostomatids (SCHNACK & ESTÉVEZ 1978), corixids (KONOPKO 2014), naucorids (LÓPEZ-RUF 1993), and notonectids (GITTELMAN 1974)). There are no broad scope accounts on the morphological distinction of the nymphs of Neotropical species, no available identification keys with such purpose, and even specialists cannot perfectly determine genera (much less species) within certain families and subfamilies based on immatures. With all this lack of knowledge, one

can only wonder if MARTINS-SILVA (2022) knew that the material examined for the study was composed of nymphs to a great extent, or if even that eluded the author.

Just by checking the photographs provided, we could determine that 13 of the specimens are surely misidentified, while two others (Figures 1A-B, D) are nymphs that cannot be identified with certainty with the current knowledge on the Neotropical fauna of water bugs. The author also identified the genus *Palmaacorixa* Abbott, 1912 (Corixidae) among her samples. This taxon is restricted to North America, and its presence indicates yet another misidentification. Therefore, the entire discussion of the article is compromised, since many of the identifications provided in the results are wrong. Moving to the new records presented in the article, the author stated to be recording the genera *Rheumatobates* Bergroth, 1892 (Gerromorpha: Gerridae) and *Gelastocoris* Kirkaldy, 1897 (Nepomorpha: Gelastocoridae) from Goiás for the first time. However, both genera had already been recorded from the state by NIESER (1970) and TODD (1957), respectively. Below, we give details on the identifications that could be assessed based on the photographs provided by MARTINS-SILVA (2022):

**Figures 1A-B.** Author's identification: *Rheumatobates* (Gerromorpha: Gerridae).

**Updated identification:** The specimen is definitely a gerrid nymph, but identification at the generic level is not possible.

**Figure 1C.** Author's identification: *Ovatametra* Kenaga, 1942 (Gerromorpha: Gerridae).

**Updated identification:** Nymph of *Rhagovelia* Mayr, 1865 (Gerromorpha: Veliidae).

**Figure 1D.** Author's identification: *Brachymetra* Mayr, 1865 (Gerromorpha: Gerridae).

**Updated identification:** The specimen is definitely a gerrid nymph, but identification at the generic level is not possible.

**Figures 1E-F.** Author's identification: *Neogerris* Matsumura, 1913 (Gerromorpha: Gerridae).

**Updated identification:** Female of *Tachygerris* Drake, 1957 (Gerromorpha: Gerridae).

**Figure 1G.** Author's identification: *Trepobates* Uhler, 1894 (Gerromorpha: Gerridae).

**Updated identification:** Female of *Halobatopsis* Bianchi, 1896 (Gerromorpha: Gerridae).

**Figures 2A-B.** Author's identification: *Limnogonus* Stål, 1868 (Gerromorpha: Gerridae).

**Updated identification:** Female of *Neogerris* (Gerromorpha: Gerridae).

**Figures 2C-D.** Author's identification: *Mesovelia* Mulsant & Rey, 1852 (Gerromorpha: Mesoveliidae)

**Updated identification:** Nymph of *Mesovelia*. The author's identification is correct.

**Figures 2E-F.** Author's identification: *Ambrysus* Stål, 1862 (Nepomorpha: Naucoridae).

**Updated identification:** Male of *Maculambrysus* Reynoso-Velasco & Sites, 2021 (Nepomorpha: Naucoridae).

**Figure 2G.** Author's identification: *Cryphocricos* Signoret, 1850 (Nepomorpha: Naucoridae).

**Updated identification:** Adult of *Australambrysus* Reynoso-Velasco & Sites, 2021 (Nepomorpha: Naucoridae)

**Figure 2H.** Author's identification: *Limnocoris* Stål, 1860 (Nepomorpha: Naucoridae).

**Updated identification:** Nymph of *Limnocoris*. The author's identification is correct.

**Figures 3A-B.** Author's identification: *Weberiella* De Carlo, 1966 (Nepomorpha: Belostomatidae).

**Updated identification:** Male of *Australambrysus* (Nepomorpha: Naucoridae).

**Figure 3C.** Author's identification: *Belostoma* Latreille, 1807 (Nepomorpha: Belostomatidae).

**Updated identification:** Male of *Cryphocricos* (Nepomorpha: Naucoridae).

**Figure 3D.** Author's identification: *Hebrus* Curtis, 1833 (Gerromorpha: Hebridae).

**Updated identification:** Adult of Saldidae (Leptodomorpha).

**Figure 3E-F.** Author's identification: *Gelastocoris* (Nepomorpha: Gelastocoridae).

**Updated identification:** Nymph of *Gelastocoris*. The author's identification is correct.

**Figure 3G-H.** Author's identification: *Hydrometra* Latreille, 1797 (Gerromorpha: Hydrometridae).

**Updated identification:** Nymph of *Ranatra* Fabricius, 1790 (Nepomorpha: Nepidae).

**Figure 4A-C.** Author's identification: *Heterocorixa* White, 1879 (Nepomorpha: Corixidae).

**Updated identification:** Female of *Sigara* Fabricius, 1775 (Nepomorpha: Corixidae).

**Figure 4D-F.** Author's identification: *Tenagobia* Bergroth, 1899 (Nepomorpha: Corixidae).

**Updated identification:** Nymph of *Martarega* White, 1879 (Nepomorpha: Notonectidae).

**Figure 4G.** Author's identification: *Sigara* (Nepomorpha: Corixidae).

**Updated identification:** The author provided only a photo of the ventral habitus, which prevents us from properly verifying the identification. It appears to be a female of *Heterocorixa* (Nepomorpha: Corixidae).

**Incorrect subsequent spellings.** The correct spelling of scientific names in taxonomic articles is critically important, because a difference in just one letter from one name to another is enough to validate both names, and a single mistakenly changed letter can hinder the assessment of the taxonomic history behind a certain name. Although misspellings can sometimes happen in taxonomic literature, [MARTINS-SILVA \(2022\)](#) was especially careless throughout the paper, making a lot of mistakes in the names of taxa or their respective authors. Below, we list the errors, divided into three sections:

#### Throughout the text in [MARTINS-SILVA \(2022\)](#)

Ephemeroptera = Ephemeroptera (page 2)

*Rheumatobates* Berbroth, 1892 = *Rheumatobates* Bergroth, 1892 (page 2)

*Hydrometra fruhstorfe* = *Hydrometra fruhstorferi* (page 2)

Haloveliina = Haloveliinae (page 2)

*Gelastocoris* Kirlakdy = *Gelastocoris* Kirkaldy (page 4)

*Notonecta* Linaeus = *Notonecta* Linnaeus (page 5)

*Buenoa* Kerkaldt = *Buenoa* Kirkaldy (page 5)

*Rheumatobares* = *Rheumatobates* (page 5)

*Stridulivelia* = *Stridulivelia* (page 5)

#### Table 1 (page 3 in [MARTINS-SILVA 2022](#))

*Ovatametra* Berbroth, 1892 = *Ovatametra* Bergroth, 1892

*Rheumatobates* Berbroth, 1892 = *Rheumatobates* Bergroth, 1892

*Weberiella* De Carlor, 1966 = *Weberiella* De Carlo, 1966

*Gelastocoris* Kirlakdy, 1897 = *Gelastocoris* Kirkaldy, 1897

*Buenoa* Kerkaldt, 1904 = *Buenoa* Kirkaldy, 1904

*Notonecta* Linaeus = *Notonecta* Linnaeus

#### Identification key (pages 8-9 in [MARTINS-SILVA 2022](#))

Leptodomorpha = Leptodomorpha

*Curicta* = *Curicta*

*Neopleia* = *Neopleia*

Taxonomic work is a difficult and often undervalued task that takes years of practice to be correctly performed. For some taxa, generic or specific identification can only be safely achieved if a specialist is consulted or through direct comparison with type specimens. Contacting other researchers is fundamental in our field and can lead to important exchanges, such as of literature or techniques. It also facilitates the use of proper terminology and the elaboration of identification keys, and can avoid duplication of efforts on the same subject or gross misidentifications. It is becoming common practice to include identification keys in many faunistic articles, which should be stimulated when they are well elaborated and illustrated. However, publishing keys containing many errors, without illustrations, and with unusual or wrong terminology puts the taxonomy of entire groups at risk and can lead to further errors, given the nature of this tool. A poorly prepared key can rapidly become cited and used by authors who might not always be aware of the problems that it contains.

Photographic equipment, even that appropriate for small insects, is becoming increasingly cheaper over time. We strongly suggest the inclusion of specimen photos in faunistic assessments, because they allow editors, reviewers, and readers to rapidly find gross errors just by examining a habitus image. If not for the inclusion of photographs, the fault results of the article discussed here might have never been discovered.

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