New records of *Adelpha atlantica* Willmott, 2003 (Nymphalidae: Limenitidinae) help to clarify its current conservation status

Augusto H. B. Rosa and André V. L. Freitas*

Departamento de Biologia Animal and Museu de Diversidade Biológica, Instituto de Biologia, Universidade Estadual de Campinas. Rua Monteiro Lobato, 255, CEP 13083-862, Campinas, São Paulo, Brazil. *Corresponding author: baku@unicamp.br.

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**Abstract:** The Neotropical genus *Adelpha* Hübner, [1819] is remarkable for its high species richness, including many species whose adults are extremely similar in dorsal wing pattern but not closely related, and by the rarity of some species in collections. Described based on only two individuals, *Adelpha atlantica* Willmott, 2003 is a rare Brazilian butterfly listed as “Endangered” in the Brazilian Red List. The present study reports six new individuals of *A. atlantica*, representing two new geographical records in the Atlantic Forest. With these two additional geographical records, both the known extent of occurrence (EOO) and the area of occupancy (AOO) have expanded considerably, suggesting that this species should be considered as “Least Concern (LC)” in future conservation status assessments.

**Key words:** area of occupancy; Atlantic Forest; Brazil; extent of occurrence.

**INTRODUCTION**

The Neotropical genus *Adelpha* Hübner, [1819] is remarkable for its high species richness (93 described species) and for including many species whose adults are extremely similar in dorsal wing pattern but not closely related (Willmott, 2003b; Ebel *et al.*, 2015; Freitas *et al.*, 2019 and references therein). In addition, several species are rare in collections, with 14 species known from fewer than 25 specimens at the time of Willmott’s (2003a) study. This was also the case for *Adelpha atlantica* Willmott, 2003, a species described based on only two individuals from two different localities in the state of Rio de Janeiro (Willmott, 2003a). In 2013, an additional specimen was collected in the municipality of Maricá (also in Rio de Janeiro state) (Almeida *et al.*, 2018). Therefore, based on its apparently restricted distribution in areas of intense anthropogenic pressure, this species was assessed as “Endangered (EN)” (MMA, 2022). Recently, as part of a large project focusing on threatened Brazilian butterflies, six additional specimens of *A. atlantica* were found in two different collections. The aim of this study is to report new geographical records of *A. atlantica* and to review its conservation status in light of these new data.

**MATERIALS AND METHODS**

Individuals of *A. atlantica* were found in four public/private collections: **DZUP**, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil; **OM**, Olaf Mielke Collection, Curitiba, Paraná, Brazil; **USNM**, Smithsonian Institution National Museum of Natural History, Washington, D.C., USA; **ZUEC**, Museu de Diversidade Biológica, Universidade Estadual de Campinas, Unicamp, Campinas, São Paulo, Brazil (Table 1). In addition, all photographs of *Adelpha* from Bahia to Rio Grande do Sul available until May 2023 in the website iNaturalist (www.inaturalist.org) were checked and identifications verified.

Geographical range (extent of occurrence EOO and area of occupancy AOO) was estimated based on all known sites of *A. atlantica*. The EOO is the area contained within the shortest continuous boundary (minimum convex polygon) that includes all known distribution points of a species, and the AOO is the area within its EOO that is actually occupied by a given taxon (IUCN, 2012; IUCN Standards and Petitions Committee, 2022). The EOO as recommended by IUCN includes all areas across the taxon’s geographical distribution to measure the degree...
Table 1. Data for all known individuals of *Adelpha atlantica* deposited in four public/private collections (see text for acronyms). PA = Protected area (where pertinent). *Acronyms for Brazilian states: PR = Paraná, RJ = Rio de Janeiro, SC = Santa Catarina; Protected areas: PSP = Parque Estadual do Palmito, PEPA = Petrópolis Environmental Protection Area, SDFEPA = Serra Dona Francisca Environmental Protection Area.

<table>
<thead>
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<th>Acronym</th>
<th>N and sex</th>
<th>Date</th>
<th>State*</th>
<th>Municipality</th>
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<td>Imbarié</td>
<td>PEPA</td>
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<td>SC</td>
<td>Joinville</td>
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<tr>
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<td>RJ</td>
<td>Maricá</td>
<td>Serra do Camburi</td>
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</tbody>
</table>

**Figure 1.** Four males of *A. atlantica* from the DZUP collection (all representing new localities for the species). A: Parque Estadual do Palmito, Paranaguá, Paraná state; B-D: Joinville, Santa Catarina state (dorsal left, ventral right).

to which risks from threatening factors are spread spatially, even if this is on land and/or ocean. Both EOO and AOO were estimated using the online open-source program GeoCAT (Geospatial Conservation Assessment Tool, available at http://geocat.kew.org) (Bachman *et al.*, 2011). As recommended by IUCN for AOO analyses, a 2 km grid of all cells (area of 4 km²) which contain distribution points for the species was used (IUCN 2012; IUCN Standards and Petitions Committee, 2022). No species distribution model was used to estimate EOO or AOO.

**RESULTS**

Six additional males were found in two collections (the female is unknown), resulting in two new sites of occurrence for *A. atlantica* in southern Brazil (Table 1, Fig. 1, 2). No individuals of *A. atlantica* were found in iNaturalist (approximately 1,500 new records. Acronyms: PR: Paraná, RJ: Rio de Janeiro, SC: Santa Catarina, SP: São Paulo.

**Figure 2.** Map showing the five known localities for *A. atlantica*. 1. Petrópolis, RJ; 2. Duque de Caxias, RJ; 3. Maricá, RJ; 4. Paranaguá, PR; 5. Joinville, SC. Red circles: previous records; yellow circles: new records.
observations were revised by the first author). In addition, a photograph of the specimen referred to as *A. atlantica* from south São Paulo mentioned in Braga (2022) was inspected, and the specimen proved to be a tattered specimen of *Adelpha capucinus velia* (C. Felder & R. Felder, 1867). The extent of occurrence (EOO) using only the previous three known records was estimated as 215 km². By adding the two new sites, the EOO was calculated as 33,164 km², an increase of 15,302%. Similarly, the previous AOO was estimated as 12 km², and increased to 20 km² after adding the two new localities.

**DISCUSSION**

The results presented here reinforce the conclusion that the perceived rarity of some species of *Adelpha* is an artifact resulting from two main causes: 1) particular behavioral traits, such as flying in the canopy and far from open trails (see Rosa *et al.*, 2023, and references therein), and 2) because of the strong similarity in wing pattern, individuals of some uncommon species have remained unnoticed in museum collections, mixed with other more common widespread species (Almeida *et al.*, 2018; Freitas *et al.*, 2019; a detailed discussion about the rarity of some *Adelpha* species and subspecies can be found in Willmott, 2003a).

Based on previous records of *A. atlantica*, its restricted distribution in habitats with continuing decline in quality caused by anthropic activity resulted in it being categorized it as “Endangered (EN)” in the list of threatened species in Brazil (MMA, 2022). With the addition of the two new locations, the EOO estimate is considerably larger and it is probable that this species may still occur in the largest conserved area of Atlantic Forest, between the states of Rio de Janeiro and Santa Catarina. As a result, we suggest that this species should be considered as “Least Concern (LC)” in future conservation status assessments, because its EOO is now above the threshold of a threatened category (more than 20,000 km²). However, based on the AOO, the species would still meet IUCN thresholds to be considered “Endangered” after the inclusion of the additional records (Rosa *et al.*, 2023). Nevertheless, we believe that this conclusion is currently not justified, since the current knowledge for this species likely underestimates its true AOO, as for many other threatened Brazilian butterflies (see Rosa *et al.*, 2023 for more information). In the particular case of *A. atlantica*, there are also large areas of suitable habitat within which this species could be present inside the EOO polygon. Finally, in addition to bringing new information about a little-known butterfly species, the present study demonstrates the importance of biological collections as source of data for ecological and conservation studies (Hilton *et al.*, 2021).

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**LITERATURE CITED**


