

Identification and distribution of the Philippine endemic *Trithemis adelpha* (Odonata: Libellulidae)

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Research Article



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All relevant data are
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Abstract. A review based on material available at Naturalis Biodiversity Center (RMNH) and images available on iNaturalist and Observation.org shows that *Trithemis adelpha*, often regarded a synonym of *T. aurora*, is a valid species and can be identified with relative ease. *Trithemis adelpha* has a more slender abdomen but is morphologically largely similar to *T. aurora*. It however differs in the general colouration of the body (red instead of purple) and the extent of black pattern on the thorax and abdomen. Based on the new records it is shown that this Philippines endemic is widespread occurring on all major islands with the exception of Palawan and Negros. Field observations indicate that this species has, compared to *T. aurora*, a preference for larger waterbodies, and is often found at slow flowing sections of larger streams.

Further key words. Anisoptera, dragonfly, Philippines, Southeast Asia

Introduction

The genus *Trithemis* Brauer, 1868, is widespread ranging from Africa to Asia. The genus contains 50 species, of which three, *Trithemis aurora* (Burmeister, 1839), *Trithemis festiva* (Rambur, 1842) and *Trithemis pallidinervis* (Kirby, 1889) occur in the Philippines. Both *T. aurora* and *T. festiva* are common and widespread across the Philippine archipelago, occurring at largely unshaded habitats. The third, *T. pallidinervis* is restricted to Luzon where it is, compared to the other two, relatively scarce. A possible fourth species, *Trithemis adelpha* (Selys, 1878), has been named based on material from the Philippines, but was regarded as a synonym of *T. aurora* in the Libellulidae monograph of Ris (1912). The species was not mentioned in The Odonata of the Philippines (Needham & Gyger, 1937) and has received little serious attention for most of the 20th century. Exception is Hämäläinen & Müller (1997) who list the species from regions Luzon, Mindoro, West & East Visayas and Mindanao, and who mention its co-occurrence with *T. aurora* from the islands of Basilan, Cebu, Panaon and Samar. They further state that ‘Since no intermediate specimens of these “forms” appear in the large material of *aurora/adelpha* complex in coll. Müller (384 males, 115 females) and the differences are distinct in both sexes, we are tempted to believe that two really distinct species occur in the Philippines, often side by side’. Despite this remark a proper redescription of characters separating the two species was never provided and in the World Odonata List it is listed as a synonym (Paulson et al., 2025). Due to years of field experience Villanueva was aware that *T. aurora* comes in two types in the Philippines. One is

a typical *T. aurora* as found throughout much of Asia, while another is more reddish instead of purple, and has more extensive black on the thorax and the tip of the abdomen. He expected the second one to be the true *T. adelpha*. This paper sets out to test if his suspicion is correct, re-describe *T. adelpha* and determine its distribution in more detail.

The history of *T. adelpha* is rather complicated. Rambur (1842) described the species *Libellula soror* which is currently regarded as a synonym of *Crocothemis servilia* (Drury, 1773). The species *Libellula soror* was also mentioned by Brauer (1868). In a note to the description of *Trithemis proserpina* (currently a synonym of *T. festiva*) Selys (1878) mentions that specimens listed as *soror* by Brauer (1868) are not identical to the *soror* described by Rambur (1842) and he proposed the replacement name *adelpha* for the specimens listed by Brauer as *soror*. The material listed by Brauer (1868) as *soror* can therefore best be regarded as the type material of *adelpha*. Ris (1912) studied these specimens and noted ‘Both sexes are large specimens with some anomalies, but within the range of variation of *aurora* and undoubtedly not Philippine subspecies but at most individual varieties’. Brauer’s material is currently stored in the Coleoptera Terrestri Collection of the “Naturhistorisches Museum Wien” (NMW, Natural History Museum Vienna).

Material and methods

A description of field characteristics that differentiate *T. adelpha* from *T. aurora* was provided by R.J. Villanueva. Based on these characters we preliminarily identified all 438 male and 127 female specimens of *T. aurora* from the Philippines, housed in the Naturalis Biodiversity Center Leiden, The Netherlands (RMNH) as either *T. aurora* or *T. adelpha*. Once separated into two groups a selection of specimens was studied in more detail using a stereomicroscope in order to find additional characteristics of use for identification. Currently all approximately 35.000 specimens of Odonata from the Philippines present in the RMNH are being digitised and information on all these specimens including all specimens of *Trithemis aurora* and *T. adelpha* will be made available in 2027 through the Central Registration System of Naturalis and from there will become available on GBIF. Should the data be desired on an earlier date, it can be obtained by contacting the authors.

A similar visual process was applied to online records of *T. aurora* from the Philippines available on the biodiversity portals iNaturalist.org (175 records) and Observation.org (11 records) (records prior to April 2025). All records, found to belong to *T. adelpha*, were grouped as such in a separate project on iNaturalist, data from these was accessed on 08. April 2025.

Furthermore, Stijn de Win paid attention to specimens of *T. aurora* while conducting field work in the Philippines in the period January-May 2025. This allowed him to test if both species can be identified in

the field and if differences in habitat preference could be observed.

Illustration of the anal appendages as well as secondary genitals were made using a digital microscope ZEISS stereo discovery v20.

Scanning electron images of the male ligulas, from both dorsal and lateral view, were taken using a JSM-IT510 JEOL scanning electron microscope at Naturalis Biodiversity Center. The prepared ligulas were sputtered with platinum and palladium (80/20) before examination.

After having established the characters of use for separating both species, we also studied material from areas to the south of the Philippines (Borneo and Sulawesi) and to the north of the Philippines (Taiwan). Studied material includes male specimens of *T. aurora* from these areas present in the RMNH collection, and images available on Observation.org and iNaturalist. All research grade observations on iNaturalist of *T. aurora*, and other *Trithemis* species from the islands of Borneo and Sulawesi were studied, while some (approx. 1,000) observations from Taiwan were studied. Online observations studied were uploaded on, or before, the 8th of April 2025.

Images of the male, described by Brauer (1868) as *Libellula soror* and later renamed by Selys (1878) to *T. adelpha* and housed at NMW, were kindly made available by Günther Wöss. These images allowed us to check if the specimens that we call *T. adelpha* can indeed be attributed to this species.

Results

Identification

The study of the material allowed us to divide the specimens into two groups, one with characters identical to *T. aurora* and a group with specimens having multiple characters diverging from *T. aurora* and which we supposed to be *T. adelpha*. The characters that allowed us to separate *T. aurora* from the *T. adelpha* are summarized in Table 1 and illustrated in Figures 1, 2, and 3. The morphology of the two species is nearly identical but *T. adelpha* has a slenderer and more parallel sided abdomen. In addition, there are multiple differences in pattern and colouration based on which most specimens can be easily identified. These differences allowed us to identify males, and to a lesser extent females, of both species on images available on iNaturalist and Observation.org with relative ease.

In addition to the differences in colouration and pattern there is also a size difference with the average *T. adelpha* being clearly larger than the average *T. aurora* from the Philippines. However, specimens of *T. aurora* from Sarawak (on the island Borneo) showed variation in size, with large *T. aurora* specimens exceeding both body and wing length of *T. adelpha* specimens.

The ligula (Figure 4) of both species is largely identical, however the distal segment of the ligula of *T. adel-*

Table 1. Main differences between male *Trithemis aurora* and *Trithemis adelpha*.

Character	<i>Trithemis aurora</i>	<i>Trithemis adelpha</i>
Size (male and female)	Hindwing male: 24–28 mm	Hindwing male: 30–33 mm
Head	Strong contrast between purple metallic top of frons and the remainder of face. (Fig. 1a, 2a)	Top of frons not or only slightly metallic, contrast between top of frons and remainder of frons poor. (Fig. 1b, 2b)
Thorax	Front of thorax clearly pruinose. Side of thorax with three vertical lines that meet at about half way and merge into a longitudinal line. (Figs 1a, 2a)	Front of thorax red or only very slightly pruinose. Side of thorax with three black lines similar to <i>aurora</i> but more pronounced and with line near abdomen splitting into Y shape at base. (Figs 1b, 2b)
Secondary genitalia in lateral view	Largely identical. (Fig. 3a).	Largely identical. (Fig. 3b)
Legs	Black legs with tibia showing dark yellow to red markings (Fig 2a).	Black legs, but tibia show much less yellow in pictures and in the field (Fig. 2b).
Colour of abdomen	Abdomen pruinose but with segments 9–10 often not or only slightly pruinose. Where pruinosity is absent, the colour is bright red. (Fig. 1a)	Abdomen bright red with black markings. Pinkish pruinosity can show on the dorsum of segments 1–4, covering less than the top half of the segment. (Fig. 1b)
Shape of abdomen	Abdomen spindle-shaped, reaching its largest width at S6. Abdomen appears broader than in <i>adelpha</i> in the field.	Abdomen more or less parallel-sided. Abdomen appears less broad than in <i>aurora</i> in the field.
Black pattern on segments 8–10	Completely absent in most cases but some black is present in some individuals, although to a much lesser extent than that of <i>adelpha</i> . (Fig. 1a)	Always with black pattern. S8–9 with middorsal black line; S9 nearly completely black on the side and underside and S10 being nearly completely black. (Fig. 1b)
Black pattern on underside S1–3	Faint, to no, black highlights along the edges of segments 1–3. The black colouration on these is absent or only slightly visible in collection specimens. (Fig. 3a)	Black markings present on segments 1–3 in the form of small lines detailing the edges of the segments. These show stronger than on <i>aurora</i> under a microscope or magnifying glass. (Fig. 3b)
Appendages	Largely reddish	Some red at base, rest black.
Wings, pterostigma	Pterostigma is red to dark red with black veins bordering it.	Pterostigma is black in the field and very dark in collected specimens. Wing venation red, extending up to pterostigma.

pha is larger than that of *T. aurora* and the apical lobe of the distal segment is triangular in *T. adelpha* and more parallel sided in *T. aurora*.

The characters listed in Table 1 allowed de Win to find *T. adelpha* at several sites on Eastern Samar and Marcel Silvius to find *T. adelpha* on Luzon. Both found the species on the same day as they encountered *T. aurora* and found it easy to differentiate between the two species without catching, with the colour difference of the abdomen (purple in *T. aurora* and red in *T. adelpha*) being the most striking difference. Figure 1 shows a comparison of two live specimens in situ. A female specimen likely belonging to *T. adelpha* is included as a supplementary figure.

Figure 5 shows the male specimen described by Brauer (1868) as *Libellula soror* and later renamed by Selys (1878) to *T. adelpha*. The labels in the upper left corner of Figure 5d show that this specimen was collected by C. Semper on the island of Luzon in 1867. The label in the center of Figure 5d is probably the original identification label of Brauer with the text written in red and the two other labels added at a later date. As far as

can be seen on the available images all characters listed in Table 1 for *T. adelpha* are also present in this specimen. These characters include the extensive black on the thorax, the presence of dark marks on the dorsum of S9–10 and the parallel sided abdomen. This confirms that the name *T. adelpha* is correctly attributed to the Philippine sibling of *T. aurora*.

Distribution, phenology and habitat

The distribution of *T. adelpha* and *T. aurora* in the Philippines, shown in Figure 6, is based on collection specimens from RMNH and records available on both iNaturalist and Observation.org. Presence on the islands Luzon, Bohol, Cebu and Mindoro, based on the collection specimens from NMW and Brauer (1868) is also included. *Trithemis adelpha* is found on all larger islands except for Palawan and Negros. No specimens clearly matching the characters given in Table 1, are known from outside the Philippines. Roughly 35 locations are known for *T. adelpha* against approximately 216 for *T. aurora* showing that the latter is by far more common.

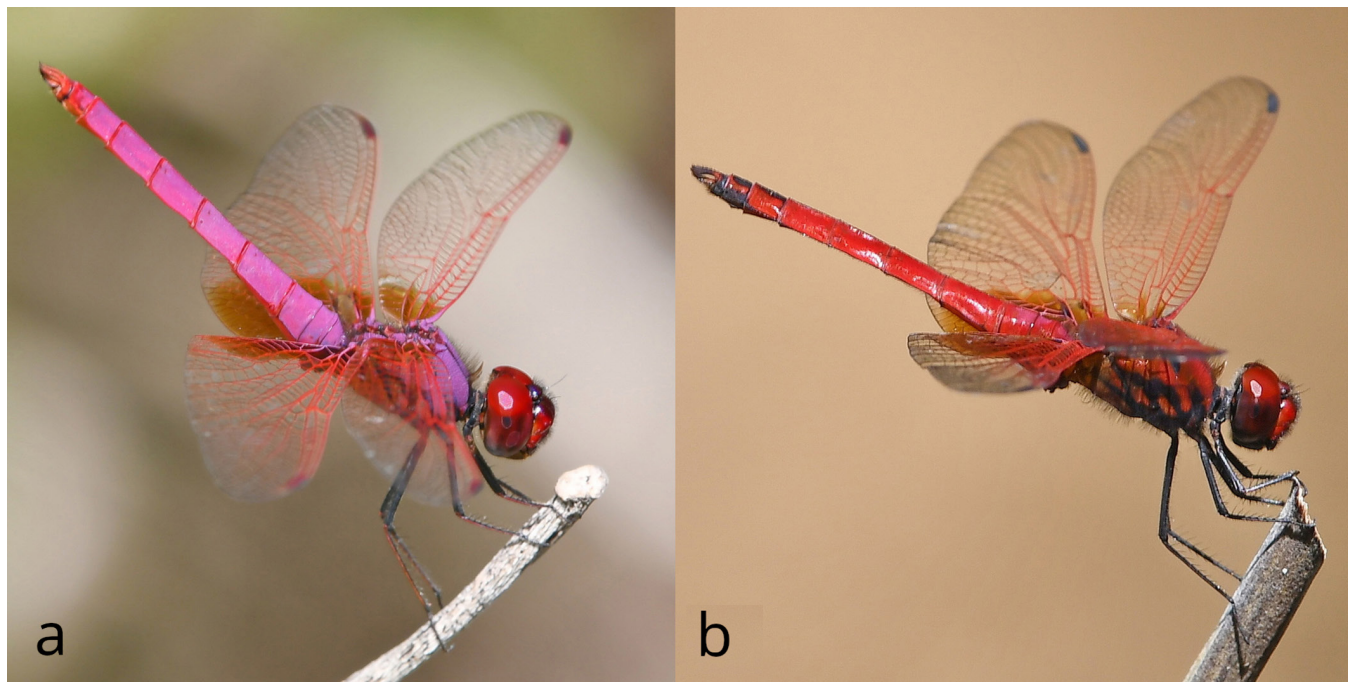


Figure 1. *Trithemis aurora* (a) and *Trithemis adelpha* (b) males in life. Guinob-an, Eastern Samar, Philippines. Photos by Stijn de Win.

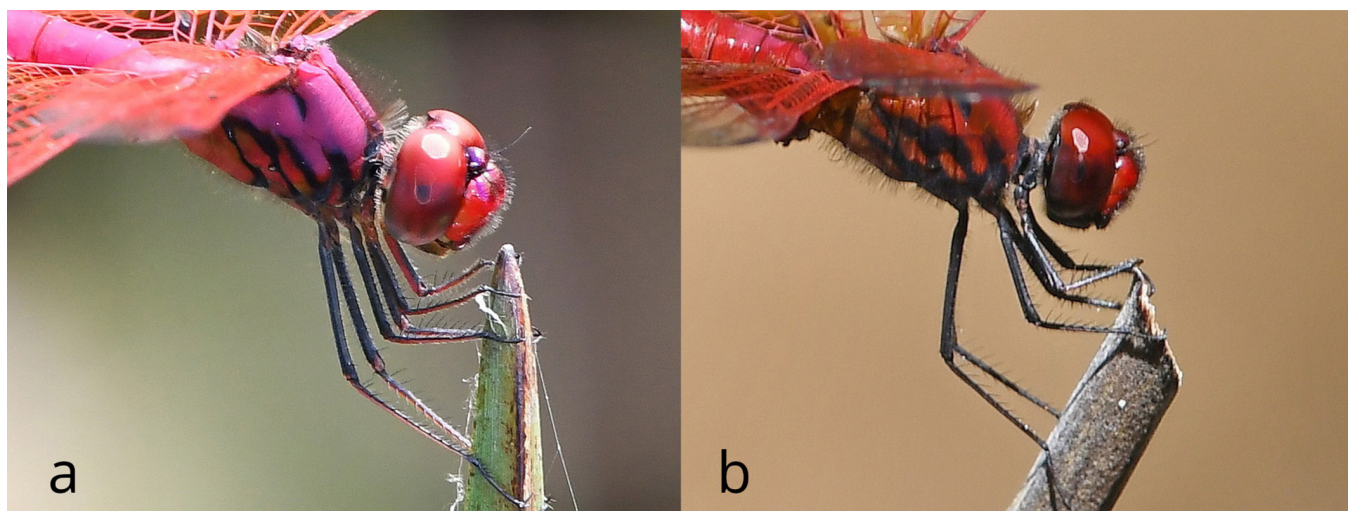


Figure 2. Thorax and tibia of *Trithemis aurora* (a) and *Trithemis adelpha* (b). *Trithemis adelpha* has, compared to *T. aurora*, a stronger marked red-black contrast and less pruinosity. While the tibia and legs of *T. aurora* show more colour than those of *T. adelpha*.



Figure 3. Secondary genitalia from lateral view. *Trithemis aurora* (a) and *Trithemis adelpha* (b). Scale bar 1000 µm.

Figure 7 shows the number of records per month for both *T. adelpha* and *T. aurora*. A record in this table represents a record of one, or multiple specimens at a unique locality, on a unique day. *Trithemis adelpha* is recorded in all months, except September, with most

records from March–July, and occasional observations until October, whereas *T. aurora* can be found throughout the year. A clear difference can be seen in the total number of records, with approximately seven times less records for *T. adelpha*.

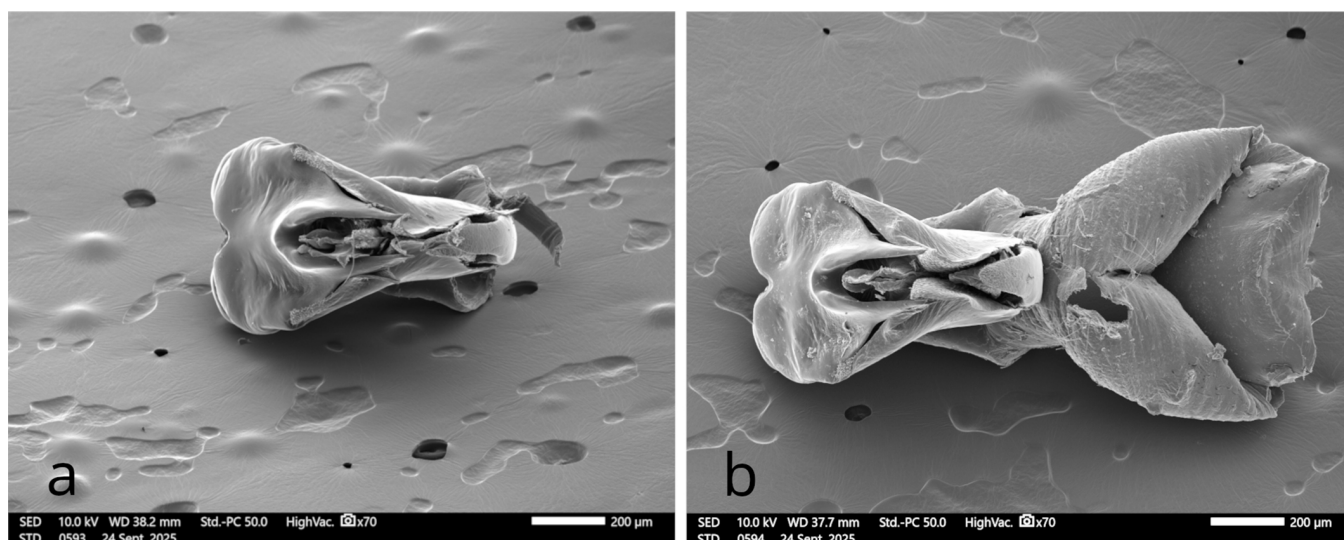


Figure 4. SEM image showing a dorsal view of genital ligula. *Trithemis aurora* (a) and *Trithemis adelpha* (b). Scale bar 200 µm.



Figure 5. Type specimen of *Trithemis adelpha* from the Naturhistorisches Museum Wien. (a) lateral view, (b) dorsal view, (c) thorax lateral view, (d) labels. Photos by Günther Wöss, NMW.

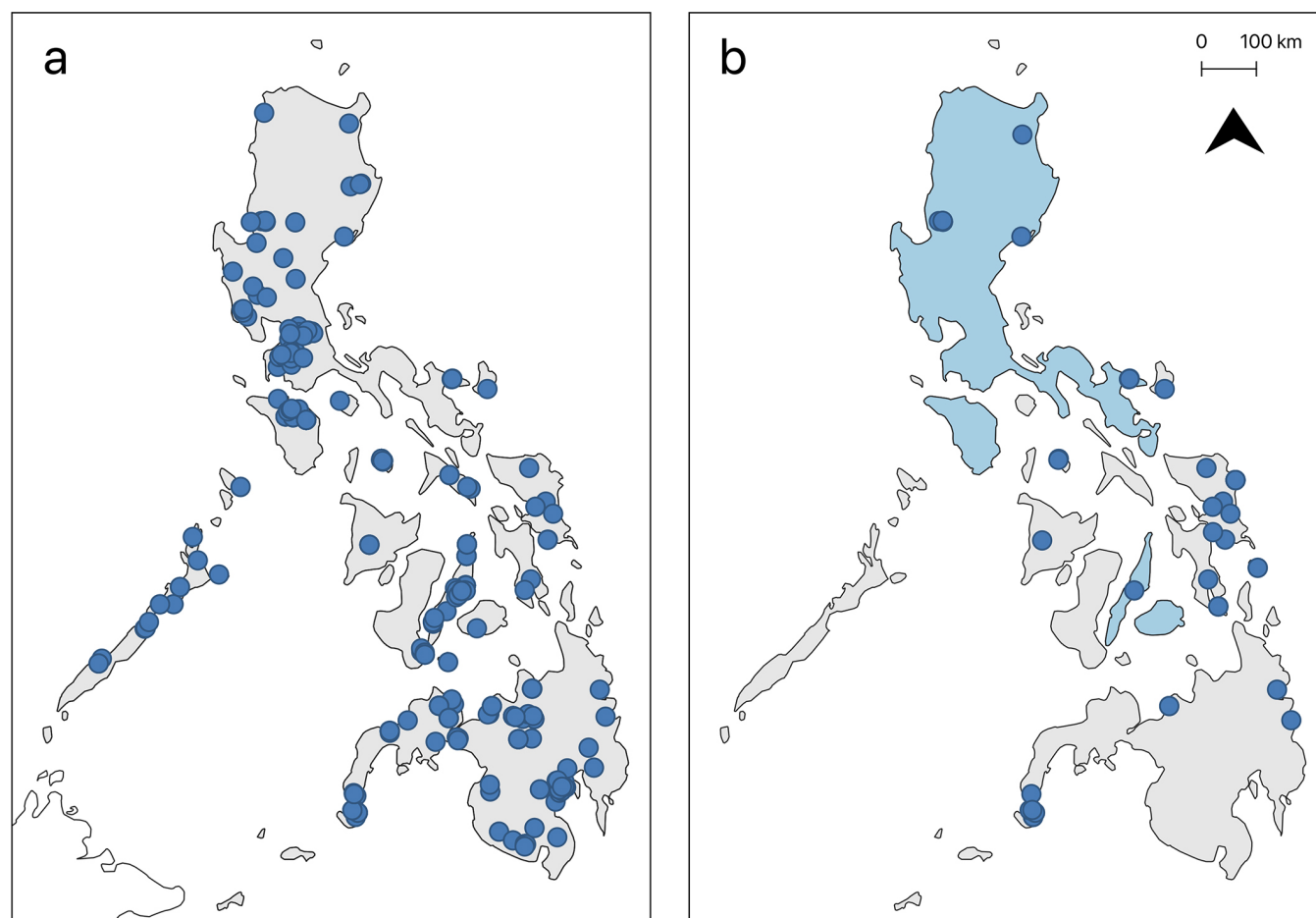


Figure 6. Distribution of *Trithemis aurora* (a) and *Trithemis adelpha* (b) in the Philippines. Localities based on collection specimens from RMNH, or records on iNaturalist and Observation.org, are shown as blue dots. Locations on an island scale in Brauer (1868) and on the label of the designated lectotype at NMW are shown as light blue colour of the islands.

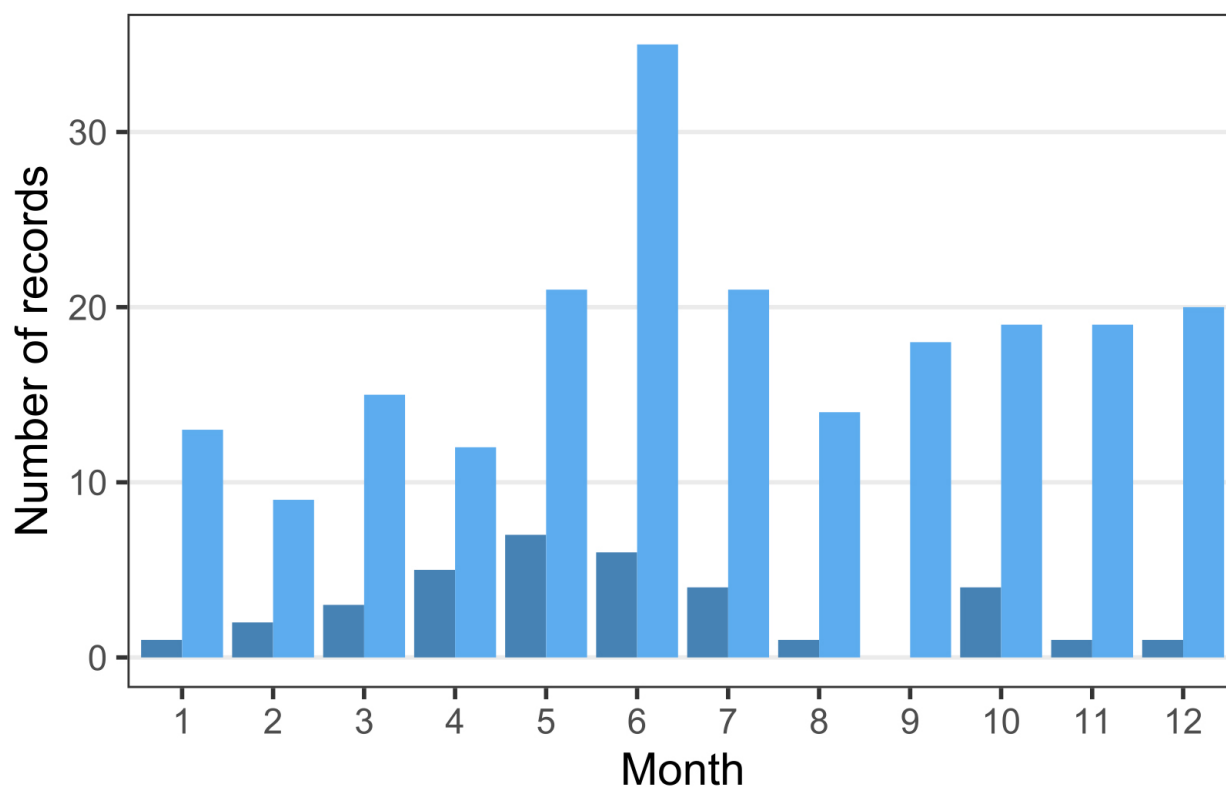


Figure 7. Number of records per month for *T. aurora* (light blue) and *T. adelpha* (dark blue).



Figure 8. Male *Trithemis adelpha* perched in its habitat. Laiban Falls, Makaira – Daraitan Road, Tanay, Rizal, Luzon, Philippines. Photo by Marcel Silvius.



Figure 9. Habitat of (a) *T. adelpha* and (b) *T. aurora*. Photo Marcel Silvius (a), Vincent Kalkman (b).

De Win observed *T. adelpha* several times at larger water bodies, often, but not always, in river sections with slower flow (for instance, pools formed beside the main river flow). He noted that it would usually perch well away from vegetation, favouring bare exposed spots such as rocks or twigs. Figure 8 shows a typical shot of *T. adelpha* in on its preferred perch. In contrast, *T. aurora* was often found perching on green vegetation at the side of the stream, not always within vicinity of the water, and in contrast to *T. adelpha*, also occurring at smaller and shallow streams. An example of the habitats of *T. adelpha* and *T. aurora* can be seen in Figure 9.

Discussion

The results show that *Trithemis aurora* and *T. adelpha* can be identified with relative ease based on differences in colouration and pattern, but morphological differences are modest at most. The most obvious differences, the slenderer abdomen, which is red instead of purple, allows for easy field identification of mature males. It is deemed unlikely that the observed differences can simply be attributed to age or seasonality; therefore *T. adelpha* is best regarded as a valid species distinct from *T. aurora*. It seems likely that *T. adelpha* is sister to *T. aurora* but molecular data is needed to support or falsify this hypothesis.

The correct attribution of the name *T. adelpha* to the Philippine *T. aurora* look-a-like was confirmed by the discovery of the male specimen used by Brauer (1868) for his description of *Libellula soror* (renamed to *T. adelpha* by Selys (1878)). In order to ensure that *T. adelpha* becomes firmly recognised as valid species and in order to prevent further confusion on the name we designate the male depicted in Figure 5 and housed at NMW as the lectotype specimen of *T. adelpha*.

Trithemis adelpha Selys, 1878 = **valid species**
= ***Libellula soror* sensu Brauer 1868**

The data shows that *T. adelpha* occurs on all major Philippine islands, with the exception of Palawan and Negros. The absence on the island of Palawan is not surprising as the fauna of this island is in many ways more similar to that of Borneo than to the rest of the Philippines. The lack of records of *T. adelpha* from Negros is most likely due to the limited amount of fieldwork on the island. No records are known from mainland Asia to the west, Borneo to the south or Taiwan to the north, making *T. adelpha* endemic to the Philippines. There are over six times more records available for *T. aurora* than for *T. adelpha*, showing that the latter is by far the most common. Nonetheless *T. adelpha* seems to be relatively common and widespread with a preference for habitats (larger or slow flowing standing water) that are not particularly threatened, making it likely that on the IUCN red list it would qualify as Least Concern.

The Philippines have a rich fauna of dragonflies and damselflies including many species and genera that are endemic to the country. For many species the information on distribution, flight period and habitat is limited, and no field images are available. Information on identification of species is scattered throughout the literature making the study of odonates by citizen scientists difficult. Our paper shows the relevance of data collected by volunteers and the impact that submitting records to portals such as iNaturalist and Observation.org can have.

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Supplementary material

Supplementary Figure. Possible female specimen of *Trithemis adelpha*.