

New records and distribution of the tiger fly *Eristalinus (Eristalodes) taeniops* (Wiedemann, 1818) (Diptera: Syrphidae) in Paraguay

Nuevos registros y distribución de la mosca tigre *Eristalinus (Eristalodes) taeniops* (Wiedemann, 1818) (Diptera: Syrphidae) en Paraguay

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Abstract. The exotic species *Eristalinus taeniops* is recorded for the first time in Paraguay from specimens collected in the cities of Asunción (Capital District) and Hernandarias (Alto Paraná Department). In addition, the records of the species on the iNaturalist citizen science platform were reviewed, confirming its presence in San Lorenzo, Luque and Fernando de la Mora (Central Department). The impact that the presence of this foreign species could generate in the country's natural ecosystems is briefly discussed.

Key words: Citizen science; distribution expansion; exotic species.

Resumen. Se registra por primera vez la especie exótica *Eristalinus taeniops* en Paraguay, a partir de ejemplares recolectados en las ciudades de Asunción (Distrito Capital) y Hernandarias (Departamento de Alto Paraná). Además, se revisaron los registros de la especie en la plataforma de ciencia ciudadana iNaturalist, confirmando su presencia en San Lorenzo, Luque y Fernando de la Mora (Departamento Central). Se discute brevemente el impacto que pudiese generar la presencia de esta especie foránea en los ecosistemas naturales del país.

Palabras clave: Ciencia ciudadana; especies exóticas; expansión de la distribución.

Syrphidae (Diptera) is one of the most numerous fly families in the world, with about 6,000 described species distributed in 200 genera (Miranda *et al.* 2013), with four currently recognized subfamilies: Microdontinae, Syrphinae, Eristalinae, and Pipizinae (Young *et al.* 2016). Of these, Eristalinae is the most speciose subfamily, with approximately 3,000 species and 114 genera (Morales and Marinoni 2009). *Eristalinus* Rondani, 1845 is a genus of Eristalinae naturally distributed in all biogeographic regions of the Old World (Thompson 1999). This is made up of 5 subgenera and around 75 species and is characterized by imitating bees and the design of the eyes, fasciated or dotted (Sonet *et al.* 2019). Two species have been introduced to the Americas: *Eristalinus (Lathyrrophthalmus) aenus* Scopoli, 1763

(Miranda *et al.* 2013) and *Eristalinus* (*Eristaloides*) *taeniops* (Wiedemann, 1818) (Thompson 1999; Thompson *et al.* 1990; Miranda *et al.* 2013).

Biological invasion, intentionally or accidentally mediated by humans, is one of the greatest impact factors in the extinction of native species (Ríos and Vargas 2003). Successful invasive insects are those that have a large distribution capacity, a wide feeding range, high birth rates, and low mortality (García *et al.* 2011).

Since its first report on the continent, in the State of Florida (United States) (Thompson *et al.* 1990), *E. taeniops* (Fig. 1) has been reported from South America in Chile (Thompson 1999; Barahona-Segovia *et al.* 2021; Olivares *et al.* 2021), Argentina (Rotondi *et al.* 2020), and Brazil (Morales and Köhler 2006, 2008). Although there are no more official reports data on the distribution of the species in other Latin American countries, the species has been photographed and identified in citizen science websites such as iNaturalist (<http://www.inaturalist.org>), a platform for observation and identification of species associated with the California Academy of Sciences that allows to expand the knowledge of the distribution of species around the world (Nugent 2018) and Ecoregistros (<http://www.ecoregistros.org>) in Bolivia, Colombia, Costa Rica, Ecuador, Mexico, Paraguay, Peru, and Uruguay (Rotondi *et al.* 2020; Olivares *et al.* 2021; iNaturalist 2023). In this report, we present the first collection records of *E. taeniops* from Paraguay, as well as a review of the records available on the iNaturalist platform for said country.

Specimens were identified following Miranda *et al.* (2013) using a Leica Wild MZ8 stereoscopic microscope and photographed with a Canon Eos Rebel t71 camera with 50 mm macro lens mounted on a close-up bellows were. Subsequently dry-stored and deposited in the entomological collection of the National Museum of Natural History of Paraguay, with catalog numbers MNHNPY-HX 2219, 2220, 2221, 2222 and 2223; while for the iNaturalist record review, the "*Eristalinus*" and "*Eristalinus taeniops*" search filters were used and removed duplicate records and misidentifications or ambiguous photos. Finally, using the geographic references of the specimens collected and the online records, a distribution map of *E. taeniops* in Paraguay was prepared using the QGIS version 3.20.0 (Fig. 2).

In total, five specimens of *E. taeniops* were collected in the country, two in a green area of Asunción city, whose ecoregion corresponds to the Humid Chaco ecoregion (Dinerstein *et al.* 1995) and three other specimens were collected in anthropized areas adjacent to forest patches, in Hernandarias city, Alto Paraná Department, whose ecoregion corresponds to the Upper Parana Atlantic Forest (Dinerstein *et al.* 1995).

The collected specimens and records in iNaturalist are broken down below:

Collected records. PARAGUAY. Distrito Capital: Asunción, Parque Guasu Metropolitano, 25.264549° S 57.535250° W, 89 masl, 28-X-2021, 2 males, Cols. B. Garcete & C. Molinas [MNHNPY-HX 2220 and MNHNPY-HX 2223]; **Departamento Alto Paraná:** Hernandarias, Centro Ambiental de Itaipu Binacional, 25.447911°S 54.632145°W, 226 masl, 22-II-2022, 1 female, Col. T. Goossen [MNHNPY-HX 2221]; Hernandarias, Santa Rosa, Condominio Costa del Lago, 25.330665°S 54.632765°W, 26-XII-2022, 2 females, Coll. T. Goossen [MNHNPY-HX 2219 and MNHNPY-HX 2222].

Photographic records (iNaturalist 2023). **PARAGUAY. Departamento Central:** San Lorenzo, Barrio San Miguel, 25.304992° S 57.527866° W, 131 masl, 16-XI-2015, 1 male. Obs. J. Movía [<https://www.inaturalist.org/observations/19511602>]; Luque, 25.267517° S 57.494217° W, 119 masl, 22-I-2020, 1 female. Obs. L. Duarte [<https://www.inaturalist.org/observations/37845388>]; Fernando de la Mora, Kokue Guazú, Barrio Nanawa, 25.338687° S 57.566143° W, 177 masl, 26-IX-2020. 1 male. Obs. A. Cardozo [<https://www.inaturalist.org/observations/60860333>]; Luque, 25.295000° S 57.456389° W, 105 masl, 6-IV-2023, 1 female. Obs. R. Castillo [<https://www.inaturalist.org/observations/153719801>]; **Distrito**

Capital: Asunción, Barrio Ciudad Nueva, 25.298243° S 57.621492° W, 142 masl, 26-IV-2021, 1 female. Obs. R. Castillo [<https://www.inaturalist.org/observations/75348409>].



Figure 1. Specimen of *Eristalinus* (*Eristalodes*) *taeniops* (Wiedemann, 1818) collected in green area of Asunción city, Paraguay. / Espécimen de *Eristalinus* (*Eristalodes*) *taeniops* (Wiedemann, 1818) recolectado en un área verde de la ciudad de Asunción, Paraguay.

Previously there were no formal records of *E. taeniops* in Paraguay in the scientific literature. The first known record to the authors was made in iNaturalist in 2015, only a decade and a half after its report in the Neotropics, in Chile (Thompson 1999). The evident ability of the species to expand across different biogeographic and climatic zones demonstrates the adaptability of *E. taeniops* and the aptitude to colonize and invade new ecosystems (Rotondi *et al.* 2020). Although the presence of *E. taeniops* in natural environments is not ruled out, all the records in our work correspond to anthropized environments, which could indicate the propensity of in these areas for the spread of this and other exotic species (Cadotte *et al.* 2017). In any case, work focusing on the presence of invasive species in natural areas is a priority to better understand these assumptions.

On the other hand, our records correspond to two different ecoregions in Paraguay, the Humid Chaco and the Atlantic Forest, which would indicate the ability of *E. taeniops* to distribute itself in other longitudes in the region. The invasive potential of *E. taeniops* must be recorded and monitored to establish its impact on the functioning of ecosystems and on other native species to establish control, management and/or eradication strategies (Rotondi *et al.* 2020).

We conclude with the confirmation of *E. taeniops* with specimens collected in two ecoregions of Paraguay, affirming the importance of citizen science records as a tool for studying biodiversity and monitoring the distribution of exotic species.

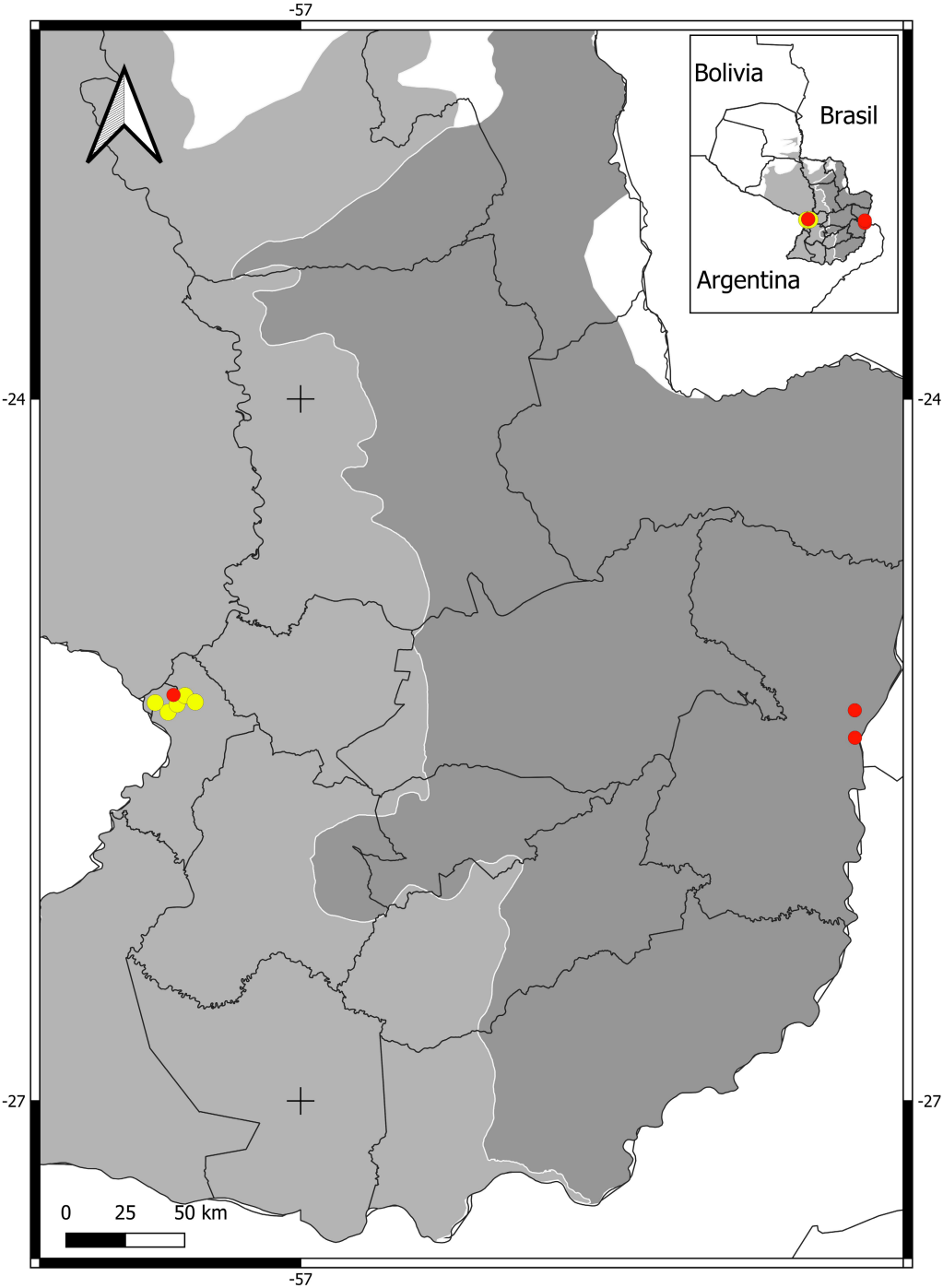


Figure 2. Distribution map of *Eristalinus (Eristalodes) taeniops* (Wiedemann, 1818) in Paraguay. Ligth gray correspond to Humid Chaco ecoregion; dark gray corresponds to Upper Parana Atlantic Forest ecoregion. Black lines corresponds to department borders. Red circles: new records of specimens collected; yellow circles: records in iNaturalist. / Mapa de distribución de *Eristalinus (Eristalodes) taeniops* (Wiedemann, 1818) en Paraguay; el gris claro corresponde a la ecorregión del Chaco Húmedo; el gris oscuro corresponde a la ecorregión del Bosque Atlántico del Alto Paraná. Las líneas negras corresponden a las fronteras departamentales. Círculos rojos: nuevos registros de especímenes colectados; círculos amarillos: registros en iNaturalist.

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Statements and Declarations

The authors declare no competing interests.

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