

# Through the restructuring of an entomological collection, a treasure: 30s' dipterans from the personal collection of Carlos Rodolpho Fischer bringing new records

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**Abstract.** Biological collections contain valuable information about biodiversity and are essential to both science and society. During the restructuring of the entomological collection at the Laboratório de Coleções Zoológicas of the Instituto Butantan, a wooden cigar box was discovered containing a collection of fly specimens (Order Diptera) collected in the municipality of São Paulo by Carlos Rodolpho Fischer, a German draftsman, photographer, and expert in Diptera. The specimens were treated with isopropyl alcohol, dried, identified, registered, and properly stored. A total of 293 individuals from 13 Diptera families were found. Of these, 248 specimens were identified to the species level. New records of three species and one genus were added to the state of São Paulo: *Acrosticta apicalis* (Williston, 1896), *Polymorphomyia tridentata* (Hendel, 1914), *Tetruaresta obscuriventris* (Loew, 1873), and *Poecilominettia* sp. 1. The biological material has been incorporated into the Coleção Entomológica do Instituto Butantan. Additionally, an internal database containing photographic records of the specimens, their respective labels, and the box in which they were created.

**Keywords.** Biodiversity; Diptera; Curating entomological collections; Entomology; Taxonomy.

**Resumo.** A reestruturação de uma coleção entomológica e um tesouro: novos registros de dípteros coletados nos anos 30 da coleção pessoal de Carlos Rodolpho Fischer. As coleções biológicas contêm informações sobre a biodiversidade e são valiosas para a ciência e a sociedade. Durante o processo de reestruturação da coleção entomológica do Laboratório de Coleções Zoológicas do Instituto Butantan, foi encontrada uma caixa de charutos de madeira contendo espécimes de moscas (Ordem Diptera) coletadas na cidade de São Paulo por Carlos Rodolpho Fischer, um desenhista alemão, fotógrafo e especialista em Diptera. O material foi higienizado com álcool isopropílico, seco, identificado, registrado e armazenado. Um total de 293 indivíduos pertencentes a 13 famílias de Diptera foi encontrado. Destes, 248 espécimes foram identificados ao nível de espécie, com a descoberta de três registros novos de espécies e de um gênero para Diptera no estado de São Paulo: *Acrosticta apicalis* (Williston, 1896), *Polymorphomyia tridentata* (Hendel, 1914), *Tetruaresta obscuriventris* (Loew, 1873), e *Poecilominettia* sp. 1. O material biológico foi incorporado à Coleção Entomológica do Instituto Butantan. Por fim, foi criado um banco interno contendo registros fotográficos dos espécimes, suas etiquetas e a caixa na qual foram originalmente armazenados.

**Palavras-chave.** Biodiversidade; Diptera; Curadoria de coleções entomológicas; Entomologia; Taxonomia.

Arq. Zool., 56(1): 1-9, 2025

<https://doi.org/10.11606/2176-7793/2025.56.1>

<https://www.revistas.usp.br/azmz>

ISSN On-Line: [2176-7793](https://doi.org/10.11606/2176-7793)

ISSN Printed: [0066-7870](https://doi.org/10.11606/0066-7870)

ISNI: [0000-0004-0384-1825](https://orcid.org/0000-0004-0384-1825)

Edited by: Maria Isabel Pinto Ferreira Landim

Received: 02/05/2024

Accepted: 29/01/2025

Published: 23/06/2025



## INTRODUCTION

### The importance of scientific collections

Scientific collections are used for different purposes, including studies of biodiversity, applied sciences, and educational activities (Colvin, 2014; Camargo *et al.*, 2015; Kharouba *et al.*, 2019; Hendery, 2021). Each collection has a unique history and holds information that reflects spatiotemporal diversity, as well as the contributions of researchers and curators who have added material and knowledge over decades (Allmon, 1994; Suarez & Tsutsui, 2004).

Given their essential strategic value in the knowledge, technological, and scientific development of countries, collections in Brazil are now considered invaluable assets of the Nation and the institutions housing them (see Lei Nº 13.123, Decreto Nº 8.772, Lei Nº 5.197 and Instrução Normativa Nº 154/2007). After signing the Convention on Biological Diversity at the United Nations Conference on the Environment in 1992, Brazil initiated a series of actions that culminated in the development of guidelines for its national biodiversity policy in 2002. This milestone brought greater visibility to Brazilian biological collections within both society and the government (Marinoni & Peixoto, 2010).

The Brazilian entomological collections are among the most important in South America, as they most comprehensively represent the Neotropical fauna (Zaher & Young, 2003). These collections have largely expanded through large-scale expeditions aimed at inventorying the insect fauna of specific regions of the country (Percequillo *et al.*, 2022; Lamas *et al.*, 2023). Despite their importance, however, they remain underfunded and neglected.

Currently, approximately 1,000,000 insect species are described in the world (Egglenton, 2020), with around 160,000 of these belonging to the Diptera, distributed across 153 families (Whitmore *et al.*, 2021; Evenhuis & Pape, 2023). The Neotropical Diptera fauna is composed of about 34,000 species (Borkent *et al.*, 2018), with Brazil accounting for nearly 35% of this diversity (12,206 species) (Rafael *et al.*, 2025). However, this represents only a fraction of the true diversity within the order (Amorim, 2010), as global estimates suggest there are between 5.5 to 10 million insect species worldwide (Mora *et al.*, 2011; Hebert *et al.*, 2016; Stork, 2018). Based on these estimates, up to 9 million insect species remain unknown, many of which may be extinct before they are ever documented and understood (Engel *et al.*, 2021).

In addition to the importance of sampling new areas, the digitization of information in entomological collections is essential. Not only does this preserve data on hundreds of undescribed taxa, but it also enables a wide range of applications in research – from taxonomy and evolution to conservation – and in society, including public health and education (Smith & Blagoderov, 2012; Wen *et al.*, 2015). Moreover, data availability facilitates collaboration between distant institutions and researchers, saving both time and financial resources (Drew *et al.*, 2013).

### The Coleção Entomológica do Instituto Butantan (Entomological Collection of the Butantan Institute) – IBSP-Ent

The Coleção Entomológica do Instituto Butantan (IBSP-Ent) was founded in 1931 by the acarologist and entomologist Flávio Oliveira Ribeiro da Fonseca (1900-1963). The collection has been organized from general specimen maintenance to incorporating new insects through donations, research projects, and submissions by the population or government agencies for taxonomic identification.

Up to now, 9,794 specimens have been officially deposited on the IBSP-Ent (including 72 type specimens), of which 3,818 are specifically from the order Diptera. The oldest fly specimen in the IBSP-Ent are nine specimens from the family Tabanidae, collected in 1902. Furthermore, the collection recently received a donation of more than 10,000 culicid specimens from the Laboratório Central do Estado do Paraná (LACEN-PR), which have since been incorporated into the collection. Significant national and international collaborations have been established with institutions that have directly and indirectly contributed to the expansion and modernization of IBSP-Ent and its partner collections.

Each year, IBSP-Ent receives insects directly associated with or indicate potential risks to humans or domestic animals. These specimens often come from private collections, environmental consulting projects, or are submitted as scientific vouchers following the publication of studies. Each insect is accompanied by at least its locality and sampling date and is mounted according to the specifications of its taxonomic group. These methods may include mounting specimens on entomological pins (stored in entomological drawers), preparing slides (stored in slide holders), or preserving them in microvials containing 70% alcohol, depending on the specimen type.

The flowchart below illustrates the process from the arrival of a specimen to its deposition in the IBSP-Ent (Fig. 1). All data are updated and digitized in a local Instituto Butantan database, with plans for integration into public, open-access, online systems and platforms. This effort contributes to biodiversity knowledge through the inclusion images, maps, and statistics, enhancing the accessibility and broader understanding of IBSP-Ent's collection data.

### Karl Rudolf Fischer (1886-1955)

Karl Rudolf Fischer was a German draftsman, photographer, and scientist without formal academic training who naturalized as a Brazilian citizen in 1920, adopting the translated name Carlos Rodolpho Fischer. After arriving in Brazil in 1910, he began his career in the state of São Paulo as a draftsman at the Hartman & Reichenbach Lithography. From 1912 to 1917, he worked at the Instituto Oswaldo Cruz in the state of Rio de Janeiro. In São Paulo, he worked at the Instituto Butantan (1919-1927) and later at the Instituto Biológico para Agricultura e Def-

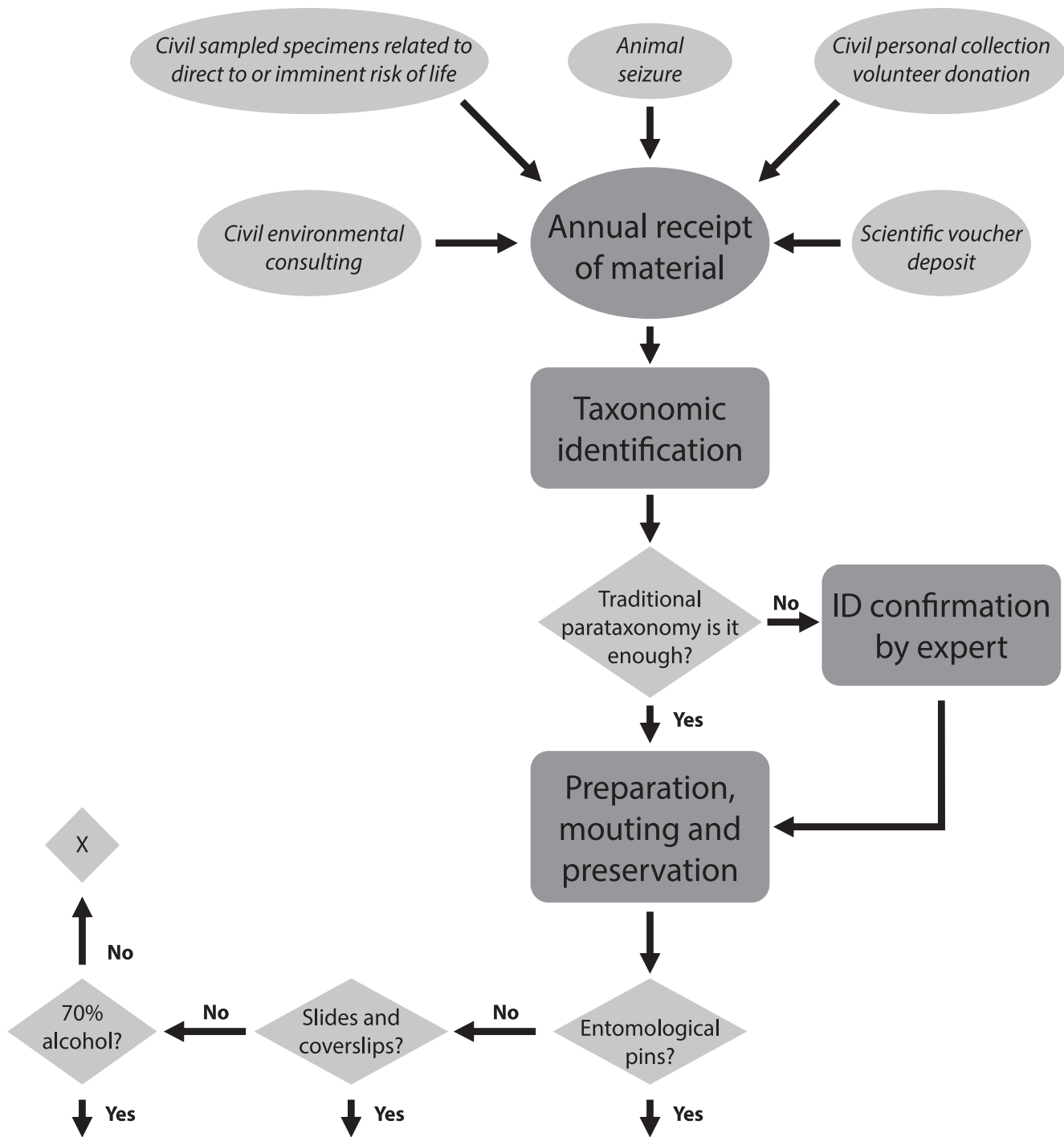
esa Animal (1927-1951). At the latter Institution, Fischer worked for over 20 years as a microscopist draftsman and later as a copywriter and proofreader, publishing more than ten scientific papers (Mendes & Monteiro, 2017; Lacerda et al., 2016).

Fischer dedicated part of his career to the study of insects, focusing on their metamorphosis, systematics, and geographic distribution. He described five species and

two genera (Table 1) and had four species named after him (Table 2).

This paper aims to make specimens of Diptera from Carlos Rodolpho Fischer's collection available, now incorporated into IBSP-Ent. Furthermore, this discovery expands the geographic records of some species and genera of Diptera, including the first records for the state of São Paulo.

### IBSP-Ent



### Updating and computerization of data

Figure 1. Flowchart describing the taxonomic assessment and validation process (routine of IBSP-Ent). X = discard or addressed to the didactic collection.

**Table 1.** List of taxa described by Carlos R. Fischer.

Order	Family	Taxon
Diptera	Curtonotidae	<i>Curtonotum punctithorax</i> (Fischer, 1933)
	Heleomyzidae	<i>Neorhinotora aristalis</i> (Fischer, 1932)
	Ropalomeridae	<i>Dactylissa</i> Fischer, 1932 <i>Dactylissa digiticornis</i> Fischer, 1932
Coleoptera	Staphylinidae	<i>Ecitosaurus</i> Fischer, 1943
Hymenoptera	Cabronidae	<i>Ectemnius tabanicida</i> (Fischer, 1929)
	Diapriidae	<i>Adelioneiva concolor</i> Fischer, 1940

**Table 2.** List of taxa in honor of Carlos R. Fischer.

Order	Family	Taxon
Diptera	Psychodidae	<i>Phlebotomus fischeri</i> Pinto, 1926
Coleoptera	Cerambycidae	<i>Methia fischeri</i> Melzer, 1923
	Phengodidae	<i>Phrixothrix fischeri</i> Pic, 1937
Squamata	Elapidae	<i>Elaps fischeri</i> Amaral, 1921 currently as synonym of <i>Micrurus decoratus</i> (Jan, 1858)

## MATERIAL AND METHODS

During the reorganization and restructuring of the IBSP-Ent, a box (Fig. 2) containing 298 specimens of Diptera sampled in the 1930s in the municipality of São Paulo by Carlos R. Fischer was found. The specimens were carefully cleaned using isopropyl alcohol and stored in entomological boxes to prevent further damage.

**Table 3.** List of specimens of Diptera sampled by Carlos R. Fischer found in a box in the IBSP-Ent. Nearly all specimens are identified to family and, when possible, to genus or species, with multiple specimens representing each species/morphospecies.

Voucher numbers (IBSP-Ent)	Number of specimens	Family	Taxon	Specialist determinator	New Records for state of São Paulo
12710	1	Anthomyiidae	<i>Anthomyia</i> sp. 1	João M. Fogaça	
12704	3	Chloropidae	<i>Thaumatomyia</i> sp. 1	Paula R. Riccardi	
12706	13	Ephydriidae	Undetermined species	Matheus Soares	
12718	1	Fanniidae	Undetermined species	João M. Fogaça	
12658, 12663	2	Lauxaniidae	<i>Chaetominettia corollae</i> (Fabricius, 1805)	Vera C. Silva	
12655-57, 12659-62, 12665-67	13	Lauxaniidae	<i>Poecilominettia</i> sp. 1	Vera C. Silva	This study
12664	1	Lauxaniidae	<i>Poecilominettia</i> sp. 2	Vera C. Silva	
12709, 12711	2	Lauxaniidae	Undetermined species	Marcoandre Savaris	
12713	1	Lonchaeidae	Undetermined species	Marcoandre Savaris	
12705	1	Lonchaeidae	Undetermined species	Geovânia Freitas	
12712	1	Muscidae	Undetermined species	Marcoandre Savaris	
12717	1	Muscidae	Undetermined species	João M. Fogaça	
12719	1	Mycetophilidae	Undetermined species	Rafaela L. Falaschi	
12701	1	Ropalomeridae	Undetermined species	Diego A. Fachin	
12668-70, 12672-73, 12675, 12715	7	Stratiomyidae	<i>Hoplitimyia mutabilis</i> (Fabricius, 1787)	Diego A. Fachin	
12671	1	Stratiomyidae	<i>Heteracanthia ruficornis</i> Macquart, 1850	Diego A. Fachin	
12708, 12714	2	Tachinidae	Undetermined species	Marcoandre Savaris	
12518-49, 12551-99, 12600-54	210	Tephritidae	<i>Neotaracia plaumanni</i> (Hering, 1938)	Marcoandre Savaris	
12716	1	Tephritidae	<i>Polymorphomyia tridentata</i> (Hendel, 1914)	Marcoandre Savaris	This study
12676-99	26	Tephritidae	<i>Tetreauresta obscuriventris</i> (Loew, 1873)	Marcoandre Savaris	This study
12720	1	Tephritidae	Undetermined species	Marcoandre Savaris	
12707	1	Ulidiidae	<i>Pterocalla</i> sp. 1	Marcoandre Savaris	
12726	1	Ulidiidae	Undetermined species	Marcoandre Savaris	
12703	1	Ulidiidae	<i>Acrosticta apicalis</i> (Williston, 1896)	Matheus Soares	This study
12702, 12721-23	4	Undetermined Acalyptratae	Undetermined species	Diego A. Fachin	
12700	1	Undetermined Diptera	Undetermined species	Rafaela L. Falaschi	

Specimens were identified to the species level whenever possible, utilizing dichotomous keys for each group with the assistance of taxonomic experts. Each specimen was assigned an additional modern label based on the original data, including the collection number and family identification (Fig. 3), and subsequently incorporated into the IBSP-Ent (see ID numbers in Table 3).

An internal database was created to document photographic records of the specimens, their respective labels, and the box in which they were stored. These images will be made available online the near future.

## RESULTS AND DISCUSSION

A total of 298 arthropod individuals were found in the box of Carlos R. Fisher, of which 293 were assigned to 13 Diptera families and at least 11 distinct genera (Figs. 4-5, Table 3). Of these, 248 specimens were identified to the species including: two *Chaetominettia corollae* (Fabricius, 1805) (Lauxaniidae); one *Heteracanthia ruficornis* Macquart, 1850 (Stratiomyidae); seven *Hoplitimyia mutabilis* (Fabricius, 1787) (Stratiomyidae); 210 *Neotaracia plaumanni* (Hering, 1938) (Tephritidae); one *Polymorphomyia tridentata* (Hendel, 1914) (Tephritidae); 26 *Tetreauresta obscuriventris* (Loew, 1873) (Tephritidae); and one *Acrosticta apicalis* (Williston, 1896) (Ulidiidae).

Three species (one of Ulidiidae and two of Tephritidae) and one genus (Lauxaniidae) are reported for the



**Figure 2.** The “treasure chest”. (A-D) Different views of the cigar box; (E) Hundreds of individuals from the Carlos R. Fischer Collection.

first time in the state of São Paulo. None of the taxa identified are associated with medical importance (details above and in Table 3).

The ulidiid *Acrosticta apicalis* was recently reported from Brazil in the municipality of Mutiaé, in the state of Minas Gerais (Maciel *et al.*, 2023). One specimen of this species was found in the Fischer collection, collected on August 30, 1933, in the municipality of São Paulo, thus expanding the distribution to the state of São Paulo.

Additionally, two Tephritidae species, *Polymorphomyia tridentata* and *Tetreauresta obscuriventris*, have expanded distributions, with their first records for the state of São Paulo. Both species were previously known from Brazil (see Aczel, 1950; Foote, 1967; Norrbom *et al.*, 1999), with additional records of *T. obscuriventris* in the state of Rio Grande do Sul (Savaris *et al.*, 2015). This species is associated with the host plant *Elephantopus mollis* Kunth (Asteraceae), which has a wide distribution in Brazil (Lorenzi, 2000; Savaris *et al.*, 2015).

Fisher studied several insects related to the taxa mentioned in this report during his career. In 1932, he studied *Anastrepha grandis* (Macquart, 1846), the South American cucurbit fruit fly (Tephritidae), and described two new species of Diptera in the family Ropalomeridae. He also investigated frontal setae variations and other characteristics in two *Anastrepha* species (Mendes & Monteiro, 2017).

The Tephritidae species collected by Carlos R. Fisher and presented here belong to the subfamily Tephritinae, which, almost all species, use host plants from the Asteraceae family (roots, stems, leaves, inflorescences, and seeds) as substrates for oviposition, larval development, and pupation, inducing the formation of galls, mines, or seed destruction in these hosts (Norrbom *et al.*, 1999; Prado *et al.*, 2002; Savaris *et al.*, 2015). These Tephritinae were sampled in areas of low vegetation and open fields dominated by Poaceae and Asteraceae plants. A sweep net was used to collect specimens by passing it over the leaves and flowers of the host plants (Savaris *personal communication*).



Figure 3. Example of a new tag added to each specimen. (A) old tag; (B) new tag.

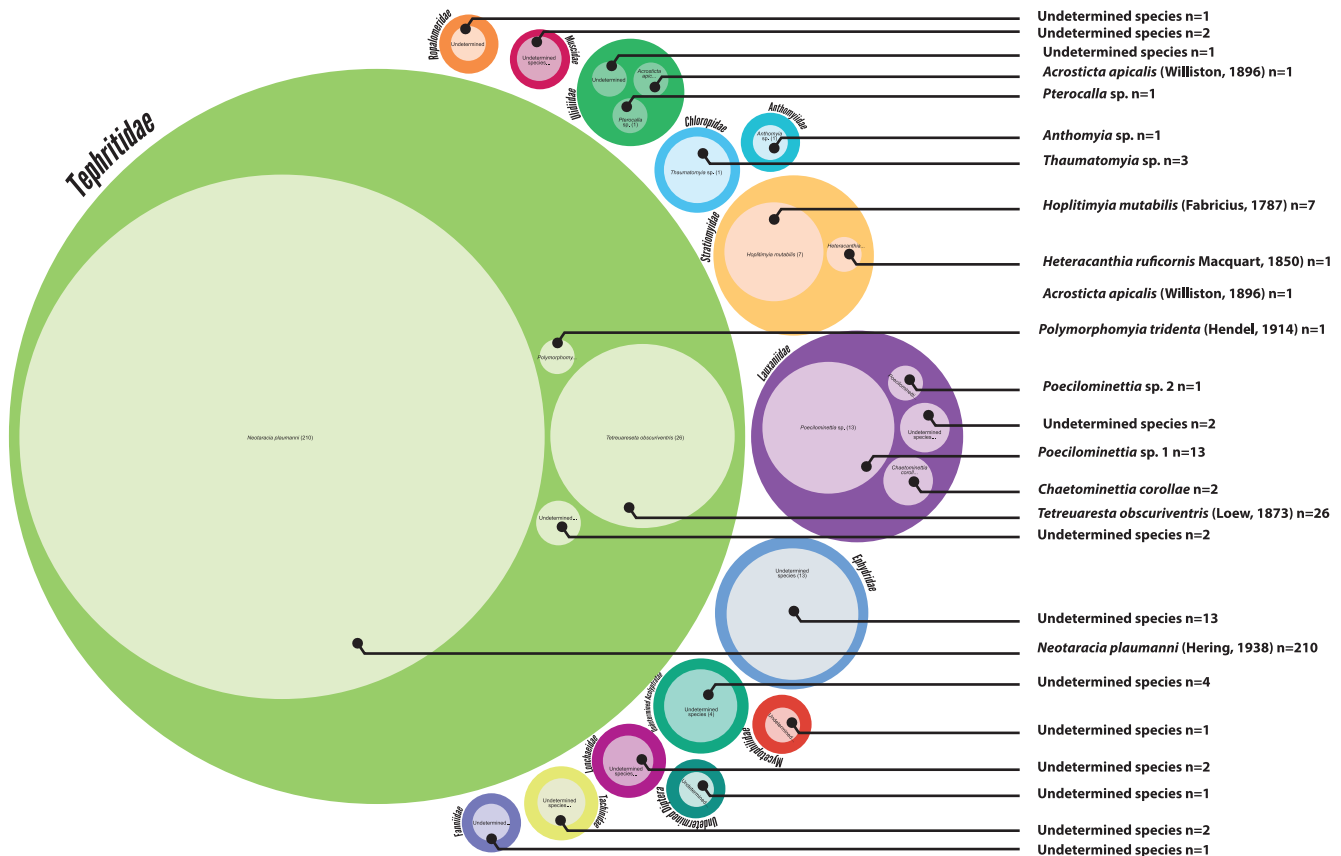
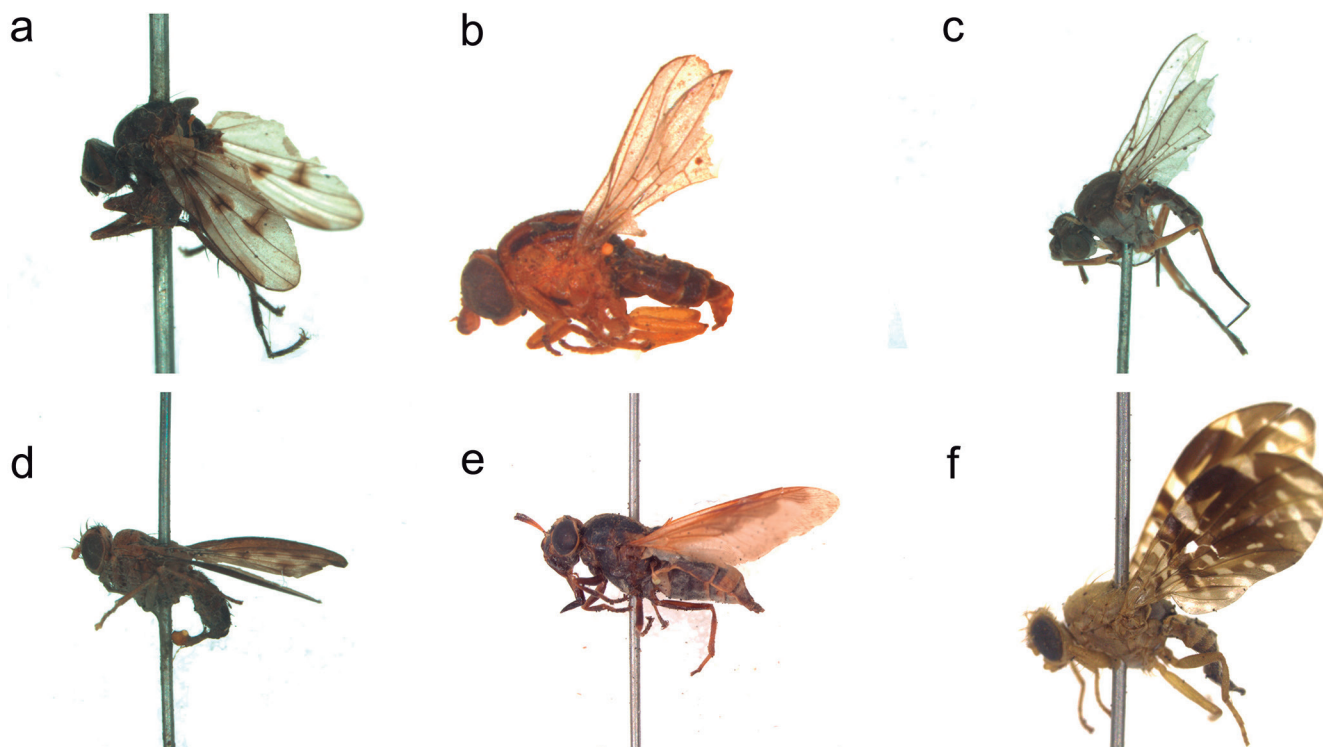


Figure 4. Proportional comparison of specimens from each taxonomic domain.



**Figure 5.** Habitus of some specimens from the Carlos R. Fischer Collection. (A) Anthomyiidae sp. 1 (*Anthomyia* sp., IBSP-Ent 12710); (B) Chloropidae (*Thaumatomyia* sp., IBSP-Ent 12704); (C) Ephydriidae (IBSP-Ent 12706); (D) Lauxaniidae (*Poecilominettia* sp. 1, IBSP-Ent 12657); (E) Stratiomyidae (*Hoplitimyia mutabilis*, IBSP-Ent 12669); (F) Tephritidae (*Tetreaesta obscuriventris*, IBSP-Ent 12685).

Regarding the genus *Poecilominettia* Hendel, 1932, 11 species are known from Brazil (Gaimari & Silva, 2020; Riccardi et al., 2022). New records of this genus have recently been published from the oceanic archipelago of Fernando de Noronha (Rafael et al., 2020), in the state of Pernambuco and Ilha de Maracá, in the state of Roraima (Riccardi et al., 2022). Here is presented the first record of the genus for the state of São Paulo, collected by Fischer in 1932.

Finally, a local image database was created to document records of the specimens, their respective labels, and the box in which they were stored. The material has been incorporated into the IBSP-Ent and will be available through the IBSP-Ent SiBBR Repository.

**AUTHOR'S CONTRIBUTION:** ECO, FV: Conceptualization; Writing – original draft; ECO, DAF, RLF, NBK, BRS, MS, FV: Data curation, Methodology; RLF, DAF, RAF, FV: Supervision; Validation; Writing – review & editing. All authors actively participated in discussing the results; they reviewed and approved the final version of the manuscript.

**CONFLICT OF INTEREST:** Authors declare there are no conflicts of interest.

**FUNDING INFORMATION:** This project did not use any external financial support.

**ACKNOWLEDGMENTS:** We would like to thank Vera Cristina Silva (Universidade de São Paulo), Paula Raile Riccardi (Museum für Naturkunde, Berlin), João Manuel Fogaça (Instituto Federal do Mato Grosso, campus Guarantã do Norte), Geovânia Freitas da Silva (Instituto Nacional de Pesquisas da Amazônia), and Matheus M.M. Soares (Museu de Zoologia da Universidade de São Paulo) for their assistance with specimen identification. We also thank Gabrielle Ribeiro de Andrade (Instituto Butantan) for her support in cataloging the specimens in the collection, and Roberto Henrique Pinto Moraes for initiating the separation of the material and coordinating the first attempt at processing it.

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