



## Insect (Hexapoda) Diversity in the Oceanic Archipelago of Fernando de Noronha, Brazil: Scenopinidae (Diptera)

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**Abstract:** This paper covers the first record of window flies, Scenopinidae (Diptera), in the archipelago of Fernando de Noronha, Brazil: *Scenopinus schulzi* Enderlein, which is briefly characterized. This species was recorded in low numbers: three males and 13 female specimens. The occurrence of scenopinids in Fernando de Noronha is regarded as an extension of the Brazilian mainland continental fauna. The colonization of the archipelago is discussed.

**Keywords:** Fernando de Noronha archipelago, window flies, neotropics, oceanic island fauna, *Scenopinus*.

## Diversidade de insetos (Hexapoda) no Arquipélago Oceânico de Fernando de Noronha, Brasil: Scenopinidae (Diptera)

**Resumo:** Este trabalho faz o primeiro registro de uma espécie de Scenopinidae no Arquipélago de Fernando de Noronha, Brasil: *Scenopinus schulzi* Enderlein, brevemente caracterizada. Esta espécie foi registrada em baixa densidade: três machos e 13 fêmeas. A ocorrência de scenopinídeos em Fernando de Noronha é atribuída à extensão territorial da fauna continental e sua colonização no arquipélago é discutida.

**Palavras-chave:** Arquipélago de Fernando de Noronha, fauna insular oceânica, mosca de janela, neotrópicos, *Scenopinus*.

## Introduction

The current list of hexapods of the Fernando de Noronha archipelago (FN) was presented by Rafael et al. (2020), which included 453 terrestrial species and morphospecies. The list was based on recently collected specimens and on several scientific and technical published works. It still is a preliminary list, and certainly incomplete since lots of specimens are not yet identified. The list is a dynamic process that requires continuous updating since the hexapod fauna from FN is still being studied by many different researchers based on recently collected specimens. Two papers were published based on new material from FN: on Pipunculidae (Diptera) (Rafael et al. 2021a) and on Tabanidae (Diptera) (Rafael et al. 2021b).

Here we present the results for Scenopinidae (Diptera), also known as window flies. Adults are 1.5–9 mm long (Winterton & Gaimari 2017), and feed on nectar and honeydew (Kelsey, 1975). Larvae are predators of arthropods in sandy, friable soils and leaf litter (Winterton & Gaimari 2017), they have also been reared from mammal, bird, and termite nests, and associated with dermestid and wood-boring beetle larvae (Kelsey, 1969, Yeates & Grimaldi 1993).

Two cosmopolitan species, *Scenopinus fenestralis* (Linnaeus, 1758) and *S. glabrifrons* Meigen, 1824, are both associated with human dwellings, being predators of carpet beetles (Dermestidae) (Winterton & Gaimari 2017). However, little else is known of their biology in the Neotropical Region. In the Amazon Basin, adults of *Metatrichia brunneipennis* Ale-Rocha & Limeira-de-Oliveira, 2021, previously treated as *Metatrichia robusta* Kröber, 1913, are known to be more active during the dry season (Rafael & Ale 1983).

The fauna of Scenopinidae has been previously recorded in other oceanic islands, always with low species numbers; 24 species of Scenopinidae are known for the Neotropical Region, and three species of *Scenopinus* have been recorded for Brazil (Lamas 2021; Ale-Rocha & Limeira-de-Oliveira 2021). Currently, the only Neotropical oceanic island records for Scenopinidae are of one species in the Galápagos Archipelago, *Scenopinus galapagosensis* Kelsey, 1970, and four records in the Caribbean islands, namely: *Scenopinus bermudaensis* Kelsey, 1971 (Bermuda); *Scenopinus pygmaeus* Loew, 1857 (Kelsey 1969) (Cuba, Jamaica), and *S. velutinus* Kröber, 1913 and *S. buscki* Kelsey, 1969 (Kelsey 1969) (Jamaica). There is also one fossil species record (*Metatrichia pria* Yeates & Grimaldi, 1993 (Perez-Gelabert 2020)

in Dominican amber from Hispaniola. In the South Atlantic Ocean scenopinid was recorded in FN as two unidentified morphospecies of *Scenopinus* (Rafael et al. 2020), both analyzed again and the identification corrected to one species.

## Material and Methods

The Brazilian oceanic archipelago of Fernando de Noronha is located in the equatorial South Atlantic region (latitude 3°45'S to 3°57'S; longitude 32°19'W to 32°41'W). It is located c. 360 km from the nearest continental port (in Natal, State of Rio Grande do Norte). The archipelago is entirely volcanic in origin and has never been connected to the mainland. The total land area is 18.4 km<sup>2</sup>, of which 16.9 km<sup>2</sup> is the main island named Fernando de Noronha (Teixeira et al. 2003), the only human-inhabited area. All islands and islets are so close, no more than 300 meters apart from each other, that, in regard to insects, they can be treated as a single unit.

The FN archipelago has a tropical oceanic climate (Aw - Köppen classification). The temperature ranges from 23.5°C to 31.5°C, with an annual mean of 28°C (IBAMA 2006) and annual precipitation of 1,400 mm, but with large inter-annual variability. It is characterized by a less rainy season, with a mean precipitation of 27.2 mm/month (August–January), and a rainy season, with a mean precipitation of 211.7 mm/month (March–July). The archipelago has a harsh environment, lacking a permanent source of freshwater, with a low vegetation diversity, and a shallow soil with little water retention (Freitas et al. 2013, Rafael et al. 2020).

The authorization to collect in FN was granted by the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) under the collecting license number 62.821. Voucher specimens are deposited at INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, at CZMA, Coleção Zoológica da Universidade Estadual do Maranhão, Caxias, Maranhão and at MNRJ, Museu Nacional do Rio de Janeiro, Rio de Janeiro.

Three sites on the main island of FN were selected for continuous collecting, using interception traps, based on the following criteria: accessibility, diversity of vegetation, low degree of exposure to human activities, and geographical position inside the National Park area. The three sites that were continuously sampled during nine months (June/2019 to February/2020) were: 1) Sancho-Dolphins bay trail, near the information and control desk, using two interception traps, model Townes (Townes 1972), placed around 100 meters of distance from each other; 2) next to the lookout at dolphins bay, using one interception trap, model Gressitt and Gressitt (1962); and 3) on the Capim-Açu trail, also using one interception trap, model Gressitt and Gressitt (1962). Collections were interrupted on March 15, after sanitary restrictions were placed due to the covid-19 pandemic. Additionally, seven-day collecting, using both interception trap models, was conducted at Sueste Bay, on a mangrove ('mangue' on labels), in June/2019 (2-9) and February/2020 (20-27). Specimens were preserved in small containers with commercial ethanol (94°), posteriorly most of the specimens being dried, pinned and labeled.

## Results

Fernando de Noronha is the only volcanic south Atlantic oceanic island where *Scenopinus* has been recorded (Rafael et al. 2020).

In nine months (from June 2019 to February 2020) using interception traps, only 14 adult specimens, three males and 13 female specimens, of *Scenopinus schulzi* Enderlein were collected.

*Scenopinus schulzi* Enderlein (Figures 1A -1D)

*Scenopinus schulzei* Enderlein, 1934: 429.

*Scenopinus schulzi*; Kelsey, 1969: 150, fig. 101 (revision); Lamas, 2021 (Brazilian on-line catalogue).

*Omphrale caenofrons* Kröber, 1937: 229.

*Scenopinus* sp. 1; Rafael et al. 2020: 15.

*Scenopinus* sp. 2; Rafael et al. 2020: 15.

The specimens from FN agrees very well with the redescription presented by Kelsey (1969). Males (Figures 1A -1C) and females (Figure 1D) run to *S. schulzi* in the key presented by that author based on the hyaline wing, brown to reddish brown halter knob, and the male abdomen (Figures 1A-1B) with three white bands (first two bands broad, third narrow). Additionally, it is the only neotropical species in the *S. velutinus* group with vein R<sub>4</sub> branching from vein R<sub>5</sub> at the middle of cell r<sub>5</sub>.

This species was considered as two morphospecies by Rafael et al. (2020) based on the white bands across the male tergites. The male collected in the mangrove, Sueste Bay, was treated as *Scenopinus* sp. 1 due to its larger size and the wider white bands on the posterior margin of the tergites (Figures 1A-1B). The male collected in the Sancho trail was treated as *Scenopinus* sp. 2 due to its smaller size and the narrower white bands on the posterior margin of the tergites. Male specimens from both morphospecies have now been dissected and, after comparing the terminalia, we concluded that both are conspecific because of the identical terminalia that also fits the figures of *S. schulzi* (Kelsey (1969)). The narrower white bands on the abdominal tergites of one male specimen are here considered to be an artifact of preservation resulted from the dehydration of the specimen. The female specimens are all identical, only differing slightly in size.

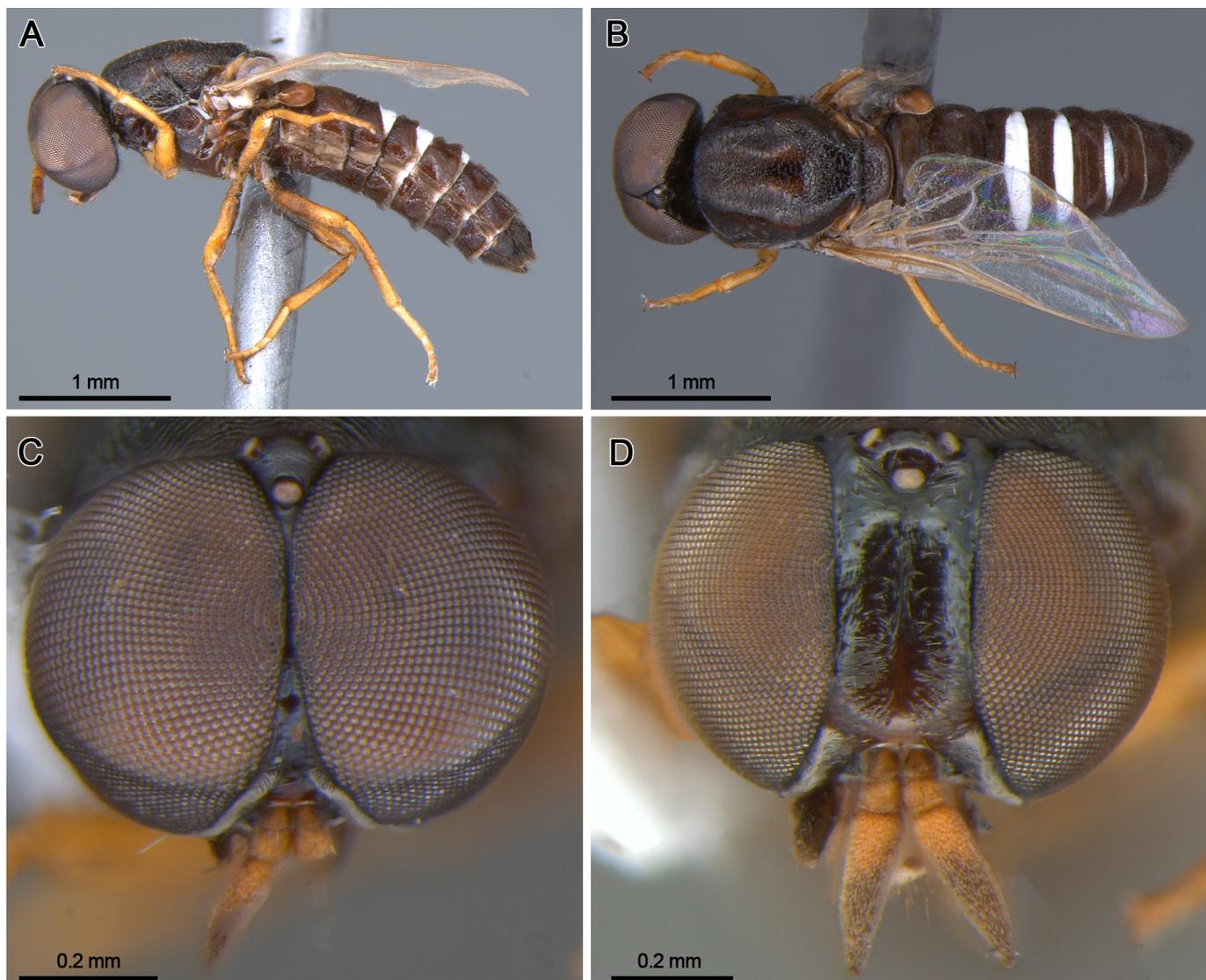
**Distribution.** Brazil: Pará, Mato Grosso and Santa Catarina (Kelsey 1969), Pernambuco (Rafael et al. 2020) and Cape Green archipelago (Baéz & Oróni 2005).

**Examined Material.** BRASIL, PE, Fernando de Noronha, 3°51'17"S-32°26'26"W, Tr. Golfinhos, 24.x-9.xi.2019, Malaise Gd, J.A. Rafael, F. Limeira-de-Oliveira, L.C. Castro cols. (1 male, 1 female, CZMA); 26.xi-8.xii, 2019, J.A. Rafael, F. Limeira-de-Oliveira, L.C. Castro cols. (1 female, CZMA); Sancho, 21.viii-8.ix.2019, Malaise peq., J.A. Rafael, F. Limeira-de-Oliveira, L.C. Castro cols. (1 male, 1 female, INPA); 8-27.x.2019 (1 female, INPA); 27.x-11.xi.2019 (2 females, MNRJ); 9-27.xii.2019 (4 females, INPA); Sueste mangue, 20-27.ii.2020, Malaise, J.A. Rafael, P.C. Grossi, F. Limeira-de-Oliveira cols. (1 male, MNRJ; 3 females, CZMA).

**Bionomy.** The specimens were collected from August/2019 to February/2020, indicating a continuous occurrence in the archipelago. No collections were made in the rainy season, from March to May. No effort was made to find the larvae in FN.

## Discussion

Fernando de Noronha is one of the smaller oceanic islands around the world but the largest one belonging to Brazil. Its insect fauna is still poorly known, and it has been neglected for a long time.



**Figures 1.** *Scenopinus schulzi*: Male, A) habitus, lateral view; B) habitus, dorsal view; C) head, frontal view; female, D) head, frontal view.

It is uncertain whether *S. schulzi* has been brought to Fernando de Noronha by man or whether it was a natural dispersal. Although natural dispersion seems less likely, it should not be discarded at this moment. There has been active commerce between the continent and FN over the years, which most likely has facilitated the transport of this species as immatures (eggs, larvae or pupae) and/or as adults. About 300 plant species have been introduced to FN (Teixeira et al. 2003), and cargo ships are not inspected to control the introduction of exotic species in the archipelago.

Interception traps are effective to collect scenopinids (Rafael & Ale 1983) and in nine months using Malaise traps only 16 specimens were collected, indicating a low density in FN as in the mainland (authors, pers. obs.). As in other group of insects, Scenopinidae has been neglected, especially in South America, and much work remains to be done especially studies on their biology and behavior.

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## Authors Contribution

José Albertino Rafael: Contribution in the concept of the study; data collection; identification of the species; data analysis and interpretation; manuscript preparation.

Rosaly Ale-Rocha: Contribution in the concept and design of the study; contribution to critical revision; manuscript preparation; preparation of the figures.

Francisco Limeira-de-Oliveira: Contribution in the concept of the study; data collection; manuscript preparation; contribution to critical revision.

## Conflicts of interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

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