

Scientific Note

New native host plant records for frugivorous flies (Diptera: Tephritidae, Lonchaeidae) in Northeastern Brazil

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Abstract. The fruit flies *Anastrepha fraterculus* (Wiedemann, 1830), *Anastrepha sororcula* Zucchi, 1979, *Ceratitis capitata* (Wiedemann, 1824) (Diptera: Tephritidae) and *Neosilba pendula* (Bezzi, 1989) (Diptera: Lonchaeidae) are recorded for the first time emerging from *Campomanesia dichotoma* (O.Berg) Mattos and *Campomanesia ilhoensis* Mattos (Myrtaceae), two native species occurring in fragments of Atlantic Forest over dunes, in the northernmost limit of this biome in the state of Rio Grande do Norte, Brazil. The flies emerged from fruit samples obtained at the conservation area at Parque Estadual Dunas do Natal. The parasitoids that emerged from the puparia were also recorded, with *Aganaspis pelleranoi* (Brèthes) being recorded for the first time for the state. These records are of importance for monitoring and further understanding of the cycles on alternative hosts especially where these species are considered agricultural pests.

Keywords: *Anastrepha fraterculus*, *Anastrepha sororcula*, *Ceratitis capitata*, *Neosilba pendula*, Myrtaceae.

Frugivorous flies (Diptera: Tephritidae, Lonchaeidae) are important agricultural pests all over the world, as their larvae develop inside several species globally commercialized fruits, producing direct damage by consuming the flesh and due to their oviposition on fruits, as well as indirect damage by letting in fungi and bacteria that cause the fruits to rot faster. Therefore, they are screened for in most quarantine facilities (Duarte & Malavasi 2000). Some species in these families are very generalist and can attack a wide range of host plants, such as the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann, 1824), and the South American fruit fly, *Anastrepha fraterculus* (Wiedemann, 1830) (Zucchi & Moraes 2021a; 2021b).

Regional studies monitoring the occurrence of fruit fly species and their hosts is a necessary step to develop and refine methods of control (Araujo et al. 2005). In the semi-arid regions of the state of Rio Grande do Norte, such studies have been conducted to establish an area free of the South American cucurbit fruit fly, *Anastrepha grandis* (Macquart, 1846) (Diptera: Tephritidae) (Araujo et al. 2000; 2005), which greatly contributed to the knowledge of the fruit fly diversity in the region; however, at that time, the methodology did not allow for a broad survey of hosts or infestation indices, which has been the subject of separate studies (Araujo & Zucchi 2002; Araujo et al. 2013).

Myrtaceae is one of the main plant families that includes hosts of fruit flies in Brazil, with at least 60 species recorded as such; the genus *Campomanesia* Ruiz & Pavón, popularly known as "gabirola" or "guabirola", is represented in Brazil by 31 species (Sobral et al. 2010). Of those, only 9 have been recorded as hosts of fruit flies (Zucchi & Moraes 2023a). As a result of monitoring of fruit flies and parasitoids, we obtained specimens from two additional species, *Campomanesia dichotoma* (O.Berg) Mattos and *Campomanesia ilhoensis* Mattos, as described below.

The fruit samples were collected between June and August 2021 at Parque Estadual das Dunas de Natal (5°48'40.2"S; 35°11'40.3"W and 5°48'35.8"S; 35°11'40.6"W), in the municipality of Natal, Rio Grande do Norte, Brazil. Fruits were collected from the ground surrounding the trees and transported to the laboratory, where they were quantified, weighted and placed in plastic trays containing slightly moistened vermiculite, and covered with a zippered bag of voile fabric. The trays

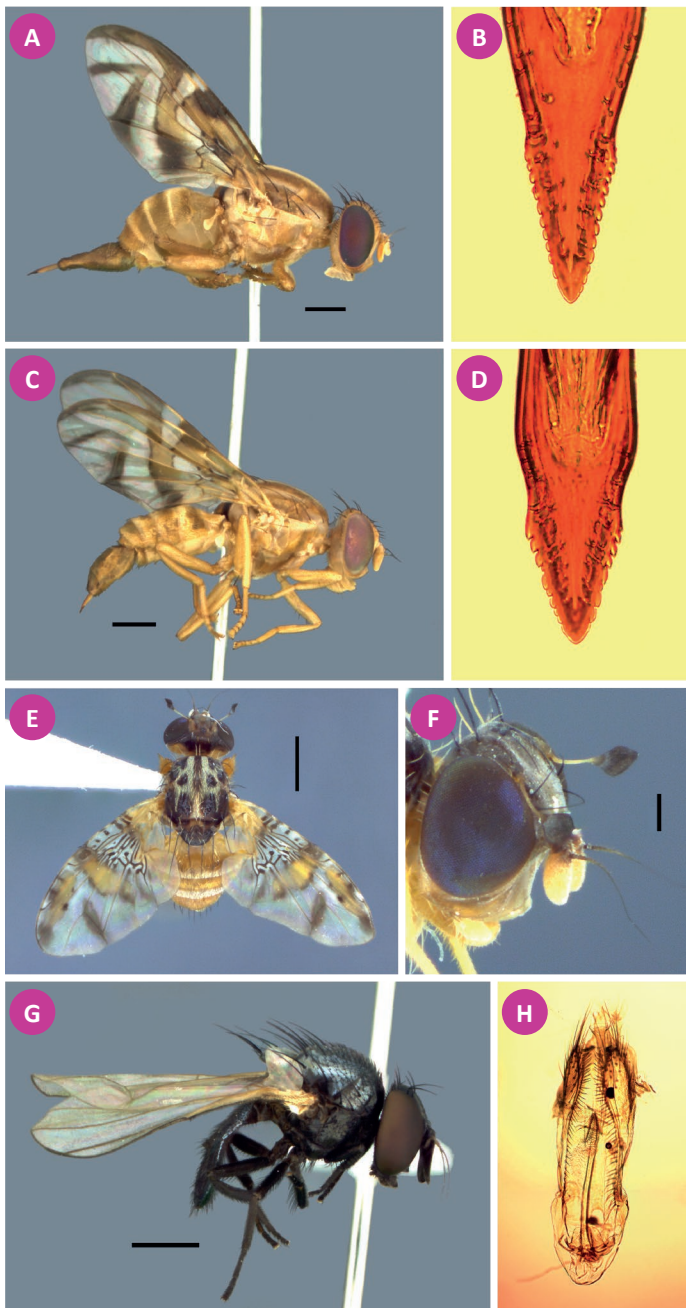
were kept at room temperature for three weeks. The vermiculite was sifted periodically in order to isolate the puparia, which were then transferred to a plastic recipient with moist vermiculite and placed in an acrylic cage (30cm x 30cm x 30cm) for emergence of the adults. After emergence, the adults were frozen and preserved in ethanol at 70%.

The *Anastrepha* Schiner, 1898 and *C. capitata* specimens were identified based on the keys to females in Araujo et al. (2000); the *Neosilba pendula* (Bezzi, 1989) (Diptera: Tephritidae) were identified based on the key to males given by Galeano-Olaya & Canal (2012), although our specimens had a slightly longer filament of the aedeagus. Their respective males and females were also compared to the descriptions in Norrbom et al. (2012). The braconid parasitoids were identified with the key provided by Marinho et al. (2018) and Wharton et al. (1997). The figitid parasitoid *Aganaspis pelleranoi* (Brèthes, 1924) (Hymenoptera: Figitidae) was identified through the key in Guimaraes et al. (2003). Vouchers of the examined material will be kept at the Fruit Fly Laboratory and Adalberto A. Varela-Freire Entomological Collection (UFRN-CENT) at Universidade Federal do Rio Grande do Norte, Natal, and Taxonomic Collection of the Ecology and Evolutionary Biology Department at Universidade Federal de São Carlos, Brazil (UFSCAR-DCBU).

Number of individuals emerged are reported in Tab. 1. A total of 515 puparia were obtained from 1,675 kg of *C. dichotoma* fruits, from which adults of *A. fraterculus*, *A. sororcula* and *N. pendula* emerged (Fig. 1, A-D, G-H). The *Anastrepha* infestation rates were 87.5 puparia per kg (0.09 puparia per fruit); rates for *N. pendula* were 69.6 puparia per kg (0.07 puparia per fruit). Three species of parasitoids emerged as well: *Doryctobracon areolatus* (Szépligeti, 1911) (Hymenoptera: Braconidae), *Opius bellus* Gahan, 1930 (Hymenoptera: Braconidae), and *A. pelleranoi* (Fig. 2A-F). A total of 238 puparia were obtained from 505g of *C. ilhoensis*. Only two species of flies emerged: *A. fraterculus* and *C. capitata* (Fig. 1A, 1B, 1E, 1F); at 239.8 puparia per kg (1.03 puparia per fruit) for *Anastrepha* and 79.2 puparia per kg (0.34 puparia per fruit) for *C. capitata*. Two species of parasitoids emerged: *D. areolatus* and *O. bellus* (Fig. 2A-D). Additional images are available at (Supplementary data 1).

Table 1. Flies and parasitoids reared from *Campomanesia dichotoma* (O.Berg) Mattos and *Campomanesia ilhoensis* Mattos, Parque Estadual das Dunas de Natal, Natal, RN, Brazil, 2021.

| Family | Species | Number of individuals | |
|-------------|---|-----------------------|---------------------|
| | | <i>C. dichotoma</i> | <i>C. ilhoensis</i> |
| Tephritidae | <i>Anastrepha fraterculus</i> (Wiedemann, 1824) | 31 | 121 |
| | <i>Anastrepha sororcula</i> Zucchi, 1979 | 116 | - |
| | <i>Ceratitidis capitata</i> (Wiedemann, 1824) | - | 40 |
| Lonchaeidae | <i>Neosilba pendula</i> (Bezzi, 1989) | 117 | - |
| Braconidae | <i>Doryctobracon areolatus</i> (Szépligeti, 1911) | 78 | 11 |
| | <i>Opius bellus</i> Gahan, 1930 | 05 | 8 |
| Figitidae | <i>Aganaspis pelleranoi</i> (Brèthes, 1924) | 01 | - |


Figure 1. Frugivorous flies emerged from *Campomanesia* fruits. (A-B) *Anastrepha fraterculus*, lateral view (A) and aculeus apex (B). (C-D) *A. sororcula*, lateral view (C) and aculeus apex (D). (E-F) *Ceratitidis capitata*, dorsal view (E) and head in lateral view (F). (G-H) *Neosilba pendula*, lateral view (G) and male genitalia (H).

This is the first record of *A. fraterculus*, *A. sororcula* and *N. pendula* on *C. dichotoma* and the first record of *A. fraterculus* and *C. capitata* on *C. ilhoensis*. Even though these plants are not economically explored

as fruit crops, our results increase the documented host range of fruit flies in an area where other Myrtaceae are relevant in local fruticulture. The parasitoids that emerged are frequently associated with these fruit fly species. *D. areolatus* and *O. bellus*, are both very well distributed in Brazil, with the former being recorded for all states, and the latter with only Mato Grosso, Paraíba, Pernambuco and Sergipe missing records. *Aganaspis pelleranoi* however, although already registered for all five regions of Brazil, is here recorded for the first time for the state for Rio Grande do Norte.


Figure 2. Parasitoids emerged from fruit flies. (A-D) *Doryctobracon areolatus*, lateral view (A) and propodeum (D). (B-E) *Opius bellus*, lateral view (B) and propodeum (E). (C-F) *Aganaspis pelleranoi*, lateral view (C) and scutellum (F).

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Author's Contributions

JMGAS, FWGV, RPRC planned and conducted field sampling; FWGV, RPRC, ADM planned record methodology; FWGV, RPRC conducted lab work; all authors contributed to writing the manuscript.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

Supplementary Material

Supplementary data 1.

Supplementary data to this article can be found online at <https://doi.org/10.5281/zenodo.8274368>.

References

- Araujo, E. L.; Medeiros, M. K.; Silva, V. E.; Zucchi, R. A. (2005) Moscas-das-frutas (Diptera: Tephritidae) no semi-árido do Rio Grande do Norte: plantas hospedeiras e índices de infestação. *Neotropical Entomology*, 34(6): 889-894. doi: [10.1590/S1519-566X2005000600003](https://doi.org/10.1590/S1519-566X2005000600003)
- Araujo, E. L.; Lima, F. A. M.; Zucchi, R. A. (2000) Rio Grande do Norte. In: Malavasi A. & Zucchi, R.A. (ed.) *Moscas-das-frutas de importância econômica no Brasil. Conhecimento básico e aplicado*, pp. 223-226. Holos, Ribeirão Preto,
- Araujo, E. L.; Zucchi, R. A. (2002) Hospedeiros e níveis de infestação de *Neosilba pendula* (Bezzi) (Diptera: Lonchaeidae) na região de Mossoró-Assu, RN. *Arquivos do Instituto Biológico*, 69(2): 91-94.
- Araujo, E. L., Ribeiro, J. C.; Chagas, M. C. M.; Dutra, V. S.; Silva, J. M. (2013) Moscas das frutas (Diptera: Tephritidae) em um pomar de goiabeira, no Semiárido Brasileiro. *Revista Brasileira de Fruticultura*, 35(2): 471-476. doi: [10.1590/S0100-29452013000200016](https://doi.org/10.1590/S0100-29452013000200016)
- Duarte, A. L.; Malavasi, A. (2000) Tratamentos Quarentenários. In: Malavasi, A.; Zucchi, R. A. (Eds.), *Moscas-das-frutas de importância econômica no Brasil, conhecimento básico e aplicado*, pp. 187-192. Holos, Ribeirão Preto.
- Galeano-Olaya, P. E.; Canal, N. A. (2012) New species of *Neosilba* McAlpine (Diptera: Lonchaeidae) and new records from Colombia. *Papeis Avulsos de Zoologia*, 52(31): 361-385. doi: [10.1590/S0031-10492012021100001](https://doi.org/10.1590/S0031-10492012021100001)
- Guimaraes, J. A.; Gallardo, F. E.; Diaz, N.B.; Zucchi, R. A. (2003) Eucoilinae species (Hymenoptera: Cynipoidea: Figitidae) parasitoids of fruit-infesting dipterous larvae in Brazil: identity, geographical distribution and host associations. *Zootaxa*, 278(1): 1-23. doi: [10.11646/zootaxa.278.1.1](https://doi.org/10.11646/zootaxa.278.1.1)
- Marinho, C. F.; Costa, V.A.; Zucchi, R. A. (2018) Annotated checklist and illustrated key to braconid parasitoids (Hymenoptera, Braconidae) of economically important fruit flies (Diptera, Tephritidae) in Brazil. *Zootaxa*, 4527(1): 21-36. doi: [10.11646/zootaxa.4527.1.2](https://doi.org/10.11646/zootaxa.4527.1.2)
- Norrbom, A. L.; Korytkowski, C. A.; Zucchi, R. A.; Uramoto, K.; Venable, G. L.; McCormick, J.; Dallwitz, M. J. (2012) *Anastrepha* and *Toxotrypana*: descriptions, illustrations, and interactive keys. Version: 9th April 2019. <https://www.delta-intkey.com/anatox/index.htm>. Access on: 14.vi.2023.
- Sobral, M.; Proença, C.; Souza, M.; Mazine, F.; Lucas, E. (2010) Myrtaceae. In: Forzza, R. C.; Leitman, P. (Eds.), *Catálogo de plantas e fungos do Brasil. Vol. 2. Angiospermas*, pp. 1301-1330. Rio de Janeiro: Instituto de Pesquisa do Jardim Botânico do Rio de Janeiro. doi: [10.7476/9788560035090](https://doi.org/10.7476/9788560035090)
- Wharton, R. A.; Marsh, P. M.; Sharkey, M. J. (1997) Manual of the New World Genera of the Family Braconidae (Hymenoptera) (Eds.) *The International Society of Hymenopterists*.
- Zucchi, R. A.; Moraes, R. C. B. (2023a) Fruit flies in Brazil: *Anastrepha* species, their host plants and parasitoids. <http://www.lea.esalq.usp.br/anastrepha/>. Access on: 14.vi.2023.
- Zucchi, R. A.; Moraes, R. C. B. (2023b) Fruit flies in Brazil: Hosts and parasitoids of the Mediterranean fruit fly. <http://www.lea.esalq.usp.br/ceratitis/>. Access on: 14.vi.2023.