

First record of *Zaprionus tuberculatus* (Diptera: Drosophilidae) in Santa Catarina State, Brazil

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Abstract – Agricultural product exports and imports have increased in recent decades. Consequently, global transportation has expanded the geographic distribution of several invasive pest species. Insect pests introduced to new environments can pose risks to native biodiversity and agricultural production, leading to negative environmental and economic impacts. This study aims to report the first record of the Afrotropical species *Zaprionus tuberculatus* (Diptera: Drosophilidae) in Santa Catarina State. The first record of *Z. tuberculatus* was in March 2023, in fruits of feijoa collected in Caçador, and yellow strawberry guava fruits collected in Videira, Alto Vale do Rio do Peixe region. This species was also recorded in red strawberry guava collected in Caçador in April 2023. We also recorded an increase in fruit species that host *Z. tuberculatus* in Brazil, with the inclusion of feijoa. These results reinforce the need to monitor this pest in the State, assess its impacts and distribution, and establish future management programs focused on it.

Index terms: Pomace fly; Invasive exotic species; Hosts.

Primeiro registro de *Zaprionus tuberculatus* (Diptera: Drosophilidae) no estado de Santa Catarina, Brasil

Resumo – Nas últimas décadas, as exportações e importações de produtos agrícolas aumentaram e o transporte global favoreceu a ampliação da distribuição geográfica de várias espécies-praga exóticas invasoras. Insetos-praga introduzidos em um novo ambiente podem colocar em risco a biodiversidade nativa e a produção agrícola, causando impactos ambientais e econômicos negativos. Neste trabalho relatamos o primeiro registro da espécie Afrotropical *Zaprionus tuberculatus* (Diptera: Drosophilidae) no estado de Santa Catarina. O primeiro registro de *Z. tuberculatus* foi em março de 2023, em frutos de goiaba-serrana coletados em Caçador e de araçá-amarelo coletados em Videira, municípios da região do Alto Vale do Rio do Peixe. Em Caçador, a espécie também foi registrada em araçá-vermelho, em abril de 2023. Registrou-se também o aumento de espécies frutíferas hospedeiras de *Z. tuberculatus* no Brasil, com a inclusão da goiabeira-serrana. Tais resultados reforçam a necessidade da realização do monitoramento desta praga no Estado, para se avaliar seus impactos, distribuição e estabelecer futuros programas de manejo da espécie.

Termos para indexação: Pomace fly; Espécie exótica invasora; Hospedeiras.

Genus *Zaprionus* (Coquillett, 1902) (Diptera: Drosophilidae) comprises 48 species (YASSIN & DAVID, 2010); among them, *Zaprionus tuberculatus* Malloch, 1932 and *Zaprionus indianus* (Gupta, 1970), both native to tropical Africa (YASSIN, 2008). These two species are among the most widely distributed drosophilids in new regions worldwide (CHASSAGNARD & TSACAS, 1993). In Brazil, *Z. indianus* was first recorded in 1999 (VILELA, 1999), and *Z. tuberculatus* in 2020 (CAVALCANTI et al., 2022).

Z. tuberculatus was the first recorded in urban parks in Brasília, it was also

the first record of this species in the American continent (CAVALCANTI et al., 2022). After that, it was also reported in São Paulo (MATEUS & MACHADO, 2022; MONTES & VILELA, 2022), Rio de Janeiro (FARIA & BITNER-MATHÉ, 2023), Rio Grande do Sul (JOBIM et al., 2023), and Minas Gerais states (MOREIRA et al., 2023).

The establishment of *Z. tuberculatus* in Brazil is worrisome since niches occupied by this species are similar to those occupied by *Z. indianus* (VIEIRA et al., 2019) and *Drosophila suzukii* (Matsumura, 1931) (AMIRESMAEILI et

al., 2019). Their interaction in the same crop can increase infestation potential; consequently, it can worsen damage to fruits. Thus, these exotic drosophilids pose a potential risk to fruit production because these generalist species efficiently exploit both native and exotic hosts (VALADÃO et al., 2019). Species belonging to the genus *Zaprionus* are acknowledged for their polyphagous habit and preference for decomposing fruits (PATLAR et al., 2012; JOSHI et al., 2014) and for fruits presenting mechanical damage caused by other insect species, such *D. suzukii* lays its

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eggs in intact fruits due to its serrated ovipositor (GARCIA et al., 2022). *Z. tuberculatus* can damage intact pear, strawberry, fig, and pomegranate fruits during oviposition (KUYULU et al., 2019), making it a significant threat to fruit production.

A member of the group of flies known as vinegar fly or pomace fly, *Z. tuberculatus*, is featured by two longitudinal white dorsal stripes along its head and thorax (Figure 1A), as well as by the prominent tubercle on the external femoral surface of the foreleg, in both sexes (Figure 1B). This tubercle presents long bristles and lays adjacent to a short cuticle expansion found on the inner surface of the fore femur (YASSIN, 2008).

The present article reports the first *Z. tuberculatus* occurrence in Santa Catarina State, which was recorded during a study focused on investigating drosophilids associated with the main native fruit trees grown in Alto Vale do Rio do Peixe region. It was conducted to gather information to support integrated drosophilid pest management programs. Therefore, it is important to conduct studies aimed at reporting both the incidence and expansion of invasive species' geographic distribution. These

studies allow future niche modeling studies and regional pest management measures (ZAZYCKI et al., 2019).

Drosophilids' natural infestation in the following fruit was assessed: *Campomanesia xanthocarpa* O. Berg. (guabiroba) (Myrtaceae), *Psidium cattleianum* Sabine (yellow and red strawberry guava) (Myrtaceae), and *Acca sellowiana* (O. Berg.) Burret (feijoa) (Myrtaceae). Fruits were collected in rural areas in two municipalities, Caçador (guabiroba and red strawberry guava) and Videira (guabiroba, yellow strawberry guava, and feijoa).

The fruits were harvested in the following months and years: guabiroba (January/2023), yellow strawberry guava and feijoa (March/2023), and red strawberry guava (April/2023). Fruits were harvested at the full ripe stage when they were more susceptible to drosophilid infestation. The harvest time set for each fruit species was considered to check the fruit ripening stage, based on research data previously collected in the investigated region (SANTOS, 2013), as well as on monitoring color changes in fruit epidermis.

A total of 50 fruits were randomly harvested (at trees and on the ground). No pesticides were applied. Each fruit

was weighed individually on an analytical scale, under laboratory conditions, and placed individually in 80mL transparent plastic containers with perforated lids covered by voile fabric to allow gas exchange. These containers were filled with a two-centimeter layer of extra-fine vermiculite, over which fruits remained for 30 days in the climatized room ($25 \pm 2^\circ\text{C}$; $70 \pm 10\%$ relative air humidity; 12-hour photoperiod). Emerged flies were collected and placed in 2mL Eppendorf-type flasks filled with 70% alcohol for subsequent screening and identification. Adults of *Z. tuberculatus* were identified following Cavalcanti et al. (2022).

The infestation rates of *Z. tuberculatus* were calculated based on the methodology by Garcia and Norrbom (2011), according to which: a) flies/fruit = total number of flies divided by the number of fruits in the sample and b) flies/kg = total number of flies divided by the total weight (kg) of fruits in the sample.

The first *Z. tuberculatus* specimens were recorded in March 2023, in feijoa fruits from Caçador municipality, as well as in yellow strawberry guava fruits collected in Videira. The flies in Caçador also emerged in red strawberry guava



Figura 1. Adulto de *Zaprionus tuberculatus*: (A) vista dorsal das faixas brancas longitudinais ao longo da cabeça e do tórax e (B) detalhe do tubérculo proeminente na superfície externa do fêmur das pernas anteriores, característico da espécie. Tamanho real do inseto = 3mm. Fotos: (A) Juracy Caldeira Lins Junior e (B) André Amarildo Sezerino.

Figure 1. Adult *Zaprionus tuberculatus* individual: (A) dorsal view of the longitudinal white stripes along the head and thorax and (B) detail of the prominent tubercle on the external femoral surface of the forelegs, typical of this species. Real insect size = 3mm. Photos: (A) Juracy Caldeira Lins Junior and (B) André Amarildo Sezerino.

Tabela 1. Espécies frutíferas nativas e seus respectivos números de frutos amostrados (n), peso, abundância de *Zaprionus tuberculatus* e número médio de exemplares de *Z. tuberculatus* por fruto⁻¹ e kg⁻¹.

Table 1. Native fruit tree species and their respective number of sampled fruits (n), weight, abundance of *Zaprionus tuberculatus*, and mean number of *Z. tuberculatus* specimens per fruit⁻¹, and kg⁻¹.

Native fruit tree species	n	Weight (Kg)	Abundance	Flies.fruit ⁻¹	Flies.Kg ⁻¹
<i>Psidium cattleianum</i> (yellow strawberry guava)	50	0.95	11	0.22	11.6
<i>Psidium cattleianum</i> (red strawberry guava)	50	0.54	70	1.40	129.6
<i>Acca sellowiana</i> (feijoa)	50	3.33	6	0.12	1.8

fruits in April 2023. *Z. tuberculatus* emergence was not recorded in guabiroba. A study conducted by Jobim et al. (2023), in Rio Grande do Sul State, detected *Z. tuberculatus* in Pelotas city in January 2023 (JOBIM, et al., 2023). These authors recorded *Z. tuberculatus* infestation in butiá, *Butia capitata* (Mart.) Becc. (Arecaceae); in Cherry of the Rio Grande, *Eugenia uniflora* L. (Myrtaceae); in strawberry guava, *Psidium cattleianum* Sabine (Myrtaceae); as well as in grape, *Vitis labrusca* L. Cv. Isabel (Vitaceae).

A total of 3,847 Drosophilidae specimens were collected from all fruits assessed in the present study: 4.1% of them belonged to species *D. sukukii*; 24.1% to *Z. indianus*; and only 2.3% to *Z. tuberculatus*. The other unidentified drosophilids accounted for 69.5% of collected specimens. The highest and lowest *Z. tuberculatus* infestation rates were recorded in red strawberry guava and feijoa fruits, respectively (Table 1).

Zaprionus tuberculatus was recorded in 49 host plant species belonging to 11 botanical families worldwide (EPPO, 2023). To the best of our knowledge, this is the first record of feijoa as a host for *Z. tuberculatus*. This highlights the successful spread of *Zaprionus* spp. worldwide due to its greater host range and rapid adaptation to different climatic conditions (Parkash and Yadav, 1993). Thus, this fruit species must be included as a host species in Brazil. According to Garcia et al. (2022), in most cases, species are passively spread via international trade of fresh fruits. Therefore, it is important to intensify both surveys on and the monitoring of *Z. tuberculatus* to verify its expansion to other regions in Santa Catarina state, as well as its population

dynamics and tri-trophic interactions with hosts and natural enemies, mainly with parasitoids, to support future pest species management programs.

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