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Scientific Note

Outbreak of *Lauritrioza alacris* (Flor, 1861) (Hemiptera, Triozidae) in a commercial plantation of bay laurel (*Laurus nobilis* L., Lauraceae) in Brazil

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Abstract. An attack of *Lauritrioza alacris* (Flor, 1861) (Hemiptera: Triozidae) was recorded in a commercial plantation of bay laurel (*Laurus nobilis* L., Lauraceae) in the municipality of Dois Lajeados, Rio Grande do Sul state (RS), Brazil. The immature triozids induced galls on the attacked leaves consisting of the thickened margins that became folded downward, forming an elongated tube-shaped roll that sheltered the immatures. All developmental stages (egg, immatures, and adults) of the psyllid were found on young leaves of bay laurel. *Lauritrioza alacris* is an introduced pest in Brazil that was detected in Pelotas, RS in 1949 and Rio de Janeiro, Rio de Janeiro state in 1953. Therefore, we are reporting the third record of *L. alacris*; however, it is the first documented information of an infestation in a commercial bay laurel plantations by *L. alacris* in Brazil. Information on taxonomy, biological aspects, distribution, and damage caused by the laurel psyllid is also provided.

Keywords: laurel psyllid, damage, distribution, occurrence, identification.

The hemipterans of the Psylloidea superfamily are known in Brazil by the vernacular name "psilídeos", although not all belong to the Psyllidae family. The common names of some economically important pests in agriculture and forestry are associated with their host plants, such as Asian citrus psyllid *Diaphorina citri* Kuwayama, 1908 (Psyllidae), the guava psyllid *Triozoida limbata* (Enderlein, 1918) (Triozoidae) and the laurel psyllid *Lauritrioza alacris* (Flor, 1861) (Triozidae). Other common names are based on the protective cover (lerp) produced by immatures, as in the case of the red gum lerp psyllid *Glycaspis brimblecombei* Moore, 1964 (Aphalaridae). Although some species do not belong to the family Psyllidae, the vernacular name psyllid has been used. Currently, Psylloidea consists of seven families (Burckhardt et al. 2021).

Psylloidea or psyllids are small insects (1 to 10 mm long) that resemble tiny cicadas. They have well-developed hind legs adapted for jumping, hence the common name jumping plant lice. Immatures and adults are generally phloem-feeders sap-sucking insects that get their food from the phloem, mostly from Eudicotyledoneae and Magnoliales, forming close associations with specific host plants. Their feeding can cause the formation of galls or curling of the leaf margins. Immatures are host-specific, and adults often feed on various plants (Hodkinson 1984; Burckhardt et al. 2014; Ouvrard 2021). Females will only lay eggs on plants that are suitable for their offspring's development. Adults usually remain on the host plant on which they originated, though they may disperse. They are thus considered monophagous or oligophagous insects, meaning that they develop on one or a few related host plant species, often associated with only one or two species of a single plant genus (Hodkinson 1984). The host plant is therefore the one on which psyllid immatures spend their immature life stages. Psyllids pass through five immature stages before becoming adults. Immatures of some species cause typical galls or gall-like formations on the host plant (Hodkinson & White 1979; Hodkinson 1984; Burckhardt 2005). We are using the term "immature" based on Burckhardt et al. (2014).

The laurel psyllid was originally described in the genus *Trioza* Foerster, 1848 as *Trioza alacris* Flor, 1861. Later, it was transferred to the monotypic genus *Lauritrioza* proposed by Conci & Tamanini (1985), who characterized this genus based on morphology and biology of immatures and adults from *Laurus nobilis* L. However, Hodkinson (1990) considered the status of *Lauritrioza* doubtful, until a comprehensive revision of dozens of species related to the laurel psyllid be carried out. No revision has been carried out yet, and the laurel psyllid is named for some authors as *T. alacris* (e.g., Burckhardt & Queiroz 2012; Zeity 2018), and by other as *L. alacris* (e.g., Landi 1997; Ouvrard 2021). Burckhardt & Ouvrard (2012), who used *Lauritrioza* as a valid name for the genus, claimed that "... genera synonymised with *Trioza* which is treated, by most authors, as an artificial receptacle for species not showing any particular morphological modifications. A sound phylogenetic analysis is required for obtaining a better base for a stable generic classification". Considering the controversy in the use of the scientific name of the laurel psyllid, we opted for *L. alacris*, as no revision has yet been published to contest the genus created by Conci & Tamanini (1985).

Although various host plants have been recorded (Ouvrard 2021), according to Hodkinson (1990), *L. alacris* is monophagous on *L. nobilis*. The laurel psyllid is native to the Mediterranean and Middle East, adventive in Central and Northern Europe, as well as North (USA) and South America (Argentina, Brazil and, Chile) (Ouvrard 2021) (Fig. 1). It is an introduced pest in Brazil that was detected in Pelotas, Rio Grande do Sul (Biezanko et al. 1949) and in Rio de Janeiro, Rio de Janeiro state (Robbs 1953) (Fig. 1) (Burckhardt & Queiroz 2012). Therefore, our record in the municipality of Dois Lajeados, RS, is a new location for the occurrence of *L. alacris* in Brazil, discovered about 70 years after its first detectation.

In December 2020, samples of a pest, that was damaging laurel plantation in the municipality of Dois Lajeados - RS were sent to the Entomology Laboratory of Embrapa Temperate Agriculture (*Embrapa Clima Temperado*), in Pelotas - RS, and damage and all stages of the pest were photographed (Figs. 2A-F). The pest was initially identified

as *L. alacris*, based on the host plant (*L. nobilis*). This identification was confirmed by examination of adults at the Insect Taxonomy Laboratory of the Luiz de Queiroz College of Agriculture, Piracicaba, São Paulo state. Identification was based on the morphological characters discussed by Hodkinson & White (1979) and Hodkinson (1990). Voucher specimens (5 females and 5 males; double mounting on minuten pin) were deposited in the collection of the Luiz de Queiroz Entomology Museum (MELQ), Piracicaba (numbers ESALQENT000569-578).

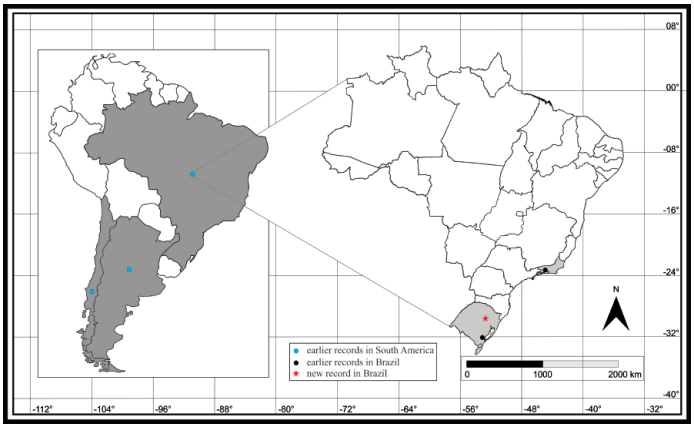

Figure 1. Distribution map of *Lauritrioza alacris* in South America and Brazil.

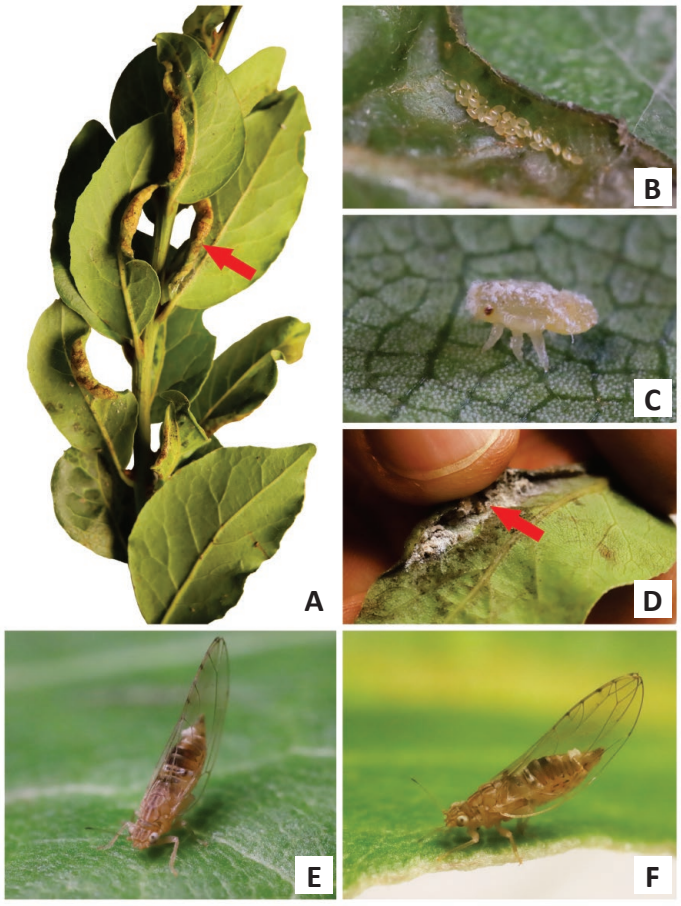

Figure 2. *Lauritrioza alacris* damage (A), clustered eggs (B), immature (C), immatures on the curled lower margin of the leaf (D), Females (dorsal and lateral views) (E - F) (Photos: Paulo Lanzetta).

Adults measure around 2 mm in length. When feeding on leaves, they assume an anteriorly inclined position (Figs. 2E-F) and jump, fly short distances or move in a way that the tip of the wings describes an 8 (D. Burckhardt, pers. comm.). Antennae are orange-yellow with two black apical segments (Figs. 2E-2F). Forewing narrowly acute in apical third, with radular spinules in V-shaped clusters in the cells around the apical and anal margin (Fig. 2F). Male and female can be easily distinguished by respective terminalia (Figs. 3A-D). However, species identification should be based on the male terminalia, especially the shape of the parameres, which are parallel-sided, and proctiger longer than parameres (Conci & Tamanini 1985; Hodkinson 1990), with a subacute apical black point (Weiss & Dickerson 1918) (Fig. 3C).

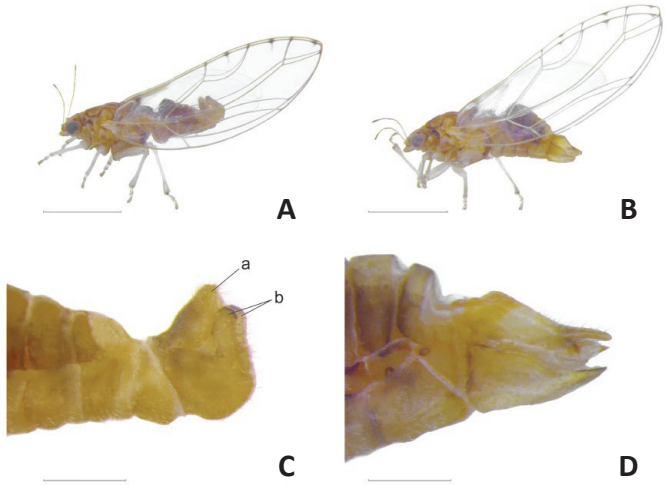

Figure 3. *Lauritrioza alacris* (lateral view from specimens in 70% ethanol). Male (A), female (B). Scale bars: 1 mm. Male terminalia (a, proctiger; b, parameres) (C), female Terminalia (D). Scale bars: 0,25 mm. (Photos: Marcoandre Savaris).

The commercial bay laurel plantation occupies an area of 2 ha (28°57'59.6"S; 51°50'22.4"W; 532 m in altitude) in the municipality of Dois Lajeados, RS. The attack occurred in 8-year-old plants, planted at a spacing of 1.8 m between rows and 1.8 m between plants, with recommended treatments for the crop. The young leaves presented the typical symptoms of *L. alacris* attack. The leaves were deformed with thickened margins that were folded downward, forming a leaf roll gall, where the immatures remained (Figs. 2A and 2D). The different developmental stages of *L. alacris* were found on bay laurel young leaves. Elliptical eggs are deposited in clusters on the margins of the abaxial face of young leaves, which curl down toward the central vein (Fig. 2B). The immatures (Fig. 2C) are protected and feed in the interior of the leaves, which curl downward (Fig. 2D) and produce waxy secretions that cover immatures' bodies. The fifth-instar immature leaves the gall for adult emergence (Conci & Tamanini 1985). The eggs and the five immature stages were described by Weiss & Dickerson (1918), and the fifth instar was described and illustrated by Conci & Tamanini (1985). Adults feed on young leaves, which curl up, making them suitable egg-laying sites (Zeity 2018), but it is more likely that the sucking of the immatures induces the gall (D. Burckhardt, pers. comm.).

Lauritrioza alacris damage directly affects the bay laurel leaves, which are the marketed product of the plant. *Laurus nobilis* is an evergreen tree with a rounded crown native to the Mediterranean. The economic importance of bay laurel lies in the use of its leaves as a flavoring in cuisines around the world (Ishimura et al. 2013). In Brazil, bay laurel cultivation occurs in the southeastern and southern regions, with a total annual production of 897 tons (IBGE 2017). In RS, commercial bay laurel cultivation is carried out in the municipality of Dois Lajeados, where the outbreak of *L. alacris* occurred. In Dois Lajeados and Guaporé (bordering municipalities) were produced approximately 300 tons of green bay laurel leaves in 2017, from a cultivated area of 24 ha (D. Denardi, pers. comm.). Nonetheless, Brazil imports an amount roughly equivalent to half of the national production.

The cultivation of *L. nobilis* has expanded in recent years in Brazil, although producers experience competition pressures from imports. The outbreak of *L. alacris* in Dois Lajeados justifies the inclusion of this species in the monitoring of bay laurel pests, as outbreaks have been more frequent in recent years. *Lauritrioza alacris* infestations of bay laurel in this municipality have occurred in plants of all ages, but it is greater in plants older than eight years (D. Denardi, pers. comm.). However, the age of the plant is less important for increasing populations of psyllids than new shoots on plants that are pruned regularly (D. Burckhardt, pers. comm.). Plants attacked by the laurel psyllid can have damage in up to 20% of their leaves. The pest attack decreases the quality of the leaves produced, making the commercialized product

less valuable. Instead of selling them whole, producers must dry and grind insect-damaged leaves for sale as ground bay leaves at a lower price.

Information on *L. alacris* in Brazil is scarce, and there are no reports of the occurrence of this pest in commercial bay laurel plantations. Textbook *Entomologia Agrícola* (Gallo et al. 2002), which has been published since 1970, about 500 species of agricultural importance, including some pests of bay laurel, are discussed, but there is no information of *L. alacris*. Therefore, we are herein documenting for the first time an outbreak of *L. alacris* in a commercial plantation of *L. nobilis* in Brazil.

Currently, there are no pesticides registered in the Brazilian Ministry of Agriculture, Livestock, and Supply (MAPA) to control the laurel psyllid or other pests of the crop, which has made phytosanitary management difficult. Further basic research on bioecology and management is therefore necessary, including techniques to monitor and control this exotic pest, which limits production and could compromise the expansion of the crop in Brazil.

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Authors' Contributions

All authors designed the study, examined the specimens, and wrote the final version of the manuscript. RAZ and SSN identified the psyllid species. MS made the distribution map and plates.

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