

New state record of gall midge species (Diptera, Cecidomyiidae) associated with *Calophyllum brasiliense* Cambess (Calophyllaceae)

Barbara Proença* and Valéria Cid Maia

Museu Nacional, Quinta da Boa Vista, São Cristóvão, 20940-040 Rio de Janeiro, RJ, Brazil

* Corresponding author: E-mail: bproenca@mn.ufrj.br

Abstract: Five gall midges species (Diptera: Cecidomyiidae) are recorded for the first time in Pirenópolis (Goiás, Brazil, Cerrado biome): *Contarinia gemmae*, *Lopesia caulinaris*, *L. conspicua*, and *L. elliptica*, as well as an unidentified species of Cecidomyiidae, causative agent of marginal leaf galls. All of these species are associated with *Calophyllum brasiliense* (Calophyllaceae). Previous records included only Southern Brazil and now, the geographic distribution of these species is widened to the Midwest Region.

Key words: geographic distribution, gall, host-plant, Cerrado

Insect galls are pathological developments of plant cells, tissues or organs due mostly to hypertrophy (over-growth) and hyperplasy (cell proliferation) under the influence of these parasitic organisms (Shorthouse and Rohfritsch 1992; Shorthouse *et al.* 2005).

Among the galling insects, Cecidomyiidae (Diptera) are the most common ones in all zoogeographic regions. Although, little is known about the geographic distribution of gall midges species in Brazil and many records are restricted to the type locality (Gagné and Jaschhof 2014).

In Brazil, 92% of the Cecidomyiidae species are monophagous and each galling species induces a single gall morphotype on its host plant, so the gall is considered as a taxonomic character of the galler. Therefore, presence of the gall morphotype indicates the presence of the galling species (Carneiro *et al.* 2009).

Calophyllum brasiliense Cambess (Calophyllaceae) is a native plant with occurrence in North (Acre, Amazonas, Pará, and Roraima states), Midwest (Goiás and Mato Grosso states), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo states), and South (Paraná and Santa Catarina states) regions. This species has been recorded in the following biomes: Atlantic Forest, Cerrado, Caatinga, and Amazonian Forest.

Five species of Cecidomyiidae induce galls on this plant: *Contarinia gemmae* Maia, 2003 (globoid bud galls); *Lopesia caulinaris* Maia, 2003 (fusiform stem galls); *Lopesia conspicua* Maia, 2003 (globose leaf galls); *Lopesia elliptica* Maia, 2003

(elliptical leaf galls); and *Lopesia linearis* Maia, 2003 (rigid linear leaf swellings) (Madeira *et al.*, 2002). Besides, a sixth gall morphotype (marginal leaf rolls) is known on leaves of *Calophyllum brasiliense*, but the galler was identified only in family level (Cecidomyiidae) (Maia 2013).

The main objective of this work is to contribute to the knowledge on the geographic distribution of gall midges species associated with *Calophyllum brasiliense*, widening their occurrence area.

The fieldwork was conducted in September 2014, in the “Cachoeira da Meia-Lua”, a private property situated 5 km from the center of the municipality of Pirenópolis (15°51'09.8” S, 048°57'29.5” W), state of Goiás (Midwest Region of Brazil), Cerrado biome.

We looked for galled individuals of *Calophyllum brasiliense* along the main patch of the “Cachoeira da Meia-Lua” (15°49'57.1” S, 048°55'11.8” W), for a distance of 200 m. Samples of each gall morphotype were photographed, collected and deposited in the insect gall collection of the Museu Nacional, Universidade Federal do Rio de Janeiro, as voucher material.

The rate of plant infestation by each galling species was investigated by counting the number of galls on 10 leaves and 20 branches of the host plant, randomly chosen. We counted the number of each galls morphotypes on leaves, buds and stems to obtain the mean average number of each gall morphotype by plant organ. We randomly selected 10 leaves with leaf galls, 10 branches with bud galls and 10 branches with stem galls.

Only one individual of *Calophyllum brasiliense* was found in the study area near the waterfall (Figure 1). It was about 3 meters high and presented flowers (Figure 2). Galls of five gall midges species were found on it: *Contarinia gemmae* (Figure 3), *Lopesia caulinaris* (Figure 4), *L. conspicua* (Figure 5), *L. elliptica* (Figure 6) and an unidentified specimen of Cecidomyiidae (responsible for the marginal leaf rolls) (Figure 7). The galls inducers were identified based on the morphology of the gall and the plant host identification, according to the original description of Maia (2003).

The previous records of *C. gemmae*, *L. caulinaris* and *L. elliptica* comprise Bertioga (state of São Paulo [SP]), Jurubatiba (state of Rio de Janeiro [RJ]), and São Tomé das Letras (state

of Minas Gerais [MG]), whereas *L. conspicua* was known only from the type-locality, Jurubatiba (RJ) (Madeira *et al.* 2002; Maia *et al.* 2008; Maia 2013). The inducer of marginal leaf rolls was previously recorded only in São Tomé das Letras (MG) (Maia 2013).

Our results extend the distribution area of these five species and represent the first record in the state of Goiás, as well as in the Midwest Region. The new records expand up to ca. 780 km the distribution area of *C. gemmae*, *L. caulinaris*, *L. elliptica* and the unidentified Cecidomyiidae, and ca. 1,000 km

the distribution area of *L. conspicua*. Furthermore, this is also the first record of *L. conspicua* in the Cerrado biome. This species was only known from Jurubatiba (Atlantic Forest biome). This study also provides the first photograph of the galls of *L. conspicua*, previously known only by drawing. Linear leaf galls induced by *Lopesia linearis* recorded in Jurubatiba and São Tomé das Letras were not found in the studied area. A map with the distance from the previously recorded localities and to the novel one, Pirenópolis (GO), is shown in Figures 8 and 9. The current known distribution of the galling species is represented in the Figure 10.

The plant infestation rate by the galls varied from 10% to 35%. The unidentified species of Cecidomyiidae (responsible for marginal rolls galls) exhibited the highest rate (35% of the investigated branches), followed by *Contarinia gemmae* (with 25%), *Lopesia conspicua* (10%), and *L. caulinaris* (10%). Although galls of *L. elliptica* were observed on the host plant, they were not found among the 20 investigated branches. In fact, this gall morphotype was found on a single leaf in the whole plant.

The average of the number of each gall morphotype per galled organ varied from 1.0 to 2.0. The highest value was



Figure 1–2. 1: The studied locality, Cachoeira da Meia-Lua (Pirenópolis-Goiás). 2: The host plant, *Calophyllum brasiliense* Cambess (Calophyllaceae).

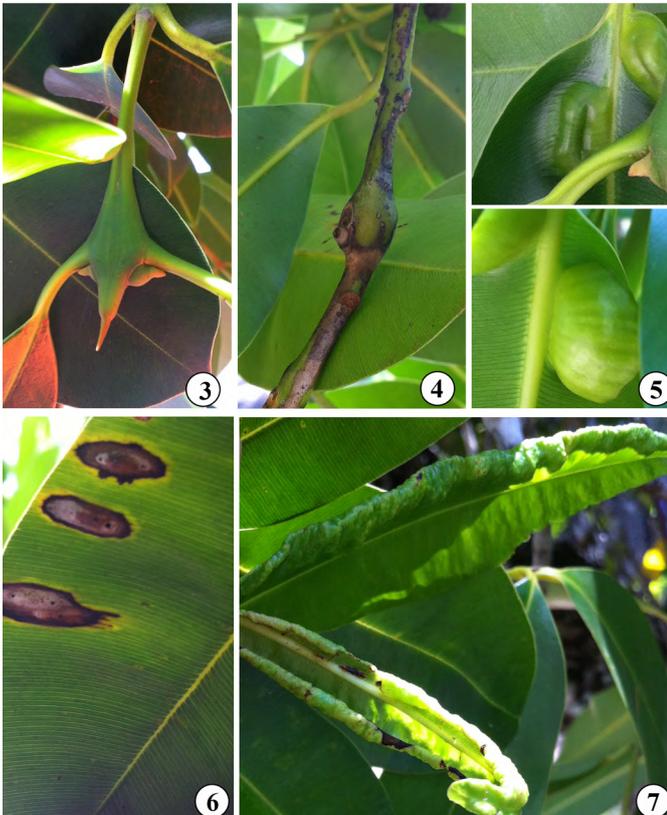
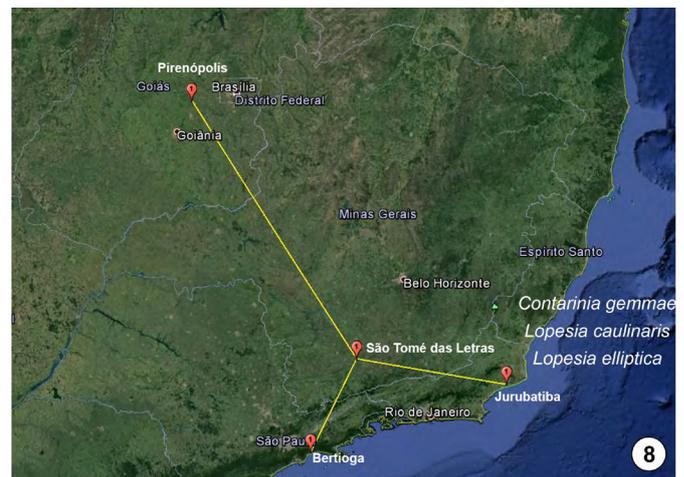


Figure 3–7. Insect galls on *Calophyllum brasiliens* Cambess (Calophyllaceae). 3: Globoid bud galls of *Contarinia gemmae* Maia, 2003. 4: Fusiform stem galls of *Lopesia caulinaris* Maia, 2003. 5: Globose leaf galls of *Lopesia conspicua* Maia, 2003 (abaxial and adaxial view). 6: Elliptical leaf galls of *Lopesia elliptica* Maia, 2003. 7: Marginal leaf rolls of an unidentified Cecidomyiidae.



Figures 8–9. Distance from the previously recorded localities of galling species on *Calophyllum brasiliense* Cambess (Calophyllaceae) to Pirenópolis (GO), the novel distribution locality record. 8: Occurrence sites of *Contarinia gemmae* Maia, 2003, *Lopesia caulinaris* Maia, 2003 and *Lopesia elliptica* Maia, 2003; 9: Occurrence sites of unidentified Cecidomyiidae in red and *Lopesia conspicua* Maia, 2003 in yellow. The markers show the localities and the lines indicate the distance among them. Map modified from Google Earth®.

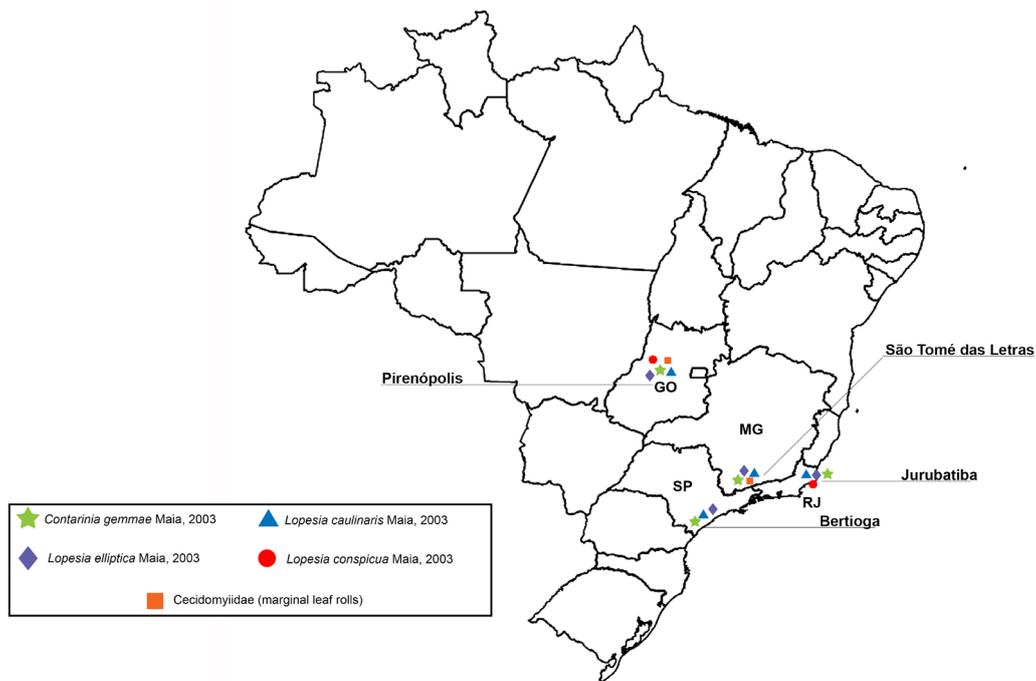


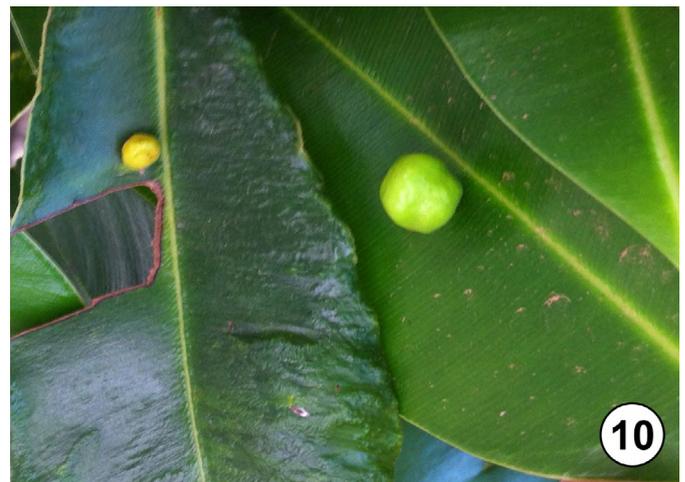
Figure 10. Known distribution in Brazil of *Contarinia gemmae* Maia, 2003, *Loplesia caulinaris* Maia, 2003, *Loplesia elliptica* Maia, 2003, *Loplesia conspicua* Maia, 2003 and the unidentified Cecidomyiidae.

observed in marginal rolls (2.0) (all galled leaves exhibited two galls). The second highest value was observed in globose leaf galls: 1.3 (seven galled leaves exhibited a single gall, whereas three galled leaves exhibited two galls). Bud and stem galls presented the same average: 1.0 (all galled branches exhibited a single bud or stem gall). The average for elliptical galls was not evaluated because only one leaf presented this gall morphotype. Bud and stem galls were not found on the same branch. Similarly, globose galls and marginal rolls were not found in the same leaf. Differing from them, the elliptical galls occurred on leaves where globose galls were also presented. As in other Brazilian inventories, the average of galls per galled organ was not investigated and we cannot compare our results with others. It is interesting to notice that globose leaf galls were found in different degrees of development, suggesting that there was a superposition of generations (Figures 11, 12 and 13).

The geographic distribution of *Contarinia gemmae*, *Loplesia caulinaris*, *L. conspicua* and *L. elliptica* is widened in the present study. All of these species were previously recorded only in the Southern Brazil. Now, their known distribution include the Midwest Region as well.

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Figures 11–13. Galls of *Loplesia conspicua* Maia, 2003 in different development degrees. **11:** Young galls. **12–13:** Mature galls (adaxial and abaxial view).

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