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ECOSYSTEMS

Cecidomyiidae (Diptera) on Myrtaceae in Brazil: richness and geographic distribution

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Abstract: Myrtaceae have a wide geographical distribution in Brazil and host a great richness of Cecidomyiidae galls. However, the number of cecidomyiid species on them has not yet been established and the knowledge of their geographic distribution is deficient. We provide the first list of cecidomyiid species on Myrtaceae and analyze their distribution in Brazilian biomes. A literature review was performed and new data were obtained from herbarium specimens of the Jardim Botânico do Rio de Janeiro. In Brazil, 13 species of Myrtaceae of five genera shelter described species of gall midges. *Eugenia* hosts the greatest richness of gall-inducers. All plant species have human uses and are native to Brazil, being seven endemic. Myrtaceae shelter 25 cecidomyiid species of 13 genera in 25 gall morphotypes. Sixteen species occur on endemic hosts, highlighting the peculiarity of the Brazilian fauna. These Cecidomyiidae occur collectively in five biomes, but most species (92%) are known from the Atlantic Forest, where 72% appear exclusively. Sixty per cent are restricted to a single Brazilian state, indicating their still poorly known distribution.

Key words: Galls, host plant, endemism, Atlantic Forest.

INTRODUCTION

Cecidomyiidae is a cosmopolitan and very diverse family of Diptera, with more than 6,500 described species, with about 600 species recorded in Neotropic countries (Gagné & Jaschhof 2017). This family is known for inducing galls on plants, due to this habit these insects are commonly known as gall midges. Nevertheless, the family includes also fungivorous, predaceous, cecidophagous and free living species, but the habit of inducing galls is predominant. The gall-inducing species are usually monophagous and each species induces a gall of unique morphology and histology on its host plant (Shorthouse et al. 2005). For this reason, the gall is considered the extended phenotype of the species and its presence on a specific plant indicates the presence of the gall-inducing species (Stone & Schönrogge 2003, Carneiro et al. 2009).

Myrtaceae are one of the largest families of eudicotyledons, comprising 5,700 species in 130 genera worldwide (Rosa & Romero 2012). Among them, 1,026 species in 27 genera are recorded in Brazil (Flora e Funga do Brasil 2020). The family has a wide geographical distribution in the country, occurring from the north to the south, in all phytogeographic domains (Flora e Funga do Brasil 2020). Several Brazilian inventories recorded a great richness of insect galls on Myrtaceae (Maia 2019). This family is the second most frequent in these publications. Furthermore, Myrtaceae were pointed out as super host in 49% of them (Araújo et al. 2019). This family also include many useful and/or ecological important plants (Lorenzi et al. 2006, Morais et al. 2014). Many species have been

investigated for their medicinal properties. These uses add economic value to plant species and cecidomyiids that induce galls on them. Nevertheless, the number of gall midge species on Myrtaceae has not yet been established and the knowledge about their geographic distribution is deficient, since most species have been recorded in few localities. The main goals of this study are to provide a list of cecidomyiid species on Myrtaceae in Brazil, to update their geographic distribution and to add new records of sample localities in order to fill this knowledge gap.

MATERIALS AND METHODS

First, we have listed all gall midge species on Myrtaceae in Brazil. Data was preliminarily retrieved from the last version of the world catalog of Cecidomyiidae written by Gagné & Jaschhof (2017). Then, all original descriptions were examined in order to obtain data on galls, host plants, and type-localities. The next step was to look for the synonyms of the plant species, to check their correct spelling, to verify their origin and distribution in Brazil based on "Flora e Funga do Brasil " site. After that, we consulted all insect gall inventories in Brazilian areas which were published from 1988 to 2019 in order to obtain records of Cecidomyiidae galls on Myrtaceae.

Subsequently, we visited the herbarium of the Jardim Botânico do Rio de Janeiro (RB) in a search for galled host plant exsiccates, which were photographed whenever galls were observed. Data on their labels were checked and new records were established by comparison with those from literature. The updated distribution of gall midge species was compared with that of host plants. Finally, the economic importance of each plant species was verified in the literature.

Cecidomyiid species were listed in alphabetical order after general results. Gall morphological characterization, geographic distribution, data on host plants (origin and distribution), and references were also provided, the last in chronological order. Localities were presented from North to South and biomes in brackets. Countries were written in capitals letters. The following abbreviations for Brazilian states were adopted: North Region: AC=Acre, AM=Amazonas, AP=Amapá, PA=Pará, RR=Roraima, and RO=Rondônia, and TO=Tocantins; Northeast Region: RN=Rio Grande do Norte, PB=Paraíba, PE=Pernambuco, AL=Alagoas, SE=Sergipe, and BA=Bahia; Midwest Region: MT=Mato Grosso, DF=Distrito Federal, GO=Goiás, and MS=Mato Grosso do Sul, Southeast Region: MG=Minas Gerais, ES=Espírito Santo, RJ=Rio de Janeiro, and SP=São Paulo, and South Region: PR=Paraná, SC=Santa Catarina, and RS=Rio Grande do Sul. New records were indicated by an asterisk followed by the herbarium acronym and number of plant voucher. To avoid repetition, data on plant species synonyms, distribution and origin were presented only when the host is cited for the first time.

RESULTS

Myrtaceae shelter 25 gall midge species which were reported from 25 gall morphotypes on 13 host plant species of five genera (Table I), namely: *Eugenia* L. (five host species), *Eugenia astringens* Cambess., *E. copacabanensis* Kiaersk., *E. hiemalis* Cambess., *E. punicifolia* (Kunth.) DC., and *E. uniflora* L.; *Myrcia* DC with three, *M. amazonica* DC., *M. ovata* Cambess., and *M. retorta* Cambess.; *Myrciaria* O. Berg. with three too, *M. delicatula* (DC.) O. Berg., *M. floribunda* (West ex Willd.) Berg., *M. tenella* (DC.) O. Berg., *Neomitranthes* Kausel ex D. Legrand and *Psidium* L., the last two with a single host species, *N. obscura* (DC.) N.

Table I. Myrtaceae: host species, origin and richness of gall midges (Diptera, Cecidomyiidae) in Brazil.

Host plant		Nr. gall midge species
Species	**Origin**	
Eugenia astringens Cambess.	Endemic to Atlantic Forest	5
Eugenia copacabanensis Kiaersk.	Endemic to Atlantic Forest	3
Eugenia hiemalis Cambess.	Native to Brazil	1
Eugenia punicifolia (Kunth.) DC.	Endemic to Brazil	1
Eugenia uniflora L.	Native to Brazil	4
Myrcia amazonica DC.	Native to Brazil	1
Myrcia ovata Cambess.	Endemic to Atlantic Forest	1
Myrcia retorta Cambess	Endemic to Brazil	1
Myrciaria delicatula (DC.) O. Berg	Native to Brazil	1
Myrciaria floribunda (West ex Willdenaw) Berg.	Native to Brazil	2
Myrciaria tenella (DC.) O. Berg.	Native to Brazil	1
Neomitranthes obscura (DC.) N. J. E. Silveira	Endemic to Atlantic Forest	3
Psidium cattleyanum Sabine	Endemic to Brazil	2
Undetermined species	-	1

Silveira, and *P. cattleyanum* Sabine, respectively. *Eugenia* hosted the greatest richness of gall midge species (14), while the others sheltered two to four species.

Seven plant species (53.8%) hosted a single gall midge species: *Eugenia hiemalis*, *E. punicifolia*, *Myrcia amazonica*, *M. ovata*, *M. retorta*, *Myrciaria delicatula*, and *M. tenella,* while six sheltered more than one, *Eugenia astringens* (four species), *E. copacabanensis* (three), *E. uniflora* (four), *Myrciaria floribunda* (two), *Neomitranthes obscura* (three), and *Psidium cattleyanum* (two). All plants are native to Brazil, seven of them are endemic to the country. Among the last, five are endemic of the Atlantic Forest (Table I). The endemic plants host 16 gall midge species (65%).

Gall midges on Myrtaceae have been collectively recorded in five Brazilian biomes. However, the great majority (92%) are known from a single biome, except *Dasineura myrciariae* Maia, 1995 and *Stephomyia epeugeniae* Gagné, 1994. The former occurs in four biomes, Amazon Forest, Atlantic Forest, Caatinga, and Cerrado, while the later in two Atlantic Forest plus Cerrado. Twenty-three species (92%) have been reported in the Atlantic Forest, 19 exclusively (72%) (Table II). Among the last, ten (about 40%) occurred on hosts endemic to the Atlantic Forest.

New locality records of five gall midge species are reported. *Dasineura globosa* Maia, 1995 and *D. marginalis* Maia, 1995, previously restricted to Rio de Janeiro state, have their area of distribution widened to Espírito Santo and Bahia. *Neolasioptera eugeniae* Maia, 1993a, reported only in Minas Gerais and Rio de Janeiro, is recorded for the first time in Paraguay, *Dasineura myrciariae*, known from Espírito Santo and Rio de Janeiro, has its distribution greatly widened, including other 13 Brazilian

Table II. Gall midges (Diptera: Cecidomyiidae) on Myrtaceae and their host plants: distribution in Brazilian biomes. 0=absence, 1=only host plant, 2=host plant and gall midge, 3=only gall midge.

Gall midge	Host	AM	AT	CA	CE	PA
Anadiplosis						
A. myrtacea	Indetermined Myrtaceae	0	2	0	0	0
Brethesiamyia						
B.myrciae	*Myrcia retorta*	0	2	0	1	0
Clinodiplosis						
C. profusa	*Eugenia uniflora*	0	2	0	1	1
Dasineura						
D.copacabanensis	*Eugenia copacabanensis*	0	2	0	0	0
D. globosa	*Eugenia astringens*	0	2	0	0	0
D. gigantea	*Psidium cattleyanum*	0	2	1	1	0
D. marginalis	*Eugenia astringens*	0	2	0	0	0
D. myrciariae	*Myrciaria floribunda*	2	2	2	2	0
D. tavaresi	*Neomitranthes obscura*	0	2	0	0	0
Elachypalpus						
E. psidii	*Psidium cattleyanum*	0	1	1	1	3
Eugeniamyia						
E. dispar	*Eugenia uniflora*	0	2	0	1	2
E. triangularis	*Eugenia uniflora*	0	2	0	1	1
Fernandesia						
F. meridionalis	*Myrciaria delicatula*	0	2	0	1	0
Jorgenseniella						
J. eugeniae	*Eugenia astringens*	0	2	0	0	0
Myrciariamyia						
M. bivalva	*Myrciaria floribunda*	1	2	1	1	0
M. fernandesi	*Myrciaria tenella*	1	1	1	2	0
M. maricaensis	*Myrcia amazonica*	1	2	0	1	0
	Myrcia ovata	0	2	0	0	0
Neolasioptera						
N. eugeniae	*Eugenia uniflora*	0	2	0	1	1
Neomitranthella						
N. robusta	*Neomitranthes obscura*	0	2	0	0	0
Stephomyia						
S. cfr. clavata	*Eugenia astringens*	0	2	0	0	0
	Eugenia hiemalis	0	2	0	1	0
S. epeugeniae	*Eugenia punicifolia*	1	2	1	1	0
S. espiralis	*Eugenia copacabanensis*	0	2	0	0	0
S. mina	*Neomitranthes obscura*	0	2	0	0	0
S. rotundifoliorum	*Eugenia astringens*	0	2	0	0	0
S. tetralobae	*Eugenia copacabanensis*	0	2	0	0	0

states and also the British Guiana, and finally *Neomitranthella robusta* Maia, 1994 is reported for the first time in the municipality of Rio de Janeiro.

From the total of 25 cecidomyiid species, 15 species (60%) are restricted to a single Brazilian state (Rio de Janeiro: 11, Minas Gerais: 2 and Rio Grande do Sul: 2), while eight occur in two or three Brazilian states, while *Neolasioptera eugeniae* occurs in Paraguay, Minas Gerais, and Rio de Janeiro, and *Dasineura myrciariae* exhibits the widest distribution, with records in all Brazilian regions, from North to South.

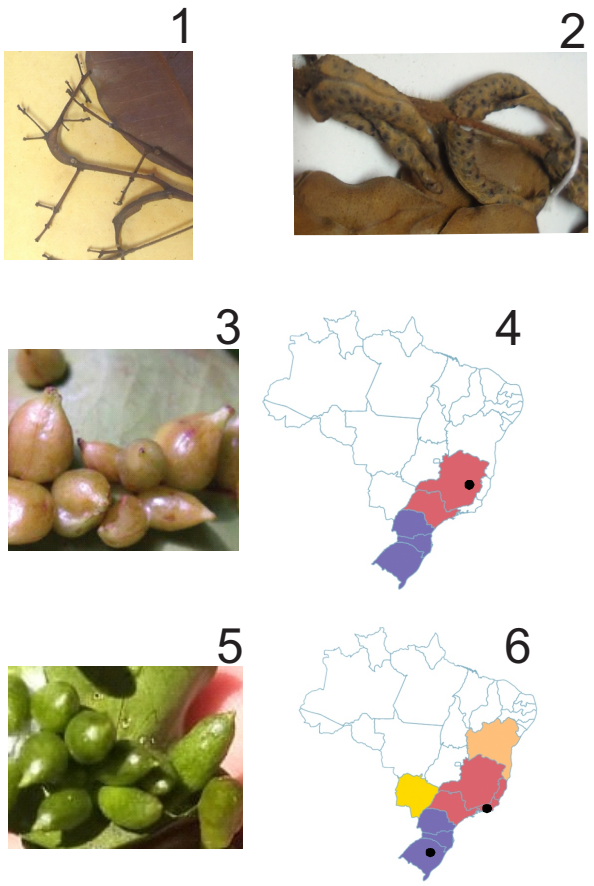
Concerning herbarium data, 1,628 exsiccates were examined, 136 of them showed Cecidomyiidae galls: *Eugenia astringens* (N=36), *E. copacabanensis* (N=1), *E. uniflora* (N=11), *Myrciaria floribunda* (N=78), and *Neomitranthes obscura* (N=10). Among them, *Myrciaria floribunda* and *Eugenia astringens* exhibited the highest number of galled exsiccates.

Galls of eight gall midge species were found, *Dasineura globosa* Maia, 2005, *D. marginalis* Maia, 2005, and *Stephomyia rotundifoliorum* Maia, 1993b on *Eugenia astringens*, *Clinodiplosis profusa* Maia, 2001a and *Neolasioptera eugeniae* on *E. uniflora*, *Dasineura copacabanensis* Maia, 1993a on *E. copacabanensis*, *Dasineura myrciariae* on *Myrciaria floribunda*, and *Neomitranthella robusta* on *Neomitranthes obscura*.

We found galls in exsiccates of *Myrcia amazonica* (Fig. 1) and *Myrciara tenella* (Fig. 2) too. Nevertheless, their inducers have not yet been determined. Furthermore, exsiccates of *M. retorta* and *Myrciaria delicatula* were examined, but they showed no galls.

List of Cecidomyiidae species on Myrtaceae:

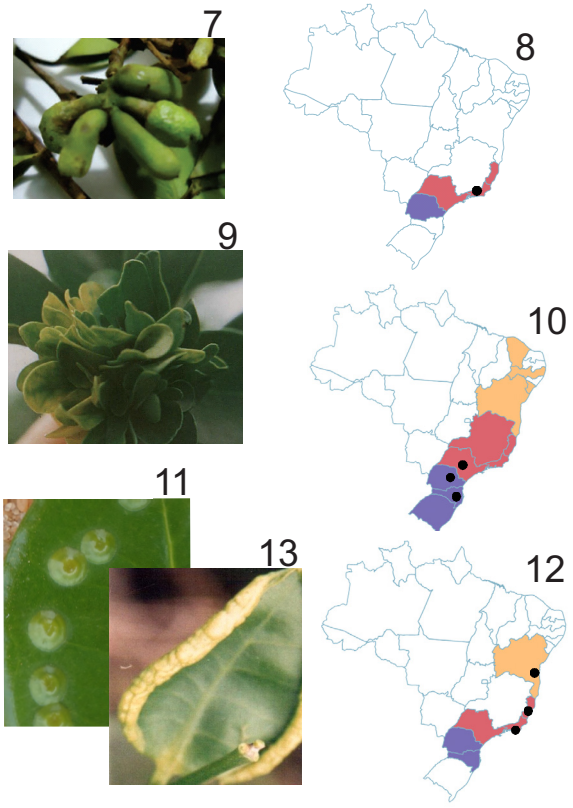
1) *Anasphondylia myrtacea* Tavares, 1920
Gall: on leaf, globoid, glabrous, and three-chambered (figure 324, p. 275 in Gagné 1994.).



Figures 1-6. Galls on Myrtaceae and maps of distribution in Brazil. 1. On *Myrcia amazonica* DC. (undetermined galler), 2. On *Myrciara tenella* (DC.) O. Berg. (undetermined galler), 3. Galls of *Brethesiamyia myrciae* Maia, 2010 on *Myrcia retorta* Cambess., 4. Map of distribution of *B. myrciae* Maia, 2010 and *M. retorta*, 5. Galls of *Clinodiplosis profusa* Maia, 2001a on *Eugenia uniflora* L. 6. Map of distribution of *C. profusa* and *E. uniflora*. Colorful areas indicate the host plant distribution: Orange – states of Northeast Region, Red – states of Southeast Region, Yellow – states of Midwest Region, Blue – states of South Region. Black circles indicate the gall midge distribution.

Geographic distribution: BRAZIL: RJ: Nova Friburgo (Atlantic Forest). Host plant: undetermined Myrtaceae. References: Tavares 1920, Gagné 1994, Gagné & Jaschhof 2017.

2) *Brethesiamyia myrciae* Maia, 2010
Gall: on leaf, conical, yellow, glabrous, and one-chambered (Fig. 3). Geographic distribution: BRAZIL: MG: Belo Horizonte (Cerrado), Três Marias

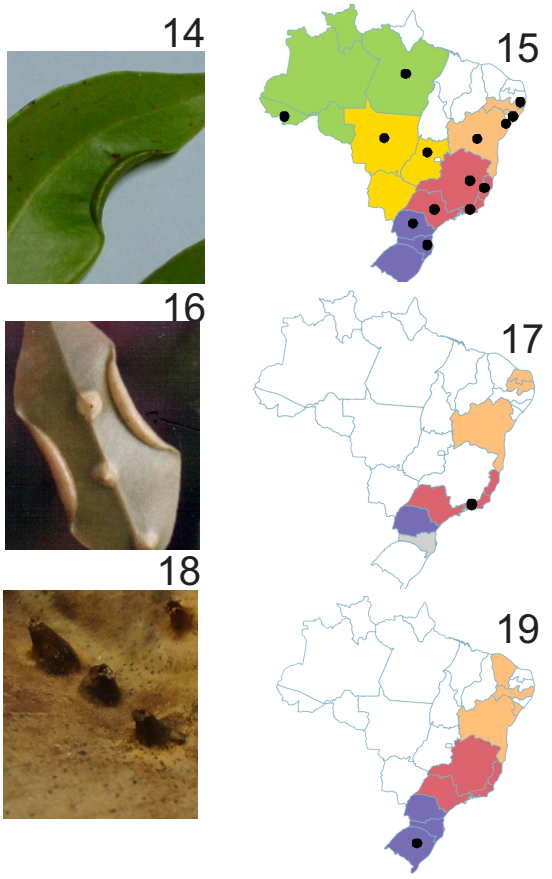


Figures 7-13. Cecidomyiidae (Diptera) galls on Myrtaceae and maps of distribution in Brazil. 7. Galls of *Dasineura copacabanensis* Maia, 1993a on *Eugenia copacabanensis* Kiaersk., 8. Map of distribution of *D. copacabanensis*, *Stephomyia espiralis* Maia, 1993b, *S. tetralobae* Maia, 1993b and *E. copacabanensis*, 9. Gall of *Dasineura gigantea* Angelo & Maia, 1999 on *Psidium cattleyanum* Sabine, 10. Map of distribution of *D. gigantea* and *P. cattleyanum*, 11. Galls of *Dasineura globosa* Maia, 1995 on *Eugenia astringens* Cambess., 12. Map of distribution of *D. globosa, Dasineura marginalis* Maia, 2005 and *E. astringens*, 13. Galls of *Dasineura marginalis*. Orange – states of Northeast Region, Red – states of Southeast Region, Blue – states of South Region. Black circles indicate the gall midge distribution.

(Cerrado). Host plant: *Myrcia retorta* (endemic to Brazil). Plant distribution: MG, SP, PR, SC, RS (Atlantic Forest, Cerrado) (Fig. 4). References: Maia et al. 2009, Maia 2010, Gagné & Jaschhof 2017.

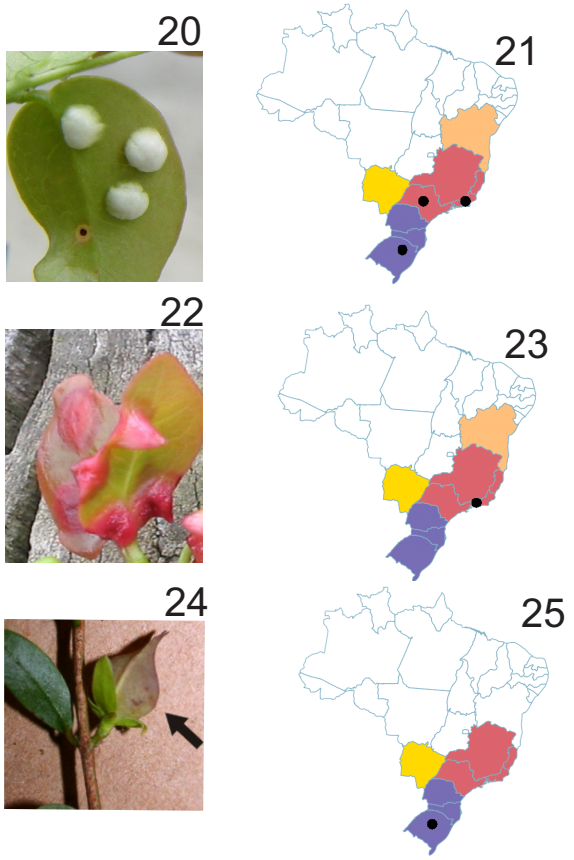
3) *Clinodiplosis profusa* Maia, 2001a

Gall: on leaf, conical, green or red, glabrous, and one-chambered (Fig. 5). Geographic distribution:

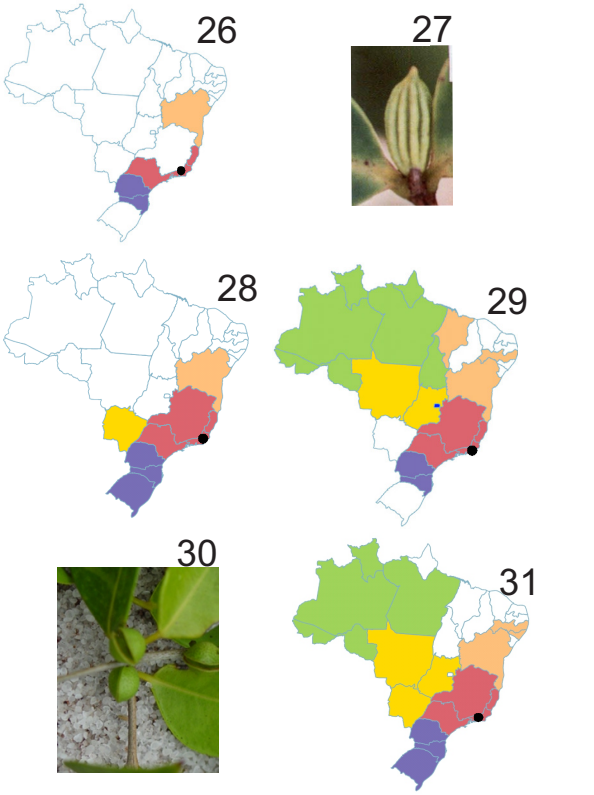


Figures 14-19. Cecidomyiidae (Diptera) galls on Myrtaceae and maps of distribution in Brazil. 14. Galls of *Dasineura myrciariae* Maia, 1995 on *Myrciaria floribunda* (West ex Willd.) Berg., 15. Map of distribution of *D. myrciariae* and *M. floribunda*, 16. Galls of *Dasineura tavaresi* Maia, 1995 on *Neomitranthes obscura* (DC.) N. J. E. Silveira, 17. Map of distribution of *D. tavaresi*, *Stephomyia mina,* Maia, 1993b and *N. obscura*, 18. Galls of *Elachypalpus psidii* Maia & Nava, 2011 on *Psidium cattyeanum* Sabine, 19. Map of distribution of *E. psidii* and *P. cattyeanum*. Green – states of North Region, Orange- states of Northeast Region, Red – states of Southeast Region, Yellow – states of Midwest Region, Blue – states of South Region. Black circles indicate the gall midge distribution.

BRAZIL: RJ: São João da Barra, Carapebus, Arraial do Cabo, Cabo Frio, Araruama, Saquarema, Maricá, Rio de Janeiro, Mangaratiba (Ilha de Marambaia) (Atlantic Forest), Paraty; RS (unstated locality). Host plant: *Eugenia uniflora* (native to Brazil). Plant distribution: BA, MG, ES, RJ, SP, MS, PR, SC, RS (Atlantic Forest, Cerrado, Pampa) (Fig.



Figures 20-25. Cecidomyiidae (Diptera) galls on Myrtaceae and maps of distribution in Brazil. 20. Galls of *Eugeniamyia dispar* Maia, Mendonça & Romanovski on *Eugenia uniflora* L., 21. Map of distribution of *E. dispar* and *E. uniflora*, 22. Galls of *Eugeniamyia triangularis* Maia & Nava, 2011 on *Eugenia uniflora* L., 23. Map of distribution of *E. triangularis* and *E. uniflora*, 24. Gall of *Fernandesia meridionalis* Rodrigues & Maia, 2013 on *Myrciaria delicatula* (DC.) O. Berg., 25. Map of distribution of *F. meridionalis* on *M. delicatula*. Orange – states of Northeast Region, Red – states of Southeast Region, Yellow – states of Midwest Region, Blue – states of South Region. Black circles indicate the gall midge distribution.



Figures 26-31. Cecidomyiidae (Diptera) galls on Myrtaceae and maps of distribution in Brazil. 26. Map of distribution of *Jorgenseniella eugeniae* Maia, 2005, *Stephomyia rotundifoliorum* Maia, 1993b and *Eugenia astringens* Cambess., 27. Gall of *Myrciamyia maricaensis* Maia, 1995. 28. Map of distribution of *M. maricaensis* and *Myrcia amazonica* DC., 29. Map of distribution of *M. maricaensis* and *Myrcia ovata* Cambess., 30. Galls of *Myrciariamyia bivalva* Maia, 1994 on *Myrciaria floribunda* (West ex Willdenaw) Berg., 31. Map of distribution of *M. bivalva* and *M. floribunda*. Green – states of North Region, Orange – states of Northeast Region, Red – states of Southeast Region, Yellow – states of Midwest Region, Blue – states of South Region. Black circles indicate the gall midge distribution.

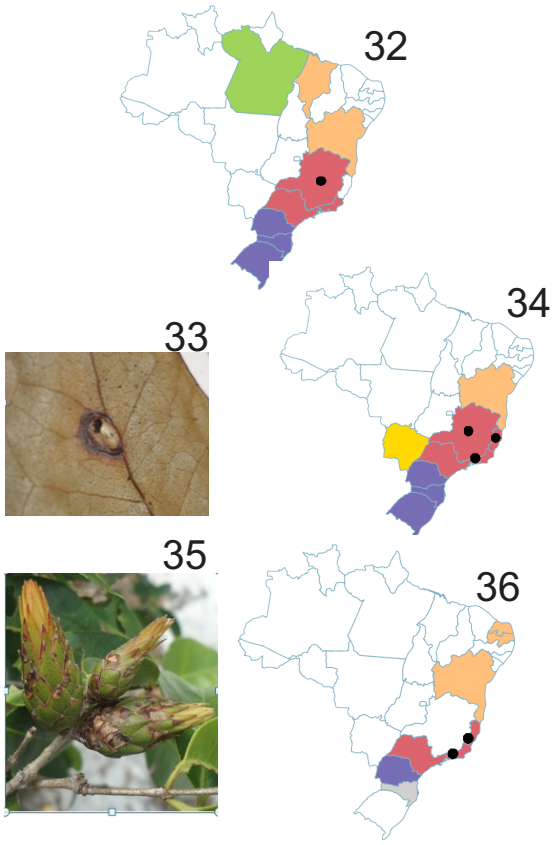
6). References: Monteiro et al. 1994, Maia 2001a, b, 2013, Oliveira & Maia 2005, Silva & Rodrigues 2011, Rodrigues et al. 2014, Carvalho-Fernandes et al. 2016, Maia & Silva 2016, Gagné & Jaschhof 2017, Goetz et al. 2018.

4) *Dasineura copacabanensis* Maia, 1993a

Gall: on bud, conical, green, glabrous, and one-chambered (Fig. 7). Geographic distribution: BRAZIL: RJ: São João da Barra, Arraial do Cabo, Cabo Frio, Araruama, Maricá, Saquarema (Atlantic Forest). Host plant: *Eugenia copacabanensis* (endemic to Atlantic Forest). Plant distribution: ES, RJ, SP, PR (Fig. 8). References: Maia 1993a, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

5) *Dasineura gigantea* Angelo & Maia, 1999

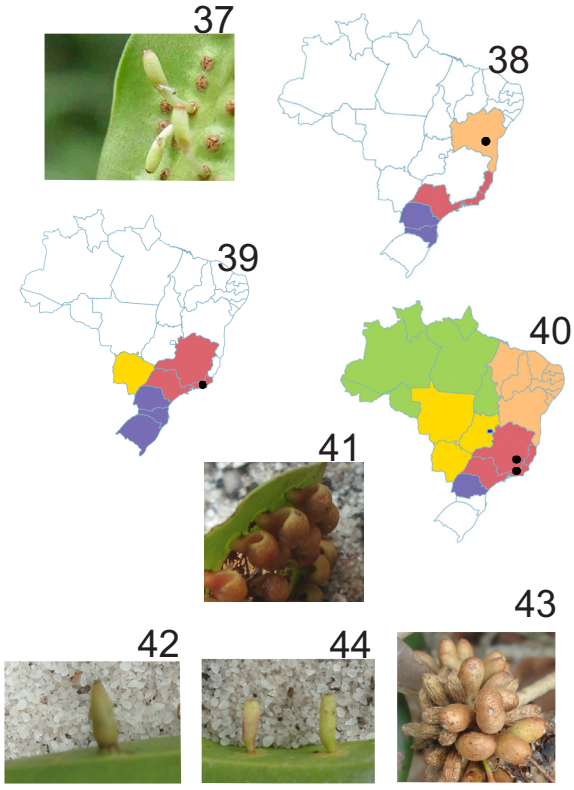
Gall: on bud, rosette, green, glabrous, and multichambered (Fig. 9). Geographic distribution:



Figures 32-36. Cecidomyiidae (Diptera) galls on Myrtaceae and maps of distribution in Brazil. 32. Map of distribution of *Myrciariamyia fernandesi* Maia, 2004, 33. Gall of *Neolasioptera eugeniae* Maia, 1993a on *Eugenia uniflora* L., 34. Map of distribution of *N. eugeniae* and *E. uniflora*, 35. Galls of *Neomitranthella robusta* Maia, 1995 on *Neomitranthes obscura* (DC.) N. J. E. Silveira, 36. Map of distribution of *N. robusta* and *N. obscura*. Green – states of North Region, Orange – states of Northeast Region, Red – states of Southeast Region, Yellow – states of Midwest Region, Blue – states of South Region. Black circles indicate the gall midge distribution.

BRAZIL: SP: Bertioga (Atlantic Forest); PR: Piraquara (Atlantic Forest); SC (unstated locality). Host plant: *Psidium cattleyanum* (endemic to Brazil). Plant distribution: CE, PE, SE, BA, MG, ES, RJ, SP, PR, SC, RS (Atlantic Forest, Caatinga, Cerrado) (Fig. 10). References: Angelo & Maia 1999, Maia et al. 2008, Gagné & Jaschhof 2017, Melo-Júnior et al. 2015.

6) *Dasineura globosa* Maia, 1995



Figures 37-44. Cecidomyiidae (Diptera) galls on Myrtaceae and maps of distribution in Brazil. 37. Galls of *Stephomyia clavata* Tavares, 1920. 38. Map of distribution of *S. clavata* and *Eugenia hiemalis* Cambess., 39. Map of distribution of *S. clavata* and *Eugenia astringens* Cambess., 40. Map of distribution of *Stephomyia epeugeniae* Gagné, 1994 and *Eugenia punicifolia* (Kunth.) DC., 41. Galls of *Stephomyia espiralis* Maia, 1993b on *Eugenia copacabanensis* Kiaersch., 42. Gall of *Stephomyia mina* Maia, 1993b on *Neomitranthes obscura* (DC.) N. J. E. Silveira, 43. Galls of *Stephomyia rotundifoliorum* Maia, 1993b on *Eugenia astringens* Cambess., 44. Galls of *Stephomyia tetralobae* Maia, 1993b on *Eugenia copacabanensis* Kiaersch. Green – states of Northt Region, Orange – states of Northeast Region, Red – states of Southeast Region, Yellow – states of Midwest Region, Blue – states of South Region. Black circles indicate the gall midge distribution.

Gall: on leaf, globoid, yellow or green, glabrous, and one-chambered (Fig. 11). Geographic distribution: BRAZIL: BA*: Conde (Ferreira, M.G.: 698, RB368876), Mata de São João (Soeiro, R.: 220, RB373825) (Atlantic Forest); ES*: Aracruz (Pereira, O. J., RB373253) (Atlantic Forest); RJ: São João da

Barra, Carapebus, Macaé* (Araújo, G. U. C.: 09, RB430334), Arraial do Cabo, Cabo Frio, Araruama, Saquarema, Maricá, Niterói, Rio de Janeiro, Mangaratiba (Ilha de Marambaia), Angra dos Reis (Ilha Grande) (Atlantic Forest). Host plant: *Eugenia astringens* (synonyms: *E. rotundifolia* Casar, *E. umbellifora* O. Berg.) (endemic to Atlantic Forest). Plant distribution: BA, ES, RJ, SP, PR, SC (Fig. 12). References: Maia 1996a, 2001b, Oliveira & Maia 2005, Maia & Barros 2009, Rodrigues et al. 2014, Carvalho-Fernandes et al. 2016, Maia & Silva 2016, Gagné & Jaschhof 2017.

7) *Dasineura marginalis* Maia, 2005

Gall: marginal leaf roll, green, glabrous, and one-chambered (Fig. 13). Geographic distribution: BRAZIL: BA*: Conde (Ferreira, M. C.: 698, RB368876), Jandaíra (Jost, T.: 650, RB471344), Salvador (Campos, G. L.: 14, RB419517) (Atlantic Forest); ES*: Conceição da Barra (Giaretta, A.: 1208, RB561360), São Mateus (Oliveira, A. G.: 12, RB562864), Guarapari (Rosa, L.V.: 112, RB356421) (Atlantic Forest); RJ: Carapebus, Macaé* (Araújo, G.U.C: 08, RB430339, Araújo, G.U.C: 09, RB 430334), Arraial do Cabo, Cabo Frio, Araruama, Saquarema, Maricá, Rio de Janeiro, Mangaratiba (Ilha de Marambaia), Angra dos Reis* (Ilha Grande) (Scheel-Ybert, R.: 398, RB413960) (Atlantic Forest) (Fig. 12). Host plant: *E. astringens*. References: Maia 2001b, Maia et al. 2005, Rodrigues et al. 2014, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

8) *Dasineura myrciariae* Maia, 1995

Gall: marginal leaf roll, green, glabrous, and one-chambered (Fig. 14). Geographic distribution: BRITISH GUIANA* (Forest Department British Guiana, RB88137), BRAZIL: AC*: Acrelândia (Daly, D. C.: 13699, RB491576) (Amazon Forest); PA*: Oriximiná (Martinelli, G.: 7266, RB202944) (Amazon Forest); MT*: Diamantino (Santos, M. F.: 377, RB488952) (Amazon Forest, Cerrado), Paranaíta (Maioli, V.: 762, RB474579) (Amazon Forest); GO*: Serra Dourada (Rizzo, A.: 4290, RB144353) (Cerrado); PE*: Araripina (Barreto, R.: 546, Serra do Araripe) (RB356700), Águas Belas (Andrade Lima, A. D. de: 69, RB374818) (Caatinga); AL*: Piaçabuçu (Lyra-Lemos, R. P.: 1900, RB374273) (Atlantic Forest); SE*: Barra dos Coqueiros (Farney, C.: 2885, RB374138), Estância (Mattos Silva, L. A.: 3012, RB374020), Pirambú (Reserva Biológica de Santa Isabel) (Farney, C.: 2942, RB295281), Santa Luzia de Itanhy (Deda, R. M.: 81: RB575815) (Atlantic Forest); BA*: Campo Formoso (Fonseca, W. N. da: 372, RB208424) (Caatinga), Conde (Ferreira, M. C.: 902, RB388876) (Atlantic Forest), Esplanada (Ribeiro, T.:12, RB397959) (Atlantic Forest), Caetité (Mendes, M. S.: 529, RB564662) (Caatinga), Morro do Chapéu (Forzza, R. C.: 1393, RB397779) (Caatinga), Salvador (Lobão, A. Q.: 320, RB322167) (Atlantic Forest), Tucano (Sant'Ana, S. C. de: 523, RB373829) (Caatinga); MG*: Diamantina (Pirani, J. R.: 5812, RB566167) (Cerrado), Buritís (Pereira, B. A.: 3230, RB390225) (Cerrado), Brumadinho (Oliveira, J. G.: 650, RB549948) (Atlantic Forest), Ouro Preto (Peron, M.: 205, RB276291) (Atlantic Forest), Teófilo Otoni (de Paula, L. F. A.: 583, RB586515) (Atlantic Forest); ES: Conceição da Barra* (Pereira, O. J.: 2964, RB423518, Giaretta, A.: 1193, RB561400), São Mateus* (Giaretta, A.: 1363, RB561401), Barra do Jucu* (Weinberg, B.: 81, RB262635), Guarapari, Linhares* (Folli, D. A.: 3887, RB439930, Nic Lughadha, E. M.: 185, RB377618, Silva, I. A.: 317, RB413042), Santa Teresa, Vitória* (Martins, M. L. L.: 208, RB374368) (Atlantic Forest); RJ: Carapebus, Macaé* (Araújo, D. S. D.: 7595, RB254732), Cabo Frio, Guapimirim* (Peroni, M.: 937, RB316229), Saquarema* (Ferreira, C. D. M.: 392, RB665796, Farney, C.: 3993, RB393512), Maricá, Niterói* (Parque Estadual da Serra da Tiririca) (Barros, A. A. M.: 2795, RB569359, Barros, A. A. M.: 2811, RB554805), Rio de Janeiro (Barra da Tijuca* Lima, H. C. de: 5494, RB328004 and RB328004, Grumari, Pedra de Itaúna* Araújo, D. S. D.: 170, RB145765, Restinga de Marambaia Dias, M. M.: 118, RB415726), Petropólis* (Sucre,

D.: 10610RB166413), Teresópolis* (Occhioni, P.: 5709, RB275236), Parque Nacional de Itatiaia* (Landrum, L. R.: 2088, RB268687), Paraty* (Marquette, R.: 962, RB307210) (Atlantic Forest); SP*: Reserva Florestal da Bocaina (Sucre, D. C.: 3024, RB138979), Araraquara (Hoehne, W.: 3810, RB275419) (Cerrado-Atlantic Forest transition), Campos do Jordão (Rubens: 260, RB206260), Jundiaí (Arzolla, F. A. R. D. P.: 335, RB405453), Mogi das Cruzes (Kuhlmann, M.: 1984, RB368879), São Paulo (Brade, A. C.: 18756, RB58940) (Atlantic Forest); PR*: Irati (Mattos, A.: 63322, RB63322), São Mateus do Sul (Silva, M. S.: 811, RB255653) (Atlantic Forest); SC*: Florianópolis (Klein, R. M.: 8163, RB547077) (Atlantic Forest). Host plant: *Myrciaria floribunda* (native to Brazil) (Amazon Forest, Atlantic Forest, Caatinga, Cerrado). Plant distribution: AC, AM, RR, RO, PE, AL, BA, GO, MT, MS, MG, ES, RJ, SP, SC, RS (Fig. 15). References: Maia 1996a, Maia 2001b, 2019, Bregonci et al. 2010, Maia et al. 2014, Maia & Carvalho-Fernandes 2016, Maia & Silva 2016, Gagné & Jaschhof 2017.

9) *Dasineura tavaresis* Maia, 1995

Gall: marginal leaf roll, green, glabrous, and one-chambered (Fig. 16). Geographic distribution: BRAZIL: ES: Guarapari (Atlantic Forest), RJ: Arraial do Cabo, Araruama, Cabo Frio, Carapebus, Maricá, Rio de Janeiro (Grumari), Saquarema (Atlantic Forest). Host plant: *Neomithranthes obscura* (DC.) N. Silveira (endemic to Atlantic Forest). Plant distribution: RN, PB, BA, ES, RJ, SP, PR, SC (Fig. 17). References: Maia 1996a, 2001b, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

10) *Elachypalpus psidii* Maia & Nava, 2011

Gall: on leaf, cylindrical, green, glabrous, and one-chambered (Fig. 18). Geographic distribution: BRAZIL: RS: Pelotas (Pampa) (Fig. 19). Host plant: *Psidium cattleyanum*. References: Maia & Nava 2011, Gagné & Jaschhof 2017.

11) *Eugeniamyia dispar* Maia, Mendonça & Romanovski, 1996

Gall: on leaf, globoid, spongy, whitish, glabrous, and one-chambered (Fig. 20). Geographic distribution: BRAZIL: RJ: Rio de Janeiro, Niterói*, Maricá (Atlantic Forest); SP: Bertioga (Atlantic Forest), RS: Porto Alegre (Atlantic Forest), Pelotas (cultived area) (Fig. 21). Host plant: *Eugenia uniflora*. References: Maia et al. 1997, 2008, Bierhals et al. 2012, Mendonça Jr & Romanowski 2012, Gagné & Jaschhof 2017, Maia 2019.

12) *Eugeniamyia triangularis* Maia & Nava, 2011

Gall: on leaf, conical, green, glabrous, and one-chambered (Fig. 22). Geographic distribution: BRAZIL: RJ: Maricá (Atlantic Forest) (Fig. 23) Host plant: E. *uniflora*. References: Maia & Nava 2011, Gagné & Jaschhof 2017.

13) *Fernandesia meridionalis* Rodrigues & Maia, 2013

Gall: on leaf, conical, pinkish, glabrous, and one-chambered (Fig. 24). Geographic distribution: BRAZIL: RS: São Francisco de Paula (Atlantic Forest). Host plant: *Myrciaria delicatula* (native to Brazil). Plant distribution: MS, MG, ES, RJ, SP, SC, RS (Atlantic Forest, Cerrado, Pampa) (Fig. 25). References: Rodrigues et al. 2013, Gagné & Jaschhof 2017.

14) *Jorgenseniella eugeniae* Maia, 2005

Gall: on leaf, lenticular, green, glabrous, and one-chambered (no fig.). Geographic distribution: BRAZIL: RJ: Arraial do Cabo (Atlantic Forest) (Fig. 26). Host plant: *E. astringens*. References: Maia et al. 2005, Gagné & Jaschhof 2017.

15) *Myrciamyia maricaensis* Maia, 1995

Gall: on bud, ovoid, green or yellow, glabrous, and one-chambered (Fig. 27). Geographic distribution: BRAZIL: RJ: Arraial do Cabo, Cabo Frio, Carapebus, Maricá (Atlantic Forest); SP: Bertioga (Atlantic Forest). Host plants: *Myrcia amazonica* DC. (synonyms: *M. lundiana* Kiaersk.) (native to Brazil) and *M. ovata* Camb. (endemic to Atlantic Forest). Plants distribution: *M. amazonica*: AC, AM, AP, PA, RO, RR, TO, PE, MA, BA, DF, GO, MT, MG, ES, RJ, SP, PR, SC (Amazon Forest, Atlantic

Forest, Cerrado), *M. ovata*: ES, RJ, SP (Atlantic Forest) (Figs. 28-29). References: Monteiro et al. 1994, Maia 1996b, 2001b, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

16) *Myrciariamyia bivalva* Maia, 1994

Gall: on bud, globoid, with two valves, yellow, glabrous (Fig. 30). Geographic distribution: BRAZIL: RJ: Arraial do Cabo, Carapebus, Maricá, Rio de Janeiro (Atlantic Forest) (Fig. 31). Host plant: *Myrciaria floribunda*. References: Maia 1995, 2001b, 2019, Gagné & Jaschhof 2017.

17) *Myrciariamyia fernandesi* Maia, 2004

Gall: on bud, globoid, bivalve, green, glabrous, and one-chambered (no fig.). Geographic distribution: BRAZIL: MG: Tiradentes (Cerrado). Host plant: *Myrciaria tenella* (DC.) O, Berg. (native to Brazil). Plant distribution: PA, MA, BA, MG, RJ, SP (Amazon Forest, Atlantic Forest, Caatinga, Cerrado) (Fig. 32). References: Maia 2004, Maia & Fernandes 2004, Gagné & Jaschhof 2017.

18) *Neolasioptera eugeniae* Maia, 1993a

Gall: on leaf, lenticular, green or yellow, glabrous, and one-chambered (Fig. 33). Geographic distribution: BRAZIL: MG: Itamonte (Atlantic Forest); ES: Guarapari (Atlantic Forest); RJ: Arraial do Cabo, Araruama, Angra dos Reis (Ilha Grande), Cabo Frio, Parque Nacional de Itatiaia, Maricá, Niterói* (Barros, A. A. M. de: 1174, RB740235), Nova Iguaçu* (Sobrinho, F. A.: 43, RB443612), Rio de Janeiro, Mangaratiba (Ilha de Marambaia), Paraty, Petropólis* (Leitão, F.: 273, RB468949), Saquarema, São João da Barra (Atlantic Forest) (Fig. 34), PARAGUAY*: Ñeembucú: Tacuaras (Zardini, E. M.: 39026, RB389343). Host plant: *E. uniflora*. References: Maia 1993a, 2013, 2014, 2019, 2020, Monteiro et al. 1994, Oliveira & Maia 2005, Maia & Oliveira 2010, Fernandes & Maia 2011, Silva & Rodrigues 2011, Maia & Souza 2013, Rodrigues et al. 2014, Carvalho-Fernandes et al. 2016, Maia & Silva 2016, Maia & Mascarenhas 2017, Gagné & Jaschhof 2017.

19) *Neomitranthella robusta* Maia, 1994

Gall: on bud, pineapple-like, green, without internal chamber (Fig. 35). Geographic distribution: BRAZIL: ES: Guarapari (Atlantic Forest); RJ: Arraial do Cabo, Araruama, Cabo Frio, Carapebus, Maricá, Rio de Janeiro* (Equipe do Arboreto, RB 425954), Saquarema (Atlantic Forest) (Fig. 36). Host plant: *Neomitranthes obscura*. References: Maia 1996b, 2001b, Gagné & Jaschhof 2017.

20) *Stephomyia clavata* Tavares, 1920

Gall: on leaf, claviform, green or red, glabrous, and one-chambered (Fig. 37). Geographic distribution: BRAZIL: BA: Madre de Deus (Atlantic Forest). Host plant: undetermined Myrtaceae. References: Tavares 1920, Gagné 1994, Gagné & Jaschhof 2017.

Maia, 2001b and Maia & Silva 2016 recorded similar galls on *Eugenia hiemalis* Cambess. (synonym: *E. multiflora* Cambess) (native to Brazil) (Atlantic Forest, Cerrado) and *E. astringens* (Figs. 38-39), respectively. The gall-inducing species was identified as *Stephomyia cfr. clavata* and *Stephomyia clavata*. Distribution: Brazil: RJ: Carapebus, Rio de Janeiro (Atlantic Forest). Plant distribution: *E. hiemalis*: MS, MG, RJ, SP, PR, SC, RS. References: Maia 2001b, Maia & Silva 2016.

21) *Stephomyia epeugeniae* Gagné, 1994

Gall: on leaf and stem, ellipsoidal, glabrous, one-chambered (no fig.). Geographic distribution: BRAZIL: RJ: Rio de Janeiro (Atlantic Forest); Minas Gerais: Belo Horizonte (Cerrado); Host plants: *Eugenia* sp. and *Eugenia punicifolia* (Kunth.) DC. (= *Eugenia ovalifolia* Cambess.) (Myrtaceae) (endemic to Brazil) (Amazon Forest, Atlantic Forest, Caatinga, and Cerrado) (Fig. 40). References: Tavares 1916, Möhn 1962, Gagné 1994, Fernandes et al. 1988, Gagné & Jaschhof 2017.

22) *Stephomyia espiralis* Maia, 1993b

Gall: on leaf, spiral-shaped, green or red, glabrous, and one-chambered (Fig. 41). Geographic distribution: BRAZIL: RJ: Arraial do Cabo, Araruama, Cabo Frio, Carapebus, Maricá,

Rio de Janeiro, Mangaratiba (Ilha de Marambaia) (Atlantic Forest) (Fig. 8). Host plant: *Eugenia copacabanensis*. References: Maia 1993b, 1999, 2001b, Rodrigues et al. 2014, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

23) *Stephomyia mina* Maia, 1993b

Gall: on leaf, conical, green or red, glabrous, and one-chambered (Fig. 42). Geographic distribution: BRAZIL: RJ: Arraial do Cabo, Araruama, Carapebus, Maricá, Rio de Janeiro (Grumari) (Atlantic Forest) (Fig. 17). Host plant: *Neomitranthes obscura*. References: Maia 1993b, 2001b, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

24) *Stephomyia rotundifoliorum* Maia, 1993b

Gall: on bud, cylindrical, brown, glabrous, and one-chambered (Fig. 43). Geographic distribution: BRAZIL: RJ: Arraial do Cabo, Araruama, Cabo Frio, Carapebus, Maricá, Rio de Janeiro, Saquarema, São João da Barra (Fig. 26). Host plant: *E. astringens*. References: Maia 1993b, 2001b, 2020, Gagné & Jaschhof 2017.

25) *Stephomyia tetralobae* Maia, 1993b

Gall: on leaf, conical, green or red, glabrous, and one-chambered (Fig. 44). Geographic distribution: BRAZIL: RJ: Arraial do Cabo, Carapebus, Maricá, Rio de Janeiro (Fig. 8). Host plant: *Eugenia copacabanensis*. References: Maia 1993b, 2001b, Carvalho-Fernandes et al. 2016, Gagné & Jaschhof 2017.

DISCUSSION

Myrtaceae sheltered 25 gall midge species obtained from 25 gall morphotypes on 13 host plant species of five genera in Brazil. Comparing their richness of cecidomyiid galls to that of other Neotropical localities, we can realize that these values are much higher in Brazil. Quintero et al. 2014 recorded only two gall morphotypes in the temperate forests of Southern South America, one on *Myrceugenia lanceolata* (Jaume) Kausel and the other on *Myrceugenia rufa* (Colla) Skottsb ex. Kausel, but only one gall midge species was identified, *Oligotrophus eugeniae* Kieffer & Herbst, 1909. Medianero et al. 2014 reported eight gall morphotypes induced by arthropods on two species of Myrtaceae in forests of Panama, without discriminating them in other taxonomic categories. One host species is *Stylogyne standleyi* Lundell. and the other was identified only at family level. The former hosted one and the latter seven gall morphotypes. Hanson & Gómez-Laurito 2005 recorded 13 gall morphotypes induced by cecidomyiids in Costa Rica. Nevertheless, data on their identification were not provided. These comparative data reveal that Myrtaceae in Brazil have an important role as host family of gall midge species. Other important hosts are Fabaceae and Asteraceae. These three families together shelter 36% of the Brazilian fauna of Cecidomyiidae, while the remaining 64% occur on 48 other plant families. However, no studies about cecidomyiids on Fabaceae and Asteraceae have been developed in Brazil.

Five genera of Myrtaceae host gall midges in Brazil. Although the number of host species varies a little among them, the number of cecidomyiid species varies greatly. *Eugenia* hosted the greatest richness of gall midge species (56% of the total). This is the most speciose genus of Myrtaceae, being well represented in abundance, frequency and richness in several Brazilian vegetal formations (Romagnolo & Souza 2006). Furthermore, *Eugenia* is widely distributed in Brazil, where it occurs in every biomes and states (Flora e Funga do Brasil 2020). According to the hypothesis of plant species richness, there is a positive correlation between plant species number and gall-inducing species richness (Price et al. 1986). The hypothesis of resource concentration predicts a positive correlation between plant species abundance

and gall-inducers richness (Begon et al. 1996), and the hypothesis of geographic area indicates that plants with wide distribution shelter more gall-inducing species than plants with more restricted distribution (Southwood 1960). Therefore, these parameters could explain the richness of gall-inducing species on *Eugenia*.

All studied host plants have economic importance, at least potentially. They are ornamental, have edible fruits, and/or are used in reforestation programs, folk medicine and/or to produce fuel, charcoal, juices, ice creams, liqueurs, wines, teas, and jellies (Table III) (Lorenzi & Souza 2001, Lorenzi et al. 2006, Useful Tropical Plants 2014). Some species are currently being examined for their antimicrobial, antitumor, anti-inflammatory and/or antioxidant properties, and/or tested as bioinsecticide (Basting et al. 2014, Carvalho-Junior et al. 2014, Galeno et al. 2014, Alvarenda et al. 2015, Tietbohl et al. 2017, Nuñez et al. 2018, Moura et al. 2018, Coradin et al. 2018, D.D. Nunes unpublished data). Besides, they have ecological importance since their fruits are food for wild animals, such as birds, bats, monkeys and fishes (Gressler 2006). As gall-inducers can negatively affect their hosts, resulting in reduction of plant growth and flowering, and decrease in fruit quality and size (McCrea et al. 1985, Fernandes 1987, Constantino et al. 2009), their impact to these plant species should be investigated as well as methods to control them.

Table III. Myrtaceae: host species of gall midges in Brazil and their human uses.

Host plant species	Human uses
Eugenia astringens Cambess.	Treatment of rheumatism, diabetes, and diarrhea, ornamental, reforestation
Eugenia copacabanensis Kiaersk.	Production of juices, ice creams, liqueurs, wines, teas, and jellies, antioxidant potential, Ornamental, reforestation
Eugenia hiemalis Cambess.	Ornamental, reforestation
Eugenia punicifolia (Kunth.) DC.	Antioxidant, antinoceptive and anti-inflammatory effects, ornamental, reforestation
Eugenia uniflora L.	Edible fruit, production of juices, ice creams, liqueurs, wines, teas, and jellies relieving headaches, cold, flu, cough, and fever, antimicrobial, ornamental, reforestation
Myrcia amazonica DC.	Edible fruit, ornamental, reforestation
Myrcia ovata Cambess.	Edible fruit, ornamental, reforestation
Myrcia retorta Cambess	Ornamental, reforestation
Myrciaria delicatula (DC.) O. Berg	Production of juices, ice creams, liqueurs, wines, teas, and jellies, ornamental, reforestation
Myrciaria floribunda (West ex Willdenaw) Berg.	Production of juices, ice creams, liqueurs, wines, teas, and jellies, antitumor, and antioxidant potential, ornamental, reforestation
Myrciaria tenella (DC.) O. Berg.	Production of juices, ice creams, liqueurs, wines, teas, and jellies, ornamental, reforestation
Neomitranthes obscura (DC.) N. J. E. Silveira	Bioinseticide, ornamental, reforestation
Psidium cattleyanum Sabine	Treatment of haemorrhages, production of fuel and charcoal, antimicrobial potential, ornamental, reforestation

Concerning plant species origin, seven are endemic to Brazil, five of them endemic to the Atlantic Forest, an expected result since Myrtaceae is the woody family with most endemism in the Atlantic Forest, as already mentioned. Information about host plant endemism is very important since most cecidomyiid species are monophagous, so their exclusive occurrence on endemic plants reveals that they are also endemic. From 25 gall midge species, 16 (64%) occur on endemic plants, 14 of them (56%) exclusively, since they are monophagous. The other two species, *Myrciamyia maricaensis* and *Stephomyia clavata*, have two hosts. The former induces galls on *Myrcia amazonica* (native to Brazil) and *Myrcia ovata* (endemic), and the latter on *Eugenia hiemalis* (native) and *Eugenia astringens* (endemic). The high number of Cecidomyiidae on exclusively endemic hosts illustrates how the Brazilian fauna on Myrtaceae is peculiar.

Regarding gall midge genera, nine are exclusively Neotropical: *Anasphondylia*, *Brethesiamyia*, *Elachypalpus*, *Fernandesia*, *Jorgenseniella*, *Neomitranthella, Eugeniamyia*, *Myrciamyia*, and *Myrciariamyia*. Among them, the first six are known from a single described species, while *Eugeniamyia*, *Myrciamyia*, and *Myrciariamyia* comprise two, two and three described species, respectively. *Eugeniamyia* occurs only on Myrtaceae, the others also on other families. Two gall midge genera occur in Nearctic and Neotropical Regions, *Neolasioptera* with 134 species, and *Stephomyia* with seven species. The last comprises six exclusively Neotropical species (Gagné & Jaschhof 2017). Phylogenetic studies indicated that *Stephomyia* origin is probably in South America and the basal host plant belongs to Myrtaceae (Maia & Barbosa 2018). The other two gall midge genera, *Clinodiplosis* and *Dasineura* are cosmopolitan, very diverse, with 107 and 476 species, respectively, and occur on several plant families (Gagné & Jaschhof 2017). These data indicate that at least five cecidomyiidi genera did not evolve exclusively on Myrtaceae. This discussion can not be extended to *Anasphondylia*, *Brethesiamyia*, *Elachypalpus*, *Fernandesia*, *Jorgenseniella*, and *Neomitranthella,* since they are known from a single species or to *Eugeniamyia*, with only two described species.

Most gall midge species have been recorded in the Atlantic Forest, probably due to the great richness of Myrtaceae in this biome. In fact, Myrtaceae are considered a model group in the Atlantic Forest, being a reliable indicato of total tree diversity from the whole biome as well as in every vegetation subcategory (Lucas & Bünger 2015). In many publications that address the floristic composition of the Atlantic Forest, Myrtaceae appear as the richest or one of the richest families (Wagner & Fiaschi 2020). These data favor the plant species richness. Besides, most taxonomical studies about gall midges have being focused on the Atlantic Forest. In the last 30 years, 143 species of gall midges have been described from Brazilian fauna, 107 (74.8%) from this biome.

Eight gall midge species are restricted to the Atlantic Forest and two species, *Brethesiamyia myrciae* and *Myrciariamyia fernandesi*, are currently only known from the Cerrado, while their host plants occur naturally in other biomes. *Elachypalpus psidii* is known only from Pelotas (RS), a municipality totally occupied by Pampa, but its host plant, *Psidium cattleianum*, does not occur naturally in this biome. In fact, *E. psidii* was obtained from a cultivated area of the EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária), where this plant has been investigated due to its economic importance. In addition to being restricted to a single biome, most cecidomyiids are also restricted to a single Brazilian state, showing that their area of occurrence is still

poorly known. Most records have been reported in RJ, the most investigated state. Comparing the distribution of gall midge species with that of their host plants, we can notice that the latter is always wider than the former, which suggests that their distribution area can be wider. Some procedures could provide data to fill these gaps, such as field-sampling in poorly studied areas, consultation of exsiccates from different herbaria (virtually or in person), and collaboration of researchers investigating this plant family.

CONCLUSION

Myrtaceae in Brazil shelter 25 gall midge species, 14 of them occur exclusively on endemic plants (56%), what reveals the great peculiarity of the Brazilian fauna. *Eugenia* is the plant genus with the highest richness of cecidomyiid species and also the most speciose among all Myrtaceae genera. All hosts have economic importance at least potentially, what attaches importance to their gall-inducers.

The great majority of cecidomyiid species are known from a single biome and most occur exclusively in the Atlantic Forest, biome with high diversity and endemism of Myrtaceae. These data suggests that the Atlantic Forest can be an important hotspot of gall midges diversity on Myrtaceae. The comparison between the geographic distribution of the host plants and that of their respective gall-inducers shows that the former is always wider than the second, so the distribution area of cecidomyiid species can be larger than that currently known.

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VCM was responsible for the concept and design of the study, contributed to data collection, analysis and interpretation, and wrote the manuscript. KDC contributed to data collection, analysis and interpretation.