

# The gall midges (Diptera, Cecidomyiidae) from three restingas of Rio de Janeiro State, Brazil

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**ABSTRACT.** One hundred and eight species of Cecidomyiinae (Cecidomyiidae) were found in association with 53 species of plant distributed among 42 genera and 32 families at restingas of Barra de Maricá, Itaipuaçu and Carapebus. Ninety four gall midge species were cecidogenous, four predaceous, five inquiline of galls and five were free living. Gallling species were associated with 47 plant species belonging to 36 genera and 28 families. The majority of the galls occurred on the leaves (N = 63); 13 on buds; nine on inflorescence, closed flower or flower peduncle; three on fruits and one on tendril. Myrtaceae were the richest plant family in number of galls followed by Burseraceae, Nyctaginaceae, Sapotaceae, Erythroxylaceae, Malpighiaceae and Solanaceae. New records of host plants and localities were recorded. Seventy nine Cecidomyiinae species were found at Restinga of Barra de Maricá, 64 at Carapebus and 41 at Itaipuaçu. Sorensen's index revealed that the restingas of Barra de Maricá and Itaipuaçu are more similar in Cecidomyiinae fauna, confirming a positive relation between geographical proximity and fauna similarity.

**KEY WORDS.** Cecidomyiidae, Diptera, gall, restinga

The restinga or coastal shrub zone is a very complex environment whose diversity is exceeded only by rain forests. Their flora has been originated from the Atlantic Forest and the plant families best represented in these areas are Leguminosae, Rubiaceae, Orchidaceae, Myrtaceae, Poaceae, Bromeliaceae and Compositae. Among them, Myrtaceae contributes significantly to its flora characterisation, being *Eugenia* Linnaeus the biggest genus in number of species (RIZZINI 1979).

Cecidomyiidae are the most common gall makers throughout the world. They comprise about 5000 known species, but only 500 have been recorded in the Neotropical region, reflecting the scarcity of taxonomic studies in this zoogeographical region.

Cecidomyiidae are divided into three subfamilies: Lestremiinae, Porricondylinae and Cecidomyiinae. The first two include mycophagous and free-living phytophagous species. The last includes all gall makers, as well as predators, inquiline, free-living phytophagous and mycophagous species. As the Cecidomyiinae comprise species of economic interest, it is much better known than the other subfamilies.

Besides the gall makers, other organisms are commonly found inside the gall, living as inquilines, predators or parasitoids. The parasitoids are considered to be the most important natural enemies of gall midges. MONTEIRO *et al.* (1993) recorded 93 kinds of insect galls in the restingas of Barra de Maricá and Arraial do

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Cabo (Rio de Janeiro State). About 75% of them appeared to be induced by Cecidomyiidae (Diptera). Parasitoids species were found in 85% of these galls. More specific data on parasitoids in restinga galls can be found in MAIA & MONTEIRO (1999a) and MAIA (1999).

The present study surveyed three different restingas of Rio de Janeiro State: Barra de Maricá, Itaipuaçu and Carapebus, whose flora is relatively well known due to surveys developed mainly by ARAÚJO & HENRIQUES (1984), SILVA & SOMNER (1984), SILVA & OLIVEIRA (1989) and ARAÚJO *et al.* (1998). The first two restingas are geographically continuous and belong to the city of Maricá. The other one is about 170 km away from Maricá.

The Restinga of Barra de Maricá (hereafter RBM) has been a protected area since 1984. It spreads over about 150 ha. The Restinga of Carapebus (hereafter RC) is part of the "Parque Nacional de Jurubatiba", whose area is about 15000 ha, Carapebus comprising 40% of it. This is the only park that includes a restinga area. While RBM and RC are well preserved, the restinga of Itaipuaçu (hereafter RI) has been partially destroyed by human activities (mainly the building industry).

## MATERIAL AND METHODS

The restingas of Barra de Maricá, Itaipuaçu and Carapebus were investigated over a period of 12 months: RBM from January to December, 1997; RI from November, 1997 to October, 1998 and RC from May, 1998 to April, 1999. Collections were made monthly along two pathways in RBM (Fig. 1), one of them adjacent to the Zacarias Beach (ZBP) and the other adjacent to the Maricá lagoon (MLP). Collections were made along the "Avenida Beira-Mar" (Beira-Mar Avenue) in RI (Fig. 1), and along two different pathways in RC, one near Carapebus lagoon and the other along the access road to "Praia Grande" (PGP) (Fig. 1). The vegetation was examined at each 200 meter point along these pathways for 30 minutes per visit. The geographic coordinates of the first and the last points of collection in each road were obtained using the Global System Position 45 (GPS 45). They are: RBM, MLP – (42°53'23"W, 22°54'00"S); (42°49'57"W, 22°57'34"S) and ZBP – (42°54'00"W, 22°58'05"S); (42°50'03"W, 22°57'37"S); RI – (42°54'13"W, 22°58'14"S); (43°00'47"W, 22°58'13"S); RC, CLP – (41°35'26"W, 22°14'50"S); (41°35'10"W, 22°13'05"S); PCG (41°38'41"W, 22°16'27"S); (41°39'56"W, 22°15'09"S).

Samples of host plant, preferably with flowers and fruits, were pressed for preservation. They were later identified mainly by MsC Andrea Costa and Dr. Rui Alves (Departamento de Botânica, Museu Nacional, hereafter MNRJ). After having received a registration number, the dried plant specimens were incorporated into MNRJ herbarium. The system of plant classification is that proposed by CRONQUIST (1988) was followed, except for the Leguminosae, as suggested by the Herbarium curator.

Data on plant species distribution was mainly based on the literature: ARAÚJO *et al.* (in press) for Apocynaceae, Asclepiadaceae, Burseraceae, Cactaceae, Celastraceae, Erythroxylaceae, Euphorbiaceae, Fabaceae, Lauraceae (excepting *Struthanthus maricensis*), Malpighiaceae (excepting *Tetrapteris phlomoides*), Melastomataceae, Myrsinaceae, *Eugenia uniflora*, *Myrciaria floribunda*, *Neomitranthes*

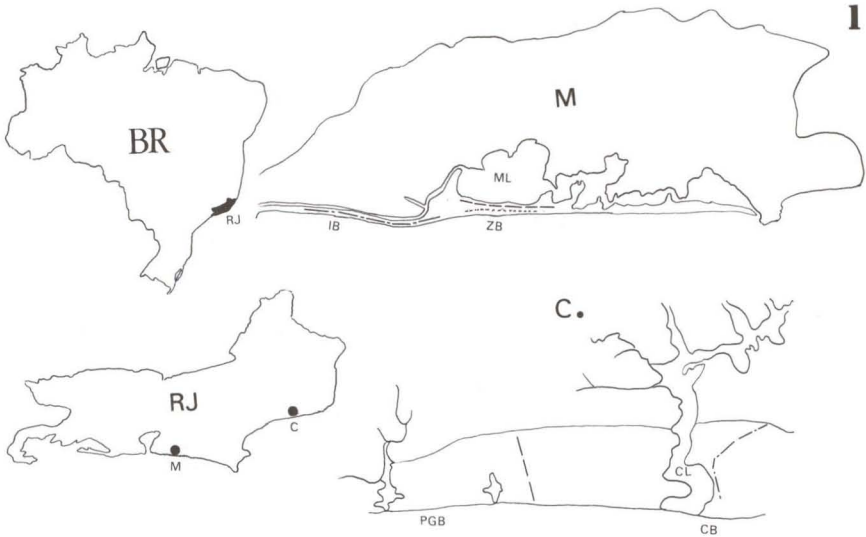


Fig. 1. Maps of Brazil, Rio de Janeiro State, Maricá city and Carapebus. (BR) Brazil, (C) Carapebus City, (CB) Carapebus Beach, (CL) Carapebus Lagoon, (M) Maricá City, (ML) Maricá Lagoon, (PGB) Praia Grande Beach, (RJ) Rio de Janeiro State, (ZB) Zacharias Beach, (— MLP) Maricá Lagoon Pathway, (..... ZBP) Zacharias Beach Pathway, (.....) Avenida Beira-mar (road).

*obscura* (Myrtaceae), Nyctaginaceae, Ochnaceae, Passifloraceae, Piperaceae, Rubiaceae, Sapindaceae, *Manilkara subsericea* (Sapotaceae), Smilacaceae, Solanaceae, Verbenaceae; PRANCE (1972) for Chrysobalanaceae; MARIZ (1974) for *Clusia lanceolata* e *Clusia fluminensis* (Clusiaceae); MOREIRA & RIZZINI (1997) for *Struthanthus maricensis* (Loranthaceae); BARROSO & MARQUES (1997) for *E. multiflora* (Myrtaceae) and REITZ (1968) for *Pouteria caimito* var. *laurifolia* and *P. venosa*. Information about *Mikania hoehnei* (Asteraceae) and *Jacquemontia holosericea* (Convolvulaceae) was given by Dr. Roberto L. Esteves and Mariana S. Machado, respectively, both botanists at MNRJ. Data on *Eugenia copacabanensis*, *Eugenia rotundifolia*, *Myrcia ovata* (Myrtaceae) and *Ximenia americana* var. *americana* (Olacaceae) were obtained from the MNRJ Herbarium.

All studied galls were photographed and the negatives organised into an archive. Samples of dried galls are incorporated in the Diptera collection of MNRJ.

Larvae and pupae of the gall midges were obtained from the dissection of each kind of gall under a stereoscopic microscope. This procedure also enabled the determination of the gall dwellers' habits, whether inquilinous, predaceous, parasitoid or gall making.

The pupal exuviae and adults were obtained by keeping some samples of each kind of gall individually in plastic pots covered by a fine screening and layered at the bottom with damp cotton. Galls of the species whose larvae pupate in the soil were kept in pots containing a layer of restinga soil on the bottom. All pots were checked daily.



Larvae, pupae, pupal exuviae and adults of Cecidomyiidae were preserved in 70% alcohol and they were later mounted on slides following the methodology of GAGNÉ (1994). The Cecidomyiidae genera were identified based mainly on the keys of GAGNÉ (1981, 1989, 1994).

The other arthropods – micro-Hymenoptera, Formicidae and Pseudoscorpiones – obtained from the galls were identified by Dr. John La Salle (International Institute of Entomology, Londres, England), Dr. Antônio Mayhé Nunes (Universidade Federal Rural do Rio de Janeiro, Brazil) and Dr. Mark Harvey (Western Australia Museum, Australia), respectively.

## RESULTS AND DISCUSSION

One hundred and eight species of Cecidomyiidae were found in the three restingas studied. The most diverse one was RBM (N = 79), followed by RC (N = 64) and RI (N = 41). The majority of them were gall makers (N = 94), but some inquiline, predaceous and free living species were found (N = 5, N = 4 and N = 6, respectively) (Tab. I).

Table I. Distribution of habits of gall midges in the restingas of Barra de Maricá (RBM), Itaipuaçu (RI) and Carapebus (RC), Rio de Janeiro State.

Habits of gall midges	Species	
	Number	Percentage (%)
Gall maker	94	87,04
Inquiline of galls	5	4,63
Predator in galls	4	3,70
Free living phytophagous	5	4,63

The gall midges were associated with 53 species of plants (42 genera and 32 families). Myrtaceae were the plant family with the greatest richness of galls (N = 24), about 24% of the total. Burseraceae were the second one with 8 kinds of galls, followed by Nyctaginaceae and Sapotaceae, each with 5, and then by Erythroxylaceae, Malpighiaceae and Solanaceae, each with 4 (Tab. II). These results differ from the pattern found by HOUARD (1933) for Central and South Americas, in which there was a remarkable predominance of galls on Leguminosae and Asteraceae. Considering that both these families are well represented in restingas (Leguminosae is the most common plant family in the restingas studied. Compositae is the second one in RC and the fourth one in RBM), this result becomes more relevant.

Most restinga galls were observed on leaves (N = 63), a world pattern already pointed out by MANI (1964). Leaves represent an abundant and constant resource in restinga areas. Lateral and apical buds were the second most attacked plant part (N = 13), followed by inflorescence (including closed flower or flower peduncle) (N = 9) and stem (N = 9), fruit (N = 4) and tendril galls (N = 1) (Tab. III).

In addition to the gall makers, other arthropods were found in the internal chambers of the galls, such as: Pseudoscorpiones, Hymenoptera, Lepidoptera and Diptera. Hymenoptera were the most frequent ones. Collectively they were found



Table II. List of host plants and number of gall or damage in the restingas of Barra de Maricá (RBM), Itaipuaçu (RI) and Carapebus (RC), Rio de Janeiro State.

Host plants Family	Species	Number kinds of gall or damage	Locality		
			RBM	RI	RC
Anacardiaceae	<i>Atronium</i> sp.	1	1	—	—
Apocynaceae	<i>Aspidosperma pyricollum</i>	1	1	—	—
Asclepiadaceae	<i>Peplonia asteria</i>	2	1	1	2
Asteraceae	<i>Mikania hoehnii</i>	2	2	2	—
	<i>Vernonia rufogrisea</i>	1	—	—	1
Bignoniaceae	<i>Arrabidaea conjugata</i>	3	3	1	2
Boraginaceae	<i>Cordia verbenacea</i>	3	3	2	2
Burseraceae	<i>Protium brasiliense</i>	2	2	—	—
	<i>Protium heptaphyllum</i>	2	—	—	2
	<i>Protium icicariba</i>	4	—	—	4
Cactaceae	<i>Selenicereus setaceus</i>	1	1	1	—
Celastraceae	<i>Maytenus obtusifolia</i>	2	2	1	1
Chrysobalanaceae	<i>Couepia ovalifolia</i>	2	2	—	—
Clusiaceae	<i>Clusia fluminensis</i>	1	1	—	—
	<i>Clusia hilariana</i>	1	—	—	1
	<i>Clusia lanceolata</i>	1	1	1	—
Convolvulaceae	<i>Jacquemontia holosericea</i>	1	1	1	—
Erythroxylaceae	<i>Erythroxylum ovalifolium</i>	4	4	4	4
Euphorbiaceae	<i>Sebastiania glandulosa</i>	3	—	3	2
Lauraceae	<i>Ocotea notata</i>	1	1	—	1
Leguminosae	<i>Dalbergia ecastophylla</i>	1	—	—	1
	<i>Inga maritima</i>	1	1	1	—
	<i>Stylosanthes guianensis</i>	1	1	—	1
Loranthaceae	<i>Psittacanthus dichrous</i>	1	1	—	—
	<i>Struthanthus maricensis</i>	1	1	—	—
Malpighiaceae	<i>Byrsonima sericea</i>	3	3	2	3
	<i>Heteropteris nitida</i>	1	1	—	—
	<i>Tetrapteris phlomoides</i>	1	1	—	—
Melastomataceae	<i>Miconia cinnamomifolia</i>	1	—	—	1
Myrsinaceae	<i>Rapanea parvifolia</i>	1	1	1	1
Myrtaceae	<i>Eugenia copacabanensis</i>	2	—	—	—
	<i>Eugenia multiflora</i>	6	—	—	6
	<i>Eugenia rotundifolia</i>	3	3	3	—
	<i>Eugenia uniflora</i>	3	3	1	1
	<i>Myrcia ovata</i>	3	3	—	3
	<i>Myrciaria floribunda</i>	3	2	1	3
	<i>Neomitranthes obscura</i>	4	4	—	4
Nyctaginaceae	<i>Guapira opposita</i>	5	5	4	2
Ochnaceae	<i>Ouratea cuspidata</i>	1	1	—	—
Oleaceae	<i>Ximenia americana</i>	1	1	1	—
Passifloraceae	<i>Passiflora mucronata</i>	1	—	—	1
Piperaceae	<i>Piper divaricatum</i>	1	—	—	1
Rubiaceae	<i>Borreria verticillata</i>	1	1	—	1
	<i>Diodia gymnocephala</i>	1	—	—	1
Sapindaceae	<i>Paullinia weinmanniaefolia</i>	3	2	2	3
Sapotaceae	<i>Manilkara subsericea</i>	3	1	1	3
	<i>Pouteria caimito</i>	1	1	1	—
	<i>Pouteria venosa</i>	1	1	1	—
Smilacaceae	<i>Smilax rufescens</i>	3	3	1	2
Solanaceae	<i>Aureliana fasciculata</i>	2	—	—	2
	<i>Solanum affine</i>	1	1	1	—
	<i>Solanum inaequale</i>	1	—	—	1
Verbenaceae	<i>Lantana camara</i>	1	1	—	—
Total		101	72	39	62

in 56% of the kinds of the galls (Tab. IV). The majority of the Hymenoptera were parasitoids, but some of them were phytophagous. Among the latter, some species were able to modify the gall morphology, such as the inquiline wasp of conical galls on *Paullinia weinmanniaefolia* (Sapindaceae). This wasp produces an enlargement of the gall and the development of endogalls (Fig. 86b). These internal protuberances grow and squash the cecidogenous larva, causing its death. Other less remarkable gall modifications due to inquiline wasps were observed in conical galls on *Erythroxylum ovalifolium* (Erythroxylaceae) (Fig. 34), cylindrical gall on *Eugenia rotundifolia* (Fig. 61) and ovoid galls on *Myrcia ovata* (Myrtaceae) (Fig. 67). These modifications cause an enlargement of the gall.

Table III. Distribution of galls in the plant parts at restingas of Barra de Maricá (RBM), Itaipuaçu (RI) and Carapebus (RC), Rio de Janeiro State.

Plant part	Kind of gall	
	Number	Percentage (%)
Leaf	63	62,4
Bud	13	12,9
Inflorescence (closed flower, flower peduncle)	9	8,9
Stem	9	8,9
Fruit	4	3,9
Tendrill	1	1,0

GAGNÉ (1994) indicated that the Pteromalidae, Platygastriidae and Torymidae were the most common parasitoids of gall midges. A different result was found in restingas, where Eulophidae and Eurytomidae were the predominant families. FERNANDES *et al.* (1988) found similar results in their research in Minas Gerais, Brazil. These data suggest that Eulophidae and Eurytomidae may be the most important natural enemies of gall midges in the Neotropical region.

Tritonymphs and adults of *Novohorus* sp. (pseudoscorpions, probably a new species) were found in cylindrical galls on two different species of Myrtaceae, namely: *Eugenia multiflora* (in RC) and *Eugenia rotundifolia* (in RBM). Pseudoscorpions are known by their predaceous habits.

*Leptothorax* sp. (Formicidae) was found in cylindrical galls on *Eugenia rotundifolia*. This species invades empty galls and establishes a society there. *Trotteria* sp., *Contarinia* sp., *Resseliella* sp. and *Clinodiplosis* spp. were found as inquilines in galls yet inhabited by cecidogenous larva. All of them caused the gall maker's death.

*Lestodiplosis* spp. are known as predators of arthropods. This habit was confirmed in the studied galls, where they preyed upon cecidogenous larvae. Nineteen species of Lasioteridi and sixty two species of Cecidomyiidi were found. The latter supertribe showed the greatest richness of species, being responsible for 76,5% of the total of the identified species, with the tribe Asphondyliini the most numerous. The best represented genera of Cecidomyiidae in this research were *Clinodiplosis* (N = 10), *Asphondylia* (N = 7), *Stephomyia* (N = 6), *Dasineura* (N = 4) and *Neolasioptera* (N =

Table IV. Frequency of Hymenoptera (parasitoids or phytophagous) in galls or plant damage at restingas of Barra de Maricá (RBM), Itaipuaçu (RI) and Carapebus (RC), Rio de Janeiro State.

	Number kinds of gall	Number kinds of gall with Hymenoptera
<i>Atronium</i> sp.	1	—
<i>Aspidosperma pyricollum</i>	1	1
<i>Peplonia asteria</i>	2	2
<i>Mikania hoehnei</i>	2	2
<i>Vernonia rufogrisea</i>	1	—
<i>Arrabidaea conjugata</i>	3	1
<i>Cordia verbenacea</i>	3	1
<i>Protium braziliense</i>	2	1
<i>Protium heptaphyllum</i>	2	2
<i>Protium icariba</i>	4	2
<i>Selenicereus setaceus</i>	1	—
<i>Maytenus obtusifolia</i>	2	1
<i>Couepia ovalifolia</i>	2	1
<i>Clusia fluminensis</i>	1	1
<i>Clusia hilariana</i>	1	1
<i>Clusia lanceolata</i>	1	1
<i>Jacquemontia holosericea</i>	1	—
<i>Erythroxylum ovalifolium</i>	4	3
<i>Sebastiania glandulosa</i>	3	3
<i>Ocotea notata</i>	1	1
<i>Dalbergia ecastophylla</i>	1	1
<i>Inga mantima</i>	1	1
<i>Stylosanthes guianensis</i>	1	1
<i>Psittacanthus dichrous</i>	1	—
<i>Struthanthus maricensis</i>	1	—
<i>Byrsonima sericea</i>	3	2
<i>Heteropteris nitida</i>	1	—
<i>Tetrapteris phlomoides</i>	1	—
<i>Miconia cinnamomifolia</i>	1	1
<i>Rapanea parvifolia</i>	1	—
<i>Eugenia copacabanensis</i>	2	2
<i>Eugenia multiflora</i>	6	5
<i>Eugenia rotundifolia</i>	3	2
<i>Eugenia uniflora</i>	3	3
<i>Myrcia ovata</i>	3	2
<i>Myrciaria floribunda</i>	3	2
<i>Neomitranthes obscura</i>	4	2
<i>Guapira opposita</i>	5	3
<i>Oouratea cuspidata</i>	1	—
<i>Ximenia americana</i>	1	—
<i>Passiflora mucronata</i>	1	—
<i>Piper divaricatum</i>	1	—
<i>Borreria verticillata</i>	1	1
<i>Diodia gymnocephala</i>	1	1
<i>Paullinia weinmanniaefolia</i>	3	1
<i>Manilkara subsericea</i>	3	3
<i>Pouteria caimito</i>	1	1
<i>Pouteria venosa</i>	1	1
<i>Smilax rufescens</i>	3	2
<i>Aureliana fasciculata</i>	2	1
<i>Solanum affine</i>	1	1
<i>Solanum inaequale</i>	1	1
<i>Lantana camara</i>	1	—
Total	101	64 (= 63)



4). Among the species of *Clinodiplosis*, 6 were associated with simple galls (marginal rolls), 2 were in complex galls and the others were free-living species, found in fruits and closed flowers. This pattern differs from the one in the Holartic region where the majority of *Clinodiplosis* species is fungivorous (GAGNÉ 1989). Concerning to *Asphondylia*, four species produced flower or fruit galls. The high incidence of this genus in the reproductive parts of the plant had already been noticed by MÖHN (1961). All *Stephomyia* species were associated with Myrtaceae, confirming their specificity to this plant family. Among the species of *Dasineura* found in the restingas, 2 induced complex galls and the others were found in marginal rolls. Living free in flowers and inducing simple galls are their most common habits in other zoogeographic regions.

The similarity of the gall composition of the restingas was measured by using Sorensen's index. The results showed that RBM is more similar to RI (RBM X RI = 0.65) than to RC (RBM X RC = 0.49). Concerning to RC X RI, the value found was about 0.47. These numbers suggest that there is a positive relationship between geographic proximity and fauna similarity.

The geographic distribution of *Asphondylia cordiae* Möhn, 1959; *Camptoneuromyia* Felt, 1908; *Alycaulus Rübsaamen*, 1916 and *Proasphondylia guapirae* Maia, 1993 were enlarged. Before this study, *Asphondylia cordiae* had been recorded only in El Salvador (GAGNÉ 1994). The first report of *Camptoneuromyia* in Brazil is made here. Previous reports were from El Salvador, Colombia, San Vincent and Trinidad. *Alycaulus* was known to occur in Colombia, Costa Rica, El Salvador and Amazonas (Brazil) (GAGNÉ, 1994). Now, the distribution area of this genus comprises Rio de Janeiro State, too. *Proasphondylia guapirae* previously recorded only in Restinga of Arraial do Cabo (Rio de Janeiro, Brazil) (MAIA 1993b) has its first report in Maricá.

Eight new genera and fourteen new species of gall midges were found in the restingas (descriptions in preparation). This number of new taxa is a consequence of the scarcity of taxonomic studies on the great diversity of species in neotropical region.

Data on Cecidomyiidae galls or damage in the three studied restingas of Rio de Janeiro State are presented here. They are arranged under host plant species in alphabetical order. Information about the host plants geographic distribution is given, as well as their registration number in the MNRJ herbarium. Regarding to the galls or damage, data include their description, gall maker identification, number of galls per leaf (in case of leaf galls), arthropod fauna associated, number of cecidogenous larvae per gall, examined material and localities and periods and points of gall occurrence.

## Data on Cecidomyiidae galls or damage

### Anacardiaceae

#### *Atronium* sp.

Registration number: 195593 (V. Maia leg.)

Points of occurrence: RBM: MLP - 200, 400, 1400, 3800, 4000, 4200, 4800, 5000, 5400 and 5600m.

Gall (Fig. 2). Leaf gall, projecting on both surfaces; circular and conspicuous on the superior surface (diameter: 0.3-0.4 cm) and permanently open on the inferior surface; glabrous; monothalamous; green or red. Number of galls/leaf: 1-5. Gall maker: Coccoidea. Other arthropods: inquiline – *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: *Clinodiplosis* sp. – 16 larvae (17.X.1987); 1 male (06.VI.1987) and 15 galls (9 on 20.VII.1995, 6 on 12.XII.1997). Periods of gall occurrence: April, June, July, October, December. Points of occurrence: 4800 m. Comments. MONTEIRO *et al.* (1993) recorded this gall but the plant was misidentified as *Protium heptaphyllum*.

## Apocynaceae

### *Aspidosperma pyricollum* Muell. Arg.

Registration number: 194938 (V. Maia *leg.*)

Distribution: Brazil (Pernambuco, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Santa Catarina).

Points of occurrence: RBM: MLP – 200, 1000, 1600, 2200, 3600, 3800, 5000-5600m; ZBP – 1800, 3000, 4600, 4800, 5200, 6200m.

Gall (Fig. 3). Leaf gall, projecting on both surfaces; circular on the superior surface (diameter: 0.2-0.3 cm) and permanently open on the opposite surface; glabrous; monothalamous; red. Number of galls/leaf: 1-16. Gall maker: Psylliidae. Other arthropods associated: Cecidomyiidi (Cecidomyiidae) (pupation in the gall) and Braconidae (Hymenoptera). Number of gall midge larvae/gall: 1. Locality: RBM. Material: Cecidomyiidi – 1 male (20.X.1986) and 22 galls (19 on 11.VIII.1990, 3 on 12.XII.1997). Periods of gall occurrence: January, April, May, August, October, December. Points of occurrence: MLP – 200, 1000, 5000, 5200, 5600m; ZBP: 1800, 4600, 4800, 5200m. Comments. RÜBSAAMEN (1907) described a similar Psylliidae gall on *Aspidosperma* sp.

## Asclepiadaceae

### *Peplonia asteria* (Vell.) Font. & Schw.

Registration number: 194939 (V. Maia *leg.*)

Monotypic genus. Endemic species of restingas. Distribution: Brazil (Bahia, Espírito Santo, Rio de Janeiro).

Points of occurrence: RBM: MLP – 200, 600-1000, 1400-2000, 2600-3000, 3400-3600m; RI: 400-2800, 3200, 3800-4200m; RC: CLP – 200-400, 1400, 1800, 2200, 3000-3400; PGP – 200-1600, 2200-2600m.

Gall (Fig. 4). Leaf roll; length: 0.8-1.0 cm, basal width: 0.2-0.3 cm; glabrous; monothalamous; green or red. Gall maker: *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 6 larvae (1 on 28.VIII.1998; 4 on 24.IX.1998 and 1 on 30.I.1999) and 2 galls (29.VI.1998). Periods of gall occurrence: July-August. Points of occurrence: CLP – 3200-3400m; PGP – 1000, 3400m.

Gall (Fig. 5). Closed flower; length: 0.6 cm, medial width: 0.4 cm; glabrous; monothalamous; green. Gall maker: *Asphondylia* sp. (Cecidomyiidae). Pupation in

the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 2 females (07.VIII.1998); RC: 7 larvae (6 on 29.VIII.1998 and 1 on 19.XII.1998), 15 pupal exuviae (29.VIII.1998), 7 females (2 on 25.VII.1998, 5 on 29.VIII.1998), 5 males (2 on 25.VII.1998 and 3 on 29.VIII.1998) and 2 galls (25.VII.1998). Other arthropods: parasitoids – Eulophidae and Torymidae (Hymenoptera). Periods of gall occurrence: July-October. Points of occurrence: RBM: MLP – 200, 800, 1400-1600, 2000m; RC: CLP – 200, 2200m; PGP – 200-600, 1000, 1400-1600, 2200, 2600m.

## Asteraceae (= Compositae)

### *Mikania hoehnei* Robinson

Registration number: 194975 (V. Maia leg.)

Distribution: Brazil (Rio de Janeiro, São Paulo, Paraná, Santa Catarina).

Points of occurrence: RBM: MLP – 200, 3000, 3200m; ZBP – 600, 1000, 1200, 1600, 2000, 2400, 3200-3800, 4200, 4800, 5000, 5600m. RI: 400, 800, 3600, 4000m.

Gall (Fig. 6). Leaf roll; length: 1.0 cm, width: 0.3 cm; glabrous; monothalamous; green. Gall maker: *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 3 larvae (21.VIII.1998), 1 female (07.VIII.1998), 1 gall (05.VI.1998); RI: 1 pupal exuviae (01.VIII.1998), 1 female (01.VIII.1998), 1 gall (12.VI.1998). Other arthropods: Eulophidae (Hymenoptera); Sciaridae (Diptera). Periods of gall occurrence: June-August. Points of occurrence: RBM: ZBP – 600m. RI: 800m.

Gall (Fig. 7). Stem swelling; ovoid; length: 1.0-1.8 cm, width: 0.5-0.8 cm; glabrous; monothalamous; coloured like the stem. Gall maker: *Alycaulus* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 9 females (2 on 10.X.1987, 7 on 07.VIII.1998), 5 galls (III.1998); RI: 3 galls (12.VI.1998). Other arthropods: *Dimeromicrus cecidomyiae* (Torymidae, Hymenoptera). Periods of gall occurrence: March, April, June, October. Points of occurrence: RBM: MLP – 600, 1000, 2000, 4800, 5600m. RI: 400m. Comments. RÜBSAAMEN (1916) described a similar gall on *Mikania* sp. from Amazonas (Brazil).

Figs 2-19. Restinga galls. (2) Leaf gall on *Atronium* sp. (Anacardiaceae); (3) Leaf gall on *Aspidosperma pyricollum* (Apocynaceae); (4-5) on *Peplonia asteria* (Asclepiadaceae): (4) rolled young leaf; (5) flower bud gall; (6-7) on *Mikania hoehnei* (Asteraceae): (6) young leaf roll; (7) stem swelling; (8) bud gall on *Vernonia rufogrisea* (Asteraceae); (9-10) on *Arrabidaea conjugata* (Bignoniaceae): (9) conical leaf gall; (10) leaf midvein swelling; (11-13) on *Cordia verbenacea* (Boraginaceae): (11) globular leaf gall; (12) Inflorescence gall; (13) Petiole swelling; (14-15) on *Protium brasiliense* (Burseraceae): (14) conical leaf gall on; (15) marginal leaf roll; (16-17) on *Protium heptaphyllum* (Burseraceae): (16) ovoid leaf gall; (17) marginal leaf roll; (18-19) on *Protium icariba* (Burseraceae): (18) conical leaf gall; (19) marginal leaf roll.





***Vernonia rufogrisea* St. Hill.**

Registration number: 195603 (V. Maia *leg.*)

Distribution: Brazil (Bahia, Tocantins, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo).

Points of occurrence: RC: CLP – 200-400, 1400-2000, 2400-2800m; PGP – 200, 600, 1600m.

Gall (Fig. 8). Spherical bud gall; diameter: 0.3 cm; pubescent; monothalamous; yellowish. Gall maker: *Asphondylia* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 1 female (28.IX.1998), 1 male (28.IX.1998), 7 galls (25.IX.1998). Periods of gall occurrence: September-January. Points of occurrence: same as the host plant.

### Bignoniaceae

***Arrabidaea conjugata* (Vell.) Mart.**

Registration number: 194951 (V. Maia *leg.*)

Distribution: from Costa Rica to Brazil (from Amazonas to Paraná).

Points of occurrence: RBM: MLP – 200, 1200, 3000-5000, 5600-6000m; ZBP – 4600-5400, 6000, 64000, 6600m. RI: 200, 400, 1000, 1200, 1800, 3400, 4000m. RC: CLP – 1200, 2000, 2400m.

Gall (Fig. 9). Conical leaf gall; length: 0.8-1.4cm; basal width: 0.5 cm; glabrous; monothalamous; green. Gall maker: Cecidomyiidi (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 5 larvae (2 on 10.X.1998, 3 on 06.XII.1997), 4 pupal exuviae (2 on III.1989, 2 on 25.I.1998), and 21 galls (11 on 12.XII.1997, 10 on II.1998); RI: 2 galls (12.VI.1998); RC: 1 larva (21.III.1999), 1 pupal exuviae (27.II.1999), 1 male (27.II.1999). Other arthropods: parasitoid – Eurytomidae (Hymenoptera). Periods of gall occurrence: January-June, October-December. Points of occurrence: RBM: MLP – 1200, 3200, 3400, 6000m; ZBP – 5200m. RI: 200m. RC: CLP – 2000m.

Gall (Fig. 10). Stem, tendril or midvein swelling; length: 0.5-0.7 cm; width: 0.2-0.3 cm; glabrous; monothalamous; coloured like the stem, clasper or midvein. Gall maker: *Neolasioptera* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RC. Material: RBM: 7 larvae (1 on 07.VIII.1998, 5 on 27.VII.1998), 6 females (X.1987), 1 male (01.X.1987) and 7 galls (06.XII.1997); RC: 3 larvae (2 on 28.X.1998, 1 on 30.I.1999). Periods of gall occurrence: April, October-December. Points of occurrence: RBM: MLP – 4000, 4800m. RC: CLP – 2000m. Comments. TAVARES (1918, 1925) described a similar gall on *Arrabidaea coleocalix*, but he had no success in rearing the gall maker.

Gall. Greatly swollen ovary; spherical; diameter: 1.2 cm; glabrous; monothalamous; purple (as the flower). Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: RBM: 2 larvae (1 on XII.1989, 1 on 10.I.1998). Periods of gall occurrence: December, January. Points of occurrence: unknown (material collected by Prof. Maria Célia Rodrigues (Departamento Botânica, MNRJ).

## Boraginaceae

***Cordia verbenacea* D. C.**

Registration number: 158517 (Jane G. da Silva leg.)

Distribution: Brazil (from Ceará to Rio Grande do Sul), Paraguay and Argentina.

Points of occurrence: RBM: MLP – 200, 400, 3200, 3600, 3800, 4400-5000, 5800-6400m; ZBP – 800, 1600, 1800, 2200, 2600, 2800, 4600, 4800, 5200-5600, 6200- 6600m. RI: 200, 1600, 2000, 2200, 3200, 3400, 3800m. RC: CLP – 200, 3200- 3400m.

Gall (Fig. 11). Globular leaf gall; diameter: 0.5 cm; hairy; monothalamous; green. Number of galls/leaf: 1-17. Gall maker: *Cordiamyia globosa* Maia, 1996 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 1 male (25.VII.1998), 2 pupal exuviae (25.VII.1998). Other arthropods: parasitoids (Hymenoptera): Pteromalidae – *Lyriscus* sp. and a new genus and species; Eulophidae – *Galeopsomyia* sp.; Eurytomidae – *Eurytoma* sp.; Torymidae – *Torymoides* sp. and *Torymus* sp.; Platygastridae – *Synopeas* sp. Periods of gall occurrence: January-June, October-December. Points of occurrence: RBM: MLP – 200, 4400, 4600, 5000m; ZBP – 4600, 5200m, 6200m. RI: 200, 1600, 2000, 2200, 3200, 3400, 3800m. RC: the same ones recorded to host plant. Comments. Gall and gall maker described by MAIA (1996a).

Gall (Fig. 12). Closed flower; ovoid; length: 0.5 cm; width: 0.2 cm; hairy; monothalamous; green or yellow. Gall maker: *Asphondylia cordiae* Möhn, 1975 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 1 larva (05.VI.1998), 4 pupal exuviae (1 on 12.I.1998, 2 on II.1998, 1 on 03.VII.1998), 2 females (II.1998), 6 galls (3 on III.1998, 3 on 05.IV.1998); RI: 2 galls (12.VI.1998). Periods of gall occurrence: January-June. Points of occurrence: RBM: MLP -200, 4600, 5000m; ZBP – 4600, 5200, 6200m. RI: 200, 1600, 2200, 3200, 3400m. RC: the same ones recorded to host plant. Comments. Gall and gall maker described by MÖHN (1975).

Gall (Fig. 13). Leaf petiole or midvein swelling; ovoid; length: 0.3-0.4 cm; basal width: 0.3 cm; apical width: 0.1 cm; glabrous; monothalamous; green. Gall maker: Clinodiplosini (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RC. Material: RBM: 7 larvae (05.VII.1998); RC: 6 galls (28.VIII.1998). Periods of gall occurrence: June-August. Points of occurrence: RBM: MLP – 200, 400, 3600m; RC: the same ones recorded to host plant.

## Bursreraceae

***Protium brasiliense* (Spr.) Engl.**

Registration number: 178083; 195592 (V. Maia leg.)

Distribution: Brazil (common in forests and with some registers in restingas)

Points of occurrence: RBM: ZBP – 600m.

Gall (Fig. 14). Conical leaf gall; on both leaf surface, but more common on the superior one; length: 0.6-1.0 cm; basal width: 0.1-0.3 cm; glabrous; monotha-



lamous; green. Number of galls/leaf: 1-13. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 10 larvae (4 on 25.IV.1998, 6 on 21.VIII.1998), 2 pupal exuviae (23.XII.1998), 3 males (23.XII.1998) and 20 galls (25.IV.1998). Periods of gall occurrence: April-December. Points of occurrence: RBM: ZBP – 600m.

Gall (Fig. 15). Marginal leaf roll; length: 1.0-1.7 cm; width: 0.1-0.2 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-7. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 1 larva (25.IV.1980 and 5 galls (25.IV.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: April-June. Points of occurrence: RBM: ZBP – 600m.

### ***Protium heptaphyllum* (Aublet.) March**

Registration number: 194959 (V. Maia *leg.*)

Distribution: South America (Colombia, Venezuela, Guyana, Suriname, French Guyana, Brazil, Bolivia, Paraguay) and Trinidad. In Brazil, it occurs in nearly all states, except in Santa Catarina and Rio Grande do Sul.

Points of occurrence: RC: CLP – 200-400, 1200-2800, 4200m; PGP -2400, 3200m.

Gall (Fig. 16). Ovoid leaf gall; length: 0.3-0.4 cm; medial width: 0.2-0.3 cm; glabrous; monothalamous; green. Number of galls/leaf: 4-15. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 2 pupal exuviae (1 on 27.XI.1998, 1 on 17.III.1999), 1 female (17.III.1999), 2 males (1 on 29.VI.1998, 1 on 27.XI.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: May-March. Points of gall occurrence: CLP – 200-400, 1200-1400, 1800-2000, 2400-2800m; PGP – 2400m.

Gall (Fig. 17). Marginal leaf roll; length: 1.0-1.7 cm; width: 0.1-0.2 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-7. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 4 larvae (1 on 29.VI.1998, 3 on 21.VI.1998), 5 pupal exuviae (1 on 29.VI.1998, 1 on 29.VII.1998, 2 on 28.IX.1998, 1 on 27.II.1999), 11 galls (23.V.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: June-February. Points of occurrence: CLP – 200-400, 1200-2800, 4200m. Comments. Gall described by TAVARES (1922).

### ***Protium icicariba* (DC.) March.**

Registration number: 184289 (A. Souza *leg.*)

Distribution: Brazil (from south Bahia to Rio de Janeiro).

Points of occurrence: RC: CLP – 400-800, 1400-1600, 2000, 2400m, 3000-3200, 3600-4200m; PGP – 400-600, 1000-3400m.

Gall (Fig. 18). Conical leaf gall; length: 0.6-1.0 cm; basal width: 0.1-0.3 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-13. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 12 larvae (3 on 29.VI.1998, 1 on 24.VII.1998, 1 on 29.VIII.1998, 2 on 24.X.1998, 3 on 27.XI.1998, 1 on 26.II.1999, 1 on 17.III.1999), 3 pupal exuviae (1

on 28.XI.1998, 2 on 19.XII.1998), 2 pupae (24.X.1998). Other arthropods: parasitoids – Hymenoptera. Periods of gall occurrence: May-February. Points of gall occurrence: CLP – 400-600, 1400-1600, 2000, 2400, 3000-3200, 3600-4200m; PGP – 400-600, 1000-3200m.

Gall (Fig. 19). Marginal leaf roll; length: 1.0-1.7 cm; width: 0.1-0.2 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-7. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 1 pupal exuviae (27.XI.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: April-February. Points of occurrence: PC – 400-600, 1400-1600, 2000, 2400m; PG – 400-600, 1000, 1600-1800, 2200-3200m.

Gall (Fig. 20). Fruit gall; kidney shaped (lateral view), enlarged basally and tapered apically; length: 0.5-0.7cm; basal width: 0.6 cm; glabrous; monothalamous; green or red. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 4 larvae (25.IX.1998), 2 pupal exuviae (29.XII.1998), 8 galls (24.V.1998). Periods of gall occurrence: May-July, September, December. Points of occurrence: CLP – 400m; PGP – 600, 1000, 3000m.

Gall. Ovoid leaf gall; length: 0.3-0.4 cm; medial width: 0,2-0.3 cm; glabrous; monothalamous; green. Number of galls/leaf: 4-15. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Periods of gall occurrence: May-October. Points of occurrence: CLP – 400, 2800m; PGP – 2400m.

## Cactaceae

### ***Selenicereus setaceus* (SD) Berg (= *Cereus setaceus*)**

Registration number: 146487 (J. Cardoso leg.)

Distribution: Bolivia, Paraguay, Argentina, Brazil (Minas Gerais, Mato Grosso, Rio de Janeiro).

Points of occurrence: RBM: all points of collecting; RI: 200-4500m; RC: CLP – 200-400, 1800, 2400m.

Gall (Fig. 21). Stem swelling; ovoid; length: 2.5-3.0 cm; width: 2.5 cm; glabrous; polithalamous; green. Gall maker: *Neolasioptera cerei* Rübssaamen, 1905 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/chamber: 1. Localities: RBM and RI. Material: RI: 3 galls (24.IV.1998). Periods of gall occurrence: April. Points of gall occurrence: RBM: MLP – 1600m; RI: 1000m. Comments. Gall and gall maker described by RÜBSAAMEN (1905).

## Celastraceae

### ***Maytenus obtusifolia* Mart. var. *obovata* Mart.**

Registration number: 194964, 194965 (V. Maia leg.)

Distribution: Brazil (Pará, Ceará, Rio Grande do Norte, Sergipe, Bahia, Espírito Santo, Rio de Janeiro, São Paulo).

Points of occurrence: RBM: MLP – 400, 800, 1000, 1400-2200, 2600-4000, 4400-5800m; ZBP: 200-6200m. RI: 200-1000, 1800, 2200, 2800-3600, 4000m. RC: CLP- 200-400, 2200-2400, 4200m; PGP – 200, 800, 1600, 2200-2600, 3000m.

Gall (Fig. 22). Circular leaf gall, projected on both surfaces; diameter: 0.6-0.7 cm; glabrous; monothalamous; green or yellow. It is a remarkable gall due to its hard walls. Number of galls/leaf: 1-25. Gall maker: Oligotrophini (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 3 males (2 on 20.XII.1986, 1 on 31.III.1987), 3 females (1 on 20.XII.1986; 1 on 01.XI.1991, 1 on 08.VI.1992), 8 pupal exuviae (2 on 01.XI.1991, 6 on 20.VII.1995), 50 galls (6 on 11.VIII.1990, 44 on 22.III.1997); RI: 28 galls (03.IV.1998); RC: 1 gall (24.V.1998). Other arthropods: parasitoid – Tetrastichinae, n. gen. (Hymenoptera). Periods of gall occurrence: January, March-August, October-December. Points of gall occurrence: the same ones recorded by host plant.

Gall (Fig. 23). Fruit gall; ovoid; length: 0.8-0.9 cm; width: 0.7 cm; glabrous; polithalamous; red. Gall maker: *Bruggmanniella maytenuse* (Maia & Couri, 1992). Pupation in the gall. Number of gall midge larvae/chamber: 1. Locality: RBM. Material: 1 male (20.XII.1986), 1 female (13.IX.1986), 2 pupal exuviae (1 on 20.XII.1986, 1 on 17.XII.1987), 6 larvae (14.VIII.1997), 8 galls (07.VIII.1998). Periods of gall occurrence: August-September, December. Points of occurrence: MLP: 2600m. Comments. Gall and gall maker described by MAIA *et al.* (1992).

## Chrysobalanaceae

### *Couepia ovalifolia* (Schott) Benth.

Registration number: 194988 (V. Maia *leg.*)

Distribution: Brazil (from Pernambuco to Rio de Janeiro).

Points of occurrence: RBM: MLP – 400-800, 1400-1600m.

Gall (Fig. 24). Circular leaf gall, projected on both surfaces; diameter: 0.4 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-16. Gall maker: *Dasineura* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: RBM: 3 pupal exuviae (05.VI.1998), 1 pupa (05.VI.1998), 2 males (1 on 15.XII.1989, 1 on 05.VI.1998), 7 females (2 on 02.XII.1989, 1 on 15.XII.1989, 4 on 05.VI.1998), 24 galls (22.III.1998). Periods of gall occurrence: March-June, December. Points of gall occurrence: the same ones recorded by host plant.

Gall (Fig. 25). Marginal leaf roll; length: 0.8-1.5 cm; width: 0.1-0.3 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-10. Gall maker: Lopesiini (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality:

Figs 20-34. Restinga galls or damage. (20) on *Protium icicariba* (Burseraceae): fruit gall; (21) Stem swelling on *Selenicereus setaceus* (Cactaceae); (22-23) on *Maytenus obtusifolia* (Celastraceae): (22) leaf gall; (23) fruit gall; (24-25) on *Couepia ovalifolia* (Chrysobalanaceae): (24) circular leaf; (25) marginal leaf roll; (26-28) galls on Clusiaceae: (26) leaf gall on *Clusia fluminensis*; (27) leaf gall on *Clusia hilariana*; (28) leaf gall on *Clusia lanceolata*; (29) flower bud on *Jacquemontia holosericea* (Convolvulaceae); (30-34) on *Erythroxylum ovalifolium* (Erythroxylaceae): (30) triangular leaf gall; (31) flower bud gall; (32) rolled young leaf; (33) conical bud gall; (34) modified bud gall.



20



24



29



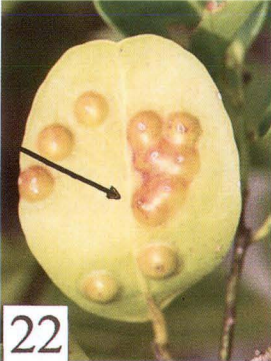
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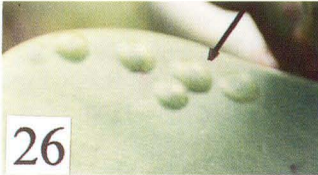
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34





RBM. Material: 34 larvae (7 on 12.III.1988, 15 on 02.XII.1989, 1 on II.1998, 9 on III.1998), 12 pupal exuviae (1 on II.1988, 1 on 01.III.1988, 3 on 02.XII.1989, 2 on 14.VIII.1997, 6 on 17.VIII.1997), 2 pupae (1 on XII.1989, 1 on II.1998), 18 females (1 on III.1988, 11 on 02.XII.1989, 6 on 12.XII.1989), 14 males (1 on III.1998, 1 on VII.1988, 4 on 17.VII.1988, 1 on 12.IX.1988, 1 on X.1989, 5 on 02.XII.1989, 1 on II.1998), 33 galls (5 on 22.III.1998, 28 on 05.IV.1998). Other arthropods: parasitoids – Hymenoptera. Periods of gall occurrence: February-April, July-August, October, December. Points of gall occurrence: the same ones recorded by host plant.

## Clusiaceae

### *Clusia fluminensis* Tr. & Pl.

Registration number: 176389 (V. Esteves *leg.*)

Distribution: Brazil (Bahia, Minas Gerais, Rio de Janeiro).

Points of occurrence: RBM: MLP – 400, 1800, 3800, 4400, 5000, 5400-5600; ZBP: 2800, 3200-5000, 5400-5800m. RI: 400, 1000, 3200-3400, 4000, 4500m.

Gall (Fig. 26). Circular leaf gall; diameter: 0.5 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-12. Gall maker: Asphondyliini, near *Zalepidota* Rübssaamen, 1907 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 8 pupal exuviae (2 on 14.VIII.1997, 6 on 17.VIII.1997), 7 females (14.VIII.1997), 7 galls (3 on 30.IV.1990, 4 on 05.IV.1998). Other arthropods: parasitoid – Eurytomidae (Hymenoptera). Periods of gall occurrence: March-June, August. Points of gall occurrence: ZBP: 3200m.

### *Clusia hilariana* Schltld.

Registration number: 179204 (A. Souza *leg.*)

Distribution: Brazil (Pernambuco, Bahia, Espírito Santo, Rio de Janeiro).

Points of occurrence: RC: CLP – 1200, 1600-3800m; PGP: 200-600, 1000-3000, 3400m.

Gall (Fig. 27). Circular leaf gall; diameter: 1.0-1.5 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-7. Gall maker: Cecidomyiidi (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 4 larvae (1 on 25.VII.1998, 2 on 27.XI.1998, 1 on 26.II.1999), 8 pupal exuviae (6 on 31.X.1998, 2 on 25.VIII.1998), 5 males (1 on 25.VIII.1998, 1 on 25.IX.1998, 3 on 31.X.1998), 3 galls (24.V.1998). Other arthropods: parasitoids – Eupelmidae, Eurytomidae and Platygastriidae (Hymenoptera). Periods of gall occurrence: May-February. Points of gall occurrence: CLP – 1200, 1600-2000, 2400, 2800m; PGP: 200-600, 1000, 1400-3000, 3400m.

### *Clusia lanceolata* Camb.

Registration number: 129511 (M. C. Viana *leg.*)

Distribution: Brazil (Rio de Janeiro, São Paulo).

Points of occurrence: RBM: MLP – 400, 800-1200, 1600, 2000-3000, 3400-3800, 4400-4600, 5000, 5400-5600m; ZBP – 200-600, 1400-6600m; RI: 400, 800, 3400-4000m.

Gall (Fig. 28). Leaf blister; diameter: 0.6-1.1 cm; glabrous; monothalamous; green or red. Number of galls/leaf: 1-18. Gall maker: *Clusiamyia nitida* Maia, 1996 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 8 larvae (4 on 20.VII.1995, 2 on 28.II.1996, 1 on II.1998, 1 on III.1998), 1 female (11.VIII.1990), 6 galls (3 on 11.VIII.1990, 3 on 05.IV.1998); RI: 5 galls (03.IV.1998). Other arthropods: parasitoid – *Inostemma* sp. (Platygastridae, Hymenoptera). Periods of gall occurrence: all months of the year. Points of gall occurrence: the same ones recorded to host plant. Comments. Gall and gall maker described by MAIA (1996b).

## Convolvulaceae

### *Jacquemontia holosericea* (Weinman) O'Donell

Registration number: 168773 (M. Alves leg.)

Distribution: Brazil (Ceará, Rio de Janeiro, São Paulo, Santa Catarina).

Points of occurrence: RBM: MLP – 200-400, 1000, 3800m; ZBP – 600m; RI: 400, 800, 3600, 4000m.

Closed flower (Fig. 29) (length: 1.0 cm; width: 0.4 cm) with 1, 2 or 3 gall midge larvae. Cecidomyiidae associated: *Schizomyia* sp., *Camptoneuromyia* sp. Pupation in the closed flower. Localities: RBM and RI. Material: RI: *Schizomyia* sp. – 2 larvae (04.IX.1998), 1 pupal exuviae (01.VIII.1998), 4 females (3 on 02.X.1998, 1 on 01.VIII.1998), 5 males (2 on 01.VIII.1998, 3 on 02.X.1998); *Camptoneuromyia* sp. – 5 females (02.X.1998); 6 attacked closed flower (10.VII.1998). Periods of occurrence: July-August, December. Points of occurrence: RBM: ZBP – 600m. RI: the same ones recorded to host plant.

## Erythroxylaceae

### *Erythroxylum ovalifolium* Peyr.

Registration number: 195003, 195004 (V. Maia leg.)

Distribution: Brazil (Minas Gerais, Rio de Janeiro).

Points of occurrence: RBM: MLP – 400-4600m; ZBP – 200-600, 1400, 1800-6600m; RI: 200-800, 3200-3800m; RC: CLP – 200-600, 1200-1400, 1800-2400, 2800-4200m; PGP – 400, 1000-2400, 2800-3000, 3400m.

Gall (Fig. 30). Triangular leaf gall; length: 0.2 cm; basal width: 0.1 cm; glabrous, monothalamous, greenish. Number of galls/leaf: 1-23. Gall maker: Lasiopteridi (Cecidomyiidae). Pupation in the soil. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 6 females (14.III.1998), 35 galls (8 on 11.VIII.1990, 27 on 05.IV.1998); RI: 2 females (1 on 12.IV.1998, 1 on 03.VII.1998). Other arthropods: parasitoids – Tetrastichinae, n. gen. (Eulophidae) and Platygastridae (Hymenoptera). Periods of gall occurrence: January-December. Points of occurrence: RBM: MLP -2000, 3200-4400, 6200m; ZBP – 200-800, 1400-2000, 2400-3000, 3400-6200m. RI: 400-600, 3400m. RC: CLP – 1200, 1800, 2800m; PGP – 1400, 2200-2400, 2800-3000m.

Gall (Fig. 31). Closed flower; ovoid; length: 0.2 cm; width: 0.1 cm; glabrous, monothalamous, greenish. Gall maker: *Asphondylia* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 2 larvae (08.IX.1998), 30 pupal exuviae (23 on 11.VIII.1997, 3 on 01.IX.1997, 1 on 28.X.1997, 1 on 12.I.1998, 2 on II.1998), 5 females (3 on VIII.1997, 2 on II.1998), 8 males (5 on 11.VIII.1997, 2 on 01.IX.1997, 1 on 28.IX.1997), 32 galls (16 on 11.VIII.1990, 16 on 17.I.1998); RI: 1 pupa (01.VIII.1998); RC: 12 pupal exuviae (10 on 29.VIII.1998, 2 on 26.IX.1998). Periods of gall occurrence: May, August-October, January-February. Other arthropods: parasitoid – Eurytomidae (Hymenoptera). Points of occurrence: RBM: MLP – 400, 5400m. RC: CLP – 200-600, 1600, 3200m; PGP – 600, 1000, 2200m. Comments. MÖHN (1959) described galls in fruits induced by *Asphondylia erythroxyli* on *Erythroxylum mexicanum*.

Gall (Fig. 32). Rolled young leaf; length: 0.8-1.0 cm; width: 0.2-0.3 cm; glabrous, monothalamous; green. Cecidomyiidae associated: *Clinodiplosis* sp. and Stomatosematidi cfr. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: *Clinodiplosis* sp.: RBM: 4 larvae (21.XI.1997); Stomatosematidi cfr.: RC: 2 males (19.XII.1998). Periods of gall occurrence: November-January. Points of occurrence: RBM: MLP -400m, RI: 600m. RC: CLP – 200-600m.

Gall (Fig. 33). Conical bud gall; length: 0.9-1.1 cm; width: 0.1-0.3 cm; glabrous; monothalamous and almost entirely green, except the apex which is brown. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 7 larvae (3 on 10.X.1997, 4 on 21.IX.1997); 2 pupal exuviae (1 on 20.IX.1987, 1 on 21.XI.1997); 3 pupae (1 on 21.IX.1987, 2 on 01.IX.1997); 3 females (1 on 22.IX.1987, 1 on 29.IX.1987, 1 on 21.IX.1997); 11 galls (1 on 10.X.1997, 1 on 12.XII.1997, 7 on 24.IV.1998, 2 on 25.IV.1998); RI: 4 galls (12.VI.1998). Other arthropods: a phytophagous species of Tetrastichinae (Eulophidae: Hymenoptera). Other material: galls modified by Tetrastichinae sp. (Fig. 34) – RBM: 3 galls (17.IV.1998); RI: 2 galls (12.VI.1998). Periods of gall occurrence: March-July, September-December. Points of occurrence: RBM: MLP -400, 2000, 3200, 4200, 4600-4800m; ZBP: 600, 2600, 3400, 4800, 5200-5400, 5800m. RC: CLP – 2000, 3000m.

## Euphorbiaceae

### ***Sebastiania glandulosa* (Mart.) Pax.**

Registration number: 145928 (J. G. da Silva leg.)

Distribution: Brazil (Minas Gerais, Rio de Janeiro, Mato Grosso, Mato Grosso do Sul, Goiás).

Points of occurrence: RBM: MLP – 1800-2400m; RI: 1800-2200, 2800m; RC: CLP – 1400-1600, 2200-2400, 3400m.

Gall (Fig. 35). Conical bud gall; length: 0.5-0.8 cm; width: 0.1-0.2cm; glabrous, monothalamous, red. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RI and RC. Material: RC: 1 larva



(26.IX.1998), 3 pupal exuviae (2 on 29.VI.1998, 1 on 28.XI.1998), 1 female (24.VII.1998), 2 galls (29.VI.1998). Other arthropods: Hymenoptera (parasitoid). Periods of gall occurrence: June-July, September-February. Points of occurrence: RI: 2800m. RC: PGP – 2200-2400m.

Gall (Fig. 36). Spherical bud gall; diameter: 0.5 cm; glabrous, monothalamous, green or yellow. Gall maker: *Schizomyia* sp. (Cecidomyiidae). Pupation in the soil. Number of gall midge larvae/gall: 1. Localities: RBM and RC. Material: RBM: 2 males (col.: 08.IX.1998; emerg.: 28.I.1999); RI: 6 galls (10.VII.1998). Other arthropods: Hymenoptera (parasitoid). Periods of gall occurrence: July, September-January. Points of occurrence: RBM: MLP – 1600-2400m; RI: 1800-2200m. RC: PGP – 2200-2400m.

Gall (Fig. 37). Marginal leaf roll; length: 0.6-0.7 cm; medial width: 0.1cm; glabrous, monothalamous, green. Gall maker: Cecidomyiidi. Pupation in gall. Number of gall midge larvae/gall: 1. Localities: RI and RC. Material: RI: 3 males (2 on 10.VII.1998, 1 on 02.X.1998); RC: 9 males (28.XI.1998), 6 galls (26.IX.1998). Other arthropods: Hymenoptera (parasitoid). Periods of gall occurrence: July, September-November. Points of occurrence: RI: 1800, 2200m. RC: PGP – 2200m.

## Lauraceae

### *Ocotea notata* (Ness) Mez.

Registration number: 195058 (V. Maia leg.)

Distribution: Brazil (Pernambuco, Alagoas, Espírito Santo, Rio de Janeiro).

Points of occurrence: RBM: MLP- all points of collecting; ZBP – 200-2000, 2400, 3400, 4200-4400, 5000, 5600-6000m. RI: 3200, 3800m. RC: CLP – 200-400, 1400-2400, 2800-4200m; PGP: 200-800, 1000, 1400-3000, 3400m.

Gall (Fig. 38). Bud gall, ovoid and with an apical spine-like projection; length: 0.7 cm (including the apical projection); width: 0.4 cm; glabrous, monothalamous; green. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RC. Material: RBM: 1 larva (07.VIII.1998), 3 galls (23.V.1998); RC: 4 larvae (1 on 24.V.1998, 2 on 27.II.1999, 1 on 17.III.1999). Other arthropods: Hymenoptera (parasitoid). Periods of gall occurrence: May-July, January-February. Points of occurrence: RBM: MLP – 600m. RC: CLP -200-400, 1400-2400, 2800-3000, 3800m; PGP – 200-600, 1000, 2400, 3000m.

## Leguminosae (= Fabaceae)

### *Dalbergia ecastophylla* L. Taub.

Registration number: 195076 (V. Maia leg.)

Distribution: wide spread throughout the tropics of the Old and New World. In the Neotropical region: from Florida (USA) to the South of Brazil, reaching Santa Catarina.

Points of occurrence: RC: CLP – 200-400m.

Gall (Fig. 39). Discoid leaf gall; diameter: 0.4 cm; glabrous, monothalamous; green. It occurs only on the leaf inferior surface. Number of galls/leaf: 3-12. Gall

maker: Cecidomyiidi (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 6 larvae (3 on 28.VI.1998, 1 on 29.VI.1998, 1 on 27.XI.1998), 8 pupal exuviae (7 on 28.VI.1998, 1 on 27.XI.1998); 8 females (2 on 28.VI.1998, 2 on 29.VI.1998, 4 on 27.XI.1998), 11 males (3 on 28.VI.1998, 4 on 29.IV.1998, 1 on 25.IX.1998, 1 on 31.X.1998, 2 on 27.XI.1998), 12 galls (23.V.1998). Periods of gall occurrence: April-July, October-November. Points of occurrence: CLP – 200-400m. Comments. Gall described by TAVARES (1922) and illustration showed by HOUARD (1933).

### *Inga maritima* Benth.

Registration number: 195075 (V. Maia leg.)

Distribution: Brazil (Southeast region).

Points of occurrence: RBM: ZBP – 600m; RC: CLP – 1400-1600m.

Gall (Fig. 40). Stem, petiole or midvein swelling; length: 0.7 cm; width: 0.1 cm; glabrous, monothalamous; green. Number of galls/leaf: 1-4. Gall maker: *Neolasioptera* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 5 larvae (3 on 15.V.1998, 2 on 21.VIII.1998), 6 pupal exuviae (2 on 15.V.1998, 1 on 05.VI.1998, 1 on 03.VII.1998, 2 on 21.VIII.1998); 4 females (2 on 15.V.1998, 1 on 03.VII.1998, 1 on 21.VIII.1998), 4 males (21.VIII.1998), 7 galls (25.IV.1998); RI: 1 larva (04.IX.1998), 1 pupal exuviae (04.IX.1998), 5 galls (12.VI.1998). Other arthropods: parasitoid – Eupelmidae (Hymenoptera). Periods of gall occurrence: April-August, September. Points of occurrence: RBM: ZBP – 600m; RI: 400m. Comments. Similar galls of *Neolasioptera ingae* were described by TAVARES (1920) on *Inga* sp. Also MÖHN (1964) described others on *Inga leptoloba* and *I. spuria*.

### *Stylosanthes guianensis* Sw.

Registration number: 195077 (V. Maia leg.)

Distribution: wide spread in Tropical America.

Points of occurrence: RBM: MLP – 3000m; RC: CLP – 200-400, 1200-2000, 2400-2800, 4200m; PGP – 200-600, 1000, 1400-1600, 2200, 2600, 3000m.

Larvae in the inflorescence (Fig. 41): *Lestodiplosis* sp. Pupation in the inflorescence. Localities: RBM and RC. Material: RBM: 3 females (23. XII.1998), 2 males (23.XII.1998); RC: 7 larvae (6 on 28.VIII.1998, 1 on 25.IX.1998), 6 pupal exuviae (29.VIII.1998), 6 females (5 on 25.IX.1998, 1 on 28.VIII.1998), 6 males

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Figs 35-56. Restinga galls or damage. (35-37) on *Sebastiania glandulosa* (Euphorbiaceae): (35) conical bud gall; (36) spherical bud gall; (37) marginal leaf roll; (38) bud gall on *Ocotea notata* (Lauraceae); (39-41) on Leguminosae: (39) leaf gall on *Dalbergia ecastophylla*; (40) petiole swelling on *Inga maritima*; (41) inflorescence of *Stylosanthes guianensis*; (42) leaf gall on *Psittacanthus dichrous* (Loranthaceae); (43-48) on Malpighiaceae: (43-45) on *Byrsonima sericea*: (43) inflorescence gall; (44) leaf gall; (45) stem swelling; (46) flower bud of *Heteropteris nitida*; (47) rosette bud gall on *tetrapteris phlomoides*; (48) bud gall on *Miconia cinnamomifolia* (Melastomataceae); (49) leaf gall on *Rapanea parvifolia* (Myrsinaceae); (50-56) on Myrtaceae – (50-51) on *Eugenia copacabanensis*: (50) spiral leaf gall; (51) fusiform leaf gall; (52-65) on *Eugenia multiflora*: (52) cylindrical stem gall; (53) circular leaf gall; (54) marginal leaf roll; (55) pyriform leaf gall; (56) claviform leaf gall.







(1 on 28.VIII.1998, 3 on 29.VIII.1998, 2 on 25.IX.1998). Other arthropods: Hymenoptera. Periods of larva occurrence: August-February. Points of occurrence: the same ones recorded to the host plant.

## Loranthaceae

### *Psittacanthus dichrous* (Mart.) Mart.

Registration number: 178110 (A. Souza leg.)

Distribution: from Brazil (Piauí, Paraíba, Alagoas, Santa Catarina, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo) to Paraguay.

Points of occurrence: RBM: MLP – 3000m.

Gall (Fig. 42). Circular leaf gall; diameter: 0.4 cm; glabrous, monothalamous; green. Number of galls/leaf: 1-4. Gall maker: Clinodiplosini (Cecidomyiidae). Pupation in the soil. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 4 larvae (3 on 20.IV.1987, 1 on 15.IX.1998), 1 pupal exuviae (col.: 08.IX.1998, emerg.: 28.IX.1998); 2 females (col.: 08.IX.1998, emerg.: 28.IX.1999). Periods of gall occurrence: April- September. Points of occurrence: RBM: CLP – 3000m.

### *Struthanthus maricensis* Rizz.

Registration number: 161002 (A. Souza leg.)

Distribution: Brazil (Rio de Janeiro).

Points of occurrence: RBM: MLP – 2000-2400m. RI: 1800, 2200m.

Gall. Ovoid midvein swelling; length: 1.0-1.5 cm; width: 0.6 cm; glabrous, monothalamous; green. Gall maker: *Asphondylia maricensis* Maia & Couri, 1992 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 6 galls (25.I.1998). Periods of gall occurrence: February, May, October. Points of occurrence: the same ones recorded to the host plant. Comments. Gall and gall maker described by MAIA *et al.* (1992).

## Malpighiaceae

### *Byrsonima sericea* DC.

Registration number: 195102 (V. Maia leg.)

Distribution: Martinica and Brazil (Ceará, Piauí, Pernambuco, Sergipe, Bahia, Goiás, Espírito Santo, Rio de Janeiro, Paraná).

Points of occurrence: RBM: MLP – 200-1000, 1400-2000, 2400m-3200, 3600-5600, 6000m; ZBP – 200-1000, 1400-2400, 2800, 3200, 3600-4200, 4600-6000m. RI: 200-400, 2800, 3400-4000m. RC: CLP – 200-600, 1200-4200m; PGP – 200, 800, 1000, 1600-2000, 2400-2600, 3000, 3400m.

Gall (Fig. 43). Ovoid closed flower; length: 1.2-1.5 cm; medial width: 0.5-0.6 cm; glabrous, polithalamous; green or brown. Gall maker: *Asphondylia byrsonimae* Maia & Couri, 1992 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1-3. Localities: RBM and RC. Material: RBM: 2 females (17.X.1987), 2 males (17.X.1987), 8 galls (24.IV.1998); RC: 22 pupal exuviae (29.VIII.1998), 7 galls (29.VI.1998). Periods of gall occurrence: April-February. Points of gall occurrence: RBM: MLP – 200, 2600m; RC: CLP – 1600-1800, 2400-3200m; PGP – 400m. Comments. Gall and gall maker described by MAIA *et al.* (1992).

Gall (Fig. 44). Circular leaf gall; diameter: 0.3 cm; glabrous, monothalamous; green on superior surface and brown on inferior surface. Number of galls/leaf: 1-5. Gall maker: Oligotrophini (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 8 larvae (7 on III.1988, 1 on 21.VIII.1998), 1 pupal exuviae (05.VI.1998), 1 female (05.VI.1998), 1 male (05.VI.1998), 37 galls (5 on VIII.1990, 32 on 25.I.1998); RC: 4 galls (23.V.1998). Other arthropods: parasitoid – Tetrastichinae (Eulophidae, Hymenoptera). Periods of gall occurrence: March-August, November-January. Points of gall occurrence: RBM: MLP – 200, 1600, 3600, 4000, 5200m; ZBP – 2800, 4000, 4800- 5200, 5600, 6000m; RI: 400, 3400-3600m; RC: CLP – 200-600, 1200-2000, 2400, 2800-3000, 3400-4200m; PGP – 200, 800-1000, 1600, 2000, 2400-2600, 3000m.

Gall (Fig. 45). Ovoid stem swelling; length: 1.5 cm; width: 0.8 cm; glabrous, mono- or polithalamous; brown. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/chamber: 1. Localities: RBM, RI and RC. Material: RBM: 3 galls (2 on 12.XII.1997, 1 on 14.III.1998); RC: 1 larva (24.V.1998). Other arthropods: Hymenoptera. Periods of gall occurrence: all months of the year. Points of gall occurrence: RBM and RI: the same ones recorded by host plant; RC: CLP – 200, 1400-1600, 2200-3000, 3400, 3800-4200m; PGP – 1800-2000m.

### ***Heteropteris nitida* DC.**

Registration number: 38993 (J. Vidal *leg.*)

Distribution: Brazil (Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná).

Points of occurrence: RBM: MLP – 2800, 4200, 5400-6200m; ZBP – 200-600, 4000, 4400, 5400-6400m. RI: 400m.

Closed flower (Fig. 46) with gall midge larvae; length: 0.6-0.7cm; width: 0.5-0.6 cm; yellow. Gall midge associated: *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the soil. Number of gall midge larvae/closed flower: 1-3. Locality: RBM. Material: 3 larvae (28.I.1998), 3 males (1 on 28.I.1998; 1 col.: 05.IV.1998, emerg.: 17.IV.1998; 1 col. 05.VI.1998, emerg.: 04.VII.1998), 5 galls (2 on 28.I.1991; 3 on 05.VI.1998). Periods of damage: January, March-April, June, November-December. Points of occurrence: RBM: the same ones recorded to the host plant.

### ***Tetrapteris phlomoides* (Spr.) Nied.**

Registration number: 178115 (A. Souza *leg.*)

Distribution: Brazil (Espírito Santo, Rio de Janeiro).

Points of occurrence: RBM: MLP – 6000m; ZBP – 6200-6400m.

Gall (Fig. 47). Rosette bud gall with small cylinders at the bottom; cylinder length: 0.4 cm; cylinder width: 0.1 cm; glabrous, monothalamous; green. Gall maker: Asphondyliini (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/cylinder: 1. Locality: RBM. Material: 8 pupal exuviae (30.IV.1990), 8 females (17.VII.1998), 2 males (1 on 17.VII.1988, 1 on 30.IV.1990), 12 galls (11 on 30.IV.1990, 1 on 05.IV.1998). Periods of gall occurrence: January, April, June-July. Points of gall occurrence: MLP – 6000m; ZBP- 6200-6400m.

## Melastomataceae

***Miconia cinnamomifolia* (DC.) Naudin.**

Registration number: 195125 (V. Maia *leg.*)

Distribution: Brazil (from Bahia to Santa Catarina).

Points of occurrence: RC: CMP – 200-400, 1600, 2000, 3200-3400m; PGP – 400, 1400, 3000m.

Gall (Fig. 48). Ovoid bud gall; length: 0.8-1.1 cm; width: 0.3-0.6 cm; glabrous, mono- or polithalamous; green. Gall maker: *Epihormomyia* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/chamber: 1. Locality: RC. Material: 5 larvae (1 on 29.VI.1998, 1 on 25.IX.1998, 1 on 29.I.1999, 1 on 30.I.1999, 1 on 17.III.1999), 1 pupal exuviae (31.X.1998), 4 females (31.X.1998), 2 males (1 on 31.X.1998, 1 on 28.XI.1998), 13 galls (29.VI.1998). Other arthropods: inquilina: *Resseliella* sp. (Cecidomyiidae) – 3 larvae on 27.II.1999; parasitoid: Hymenoptera. Periods of gall occurrence: June-March. Points of gall occurrence: CLP – 1600, 2000, 3200-3400m; PGP – 1400, 3000m.

## Myrsinaceae

***Rapanea parvifolia* (A. DC.) Mez.**

Registration number: 195186, 195187 (V. Maia *leg.*)

Distribution: Brazil (Bahia, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

Points of occurrence: RBM: MLP – 400, 800-1000, 1400-1800, 2200-3400, 3800, 4200, 4600-5800m; PGP – 200-600, 1000-2400, 3200-6200m. RI: 400, 800, 1200-1400, 1800-2200, 2803000, 4000m. RC: CLP – 200-400, 1800-2600, 3600-4200m; PGP – 600, 1600-2400, 2800-3000, 3400m.

Gall (Fig. 49). Circular leaf gall; diameter: 0.4 cm; glabrous, monothalamous; green. Number of galls/leaf: 1-5. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 7 larvae (1 on 28.XII.1987, 4 on 28.XII.1988, 2 on 02.XII.1989), 7 galls (2 on 02.XII.1989, 5 on 05.IV.1998); RC: 11 galls (23.V.1998). Periods of gall occurrence: January, March-April, June, December. Points of gall occurrence: RBM: MLP – 4400-4600m; ZBP – 200, 4200-4400, 5000m. RI: 800m. RC: CLP – 400, 1800-2600, 3600-3800, 4200m; PGP – 1600, 2000-2400, 2800m.

## Myrtaceae

***Eugenia copacabanensis* Kiaersk.**

Registration number: 195279, 195280 (V. Maia *leg.*)

Distribution: Brazil (Bahia, Rio de Janeiro).

Points of occurrence: RBM: MLP – 800, 600, 2600-3800, 5200-5400, 5800m; PGP – 2000, 2400-3000, 3400, 5800m.

Gall (Fig. 50). Spiral leaf gall; length: 0.4 cm; width: 0.2 cm; glabrous, monothalamous; green or red. Number of galls/leaf: 1-33. Gall maker: *Stephomyia spiralis* Maia, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge



larvae/gall: 1. Locality: RBM. Material: RBM: 6 larvae (1 on 21.X.1997, 1 on 25.I.1998, 4 on 05.X.1998), 1 pupal exuviae (06.XII.1997), 1 pupa (25.I.1998), 59 galhas (1 on 21.X.1997, 2 on 06.XII.1997, 56 on 12. XII.1997). Other arthropods: parasitoid – Tetrastichinae, n. gen. (Eulophidae, Hymenoptera). Periods of gall occurrence: January, May-June, October-December. Points of gall occurrence: MLP – 2600, 3600-3800, 5200, 5800m. Comments. Gall and gall maker described by MAIA (1993c).

Gall (Fig. 51). Fusiform leaf gall; length: 0.9 cm; width: 0.2 cm; glabrous; monothalamous; green or red. Number of galls/leaf: 1-37. Gall maker: *Stephomyia tetralobae* Maia, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 8 larvae (2 on 23.X.1992, 6 on 21.X.1997), 6 pupal exuviae (06.XII.1997), 7 females (06.XII.1997), 2 males (10.IX.1993), 60 galls (06.XII.1997). Other arthropods: parasitoids – *Rileya* sp. and Tetrastichinae, n. gen. (Hymenoptera). Periods of gall occurrence: January, June, September-December. Points of gall occurrence: MLP – 1600, 2600, 3800, 5400m. Comments. Gall and gall maker described by MAIA (1993c).

### ***Eugenia multiflora* Camb.**

Registration number: 195294 (V. Maia *leg.*)

Distribution: Brazil (Rio de Janeiro, South Region).

Points of occurrence: RC: CLP – 200-600, 1200-1600, 2000-2800, 4200m; PGP – 1200-1600, 2600-3400m.

Gall (Fig. 52). Cylindrical stem gall; length: 1.1 cm; width: 0.2 cm; glabrous, monothalamous; brown. Gall maker: *Stephomyia* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 8 larvae (2 on 27.VI.1998, 3 on 29.VI.1998, 3 on 29.VIII.1998), 3 pupal exuviae (1 on 25.IX.1998, 1 on 31.X.1998, 1 on 27.XI.1998), 4 females (1 on 31.X.1998, 3 on 27.XI.1998), 11 galls (23.V.1998). Other arthropods: inquiline – *Leptothorax* sp. (Formicidae, Hymenoptera); parasitoids – Eupelmidae and Platygastriidae (Hymenoptera). Periods of gall occurrence: May-February. Points of gall occurrence: CLP – 200-600, 1200-1600, 2000-2400, 2800, 4200m; PGP – 1600, 3400m.

Gall (Fig. 53). Circular leaf gall; diameter: 0.4-0.5 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-14. Gall maker: Lasiopteridi (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 2 larvae (19.XII.1998), 1 female (26.IX.1998), 2 males (27.XI.1998), 10 galls (23.V.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: May-February. Points of gall occurrence: CLP – 200-600, 1200-1600, 2000-2400, 2800m; PGP – 1200-1600, 2200, 2600-2800, 3400m.

Gall (Fig. 54). Marginal leaf roll; length: 1.5-2.5 cm; width: 0.2 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-2. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 9 larvae (27.XI.1998), 1 pupal exuviae (23. V.1998), 2 galls (23.V.1998). Other arthropods: parasitoid – Eulophidae (Hymenoptera). Periods of gall occurrence: May-February. Points of gall occurrence: CLP – 200-600, 1200-1600, 2000-2200, 2600m; PGP – 1400, 1600, 2200-2800, 3200-3400m.

Gall (Fig. 55). Pyriform leaf gall, wide at the base and tapered at the apex; length: 0,3-0,5 cm; basal width: 0,3 cm; glabrous; monothalamous; yellow. Number of galls/leaf: 1-5. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 2 larvae (20.III.1999). Other arthropods: parasitoids – Eupelmidae and Eulophidae (Hymenoptera). Periods of gall occurrence: July-March. Points of gall occurrence: CLP – 200, 1600m.

Gall (Fig. 56). Claviform leaf gall; length: 0.4 cm; basal width: 0,2 cm; glabrous; monothalamous; green or red. Number of galls/leaf: 1-49. Gall maker: *Stephomyia clavata* ? (Tavares, 1920) (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 26 pupal exuviae (25 on 26.IX.1998, 1 on 19.XII.1998), 10 females (6 on 26.IX.1998, 3 on 31.X.1998, 1 on 19.XII.1998), 2 males (26.IX.1998), 7 galls (23.V.1998). Other arthropods: parasitoids – Eulophidae, Eupelmidae and Platygastriidae (Hymenoptera). Periods of gall occurrence: May, August-December. Points of gall occurrence: CLP – 200-400, 1200m. Comments. TAVARES (1920) described *Stephomyia clavata* and its gall on an undetermined Myrtaceae. The types of this species are possibly lost and its original description is superficial. HOUARD (1933) showed a drawing of the galls. GAGNÉ (1994) transferred this species originally included in *Oxasphondylia* to *Stephomyia*, based on its gall morphology.

Gall (Fig. 57). Leaf gall, triangular; length: 0,5 cm; basal width: 0,4 cm; glabrous; monothalamous; yellow. Number of galls/leaf: 1-7. Gall maker: Cecidomyiinae. Pupation in the soil. Number of gall midge larvae/gall: 1. Locality: RC. Material: 7 larvae (4 on 31.X.1998, 1 on 26.II.1999 and 2 on 20.III.1999). Periods of gall occurrence: October-February. Points of gall occurrence: PC – 200, 1600m.

### ***Eugenia rotundifolia* Casar**

Registration number: 195293, 195281 (V. Maia leg.)

Distribution: Brazil (Rio de Janeiro, Bahia).

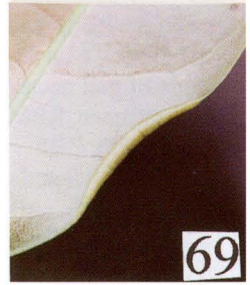
Points of occurrence: RBM: MLP – 400-2000, 2400-4600, 5000-6400m; ZBP – 200-400, 1000-6400m. RI: 200, 600-1200, 2000, 2800-4000, 4400m.

Gall (Fig. 58). Marginal leaf gall; length: 2.0-2.5 cm; width: 0.2 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-3. Gall maker: Cecidomyiidi (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1-5. Localities: RBM and RI. Material: Cecidomyiidi – RBM: 1 male (14.VIII.1997), 3 females (1 on 28.VI.1992, 1 on 30.XI.1992, 1 on 22.VIII.1993), 2 pupal exuviae (1 on 07.III.1988, 1 on 22.VIII.1993), 14 galls (3 on 05.VI.1992, 4 on 12.XII.1997, 3 on 25.I.1998, 4 on 22.III.1998); RI: 6 galls (03.IV.1998). Other

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Figs 57-72. Restinga galls on Myrtaceae. (57) Triangular leaf gall on *Eugenia multiflora*; (58-61) on *Eugenia rotundifolia*: (58) marginal leaf roll; (59) circular leaf gall; (60) cylindrical stem gall; (61) modified cylindrical gall; (62-64) on *Eugenia uniflora*: (62) conical leaf gall; (63) circular leaf gall; (64) fruit galls; (65-67) on *Myrcia ovata*: (65) globular leaf gall; (66) bud gall; (67) modified bud gall; (68) flower petiole swelling on *Myrcia ovata*; (69-71) on *Myrciaria floribunda* (Myrtaceae): (69) marginal leaf roll; (70) bivalve bud gall; (71) stellate leaf gall; (72) on *Neomitranthes obscura*: (72a) marginal leaf roll; (72b) triangular leaf roll.







arthropods: predator – *Lestodiplosis* sp. (Cecidomyiidae) (1 male on 02.XII.1989), parasitoids – Tetrastichinae, n. gen. (Eulophidae) and Torymidae (Hymenoptera). Periods of gall occurrence: all months of the year. Points of gall occurrence: RBM – MLP – 400-800, 2400, 2800, 3400-3800, 4400, 5600, 6000m; ZBP – 200-400, 1000, 1400-4600, 5000-6000m; RI: 200-800, 1200-1400, 2800, 3200-3600m. Comments. Gall described by MAIA (1995b).

Gall (Fig. 59). Circular leaf gall; diameter: 0.6 cm; glabrous; monothalamous; yellow. Number of galls/leaf: 1-40. Gall maker: *Dasineura globosa* Maia, 1995 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RI. Material: RBM: 43 galls (11 on 30.IV.1990, 18 on 22.III.1998, 14 on 03.IV.1998); RI: 1 female (04.IX.1998), 17 galls (03.IV.1998). Periods of gall occurrence: January, March-July, September-December. Points of gall occurrence: RBM: MLP – 600-800, 1400, 1800, 2400, 2800, 3400-3800, 4200, 6000, 6400m; ZBP – 400, 1000, 1600, 2000-6000m. RI: 200-1200, 2800-4000m. Comments. Gall and gall maker described by MAIA (1995b).

Gall (Fig. 60). Cylindrical stem gall; length: 1.5-1.8 cm; width: 0.4-0.5 cm; glabrous; monothalamous; brown. Gall maker: *Stephomyia rotundifoliorum* Maia, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RI. Material: RBM: 6 larvae (14.VIII.1997), 37 galls (13 on 05.VI.1992, 3 on 22.XI.1997, 21 on 17.IV.1998), 7 galls modified by phytophagous wasps; RI: 89 galls (03.IV.1998). Other arthropods: parasitoids (Hymenoptera) – *Rileya* sp. (Eurytomidae), *Donquickeia* n. sp. (Braconidae), Eupelmidae and Torymidae; predators – *Novohorus* sp. (Pseudoscorpiones: Olpiidae); inquiline – Hymenoptera. Other material: galls modified by phytophagous wasps (Fig. 61) – RBM: 7 galls (22.XI.1997); RI: 89 galls (03.IV.1998). Periods of gall occurrence: all months of the year. Points of gall occurrence: RBM – MLP – 600, 1200, 1800, 2400, 2800, 3400, 3800, 6400m; ZBP – 200, 1400-1800, 2600, 5200m; RI: 200-400, 800, 1200m. Comments. Gall and gall maker described by MAIA (1993c).

### ***Eugenia uniflora* Linnaeus**

Registration number: 195291, 195292 (V. Maia leg.)

Distribution: Brazil (Southeast and South regions), Uruguay and Argentina.

Points of occurrence: RBM: MLP – 600, 1000, 1800, 4000-4400, 4800-5200, 5600-6400m; ZBP – 2600, 5200, 6200m. RI: 1600m. RC: 200 m.

Gall (Fig. 62). Conical leaf gall; length: 0.6 cm; width: 0.2 cm; glabrous; monothalamous; green or red. Number of galls/leaf: 1-36. Gall maker: Cecidomyiidi (Cecidomyiidae). Pupation in the soil. Number of gall midge larva/gall: 1. Localities: RBM and RI. Material: RBM: 3 larvae (2 on 12.X.1987, 1 on 06.VI.1992), 25 galls (03.VII.1998). Other arthropods: parasitoids – Eulophidae: *Chrysonotomyia* sp. and Tetrastichinae n. gen.; Platygasteridae (Hymenoptera). Periods of gall occurrence: January, April, June, October-December. Points of gall occurrence: RBM: MLP-3600-4200, 5200, 6000, 6200m; RI: 1600m.

Gall (Fig. 63). Circular leaf gall; diameter: 0.25 cm; glabrous; monothalamous; green or red. Number of galls/leaf: 1-10. Gall maker: *Neolasioptera eugeniae* Maia, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall:

1. Locality: RBM. Material: RBM: 29 galls (4 on 30.IV.1990, 25 on 05.IV.1998). Periods of gall occurrence: January, March-April, June, November-December. Points of gall occurrence: MLP- 3600-4200, 5600, 6000m; ZBP – 5200, 6200m. Comments: Gall and gall maker described by MAIA (1993a).

Gall (Fig. 64). Fruit gall; triangular; length: 0.3 cm; width: 0.2 cm; glabrous; monothalamous; red. Number of galls/fruit: 1-14. Gall maker: Cecidomyiinae. Number of gall midge larva/gall: 1. Locality: RBM. Material: 6 galls (17.VII.1997). Other arthropods: parasitoid – Eurytomidae (Hymenoptera) Periods of gall occurrence: July. Points of gall occurrence: MLP – 4800m.

### ***Myrcia ovata* Camb.**

Registration number: 195282 (V. Maia *leg.*)

Distribution: Brazil (Rio Grande do Norte, Rio de Janeiro).

Points of occurrence: RBM: ZBP – 600m. RC: CLP – 400, 1200-2000, 2600m; PGP – 200, 600-800, 1400-1600, 2200 m.

Gall (Fig. 65). Globular leaf gall; diameter: 0.1 cm; glabrous; monothalamous; yellow. Number of galls/leaf: 1-8. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RC. Material: RC: 1 female (19.XII.1998), 5 galls (25.IV.1999). Other arthropods: inquiline -Tetrastichinae (Hymenoptera: Eulophidae). Periods of gall occurrence: April-February. Points of gall occurrence: RBM: the same one recorded to the host plant; RC: CLP – 400-600, 1200-2000m; PGP – 400-800, 2200m.

Gall (Fig. 66). Bud gall; ovoid with longitudinal ridges extending from base to apex; length: 1.0 cm; width: 0.2-0.3 cm; glabrous; monothalamous; yellow. Gall maker: *Myrciamyia maricaensis* Maia, 1995 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RC. Material: RBM: 4 galls (2 on 04.VIII.1992, 2 on 25.IV.1998); RC: 2 galls (28.VI.1998). Other arthropods: inquiline – *Aprostocetus* sp. (Hymenoptera: Eulophidae). Other material: galls modified by phytophagous wasps (Fig. 67) – RBM: 3 galls (25.IV.1998); RC: 2 galls (28.VI.1998). Periods of gall occurrence: April, June, August. Points of gall occurrence: RBM: ZBP- 600m; RC: CLP – 200, 1400, 2000m; PGP – 1600m. Comments. Gall and gall maker described by MAIA (1995a).

Gall (Fig. 68). Flower peduncle swelling; ovoid; length: 1.3 cm; width: 0.2cm; glabrous; monothalamous; green. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RC. Material: RBM: 1 larva (22.V.1992), 3 galls (16.V.1998); RC: 1 larva (24.VII.1998), 1 gall (23.V.1998). Periods of gall occurrence: April-August. Points of gall occurrence: RBM: ZBP- 600m; RC: CLP – 400, 1200-1600, 2000m; PGP – 2200m.

### ***Myrciaria floribunda* (West ex Willdenow) Berg.**

Registration number: 195283, 195284 (V. Maia *leg.*)

Distribution: Neotropical (from Caribe to South of Brazil).

Points of occurrence: RBM: MLP – 200-800, 1200-6000, 6400m; ZBP – 600-800m. RC: CLP – 400, 1200-2000, 2600m; PGP – 200-2000, 2400, 4000-4200, 5000, 5600-6000 m. RI: 1000m. RC: CLP – 200, 600, 1200, 2600m; PGP – 600-800, 1600-1800, 2200m.

Gall (Fig. 69). Marginal leaf roll; length: 0.6 cm; width: 0.1cm; glabrous; monothalamous; green. Number of galls/leaf: 1-3. Gall maker: *Dasineura myrciariae* Maia, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM, RI and RC. Material: RBM: 9 larvae (2 on I.1993, 1 on 09.III.1993, 5 on 10.X.1997, 1 on 08.IX.1998), 2 pupal exuviae (10.X.1997), 1 pupa (10.X.1997), 1 female (10.X.1997), 8 galls (4 on 22.VI.1992, 4 on 25.I.1998); RI: 5 galls (03.IV.1998); RC: 1 larva (27.XI.1998), 9 galls (24.V.1998). Other arthropods: predator – *Lestodiplosis* sp. (Cecidomyiidae); parasitoid – *Proacrias* sp. (Hymenoptera: Eulophidae). Periods of gall occurrence: January, March, May-February. Points of gall occurrence: RBM: MLP – 200-600, 1600, 2800, 3400, 5400, 6000 m; ZBP- 200-400, 1000-2400, 4000-4200, 5000, 5600-6000m; RI: 1000m; RC: CLP – the same ones recorded to the host plant; PGP – 600, 1600, 2200m. Comments. Gall and gall maker described by MAIA (1995b).

Gall (Fig. 70). Bivalve bud gall; ovoid; length: 0.7cm; width: 0.5 cm; glabrous; monothalamous; green or yellow. Gall maker: *Myrciariamyia bivalva* Maia, 1994 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RC. Material: RBM: 12 galls (2 on 19.VII.1987, 1 on 08.VI.1992, 1 on 06.VII.1992, 8 on 29.VIII.1993); RC: 1 pupal exuviae (24.VIII.1998), 1 pupa (24.VIII.1998). Periods of gall occurrence: June-August. Points of gall occurrence: RBM: MLP – 200-600, 1400-1800, 2400, 3000-3200, 4600-4800 m; ZBP- 600m; RC: CLP – 1200m; PGP – 2200m. Comments. Gall and gall maker described by MAIA (1994).

Gall (Fig. 71). Stellate leaf gall (diameter: 0.4 cm) with a small cylinder in the middle; glabrous; monothalamous; green or yellow. Number of galls/leaf: 1-5. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larva/gall: 1. Locality: RC. Material: 1 larva (24.V.1998), 6 galls (24.V.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: May-February. Points of gall occurrence: RC: the same ones recorded to the host plant.

### ***Neomitranthes obscura* (DC.) N. J. E. Silveira**

Registration number: 195285, 195286 (V. Maia *leg.*)

Distribution: Brazil (Rio de Janeiro, Espírito Santo).

Points of occurrence: RBM: MLP – 400-1400, 1800, 2200-3400, 3800-4000, 4400-4600, 5000-5600m; ZBP – 2000-2400, 2800-4600, 5000, 5800-6200m. RI: 400, 1800, 2800m. RC: CLP – 200, 600, 1200, 1600, 2000-2600, 4200m; PGP – 200-600, 1000-1200, 2200, 2600-2800m. RI: 400, 1800, 2800m. RC: CLP – 200, 600, 1200, 1600, 2000-2600, 4200m; PGP – 200-600, 1000-1200, 2200, 2600-2800m.

Gall (Fig. 72). Marginal leaf roll; length: 1.0 cm; width: 0.5 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-4. Gall midges: *Dasineura tavaresi* Maia, 1993 (Cecidomyiidae) and *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: *Dasineura tavaresi*: 1; *Clinodiplosis* sp.: 2-5. Localities: RBM, RI and RC. Material: RBM: 8 galls (5 on 27.VIII.1992, 3 on 05.IV.1998); RC: 6 galls (23.V.1998); *Clinodiplosis* sp. – RI: 7 larvae (10.VII.1998), RC: 2 larvae (27.II.1999). Other arthropods: free living inquiline – *Stenoma*



*annosa* (Lepidoptera). Periods of gall occurrence: May-February. Points of gall occurrence: RBM: MLP – 400-600, 3400, 4400-4600 m; ZBP – 200-600, 1000-1800, 2200-2400, 3000-4600, 5000, 5800-6200m; RI: 1800, 2800m; RC: CLP – 200-600, 1200-2000, 2400-2600, 4200m; PGP – 200-600, 1000-1200, 1600, 2200, 2600-2800m. Comments. Gall and gall maker described by MAIA (1993c).

Gall (Fig. 72). Triangular leaf gall; length: 0.2 cm; basal width: 0.3 cm; glabrous; monothalamous; red or green. Number of galls/leaf: 1-5. Gall maker: Cecidomyiinae. Pupation in the soil. Number of gall midge larva/gall: 1. Localities: RBM and RC. Material: RBM: 14 galls (8 on 27.VIII.1992, 2 on 28.VIII.1992, 4 on 17.IV.1998). Periods of gall occurrence: April, November-December. Points of gall occurrence: RBM: MLP – 3800; RC: PGP – 1000, 2200m.

Gall (Fig. 73). Pine-like bud gall; length: 2.5 cm; basal width: 0.8cm; glabrous; without internal chamber; green. Gall maker: *Neomitranthella robusta* Maia, 1995 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 4-21. Localities: RBM and RC. Material: RBM: 5 larvae (3 on 20.VII.1990, 3 on 23.IX.1992), 1 male (22.VII.1992), 10 galls (8 on 11.VIII.1990, 2 on 17.IV.1998); RC: 10 galls (23.V.1998). Other arthropods: parasitoid – Tetrastichinae, n. gen. (Eulophidae, Hymenoptera). Periods of gall occurrence: March-February. Points of gall occurrence: RBM: MLP – 400, 2800, 4400-4600m; ZBP – 600, 1000, 1400-1600, 2200, 3600-3800, 4400-4600m; RC: CLP – 200-600, 1200-1600, 2000, 2400-2600, 4000-4200m; PGP – 200-400, 800-1200, 1600, 2200, 2600-3000, 3400m. Comments. Gall and gall maker described by MAIA (1995a).

Gall (Fig. 74). Conical leaf roll; length: 0.8 cm; width: 0.1-0.2 cm; glabrous; monothalamous; green or red. Number of galls/leaf: 1-7. Gall maker: *Stephomyia mina* Maia, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RC. Material: RBM: 3 galls (2 on 15.I.1989, 1 on 28.XI.1993); RC: 7 galls (24.V.1998). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: January, June-November. Points of gall occurrence: RBM: MLP – 2200m; RC: CLP – 1200, 2000, 4200m; PGP – 800, 2200m. Comments. Gall and gall maker described by MAIA (1993c).

## Nyctaginaceae

### *Guapira opposita* (Vell.) Reitz.

Registration number: 195297 (V. Maia leg.)

Distribution: Brazil (nearly all states).

Points of occurrence: RBM: MLP – 200-3800, 4400-4600, 5000-5600, 6000-6400m; ZBP – 200-6600m. RI: 200-1800, 2200, 2800, 3200-3800m. RC: CLP – 200, 1200, 3000, 3400-3600m.

Gall (Fig. 75). Circular leaf gall; diameter: 0,3 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-20. Gall maker: *Bruggmannia elongata* Maia & Couri, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM, RI and RC. Material: RBM: 9 larvae (28.II.1996), 30 galls (5 on 30.IV.1990, 25 on 05.IV.1998); RI: 1 pupal exuviae (10.VII.1998); RC: 15 pupal exuviae (26.IX.1998), 1 pupa (29.VI.1998), 8 female (26.IX.1998),

7 males (10.VII.1998). Other arthropods: parasitoids – *Rileya* sp. and *Eurytoma* sp. (Eurytomidae), *Platygaster* sp. (Platygastridae), *Galeopsomyia* sp., *Chrysotomyia* sp., *Cirrospilus* sp. and *Pentastichus* sp. (Eulophidae). Periods of gall occurrence: January-December. Points of gall occurrence: RBM: MLP – 200, 600-800, 1400, 1800, 2000, 3000, 3400-3800, 5200-5400, 6200m; ZBP- 200-1800, 2200-6600m; RI: the same ones recorded to the host plant; RC: CLP – 200-400, 1200, 3000, 3400-3600m; PGP – 1000, 1400, 1800, 2000-2200, 3200m. Comments. Gall and gall maker described by MAIA & COURI (1993).

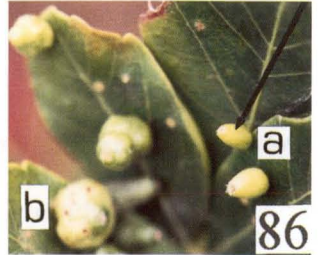
Gall (Fig. 76). Rosette leaf with tubular galls in the base; tube length: 0.4cm; tube width: 0.1cm; glabrous; monothalamous; green. Gall maker: *Pisphondylia braziliensis* Maia & Couri, 1992 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/tube: 1. Locality: RBM. Material: 1 male (08.IX.1998). Periods of gall occurrence: August-September. Points of gall occurrence: RBM: MLP – 4000m. Comments. Gall and gall maker described by COURI & MAIA (1992).

Gall (Fig. 77). Stem swelling; ovoid; length: 0.8 cm; width: 0.4 cm; glabrous; polithalamous; brown. Gall maker: *Proasphondylia guapirae* Maia & Couri, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/chamber: 1. Localities: RBM, RI and RC. Material: RBM: 5 larvae (10.X.1997), 4 pupal exuviae (2 on 21.X.1997, 2 on 21.XI.1997), 1 pupa (21.X.1997), 1 female (10.X.1997), 2 males (1 on 10.X.1997, 1 on 21.XI.1998), 6 galls (1 on 30.IV.1990, 4 on 05.IV.1998, 1 on 25.IV.1998); RC: 1 gall (28.VI.1998). Periods of gall occurrence: April-June, October-January. Points of gall occurrence: RBM: MLP – 200-800, 1600-1800, 2000m; ZBP- 3400m; RI: the same ones recorded to the host plant; RC: CLP – 200-400, 1200, 3000, 3400-3600m. Comments. Gall and gall maker described by MAIA & COURI (1993).

Gall (Fig. 78). Triangular leaf gall (projecting on both surfaces); length: 0.6 cm; basal width: 0.4 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-7. Gall maker: *Bruggmannia* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM, RI and RC. Material: RBM: 1 larva (20.IV.1988), 1 pupal exuviae (05.X.1998), 3 females (1 on 12.IX.1987, 1 on 17.XII.1987, 1 on X.1988), 2 males (1 on 17.XII.1987, 1 on 05.X.1998), 13 galls (01 on 30.IV.1990, 12 on 22.I.1998); RI: 1 larva (02.X.1998), 1 pupal exuviae (10.VII.1998); 1 female (10.VII.1998). Other arthropods: parasitoids – *Rileya* sp. and *Eurytoma* sp. (Eurytomidae) and *Galeopsomyia* sp. (Eulophidae). Periods of gall occurrence: January-December. Points of gall occurrence: RBM: MLP – 1800, 3800, 5400m; ZBP- 200-400, 800, 2600, 3000-3200m; RI: 1800m; RC: CLP – 1200m. Comments. Gall described by MAIA & MONTEIRO (1999).

Figs 73-87. Restinga galls. (73-74) on Myrtaceae, *Neomitranthes obscura*: (73) pine-like bud gall; (74) conical leaf roll; (75-79) on *Guapira opposita* (Nyctaginaceae): (75) circular leaf gall; (76) rosette bud gall; (77) stem swelling; (78) triangular leaf gall; (79) globular leaf gall; (80) barrel-shaped leaf gall on *Ouratea cuspidata* (Ochnaceae); (81) stem swelling on *Ximenia maericana* (Olacaceae); (82) rolled young leaf on *Passiflora mucronata* (Passifloraceae); (83-84) on Rubiaceae: (83) inflorescence gall on *Borreria verticillata*; (84) inflorescence gall on *Diodia gymnocephala*; (85-87) on *Paullinia weinmanniaefolia* (Sapindaceae): (85) rolled young leaf; (86a) conical leaf gall; (86b) modified conical leaf gall; (87) tendril swelling.







Gall (Fig. 79). Globular leaf gall; diameter: 0.2 cm; hairy; monothalamous; red or yellow. Number of galls/leaf: 1-21. Gall maker: *Bruggmannia robusta* Maia & Couri, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM, RI and RC. Material: RBM: 4 pupal exuviae (21.IX.1992), 4 males (21.IX.1992), 6 galls (30.IV.1990); RI: 4 pupal exuviae (12.VI.1998), 4 males (12.VI.1998), 5 galls (12.VI.1998). Other arthropods: parasitoids (Hymenoptera) – *Rileya* sp. (Eurytomidae), *Platygaster* sp. (Platygastridae), *Galeopsomyia* sp. and *Chrysotomyia* sp. (Eulophidae). Periods of gall occurrence: January-December. Points of gall occurrence: RBM: MLP – 600, 1400, 1800, 3400-3600, 5200-5400 m; ZBP-200, 600, 1400-1600, 2400-3200, 4000, 4400-4800, 5200m; RI: 800, 1200, 1800, 2200, 3200m; RC: CLP – 2600m. Comments. Gall and gall maker described by MAIA & COURI (1993).

### Ochnaceae

#### *Ouratea cuspidata* (St. Hil.) Engl.

Registration number: 195300 (V. Maia leg.)

Distribution: Brazil (Ceará, Rio Grande do Norte, Bahia, Mato Grosso, Minas Gerais, Espírito Santo, Rio de Janeiro).

Points of occurrence: RBM: MLP – 200, 800, 1200-1600, 3600m; ZBP – 200-1400m, 1800-2000, 2400. RI: 200-800, 1200-1400, 1800-2200, 2800, 3200-3600m. RC: CLP – 3400, 3800m; PGP – 2400m.

Gall (Fig. 80). Leaf gall; barrel-like with a pointed projection at the apex; length: 0.5 cm; basal width: 0.3 cm; glabrous; monothalamous; brown. Number of galls/leaf: 1-88. Gall maker: *Contarinia* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Locality: RBM. Material: RBM: 1 pupal exuviae (25.X.1998), 3 females (2 on 13.IV.1987, 1 on 26.VIII.1989), 2 males (1 on 13.IV.1987, 1 on 23.XII.1998), 145 galls (4 on 25.VIII.1989, 9 on 05.VI.1992, 132 on III.1998). Periods of gall occurrence: March-August. Points of gall occurrence: RBM: ZBP- 600m.

### Olacaceae

#### *Ximения americana* L. var. *americana*

Registration number: 145929 (J. G. da Silva leg.)

Distribution: Brazil (Ceará, Pernambuco, Bahia, Mato Grosso, Rio de Janeiro, São Paulo).

Points of occurrence: RBM: MLP – 1600-1800, 2400, 3000, 3800, 4400, 6000m; ZBP – 1600m, 2400-3200, 4000-4600, 5200. RI: 400, 1000, 2000, 3000, 4400m.

Gall (Fig. 81). Ovoid stem swelling; length: 0.9-1.1cm; width: 0.5-0.6 cm; glabrous; monothalamous; brown. Gall maker: *Asphondylia communis* Maia & Couri, 1993 (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/gall: 1. Localities: RBM and RI. Material: RBM: 4 larvae (10.XI.1997), 3 males (2 on 27.IX.1989, 1 on 29.IX.1989); RI: 1 gall (03.IV.1998). Periods of gall occurrence: April, September-November. Points of gall occurrence: RBM: ZBP- 4400m; RI: 400, 1000m. Comments. Gall and gall maker described in MAIA *et. al.* (1992).

## Passifloraceae

***Passiflora mucronata* Lam.**

Registration number: 195601 (V. Maia *leg.*)

Distribution: Brazil (Bahia, Espírito Santo, Rio de Janeiro).

Points of occurrence: RC: CLP – 200-400, 1200-2000, 2400, 4000m; PGP – 200-600, 1000-1800, 2200, 3000m.

Gall (Fig. 82). Rolled young leaf; length: 1.2 cm; width: 0.4 cm; glabrous; monothalamous; green. Gall maker: *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the soil. Number of gall midge larvae/gall: 1-3. Locality: RC. Material: RBM: 1 larva (31.X.1998), 1 female (col.: 30.I.1999; emerg.: 23.III.1999), 2 males (col.: 30.I.1999, emerg.: 23.III.1999). Periods of gall occurrence: October-January. Points of gall occurrence: RC: CLP – 400, 1200-1600, 2000, 2400, 4000m; PGP – 1000-1200, 1600-1800, 2200, 3000m.

## Piperaceae

***Piper divaricatum* Meyer**

Registration number: 195600 (V. Maia *leg.*)

Distribution: South America. In Brazil: Amazonas, Amapá, Ceará, Pernambuco, Bahia, Mato Grosso, Minas Gerais, Espírito Santo, Rio de Janeiro.

Points of occurrence: RC: PGP – 1400, 2200m.

Free living gall midge larvae in the inflorescence. Locality: RC. Material: 2 larvae (27.II.1999), 2 attacked inflorescence (27.II.1999). Periods of gall midge attack: February. Points of gall occurrence: PGP – 1400, 2200m.

## Rubiaceae

***Borreria verticillata* (L.) Meyer**

Registration number: 195215 (V. Maia *leg.*)

Distribution: from Guyana and Venezuela to Uruguay.

Points of occurrence: RBM: MLP – 200-600, 1400, 2000-2200, 3000-3600, 4000, 5000, 5800, 6200-6400m; ZBP – 400, 800-1600, 2000-2200, 4400, 5400-5600m. RI: 200-600, 1000-1800, 2800-3600m. RC: CLP – 200-400, 1000-1600, 2000, 2400, 2800, 3000-4200; PGP – 1000-3200m.

Gall (Fig. 83). Inflorescence gall, fusiform; length: 1.0 cm; basal width: 0.3 cm; glabrous; monothalamous; green. Gall maker: *Asphondylia borreriae* Rübssaamen, 1905 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RC. Material: RBM: 13 larvae (8 on 12.VI.1997, 5 on 06.XII.1997), 3 pupal exuviae (2 on 17.X.1987, 1 on 12.VI.1997), 1 female (12.VI.1997), 12 galls (3 on 17.X.1987, 9 on 25.IV.1998); RC: 2 exuviae (23.V.1998), 1 pupa (23.V.1998), 1 female (23.V.1998), 17 galls (23.V.1998). Other arthropods: parasitoids (Hymenoptera): *Rileya* sp. (Eurytomidae), *Horismenus* sp. (Eulophidae). Periods of gall occurrence: April-January. Points of gall occurrence: RBM: MLP – 200, 600, 3600m; RC: CLP – the same ones recorded to the host plant; PGP – 1400, 2200, 2600, 3200m. Comments. Gall and gall maker described by RÜBSAAMEN (1905). MAIA & COURI (in MAIA *et al.* 1992) described the male, female and larva.

***Diodia gymnocephala* (DC.) K. Schum**

Registration number: 195598, 195599 (V. Maia *leg.*)

Distribution: Guyanas, Venezuela, Paraguay, Brazil.

Points of occurrence: RC: PGP – 1400, 2200, 3200m.

Gall (Fig. 84). Inflorescence gall, fusiform; length: 0.7 cm; basal width: 0.5 cm; glabrous; monothalamous; green. Gall maker: *Clinodiplosis* sp. (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 8 larvae (1 on 28.VIII.1998, 7 on 26.IX.1998), 27 pupal exuviae (3 on 28.VIII.1998, 1 on 28.IX.1998, 23 on 30.I.1999), 9 females (3 on 28.VIII.1998, 3 on 25.IX.1998, 1 on 26.IX.1998, 2 on 31.X.1998), 14 males (7 on 28.VIII.1998, 2 on 25.IX.1998, 2 on 26.IX.1998, 1 on 31.X.1998, 2 on 28.XI.1998). Other arthropods: parasitoids – Platygastriidae and Torymidae (Hymenoptera). Periods of gall occurrence: August-February. Points of gall occurrence: the same ones recorded to the host plant.

## Sapindaceae

***Paullinia weinmanniaefolia* Mart.**

Registration number: 195225 (V. Maia *leg.*)

Distribution: Brazil (Bahia, Espírito Santo, Rio de Janeiro).

Points of occurrence: RBM: MLP – 200-2600, 3000, 3400-4400, 5000-5800m; ZBP – 200-2800, 3400-6200m. RI: 200-1400, 1800, 2800-3400, 4000m. RC: CLP – 200-600, 1000-2800, 4000-4200m; PGP – 200, 800, 1400-1600, 2600-2800m.

Gall (Fig. 85). Rolled young leaf; length: 0.7 cm; width: 0.1-0.2 cm; glabrous; monothalamous; green or yellow. Gall maker: Cecidomyiinae. Pupation in the soil. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 5 galls (28.I.1991); RC: 3 galls (23.X.1998). Other arthropods: inquiline – *Clinodiplosis* sp. (Cecidomyiidae), pupation in the soil; RBM: 9 larvae (4 on 28.IX.1991, 5 on 01.IX.1997), 5 females (col.: 05.VI.1998, emerg.: 16.VI.1998, 10.VII.1998), 1 male (col.: 05.VI.1998, emerg.: 10.VII.1998); RC: 4 female (2 col. 29. VIII.1998, emerg.: 26.IX.1998, 03.X.1998; 2 col. 31.X.1998, emerg.: 09. IX.1998, 21.XI.1998), 9 males (col. 29.VIII.1998, emerg.: 2 on 24.IX.1998, 1 on 01.X.1998, 3 on 03.X.1998, 1 on 07.X.1998, 1 on 09.X.1998, 1 on 22.IX.1998); predator – *Lestodiplosis* sp. (Cecidomyiidae), 1 larva (21.IX.1998). Periods of gall occurrence: May-January. Points of gall occurrence: RBM: MLP – 200m; ZBP-600m; RI: 1800, 2800, 3200-3400m; RC: CLP – 200-600, 1000-1600, 2000, 2400, 4200m. Comments. Gall described by GAGNÉ (1994).

Gall (Fig. 86a). Conical leaf; length: 0.6 cm; width: 0.2 cm; glabrous; monothalamous; green or yellow. Number of galls/leaf: 1-4. Gall maker: Oligotrophini n. gen. and n. sp., near *Ficiomyia* felt, 1922 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 1 larva (17.VII.1992), 2 pupal exuviae (1 on 24.X.1987, 1 on II.1998), 4 females (2 on X.1987, 1 on VIII.1988, 1 on 17.VII.1992), 1 male (24.X.1987), 8



galls (5 on 17.VII.1992, 2 on 20.VII.1995, 1 on 17.IV.1998); RI: 7 galls (22. XI.1997). Other arthropods: inquiline (Hymenoptera) – Eulophidae; parasitoids (Hymenoptera) – Eurytomidae, Platygastriidae and *Dimeromicrus cecidomyiae* (Torymidae). Other material: galls modified by the inquiline (Fig. 86b) – RC: 2 galls modified by the inquiline (29.VI.1998). Periods of gall occurrence: April-February. Points of gall occurrence: RBM: ZBP – 5800m; RI: 200-800m; RC: CLP – 200-400, 1200-2800, 4000- 4200m; PGP – 200, 1400-1600, 2600m.

Gall (Fig. 87). Tendril swelling; length: 2.0-2.6 cm; width: 0.3-0.4 cm; glabrous; monothalamous; brown. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 1 pupal exuvia (26.IX.1998), 4 galls (29.VI.1998). Periods of gall occurrence: June, September. Points of gall occurrence: CLP – 1800, 2200, 2800, 4200m.

## Sapotaceae

### *Manilkara subsericea* (Mart.) Dubard.

Registration number: 195231, 195232 (V. Maia *leg.*)

Distribution: Brazil (Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina).

Points of occurrence: RBM: MLP – 400, 1400, 2200, 2800, 3200, 4800, 5600, 6200m; ZBP – 200-600, 1400-4400, 4800, 5400-6200m. RI: 200-1400, 1800-2200, 2800, 3200-3400, 3800-4000m. RC: CLP – 200, 1200-1600, 2000, 2400m; PGP – 400-600, 1400-2600, 3000m.

Gall (Fig. 88). Circular leaf gall; length: 0.7-0.4 cm; width: 0.4-0.2 cm; glabrous; monothalamous; green. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 2 larvae (25.I.1998), 8 galls (26.XI.1997); RI: 1 larva (04.IX.1998), 9 pupal exuviae (2 on 10.VII.1998, 7 on 02.X.1998), 1 male (10.VII.1998), 2 galls (03.IV.1998); RC: 2 exuviae (28.XI.1998), 16 galls (23.V.1998). Other arthropods: inquiline – *Contarinia* sp. (Cecidomyiidae): 1 male (24.X.1987); parasitoids – *Clesterocerus* sp. and *Hadrotichodes* sp. (Hymenoptera: Eulophidae). Periods of gall occurrence: March-January. Points of gall occurrence: RBM: MLP – 1400, 2800, 5600, 6200m; ZBP- 400-600, 1400-1600, 2200, 2600, 3000-3200m; RI: 400, 800, 1000, 1400, 1800, 2000, 2800, 3200-3400, 3800-4000m; RC: CLP – 200, 1200-1600, 2400, 2600m; PGP – 400-600, 1600-1800, 2200, 2600m. Comments. Gall described by GAGNÉ (1994).

Gall (Fig. 89). Ovoid bud gall with a spine-like projection at the apex; length: 0.7cm; width: 0.3cm; glabrous; bi- or monothalamous; green. Gall maker: Cecidomyiidi (Cecidomyiidae). Pupation in the gall. Number of gall midge larva/chamber: 1. Locality: RC. Material: 9 larvae (1 on 29.VI.1998, 2 on 29.VIII.1998, 2 on 25.IX.1998, 1 on 31.X.1998, 1 on 17.III.1999), 5 pupal exuviae (3 col. 29.VIII.1998, emerg.: 30.VIII.1998; 2 col. 31.X.1998, emerg.: 04.XI.1998), 6 males (3 col. 29.VIII.1998, emerg.: 30.VIII.1998; 1 col. 25.IX.1998, emerg.: 04.X.1998, 1 col. 31.X.1998, emerg.: 04.XI.1998, 1 col. 27.II.1999, emerg.: 27.II. 1999), 1 female (col. 31.X.1998, emerg.: 04.XI.1998). Other arthropods: parasitoid – Torymidae

(Hymenoptera). Periods of gall occurrence: May-June, September-November, January-February. Points of gall occurrence: RC: CLP – 200, 1400, 2000, 2400m; PGP – 400-600, 1400-1600m.

Gall (Fig. 90). Tubular leaf gall; length: 0.2 cm; width: 0.1cm; glabrous; monothalamous; yellow. Number of galls/leaf: 1-17. Gall maker: Asphondyliini, near to *Macroporpa* Rübsaamen, 1916 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 13 larvae (12 on 29.I.1999, 1 on 17.III.1999); 7 pupal exuviae (3 col.: 31.X.1998, emerg.: 04.XI.1998-05.XI.1998; 2 on 27.XI.1998, 1 on 28.XI.1998, 1 col.: 29.I.1999, emerg.: 09.II.1999), 3 males (col. 28.XI.1998, emerg.: 30.XI.1998). Other arthropods: parasitoids – Eurytomidae and Platygastriidae (Hymenoptera). Periods of gall occurrence: June-December, February-March. Points of gall occurrence: the same ones recorded to the host plant.

***Pouteria caimito* (R. & P.) Radlk. var. *laurifolia* (Gomes) Baehni**

Registration number: 161037 (A. Souza leg.)

Distribution: Brazil, Colombia, Peru and Trinidad.

Points of occurrence: RBM: MLP – 3000, 3600, 4000, 5800m; ZBP – 200-400, 800, 3200, 6200m.

Gall (Fig. 91). Tubular leaf gall; length: 0.5-0.3 cm; width: 0.1-0.2 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-7. Gall maker: Cecidomyiidi. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 21 larvae (5 on 02.XII.1989, 4 on 05.VII.1995, 4 on 06.XII.1997, 8 on 05.IV.1998), 3 males (2 on 23.III.1987, 1 on 06.XII.1997). Other arthropods: inquiline – *Trotteria* sp. (Cecidomyiidae): RBM: 2 pupal exuviae (1 on 06.XII.1997, 1 on 16.V.1998), 5 female (3 on 27.IV.1987, 1 on 21.V.1988, 1 on 13.VIII.1998), 5 males (4 on 27.IV.1987, 1 on 21.V.1988); parasitoids (Hymenoptera) – Eupelmidae, Platygastriidae and *Dimeromicrus cecidomyiae*. Periods of gall occurrence: March-May, July, October-December. Points of gall occurrence: RBM: MLP – 3000, 3600m; ZBP – 200, 800, 3200m; RI: 4000m.

***Pouteria venosa* (Mart.) Baehni (= *Pouteria marginata*)**

Registration number: 145923 (José Augusto leg.)

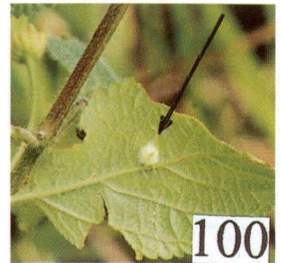
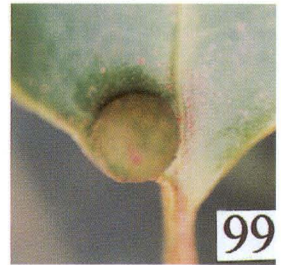
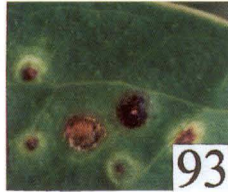
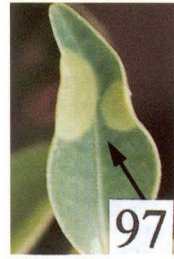
Distribution: Brazil (Amazonas, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina).

Points of occurrence: RBM: MLP – 200, 800, 1200, 4000-6600m; ZBP – 2200, 2600-4000, 4400-4800, 5200-5400, 5800, 6200-6600m. RI: 1200, 1800-2200, 3200m.

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Figs 88-100. Restinga galls or damage. (88-92) on Sapotaceae: (88-90) on *Manilkara subsericea* (Sapotaceae): (88) leaf gall; (89) bud gall; (90) tubular leaf gall; (91) tubular leaf gall on *Pouteria caimito* var. *laurifolia*; (92) leaf gall on *Pouteria venosa*; (93) leaf gall on *Smilax rufescens* (Smilacaceae); (94-95) on *Smilax rufescens* (Smilacaceae): (94) larvae in fruits; (95) midvein swelling; (96-99) on Solanaceae – (96-97) on *Aureliana fasciculata*: (96) rolled young leaf; (97) elliptical leaf gall; (98) globular leaf gall on *Solanum affine*; (99) leaf blister on *Solanum inaequale*; (100) globular gall on *Lantana camara* (Verbenaceae).







Gall (Fig. 92). Circular leaf gall; diameter: 0.4-0.5 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-21. Gall maker: Lopesiini (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 15 larvae (10 on 02.XII.1989, 3 on 16.XII.1989, 1 on 05.VI.1998, 1 on 03.VII.1998), 4 pupal exuviae (3 on 17.IV.1998, 1 on 08.IX.1998), 12 females (4 on 22.I.1987, 4 on 27.IV.1987, 1 on 22.IX.1987, 1 on 21.V.1988, 1 on VI.1988, 1 on 13.VIII.1988), 18 males (12 on 22.I.1987, 1 on 23.III.1987, 2 on 27.IV.1987, 1 on 22.IX.1987, 1 on 21.V.1988, 1 on 06.XII.1997), 11 galls (25.I.1998); RI: 16 pupal exuviae (9 on 10.VII.1998, 7 on 04.IX.1998), 12 females (6 on 10.VII.1998, 6 on 04.IX.1998), 3 males (10.VII.1998). Other arthropods: parasitoids (Hymenoptera) – Eupelmidae, Torymidae, Tetrastichinae, n. gen (Eulophidae) and Eurytomidae. Periods of gall occurrence: January, March-June, August-September, December. Points of gall occurrence: RBM: MLP – 200, 4600, 6000, 6400m; ZBP – the same ones recorded to the host plant; RI: 1200, 2000m.

## Smilacaceae

### *Smilax rufescens* Griseb

Registration number: 195254, 195255 (V. Maia *leg.*)

Distribution: Brazil (Amazonas, Rondônia, Maranhão, Alagoas, Bahia, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina).

Points of occurrence: RBM: MLP – 200-400, 1000, 1400-3800, 4400, 5000, 5400-5600, 6200m; ZBP – 200, 600-1600, 2200-2400, 3000, 3400, 4000, 4400m. RC: CLP- 200-800, 1200-4200m; PGP – 200-400, 800-3400m.

Gall (Fig. 93). Circular leaf gall; diameter: 0.3 cm; glabrous; monothalamous; green or yellow. Number of galls/leaf: 3-78. Gall maker: *Smilasioptera candelariae* Möhn, 1975 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM, RI and RC. Material: RBM: 5 larvae (1 on 07.VII.1987, 1 on 15.XI.1989, 3 on 06.XII.1997), 15 pupae (12 on 05.VI.1992, 3 on 06.XII.1997), 17 females (11 on 07.VII.1987, 5 on 09.IX.1987, 1 on 08.VII.1992), 1 male (07.VII.1987), 25 galls (25.IV.1988); RC: 11 pupal exuviae (4 on 29.VI.1998, 7 on 31.X.1998), 7 females (2 on 29.VI.1998, 4 on 31.X.1998, 1 on 19.XII.1998), 7 males (31.X.1998), 35 galls (23.V.1998). Other arthropods: parasitoids – *Pentastichus* sp. (Hymenoptera: Eulophidae). Periods of gall occurrence: May-July, September-January. Points of gall occurrence: RBM: MLP – 200, 400, 1000m; ZBP- 1600m; RI: 3500m; RC: the same ones recorded to the host plant. Comments. Gall described by TAVARES (1909) and gall maker described by MÖHN (1975) on *Smilax mexicanum*.

Free living gall midge larva on immature fruits (diameter: 0.8 cm) (Fig. 94). Number of gall midge larvae/fruit: 1-10. Gall midge: *Clinodiplosis* sp. Pupation In the gall. Locality: RBM. Material: 16 larvae (25.IV.1998). Periods of larva occurrence: April-may. Points of larva occurrence: ZBP – 600m.

Gall (Fig. 95). Midvein swelling; length: 0.7 cm; width: 0.4 cm; glabrous; monothalamous; green. Number of galls/leaf: 1-5. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RC.

Material: RC: 13 galls (8 on 29.IV.1998, 5 on 26.IX.1998). Periods of gall occurrence: November-February. Points of gall occurrence: RBM: MLP – 6200m; RC: CLP – 200, 1600m; PGP – 1400m.

## Solanaceae

### *Aureliana fasciculata* (Vell.) Sendth.

Registration number: 195260 (V. Maia *leg.*)

Distribution: Brazil (Acre, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

Points of occurrence: RC: CLP- 400-600, 1200m; PGP – 2600m.

Gall (Fig. 96). Rolled young leaf; length: 1.2 cm; width: 0.2 cm; glabrous; monothalamous; brownish. Gall maker: Cecidomyiinae. Pupation in the soil. Number of gall midge larvae/gall: 1. Locality: RC. Material: 2 larvae (28.VIII.1998), 3 galls (28.VIII.1998). Other arthropods: parasitoids – Hymenoptera. Periods of gall occurrence: August-September, October-February. Points of gall occurrence: the same ones recorded to the host plant.

Gall (Fig. 97). Elliptical leaf gall; length: 0.5 cm; width: 0.3 cm; glabrous; monothalamous; green. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RC. Material: 1 larva (29.VIII.1998), 1 gall (29.VIII.1998). Periods of gall occurrence: August. Points of gall occurrence: PGP – 1200m.

### *Solanum affine* Sendth

Registration number: 195261 (V. Maia *leg.*)

Distribution: Brazil (Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina).

Points of occurrence: RBM: MLP – 200-800, 1600, 3600, 4000, 5800-6200m; ZBP – 600-800, 1400, 2200, 2800, 3400-3800, 4400-4800, 5600, 6200-6600m. RI: 1000-1200, 1600-2000, 2400, 2800-3000, 3400-4000m.

Gall (Fig. 98). Globular leaf gall; diameter: 0.4 cm; glabrous; monothalamous; yellow. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall midge larvae/gall: 1. Localities: RBM and RI. Material: RBM: 27 larvae (23 on 24.X.1987, 4 on 10.X.1997); RI: 4 galls (12.VI.1998). Other arthropods: parasitoid – *Miotropia* sp. (Hymenoptera: Eulophidae). Periods of gall occurrence: June, October. Points of gall occurrence: RBM: MLP – 200m; RI: 1600m. Comments. Similar galls were described by TAVARES (1918) on *Solanum* sp.

### *Solanum inaequale* Vell.

Registration number: 195597 (V. Maia *leg.*)

Distribution: Brazil (Ceará, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

Points of occurrence: RC: CLP – 2000m.

Gall (Fig. 99). Leaf blister; length: 0.5 cm; width: 0.3 cm; glabrous; monothalamous; green. Gall maker: Cecidomyiinae. Pupation in the gall. Number of gall

midge larvae/gall: 1. Locality: RC. Material: RBM: 1 larva (28.XI.1998), 4 pupal exuviae (3 on 28.XI.1998, 1 on 21.II.1999). Other arthropods: parasitoid – Hymenoptera. Periods of gall occurrence: November, February. Points of gall occurrence: CLP – 2000m.

## Verbenaceae

### *Lantana camara* L.

Registration number: 195267, 195268 (V. Maia *leg.*)

Distribution: Tropical and subtropical Americas. Few specimens in Asia and Africa. In Brazil, it occurs in Minas Gerais, Rio de Janeiro, São Paulo, Paraná.

Points of occurrence: RBM: MLP – 200, 400m.

Gall (Fig. 100). Globular leaf gall; diameter: 0.4 cm; hairy; monothalamous; green. Number of galls/leaf: 1-5. Gall maker: *Schimatodiplosis lantanae* RübSaamen, 1907 (Cecidomyiidae). Pupation in the gall. Number of gall midge larvae/gall: 1. Locality: RBM. Material: 3 pupal exuviae (03.VII.1998), 1 female (05.VI.1992), 5 males (1 on 05.VI.1998, 4 on 03.VII.1998), 7 galls (5 on 05.VI.1998 2 on 03.VII.1998). Periods of gall occurrence: June-July. Points of gall occurrence: MLP – 200, 400m. Comments. Gall and gall maker described by RÜBSAAMEN (1907); gall illustration showed by HOUARD (1933).

## New records

New records of localities and arthropods in galls and new associations between gall midges and host plant.

Localities: *Asphondylia cordiae* Möhn, 1959 in Brazil (previous register: El Salvador); *Alycaulus* RübSaamen, 1916 in State of Rio de Janeiro (previous registers: Amazonas, Brazil; Colombia; Costa Rica and El Salvador); *Camptoneuromyia* Felt, 1908 in Brazil (previous registers: El Salvador, Colombia, São Vicente and Trinidad) and *Proasphondylia guapira* Maia, 1993 in Maricá city (previous register: Arraial do Cabo city).

Association gall midges X host plant: *Clinodiplosis* Kieffer, 1895 on Bursaceae, Malpighiaceae and Smilacaceae; *Dasineura* Rondani, 1840 on Chrysobalanaceae; *Contarinia* Rondani, 1860 on Ochnaceae and Sapotaceae; *Asphondylia cordiae* on *Cordia verbenacea* (previous registers: on *Cordia alba* and *Cordia dentata*) and *Schizomyia* Kieffer, 1889 on Malpighiaceae.

## CONCLUSIONS

Cecidomyiinae galls are very abundant in restinga environments, where they are associated with many plant families. Among them, the Myrtaceae shows the greatest richness of galls. This family as well as Leguminosae and Asteraceae are well represented in restingas, but only the first is rich in galls, result that differs from the South and Central Americas pattern suggested by HOUARD (1933).

The majority of the restinga galls occurs on the leaves, confirming a world trend as showed by MANI (1964).

The Cecidomyiidae genera best represented in this environment are: *Clinodiplosis*, *Asphondylia*, *Stephomyia*, *Dasineura* and *Neolasioptera*.



The geographical distribution of four species of gall midge were enlarged and new records of host plant families were made.

Concerning the arthropod fauna associated with galls, the parasitoids (Hymenoptera), especially Eulophidae and Eurytomidae are the most common secondary dwellers in galls, suggesting that these families are the most important natural enemies of Cecidomyiinae in restingas.

Sorensen index showed that the Cecidomyiidae fauna of RBM and RI are more similar than that of RC, what indicates a positive relation between geographical proximity and fauna similarity.

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