

INSECT GALLS FROM SERRA DE SÃO JOSÉ (TIRADENTES, MG, BRAZIL)

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Received February 21, 2003 – Accepted July 30, 2003 – Distributed August 31, 2004

(With 107 figures)

ABSTRACT

One hundred thirty-seven morphotypes of insect galls were found on 73 plant species (47 genera and 30 families) in Serra de São José, in Tiradentes, MG, Brazil. Fabaceae, Myrtaceae, Asteraceae, and Melastomataceae were the plant families that supported most of the galls (49.6% of the total). Galls were mostly found on leaves and stems (66.4% and 25.5%, respectively). Galls were induced by Diptera, Lepidoptera, Coleoptera, Hemiptera (Sternorrhyncha), Hymenoptera, and Thysanoptera. The majority of them (73.7%) were induced by gall midges (Cecidomyiidae: Diptera). Besides the gall inducers, other insects found associated with the galls were parasitoids (Hymenoptera), inquilines (Coleoptera, Lepidoptera, Diptera, and Hemiptera), and predators (Diptera).

Key words: galls, insects, rupestrian fields, cerrado, Minas Gerais.

RESUMO

Galhas de insetos da Serra de São José (Tiradentes, MG, Brasil)

Foram encontrados 137 tipos de galhas de insetos em 73 espécies de plantas (47 gêneros e 30 famílias) na Serra de São José (Tiradentes, MG, Brasil). Fabaceae, Myrtaceae, Asteraceae e Melastomataceae foram as famílias de plantas com maior diversidade de galhas (49,6% do total). As galhas predominaram nas folhas e caules (66,4% e 25,5%, respectivamente). Como galhadores, encontramos espécies de Diptera, Lepidoptera, Coleoptera, Hemiptera (Sternorrhyncha), Hymenoptera e Thysanoptera. A maioria das galhas (73,7%) foi induzida por Cecidomyiidae (Diptera). Além dos galhadores, outros insetos foram encontrados associados às galhas, como parasitóides (micro-Hymenoptera), inquilinos (Coleoptera, Lepidoptera, Diptera e Hemiptera) e predadores (Diptera).

Palavras-chave: galhas, insetos, campos rupestres, cerrado, Minas Gerais.

INTRODUCTION

Galls are abnormal plant growths that occur in response to feeding or other stimuli by foreign organisms (viruses, bacteria, fungi, mites, insects, and others). Insects are the most frequent gall-inducers, especially gall midges (Diptera, Cecidomyiidae). Some Hemiptera (Psyllidae,

Agaontidae, Aphidae, Adelgidae, Pemphigidae), Hymenoptera (Tenthredinidea, Cynipidae, Eurytomidae), Coleoptera (Curculionidae, Cerambycidae), Lepidoptera (Mompidae, Heliozelidae, Tortricidae), Thysanoptera, and other Diptera (Tephritidae, Agromyzidae, Chloropidae, Fergusoninidae) are also known to induce galls on a vast number of host plants.

Galling insects are most species-rich in the rupestrian fields and in the cerrado (savanna) vegetation of neotropical southeastern Brazil (Fernandes & Price, 1988; Lara & Fernandes, 1996). Despite their richness, little is known about the taxonomy of these galling species.

We surveyed the Serra de São José, an area of rupestrian fields and cerrado in the State of Minas Gerais, southeastern Brazil (21°03-07'S and 44°06-13'W) in an attempt to broaden our knowledge of galling species diversity in the Brazilian cerrado. The serra is a 15 km long mountain range, 900 to 1,430 m above sea level, running from WSW to ENE at the contact zone of two main mountain chains: the Espinhaço Range which extends northward and the Serra da Mantiqueira running from south and west (Alves, 1992). The local climate is classified as Cwa (continental with dry winter). Absolute temperatures oscillate greatly, thus constituting a stress factor for plant species (Alves, *op. cit.*).

Serra flora comprises about 800 species, and the best represented vascular plant families are the Orchidaceae, Asteraceae, Poaceae, and Melastomataceae. Some species, namely *Sarcoglottis caudata*, *Liparis beckeri*, *Palexia phallocallosa*, *Eugenia langsdorfii*, and *Croton gnidiaceus* are presently considered narrow endemics of the São José Range (Alves, 1992).

MATERIAL AND METHODS

The Serra of São José was investigated for galls over a period of 12 months from August 2001 to July 2002. Collections were made monthly along three pathways: the access roads to "Cachoeira do Mangue" (hereafter CM), "Calçada da Serra" (hereafter CS), and "Cachoeira do Bom Despacho" (hereafter BD) (Fig. 1). The vegetation was examined along each pathway for ca. 8 hours per visit. All plant organs were investigated, except for the roots. Samples of host plants, preferably in the fertile state, were pressed in the field. The Asteraceae species were identified by Roberto L. Steves (Universidade do Estado do Rio de Janeiro, Brazil) and all other plant species by Ruy J. Válka Alves (Museu Nacional, Rio de Janeiro, hereafter MNRJ, Brazil). Voucher specimens

were included in the Herbarium (R) whenever fertile plant material was collected. Authors and scientific plant names were checked on "mobot.mobot.org".

The galls were photographed and the negatives organized into an archive. Samples of dried galls were incorporated in the Diptera collection of MNRJ.

Immature insects were obtained by from the dissection of each kind of gall under a stereoscopic microscope. This procedure also enabled insect habit determination (whether of inquilines, predators, parasitoids, or galling species).

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

Larvae, pupae, pupal exuviae, and adults of Cecidomyiidae were preserved in 70% alcohol and later mounted on slides, following the methodology of Gagné (1994). The gall midge genera were identified based mainly on the keys of Gagné (1989, 1994). The other insects (Hymenoptera, Coleoptera, Lepidoptera, and Diptera: Chloropidae) were identified by Maria Antonieta Pereira de Azevedo (MNRJ), Sérgio Vanin (Universidade de São Paulo, Brazil), Victor Becker (Brazil), and Luc De Bruyn (Institute of Nature Conservation, Belgium), respectively.

All material is deposited in the collections of MNRJ, except part of the Coleoptera, Chloropidae (Diptera), and Lepidoptera samples which were donated to S. Vanin, L. De Bruyn, and V. Becker, respectively.

RESULTS

One hundred thirty-seven (137) morphotypes of insect galls were found in the Serra de São José. They were induced by species of Diptera (Cecidomyiidae, Tephritidae, and Muscomorpha), Hemiptera (Sternorrhyncha), Lepidoptera, Coleoptera, Thysanoptera, and Hymenoptera (Table 1). The Cecidomyiidae were the most common gall inducers, being responsible for 73.7% of the recorded galls. The Lepidoptera was second, with only 7.3%.

TABLE 1
Abundance of galling insect taxa in the Serra de São José (Tiradentes, MG, Brazil).

Galling species	N. of gall morphotypes
Cecidomyiidae (Diptera)	101
Lepidoptera	10
Hemiptera (Sternorrhyncha)	8
Curculionidae (Coleoptera)	2
Eulophidae (Hymenoptera)	2
Thysanoptera	2
Tephritidae (Diptera)	1
Muscomorpha (Diptera)	1
Undetermined insect	10

The galling species were associated with 73 species of plants belonging to 47 genera and 30 families. Fabaceae, Myrtaceae, Asteraceae, and Melastomataceae were the plant families with the greatest gall richness of galls, with 20, 18, 16, and 14 kinds of gall, respectively. These four families comprised about 49.6% (N = 68) of all galls (Table 2). Galls induced by Cecidomyiidae were frequent on almost all plant families. Only in the Melastomataceae the trend was toward the induction by lepidopterans (50%).

The plant species which supported the higher number of galls were *Protium heptaphyllum* (Burseraceae, N = 7), *Copaifera langsdorffii* (Fabaceae, N = 6), *Myrcia* sp. (Myrtaceae, N = 6), *Croton floribundus* (Euphorbiaceae, N = 5), and *Miconia theaezans* (Melastomataceae, N = 5). Although Asteraceae was one of the plant families with the greatest richness of galls, each species supported only 1 or 2 gall morphotypes. Contrasting with the Asteraceae, the species belonging to Fabaceae and Myrtaceae species showed a range of from 1 to 6 galls. Melastomataceae presented a similar pattern: from 1 to 5 gall morphotypes.

Some host plants are considered rare in the State of Minas Gerais, probably due to indiscriminate human exploitation of their fruits, seed, or wood (e.g., *Anona crassiflora* (Annonaceae, "araticum"), *Astronium fraxinifolium* (Anacardiaceae, "gonçaleira"), *Byrsonima verbascifolia* (Malpighiaceae, "murici-de-flor-amarela"), *Campomanesia pubescens* (Myrtaceae, "gabirola"), and *Stryphnodendron adstringens* (Fabaceae, "barbatimão") (Brandão *et al.*, 1992).

Most galls were induced on leaves (66.4%). The stem was the second most attacked plant organ (25.5%), followed by buds (13.1%), petiole (2.2%), and flower bud or inflorescence (1.4%). None of the studied galls occurred on fruits; roots were not investigated. The majority of the gall inducers attacked a specific plant part, but some of them (N = 9) attacked simultaneously two or three plant parts (Table 3).

In addition to the gall formers, other insects were also found in the galls. These were classified as parasitoids, inquilines, or predators.

Friebrigella sp. (Chloropidae: Diptera), the only species of Chloropidae in our study, was found every month in galls of Lepidoptera on *Leandra aurea*, a genus including only predator species. In the same gall, gall midge larvae were found as inquilines between gall hairs. Muscomorpha larvae (2 spp.), Coleoptera (4 spp.), and Lepidoptera (13 spp.) were found in 18 gall morphotypes, as galling species (1, 2, and 10 spp., respectively) or as inquilines (1, 2, and 3 spp., respectively). Sciaridae (2 spp.), Psyllidae (1 sp.), and Heteroptera (1 sp.) were found in four different galls only as inquilines. Hymenoptera species were found in about 35% of the gall morphotypes; none of them presented inquilinous habits. Almost all were parasitoids, except two species which were considered gall inducers (Table 4). Among the Hymenoptera, we found species belonging to the Eurytomidae, Braconidae, Platygasteridae, Eulophidae, Pteromalidae, Ichneumonidae, and Encyrtidae. The two hymenopteran galling species belong to the Eulophidae (Table 5).

One hundred four (104) species of Cecidomyiidae were obtained, most of them as galling species (N = 101, 97.1%), but also as inquiline (N = 2, 1.94%) and as predators (N = 1, 0.96%) (Tab. 4).

The majority of the gall midges (Cecidomyiidae) from Serra de São José showed only one generation per year and almost all of the galls were rare. Hence, few samples were obtained and many gall midges were, thus, not determined.

TABLE 2
Richness of insect galls per plant family in the Serra de São José (Tiradentes, MG, Brazil).

Plant family	N. of gall morphotypes
Anacardiaceae	2
Annonaceae	0
Asteraceae	16
Boraginaceae	1
Burseraceae	7
Clusiaceae	4
Chrysobalanaceae	1
Dilleniaceae	2
Erythroxylaceae	5
Euphorbiaceae	9
Fabaceae	20
Lamiaceae	2
Lauraceae	1
Lythraceae	1
Malpighiaceae	4
Melastomataceae	14
Myrsinaceae	2
Myrtaceae	18
Nyctaginaceae	3
Piperaceae	5
Rubiaceae	3
Sapindaceae	3
Scrophulariaceae	1
Smilacaceae	1
Tiliaceae	3
Ulmaceae	3
Umbelliferae	1
Verbenaceae	2
Vochysiaceae	1
Winteraceae	1

TABLE 3
Abundance of insect galls on plant organs in the Serra de São José (Tiradentes, MG, Brazil). The parenthesized values indicate the number of gall morphotypes that occurred simultaneously on other plant organs.

Plant part	N. gall morphotypes
Leaves	91 (9)
Stem	36 (9)
Bud	18 (1)
Petiole	3 (3)
Flower bud or inflorescence	2
Petiole, veins (leaves) and stem	1
Petiole and midvein (leaves)	2
Stem and leaves	7
Bud and leaves	1

TABLE 4
Habit frequency of insects associated with galls in the Serra de São José (Tiradentes, MG, Brazil).

Insect taxon	N. species as				
	Gall inducer	Inquiline	Predator	Parasitoid	Total
Cecidomyiidae	101	2	1	–	104
Hymenoptera	2	–	–	46	48
Lepidoptera	10	3	–	–	13
Coleoptera	2	2	–	–	4
Sciaridae	–	1	–	–	2
Muscomorpha	1	1	–	–	2
Thysanoptera	2	–	–	–	2
Psyllidae	–	1	–	–	1
Tephritidae	1	–	–	–	1
Chloropidae	–	–	1	–	1
Heteroptera	–	1	–	–	1

Nevertheless, 10 genera of Cecidomyiidae are recorded, namely: *Asphondylia* Loew, 1850; *Clinodiplosis* Kieffer, 1895; *Contarinia* Rondani, 1860; *Dactylodiplosis* Rübtsaamen, 1916; *Dasineura* Rondani, 1840; *Lopesia* Rübtsaamen, 1908; *Myrciariamyia* Maia, 1994; *Neolasioptera* Felt, 1908; *Stephomyia* Tavares, 1916; and *Zalepidota* Rübtsaamen, 1907. Among them, the most common genus was *Neolasioptera* with 6

species (galling species). *Asphondylia*, *Contarinia*, *Dasineura*, *Neolasioptera*, and *Stephomyia* species had already been recorded for the State of Minas Gerais (Fernandes *et al.*, 1988; Maia *et al.*, 2002), but these are the first records of *Clinodiplosis*, *Dactylodiplosis*, *Lopesia*, and *Myrciariamyia* species for this state. As no previous gall survey was done in Serra de São José, all records are new for this locality.

This is also the first record of insect galls on the following 22 plant species: *Anona crassiflora* Mart, *Aspilia duarteana* Santos, *Baccharis microcephala* (Less.) DC., *Baccharis reticularia* DC., *Mikania lindbergii* Baker, *Mikania micrantha* Kunth., *Mikania sessilifolia* DC., *Vannilosmopsis erythropapa* Schult, *Vernonia crotonoides* Schult. Bip., *Vernonia obscura* Less., *Davilla braziliana* DC., *Croton gnidiaceus* Baill., *Croton timandroides* (Didr.) Müll. Arg., *Stryphnodendrum adstringes* (Aubl.) Benth, *Byrsonima variabilis* A. Juss., *Leandra aurea* (Cham.) Cogn., *Miconia theaezans* (Bonpl.) Cogn., *Tibouchina candolleana* (DC.) Cogn., *Rapanea andina* Mez., *Myrciaria tenella* (DC.) O. Berg., *Palicourea rigida* Kunth, and *Buchnera rosea* Kunth.

Data on insect galls are presented here under host plant species in alphabetical order and include their description, galling species identification, other associated insects, period of gall occurrence, site of collection (CS, CM, and BD), and deposited material (galls).

Anacardiaceae

Astronium fraxinifolium Schott ex Spreng: Opened leaf gall. Galling species: Hemiptera (Sternorrhyncha). Period: August (CS). Comments: gall recorded on *Astronium* sp. for the restinga of Barra de Maricá (Maricá, RJ) by Maia (2001, p. 593, Fig. 2).

Schinus terebinthifolius Raddi: Opened leaf gall. Galling species: Coccidea (Hemiptera, Sternorrhyncha). Period: March (CM). Deposited material: 22 galls. Comments: similar to gall described by Houard, 1933 (p. 204-211; Fig. Q).

Annonaceae

Anona crassiflora Mart.: Spheroid leaf gall (Fig. 2). Galling species: Hemiptera (Sternorrhyncha). Other associated insects: parasitoids – Eurytomidae (1 female), Braconidae (1 female). Period: May (CM), September (CM). Deposited material: 13 galls (03.V.2001). Comments: Houard (1933) listed 4 kinds of galls on *Anona* sp. (3 induced by Cecidomyiidae, Diptera and one induced by Psyllidae (Hemiptera); none of them similar in shape. This is the first record of gall on *Anona crassiflora*.

Asteraceae

Aspilia duarteana Santos: Globoid stem swelling (Fig. 3). Galling species: Cecidomyiidae. Period: March (CS). Deposited material: 5 galls (03.V.2001). Comments: first record of gall on *Aspilia duarteana*.

Baccharis microcephala (Less.) DC: Ovoid bud gall (Fig. 4). Galling species: Cecidomyiidae. Other associated insects: parasitoids – Eulophidae sp. (2 females); *Galeopsomyia* sp. (Eulophidae, 2 males, 1 female); *Eurytoma* (Eurytomidae, 1 male). Period: April (CM); May (CS and CM). Deposited material: 4 galls, 25.IV.2002.

Midvein swelling (Fig. 5). Galling species: Cecidomyiidae. Other associated insects: Eulophidae sp. 1 (1 male and 1 female), Eulophidae sp. 2 (2 females). Period: September-October, (CS and CM); January (CS); April (CM); May (CS and CM). Deposited material: 4 galls, 24.X.2001.

Comments: first records of gall on *Baccharis microcephala*.

Baccharis reticularia DC: Swelling of petiole, veins or stem, greenish or reddish (Fig. 6). Galling species: Cecidomyiidae. Other associated insects: parasitoids – Platygasteridae (3 females and 1 male). Period: March (BD); October (CM); November (CM and CS); December (CS and CM); April (CM); May (CM). Deposited material: 6 galls on stem (2 galls, 28.IX.2001; 2 galls, 25.X.2001; 1 gall, 20.XI.2001; 1 gall, 28.V.2002); 2 galls on petiole (25.X.2001), 3 on midvein (25.X.2001).

Marginal leaf roll, reddish (Fig. 7). Galling species: Lasiopteridi (Cecidomyiidae). Other associated insects: Heteroptera (3 nymphs). Period: October (CM); May (CM). Deposited material: 11 galls (6 galls, 25.X.2001; 5 galls, 20.XI.2001).

Cylindrical outgrowths of the leaves (Fig. 8). Galling species: Cecidomyiidae. Period: May (CM).

Comments: first records of gall on *Baccharis reticularia*.

Baccharis serrulata (Lam.): Pres. Spherical red leaf or stem gall (Fig. 9). Galling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: November (CS). Deposited material: 1 gall, 21.XI.2001. Comments: Fernandes *et al.* (1996) listed 121 kinds of insect galls on *Baccharis* spp., including *B. serrulata*.

TABLE 5
Distribution of Hymenoptera on host plants and their association with galling species in the Serra de São José (Tiradentes, MG, Brazil).

Host plant	Plant part	Galling species	Parasitoid
<i>Anona crassifolia</i>	leaf	Sternorrhyncha	Eurytomidae/Braconidae
<i>Baccharis microcephala</i>	leaf (midvein)	Cecidomyiidae	Eulophidae/Eurytomidae
<i>Baccharis reticularia</i>	petiole/vein/stem	Cecidomyiidae	Platygastridae
	bud	Cecidomyiidae	Eulophidae/ <i>Galeopsomyia</i> (Eulophidae)/ Eurytoma (Eurytomidae)
<i>Baccharis serrulata</i>	leaf	Cecidomyiidae	Hymenoptera
<i>Mikania lindbergii</i>	stem	<i>Neolasioptera</i> sp. (Cecidomyiidae)	Hymenoptera
<i>V. erythropapa</i>	leaf	<i>Asphondylia</i> sp.n. (Cecidomyiidae)	Hymenoptera
<i>Vernonia polyanthes</i>	bud	<i>T. rudolphi</i> (Tephritidae)	Hymenoptera
<i>Calophyllum</i> sp.	leaf	<i>Lopesia</i> sp. (Cecidomyiidae)	<i>Galeopsomyia</i> /Pteromalidae
			Eulophidae/Eurytomidae
	stem	<i>Lopesia</i> sp. (Cecidomyiidae)	Hymenoptera
	leaf	probably Thysanoptera	Hymenoptera
<i>Davilla braziliana</i>	leaf	<i>Asphondylia</i> sp. (Cecidomyiidae)	Hymenoptera
<i>Erythroxyllum suberosum</i>	leaf	<i>Dasineura</i> sp. (Cecidomyiidae)	Hymenoptera
<i>E. frangulifolium</i>	bud	Eulophidae (Hymenoptera)	-----
<i>Croton floribundus</i>	leaf	<i>Clinodiplosis</i> sp. (Cecidomyiidae)	Hymenoptera
	leaf	Cecidomyiidae	Hymenoptera
	leaf (midvein)	Cecidomyiidae (gen.n.)	Hymenoptera
	leaf (roll)	undetermined	Hymenoptera
<i>Andira</i> sp.	stem	Cecidomyiidae	Eulophidae
	leaf	Cecidomyiidae	Hymenoptera
<i>Copaifera langsdorffii</i>	leaf (discoïd)	Cecidomyiidae	Hymenoptera
<i>Inga</i> sp.	leaf (midvein)	Cecidomyiidae	Hymenoptera
Fabaceae undetermined	bud (horn)	Cecidomyiidae	Hymenoptera
	stem	<i>Neolasioptera</i> sp. (Cecidomyiidae)	Hymenoptera
<i>Byrsonima variabilis</i>	stem	undetermined	<i>Sycophila</i> (Eurytomidae)/ <i>Eurytoma</i> (Eurytomidae)/ Eupelmidae/Eulophidae/ Ichneumonidae/Platygastridae
<i>Byrsonima verbascifolia</i>	leaf	Cecidomyiidae	<i>Eurytoma</i> (Eurytomidae)/ Eulophidae
			<i>Dimeromicrus cecidomyiae</i> (Torymidae)
			Signiphoridae
<i>Leandra aurea</i>	bud	Lepidoptera	Hymenoptera
	leaf	Lepidoptera	Hymenoptera
<i>Miconia</i> sp. 2	leaf/stem	Cecidomyiidae	Hymenoptera
<i>Miconia theaezans</i>	bud (spheroid)	Cecidomyiidae	Hymenoptera
<i>Tibouchina candolleana</i>	leaf (vein)	<i>Rochadiplosis</i> (Cecidomyiidae)	Hymenoptera
<i>Rapanea andina</i>	leaf	Cecidomyiidae	Hymenoptera
<i>Eugenia</i> cf. <i>ovalifolia</i>	leaf	<i>Stephomyia</i> (Cecidomyiidae)	Hymenoptera

Table 5 (Continued.)

Host plant	Plant part	Galling species	Parasitoid
<i>Eugenia</i> cf. <i>ovalifolia</i>	leaf	<i>Stephomyia</i> (Cecidomyiidae)	Hymenoptera
<i>Myrcia</i> sp.	bud (ovoid)	Cecidomyiidae	Hymenoptera
	leaf (marginal roll)	Cecidomyiidae	Hymenoptera
	leaf (roll)	Thysanoptera	Hymenoptera
<i>Myrciaria tenella</i>	leaf (bivalve)	<i>Myrciariamyia</i> (Cecidomyiidae)	Hymenoptera
Myrtaceae (undetermined)	leaf (tubular)	undetermined	Hymenoptera
	leaf (fold)	Sternorrhyncha	Hymenoptera
<i>Guapira</i> sp.	leaf	Lopesiini (Cecidomyiidae)	Hymenoptera
	stem	Asphondyliini (Cecidomyiidae)	Hymenoptera
<i>Piper</i> sp. 1	leaf/stem	Asphondyliini (Cecidomyiidae)	Hymenoptera
<i>Piper</i> sp. 3	leaf (midvein)	Cecidomyiidae	Hymenoptera
<i>Borreria</i> cf. <i>brachystemonoides</i>	stem	Cecidomyiidae	Encyrtidae
<i>Paullinia</i> sp.	stem	Cecidomyiidae	Hymenoptera
<i>Luehea</i> cf. <i>divaricata</i>	leaf/stem (mamilif.)	Cecidomyiidae	Hymenoptera
<i>Lantana lilacina</i>	stem	<i>Neolasioptera</i> sp. (Cecidomyiidae)	Hymenoptera
	leaf (tubular)	Cecidomyiidae	Hymenoptera
<i>Qualea parvifolia</i>	leaf	Cecidomyiidae	Hymenoptera
<i>Drimys brasiliensi</i>	bud	Eulophidae	—

Mikania lindbergii Baker: Succulent stem gall (Fig. 10). Galling species: *Neolasioptera* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: September–November (CM); December (CM and CS); January (CM); April–May (CS and CM). Deposited material: 6 galls (1 gall, 21-23.III.2001; 2 galls, 20.X.2001; 3 galls, 01.IX.2001). Comments: first record of gall on *Mikania lindbergii*.

Mikania micrantha Kunth: Globoid leaf gall (Fig. 11). Galling species: Cecidomyiidae. Period: May (CM); April (CM). Deposited material: 5 galls on 03.V.2001. Comments: first record of gall on *Mikania micrantha*.

Mikania sessilifolia DC.: Reddish circular leaf gall. Galling species: *Neolasioptera* sp. (Cecidomyiidae). Period: April–May (CM).

Tapered swelling of petiole and midvein, hairy (Fig. 12). Galling species: Cecidomyiidae. Period: April (CM). Comments: Gagné (1994) listed many Cecidomyiidae galls on different species of *Mikania*

and Gagné *et al.* (2001) described 8 Cecidomyiidae galls on *Mikania glomerata* in Brazil. These are the first records of gall on *Mikania sessilifolia*.

Vannilosmopsis erythropapa Schult: Spheroid leaf gall, yellowish or whitish, glabrous (Fig. 13). Galling species: *Asphondylia* sp. n. (Cecidomyiidae). Other associated insects: Hymenoptera and Tephritidae (4 adults). Period: March (CM); May (CM); August (BD); September (BD); October (BD, CS, and CM); November (CM and CS); December–January (CM); May (CM). Deposited material: 8 galls, 21-23.III.2001. Comments: Eriophyidae gall listed in Houard (1933, p. 394) and Rübсаamen (1908). First record of insect galls on *Vannilosmopsis erythropapa*.

Vernonia crotonoides Schult. Bip.: Leaf gall, hairy (Fig. 14). Galling species: Cecidomyiidae. Period: May (CM). Deposited material: 2 galls, 03.V.2001. Comments: first record of insect galls on *Vernonia crotonoides*.

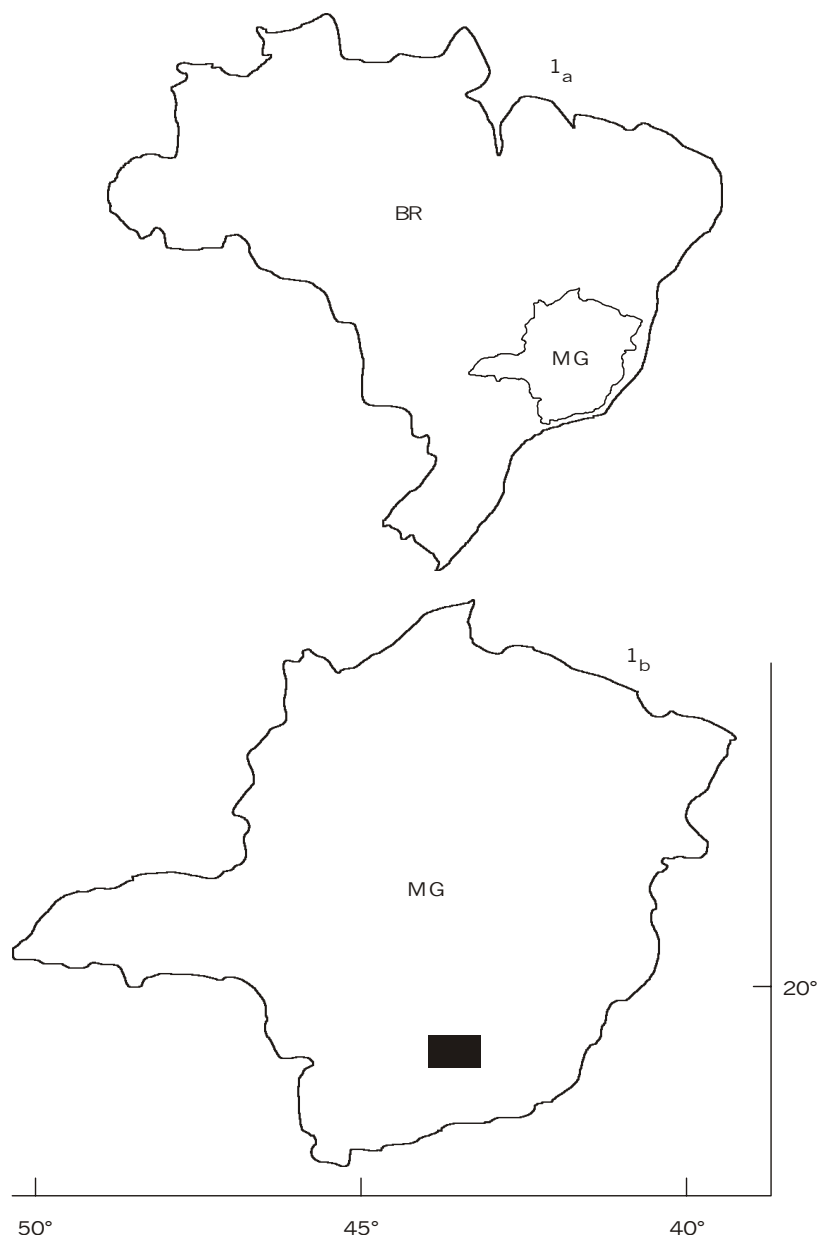


Fig. 1 — Map of Brazil (a) and Minas Gerais State (b). The black rectangle represents the Serra de São José.

Vernonia polyanthes Less: Stem gall, ovoid, brown, glabrous. Gallling species: *Tomoplagia rudolphi* (Diptera, Tephritidae). Other associated insects: Hymenoptera and Tephritidae (1 larva, 30.I.2002). Period: March (CM); January (CM). Deposited material: 3 galls, 03.V.2001. Comments: This gall has already been recorded on the same plant species by Fernandes *et al.* (1988) for Belo Horizonte (Minas Gerais). Other records of insect galls on *Vernonia* spp. were made by Gagné, 1994

(gall succulent, thick-walled, monothalamous on stem or petiole on *V. polyanthes*; gallling species: *Asphondylia* sp.; distr.: MG); Möhn, 1964 (tapered stem swelling on *Vernonia* sp.; gallling species: *Neolasioptera vernoniensis*; distr.: MG); Möhn, 1959 (swollen achene on *V. canescens*; gallling species: *Asphondylia herculesi*; distr.: El Salvador); Möhn, 1959 and 1960 (swollen bud on *V. canescens* and *V. patans*; gallling species: *Asphondylia ajallai*; distr.: El Salvador).

Vernonia obscura Less: Bud or leaf gall, hairy (Fig. 15). Gallling species: Cecidomyiidae. Period: April (CM). Deposited material: 2 galls, 27.V.2002. Comments: first record of gall on this plant.

Vernonia sp.: Stem swelling (Fig. 16). Gallling species: Muscomorpha. Period: April (CM). Deposited material: 3 galls, 24.IV.2002. Comments: Houard (1933) listed Lepidoptera and Eriophyidae galls on *Vernonia* spp. (p. 394).

Boraginaceae

Cordia cf.: Globoid hairy gall on inflorescence (Fig. 17). Gallling species: Cecidomyiidae. Period: September (CS); November-January (CS). Deposited material: 22 galls, 28.IX.2001.

Burseraceae

Protium heptaphyllum (Aubl.) Marchand: Pouch gall on leaf margin (Fig. 18). Gallling species: Cecidomyiidae. Period: September (CM). Deposited material: 2 galls, 01.IX.2001.

Marginal leaf roll (Fig. 19). Gallling species: *Lopesia* sp. (Cecidomyiidae). Period: September-January (CS and CM); April (CS and CM). Deposited material: 4 galls, 28.IX.2001. Comments: Maia (2001) recorded this gall for the restinga of Barra de Maricá (p. 593, Fig. 17).

Opened leaf gall (Fig. 20). Gallling species: Hemiptera (Sternorhyncha). Period: October (CM); January (CM).

Midvein swelling. Gallling species: Cecidomyiidae. Period: October (CM). Deposited material: 12 galls, 28.IX.2001.

Conical leaf gall parallel to the leaf surface. Gallling species: Cecidomyiidae. Period: January (CM).

Conical leaf gall perpendicular to the leaf surface (Fig. 21). Gallling species: *Dactylodiplosis* sp. (Cecidomyiidae). Period: May (CM). Deposited material: 19 galls (15 galls, 27.V.2002; 4 galls, 28.V.2002).

Spherical leaf gall, orangish green, hairy. Gallling species: Cecidomyiidae (3 larvae, 28.V.2002). Period: April-May (CM). Deposited material: 27 galls (25.IV.2002).

Comments: Maia (2001) recorded a marginal leaf roll and a conical leaf gall perpendicular to the leaf surface on the same plant species for restinga of Barra de Maricá (Maricá, RJ).

Clusiaceae

Calophyllum sp.: Elliptical leaf gall, yellow (Fig. 22). Gallling species: *Lopesia* sp. (Cecidomyiidae). Other associated insects: parasitoids – *Galeopsomyia* sp. (Eulophidae, 5 females, 1 male); *Eulophidae* sp. (new genus, 1 male); *Eurytoma* sp. (Eurytomidae, 2 females, 1 male); *Pteromalidae* sp. (1 female) and inquiline – Sciaridae (2 adults). Period: September-January (CM); April-May (CM). Deposited material: 19 galls, 01.IX.2001.

Stem swelling gall (Fig. 23). Gallling species: *Lopesia* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: September-January (CM); May (CM). Deposited material: 9 galls (6 galls, 01.IX.2001; 1 gall, 20.XI.2001; 2 galls, 28.V.2002).

Marginal leaf roll (Fig. 24). Gallling species: probably Thysanoptera. Other associated insects: Hymenoptera and Sciaridae (1 adult). Period: September-December (CM); April (CM).

Linear outgrowth of the leaves (Fig. 25). Gallling species: Cecidomyiidae. Period: September-January (CM); April-May (CM). Deposited material: 13 galls (8 galls, 25.X.2001; 5 galls, 25.IV.2002).

Comments: Houard (1933) listed an Eriophyidae gall on *Calophyllum calaba* Jac.

Chrysobalanaceae

Licania sp.: Stem swelling. Gallling species: Cecidomyiidae. Period: March (CM). Deposited material: 1 gall on 21-23.III.2001. Comments: first record of gall on this plant genus.

Dilleniaceae

Davilla braziliana DC.: Pine-like bud gall (Fig. 26). Gallling species: *Asphondylia* sp. (Cecidomyiidae). Other associated insects: inquiline: *Clinodiplosis* sp. (Cecidomyiidae); Lepidoptera (1 immature specimen). Period: March (CM); August-September (CM); October-November (CM); May (CM). Deposited material: 4 galls (2 galls, 21-23.III.2001 collected by V. C. Maia and 2 galls, 12.X.1999 collected by R. J. V. Alves).

Circular leaf gall (Fig. 27). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: May (CM). Deposited material: 5 galls on 28.V.2002.

Comments: two kinds of Eriophyidae galls on *D. lucida* and *D. flexuosa* (Ref.: Tavares, 1922 and Houard, 1933, p. 241-242); swollen aborted flower on *D. rugosa* induced by Cecidomyiid (Ref.: Gagné, 1994); leaf blister on *D. rugosa* induced by Cecidomyiid. Distr. RJ (Ref.: Tavares, 1922). These are the first records of gall on *Davilla braziliiana*.

Erythroxyloaceae

Erythroxyllum suberosum St. Hil.: Reddish and hairy leaf gall (Fig. 28). Gallling species: *Dasineura* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: March (CM and BD); September (CM and BD); October (CM); November (BD). Deposited material: 2 galls, 08.IX.1997 collected by R. J. V. Alves. Comments: This gall has already been recorded on the same plant species by Fernandes & Martins (1985, p. 63, fig. 13). Gagné (1994) listed a spheroid, fuzzy gall induced by Cecidomyiidae on *E. coelophlebium*. Ref.: Fernandes *et al.* (1988, p. 20, Fig. 7). Distr. MG.

Circular leaf gall (Fig. 29). Gallling species: Cecidomyiidae. Period: September-November (BD). Deposited material: 7 galls, 21.XI.2001.

Erythroxyllum frangulifolium St. Hilaire: Apical bud gall (Fig. 30). Gallling species: Eulophidae (Hymenoptera). Period: May (CM); September (CM); November (BD and CM); December (CM); January (CM); April-May (CM). Deposited material: 1 gall, 03.V.2001. Comments: Fernandes *et al.* (1988, p. 21, Fig. 22) described the same gall for Belo Horizonte (Minas Gerais).

Marginal leaf roll (Fig. 31). Gallling species: Cecidomyiidae. Period: October (CM). Deposited material: 2 galls, 24.X.2001.

Erythroxyllum sp.: Blister leaf gall (Fig. 32). Gallling species: Cecidomyiidae (mature larvae pupate into soil). Other associated insects: parasitoids – Hymenoptera. Period: September (CM); November-December (CM); April-May (CM). Deposited material: 17 galls, 01.IX.2001.

Euphorbiaceae

Croton antisiphiliticus Mart.: Circular leaf gall, yellowish (Fig. 33). Gallling species: *Contarinia*

sp. (Cecidomyiidae). Period: September (BD); October (BD and CM); November (CM). Deposited material: 3 galls, 29.IX.2001.

Midvein swelling. Gallling species: Cecidomyiidae (3 larvae, 25.X.2001). Period: October (BD). Deposited material: 3 galls, 25.X.2001.

Comments: Gonçalves-Alvim & Fernandes (2001) recorded a stem gall induced by Cecidomyiidae on the same plant species.

Croton floribundus Spreng.: Spheroid hairy gall on leaves or stem (Fig. 34). Gallling species: *Clinodiplosis* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera; inquiline – Lepidoptera (2 immature specimens, 30.I.2002; 25.IV.2002). Period: March (CM); August-September (CS); October (CM); December (CS); January (CS); April-May, 2002 (CS). Deposited material: 10 galls (4 galls, 21-23.III.2001; 6 galls, 30.I.2002).

Ovoid leaf gall, slightly hairy (Fig. 35). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: March (CS); August (CS); November-December (CS); April (CS). Deposited material: 3 galls, 21-23.III.2001.

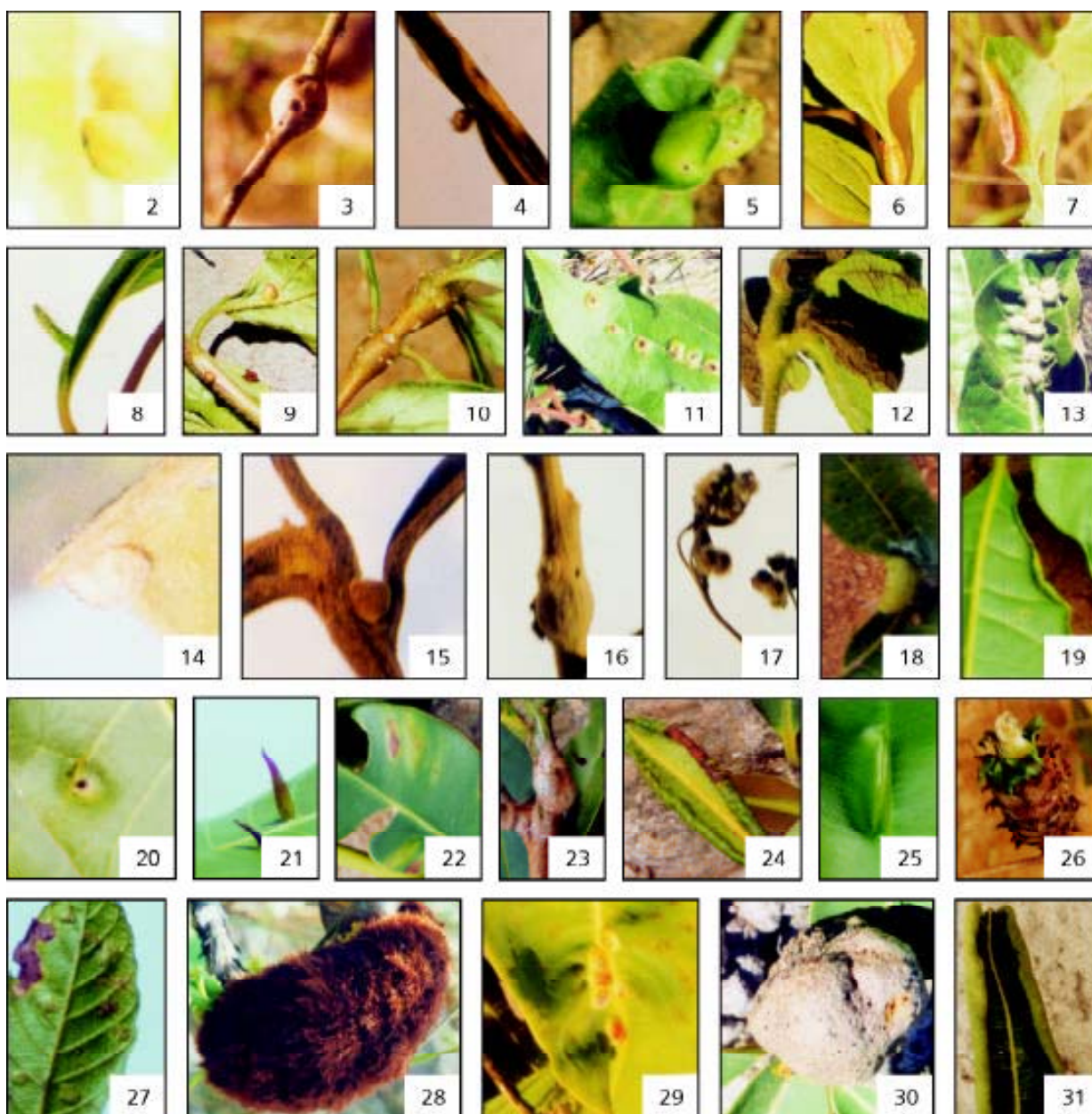
Discoidal leaf gall (Fig. 36). Gallling species: Cecidomyiidae. Period: August-September (CS); April-May (CS). Deposited material: 4 galls, 28.IX.2001.

Midvein swelling (Fig. 37). Gallling species: *Lasiopteridi*, gen. n. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: August (CS); October (CM); November-January (CS). Deposited material: 10 galls, 28.IX.2001.

Marginal leaf roll (Fig. 38). Gallling species: undetermined insect. Period: March (CS). Deposited material: 4 galls, 21-23.III.2001. Obtained insects: Hymenoptera.

Croton gnidiaceus Baill.: Globoid stem swelling (Fig. 39). Gallling species: Cecidomyiidae. Period: November (CS). Deposited material: 1 gall, 21.XI.2001. Comments: first record of gall on this plant species.

Croton timandroides (Didr.) Müll. Arg.: Globoid stem swelling (Fig. 40). Gallling species: Cecidomyiidae. Period: March (CM); May (CM). Deposited material: 3 galls (2 galls, 21-23.III.2001; 1 gall, 03.V.2002).



Figs. 2-31 — Insect galls of Serra de São José (Tiradentes, Minas Gerais). 2. Leaf gall on *Anona crassiflora*. 3. Stem gall on *Aspilia duarteana*. 4-5. Leaf galls on *Baccharis microcephala*: 4. Cylindrical gall; 5. Midvein swelling. 6-8. Galls on *Baccharis reticularia*: 6. Stem gall; 7. Marginal leaf roll; 8. Cylindrical outgrowths of the leaf. 9. Leaf or stem galls on *Baccharis serrulata*. 10. Stem gall on *Mikania lindbergii*. 11. Leaf galls on *Mikania micrantha*. 12. Stem gall on *Mikania sessilifolia*. 13. Leaf galls on *Vannilosmopsis erythropapa*. 14. Leaf gall on *Vernonia crotonoides*. 15. Bud or leaf gall on *Vernonia obscura*. 16. Stem gall on *Vernonia* sp. 17. Inflorescence gall on *Cordia* sp. 18-21. Galls on *Protium heptaphyllum*: 18. Pouch gall on leaf margin; 19. Marginal leaf roll; 20. Opened leaf gall; 21. Conical leaf gall. 22-25. Galls on *Calophyllum* sp.: 22. Elliptical leaf gall; 23. Stem gall; 24. Marginal leaf roll; 25. Triangular leaf gall. 26-27. Galls on *Davilla braziliana*: 26. Bud gall; 27. Leaf gall. 28-29. Galls on *Erythroxylum suberosum*: 28. Hairy leaf gall; 29. Circular leaf gall. 30-31. Galls on *Erythroxylum frangulifolium*: 30. Bud gall; 31. Marginal leaf roll.

First record of gall on this plant species. Comments: Gagné (1994) related fusiform stem swellings caused by cecidomyiids on *Croton buxifolius* and *C. migrans*. Distr.: RJ and MG, Brazil. Ref. Rübsaamen (1905), Tavares (1922), and Houard (1933). Tavares (1925) and Houard (1933; Fig. B, p. 188) described spheroid leaf galls with stellate hairs induced by *Styracodiplosis cearensis* on *C. hemiargyneus*. Distr.: Ceará, Brazil. Rübsaamen (1905) recorded galls on lower and upper leaf surface caused by cecidomyiid on *Croton* sp. Distr.: RJ, Brazil. Rübsaamen (1905) and Houard (1933) listed marginal leaf rolls induced by cecidomyiid on *Croton* sp. Distr.: RJ, Brazil. Tavares (1915) and Houard (1933, Fig. 441, p. 188) related blister galls caused by cecidomyiid on *C. argentinus*. Distr.: Argentina. Houard (1933) listed a Eriophyidae gall on *C. floribundus*. Distr.: Brazil. Ref.: Rübsaamen (1905).

Fabaceae

Andira sp.: Globoid stem swelling (Fig. 41). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Eulophidae (2 females from different species). Period: August-September (CM). Deposited material: 4 galls, 31.VIII.2001. Comments: Houard (1933, Figs. 249-250a-b) related a similar gall on *Andira* sp.

Globoid leaf gall, yellowish, glabrous (Fig. 42). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: September (CM). Deposited material: 24 galls, 28.IX.2001.

Sinuuous leaf gall. Gallling species: Cecidomyiidae. Period: January (CM). Deposited material: 4 galls, 30.I.2002. Comments: Tavares (1920) described this gall and the gallling species – *Andirodiplosis bahiensis*. Houard (1933) illustrated the gall (Fig. 258-260, l-m).

Tapered stem swelling (Fig. 43). Gallling species: Curculionidae (Coleoptera). Period: August (CM). Deposited material: 3 galls (2 galls, 31.VIII.2001; 1 gall, 28.IX.2002).

Copaifera langsdorffii Desf.: Horn-shaped outgrowths of leaves (Fig. 44). Gallling species: Cecidomyiidae. Period: May (CM); August (CM); October (CM); January (CM), April-May (CM). Deposited material: 50 galls (1 gall, 03.V.2001; 47 galls, 25.V.2002; 2 galls, 28.V.2002). Comments. Fernandes & Martins (1985) illustrated this gall (p.

62, Fig. 10); Fernandes *et al.* (1988) recorded it for Belo Horizonte (MG).

Globose leaf gall, brown and hairy. Gallling species: undetermined insect. Period: May (CM). Deposited material: 18 galls, 03.V.2001.

Stem swelling. Gallling species: Cecidomyiidae. Period: May (CM), January (CM). Deposited material: 1 gall, 03.V.2001.

Globoid leaf gall, green and glabrous (Fig. 45). Gallling species: undetermined insect. Period: May (CM). Deposited material: 2 galls, 03.V.2001.

Discoid leaf gall, yellow (Fig. 46). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera; inquiline – Coleoptera (1 adult, 28.V.2002). Period: April-May (CM). Deposited material: 28 galls (03 galls, 03.V.2001; 25 galls, 25.IV.2002).

Bud gall, spheroid, green, with rough surface (Fig. 47). Gallling species: Lepidoptera. Period: May (CM), December (CM). Deposited material: 13 galls (6 galls, 03.V.2001; 3 galls, 04.V.2001; 1 gall, 24.X.2001; 2 galls, 27.XII.2001; 1 gall, 28.V.2002).

Inga sp.: Midvein swelling (Fig. 48). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: October (CM); January (CM). Deposited material: 4 galls (1 gall, 25.X.2001; 3 galls, 30.I.2002). Comments: Houard (1933) listed and illustrated a similar gall (Fig. 129b). Maia (2001) described a similar gall on *Inga maritima* induced by *Neolasioptera* sp. (Cecidomyiidae).

Globose, hairy, yellow leaf gall (Fig. 49). Gallling species: undetermined insect. Period: April (CM). Deposited material: 3 galls, 25.IV.2002.

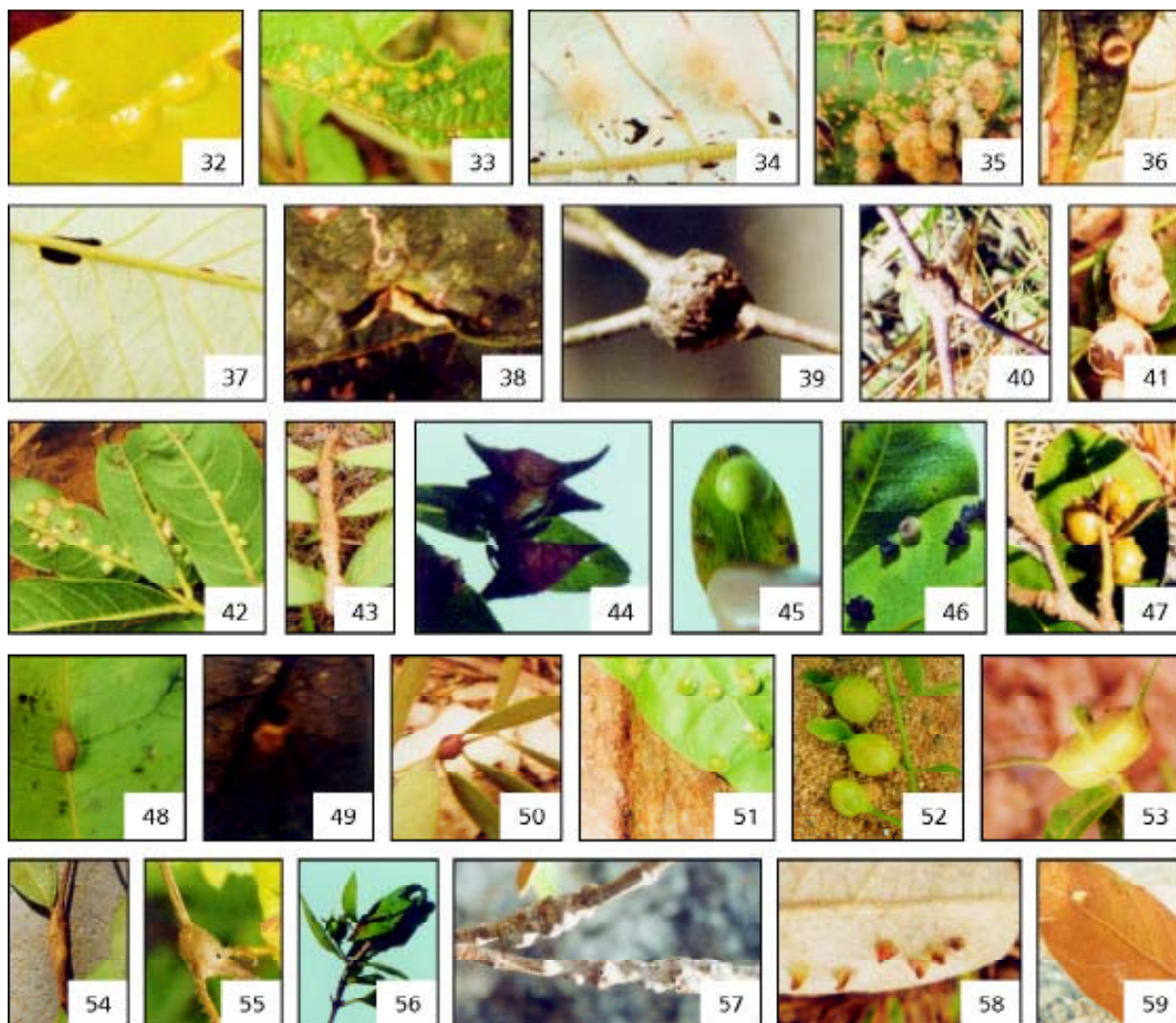
Comments: Gagné (1994) listed several galls on *Inga* spp. caused by *Neolasioptera* spp.

Stryphnodendron adstringens (Aubl.) Benth.: Globoid stem swelling (Fig. 50). Gallling species: Cecidomyiidae. Period: March (CM); May (CM); September (BD). Deposited material: 7 galls, 21-23.III.2002. Comments: first record of gall on this plant species.

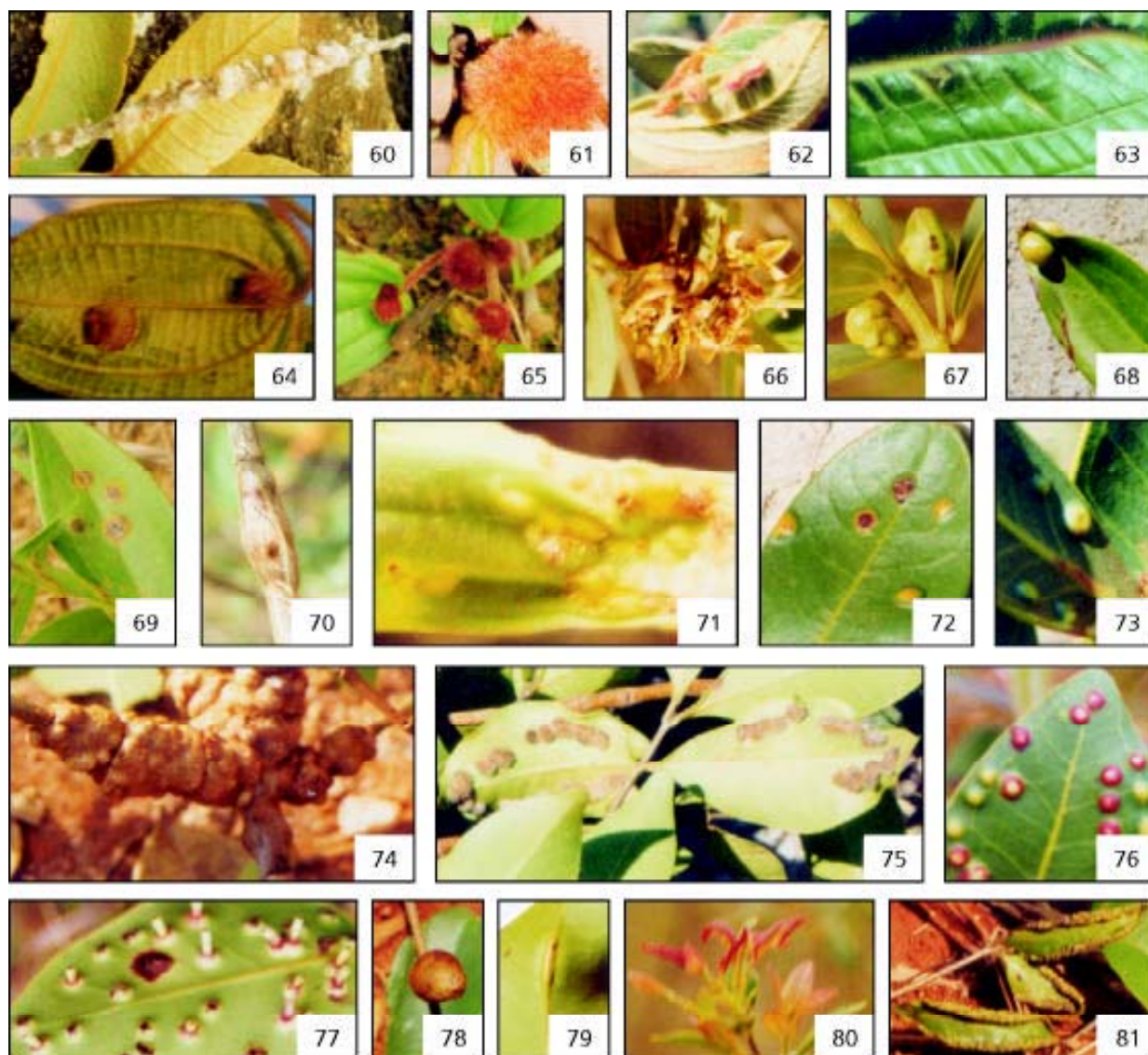
Undetermined Fabaceae (sp. 1)

Pouch gall on leaves. Gallling species: undetermined insect. Period: November (CM). Deposited material: 1 gall, 20.XI.2001.

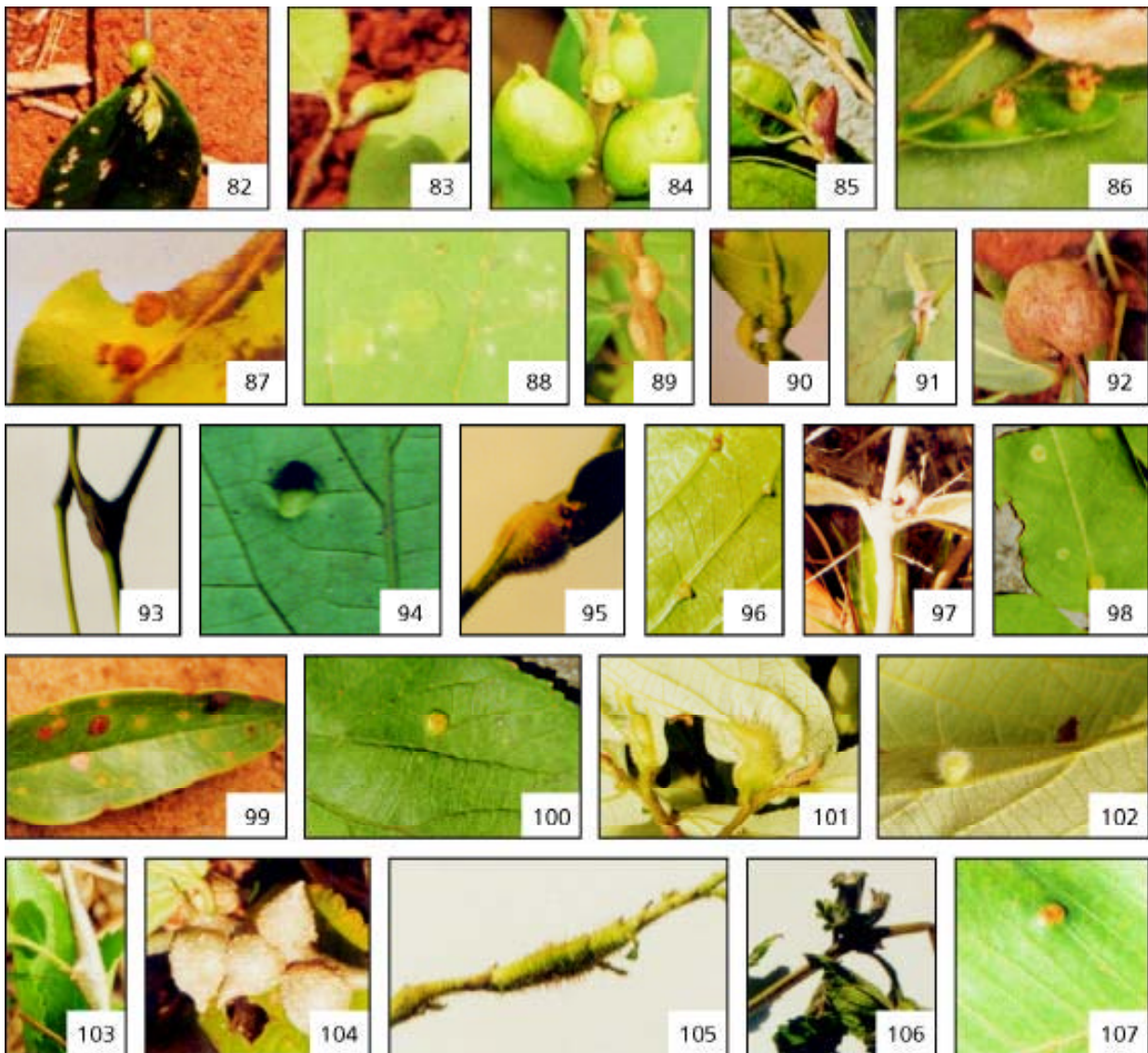
Swelling of midvein basis. Gallling species: Cecidomyiidae. Period: April (CM)



Figs. 32-59 — Insect galls of Serra de São José (Tiradentes, Minas Gerais). 32. Leaf gall on *Erythroxylum* sp. 33. Leaf galls on *Croton antisiphiliticus*. 34-38. Galls on *Croton floribundus*: 34. Spheroid leaf galls; 35. Ovoid leaf galls; 36. Discoidal leaf gall; 37. Midvein swelling; 38. Marginal leaf gall. 39. Stem swelling on *Croton gnidiaceus*. 40. Stem swelling on *Croton timandroides*. 41-43. Galls on *Andira* sp.: 41. Globoid stem swelling; 42. Globoid leaf gall; 43. Tapered stem swelling. 44-47. Galls on *Copaifera langsdorffii*: 44. Horn-shaped outgrowths of leaves; 45. Globoid leaf gall; 46. Discoid leaf gall; 47. Bud gall. 48-49. Galls on *Inga* sp.: 48. Midvein swelling; 49. Leaf gall. 50. Stem gall on *Stryphnodendron adstringens*. 51. Leaf gall on Leguminosae sp.2. 52. Bud gall on Leguminosae sp.3. 53-54. Galls on Mimosaceae: 53. Bud gall; 54. Stem swelling. 55. Stem swelling on *Hyptis* sp. 56. Stem gall on *Diplusodon virgatus*. 57-58. Galls on *Byrsonima variabilis*: 57. Stem swelling; 58. Leaf gall. 59. Leaf gall on *Byrsonima verbascifolia*.



Figs. 60-81 — Insect galls of Serra de São José (Tiradentes, Minas Gerais). 60. Stem galls on *Byrsonima* sp. 61-62. Galls on *Leandra aurea*: 61. Bud gall; 62. Leaf gall. 63. Vein swellings on *Miconia* sp.1. 64. Leaf galls on *Miconia* sp. 2. 65. Leaf and stem galls on *Miconia* sp. 3. 66-69. Galls on *Miconia theaezans*: 66. Rosette bud gall; 67. Spheroid bud gall; 68. Blister leaf gall; 69. Circular leaf gall. 70-71. Galls on *Tibouchina candolleana*: 70. Stem swelling; 71. Elliptical gall on leaves and stem. 72. Circular leaf gall on *Rapanea andina*. 73. Circular leaf gall on *Campomanesia pubescens*. 74. Stem swellings on *Eugenia* sp.1. 75. Globoid leaf gall on *Eugenia* sp.2. 76-77. Cylindrical outgrowths of leaves on *Eugenia* cf. *ovalifolia*: 76. Leaf upper surface view; 77. Leaf lower surface view. 78-81. Galls on *Myrcia* sp.: 78. Bud gall; 79. Midvein swelling; 80. Leaf roll; 81. Marginal leaf roll.



Figs. 82-107 — Insect galls of Serra de São José (Tiradentes, Minas Gerais). 82-83. Galls on *Myrcia* sp.: 82. Bud gall; 83. Fold leaf. 84. Bud gall on *Psidium* sp. 85. Fold leaf on Myrtaceae sp.1. 86-87. Galls on Myrtaceae sp.2: 86. Tubular leaf galls; 87. Globose leaf galls. 88-90. Galls on *Guapira* sp.: 88. Spot leaf gall; 89. Stem swelling; 90. Midvein swelling. 91. Leaf gall on *Piper* sp.1. 92. Stem swelling on *Piper* sp.2. 93-94. Galls on *Piper* sp.3: 93. Stem swelling; 94. Globoid vein swelling. 95. Stem swelling on *Borreia* cf. *brachystemonoides*. 96. Vein swelling on *Palicourea rigida*. 97. Bud gall on *Sapicia brasiliensis*. 98. Vein swelling and spot leaf gall on *Paullinia* sp. 99. Leaf gall on *Smilax elastica*. 100-101. Galls on *Luehea* cf. *divaricata*: 100. Globoid leaf gall; 101. Midvein swelling. 102-104. Galls on *Celtis glycyarpa*: 102. Circular leaf gall; 103. Stem swelling; 104. Mamiliform outgrowths of leaves and stem. 105-106. Galls on *Lantana lilacina*: 105. Stem gall; 106. Tubular outgrowths of the leaves. 107. Leaf gall on *Qualea parvifolia*.

Undetermined Fabaceae (sp. 2): Globose, hairy, green leaf gall (Fig. 51). Gallling species: Cecidomyiidae. Period: May (CM).

Undetermined Fabaceae (sp. 3): Spherical bud gall, green (Fig. 52). Gallling species: Cecidomyiidae. Mature larvae pupate into soil. Period: September (CM).

Undetermined Fabaceae (sp. 4)

Horn-shaped bud gall, yellowish (Fig. 53). Gallling species: Curculionidae (Coleoptera, 1 adult, 27.XII.2001). Other associated insects: inquiline – *Contarinia* sp. (Cecidomyiidae); parasitoids – Hymenoptera. Period: August (CM); November-December (CM and CS); January (CM); April-May (CM). Deposited material: 6 galls (2 galls, 31.VIII.2001; 3 galls, 20.XI.2001; 1 gall, 27.XII.2002).

Tapered stem swelling (Fig. 54). Gallling species: *Neolasioptera* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: November (CM); December (CM and CS); January (CM); April-May (CM). Deposited material: 5 galls (2 galls, 21.XI.2001; 3 galls, 27.XII.2001).

Globoid leaf gall. Gallling species: Cecidomyiidae. Period: November (CM).

Lamiaceae

Hyptis sp.: Stem swelling, hairy (Fig. 55). Gallling species: Cecidomyiidae. Period: September-October (CM); April (CM). Comments: Möhn (1964) described a similar gall on *Hyptis suaveolens* and its gallling species – *Neolasioptera hyptis*. Distr. El Salvador.

Globose hairy leaf gall. Gallling species: Cecidomyiidae. Period: October (CM).

Lauraceae

Ocotea sp.: Opened leaf gall. Gallling species: Coccoidea (Hemiptera, Sternorrhyncha). Period: April, 2002. Comments. Houard (1933) listed galls on *Ocotea* spp. and Monteiro *et al.* (1993) listed a similar gall induced by Sternorrhyncha on *Ocotea notata*.

Lythraceae

Diplusodon virgatus Pohl.: Apical stem swelling covered by leaves (Fig. 56). Gallling species: Cecidomyiidae. Period: May (CM). Comments: first record of gall on this plant species.

Malpighiaceae

Byrsonima variabilis A. Juss.: Stem swelling, glabrous (Fig. 57). Gallling species: undetermined insect. Period: September (BD); October-November (CM); January (CS and CM); April-May (CM). Deposited material: 20 gall, 29.IX.2001. Obtained insects: *Sycophila* sp.1 (Eurytomidae, 13 females, 1 male); *Sycophila* sp.2 (Eurytomidae, 5 females, 9 males); *Eurytoma* sp. (Eurytomidae, 2 females, 1 male); *Eupelmidae* sp. (1 male); *Eulophidae* sp. (2 females); *Platygastridae* sp. (1 male); *Ichneumonidae* sp. (1 female).

Conical leaf gall (Fig. 58). Gallling species: Cecidomyiidae. Period: April (CM).

Comments: these are the first records of gall on *Byrsonima variabilis*.

Byrsonima verbascifolia A. Juss.: Conical leaf gall (Fig. 59). Gallling species: Cecidomyiidae. Other associated insects: *Eurytoma* sp. (Eurytomidae, 1 female, 7 males); *Eulophidae* sp. (6 females, 5 males); *Eupelmidae* sp. (5 males); *Dimeromicrus cecidomyiae* (Torymidae, 1 male); *Signiphoridae* sp. (1 female); Psyllidae (1 adult). Period: March (BD); September (BD); October (CM); December (CM). Deposited material: 20 galls, 01.IX.2001. Comments: gall described by Tavares (1921), listed and illustrated by Houard (1933, Fig. G, p. 157-158), and related by Gonçalves-Alvim & Fernandes (2001).

Byrsonima sp.: Stem swelling, hairy (Fig. 60). Gallling species: undetermined insect. Period: November (BD). Deposited material: 1 gall, 21.XI.2001.

Melastomataceae

Leandra aurea (Cham.) Cogn.: Spherical bud gall, reddish, hairy (Fig. 61). Gallling species: Lepidoptera (adults and immature specimens). Other associated insects: inquiline – *Anthonomus* sp.n. (Coleoptera, Curculionidae; 9 adults, XI.2001); predators – *Friebrigella* sp. (Diptera, Chloropidae; 2 adults, 24.X.2001) and *Lestodiplosis* sp. (Diptera, Cecidomyiidae); parasitoids – Hymenoptera. Period: March (CM and BD); May, (CM); August (CM); September (BD); October (BD, CM and CS); November (CM); December-January (CM); April-May (CM). Deposited material: 4 galls, 21-23.III.2001.

Spherical reddish leaf gall, hairy (Fig. 62). Gallling species: Lepidoptera (4 adults, 27.XII.2001). Other associated insects: parasitoids – Hymenoptera. Period: May (CM); October (CM); December (CM); January (CM); May (CM). Deposited material: 6 galls, 21-23.III.2001.

Comments: Houard (1933) described and illustrated Eriophyidae galls on *Leandra* sp. (p. 291). These are the first records of gall on *Leandra aurea*.

Miconia sp.1: Tubular hairy leaf gall, green. Gallling species: undetermined insect. Period: December (CM); May (CM). Deposited material: 5 galls, 28.XII.2001.

Vein swelling (Fig. 63). Gallling species: Cecidomyiidae. Period: December (CM); May (CM).

Miconia sp.2: Globose, reddish and hairy gall on leaves and stem (Fig. 64). Gallling species: Lepidoptera. Period: April. Deposited material: 2 leaf galls (24.IV.2002), 8 stem galls (24.IV.2002).

Miconia sp.3: Spheroid, hairy, reddish gall on leaves and stem (Fig. 65). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: November (CM); January (CM); May (CM). Deposited material: 8 galls, 24.IV.2002.

Miconia theaezans (Bonpl.) Cogn.: Rosette bud gall (Fig. 66). Gallling species: Lepidoptera. Period: October (CM); January (CS and CM); April (CM); May (CS and CM). Deposited material: 10 galls (8 galls, 22.III.2001; 2 galls, 29.IX.2001).

Tubular bud gall. Gallling species: Lepidoptera. Period: April-May (CM). Deposited material: 6 galls, 28.V.2002.

Spheroid bud gall (Fig. 67). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: April-May (CM). Deposited material: 6 galls, 25.IV.2002.

Blister leaf gall (Fig. 68). Gallling species: Cecidomyiidae. Period: October (CM). Deposited material: 17 galls, 25.X.2001.

Circular leaf gall (Fig. 69). Gallling species: Cecidomyiidae. Period: March (CM). Deposited material: 15 galls, 22.III.2001.

Comments: Houard (1933, p. 293-302) described several galls on *Miconia* spp. Gagné (1994) listed a tapered stem swelling caused by Cecidomyiidae. Rübsaamen (1907), Tavares (1925),

Houard (1933) described complex leaf galls induced by cecidomyiids. This is the first record of gall on this plant species.

Tibouchina candolleana (DC.) Cogn.: Vein swelling. Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: September-November (CM); December (CM and CS); January (CM); April, (CS and CM); May (CM). Deposited material: 12 galls (10 galls, 31.VIII.2001; 1 gall, 25.X.2001; 1 gall, 29.I.2002).

Stem swelling (Fig. 70). Gallling species: Lepidoptera. Period: August (CM), October (CM). Deposited material: 6 galls (2 galls, 31.VIII.2001; 4 galls, 24.X.2001).

Elliptical gall on leaves or stem, hairy (Fig. 71). Gallling species: Lepidoptera. Period: May, August, October (CM).

Comments: Rübsaamen (1908) described a vein gall on *T. granulosa* (Distr. RJ, Brazil); Tavares (1917) described two different leaf galls on *Tibouchina* sp., one spherical, hairy, and induced by *Rochadiplois tibouchinae*, and the other a blister gall caused by an undetermined Cecidomyiidae. Houard (1933) listed both galls. This is the first record of gall on *Tibouchina candolleana*.

Myrsinaceae

Rapanea andina Mez.: Circular leaf gall (Fig. 72). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: March (CS); May (CM); October (CM); December (CM). Deposited material: 10 galls (3 galls, 21-23.III.2001; 7 galls, 01.IX.2001). Comments: Maia (2001) recorded a similar gall induced by Cecidomyiidae on *Rapanea parvifolia* for the restinga of Barra de Maricá (Maricá, RJ, Brazil).

Stem swelling. Gallling species: Lepidoptera. Period: October (CM). Deposited material: 1 gall, 24.X.2001.

Comments: first records of gall on *Rapanea andina*.

Myrtaceae

Campomanesia pubescens (DC.) O. Berg.: Circular leaf gall, yellowish (Fig. 73). Gallling species: Cecidomyiidae. Period: May (CM); October (CM). Deposited material: 16 galls, 03.V.2001. Comments: first record on this plant species.

Eugenia sp.1: Stem swelling (Fig. 74). Gall maker: Cecidomyiidae. Period: May (CM); September (CM).

Eugenia sp.2: Globoid leaf gall, brown, hairy (Fig. 75). Gallling species: Cecidomyiidae. Period: May (CM). Deposited material: 35 galls, 03.V.2001.

Eugenia cfr. *ovalifolia* Camb.: Cylindrical outgrowths of leaves (Figs. 76-77). Gallling species: *Stephomyia* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: September (CM). Deposited material: 65 galls, 01.IX.2001. Comments: Tavares (1921) described a similar gall and its gallling species – *Stephomyia clavata* (as *Oxasphondylia*) on an undetermined species of Myrtaceae. Houard (1993) illustrated this gall (p. 276, Fig. e); Fernandes & Martins (1985) recorded the occurrence of this gall on *Eugenia ovalifolia* in Belo Horizonte (MG, Brazil).

Myrcia sp.: Bud gall (Fig. 78). Gallling species: Cecidomyiidae (probably *Myrciamyia* sp.). Other associated insects: Hymenoptera – inquiline, modifies the appearance of the gall. Period: August (CM); September (BD, CS and CM); October (CM); November (CM and CS); April, 2002 (CM). Deposited material: 7 modified galls, 31.VIII.2001. Comments: Maia (2001) described a similar gall induced by *Myrciamyia maricensis* on *Myrcia ovata* and also modified by an inquiline Hymenoptera in the restinga of Barra de Maricá (Maricá, RJ, Brazil).

Midvein swelling (Fig. 79). Gallling species: *Neolasioptera* sp. (Cecidomyiidae). Period: August (CM) Deposited material: 1 gall, 31.VIII.2001. Comments: Maia (2001) described a similar gall also induced by *Neolasioptera* on *Myrcia ovata* in the restinga of Barra de Maricá (Maricá, RJ, Brazil).

Leaf roll (Fig. 80). Gallling species: Thrips (Thysanoptera, adults and nymphs). Other associated insects: Hymenoptera. Period: November (CM and CS); December-January (CM). Deposited material: 1 gall, 30.I.2002.

Marginal leaf roll (Fig. 81). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: September (BD and CM); October (CM); December (CM and CS); January (CM); April-May (CM). Deposited material: 10 galls, 01.IX.2001.

Apical bud gall, green with a terminal pointed projection (Fig. 82). Gallling species: undetermined insect. Period: September (CM). Deposited material: 1 gall, 28.IX.2001.

Leaf fold along midvein (Fig. 83). Gallling species: Hemiptera (Sternorrhyncha). Period: September (BD and CM); November-December (CM); April-May (CM). Deposited material: 4 galls, 31.VIII.2001.

Comments: Fernandes *et al.* (1988) recorded several galls on *Myrcia itambensis* in Belo Horizonte (MG, Brazil), none of them similar in shape.

Myrciaria tenella (DC.) O. Berg.: Bivalve bud gall. Gallling species: *Myrciariamyia* sp.n. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: October-December (CM). Deposited material: 4 galls, 21.XI.2001. Comments: Maia (2001) described a similar gall on *Myrciaria floribunda* induced by *Myrciariamyia bivalva* in the restinga of Barra de Maricá (Maricá, RJ, Brazil).

Leaf fold along midvein. Gallling species: Hemiptera (Sternorrhyncha). Other associated insects: Muscomorpha (2 larvae, 30.I.2002) and Hymenoptera. Period: October (CM); December (CM). Deposited material: 13 galls (11 galls, 21.XI.2001; 2 galls, 30.I.2002).

Comments: first records of gall on *Myrciaria tenella*.

Psidium sp.: Globoid succulent bud gall (Fig. 84). Gallling species: Cecidomyiidae. Period: August (CS); September (CS); November (CS).

Comments: Houard (1933) listed several galls on *Psidium* sp., none of them similar in shape.

Undetermined Myrtaceae (sp.1): Cylindrical leaf gall. Gallling species: Cecidomyiidae. Period: August (CM). Deposited material: 1 gall on 31.VIII.2001.

Leaf fold along midvein (Fig. 85). Gallling species: Hemiptera (Sternorrhyncha). Period: August (CM). Deposited material: 1 gall, 31.VIII.2001.

Undetermined Myrtaceae (sp.2): Tubular leaf gall, green, with small apical projections (Fig. 86). Gallling species: undetermined insect. Period: August (CS); September (CM); April (CS). Deposited material: 21 galls (16 galls, 31.VIII.2001; 5 galls, 24.IV.2002). Obtained insects: Hymenoptera.

Globose leaf gall, hairy (Fig. 87). Gallling species: Cecidomyiidae. Period: August (CS). Deposited material: 3 galls, 31.VIII.2001.

Midvein basis swelling. Gallling species: Cecidomyiidae. Period: August (CS). Deposited material: 1 gall, 31.VIII.2001.

Nyctaginaceae

Guapira sp.: Spot leaf gall (Fig. 88). Gallling species: Lopeiini (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: September (CS); November (CM); December (CM and CS); January (CS and CM); April-May (CM). Deposited material: 10 galls (5 galls, 28.IX.2001; 5 galls, 20.XI.2001).

Stem swelling (Fig. 89). Gallling species: Asphondyliini (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: September (CS); October (CM); November-January (CS and CM); May (CM). Deposited material: 3 galls, 28.IX.2001.

Midvein or petiole swelling (Fig. 90). Gallling species: Cecidomyiidae. Period: December (CM); April (CM).

Comments: Maia (2001) recorded five kinds of Cecidomyiidae galls on *Guapira opposita* for the restinga of Barra de Maricá (Maricá, RJ), all induced by species of Asphondyliini. This is the first record of a non-Asphondyliini galling species on *Guapira* spp.

Piperaceae

Piper sp.1: Conical outgrowths of leaves and stem (Fig. 91). Gallling species: Asphondyliini (probably a new genus and species). Other associated insects: parasitoids – Hymenoptera; inquiline – Lepidoptera (immature specimen, 21.XI.2001). Period: August-January (CS). Deposited material: 3 galls (2 galls, 31.VIII.2001; 1 gall, 21.IX.2001). Comments: Rübsaamen (1908) described a similar gall for Rio de Janeiro (Brazil).

Piper sp.2: Globoid stem swelling (Fig. 92). Gallling species: *Zalepidota* sp. (Cecidomyiidae). Period: August-September (CS); October (CM); April-May (CM). Deposited material: 6 galls (4 galls, 31.VIII.2001; 2 galls, 25.X.2001). Comments: Tavares (1909, 1925) described similar galls induced by *Zalepidota piperis* and *Z. tavaresi* on *Piper* sp.

Piper sp.3: Tapered stem swelling (Fig. 93). Gallling species: Cecidomyiidae. Period: January (CS); May (CS). Deposited material: 2 galls, 27.V.2002.

Globoid vein swelling (Fig. 94). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: April (CS); May (CM).

Globoid bud gall. Gallling species: Cecidomyiidae. Period: April (CS).

Comments: Rübsaamen (1908) and Möhn (1960) recorded stem swellings on undetermined *Piper* for Rio de Janeiro (Brazil) and El Salvador, respectively.

Rubiaceae

Borreria cfr. *brachystemonoides* Cham. & Schltld.: Stem swelling, hairy (Fig. 95). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Encyrtidae sp. (2 adults). Period: May (CS). Deposited material: 01 gall, 27.V.2002. Comments: Houard (1933) described a similar gall of Cecidomyiidae on *Borreria* sp. (p. 388).

Palicourea rigida Kunth: Triangular vein swelling (Fig. 96). Gallling species: Cecidomyiidae. Period: November (CM). Deposited material: 6 galls, 21.IX.2001. Comments: Gagné (1994) listed two Cecidomyiidae gall on *Palicourea* sp. for Costa Rica (none of them similar in shape). This is the first record of gall on *Palicourea rigida*.

Sapicia brasiliensis Wernhm: Bud gall, glabrous (Fig. 97). Gallling species: Cecidomyiidae. Period: May (CM). Comments: Gonçalves-Alvim & Fernandes (2001) reported the same gall on the same host plant species for Três Marias (MG, Brazil).

Sapindaceae

Paullinia sp.: Vein swelling (Fig. 98). Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: January (CS and CM); April (CS and CM); May (CM). Deposited material: 8 galls (1 gall, 30.I.2002; 7 galls, 25.IV.2002).

Stem swelling. Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: January (CM); April (CS). Deposited material: 3 galls, 25.IV.2002.

Spot leaf gall (Fig. 98). Gallling species: Cecidomyiidae. Period: April, May (CM).

Comments: Rübsaamen (1908) described a spheroid gall on *Paullinia* sp. in Brazil (Amazo-

nas). Maia (2001) related a stem swelling on *P. weinmanniaefolia* for Rio de Janeiro (Brazil). Gagné (1994) recorded a rolled young leaf on *P. weinmanniaefolia* in Rio de Janeiro (Brazil).

Scrophulariaceae

Buchnera rosea Kunth.: Stem swelling. Gallling species: Cecidomyiidae. Period: November (CS). Comments: first record of gall on this plant species.

Smilacaceae

Smilax elastica Griseb.: Spot leaf gall (Fig. 99). Gallling species: probably *Smilasioptera candelariae* (Cecidomyiidae). Period: August (CS); September (BD and CM); December (CM); January (CM); April (CS and CM). Deposited material: 28 galls (16 galls, 31.VIII.2001; 12 galls, 01.X.2001). Comments: Maia (2001) recorded a similar gall on *Smilax rufescens* for the restinga of Barra de Maricá, Maricá, RJ, Brazil).

Tiliaceae

Luehea cf. *divaricata* Mart.: Globoid, hairy, yellowish leaf gall (Fig. 100). Gallling species: Cecidomyiidae. Period: October (CM); December (CS); April (CS). Deposited material: 7 galls, 24.X.2001.

Comments: Gagné (1994) listed this gall for Minas Gerais (Brazil) and presented an illustration (Fig. 339, p. 304).

Midvein swelling (Fig. 101). Gallling species: Cecidomyiidae. Period: August (CS); October (CM); December (CS). Deposited material: 6 galls, 30.I.2002.

Comments: Gagné (1994) listed this gall for Minas Gerais (Brazil) and presented an illustration (Fig. 339, p. 304).

Circular leaf gall. Gallling species: Cecidomyiidae. Period: November-January (CS). Deposited material: 20 galls, 24.X.2001.

Ulmaceae

Celtis glycyarpa Mart. ex Miq.: Circular leaf gall, yellow (Fig. 102). Gallling species: Cecidomyiidae. Period: May (CS).

Tapered stem swelling (Fig. 103). Gallling species: Cecidomyiidae. Period: May (CS). Deposited material: 2 galls, 25.IV.2002.

Mamiform outgrowths of leaves and stem (Fig. 104). Gallling species: *Neolasioptera* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: August (CS); October (CM); December-January (CS); April-May (CS). Deposited material: 5 galls (1 gall, 31.VIII.2001; 4 galls, 27.XII.2001). Comments: Fernandes & Martins (1985) illustrated a similar gall on an undetermined Ulmaceae (p. 63, Fig. 12).

Umbelliferae

Eryngium sp.: Flower bud gall. Gallling species: Cecidomyiidae. Period: April (CS). Deposited material: 14 galls, 29.I.2002. Comments: first record of gall on *Eryngium* spp.

Verbenaceae

Lantana lilacina Desf.: Tapered stem gall, hairy (Fig. 105). Gallling species: *Neolasioptera* sp. (Cecidomyiidae). Other associated insects: parasitoids – Hymenoptera. Period: September (CM and CS); November-December (CM). Deposited material: 9 galls (4 galls, 01.IX.2001; 5 galls, 28.IX.2001). Comments: Houard (1933) listed a similar gall induced by an undetermined Cecidomyiidae (p. 347, Fig. 803-804d-e).

Tubular outgrowths of the leaves (Fig. 106). Gallling species: Cecidomyiidae. Period: May (CS). Deposited material: 8 galls, 27.V.2002. Obtained insects: Hymenoptera. Comments: Houard (1933) reported and illustrated the same gall (p. 347, Fig. 808-810k-m).

Vochysiaceae

Qualea parvifolia Mart.: Circular leaf gall. Gallling species: Cecidomyiidae. Other associated insects: parasitoids – Hymenoptera. Period: May (CM). Deposited material: 14 galls, 03.V.2001. Comments: Gonçalves-Alvim & Fernandes (2001) described and illustrated this gall (p. 92, Fig. 299).

Winteraceae

Drimys brasiliensis Miers.: Globoid bud gall, brown (Fig. 107). Gallling species: Eulophidae (Hymenoptera). Period: March, (CS). Deposited material: 1 gall, 21-23.III.2001. Comments: Houard (1933) listed an insect gall on this plant genus.

DISCUSSION

The majority of the galls from Serra de São José were induced by Cecidomyiidae (76,5%). As the Cecidomyiidae cause about 70% of all described galls in the world, these results were expected. Gonçalves-Alvim & Fernandes (2001) surveyed the cerrado vegetation of Três Marias (Minas Gerais) and showed similar results.

There was a predominance of galls on Fabaceae (=Leguminosae), Myrtaceae, and Asteraceae. Houard (1933) has already designated the Fabaceae as the family with the greatest richness of insect galls in Central and South America. Further, Gonçalves-Alvim & Fernandes (*op. cit.*) indicated the predominance of galls on Fabaceae, Myrtaceae, and Asteraceae for cerrado vegetation.

Most galls were observed on leaves (65%), a world pattern noted by Mani (1964), and corroborated by Maia (2001) for restinga areas and Gonçalves-Alvim & Fernandes (2001) for cerrado vegetation. The second most attacked plant organ was the stem. Similar results were presented by Gonçalves-Alvim & Fernandes (*op. cit.*).

According to Fernandes & Price (1988) and Lara & Fernandes (1996), rupestrian fields and the cerrado vegetation of southeastern Brazil comprise the hottest spot for richness of galling insect species. Gonçalves-Alvim & Fernandes (2001) recorded 92 spp of galling insects in Três Marias; 136 are recorded herein. These results corroborate the trend.

In comparing the host plant species and the insect galls from Serra de São José and Três Marias, we noted that these areas show a weak similarity. Only three kinds of galls occurred in both areas: spherical leaf gall, orangish green, hairy on *Protium heptaphyllum*; conical leaf gall on *Byrsonima verbascifolia*; and spheroid leaf gall, brown, glabrous on *Sapiccia brasiliensis*.

For associated fauna, there was a predominance of parasitoid species of Hymenoptera, specially of the families Eulophidae and Eurytomidae families. This corroborates the trend found by Maia (2001) and Fernandes *et al.* (1988), in which these two families are identified as the most important natural enemies of gall midges in the Neotropical region.

Acknowledgements — We are grateful to R. J. V. Alves (MNRJ) for identifying the host plants (except for Asteraceae species) and for reviewing the manuscript; J. N. de M. Machado (IBAMA, Tiradentes) for logistic support; R. L. Steves (UERJ) for Asteraceae identification; D. Medeiros (MNRJ) for field assistance; L. de Bruyn (Institute of Nature Conservation) for Chloropidae identification; M. Couri (MNRJ) for manuscript review; and to CNPq for financial support to VCM (150061/01-3) and GWF (52.17722/95-8).

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