GALLS AND GALL MAKERS IN PLANTS FROM THE PÉ-DE-GIGANTE CERRADO RESERVE, SANTA RITA DO PASSA QUATRO, SP, BRAZIL

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ABSTRACT

Thirty-six morphologically different types of galls were obtained in leaves, leaflets, veins, petioles, stems, tendrils and flower buds from twenty-five species of plants in the Pé-de-Gigante Reserve, municipality of Santa Rita do Passa Quatro, state of São Paulo, Brazil. The host plant species belong to the closely related families Anacardiaceae, Annonaceae, Asteraceae, Bignoniaceae, Caryocaraceae, Erythroxylaceae, Fabaceae, Malpighiaceae, Melastomataceae, Myrtaceae, Ochnaceae, Polygalaceae, Sapindaceae, Sapotaceae, and Smilacaceae. The most common gall makers included *Cecidomyiidae* (Diptera), *Pteromalidae* (Hymenoptera) and *Diaspididae* (Sternorrhyncha-Hemiptera). This is the first report of galls found in the following plant genera: *Gochnatia* (Asteraceae), *Distictela* (Bignoniaceae), *Banisteriopsis* (Malpighiaceae), *Ouratea* (Ochnaceae), and *Bredemeyera* (Polygalaceae). The results of this work contribute to the body of knowledge about the relationship among host plants, gall makers, and the gall morphology of Pé-de-Gigante Cerrado Reserve.

Keywords: *Cecidomyiidae*, cerrado, gall, gall maker.

RESUMO

Galhas e galhadores em plantas da Reserva de Cerrado Pé-de-Gigante, Santa Rita do Passa Quatro, SP, Brasil

Trinta e seis diferentes tipos morfológicos de galhas foram obtidos em folhas, foliólulos, nervuras, pecíolos, ramos e inflorescências de vinte e cinco espécies de plantas na Reserva de Cerrado Pé-de-Gigante, Município de Santa Rita do Passa Quatro, SP, Brasil. As plantas hospedeiras pertencem às famílias: *Anacardiaceae,* Annonaceae, Asteraceae, Bignoniaceae, Caryocaraceae, Erythroxylaceae, Fabaceae, Malpighiaceae, Melastomataceae, Myrtaceae, Ochnaceae, Polygalaceae, Sapindaceae, Sapotaceae e Smilacaceae. Entre as famílias dos insetos galhadores foram observados Cecidomyiidae (Diptera), Pteromalidae (Hymenoptera) e *Diaspididae* (Sternorrhyncha-Hemiptera). Este é o primeiro relato da presença de galhas em plantas dos seguintes gêneros: *Gochnatia* (Asteraceae), *Distictela* (Bignoniaceae), *Banisteriopsis* (Malpighiaceae), *Ouratea* (Ochnaceae) e *Bredemeyera* (Polygalaceae). Os resultados deste trabalho contribuem para o aumento do conhecimento das relações entre plantas hospedeiras e galhadores e da morfologia das galhas da Reserva de Cerrado Pé-de-Gigante.

Palavras-chave: *Cecidomyiidae*, cerrado, galha, galhador.

INTRODUCTION

Different gall makers can attack the same vegetal species, causing the reorganization of species-specific characteristics (Hartley, 1998). The manipulation of the host plant by a gall maker can be so great that the latter assumes control of the gall tissue's chemical composition, which can be quite different from the ungalled tissue (Scareli-Santos, 2001). Some authors have commented on the high level of specificity of gall makers and host plant association (Mani, 1964; Abrahamson & Weiss, 1987).

Although gall inducers belong to many different taxa, the gall makers induce galls in relatively few plant groups, and each one is closely related with the host. According to Abrahamson & Weiss (1987), 87% of all cynipids attack specifically certain species of *Quercus* (Fagaceae). Cynipid (Cynipini, Hymenoptera) – oak (*Quercus* spp., Fagaceae) interaction is a kind of association that Brooks & McLennan (1991) called association by descent or coevolution. This kind of relationship is well known in the Nearctic region, but its study is still incipient in the Neotropical region because gall maker-host plant systems and the relationships between them are only just beginning.

This paper focuses on the determination of the relationship between host plants and gall makers from the Pé-de-Gigante Cerrado Reserve, characterizing the gall morphology, which is very specific to each host plant-gall maker.

MATERIAL AND METHODS

Sampling area

Samples were collected in the Pé-de-Gigante Cerrado Reserve, situated in the municipality of Santa Rita do Passa Quatro, SP, southeastern Brazil (Fig. 1), from 1996 through 2001. The site's geographical coordinates are: 21° 35' S and 47° 35' W. Samples were collected monthly from 1997 to 1998 and at irregular intervals during the other years. The reserve is situated in the Santa Rita mountains at an altitude of 590 to 740 m.

About 98% of the reserve is covered by Cerrado (savanna-like vegetation) with varying physiognomies (Batalha & Mantovani, 2000), which were studied by Pivello *et al*. (1999) based on Landsat-TM satellite images (Fig. 2).

Treatment of samples

The samples were treated as described by Fernandes *et al*. (1988). Cecidomiids were

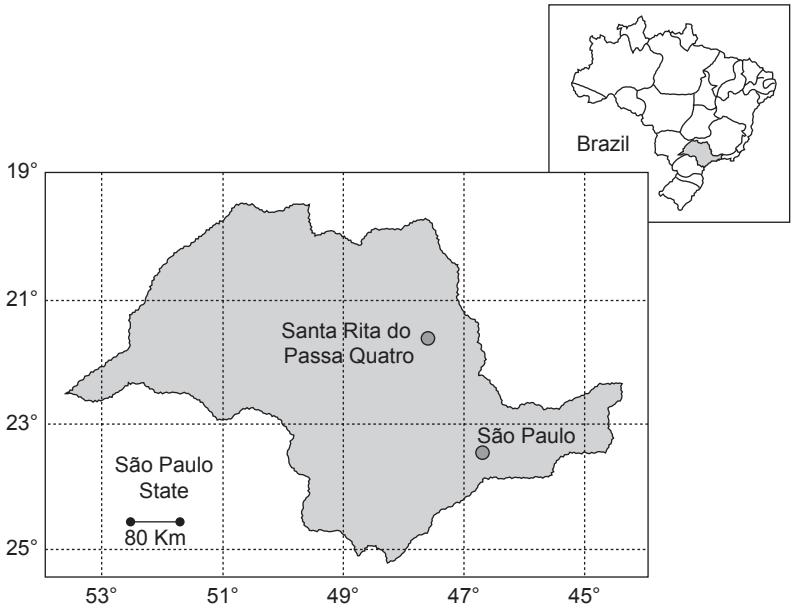


Fig. 1 — Location of the municipality of Santa Rita do Passa Quatro, SP, Brazil (Sallis *et al*., 1995 *apud* Batalha, 1997).

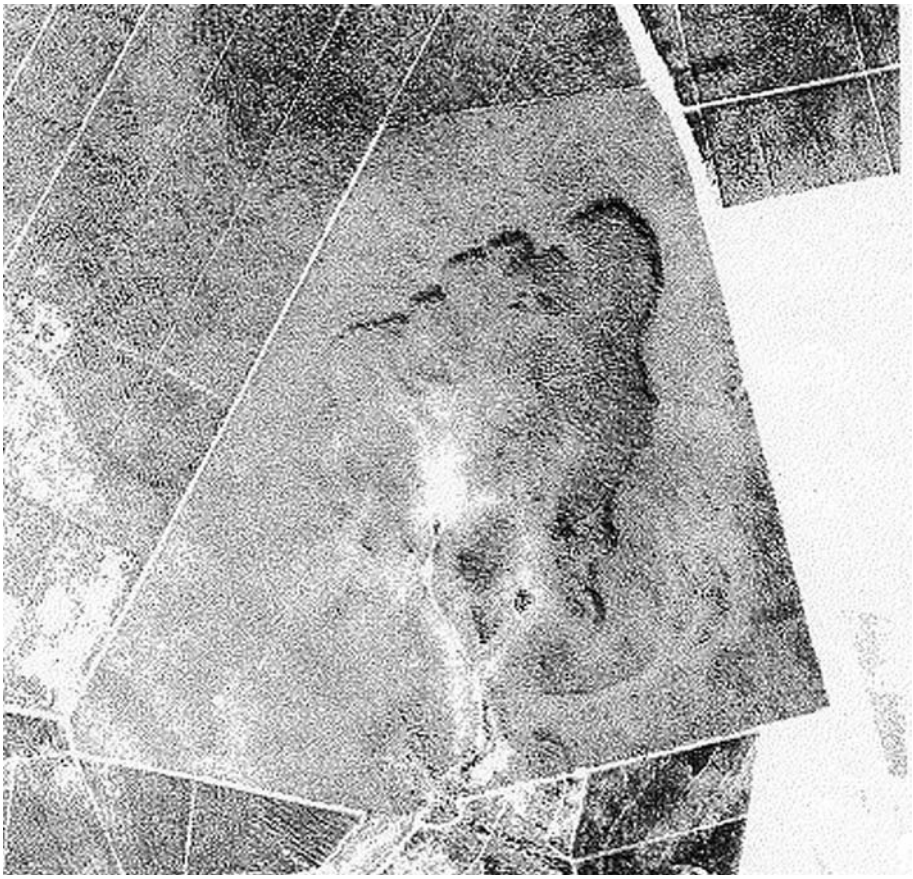


Fig. 2 — Aerial view of Pé-de Gigante Cerrado Reserve, Santa Rita do Passa Quatro, SP, Brazil (Source: Pivello *et al*., 1999).

identified using keys to immatures of the Nearctic Region (Gagné, 1989), and immatures and adults of the Neotropical region (Gagné, 1994). Vouchers of host plants were deposited in the Botanical Section and galls and insects in the Laboratory of Diphthera at the University of São Paulo Faculty of Philosophy, Sciences and Letters Department of Biology in Ribeirão Preto, SP, Brazil.

All the specimens were given a registration number (RN) which is listed in Appendix. The names and distribution of the plant species were looked up in Lorenzi's book (1992) and/or on the homepage of the Missouri Botanical Garden's VAST (VAScular Tropicos) database at: http://mobot.mobot.org/W3T/Search/vast.html. Urso-Guimarães & Scareli-Santos are the authors of the gall pictures presented in this paper.

RESULTS AND DISCUSSION

Table 1 provides information about the relationship between host plants and gall makers of each gall type, while Table 2 lists information on the gall morphology of each host plant. Appendix contains data on the samples and additional information. The galls are featured in Figs. 3 to 32 .

Plant Hosts and Galls of the Pé-de-Gigante Cerrado Reserve

As mentioned earlier herein, morphologically dissimilar galls are frequently found in the same plant species. In the Pé-de-Gigante reserve, *Duguetia furfuracea* (A. St.-Hil.) Benth. & Hook. f. (Figs. 4-6) and *Myrcia bella* Cambess. (Figs. 23-26) presented three types of galls, while

TABLE 1
Morphological description of galls in host plant species of the Pé-de-Gigante Cerrado Reserve, Santa Rita do Passa Quatro, State of São Paulo, Brazil.

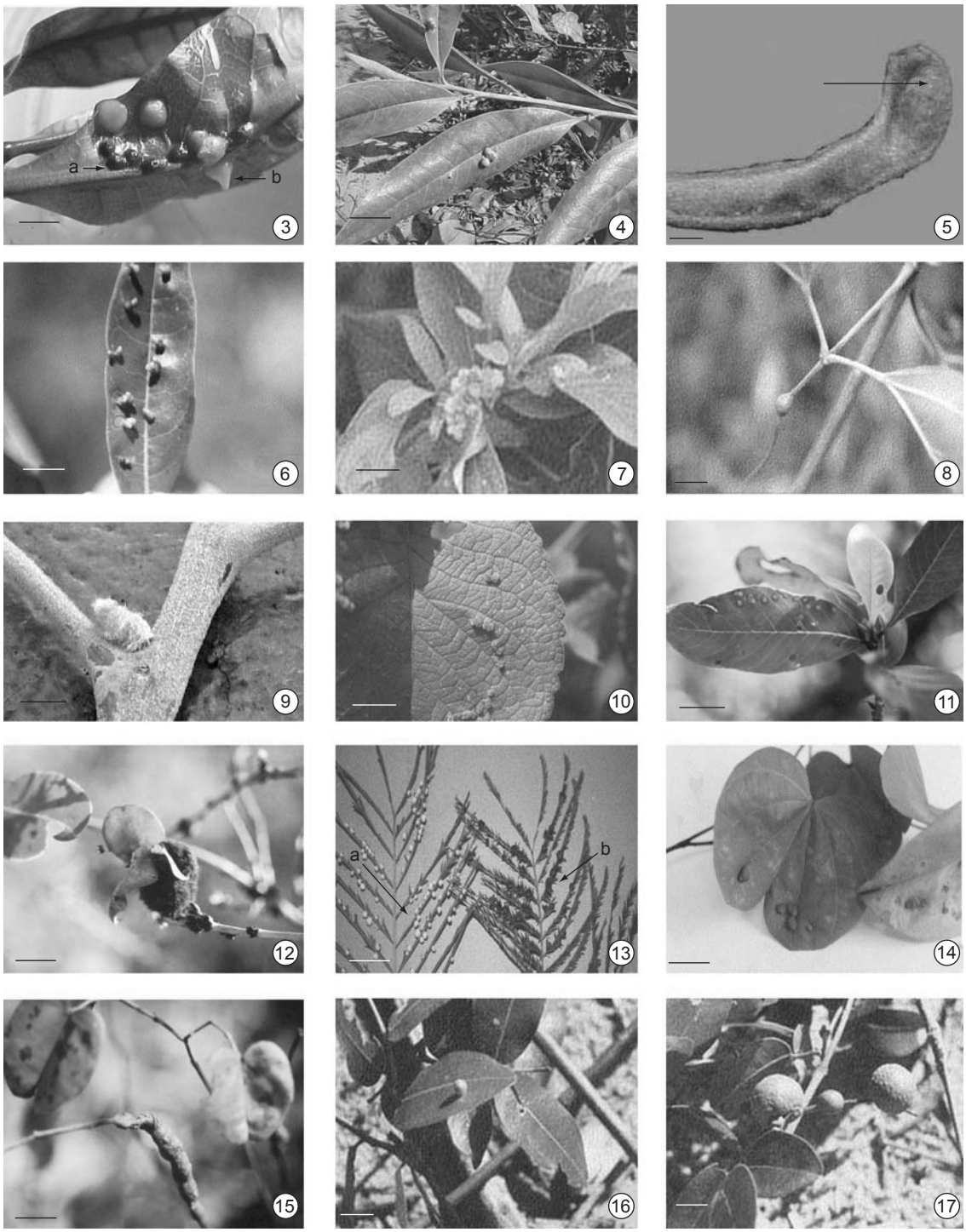
Host plant		Gall morphology					Figure
Family	**Species**	**Organ**	**Shape**	**Color**	**Pubescence**	**Occurrence**	**Number**
Anacardiaceae	*Anacardium humile*	Leaf	Conical	Red	Absent	Isolated	3
Anacardiaceae	*Anacardium humile*	Leaf	Conical	Cream	Present	Isolated	3
Anacardiaceae	*Tapirira guianensis*	Leaf	Conical	Red	Present adaxial	Isolated	-
Annonaceae	*Annona dioica*	Leaf	Globoid	Cream	Present abaxial	Isolated	-
Annonaceae	*Duguetia furfuracea*	Leaf	Globoid	Green to brown	Present	Isolated	4
Annonaceae	*Duguetia furfuracea*	Leaf and stem	Lenticular	Light brown	Present	Isolated	5
Annonaceae	*Duguetia furfuracea*	Leaf	Polipoid	Pink	Absent	Isolated	6
Asteraceae	*Gochnatia pulchra*	Leaf and stem	Globoid	Cream	Present	Grouped	7
Bignoniaceae	*Distictela elongata*	Tendril and leaf	Fusiform	Green	Absent	Isolated	8
Bignoniaceae	*Tabebuia ochracea*	Leaf and stem	Conical	Cream	Present	Isolated	9
Caryocaraceae	*Caryocar brasiliense*	Leaf	Discoid	Ligth brown	Present	Isolated	10
Chrysobalanaceae	*Couepia grandiflora*	Leaf	Discoid	Cream	Present	Isolated	11
Erythroxylaceae	*Erythroxylum suberosum*	Leaf	Conical	Red	Present	Grouped	12
Fabaceae	*Anandenanthera peregrina var. falcata*	Leaflet base	Globoid	Cream	Absent	Isolated	13a
Fabaceae	*Anandenanthera peregrina var. falcata*	Leaflet base	Conical	Red	Absent	Isolated	13b

TABLE 1
Continued...

Host plant		Gall morphology					Figure
Family	**Species**	**Organ**	**Shape**	**Color**	**Pubescence**	**Occurrence**	**Number**
Fabaceae	*Bauhinia rufa*	Leaf	Conical	Red	Present	Grouped	14
Fabaceae	*Bauhinia rufa*	Stem	Fusiform	Brown	Absent	Grouped	15
Fabaceae	*Bauhinia rufa*	Leaf	Globoid	Green	Absent	Isolated	-
Fabaceae	*Copaifera langsdorffii*	Leaf	Globoid	Green	Absent	Isolated	16
Fabaceae	*Copaifera langsdorffii*	Petiole	Globoid	Brown	Absent	Isolated	17
Malpighiaceae	*Banisteropsis pubipetala*	Stem	Fusiform	Green	Absent	Isolated	-
Malpighiaceae	*Banisteropsis pubipetala*	Leaf	Conical	Green	Absent	Isolated	18
Malpighiaceae	*Byrsonima intermedia*	Stem	Fusiform	Brown	Absent	Isolated	19
Malpighiaceae	*Heteropterys byrsonimifolia*	Stem	Fusiform	Brown	Absent	Isolated	20
Melastomataceae	*Miconia stenostachya*	Leaf	Discoid	Cream	Present	Grouped	21
Myrtaceae	*Eugenia birmaginata*	Leaf	Cylindrical	Green	Absent	Isolated	22
Myrtaceae	*Myrcia bella*	Leaf vein and stem	Fusiform	Brown	Absent	Isolated	23
Myrtaceae	*Myrcia bella*	Stem	Fusiform	Brown	Absent	Grouped	24
Myrtaceae	*Myrcia bella*	Leaf bud	Complex gall	Green/ brown	Absent	Isolated	25 and 26
Myrtaceae	*Myrcia uberavensis*	Floral bud	Complex gall	Ligth green	Absent	Isolated	27
Ochnaceae	*Ouratea spectabilis*	Leaf	Conical	Green	Absent	Isolated	28
Polygalaceae	*Bredemeyera floribunda*	Stem	Fusiform	Brown	Absent	Isolated	29
Sapindaceae	*Toulicia tomentosa*	Leaf	Discoid	Ligth brown	Present	Isolated	30
Sapotaceae	*Pouteria torta*	Leaf	Cylindrical	Green	Present	Isolated	31
Smilacaceae	*Smilax coriifolia*	Leaf	Fusiform/ globoid	Green	Absent	Isolated	32

TABLE 2
Morphological description of galls and gall makers in host plant species of the Pé-de-Gigante Cerrado Reserve, Santa Rita do Passa Quatro, State of São Paulo, Brazil.

Host plant		Gall morphology			Gallmaker
Family	**Species**	**Organ**	**Shape**	**Color**	**Identification**
Anacardiaceae	*Anacardium humile*	Leaf	Conical	Red	*Contarinia* sp. n. 1 (Cecidomyiini, Cecidomyiidae)
Anacardiaceae	*Anacardium humile*	Leaf	Conical	Cream	Gen. n., sp. n. (Cecidomyiini, Cecidomyiidae)
Anacardiaceae	*Tapirira guianensis*	Leaf	Conical	Red	Gen. n., sp. n. (Lopesiini, Cecidomyiidae) *Dasineura* sp. n (Oligothrophini, Cecidomyiidae)
Annonaceae	*Annona dioica*	Leaf	Globoid	Cream	Larva of Lasiopteridi (Cecidomyiidae)
Annonaceae	*Duguetia furfuracea*	Leaf	Globoid	Green to brown	Eulophidae (Hymenoptera)
Annonaceae	*Duguetia furfuracea*	Leaf	Lenticular	Green	*Bruggmanniella annonae* Urso-Guimarães & Amorim, 2002 (Asphondyliini, Cecidomyiidae)
Annonaceae	*Duguetia furfuracea*	Leaf	Polipoid	Pink	Larva of Cecidomyiinae (Cecidomyiidae)
Asteraceae	*Gochnatia pulchra*	Leaf and stem	Discoid/Globoid	Cream	Larva of Cecidomyiinae (Cecidomyiidae)
Bignoniaceae	*Distictela elongata*	Tendril and stem	Fusiform	Green	*Contarinia* sp.n. 2 (Cecidomyiini, Cecidomyiidae)
Bignoniaceae	*Tabebuia ochracea*	Leaf	Conical	Cream	Larva of Cecidomyiinae (Cecidomyiidae)
Caryocaraceae	*Caryocar brasiliense*	Leaf	Discoid	Ligth brown	Diaspididae (Hemiptera)
Chrysobalanaceae	*Couepia grandiflora*	Leaf	Discoid	Cream	*Neolasioptera* sp.n. (Alycaulini, Cecidomyiidae)
Erythroxylaceae	*Erythroxylum suberosum*	Leaf	Conical	Red	Gen. n., sp. n. (Oligotrophini, Cecidomyiidae)
Fabaceae	*Anandenanthera peregrina var. falcata*	Leaflet base	Globoid	Cream	Larva of Cecidomyiini (Cecidomyiidae)
Fabaceae	*Anandenanthera peregrina var. falcata*	Leaflet base	Conical	Red	Larva of Oligotrophini (Cecidomyiidae)
Fabaceae	*Bauhinia rufa*	Leaf	Conical	Red	Larva of Cecidomyiinae (Cecidomyiidae)
Malpighiaceae	*Banisteropsis pubipetala*	Leaf	Fusiform	Green	*Clinodiplosis* sp. n. (Clinodiplosini, Cecidomyiidae)
Melastomataceae	*Miconia stenostachya*	Leaf	Discoid	Cream	Fungus
Myrtaceae	*Eugenia birmaginata*	Leaf	Cylindrical	Green	*Asphondylia* sp. n. (Asphondyliini, Cecidomyiidae)
Ochnaceae	*Ouratea spectabilis*	Leaf	Conical	Green	*Contarinia* sp. n. 3 (Cecidomyiini, Cecidomyiidae)
Sapindaceae	*Toulicia tomentosa*	Leaf	Discoid	Ligth brown	Larva of Cecidomyiinae (Cecidomyiidae)
Sapotaceae	*Pouteria torta*	Leaf	Cylindrical	Green	*Youngomyia* sp n 1 (Cecidomyiinae, Cecidomyiidae)
Smilacaceae	*Smilax coriifolia*	Leaf	Fusiform/globoid	Green	Larva of Cecidomyiinae (Cecidomyiidae)



Figs. 3-17 — Galls species of Pé-de-Gigante Cerrado Reserve. 3) *Anacardium humile*; 4-6) *Duguetia furfuraceae*; 7) *Gochnatia pulchra*; 8) *Distictela elongata*; 9) *Tabebuia ochracea*; 10) *Caryocar brasiliense*; 11) *Couepia grandiflora*; 12) *Erythroxylum suberosum*; 13) *Anadenanthera peregrina* var. *falcata*; 14-15) *Bauhinia rufa*; and 16-17) *Copaifera langsdorffii*. (Scale bar = 1 cm).

Figs. 18-32 — Galls species of Pé-de-Gigante Cerrado Reserve. 18) *Banisteriopsis pubipetala*; 19) *Byrsonima intermedia*; 20) *Heteropterys byrsonimifolia*; 21) *Miconia stenostachya*; 22) *Eugenia bimarginata*; 23-24) *Myrcia bella*; 25-26) *Myrcia bella*; 27) *Myrcia uberavensis*; 28) *Ouratea spectabilis*; 29) *Bredemeyera floribunda*; 30) *Toulicia tomentosa*; and 31) *Pouteria torta*; 32) *Smilax coriifolia* (Scale bar = 1 cm).

Anacardium humile A. St.-Hil. (Fig. 3), *Tabebuia ochracea* (Cham.) Standl. (Fig. 9), *Anadenanthera peregrina* (L.) Speg. *var. falcata* (Benth.) Altschul (Fig. 13) and *Copaifera langsdorffii* Desf. (Figs. 16, 17) presented two types. The other plant species contained one type of gall.

The galls showed variations in color and appearance, especially during the maturation period, as depicted for the globoid gall of *D. furfuracea* (Fig. 4), from green to dark gray, and a scaly aspect when mature. In the maturation period, the structures take on stronger shades, as observed in the polypoid leaf gall of *D. furfuracea* (Fig. 6), *Copaifera langsdorffii* (Figs. 16, 17), in the leaf bud, leaf vein and stem, and petiole galls of *M. bella* (Figs. 23-26). When young, the globoid gall of *A. peregrina* is pale yellow, and turns red after maturation (Fig. 13a). All the sampled galls belong to the closed type.

Galls of *Gochnatia pulchra* (Fig. 7), *Tabebuia ochracea* (Fig. 9), *Erythroxylum suberosum* A. St.-Hil. (Fig. 12), and *Pouteria torta* (Mart.) Radlk. (Fig. 31) presented large quantities of trichomes, probably formed as a protection for insects inside the gall. Fernandes *et al*. (1987) stated that the presence of large quantities of trichomes offers a protective barrier for the inducer's insect larvae against attack by parasitoids and small sucking herbivores that feed on gall tissues.

The distribution of galls in plant organs frequently presented an isolated pattern, which Fernandes *et al.* (1988) proposed is a protective strategy against natural enemies. The isolated oviposition of the inducer generates isolated galls, forcing parasitoids to spend their energy searching for and using the galls in immature stages.

This is the first report of galls in the following plant genera: *Gochnatia* (Asteraceae), *Distictela* (Bignoniaceae), *Banisteriopsis* (Malpighiaceae), *Ouratea* (Ochnaceae), and *Bredemeyera* Polygalaceae).

Gall makers

One of the most interesting results of this work is the detection of relationships among host plants, gall makers and associated insects, as indicated in Table 2.

Cecidomyiidae (Diptera) are the predominant gall inducers, but inducers were also reared from *Eurytomidae* (Hymenoptera), *Diaspididae* (Hemiptera), and fungus. *Trotteria* sp. n.1 (Cecidomyiidae, Trotteriini) was found as an inquiline in ex-galls of *Youngomyia* sp.n. in *Pouteria torta*. *Trotteria* also belongs to the family Cecidomyiidae and is traditionally found as an inquiline in ex-galls of Cecidomyiidae in the Neotropical region (Gagné, 1994; Maia, 2001b).

About 95% the host plant-gall maker relationships reported here are new to science. The relationships reported so far have been Malpighiaceae-*Clinodiplosis* from Peru described by Gagné (1994), and *Pouteria-Youngomyia-Trotteria*, whose relationship was reported by Rübsaamen (1916) and Maia (2001b) in a restinga (coastal sandy plains) environment in Rio de Janeiro, Brazil. Tavares (1918) and Houard (1933) also reported galls of *Annona* sp. induced by cecidomiids, and Fernandes *et al*. (1988) and Maia (2001a) described galls in *Erythroxylum*, albeit without providing the plant's specific identification.

The cecidomiids, one of largest families of Diphthera, are little known in Brazil, particularly in areas of open vegetation. As additional results of this study, three new occurrences of genera and thirteen new occurrences of species of the family Cecidomyiidae were identified, and have been described in other papers (Urso-Guimarães & Amorim, 2005; Urso-Guimarães & Amorim, *submitted*). In nine cases, the inducer was collected only in immature stages (larvae), despite five years of diligent sample collecting. These nine types of larvae are from cecidomiids, but specific identification at this level is rarely positive.

The cases in which identification was possible are presented with their diagnostic characteristics. Larvae reared in the creamy gall of *Anacardium humile* (Fig. 3a) probably belong to a new genus of Cecidomyiini. The larvae do not match the key for immatures of the Nearctic Region genera (Gagné, 1989). *Anacardium humile* also yielded larvae of *Contarinia* sp.n.1 in a red gall (Fig. 3b). *Contarinia* is a cosmopolitan genus whose larval diagnostic characteristic is the presence of a pair of corniform papillae in the terminal segment. The new species has two such papillae.

Specimens of the new genus of Lopesiini were collected in the leaf gall of *Tapirira guianensis* Aubl. occurring together with larvae of *Dasineura*. Lopesiini is a tribe with six genera, and the specimens found in this work will be described

as a new genus based on the separated ovipositor cerci of females. The other Lopesiini have fused cerci. *Dasineura* belongs to a nonmonophyletic tribe, Oligotrophini (Gagné, 1994), which has nineteen other Neotropical genera. The diagnostic features of *Dasineura* are clove-shaped larval spatula with six papillae on each side of the spatula and eight terminal papillae in the anal segment. The association with *T. guianensis* is exclusive to this new species.

Specimens of Oligotrophini induce hairy leaf gall in *Erythroxylum suberosum* (Fig. 12).This is a new genus since the specimens do not match the key to Neotropical cecidomiids (Gagné, 1994).

Specimens of both genera reared in *Pouteria torta* belong to a new species. The specimens match the description of *Youngomyia* except for the female's elongated cerci, which are discoid in other species of this genus. The *Trotteria* species share mid and hind femora successively larger than the fore femur. The new species has tibial spurs, a feature exclusive to this family.

The 9th abdominal segment of the specimens of the new species of *Bruggmanniella* have a pyriform basal portion, two longitudinal sclerotized dorsal bands, otherwise membranous and striated, and the pupa has a pair of distal projections on the 8th abdominal segment.

The larva of the new *Clinodiplosis* species has a sclerotized band in the dorsal portion of the thorax, which is exclusive to this species.

As mentioned earlier, the host plant-gall maker relationship is very specific. In the key for the Neotropical Cecidomyiinae, many of the couplets that identify genera are related with the hosts. The species of *Asphondylia*, *Neolasioptera*, and the two species of *Contarinia* were identified as new because this is the first record of these genera, respectively, in galls on *Eugenia bimarginata* (Myrtaceae), *Couepia grandiflora* (Chrysobalanaceae), *Distictela elongata* (Bignoniaceae), and *Ouratea spectabilis* (Ochnaceae).

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APPENDIX

DATA ON CECIDOMYIIDAE GALLS OR DAMAGE

Anacardium humile A. St. Hil (Anacardiaceae)

RN: 169/97, 179/97 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.).

Gall 1 (Fig. 3a). Leaf gall, red, conical, unilocular, larva light yellowish. Gall maker: *Contarinia* sp. n. 1. Material: larvae. Period of occurrence: October-November.

Gall 2 (Fig. 3b). Leaf gall, white, conical, unilocular, larva white. Gall maker: Gen.n., sp.n. (Cecidomyiini, Cecidomyiidae). Material: larvae. Period of occurrence: October-November.

Tapirira guianensis Aubl. (Anacardiaceae)

RN: 114/97, 115/97, 132/97, 147/97, 161/97, 198/98, 234/99, 484/2001, 587/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf conical gall, red, hairy, unilocular, larva orange and white. Gall maker: Gen. n., sp. n. (Lopesiini, Cecidomyiidae) or *Dasineura* sp. n. 1. Material: Gen. n., sp. n: females, exuviae and orange larvae, pupation in gall; *Dasineura* sp. n. 1: white larvae. Period of occurrence: February to November.

Annona dioica A. St.-Hil. (Annonaceae)

Gall. RN: 01 (Scareli-Santos, C. *leg.*). Leaf gall, globoid, cream colored, unilocular. Gall maker: unidentified Lasiopteridi (Cecidomyiidae). Material: larvae. Period of occurrence: May.

Duguetia furfuracea (A. St.-Hil.) Benth. & Hook. f. (Annonaceae)

Gall 1 (Fig. 4). RN: 65a, b/1996, 91/1997, 100/1997, 104/1997, 106/1997, 120/1997, 129/1997, 141/1997, 152/1997, 165/1997, 180/1997, 254/2000, 258/2000, 481/2001 (Urso-Guimarães, MV *leg.*). Leaf globoid gall, green to brown, unilocular, larva white. Gall maker: Eulophidae (Hymenoptera). Material: adults. Pupation in gall. Period of occurrence: January to December.

Gall 2 (Fig. 5). RN: 481/2001 (Urso-Guimarães, M. V. & Scareli-Santos, C. *leg.*). Leaf gall, lenticular, light brown, unilocular. Gall maker: *Bruggmanniella annonae* Urso-Guimarães & Amorim, 2002. Material: exuvia. Pupation in gall. Period of occurrence: March to May.

Gall 3 (Fig. 6). RN: 65c/1996, 255/2000, 481/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Leaf gall, polipoid, pink, glabrous, unilocular, larva white. Gall maker: unidentified Cecidomyiinae. Material: larvae. Period of occurrence: March, May, December.

Gochnatia pulchra Cabrera (Asteraceae)

Gall (Fig. 7). RN: 85/97, 98/97, 101/97, 124/97, 166/97 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf and stem gall, globoid, totally covered by cream colored trichomes, unilocular, larva cream colored. Gall maker: Cecidomyiidae. Material: larva. Period of occurrence: January, February, October.

Distictella elongata (Vahl) Urb (Bignoniaceae)

Gall (Fig. 8). RN: 99/97, 127/97, 139/97, 261/2000 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Swollen tendril and leaf vein green, glabrous, unilocular, larva cream colored. Gall maker: *Contarinia* sp.n. 2. Material: adults, exuviae, larva. Pupation in gall. Period of occurrence: January, March, May.

Tabebuia ochracea (Cham.) Standl. (Bignoniaceae)

Gall (Figs. 9). RN: 126/97, 158/97, 164/97, 168/97, 182/97, 183/97, 267/2000, 574/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Stem and leaf galls, conical, with cream colored trichomes, larva cream colored. Gall maker:

unidentified Cecidomyiinae. Material: larvae. Period of occurrence: March, May, July, September, October, November.

Caryocar brasiliense Cambess (Caryocaraceae)

Gall (Fig. 10). RN: 263/2000 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Leaf gall, discoid gall, hairy, light brown, unilocular. Gall maker: Diaspididae (Hemiptera). Material: adults. Period of occurrence: May.

Couepia grandiflora (Mart. & Zucc.) Benth. ex Hook. f. (Chrysobalanaceae)

Gall (Fig. 11). RN: 572/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Leaf gall, discoid, with cream colored trichomes, isolated, unilocular. Gall maker: *Neolasioptera* sp. n. Material: larvae. Period of occurrence: September.

Erythroxylum suberosum A. St.-Hil. (Erythroxylaceae)

Gall (Fig. 12). RN: 116/97, 146/97, 153/97, 162/97, 573/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf gall, following the principal vein, with red trichomes, multilocular, larva white. Gall maker: Gen.n., sp. n. (Oligotrophini, Cecidomyiidae). Material: adults, exuviae, larvae. Pupation in gall, associated with fungus. Period of occurrence: February, May, July, September.

Anadenanthera peregrina (L.) Speg. var. falcata (Benth.) Altschul (Fabaceae)

Gall 1 (Fig. 13a). RN: 84/97, 102/1997, 145/1997, 150/1997, 188/98 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaflet gall, cream colored, globoid glabrous, unilocular, larva white. Gall maker: unidentified Cecidomyiini. Material: larvae. Period of occurrence: January, May, July.

Gall 2 (Fig. 13b). RN: 185/1997, 188/98 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Leaflet galls, red, conical with the apical portion tapered, glabrous, unilocular, larva white. Gall maker: unidentified Oligotrophini. Material: larvae. Period of occurrence: March, September, December.

Bauhinia rufa (Bong.) Steud. (Fabaceae)

Gall 1 (Fig. 14). RN: 67a/1996, 67c/1996, 88/1997, 121/1997 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Leaf conical gall, with red trichomes, multilocular. Gall maker: unidentified Cecidomyiinae. Material: larvae. Period of occurrence: December – February.

Gall 2 (Fig. 15). RN: 130/1997 (Urso-Guimarães, MV & Scareli-Santos, C. *leg.*). Fusiform stem gall, brown, multilocular. Material: galls. Period of occurrence: March.

Bauhinia rufa (Bong.) Steud.

Gall 3. RN: 67b/96 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Globoid, joining half the leaf, unilocular, Material: galls. Period of occurrence: December.

Copaifera langsdorffii Desf. (Fabaceae)

RN: 0140/1997 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.).

Gall 1 (Fig. 16). Leaf gall, green, globoid. Material: galls. Period of occurrence: May.

Gall 2 (Fig. 17). Globoid gall, hanging from leaf by a petiole, brown, multilocular. Gall maker: unidentified. Material: galls. Period of occurrence: May.

Banisteriopsis pubipetala (A. Jess.) Cuatrec (Malphighiaceae)

Gall 1 (Fig. 18). RN: 159/1997, 237/1999, 577/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf gall green, conical, glabrous. Gall maker: *Clinodiplosis* sp. n. Material: adults, exuviae, larvae. Period of occurrence: July-September.

Gall 2. RN: 159/1997, 237/1999, 577/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Stem gall, green to brown, fusiform, glabrous. Material: galls. Period of occurrence: September.

Byrsonima intermedia A. Juss. (Malphighiaceae)

Gall (Fig. 19). RN: 70/1996 (Urso-Guimarães, MV *leg*.). Swollen stem, fusiform, brown, glabrous, multilocular. Gall maker: unidentified. Material: larvae. Period of occurrence: December.

Heteropterys byrsonimifolia A. Juss (Malphighiaceae)

Gall (Fig. 20). RN: 249/99 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Swollen stem, fusiform, brown, multilocular. Material: Galls. Period of occurrence: September.

Miconia stenostachya Schrank & Mart DC. (Melastomataceae)

Gall (Fig. 21). RN: 151/1997, 250/1999 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.).

Leaf galls, in groups, discoid cream colored. Gall maker: fungus. Period of occurrence: July, September.

Eugenia bimaginata A. DC. (Myrtaceae)

Gall (Fig. 22). RN: 94/1997, 113/1997, 118/1997, 133/1997, 144/1997, 266/2000 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf gall, cylindrical, cream colored, unilocular, larva white. Gall maker: *Asphondylia* sp. n. Material: female, exuviae, larvae. Pupation in gall. Period of occurrence: January to March, May.

Myrcia bella Cambess (Myrtaceae)

Gall 1 (Fig. 23). RN: 86/1997. Swollen vein leaf and petiole, brown, fusiform, glabrous, unilocular. Material: galls (15.i.1997). Period of occurrence: January.

Gall 2. (Fig. 24). RN: 108/1997, 119/1997, 157/1997, 160/1997 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Swollen stem gall, brownish, glabrous, unilocular. Material: galls. Period of occurrence: January, February, July.

Gall 3. (Figs. 25, 26). RN: 92/1997, 260/2000, 482/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Complex gall in leaf bud, green, glabrous, multilocular. Material: galls. Period of occurrence: January, May.

Myrcia uberavensis O. Berg. (Myrtaceae)

Gall (Fig. 27). RN: 87/1997, 110/1997 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Swollen of floral bud, green to brown, multilocular, gregarious larvae. Material: galls. Period of occurrence: January.

Ouratea spectabilis (Mart. ex Engl.) Engl. (Ochnaceae)

Gall (Fig. 28). RN: 236/1999, 583/2001 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf abaxial surface, conical, unilocular. Gall maker: *Contarinia* sp. n. 3. Material: larvae. Period of occurrence: September.

Bredemeyera floribunda Willd. (Polygalaceae)

Gall (Fig. 29). RN: 241/1999 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Swollen stem gall, brown, glabrous, unilocular. Material: Galls (02.ix.1999). Period of occurrence: September.

Toulicia tomentosa Radlk. (Sapindaceae)

Distribution of plant species in the Neotropical Region: Bolivia, Brazil, Paraguay.

Gall (Fig. 30). RN: 105/1997, 155/1997, (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Discoid leaf gall, green to brown, with the escape hole in the adaxial surface, unilocular. Gall maker: unidentified Cecidomyiidae. Material: larvae. Period of occurrence: January, June.

Pouteria torta (Mart.) Radlk. (Sapotaceae)

Gall (Fig. 31). RN: 66/1996, 97/1997, 103/1997, 117/1997, 176/1997, 181/1997, 184/1997, 186/98, 187/98, 189/98, 190/98, 191/98, 192/98, 193/98, 197/1998, 199/1998, 200/1998, 201/1998, 231/99, 233/99, 259/2000 (Urso-Guimarães, MV & Scareli-Santos, C. *leg*.). Leaf galls, green, conical, with red trichomes at the tip, larva orange. Gall maker: *Youngomyia* sp n. Material: adults, pupa, larva of *Youngomyia* sp n 1. and *Trotteria* sp n 1 (inquiline). Pupation in gall. Period of occurrence: January to December.

Smilax coriifolia A. DC. (Smilacaceae)

Gall (Fig. 32). RN: 122/1997, 151/1997, 173/1997 (Urso-Guimarães, MV *leg*.). Swollen principal leaf vein, light green to brown, fusiform or globoid, glabrous grouped galls, larva white. Gall maker: unidentified Cecidomyiinae. Material: larvae. Period of occurrence: February, July, October.