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Utilization of Floral Resources by Bees of the Genus *Frieseomelitta* von Ihering (Hymenoptera: Apidae)

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Utilização de Recursos Florais por Abelhas do Gênero *Frieseomelitta* von Ihering (Hymenoptera: Apidae)

RESUMO - No presente estudo procurou-se investigar fatores que influenciariam o modo de utilização de recursos florais por abelhas *Frieseomelitta* von Ihering. Os dados obtidos na literatura sobre estudos biocenóticos de Apoidea visitando flores no Brasil foram analisados, com identificação e quantificação dos recursos florais utilizados pelas espécies de *Frieseomelitta*, em diferentes áreas. O fenograma de similaridade no uso de recursos entre as espécies de *Frieseomelitta* foi comparado com a hipótese filogenética proposta para o grupo. Das oito espécies de *Frieseomelitta* registradas em 19 estudos, *F. doederleini* (Friese); *F. francoi* (Moure); *F. languida* Moure, *F. varia* (Lepeletier) e *Frieseomelitta* **sp. nov.**; foram amostradas em 36 famílias botânicas. As similaridades e as disparidades encontradas entre as áreas e entre as espécies de *Frieseomelitta* refletiram as semelhanças e diferenças da composição da vegetação de cada área. Abelhas *Frieseomelitta* apresentam padrão de forrageio semelhante ao observado para outros grupos de abelhas eussociais, visitando diversas espécies vegetais, mas concentrando a visita em poucas espécies. *F. languida* e *F. doederleini*, embora apresentem parentesco mais distante dentre as espécies do gênero, mostraram maior similaridade no uso dos recursos, enquanto que *F. varia* e *F. languida*, espécies mais aparentadas do gênero, não apresentaram similaridades no uso de recursos. Embora as informações disponíveis não sejam, ainda, conclusivas, mostram que as restrições filogenéticas não influenciam especificamente o padrão de utilização dos recursos florais pelas espécies de *Frieseomelitta*.

PALAVRAS-CHAVE: Abelha eussocial, caatinga, restrição filogenética, planta visitada

ABSTRACT - The present study intended to verify which factors (phylogenetic relationship or local ecological conditions) would determine how *Frieseomelitta* bees use floral resources. The data obtained in the literature on biocenotic studies of Apoidea visiting flowers in Brazil were analyzed, with identification and quantification of floral resources used by *Frieseomelitta* species in different areas. The phenogram of similarity on use of resources among *Frieseomelitta* species was compared to the phylogenetic hypothesis proposed for the group. Among the eight *Frieseomelitta* species registered in 19 studies, *F. doederleini* (Friese), *F. francoi* (Moure), *F. languida* Moure, *F. varia* (Lepeletier) e *Frieseomelitta* **sp. nov.**, were collected using resources from 36 plant families. *F. doederleini*, *F. languida* e *F. varia* centralized their activity in Caesalpiniaceae, Malpighiaceae e Anacardiaceae. The similarities and disparities found among areas and *Frieseomelitta* species reflected the similarities and differences of the vegetation composition in each area. *Frieseomelitta* bees presented a forage pattern similar to that one presented by other highly social bees, visiting flowers of many plant species, but concentrating their activities in few plant species. Despite the low phylogenetic relationship between *F. languida* and *F. doederleini,* they showed a high similarity on the use of floral resource, while *F. varia* e *F. languida*, species with high phylogenetic relationship, showed low similarity in the use of resource. Although the data obtained are not conclusive, it indicates that phylogenetic restrictions do not influence the pattern of use of floral resource by *Frieseomelitta* bees.

KEY WORDS: Caatinga, eusocial bee, phylogenetic restriction, visited plant

Most of the studies on resource usage by eusocial bees, carried out in Brazil (e.g. Imperatriz-Fonseca *et al*. 1984, Ramalho *et al*. 1989, Wilms *et al*. 1996) suggest that, although Meliponina present generalist habits they concentrate their foraging on only a few floral sources. These studies reveal several patterns in the use of certain botanical families in particular that allow inferences regarding floral preferences among these bees.

However, such a preference in the use of resources is related to the animals' relative ability to collect or consume an item of a given food type (Schoener 1974, Lawlor 1980). This ability is inherent to each species and is related to the degree of relationship between the species and availability of the resources in the environment.

Biesmeijer & Slaa (2006) have recently accomplished a comparative analysis of food plants use by eusocial bees in tropical bee assemblages. However the forums that seek to elucidate the patterns of resource use by communities of eusocial bees in Brazil have not used an approach that takes into consideration the phylogeny of congeneric species. Furthermore, the availability of resources in the environments under study is not yet quantified (the supply of resources can also vary from region to region and time of year). The interpretation of the results of these studies is based only on the community's consumption, through an analysis of the extent of the trophic niche of the particular species. This is mainly due to the basic taxonomic impediments existent for the study of bees in Brazil, like the reduced number of taxonomists, few generic revisions, existence of synonymies, incorrect identification of species and the lack of strong phylogenetic hypotheses (Silveira *et al*. 2002a).

Data concerning the phylogenetic relationship among stingless bees are even scarcer, though with notable studies on the genera *Paratrigona* Schwarz and *Aparatrigona* Moure (Camargo & Moure 1994), *Geotrigona* Moure (Camargo & Moure 1996) and *Partamona* Schwarz (Pedro & Camargo 2003). Recent hypotheses try to explain the phylogenetic relationship among species of the genus *Frieseomelitta* von Ihering (F. F. de Oliveira, in preparation).

Frieseomelitta is a stingless bees genus (Meliponinae, Trigonini), exclusively Neotropical, with wide geographical distribution, occurring from Southwest of Mexico to the Southeast Region of Brazil. Specimes can be found in forests, cerrado, caatinga and mountainous regions, reaching up to 1600 m of altitude (Iguala, Guerrero, Mexico) (Oliveira 2003).

The objective of the present study was to evaluate whether the pattern of floral resource utilization by eusocial bees of the genus *Frieseomelitta* results from phylogenetic restrictions inherent to each species, or whether ecological factors could be the determinant factors for the patterns observed. The study was based on information obtained from a meta-analysis of the studies on flower visiting by species of *Frieseomelitta* (in diverse Brazilian ecosystems) and on the phylogenetic hypothesis proposed for the group (by one of the authors of this work).

It is assumed that, if phylogenetic restrictions are the most decisive factor in the pattern of floral resource utilization, phylogenetically close species of *Frieseomelitta* will present similar patterns, even when resident in communities located in different areas. On the other hand, if local ecological interactions influence the pattern of floral resource utilization, then phylogenetically close species of *Frieseomelitta* will show dissimilar patterns, even when resident in communities located in the same area.

Thus, this work aimed to achieve the following specific objectives:

1. to analyze the Brazilian studies of bee flower visitation in which *Frieseomelitta* species were collected;
2. to verify the faunistic similarity of *Frieseomelitta* species among the areas studied in Brazil;
3. to identify the floral resources used by *Frieseomelitta* species in different Brazilian habitats;
4. to quantify the relative abundance of floral resources used by *Frieseomelitta*;
5. to determine the similarity in the use of floral resources among the species of *Frieseomelitta* and the areas studied;
6. to identify possible ecological trends in the use of floral resources by *Frieseomelitta* bees.

Material and Methods

An analysis was undertaken of the biocenotic studies done in Brazil. These studies usually deal with the plants commonly visited by the various groups of bees, as well as with the predominant species and rare bees and the richness of species according to each area. The information enables a meta-analysis that uses statistical methods to combine the results of separate studies and thereby identifies the existence or lack of tendencies and proposes hypotheses to explain them.

So, information on this subject available in the specialized literature (such as theses, dissertations and other works) was analyzed. Studies were pre-selected that presented the following common factors: 1) undertaken in Brazil; 2) with direct methodology (collections of bees visiting flowers) or indirect methodology (polynic analysis) to describe the use of floral resources by the bees; and 3) samplings of *Frieseomelitta* individuals.

The studies were further classified into those that identified the floral resources used by the *Frieseomelitta* bees and also those that specified the relative abundance of the floral resources. Works that did not correspond to the above criteria were excluded from the analysis.

A grouping analysis was performed, based on the UPGMA method (cluster analysis) in order to evaluate the similarity between species of *Frieseomelitta* and/or the areas studied in the Brazilian biomas where these bees are found. This is a method of quantitative hierarchical classification, which accumulates a species or group of species each time, until it finally generates a single grouping incorporating all the species. During the process, the pairs with greatest similarity are grouped first, until the formation of the final grouping with all the species.

Sorensen's similarity index for the application of UPGMA was used in the present study. The formula to calculate this index is: $CA = 2c/a+b \times 100$, where "CA" is the association

coefficient, "c" is the number of species common to the two samples, "a" is the number of species in the sample "A", and "b" the number of species in the sample "B" (Southwood & Henderson 2000). This index takes into account only the presence or absence of the species and was chosen due to the difficulty in obtaining data on the relative abundance of *Frieseomelitta* species on the flowers.

The similarity matrix and phenogram were prepared using Multivariate Statistical Package version 3.12d.

The areas were classified based on the biogeographical categories proposed by Udvardy (1975) and used by Pinheiro-Machado *et al*. (2002), who identified the following vegetational formations, where systematic investigations of Apoidea were undertaken in Brazil: tropical humid forest (Atlantic Forest and Amazonian Forest); subtropical humid and temperate forests; tropical savannas (*cerrado*); tropical dry forest (*caatinga*) and temperate grasslands.

Results

From the nineteen studies analyzed, eight species of *Frieseomelitta* were registered, namely: *F. doederleini* (Friese, 1900) (F.d.); *F. francoi* (Moure, 1946) (F.f); *F. flavicornis* (Fabricius, 1798) (identified as *F. savannensis* (Roubik, 1980)) (F.s.); *Frieseomelitta* **sp. nov.** (F.F. de Oliveira in preparation - identified as *F. silvestrii faceta* Moure); *F. languida* Moure, 1989 (F.l); *F. trichocerata* Moure, 1988 (F.t.); *F. dispar* (Moure, 1950) (F.v.d); and *F. varia* (Lepeletier, 1836) (F.v.). In some studies, individuals of *Frieseomelitta* were not identified at species level (F.sp.) (Table 1).

The faunistic similarity between the species of *Frieseomelitta* according to the areas studied in Brazil is presented in Fig. 1. Nine studies reported the floral resources visited by *Frieseomelitta* and four out of these were performed in the *cerrado*, four in the *caatinga* and one in the Amazon region (Table 2).

In the above mentioned studies, individuals from five species of *Frieseomelitta* (F.d.; F.f.; F.sp.nov.; F.l.; and F.v.) were collected when they visited 73 species of vegetation belonging to 36 botanical families. The botanical families that presented the largest number of vegetable species visited by *Frieseomelitta* individuals were as follows: Caesalpiniaceae (n = 10), Anacardiaceae (n = 6), Fabaceae (n = 6), Euphorbiaceae (n = 5), Malpighiaceae (n = 5), Bignoniaceae (n = 3), Capparaceae (n = 3) and Mimosaceae (n = 3) (Table 2).

The analysis of the studies in which it was possible to determine the relative abundance of *Frieseomelitta* individuals (F.d.; F.l. and F.v.) revealed that 24 botanical families were visited and that these bees tended to concentrate the visits on Caesalpiniaceae, Malpighiaceae and Anacardiaceae families (Fig. 2).

In areas of *caatinga*, such as in Ibiraba, Bahia state (BA), 316 individuals of *F. languida* were collected when they visited 11 botanical families; of this total 54.5% were collected on the Caesalpiniaceae species *Copaifera coriacea* Mart. Similar data were observed in São João do Cariri, Paraíba state (PB), where most visits (33.2%) of the 46 individuals of *F. doederleini* were registered on 12 botanical families and the individuals were collected when visiting *Caesalpinia pyramidalis* Tul., also a Caesalpiniaceae (Aguiar *et al*. 1995).

Regarding the botanical family Malpighiaceae, in Ibiraba, BA, 88 (25.3%) all individuals of *Frieseomelitta* were collected on *Byrsonima gardnerana* Adr. Juss., and in Cajuru, São Paulo state (SP), three individuals of *F. varia* were collected on *Mascagnia cordifolia* Griseb. The Anacardiaceae family in Nova Casa Nova, BA, represented only by *Astronium* aff. *urundeuva* (Fr. All.) Engl., was frequently visited by *F. doederleini*, accounting for 53 (62.4%) of the total of 85 individuals collected on eight botanical families.

Fig. 3 presents the phenogram of similarity among the species of *Frieseomelitta* according to the botanical families visited. *F. languida* and *F. doederleini* formed an independent group. The similarities between the areas in terms of the genera of plants visited by *Frieseomelitta* are shown in Fig. 4.

Discussion

Species of *Frieseomelitta* have been sampled in studies on the use of floral resources carried out in Brazil in areas located in humid tropical forests (Amazon Forest), tropical savannas (*cerrado*) and dry forests (*caatinga*). However, they were not registered in areas more to the south of the country, probably due to the biogeographic distribution of the *Frieseomelitta* genus (Silveira *et al*. 2002b) and also to their intolerance to cold climates (Ribeiro & Bego 1994).

Despite six species of *Frieseomelitta* were documented during the investigation of nests in the Amazon (Camargo 1994), only three species were registered (*F. flavicornis*; *Frieseomelitta* **sp. nov.** and *F. trichocerata*) in punctual studies on the use of floral resources and pollination, undertaken in that region (Absy *et al*. 1984; Laroca 1999; Falcão *et al*. 1999, 2001, 2002). According to Pinheiro-Machado *et al*. (2002), to date, no systematic studies have collected bees from flowers in the Amazon basin. The lack of this type of study could be due to the difficulty on collecting bees in the canopy of the forests.

The *caatinga* ecosystem presented the greatest richness of *Frieseomelitta* species (n = 4) collected on flowers, certainly due to the ease of collection and to its representativity in areas such as Milagres (Castro 2001) and Ibiraba, BA (Neves & Viana 2002), where the genus stood out in number of species, when compared with other genera of eusocial bees.

In relation to the faunistic similarity observed in this study, one can to a certain extent affirm that it reflects the geographical distribution of the *Frieseomelitta* species. For instance, species such as *F. flavicornis*, *Frieseomelitta* **sp. nov.** and *F. trichocerata* have been registered exclusively in areas located in the Amazon. However, *F. languida* and *F. varia* have only been found in areas located in the *caatinga* and *cerrado*, respectively.

When the comparison among areas also considered floral resources, the families Caesalpiniaceae, Malpighiaceae and Anacardiaceae seem very important for the populations of *Frieseomelitta*, mainly for those located in areas of *caatinga* and *cerrado*, since they were visited by at least four of the five

Table 1. Brazilian studies registering *Frieseomelitta* individuals, based on collection from flowers and polynic analysis.

Biogeographical categories (Udvardy, 1975)	Areas	Coordinates	F.d.	F.f.	F.s.	F.sp. nov.	F.l.	F.t.	F.d.	F.v.	F.sp.	Total	Authors
Tropical humid forests (Amazonian Forest)	Região do médio Amazonas	3°5' S e 55°7' W				x						1	Absy *et al.* (1984)
	Porto Velho - RO	8°42' S e 63°54' W						x				1	Laroca (1999)
	Manaus - AM	3°8' S e 60°1' W			x	x					x	3	Falcão *et al.* (1999, 2001, 2002)
Tropical savannas (*cerrado*)	Uberlândia - MG	19°19' S e 48°23' W	x							x		2	Carvalho & Bego (1997)
	Luis Antônio - SP	21°42' S e 47°42' W								x		1	Mateus (1998)
	Cajuru - SP	21°18' S e 47°12' W								x		1	Pedro (1992)
	Paraopeba - MG	19º20'S e 44º20'W								x	x	2	Silveira & Campos (1995)
	Lençóis - BA	12°34' S e 41°23' W		x								1	Viana (1992); Martins (1994)
Tropical dry forest (*caatinga*)	São João do Cariri - PB	7°25' S e 36°30' W	x									1	Aguiar & Martins (1997)
	Castro Alves - BA	12°45' S e 39°25' W									x	1	Carvalho (1999)
	Nova Casa Nova - BA	9°26' S e 41°50' W	x									1	Castro (1994); Martins (1994)
	Milagres - BA	12°53' S e 39°51' W	x	x			x					3	Castro (2001)
	Região de Patos - PB	7°2' S e 37°16' W							x			1	Zanella (1999)
	Ibiraba - BA	10°48' S e 42°50' W	x				x				x	3	Viana (1999); Neves (2001); Neves & Viana (2002)

Species: F.d. = *F. doederleini*; F.f. = *F. francoi*; F.s. = *F. flavicornis* (identified as *F. savannesnsis*, F.F. de Oliveira in preparation); *F.*sp.n. = *Frieseomelitta* **sp.nov.** (F.F. de Oliveira in preparation – identified as *F. silvestrii faceta* Moure **nom. nud.**); F.l. = *F. languida*; F.t. = *F. trichocerata*; F.d. = *F. dispar*; F.v. = *F. varia*; F.sp. = species of *Frieseomelitta* not identified.

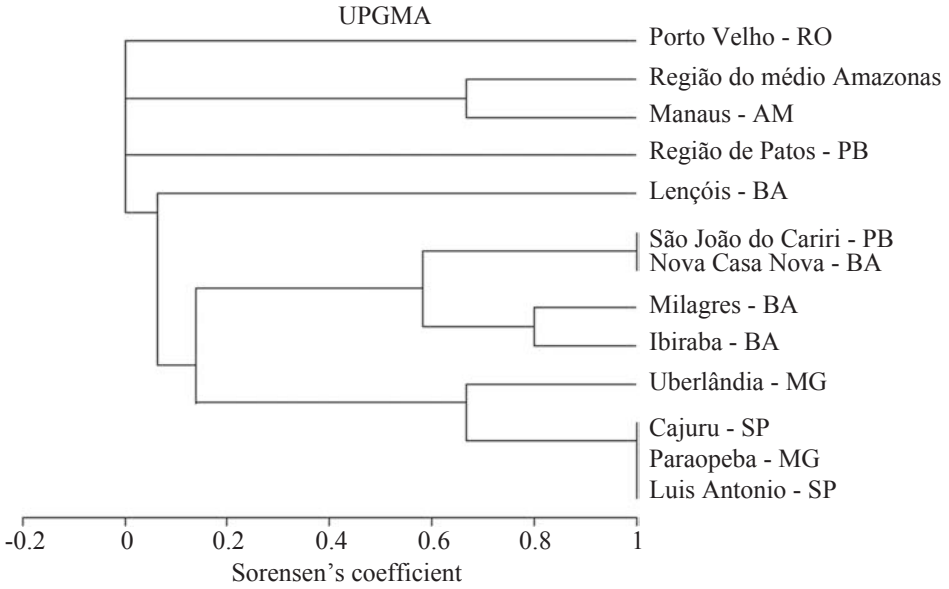

Fig. 1. Similarity between *Frieseomelitta* faunas of 13 areas studied in Brazil. (Authors and areas studied: Laroca 1999, Porto Velho, RO; Absy *et al*. 1984, Médio Amazonas; Falcão *et al*. 1999, 2001, 2002, Manaus, AM; Zanella 1999, Patos, PB; Viana 1992 e Martins 1994, Lençóis, BA; Aguiar & Martins 1997, São João do Cariri, PB; Castro 1994 e Martins 1994, Nova Casa Nova, BA; Castro 2001, Milagres, BA; Viana 1999, Neves 2001 e Neves & Viana 2002, Ibiraba, BA; Carvalho & Bego 1997, Uberlândia, MG; Pedro 1992, Cajuru, SP; Silveira & Campos 1995, Paraopeba, MG; Mateus 1998, Luis Antônio SP).

species registered (*F. doederleini*, *F. francoi*, *Frieseomelitta* **sp. nov.** and *F. languida*).

In the present study, individuals of *Frieseomelitta* visited species belonging to Caesalpiniaceae in all *caatinga* areas [Ibiraba, BA (Neves & Viana 2002), São João do Cariri, PB (Aguiar & Martins 1997), Nova Casa Nova, BA (Castro 1994, Martins 1994), and Milagres, BA (Castro 2001)], with a relatively high abundance in Ibiraba, BA (Neves & Viana 2002) and São João do Cariri, PB (Aguiar & Martins 1997), what reinforces the great importance of this resource in the *caatinga* areas studied.

The predominance of eusocial bees visiting Caesalpiniaceae could be a consequence of the melitophilous characteristics present in species as *C. coriacea* and *C. pyramidalis*, like massal floration and simultaneously nectar and pollen resources. These two vegetable species probably represent a key resource for the populations of *Frieseomelitta* in Ibiraba, BA (Neves & Viana 2002) and São João do Cariri, PB (Aguiar & Martins 1997).

The prominence of Malpighiaceae and Anacardiaceae families is due to visits by *F. doederleini* and *F. languida* to individuals of *B. gardnerana* present in Ibiraba, BA (Neves & Viana 2002) and to the presence of *A. urundeuva* in Nova Casa Nova, BA (Castro 1994, Martins 1994), frequently visited by *F. doederleini*. Plants of *A. urundeuva* were also present in São João do Cariri, PB (Aguiar & Martins 1997), although only one individual of *F. doederleini* was collected from them.

Some considerations should be made regarding the results discussed in this work. Unfortunately most of the studies in the literature only present graphical data regarding the relative abundance (percentage of *Frieseomelitta* individuals collected on flowers) for the species of vegetation visited by the various species of *Frieseomelitta*, often due to their low abundance in the areas studied; other studies only provide information regarding the species of bees and predominant plants. Consequently in some studies, like those undertaken in Uberlândia, Minas Gerais State (MG), (Carvalho & Bego 1997), Lençóis, BA (Viana 1992, Martins 1994) and in Milagres, BA (Castro 2001), the relative abundance of *Frieseomelitta* individuals on the flowers could not be obtained, what, in a certain manner, restricted the analysis.

However, based on the data analyzed here, it can be inferred that *Frieseomelitta* bees visited a great number of plant species, but tended to concentrate on just a few species [(Ibiraba, BA (Neves & Viana 2002) and São João do Cariri, PB (Aguiar & Martins 1997)].

This foraging pattern is similar to that observed for other species of eusocial bees, such as: *Plebeia* Schwarz, that visited with high intensity only Anacardiaceae, Balsaminaceae, Solanaceae and Palmae (Knoll & Imperatriz-Fonseca 1993); *Scaptotrigona* Moure concentrated its foraging on Compositae, Leguminosae, Myrataceae and Euphorbiaceae (Ramalho 1990); *Melipona* Illiger visited with greater intensity plants of the Myrtaceae, Melastomataceae, Solanaceae and Mimosaceae families (Ramalho *et al*. 1989); *Tetragonisca angustula* (Latreille) concentrated foraging on Euphorbiaceae, Moraceae, Leguminosae and Myrtaceae (Imperatriz-Fonseca *et al*. 1984).

Concerning which floral resources are used, it was expected that phylogenetic restrictions would influence the use of these resources by the species of *Frieseomelitta*, and that species closely related would show similarity, even when they inhabited different areas. However, *F. varia* and *F. languida* presented a close relationship (Fig. 5) but this similarity was

Table 2. Plants visited by *Frieseomelitta* individuals in Brazilian studies.

Plants visited		Species of *Frieseomelitta*				
Botanical families	Species	F.d.[2, 3, 4, 6]	F.f.[4, 8]	F.sp.nov.[1]	F.l.[4, 6]	F.v.[3, 5, 7]
Acanthaceae	*Harpochilus neesianus* Mart. ex. Ness.				x	
Amaranthaceae	*Gomphrena vaga* Mart.	x				
Anacardiaceae	*Astronium urundeuva* (Fr. All.) Engl.	x				
	Spondias sp.				x	
	Spondias mombim L.			x		
	Spondias tuberosa Arruda	x	x		x	
	Schinopsis brasiliensis Engl.	x	x		x	
	Tapirira guianensis Aubl.			x		
Apocynaceae	*Aspidosperma pyrifolium* Mart.	x				
Araliaceae	*Didymopanax vinosum* (C.&S.) March.					x
Asclepiadaceae	*Ditassa retusa* Mart		x			
Asteraceae	*Centratherum punctatum* Cass.		x			
Bignoniaceae	*Arrabidaea* sp.	x			x	
	Tabebuia rosea (Bertol.) A. DC				x	
	Tabebuia impetiginosa (Mart. ex DC.) Standl.	x				
Boraginaceae	*Cordia leucocephala* Moric.	x				
Cactaceae	*Pilosocereus* sp.	x				
Caesalpiniaceae	*Caesalpinia microphylla* Mart.	x				
	Caesalpinia pyramidalis Tul.	x	x			
	Caesalpinia ferrea Mart.				x	
	Cassia sp.			x		
	Copaifera coriacea Mart.				x	
	Hymenaea eriogyne Benth.				x	
	Peltogyne pauciflora Benth.				x	
	Senna gardneri (Benth.) Irwin & Barneby				x	
	Senna macranthera (Collad.) Irwin & Barneby				x	
	Tamarindus indica L.	x	x		x	
Capparaceae	*Capparis yco* Mart. ex Eichler				x	
	Capparis jacobinae Mart. ex Eichler				x	
	Cleome spinosa Jacq.	x				
Caryocaraceae	*Caryocar brasiliensis* Camb.	x				x
Celastraceae	*Maytenus rigida* Mart.				x	
Combretaceae	*Combretum leprosum* Mart.	x				
Connaraceae	*Rourea induta* Planch.					x
Convolvulaceae	*Evolvulus glomeratus* Ness ex Mart		x			
Euphorbiaceae	*Alchornea* sp.			x		
	Croton mucronifolius Muell. Arg.	x				

Continue

Table 2. Continuation.

Plants visited		Species of *Frieseomelitta*				
Botanical families	Species	F.d.[2, 3, 4, 6]	F.f.[4, 8]	F.sp.nov.[1]	F.l.[4, 6]	F.v.[3, 5, 7]
Euphorbiaceae (continuation)	*Croton sonderianus* Muell. Arg.	x				
	Jatropha pohliana Muell. Arg.	x				
	Maprounea guianensis Aubl.	x				
Fabaceae	*Aeschynomene* cf. *martii* Benth.				x	
	Cajanus cajan (L.) Millsp		x			
	Canavalia aff *dictyota* Piper		x			
	Chaetocalyx scandens (L.) Urb.				x	
	Dioclea marginata Benth.				x	
	Luetzelburgia auriculata (Fr. All.) Ducke	x				
Labiatae	*Hyptis crenata* Pohl. ex. Benth.	x				x
	Marsypianthes chamaedrys (Vahl) Kuntze		x			
Malpighiaceae	*Banisteriopsis pubipetala* (Juss.) Cuatr					x
	Byrsonima crassa Nield.					x
	Byrsonima aff. *crassifolia* (L.) Kunth		x			
	Byrsonima gardnerana Adr. Juss.	x			x	
	Mascagnia cordifolia Griseb.					x
	Tetrapteris sp.				x	
Malvaceae	*Herissantia crispa* (L.) Briz.	x				
	Sida galheirensis Ulbr.	x				
Melastomataceae	*Miconia* sp.			x		
Memecylaceae	*Mouriri pusa* Gardner	x			x	
Mimosaceae	*Anadenanthera colubrina* (Vell.) Brenan	x				
	Mimosa ophthalmocentra Mart. ex Benth.	x				
	Mimosa tenuiflora (Willd.) Poir.				x	
Moraceae	*Cecropia* sp.			x		
Molluginaceae	*Glischrothamnus ulei* Pilger.				x	
Olacaceae	*Ximenia americana* L. ssp. Americana				x	
Onagraceae	*Ludwigia octovalis* (Jack) Raven		x			
Polygalaceae	*Polygala martiana* A. W. Bernn.				x	
Proteaceae	*Roupala montana* Aubl.					x
Rubiaceae	*Borreria* sp.		x			
	Diodia apiculata (Willd. Ex Roen & Schult) K. Schum.	x				
Simarubaceae	*Simaba ferruginera* St. Hil.	x			x	
Solanaceae	*Nicotiana glauca* Graham	x				
Velloziaceae	*Vellozia dasypus* Seubert		x			
Verbenaceae	*Lippia* aff. *origanoides* H. B. K.		x			

Species: F.d. = *F. doederleini*; F.f. = *F. francoi*; F. **sp.nov.** = *Frieseomelitta* **sp. nov.** (F.F. de Oliveira in preparation – identified as *F. silvestrii faceta* Moure **nom. nud.**); F.l. = *F. languida*; F.v. = *F. varia*.; Studies: [1] Absy *et al*. (1984), [2] Aguiar *et al*. (1995), [3] Carvalho & Bego (1997), [4] Castro (1994, 2001), [5] Mateus (1998), [6] Neves (2001), [7] Pedro (1992), [8] Viana (1992).

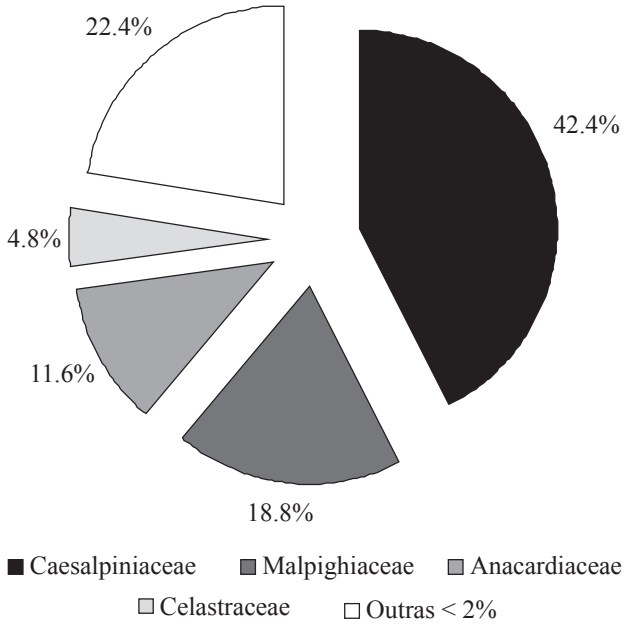

Fig. 2. Relative abundance of the families visited by individuals of *F. doederleini*, *F. languida* and *F. varia* in *caatinga* and *cerrado* areas of Brazil (Authors and areas studied: Pedro 1992, Cajuru, SP; Castro 1994, Nova Casa Nova, BA; Aguiar *et al*. 1995, São João do Cariri, PB; Neves 2001, Ibiraba, BA).

not registered (Fig. 3). The opposite was observed with *F. languida* and *F. doederleini*, despite their higher phylogenetic distance, they presented the greatest similarity in the use of floral resources when pairs of species were analyzed.

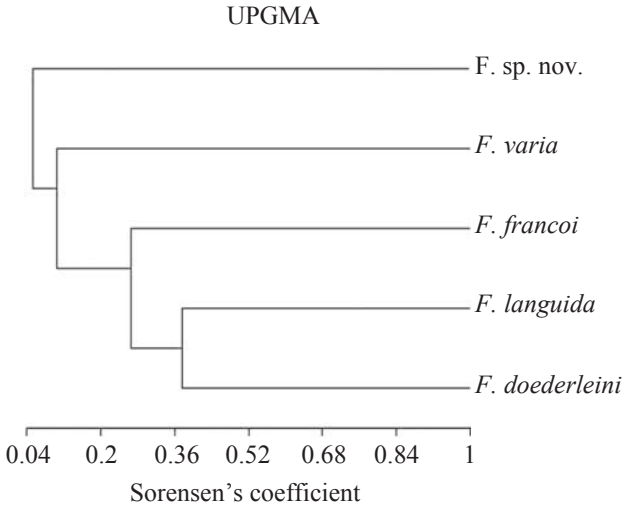

Fig. 3. Similarity among the species of *Frieseomelitta* in Brazil, according to the families visited. (Absy *et al*. 1984; Pedro 1992; Viana 1992, 1999; Zanella 1999; Martins 1994; Silveira & Campos 1995; Carvalho & Bego 1997; Mateus 1998; Falcão *et al*. 1999, 2001, 2002; Castro 2001; Neves 2001; Neves & Viana 2002).

Thus, in principle, it seems that the phylogenetic restrictions do not influence the use of resources by species of *Frieseomelitta* and that this can also be generalized for other groups of eusocial bees.

It is probable that ecological factors, such as availability of the floral resources and characteristics of the local vegetation structure, such as composition and abundance, are more relevant in the pattern of floral resource usage for species of

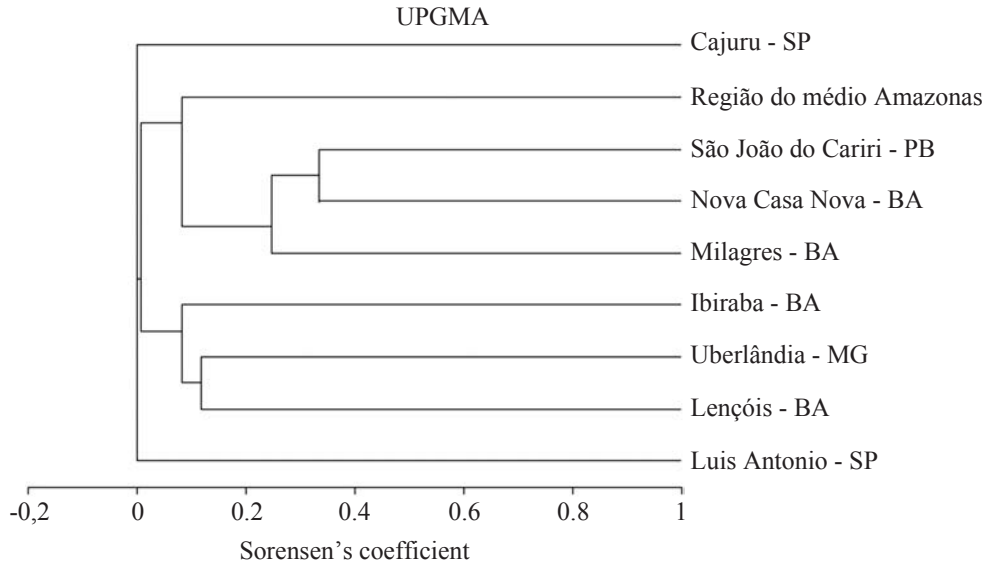

Fig. 4. Similarity among the areas according to the genera of plants visited by *Frieseomelitta* in Brazil. (Authors and areas studied: Pedro 1992, Cajuru, SP; Absy *et al*. 1984, Médio Amazonas; Aguiar & Martins 1997, São João do Cariri, PB; Castro 1994 e Martins 1994, Nova Casa Nova, BA; Castro 2001, Milagres, BA; Viana 1999, Neves 2001 e Neves & Viana 2002, Ibiraba, BA; Carvalho & Bego 1997, Uberlândia, MG; Viana 1992 e Martins 1994, Lençóis, BA and Mateus 1998, Luis Antônio, SP).

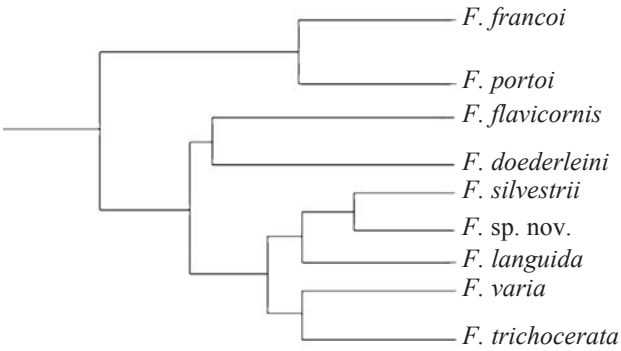

Fig. 5. Phylogeny of the *Frieseomelitta* species in Brazil. Data kindly provided by F. F. de Oliveira (in preparation).

Frieseomelitta eusocial bees. The similarities and disparities in the use of floral resources observed among species of *Frieseomelitta*, in this study could be related to the similarities and differences found between the biomas, mainly *caatinga* and *cerrado* (Fig. 4) and to the ecological interactions between the populations present in each bioma.

If there was some influence originating from the phylogenetic restrictions, it seems that they would be expressed on a higher taxonomic level and would serve to differentiate the foraging behavior of eusocial bees from solitary bees.

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