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THE ARBOREAL ANT MOSAIC IN TWO ATLANTIC RAIN FORESTS

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ABSTRACT. Using the "canopy raft" and the "canopy sled," two techniques permitting direct observation and sampling, we studied the arboreal ant mosaic in two equatorial Atlantic forest canopies, one in Cameroon, the other in French Guiana. In both cases, 167 individual trees were sampled. The trees sampled in Cameroon (29 families; 63 species) were occupied by only three dominant ant species: *Oecophylla longinoda* and two *Crematogaster* species, one of them occupying 88.6% of the trees. *Camponotus brutus,* a sub-dominant species, was recorded on three out of eight trees unoccupied by dominants. The trees sampled in French Guiana (35 families; 90 species) were occupied by 43 dominant and/or sub-dominant ant species, with five dominants noted more frequently than the others: *Azteca instabilis* (19.2% of the trees), *Cephalotes atratus* (10.8%), *Crematogaster limata parabiotica, A. chartifex,* and *Dolichoderus quadridenticulatus* (9.6% each). The most frequent subfamily of ants was the Myrmicinae in Cameroon (89.2%), and the Dolichoderinae in French Guiana (53%). In Cameroon, trees were noted to be occupied by two or three dominants (i.e., co-dominants), while this situation represented 29.4% of the Guianian trees.

Key words: ant mosaics, rain forest, French Guiana, Cameroon

INTRODUCTION

The ants of tropical rain forest canopies are characterized by their great abundance, with estimates varying from 19% to 69.7% of all arboreal arthropods; and they represent 10% to 46% of the arboreal arthropod biomass (Fittkau & Klinge 1973, Adis et al. 1984, Stork 1987, Watanabe & Ruaysoongnern 1989, Tobin 1991, Majer 1993, Stork & Blackburn 1993, Davidson & Patrell-Kim 1996, Floren & Linsenmair 1997). The species richness of tropical arboreal ants can be high (192 species were collected in a rainforest canopy in Malaysia; Floren & Linsenmair 1997; see also references cited therein), yet only a few ant species are numerically abundant and therefore called "dominants." Dominant ants are characterized by extremely populous colonies (up to several million individuals), the ability to build their nests (mostly carton builders), and a highly developed intra- as well as interspecific aggressiveness that results in a mosaic pattern distribution of their territories. Among the biotic features determining the arboreal ant mosaic, two aspects are classically cited: habitat heterogeneity and the territoriality of dominant ants (see Hölldobler & Wilson 1990 and literature cited therein).

Sometimes, two dominants can share the same territory, and are called "co-dominant." Dominant species tolerate "non-dominant" species with smaller colonies. An intermediary status also exists, "sub-dominant" species. In certain situations the latter are able to defend territories as do dominants (Majer 1972, 1993, Leston 1973, Majer et al. 1994). When sub-dominant species play the role of dominant, their density in the foliage is high, as is their level of aggressiveness. Nevertheless, two or more of these species can tolerate each other (co-dominant status) resulting in a larger population defending the same territory (see Mercier & Dejean 1996, Mercier et al. 1997, 1998).

Studies of the canopy ant mosaic have been conditioned by the size of the trees, so that most research data involving large samples were obtained from plantations (citrus, cocoa, or mango) whose low canopy permits direct observation (Taylor 1977, Jackson 1984, Majer 1993, 1994, Smith 1994, Medeiros et al. 1995) or easy sampling (palm trees to 15 m in height; Dejean et al. 1997b). The high rain forest canopy ant mo-

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saic has been studied on fallen trees, or using chemical knock-down techniques (Wilson 1959, Leston 1978, Majer 1990, Majer & Camer-Pesci 1991, Dejean et al. 1994).

For the present study we used the "canopy raft" and the "canopy sled," two complementary methods permitting direct access to the undisturbed canopy and the sampling of a large number of tall trees. With the same method we compared the ant mosaics in two Atlantic forests situated on either side of the ocean at nearby latitudes.

Materials and Methods

This study was carried out at the field station established at Akok in the Campo Forest Reserve, Southern Province, Cameroon, and in the forest of Paracou, French Guiana, during the *Opération Canopée* 91 and 96, respectively. We used the "canopy raft" (measuring about 600 m^2 in Cameroon, adjusted to 400 m^2 in French Guiana, as the tree crowns were smaller) and the "canopy sled" (for the structures and details on the sites see Ebersolt 1992, 1998).

Each study was conducted on five different sites using the "canopy raft" and during six excursions of the "canopy sled" permitting sampling on 167 trees both in Cameroon and French Guiana. We believe that our methods resulted in a random sampling of canopy ants, for the following reasons. Although the criteria determining the positioning of the "raft" are conditioned only by the shape of the supporting tree crown (which must be sufficiently large and even to support the raft), the surrounding trees, accessible along the edges, do not necessarily meet this condition. The six excursions of the "canopy sled" covered different loops in the forest and were evenly spread over the entire 360 degrees around the station. The trees sampled corresponded to irregular alighting determined by chance.

We studied only the distribution of dominant or co-dominant ants (i.e., dominant species themselves and sub-dominant species when they have large colonies defending a territory).

Voucher specimens of ants gathered from Cameroon were deposited and identified in the Natural History Museum, London; those from French Guiana in the Laboratorio de Mirmecologia, Itabuna, Bahia, Brazil. The nomenclature used for identification was developed by Bolton (1995). Comparisons of percentages were made using the Fisher exact test (StaXact 2.05 software).

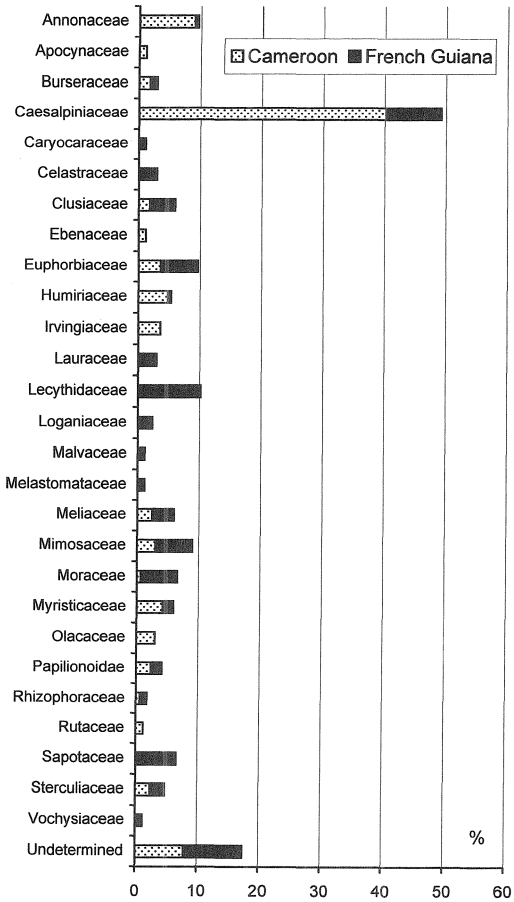

FIGURE 1. Comparison between the tree families of the Atlantic forests of Cameroon and French Guiana (167 trees in both cases).

Results

The trees sampled in Cameroon belonged to 63 species and 29 families; those from French Guiana to 92 species and 36 families (APPENDICES 1 and 2). In both situations some trees remained undetermined, even at the family level. In Cameroon, Caesalpiniaceae greatly dominated (40.2% of the trees), with *Dialium* being the most frequent. Annonaceae were second (9%), while other families were represented by low percentages (FIGURE 1). In French Guiana, six families represented at least six percent of the trees, with Lecythidaceae being the most frequent (10.2%).

In the Cameroonian forest canopy, we recorded only three dominant ant species belonging to the subfamilies Myrmicinae and Formicinae: two *Crematogaster,* with *C. depressa* Latreille occupying 87.4% of the trees and *Oecophylla*

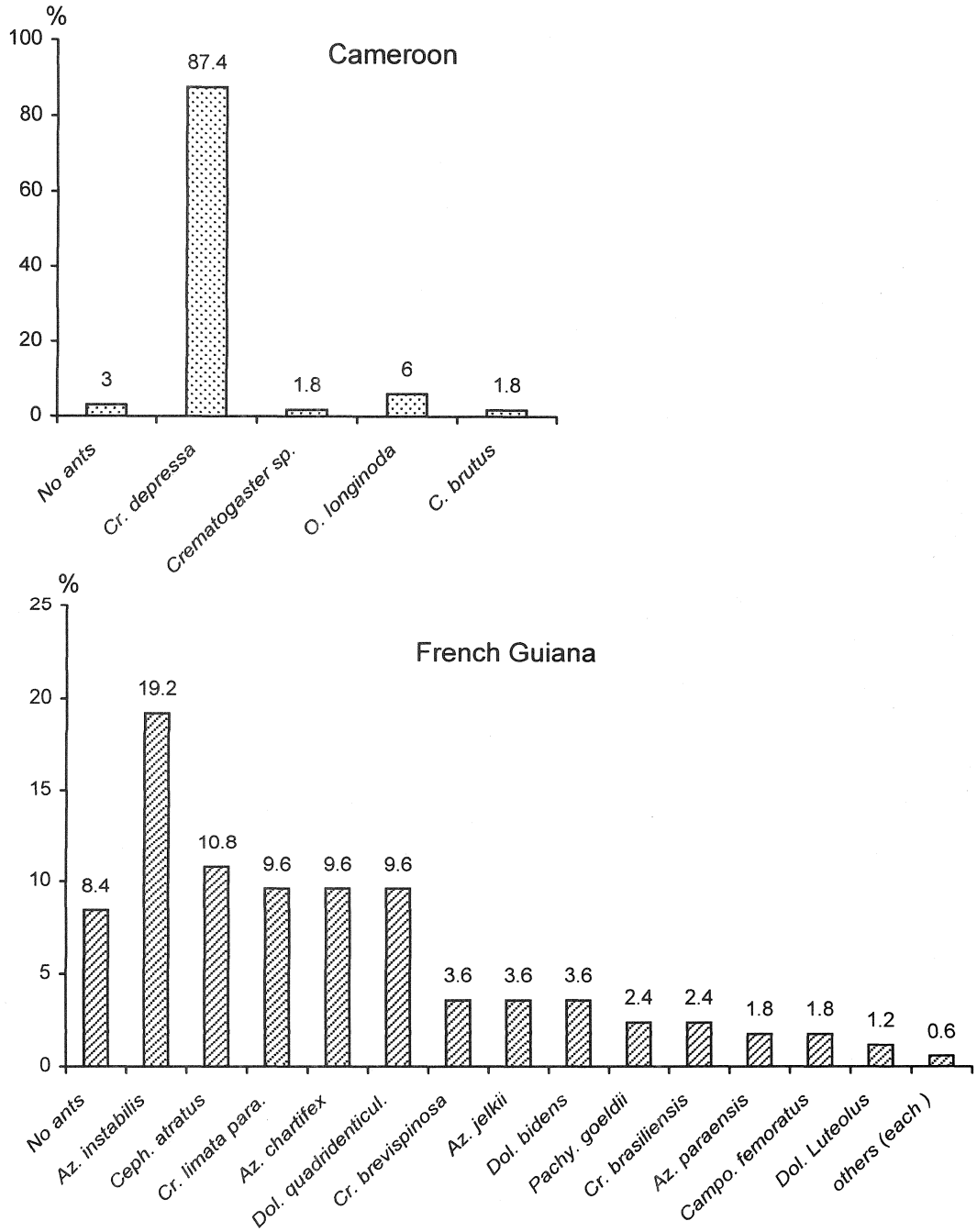

FIGURE 2. Percentages of trees occupied by dominant or co-dominant ant species (167 trees both in Cameroon and French Guiana).

longinoda Latreille (6%). *Camponotus brutus* F., a sub-dominant species, occupied the crowns of three trees (1.8%); while we did not record ants on 3% of the trees (APPENDIX 1, FIGURE 2). Other ant species were recorded, with the help of the raft, but were in a position of non-dominance.

The canopy ant mosaic of French Guiana was

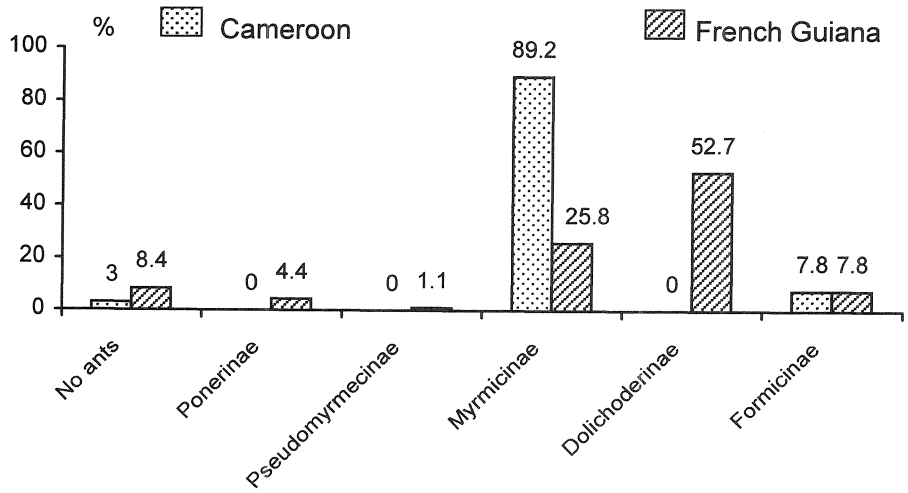

FIGURE 3. Comparison between the subfamilies of ants occupying the tree crowns. Note the absence of Dolichoderinae in Cameroon, while this subfamiliy is the most frequent in French Guiana (167 trees in both cases).

very different with 43 ant species able to occupy the crowns of trees, alone or in association with others (FIGURE 2). They belonged to five subfamilies, the Dolichoderinae being the most frequent (52.7% of the trees) (APPENDIX 2, FIGURE 3). The five most frequent dominant species were three Dolichoderinae, *Azteca instabilis* Fr. Smith, *A. chartifex* Forel and *Dolichoderus quadridenticulatus* Roger (FIGURE 2) and two Myrmicinae, *Cephalotes atratus* L. and *Crematogaster limata parabiotica* Fr. Smith. Although each of these species can be associated with another, a significant difference was noted between *C. l. parabiotica* (usually co-dominant) and *A. instabilis* (usually dominant; FIGURE 4).

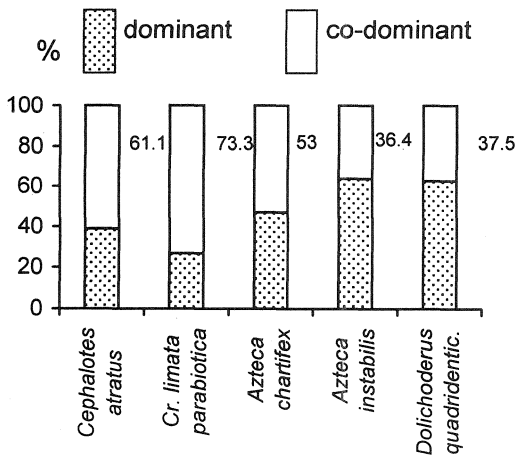

FIGURE 4. Comparison between cases when the crowns were occupied by one ant species (dominant) or by two or more ant species (co-dominant) in French Guiana. Only the five most frequent ant species were compared, resulting in a significant difference for only *Crematogaster. limata parabiotica* versus *Azteca instabilis* ($P = 0.03$).

The three Dolichoderinae seem to be mutually exclusive as they were never found on the same tree (APPENDIX 2). Finally, in the African forest we recorded only dominant species while in French Guiana we recorded dominant and co-dominant species. The comparison resulted in significant differences (FIGURE 5).

DISCUSSION

Both forests studied were directly exposed to strong winds, with numerous treefall gaps and some pioneer trees belonging to the genera *Musanga* in Cameroon and *Goupia* in French Guiana where *Cecropia* were limited to forest edges. The canopies were very different with a larger diversity of small-crowned trees in French Guiana (so, the use of a smaller raft; see Ebersolt 1998).

Compared to the uniformity recorded in Cameroon, the larger diversity of ant species able to occupy tree crowns in French Guiana was high, although only five species occupied 53.3% of the tree crowns.

Several factors explain the larger diversity of dominant ant species in the Guianian forest. The larger diversity of tree species might have repercussions on the diversity of ants; but beyond this diversity, their smaller crowns permit subdominant species to take on the role of dominant

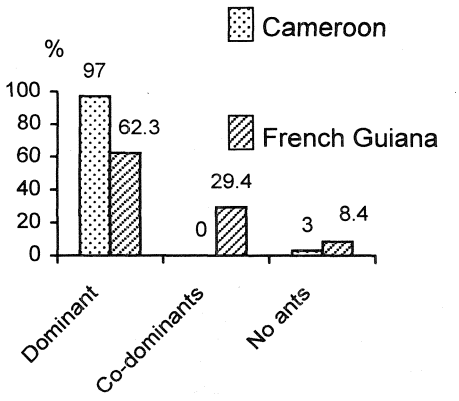

FIGURE 5. Comparisons between the two Atlantic forests when considering tree crowns occupied by a dominant or by co-dominant ants (167 trees in both cases). The difference between the two forests was highly significant ($P = 4 \times 10^{-18}$).

(relationships between the respective sizes of the colony and the territory). As a result, we also recorded Ponerinae, considered as "primitive" and unexpected in this role, although noted in pioneer vegetal formations and tree crop plantations (Majer et al. 1994, Smith 1994, Medeiro et al. 1995, Dejean et al. 1997a). The abundance of epiphytic bromeliads and orchids in Neotropical forests and their role in lodging ants influences sub-dominant ant diversity (see Dejean et al. 1995, Dejean & Olmsted 1997). In the Cameroonian forest, epiphytes sheltering ants were restricted to ferns of the genus *Platycerium* which sheltered *Camponotus brutus,* a sub-dominant species. The evolutionary process between arboreal ants and epiphytes in America also implies the active role of the ants in the formation of ant gardens (Davidson 1988, Orivel et al. 1998) and concerns the ability of two or several ant species to share the same territory (i.e., co-dominants). Although co-dominants were first described in Africa (Majer 1972, Leston 1973), we did not record them in the Cameroonian forest canopy, but noted them in 29.4% of the French Guianan trees. This situation is frequent in tropical America (Dejean & Olmsted 1997), where moreover certain species also share nests. This phenomenon, called parabiosis, concerns mostly *Crematogaster limata parabiotica* (Myrmicinae) and *Camponotus femoratus* F. (Formicinae); but it also has been noted for Dolichoderinae and Ponerinae (Davidson 1988, Orivel et al. 1997).

The canopy also sheltered specific dominant and sub-dominant ants. For instance, Pseudomyrmecinae were rare at our rainforest sites in French Guiana and absent in Cameroon (but present in an old secondary forest). Our findings corroborate those of Delabie et al. (1998) who believe that this subfamily is more represented and diversified in disturbed areas. Also, we did not record *T. aculeatum* Mayr, a dominant African Myrimicinae frequent in the forest edge, in old secondary forests, and in tree crop plantations (Jackson 1984, Dejean et al. 1994, 1997b), at our sites in Cameroon.

In conclusion, the present study emphasizes large differences in the evolutionary processes leading to the formation of the ant mosaics on each side of the Atlantic Ocean. The larger diversity on the American side can be explained by the large presence of myrmecophytic epiphytes and smaller territories to defend (due to smaller tree crowns). Other factors are the diversification of the Dolichoderinae (most African species are ground-dwelling) with several species from the genera *Azteca* and *Dolichoderus,* and behavioral influences—most ant species can share their territories, sometimes even their nests, with certain others.

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APPENDIX 1. Relationships between dominant/subdominant arboreal ant species and their host tree species in Cameroon. Three of the ant species were dominant (*Crematogaster depressa, Cr.* sp. 1, and *Oecophylla longinoda*), and one sub-dominant (*Camponotus brutus*). Numbers represent percentage of total trees in which found (N = 167).

Host tree species	Total % of trees	*Cr. depressa*	*Cr.* sp. 1	*Oe. longinoda*	*Ca. brutus* (sub-dominant)	No dominant ants
Anacardiaceae						
Antrocaryon micraster	0.6	0.6				
Annonaceae						
Enantia chlorantha	1.2	0.6				0.6
Pachypodanthium staudtii	2.4	2.4				
Xylopia staudtii	3.6	3.0	0.6			
Undetermined	1.8	1.8				
Apocynaceae						
Landolphia sp.	0.6	0.6				
Undetermined	0.6				0.6	
Burseraceae						
Santiria trimera	1.2	1.2				
Santiria sp.	0.6	0.6				
Caesalpiniaceae						
Afzelia bipindensis	0.6	0.6				
Anthonotha fragrans	1.8	1.2	0.6			
Anthonotha lamprophyllum	1.2	1.2				
Brachystegia cynometroides	0.6	0.6				
Cynometra sp.	1.2	1.2				
Dialium pachyphyllum	24.6	24.0		0.6		
Didelotia africana	0.6	0.6				
Erythrophleum guineense	5.4	5.4				
Gilbertiodendron N° 4275	1.2	0.6	0.6			
Hymenostegia afzelii	0.6	0.6				
Mildbraediodendron excelsum	0.6	0.6				
Tetraberlinia bifoliolata	0.6	0.6				
Undetermined	1.2	1.2				
Cecropiaceae						
Musanga cecropioides	0.6	0.6				
Chrysobalanaceae						
Maranthes chrysophylla	0.6	0.6				
Clusiaceae						
Garcinia kola	0.6			0.6		
Symphonia globulifera	1.2					1.2
Combretaceae						
Strephonema pseudocola	0.6	0.6				
Dilleniaceae						
Tetracera sp.	0.6	0.6				
Ebenaceae						
Diospyros sanza-minika	0.6	0.6				
Diospyros sp. N° 4333	0.6	0.6				
Euphorbiaceae						
Dichostemma glaucescens	0.6	0.6				
Drypetes gossweileri	1.2	1.2				
Sapium ellipticum	0.6	0.6				
Uapaca guineensis	1.2	1.2				

APPENDIX 1. Continued.

Host tree species	Total % of trees	*Cr. depressa*	*Cr.* sp. 1	*Oe. longinoda*	*Ca. brutus* (sub-dominant)	No dominant ants
Fabaceae (Papilionoideae)						
Millettia laurentii	1.8	1.8				
Undetermined: N° 4259	0.6	0.6				
Flacourtiaceae						
Homalium longistylum	0.6	0.6				
Humiriaceae						
Sacoglottis gabonensis	4.8	4.8				
Irvingiaceae						
Desbordesia sp. N° 4266	0.6	0.6				
Irvingia gabonensis	2.4			2.4		
Undetermined	0.6	0.6				
Meliaceae						
Carapa procera	2.4	1.8		0.6		
Mimosaceae						
Albizia sp.	0.6	0.6				
Piptadeniastrum africanum	1.8	1.8				
Undetermined	0.6					0.6
Moraceae						
Ficus sp.	0.6	0.6				
Myristicaceae						
Pycnanthus angolensis	1.8	1.8				
Staudtia kamerunensis	0.6	0.6				
Scyphocephalium mannii	0.6	0.6				
Scyphocephalium sp. N° 4332	1.2	1.2				
Myrtaceae						
Syzygium staudtii	0.6	0.6				
Olacaceae						
Coula edulis	1.2	0.6				0.6
Ongokea gore	1.2	0.6			0.6	
Strombosia zenkeri	0.6	0.6				
Rhizophoraceae						
Anopyxis klaineana	0.6	0.6				
Rubiaceae						
Nauclea diderrichii	0.6	0.6				
Rutaceae						
Fagara macrophylla	1.2			1.2		
Simaroubaceae						
Odyendyea gabonensis	0.6	0.6				
Sterculiaceae						
Cola hypochrysea	0.6	0.6				
Cola lateritia	0.6	0.6				
Ulmaceae						
Holoptelea grandis	0.6	0.6				
Vochysiaceae						
Erismadelphus exsul	0.6	0.6				
Undetermined family	7.8	6.6		0.6	0.6	
Number of corresponding trees	167	146	3	10	3	5

APPENDIX 2. Relationships between dominant/subdominant arboreal ant species and their host tree species in French Guiana. Numbers represent percentage of total trees in which found (N = 167). An asterisk ()* indicates cases where sub-dominant species were noted. Co-dom = co-dominant species.

Host tree species	% of trees	*Cephalotes atratus*	*Crematogaster limata parabiotica*	*Azteca chartifex*	*Azteca instabilis*	*Dolichoderus quadridenticulatus*	Other ant species
Anacardiaceae							
Tapirira sp.	0.6						0.6: *Crematogaster* sp.
Annonaceae							
Duguetia calycina	1.2					0.6	0.6: *Crematogaster amapaensis* + *Azteca paraensis*
Arecaceae							
Undetermined	0.6						0.6: *Dolichoderus attelabiodes*
Bignoniaceae							
Jacaranda copaia	0.6						No ants
Boraginaceae							
Cordia sagotii	0.6			0.6			
Burseraceae							
Undetermined (ref. FH 4453)	0.6		Co-dom	Co-dom			Co-dom: *Dolichoderus bidens*
Undetermined	0.6						0.6: *Dolichoderus decollatus*
Caesalpiniaceae							
Bocoa prouacensis	0.6	0.6*					Co-dom: *Azteca jelskii*
Dicorynia guianensis	2.4						No ants
Eperua falcata	2.4	0.6*			1.8*		Co-dom: *Azteca* sp.; *D. decollatus*; *C. arboreus*; *Cr. heathi*
Eperua grandiflora	1.2				0.6		0.6: *Azteca* sp.
Eperua sp.	1.2						0.6: *C. femoratus* + *Cr. brasiliensis* 0.6: *C. bidens* + *Ps. gracilis*
Macrolobium cf. *bifolium*	1.8					1.2	0.6: *Camponotus rapax*
Tachigali sp.	0.6						0.6: *Dolichoderus bidens*
Vouacapoua americana	1.2		0.6				0.6: *Pachycondyla goeldii*
Caryocaraceae							
Caryocar glabrum	0.6				0.6		
Caryocar sp.	0.6						0.6: *Camponotus* sp.
Celastraceae							
Goupia glabra	3.0			0.6			0.6: *Azteca schimperi* + *Cr. brevispinosa* 0.6: *Crematogaster* sp.; 0.6: no ants 0.6: *Camponotus arboreus*
Chrysobalanaceae							
Licania canescens	1.8	Co-dom		Co-dom	0.6	0.6	
Licania laxiflora	0.6	Co-dom		Co-dom			Co-dom: *Cr. brevispinosa* + *Pachycondyla villosa*

APPENDIX 2. Continued.

Host tree species	% of trees	*Cephalotes atratus*	*Crematogaster limata parabiotica*	*Azteca chartifex*	*Azteca instabilis*	*Dolichoderus quadridenticulatus*	Other ant species
Licana ovalifolia	0.6						0.6: *Azteca schimperi*
Licania sprucei	0.6		0.6				
Parinari montana	0.6		0.6				
Undetermined	1.2						0.6: *Solenopsis (Diplorhoptrum) sp. 1; 0.6: No ants*
Clusiaceae							
Clusia sp.	1.8						0.6: *Cr. brasiliensis; 0.6: C. fastigatus; 0.6: No ants*
Symphonia globulifera	1.2		Co-dom		Co-dom		0.6: *Camponotus sp. + Crematogaster* sp.
Symphonia sp.	0.6	0.6					
Tovomita sp.	0.6				0.6*		Co-dom: *Cr. amapaensis + Camponotus* sp. + *Pheidole* sp.
Cyclanthaceae							
Undetermined	0.6						0.6: *Cr. brevispinosa*
Dichapetalaceae							
Tapura capitulifera	0.6						0.6: *Dolichoderus lutosus + Pseudomyrmex pupa*
Elaeocarpaceae							
Sloanea sp.	0.6					0.6	
Euphorbiaceae							
Chaetocarpus schomburgkianus	3.0	1.2*		Co-dom	1.2*	Co-dom	Co-dom: *C. femoratus + C. rapax + Pachycondyla foetida*
Drypetes sp.	0.6	Co-dom	Co-dom	Co-dom			Co-dom: *C. crassus*
Hevea guyanensis	0.6				0.6*		Co-dom: *Crematogaster* sp.
Sagotia racemosa	1.8			0.6	0.6		0.6: *Azteca jelskii + C. novogranadensis*
Fabaceae (Papilionoideae)							
Andira coriacea	0.6			0.6*			Co-dom: *Procryptocerus* sp.
Hymenolobium flavum	0.6						No ants
Swartzia panacoco	1.2				0.6		0.6: *Azteca* sp.
Hugoniaceae							
Hebepetalum humiriifolium	0.6				0.6*		Co-dom: *Crematogaster erecta*
Humiriaceae							
Humiria balsamifera	0.6						No ants
Lauraceae							
Licaria cannella	0.6						0.6: *Azteca jelskii*
Ocotea rubra	0.6				0.6		
Ocotea sp.	0.6				0.6		
Undetermined	1.2					0.6	0.6: *Pachycondyla* sp. nr *crenata*

APPENDIX 2. Continued.

Host tree species	% of trees	*Cephalotes atratus*	*Crematogaster limata parabiotica*	*Azteca chartifex*	*Azteca instabilis*	*Dolichoderus quadridenticulatus*	Other ant species
Lecythidaceae							
Couratari guianensis	0.6						0.6: *Dolichoderus bidens*
Eschweilera micrantha	2.4	1.2			0.6		0.6: *Pachycondyla crenata*
Eschweilera sagotiana	0.6	0.6					
Lecythis idatimon	0.6				0.6		
Lecythis persistens	1.2				0.6	0.6*	Co-dom: *Camponotus godmani*
Lecythis sp.	1.8		0.6*				0.6: *Za. cordatus*; 0.6 *Crematog.* sp; Co-dom: *Cr. brevispinosa*
Undetermined (ref. FH 4454)	0.6			0.6*			Co-dom: *Myrmelachista* sp. 1 + *Procrypt. pictipes*
Undetermined (ref. FH 4455)	0.6		0.6*				Co-dom: *Myrmelachista* sp. 1
Undetermined	1.8				0.6		0.6: *Dolichoderus bidens; 0.6: Camponotus sp. 1*
Leguminosae							
Undetermined (ref. FH 4456)	0.6						0.6: *Crematogaster* sp.
Loganiaceae							
Undetermined	2.4		Co-dom	Co-dom	1.2*		Co-dom: *Xenomyrmex* sp. + *Cr. erecta*; 0.6: No ants
Malvaceae							
Undetermined	1.2						0.6: *Azteca schimperi*; 0.6: no ants
Melastomataceae							
Mouriri crassifolia	1.2					0.6*	0.6: *Azteca jelskii*; Co-dom: *Az. jelskii + Az. paraensisi*
Meliaceae							
Carapa procera	3.6		0.6	0.6	1.2	0.6*	0.6 *Azteca* sp.; Co-dom: *Azteca jelskii*
Mimosaceae							
Abarema mataybifolia	0.6						0.6: *Dolichoderus bidens*
Enterolobium schomburgkii	0.6				0.6*		Co-dom: *Camponotus* sp. 2
Inga cf. alba	1.2			0.6	0.6		
Inga sp.	0.6						0.6: *Azteca jelskii*
Parkia nitida	0.6					0.6*	Co-dom: *Daceton armigerum*
Parkia pendula	0.6	Co-dom	Co-dom				
Parkia velutina	0.6rqc		0.6*				Co-dom: *Pseudomyrmex* sp. gp *pallidus*
Parkia sp.	1.2		0.6				0.6: *Crematogaster brevispinosa*

APPENDIX 2. Continued.

Host tree species	% of trees	*Cephalotes atratus*	*Crematogaster limata parabiotica*	*Azteca chartifex*	*Azteca instabilis*	*Dolichoderus quadridenticulatus*	Other ant species
Moraceae (including Cecropiaceae)							
Brosimum guianense	0.6					0.6	
Brosimum parinarioides	0.6						0.6: *Ectatomma lugens*
Brosimum rubescens	0.6						0.6: *Azteca jelskii*
Coussapoa sp.	0.6						0.6: *Azteca* sp.
Helicostylis pedunculata	1.2				0.6	0.6*	Co-dom: *Pseudomyrmex* sp.
Morus sp.	0.6						0.6: *Crematogaster* sp. + *Camponotus crassus*
cf. Morus	0.6						0.6: *Pseudomyrmex gracilis*
Trymatococcus oligrandus	0.6						0.6: *Dolichoderus bidens*
Undetermined	0.6		Co-dom		Co-dom		Co-dom: *Tapinoma* sp. 1
Myristicaceae							
Virola michelii	1.2			0.6			0.6: *Crematog.* sp.; Co-dom: *Paraponera clavata* + *C. rapax*
Virola sp.	0.6			0.6*			Co-dom: *Pseudomyrmex oculatus*
Opiliaceae							
Undetermined (ref. FH 4469)	0.6			0.6			
Quiinaceae							
Quiina macrophylla	0.6						0.6: *Azteca paraensis*
Rhizophoraceae							
Cassipourea guianensis	1.2	0.6					0.6: *Azteca paraensis*
Rosaceae							
Undetermined	0.6						No ants
Sapotaceae							
Chrysophyllum pomiferum	0.6	0.6*					Sd. *Ectatomma tuberculatum* + *Odontomachus hastatus*
Chrysophyllum sp.	1.2	1.2*					Sd. *Pachycondyla foetida*
Ecclinusa guianensis	0.6				0.6		
Pouteria engleri	0.6					0.6	
Pouteria grandis	0.6						No ants
Pradosia sp.	0.6						0.6: *Cr. nigropilosa* + *Dolichoderus gagates*
Undetermined	2.4	0.6			1.2*		0.6: No ants; Co-dom: *Zacryptocerus cordatus*
Sterculiaceae							
Sterculia (ref. FH 4474)	0.6		0.6*				Co-dom: *Zacryptocerus maculatus*
Sterculia sp.	0.6						0.6: *Pachycondyla goeldii*

APPENDIX 2. Continued.

Host tree species	% of trees	*Cephalotes atratus*	*Crematogaster limata parabiotica*	*Azteca chartifex*	*Azteca instabilis*	*Dolichoderus quadridenticulatus*	Other ant species
Undetermined (ref. FH 4473)	0.6						0.6: *Cr. brevispinosa* + *Pachycondyla goeldii*
Undetermined (ref. FH 4452)	0.6						0.6: *Cr. brasiliensis* + *C. fastigatus* + *Ps. gracilis*
Vochysiaceae							
Qualea rosea	1.2					0.6	0.6: *Cr. brevispinosa* + *Myrmelachista* sp. 1
Undetermined family							
Undetermined 1	0.6						0.6: *Azteca paraensis*
Undetermined 2	0.6						0.6: *Cr. erecta* + *C. godmani* + *Ectatomma tuberculatum* + *E. edentatum*
Undetermined 3	0.6						0.6: *C. femoratus* + *Cr. brasiliensis* + *C. crassus*
Undetermined 4	0.6						0.6: *C. femoratus* + *Cr. brasiliensis*
Undetermined 5	0.6			0.6			
Undetermined 6	0.6						0.6: *Crematogaster brevispinosa*
Undetermined 7	0.6						0.6: *Azteca jelskii*
Undetermined 8	0.6	0.6					
Undetermined 9	0.6		0.6*				Co-dom: *Dolichoderus bidens* + *C. crassus*
Undetermined 10	0.6						0.6: *Pachycondyla goeldii*
Undetermined 11	0.6						0.6: *Dolichoderus lutosus* + *Crematogaster* sp. 1
Undetermined 12	0.6						0.6: *Camponotus* sp. 2
Undetermined 13	0.6						0.6: *Azteca* sp.
Undetermined 14	0.6						0.6: *Camponotus crassus* + *C. abdominalis*
Undetermined 15	0.6				0.6		
Dead tree	0.6						0.6: *Camponotus abdominalis* + *Anochetus targionii*
Number of corresponding trees	167	18	16	16	32	16	69