

## Birds at *Eucalyptus* and other flowers in Southern Brazil: a review

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**RESUMO. Aves em *Eucalyptus* e outras flores no sul do Brasil: uma resenha.** No sul do Brasil, anotei 14 espécies de beija-flores, um pica-pau, três psitacídeos, quatro tiranídeos, um tejo, e 31 sanhaços e parentes em flores de eucalipto. Outros pesquisadores têm registrado três outros beija-flores, outro periquito, quatro outros tiranídeos, um pitiguarí, um sabiá, e cinco traupídeos e relativos, num total de 69 espécies. Entretanto, as plantações comerciais raramente florescem, e assim o uso é localizado ou inconstante. Os Phaethorninae do sub-bosque não foram avistados em eucaliptos, raramente em outras árvores altas e multifloradas. As bromélias e outras flores foram anotadas em vários estudos, que adicionam 89 espécies de aves, incluindo 14 Psittacidae, 17 Trochilidae e 37 Thraupidae e parentes. Flores isoladas, baixas e as epífitas foram visitadas principalmente pelos beija-flores (algumas por *Coereba*), mas, também, algumas árvores altas (*Chorisia*). Como o dobro de traupídeos em relação aos beija-flores visitam as flores, há a necessidade de cuidadosas observações bem cedo de manhã das aves de copa e paisagens não fragmentadas. Entretanto, as plantações podem atrair as aves artificialmente, como os comedores. O néctar de flores em cacho (*Mabea*, *Combretum*) é preferido por vagantes de copa de grupos mistos ou traupídeos e parentes de borda, que muitas vezes “trepam” sobre os cachos como os papagaios ou pica-paus (ou marsupiais e outros mamíferos) ao invés de adejar em flores separadas como os Trochilidae; ou podem “bicar” das proximidades como os Nectariniidae e *Coereba*. Os trepadores ou puxadores de pétalas, mesmo os ladrões de néctar, podem causar a evolução de umbelas e outras flores em cacho, porque a ave, mamífero ou inseto recebe o pólen de flores das proximidades. Os Psittacidae, trinca-ferros e outros, comendo as flores podem polinizar se tocarem as flores próximas. As árvores multifloradas podem também atrair os gaviões, causando ondas de traupídeos, papagaios e outros a se mudarem para polinizar outras árvores via “medo e nectarivoria”. Certos grupos, especialmente os sabiás e os tiranídeos, parecem usar pouco o néctar, esses últimos muitas vezes capturando insetos.

**PALAVRAS-CHAVE:** Beija-flores, Emberizidae, *Eucalyptus*, flores, sanhaços, Psittacidae, sul do Brasil.

**ABSTRACT.** In southern Brazil, I recorded 14 species of hummingbirds, one woodpecker, three Psittacidae, four Tyrannidae, one mockingbird, and 31 tanagers and relatives at eucalyptus flowers. Others have registered 3 different hummingbirds, another parrotlet, four more tyrannids, a peppershrike, a thrush, and 5 tanagers and related birds, for a total of 69 species. However, commercial plantations rarely flower, so use is local or undependable. Understory Phaethorninae are not recorded at eucalyptus, rarely at other tall and hence multiflowered trees. Bromelias and other flowers are noted in various studies, which add 89 species of flower feeders, including 14 Psittacidae, 17 Trochilidae, and 37 tanagers and relatives. Isolated low flowers and epiphytes are mostly visited by hummingbirds (some by *Coereba*), but some tall trees (*Chorisia*) also. As two times as many tanager species visit flowers as hummingbirds, researchers will have to get up early and patiently study treetop and nonpatchy habitats. However, tree plantations can attract artificially, like feeders. Bunch-flowering extrafloral nectar (*Mabea*, *Combretum*) is preferred by wandering mixed-flock treetop or edge tanagers and relatives, which often “crawl” over bunched flowers like parrots or woodpeckers (or marsupials and other mammals) rather than “hover” at separate flowers like nonflocking Trochilidae or “peck” from nearby like Nectariniidae and *Coereba*. Clamberers and petal-pullers, even nectar robbers, can cause evolution of umbels and other bunched flowers, for the bird, mammal or insect receives pollen from nearby flowers. Psittacidae, saltators and others mostly eat flowers, but can pollinate if they touch nearby flowers. Multiflowered trees can also attract hawks, causing waves of tanagers, parrots and others that move on to pollinate trees via “fear and nectarivory.” Certain groups, notably thrushes and tyrannids, seem to use nectar little, the latter often catching insects.

**KEY WORDS:** Emberizidae, *Eucalyptus*, flowers, hummingbirds, Psittacidae, southern Brazil, tanagers.

*Eucalyptus*, native in Australia where grouped flowers attract many birds and insects (Penfold and Willis 1961, Franklin and Noske 2000), or mammals (Wiens *et al.* 1979, Jackson 2001), is widely introduced for wood pulp and lumber. As productive woodlots are cleared out underneath and cut every 7 years or so, they rarely flower. However, when eucalyptus are used for shade or left unharvested, flowers do attract birds (Skutch 1954, Mitchell 1957, Montaldo 1984, Willis 1987, Vielliard and Silva 1987, Belton 1994, Azevedo 1995, Machado and Lamas 1996, Sick 1997, Antunes 2000).

Here I report birds at flowers in a central São Paulo eucalyptus woodlot, with occasional observations from other areas of southeastern Brazil. I also comment on

Antunes’ studies (to be published) in the woodlot, note records at other flowers and review published reports.

### METHODS

Some 257 species of birds are recorded in and around the 2314-ha semi-abandoned eucalyptus woodlot of the “Horto Florestal” and lake (590 m, 22° 25' S, 47° 31' W) just east of Rio Claro (Willis, in press). The trees, often planted in 1910-1940, have dense understory except for blocks cut over in 1985-93. Observations were at a few trees, especially at one that flowered in mid-winter next to the dam at the lake (records A-O in Appendix), on 11/8/85, 13/4, 18/5, 14/6 and 20/7/86, 16/8/87, 31/7 and 18/8/

88, 16/7, 18/8 and 1/10/89, 24/6/90, 20/7/92, 13/8 and 20/8/93. Other visits (records X-Y) were 5/8/01 and 19/8/01. Nearby trees were checked (P) on 25/3/00. At other trees off east, near the east side of the woodlot, visits (records Q-W) were 24/3, 14/4 and 26/5/91, 13/6, 29/8 and 14/11/93, and 15/5/94.

Rows of eucalyptus in open cerrado west of the Itaqueri River railroad bridge (700 m, 2215/4752) were checked (records a-d) 14/6/92, 14/3 and 20/6/93, and 16/4/95; others at nearby Posto Siriema (730 m and 2216/4755) on 6/6/99, 1/7 and 7/7/00, 20/01, 3/6, and 9/6/01 (records e-j). A few trees were checked by the forest edge (800 m, 2416/4825) at Intervalles (record y) on 20/9/87 and at Bananal 26/6/93 (z, at 480 m and 2237/4414). Others at the headquarters (650 m, 1958/4032) of the Santa Lucia Reserve, on 20/2/90, 17/1/93, 9/9/94, 23/7 and 6/3/95 and 18/5/96, and at the Museu Mello Leitão (680 m, 1958/4036) in nearby Santa Teresa 19/3/95, added some distant sites (records 1-7) in upland Espirito Santo. The 44 observations (25 in the Horto) were of 0.1-2.3 hours (mean 0.5).

Records of birds at other flowers were occasional, 1975 on. Literature records include abstracts at meetings, as papers sometimes are not published.

## RESULTS

I recorded 10 hummingbirds and 24 other species at eucalyptus flowers in the Horto, plus 4 hummingbirds and 16 other species elsewhere (54 species, Appendix). Antunes registered 40 species visiting eucalyptus flowers in the Horto (*Sporophila* and *Piranga flava* only before his main study). With 9 others I registered (Appendix: *Thalurania*, *Dryocopus*, *Myiozetetes*, *Cyanerpes*, *Euphonia violacea*, *Trichothraupis*, *Molothrus*, *Tiaris*, and *Zonotrichia*), the total is 49 species. I recorded 14 of his birds only elsewhere (5) or using other flowers or fruits: *Aratinga*, *Forpus xanthopterygius*, *Colibri*, *Anthracothorax nigricollis*, *Camptostoma obsoletum*, *Serpophaga subcristata*, *Todirostrum cinereum*, *Megarynchus pitangua*, *Tyrannus*, *Mimus*, *Cyclarhis gujanensis*, *Hemithraupis*, *Dacnis nigripes*, *Piranga flava*. I saw most of these species in eucalyptus there at times, but did not confirm flower use. A 15th species, *Hylocharis cyanus*, was a new record for the Horto (26/7/98, probably a winter vagrant from the south or east). Three of the 15 are hummingbirds. Of the above 15, he registered only *Megarynchus*, *Camptostoma*, *Aratinga* and *Forpus* more than nine times each.

Eight species, including four hummingbirds, are recorded in eucalyptus in southeastern Brazil and region only by other authors: *Discosura longicauda*, *Stephanoxis lalandi* and *Clytolaema rubricauda* by Ruschi (1982), *Amazilia fimbriata*, *Turdus amaurochalinus*, *Thraupis bonariensis*, *Paroaria coronata* and *Agelaius ruficapillus* in Belton (1994). However, Ruschi falsified many records

(Vanzolini 1999, Simon 2000, Pacheco and Bauer 2001, Willis and Oniki in press), and his reports unfortunately have to be discounted, as do certain general works (Grantsau 1989, Schuchmann 1999) that seem to be referring to his "records." The regional total in eucalyptus flowers is 69 species, of which 17 were hummingbirds. Four were Psittacidae, and 36 were tanagers and relatives.

Other kinds of flowers (below) add 89 species of birds in southeastern South America, including 14 Psittacidae, 17 Trochilidae, and 37 tanagers and relatives.

*Psittacidae*. As noted by Antunes (2000) and others, Psittacidae commonly eat or chew eucalyptus flowers. Marcondes-Machado *et al.* (1992) record *Brotogeris chiriri* and *Forpus* eating seeds rather than flowers of eucalyptus, as for *Thraupis palmarum* (Niethammer, 1956).

*Aratinga* flocks fed in eucalyptus flowers, and also roosted in tall eucalyptus without flowers between Itaqueri and Siriema, especially in winter; in summer scattered pairs nest in road banks or hollow trees in woodlots, and groups are uncommon (Vielliard *et al.* 1996 report *Amazona rhodocorytha* flocks roosting in eucalyptus). The species is more common in the Itaqueri cerrado-border region, but is increasing around Rio Claro and other partly deforested areas of the state, occasionally even in summer nowadays. Groups chewed bases of *Erythrina* flowers by the Itaqueri (4/10/87, 11/8-25/8/91), and Hartert and Venturi (1909) report use in Argentina (as do other authors northward).

*Erythrina* flowers over cocoa at Barrolândia, BA (25/7/97) were attacked by several *Aratinga aurea*, *Brotogeris tirica* and *Amazona amazonica* (this recorded in *Erythrina* in Trinidad, Feinsinger *et al.* 1979). *A. aurea* chewed flowers of *Tabebuia* at Serra das Araras, MT (30/7/87) and fed another, while aggressive pairs of *Brotogeris chiriri* chewed one flower base after another, dropping hundreds of flowers, at the Luiz Antonio Reserve headquarters 31/8/97 (650 m, 2134/4744, Willis, Y. Oniki and students). *Aratinga auricapilla* chewed *Croton floribundus* flowers at the Rio Sapucaí (640 m, 2043/4731, 8/3/84). *Brotogeris tirica* chewed *Dalbergia nigra* flowers at CVRD, Linhares, ES, 16/7/93. *Pyrrhura leucotis* chewed vine flowers there 16/9/94. *Touit surda* visited flowers of *Clusia* on a rock face near Santa Lúcia, on 3/5/90; I did not verify activity. *Pionus maximiliani*, which eats eucalyptus flowers, did chew *Erythrina* (27/9/92) and *Bauhinia* (26/8/01) at the Horto, *Inga* above Miracatu (at 690 m, 2402/4710, 8/6/86, R. Antonelli and Willis), and *Chorisia speciosa* petals at the Fazenda São José woodlot near Rio Claro (17/4/91, Willis and Oniki 2002).

Young (1929) reported *Ara nobilis* eating *Erythrina*. Abe (2000) noted *Amazona vinacea* eating flowers of *Erythrina*, *Laplacea* and *Mimosa*. Cotton (2001) reports Colombian *Erythrina* visits and pollen on plumage for two species, flower eating by five others. Roth (1984) noted *Aratinga leucophthalmus* eating flowers of *Ficus*.

Pollination of *Platonia* flowers is registered in the Amazon for this species and *Pionites leucogaster*, with *Brotogeris chrysopterus* pollinating other Clusiaceae (Maués and Venturieri 1996). *A. aurea* is recorded eating petals of *Bowdichia* (Rojas and Ribon 1997), *Tabebuia* and *Caryocar* (Antas and Cavalcanti 1988), and *Quelea* (Galetti and Pedroni 1996). *A. acuticaudata* eats *Inga vera* flowers in the dry winter, as do *Myopsitta monachus* and *Nandayus nenday* (Fecchio and Ragusa-Netto 2001). *Pyrrhura frontalis* eats flowers (Mitchell 1957, Pizo *et al.* 1995, Kristosch and Marcondes-Machado 2001), as do *Brotogeris tirica* (*Erythrina*, Goeldi 1894, Pizo *et al.* 1995; Galetti 1997 in *Pseudobombax*), *B. chiriri* (14 species, Paranhos 1994; *Inga vera* in winter dry season, Fecchio and Ragusa-Netto 2001), *Forpus* (Pizo *et al.* 1995; Barros 1994), *Pionus* (Erickson and Mumford 1976, Pizo *et al.* 1995, Sick 1997, Galetti 1993), *Amazona brasiliensis* (Scherer-Neto 1993), and *Triclaria malachitacea* (Pizo *et al.* 1995).

One *A. aurea* pair got extrafloral nectar in remela-de-pomba *Combretum lanceolatum* by the river at Campos de Jofre, MT, 20/7/82; *A. acuticauda* and *Myiopsitta monachus* had done so two days earlier. Sazima *et al.* (2001) recorded many *A. aurea*, also *A. leucophthalmus*, *Ara nobilis*, and *Brotogeris chiriri*. Prance (1980) records *Cebus* monkeys. *A. weddellii* was on extrafloral nectar of *Mabea* at Pontes e Lacerda, MT, 2/8/87, *Ara maracana* on *Mabea* in Minas Gerais (Ferrari and Strier 1992). Robinson (1997) recorded 6 species at *Combretum* and *Quararibea* flowers in Peru.

In the Australian region, lorries often visit bunch flowers and can “mess and soil” pollinate (see Stiles 1981, Brown and Hopkins 1995, and Forshaw 1978). Beaks of Amazonian parakeets in flowers may pollinate (Maués and Venturieri 1996, Vicentini and Fischer 1996). Both flower eating and bunch-flower nectar often involve parrots, woodpeckers and other birds “clambering” or “crawling” over flowers, an activity known to pollinate in the case of bats and other mammals and, recently suggested to be common in tanagers and relatives (below), in contrast to “hovering” by hummingbirds and “pecking” from nearby perches by many Old World Nectariniidae and similar neotropical *Coereba flaveola*. Early authors thought clambering and flower-eating primitive, leading to regular pollination (Faegri and Pijl 1971). Below, I also note “petal-pulling” by tanagers eating petals.

**Hummingbirds.** Hovering *Melanotrochilus* were 1-4 individuals per tree, here April-Nov. (Antunes 2000 also recorded Jan.-March in *E. eugenoides*), but are not known to nest near Rio Claro. Other records there include ones in flowers of *Myrocarpus frondosus* (4/7/82), *Delonix regia* (27/10/85, plus 9/10/98 at Fazenda Aretuzina at 2126/4735 near São Simão), and *Tabebuia umbellata* (17/10/82 near Rio Claro at Fazenda São José, Willis and Oniki 2002). One visited *Mabea* at the Itirapina lake, 10/6/01 (also

Vieira *et al.* 1992 and Olmos and Boulhosa 2000). At Fazenda Paineiras (740 m, 2208/4752) up to 10 were in paineira (*Chorisia speciosa*) flowers Feb.-April, perhaps with local migrations (also April in the Horto). Near Santa Lúcia Reserve, where the species nests and is abundant except midwinter, birds visited *Inga* flowers 17/2/90 (also 11/8/91 at Paineiras, and in Snow and Teixeira 1982 and Piratelli *et al.* 1991), *Eucalyptus* in March and jambo *Eugenia jambos* 25/4/96. At Paineiras (22/4/90) and in highlands at Itirapuã (2035/4709, 1150 m, 21/11/87) they were at *Alchornea* flowers. Occasional birds visit low *Grevillea banksii* at the Itirapina lake (750 m, 2215/4749), Capão Bonito (23/9/87, 700 m, 2401/4821) and elsewhere, or at *Lantana* (Almeida and Ritter 2000), but low flowers are not used in most cases, despite use of low sugar-water feeders. Mitchell 1957, Sander and Voss 1982, Vielliard and Silva 1987 and Belton (1994) also record *Melanotrochilus* at eucalyptus; Tampson at *Erythrina* (Haverschmidt 1968, Feinsinger *et al.* 1979 and Cotton 2001 recorded related *Florisuga mellivora*), Ribon *et al.* (1994) in *Melanoxylon*, Martuscelli (1985) in *Psidium*, Martuscelli and Chiea (1985) in *Miconia*, Wied (1830-34) at papaya and guava, Graham (1986) in *Spathodea*, Voss (in Sick 1968) and Azevedo (1995) *Dombeya* (plus 3 others, Azevedo 1995), Machado *et al.* (1997), Alves *et al.* (2000), and Sluys *et al.* (2001) at *Vriesia*, and Snow and Teixeira (1982) at *Inga* and *Mendoncia*, Oniki *et al.* (2000) at *Duranta*, Fischer *et al.* (1992) at a bat flower, Sazima *et al.* (1993) at *Norantea*, Buzato *et al.* (2000) at this and 2 other flowers, Mendonça *et al.* (2001) as aggressive.

*Amazilia lactea* and *A. versicolor* nest near Rio Claro, with 10 *A. versicolor* in eucalyptus at Intervales and up to five per tree at Rio Claro (13/6/93). Occasional white-throated birds occur in winter, but only green-throated birds nest at Rio Claro or Santa Lúcia. Belton (1994) records it at eucalyptus flowers. It was in *Tabebuia* near Buritizal (750 m, 2012/4737, 11/9/87), and *Inga* the same day; *Inga* also at Fazenda S. José 9/9/01, Paineiras 11/8/91, Santa Lúcia 17/2/90 and nearby Nova Lombardia Reserve (850 m and 1955/4034) on 5/3/95, *Sida* at Santa Teresa (29/1/94), *Cestrum* at Faz. Capricórnio (21/8/94, 2323/4504), and white-throated birds in *Dioclea* vines (Sooretama Reserve, ES, 17/7/93).

I recorded up to 5 *A. lactea* per eucalyptus tree (16/8/87), but 10 or more were fussing (one *versicolor* too) in a flowering *Schizolobium excelsum* tree near the same lake 6/10/87 (other records Sept.-Oct.) and up to 12 in *Bauhinia variegata* (7/7/82). Other records were *Bauhinia rufa* (3/12/95), several in *Myrocarpus frondosus* (4/7/82), plus single birds in *Croton floribundus* (22/3/87; plus *A. versicolor*; this also recorded Dec. in São José, Willis and Oniki 2002). Oniki *et al.* (2000b) note visits to *Agapanthus*, *Hemerocallis*, *Clerodendrum* and *Petrea volubilis*. *Inga* flowers (Aug.-Sept.) are commonly visited in the region (also 22/9/96 at Faz. Colorado, 880 m and 2048/4721), as

*Tabebuia* in July-Oct. at S. José. It was in *Vochysia* below the Serra do Cipó, MG (20/12/97) and at Faz. Cecília (with *versicolor*, 7/9/97, 850 m and 2046/4714), *Ipomoea* in Pedra Azul, MG (16/3/94), plus *Stachytarpheta glabra* high on the Serra da Piedade, MG, 21-23/12/97 and 22-24/1/00 (with Y. Oniki and M. Vasconcelos; one *versicolor* 24/1).

A few of both *Amazilia* were in *Chorisia* at Paineiras on 7/4/91, *A. versicolor* on 23/2/92, and *lactea* in *Alchornea* on 22/4/90, likely local individuals and not migrants as in *Melanotrochilus. Sessea brasiliensis* (2/7/89) and *Erythrina* (10/11/84) had both in the Horto, the latter *lactea* 18/11/90.

*Amazilia lactea* visits *Grevillea* all year at the Itirapina lake (where *versicolor* too, rarely), plus Capão Bonito and Barão Geraldo suburbs (620 m, 2250/4705), where also *Malvaviscus* and *Verbena*. It and *versicolor* were at *Malvaviscus* at Fazenda Barreiro Rico headquarters (570 m and 2241/4807) 4/00 and 3/01. A group of *Bauhinia* at Barão Geraldo were visited July-Aug. 1998, the *lactea* only common at the end of flowering when dominant *Eupetomena* were gone, while one *versicolor* hid from both deep in the tree crowns. *Bauhinia* also was visited at the Horto (19 and 26/8/01). Low flowers are not much visited: *Leonotis nepetaefolia* (17/11/89 by both by the Itaqueri, 3/12/95 *lactea* Horto), *Ipomoea hederifolia* 17/11/89 (*lactea*), and *Vernonia* (4/8/94 at Rincão do Serafim, ES, 730 m and 1957/4040). Other records for *lactea* were at *Lantana camara* (Imitagem, RJ, on 8/4/94), *Tabebuia* (Imitagem, 2/9/94), *Delonix* (27/10/85 in the Horto, also Oct. at S. Simão) and *Styrax ferruginea* (30/6/01 at Broa airport). *A. lactea* comes out of the forest somewhat, restricts the small *versicolor* a lot at concentrated flowers, and can set up small territories on different branches of a large tree.

Machado and Sazima (1987) record *versicolor* at *Lantana* and two *Ipomoea*, *lactea* was only at *I. hederifolia*, where territorial. Both robbed nectar from *Ruellia* (Machado and Sazima 1995 and Sigrist and Sazima 2002). Sazima and Sazima 1995 (see 1999) photographed *lactea* at *Bomarea*, Sazima and Machado (1983) noted it at *Mutisia*, Rojas and Ribon (1997) at *Bowdichia*, Gobatto-Rodrigues and Stort (1992) at *Pyrostegia*, Snow and Teixeira (1982) and Nogueira-da-Gama *et al.* (2000) at *Inga*, Buzato in Braz *et al.* (2000) at *Mendoncia*, Figueiredo and Alves (1991) at introduced *Nopalea*, Veiga and Machado (1991) at *Paulownia*, Antunes in Oniki *et al.* (2000) at *Dicliptera* and *Genipa*, Mendonça *et al.* (2001) at 17 species. Ribon *et al.* (1994) register *lactea* and another species at *Melanoxylon*, Voss (in Sick 1968) *A. versicolor* in *Dombeya*, Piratelli *et al.* (1991) both species in *Inga* and *Jaracatia*. Machado *et al.* (1998) found *versicolor* in *Vriesia*, Stiles (1996) in *Decagonocarpus*, Snow and Snow (1986) at short-corolla flowers, Fischer *et al.* (1992) at bat flowers, Sazima *et al.* (2001) at *Combretum* (*A. fimbriata*?).

Inexperienced authors often report *Amazilia fimbriata* in upland São Paulo or Espírito Santo, but smaller *versicolor* is easily mistaken for it. *A. f. nigricauda* in interior low-canopy dry forests, *A. f. tephrocephala* in scrub on the coast, replace similar-sized upland *A. lactea*. In the reserve of Luiz Antônio (Rio Mogi Guaçu, 530 m, 2135/4747), *fimbriata* was at *Inga* flowers at edges 2/9/97 (also nearby Fazenda dos Alpes, 530 m and 2139/4800, on 1/9/96; Picinguaba at 2322/4449, 5/10/97 and Reserva Poço das Antas, RJ on 9/7/97). It was at a small white cactus flower 27/1/93 (mouth Rio Itaúnas, ES), *Hydrangea* (Pau-brasil Reserve, BA, 29/7/95), and a purple-flowered vine at Faz. Inferno Verde, Ituberá, BA, 1/8/94. We have seen it at other low and edge flowers, not at tall trees, in other regions, and think it may avoid tall trees or woodlands where the other two *Amazilia* are better adapted. It is uncertain if it regularly uses eucalyptus flowers, due to short-cycle pulp cutting in the Itaúnas region and relative lack of plantations in dry interior São Paulo (except Luiz Antonio and a few others). Belton (1994) records it at eucalyptus flowers off south, Vielliard and Silva (1987) (perhaps *A. versicolor*) in central São Paulo. Sazima and Sazima (1999), Sluys and Stotz 1995), Sluys *et al.* (2001), Alves *et al.* (2000), Siqueira-Filho (1998), and Varassin and Sazima (2000) (probably misidentified *versicolor*) record bromeliads, Sick and Pabst (1968) in *Thunbergia*, Oliveira and Gibbs (1994) in 5 *Vochysia* species, Santos *et al.* (1997) it and another (*versicolor*?) at *Vochysia*, Cotton (1998b) at *Palicourea*, Antas and Cavalcanti (1988) in *Calliandra*, *Malvaviscus* and *Bauhinia*, Braz *et al.* (2000) at *Geissomeria*, Sazima *et al.* (1993) at *Norantea*, Buzato *et al.* (2000) at this and two others, Melo (2001) at *Caryocar*, Souza (2001) in *Chorisia*, Cotton (2001) and Almeida and Alves (2001) in *Erythrina*, Machado and Lopes (1998) in *Psiguria*, Amaya-Márquez *et al.* (2001) at 25 species in Colombia. *Amazilia leucogaster* was at a bromeliad in Pernambuco (Siqueira-Filho 1998).

*Anthracothorax* is a summer treetop or edge bird that uses eucalyptus flowers (two records Antunes (2000), several Feb.-April by Mitchell, and Oct.-Mar. by Vielliard and Silva 1987); not recorded here as most of my studies were in the winter. I recorded it in *Spathodea* (20/1/00, also Schäfer and Phelps 1954) and *Grevillea* at the Itirapina lake, at *Schizolobium* (6/10/87) and catching insects at the Horto edges, in *Chorisia* (13/1/87, at Aracaçu at 670 m and 2341/4831, Paineiras 17/2/91), *Malvaviscus* (Barreiro Rico, 23-24/3/01; also Morais 1999), *Erythrina* over cocoa (Barrolândia, on 25/7/97) and *Delonix* (São Simão, October). Haverschmidt 1968, Voss 1977, Feinsinger *et al.* 1979 and Cotton 2001 report it at *Erythrina*, Wied (1830-34) in papaya, Vieira *et al.* (1992) and Olmos and Boulhosa (2000) at *Mabea*, Ribon *et al.* (1994) at *Melanoxylon*, Machado *et al.* (1997) in *Vriesia*, Sazima and Machado (1983) at *Mutisia*, Cotton (1998) at 3 species,

Snow and Snow (1972) at 3 species (especially *Erythrina*), Snow and Snow (1980) at jambo and bananas, Snelthage (1928) in *Inga*, Leck (1971) at *Tabebuia* and *Ixora*, Oliveira (1998) in *Calliandra*, Figueiredo and Alves (1991) at introduced *Nopalea*, Sazima *et al.* (1993) at *Norantea*, Souza (2001) in *Chorisia*.

*Heliomaster* Antunes (2000) and I only recorded a few times at eucalyptus. It is uncommon around the Horto, mainly in *Bauhinia rufa* a few meters up in December (Antunes, Willis). It seems to use its long bill to bypass the divergent long stamens and petals, which may discourage hummingbirds because bats are the normal pollinators. It did use *Tabebuia umbellata* flowers in July at São José, long *Pyrostegia* and *Bougainvillea* at the Araraquara campus of UNESP (625 m, 2149/4812, 15/5/82; the former also at Paineiras 25/8/91), *Chorisia* at Paineiras (28/2/88; 17/2/91 four birds in one tree), *Erythrina speciosa* at Itirapina 25/8/91, *Malvaviscus* at Barreiro Rico in March and April, *Grevillea* at Itirapina (22/4/01), and *Delonix* at São Simão in October. The related *Heliomaster longirostris* used *Hibiscus* flowers in Barão Geraldo 9/9/81 (Willis and Oniki 1993); it is a rare vagrant at edges in the state (see Feinsinger *et al.* 1979 for Trinidad). Fry (1970) reports it at *Vochysia*, Skutch (1972) in bananas and *Erythrina*, Bruneau (1997) lists various Central American reports in *Erythrina*, Stiles *et al.* (1989) at *Heliconia*. Stiles (1981) considers that it and other long-billed *Heliomaster* rather replace Phaethorninae high in trees or in dry areas. Galetto *et al.* (2000) report *Heliomaster furcifer* at *Erythrina*.

*Eupetomena* also was uncommon at eucalyptus in the closed-canopy Horto, though once at palm flowers there (12/10/86) and common at edge eucalyptus near cerrados (Itaqueri, Siriema). At Itaqueri, it is often at low *Reichsteineria sceptrum* flowers in open prairies after fires (Oct.-Dec.), but needs eucalyptus or gallery-woods nearby for shade. It is also common in town at Rio Claro, visiting *Musa paradisiaca* banana flowers (23/9/00 and other dates); Oniki (pers. com.) recorded *Agapanthus* and *Hemerocallis* (26/11/93); *Sanchezia nobilis* (7/9/93). It is in *Malvaviscus* (all year; also at Barreiro Rico) and *Bauhinia* (June-July) in Barão Geraldo suburbs; also *Grevillea* there, Capão Bonito, and Itirapina (where *Spathodea* 20/1/00 and *Mabea* 3/6/01). Other records were *Styrax ferrugineus* (10/6/01, Broa airport cerrado, 2212/4754 and 30/6/01 at 2212/4758); *Alchornea* (22/4/90, Paineiras), *Inga* (9/9/01, Faz. S. José; 11/8/91, Paineiras; 11/9/87 near Buritizal; Alpes 1/9/96), *Dioclea* (Sooretama, 17/7/93), mirueira (Monte Pascoal, BA, 24/7/93), *Clerodendron* (Itacaré, BA, 30/7/94), *Calliandra scutellifera* (CVRD, 16/9/94), *Delonix* (São Simão, October). Dozens were in *Erythrina* at Barrolândia (July), where in *Grevillea* as at Pau-brasil, BA (also by Piratelli and Lavrado 1990 and Nogueira-da-Gama *et al.* 2000).

Few were in *Stachytarpheta*, Serra da Piedade, January, or orange *Psittacanthus*, Serra do Cipó, 3/3/97. Dominant birds attack other species, especially in *Grevillea* where bushes can be defended and provide shade to wait, but cannot defend large eucalyptus as many birds move in. It even attacks bats (Von Matter 2001).

Montaldo (1984) records it in eucalyptus, as Mitchell (1957) (also *Russelia*, *Malvaviscus*). Olmos and Boulhosa (2000) found it uncommon and Vieira *et al.* (1992) common at *Mabea*, Abendroth (1965), Alves *et al.* (2000), Sluys and Stotz (1995) and Sluys *et al.* (2001) at bromeliads, Martuscelli and Chiea (1985) in *Miconia* flowers, Erickson and Mumford (1976) in *Erythrina*, *Spathodea*, *Delonix* and bananas, Vitali-Veiga and Machado (2000) and Almeida and Alves (2001) in *Erythrina*, Gobatto-Rodrigues and Stort (1992) at *Pyrostegia*, Piratelli *et al.* (1991) at *Inga* and *Jacaratia* crowns, Ribon *et al.* (1994) in *Melanoxylon*, Helme (1996) in *Vochysia*, Negret and Negret (1981) at this and *Spathodea*, Sazima *et al.* (1982) at bat-flower *Luehea*, Sazima *et al.* (1993) at *Norantea*, Machado and Sazima (1987) in *I. hederifolia* pendent flowers, Machado and Sazima (1995) and Sigrist and Sazima (2002) at *Ruellia*, Graham (1986) at *Inga* and *Erythrina*, Oliveira (1998) in *Calliandra*, Oliveira *et al.* (1991) in *Spathodea*, Melo (2001) at *Caryocar*, Souza (2001) in *Chorisia*, Mendonça *et al.* (2001) dominant at 2 species, Veiga and Machado (1991) at *Paulownia*, Siqueira-Filho (1998) at a bromeliad, Antunes in Oniki *et al.* (2000) in *Genipa*, Rojas and Ribon (1997) and Noronha and Silberbauer-Gottsberger (1980) in *Bowdichia*.

*Leucochloris* is rare in central São Paulo at bushy edges or eucalyptus in winter; registered in low *Pyrostegia* in Avaré (800 m, 2306/4856, on 11/7/96). In Maromba, RJ it was in *Tabebuia heptaphylla* (3/9/95), near Campos do Jordão in *Abutilon* and a red flower (12/8/01), in Santa Lúcia in *Inga* (17/2/90), as birds summer and can winter southward or in mountains. Voss (in Sick 1968) reports it in *Dombeya*, Machado *et al.* (1987) and Varassin and Sazima (2000) in *Vriesia*, Graham (1986) in *Mendoncia*, Vielliard and Silva (1987) in eucalyptus mostly in fall and winter, Azevedo (1995) in eucalyptus plus 5 other flowers, Bó and Darrieu (1988) in *Aloe* and *Leonotis*, Galetto *et al.* (2000) in *Erythrina*, Goeldi (1894) in balsaminas and *Agapanthus*, Bertoni (1901) in banana and tobacco flowers, Piratelli (1997a, b) at one of two *Hippeastrum*, Olmos and Boulhosa (2000) in *Mabea*, Snow and Teixeira (1982) in 3 species, Sazima *et al.* (1994) in three *Siphocampylus*, Sazima *et al.* (1996) in 18 species (3 bromeliads; even clings to sepals to perch and enter the bat flower *Hippeastrum aviflorum*; this is one of the few cases of hummingbirds “crawling” like a bat or tanager, but here involves single flowers), Buzato *et al.* (2000) in 28 species, Abendroth (1965) in bromeliads, Mendonça *et al.* (2001) as dominant, Vasconcelos and Lombardi (2000) at three species.

*Aphantochroa* was common at eucalyptus in the Horto, though not in cerrado areas (a few defend *Grevillea* at Itirapina or 8/1/89, *Spathodea*). Only a few individuals were together, as it seems aggressive. It is occasional at *Bauhinia* small trees in the Horto (11/1/94, 26/8/95, 19 and 26/8/01), at *Schizolobium exselsum* trees (Sept.-Oct.), *Erythrina crista-galli* (10/11/84), *Lafoensia glyptocarpa* (24/6/90), at *Erythrina speciosa* (10/7/84 and in 2001), and a yellow-flower Bignoniaceae vine (14/4/91). *Chorisia* (Feb.-June, also Aracaçu on 13/1/87 and the Horto 13/4/01) and *Bombax* (19/7/87) attract them at Paineiras, *Alchornea* at Itirapuã (21/11/87), yellow *Tabebuia* at Buritizal (11/9/87) plus *Inga* there and at Santa Lúcia (17/2/90). At the latter, jambo (25/4/96), japanese plum (26/4/96) and *Tabebuia heptaphylla* (18/1/93); bushes and small trees and a small red flower (26/4/96) were visited. Common there and Santa Teresa, it did not fly up in tall eucalyptus much. It did nest 9 and 10 m up in two eucalyptus at Santa Teresa and 10 m up in another in the Rio Claro Horto. *Spathodea* (Graham 1986), *Norantea* (Sazima *et al.* 1993), *Duranta* (Oniki *et al.* 2000), two bromeliads (Varassin and Sazima 2000), and bananas (Goeldi 1894) are the only certain literature records.

*Chlorostilbon* foraged low and rarely in eucalyptus, being a small and evasive species chased into dense foliage by nearly all the species above. Belton (1994) also recorded use in July. As Antunes (2000), I registered mostly birds in female plumage. It is common around town, even nesting on porches, though less common recently with closed-in houses and yards. It visits *Grevillea* and *Malvaviscus* and (29/7/97) verbena or *Bauhinia* (June-July) in Barão Geraldo but is chased by *Eupetomena* and *A. lactea*, as in *Delonix* at São Simão (Oct.). At the Itirapina lake, it flees from others at *Grevillea*, as at Capão Bonito (23/9/87). Around the Horto, it evades attack by wandering to a variety of small plants to large trees: *Leonotis nepetaefolia* (3/12/95), *Ricinus communis* (idem), *Melia azedarach* (26/8/95), *Bauhinia forficata* (idem), *Croton floribundus* (22/3/87), *Schizolobium* (27/9/87); on the nearby campus *Petrea volubilis* (26/11/93); in nearby woods, a white-flower vine (28/7/00; Willis and Oniki 2002) or, in Paineiras, a yellow-flowered tree (30/9/91) and *Alchornea* (22/4/90). *Pyrostegia* (Corumbataí, 17/6/82, Broa airport 30/6/01) was used, and supposedly bee-pollinated *Styrax ferrugineus* (Broa airport, 10/6 and 30/6/01), as *Vochysia* (Avaré cerrado at 720 m, 2258/4849, 31/12/97; Faz. Colorado, 7/9/97 and Serra do Cipó, MG, 20/12/97); *Mabea* (24/5/96; 3/6 and 10/6/01 at the Itirapina lake; also Vieira *et al.* 1992) and a flowering bush 2/9/94 at Imitagem, RJ; low small Gesneriaceae on natural rocks (S. Lúcia 25/4/96 to 22/5/96), *Bougainvillea* at the S. Teresa Museum (6/9/94) and *Vernonia* at Rincão do Serafim (also Bananal, SP, 31/7/95), all places where the species dares go to hummer feeders only at dawn and dusk, as Von Matter

(2001) also noted. It is common in *Stachytarpheta*, Dec.-Jan., Serra da Piedade, MG; in *Abstroemeria* in Monte Verde, MG, 7/9/95; *Pittosporum* 24/2/97 in Serra do Caparaó, MG.

Voss and Sander (1980) report it lapping fruit of *Ficus diabolicus*, Mitchell (1957) piercing snapdragons, Sluys and Stotz (1995) use of a bromeliad, Ribon *et al.* (1994) in *Melanoxylon*, Wetmore (1926) at red *Psittacanthus*, Piratelli *et al.* (1991) low in *Jacaratia*, Machado and Sazima (1987) two *Ipomoea* and *Lantana*, Almeida and Ritter (2000) on *Lantana*, Sazima and Sazima (1988) on bat-pollinated *Helicteres*, Sazima and Sazima (1990, 1999) on *Vellozia declinans*, Sazima and Sazima (1995) robbing *Abutilon* nectar, Graham (1986) at *Grevillea*, Durnford (1877) in *Ceiba*, Aplin (1894) in oranges and *Erythrina*, Castellanos (1932) perching on flowers, Aizen and Feinsinger (1994) in *Tillandsia* and *Ligaria*, Souza (2001) in *Chorisia*, Sander and Voss (1982) use of *Chorisia*, *Malvaviscus* and *Luehea*, Piratelli (1997a, b) at one of two *Hippeastrum*, Machado *et al.* (1997) in *Vriesia*, Santos (1998) and Noronha and Silberbauer-Gottsberger (1980) and Rojas and Ribon (1997) in *Bowdichia*, Snow and Teixeira (1982) in *Rudgea* and *Stromanthe*, Vitali-Veiga and Machado (2000) and Galetto *et al.* (2000) in *Erythrina*, Antunes in Oniki *et al.* (2000) in *Genipa*, Buzato in Braz *et al.* (2000) at *Mendoncia*, Oliveira *et al.* (1991) in *Spathodea*, Mendonça *et al.* (2001) on campus, Quirino and Machado (2001) at *Combretum*, Vasconcelos and Lombardi (2000) at *Abstroemeria*, Siqueira-Filho (1998) at a bromeliad. All indicate a subordinate bird that flees to any old or peripheral or small flower low at edges or in fragmented habitats, avoiding forest interior and open zones. It can "buzz" larger hummers from behind just to surprise them. At times it is in trees (*Erythrina*, *Chorisia*).

*Colibri* was once at eucalyptus in the Horto (Antunes) being rare at edges away from cerrados (where several records at eucalyptus). Mitchell (1957) and Vielliard and Silva (1987) record it at eucalyptus, Mitchell (1957) at garden larkspurs. At the Horto, there were records in *Bauhinia* (3/12/95, also Serra da Canastra, MG 11/9/97) and *Leonotis* (3/12/95); also in *Tabebuia* (17/10/82) and *Croton floribundus* (12/12/82) by a nearby woodlot (Willis and Oniki 2001). It was in *Alchornea* flowers at Paineiras, 22/4/90. It rarely visits *Grevillea* at Capão Bonito and the Itirapina lake (a few 20/1/01; also Antas and Cavalcanti 1988), even though near cerrado where it uses low *Reichsteineria* after fires (Oct.-Dec.), or *Leonotis* (Nov.). In Avaré cerrados, it was at *Vochysia* 21/12/97. At S. Lúcia, ES, where it has moved in to clearings or rock slopes in forest, it was at *Inga* 17/12/90. It visited *Stachytarpheta*, Serra da Piedade, Dec.-Jan., *Kielmeyera* 19/12/97 and *Palicourea* 20/12 in the Serra do Cipó. Wied (1830-34) reports it at papaya, Sluys *et al.* (2001) and Alves *et al.* (2000) in *Vriesia*, Sclater and Hudson (1888-89) at orange

blossoms, Sazima and Machado (1983) at *Mutisia* (attacked *Anthracothorax*), Oliveira and Gibbs (1994) in three *Vochysia* species, Piratelli (1997a, b) at one of two *Hippeastrum*, Sazima (1977) at *Barbacenia*, Sazima and Sazima (1990) as territorial in *Vellozia leptopetala*, Oliveira (1998) in *Calliandra*, Rojas and Ribon (1997) in *Bowdichia*, Almeida and Ritter (2000) in *Lantana*, Piovano *et al.* (1995) in *Ruellia*, Vasconcelos and Lombardi (2000) at *Sinningia*.

Curve-billed *Polytmus* summers low on wet campos near the Itaqueri eucalyptus, but rarely faces up to aggressive *Colibri* or *Eupetomena*. It was at *Reichsteineria* there with them only rarely (Oniki 1996), flying off to nearby pink-umbel herbs (1/11/88) to avoid problems, also *Leonotis* (14/3/93) and *Stylosanthes guianensis* (22/4/90). Feinsinger *et al.* (1985) report it losing battles, too. In coastal Espírito Santo and Bahia, it is low on open sandy or dune prairies, and is unlikely to use tall eucalyptus there or here; it uses *Crotalaria* (27/7/95) and bromeliads (Sluys and Stotz 1995, Alves *et al.* 2000). In Trinidad, *Heliconia* and *Lagerstroemia* (French 1980), in Surinam gardens *Russelia* (Haverschmidt 1975).

I noted upland *Stephanoxis lalandi* in *Fuchsia* at Itatiaia (17/11/98). Mitchell (1957) noted it in *Fuchsia*, Camargo (1946) in “amoreira do campo”, Storer (1989) on *Billbergia*, Snow and Teixeira (1982) in 9 species, Sazima *et al.* (1994) in *Siphocampylus*, Sazima *et al.* (1996) on 12 species – the male sometimes territorial, Buzato (in Siqueira-Filho 1998) on *Buddleja*, Brooks *et al.* (1993) on date palm, Bertoni (1901) in *Salvia*. Oniki and I recorded it in *Ruellia* at Itabó, Paraguay, 11/5/95 and I noted it at *Mutisia speciosa* 11/8/01 near Campos do Jordão (at 2239/4528). It was present near Intervales eucalyptus but seems to avoid *Thalurania* there and at other montane zones.

*Clytolaema rubricauda* is an upland canopy and edge species, not recorded at eucalyptus at Intervales or Santa Lúcia (where common, especially winter, Willis and Oniki in press). In *Tropaeolum majus* (2/9/95, Maromba, RJ), *Fuchsia* 17/11/98 in Itatiaia and in jambo and japanese plums at S. Lúcia (April), *Tabebuia heptaphylla* (11/9/94), and 8/9/94 in *Inga* at nearby Nova Lombardia. In plums, *Aphantochroa* attacked it several times, and the two may compete directly; they are mostly parapatric. Machado *et al.* (1997) record it in *Vriesia*, Varassin and Sazima (2000) in *Portea*, Bertoni (1901) in *Salvia*, Graham (1986) in *Canna*, Goeldi (1894) in *Inga*, *Croton* and japanese plums (citing Reeves in Gould for yucca, serra tamarinds, guaxima and marianna), Snow and Teixeira (1982) in 6 species, Sazima *et al.* (1994) in *Siphocampylus*, Sazima *et al.* (1996) in eight species (male territorial, female wanders), Buzato *et al.* (2000) in 10, Vasconcelos and Lombardi (2000) in *Collaea*.

*Hylocharis* hummingbirds are sometimes at eucalyptus. *H. chrysurus* is common in *Grevillea* at the Itirapina lake

and singing low in or at edges of bushy cerrados in that region, but unrecorded near Rio Claro. Although a bit higher than *Chlorostilbon* in the hierarchy, it wanders to scattered flowers like a subordinate bird – *Lantana* near Itirapina (6/11/88), *Mabea* at the lake (3/6 and 10/6/01), *Pyrostegia Avaré* (11/7/96), *Bauhinia* 9/8/95 at Reserva Itabó in Paraguay, *Inga* at Luiz Antonio (2/9/97) and Alpes (1/9/96), in *Malvaviscus* at Barreiro Rico (March and April), or 10 m up in *Alchornea* at Paineiras (April) and *Delonix* at São Simão (Oct.). Belton (1994), Sander and Voss (1982) (also *Chorisia*, *Erythrina* and japanese-lantern), and Montaldo (1984) record it at eucalyptus off south, where Belton (1994) notes use of an open-area bromeliad, *Eryngium ciliatum*, Voss (in Sick 1968) in *Dombeya*, Zapata (1977) in *Combretum*, Galetto *et al.* (2000) in *Erythrina*, Souza (2001) in *Chorisia*, Noronha and Silberbauer-Gottsberger (1980) in *Bowdichia*, Olmos and Boulhosa (2000) in *Mabea*. Near Miranda, MS, it was at five species (Araújo 2000).

*H. cyanus* (once in eucalyptus canopy, Antunes 2000) is mostly low at edges of coastal forests and scrub: *Inga* at Poço das Antas (July), *Duranta* at S. Lúcia (13/1/95, Oniki *et al.* 2000), a Verbenaceae down the river (23/7/95), *Psychotria* (26/12/92) and *Dioclea* (17/7/93) and *Coffea arabica* (19/7) at Sooretama, two Malvaceae (24/7 and 16/9/95) plus *Heliconia* and *Grevillea* (20/12/93) at nearby CVRD, *Combretum* on the Rio Mucuri (17/7/97), miruelas at Monte Pascoal (24/7/93), a yellow meadow Compositae at Guaraní (18/10/96), *Mikania* at Una, BA (28/7/94), Melastomaceae off north (same day), *Paullinia* at Lagoinha, BA (29/7/93), *Cuphea*, *Stachytarpheta cayenensis* and *Lantana camara* at Pau-brasil (13/2/93), and *Erythrina* at Barrolândia (July). Wied (1830-34) reports it at papaya, Sazima *et al.* (1993) in *Norantea*, Sazima *et al.* (1995) in *Aechmea* and *Quesnelia*.

*Hylocharis sapphirina* is at northern coastal forests and edges: *Inga* 5/3/95 at Nova Lombardia (where it supplanted *A. versicolor*, *Lophornis magnifica* and *Chrysolampis*, attacked and was attacked by *Thalurania glaucopsis*), a small understory tree at CVRD (16/9/94) and tall tree there (24/7/95), *Dioclea* at Sooretama (July), *Erythrina* at Barrolândia (July), *Grevillea* at Pau-brasil (also Piratelli and Lavrado 1990). Kerr (1892) registered it in acacias, Novaes (1980) at cotton and papaya flowers, Machado and Sazima (1995) robbing *Ruellia*.

I seldom recorded *Calliphlox* in eucalyptus, though Vielliard and Silva (1987) noted it Jan.-May and Antunes (2000) had over 100 records; most of his records were in summer, and I checked more in winter. Also, it can hide from near the ground to high in the canopy, and be detected mainly by long studies. In the Horto, it was also in *Myrocarpus frondosus* (4/7/82), *Bauhinia rufa* (3/12/95), *Croton floribundus* (plus small Malvaceae and a composite herb, 22/3/87) and *Sessea brasiliensis* (2/7/89). In the



suburb of Barão Geraldo it rarely visits *Grevillea* (as at Itirapina) because of defending *Eupetomena* and *A. lactea*, while in *Bauhinia* (2/7 and 25/7/98) it also had to flee. It had to sneak in among other larger species in *Chorisia* (Paineiras 28/2/88), *Vochysia* trees (Serra do Cipó, MG, 20/12/97) *Stachytarpheta* bushes Dec.-Jan. (Serra da Piedade, MG), and in *Inga* (S. Lúcia, ES, 17/2/90; Nova Lombardia, 5/3/95). At *Clerodendron* (Monte Verde, MG, 7/9/95), *Begonia* (29/1/94, S. Teresa), low *Duranta* (Oniki *et al.* 2000) and a tiger lily (S. Lúcia, 16/1/93), there were no competitors. Wied (1830-34) found it in *Jatropha*, Machado *et al.* (1997), Alves *et al.* (2000) and Sluys *et al.* (2001) common in *Vriesia*, Machado and Sazima (1987) buzzing at others in *I. hederifolia*, Olmos and Boulhosa (2000) in *Mabea*, Antunes in Oniki *et al.* (2000) in *Dicliptera*, Goeldi (1894) in oranges, *Zinnia*, *Croton* and japanese plums, Bertoni (1901) in *Salvia* and oranges (piercing flowers), Rojas and Ribon (1997) in *Bowdichia*, Buzato *et al.* (2000) in *Buddleja*.

One seldom records small bumblebee-like *Lophornis* in eucalyptus (they are absent near Rio Claro and Itirapina). *L. chalybea* (once at Intervalles plus once by Vielliard and Silva 1987) and *L. magnifica* (once at S. Lúcia) also hide well in various levels of trees and bushes, the former more coastally (*Cestrum* at Faz. Capricórnio, 21/8/94; *Norantea* by Sazima *et al.* 1993; *Buddleja* by Buzato *et al.* 2000) and the latter more to the north. *L. magnifica* visited low *Vernonia* (Rincão do Serafim, ES, 4/8/94), *Lantana* (S. Lúcia Abaixo, 30/12/95), and *Duranta* (S. Lúcia, 26/4/96, Oniki *et al.* 2000) but also small trees there (japanese plum, 26/4/96), at Nova Lombardia (*Inga*, 5/3/95) and below the Serra do Cipó (*Vochysia*, 20/12/97). Goeldi (1894) notes japanese plums and *Hygrophila*, Sick and Pabst (1968) *Hibiscus*, Fry (1970) *Qualea*. Ribon *et al.* (1994) record it in *Melanoxylon*.

*Popelairia langsdorffi* of mountains is recorded at cactus flowers by Magalhães (1939) and *Inga* in Boracéia (2/2/87, D. F. Stotz pers. comm.) but not yet in eucalyptus. *Discosura longicauda* of lowland northeastern forest edges we saw only flying like a wasp around *Cecropia* leaves (Oniki *et al.* 2000). Hopkins recorded it at *Parkia nitida* tree flowers in Amazonia.

Antunes (2000) did not note *Thalurania glaucopis* of the understory and border in tall eucalyptus, but I recorded a few winter birds, as well as one at Intervalles. Although as large as *A. lactea*, it is more of a "trapliner" than a territorial species, and wanders to a large number of flower species, from epiphytes and herbs to trees, without spending long periods even at the latter unless there are no aggressive species present. Snow and Snow (1986) found the male more territorial than the female (*Heliconia* and *Dahlstedtia* flowers), as did Abreu and Vieira (2000, in *Geissomeria* and *Mendoncia*).

It perhaps does not nest in the Horto, though nesting in a natural woodlot nearby (Willis and Oniki 2002). In

that woodlot, it was at *Inga* (2/9/01) and *Tabebuia umbellata* (18/7/82), in the Horto at *Schizolobium* (30/9/91), *Sessea* (2/7/89); at the Itirapina lake and Pau-brasil in *Grevillea* near woods, in Paineiras, at *Chorisia* (Feb.-June; also Souza 2001), in Luiz Antonio at *Pyrostegia* (1/9/97), in Itirapuã at *Alchornea* (21/11/87), at Barreiro Rico at *Malvaviscus*, in Fazenda Paraíso (650 m, 2222/4940) at a yellow Bignoniaceae vine (14/4/96) as Paineiras (3/6/01), at Faz. Capricórnio in bananas (10/8/86, also Nova Lombardia 12/7/97), *Calliandra*, and *Cestrum* (21/8/94), Ubatuba *Mabea* (2325/4507, 20/8/88; also Vieira *et al.* 1992), a red *Passiflora* (950 m, 2322/4508, 3/10/97), Picinguaba another flower (2322/4452, 4/10/97) and *Inga* (5/10/97; also S. Lúcia 17/2/90, Nova Lombardia 8/9/94 and 5/3/95, and Floresta Nacional do Rio Preto, 15/2/93); in Imitagem, RJ at *Erythrina* (28/7/97), in Santa Lúcia at japanese plum and jambo (April), *Impatiens* (21/8/94), also *Duranta repens* (13/1/95, Oniki *et al.* 2000) and *Vernonia polyanthes* and *Rechsteineria* (30/6/93), in Nova Lombardia at *Lantana camara* (28/12/95, also Almeida and Ritter 2000), *Eryobothria* (30/1/94), a red mistletoe (27/1-19/2/95) and red bromeliad (19/2) and yellow one (11/9/94), in Sooretama at *Dioclea* (17/7/93), and *Coffea arabica* (19/9), and in Sapucaira, BA at a shrub (20/7/94). Ribon *et al.* (1994) record it in *Melanoxylon*, Martuscelli and Chiea (1985) in *Miconia*, Martuscelli (1985) in *Psidium*, Mitchell (1957) at *Russelia*, *Erythrina* and dwarf *Poinciana*, Sazima and Sazima 1988 (see 1999) in bat-pollinated *Helicteres*, Storer (1989) on *Billbergia*, Sazima *et al.* (1993) in *Norantea*, Sazima *et al.* (1995) at 6 species, Buzato *et al.* (2000) at 11, Sluys *et al.* (2001), Alves *et al.* (2000), Varassin and Sazima (2000) and Pizo (1994) at bromeliads, Voss (1977) in *Malvaviscus*, Piratelli (1997a, b) in two *Hippeastrum*, San Martin-Gajardo and Freitas (1999) puncturing flowers, Passos and Sazima (1995) in *Manettia*, Antunes in Oniki *et al.* (2000) at *Dicliptera*, Braz *et al.* (2000) at *Mendoncia*, *Justicia* and *Geissomeria*, I. Sazima (in Sigrist and Sazima 2002) at *Ruellia*, Vasconcelos and Lombardi (2000) at *Vanhouttea*, Almeida and Alves (2001) at *Erythrina speciosa*.

*Thalurania furcata* of cerrado woods off north also wanders, but was only recorded in flowering trees – *Tabebuia heptaphylla* and *Inga* at Buritizal (11/9/87; also Layard, 1873), *Vochysia* at Serra do Cipó, MG (20/12/97). Leck (1971) noted it at five species, Ayala (1986) at 15, Cotton (1998) at 7, Cotton (2001) at *Erythrina*, Sazima (1981) in *Pavonia*, Almeida *et al.* (1997) nonterritorial and Amaya-Márquez *et al.* (2001) at 15 species, Stiles (1975) territorial at *Heliconia* clumps, Bertin and Wilzbach (1979) in *Hamelia*, Oliveira (1998) in *Calliandra*, Bittrich and Amaral (1996) in *Symphonia*, Melo (2001) in *Caryocar*. *Heliactin bilopha* of semiopen cerrado off north also was not recorded at eucalyptus; I recorded it at purple thistles and pecking insects off *Solanum* leaves at Águas Emendadas



Park, Brasília (22/7/89). Negret and Negret (1981) noted it at *Hyptis* and *Croton*, Negret (1988) at Verbenaceae.

*Chrysolampis mosquitus* of borders and semiopen zones off north wanders south in summer at times (male sunning on treetop at Selvíria, MS, 20/11/87; Pantanal lowlands, MT in January; *Inga* in Nova Lombardia 5/3/95; fleeing *Eupetomena* in *Grevillea* at CVRD in Sept.; *Grevillea* at Itirapina 25/12/94; *Chorisia* in Barreiro Rico by W. Bokermann, see Willis and Oniki 1985) but is unrecorded at eucalyptus. Feinsinger *et al.* (1979, also *Heliconia*), Todd and Carriker (1922) and Goeldi (1894) noted *Erythrina* (Goeldi citing orange flowers by Reeves in Gould). Wied (1830-34) reported it at *Gothea*, Fry (1970) at *Vochysia*, Zenaide (1953) at *Bowdichia*, Machado and Sazima (1995) robbing *Ruellia* in September, Raw (1996) at *Melocactus*. Northward, Hokche and Ramirez (1990) report it at *Bauhinia*, Snow and Snow (1972) at 4 species, Voous (1977) at 15 species.

*Augastes scutatus* of mountains off north was in *Stachytarpheta* bushes at the Serra da Piedade, 21/12/97. Sazima (1977) recorded it in *Barbacenia*. Y. Oniki and I recorded *A. lumachellus* at *Hyptis hagei* (Morro do Pai Inácio, BA, 10/5/96). Romão *et al.* (2001) recorded mostly *Hyptis* there, also *Pavonia* and six others.

*Chlorestes notatus* of edges in northeastern coast zones was singing 21/1/93 in young eucalyptus at the Rio Itaúnas, but was only at flowers of *Erythrina* over cocoa at Barrolândia (July), *Grevillea* at Pau-brasil (23/7/97), *Gaylussacia* at Una, BA (28/7/94), and small blue *Cuphea* flowers (28/7/94, natural open zone N of Olivença, BA). Bittrich and Amaral (1996) noted it at *Symphonia* in Manaus, Feinsinger *et al.* (1979) in *Erythrina* in Trinidad, and Cotton (2001) in Colombia. *Heliothryx aurita* of edges and midlevels of coastal forests never visited eucalyptus; it was in *Erythrina* at Barrolândia and even a bush at the open-area headquarters (Feb. 2000). Ingels (1981) noted it piercing a withered night flower, *Cereus*, Hopkins (1984) at 2 Amazonian *Parkia* trees, Vicentini and Fischer (1996) at Amazonian *Moronobea*, and Martinelli (1997) visiting in a bromeliad, *Nidularium*.

Neither Antunes (2000) nor I recorded traplining, understory Phaethorninae at eucalyptus flowers. *Phaethornis pretrei* is common in and at edges of the Rio Claro Horto, and uses at least three low flowers there (Antunes, 2000). I recorded *Thevetia peruviana* (18/11/90) there, *Hibiscus* (13/8/89) in nearby S. José, *Pyrostegia* in the Corumbataí cerrado (865 m, 2214/4741, 2/6/89) and Faz. Sta. Cecília (7/9/97), *Mabea* at the Itirapina lake (10/6/01), *Alchornea* in the upper understory at Itirapuã (21/11/87), rather tall *Delonix* at São Simão (Oct.), and *Salvia* at S. Teresa (27/3/94). Oniki (pers. comm.) recorded visits to *Clerodendrum* and *Hemerocallis* (campus, Rio Claro, 26/11/93). It regularly visits *Heliconia rostrata* in our suburban yard at Barão Geraldo, where attacked by

*Eupetomena* if it tries to rise into *Grevillea* (as at Itirapina) or *Malvaviscus*. In *Malvaviscus* at Barreiro Rico, it is more common. Rare *Stachytarpheta* in Dec.-Jan., Serra da Piedade, MG; *Ruellia* at Palmeiras, BA, 8-9/5/96.

Machado and Sazima (1987) recorded it at pendent *I. hederifolia*, not upright flowers. Sazima and Sazima (1995) photographed one at *Mutisia*, Sazima and Machado (1983) saw it at *Mutisia*, Sazima (1981) at *Pavonia*, Almeida *et al.* (1997) and Pinto (1943) at *Heliconia* (but not *Erythrina*), Piratelli (1997a, b) more at one of two *Hippeastrum*, Santos (1998) in *Bowdichia*, Oliveira (1998) in *Calliandra*, Gobatto-Rodrigues and Stort (1992) at *Pyrostegia*, Olmos and Boulhosa (2000) at *Mabea*, Antunes in Oniki *et al.* (2000) at *Dicliptera*, Braz *et al.* (2000) in *Geissomeria* and *Ruellia* (citing Buzato for *Mendoncia*), I. Sazima (in Sigrist and Sazima 2002) in *Ruellia*, Figueiredo and Alves (1991) at introduced *Nopalea*, Souza (2001) in *Chorisia*, Mendonça *et al.* (2001) as nonaggressive.

*Phaethornis eurynome* and *P. squalidus* are common in and near forest understory at Intervalles and near S. Lúcia, but never rise into eucalyptus. At Santa Lúcia, the former visited *Hibiscus* (21/2/97), two *Costus* species (25/1/93), red tube flowers (25/4/96, 4/9/94) and vine (29/6/93), or understory flower (13/10/96), ground bromelias atop the nearby morro (11/9/94), and only briefly low jambo trees (25/4/96) where others were aggressive. At nearby Nova Lombardia, a small-flowered vine (8/9/94), two *Passiflora* (21/9/93, 10/9/94), red understory mistletoe (27/1-20/2/95) and nearby red bromeliad (19/2). One of the latter birds checked our red car, and finally started checking me, even poking its bill in my nose once, as I was quiet there for days watching a piha nest (Willis and Oniki 1998). At Maromba, RJ, *Abutilon megapotamicum* (2/9/95). Abendroth (1965), Pizo (1994), Varassin and Sazima (2000) and Machado *et al.* (1998) found it common in similar bromeliads, as *Vriesia* (once by Araujo *et al.* 1994). Graham (1986) noted *Impatiens*, *Salvia*, *Mendoncia* and *Psychotria*. Sazima *et al.* (1995) recorded it at 3 species, Buzato *et al.* (2000) at 38 species (even territorial at abundant *Camptosema*), Passos and Sazima (1995) at *Manettia*, Bertoni (1901) noted *Salvia* and tobacco, Azevedo (1995) in *Dombeya*, Snow and Teixeira (1982) 7 species, Machado *et al.* (2000) in 16 species (8 being bromeliads), Snow and Snow (1986) some 11 species (9 with corolla 39-50 mm).

*Phaethornis squalidus* at S. Lúcia visited *Passiflora* (16/3/94), a blue morning glory (3/9/94), *Impatiens* (24/4/96) and low in *Malvaviscus* (28/6/93) all near the ground. Pizo (1994) and Varassin and Sazima (2000) found it at bromelias, Vasconcelos and Lombardi (2000) at *Camptosema*, Passos and Sazima (1995) at *Manettia*, Braz *et al.* (2000) at 3 Acanthaceae. Varassin and Sazima (2000) recorded it to 12 m up, but I saw only *eurynome* reaching that height in nearby Nova Lombardia.

*Phaethornis ruber* of the coast were noted at *Grevillea* at Pau-brasil (22-23/7/97) and *Heliconia latispatha* (12/2/93); it is registered at *Nematanthus* (Franco and Buzato 1992), *Malvaviscus* and *Beloperone* (Sick and Pabst 1968), at 5 Acanthaceae (Braz *et al.* 2000), also 3 others (Sazima *et al.* 1995) and 7 (Buzato *et al.* 2000) or 6 others (Cotton 1988), touching oily pollen of *Souroubea* with wings and tail (Machado and Lopes 1998, 2000), robbing *Irlbachia* (Machado *et al.* 1998), on cotton in a clearing (Novaes 1980), at a lily at night (Sick and Teixeira 1981), attacking bees at an orchid (Singer and Sazima 2001), visiting a bromeliad (Siqueira-Filho 1998), and even puncturing flowers (San Martin-Gajardo and Freitas 1999), at 9 species northward in the Guianas (Snow 1973), and several flowers in Colombia (Amaya-Márquez *et al.* 2001).

*Phaethornis idaliae*, common in lowlands off northeast of S. Lucia, was at woodlots near but not under eucalyptus; it was at a low *Psychotria* (26/12/92), *Justicia* (18/7/93), and *Dioclea* (17/1/93) at Sooretama, at CVRD, *Grevillea* and *Heliconia* (14/7-20/12/93) and a small pendent red flower (14/9/94). A few were at *Vriesea* in the open (Sluys and Stotz 1995). *P. gounellei* we captured at *Ruellia* understory flowers in scrub above Palmeiras, BA (9/5/96).

*Ramphodon naevius* of understory at S. Lúcia never rose into eucalyptus; it visited *Hibiscus* (24/1/94), papaya (24/1/94, 18/5/96) and banana (30/6/93) flowers at the lab, plus planted *Erythrina speciosa* by the forest road above Ubatuba (19/8/84). Araújo *et al.* (1994) recorded it as the only pollinator of three *Vriesea*, San Martin-Gajardo and Freitas (1999) in *Besleria*, Fischer *et al.* (1992) at a bat flower, Magalhães (1939) in orchids, Franco and Buzato (1992) in *Nematanthus*, Aleixo and Galetti (1997) and Varassin and Sazima (2000) in bromelias, *Musa* and *Aphelandra*. Sazima *et al.* (1995) register 21 species, Buzato *et al.* (2000) 28, rarely to 10-15 m up.

*Glaucis hirsuta* of coastal forest understory and edges also never rose to eucalyptus; they were recorded at *Heliconia* (Km 45 edges near Conceição da Barra, ES, 29/1/93; and Guaraní, BA edges), *Grevillea* (Pau-brasil in July), and *Erythrina* (Barrolândia in July). At feeders in S. Teresa, it was attacked by *Aphantochroa* but won some bouts with *Melanotrochilus*. At *Grevillea* at CVRD, it attacked *Hylocharis sapphirina* but fled from *Eupetomena* (see Feinsinger *et al.* (1985) and Snow and Snow (1972) for hierarchy in Trinidad, Snow (1973) for Guyana, Cotton (1998a, b) for Amazonia, and Poulin *et al.* (1994) for Venezuela). Sazima *et al.* (1995) record it at *Heliconia*, Varassin and Sazima (2000) at *Aechmea*, Chapman (1894) at wild bananas, Amaya-Márquez *et al.* (2001) at 31 species. In Panama, it visits *Heliconia* (Wetmore 1926). Forest-understory *Heliconia* was the staple food of *Glaucis dohrnii* (Rio Murici, BA, 1/2/94; 8/2/93 at Reserva Pau-brasil); it may be disappearing because nowadays it cannot migrate through cleared areas

to other distant woods when local *Heliconia* stop flowering for a few months.

*Piciformes*. One *Bailloni* *bailloni* at Santa Lúcia, 24/1/94, visited papaya flowers by the lab. Galetti *et al.* (2000) saw it eat two types of flowers. A *Dryocopus lineatus* in eucalyptus at the Rio Claro Horto, 25/3/00, left off pecking the trunk and flew to crawl in groups of flowers at the tips of several nearby limbs, apparently putting its beak in flowers (Willis and students). Robinson (1997) recorded it, 4 other woodpeckers, a barbet and 4 toucans among 34 species at *Quararibea* and *Combretum* flowers along a lake in Peru. *Melanerpes candidus* visited *Combretum* (Sazima *et al.* 2001). *Melanerpes cruentatus* seemed after extrafloral nectar on *Mabea* at Pontes e Lacerda, MT, 2/8/87. All these species crawl over groups of flowers, rather than hover or peck (from a nearby perch). Azevedo recorded *Colaptes campestris* after insects in eucalyptus, Toledo (1977) *Centurus* at *Epiphyllum* flowers, Toledo and Hernández (1979) another *Centurus* at *Erythrina*, Feinsinger *et al.* (1979) a *Piculus*, *Melanerpes* and *Veniliornis*, Morton (1979) a *Melanerpes*, Fleming *et al.* (1996) and McGregor *et al.* (1962) *Colaptes auratus* and a *Melanerpes* at cactus flowers, Nadkarni and Matelson (1989) a barbet at flowers in Costa Rica.

*Tyrannidae*. At least 55 tyrannids are recorded in the Rio Claro Horto (Willis in press), and 22 wander in the eucalyptus trees, usually catching insects. Antunes (2000) notes three species getting insects on flowers (*Camptostoma*, *Serpophaga* and *Todirostrum*), but the species I noted in eucalyptus were probably not "flower watchers," a subject we plan to consider in a separate note. *Elaenia flavogaster*, with bill into flowers at Itaqueri and *Pitangus sulphuratus*, on *Combretum* with parakeets and icterids at Campos de Jofre (20/7/87), were probably getting nectar. *Pipra fasciicauda* on *Mabea* at Porto Limão, MT (31/7/87) may have done so, as *Elaenia albiceps* at Barreiro Rico (24/9/90). Kratter *et al.* (1993) record a flower in an *Elaenia albiceps* stomach, Johow 1901 (*in* Faegri and Pijl 1971) visits to introduced *Aloe ferox*, Traveset *et al.* (1998) pollination of *Fuchsia* (as by the hummingbird *Sephanoides galeritus*). Vieira *et al.* (1992) record *Pitangus*, *Megarynchus*, *Elaenia mesoleuca* and *Serpophaga* on *Mabea*; Olmos and Boulhosa (2000) *E. flavogaster* and *chiriquensis* flying or perching on it; Roitman *et al.* (1997) record *Pitangus* and *Elaenia parvirostris* eating *Myrrhinium* petals. *Pitangus*, *E. flavogaster* and *Machetornis rixosus* ate *Combretum* jelly (Sazima *et al.* 2001). *Oxyruncus cristatus* on *Clusia* flowers at S. Lúcia (5/9/92) may have been after nectar or insects. These birds vary between pecking or crawling over flowers, plus sallying in the case of insectivorous flower watchers.

*Oscines*. *Mimus* definitely puts its beak into eucalyptus flowers after nectar (Antunes 2000, and at cerrado edges near Itirapina), as did *Passer* and *Carduelis* at Posto

Siriema. *Mimus* visits *Hortia* (Barbosa, 1999), and eats *Myrrhinium* (Roitman *et al.* 1997) and *Centrolobium* flowers (Maciel and Costa 1997); *Mimus* and *Passer* visited *Mabea* (Vieira *et al.* 1992), while *Passer* was in *Erythrina* (Vitali-Veiga and Machado 2000), *Tabebuia* and eating anthers of *Cassia* (Kühlmann and Kuhn 1947). *Passer* often eat or puncture flowers in Europe (Faegri and Pijl 1971). In Trinidad, *Mimus gilvus* visited *Erythrina* (Feinsinger *et al.* 1985).

In Arizona, a thrasher and *Campylorhynchus* wrens visited saguaro flowers (McGregor *et al.* 1962). In Mexico, *Campylorhynchus* visited *Bernoullia* flowers (Toledo 1977), as *Erythrina* (Toledo and Hernández 1979). In Costa Rica, a *Troglodytes* visited a few flowers (Nadkarni and Matelson 1989). *Carduelis* was in *Zinnia* flowers (Pinheiro 1992). The cerrado edge jay *Cyanocorax cristatellus* flocks in eucalyptus at Siriema and the Horto (where a recent invader), but never was seen at flowers. Melo recorded groups probing flowers of *Caryocar*. Skutch 1954 found one *Psilorhinus morio* at banana flowers, Bruneau a jay at *Erythrina* in Mexico, Toledo (1977) others at *Bernoullia* and *Ceiba* there, and Olmos and Boulhosa (2000) a *C. chrysops* getting nectar at *Mabea*.

Antunes (2000) registered *Cyclarhis* getting insects on flowers, Feinsinger *et al.* (1979) in *Erythrina*. *Vireo olivaceus* was on *Mabea* at Pontes e Lacerda, 2/8/97, likely for nectar; Layard (1873) records petals in the stomach. *Hylophilus amaurocephalus* removed a small red flower in the bill and held it under one foot, pecking a hole (for insects? Itaqueri, 16/4/95). *Turdus leucomelas* and *T. amaurochalinus* were on *Mabea* at Porto Limão, 31/7/87; the former also recorded by Vieira *et al.* (1992) and Olmos and Boulhosa (2000). *T. amaurochalinus* ate eucalyptus flowers off south (Belton 1994), and of “copieiro” on the ground (Sander and Voss 1982). *Turdus rufiventris* and *T. leucomelas* ate *Myrrhinium* petals (Roitman *et al.* 1997) and “sweet jelly” of *Combretum* (Sazima *et al.* 2001). These species often crawl over flowers, or peck separate flowers from a nearby perch.

Nine-primaried Emberizidae and relatives provided many more records at eucalyptus and other flowers, mostly bunch-flowering ones where crawling or petal-pulling was possible. Of 46 Emberizidae and relatives in the Horto (Willis, in press), 27 move up into tall eucalyptus at times. *Piranga flava* is now mainly in eucalyptus in São Paulo; it was earlier a cerrado bushtop species, rather adapted for semiopen canopy (recorded in eucalyptus flowers by Antunes before his 1998 studies). Melo (2001) found it at flowers of *Caryocar*.

The flowering tree on the Horto dam produced a pair of *Cyanerpes cyaneus* in July-Aug. 1985 and 86 (Willis 1987), again 16/8/87, then a female 31/7/88 (Willis and Oniki 1993), and she (?) was in an *Alchornea* fruiting tree nearby 2/10/94. I am no longer sure this was a case of

repeated pair migration; perhaps a vagrant pair settled and survived for years, the female to 1994, due to varied eucalyptus and other introduced flowers and fruit in the Horto. However, the only other state record is in *Mabea* off west (Olmos and Boulhosa 2000). It was common in *Erythrina* at Barrolândia (July) and in mirueira at Monte Pascoal (July). Skutch (1954) records it at *Calliandra*, *Inga* and eucalyptus flowers, Haverschmidt (1968) and Morton (1979) in *Erythrina*, Snow and Snow (1971) in others, Toledo (1977) in *Bernoullia*, Tashian (1953) in *Inga*, Beehler (1980) in *Luehea*. Quirino and Machado (2001) in *Combretum*. It opens its beak in flowers little (Winkel 1968).

*Chlorophanes spiza* of coastal forests never reaches the interior, except highlands northward and eucalyptus near S. Lúcia (where at japanese plums in April). Sazima *et al.* (1993) record it on extrafloral nectar of *Norantea* racemes. Skutch (1981) recorded it in jambo and others, Leck (1972) on *Lantana*, Steiner (1979) in *Erythrina*. In Trinidad, it gets insects and nectar in jambo, *Inga*, *Calliandra* and *Zanthoxylum* (Snow and Snow 1971). Beehler (1980) noted it more after insects in *Luehea*.

*Dacnis nigripes*, once in Horto eucalyptus in 10/98 (Antunes 2000), was a migrant at *Alchornea* fruit there in 10/94; it summers southward and winters to the north (*Erythrina* flowers over cocoa at Faz. Capricórnio 10/8-21/8/94, and *Alchornea* fruit at Picinguaba in October). Gonzaga (1983) recorded it in *Mabea* just north. *D. cayana* is common at edges and Horto eucalyptus flowers or *Inga* (24/10/93); attacking hummingbirds in *Myrocarpus frondosus* there (5/7/82); at *Tabebuia* and *Inga* (9/9/01) in nearby S. José (July), *Chorisia* at Paineiras (June), *Mabea* at Barreiro Rico (April), Itirapina (3/6 and 10/6/01) and Ubatuba (Aug.) plus Queiradeus Abaixo, ES (250 m, 1937/4049, 22/5/96), japanese plums at S. Lúcia (April), and *Dioclea* vines at Sooretama in July (with *Euphonia violacea*, a coastal species that visits eucalyptus in winter in the Rio Claro Horto). Snow and Snow (1971) record it more after insects than after nectar (Winkel 1968 notes it has a weak muscle to open the beak, unlike *Coereba*, it does pry open flowers), Piratelli and Lavrado (1990) in *Grevillea*, Beehler (1980) in *Luehea*, Feinsinger *et al.* (1985) in *Erythrina*, Leck (1972) on *Lantana*, Melo (2001) on *Caryocar*, Mitchell (1957) on fig and mango flowers, Ribon *et al.* (1994) on *Melanoxylon*, Rojas and Ribon (1997) on *Bowdichia*, Sazima *et al.* (1993) on extrafloral nectaries of *Norantea*, Olmos and Boulhosa (2000) very common hanging down on *Mabea*.

*Coereba*, with strong beak-opening muscles and a protective nasal operculum (Stiles 1981), are certainly regular at flowers, including eucalyptus in the Horto and elsewhere. There they were at *Chorisia* (28/2/88), *Schizolobium exselsum* (6/10/87) and *Bauhinia* (26/8/01), in S. José at *Tabebuia* (18/7/82), *Croton floribundus* (Dec.) and a white-flowered vine (July), in Barão Geraldo in

*Bauhinia* (6/6/98), *Malvaviscus* (also by Morais 1999) and *Grevillea* (as at Itirapina and Pau-brasil), in Barreiro Rico at *Mabea* (24/4/93) as at the Itirapina lake (10/6/01), at the Serra da Piedade rare in *Stachytarpheta* (Dec.-Jan.), at Pau-brasil in *Stenolobium stans* (28/7/93, Oniki, pers. comm.); at Barrolândia in *Erythrina* (July; see also Mitchell 1957, Steiner 1979, Vitali-Veiga and Machado 2000 and Erickson and Mumford 1976). Use of edge trees is frequent, despite competing hummingbirds, and seldom scattered low or forest-interior flowers. Snow and Snow (1971) record it in *Inga*, *Tabebuia* and 48 other flowers, Johnson (2000) in *Inga*, Martuscelli and Chiea (1985) in *Miconia*, Feinsinger *et al.* (1985) in *Erythrina* and others, Poulin *et al.* (1994) note insects and nectar, Marcondes *et al.* (1987) note *Erythrina*, *Euphorbia* and *Hibiscus*, Ribon *et al.* (1994) in *Melanoxylon*, Piratelli and Lavrado (1990) in *Grevillea*, Graham (1986) in 8 species, Leck (1971) in 4, Santos (1998) and Rojas and Ribon (1997) in *Bowdichia*, Azevedo (1995) in 4 flowers, Sazima *et al.* (1993) at *Norantea* along the racemes, Sazima and Sazima (1999) at others, Almeida and Ritter (2000) in *Lantana*, Alves *et al.* (2000) in *Tillandsia*, Rocca and Sazima (2001) in *Citharexylum* (as well as hummingbirds), Quirino and Machado (2001) and Sazima *et al.* (2001) in *Combretum*.

*Conirostrum* are regular in the Horto and other dry forests in the canopy of eucalyptus and other trees, in mixed flocks, early in the day; later, these flocks descend to native understory. They visit flowers jointly at times. At dawn, *Mabea* flowers at Queiradeus Abaixo (May), at dusk at Itirapina (10/6/01), as by Olmos and Boulhosa (2000) (“*C. bicolor*”). It probed *Inga* at Faz. S. José (9/9/01). *Hemithraupis ruficapilla*, with others at eucalyptus flowers infrequently, are common in the flocks; also probing *Croton floribundus* (12/12/82) and *Inga* in S. José (9/9/01) and *Mabea* in Barreiro Rico (April) and Ubatuba (20/8/88). Ribon *et al.* (1994) register it in *Melanoxylon*, Sazima *et al.* (1993) in *Norantea*. Melo (2001) records *H. guira* at *Caryocar* flowers. *Hemithraupis flavicollis*, of flocks in lowland forests and edges off north, is not yet recorded in eucalyptus; it was in *Mabea* at Queiradeus Abaixo. *Nemosia pileata* often is in the flocks, even in eucalyptus; *Mabea* at Queiradeus Abaixo (also by Olmos and Boulhosa 2000). *Thlypopsis* can fly up from the dense understory and use eucalyptus flowers when a mixed flock moves in (insects in palm flowers at dawn, 1/5/01 in S. José, also *Inga* 9/9/01). *Parula* of edge treetops can move in at such times (Belton 1994 also; *Myrrhinium* and *Pisonia* flowers, Roitman *et al.* 1997; insects in *Abutilon* flowers, Descourtilz 1944). It may be that some of these birds are getting insects near the flowers rather than nectar, except for the *Mabea* and *Norantea* records. *Tersina viridis* Mitchell recorded at bases of *Delonix*, Vieira *et al.* (1992) in *Mabea* and Robinson (1997) in flowers in Peru. It is more of a frugivore than nectar feeder.

A number of medium-sized tanagers often move to eucalyptus or other flowers when other birds are active. Some *Thraupis* and *Ramphocelus* (and probably others) drink nectar directly, especially by perching over or near flowers like a woodpecker or mammal. At the Campos de Jordão Orotour Hotel, *T. sayaca* drank sugar water from hummingbird feeders (30/5/96), once even trying to hover (*Coereba* often tries to hover in front of feeders). At Paineiras, it was in *Alchornea* with hummingbirds (22/4/90). It was in *Erythrina* (Barrolândia, July) with *Cacicus* (latter noted at *Erythrina* by Berla 1994, and by Sick 1997 at mistletoes), *Ramphocelus bresilius*, *Thraupis palmarum* and *Tangara cayana*. Mitchell (1957) reports *sayaca* probing the bases of *Erythrina* flowers. Sick (1997), Sander and Voss (1982), Belton (1994) and Azevedo (1995) record it at eucalyptus. Melo (2001) records *sayaca* and *palmarum* at *Caryocar*. *T. sayaca* and *T. palmarum* were in *Melanoxylon* (Ribon *et al.* 1994), *palmarum* at *Erythrina* (Snow and Snow 1971, Feinsinger *et al.* 1979, and Morton 1979). Melo (2001) found *T. cayana* at *Caryocar*, also *Tachyphonus rufus* (recorded in *Erythrina* and other flowers in Trinidad, Snow and Snow 1971).

*Thraupis palmarum* was at palm flowers in the Rio Claro Horto 12/10/86. Cotton (2001) recorded it (plus two tanagers not found southward). Santos (1998) noted it in *Bowdichia* (also *T. sayaca*, *E. chlorotica*, *R. carbo*, aggressive *Icterus cayanensis* and wandering *Troglodytes aedon* and *Myiozetetes similis*). *R. carbo* was also at *Inga* in São José (4/10/98) and in a yellow Bignoniaceae vine at Paineiras (3/6/01). Feinsinger *et al.* (1985) and Cotton (2001) report it in *Erythrina*, Snow and Snow (1971) in this and other flowers. *Schistochlamys* robbed nectar at the base of *Pyrostegia venusta* (Corumbataí, 17/6/82). *Tangara velia* of northeastern lowlands was at canopy flowers in the CVRD, 16/9/94. *Tachyphonus cristatus* was at a flower bush at S. Lúcia, 25/4/96; Descourtilz (1944) recorded it at *Mabea*, *Euphonia pectoralis* and *Chlorophonia cyanea* at flowers, and *Pitylus fuliginosus*, *Cacicus haemorrhous*, *Euphonia chalybea* and *E. violacea* at *Abutilon*.

Jambo flowers attracted *Thraupis ornata* and japanese plum flowers attracted it and *Tangara seledon*, *Tachyphonus coronatus*, *Schistochlamys ruficapilla*, *Euphonia pectoralis* plus *E. violacea* and others in April at S. Lúcia. Mass-flowering trees like *Inga* or orchards like *Erythrina* and japanese plums thus attract many emberizids, from cowbirds and caciques to tanagers, at least where there are forest reserves nearby. Birds in bromelia flowers include *Tangara seledon* (Sick 1997). In *Tabebuia heptaphylla*, I noted *Psarocolius decumanus*, which french (1980) and Cotton (2001) registered at *Erythrina*.

Skutch (1954) found icterids at banana flowers. Morton (1979), Bruneau (1997), Toledo (1977) and Toledo and Hernández (1979) list other icterid records from Central America, Feinsinger *et al.* (1985) from the Trinidad region,

Cotton (2001) from Colombia. Neill (1987) registers chewing and dropping flowers for icterids and *Pheucticus*. Stiles (1981) even thought passerine pollination was mainly by icterids, though noting one parulid in flocks at flowers. Pizo (1994) recorded *Cacicus haemorrhous* at 3 flowers and *Cacicus chrysopterus* at *Fuchsia* flowers, Sick (1997) noted *C. solitarius* at *Hibiscus* (Cotton 2001 at *Erythrina*) and *Pipraeidea* at flowers.

Remela-de-pombo (*Combretum*) at Cuiabá attracted *R. carbo* (12/7/87), then (18/7-20/7) *Paroaria capitata*, *Coryphospingus cucullatus*, *Saltator caerulescens*, *Molothrus* and *Agelaius cyanopus* (plus *Thraupis palmarum* on 20/7). Sazima *et al.* (2001) record 5 icterids (*Cacicus cela*, *Gnorimopsar chopi*, *Icterus cayanensis*, *I. jamacaii*, *Psarocolius decumanus*) and 8 tanager relatives (*Ramphocelus*, *Tachyphonus rufus*, *Thraupis palmarum*, *T. sayaca*, *Euphonia chlorotica*, *Coryphospingus*, *Paroaria*, and *Saltator*) plus 15 species noted above or below. Timken (1970) found *Icterus* at *Combretum* (and other) flowers. Robinson (1987) found *Scaphidura oryzivora* at *Combretum* (and *Quararibea*) flowers, Robinson (1997) some 18 blackbirds and tanagers (he also found an *Agelaius* and *Icterus* at *Heliconia*), Gryj *et al.* (1990) *Parula* and *Volatinia jacarina*.

*Thraupis sayaca* was at *Mabea* (Barreiro Rico, April) as understory *Trichothraupis* and edge *Ramphocelus carbo*, *Tangara cyanocephala* of the coast was at *Mabea* in Ubatuba (20/8/88), with *Tangara seledon*, *Trichothraupis* and *Tachyphonus cristatus*; 15 *Caryothraustes canadensis* flocked to *Mabea* at Queiradeus Abaixo (May). Busy flocks of several pairs of *Euphonia chlorotica* wandered back and forth on *Mabea* flowers with other birds (*Dacnis*, *Conirostrum*) at the Itirapina lake, often hanging down the spikes, 10/6/01. Vieira *et al.* (1992) record 19 species in *Mabea fistulifera*, plus 4 tyrannids, *Mimus*, *Passer*, a thrush, and 6 hummingbirds. Their list of emberizids resembles the Appendix for eucalyptus in 16 cases, adding only *Tersina viridis*, *Sicalis flaveola* and *Saltator similis*. Olmos and Boulhosa (2000) recorded *T. palmarum* and many *T. sayaca* and *Tangara cayana*, arriving and leaving in tanager flocks as often in my *Mabea* or eucalyptus records. They comment on use by bats and mammals crawling over the flower bunches, noting that the species produces more nectar late in the day and at night. Beehler (1980) and Toledo (1977) discuss literature and observations of similar flocks. Descourtilz (1944) had recorded *Tachyphonus coronatus*, Ferrari and Strier (1992) record *Cacicus haemorrhous*. Medium-sized emberizids seem to appreciate the species with bunched extrafloral nectaries. *Hortia* is a bunch flower that attracts them all winter (*Volatinia*, *Coryphospingus*, *Saltator atricollis*, *Zonotrichia*, *Schistochlamys*; Barbosa). Racemes of *Norantea brasiliensis* with extrafloral nectaries also attract wandering flocks of tanagers, at least near the forest even if not in scrubby restinga (Sazima *et al.* 1993:

*Euphonia violacea*, *Ramphocelus bresilius*, *Tachyphonus cristatus*, *Tangara cyanocephala*, *T. desmaresti* and *T. seledon* plus others noted above).

*Cassia* yellow petals in open racemes were eaten by *Tangara cayana* and two pairs of *Thraupis sayaca* (24/4/01, 17:00-17:25, campus Rio Claro). The mixed flock moved in, *cayana* eating a few petals, with pairs of *sayaca* taking over and pecking petals off to chew and eat one after another. To pull the petal off took force, the other flowers and high stamens often pulled over and brushing the tanager; they did not crawl on the racemes, though reaching down or up at times. As night approached, the last pair left after the flock. A *Tangara cayana* male ate bits of a *Tabebuia* flower at the Horto (2/10/94), and others visited these trees in nearby S. José (July) and Poço das Antas (July). A pair probed *Inga* flowers 9/9/01 at S. José. In *Inga* at the Horto, 30/10/82, one pecked holes in the base of a flower while a female *Tiaris* chewed flower bases (this species can chew *Cecropia* follicles in Paineiras; it is occasionally with flocks at eucalyptus flowers, as are *Sporophila caerulescens*, both at 10-20 m up or well above the normal zones at times; the latter was in *Croton floribundus* flowers in Paineiras, 6/11/88). *Tiaris bicolor* was in *Erythrina* off north (Feinsinger *et al.* 1979). One *T. cayana* pecked insects from petals of *Chorisia* at the Horto (14/4/91), near *Thraupis sayaca*. Another ate the bases of peach flowers at S. Lúcia (27/6/93), as noted by Mitchell (1957). *Saltator similis* ate blue-and-white Bignoniaceae vine petals of São José, 19/4/91) and flowers at Nova Granada (Oct.).

*Tachyphonus coronatus* removed sepals and petals of *Inga* (Horto, 24/10/93) or chewed flowers (S. José, 9/9/01) and of a yellow Bignoniaceae vine (Horto, 26/5/91). Azevedo (1995) also recorded *sayaca* eating petals, as of pitangueiras, Rojas and Ribon (1997) eating petals and nectar of *Bowdichia*. Roitman *et al.* (1997) noted it eating petals of *Myrrhinium* (as *Molothrus badius*, *Thraupis bonariensis*, *Stephanophorus diadematus*, *Saltator aurantirostris*, *Poospiza lateralis* of cool or dry climates). Belton (1994) records *Stephanophorus* eating pear petals, *Thraupis bonariensis* eating orange flowers. Skutch (1954), Morton (1979), and Feinsinger *et al.* (1979) report *Saltator* eating flowers northward, and Toledo and Hernández (1979) *Pheucticus*. Williamson (1975) records *S. aurantirostris* eating petals of 3 species, D'Orbigny (1847) others, Ragusa-Netto (1997) *Cypsnagra hirundinacea* eating flowers of *Pouteria torta*. Ingels (1983) reported *T. palmarum* chewing flowers of *Erythrina*, *Delonix*, *Cassia* and *Poinciana*, Snow and Snow (1971) *Erythrina* and *Tabebuia*.

Such emberizids as *Icterus cayanensis* (also on *Myrrhinium*, *Tabebuia* and *Combretum*, see Roitman *et al.* (1997); *Erythrina*, Galetto *et al.* (2000); on *Tecoma*, Wetmore (1926), *R. carbo* and *T. coronatus* often move

up from the understory or edges to flock in eucalyptus midlevels at dawn or near dusk, sunning or after insects with busy tyrannids even in months when there are no flowers. Belton (1994) records *T. coronatus* at eucalyptus flowers (as well as *Agelaius ruficapillus*, *Paroaria coronata*, *Thraupis bonariensis*, *Parula* and *Coereba*) Ones from nearby open zones, as *Zonotrichia capensis* and *Molothrus*, can also move up (*Molothrus* at treetop flowers, Friedmann and Smith (1950); *Zonotrichia* visits *Mabea*, see Vieira *et al.* (1992), and *Myrrhinium*, Roitman *et al.* (1997); eats *Cassia* anthers, Kühlmann and Kühn (1947). Seed eaters (*Sporophila*) can move up to drink nectar in winter, as recorded here; *S. nigricollis* was hanging to a flower (Wied 1830-34). Thrushes rarely risk this, though they can appear on roads or at edges of clearings at dawn. Records in the Appendix include some birds that may have been sunning or after insects, though many were seen crawling over flower bunches or with beaks in flowers. There is normally more activity at dawn or dusk than at midday, a phenomenon characteristic of open country or edge birds and which edge-living northern ornithologists often assume is normal behavior (tropical forest birds are different, Willis MS).

*Other birds.* Flower eating or opening is known for *Rhynchotus rufescens* and *Nothura maculosa* (Setubal *et al.* 1992), *Gallinula chloropus* (Peterson 1941), *Porphyrola martinica* (Meanley 1963; also carrying off unopened flowers of water lilies at Iepê, SP, and near Lençóis, BA), *Jacana jacana* (Wetmore 1926), *Thinocorus rumicivorus* (Sérsic and Cocucci 1996), and *Chauna torquata* (Aravena 1928). Although the first five occur in or near the Rio Claro Horto, none of these ground or water birds would visit eucalyptus or most other flowers considered here. McGregor *et al.* (1962) and Fleming *et al.* (1996) report *Zenaida* species visiting cactus flowers, but records are lacking for Brazilian doves except *Columba plumbea* eating introduced *Liquidambar* flowers (Graham 1986) and *Columba cayennensis* and *C. picazuro* (as well as the furnariid *Pseudoseisura cristata*) on *Combretum* (Sazima *et al.* 2001). Pigeons pollinate in other parts of the world, for instance visiting flowers that look like fruit, between regular flowers, in Indonesia (Beccari 1877 in Faegri and Pijl 1971).

## DISCUSSION

Machado and Lamas (1996) noted a few nectarivorous Trochilidae and “frugivorous” Psittacidae even in eucalyptus without native understory, indicating that such birds may survive in pure stands. Since some of their birds were *Phaethornis* that never use eucalyptus flowers, their suggestion is open to question. Motta-Júnior (1990) noted few birds in eucalyptus, some of them “open-canopy” cerrado birds as in the Rio Claro Horto. Antunes (2000) noted that the eucalyptus flowers can provide nectar for

birds all year in the Rio Claro Horto, one of the few places in the New World with diverse species planted.

While I agree with these authors that eucalyptus flowers or foliage can provide food for birds in certain cases, I also think that modern plantations will rarely provide much more than wood pulp. Yoshika Oniki and I helped ornithologists of Aracruz Florestal in huge low eucalyptus plantations of northeastern Espírito Santo in the early 1990's, noting hardly any birds except a scatter of original species in the remarkably small and few second-growth forest patches between plantations (Itaúnas and Km. 45 for instance, in this text). Since then, Aracruz drastically cut back environmental studies to save money, as have most other such companies. We have worked near one large forest area of Veracruz Florestal (here, “Pau-brasil”), preserved so as to plant eucalyptus in pasture areas about, but without company aid. We have heard of studies years ago in patches of natural habitat of the Duratex eucalyptus company near Agudos, SP, others of the Champion company near Mogi-Mirim, SP, and recently at patches near other plantations at Itatinga, SP, but all remain unpublished as if the companies do not spend money publishing.

One does have to remember, as noted briefly by Feinsinger *et al.* (1979), that plantations of *Erythrina* over cocoa and old eucalyptus plantations do produce far more nectar than natural forest zones, even leading to excess nectar at the end of the day. This could lead to unusual use by such passerines as tanagers, a “bird-feeder” relationship; one needs to study natural areas and uses. However, *Inga* and other flowering trees (*Tabebuia*, *Chorisia*) are often naturally common.

Small shade-tree plantings at Siriema, Santa Lúcia and S. Teresa do allow eucalyptus to grow and produce flowers. A large plantation like the Horto was left “semi-abandoned” only because the Brazilian railroad systems were replaced by highways since 1950, and became bureaucratic government-supported organizations rather than “productive” companies. With private railroad corporations now replacing the government ones, similar old-growth eucalyptus areas have been turned over to the “landless poor” or “sem-terra” in dozens of cases, leaving only the Rio Claro and one other Horto with the state “Instituto Florestal” for possible (?) environmental use.

One such eucalyptus experimental area of the Instituto was “stolen” over 10 years ago near São Simão, by people who say they are landless poor (but not of major “Movimento Sem-Terra” or “MST” organizations, which claim to be careful not to attack native forest or state experiment stations). They did not let me enter to check birds in 1998, even for free as guest at the nearby Faz. Aretuzina of the biologist Dr. Paulo Nogueira-Neto (see records at *Delonix* herein). It is not clear what will be the fate of the Rio Claro Horto, except trails for joggers and

exercise and a scenic lake. Large tracts were simply cut before transfer to the Instituto Florestal in 1998.

Gryj *et al.* (1990) show that *Combretum* flowers have hexose, easier to digest than the sucrose in most hummingbird flowers, which could explain why *Parula* and other Emberizidae use *Combretum* so much. Martinez del Rio and Karasov (1990) indicate that passerines could have trouble digesting sucrose, partly explaining differences in flower use; they note much hexose in certain *Erythrina*, attracting passerines, and high sucrose in others, attracting hummingbirds. Here, both hummers and tanagers were in one species of *Erythrina*, and in most species of eucalyptus. Bruneau (1997) discusses *Erythrina* off north, including studies by Baker and Baker (cited by Bruneau 1997) that report low amino acids and more sucrose in hummingbird flowers. Further study is needed. Weak vs. strong muscles to open the beak in flowers could help explain differences (Winkel 1968).

Another possibility is that larger dense flower groups, as in *Mabea*, *Combretum* and *Eucalyptus*, attract passerines, parrots, woodpeckers or other large birds, which wander over the flower group and pollinate with their plumage. Wied (1830-34) already noted a seedeater hanging on a flower, without specifying if it was a flower bunch. Sazima *et al.* (1993) noted flocks of tanagers pollinating *Norantea* better than hummingbirds. Brown and Hopkins (1995) note much clambering in New Guinea. However, recent neotropical discussions are mostly hidden in South American literature, while others (Toledo 1977, Beehler 1980) seem to have been forgotten. Barbosa (1999) suggested this for *Hortia* large flower clumps in the cerrado. Olmos and Boulhosa (2000) suggest evolution of bird clamberers from pollination systems linked with clambering bats, opossums and other mammals in the case of bunch-flower *Mabea* (a pendent inflorescence). The tanagers eating *Cassia* petals did not crawl on nearby flowers, but did pull flower groups that brushed them; a tough petal would cause this kind of possible pollen transfer. These types of flowers attract few hummingbirds. *Eucalyptus* and *Erythrina* do attract both large birds and hummingbirds, due to massive flowering, but the former are introduced from Australia where there are no hummingbirds and perhaps are not pollinated by them as they hover outside the stamens or stigmas. In Australia, clambering mammals and birds (like neotropical tanagers) probably are pollinators, and bunches of flowers could have pre-adapted them for attracting tanager clamberers or petal-pullers. By contrast, understory plants and epiphytes are small, hence have scattered flowers and depend on hovering hummingbirds rather than larger birds. Bawa *et al.* (1985) noted hummingbird pollination principally in the subcanopy or lower down, bee pollination more in the canopy. This could be partly due to midday heat in the canopy or to hawks and falcons there; but *Hortia* and *Combretum* tend to be exposed or at edges.

Since twice as many species of tanagers and relatives visit flowers as hummingbirds, yet are rarely noted compared to dozens of studies on the latter, it is likely that upper-level tropical trees and mixed flocks of tanagers need more study, with researchers learning to identify birds at a distance. Bittrich and Amaral, for instance, identified hummingbirds but few oscines at a tree in Manaus. Oil on pollen could help it stick to plumage, rather than to beaks (Machado and Lamas 1996 note oil, but seem not to think it could be for legitimate pollination by a non-hummingbird). Pollen threads could help bind to feathers as well as to beaks (Rose and Barthlott 1995). Hemsley and Ferguson (1985) note sticky pollen (“pollenkitt”) for passerine-pollinated *Erythrina*, with “sexinous” surface granules, different from dry and powdery pollen in hummingbird-pollinated species. Tanager flocks often disappear outside forest areas, although these canopy species still are fairly diverse in the large eucalyptus area at Rio Claro (not on the nearby semi-open campus). This could cause problems for tree pollination in patchy forests, even where hummingbirds survive. Also, researchers could be wrong in thinking neotropical trees are infrequently pollinated by birds (compared to paleotropical ones) if they rarely stay hours early in the day looking for tanager flocks, or seldom study in large forest areas. Even Stiles (1981) seemed to not consider tanagers as important in Central America, though Nadkarni and Matelson (1989) recorded some species, with one *Tangara* at flowers more than fruit. One does need studies in natural forests, as noted above.

It is likely that bunch flowers (umbels, panicles) evolve to exploit mammals and tanagers (even bees and flies, see Figueiredo and Sazima 2000 and Navarro 2000) that clamber, for other flowers in a group put pollen on the body of the animal that is getting nectar at one flower. Even a flower robber can be exploited, for pollen from other flowers sticks to it as it robs flower no. 1, as noted long ago by Graves (1982) and McDade and Kinsman 1980 (see Maloof and Inouye 2000). In other cases, the robber can lower pollination (Irwin and Brody 2000, for instance). Mistletoe bunch flowers in New Zealand exploded to spread pollen when chewed by now rare native birds (Sessions, 2000). “Mess and soil” pollination by lorries and others even occurs in eucalyptus (see Stiles 1981). Pollen from Africa is found on migrants arriving in England (Ash in Faegri and Pijl 1971), this type of pollination has long been known but tends to be forgotten. Nectar robbers could force hummingbirds and other pollinators to move between plants and cross-pollinate (Hernández and Toledo 1979). Another reason for bunch and massive full-tree flowering could be to attract waves of tanagers (Australia, honeyeaters) that move on to distant trees and return irregularly, to avoid hawks and other predators. “Fear and frugivory” (Howe, 1979) can be extended to “fear and nectarivory” in the case of icterid (Morton 1979), tanager,



honeyeater, and parrot flocks that move in and flee, even though hummingbirds are less susceptible and do not form mixed flocks.

Rarity of oscines in *Chorisia* trees is rather unusual, though Souza (2001) reports several catching insects. The flowers are separate even though in large numbers at flowering time, and attract many hummingbirds despite not being scattered in the understory like most hummingbird flowers.

Some groups of birds rarely or never use nectar or eat flowers: doves, jays (Corvidae), nightjars, swallows and swifts, ovenbirds, thrushes (except for clambering use of extrafloral nectar in a few cases). Thrushes eat so much fruit that rarity of nectar use in the southeastern neotropics seems strange. Flycatchers and *Tersina* also use nectar or petals little, perhaps due to their flattened beaks and tendencies to sally for food; only *Elaenia* species seem to peck flowers a fair amount. Several species do catch insects near flowers, a subject for later analysis. Emberizidae catch insects near flowers, as well as eat petals or nectar at times. Use by clambering woodpeckers was rather unexpected, but Robinson (1997) earlier found considerable use at a natural forest edge in Peru.

It is interesting that other authors rarely record flowers for some southeastern hummingbirds; our records are almost the only ones for *Aphantochroa* and *Heliomaster squamosus*. Both tend to work tall trees, little studied by botanists, but *Melanotrochilus* also does so yet has a fair number of records. *Melanotrochilus* is easy to identify at a distance, of course.

Many Psittacidae and Trochilidae, plus a scattering of migrant Emberizidae, do fly between patches of eucalyptus or other planted flowers (*Grevillea* at Itirapina Lake, *Erythrina* over cocoa at Faz. Capricórnio and Barrolândia). These planted flowers can provide transit sites between flowers of native forest trees (here *Chorisia* at Fazenda Paineiras, for example, notably for migratory *Melanotrochilus*). Frisch and Frisch (1995) encourage planting garden flowers, without discussing the problems of where the birds will nest or spend periods between flowering spells. *Grevillea* do flower all year, but tend to be taken over by aggressive *Eupetomena*. It is difficult to plant a variety of species of eucalyptus except at the former experiment station of the Horto of Rio Claro, where eucalyptus culture was introduced to Brazil in the early 1900's by the agronomist Navarro de Andrade. Antunes (2000) showed that different species provide flowers in different months. Some hummingbirds do well in town (*Eupetomena*), others moderately well (*Chlorostilbon*), and a few others come from natural habitats nearby, or from old eucalyptus. Others (*Thalurania*) rarely leave the forest, except at Barreiro Rico where a large forest patch is nearby.

Large scale sugar-water feeders attract hummingbirds, notably around S. Teresa where Augusto Ruschi introduced

the system. However, most birds nest elsewhere, and can winter elsewhere. One would have fewer hummingbirds at feeders there if Ruschi had not convinced people to set aside natural reserves next to town. Moreover, sugar is expensive and needs planted areas, or it could go to poor people for free (Catholic priests, pers. comm.).

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Appendix. Records of birds at eucalyptus flowers (see "Methods")

*Pyrrhura frontalis* – 2  
*Aratinga leucophthalmus* – f  
*Pionus maximiliani* – PV  
*Melanotrochilus fuscus* – ABFGHJKMNORTVd257  
*Thalurania glaucopis* – AGHMy  
*Amazilia lactea* – ABCDFGHIJLNOTVWXY  
*Amazilia versicolor* – ABDFGHJKLNOSTUVWXhy  
*Eupetomena macroura* – MTcdfhij  
*Chlorostilbon aureoventris* – CDTWh  
*Aphantochroa cirrochloris* – ABDFGHJNOTUVWX  
*Leucochloris albicollis* – DMWy  
*Polytmus guainumbi* – b  
*Colibri serrirostris* – dfh

*Heliomaster squamosus* – X  
*Lophornis magnifica* – 5  
*Lophornis chalybea* – y  
*Calliphlox amethystina* – RW  
*Dryocopus lineatus* – P  
*Mionectes rufiventris* – y  
*Elaenia flavogaster* – cdf  
*Tyrannus melancholicus* – y  
*Myiozetetes similis* – A  
*Mimus saturninus* – cfgi  
*Dacnis cayana* – AFGHOVXYehyz25  
*Chlorophanes spiza* – 5  
*Cyanerpes cyanus* – AEFG  
*Coereba flaveola* – ADGIKVVXh5  
*Parula pitiayumi* – FGy  
*Euphonia chlorotica* – AGLNWXac  
*Euphonia violacea* – AFGHMXY  
*Conirostrum speciosum* – DFHOW  
*Nemosia pileata* – GHOTV  
*Hemithraupis ruficapilla* – y  
*Thlypopsis sordida* – ADG  
*Tangara cayana* – FGHIKMTVWXacj7  
*Tangara preciosa* – y  
*Tangara cyanoventris* – 36  
*Pipraeidea melanonota* – GTy  
*Thraupis sayaca* – ADFGHIJLMOQTUVWXYefhijz57  
*Thraupis palmarum* – LXY4  
*Thraupis ornata* – y57  
*Ramphocelus carbo* – AEGHIJLMOTVXYefh  
*Tachyphonus coronatus* – NOTUVi  
*Trichothraupis melanops* – T  
*Orthogonys chloricterus* – y  
*Schistochlamys ruficapilla* – ad  
*Molothrus bonariensis* – JV  
*Icterus cayanensis* – Y  
*Cacicus haemorrhous* – y  
*Tiaris fuliginosa* – AFO  
*Sporophila caerulea* – NOUfgij  
*Zonotrichia capensis* – V  
*Carduelis magellanica* – efgij  
*Passer domesticus* – g