

EPIPHYTE PLANTS USE BY BIRDS IN BRAZIL

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ABSTRACT

This study firstly reviewed the interspecific interaction records between birds and epiphyte plants in Brazil. Forty two documents, including articles, scientific notes, books and thesis, and 35 personal records and from collaborators were argued, totaling 112 species of birds that interacted with 97 species of epiphyte plants. Two articles treated the theme specifically and another 40 treated related subjects, such as: pollination of epiphytes, ecology and feeding behavior of birds. Studies were concentrated mainly in Atlantic Forest, in the southeastern Brazilian region. The epiphyte species more visited by birds was *Aechmea nudicaulis* (Bromeliaceae). The main visitor of epiphytes was *Ramphodon naevius* (Trochilidae). According to the number of authors' citations an index of generality in bird-epiphyte interactions was created. As result the index inferred that the ovenbird *Cichlocolaptes leucophrus* and the bromeliad *Nidularium procerum* are less generalist and more specialist species in bird-epiphyte interactions. The totality of the papers showed a considerable number of bird species that use the epiphytes plants and its resources, including nectar, fruits, invertebrates, nest material, nesting place, water and bath. Considering the importance of epiphytes to supply a variety of resources for birds, these results highlighted the necessity of additional and specific studies about the theme in various Brazilian regions and biomes.

Keywords: Atlantic Forest, avian community, bird-plant interaction, bromeliads, resources.

RESUMO

O USO DE PLANTAS EPÍFITAS POR AVES NO BRASIL. O presente estudo trata-se da primeira revisão sobre registros de interações interespecíficas entre aves e plantas epífitas no Brasil. Quarenta e dois documentos, incluindo artigos, notas científicas, livros, teses e 35 registros pessoais e de colaboradores foram levantados, totalizando 112 espécies de aves que interagiram com 97 espécies de plantas epífitas. Dois artigos se referiram sobre o tema especificamente, e outros 40 documentos trataram de assuntos relacionados, tais como polinização de epífitas, ecologia e forrageamento de aves. Os estudos foram realizados principalmente na Mata Atlântica da região sudeste do Brasil. A espécie de epífita mais visitada pelas aves foi *Aechmea nudicaulis* (Bromeliaceae). A principal espécie de ave visitante de plantas epífitas foi *Ramphodon naevius* (Trochilidae). Considerando o número de citações, foi criado um índice de generalização para interações entre espécies de aves e epífitas. Este índice inferiu que o furnariídeo *Cichlocolaptes leucophrus* e a bromélia *Nidularium procerum* são respectivamente as espécies menos generalistas e mais especialistas em interações interespecíficas aves-epífitas. A totalidade dos estudos mostrou um considerável número de espécies de aves que utilizam as plantas epífitas e seus recursos, incluindo néctar, frutos, invertebrados, material para ninho, local para nidificação, água e banho. Considerando a importância da variedade de recursos oferecidos pelas plantas epífitas, os resultados encontrados na presente revisão destacam a necessidade de estudos adicionais e específicos sobre o tema em várias regiões e biomas brasileiros.

Palavras-chave: Mata Atlântica, comunidade de aves, interação ave-plantas, bromélias, recursos.

RESUMEN

EL USO DE PLANTAS EPÍFITAS POR AVES EN BRASIL. El presente estudio es la primera revisión de registros de interacciones interespecíficas entre aves y plantas epífitas en Brasil. Cuarenta y dos documentos, incluyendo artículos, notas científicas, libros, tesis y 35 registros personales y de colaboradores fueron levantados, totalizando 112 especies de aves que interactúan con 97 especies de plantas epífitas. Dos artículos se refieren al tema específicamente, y otros 40 documentos tratan de asuntos relacionados, tales como polinización de epífitas, ecología y forrajeo de aves. Los estudios fueron realizados principalmente en el Bosque Atlántico de la región sudeste de Brasil. La especie de epífita más visitada por las aves fue *Aechmea nudicaulis* (Bromeliaceae). La principal especie de ave visitante de plantas epífitas fue *Ramphodon naevius* (Trochilidae). Considerando el número de citas, fue creado un índice de generalización para interacciones entre especies de aves y epífitas. Este índice infirió que el furnarídeo *Cichlocolaptes leucophrus* y la bromelia *Nidularium procerum* son respectivamente las especies menos generalistas y más especialistas en interacciones interespecíficas aves-epífitas. La totalidad de los estudios mostró un número considerable de especies de aves que utilizan plantas epífitas y sus recursos, incluyendo néctar, frutos, invertebrados, material para la construcción de nidos, lugares para anidamiento, agua y baño. Considerando la importancia de la variedad de recursos ofrecidos por las plantas epífitas, los resultados encontrados en la presente revisión destacan la necesidad de estudios adicionales y específicos sobre el tema en varias regiones y biomas brasileños.

Palabras-clave: Bosque Atlántico, comunidades de aves, interacción ave-planta, bromelias, recursos.

INTRODUCTION

Great part of studies involving bird and plant interactions emphasizes the consummation of non-epiphytes resources in tropical forests (Nadkarni & Matelson 1989). In Brazil, few studies approached the use of resources from epiphyte plants by birds and the causes for this scientific gap are not explained (Pizo 1994, Cestari & Pizo 2008).

The epiphytes are not parasites, and they require only support and suitable micro-habitats on host plants (phorophytes) to develop (Nadkarni & Matelson 1989). They are concentrated in the medium and high strata of tropical forests, encompassing up to 30% of total biomass of vascular plants (Benzing 1990). According to Richards (1996), the epiphyte plants are structurally and physiologically adapted to different conditions of micro-habitats. Notwithstanding, they contribute expressively to the high diversity and complexity of habitat structure.

Birds are also diverse and explore a great quantity of micro-habitats in tropical environments so that ecological specializations between birds and epiphytes may exist (see Remsen Jr. 1985, Nadkarni & Matelson 1989, Sillett 1994, Cestari & Pizo 2008). Birds explore flowers, nectar, fruits, seeds, accumulated water, nest materials and nest places from epiphytes (Nadkarni & Matelson 1989, Pizo 1994, Cestari &

Pizo 2008). The leaves and roots from epiphytes may shelter bird's preys. Likewise, the rosette leaves from some bromeliads store water, dead leaves and organic material that favor the presence of invertebrates and small vertebrates (Picado 1911, Laessle 1961). In the course of colonization, the organic material and moistness of barks and forks favor initially cryptic epiphytes (such as mosses) that create micro-habitat for larger and vascular epiphytes, larvae and adults of arthropods, and other invertebrates (Lyford 1969, Nadkarni & Longino 1988).

The epiphytes apparently offer smaller biomass and volume of resources than their phorophytes. Although, the importance of epiphytes for birds may be lodged in the periods of scarcity non-epiphyte resources in the forest as well as in the extra-resources offered by epiphytes for birds along the year (Nadkarni 1994). Epiphytes are faced as a new source of resources for birds in the tropics (Nadkarni & Matelson 1989, Sillett 1994), beside larger insects, army ants, bamboo clumps and suspended dead leaves (Remsen Jr. & Parker III 1984). Despite this, the scarcity of data involving registrations of bird-epiphyte interactions might be related with the need of considerable efforts on the field due the frequent obstruction of observer's vision in dense tropical forests. Actually, the number of Brazilian bird species that use epiphyte plants are unknown. In several times, the access to the highest

forest stratum is not primordial due to the amount of epiphytes in low and medium strata of some Brazilian forests, such as the Atlantic Forest (Pizo 1994, Cestari & Pizo 2008).

This study revised the use of epiphyte plants by birds in Brazilian territory. Papers, thesis, personal field observations and data from collaborators were used to quantify the interactions between bird and epiphytes species, as well as epiphyte resources most used by birds in the Brazilian biomes. In that way, some primordial questions about the theme were argued, such as: (1) Is there any Brazilian biome where the major number of bird-epiphyte interactions occur? (2) Which are the more visited epiphyte group and the main bird family of visitors?, (3) Which are the main explored resources?, (4) How are the degree of specialization or generality in bird-epiphyte interactions?

MATERIAL AND METHODS

The bibliographic revision contained the following keywords: bird, *ave*, birds, *aves*, Brazil, *Brasil*, epiphyte, *epífita*, epiphytes and *epífitas*. Additional keywords such as: pollination, *polinização*, hummingbirds, and *beija-flores* were included due the highest number of papers related with pollination of epiphytes (mainly bromeliads) found in the first trial. The search involved national (Brazilian) and international papers in Ornithology, Ecology, Biology, Botany and Zoology from 1900 to 2009 years. It premised papers with field studies conducted in Brazilian territory. In occasions that two papers referred to the same field data, the older or more complete paper in terms of number of species was chose. Thesis, personal field records about interactions between birds and epiphytes, and records from collaborators were also included in this revision.

Only one record per bird-epiphyte species interaction was considered in each of the studies. For instance, if one study cited three interactions between the same bird and epiphyte species, it was considered as one record of interaction. Thus, an index of generality on interactions between bird and epiphyte was created for species with five or more interactions records, following the formula:

$$IG = (N_T/N_R) * N_T$$

IG represents the degree of interaction's generality of a species. N_T is the total number of taxons (groups, genus and species) that a species *A* (of bird or epiphyte) interacted; N_R is the total number of interaction records of the species *A*. The *IG* value will be greater in the case of a species *A* (of bird or plant) that interacts with a high number of other species as fewer times it does. For instance, if the bird species *A* interacted with 30 species of epiphytes in a total of 33 records, the IG_A value is 27.7. This value is lesser than another bird *B* that interact with 30 species of epiphytes in the minimum of 30 records ($IG_B = 30$), indicating that species *A* is less generalist and more specialist than species *B* because the first interacted more than once with any epiphyte species

Based on the classification scheme proposed by Benzing (1990), the present study considered only holo-epiphytes, accidental epiphytes, facultative epiphytes, and non-arboreal hemi-epiphytes. In the three first categories, epiphytes have no root contact with the soil in entire life cycle. Differently, the hemi-epiphytes species have root contact with the ground in some phase of life cycle. The arboreal hemi-epiphytes (ex., *Ficus* spp., *Coussapa microcarpa*) were not considered due its similar ecological function than non-epiphytes plants in terms of vegetation structure and demand of resources for birds.

The nomenclature of epiphytes was based on World Checklist of Selected Plant Families (2009) and Tropicos.org (2009). The nomenclature of bird species was based on Brazilian Ornithological Records Committee (2008). Some papers and collaborator's records between birds and epiphytes have no species identification, but only genus or groups (the latter in the case of plants). Some authors did not cite the Brazilian biome where the interactions were registered too.

RESULTS

Only two papers aimed specifically the use of epiphyte plants by birds (Pizo 1994, Cestari & Pizo 2008). Another 40 studies (including papers and thesis) presented themes about pollination and floral biology of epiphyte species (Ruschi 1949, Snow & Teixeira 1982, Sazima *et al.* 1993, Sazima *et al.* 1995, Van Sluys & Stotz 1995, Araújo 1996, Sazima *et al.* 1996, Siqueira-Filho 1998, Sazima & Sazima

1999, Alves *et al.* 2000, Buzato *et al.* 2000, Varassin & Sazima 2000, Siqueira-Filho & Machado 2001, Freitas e Lopes 2002, Nara & Webber 2002, Varassin 2002, Canela & Sazima 2003, Araújo *et al.* 2004, Kaehler *et al.* 2005, Lenzi *et al.* 2006, Machado & Semir 2006, Rocca-de-Andrade 2006, Piacentini & Varassin 2007), diet of birds, feeding and nesting behavior of birds in epiphyte species (Voss & Sander 1981, Snow & Snow 1986, Pizo *et al.* 1995, Sick 1997, Hofling & Camargo 1999, Mallett-Rodrigues 2001, Pizo *et al.* 2002, Lima *et al.* 2003, Develey & Endrigo 2004, Parrini & Pacheco 2006, Sigrist 2006, Carrano 2007, Parrini & Pacheco 2007, Guaraldo 2009, Parrini *et al.* 2009, Parrini & Pacheco 2009, Sazima 2009). Personal records were seven and collaborators contributed with 28 records. The majority of the studies, including personal records and records from collaborators, were conducted on southeast region of the Atlantic Forest (n = 47; 62%). Also, records of

bird species (n = 87; 77%) and epiphytes species (n = 85; 87%) were higher in this region (Figure 1).

According to author's recordings, one hundred and twelve species of birds interacted with 97 species of epiphytes (Table I). Occasionally, some studies (Ruschi 1949, Pizo 1994, Pizo *et al.* 1995, Sick 1997, Mallett-Rodrigues 2001, Varassin 2002, Develey & Endrigo 2004, Lenzi *et al.* 2006, Parrini & Pacheco 2006, Sigrist 2006, Carrano 2007, Parrini & Pacheco 2007, Cestari & Pizo 2008, Parrini *et al.* 2009, Sazima 2009) and collaborators (A. Christianini, A. C. Guaraldo, A. Pretty, A. R. Mellina, C. O. A. Gussoni, E. L. Rodrigues, F. Respirar, J. C. T. Menezes, L. F. Perello, M. Salgado, M. A. Pizo) cited only epiphyte groups (ex., Bromeliaceae, Orchidaceae, Araceae, Gesneriaceae, Pteridophyta, Cactaceae, Loranthaceae, Marcgraviaceae, Rubiaceae and Bryophyta) and epiphyte or bird genus.

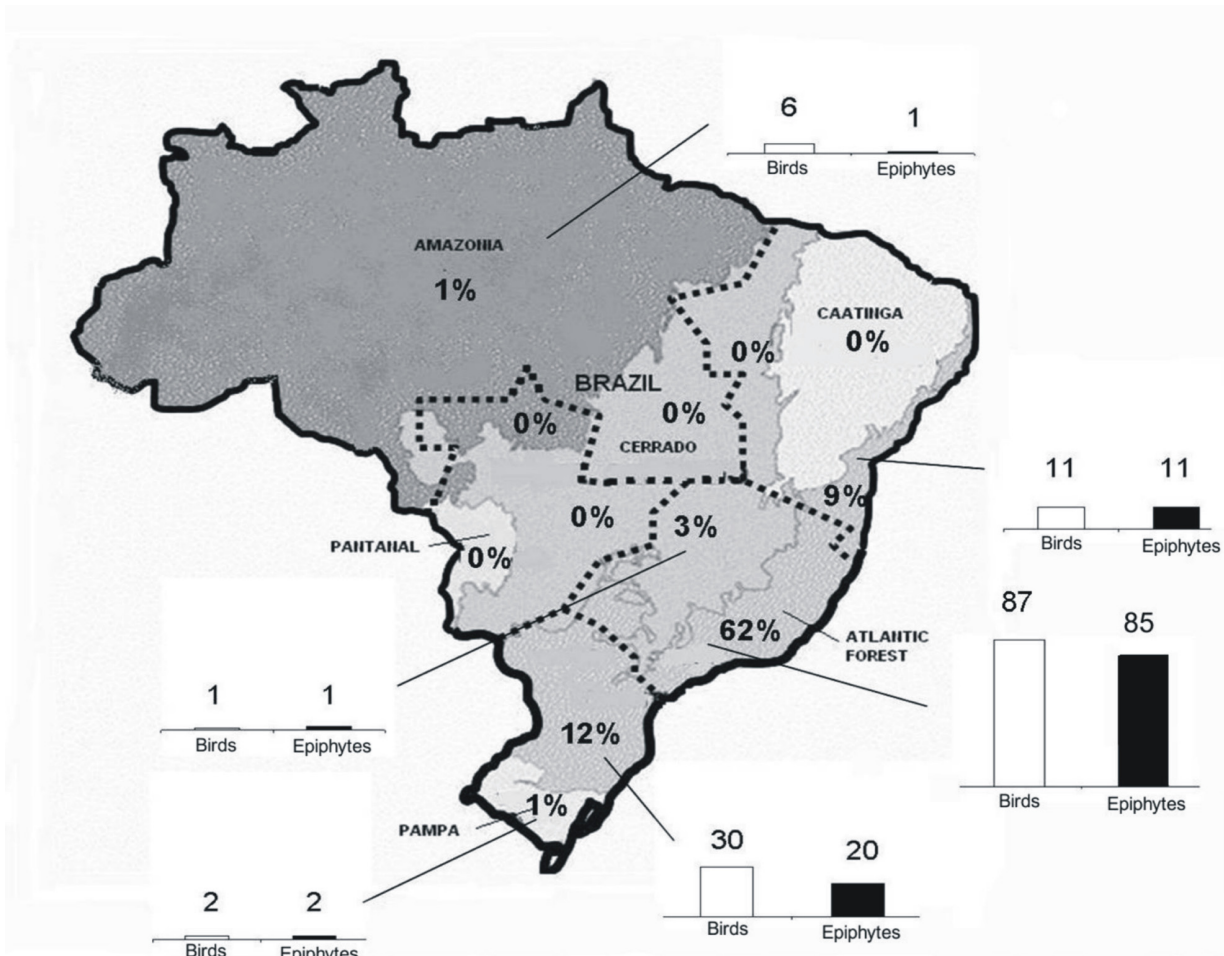


Figure 1. Percentage of documents and number of bird species and epiphyte species recorded in the Brazilian biomes and regions. The white bar represents the number of bird species and the black bar represents the number of epiphyte species.

Figura 1. Porcentagens de estudos e número de espécies de aves e epífitas registrados em biomas e regiões brasileiras. A barra branca representa o número de espécies de aves e a barra preta representa o número de espécies de plantas epífitas.

Table 1. Authors and references that cited bird visitors on epiphyte plants in Brazil. The epiphyte plant species in parenthesis are the actual accepted names according to the World Checklist of Selected Plant Families and Tropicos.org (2009). The habits of the plants were classified according to Benzing (1990) and were transcribed following to the current record of the authors. The asterisk (*) above the authors' references refers to personal observation or observations of collaborator authors. The numbers above of the bird species refer to the corresponding author references that recorded bird-epiphyte interactions, followed by number of citations and exploited resource in parenthesis. Groups of epiphytes: Arac = Araceae, Brom = Bromeliaceae, Bryo = Bryophyta, Cact = Cactaceae, Gesn = Gesneriaceae, Marc = Marcgraviaceae, Pter = Pteridophyta, Rubi = Rubiaceae. Resources: bat = bath, flo = flower, inv = invertebrates, mat = material to build nest, nec = nectar, nes = nesting, nor = non resource (inspecting), see = seed, wat = water.

Tabela 1. Autores e referências que citaram aves visitantes de plantas epifitas no Brasil. As espécies de plantas epifitas entre parênteses são os nomes científicos atualmente aceitos de acordo com World Checklist of Selected Plant Families e Tropicos.org (2009). Os hábitos das plantas foram classificados de acordo com Benzing (1990) e foram transcritos seguindo os registros dos autores. O asterisco (*) acima das referências refere-se a observações pessoais ou observações de autores colaboradores. Os números acima das espécies de aves referem-se às referências dos autores que registraram interações aves-epifitas, seguidas pelo número de citações e recursos explorados entre parênteses. Grupo de epifitas: Arac = Araceae, Brom = Bromeliaceae, Bryo = Bryophyta, Cact = Cactaceae, Gesn = Gesneriaceae, Lora = Loranthaceae, Marc = Marcgraviaceae, Pter = Pteridophyta, Rubi = Rubiaceae. Recursos: bat = banho, flo = flor, inv = invertebrados, mat = material para construção de ninho, nec = néctar, nes = nidificação, nor = sem recurso (somente inspecionando), see = semente, wat = água.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Acanthostachys strobilacea</i>	Brom	Holo-epiphyte	Sazima & Sazima (1999)	Atlantic Forest	4	<i>Amazilia lactea</i> (1, nec), <i>Chlorostilbon lucidus</i> (1, nec), <i>Coereba flaveola</i> (1, nec), <i>Phaethornis pretrei</i> (1, nec)
<i>Aechmea</i> spp.	Brom	Holo-epiphyte, facultative	Sigrist (2006)	Atlantic Forest	2	<i>Lophornis chalybeus</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec)
<i>Aechmea araneosa</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	5	<i>Amazilia fimbriata</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec), <i>P. squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec)
<i>Aechmea beeriana</i> (<i>Aechmea vallerandi</i>)	Brom	Facultative	Nara & Weber (2002)	Amazonian	6	<i>Campylopterus largipennis</i> (1, nec), <i>Florisuga mellivora</i> (1, nec), <i>Glaucis hirsutus</i> (1, nec), <i>Phaethornis bourcierii</i> (1, nec), <i>P. superciliosus</i> (1, nec), <i>Thalurania furcata</i> (1, nec)
<i>Aechmea bromeliifolia</i>	Brom	Facultative	Sazima & Sazima (1999) ¹ ; Varassin (2002) ²	Atlantic Forest	8	<i>Amazilia lactea</i> ¹ (1, nec), <i>Chlorostilbon lucidus</i> ¹ (1, nec), <i>Coereba flaveola</i> ¹ (1, nec), <i>Glaucis hirsutus</i> ² (1, nec), <i>Phaethornis eurynome</i> ² (1, nec), <i>P. squalidus</i> ² (1, nec), <i>Ramphodon naevius</i> ² (1, nec), <i>Thalurania glaucopis</i> ² (1, nec)
<i>Aechmea coelestis</i>	Brom	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	3	<i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec), <i>Phaethornis squalidus</i> (1, nec)
<i>Aechmea distichantha</i>	Brom	Facultative	Araújo (1996) ¹ ; Sazima & Sazima (1999) ² ; Buzato et al. (2000) ³ ; Araújo et al. (2004) ⁴	Atlantic Forest	9	<i>Amazilia fimbriata</i> ^{1,2} (2, nec), <i>Coereba flaveola</i> ² (1, nec), <i>Hylocharis cyanus</i> ⁴ (1, nec), <i>Leucochloris albicollis</i> ³ (1, nec), <i>Phaethornis eurynome</i> ³ (1, nec), <i>P. ruber</i> ¹ (1, nec), <i>Ramphodon naevius</i> ^{1,3,4} (3, nec), <i>Stephanoxis lalandi</i> ³ (1, nec), <i>Thalurania glaucopis</i> ^{1,2,4} (3, nec)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Aechmea fulgens</i>	Brom	Facultative	Freitas e Lopes (2002)	Atlantic Forest	2	<i>Amazilia fimbriata</i> (1, nec), <i>Phaethornis ruber</i> (1, nec)
<i>Aechmea gracilis</i>	Brom	Holo-epiphyte	Alves <i>et al.</i> (2000)	Atlantic Forest	1	<i>Thalurania glaucopsis</i> (1, nec)
<i>Aechmea lindenii</i>	Brom	Holo-epiphyte	Lenzi <i>et al.</i> 2006	Atlantic Forest	6	<i>Amazilia fimbriata</i> (1, nec), <i>Chiroxiphia</i> sp. (1, fru), <i>Tachyphonus coronatus</i> (1, fru), <i>Tangara</i> sp. (1, fru), <i>Thalurania glaucopsis</i> (1, nec), <i>Thalurania</i> sp. (1, nec)
<i>Aechmea lingulata</i>	Brom	Holo-epiphyte	Breier, T. *	Atlantic Forest	1	<i>Tangara seledon</i> (1, wat)
<i>Aechmea muricata</i>	Brom	Facultative	Freitas e Lopes (2002)	Atlantic Forest	2	<i>Glaucis hirsutus</i> (1, nec), <i>Phaethornis ruber</i> (1, nec)
<i>Aechmea mutica</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	3	<i>Phaethornis eurynome</i> (1, nec), <i>P. squallidus</i> (1, nec), <i>Thalurania glaucopsis</i> (1, nec)
<i>Aechmea nudicaulis</i>	Brom	Holo-epiphyte	Pizo (1994) ¹ ; Araújo (1996) ² ; Buzato <i>et al.</i> (2000) ³ ; Varassin (2002) ⁴ ; Araújo <i>et al.</i> (2004) ⁵ ; Machado & Semir (2006) ⁶ ; Rocca-de-Andrade (2006) ⁷ ; Piacentini & Varassin (2007) ⁸	Atlantic Forest	15	<i>Amazilia brevirostris</i> ⁷ (1, nec), <i>A. fimbriata</i> ² (1, nec), <i>A. versicolor</i> ⁸ (1, nec), <i>Anthracothorax nigricollis</i> ² (1, nec), <i>Clytolaema rubricauda</i> ³ (1, nec), <i>Florisuga fusca</i> ² (1, nec), <i>Hylocharys cyanus</i> ^{2,3} (2, nec), <i>Leucocloris albicollis</i> ³ (1, nec), <i>Lophornis chalybea</i> ⁸ (1, nec), <i>Florisuga fusca</i> ⁸ (1, nec), <i>Phaethornis eurynome</i> ^{2,4} (1, nec), <i>Ramphodon naevius</i> ^{3,7,8} (3, nec), <i>Stephanoxis lalandi</i> ³ (1, nec), <i>Tangara seledon</i> ¹ (1, fru), <i>Thalurania glaucopsis</i> ^{2,3,6,7,8} (5, nec)
<i>Aechmea organorsis</i>	Brom	Facultative	Araújo <i>et al.</i> (2004) ¹ ; Machado & Semir (2006) ² ; Piacentini & Varassin (2007) ³	Atlantic Forest	4	<i>Clytolaema rubricauda</i> ² (1, nec), <i>Hylocharys cyanus</i> ¹ (1, nec), <i>Ramphodon naevius</i> ^{1,3} (2, nec), <i>Thalurania glaucopsis</i> ^{1,2,3} (3, nec)
<i>Aechmea ornata</i>	Brom	Facultative	Pizo <i>et al.</i> (1995) ¹ ; Machado & Semir (2006) ² ; Piacentini & Varassin (2007) ³	Atlantic Forest	3	<i>Phaethornis eurynome</i> ² (1, nec), <i>Ramphodon naevius</i> (1, nec) ³ , <i>Thalurania glaucopsis</i> ^{2,3} (2, nec), <i>Triclaria malachitacea</i> ¹ (1, flo),

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Aechmea pectinata</i>	Brom	Holo-epiphyte, facultative	Snow & Snow (1986) ¹ ; Araujo (1996) ² ; Buzato <i>et al</i> (2000) ³ ; Canela & Sazima (2003) ⁴ ; Araujo <i>et al.</i> (2004) ⁵ ; Piacentini & Varassin (2007) ⁶	Atlantic Forest	6	<i>Amazilia fimbriata</i> ²⁻⁴ (2, nec), <i>Florisuga fusca</i> ⁴ (1, nec), <i>Phaethornis eurynome</i> ¹ (1, nec), <i>P. ruber</i> ⁴ (1, nec), <i>Ramphodon naevius</i> ^{3,4,5} (4, nec), <i>Thalurania glaucopis</i> ^{2,4,5,6} (4, nec)
<i>Aechmea pineliana</i>	Brom	Holo-epiphyte	Varassin (2002)	Atlantic Forest		<i>Aphantochroa cirrhochloris</i> (1, nec), <i>Phaethornis squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec)
<i>Aechmea tormentosa</i>	Brom	Facultative	Freitas e Lopes (2002)	Atlantic Forest	3	<i>Amazilia fimbriata</i> (1, nec), <i>Glaucis hirsutus</i> (1, nec), <i>Phaethornis ruber</i> (1, nec)
<i>Aechmea triangularis</i>	Brom	Holo-epiphyte	Varassin (2002)	Atlantic Forest	3	<i>Amazilia fimbriata</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec)
<i>Aechmea victoriana</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	5	<i>Amazilia fimbriata</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec), <i>P. squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec)
<i>Ananas bracteatus</i>	Brom		Piacentini & Varassin (2007)	Atlantic Forest	2	<i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec)
<i>Anthurium scandens</i>	Arac	Holo-epiphyte	Breier, T.*	Atlantic Forest	1	<i>Tangara seledon</i> (1, fru)
Araceae	Arac		Cestari & Pizo (2008)	Atlantic Forest	10	<i>Automolus leucophthalmus</i> (1, nor), <i>Basileuterus culicivorus</i> (1, nor), <i>Drymophila squammata</i> (1, nor), <i>Dysithamnus mentalis</i> (1, nor), <i>Euphonia pectoralis</i> (1, fru), <i>Habia rubica</i> (1, nor), <i>Myrmotherula minor</i> (1, inv), <i>Xyphorhynchus fuscus</i> (1, nor), <i>Phylidor atricapillus</i> (1, nor), <i>Myiobius barbatus</i> (1, nor)
<i>Billbergia</i> sp.	Brom		Sick (1997)	No information	1	<i>Ramphodon naevius</i> (1, nec)
<i>Billbergia amoena</i>	Brom	Holo-epiphyte	Varassin (2002) ¹ ; Machado & Semir (2006) ²	Atlantic Forest	2	<i>Phaethornis eurynome</i> ^{1,2} (2, nec), <i>P. squalidus</i> ¹ (1, nec)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Billbergia distachia</i>	Brom	Facultative	Buzato <i>et al.</i> (2000)	Atlantic Forest	2	<i>Leucochloris albicollis</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec)
<i>Billbergia pyramidalis</i>	Brom	Holo-epiphyte, Facultative	Sazima <i>et al.</i> (1995) ¹ ; Araújo (1996) ² ; Buzato <i>et al.</i> (2000) ³	Atlantic Forest	1	<i>Ramphodon naevius</i> ^{1,2,3} (3, nec)
Bromeliaceae	Brom	Holo-epiphyte, facultative	Ruschi (1949) ¹ ; Pizo (1994) ² ; Sick (1997) ³ ; Mallet-Rodrigues (2001) ⁴ ; Develey & Endrigo (2004) ⁵ ; Parrini & Pacheco (2006) ⁶ ; Sigris (2006) ⁷ ; Parrini & Pacheco (2007) ⁸ ; Cestari & Pizo (2008) ⁹ ; Parrini & Pacheco (2009) ¹⁰ ; Parrini <i>et al.</i> (2009) ¹¹ ; Menezes, J. C. T.* ¹² ; Respirar, F.* ¹³ ; Pretty, A.* ¹⁴ ; Rodrigues, E. L.* ¹⁵ ; Gussoni, C. O. A.* ¹⁶ ; Cestari, C.* ¹⁷ ; Salgado, M.* ¹⁸ ; Mollina, A. R.* ¹⁹	Atlantic Forest, Urban Area, Cerrado	60	<i>Amazilia brevirostris</i> ¹ (1, nec), <i>Anabacerthia amaurotis</i> ⁶ (1, nor), <i>Automolus leucophthalmus</i> ^{6,17} (2, nor), <i>Basileuterus culicivorus</i> ⁹ (1, nor), <i>Batara cinerea</i> ² (1, nor), <i>Brotogeris tirica</i> ² (1, fru), <i>Cactus haemorrhous</i> ^{2,9} (1, nor), <i>Calliphlox amethystina</i> ¹ (1, nec), <i>Canorchilus longirostris</i> ⁹ (1, inv), <i>Celeus flavescens</i> ⁹ (1, nor), <i>Chlorostilbon notatus</i> ¹ (1, nec), <i>Cichlocolaptes leucophrys</i> ^{3,5,7,9} (5, inv, nor), <i>Clytolaema rubricauda</i> ¹ (1, nec), <i>Conopias trivirgatus</i> ² (1, nes), <i>Cranioleuca pallida</i> ¹⁰ (1, nor), <i>Cyanocorax caeruleus</i> ¹⁷ (1, nor), <i>Dendrocolaptes platyrostris</i> ² (1, inv), <i>Dysithamnus mentalis</i> ² (1, wat), <i>D. sitcithorax</i> ^{2,9} (2, wat, nor), <i>E. pectoralis</i> ^{2,9} (2, nec), <i>Glaucis dornii</i> ^{1,3} (2, nec), <i>G. hirsutus</i> ^{1,7} (2, nec), <i>Heliobletus contaminatus</i> ^{11,17} (2, nor, inv), <i>Hemithraupis ruficapilla</i> ² (1, inv), <i>Hemiricus margaritaceiventris</i> ³ (1, mat), <i>Lepidocolaptes squamatus</i> ⁸ (1, inv), <i>Leptopogon amaurocephalus</i> ² (1, inv), <i>Myiopagis caniceps</i> ¹⁵ (1, nes), <i>Orthogonyx chloricterus</i> ^{2,7} (2, inv), <i>Pachyrhamphus rufus</i> ² (1, mat), <i>Penelope obscura</i> ¹⁸ (1, wat), <i>Phaethornis eurynome</i> ^{1,2} (2, nec), <i>P. idaliae</i> ¹ (1, nec), <i>P. ruber</i> ^{1,9} (2, nec), <i>P. squalidus</i> ^{1,2} (2, nec), <i>Phylidor atricapillus</i> ^{4,9} (2, nor), <i>P. rufum</i> ² (1, inv), <i>Piculus flavigula</i> ⁹ (1, nor), <i>Pitangus sulphuratus</i> ¹⁹ (1, nes), <i>Polytmus guainumbi</i> ¹ (1, nec), <i>Ramphastos vitellinus</i> ¹⁴ (1, wat), <i>Ramphodon naevius</i> ^{1,9} (2, nec), <i>Salpator similis</i> ² (1, inv), <i>Sittasomus griseicapillus</i> (1, nor), <i>Synallaxis ruficapilla</i> ² (1, wat), <i>Syndactila rufosuperciliata</i> ² (1, inv), <i>Tachyphonus coronatus</i> ² (1, inv), <i>T. cristatus</i> ⁹ (1, bat), <i>Tangara cyanocephala</i> ² (1, wat, nes), <i>T. seledon</i> ^{2,3,9,12,16} (3, bat, mat, nes, nor), <i>Thalurania glaucopis</i> ^{1,2,9} (3, nec), <i>Thraupis cyanoptera</i> ² (1, nes), <i>T. ornata</i> ² (1, nes), <i>Trogon viridis</i> ¹⁵ (1, nes), <i>Turdus flavipes</i> ⁹ (1, wat), <i>T. rufiventris</i> ¹⁵ (1, nes), <i>T. subalaris</i> ¹⁵ (1, nes), <i>Xiphocolaptes albicollis</i> ^{2,9} (1, nor; 2, inv), <i>Xiphorhynchus fuscus</i> ⁹ (2, inv, nor)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
Bryophyta	Bryo		Parrini & Pacheco (2006) ¹ ; Parrini & Pacheco (2007) ² ; Parrini & Pacheco (2009) ³ ; Parrini <i>et al.</i> (2009) ⁴	Atlantic Forest	4	<i>Anabacantha amaurotis</i> ¹ (1, inv), <i>Crantioleuca pallida</i> ³ (1, nor), <i>Lepidocolaptes squamatus</i> ² (1, inv), <i>Heliobletus contaminatus</i> ⁴ (1, inv).
<i>Canistropsis bilbergioides</i>	Brom	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	2	<i>Ramphodon naevius</i> (1, nec), <i>Thalaurania glaucopsis</i> (1, nec)
<i>Canistropsis seidelii</i>	Brom	Facultative	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Canistrum aurantiacum</i>	Brom	Facultative	Siqueira-Filho & Machado (2001)	Atlantic Forest	7	<i>Chlorostilbon lucidus</i> (1, nec), <i>Thalaurania watertonii</i> (1, nec), <i>Glaucis hirsutus</i> (1, nec), <i>Phaethornis pretrei</i> (1, nec), <i>P. ruber</i> (1, nec), <i>Pipra rubrocapilla</i> (1, fru), <i>Tangara fastuosa</i> (1, fru)
<i>Canistrum cyathiforme</i>	Brom	Holo-epiphyte	Sazima <i>et al.</i> (1996)	Atlantic Forest	2	<i>Phaethornis eurynome</i> (1, nec), <i>Leucochloris albicollis</i> (1, nec)
<i>Canistrum giganteum</i>	Brom	Holo-epiphyte	Snow & Snow (1986)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Canistrum terminalis</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Canistrum triangulare</i>	Brom	Holo-epiphyte	Varassin (2002)	Atlantic Forest	3	<i>Aphantochroa cirrhochloris</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalaurania glaucopsis</i> (1, nec)
<i>Edmundoa ambigua</i>	Brom	Facultative	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Edmundoa lindenii</i>	Brom	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Elleanthus brasiliensis</i>	Orch	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	1	<i>Thalaurania glaucopsis</i> (1, nec)
Gesneriaceae	Gesn	Holo-epiphyte, facultative	Cestari & Pizo (2008)	Atlantic Forest	1	<i>Euphonia violacea</i> (1, nor)
<i>Hillia illustris</i>	Rubi	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Hohenbergia ridleyi</i>	Brom	Holo-epiphyte	Siqueira-Filho (1998)	Atlantic Forest	5	<i>Amazilia fimbriata</i> (1, nec), <i>A. leucogaster</i> (1, nec), <i>Chlorostilbon lucidus</i> (1, nec), <i>Eupetomena macroura</i> (1, nec), <i>Phaethornis ruber</i> (1, nec)
<i>Lepismium</i> sp.	Cact	Holo-epiphyte	Guaraldo, A. C.*	Urban Area	1	<i>Euphonia chalybea</i> (1, fru)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Maregravia polyantha</i>	Marc	Hemi-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	2	<i>Ramphodon naevius</i> (1, nec), <i>Thalaurania glaucopsis</i> (1, nec)
<i>Monstera adansonii</i>	Arac	Hemi-epiphyte	Guaraldo, A. C.*	Atlantic Forest	2	<i>Habia rubica</i> (1, fru), <i>Orthogonys chloricterus</i> (1, fru)
<i>Nematanthus fluminorsis</i>	Gesn	Holo-epiphyte	Sazima <i>et al.</i> (1995)	Atlantic Forest	2	<i>Phaethornis ruber</i> (1, nec), <i>Ramphodon naevius</i> (1, nec)
<i>Nematanthus fritschii</i>	Gesn	Holo-epiphyte	Sazima <i>et al.</i> (1995)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Nematanthus gregarius</i>	Gesn	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	2	<i>Amazilia versicolor</i> (1, nec), <i>Thalaurania glaucopsis</i> (1, nec)
<i>Nematanthus striatus</i>	Gesn	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	4	<i>Florisuga fusca</i> (1, nec), <i>Phaethornis squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalaurania glaucopsis</i> (1, nec)
<i>Neoregelia</i> sp.	Brom	Holo-epiphyte, facultative	Sick (1997); Varassin (2002) ²	Atlantic Forest	3	<i>Phaethornis squalidus</i> ² (1, nec), <i>Ramphodon naevius</i> ¹ (1, nec), <i>Tachyphonus coronatus</i> ¹ (1, fru)
<i>Neoregelia johannis</i>	Brom	Facultative	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Neoregelia magdalenae</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	5	<i>Amazilia fimbriata</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec), <i>P. squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalaurania glaucopsis</i> (1, nec)
<i>Nidularium</i> sp.	Brom	Holo-epiphyte, facultative	Sick (1997); Guaraldo, A. C.* ²	Atlantic Forest	2	<i>Tachyphonus coronatus</i> ¹ (1, fru), <i>Tangara peruviana</i> ² (1, wat)
<i>Nidularium angustibracteatum</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Nidularium campoalegreense</i>	Brom	Facultative	Kaehler <i>et al.</i> (2005)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Nidularium cariacense</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	3	<i>Phaethornis eurynome</i> (1, nec), <i>P. squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Nidularium innocentii</i>	Brom	Holo-epiphyte, facultative	Snow & Snow (1986) ¹ ; Araújo (1996) ² ; Buzato <i>et al.</i> (2000) ³ ; Machado & Semir (2006) ⁴ ; Piacentini & Varassin (2007) ⁵	Atlantic Forest	4	<i>Clytolaema rubricauda</i> ¹ (1, nec), <i>Phaethornis eurynome</i> ⁴ (1, nec), <i>Ramphodon naevius</i> ^{1,3,5} (3, nec), <i>Leucochloris albicollis</i> ¹ (1, nec)
<i>Nidularium krigseiae</i> (<i>Nidularium amazonicum</i>)	Brom	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	3	<i>Phaethornis squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopsis</i> (1, nec)
<i>Nidularium marigoii</i>	Brom	Facultative	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Nidularium procerum</i>	Brom	Holo-epiphyte, facultative	Araújo (1996) ¹ ; Araújo <i>et al.</i> (2004) ² ; Buzato <i>et al.</i> (2000) ³ ; Piacentini & Varassin (2007) ⁴ ; Varassin (2002) ⁵	Atlantic Forest	2	<i>Phaethornis eurynome</i> ⁵ (1, nec), <i>Ramphodon naevius</i> ^{1,2,3,4,5} (5, nec)
<i>Nidularium rubens</i>	Brom	Facultative	Machado & Semir (2006)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Nidularium seidelli</i>	Brom	Holo-epiphyte	Araújo (1996)	Atlantic Forest	2	<i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopsis</i> (1, nec)
Orchidaceae	Orch	Holo-epiphyte	Cestari & Pizo (2008)	Atlantic Forest	1	<i>Myiobius barbatus</i> (1, nor)
<i>Philodendron</i> sp.	Arac	Hemi-epiphyte	Parrini & Pacheco (2006)	Atlantic Forest	1	<i>Anabacerthia amaurotis</i> (1, nor)
<i>Portea leptantha</i> (<i>Aechmea leptantha</i>)	Brom	Facultative	Freitas e Lopes (2002)	Atlantic Forest	2	<i>Amazilia fimbriata</i> (1, nec), <i>Phaethornis ruber</i> (1, nec)
<i>Portea petropolitana</i>	Brom	Holo-epiphyte	Freitas e Lopes (2002)	Atlantic Forest	1	<i>Clytolaema rubricauda</i> (1, nec)
<i>Psittacanthus dichrous</i>	Lora	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	3	<i>Euphonia pectoralis</i> (1, nec), <i>Orthogonyx chloricterus</i> (1, nec), <i>Thalurania glaucopsis</i> (1, nec)
Pteridophyta	Pter	Holo-epiphyte	Cestari & Pizo (2008)	Atlantic Forest	1	<i>Drymophila squamata</i> (1, nor)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Quesnelia arvensis</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000) ¹ ; Araújo <i>et al.</i> (2004) ²	Atlantic Forest	3	<i>Hylocharis cyanus</i> ¹ (1, nec), <i>Ramphodon naevius</i> ^{1,2} (2, nec), <i>Thalurania glaucopsis</i> ^{1,2} (2, nec)
<i>Quesnelia humilis</i>	Brom	Facultative	Buzato <i>et al.</i> (2000) ¹ ; Araújo <i>et al.</i> (2004) ²	Atlantic Forest	1	<i>Ramphodon naevius</i> ^{1,2} (2, nec)
<i>Quesnelia marmorata</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000) ¹ ; Sazima <i>et al.</i> (1995) ²	Atlantic Forest	3	<i>Hylocharis cyanus</i> ¹ (1, nec), <i>Ramphodon naevius</i> ^{1,2} (2, nec), <i>Thalurania glaucopsis</i> ¹ (1, nec)
<i>Quesnelia strobilispica</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	5	<i>Amazilia fimbriata</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec), <i>P. squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec), <i>Thalurania glaucopsis</i> (1, nec)
<i>Quesnelia testudo</i>	Brom	Accidental holo-epiphyte	Snow & Teixeira (1982) ¹ ; Araújo <i>et al.</i> (2004) ²	Atlantic Forest	3	<i>Leucochloris albicollis</i> ¹ (1, nec), <i>Phaethornis eurynome</i> ¹ (1, nec), <i>Ramphodon naevius</i> ² (1, nec)
<i>Rhipsalis sp.</i>	Cact	Holo-epiphyte	Pizo <i>et al.</i> (1995) ¹ ; Carrano (2007) ² ; Sigrist (2006) ³ ; Rocca-de-Andrade (2006) ⁴ ; Perello, L. F. ⁵ ; Pizo, M. A. ⁶	Atlantic Forest, Pampas	14	<i>Brotogeris tirica</i> ¹ (1, fru), <i>Chlorophanes spiza</i> ² (1, fru), <i>Coereba flaveola</i> ⁵ (1, fru), <i>Dacnis cayana</i> ² (1, fru), <i>Euphonia chalybea</i> ² (1, fru), <i>Euphonia pectoralis</i> ^{2,6} (2, fru), <i>Euphonia violacea</i> ² (1, fru), <i>Forpus xanthopterygius</i> ¹ (1, fru), <i>Hemithraupis guira</i> ² (1, fru), <i>Hemithraupis ruficapilla</i> ² (1, fru), <i>Pyrrhura frontalis</i> ¹ (1, fru), <i>Tachyphonus cristatus</i> ² (1, fru), <i>Tangara seledon</i> ² (1, fru), <i>Thalurania glaucopsis</i> ⁴ (1, nec)
<i>Rhipsalis baccifera</i>	Cact	Holo-epiphyte	Guaraldo (2009)	Atlantic Forest	3	<i>Euphonia pectoralis</i> (1, fru), <i>Tangara seledon</i> (1, fru), <i>Zonotrichia capensis</i> (1, fru)
<i>Rhipsalis myosurus</i> (<i>Lepismium cruciforme</i>)	Cact	Holo-epiphyte	Voss & Sanders (1981)	No information	4	<i>Euphonia chalybea</i> (1, fru), <i>Euphonia chlorotica</i> (1, fru), <i>Euphonia cyanocephala</i> (1, fru), <i>Euphonia pectoralis</i> (1, fru)
<i>Rhipsalis pachyptera</i>	Cact	Holo-epiphyte	Guaraldo (2009)	Atlantic Forest	1	<i>Euphonia pectoralis</i> (1, fru)
<i>Rhipsalis puniceodiscus</i>	Cact	Holo-epiphyte	Guaraldo (2009)	Atlantic Forest	1	<i>Tangara cyanocephala</i> (1, fru)
<i>Rhipsalis pulvinigera</i>	Cact	Holo-epiphyte	Breier, T.*	Atlantic Forest	1	<i>Euphonia sp.</i> (1, fru)
<i>Rhipsalis teres</i>	Cact	Holo-epiphyte	Pizo <i>et al.</i> (2002) ¹ ; Guaraldo (2009) ²	Atlantic Forest	4	<i>Carpornis cucullata</i> ¹ (1, fru), <i>Coereba flaveola</i> ² (1, fru), <i>Euphonia chlorotica</i> ² (1, fru), <i>Euphonia pectoralis</i> ² (2, fru)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Schwarzia brasiliensis</i>	Marc	Holo-epiphyte and facultative	Sazima <i>et al.</i> (1993) ¹ ; Rocca-de-Andrade (2006) ²	Atlantic Forest	21	<i>Amazilia fimbriata</i> ¹ (1, nec), <i>A. versicolor</i> ² (1, nec), <i>Anthracothonax nigricollis</i> ¹ (1, nec), <i>Aphantochroa cirrhocloris</i> ¹ (1, nec), <i>Celeus flavescens</i> ² (1, nec), <i>Chlorophanes spiza</i> ¹ (1, nec), <i>Coereba flaveola</i> (1, nec), <i>Dacnis cayana</i> ¹ (1, nec), <i>Eupetomena macroura</i> ¹ (1, nec), <i>Euphonia violacea</i> ¹ (1, nec), <i>Florisuga fusca</i> ^{1,2} (2, nec), <i>Hemithraupis ruficapilla</i> ¹ (1, nec), <i>Hylocharis cyanus</i> ¹ (1, nec), <i>Lophornis chalybea</i> ¹ (1, nec), <i>Ramphocelus bresilius</i> ¹ (1, nec), <i>Ramphodon naevius</i> ² (1, nec), <i>Tachyphonus cristatus</i> ¹ (1, nec), <i>Tangara cyanocephala</i> ¹ (1, nec), <i>T. desmaresti</i> ¹ (1, nec), <i>T. seledon</i> ¹ (1, nec), <i>Thalurania glaucopis</i> ^{1,2} (2, nec)
<i>Sinningia</i> sp.	Gesn	Holo-epiphyte	Rocca-de-Andrade (2006)	Atlantic Forest	1	<i>Phaethornis squalidus</i> (1, nec)
<i>Tillandsia</i> sp.	Brom	Holo-epiphyte	Sigrist (2006) ¹ , Parrini & Pacheco (2007) ² , Christianesi, A. ³	Atlantic Forest	4	<i>Dacnis nigripes</i> ³ (1, mat), <i>Euphonia chlorotica</i> ³ (1, mat), <i>Lepidocolaptes squamatus</i> ² (1, inv), <i>Phaethornis eurynome</i> ¹ (1, nec)
<i>Tillandsia aeranthos</i>	Brom	Holo-epiphyte	Snow & Teixeira (1982)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec), <i>Leucochloris albicollis</i> (1, nec)
<i>Tillandsia gardneri</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000) ¹ ; Freitas e Lopes (2002) ²	Atlantic Forest	1	<i>Phaethornis ruber</i> ^{1,2} (2, nec)
<i>Tillandsia geminiflora</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000) ¹ ; Varassin (2002) ² ; Araujo <i>et al.</i> (2004) ³ ; Machado & Semir (2006) ⁴	Atlantic Forest	9	<i>Amazilia fimbriata</i> ² (1, nec), <i>A. versicolor</i> ⁴ (1, nec), <i>Chlorostilbon lucidus</i> ⁴ (1, nec), <i>Leucochloris albicollis</i> ⁴ (1, nec), <i>Florisuga fusca</i> ³ (1, nec), <i>Phaethornis eurynome</i> ^{1,2} (1, nec), <i>P. ruber</i> ² (1, nec), <i>Ramphodon naevius</i> ³ (1, nec), <i>Thalurania glaucopis</i> ² (1, nec)
<i>Tillandsia stricta</i>	Brom	Holo-epiphyte	Snow & Snow (1986) ¹ ; Alves <i>et al.</i> (2000) ² ; Buzato <i>et al.</i> (2000) ³ ; Freitas e Lopes (2002) ⁴ ; Araujo <i>et al.</i> (2004) ⁵ ; Machado & Semir (2006) ⁶ ; Rocca-de-Andrade (2006) ⁷	Atlantic Forest	10	<i>Amazilia fimbriata</i> ² (1, nec), <i>A. versicolor</i> ^{1,6} (2, nec), <i>Clytolaema rubricauda</i> ³ (1, nec), <i>Leucochloris albicollis</i> ^{3,6} (2, nec), <i>Florisuga fusca</i> ⁵ (1, nec), <i>Phaethornis eurynome</i> (1, nec), <i>P. ruber</i> ⁴ (1, nec), <i>Polytmus gainumbi</i> ² (1, nec), <i>Stephanoxis lalandi</i> ² (1, nec), <i>Thalurania glaucopis</i> ^{3,7} (2, nec)
<i>Tillandsia tenuifolia</i>	Brom	Holo-epiphyte	Machado & Semir (2006)	Atlantic Forest	1	<i>Leucochloris albicollis</i> (1, nec)
<i>Tillandsia usneoides</i>	Brom	Holo-epiphyte	Pizo (1994) ¹ ; Hoffing & Camargo (1999) ² ; Guaraldo, A. C. ³ ; Gussoni, C. O. A. ⁴	Atlantic Forest, Cerrado	5	<i>Cacicus haemorrhous</i> ^{1,3,4} (3, mat), <i>Euphonia chlorotica</i> ³ (1, mat), <i>Pachyrhamphus rufus</i> (1, mat), <i>Parula pitayumi</i> ² (1, nes), <i>Satrapa icterophrys</i> ⁵ (1, mat)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Vriesea</i> sp.	Brom	Holo-epiphyte, facultative	Pizo <i>et al.</i> (1995) ¹ ; Lima <i>et al.</i> (2003) ² ; Sigríst (2006) ³ ; Guaraldo, A. C.* ⁴	Atlantic Forest	4	<i>Brotogetis tirica</i> ¹ (1, see), <i>Coereba flaveola</i> ⁴ (1, bat) <i>Lophornis chalybea</i> ¹ (1, nec), <i>Tangara seledon</i> ² (1, nes)
<i>Vriesea altodaserrae</i>	Brom	Facultative	Kaehler <i>et al.</i> (2005) ¹ ; Machado & Semir ² (2006)	Atlantic Forest	9	<i>Amazilia versicolor</i> ^{1,2} (2, nec), <i>Anthracothorax nigricollis</i> ^{1,2} (2, nec), <i>Chlorostilbon lucidus</i> ² (1, nec), <i>Cytolaema rubricauda</i> ^{1,2} (2, nec), <i>Leucochloris albicollis</i> ^{1,2} (2, nec), <i>Lophornis magnificus</i> ¹ (1, nec), <i>Florisuga fusca</i> ² (1, nec), <i>Phaethornis eurynome</i> ^{1,2} (2, nec), <i>Thalurania glaucopis</i> ^{1,2} (2, nec)
<i>Vriesea carinata</i>	Brom	Facultative	Araújo <i>et al.</i> (2004) ¹ ; Machado & Semir (2006) ² ; Rocca-de-Andrade (2006) ³ ; Piacentini & Varassin (2007) ⁴	Atlantic Forest	2	<i>Phaethornis eurynome</i> ² (1, nec), <i>Ramphodon naevius</i> ^{1,3,4} (3, nec)
<i>Vriesea ensiformis</i>	Brom	Holo-epiphyte	Araújo (1996) ¹ ; Buzato <i>et al.</i> (2000) ² ; Varassin & Sazima (2000) ³ ; Araújo <i>et al.</i> (2004) ⁴ ; Rocca-de-Andrade (2006) ⁵ ; Piacentini & Varassin (2007) ⁶	Atlantic Forest	5	<i>Leucochloris albicollis</i> ³ (1, nec), <i>Phaethornis eurynome</i> ^{2,3} (2, nec), <i>P. squalidus</i> ³ (1, nec), <i>Ramphodon naevius</i> ^{1,2,3,4,6} (5, nec), <i>Thalurania glaucopis</i> ¹ (1, nec)
<i>Vriesea flammaea</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000) ¹ ; Araújo <i>et al.</i> (2004) ² ; Machado & Semir ³ (2006)	Atlantic Forest	5	<i>Leucochloris albicollis</i> ³ (1, nec), <i>Florisuga fusca</i> ^{1,2} (2, nec), <i>Phaethornis eurynome</i> ³ (1, nec), <i>Ramphodon naevius</i> ¹ (1, nec), <i>Thalurania glaucopis</i> ² (1, nec)
<i>Vriesea friburgensis</i>	Brom	Facultative	Piacentini & Varassin (2007)	Atlantic Forest	2	<i>Amazilia fimbriata</i> (1, nec), <i>Thalurania glaucopis</i> (1, nec)
<i>Vriesea gracilior</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	3	<i>Phaethornis eurynome</i> (1, nec), <i>P. squalidus</i> (1, nec), <i>Ramphodon naevius</i> (1, nec)
<i>Vriesea guttata</i>	Brom	Holo-epiphyte	Kaehler <i>et al.</i> (2005)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Vriesea heterostachys</i>	Brom	Holo-epiphyte	Kaehler <i>et al.</i> (2005)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Vriesea incurvata</i>	Brom	Holo-epiphyte	Snow & Snow (1986) ¹ ; Buzato <i>et al.</i> (2000) ² ; Araújo <i>et al.</i> (2004) ³ ; Rocca-de-Andrade (2006) ⁴ ; Machado & Semir (2006) ⁵ ; Piacentini & Varassin (2007) ⁶ ; Cestari, C. ^{*7}	Atlantic Forest	4	<i>Euphonia pectoralis</i> ⁷ (1, nes), <i>Florisuga fusca</i> ⁵ (1, nec), <i>Phaethornis eurynome</i> ^{1,5} (2, nec), <i>Ramphodon naevius</i> ^{2,3,4,6} (4, nec)
<i>Vriesea jonghei</i>	Brom	Holo-epiphyte	Snow & Snow (1986)	Atlantic Forest	6	<i>Amazilia versicolor</i> (1, nec), <i>Chytolaena rubricauda</i> (1, nec), <i>Leucochloris albicollis</i> (1, nec), <i>Florisuga fusca</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec)
<i>Vriesea morrenii</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Vriesea neoglutinosa</i>	Brom	Facultative	Van Sluys & Stotz (1995)	Atlantic Forest	4	<i>Amazilia fimbriata</i> (1, nec), <i>Chlorostilbon lucidus</i> (1, nec), <i>Phaethornis idaliae</i> (1, nec), <i>Polytmus guainumbi</i> (1, nec)
<i>Vriesea philippocoburgii</i>	Brom	Holo-epiphyte, facultative	Buzato <i>et al.</i> (2000) ¹ ; Araújo <i>et al.</i> (2004) ² ; Machado & Semir (2006) ³ ; Rocca-de-Andrade (2006) ⁴	Atlantic Forest	5	<i>Anthracothorax nigricollis</i> ⁴ (1, nec), <i>Phaethornis eurynome</i> ² (1, nec), <i>Phaethornis squalidus</i> ⁴ (1, nec), <i>Ramphodon naevius</i> ^{1,2,4} (3, nec), <i>Thalurania glaucopsis</i> ^{3,4} (2, nec)
<i>Vriesea platynema</i>	Brom	Holo-epiphyte	Kaehler <i>et al.</i> (2005) ¹ , Rocca-de-Andrade (2006) ²	Atlantic Forest	5	<i>Leucochloris albicollis</i> ¹ (1, nec), <i>Phaethornis eurynome</i> ¹ (1, nec), <i>Phaethornis squalidus</i> ² (1, nec), <i>Ramphodon naevius</i> ² (1, nec), <i>Thalurania glaucopsis</i> ¹ (1, nec)
<i>Vriesea procera</i>	Brom	Holo-epiphyte, Facultative	Araújo <i>et al.</i> (1996) ¹ ; Alves <i>et al.</i> (2000) ² ; Buzato <i>et al.</i> (2000) ³	Atlantic Forest	6	<i>Amazilia brevirostris</i> ¹ (1, nec), <i>A. fimbriata</i> ^{1,2,3} (3, nec), <i>Colibri serrirostris</i> ² (1, nec), <i>Eupetomena macroura</i> ² (1, nec), <i>Florisuga fusca</i> ² (1, nec), <i>Thalurania glaucopsis</i> ² (1, nec)
<i>Vriesea psittacina</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	4	<i>Leucochloris albicollis</i> (1, nec), <i>Phaethornis squalidus</i> (1, nec), <i>P. eurynome</i> (1, nec), <i>Ramphodon naevius</i> (1, nec)
<i>Vriesea rodigasiana</i>	Brom	Holo-epiphyte	Araújo (1996) ¹ ; Buzato <i>et al.</i> (2000) ² ; Piacentini & Varassin (2007) ³ ; Cestari, C. ^{*4}	Atlantic Forest	8	<i>Amazilia fimbriata</i> ¹ (1, nec), <i>Callyphlox amethystina</i> ³ (1, nec), <i>Euphonia violacea</i> ⁴ (1, nec; 1, wat), <i>Phaethornis ruber</i> ² (1, nec), <i>Piculus flavigula</i> (1, nor), <i>P. squalidus</i> ³ (1, nec), <i>Ramphodon naevius</i> ³ (1, nec), <i>Thalurania glaucopsis</i> ^{2,3} (2, nec)

Continuation of Table I.

Plant Species	Group	Habit	References	Biome	Number of visitor bird species	Bird species (Number of citations, exploited resource)
<i>Vriesea scalaris</i>	Brom	Holo-epiphyte	Buzato <i>et al.</i> (2000)	Atlantic Forest	1	<i>Ramphodon naevius</i> (1, nec)
<i>Vriesea sceptrum</i>	Brom	Facultative	Buzato <i>et al.</i> (2000)	Atlantic Forest	2	<i>Leucochloris albicollis</i> (1, nec), <i>Phaethornis eurynome</i> (1, nec)
<i>Vriesea simplex</i>	Brom	Facultative	Varassin (2002)	Atlantic Forest	1	<i>Phaethornis eurynome</i> (1, nec)
<i>Vriesea vagans</i>	Brom	Holo-epiphyte	Alves <i>et al.</i> (2000) ¹ ; Araújo <i>et al.</i> (2004) ² ; Rocca-de-Andrade (2006) ³	Atlantic Forest	6	<i>Amazilia fimbriata</i> ¹ (1, nec), <i>Chytolaema rubricauda</i> ³ (1, nec), <i>Florisuga fusca</i> ¹ (1, nec), <i>Polytmus guainumbi</i> ¹ (1, nec), <i>Ramphodon naevius</i> ³ (1, nec), <i>Thalurania glaucopis</i> ^{1,2,3} (3, nec)
<i>Witrockia cyathiformis</i> (<i>Canistrum cyathiforme</i>)	Brom	Facultative	Buzato <i>et al.</i> (2000) ¹ ; Kaehler <i>et al.</i> (2005) ²	Atlantic Forest	4	<i>Amazilia versicolor</i> ² (1, nec), <i>Leucochloris albicollis</i> ^{1,2} (2, nec), <i>Phaethornis eurynome</i> ^{1,2} (2, nec), <i>Thalurania glaucopis</i> ² (1, nec)

The bromeliads (Bromeliaceae) have the greatest richness (80 species) visited by birds and also stood out as the most visited epiphytes with 455 citations. The hummingbirds (Trochilidae) reached the highest richness (35 species) and number of interactions (n = 298) in these epiphytes. Considering all the bird-epiphyte interactions, the hummingbirds was over

again placed in first with 35 species that visited more frequently (395 citations) the epiphytes, followed by Thraupidae with 18 species and 28 citations and, Furnariidae with nine species and 25 citations (Figure 2). Nectar was the most sought epiphyte resource by birds (Figure 3).

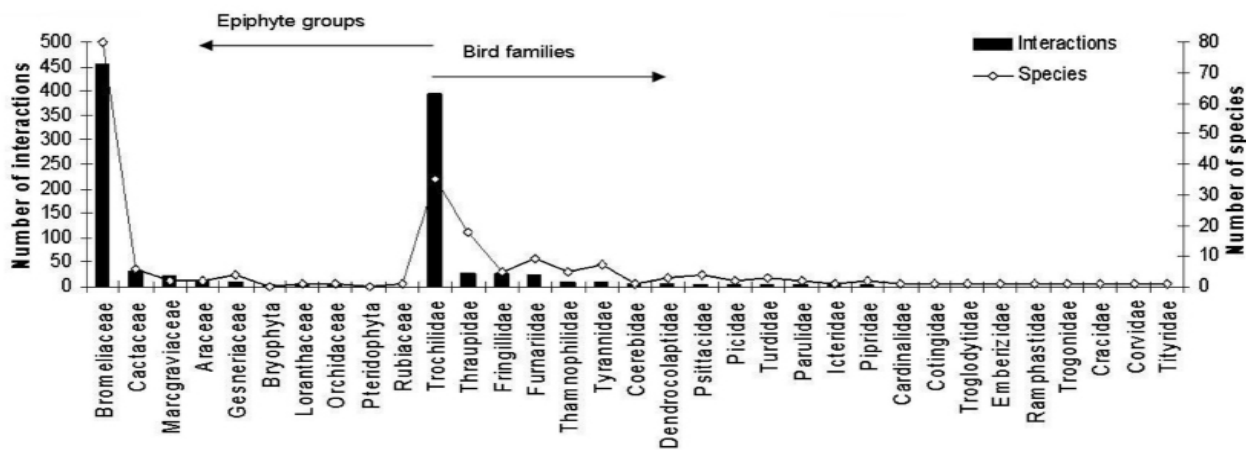


Figure 2. Number of cited interactions and number of species in epiphyte groups and in bird families recorded in Brazil.
 Figura 2. Número de citações de interações e número de espécies em grupos de epifitas e famílias de aves registradas no Brasil.

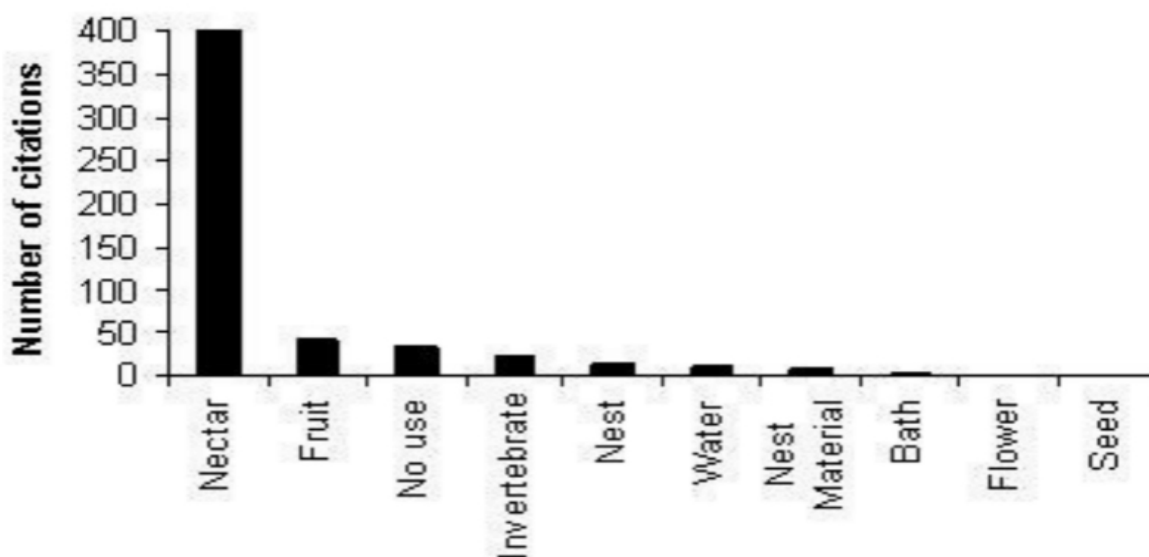


Figure 3. Number of interaction citations on epiphytes resources by birds recorded in Brazil.
 Figura 3. Número de citações de interações por aves em recursos de epifitas registradas no Brasil.

Aechmea nudicaulis (Bromeliaceae), *Schwartzia brasiliensis* (Marcgraviaceae) and *Vriesea altodaserrae* (Bromeliaceae) were the first three most visited epiphytes, respectively with 25, 23 and 15 citations. *S. brasiliensis*, *A. nudicaulis*, *Tillandsia stricta* and *Vriesea rodigasiana* had the major richness of bird visitors, respectively with 21, 15 and the last two species with 10 species (Table I).

The hummingbirds *Ramphodon naevius*, *Thalurania glaucopis* and *Phaethornis eurynome* interacted more frequently with epiphytes,

respectively with 86, 69 and 53 citations. Considering the richness' visitors in epiphytes, *R. naevius* were still placed in first (48 species), followed by *P. eurynome* (43 species) and *T. glaucopis* (42 species).

The hummingbird *P. eurynome* (IG = 34.88) and the bromeliad *V. rodigasiana* (IG = 1.25) were considered more generalists species while the ovenbird *Cichlocolaptes leucophrus* (IG = 0.20) and the bromeliad *Nidularium procerum* were considered more specialists species among the birds and epiphytes (Tables II and III).

Table II. Degree of interaction generality of birds (IG) with more than five citations of interactions in epiphytes in Brazil. N_R is the total number of interaction records of the bird species; N_T is the total number of interacted taxons (groups, genus and species) of the bird species. The IG value increases in more generalists bird species in interactions with epiphyte plants.

Tabela II. Grau de generalização em interações de aves (IG) com mais de cinco citações de interações em epífitas no Brasil. N_R : número total de registros de interação das espécies de aves; N_T : número total de táxons (grupos, gêneros e espécies) que as aves interagiram. O valor de IG aumenta em espécies de aves mais generalistas em interações com plantas epífitas.

Bird species	N_R	N_T	IG
Trochilidae			
<i>Anthracothorax nigricollis</i>	5	4	3.20
<i>Glaucis hirsutus</i>	7	6	5.14
<i>Hylocharis cyanus</i>	7	6	5.14
<i>Amazilia versicolor</i>	12	9	6.75
<i>Chlorostilbon lucidus</i>	7	7	7.00
<i>Clytolaema rubricauda</i>	10	9	8.10
<i>Florisuga fusca</i>	15	12	9.60
<i>Phaethornis ruber</i>	14	13	12.08
<i>Leucochloris albicollis</i>	21	18	15.42
<i>Amazilia fimbriata</i>	25	21	17.64
<i>Phaethornis squalidus</i>	23	21	19.17
<i>Thalurania glaucopis</i>	69	43	26.80
<i>Ramphodon naevius</i>	86	51	30.20
<i>Phaethornis eurynome</i>	53	45	38.20
Furnariidae			
<i>Cychlocolaptes leucophrus</i>	5	1	0.20
Coerebidae			
<i>Coereba flaveola</i>	8	8	8.00
Thraupidae			
<i>Tangara seledon</i>	11	8	5.82
Fringillidae			
<i>Euphonia violacea</i>	5	4	3.20
<i>Euphonia pectoralis</i>	11	9	7.36

Table III. Degree of interaction generality of epiphytes (*IG*) with more than five citations of interactions with birds in Brazil. N_R is the total number of interaction records of the epiphyte species; N_T is the total number of interacted taxons of the epiphyte species. The *IG* value increases in more generalists epiphyte species in interactions with birds.

Tabela III. Grau de generalização em interações de epífitas (*IG*) com mais de cinco citações de interações com aves no Brasil. N_R : número total de registros de interação das espécies de epífitas; N_T : número total de táxons que as epífitas interagiram. O valor de *IG* aumenta em espécies de epífitas mais generalistas em interações com aves.

Plant species	N_R	N_T	<i>IG</i>
Bromeliaceae			
<i>Nidularium procerum</i>	6	2	0.33
<i>Aechmea pectinata</i>	13	6	0.46
<i>Vriesea ensiformis</i>	10	5	0.50
<i>Vriesea incurvata</i>	8	4	0.50
<i>Aechmea organensis</i>	7	4	0.57
<i>Aechmea nudicaulis</i>	25	15	0.60
<i>Aechmea ornata</i>	5	3	0.60
<i>Quesnelia arvensis</i>	5	3	0.60
<i>Vriesea altodaserrae</i>	15	9	0.60
<i>Vriesea philippocoburgii</i>	8	5	0.62
<i>Aechmea distichantha</i>	14	9	0.64
<i>Nidularium innocentii</i>	6	4	0.66
<i>Wittrockia cyathiformis</i>	6	4	0.66
<i>Tillandsia usneoides</i>	7	5	0.71
<i>Vriesea procera</i>	8	6	0.75
<i>Vriesea vagans</i>	8	6	0.75
<i>Tillandsia stricta</i>	13	10	0.77
<i>Vriesea flammea</i>	6	5	0.83
<i>Aechmea araneosa</i>	5	5	1.00
<i>Aechmea beeriana</i>	6	6	1.00
<i>Aechmea bromeliifolia</i>	8	8	1.00
<i>Aechmea lindenii</i>	6	6	1.00
<i>Canistrum aurantiacum</i>	7	7	1.00
<i>Hohenbergia ridleyi</i>	5	5	1.00
<i>Neoregelia magdalenae</i>	5	5	1.00
<i>Quesnelia strobilispica</i>	5	5	1.00
<i>Tillandsia geminiflora</i>	9	9	1.00
<i>Vriesea jonghei</i>	6	6	1.00
<i>Vriesea platynema</i>	5	5	1.00
<i>Vriesea rodigasiana</i>	8	10	1.25
Cactaceae			
<i>Rhipsalis teres</i>	5	4	0.80
Maregraviaceae			
<i>Schwartzia brasiliensis</i>	23	21	0.91

DISCUSSION

The highest number of interactions between birds and epiphytes in Atlantic Forest from southeastern Brazil was expected due the complex net of interactions between these organisms in this biome (Cestari & Pizo 2008). The Atlantic Forest presents a notable topographic differentiation that permits the incidence of light in a major part of its vegetation strata. This fact creates micro-climates that favour the establishment of a great diversity of epiphytes (Ab'Saber 2007), increasing their probability of use by birds. In terms of quantity of ecological studies conducted in this biome, the southeast region supports approximately 42% of the total human Brazilian population (IBGE 2007). This highest demography probably reflects the major number of researchers and consequently a concentration of studies in this region. Notwithstanding, there is a clear lack of ecological investigations about bird-epiphyte interactions in other Brazilian regions and biomes.

The bromeliads were the most cited group of epiphytes. They provide an important quantity of nectar to hummingbirds, their main pollinators and most cited birds in the present review (Smith & Downs 1974, Snow & Snow 1986, Sazima *et al.* 1996). In Brazil, some bromeliads and hummingbirds species are especially endemic at Atlantic Forest (Reitz 1983, Sick 1984, Martinelli *et al.* 2008). According to Sick (1984), a parallel evolution between bromeliads and hummingbirds traced the mutualism presently recorded. Probably, groups of hummingbird species generated multiple selecting pressures on groups of bromeliads species in a diffuse coevolution process (Feisinger 1983). Notwithstanding, the intrinsic relationship between birds and bromeliads awaked special attention of researchers interested in pollination process and floral biology of bromeliads that compounded the majority of manuscripts found in this review.

Regardless nectar, “tank” bromeliads may also offer a highest variety of resources to birds than other epiphytes (Pizo 1994, Cestari & Pizo 2008). Its “rosette” shape structure formed by leaves store water and organic material, creating a micro-habitat that favors the presence of bird’s preys as invertebrates and small vertebrates (Picado 1911, Laessle 1961). Additionally, the accessible stored water can be used

by birds for bath and drink (Cestari & Pizo 2008). In the present review the bird families Thraupidae and Furnariidae interacted frequently with bromeliads searching for resources other than nectar. Nadkarni and Matelson (1989) found similar results in a bird-epiphyte interactions review conducted in Central America. The tanagers (Thraupidae) used a higher variety of available resources, such as fruits, invertebrates, water and places or materials for nesting. The ovenbirds (Furnariidae) are more restricted to search sheltered invertebrates in the accumulated organic material of roots and dead leaves.

Considering other groups of epiphytes and their resources explored by birds, aroids (Araceae) supplied mainly fruits and invertebrates; cactuses (Cactaceae) supplied fruits, and mosses (Bryophyta) supplied invertebrates. The Gesneriaceae, Loranthaceae, Marcgraviaceae, Orchidaceae and Rubiaceae groups supplied nectar. Although the absence of available resources in Pteridophyta, some birds probably inspected its roots and leaves looking for sheltered invertebrates (Table I).

Forage specialization of Brazilian birds in epiphytes is rarely cited in the literature (ex., *Heliobletus contaminatus*, Parrini *et al.* 2009) and more species are cogitated to be specialists (Pizo 1994, Cestari & Pizo 2008). Considering the number of species interactions and the total number of cited interactions, the ovenbird *C. leucophrus* and the bromeliad *N. procerum* were pointed out as more specialists. This result involved the previous cogitation of *C. leucophrus* as bromeliad specialist in a study about bird and epiphyte interactions conducted at Atlantic Forest from southeastern Brazil (Cestari & Pizo 2008). *C. leucophrus* moves permanently among tank bromeliads, dislodging accumulated dead leaves and organic material searching for invertebrates (Pizo 1994, Sick 1997, Develey & Endrigo 2004, Sigrist 2006, Cestari & Pizo 2008).

The ornithophilous *N. procerum* has long-tubed corolla and high-reward flowers to hummingbirds (Araújo 1996). Authors cited only the two long-billed hummingbirds *R. naevius* (five citations) and *P. eurynome* (one citation) as its visitors (Araújo 1996, Buzato *et al.* 2000, Varassin 2002, Araújo *et al.* 2004, Piacentini & Varassin 2007). Probably, these hummingbird species act as very important pollinators in the short flowering period (1 to 4 months per year)

of *N. procerum* if compared with other bromeliads species (Araújo 1996, Buzato *et al.* 2000, Araújo *et al.* 2004, Piacentini & Varassin 2007). Further, *R. naevius* and *P. eurynome* have distinct habitat preferences and in spite of they share the same sites, their mutual presences are generally rare (Sazima *et al.* 1995, Varassin 2002, Araújo *et al.* 2004).

Considering the literary approach of this review to retract specialization on bird-epiphyte interactions, more studies involving epiphyte and non-epiphytes availability and its associations with bird species forage are still necessary to verify selectivity and specialization (Sillett 1994, Cestari & Pizo 2008). The degree of bird specialization in epiphytes may reflect its survivorship and abundance. In this way, quantity and richness of epiphytes may influence the presence of some species of birds (Nadkarni & Matelson 1989, Cestari & Pizo 2008).

Studies of applied ecology proved that epiphytes act in the regulation of micro-climates that birds live, proportioning a better environment to shelter it (Stuntz *et al.* 2002). Coffee cultivated areas with epiphytes showed a higher richness and abundance of birds than crop areas without epiphytes from Central and North America (Cruz-Angón & Greenberg 2005, Wunderle & Jr. Latta 1998). Probably, the absence of epiphytes in degraded areas from Brazil may influence the richness and abundance of avian community, but this is a subject to be explored.

Epiphytes may also available additional resources in the forest favoring opportunist bird species along the year (Nadkarni 1994, Cestari & Pizo 2008). Although, study efforts seeking to identify what bird species use epiphytes must be primarily conducted. Despite the major number of studies conducted in Atlantic Forest from southeastern Brazil, the great extend of the country assures that other tropical and subtropical regions are propense to a higher number of bird-epiphyte interactions since they present favorable conditions to epiphytes presence and elevated richness of birds. In this way, the list of birds and epiphytes presented in this revision is farther from its end.

In a large scale, future investigations in ecological studies about bird-epiphyte interactions must be directed on the contribution of epiphytes presence to the abundance and richness of opportunist and specialist bird species, comparing mainly fragmented

and continuous forests habitats. More focused studies will be primordial to increase the number of bird species that explore epiphytes, identify its specialization on uses, and the costs-benefits and ecological importance for both life forms.

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