Figures 1-8. (1) *Carpornis cucullatus* e *Nectandra megapotamica* (Lauraceae); (2) *Carpornis melanocephalus* e *Matayba elaeagnoides* (Sapindaceae); (3) *Lipaugus lanioides* (regurgitando semente) e *Tapirira guianensis* (Anacardiaceae).; (4) *Laniisoma elegans* e *Cordia ecalyculata* (Boraginaceae); (5) *Oxyruncus cristatus* e *Trema micrantha* (Ulmaceae); (6) *Phibalura flavirostris* e *Myrsine coriacea* (Myrsinaceae); (7) *Pyroderus scutatus* e *Euterpe edulis* (Arecaceae); (8) *Procnias nudicollis* e *Cupania vernalis* (Sapindaceae). From a watercolor painting by Tomas Sigrist.

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Frugivory in cotingas of the Atlantic Forest of southeast Brazil

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RESUMO. **Frugivoria em cotingídeos na Mata Atlântica do sudeste do Brasil.** Neste trabalho apresentamos uma lista dos frutos comidos por oito espécies de cotingídeos (*Carpornis cucullatus*, *C. melanocephalus*, *Laniisoma elegans*, *Lipaugus lanioides*, *Oxyruncus cristatus*, *Phibalura flavirostris*, *Procnias nudicollis* e *Pyroderus scutatus*) no Parque Estadual Intervales (PEI), uma reserva de Mata Atlântica localizada no sudeste do Brasil. Além de investigar a dieta frugívora dos cotingídeos, nosso objetivo foi também fornecer subsídios para a compreensão do padrão de uso de frutos por estas aves. Entre 1990 e 2001 quatro áreas localizadas no PEI foram visitadas regularmente. Estas áreas formam um gradiente altitudinal (70-800 m a.n.m.) e também um gradiente de perturbação (florestas secundárias iniciais a primárias). Os registros de alimentação foram feitos ao longo das várias trilhas e estradas não pavimentadas que cortam as áreas de estudo. Os cotingídeos comeram uma variedade de frutos (99 espécies em 34 famílias) cujos tamanhos variaram de pequeno (< 5 mm de diâmetro) a grande (até 37 mm) e incluíam algumas espécies não-ornitocóricas. Com exceção de *P. nudicollis*, todas as outras espécies exploraram não somente frutos típicos do interior da floresta como também frutos de vegetação secundária, sugerindo então que este tipo de vegetação não constitui *per se* uma barreira para a sobrevivência destas aves no que se refere à exploração de frutos.
Palavras-Chave: Cotingidae, dispersão de sementes, frugivoria, Mata Atlântica.

ABSTRACT. In this paper we present a list of plant species whose fruits are eaten by eight cotinga species (*Carpornis cucullatus*, *C. melanocephalus*, *Laniisoma elegans*, *Lipaugus lanioides*, *Oxyruncus cristatus*, *Phibalura flavirostris*, *Procnias nudicollis*, and *Pyroderus scutatus*) at Parque Estadual Intervales (PEI), an Atlantic Forest reserve in southeast Brazil. Besides providing a list of fruits eaten by cotingas, our goal is to allow insights into fruit use by these birds whose ecology is poorly known. From 1990 to 2001 four sites located within PEI were regularly visited. These sites form an altitudinal gradient (70-800 m a.s.l.) and also a gradient of forest disturbance (second-growth to old-growth vegetation). Feeding records were made along several trails and dirt roads that crossed the study sites. Cotingas ate a variety of fruits (99 species in 34 families) that ranged from small (< 5 mm diameter) to large (up to 37 mm) and included some non-ornithochorous ones. With the exception of *P. nudicollis*, cotingas exploited not only fruits typical of the forest interior but also fruits of secondary vegetation, suggesting that concerning fruit exploitation early successional vegetation does not represent a barrier for the survival of these cotingas.
Key Words: Atlantic Forest, Cotingidae, frugivory, seed dispersal.

The Cotingas (Cotingidae) form one of the most characteristic avian families of the Neotropical region, where it is endemic (Snow 1982). Predominantly frugivorous birds, the reliance of cotingas on fruits is so high that in the past some species were taken as rare examples of exclusively frugivorous birds (e.g., *Procnias* spp., Snow 1982). Additional information revealed that besides fruits these birds also consume arthropods and, in a much smaller extent even mollusks, small lizards and bats (Hempel 1949, Schubbart *et al.* 1965, Snow 1982, Whittaker 1995, Sick 1997).

Cotingas disperse the seeds of a variety of plants, including large-seeded species that have a few others effective dispersers (e.g., many species in the Lauraceae; Snow 1970, Wenny and Levey 1998). However, as with any frugivorous bird, fruits do not represent a uniform food source for cotingas because fruits differ in many aspects that may influence their use by birds. Fruit size, for example, may constraint fruit consumption by gape-limited bird species (Wheelwright 1985). The forest stratum occupied by a fruiting plant is another feature that may constraint fruit use. For instance, an understory fruit is possibly unavailable for canopy-dwelling birds such as some cotinga species (e.g. *Procnias* spp.). Similarly, as birds typical of the forest interior, some cotingas may avoid venturing out to forest borders to eat a fruit.

In this paper we present a list of plant species whose fruits are eaten by eight cotinga species (*Carpornis*

cucullatus, *C. melanocephalus*, *Laniisoma elegans*, *Lipaugus lanioides*, *Oxyruncus cristatus*, *Phibalura flavirostris*, *Procnias nudicollis*, and *Pyroderus scutatus*) at an Atlantic Forest reserve in southeast Brazil. Besides providing a list of fruits eaten by cotingas, our goal is to allow insights into fruit use by these birds.

STUDY AREA AND METHODS

The study was carried out at Parque Estadual Intervales, a reserve with 490 km^2 located at the Serra de Paranapiacaba massif of southeast Brazil. Parque Intervales forms, with adjacent reserves, one of the largest blocks of Atlantic Forest preserved (SMA 2001). From 1990 to 2001 we regularly visited four sites in search of frugivores and their food plants. These sites, locally known as Sede, Barra Grande, Carmo and Saibadela, form an altitudinal gradient and also a gradient of forest disturbance. Sede (approximately 800 m a.s.l.) is the most disturbed site, composed by a mosaic of successional stages that ranges from young-secondary to high-graded forest (*sensu* Clark 1996; see also Nascimento 1994). Barra Grande (800 m) and Carmo (500 m) are moderately disturbed, being composed mainly by old-secondary and high-graded forest. Old-growth forest predominates at Saibadela (100 m), the least disturbed site. Noteworthy is the high abundance of bamboos (*Guadua angustifolia*, *Chusquea* spp., *Merostachys* spp.) at Sede and Carmo, and of palmito-juçara (*Euterpe edulis*) at Saibadela (255.6 mature plants/ha according to Almeida-Scabbia 1996; each plant produces annually hundreds or thousands of fruits; Laps 1996, Galetti *et al.* 1999).

Sede and Saibadela represent two climatic extremes. Annual rainfall ranges from approximately 1600 mm at Sede to over 4000 mm at Saibadela. Mean annual temperatures are around 18°C at Sede and 24°C at Saibadela. Temperatures often drops below 10°C during winter at Sede and frosts may occur; at Saibadela low temperatures may occur but rarely dropping below 10°C and frosts never happen. Bearing in mind that Saibadela never experiences a true dry season because the monthly rainfall is always > 100 mm, we can roughly divide the year at Parque Intervales in a wet-hot season spanning from September to April, and a dry-cold season from May to August.

Eight species of cotingas occur at Parque Intervales: Hooded (*Carpornis cucullatus*) and Black-headed Berryeaters (*C. melanocephalus*), Shrike-like Cotinga (*Laniisoma elegans*), Cinnamon-vented Piha (*Lipaugus lanioides*), Sharpbill (*Oxyruncus cristatus*), Swallow-tailed Cotinga (*Phibalura flavirostris*), Bare-throated Bellbird (*Procnias nudicollis*), and the Red-ruffed Fruitcrow (*Pyroderus scutatus*). Of these, *P. flavirostris* is a vagrant species, *L. elegans* is only rarely seen, *C. melanocephalus* is restricted to the lowlands (Saibadela), *C. cucullatus* is more common at Sede, *L. lanioides* reaches its highest abundance at Carmo, whereas *P. scutatus* is more frequently observed at Saibadela (Aleixo and Galetti 1997, Vielliard and Silva 2001). According to the most recent Red Data Book (BirdLife International 2000), both *C. melanocephalus* and *L. lanioides* are considered vulnerable species while *P. nudicollis* is near-threatened.

Feeding records were made while the authors walked through several trails and dirt roads that crossed the study site. These trails covered not only secondary vegetation but also pristine forests. Whenever a cotinga was observed feeding on fruits we recorded the bird and plant species. Unknown plants were marked for future identification. This method may overrepresent abundant plant species and conspicuous bird species. However, our intention is provide only a qualitative rather than quantitative analysis of the fruit diet of cotingas and thus we do not believe that this potential methodological bias severely affected the general picture we achieved. Moreover, none of the cotingas studied may be really called a conspicuous bird; they are shy, often quiet birds.

To describe and compare the size of fruits eaten by the cotingas, recently fallen fruits or fruits collected directly from the plant were measured with caliper to the nearest 0.1 mm. Sizes of fruits indicated in the text always refer to maximum width. For the purpose of this paper we arbitrarily consider small fruits those with < 15 mm maximum width, medium-sized fruits have 16-30 mm, and large fruits > 30 mm maximum width. Values shown refer to mean ± 1 SD.

RESULTS AND DISCUSSION

The fruits of 99 plant species representing 34 families were recorded as part of the diet of cotingas at Parque Intervales (table 1). The actual number of plants recorded is likely greater because unidentified species in some speciose genera (e.g., *Maytenus*, Celastraceae; *Leandra*, Melastomataceae; *Eugenia*, Myrtaceae) may represent more than one species. Most of fruits eaten by cotingas came from trees (77 species), followed by shrubs (13 species), lianas (5 species), parasites (2 species), one herb and one epiphyte (table 1). Plant families well represented in our survey were those that normally predominate in the Atlantic Forest of southeast Brazil in terms of number of species (see Siqueira 1994, Oliveira-Filho and Fontes 2000): Myrtaceae (18 species), Melastomataceae (13 species), Lauraceae (12 species), Rubiaceae (8 species). These families are particularly well represented at Parque Intervales (Nascimento 1994, Almeida-Scabbia 1996). *Euterpe edulis* (Arecaceae) was the most popular plant species among cotingas; it was eaten by six species. This palm is present all around Parque Intervales, being especially commom at Saibadela (Almeida-Scabbia 1996).

Table 1. Fruit species eaten by cotingas at Parque Estadual Intervales, southeast Brazil. (a) Plant habit: E = epiphyte, H = herb, L = liana, P = parasite, S = shrub, T = tree. (b) Mean fruit width; at least 10 fruits for each species were measured. (c) Bird species: Cc = *Carpornis cucullatus*, Cm = *C. melanocephalus*, Le = *Laniisoma elegans*, Ll = *Lipaugus lanioides*, Oc = *Oxyruncus cristatus*, Pf = *Phibalura flavirostris*, Pn = *Procnias nudicollis*, Ps = *Pyroderus scutatus*.

Plant family/species	Plant habit [a]	Fruit width (mm) [b]	Bird species [c]
Anacardiaceae			
Tapirira guianensis	T	–	Ll, Ps
Apocynaceae			
Peschiera catharinensis	T	–	Oc
Aquifoliaceae			
Ilex brevicuspis	T	3.5	Ps
Araliaceae			
Didymopanax angustissimum	T	7.6	Cc, Ll
Arecaceae			
Euterpe edulis	T	12.2	Cc, Cm, Ll, Oc, Pn, Ps
Geonoma gamiova	S	11.0	Cc
Geonoma pauciflora	S	8.0	Cc
Burseraceae			
Protium widgrenii	T	12.0	Ll
Cactaceae			
Rhipsalis teres	E	–	Cc
Caesalpiniaceae			
Copaifera trapezifolia	T	23.0	Ll
Canellaceae			
Cinnamodendron dinizii	T	14.0	Ps
Cecropiaceae			
Cecropia glazioui	T	–	Ll
Coussapoa microcarpa	T	5.1	Ll
Celastraceae			
Maytenus robusta	T	7.8	Ps
Maytenus spp.	T	–	Cc, Cm. Ll
Euphorbiaceae			
Alchornea glandulosa	T	4.2	Ll
Alchornea triplinervia	T	4.2	Cc
Hyeronima alchorneoides	T	3.2	Ll

Continued

Table 1. Continued. (a) Plant habit: E = epiphyte, H = herb, L = liana, P = parasite, S = shrub, T = tree. (b) Mean fruit width; at least 10 fruits for each species were measured. (c) Bird species: Cc = *Carpornis cucullatus*, Cm = *C. melanocephalus*, Le = *Laniisoma elegans*, Ll = *Lipaugus lanioides*, Oc = *Oxyruncus cristatus*, Pf = *Phibalura flavirostris*, Pn = *Procnias nudicollis*, Ps = *Pyroderus scutatus*.

Plant family/species	Plant habit [a]	Fruit width (mm) [b]	Bird species [c]
Lauraceae			
Cryptocaria moschata	T	19.1	Ps
Nectandra cuspidata	T	23.3	Cc
Nectandra megapotamica	T	9.0	Cc, Ll, Pn, Ps
Nectandra sp.	T	–	Cc
Ocotea aeciphila	T	10.7	Cc
Ocotea dispersa	T	9.0	Ll
Ocotea odorifera	T	10.9	Cc
Ocotea spixiana	T	–	Cc
Ocotea teleiandra	T	14.3	Cc
Persea pyrifolia	T	15.6	Cc, Ps
Persea sp.	T	–	Cc
Unidentified	T	–	Ll, Pn
Liliaceae			
Smilax elastica	L	11.4	Cc
Loranthaceae			
Psittacanthus sp.	P	–	Oc
Struthanthus vulgaris	P	–	Oc
Malpighiaceae			
Unidentified	T	–	Ll
Melastomateceae			
Leandra australis	S	7.0	Cc
Leandra dasytricha	S	5.1	Cc, Ll
Leandra pilonensis	S	7.0	Cc
Leandra regnelli	S	–	Cc
Leandra spp.	S	–	Cc, Ll
Miconia budlejoides	S	4.4	Ll
Miconia cabucu	S	4.0	Ll
Miconia cubatanensis	T	4.7	Cc
Miconia latecrenata	S	–	Oc
Miconia pusilliflora	T	–	Cc, Le
Miconia racemifera	S	3.9	Ll
Miconia valtherii	S	3.9	Ll
Unidentified	S	–	Ll
Meliaceae			
Cabralea canjerana	T	9.7	Oc

Continued

Table 1. Continued. (a) Plant habit: E = epiphyte, H = herb, L = liana, P = parasite, S = shrub, T = tree. (b) Mean fruit width; at least 10 fruits for each species were measured. (c) Bird species: Cc = *Carpornis cucullatus*, Cm = *C. melanocephalus*, Le = *Laniisoma elegans*, Ll = *Lipaugus lanioides*, Oc = *Oxyruncus cristatus*, Pf = *Phibalura flavirostris*, Pn = *Procnias nudicollis*, Ps = *Pyroderus scutatus*.

Plant family/species	Plant habit [a]	Fruit width (mm) [b]	Bird species [c]
Menispermaceae			
Abuta selloana	L	16.2	Ps
Monimiaceae			
Mollinedia triflora	T	–	Ll
Mollinedia spp.	T	–	Cm, Ll, Ps
Moraceae			
Ficus enormis	T	14.0	Ll
Ficus luschnathiana	T	12.2	Cc, Ll, Pn
Ficus sp.	T	–	Ll
Morus nigra	T	–	Cc
Myristicaceae			
Virola bicuhyba	T	21.0	Ll, Pn, Ps
Virola gardneri	T	37.0	Ps
Myrsinaceae			
Myrsine coriacea	T	3.3	Ll, Oc, Pf
Myrsine lancifolia	T	4.1	Ll
Myrtaceae			
Campomanesia xanthocarpa	T	14.1	Ps
Eugenia mosenii	T	19.6	Cc, Cm
Eugenia neoglomerata	T	17.5	Cm
Eugenia spp.	T	–	Ll, Ps
Gomidesia affinis	T	15.0	Cc
Gomidesia anacardiifolia	T	15.2	Cc, Cm
Gomidesia spectabilis	T	16.3	Cc, Cm
Marlierea obscura	T	14.0	Cm, Ps
Marlierea suaveolens	T	16.5	Cm
Marlierea sp.	T	–	Cm
Myrcia grandiflora	T	15.9	Cc
Myrcia rufula	T	10.4	Cc, Pn
Myrcia sp.	T	–	Cc
Siphoneugena densiflora	T	10.5	Cc
Unidentified 1	T	–	Pn, Ps
Unidentified 2	T	–	Cc
Unidentified 3	T	–	Ll
Unidentified 4	T	–	Cc, Pn
Nyctaginaceae			
Guapira opposita	T	5.3	Cc

Continued

Table 1. Continued. (a) Plant habit: E = epiphyte, H = herb, L = liana, P = parasite, S = shrub, T = tree. (b) Mean fruit width; at least 10 fruits for each species were measured. (c) Bird species: Cc = *Carpornis cucullatus*, Cm = *C. melanocephalus*, Le = *Laniisoma elegans*, Ll = *Lipaugus lanioides*, Oc = *Oxyruncus cristatus*, Pf = *Phibalura flavirostris*, Pn = *Procnias nudicollis*, Ps = *Pyroderus scutatus*.

Plant family/species	Plant habit [a]	Fruit width (mm) [b]	Bird species [c]
Onagraceae			
Fuchsia regia	L	4.7	Cc
Rosaceae			
Rubus urticaefolius	H	7.9	Cc
Rubiaceae			
Alibertia sp.	T	–	Ll
Amaioua sp.	T	9.0	Ll
Ixora heterodoxa	T	8.5	Cc
Psychotria longipes	T	5.3	Cc
Psychotria mapoureoides	T	5.0	Ll, Pf, Ps
Psychotria suterella	T	9.7	Cm
Psychotria sp.	T	–	Cm
Rudgea jasminoides	T	9.0	Cc
Sapindaceae			
Cupania oblongifolia	T	11.0	Ll
Cupania vernalis	T	8.4	Ll, Pn
Matayba elaeagnoides	L	15.0	Cm, Pn
*Paullini*a sp.	L	10.0	Oc
Sapotaceae			
Chrysophylum viride	T	20.0	Ps
Solanaceae			
Solanum swartzianum	T	10.7	Ll
Symplocaceae			
Symplocos glanduloso-marginata	T	4.7	Cc
Symplocos tetrandra	T	7.9	Cc
Symplocos variabilis	T	8.3	Cc
Ulmaceae			
Trema micrantha	T	2.2	Ll, Oc
Verbenaceae			
Citharexylum myrianthum	T	11.6	Cm, Ps

Henceforth we comment on each of the six species for which we have more than two records (*Carpornis cucullatus*, *C. melanocephalus*, *Lipaugus lanioides*, *Oxyruncus cristatus*, *Procnias nudicollis*, and *Pyroderus scutatus*). *Laniisoma elegans* and *Phibalura flavirostris* had only one and two records, respectively (table 1), and thus were excluded from the following accounts.

Carpornis cucullatus. Fruits of 45 plant species representing 15 families were recorded in the diet of *C. cucullatus* (table 1). *Carpornis cucullatus* ate small- to medium-sized fruits averaging 10.3 ± 4.6 mm (N = 33, range 4.2-23.3 mm). Fruits eaten included many species characteristic of the forest interior, as well as species that grow in forest edges and trail margins (e.g., *Leandra* spp., Melatomataceae; *Rubus urticaefolius*, Rosaceae), and even an exotic species (*Morus nigra*, Moraceae) whose fruits were eaten in an orchard at Saibadela. Of the cotinga species studied, *C. cucullatus* has perhaps the broadest fruit diet, playing an important role in the seed flow among different habitats (see Silva *et al*. 2002). According to the survey of Silva *et al.* 2002, *C. cucullatus* is the most important avian frugivore at Barra Grande and the third most important at Sede.

Contrary to what Snow (1982) thought, fruits of epiphytes and vines do not form the staple diet of this species. Only one epiphyte (*Rhipsalis teres*, Cactaceae) and one liana (*Smilax elastica*, Liliaceae) were recorded for *C. cucullatus*. Even though feeding bouts involving epiphytes are easily overlooked when one searches the forest from the ground, we do not believe that fruits of these plants will form a disproportionate important part in the diet of *C. cucullatus* at Parque Intervales. Puzzling is the paucity of records involving *Euterpe edulis* when compared to other cotingas (see below). In only one instance *C. cucullatus* was observed eating an *E. edulis* fruit at Carmo, despite its annual availability all over the study sites.

Carpornis melanocephalus. Fruits of 14 plant species (7 families) were recorded in the diet of *C. cucullatus*, all of them at Saibadela (table 1). Small- and medium-sized fruits were eaten (mean fruit width: 14.8 ± 3.0 mm, N = 10, range 9.7-19.6 mm). Besides many plant species typical of the forest interior, *C. melanocephalus* also consumed the fruits of *Citharexylum myrianthum* (Verbenaceae), which grows in forest edges at Saibadela. As with *C. cucullatus*, *E. edulis* was rarely recorded (only twice), despite the impressive abundance of these fruits at Saibadela (see Study Areas). According to Galetti *et al.* (1999), only 7.7% of the 26 feeding bouts recorded for *C. melanocephalus* feeding on fruits at Saibadela were on *E. edulis*.

Fruits eaten by *C. melanocephalus* were on average larger than those eaten by *C. cucullatus* (t-test on log-transformed data: t = -2.98, df = 41, p = 0.005), which corroborates the suggestion by Snow (1982) that, based on subtle differences in bill shape, *C. melanocephalus* would differ from *C. cucullatus* in the kinds of fruits they eat. However, it is important to note that these species are altitudinally segregated for most of the year, facing therefore different assemblages of fruit species. It would be informative to know if the difference in fruit size detected here holds also where both species occurs syntopically, as in the Saibadela forest during winter periods.

Lipaugus lanioides. Fruits of 38 plant species (20 families) were recorded in the diet of *L. lanioides* (table 1). Based on 72 feeding bouts recorded at Carmo, R. Laps (unpubl. data) calculated that the diet of *L. lanioides* is comprised by 86.1% of fruits and 13.9% of insects. Like previous species, the sizes of fruits eaten by this cotinga vary from small to medium (mean fruit with: 8.3 ± 5.4 mm, N = 25, range 2.2 – 23.0 mm). Plant species typical of forest edges and clearings (e.g. *Cecropia glazioui*, *Trema micrantha*, *Miconia* spp.) are eaten frequently. Contrary to both *Carpornis* species, *L. lanioides* feeds extensively on *E. edulis* fruits, being one of its main seed dispersers at Carmo (Laps 1996). In fact, Collar *et al.* (1992) suggested that *L. lanioides* depends heavily upon the fruits of *E. edulis*, a belief that was not confirmed with more detailed studies (Galetti and Aleixo 1998). In August 1993 *Lipaugus lanioides* was observed eating immature fruits of *Alibertia* sp. (Rubiaceae) at Carmo.

Oxyruncus cristatus. The Sharpbill ate fruits of 9 plant species (8 families; table 1), all of which produce small fruits. These fruits ranged in size from 2.2 mm to 12.2 mm (7.5 ± 4.4, N = 5), and included species typical of second-growth vegetation (e.g. *T. micrantha*; *Myrsine coriacea*, Myrsinaceae). Among the species studied, *O. cristatus* was the only species observed eating the fruits of parasitic plant species in the family Loranthaceae (table 1). Very often these plants maintain a close relationship with a restricted group of avian seed dispersers (Restrepo *et al.* 2002). The possibility that *O. cristatus* be part of this group should be investigated more carefully in the future.

As with *L. lanioides*, *O. cristatus* was observed eating immature fruits of *Peschiera catharinensis* (Apocynaceae) in August 1993 at Carmo. These were the only records of unripe fruit consumption we got and may represent a consequence of fruit scarcity because August is a month of low fruit production at Carmo (Pizo 1994, Laps 1996). As Foster (1977) observed for *Chiroxiphia linearis* at Costa Rica, when faced with a period of depressed fruit production frugivorous birds might take unripe fruits that normally do not enter their diet.

Procnias nudicollis. The Bellbird was recorded eating the fruits of 10 plant species (6 families), which ranged in size from 8.4 to 21.0 mm (12.6 ± 4.3 mm, N = 7). Contrary

to the previous species, fruits typical of second-growth vegetation were not recorded for *P. nudicollis*. Noteworthy also is the fact that fruits of Lauraceae are poorly represented in our list (two records for two species), despite the relative richness of this family at Intervales (Almeida-Scabbia 1996). In this respect, *P. nudicollis* differs from what Snow (1970, 1973) observed for *P. averano* in Trinidad and suggested for other *Procnias* species. Such incongruence may reflect a real difference among species but may only represent an artifact of methodology. Despite the conspicuous male plumage, *P. nudicollis* is not abundant at Intervales and is not easily observed eating fruits. In addition, several Lauraceae species present a supra-annual fruiting pattern (*sensu* Newstrom *et al.* 1994), passing several years of nil fruit production (M. A. Pizo, pers. obs.). Therefore, a more complete list of fruits eaten by *P. nudicollis* should be obtained by collecting seeds under traditional calling posts, as did Snow (1970) for *P. averano*.

Pyroderus scutatus. Fruits of 18 plant species (13 families) were recorded in the diet of *P. scutatus* (table 1), all but *Citharexylum myrianthum* are species of the forest interior. With the widest gape among the cotingas studied (29.0 ± 3.2 mm; R. Laps unpubl. data), *P. scutatus* was the only species to eat large fruits (14.7 ± 8.0 mm, N = 15, range 3.5 –37 mm). It was also the only species observed eating monkey-dispersed fruits (*Abuta selloana*, Menispermaceae; *Cryptocaria moschata*, Lauraceae; and *Chrysophyllum viride*, Sapotaceae).

Based on hunter information Sick (1997) stated that *P. scutatus* eats basically the same fruits of toucans. In fact, both share many fruit species and even participate in mixed species flocks at Saibadela (Galetti *et al.* 2000).

Conservation perspectives. Cotingas ate a variety of fruits that ranged from small to medium-sized and included some non-ornithochorous ones (*sensu* van der Pijl 1982). With the exception of *P. nudicollis*, our data showed that they not only exploit fruits typical of forest interior but also fruits of secondary vegetation. Therefore, at least in what concerns fruit use, early successional vegetation does not represent a barrier for the survival of the cotingas studied. They may thrive in habitats with a certain degree of disturbance providing they also find patches of non-disturbed forest and sufficient forested habitat to find their food plants in an around-the-year basis and eventually realize their periodic movements, which in the Atlantic Forest of southeast Brazil likely involves different altitudes.

Frugivorous birds often engage in seasonal movements while tracking the availability of their food plants (Leighton and Leighton 1983, Wheelwright 1983, Loiselle and Blake 1991, Kinnaird *et al.* 1996). For the cotinga species occurring at Parque Intervales such movements have not been studied but it is likely for some species. For instance, *P. scutatus* and *C. cucullatus* are only seen in the lowlands (Saibadela) during the winter (May-August; Aleixo and Galetti 1997), which coincide both with the fruiting period of *Euterpe edulis* at the lowland (Galetti *et al.* 1999) and the period of scarcity of fleshy fruits at the highlands (Carmo, Sede, and Barra Grande; Pizo 1994, Laps 1996). A close association between the movements of these species (especially *P. scutatus*) and the fruiting pattern of *E. edulis*, as previously hypothesized for *L. lanioides* (Collar *et al.* 1992), should be investigated in the future.

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