

---

Diet of the Scaly-Headed Parrot (*Pionus maximiliani*) in a Semideciduous Forest in Southeastern Brazil

Author(s): Mauro Galetti

Source: *Biotropica*, Vol. 25, No. 4 (Dec., 1993), pp. 419-425

Published by: The Association for Tropical Biology and Conservation

Stable URL: <http://www.jstor.org/stable/2388865>

Accessed: 15/04/2010 21:29

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=tropbio>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The Association for Tropical Biology and Conservation is collaborating with JSTOR to digitize, preserve and extend access to *Biotropica*.

## Diet of the Scaly-headed Parrot (*Pionus maximiliani*) in a Semideciduous Forest in Southeastern Brazil<sup>1</sup>

Mauro Galetti<sup>2</sup>

Departamento de Zoologia, I.B., Universidade Estadual de Campinas, C.P. 6109, 13081 Campinas, São Paulo, Brazil

### ABSTRACT

The diet of the Scaly-headed Parrot (*Pionus maximiliani*) was studied during three consecutive years in a 250 ha semideciduous forest in southeastern Brazil. The parrots showed a generalist and seasonal diet. Seeds composed 70.4 percent of the diet of parrots, followed by flowers (20.3%), corn from plantations that surround the forest (7.7%) and fruit pulp (1.6%). In the dry season flowers constituted 38 percent of the diet and leguminous fruits comprised 41.2 percent of its diet. Parrots are important predispersal seed predators and have a high impact on the fitness of plants in semideciduous forests, due to their high consumption of seeds and flowers.

### RESUMO

A dieta da maritaca (*Pionus maximiliani*) foi estudada durante três anos consecutivos em uma floresta de 250 ha no sudeste do Brasil. As maritacas apresentaram uma dieta generalista e sazonal. Sementes compuseram a 70.4% da sua dieta, seguido de flores (20.3%), milho das plantações que circundam a floresta (7.7%) e polpa de frutos (1.6%). Na estação seca as flores constituíram 38% da dieta das maritacas. Frutos das leguminosas perfizeram uma porção importante na dieta das maritacas (41.2%). As maritacas são importantes predadores de sementes pré-dispersão e exercem grande impacto no sucesso reprodutivo das plantas em florestas semidecíduas devido seu alto consumo de sementes e flores.

*Key words:* Brazil; diet; flower eating; parrot; *Pionus maximiliani*; seed predation; semideciduous forest.

PARROTS CONSTITUTE THE HIGHEST BIOMASS of canopy frugivorous birds in tropical forests (Terborgh *et al.* 1990), but the ecology of these birds is not well understood because of the difficulty in studying them (Roth 1984, Sick 1985, Oren & Novaes 1986, Snyder *et al.* 1987, Munn 1988, Chapman *et al.* 1989, Forshaw 1989, Brandt & Machado 1990).

Psittacids are important seed predators on some plant species (Higgins 1979, Howe 1980, Janzen 1981, Roth 1984, Galetti & Rodrigues 1992) and sometimes seed dispersers of others (Hopkins & Hopkins 1983, Fleming *et al.* 1985). Insects, snails, and other plant material are also eaten by parrots (Roth 1984, Sick 1985, Munn 1988, Forshaw 1989, Sazima 1989).

In this study the feeding ecology of the Scaly-headed Parrot (*Pionus maximiliani* Kuhl) in a semideciduous forest in southeastern Brazil is described.

The Scaly-headed Parrot is a medium-sized bird (29 cm long) and weighs 233–289 g (Forshaw 1989). The species occurs from Northern Argentina to North Ceará, Piauí and Goiás in Brazil (Forshaw 1989).

### STUDY SITE AND METHODS

From August 1988 to December 1991 I studied a population of the Scaly-headed Parrot (*Pionus maximiliani*) at Santa Genebra Reserve in southeastern Brazil. Santa Genebra Reserve is a 250 ha forest fragment covered by subtropical moist forest (Holdridge 1967) or tropical semideciduous forest (*sensu* Longman & Jenik 1987) situated in Campinas (22°47'S, 49°07'W; 670 m a.s.l.), São Paulo, Brazil. The forest was fragmented in the 1950s and the remnant area is surrounded by corn and soybean plantations, and more recently by human habitations.

Mean annual rainfall is 1366 mm, and the year can be divided into wet (November–February), dry (May–August), and transitional (March–April and September–October) seasons. The mean annual temperature is 20.6°C (Fig. 1).

<sup>1</sup> Received 26 June 1992, revision accepted 3 February 1993.

<sup>2</sup> Present address: Sub-Department of Veterinary Anatomy, University of Cambridge, Tennis Court Road, Cambridge CB2 1QS, U.K.

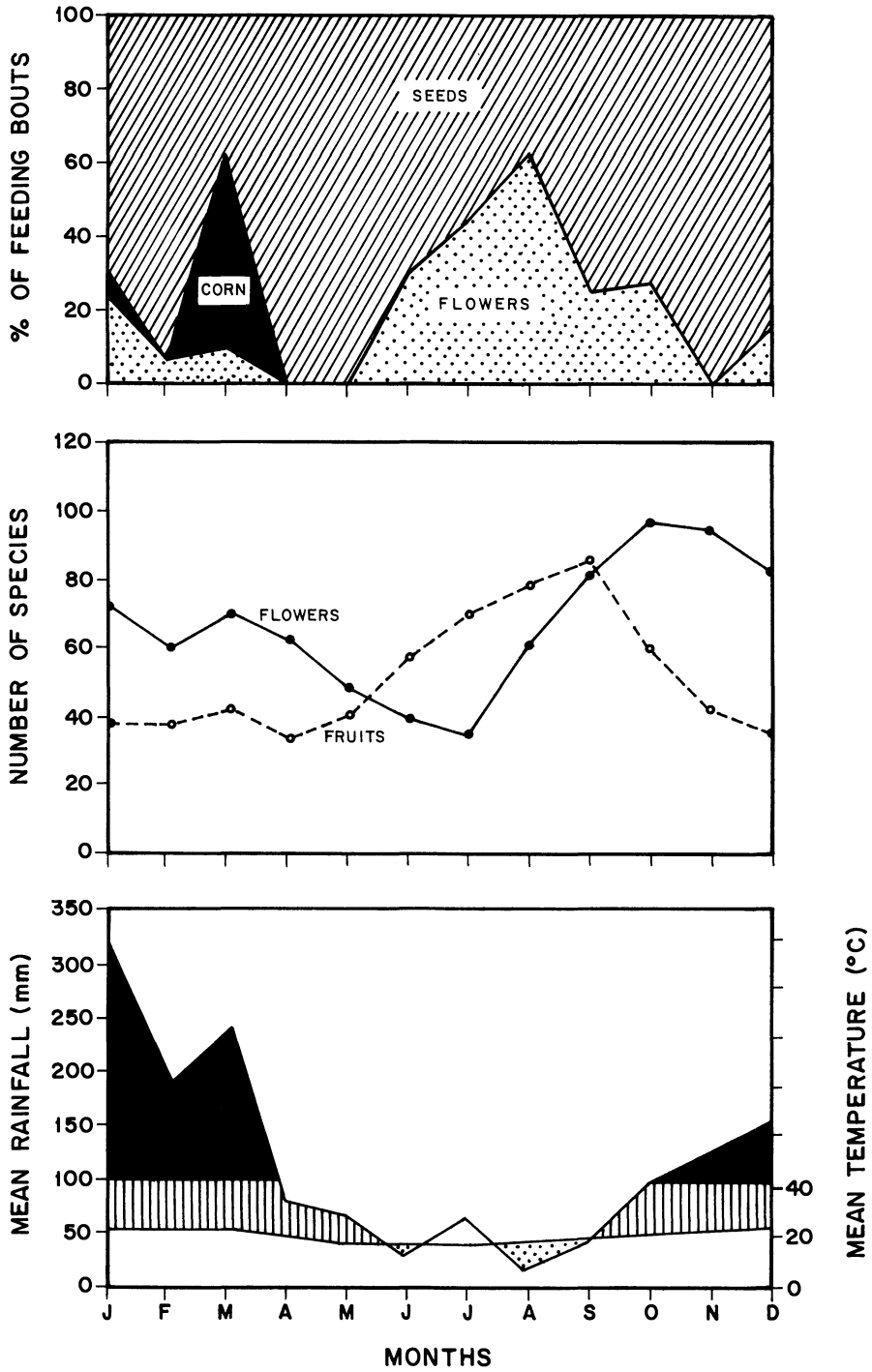


FIGURE 1. Lower: Mean monthly temperature and precipitation in Campinas, São Paulo, SE Brazil (1988-1991), indicating periods of drought (stippled) and of rainfall superabundance (black). Middle: Phenology of woody plants (from Morellato 1991). Upper: Monthly diet as percentage of feeding bouts of *Pionus maximiliani* at Santa Genebra Reserve.

The forest has trees 15–20 m high, and is characterized by a discontinuous canopy and by emergent trees reaching 30 m such as *Cariniana legalis* (Lecythidaceae) and *Hymenaea courbaril* (Caesalpinaceae). The Mimosaceae, Fabaceae, Rubiaceae, and Meliaceae are the most common plant families (Morellato 1991).

The bird composition of Santa Genebra was studied by Willis (1979) who recorded 146 species. Just three parrot species live in the reserve, the Blue-winged Parrotlet (*Forpus crassirostris*), the Scaly-headed Parrot and an introduced pair of Orange-winged Amazons (*Amazona amazonica*) (M. Galetti, pers. obs.).

One to three days each week between 0630 and 1230, I walked along a 5 km route of forest edges and trails recording the flock size and feeding behavior of the parrots. All the seasons received the same effort of field work. Whenever I found a parrot feeding, I recorded a feeding-bout, each bout representing one or more parrots feeding on the flowers, pulp, or seed of a plant species. If the parrot changed to another food source, a new bout was recorded (Altmann 1974). Each feeding bout varied from a few seconds to several minutes. This method of diet calculation emphasizes the diversity of different items ingested by parrots, but does not provide the amount of each plant species used. However, I used this method because parrots usually fly away upon detecting the presence of an observer. The estimate of the parrot's diet is based on the frequency of feeding bouts (see Snyder *et al.* 1987).

Phenological data collected during the same period as my study (Morellato 1991) were used to estimate the seasonal food availability to parrots of 265 plant species (135 lianas and 130 trees and scrubs) (Fig. 1).

The Spearman rank correlation ( $r_s$ ) was chosen to evaluate the relationship between food availability and diet of parrots. The Kruskal-Wallis test was used to evaluate the seasonal differences in the parrot's diet. Statistical analysis followed Zar (1984).

## RESULTS

The Scaly-headed Parrot was observed in 182 feeding bouts on 38 plant species from 18 families (Table 1). The families most utilized by parrots were Mimosaceae, Euphorbiaceae, and Fabaceae. Legumes (Fabaceae, Mimosaceae, and Caesalpinaceae) comprised 41.2 percent of the feeding bouts (Table 1). Seeds comprised 70.4 percent of the parrot's diet, followed by flowers (20.3%), corn

(7.7%) from plantations surrounding the reserve, and fruit pulp (1.6%).

Santa Genebra forest showed a seasonal availability on flower and fruit throughout the year (Morellato 1991; Fig. 1). Flowers have two peaks of availability, being one in March (end of wet season), and one in October (beginning of wet season). Although fruit availability increased during the dry season (Fig. 1), most species have dry wind dispersed fruits (Morellato 1991).

The diet of parrots at Santa Genebra changed seasonally (Kruskal-Wallis test,  $\chi^2 = 33.38$ ,  $P < 0.001$ ). Flower eating was higher during the dry season (ca 39% of feeding bouts, Fig. 1) than in the wet (14.5%) and transitional season (12.3%). Flower feeding was not correlated, however, with flower availability ( $r_s = 0.21$ ,  $N = 12$ , NS).

Seeds were consumed throughout the year but more often in the wet season (83% of feeding bouts; Fig. 1). Seed eating was negatively correlated with fleshy fruit availability ( $r_s = -0.67$ ,  $N = 12$ ,  $P < 0.05$ ). Corn was eaten mostly in May when ripening fruits were present in nearby fields (Fig. 1). A large flock of 35 Scaly-headed Parrots was seen eating corn. In the forest the mean flock size is about 2.5 parrots, ranging from 2 to 10 birds (M. Galetti, pers. obs.).

The Scaly-headed Parrot ate 29 fruit species at Santa Genebra (Table 1). The size of fruits consumed ranged from *Astronium graveolens* capsules 1.8 cm long to large *Inga* pods 18.5 cm in length. Most (89% of feeding bouts) of the fruit consumption occurred in the forest canopy. The seeds of three species of *Inga* and of *Dicella bracteosa* were the species most frequently consumed by *Pionus* at Santa Genebra (Table 1). In all fruit species the parrots ate the seeds as well. On only three occasions were the parrots observed to eat pulp of *Chrysophyllum marginatum* and *Calophyllum brasiliensis* fruits. Dry nonfleshy fruits (18 species) were consumed by parrots mainly during the dry season when they were available. The parrots were not observed dispersing seeds by endozoochory, mainly because all species eaten have large seeds. However, when feeding, parrots drop many fruits on the ground which then become available to secondary seed dispersers (ants or rodents).

Parrots ate 13 species of flowers at Santa Genebra, consuming petals, the ovary, and even pollen in *Chorisia speciosa*. Bird and bat pollinated flowers rich in nectar were eaten by parrots. It is noteworthy that the parrots were the main predator of flowers of *Inga* spp., which were its main seed source.

TABLE 1. *Plants eaten by Pionus maximiliani at Santa Genebra Reserve, Campinas, southeastern Brazil.*

Species	Type fruit <sup>a</sup>	Feeding bouts <sup>b</sup>	% of diet	Month, part eaten <sup>c</sup>	Abundance <sup>d</sup>
<b>ANARCADIACEAE</b>					
<i>Astronium graveolens</i> Jacq.	D	4	2.2	Oct (se)	frequent
<b>APOCYNACEAE</b>					
<i>Aspidosperma polyneuron</i> Muell. Arg.	D	3	1.65	May (se)	occasional
<b>ARALIACEAE</b>					
<i>Dendropanax cuneatum</i> Decne & Planch.	F	1	0.55	Oct (se)	rare
<b>BIGNONIACEAE</b>					
<i>Pyrostegia venusta</i> (Ker-Gaw) Miers		3	1.65	Jul (fl)	frequent
<i>Zeyhera tuberculosa</i> (Vell.) Bur.		1	0.55	Jan (fl)	occasional
Unidentified species	D	1	0.55	Jan (se)	indet.
<b>BOMBACACEAE</b>					
<i>Chorisia speciosa</i> St. Hill.		2	1.10	May (fl)	rare
<i>Pseudobombax grandiflorum</i> (Mart et Zucc) Robins		3	1.65	Jun (fl)	occasional
<b>CAESALPINACEAE</b>					
<i>Copaifera langsdorffii</i> Desf.	F	3, 6	4.95	Jan (fl), Apr–Jun (se)	frequent
<i>Hymenaea courbaril</i> Plum. et Endl.	F	1, 4	2.75	Oct (fl), May–Mar (se)	occasional
<b>CECROPIACEAE</b>					
<i>Cecropia hololeuca</i> Miq.	F	1	0.55	Dec (se)	occasional
<b>EUPHORBIACEAE</b>					
<i>Croton floribundus</i> Spreng	D	16	8.8	Nov–Mar (se)	frequent
<i>Croton salutaris</i> Casar.	D	1	0.55	Jan (se)	frequent
<i>Dalechampia pentaphylla</i> Lam.	D	2	1.10	May–Jun (se)	frequent
<i>Pachystroma longifolium</i> Muell. Arg.	D	13	7.15	Jun–Oct (se)	frequent
<i>Pera glabrata</i> Poepp. ex Baill.	F	1	0.55	Nov (se)	rare
<i>Sebastiania</i> sp.	D	1	0.55	Nov (se)	frequent
<b>FABACEAE</b>					
<i>Centrolobium tomentosum</i> Guill. ex Benth		1	0.55	Feb (fl)	frequent
<i>Erythrina falcata</i> Benth.		11	6.05	Aug–Sep (fl)	localized
<i>Lonchocarpus guilberminianus</i> (Tul.) Malme	D	1	0.55	Jan (se)	rare
<i>Macherium nictitans</i> Vog.	D	2	1.10	Jul (se)	rare
<i>Macherium aculeatum</i> Raddi	D	3	1.65	Jul–Aug (se)	rare
<i>Myroxylon peruiferum</i> L.		2	1.10	Jul–Aug (fl)	rare
<i>Platypodium elegans</i> Vog.	D	1	0.55	Dec (se)	frequent
<b>GRAMINEAE</b>					
<i>Zea mays</i> L.	F	14	7.7	Jan, Apr (se)	localized
<b>GUTTIFERA</b>					
<i>Calophyllum brasiliensis</i> St. Hill.	F	1	0.55	Jun (pu)	localized
<b>MALPIGHIACEAE</b>					
<i>Dicella bracteosa</i> (Juss.) Griseb	D	18	9.9	Jan–Mar (se)	frequent
<b>MIMOSACEAE</b>					
<i>Piptadenia gonoacantha</i> (Mart.) Marbr.	D	1, 7	4.4	Jan (fl), Jul–Sep (se)	frequent
<i>Inga</i> spp. ( <i>luschnantiana</i> , <i>affinis</i> , <i>uruguensis</i> )	F	8, 22	16.5	Aug–Dec (fl), Sep–Mar (se)	frequent
<i>Acacia polyphylla</i> DC.	D	2	1.10	Aug (se)	frequent
<b>MYRTACEAE</b>					
<i>Eucalyptus</i> sp.		2	1.10	Jul (fl)	localized
<b>RHAMNACEAE</b>					
<i>Columbrina glandulosa</i> Perkins	D	2	1.10	Sept (se)	rare
<b>RUTACEAE</b>					
<i>Esebeckia leiocarpa</i> Engl.	D	12	6.60	Apr–Jul (se)	occasional
<i>Metrodorea stipularis</i> Mart.	D	2	1.10	Jul–Sep (se)	occasional

TABLE 1. *Continued.*

Species	Type fruit <sup>a</sup>	Feeding bouts <sup>b</sup>	% of diet	Month, part eaten <sup>c</sup>	Abundance <sup>d</sup>
SAPOTACEAE					
<i>Chrysophyllum marginatum</i> (Hook. et Arn) Raldk	F	2	1.10	Mar–Apr (pu)	rare
TILIACEAE					
<i>Luehea divaricata</i> Mart.		1	0.55	Dec (fl)	rare

<sup>a</sup> Type fruit: D = dry fruit; F = fleshy fruit.

<sup>b</sup> In plants where both flowers and fruits are consumed, the first number is flower and the second is seed.

<sup>c</sup> Part eaten: pu = pulp, se = seed, fl = flower.

<sup>d</sup> Plant abundance: frequent = species common in the forest; occasional = species not common; localized = species that are found in specific microhabitats, such as swamps; rare = known from few individuals in the forest.

Some of the flowers eaten were from tree species that produce abundant and conspicuous flowers in a short period, such as *Copaifera langsdorffii*, and *Erythrina falcata*. The Scaly-headed Parrot, together with capuchin monkeys (*Cebus apella*) and brown howler monkeys (*Alouatta fusca*) destroyed the entire flower crop of *Erythrina falcata*.

Leaves were usually ignored by parrots. On two occasions the parrots mandibulated leaves of *Zeyhera tuberculosa*, but they were not eaten. Parrots were observed eating galls of *Piptadenia gonoacantha*, perhaps for the insects.

## DISCUSSION

Parrots may play an important role in the damage of fruit crops of some tree species (Higgins 1979, Howe 1980, Janzen 1981, Galetti & Rodrigues 1992). They are also known to damage cultivated crops, mainly corn (Bucher 1992). If we consider the annual diet, corn seeds were consumed in moderation by *Pionus* at Santa Genebra. However, in March corn was an important food source to parrots, comprising about 19 percent of their diet. The characteristics of fruits used in agricultural crops are usually similar to the fruits eaten by parrots in the forest (massive crops, large seeds, and clumped distribution). The damage of the Scaly-headed Parrots in the corn plantations was not quantified, but the agriculturists argued that the parrots together with capuchins are the main pests in the corn fields surrounding the reserve.

Seeds of leguminous species, which are abundant in the forest, were the most important diet items of the Scaly-headed Parrot at Santa Genebra. In a parrot community in Amazonian forest, Roth (1984) also observed that leguminous fruits, especially *Inga* spp., were very important in the diet

of parrots and macaws. Parrots can act as important predispersal seed predators, while bruchid beetles are important postdispersal seed predators of leguminous trees (Janzen 1969). Leguminous seeds generally have high levels of secondary compounds to deter seed predation and some seeds such as *Lonchocarpus* are rejected by all vertebrate seed predators (Janzen *et al.* 1990). At Santa Genebra I did not analyze the secondary compounds of plants eaten by parrots, but I saw the Scaly-headed Parrot eating *Lonchocarpus guilherminianus* only once, and few fruits were eaten. However, the lower consumption of *Lonchocarpus* seeds may be due to its low abundance in the forest. On the other hand, there occurs at the study site, at least, two species of *Croton* (*salutaris* and *floribundus*). Both have a high density and their fruits are very similar morphologically. However, usually only fruits of *C. floribundus* were eaten by parrots and other vertebrate seed predators (Galetti 1992). *Croton salutaris* fruits are probably avoided by parrots and other vertebrate seed predators, due to the high amount of secondary compounds (A. Caldas, pers. comm.). Munn (1988) observed, however, that macaws can eat toxic fruits in Peru, but he also did not analyze the secondary compounds of these fruits.

Although dry fruits sometimes have hard structures to deter seed predators, they composed a large percentage of the diet of parrots, squirrels, and capuchin monkeys in semideciduous forests (Galetti 1992). However, some fruits were eaten only by capuchin monkeys, which have a strong jaw musculature capable of breaking hard fruits, such as Lecythidaceae species (Peres 1991).

The Scaly-headed Parrots did not disperse any plant species by endozoochory at Santa Genebra. Janzen (1981) argued that parrots can destroy even small seeds of *Ficus* spp. On the other hand, Flem-

ing *et al.* (1985) observed that *Brotogeris* parakeets can disperse tiny seeds of *Mutingia calabura*. Although I never saw parrots eating *Ficus* fruits, they have been observed in the diet of the Scaly-headed Parrot in Mato Grosso, Brazil (Stones & Roberts 1935).

Flowers have been recorded infrequently in the diet of parrots, although these resources may have been underestimated (Roth 1984). For the Scaly-headed Parrot's diet at Santa Genebra, flowers were the second main food item comprising about 20 percent of their diet. Flowers are also usually eaten by other parrot species in the Atlantic forest in southeastern Brazil (Galetti *et al.* 1992). Snyder *et al.* (1987) observed the *Amazona vittata* eating flowers only three times in Puerto Rico (of a total of 118 feeding bouts). In contrast to Australian parrots (Forshaw 1989), neotropical parrots have not been observed to pollinate flowers and are mainly destructive.

Parrots may greatly reduce plant fitness when they consume flowers and seeds. The high predation on *Inga* flowers by parrots may have decreased the number of fruits set; *Inga* fruits were one of the most important items in the *Pionus*' diet. Ayres (1986) observed the same pattern of utilization in the *Eschweilera* (Lecythidaceae) flowers and fruits eaten by *Cacajao* monkeys, a specialized seed predator. He suggested that *Eschweilera* is sufficiently abundant that enough fruit remains to support the *Cacajao* population. Probably the long period of

flowering in *Inga* and their high density at Santa Genebra are enough to satiate the parrots and consequently some fruits are set. On the other hand, *Erythrina falcata* produce massive flower crop in a short period, and are particularly rare at the study site. During my field work at Santa Genebra I never saw fruits of this leguminous tree, because all flowers were eaten by parrots and monkeys.

The intense consumption of flowers by Scaly-headed Parrot at Santa Genebra can be due to the fact that this population thrives in a small forest fragment which apparently has lower food resource than continuous forests. On the other hand, flower eating may be a common behavior of parrots and monkeys thriving in semideciduous forests in southeastern Brazil (Galetti 1992). More studies about the role of parrots as seed and flower predators are important to predict their impact in forest fragment regeneration and agricultural crops.

## ACKNOWLEDGMENTS

I am very grateful to M. Rodrigues, M. A. Pizo, F. Olmos, G. B. Williamson, S. Buzato, N. Wheelwright, and S. Beissinger for critical comments on the manuscript, M. Paschoal, F. Pedroni, and M. A. Pizo for assistance in the field work, Fundação José Pedro de Oliveira for the permission to work in the reserve, H. F. Leitão-Filho for identification of the plants, L. P. C. Morellato for critical discussions, and to FAPESP and CAPES for financial support, and to CNPq for the doctoral fellowship in Cambridge. This paper is in memoriam of Dr. Helmut Sick who dedicated his life to the study of Brazilian birds.

---

## LITERATURE CITED

- ALTMANN, J. 1974. Observational study of behavior: sampling methods. *Behaviour* 49: 227-267.
- AYRES, J. M. 1986. Uakaris and Amazonian flooded forest. Ph.D. Thesis, University of Cambridge, Cambridge, England.
- BRANDT, A., AND R. B. MACHADO. 1990. Area de alimentação e comportamento alimentar de *Anodorhynchus leari*. *Ararajuba* 1: 57-63.
- BUCHER, E. H. 1992. Neotropical parrots as agricultural pests. In S. R. Beissinger and N. F. R. Snyder (Eds.). *New World Parrot in crisis*, pp. 201-220. Smithsonian Institution Press, Washington, D.C.
- CHAPMAN, C. A., L. J. CHAPMAN, AND L. LEFEVRE. 1989. Variability in parrot flock size: possible functions of communal roosts. *Condor* 91: 842-847.
- FLEMING, T. H., C. F. WILLIAMS, F. J. BONACCORSO, AND L. H. HERBST. 1985. Phenology, seed dispersal, and colonization in *Mutingia calabura*, a neotropical pioneer tree. *Am. J. Bot.* 72: 383-391.
- FORSHAW, J. M. 1989. Parrots of the world. 3rd edition. Lansdowne Editions, Willoughby, Australia.
- GALETTI, M. 1992. Sazonalidade na dieta de vertebrados frugívoros em uma floresta semidecídua no Brasil. Master's Thesis, Universidade Estadual de Campinas, Campinas.
- , AND M. RODRIGUES. 1992. Comparative seed predation on pods by parrots in Brazil. *Biotropica* 24: 222-224.
- , M. A. PIZO, I. SIMÃO, AND M. RODRIGUES. 1992. O que comem os papagaios. *Ciência Hoje* 85: 63.
- HIGGINS, M. L. 1979. Intensity of seed predation on *Brosimum utile* by Mealy Parrots (*Amazona farinosa*). *Biotropica* 11: 80.
- HOLDRIGE, L. R. 1967. Life zone ecology. Tropical Science Center, San Jose, Costa Rica.
- HOPKINS, H. C., AND M. J. HOPKINS. 1983. Fruit and seed biology of the neotropical species of *Parkia*. In S. L.

- Sutton, T. C. Whitmore, and A. C. Chadwick (Eds.). Tropical rain forest: ecology and management, pp. 197–209. Blackwell Scientific Publications, Ltd., Oxford, England.
- HOWE, H. 1980. Monkey dispersal and waste of a neotropical fruit. *Ecology* 61: 944–959.
- JANZEN, D. H. 1969. Seed-eaters versus seed size, number, toxicity and dispersal. *Evolution* 23: 1–27.
- . 1981. *Ficus ovalis* seed predation by an Orange-chinned Parakeet (*Brotogeris jugularis*) in Costa Rica. *Auk* 98: 841–844.
- , L. E. FELLOWS, AND P. G. WATERMAN. 1990. What protects *Lonchocarpus* (Leguminosae) seeds in a Costa Rican dry forest? *Biotropica* 22: 272–285.
- LONGMAN, K. A., AND J. JENIK. 1987. Tropical forest and its environments. Longman Publishing Group, New York, New York.
- MORELLATO, L. P. C. 1991. Estudo da fenologia de árvores, arbustos e lianas de uma floresta semidecídua no sudeste do Brasil. Ph.D. Thesis, Universidade Estadual de Campinas, Campinas.
- MUNN, C. A. 1988. Macaw biology in Manu National Park, Peru. *Parrot Letter* 1: 18–21.
- OREN, D. C., AND F. C. NOVAES. 1986. Observations on the Golden Parakeet *Aratinga guarouba* in Northern Brazil. *Biol. Conserv.* 36: 329–337.
- PERES, C. A. 1991. Seed predation of *Cariniana micrantha* (Lecythidaceae) by brown capuchin monkeys in Central Amazonia. *Biotropica* 23: 262–270.
- ROTH, P. 1984. Repartição do habitat entre psitacídeos no sul da Amazônia. *Acta Amazonica* 14: 175–221.
- SAZIMA, I. 1989. Peach-fronted Parakeet feeding on winged termites. *Wilson Bull.* 101: 656–657.
- SICK, H. 1985. Ornitologia Brasileira, uma introdução. Editora Universidade de Brasília, Brasília.
- SNYDER, N. F. R., J. W. WILEY, AND C. B. KEPLER. 1987. The parrots of Luquillo: natural history and conservation of the Puerto Rican Parrot. Western Foundation of Vertebrate Zoology, Los Angeles, California.
- STONES, W., AND H. R. ROBERTS. 1935. Zoological results of the Mato Grosso expedition to Brazil in 1931. II Birds. *Proc. Acad. Nat. Sci. Philad.* 86: 363–397.
- TERBORGH, J., S. ROBINSON, T. PARKER III, C. MUNN, AND N. PIERPONT. 1990. Structure and organization of an amazonian forest bird community. *Ecol. Monogr.* 60: 213–238.
- WILLIS, E. O. 1979. The composition of avian communities in reminiscent woodlots in southern Brazil. *Papéis Avulsos de Zoologia* 23: 1–25.
- ZAR, J. H. 1984. *Biostatistical Analysis*. 2nd edition. Prentice-Hall International Editions, London, England.