

## SEED AND FRUIT PREDATION OF *KIELMEYERA* (GUTTIFERAE) AND *QUALEA* (VOCHYSIACEAE) SPECIES BY SIX PSITTACID SPECIES IN THE BRAZILIAN CERRADO.

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*Key words:* cerrado, feeding behavior, Neotropical savanna, parrots, Psittacidae, woodland trees.

### INTRODUCTION

Seeds, fruits and flowers are the principal components in the diet of Neotropical parrots (Psittacidae), but other resources as leaves, nectar, and insects are also included (Roth 1984, Sazima 1989, Galetti & Pedroni 1996, Sick 1997, Martinez & Prestes 2002, Forshaw 2006). The psittacids are important seed predators of some plant species (Higgins 1979, Janzen 1981, Jordano 1983, Galetti & Rodrigues 1992, Galetti 1993, Francisco *et al.* 2002, Ragusa-Netto 2004).

Thirty-three psittacid species have been recorded in the cerrado region, two of them being endemic species, *Alipiopsitta xanthops* (formely *Amazona xanthops*, but see Caparroz & Duarte 2004, Rusello & Amato 2004, Caparroz & Pacheco 2006) and *Pyrrhura pfrimeri* (Silva 1995). Despite the high number of psittacid species in the cerrado, very little ecological information is available about these species. Even relatively simple information like diet and feeding behavior are still deficient for many parrots in the Brazilian cerrado, including *A. xanthops* (Schubart *et al.* 1965, Antas & Cavalcanti 1988, Marcondes-Machado *et al.* 1994, Galetti & Pedroni 1996, Olmos *et al.* 1997). Therefore, to contribute to a greater knowledge of frugivory and the feeding ecology of parrots in the cerrado, we report on psittacid species feeding on seeds and fruits of woodland trees (*Kielmeyera* and *Qualea* species) in twelve localities of central Brazil.

### METHODS

The twelve areas where our sightings were recorded are widely distributed in cerrado and contain all physiognomies described for the biome (Oliveira-Filho & Ratter 2002). However, all observations were recorded in three habitat types (see Table 1 for details). The localities are grouped as follows: (a) Distrito Federal: Brasília National Park (PNB) (15°37'S, 47°54'W), Roncador Ecological Reserve (IBGE) (15°55'S, 47°53'W), Fazenda Água Limpa (FAL) (15°45'S, 47°57'W), Cafuringa Area of Environmental Protection (APA) (15°30'S, 48°07'W), Vicente Pires region (VP) (15°47'S, 48°00'W); (b) Goiás State: Emas National Park (PNE) (17°49'S, 52°39'W), Serra de Caldas Novas State Park (PES-CAN) (17°43'S, 48°42'W), Chapada dos Veadeiros National Park (PNCV) (15°45'S, 47°57'W), Fazenda Cachoeira in Flores de Goiás municipality (14°25'S, 47°00'W), Colinas do Sul municipality (14°03'S, 47°95'W); (c) Minas Gerais State: Buritis municipality (15°21'S, 46°26'W); and (d) Mato Grosso State: Chapada dos Guimarães National Park (PNCG) (15°21'S, 55°49'W).

The genera *Kielmeyera* (Guttiferae) and *Qualea* (Vochysiaceae) are represented in the cerrado region by 16 and 11 spp. respectively (Mendonça *et al.* 1998). These tree species are deciduous and anemochoric; their fruits are dry and usually open before maturation when the seed dispersal period occurs in the dry season (Oliveira & Moreira 1992, Wetzel 1997).

The records were collected during different work field seasons from May 1997 to October 2006. The data recording methodology was similar to or adapted from Galetti (2002). For each feeding bout we recorded: place and habitat, date, initial hour of observation, psittacid species, number of individuals feeding, consumed item and plant species. Plant and parrot species follow taxonomy in Mendonça *et al.* (1998) and Forshaw (2006) respectively.

## RESULTS

We observed six psittacid species feeding on seeds and/or fruits of *Kielmeyera* (2 spp.) and *Qualea* species (3 spp.), in a total of 25 feeding bouts (Table 1). The parrots took mature seeds mainly, but in some cases we observed the consumption of immature seeds.

The Blue-fronted Parrot, *Amazona aestiva*, was the most commonly observed species in our study,

TABLE 1. Parrots feeding on *Kielmeyera* (Guttiferae) and *Qualea* (Vochysiaceae) species in the Brazilian cerrado. Consumed item: (s) seed and (fr) fruit. Place and abbreviations: (IBGE) Roncador Ecological Reserve, (FAL) Fazenda Água Limpa, (PNB) Brasília National Park, (APA) Cafuringa Area of Environmental Protection, and (VP) Vicente Pires region, Distrito Federal; (PNE) Emas National Park, (PNCV) Chapada dos Veadeiros National Park, (PESCAN) Serra de Caldas Novas State Park, Colinas do Sul municipality and Flores de Goiás municipality, Goiás State; Buritis municipality, Minas Gerais State; (PNCG) Chapada dos Guimarães National Park, Mato Grosso State. Vegetation type follows Oliveira-Filho & Ratter (2002).

Psittacidae	Number of Individuals	Plant species	Item	Time	Date	Place	Vegetation type
<i>Ara ararauna</i>	01	<i>Q. grandiflora</i>	s	17:00	14/Aug/02	IBGE	Cerradão
<i>Aratinga aurea</i>	04	<i>Q. grandiflora</i>	s	11:10	17/Feb/00	PNCG	Cerrado s.s
<i>Aratinga aurea</i>	03	<i>Q. grandiflora</i>	s	11:20	22/Dec/03	FAL	Campo sujo
<i>Aratinga aurea</i>	03	<i>Q. parviflora</i>	s	08:58	18/Oct/04	Flores	Cerrado s.s
<i>Aratinga aurea</i>	03	<i>Q. multiflora</i>	s	06:30	22/Aug/06	VP	Cerrado s.s
<i>Aratinga aurea</i>	06	<i>Q. grandiflora</i>	s	16:50	23/Sep/06	PNCV	Campo sujo
<i>Aratinga aurea</i>	05	<i>Q. grandiflora</i>	s	07:30	19/Oct/06	Colinas	Cerradão
<i>Forpus xanthopterygius</i>	03	<i>Q. multiflora</i>	s	06:45	04/Sep/03	FAL	Cerrado s.s
<i>Brotogeris chiriri</i>	04	<i>Q. parviflora</i>	s	10:50	19/Nov/01	Buritis	Cerrado s.s
<i>Brotogeris chiriri</i>	03	<i>Q. grandiflora</i>	s	07:15	11/Dec/02	FAL	Cerrado s.s
<i>Brotogeris chiriri</i>	08	<i>Q. grandiflora</i>	s	06:50	17/Oct/06	Colinas	Cerrado s.s
<i>Alipiopsitta xanthops</i>	10	<i>K. coriacea</i>	s	17:20	30/Mar/98	PNE	Campo sujo
<i>Alipiopsitta xanthops</i>	12	<i>K. coriacea</i>	s	18:08	30/Mar/98	PNE	Campo sujo
<i>Alipiopsitta xanthops</i>	02	<i>K. coriacea</i>	fr	08:30	03/Oct/98	PNB	Campo sujo
<i>Alipiopsitta xanthops</i>	02	<i>K. coriacea</i>	fr	07:10	16/Mar/06	APA	Cerrado s.s
<i>Alipiopsitta xanthops</i>	03	<i>K. coriacea</i>	fr	08:40	20/Mar/06	APA	Campo sujo
<i>Amazona aestiva</i>	03	<i>K. coriacea</i>	s	18:15	11/May/97	PNE	Campo sujo
<i>Amazona aestiva</i>	01	<i>K. coriacea</i>	fr	09:40	23/Aug/01	FAL	Cerrado s.s
<i>Amazona aestiva</i>	04	<i>K. coriacea</i>	s	07:50	03/Sep/01	FAL	Cerrado s.s
<i>Amazona aestiva</i>	01	<i>K. coriacea</i>	fr	17:40	13/Feb/02	PNE	Campo sujo
<i>Amazona aestiva</i>	01	<i>K. speciosa</i>	s	16:00	13/Jun/03	FAL	Cerrado s.s
<i>Amazona aestiva</i>	02	<i>K. coriacea</i>	s	08:20	11/Aug/03	PESCAN	Cerrado s.s
<i>Amazona aestiva</i>	04	<i>K. coriacea</i>	s	06:50	02/Jun/06	APA	Campo sujo
<i>Amazona aestiva</i>	02	<i>K. speciosa</i>	s	10:00	04/Jun/06	APA	Cerrado s.s
<i>Amazona aestiva</i>	03	<i>K. coriacea</i>	s	08:00	12/Jul/06	APA	Campo sujo

recorded in nine feeding bouts (Table 1). This species consumed both immature and mature seeds. In FAL, in the first record, an individual pecked an immature fruit of *K. coriacea* while grabbing the fruit with its feet against the tree branch, broke it open, discarded the fruit peel, and finally flew away carrying the fruit. In the second record, we observed individuals in an area with a high density of *K. coriacea* trees where each parrot was perched on a different tree, collecting seeds at the open fruits and consuming only the embryo seed. In the first record at PNE, we observed the same behavior as in FAL, however the *K. coriacea* fruit was at the initial development stage and was very small. In the second record, the parrot consumed the seeds at open fruits.

We observed Yellow-faced Parrots, *A. xanthops*, eating immature fruits in all records. In PNB, *A. xanthops* were fairly quiet and were only seen once the observer approached, when an individual flew carrying a fruit, dropping it after few meters. Another individual flew in the same direction, and the fruit showed some signs of pecking. In PNE and APA, we observed groups with the same feeding behavior; the parrots broke open immature fruits and ingested the green seeds.

We observed groups of Peach-fronted Parakeets, *Aratinga aurea*, consuming seeds in open fruits. In six records (Table 1) the feeding behavior was the same: the parakeets perched on tree branches, pulled the seeds out and triturated them before swallowing. In Flores de Goiás, an individual of *A. aurea* consumed at least 30 seeds from several fruits in ten minutes.

We observed a group of Blue-winged Parrotlets, *Forpus xanthopterygius*, perched on a 5 m canopy tree vocalizing intensely, while collecting small seeds from the open fruit. We recorded two feeding bouts of Yellow-chevroned Parakeet, *Brotogeris chiriri* (Table 1). In all cases the parakeets perched on canopy trees when collecting and ingesting seeds from mature and open fruits. In general, the seeds were triturated before the ingestion. In FAL, some *Brotogeris* parakeets climbed on the fruit to facilitate access to the seeds. We have only one record for the Blue-and-yellow Macaw, *Ara ararauna*, breaking immature fruit using the bill and consuming some seeds.

## DISCUSSION

The genera *Qualea* and *Kielmeyera* are very common in the Brazilian cerrado vegetation, *Q. grandiflora* and

*Q. parviflora* being the most widespread species (Ratter *et al.* 2003). However very little has been published on seed and fruit predation in these plant species. Fruits and seeds of *Kielmeyera* are frequently attacked by *Anthonomus biplagiatus* (Coleoptera) (Clark & Martins 1987, Oliveira & Silva 1993). Among birds, *Neothraupis fasciata* (Thraupidae) eat seeds of *Q. parviflora* (Alves 1991) and *A. aurea* has previously been observed feeding on flowers of *Qualea* sp. (Galetti & Pedroni 1996).

Despite all our observations corroborating typical predation behavior, parrots can also act as potential seed dispersers since they prey on immature fruits (e.g., Yellow-faced parrot *S. xanthops*) and intact or partially consumed seeds can maintain their germination capacity in greenhouse experiments (as observed for *K. coriacea*, R. Haidar pers. comm.). The predation of immature fruits by parrots has been observed in captivity, where *A. ararauna* consumed immature fruits of the palm tree *Syagrus romanzoffiana*, mainly endosperm and endocarp (Kuniy *et al.* 2001). In nature, they partially eat the fruit pulp of the palm *Mauritia flexuosa*, and rarely eat immature fruit (Villalobos 1994).

All psittacid species were observed on foraging activities mostly early in the morning or later in the afternoon, the intense activity period usually observed in parrots (Brandt & Machado 1990, Gilardi & Munn 1998, Forshaw 2006). Our records of casual feeding bouts by psittacids in cerrado areas show that several species consume the same resource. However other studies are necessary to evaluate if *Qualea* and *Kielmeyera* are key species in the diet of parrots. *Qualea* spp. fruits are smaller and it is easier to access the seeds than in *Kielmeyera* spp. fruits. Despite the record of *A. ararauna* foraging on *Qualea grandiflora* fruits, all other feeding bouts for *Qualea* spp. fruits or seeds were recorded for the smaller species of psittacids. In the same way, all the records for *Kielmeyera* spp. were of *Amazona* and *Alipiopsitta* parrots, with stronger bills and larger body size. Further investigation is needed to address the question if this fact suggests an ecological segregation among the species regarding resource size.

## ACKNOWLEDGMENTS

We thank C. Proença (Herbarium/UnB), I. Azevedo, M. Sampaio, and E. Guarino for the identification of some plants. We thank D. A. Kelt and an anonymous

mous reviewer for their comments and suggestions on the manuscript. We also thank M. G. Lima and A. C. Franco for support, F. Olmos for help with references, R. Haidar for information about seed germination, and I. Oliveira for field assistance. We are grateful to the Ecology and Botany Departments (UnB) for research assistance. The work field in FAL, PNB, PNE and PESCAN was supported by the Ecology Pos-Graduate Program (UnB), Ministry of Education (CAPES), and the Brazilian National Research Council (CNPq). The work field in Flores de Goiás was supported by Fundação Pró-Natureza (FUNATURA).

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*Accepted 13 February 2007*