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DIET OF THE CHACO CHACHALACA

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ABSTRACT.—Chaco Chachalacas (*Ortalis canicollis*) in the semi-arid Chaco forest region of northern Argentina fed mainly on herbaceous leaves (37% of the dry mass of its diet) and fleshy fruits (25%). Leaves and fruit were consumed year round. The rest of the diet consisted of caterpillars and flowers. The Chaco Chachalaca consumed all the fruit species available to it during this study period. Fruits most frequently eaten were: (1) fruit thickly bunched on the plant with long availability, even though of lower quality and (2) fruit of good quality (judged by pulp and total solids content). Low quality fruits not clumped together were less used in spite of their abundance in the forest. *Received 24 Feb. 1993, accepted 1 Mar. 1994.*

Guans (*Penelope*) and chachalacas (*Ortalis*) feed on leaves and fruit and probably are seed dispersers (Delacour and Amadon 1973, Terborgh 1986, Strahl and Grajal 1991). Marion (1976) found that fleshy fruit makes up approximately half of the diet of the Plain Chachalaca (*O. vetula*), a species also described as herbivorous-frugivorous by Christiansen (1978). Similarly, the Crested Guan (*P. purpurascens*) is one of the dispersers of wild nutmeg (*Virola surinamensis*), whose seeds it regurgitates (Howe and Vande Kerckhove 1980). In the forests of Northwest Argentina (El Rey National Park), the Dusky-legged Guan (*P. obscura*) feeds on various species of fleshy fruit in both summer and autumn (Brown 1986).

The Chaco Chachalaca (*O. canicollis*) inhabits the thorny Chaco forest of Bolivia, Paraguay, and Argentina where it is relatively abundant. There are no previous records of its feeding habits. In the woodlands of the western Argentine Chaco forest, the fruit supply is markedly seasonal and is most concentrated in the wet spring–summer season (Protomastro 1988). Winter is a time of shortage, both of water and of fruit and insects. The Chaco Chachalaca is the only fruit-dispersing bird living in the Chaco woodland throughout the year. Its diet is comprised mainly of plant leaves and fleshy fruits. Seeds pass through its digestive system intact and are probably viable at dispersion.

METHODS

We studied chachalacas in a second-growth woodland area of the 114,000 ha Copo Natural Preserve (25°55′S, 62°05′W), located in Santiago del Estero Province, Argentina. The vegetation is Chaco thorn forest (Cabrera 1976, Hueck 1978). Dominant tree species are quebracho colorado (*Schinopsis quebracho-colorado,* Anacardiaceae), quebracho blanco

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(*Aspidosperma quebracho-blanco,* Apocinaceae), and mistol (*Zizyphus mistol,* Rhamnaceae). The forest is interspersed with strips of natural grassland lying in ancient water courses. Ten of the 24 species of trees and bushes found in the area provide fleshy fruits or arillate seeds for the bird community (Protomastro 1988). Nevertheless these species do not bear fruit every year. There are marked seasonal changes in rainfall and temperature in the area. Eighty percent of the annual rainfall (650 mm) occurs in the wet season which lasts from October through March. Mean annual temperature, measured at the nearest weather station (Campo Gallo, 120 km to the SW), was 21.9°C, and the average maximum and minimum temperatures determined for January (summer) and July (winter) were 35.5°C–20.2°C and 23.0°C–7.1°C, respectively (1951–1980, Servicio Meteorológico Nacional of Argentina).

Between March 1986 and April 1987, a total of 29 Chaco Chachalacas were collected (1–4 per month), one of them a young. We collected them in a secondary forest area of approximately 20 ha. There were ecotones with natural grassland near the area. A greater number of specimens was not taken because sampling was carried out in a wildlife reserve. We weighed and measured the birds and identified sex and reproductive state. Esophagi, gizzards, and intestines were preserved in 70% ethyl alcohol. In the laboratory we separated and identified the items, which were oven-dried at 40°C and weighed (± 0.1 mg). We identified and counted seeds found in digestive tracts and recorded their condition in order to estimate potential dispersal. Potentially dispersable species were considered to be those which we observed in the intestine without visible damage.

The abundance of woody plants with fleshy fruits and arillated seeds was quantified along a transect 1000 m long by 4 m wide. Once a month, we counted the number of plants with ripe fruits, green fruits, or without fruits. The number of individuals analyzed according to their abundance in the forest varied from 10 to 143.

The total fresh mass, fresh seed mass, and net pulp mass (by subtraction) of the ripe fruit were determined, as was the major cross-width (using calipers). The total solids percentage was obtained using a field refractometer. We used this measure as a quick approximation of nutrient reward of the pulp. Our field observations suggest that sugars are the principal reward. However, when refractometer readings are not specific for sugars, then we express the results as total percent of solids (White and Stile 1985). The fruit and seeds were group weighed on a scale (0 to 10 g); therefore, individual variation in mass could not be determined.

RESULTS

The average mass of adult specimens was 539 g, (± 60 g, SD; N = 24). The dry mass of the esophagus and gizzard contents varied between 0.45 g and 9.70 g. Only seven individuals had food in the esophagus. The gizzard contents alone had an average mass of 2.62 g (± 1.34 g, N = 29). Food items found in greatest proportions in the diet were herbaceous leaves and fleshy fruits, followed by caterpillars and flowers (Table 1). Herbaceous leaves and fruit made up 62% of the total dry mass of the diet of the Chaco Chachalaca, and they were consumed year round (Fig. 1). The proportion of fruits in their diet was significantly higher during the October through March wet season (Mann-Whitney one-tail test, $P < 0.01$). The proportion of leaves consumed showed no significant difference between dry and wet seasons. Caterpillars and flowers were consumed only during certain periods and the former consisted exclu-

TABLE 1
GENERAL COMPOSITION OF THE CHACO CHACHALACA DIET IN THE COPO PRESERVE, ARGENTINA

Food item	Dry mass as percentage[a]	Presence in esophagus-gizzard contents
Herb leaves	36.6	21/29
Vegetable remains	1.9	12/29
Total vegetable items	38.5	25/29
Molle fruit	12.1	12/29
Mistol fruit	4.0	3/29
Sangre de toro fruit	2.4	11/29
Tala blanca fruit	1.9	4/29
Tala fruit	2.2	7/29
Coro fruit	2.3	3/29
Total fruit items	24.9	25/29
Mistol caterpillars	22.1	6/29
Total animal items	22.1	6/29
Garabato flowers	3.7	3/29
Creeper flowers	1.5	5/29
Sacha naranjo flowers	0.3	1/29
Soft seeds	1.1	4/29
Total flowers and seeds	6.6	13/29
Stones	7.9	13/29
Total stones	7.9	

[a] Item dry mass/total dry mass of 29 samples × 100.

sively of one unknown butterfly, a caterpillar on mistol (*Zizyphus mistol*). This caterpillar abounds only in certain years, one of which happened to be that in which our sampling was carried out. Flower buds and flowers (particularly garabato [*Acacia* sp.] and Sacha Naranjo [*Capparis retusa*]) were found in the specimens sampled from June through December. Consumption coincided partly with peak availability of buds (late August and September) and flowers (September and October) (Protomastro 1988).

Chaco Chachalacas consumed the fruit of six plant species, five woody and one herbaceous (Table 2). The other five woody species did not bear fruit during the study year. Chachalacas used fleshy fruits whenever they were available. The fruits were eaten when ripe, with the exception of green tala drupes (*Celtis pallida*), eaten at the end of October 1986, and some green molle (*Schinus polygamus*) drupes mixed with the ripe fruit. Small seeds were defecated, and the large ones were probably regurgitated

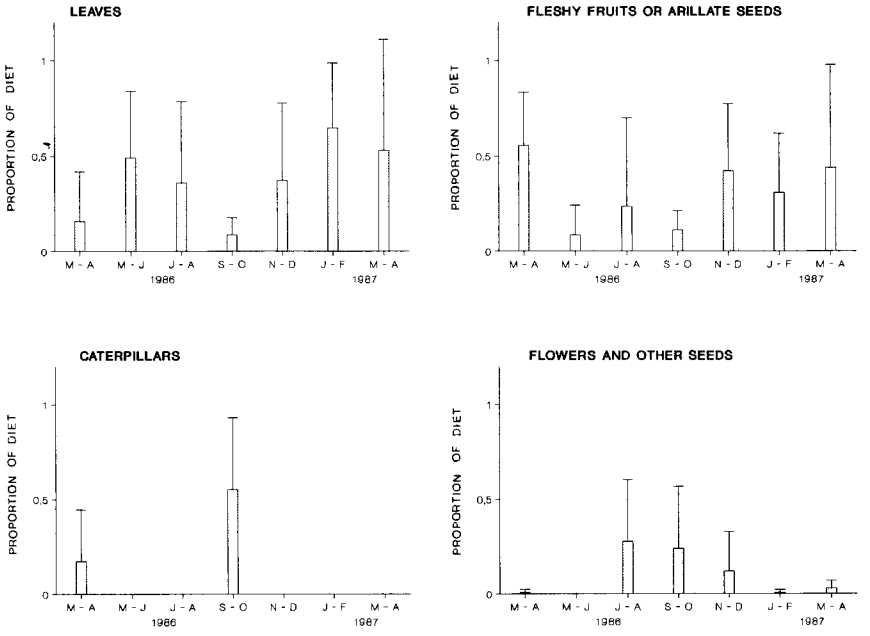

FIG. 1. Proportions of main food item types in esophagus and gizzard contents in bimonthly periods. Average proportion and standard deviation are shown. The number of Chaco Chachalaca for each period were: M–A = 6, M–J = 5, J–A = 4, S–O = 5, N–D = 4; J–F = 3, M–A = 2.

TABLE 2

PLANT SPECIES CHARACTERISTICS

Species	Habit (height)	Number of fruits per plant	Basal area in forest[a]
Molle	Bush (6 m)	5000 to 100,000	0.3
Tala	Bush (2 m)	10 to 300	1.3
Tala blanca	Bush (3 m)	1000 to 50,000	2.1
Mistol	Tree (6 m)	50 to 500	6.5
Coro	Tree (4 m)	20 to 500	0.2
Sangre de toro	Herb (50 cm)	50 to 250	no data

[a] Stem and trunk basal area in m^2 per ha, mean of 7 plots of 225 m^2 (Protomastro 1988).

(mistol and coro [*Jodina rhombifolia*]), because they were never found in the intestine.

Molle was the most commonly consumed fruit and appeared in 12 birds in spite of its low basal area in the forest (Table 2), few fruiting plants (Fig. 2) and low pulp mass (Table 3). However, molle has thousands of fruits on each plant and has long fruiting periods of three months. Mistol fruit contained the greatest net pulp mass and the highest total percent of solids (Table 3). We did not find any mistol tree bearing fruit in our sampling despite its high basal area. In another sampling (Protomastro 1988), only one of ten specimens bore scarce ripe fruit in the same area and time. However, some individuals located at the forest-grassland edges (near the study area) carried large quantities of fruit. The other four species were eaten in similar proportions. The tala had a large number of fruit-bearing individuals (Fig. 2), which agrees with its large basal area in the forest (Table 2), but it bears only a few drupes per plant. Two peaks of fruit availability (Fig. 2) fell within a single variable fruiting period lasting from December to March. Tala blancas (*Achatocarpus praecox*) have thickly bunched fruits with many drupes per plant. Fruiting periods of tala blanca and coro trees are November–December and September–October, respectively (Fig. 2). Sangre de toro (*Rivina humilis*) fruit was used mainly in the May–June period but appeared in stomach contents in November, December, February, and April as well. It was the only available fruit in the May–June period. We did not measure the bi-monthly number of fruiting herbs but sangre de toro fruiting period seems to be very broad.

Fruits of molle and tala blanca shrubs were found in great quantities in gut contents (median 117.5 fruit [12 samples] and 47.5 fruit [4 samples], respectively). This agrees with the high frequency of the fruits on these plants. Sixteen digestive tracts contained one fruit species, and only four contents had three to four fruit species. In six of twelve samples with molle this fruit appeared with fruits of mistol, tala, sangre de toro, or tala blanca.

We observed that Chaco Chachalaca fed in groups. The birds remained on shrubs or trees and walked on the ground in open sites or tracks. In the evening, they slept in trees. Chaco Chachalacas breed during the rainy season. Egg laying probably occurs during December, as one mid-December specimen contained a half-formed egg, 20 mm in diameter. In addition to 28 adults, collected at the beginning of January, a chick weighing 150 g was collected accidentally and a young chachalaca weighing 270 g was obtained at the end of February. In February, many groups with young were observed on the roads. During the period considered to be that in which the chicks were being fed (December–January), no food of animal

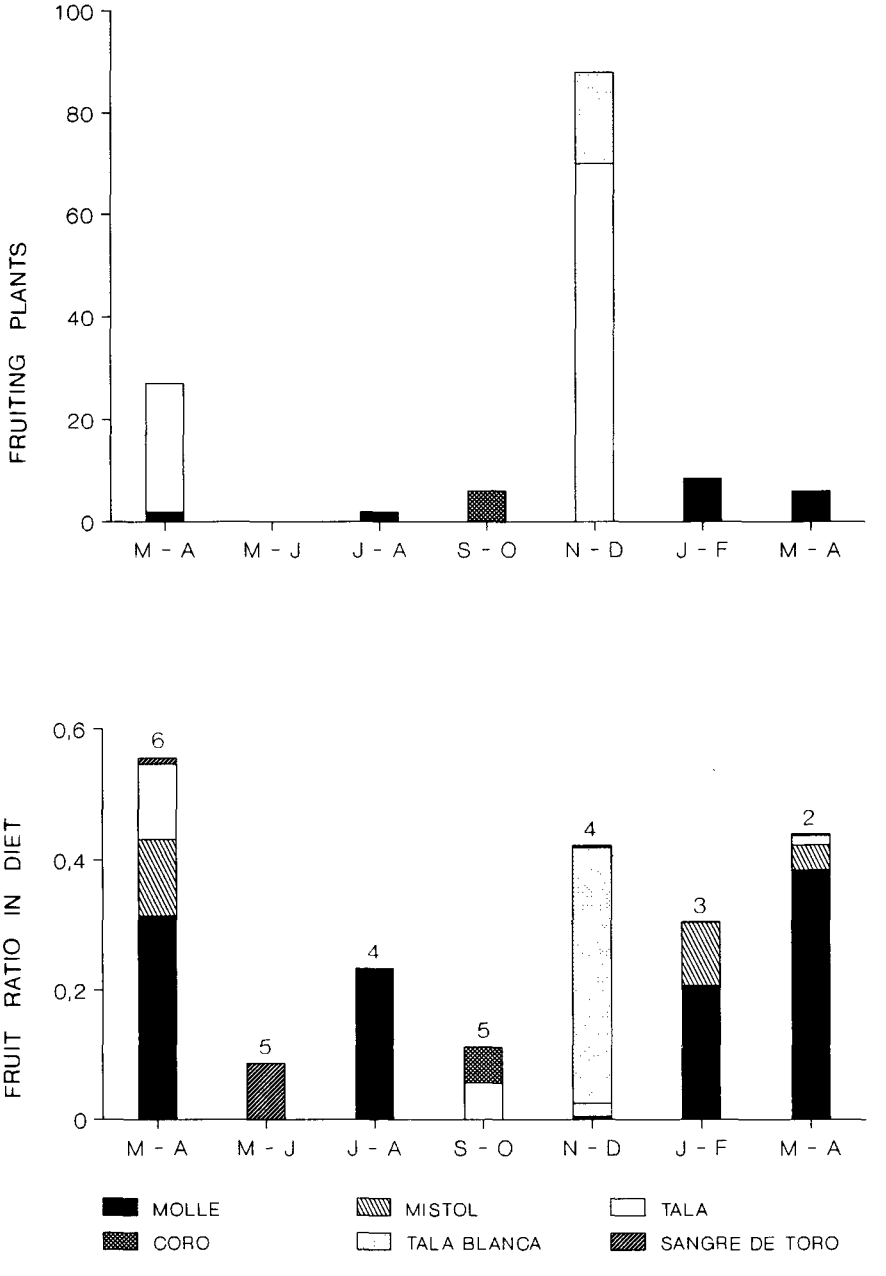

FIG. 2. Proportional fruit availability and fruit consumption by the Chaco Chachalaca. Availability is shown as the bi-monthly average of fruit-bearing individuals along the phenology track. Consumption is shown as the average (bi-monthly) proportion of the dry weight of different fruit species.

TABLE 3
FRUIT CHARACTERISTICS

Species	Type and color of fruit	Diameter in mm[a]	Fresh mass[b]	Pulp in g[c]	Total solids[d]
Molle	Purple drupe, one seed	4.3 ± 0.1	0.03	0.02	20%
Tala	Orange drupe, one seed	7.3 ± 0.3	0.19	0.16	17%
Tala blanca	Translucent drupe, one seed	6.8 ± 0.2	0.18	0.17	21%
Mistol	Red drupe, floury pulp, one seed	10.8 ± 0.3	0.77	0.66	40%
Coro	Red capsule, one seed[e]	7.1 ± 0.3	0.28	0.17	15%
Sangre de toro	Red berry, 1 to 3 seeds	Approx. 5	—	—	—

[a] N = 20.
[b] In g.
[c] Total fresh weight, less fresh mass of seed.
[d] Measured with field refractometer.
[e] Diameter of seed with aril.

origin was observed in gizzard contents (N = 3). The chick contained 1.2 g of food including leaves, tala blanca, and flowers.

DISCUSSION

Leaves were a very important resource (37% of dry mass). We found no woody plant leaves, which have high levels of secondary compounds (Protomastro 1988); all leaves were eaten by chachalacas from herbaceous plants. In the wet season, such leaves are common, but in dry season they grow only in humid microhabitats which are scarce. The Chaco Chachalaca used good quality fruit (with highest pulp and total solids percentages) or that which was abundantly bunched. This seems logical for large-sized birds which obtain their food by perching in trees and bushes and feeding in groups, taking into account the cost of travel, maneuvering, and access in fruit selection (Moermond and Denslow 1983, Levey et al. 1984, Martin 1985). In the field, we noticed that the Chaco Chachalaca re-visits plants or groups of plants bearing abundant fruit. Moreover, the majority of gut contents (60%) had only one fruit species. This was most frequent in the case of the most commonly eaten fruit, molle. The fruit of this plant grows in profusion on each plant, and the plants are grouped in low-lying areas having a greater moisture content in the soil (Protomastro and Caziani, pers. obs.). The fruiting period of molle is very prolonged, which favors extensive foraging of the same group of bushes.

During the winter, molle fruit seems to be a key resource like herb leaves and sangre de toro fruit. Chaco Chachalacas were the only dispersers of the coro fruit and of the molle plants fruiting in the dry season. Seeds were found intact throughout the digestive tract. The summer-fruit-

ing molle, the tala, and the tala blanca have other avian dispersers, in addition to the Chaco Chachalaca, including the Creamy-bellied Thrush (*Turdus amaurochalinus*), Small-billed Elaenia (*Elaenia parvirostris*) and White-crested Elaenia (*E. albiceps*). These birds are summer visitors that arrive in the forest in September and remain there during the wet season; their visits thus coincide with the period in which fruit is most abundant (Caziani 1987 and unpubl. data). The mistol tree has other dispersers, such as the red iguana (*Tupinambis rufescens*) and the southern three-banded armadillo (*Tolypeustes matacos*) (Bolkovic et al. 1989). We suspect that Chaco Chachalacas are more abundant in secondary woodlands (selective logging), because we heard many groups of birds singing in the morning (more rarely in the evening) in this kind of forest but not in pristine woodlands. Characteristics which could explain this pattern are (1) the Chaco Chachalaca seems to prefer open places which are common in exploited woodland and (2) fruit density of tala blanca and tala is significantly greater in secondary forest (Protomastro 1988; Caziani and Protomastro, unpubl. data).

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GRADUATE AND POST-GRADUATE RESEARCH GRANTS

The Biological Research Station of the Edmund Niles Huyck Preserve offers grants (max. = $2,500) to support biological research which utilizes the resources of the Preserve. Among the research areas supported are basic and applied ecology, animal behavior, systematics, evolution, and conservation. The 2000 acre Preserve is located on the Helderberg Plateau, 30 miles southwest of Albany. Habitats include northeast hardwood-hemlock forests, conifer plantations, old fields, permanent and intermittent streams, 10 and 100 acre lakes and several waterfalls. Facilities include a wet and dry lab, library, and houses/cabins for researchers. Deadline = February 1, 1995. Application material may be obtained from Dr. Richard L. Wyman, Executive Director, E.N. Huyck Preserve and Biological Research Station, P.O. Box 189, Rensselaerville, New York 12147.