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DIET OF THE CHILEAN TINAMOU (*NOTHOPROCTA PERDICARIA*) IN SOUTH CENTRAL CHILE

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Dieta de la Perdiz chilena (*Nothoprocta perdicaria*) en el centro-sur de Chile.

Key words: Diet, gramineous, *Nothoprocta perdicaria*, Chilean Tinamou, Poaceae, Chile.

Studies of bird diet have been important for understanding their life history and ecological requirements. However, few dietary studies have been carried out on Tinamiform birds, and particularly on species of the *Nothoprocta* genus (Cabot 1992; Mosa 1993, 1997; Garitano-Zavala *et al.* 2003). In fact, no study is available for Chilean Tinamou (*Nothoprocta perdicaria*) (Cabot 1992, Jaksic 1997), and the only study on its diet has not been published (Rottmann unpubl.). The scarce information on the food of Chilean Tinamou suggests that it has a mixed diet, including plant material and small invertebrates (Housse 1945, Egli & Aguirre 2000).

Ecological studies on the Chilean Tinamou are prioritaries because it is an endemic bird to Chile (Araya & Millie 2000) and its population seems to be declining in number as a result of intensive hunting (Cabot 1992, Egli & Aguirre 2000). Here, we report for the first time the Chilean Tinamous diet in the Ñuble Province, south central Chile. Our objective was to determine if the Chilean Tinamou is a tropically generalist or specialist species.

We analysed the contents of crops and stomachs obtained from 79 birds captured in different agricultural areas, years, and seasons (Table 1) in the Ñuble Province, south central Chile (Fig. 1). Ñuble province has a Mediterranean temperate climate with an average temperature of 13.5ºC and an average annual precipitation of 1055 mm (Del Pozo & Del Canto 1999). Ñuble Province corresponds to a transitional zone between the dry scrubland of central Chile and the temperate rainforest of southern Chile with a high diversity of flora and fauna (Muñoz *et al.* 1996).

Although we analysed crops and stomachs, contents of the latter only included a little mineral and vegetal material; thus, our

TABLE 1. Information about the Chilean Tinamou (*Nothoprocta perdicaria*) (N = 79) captured in agrosystems for dietary analysis in Ñuble Province, south central Chile.

Seasons	Years	Number of birds
Summer	1995	10
Summer	1995	24
Winter	1999	12
Winter	2000	18
Winter	2001	15
Total of birds		79

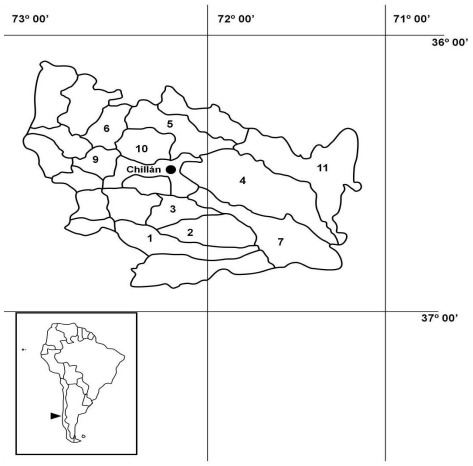

FIG. 1. Agricultural localities where the 79 Chilean Tinamous (*Nothoprocta perdicaria*) were capture for crop and stomach content analysis. Pemuco (1), El Carmen (2), San Ignacio (3), Coihueco (4), San Carlos (5), Ninhue (6), Pinto (7), Chillán (8), Portezuelo (9), San Nicolás (10), and San Fabián (11).

results reflect instead information from crops. Crops contents were dried for 24 h at 30ºC. The seeds collected from crops that could not be identified were germinated. Each food item was quantified based on its proportional occurrence (O), number frequency (NF), and biomass (B). The taxonomic classification of plant species follows Finot & Bravo (1985), Marticorena & Quezada (1985), Matthei (1995), and Finot (1997). The food-niche breadth (i.e., diet diversity) for each season was calculated according to the Shannon-Wiener index (H, Krebs 1989) and were statistically compared by the Hutcheson *t*-test (see Zar 1984). Differences in seasonal consumption of plant and animal material were evaluated with chi-square tests using contingence tables (Zar 1984).

Diet consisted mainly of wild plant seeds (Table 2). The consumption of animal material was scarce and consisted of one insect and crustacean species (Table 2). During the summer, the seeds of the Poaceae family were most common, among which *Panicum capillare* and the *Lolium* sp. were the most consumed. Although, in terms of occurrence, *Lolium* sp. had higher importance than *P. capillare*, the seeds of the latter were dominant in terms of number and biomass (Table 2). During the winter, the seeds of Convolvulaceae (O = 19.2%, NF = 25.9%, B = 31.5%), Fabaceae (O = 19%, NF = 24%, B = 22%) and Polygonaceae (O = 12.8%, NF = 25.5%, B = 7%) were the most common in the diet. The most important species by occurrence, number, and biomass were *Convolvulus arvensis* and *Polygonum aviculare* (Table 2). *P. aviculare* was dominant in number and relatively important in occurrence, but its biomass contribution was smaller (Table 2).

After combining the results from both seasons, the Poaceae seeds constituted the diets main component either in occurrence, number and/or biomass (Table 2). Polygonaceae seeds were second in importance (Table 2). Even though the Fabaceae seeds were important in terms of occurrence, their number and biomass were low (Table 2). *P. capillare* and *Lolium* sp. were once gain the most consumed taxa (Table 2). Other relatively important species in occurrence were *P.*

TABLE 2. Diet of the Chilean Tinamou (*Nothoprocta perdicaria*) determined by analysis of stomach and crop contents in Ñuble Province, south central Chile. N = Number of birds, O% =Frequency of occurrence, NF% = Percentage of number frequency, B% = Percentage of biomass.

Dietary items	Summer (N = 34)			Winter (N = 45)			Combined (N = 79)		
	O%	NI%	B%	O%	NI%	B%	O%	NI%	B%
Asteraceae									
Ambrosia sp.	2.5	0.1	0.3	3.2	1.3	0.8	2.8	0.2	0.3
Centaurea melitensis[a]	0.8	0.1	0.1	0.8	1.6	8.6	0.8	0.2	2
Cirsium sp.	0.8	0.1	0.2	0	0	0	0.4	*	0.1
Crepis sp.	1.6	0.4	1.4	0	0	0	0.8	0.4	1.1
Boraginaceae									
Echium vulgare[a]	1.6	0.5	0.7	0	0	0	0.8	0.5	0.5
Brassicaceae									
Brassica campestris[a]	3.3	0.1	0.1	0	0	0	1.6	0.1	*
Raphanus sp.	0.8	*	0.4	0	0	0	0.4	*	0.3
Chenopodiaceae									
Chenopodium album[a]	0.8	0.4	0.1	0	0	0	0.4	0.4	0.1
Chenopodium sp.	0	0	0	8	3.7	3.3	4.0	0.2	0.7
Convolvulaceae									
Convolvulus arvensis[a]	1.6		0.1	19.0	26.0	31.5	11.0	1.6	7.0
Fabaceae									
Galega officinalis[a]	0	0	0	1.6	1.4	5.5	0.8	0.1	1.2
Trifolium subterraneum[b]	0	0	0	0.8	0.2	0.3	0.4	*	*
Medicago polymorpha[B]	0	0	0	6.4	21.0	9.8	3.2	1.3	2.2
Vicia sativa[b]	0	0	0	10.0	1.7	6.3	5.3	0.1	1.0
L*athyrus sativus*[b]	0.8	*	1.7	0	0	0	0.4	*	1.3
Lathyrus sp.	0	0	0	0.8	*	0.1	0.4	*	*
Lens culinaris[b]	0	0	0	0.8	*	0.1	0.4	*	*
Vicia sp.	3.3	*	0.3	0	0	0	1.6	*	0.2
Malvaceae	0.8	0.1	0.2	0	0	0	0.4	*	0.2
Mimosaceae									
Acacia sp.	1.6	*	0.1	3.2	6.6	15.2	2.4	0.4	3.3
Oxalidaceae									
Oxalis sp.	0.8	*	0	7.2	2.3	1.0	4.0	0.1	0.2
Polygonaceae									
Polygonum aviculare[a]	2.5	2.8	2.7	13.0	26.0	7	7.7	4.2	3.6

TABLE 2. Continued.

Dietary items	Summer (N = 34)			Winter (N = 45)			Combined (N = 79)		
	O%	NI%	B%	O%	NI%	B%	O%	NI%	B%
Polygonum sp.	5.0	2.7	3.3	0	0	0	2.4	2.6	2.6
Ranunculaceae									
Margyricarpus sp.	0	0	0	0.8	*	*	0.4	*	*
Cyperaceae									
Carex sp.	0.8	0.5	1.3	0	0	0	0.4	0.5	1.1
Poaceae									
Avena sativa[b]	0	0	0	0.8	*	0.1	0.4	*	*
Bromus hordeacus[a]	3.3	0.4	3.3	0	0	0	1.6	0.4	2.6
Echinocloa crusgalli[a]	0	0	0	0.8	0.2	0.1	0.4	*	*
Echinocloa sp.	4.9	3.0	4.5	0	0	0	2.4	2.9	3.5
Hordeum sp.	3.3	0.3	0.7	0	0	0	1.6	0.3	0.5
Lolium multiflorum[b]	0.8	*	0.1	0	0	0	0.4	*	*
Lolium sp.	17.6	16.3	25.2	8.0	2.5	1.4	12.5	15.5	20.3
Panicum capillare[a]	8.2	70.9	38.4	7.2	4	1.1	7.7	66.7	30.4
Triticum sp.[a]	5.0	0.2	3.8	0	0	0	2.4	0.2	3.0
Unidentified seeds	12.3	1.0	9.0	6.4	2.2	7.3	9.3	1.0	8.6
Total of seeds	(84.4)	(99.9)	(98.0)	(99.2)	(99.8)	(99.5)	(91.9)	(99.9)	(98.2)
Animal material	(15.6)	(*)	(2.0)	(0.8)	(*)	(0.5)	(8.1)	(*)	(1.7)
Insects									
Dichropus araucanus	12.3	*	1.9	0	0	0	6.1	*	1.5
Crustacea									
Julus terrestris	3.3	*	0.1	0.8	*	0.5	2.0	*	0.2
Total frequency	122			125			247		
Total No. of items		66247			4472			70719	
Total mass (g)			135.8			37.1			172.9

[a]Weed seeds.
[b]Seeds of cultivated plants.
*Traces (< 0.1%).

aviculare (O = 7%) and *C. arvensis* (O = 11%).

A significant difference was found between summer and winter diet diversities at the species level (*H'* = 1.22, and *H'* = 1.0, respectively; t_{25} =3.64, $P < 0.05$). Similarly, at the family level, diet was significantly more during summer than during winter (*H'* = 1.45, and *H'* = 0.9, respectively; t_{190} = 11.74 $P <$

0.001). Chilean Tinamous consumed a higher proportion of invertebrates during summer compared to winter, but differences were not significant ($\chi^2 = 3.03$, $P > 0.05$).

The Chilean Tinamou in Ñuble appears to be essentially a granivorous species with invertebrates being consumed in a variable proportion depending of the season. Our results are similar to those found for other tinamous species (e.g., Mosa 1993, Garitano-Zavala *et al.* 2003) and confirm the study by Dorst & Vuilleumier (1986) who considered that tinamous are large terrestrial granivorous-insectivorous birds. In spite of the small sample size and that our study was locally limited, we found 37 distinct food items. In a more comprehensive study, Rottmann (unpub.) identified a total of 140 distinct food items. This indicates that the Chilean Tinamou has a wide trophic spectrum and composition of diet may vary among localities. This is consistent with the previous studies made on other tinamous species elswhere (Jimbo 1957, Bonetto *et al.* 1960, Bump & Bump 1969, Grigera 1973, Silva & Sander 1981, Mosa 1997, Garitano-Zavala *et al.* 2003) and demonstrates the trophic generalism of the Chilean Tinamou.

We found a significant seasonal difference in food-niche breadth which suggests that the Chilean Tinamou would use food resources according to their seasonal abundance. A greater consumption of Poaceae seeds and invertebrates during the summer probably mirrors a greater availability of these foods. The seasonal oscillation in consumption of animal pieces would be due to changes in the environmental availability determined by the invertebrate life cycle, particularly grasshoppers. This trend has also been observed in the Spotted Tinamou (*Nothura maculosa*; Bonetto *et al.* 1960, Grigera 1973), Andean Tinamou (*Nothura pentlandii*; Mosa 1993), and Paled Spotted Tinamou (*Nothura darwini*; Mosa 1997) in Argentina. Thus, our data suggest that the Chilean Tinamou would be an opportunistic species consuming those food items temporally or spatially more abundant or accessible.

Although the Chilean Tinamou has been considered as habitat-generalist (de La Peña & Rumboll 1998, Araya & Millie 2000, Egli & Aguirre 2000), in our study areas, we found a high proportion of weed seeds and very low proportion of seeds of cultivated plants in the diet of Chilean Tinamous which suggests that it foraged mainly on abandoned pastures or shrubs. Further research is necessary in the field to determine the degree of trophic opportunism and the relationship between diet and habitat in the Chilean Tinamou.

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