

VARIATION OF NESTLING DIET ACROSS THE BREEDING SEASON IN SPANISH SPARROW *PASSER HISPANIOLENSIS* IN SOUTHERN PORTUGAL

VARIACIÓN DE LA DIETA DE LOS POLLOS DURANTE EL PERIODO REPRODUCTOR EN EL GORRIÓN MORUNO *PASSER HISPANIOLENSIS* EN EL SUR DE PORTUGAL

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The Spanish Sparrow is the most gregarious of the Palaearctic sparrows (Summers-Smith, 1988), nesting in very dense tree colonies, both in other birds nests and in man-made structures (Sacarrão & Soares, 1975; Alonso, 1984; Metzmacher, 1990). The nesting in colonies is highly synchronised (Alonso, 1984; Metzmacher, 1990), with 75% to 89% of the nests first egg being laid within 5 days (Gavrilov, 1963; Marques, 2002). In this study we report on the diet of the nestlings of Spanish Sparrow and analyse the variation of the diet composition within the breeding season. Information about a species' food habits is fundamental for the understanding of its ecology. This knowledge is particularly important in species with impact in human activities. The Spanish Sparrow *Passer hispaniolensis* is mainly a seedeater (Alonso, 1985) that can become a serious problem in cereal cultivation in semi-arid areas (Gavrilov, 1963; Mirza *et al.*, 1975; Metzmacher, 1983; Summers-Smith, 1988). Estimations of high levels of damage have been reported in cereal crops in Libya and Kazakhstan (Mirza *et al.*, 1975; Gavrilov *et al.*, 1995).

The nestling diet of this species has been studied in North Africa, Algeria (Metzmacher, 1983) and Libya (Mirza *et al.*, 1975) and in Kazakhstan (Gavrilov, 1963). Only Metzmacher (1983) presented detailed results on the composition of nestlings' diet. In these studies the invertebrates are the prey most consumed by nestlings (ranging from 75% and 90% of the weight), while vegetable items are less important. Inversely, in adult birds the vegetal fraction is the most important (Gavrilov, 1963;

Mirza *et al.*, 1975; Alonso, 1982; Metzmacher, 1983).

The study was carried out in May and June 2000 in Castro Verde, Southern Portugal (37° 41'N, 08° 03'W). The Castro Verde region is a cereal crop steppe, alternating with fallow grounds, which are usually grazed by sheep and cattle. The sparrows nest in the small *Eucalyptus* spp. plantations and olive groves that abound in the area. Diet samples were obtained using the ligature method, which consists in applying a constricting band around the neck of nestlings with sufficient pressure on the proventriculus to prevent them from swallowing food items brought to the nest by the parents, but loose enough to avoid strangling (Kluijver, 1933). This method has a wide use to analyse the nestling diet (e.g. Henry, 1982; Martinez *et al.*, 1992; but see Moreby & Stoate, 2000). In our study, the ligature was a plastic electric cable tie, as described by Mellott & Woods (1993). The ligature remained around the nestlings' neck for a period of time ranging between 55 and 95 minutes (64.6 ± 1.2 minutes) after which food items were removed. The nestlings from which food was taken were compensated with insectivorous bird ration. Food was collected from 41 nests (corresponding to 157 nestlings) with ages ranging from 5 to 10 days in three different colonies.

Collected items were preserved in a solution of ethanol (70%) and later identified in the laboratory to the family level. For biomass estimates (g dry weight), the samples were placed in an oven at 70°C for 48 hours and later all items of each prey type were weighted on a

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precision balance (0.001 g). For determining the grit size we used the average of the longest diameter and its perpendicular diameter (measured to the nearest 0.01 mm).

To examine the data, we calculated the percentage of occurrence (PO) as a measure of the regularity of the appearance of a prey type (number of occurrences \times 100 / total number of broods sampled); the relative frequency (RF), which relates the number of occurrences of a food type with the total number of identified prey (number of occurrences \times 100 / total number of food items); and the biomass percent (BP) that gives us the importance of a particular prey type in terms of biomass (prey biomass \times 100 / total biomass consumed). The biomass delivered by adults per nestling was determined by dividing the total dry weight by the duration of the sampling period in hours and by the number of nestlings in the nest.

The variation of the nestlings' diet in was analysed using the X^2 test for contingency tables (Zar, 1999). Results are presented as mean \pm SE (standard error of mean).

Three classes of invertebrates were detected as prey of Spanish sparrow parents to feed nestlings (Table 1). Out of the 150 food items analysed the insects were the main prey, comprising 79.3% of the all items and 84.1% of the total biomass. Arachnids (spiders) and gastropods (land snails) were the other invertebrate prey detected. Seeds were present in 19.5% of the broods and represented 8.7% of the items (9.7% of the total biomass). All the seeds were from cereal plants.

Among the insects, Lepidoptera larvae were the most important prey type, comprising 43.3% of insect biomass. Other important orders were Orthoptera 32.8% (mainly Acrididae) and Mantodea 17.3%. In five nests we de-

TABLE 1

Percentage of occurrence ($n = 41$), relative frequency and percentage of biomass ($n = 150$) of the food items consumed by nestling Spanish Sparrows in southern Portugal (n.i. = non-identified food item). [Porcentaje de aparición ($n = 41$), frecuencia relativa y porcentaje de biomasa ($n = 150$) de presas consumidas por pollos de Gorrión Moruno en el Sur de Portugal (n.i. = presa no identificada).]

Class [Clase]	Order [Orden]	Family [Familia]	Percentage occurrence [Porcentaje]	Relative frequency [Frec. Relativa]	Percentage biomass [% de biomasa]	
Insecta	Orthoptera		63.4	26.0	27.6	
		Acrididae	51.5	20.0	20.0	
		Tettigoniidae	17.1	6.0	7.6	
	Mantodea	Mantidae	9.8	4.0	14.6	
		Homoptera	Issidae	17.1	8.7	1.2
	Heteroptera		12.2	4.7	3.2	
		Scutelleridae	9.8	4.0	3.1	
		n.i.	2.4	0.7	0.1	
		Coleoptera		12.2	3.3	1.3
		Cetoniidae	4.9	1.3	1.2	
		Scarabaeidae	2.4	0.7	0.0	
		Staphylinidae	2.4	0.7	0.0	
		Tenebrionidae	2.4	0.7	0.1	
	Lepidoptera			48.8	32.7	36.4
		Larvae n.i.		48.8	32.0	35.7
Adults n.i.			2.4	0.7	0.7	
Arachnida	Araneae	19.5	5.3	3.2		
Gastropoda	Stylommatophora	7.3	3.3	2.5		
Seeds			19.5	8.7	9.7	
n.i.			9.8	3.3	0.5	

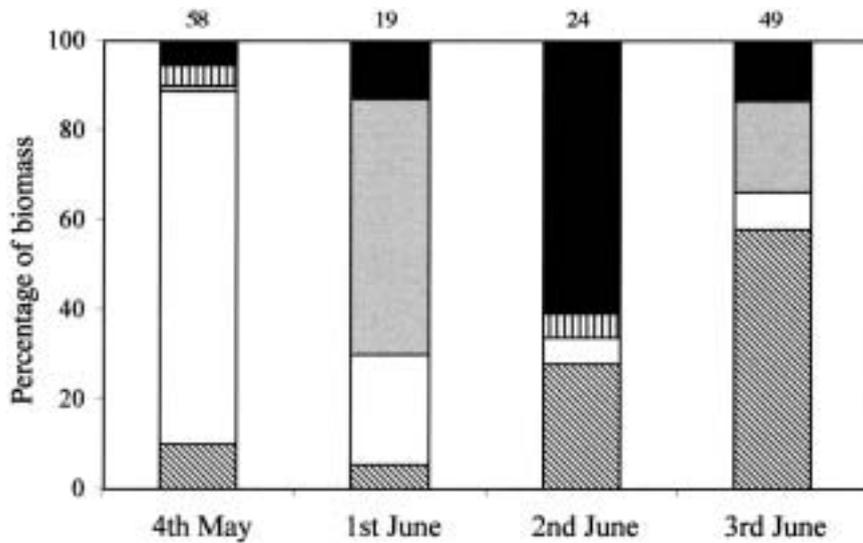


FIG. 1.—Variation of diet of nestling Spanish Sparrows for the four most abundant prey (percentage of biomass) between the last week of May and the third week of June (diagonal lines = Orthoptera; white = Lepidoptera; grey = Mantodea; vertical lines = seeds; black = others). The number of prey items are given above bars.

[Variación de la dieta de los pollos de Gorrión Moruno para las cuatro presas más abundantes (% de biomasa) entre la última semana de mayo y la tercera semana de junio (líneas oblicuas = Orthoptera; barras blancas = Lepidoptera; barra gris = Mantodea; líneas verticales = semillas; negro = otros). El tamaño muestral se da sobre las barras.]

tected grit accompanying nestlings' diet. The grit weighted 0.04 ± 0.02 g per nestling ($n = 5$) and their size ranged from 1.08 to 5.48 mm (2.92 ± 0.42 mm, $n = 12$). The number of grit particles per nestling ranged between 1 and 5 (2.2 ± 0.7 , $n = 5$). The presence of grit was always associated with hard prey as land snails, Scutelleridae, Acrididae or seeds but never with soft prey like Lepidoptera larvae or Homoptera. Parents delivered on average 0.023 ± 0.003 g dry weight per hour per nestling ($n = 41$).

During the breeding season the composition of the diet of nestlings varied considerably. The presence of the two major groups of prey presented different trends with the Orthoptera increasing in biomass while the Lepidoptera decreased (Fig. 1), further, the variation of the diet composition present significant differences ($X^2 = 61.87$, $df = 12$, $P < 0.001$).

These results show that Spanish Sparrows are mainly insectivorous when feeding nestlings, with 90.3% of the food biomass being of animal origin. Our results are similar to other

studies of the nestling diet of Spanish Sparrows (Gavrilov, 1963; Mirza *et al.*, 1975; Alonso, 1982; Metzmacher, 1983). In this study Lepidoptera, jointly with Orthoptera, were the most important prey comprising more than half of the food items in weight. In North Africa, nestlings are fed almost exclusively with grasshoppers (Orthoptera) with the Lepidoptera representing a very small fraction in the nestlings' diet (Metzmacher, 1983).

Another interesting finding in our study was the presence of grit particles in the nestlings' diet. Alonso (1985) had previously reported this finding and the particles that he found are similar in size to the ones we found. However, Alonso recorded a higher number of grit particles (89.1 particles per nestling diet) that were considerably heavier (0.35 g per nestling) than the ones detected by us. These differences are probably due to the different methods used, the «ligature method» in our study and the «stomachal contents» in Alonso's. The later method sampled for longer time resulting in the accu-

mulation of grit from different feeding events. Contrary to Alonso, we found that the presence of grit was generally associated with hard food. This difference could also be explained by the long period of sampling of the «stomachal content method» with the presence of grit being due to food items already digested or to the presence of food items from subsequent feeds.

The variation in the nestling diet during the study period denotes generalist food habits, with parents providing the most abundant preys to nestlings (*pers. obs.*). Metzmacher (1983) in Algeria also reported variation of prey hierarchy with season.

Although the Spanish Sparrow is potentially detrimental to cereal crops on account of being a gregarious seedeater that locally occurs in very high densities (Alonso, 1982; Marques, 2002), care should be taken while evaluating the impact of this species on human activities. The consumption of invertebrates that are potential pests, such as caterpillars (Lepidoptera) and locusts (Orthoptera), by the nestlings could also suggest the existence of a positive effect as a pest control.

RESUMEN.—*En este estudio se muestra la variación temporal durante la época reproductora de la dieta de los pollos de Gorrión Molinero en el Sur de Portugal. Las principales presas aportadas al nido fueron orugas de lepidópteros. A lo largo de la estación reproductora se produce un incremento en la cantidad de Orthoptera y una disminución de Lepidoptera aportados por los adultos a los pollos. El alto consumo de invertebrados que son potenciales plagas (orugas, saltamontes), sugiere que esta especie puede tener efectos positivos en el control de posibles plagas de insectos.*

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