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THE FOODS OF NESTING AND ADULT STARLINGS *(Sturnus vulgaris)* POISONED BY LINDANE

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ABSTRACT

An accidental bird poisoning in May 1971 in the Obornjaca region, Yugoslavia, exterminated a Starling colony. The food in 186 chick and 56 adult stomachs was analysed: more than 95% of the insects eaten were Orthoptera and Coleoptera, including many species harmful to agriculture. Differences in diet between the chicks and their parents may be explained by time of day or by the location in which adult birds foraged.

INTRODUCTION

Although they have studied Starlings for some time (Szlivka 1958, 1962, 1983), ornithologists in Yugoslavia have not yet studied their feeding biology. Only Kovacevic & Danon (1952) have examined 15 stomachs, giving a little information on food habits.

In some neighbouring countries monthly changes in the food of the Starling have been described. Szijj (1957), especially, studied Starling food extensively over the whole of Hungary, considering a huge amount of data and concluding that the Starling is of great importance for agriculture.

Differences between my data and foreign studies in feeding biology support the statement by Formozov *et al.* (1950) that changes in food and feeding habits are related to the distribution of insects. In Hungary, in chick food studies from many parts of the country, *Gryllus* species comprise the main food.

Depending on the season, this is followed by Acrididae, *Opatrum subulosum, Otiorrhynchus* sp., *Baris* sp., and *Harpalus* sp., etc. (Szijj 1957). According to Formozov *et al.* (1950) *Melolontha melolontha* and *Bothynoderes punctiventris* are the most frequent species. Spangenberg (1949), in his study

on birds of woodland shelterbelts, considered the Starling to be one of the most useful species to agriculture.

Schmidt (1952) watched a big flock of Starlings consume *Carabus nemoralis* around Kiel, Germany, and Lambert (1951) saw a flock of 80-100 collecting larvae of the Colorado beetle on a potato field of about 0.1 ha near Frankfurt. Kalmbach (1921), in a study based on 2157 stomach contents, declared the Starling to be a definitely useful bird in destroying agricultural pests.

In Australia, Starlings consume Curculionoidea (62%), Mollusca (27%), Tenebrionoidea (26%), Formicoidea (20%), Coleoptera (17%), Lepidoptera (14%), Dermaptera (13%), Acridoidea (12%) and Araneidae (10%); other items comprise less than 10% (Thomas 1957).

Szijj (1957) stated also that 78.3% of the Starling's animal food was noxious insects, 1.4% useful insects, and 20.3% of uncertain status. The vegetable food in the stomachs was rather different, comprising 28.7% noxious plants, 0.8% useful plants, and 70.5% plants of indifferent status.

The present paper describes a local case which is not necessarily typical. It is a forerunner of a large-scale qualitative and quantitative study of the food of the Starling in Yugoslavia.

STUDY AREA

In 1963 the Obornjaca meadow east of Ġunaros, NE Yugoslavia (45°45'N, 19°50'E), was drained and the water led to the brook Cik, flowing through this area. Without any reason the *Populus alba* and *P. robusta* groves were felled, and later the *Salix* sp. as well. With my former students, we cut a slope to form a nesting wall in the loess for the Starlings (Fig. 1). Then we bored 200 holes, which housed 84 pairs in 1968. Since then nesting has been continuous and the population has grown steadily.

The Starlings find food on the neighbouring arable land and on the high-grass meadow of the drained area. On the alluvial land surrounding the loess wall the main crop was sugarbeet with, farther away, wheat, maize and sunflower.

Poisoning: When banding Starlings on 14 May 1971, I was surprised to find only 3-4 adults, moving nervously. There was no activity at the nests, although 10 days before the colony had been reported to be really busy.

Then I collected 101 just-feathered young and 88 younger ones. There were no dead adults in the nests. Among the chicks 144 were dead and 45 were moving slowly with foam at the mouth and wet smelly cloacas.

I learned only in 1986 that Dr Fekete had at that time collected dead adult Starlings on his parents' land and in the surrounding sugarbeet fields and had preserved their stomachs. Dr Fekete kindly offered me 56 stomachs and told me that on 13 May 1971 he had observed Starlings on the ground helpless as they tried in vain to lift off, running to and fro, sitting down from time to time and panting with open beak. Some lost balance and fell on their side with foaming mouth, legs stretched out in spasms. All showed typical diarrhoea and narrow-slit eyes.

On 20 May 1971 I forwarded 20 dead chicks for toxicological investigation. After a rather long time, i.e. almost two years, I was informed that they had died because of Lindane spraying, which had been used against *Bothynoderes punctiventris and Psaladium maxillosum,* pests of sugarbeet. Lindane in its present form is the gamma isomer of benzene hexachloride, a product very dangerous for warm-blooded animals, and its continued use in agriculture is being investigated. In addition, it is phytotoxic, Dr Fekete informing me that it caused burns on the young sugarbeet and maize leaves.

One cannot tell whether the birds died through single or multiple consumption of the poisoned insects. In my view, the young were poisoned at once, the adults by multiple doses. After the spraying was carried out on 13 May in sunny but windy weather, the birds may have collected the wriggling half-dead insects in the afternoon or evening. Adult Starlings visit larger young, with growing feathers, about 100-110 times daily. Food is brought in, on average, every 5 minutes in the morning, every 10-11 minutes around noon, and every 20-25 minutes during the evening. Thus the young may have received the poison at any time from morning to evening, depending on the origin of the various feeding batches, whereas the adults observed by Dr Fekete were continuously collecting poisoned insects.

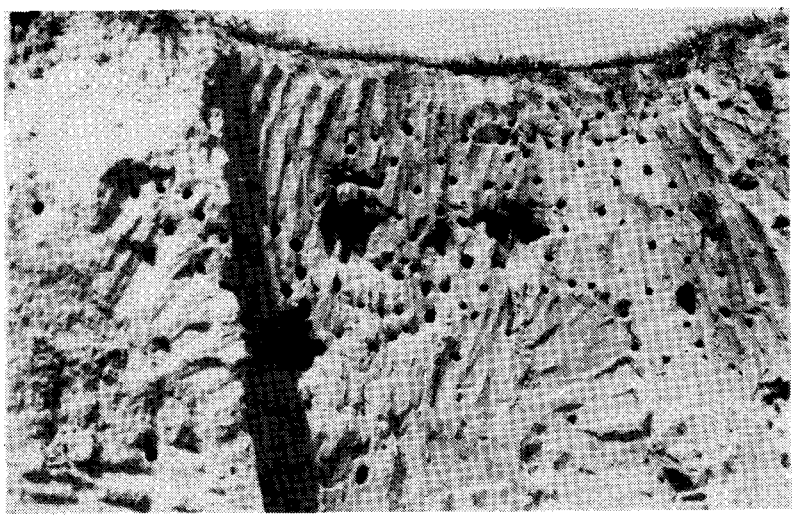

FIGURE 1 — Loess wall, the place of mass extinction of starlings
Photo: Szlivka L

RESULTS

Insects were identified according to Dudich & Loksa (1969) from the insect identification books of Calver (1876) and Moczar (1975).

From 186 chick stomachs 358 insects were identified, and the 56 adults provided 100 items. The content of adult stomachs was low, probably as

a result of vomiting at an early stage of poisoning. Vomiting probably explains why 20 stomachs were empty.

Identifying insects is straightforward in food studies, and field investigations provide information on ethological aspects of food collection by Starlings. However, it is sometimes doubtful whether an identified insect really is important in the "normal" diet. For example, Szijj (1957) found *Harpalus* en masse in the stomachs, whereas I have yet to record it. I think the Starling will take almost any insect before it, except that in some other investigations I have found that it will not touch *Maloe* and *Heteroptera* spp. To this extent, food status is determined, and is a function of the area and feeding biology of the bird.

TABLE 1 — Stomach contents of 186 chicks and 56 adult Starlings

Insect species	Chicks		Adults	
	No.	%	No.	%
Orthoptera				
Dociostaurus maroccanus			6	6.0
Calliptamus italicus			17	17.0
Gryllus desertus	22	6.1	5	5.0
Tridactilus variegatus	10	2.8		
Gryllotalpa gryllotalpa	91	25.5	16	16.0
Hemiptera				
Pyrrhocoris sp. larvae	6	1.7		
Coleoptera				
Melolontha melolontha	27	7.5	9	9.0
Opatrum subulosum	11	3.1		
Agriotes sp.			10	10.0
Cassida nebulosa	9	2.5		
Otiorrhynchus ligustici	7	1.9		
Bothynoderes punctiventris	64	17.9	21	21.0
Psaladium maxillosum	30	8.4	15	15.0
Polydrosus mollis	1	0.4		
Sitona sp.	66	18.4	1	1.0
Platyparea poecilopterа	7	1.9		
Hymenoptera				
Cimbex connata	7	1.9		
Total	358	100	100	100

Food of chicks

Gryllotalpa gryllotalpa dominated, forming 25.5% of the food (Table 1). This insect causes considerable damage for gardeners by digging out plants in light soils and tearing the roots. In my view these insects were not poisoned.

Sitona spp. formed 18.4% of the food. Its damage to lucerne is well known: the larva causes the main damage as it prevents the lucerne improving the soil by destroying the nitrogen-fixing root nodules. A 20 ha area was treated with insecticide at that time, but as far as I know Lindane was not used.

Gryllus desertus comprised 6.1%. It too is a well-known pest; in drought it may easily reach the underground parts of sugarbeet and cause considerable damage.

Melolontha melolontha, according to Dr Fekete, swarmed from an area of about 2 ha of wasteland and the Starlings caught them in the air. They always dewinged the insects, as could be seen from the remains.

Bothynoderes punctiventris represented 17.9% of the food, *Psaladium maxillosum* 3.1%, and *Tridactilus variegatus* 2.8%. These may have not been affected directly by poison. *Tridactilus* is not a typical agricultural insect. It prefers meadows, some of which were available adjacent to the sugarbeet plantations, and so possibly the meadow also got its share of spray.

In general *Bothynoderes punctiventris* may cause damage in dry springs, such as in 1971 and 1986, to sugarbeet plantations, sometimes destroying 40% of the seedlings. Because of this, resowing is often necessary. The insects cause damage to seedlings and young plants for some weeks after thinning out, and to sow again means about 3 weeks are lost and the harvest is reduced.

The parents more or less broke off the wings of the insects, showing perfect orientation at the time of catching the prey. *Psaladium maxillosum* and *Opatrum subulosum*, collected from maize fields and lucerne, were treated similarly. Other insect species such as *Pyrrhocoris*, *Otiorrhynchus*, *Polydrosus*, *Platyparea*, *Cassida* and *Cimbex* made up only 13.4% of the food of the young. These insects, except *Opatrum subulosum* (3.1%) and *Cassida nebulosa* (2.5%), cannot be regarded as important food items, at least not in this area.

Food of adults

All adult stomachs were preserved in alcohol; although it was diluted, some insects were so discoloured or disintegrated that it was impossible to identify them, and these had to be left out.

Twenty stomachs contained nothing and the remaining 36 contained 100 insects (Table 1).

In adult food *Bothynoderes punctiventris* dominated (21%), followed by *Calliptamus italicus* (17%), then *Gryllotalpa gryllotalpa* (16%), *Psaladium maxillosum* (15%), *Agriotes* sp. (10%), *Melolontha melolontha* (9%), *Dociostaurus maroccanus* (6%), *Gryllus desertus* (5%), and *Sitona* sp. (1%).

Some points should be mentioned: I did not find *Calliptamus italicus*, *Dociostaurus maroccanus* or *Agroites* sp. in the young Starlings. These insects prefer meadows with dense grass, especially after swarming. I suggest that the adults, after having finished feeding the chicks in the evening, did not return to the arable land but rather to the meadows to collect their own food. On the other hand, I cannot explain the presence of only a single *Sitona* sp. (1% in the adult stomachs), when it was the second most important food of the young.

CONCLUSIONS

Unrestrained use of insecticides causes serious damage to birds collecting food for the young, especially to useful insect-feeders such as the Starling. After drainage and spraying, the nesting population of birds in this region was reduced form 56 to 22. The Starling colony was abandoned, and now they nest in small numbers in the roofs of farm buildings.

Practically all the food the Starlings fed to the chicks were agricultural pests, and they are clearly useful birds for agriculture. I determined 17 insect species from the stomach contents. Other workers have identified more; but this was not a systematical collection, only a by-product of a biological disaster which provided the opportunity to obtain some information.

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