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Diet of four rodent species from *Robinia pseudo-acacia* stands in South Moravia

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The importance of *Robinia pseudo-acacia* stands as a food supply for four species of small mammals, *Apodemus sylvaticus* (Linnaeus, 1758), *A. flavicollis* (Melchior, 1834), *Clethrionomys glareolus* (Schreber, 1780), *Microtus arvalis* (Pallas, 1778) was studied. The trophic diversity and equitability in all rodent species suggested a rich food supply. Greater trophic overlap as well as greater qualitative and quantitative similarity of food was found in both species of *Apodemus* only. *Robinia* stands not only represented a refuge but also offered enough food for all four species of rodents.

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Introduction

Only a few small stands of forest are left in the intensively cultivated agricultural landscape of South Moravia, the most common species found being the *Robinia pseudo-acacia*. The aim of the present investigation is to establish whether such stands offer a sufficient food supply for the rodents. Also of interest is the extent to which mammal trophic niches overlap; this latter issue addresses not only the trophic diversity relative to the diversity of plant cover (as a food supply) but also the question of whether small rodents in the false acacia stands consume crops from the adjacent fields. Although the diet of similar assemblages of small rodents has been investigated in other biotopes, such as reed swamps (Holišová 1975, Holišová and Obrtel 1977), spruce forest (Holišová and Obrtel 1980), and lowland forest (Obrtel and Holišová 1974, 1977), my study is the first to compare foraging strategies of these species in false acacia stands. As this material is small, only the main trophic strategy is mentioned.

Study area, material and methods

The study took place in the Pohořelice district, around 25 km south of Brno (Czech Republic). My investigation concentrated on five stands dominated by *Robinia pseudo-acacia*. The development of

Table 1. Proportion of principal food items (%v – percentage volume, %f – percentage frequency, I – index importance), trophic diversity (H'), equitability (J'), and number of food items (S) taken by four co-existing rodent species in *Robinia pseudo-acacia* stands.

Items	*A. flavicollis* (*n* = 19)			*A. sylvaticus* (*n* = 46)			*C. glareolus* (*n* = 23)			*M. arvalis* (*n* = 21)		
	%f	%v	I	%f	%v	I	%f	%v	I	%f	%v	I
Vegetative parts of dicotyledons (herbs)	15.3	8.4	11.7	18.0	9.9	14.2	22.4	40.1	31.4	22.1	14.0	18.0
Vegetative parts of monocotyledons	1.9	1.0	0.9	5.1	0.3	2.7	4.2	6.5	5.3	17.8	20.1	18.9
Leaves and shoots of woody plants	1.9	2.6	2.3	1.2	0.3	0.8	7.4	4.8	6.1	8.2	5.9	7.1
Animal food	33.0	16.0	24.5	33.1	34.6	34.1	18.2	1.8	10.0	6.8	5.7	6.3
Seeds and fruit	30.7	53.9	42.5	34.0	47.0	40.0	24.0	19.4	22.0	36.8	48.8	42.9
Blossoms	1.9	0.1	1.0	0.6	0.1	0.3	2.4	4.3	3.4	4.2	2.6	3.2
Underground parts of plants	5.7	1.6	3.6	2.2	2.2	2.2	8.2	6.4	7.3			
Crop plants	9.6	17.3	13.5	5.2	5.4	5.3	0.8	3.7	2.3			
Fungi				0.6	0.2	0.4	11.6	12.9	11.8	2.7	1.0	1.9
Mosses							0.8	0.1	0.4			
Others and unidentified items										1.4	1.9	1.7
H'	2.62			3.11			3.14			2.65		
J'	0.83			0.82			0.88			0.85		
S	23			44			37			23		

the herb and shrub layer depended on the age and crown coverage of the tree stands. Small stands act as refuges, having a character similar to ecotones. For a more detailed description of the biotope see Pelikán (1989).

In five phytologically similar stands of false acacia, small mammals were trapped, during a three year period, in spring (April), summer (June–July) and autumn (September). Stomach content analysis was carried out on the four species found: *Apodemus sylvaticus* (Linnaeus, 1758) – 46 specimens, *A. flavicollis* (Melchior, 1834) – 19 specimens, *Clethrionomy glareolus* (Schreber, 1780) – 23 specimens, and *Microtus arvalis* (Pallas, 1778) – 21 specimens. Microscopic identification of the animal and plant food resources was done seperately. Vegetable food was identified through comparison with reference samples. The relative volume (%v) and relative frequency (%f) were used to calculate the importance index (%I, Obrtel and Holišová 1974). The trophic diversity (H') and equitability (J') were calculated according to Shannon and Weaver (1949) and Sheldon (1969) respectively. The similarity of food composition (overlap of trophic requirements) was evaluated using the index C (Zaret and Rand 1971), similarity of botanical food composition was calculated using the community coefficient CC (Westoby *et al.* 1976) and the quantitative similarity of food components was evaluated using the similarity index SI (Anthony and Smith 1974). All indexes were calculated on the raw species data (i.e. before being combined in the groups of Table l), some of these data are also used in the results. For a detailed description of the methods and the area under study, see Obrtel and Holišová (1974) and Pelikán (1989).

Results and discussion

Analysis of 109 stomach contents, indicates that rodents of four species consumed a total of 70 different items. In both species of *Apodemus*, seeds and fruits were the most important food component (Table 1), with animal food the next most important. Vegetative parts of herb dicotyledons and monocotyledons, and leaves and shoots of woody plants, formed an important part of the diet spectrum. Field crops in the vicinity of the false acacia stands were also consumed, as were some roots, blossoms and fungi. The diet of *A. flavicollis* and *A. sylvaticus* were generally similar (Table 2), indeed, there was a considerable overlap. However, compared to other species, the quantitative similarity and overlap of trophic requirements was very low.

C. glareolus also took a wide range of food items (Table l). The vegetative parts of dicotyledons were an important part of the diet. Though forming a low calorific value, together with monocotyledons and woody plants they were a predominant dietary component (I = 42.8). Roots and crops were of less importance. When compared with the other species, its diet diversity and equitability were the highest (Table 1), as was its qualitative similarity (CC) with the *M. arvalis* (Table 2). Trophic overlap increased with respect to *A. sylvaticus* only.

In the diet of *M. arvalis* a low caloric food was very important part of the diet (I = 44.0), but the seeds and fruits with other calorically rich diet components predominated (I = 52.4). The similarity index (SI) and community coefficient (CC) remained low with respect to the other three species, except *C. glareolus* with regard to CC (Table 2).

Table 2. Community coefficient (CC), similarity index (SI), trophic overlap (C), and the number of shared food items (S) in the four rodent species.

	A.s.–A.f.	*A.s.–C.g.*	*A.s.–M.a.*	*A.f.–C.g.*	*A.f.–M.a.*	*C.g.–M.a.*
CC	50.7	47.0	41.2	34.5	34.8	47.5
SI	53.7	30.9	22.2	19.4	13.7	28.1
C	0.767	0.33	0.236	0.203	0.151	0.24
S	17	20	14	10	8	14

The crop plants grown in the vicinity of the false acacia stands were also consumed by rodent studied. The consumption of all parts of beet *Beta vulgaris*, lucerne *Medicago sativa* and grains of maize, barley and wheat were found. No field crops were found in the stomachs of *M. arvalis* (Table 1).

The importance of *Robinia pseudo-acacia* as a food supply for small rodents was also considered. *C. glareolus* showed the highest consumption of this species (total I = 14.5). The seedlings, buds, blossoms and seeds are all eaten. Seedlings were also consumed by *M. arvalis* (I = 6.3), only the seeds were eaten by *A. sylvaticus,* however, no consumption of this plant was found in *A. flavicollis*.

The main tendency underlying the dietary strategy of small rodents is a shift from the consumtion of vegetative parts to the consumption of animals, seeds and fruit, i.e. from low calorific to high calorific foods (Hansson 1971, Butet 1990). In false acacia stands, rich calorific food formed a total of 89.3%v in *A. sylvaticus*, 88.9%v in *A. flavicollis*. In contrast, low calorific dietary items were an important food source for the voles studied (40.0%v for *M. arvalis* and 51.4%v for *C. glareolus*) and the least so in both *Apodemus* species (12.0%v for *A. flavicollis* and 10.5%v for *A. sylvaticus*). It was found by Holišová (1959, 1975), and Holišová and Obrtel (1980) that *M. arvalis* consume low caloric, voluminous food by preference, though in false acacia stands seeds were consumed to a great degree (48.8%v). The feeding strategy of *C. glareolus* in false acacia was found to be similar to that reported in other biotopes (Holišová 1972, Holišová and Obrtel 1979). According to Obrtel and Holišová (1977), trophic competition may occur only if common food resources are insufficient and if population densities of competing species are too high. This was not the case in the present study. Our analysis show that false acacia stands form an important element that contributes to the environmental diversity of the South Moravian agricultural landscape. These stands are important for the survival of small mammal populations and their food supply. Although the study material was small, it is evident that all the studied species retained their basic feeding strategy, even in that biotope.

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