

Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa»	Vol. L	pp. 463–477	© Octobre 2007
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**CONTRIBUTIONS TO THE KNOWLEDGE OF THE FOOD
STRUCTURE OF RED-RUMPED SWALLOW (*HIRUNDO DAURICA
RUFULA* TEMM. 1835) (PASSERIFORMES: HIRUNDINIDAE) IN
ROMANIA AND TURKEY
[Partial results of „Focida” 2006 expedition in Turkey]**

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Abstract. In this paper we dealt with the food structure of the Red-rumped Swallow, *Hirundo daurica rufula*, in the eastern side of its European range, analyzing the stomach content of seven adult specimens from Romania and two nestlings of 10-12 days old from western Turkey. The number of the identified preys in the digestive tubes of the adults varied between 8 and 51 and in those of the nestlings, between 37 and 82 preys/individual. The food of the Romanian adult Red-rumped Swallow consisted of coleopterans, representing 67% of the total of the identified preys, followed by heteropterans with 15%, and the nestlings food consisted of mainly coleopterans (37% of all preys) and Heteroptera (35% of all preys). Data on the nestlings' food complete the data from literature according to which their food would be formed of winged ants in a high percentage (94%), but which are available only in short periods of time along an entire breeding season, forcing the birds to find alternative sources of food. Dipterans are poorly represented, only 2% of the total of the identified preys.

Résumé. On présente la diète de l'Hirondelle rousseline, *Hirundo daurica rufula*, dans la partie orientale de son aréal européen, grâce à l'analyse du contenu stomacal de 7 adultes de Roumanie et de 2 hirondeaux de Turquie. Le nombre de proies identifiées dans la nourriture des adultes a varié entre 8 et 51, tandis que celui de la nourriture des hirondeaux a varié entre 37 et 82 proies/individu. La nourriture des adultes a été constituée de manière prépondérante par des coléoptères, qui ont représenté 67% du nombre total de proies identifiées, suivis par les hétéroptères avec 15%, tandis que celle des hirondeaux a consisté en coléoptères (37% des proies) et en hétéroptères (35% des proies). Les données obtenues complètent celles de la littérature, selon lesquelles la nourriture de hirondeaux serait formée en majeure partie (94%) de fourmis ailées, mais vu le fait que ces dernières ne sont disponibles comme source de nourriture que pendant de courtes périodes de temps au cours d'une saison de reproduction, les oiseaux sont obligés de chercher des sources alternatives de nourriture. Les diptères sont faiblement représentés, ne couvrant que 2% du total des proies identifiées.

Key words: *Hirundo daurica rufula*; Red-rumped Swallow; food; trophic spectrum; Romania, Turkey.

INTRODUCTION

Red-rumped Swallow is a species spread in South-East Europe, Asia and Africa. Subspecies *Hirundo daurica rufula* breeds in the Iberian Peninsula and Morocco; eastwards up to Kazakhstan and Kashmir (Turner, 1989). It also breeds in Somalia. Wintering districts of this subspecies are not well known, but there is a regular passage in the East of the Mediterranean Sea and northern Africa. There are two distinct migration ways, one in western Africa for the western birds and the Nile Valley, for the eastern ones (Etchecopar & Hue, 1964). It is a common migratory in western and northern high regions of Ethiopia and it also was reported from Chad, Mali and Senegal (Turner, op. cit.). In Romania, it is reported as a summer guest in

English translation by Mihaela Barcan Achim.

Dobrogea by Radu (1976), Radu & Teodorescu (1988), Petrescu (1999) and in Banat by Paspaleva (1977), Radu (1977, 1990, 1991).

Regarding the food of the Red-rumped Swallow, there are sporadic reports, especially made from the eastern side of the range, from the ex-soviet republics (Kazakhstan, Kirgiziya, Uzbekistan). The analysis of the stomach content in the specimens from Kazakhstan revealed the presence of the Heteroptera species, dipterans and of some small-sized coleopterans in its food (Dolgushin & col., 1970). In Uzbekistan, cicadas and coleopterans (Tenebrionidae, Coccinellidae and Chrysomelidae) were identified in food (Salimov, 1977), and in Uzbekistan, Scarabeidae (Pek & Fedyanina, 1961). In China, in the food of the subspecies *H. d. nepalensis* coleopterans, orthopterans, flies, mosquitoes and other insects were identified (Shaw, 1930).

In literature there are numerous data of this kind dealing with the food of the Red-rumped Swallow in different parts of its range, Cramp (1988) making their synthesis. As regards the content of the Red-rumped Swallow food in the western side of its range, there is a single report, published by Prodon (1982), who approached aspects of species reproduction and diet in France, where he found out that the nestlings food is formed of 94% winged ants, analyzing the faeces.

Also, there are contributions regarding the feeding frequency of the chickens of 5 – 15 days old, in Bulgaria (Simeonow, 1968), in Spain (de Lope-Rebolo, 1980) and in France (Prodon, 1982).

MATERIAL AND METHOD

The material presented in this paper originates in Romania and in western Turkey and belongs to the subspecies *Hirundo daurica rufula* Temm., 1835 (Fig. 1).

For the study on the food of swallows and martins there are several methods, the mostly used being: neck ring method; utilizing of some artificial nestling; analysis of the stomach content of the dead species or of those from museum collections; the analysis of the food remains from nests and the analysis of the faeces eliminated by chickens.

For this study we used the method of the analysis of the stomach content and we used nine stomachs of Red-rumped Swallow specimens from the ornithological collection of “Grigore Antipa” National Museum of Natural History of Bucharest.

Seven of these stomachs are from adult specimens collected from Romania by Dr. Dimitrie Radu within the period 1976-1990 and they have the following collecting data: birds collected on 14th of July 1976 from Cobadin (Constanța County) (inventory numbers ORN 1283 and ORN 1284); two birds collected on 15th of July 1988 from Canarua Fetei (Constanța County) with inventory numbers ORN 1749 and ORN 1750; two birds collected on 23rd of July 1989 from Mraconia Valley (Mehedinți County) with inventory numbers ORN 1285 and ORN 1286; and a specimen collected on 27th of July 1990 from Cochirleni (Constanța County) with inventory number ORN 1748.

The second part of the material which we had at our disposal and was analyzed (stomachs from two nestlings of 10-12 days old) was collected during the period 29th of July – 7th of August 2006, from western Turkey, when Dr. Corneliu Pârvu from “Grigore Antipa” National Museum of Natural History (Bucharest) participated to the „Focida” 2006 Expedition in this region of Turkey being invited by SEOPM „Oceanic Club” from Constanța. Also, during this expedition a fallen nest of Red-rumped Swallow was collected.

Besides diet structure we analyzed some ecological aspects of the prey affiliation to the trophodynamic module (MTD), identifying phytophagous (FT),

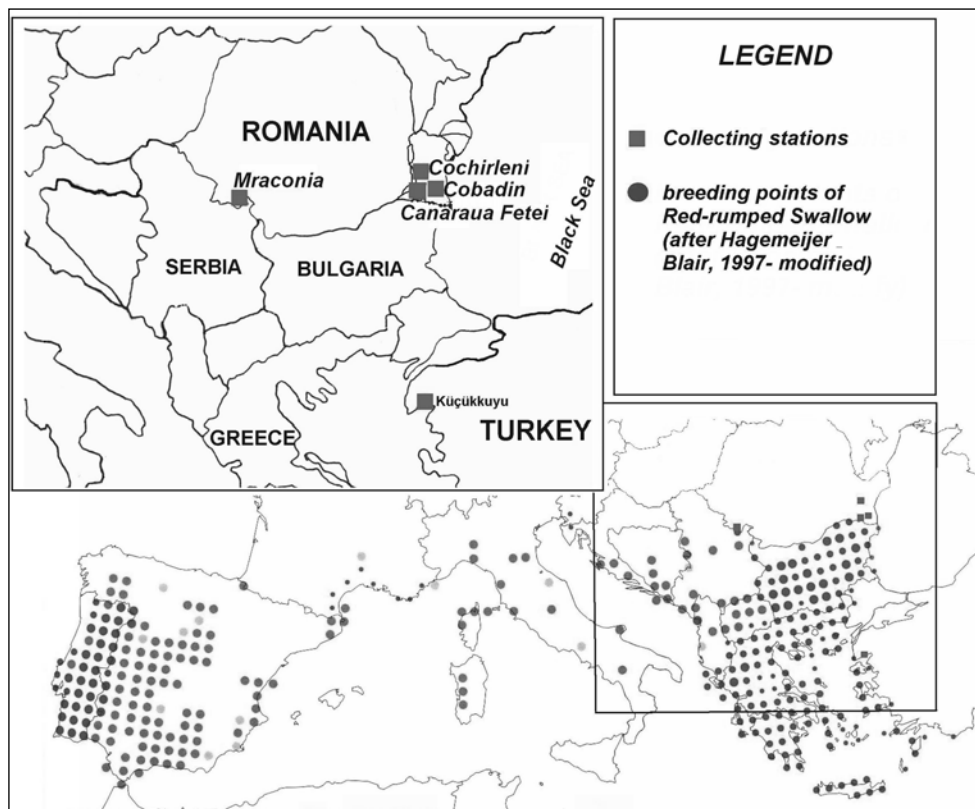


Fig. 1 – Distribution range of the Red-rumped Swallow, *Hirundo daurica rufula*, in Europe (●) (after Hagemeyer & Blair, 1997 - modified) and (■) the collecting sites of the studied material.

zoophagous (ZF), parasitoid (PZ), saprophagous (SP), necrophagous (NF) species, or their economical importance (Ec. Imp.), identifying useful species (US), the injurious ones (HS), species with a reduced importance (LI), decaying (DS), species which attack sporadically (SA) and species whose importance was not established, yet (UNS) (Tab. 2).

RESULTS AND DISCUSSIONS

By this paper we proposed to complete the knowledge on the food of subspecies *Hirundo daurica rufula* making a qualitative analysis of the stomach content in nine specimens originating in the eastern side of the European range, i.e. Romania and Turkey.

The small number of samples which we had at our disposal, seven stomachs of adult birds from Romania and two nestlings from Turkey, were insufficient for making a quantitative study on the trophic spectrum of this species, this being the reason why we studied the food from the qualitative point of view. We observed the diet structure of this species and we identified the share of the main insect orders from food, as well as the share of the families as in the case of the more abundant orders, for instance, coleopterans.

Table 1

The share of different insect orders in the food of the seven adults of *Hirundo daurica rufula* from Romania.

Origin of samples	Main groups of preys												Total no of preys/sample
	Coleoptera		Heteroptera		Hymenoptera		Homoptera		Diptera		Other groups		
	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	
#1 Cobadin	14	51.85	8	29.62	2	7.4	-	-	-	-	3	11.11	27
#2 Cobadin	8	80	2	20	-	-	-	-	-	-	-	-	10
#3 Mraconia	49	96.07	2	3.92	-	-	-	-	-	-	-	-	51
#4 Mraconia	10	34.48	9	31.03	2	6.89	1	3.44	3	10.34	3	13.79	28
#5 Cochirleni	4	50	2	25	1	12.5	-	-	-	-	1	12.5	8
#6 Canaraua Fetei	13	61.9	1	4.76	-	-	7	33.33	-	-	-	-	21
#7 Canaraua Fetei	16	72.72	1	4.54	3	13.63	-	-	-	-	2	9.09	22
TOTAL	114		25		8		8		3		9		167

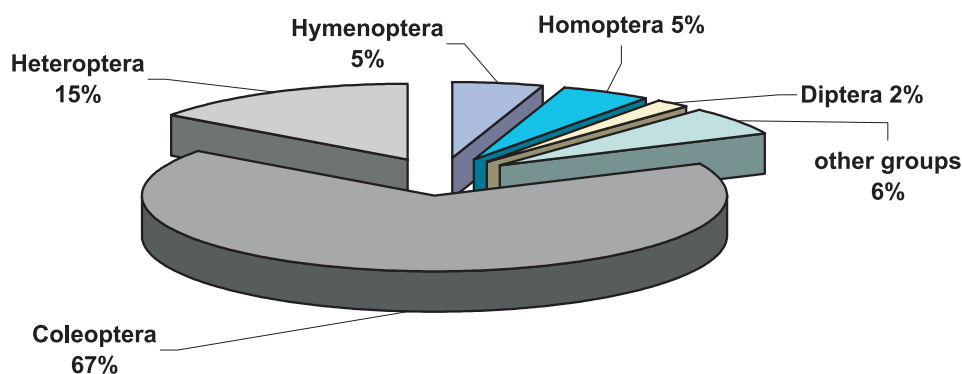


Fig. 2 – The share of the main insect orders in the food of the adults of Red-rumped Swallow from Romania.

Red-rumped Swallows usually feed alone or in small loose groups. During breeding period, generally they feed close to the nest site, at the vegetation level, but also they can hunt at 100 m high (Turner, op. cit.). Most of the preys are captured on fly, but occasionally they feed on the ground. In Arabia, some specimens were observed landing for catching flies from the camel dung (Meinerthagen, 1954), termites on the ground or other insects on plants (Cramp, op. cit.).

Such kind of situation results from our observations, the proof being the presence of a spider of Thomisidae family in sample #4 from Mraconia Valley (Mehedinți County, Romania), spider which usually lives on flowers and which might not have been caught in air by the usual feeding way of the swallow (Tab. 2).

Food of the adults

Identified prey number in the stomachs of the Red-rumped Swallow adults from Romania varied between 8 and 51 (Tab. 2). The share of the different insect

orders in food is presented in tab. 1 and fig. 2, and the complete list of the identified taxa is presented in tab. 2.

In the seven alimentary canals from the Romanian adult birds we found 167 preys, which mean an average of 24 preys / individual. The number of the identified preys varied between 8 preys in the specimen #5 from Cochirleni and 51 preys in the specimen #3 from Mraconia Valley. The most important share had coleopterans, which represented 67% from the total of the identified preys, followed by Heteroptera (15% of the caught preys), hymenopterans and Homoptera (5% each), dipterans (2% out of preys) and other groups of unidentified insects (6%). The share of these categories is represented in fig. 2.

From the percentage point of view, the most important food is represented by coleopterans. Coleopteran share in the food of the seven adult swallows varied between 34.48% in specimen #4 from Mraconia Valley and 96.07% of the total identified preys in the specimen #3, also from Mraconia.

Coleopterans were represented by species of 11 families: Scolytidae, Bruchidae, Curculionidae, Chrysomelidae, Histeridae, Dermestidae, Scarabaeidae, Cantharidae, Coccinellidae, Carabidae and Staphylinidae.

Heteroptera were represented by three families: Pentatomidae, Cydnidae and Miridae, and from the percentage point of view they varied significantly. So, in the studied specimens, the smallest percentage of captured Heteroptera was of 3.92%, recorded in the specimen #3 from Mraconia Valley, and the highest percentages were recorded in the specimens #4 from Mraconia (31.03%), #5 from Cochirleni (25%) and the specimen #1 from Cobadin (29.62%).

Making a comparison, the specimen #3 from Mraconia Valley consumed a large number of coleopterans (96.07% of the total preys), represented by 49 specimens, out of which 37 were specimens of *Sitona crinitus* Herbst., a damaged curculionid of Leguminosae (alfalfa, clover, etc.), compensating the small number of Heteroptera.

Dipterans are poorly represented in the food of the studied Red-rumped Swallows, representing 10.34% of the caught preys of the specimen #4 from Mraconia Valley, and being absolutely absent in the other samples. This thing might have happened due to the faster flight of dipterans in comparison with that of coleopterans, Heteroptera or hymenopterans. Because of their slower flight they become much easier preys for swallows. Another possible explanation is that the Red-rumped Swallow prefers the semi-arid terrains as feeding places, where dipterans are less present than the other insect groups. Therefore, from the energetic point of view, catching of dipterans is not advantageous. In Romania, as regards the Barn Swallow *Hirundo rustica*, which usually feeds inside or near human settlements, the diet is formed of a proportion of 62.36% of dipterans (Pap & col., 1998).

The two species are not in competition for food, first of all because the Barn Swallow is mainly a synanthropic species, while the Red-rumped Swallow breeds and takes its food in open and uninhabited areas, but they present very well two different strategies of exploration and catching food. While *Hirundo rustica* hunts medium-large sized dipterans, which are very abundant around human localities, *Hirundo daurica* prefers to hunt coleopterans, constrained of what the habitat offers, which it catches flying above the vegetation where they are very numerous.

Food of the nestlings

The diet of the nestlings of the Red-rumped Swallow was analyzed by investigation of the stomach content of two nestlings from Küçükuyu (western

Table 2 (continued)

Identified preys	MTD	Ec. Imp.	Cobadin ROMANIA 14.07.1976			Mraconia Valley ROMANIA 23.06.1989			Cochirleni ROMANIA 27.07.1990			Canaraua Fetei ROMANIA 15.07.1988			Küçükkuşu TURKEY 30.07.2006								
			#1		#2		#3		#4		#5		#6		#7		#8		#9				
			no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%			
Fam. Bruchidae																							
<i>Acanthoscelides obtectus</i> Say	FT	HS								1	12.5							2	2.46				
<i>Bruchidius cinerascens</i> Gyll.	FT	LI								1	12.5												
<i>Euspermophagus sericeus</i> Geoff.	FT	HS																		1	1.2		
<i>Bruchidius preparvulus</i> Boh.	FT	LI																		3	3.7		
Fam. Scolytidae																							
<i>Hyalastes ater</i> Payk.	FT	HS																			1	1.2	
<i>Ips typographus</i> L.	FT	HS																			2	2.46	
Unidentified coleopterans	Uns	Uns			1	1.96															3	3.7	
Ord. Hymenoptera																							
Fam. Chalcididae																							
Unidentified species	PZ	US																			1	2.7	
Fam. Braconidae																							
Unidentified species	PZ	US																			2	5.4	
Fam. Formicidae																							
<i>Myrmica rubra</i> L.	ZF	US																				1	1.2
<i>Lasius niger</i> L.	ZF	US	1	3.7																			
<i>Lasius</i> sp.	ZF	US																					
Unidentified Formicidae	ZF	US																			4	10.81	
Fam. Ichneumonidae																							
<i>Ichneumon</i> sp.	PZ	US																			1	2.7	
Unidentified hymenopterans	Uns	Uns	1	3.7																	3	13.63	
																					2	5.4	
																					5	6.17	

Table 2 (continued)

Identified preys	MTD	Ec. Imp.	Cobadin ROMANIA 14.07.1976			Mraconia Valley ROMANIA 23.06.1989			Cochirleni ROMANIA 27.07.1990			Canaraua Fetei ROMANIA 15.07.1988			Küçükkuşyu TURKEY 30.07.2006					
			#1		#2		#3		#4		#5		#6		#7		#8		#9	
			no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%
Ord. Diptera																				
Fam. Hybotidae																				
<i>Crossopalpus</i> sp.	Uns	Uns																1	1.2	
Fam. Chloropidae																				
<i>Chlorops</i> sp.	Uns	Uns																1	1.2	
Unidentified dipterans	Uns	Uns					3													
Other insect groups	Uns	Uns	3	11.11			3	10.71	3	12.5	1		2	9.09	3	8.1	4	4.81		
Unidentified plant seeds																				
Gastroliths																		2	-	
			27	100	10	100	51	100	28	100	8	100	21	100	37	100	83	100	3	-

Share of different insect orders in the food of the two chickens of *Hirundo daurica rufula* from Turkey.

Table 3

Sample origin	Main groups of preys												Total no of preys/
	Coleoptera		Heteroptera		Hymenoptera		Homoptera		Diptera		Other groups		
	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	Spec. no.	% of preys	
#8 Küçükkuuyu	6	16.21	17	45.94	10	27.02	1	2.7	-	-	3	8.1	37
#9 Küçükkuuyu	38	46.34	25	30.48	12	14.65	1	1.21	2	2.43	4	4.87	82
TOTAL	44		42		22		2		2		7		119

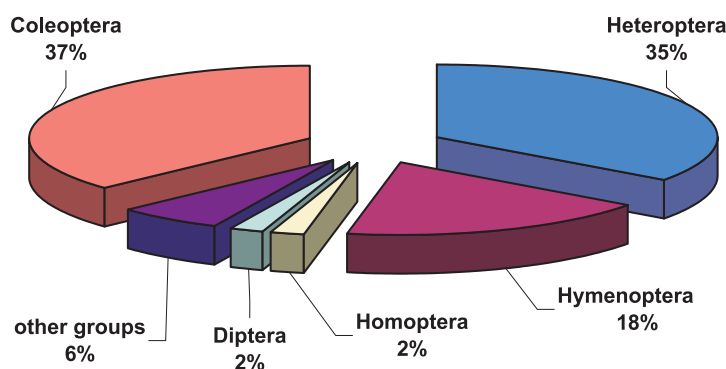


Fig. 3 – Share of the main insect orders in the food of nestlings of the Red-rumped Swallow from Turkey.

Turkey) (Fig. 1). We have identified preys of five insect orders (Tab. 3). In the two studied stomachs, the number of the identified preys was of 37, respectively 82 preys, with an average of 59.5 preys / individuals. The much larger number of preys identified in the stomachs of the nestlings is due to the energetic necessity, much higher during developing period. The most important share of the total of the identified preys in the two studied stomachs was that of the coleopterans, which represented 37%, followed by Heteroptera, representing 35%, and hymenopterans, with 18% (Fig. 3).

These proportions are apparently in contrast with the data from literature (Prodon, 1982), who established that in France the food of the nestlings is formed of 94% winged ants. On the one hand, the difference might be explained by the different structure of the available fauna as a food source in the two study areas, one in East, the other in West side of the European range. On the other side, winged ants are available as a food source only during short periods of time, along the breeding season.

In the stomachs of the two nestlings from Küçükkuuyu (Turkey) we identified gastroliths represented by little stones with dimensions between 1 and 1.3 mm, as well as clay pieces and remains of mollusks shells of about same dimensions. We did not find gastroliths in any of the Romanian adult specimens. The question is if these pieces were brought by parents in order to make easier the digestion of preys or they were swallowed by nestlings directly from the nest.

Ecological considerations

In systemic ecology, the group of species which belong or not to the same systematic group and exploit the same category of resources from a biocenosis of an ecosystem, in a similar manner, is named the trophodynamic module (MTD). MTD shows and organizes the direction of the matter and energy flow, and the sum of the MTDs identified within a biocenosis form the trophic structure of the biocenosis.

The analysis of the trophodynamic module shows the relations of the Red-rumped Swallow with the primary and secondary consumers, offering important data on the importance of the species within the equilibrium of the ecosystems which it populates. From this point of view, making a comparison between the share of the trophic categories which form the food of the Red-rumped Swallow (Fig. 4) we remarked an obvious prevalence of the phytophagous species (primary consumers), which were represented by 167 preys (57%), followed by the zoophagous ones (secondary consumers) which were represented by 68 preys (24%). Lower values of the numerical abundance had the parasitoid species (secondary consumers, which represented 3%), saprophagous species (decaying

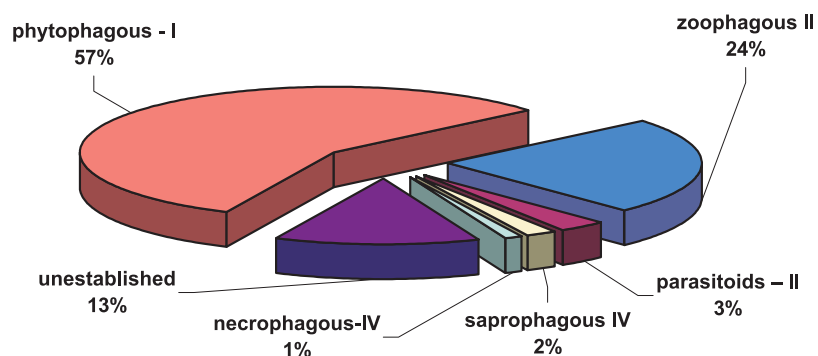


Fig. 4 – Share of the trophic categories of the preys of the Red-rumped Swallow.

species, which represented 2%) and necrophagous species (decaying species, which represented 1%). For the rest of 13% we could not establish the affiliation to one of the mentioned trophic categories.

From economical point of view, the preys of the Red-rumped Swallow are mainly pest species, 49% (141 preys), followed by useful species, 26% (73 preys), species with a reduced importance, 16% (46 preys) and decaying species, 2% (7 preys). For the rest of 7% (19 preys) the affiliation to one of these categories was not established.

From the species considered injurious to the agricultural crops, those frequently occurred in the annual and perennial Leguminosae cultures (alfalfa, clover, bean, bird's foot, esparcet, horse bean, lentil or pea) distinguish by the numerical abundance in the food of the Red-rumped Swallow. Leguminosae cultures, annual and perennial, cover almost 9% of the arable territory surface of Romania, around 800,000 ha (Perju & col., 1993). Seed culture production of Leguminosae is considerably affected by pests.

Because the chemical protection of the Leguminosae cultures is expensive and difficult, any pest control element which acts in maintaining the injurious

species density at some values around the economic damage threshold (EDT) can be included into the trophodynamic module of the zoophagous species from the Leguminosae cultures.

Thus, coleopteran species of the Curculionidae family (*Sitona lineatus*, *S. crinitus*, *S. hispidulus*, *Tychius flavus*) were identified in the stomachs of the Red-rumped Swallows in percentages between 25.92 % and 40 % (*Sitona lineatus*) in the samples collected from locality Cobadin, respectively 72.54 % for *S. crinitus* in those collected in Mraconia Valley. In high percentage specimens of *Tychius flavus* occurred, an important seed pest in alfalfa cultures. Also, the presence in samples of some species of genera *Bruchidius*, *Euspermophagus*, *Acanthoscelides*, of Bruchidae family confirms that the Red-rumped Swallow can be associate to the trophodynamic module of zoophagous species from Leguminosae cultures.

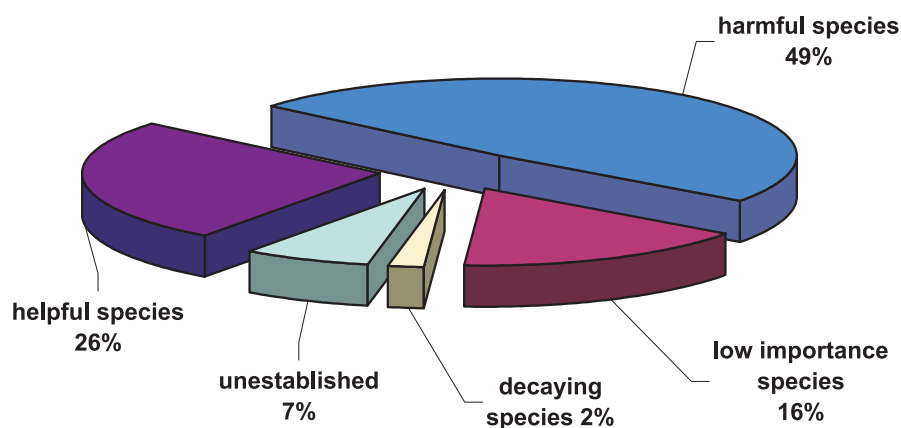


Fig. 5 – Share of different prey categories of the Red-rumped Swallow according to their economical importance.

From this point of view, the Red-rumped Swallow is important, because it integrates as a pest, ecological and important controller of the population density of the injurious insects by his trophic behaviour. If we also take into consideration that numerous unidentified dipteran and hymenopteran species can be injurious species economically (many remains might be specimens of *Bruchophagus roddi* Guss., *Contarinia medicaginis* Kieff., *Dasyneura* sp., *Agromyza* sp., etc. due to the lack of the morphological elements which represent taxonomical features of identification), the ecological importance of this species seems to be much higher.

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CONTRIBUȚII LA CUNOAȘTEREA COMPOZIȚIEI HRANEI RÂNDUNICII
ROȘCATE (*HIRUNDO DAURICA RUFULA* TEMM., 1835) (PASSERIFORMES:
HIRUNDINIDAE) ÎN ROMÂNIA ȘI TURCIA
[Rezultatele parțiale ale expediției „Focida” 2006 în Turcia]

REZUMAT

În lucrare am urmărit compoziția dietei rândunicii roșcate *Hirundo daurica rufula* în partea estică a arealului european prin analiza conținutului stomacal a șapte exemplare adulte din România și a doi pui cu vârsta de 10-12 zile din vestul Turciei. În ceea ce privește numărul de prăzi identificate în tuburile digestive analizate, în hrana adulților acesta a variat între 8 și 51, iar în hrana puilor între 37 și 82 prăzi/individ. Hrana adulților de rândunică roșcată din România a fost formată preponderent din coleoptere, care au reprezentat 67% din totalul prăzilor identificate, urmate de heteroptere cu 15%, iar hrana puilor a fost formată preponderent din coleoptere (37% din prăzi) și heteroptere (35% din prăzi). Datele obținute privind hrana puilor completează datele din literatură potrivit cărora hrana puilor ar fi formată în procent mare (94%) din furnici aripate, dar care sunt disponibile ca sursă de hrană numai perioade scurte de timp în cursul unui sezon de reproducere, obligând păsările să caute surse alternative de hrană. Dipterele sunt slab reprezentate, ocupând doar 2% din totalul prăzilor identificate.

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