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THE BEETLES (COLEOPTERA) IN THE NESTS OF DELICHON URBICA IN SLOVAKIA

ZBYŠEK ŠUSTEK, DAŠA HORNYCHOVÁ

The present paper deals with the beetles collected by D. Hornychová from the nests of *Delichon urbica* (L.) together with several other groups of Arthropoda during the years 1971—1972. It represents a continuation of previous papers (Jurík, Šustek, 1977; Šustek, Jurík, 1980) on the Coleoptera in the avian nests of Central Europe. The extensive materials of nests and the nidobiology of *Delichon urbica* essentially different from many other birds, and its close relation to man were the reason for a separate publication. The knowledge of the Coleoptera in the nests of *Delichon urbica* is modest being reduced on the registration of findings of a few species by Norberg (1936) and Hicks (1962).

METHODS

The sampling of the nests and selection of Arthropods inhabiting them were described in detail by Hornychová (1974). The existing numbers of nests in the colonies of *Delichon urbica* studied and the necessity to obtain extensive material during a short period without disturbing colonies were the reason to sample the nests in more localities, viz. Borinka, Hrubý Šúr, Záhorská Bystrica, Topoľčianky, Vlčkovce, Čataj, Podunajské Biskupice, Vrakuňa and Dolný Bar. All above localities are found in the homogenous geographical and climatical conditions of West Slovakia lowland being little distant from each other. So the dynamics of beetles was reconstructed on the basis of material obtained in described way. To complete the list of species occurring in the nests of *Delichon urbica* in Central Europe the material from 4 positive nests collected by M. Jurík (1974) in South Moravia was used.

To test the significance of the material studied the cumulative numbers of beetles species and individuals obtained succesively from 5, 10, ... 115 nests were five times repeatedly calculated and the areal curves were drawn. From the cumulative numbers of individuals the mean dominance range of each dominant (> 5 %) and subdominant (1—5 %) was calculated and the mutual ratio of the above species in 5, 10, ... 115 nests was tested succesively by Pearson chi-square test to find out how it differs from their mutual rations in all 121 nests. The mean increase in individuals and species number per nest was analysed by linear and exponential regression formulas.

For the evaluation of occurrence of beetles in the nests the index of occurrence (I0) and the index of occurrence intensity (I0I) (Jurík, Šustek, 1977) were used. The association of predators with other nests inhabiting Arthropods was evaluated by Phi-correlation coefficient (Leuschner, 1974).

Correspondingly to the nidobiology of *Delichon urbica*, the nests were classified into six groups, viz winter nests (W), nests under construction (C), nests with eggs (E), nests with nestlings (N), nests abandoned by nestlings (AN) and nests abandoned by adults (A). The timing of these groups is seen from diagram 7. The group of the nests under construction involves obviously also some nests from the last year occupied repeatedly. It was not possible to treat these nests separately being confused in the samplings protocols and in the thesis of Hornychová (1974). The material scattered large number of species constituting natural trophical groups, the ecology of beetles and their annual dynamics are studied on the corresponding levels of such groups.

MATERIAL

218 beetles were obtained from 121 nests of *Delichon urbica*. They belong to 40 species and 17 families (Tab. 1). Six species (*Tachyporus hypnorum, Tachyporus obtusus, Tachyporus solutus, Ptinus clavipes, Meligethes aeneus* and *Propylea quattuordecimpunctata*) were dominant. Five species (*Pleurophorus caesus, Ptinus fur, Anthrenus pimpinelae, Stilbus testaceus, Adalia bipunctata*) were subdominant. One species (*Epuraea variegata*) was recendent and 28 remaining species were influent. Individual families were represented as follows: *Staphylinidae* (3 sp., 90 ind.), *Ptinidae* (4 sp., 28 ind.), *Nitidulidae* (3 sp., 24 ind.), *Coccinellidae* (3 sp., 19 ind.), *Dermestidae* (3 sp., 12 ind.), *Chrysomelidae* (6 sp., 6 ind.), *Scarabaeidae* (2 sp., 6 ind.), *Phalacridae* (1 sp., 6 ind.), *Cryptophagidae* (3 sp., 3 ind.), *Lathridiidae* (3 sp., 3 ind.), *Curculionidae* (3 sp., 3 ind.), *Carabidae* (1 sp., 1 ind.), *Hydrophilidae* (1 sp., 1 ind.), *Anobiidae* (1 sp., 1 ind.), *Bruchidae* (1 sp., 1 ind.), *Tenebrionidae* (1 sp., 1 ind.), *Scolytidae* (1 sp., 1 ind.).

Tab. 1. Review of Coleoptera occurring in the nests of *D. urbica*

Family and species	Trophic relations	Number of positive nests	Abundance	Dominance	I0 (Totaly 135 nests)	I0I
CARABIDAE			(1)			
Amara aenea (De Geer)	P	1	1	0.49	0.007	1.00
HYDROPHYLIDAE			(1)			
Cercyon terminantus (Marsh.)	S	1	1	0.49	0.007	1.00
STAPHYLINIDAE			(90)			
Tachyporus hypnorum (Fabr.)	Ca	19	41	18.52	0.281	2.00
Tachyporus obtusus (Linn.)	Ca	13	47	22.06	0.333	3.46
Tachyporus solutus (Er.)	Ca	4	12	5.51	0.052	1.75
SCARABEIDAE			(6)			
Pleurophorus caesus (Greutz.)	S	5	5	2.46	0.037	1.00
Aphodius fimetarius (Linn.)	Co	1	1	0.49	0.007	1.00
ANOBIIDAE			(1)			
Ernobius sp.	P	1	1	0.49	0.007	1.00
PTINIDAE			(28)			
Ptinus clavipes Panz.	D	8	17	8.27	0.126	2.13
Ptinus fur (Linn.)	D	8	9	4.44	0.067	1.13
Ptinus raptor (Fabr.)	D	1	1	0.49	0.007	1.00
Ptinus variegatus Rossi	D	1	1	0.49	0.014	2.00
DERMESTIDAE			(12)			
Dermestes lardarius Linn.	N	1	1	0.49	0.007	1.00
Anthrenus pimpinellae Fabr.	N	4	10	4.92	0.074	2.50
Anthrenus polonicus Mrocz.	N	1	2	6.98	0.007	1.00
PHALACRIDAE			(6)			
Stilbus testaceus (Panz.)	P	5	6	2.95	0.044	1.20
NITIDULIDAE			(24)			
Epuraea variegata (Herbst.)	P-S	1	2	0,98	0,014	2.00
Kateretes bispulatus (Payk.)	P	1	1	0.49	0.007	1.00
Meligethes aeneus (Fabr.)	P	11	21	10.24	0.156	1.91
CRYPTOPHAGIDAE			(3)			
Cryptophagus acutangulus (Gyll.)	M	1	1	0.49	0.007	1.00
Cryptophagus villosus Heer.	M	1	1	0.49	0.007	1.00
Atomaria linearis Steph.	P	1	1	0.49	0.007	1.00
LATHRIDIIDAE			(3)			
Enicmus minutus (Linn.)	M	1	1	0.49	0.007	1.00
Corticaria gibbosa (Herbst.)	M	1	1	0.49	0.007	1.00
Corticaria pubescens Gyll.	M	1	1	0.49	0.007	1.00
COCCINELLIDAE			(19)			
Propylea quattuordecimpunctata (Linn.)	Ca	10	13	5.96	0.096	1.30
Adalia bipunctata (Linn.)	Ca	3	5	2.46	0.037	1.67
Coccinella septempunctata Linn.	Ca	1	1	0.49	0.007	1.00

Tab. 1 — continuation

Family and species	Trophic relations	Number of positive nests	Abundance	Dominance	IO (Totaly 135 nests)	IOI
TENEBRIONIDAE			(1)			
Alphitobius diaperinus Panz.	D	1	1	0.49	0.007	1.00
CHRYSOMELIDAE			(6)			
Lema lichenis Voet	P	1	1	0.49	0.007	1.00
Aphtona euphorbiae (Schrank.)	P	1	1	0.49	0.007	1.00
Aphtona sp.	P	1	1	0.49	0.007	1.00
Phyllotreta undulata Kutsch.	P	1	1	0.49	0.007	1.00
Psylloides chrysocephalus (Linn.)	P	1	1	0.49	0.007	1.00
Psylloides cuculata	P	1	1	0.49	0.007	1.00
BRUCHIDAE			(1)			
Bruchus pisorum (Linn.)	P	1	1	0.49	0.007	1.00
CURCULIONIDAE			(3)			
Sitona hispidulus (Fabr.)	P	1	1	0.49	0.007	1.00
Ceutorrhynchus denticulatus (Schrank.)	P	1	1	0.49	0.007	1.00
Ceutorrhynchus maculaalba (Herbst.)	P	1	1	0.49	0.007	1.00
SCOLYTIDAE			(1)			
Xylocleptes bispinus (Dutt.)	P	1	1	0.49	0.007	1.00
Total			218			
Number of species			40			

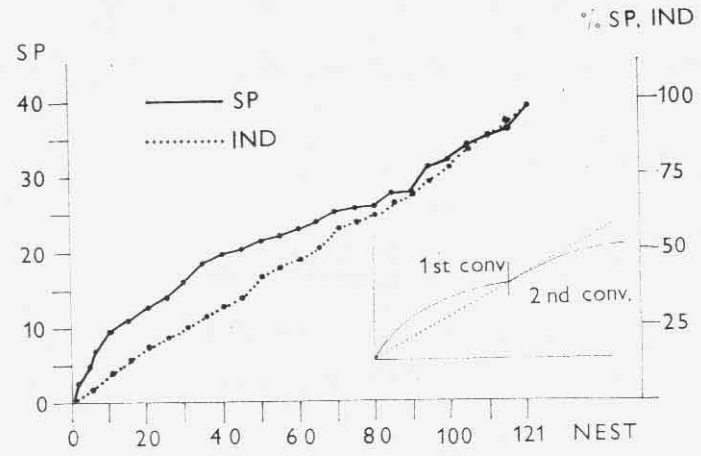
Ca — carnivorous, predaceous, P — phytophagous, D — detritophagous, N — necrophagous, Co — coprophagous, Sa — saprophagous, M — mycetophagous

Only two species, *Ptinus fur* and *Cryptophagus acutangulus*, from 40 species registered are mentioned by Hicks (1962) for the nests of *Delichon urbica*. Five other species mentioned in his paper could not be found in our material (*Ptinus tectus, Attagenus pellio, Anthrenus scrophulariae, Anthernus museorum, Lathridius angusticollis*), but these species were either found in the nests of other birds (Nordberg, 1936; Hicks, 1962; Jurík, Šustek, 1977; Šustek, Jurík, 1980) or they are closely ecologicaly and systematically related with the species listed in the present paper (Tab. 1). So 38 species may be treated at present in the nests of *Delichon urbica* for the first time from the purely faunistical point of view. Consequently 45 species of beetles are known to inhabit the nests of *Delichon urbica* at present. However, this surprizingly large number of such species is to be interpreted in view of the following statistical and ecological facts.

THE STATISTICAL SIGNIFICANCE OF THE MATERIAL

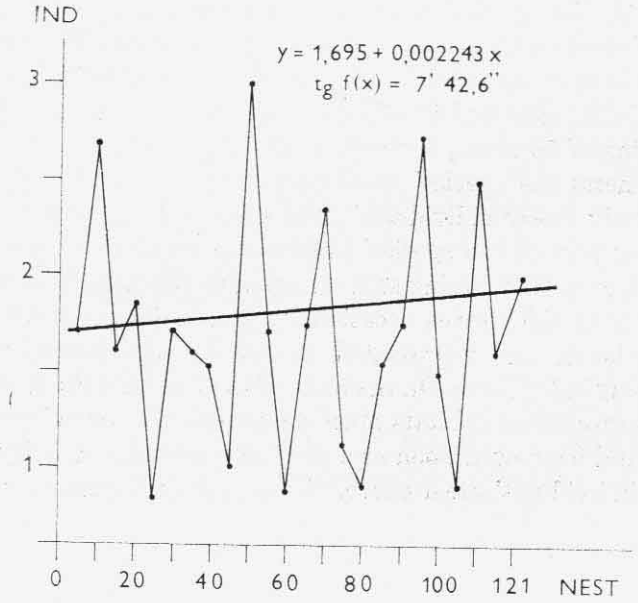
The large number of species found in the nests of *Delichon urbica* for the first time and the limited number of individuals [when compared with the nests of *Passer domesticus* and *Riparia riparia* (Jurík, Šustek, 1977; Šustek, Jurík, 1980)] in relation to number of nests arises the question of the significance of the material collected.

The reply on this question is given by the species' and individuals' areal curves (Diagr. 1). The species' areal curve is convex and it is situated above the individuals' areal curve within the limits of 0—90 nests. The increase in the species number is most intensive in the first 40 nests, where 50 % of all species occurred. Within the limits of 40—90 nests the species increase is getting slow and, in the point of 90 nests, it reaches the local minimum. Starting at the number of 90 nests the species' areal curve appears to strongly coincidate with the obviously linear individuals' areal curve till the point of 121 nests. The first convex part of the species' areal curve appears to correspond with the number of the species having some relation to the nest. The second linear part corresponds to the species occasionally penetraiting the nests from the surrounding habitats and represented mostly by agricultural pests or by various migraiting individuals. On the basis of the fact that the number of such species in the surrounding habitats must be limited, the second part of species areal curve should be viewed upon as a start of a second convexity, which will lay under the individuals' areal curve. Consequently the number of 90 nests

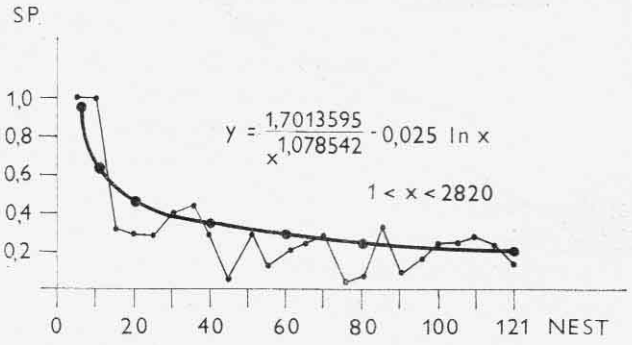


Diagr. 1. Species' and individuals' areal curve and the model of species' areal curve in a more extensive material

of *Delichon urbica* appears to be sufficient for exact characteristics of species' spectrum of the Coleoptera in the nests of *Delichon urbica*. The same conclusion is valid if the mean increase in individual and species number per nest is analysed (Diagr. 2, 3). It is obvious from diagrams 1—3 that a large number of species registered in the nests of *Delichon urbica* must be expected, if additional material could be examined. It is possible to check their probable



Diagr. 2. Mean increase of individuals' number per nest and its linear model



Diagr. 3. Mean increase of species' number per nest and its exponential model

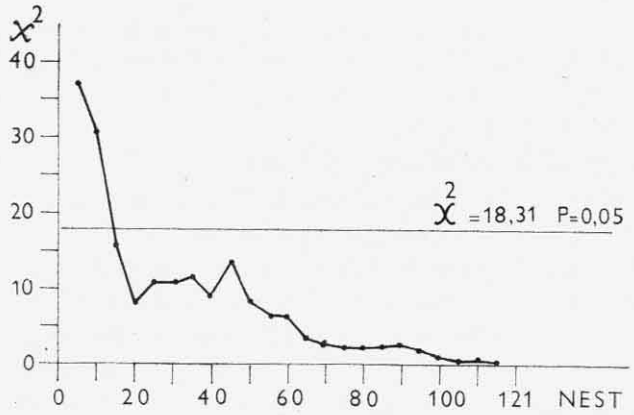
number on the basis of the number of nests studied by the integration of the formula of mean species number increase per nest presented in the diagram 3. However such "new" findings have no essential importance for the knowledge of nidobiology of *Delichon urbica*.

For the ecological analysis of the nest-inhabiting Coleoptera the mutual ratio of dominant species is important. As seen from diagram 4, the mutual ratio of dominant and subdominant species obtained in 15 and more nests does not differ signifficantly from the mutual ratio obtained from the total of 121 nests studied. The mutual ratio obtained in 60 and more nests is practicaly identical with the ratio obtained in 121 nests. Considering the facts, that in this calculation both positive and negative nests from the whole year were included and that nests highly positive as for Coleoptera are concentrated in a relatively short summer period (Diagr. 6 and 7), the lower mean number of 10 nests collected monthly should be sufficient and significant for the study of the population dynamics of Coleoptera in the nests of *Delichon urbica*.

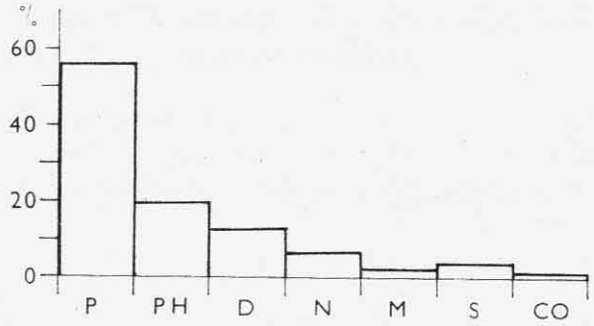
TROPHICAL RELATIONS OF THE COLEOPTERA IN THE NESTS OF DELICHON URBICA

Seven trophical groups of Coleoptera were registered in the material studied, predator (56 %), phytophagous (19 %), detritophagous (13 %), necrophagous (6 %), mycetophagous (2 %), saprophagous (3,5 %) and coprophagous (0.5 %) forms.

The predators were represented by three species of the family *Staphylinidae*, and by three species of the family *Coccinellidae*. Their relation to the nests are very loose. The species *Tachyporus hypnorum, Tachyporus obtusus* and *Tachyporus solutus* are typical for the soil surface fauna in the field or meadow ecosystems in Central Europe (Skuhravý, Novák, Starý, 1959). As patent from diagrams 6 and 7 they concentrate in the nests with cumulated organical material, and they hibernate there. It showes that thay find food in the nests but their relation to any other Arthropods is very loose as documented by very low and variable indices of association. Any kind of predator preference of flies larvae, as observed in the nests of *Riparia riparia* (Šustek, Jurík, 1980) or preference of small mites, as in *Passer domesticus* (Jurík, Šustek, 1977), was not registered. The species *Propylaea quattuordecimpunctata, Adalia bipunctata* and *Coccinella septempunctata* are predominantly aphidophagous and psyllidophagous. In a more limited scale they feed on other insects, too. All three species are euconstant and dominant components of cereal, potato or sugar-beet fields ecosystems in Central Europe (Hodek, 1973; Klausnitzer, 1966).

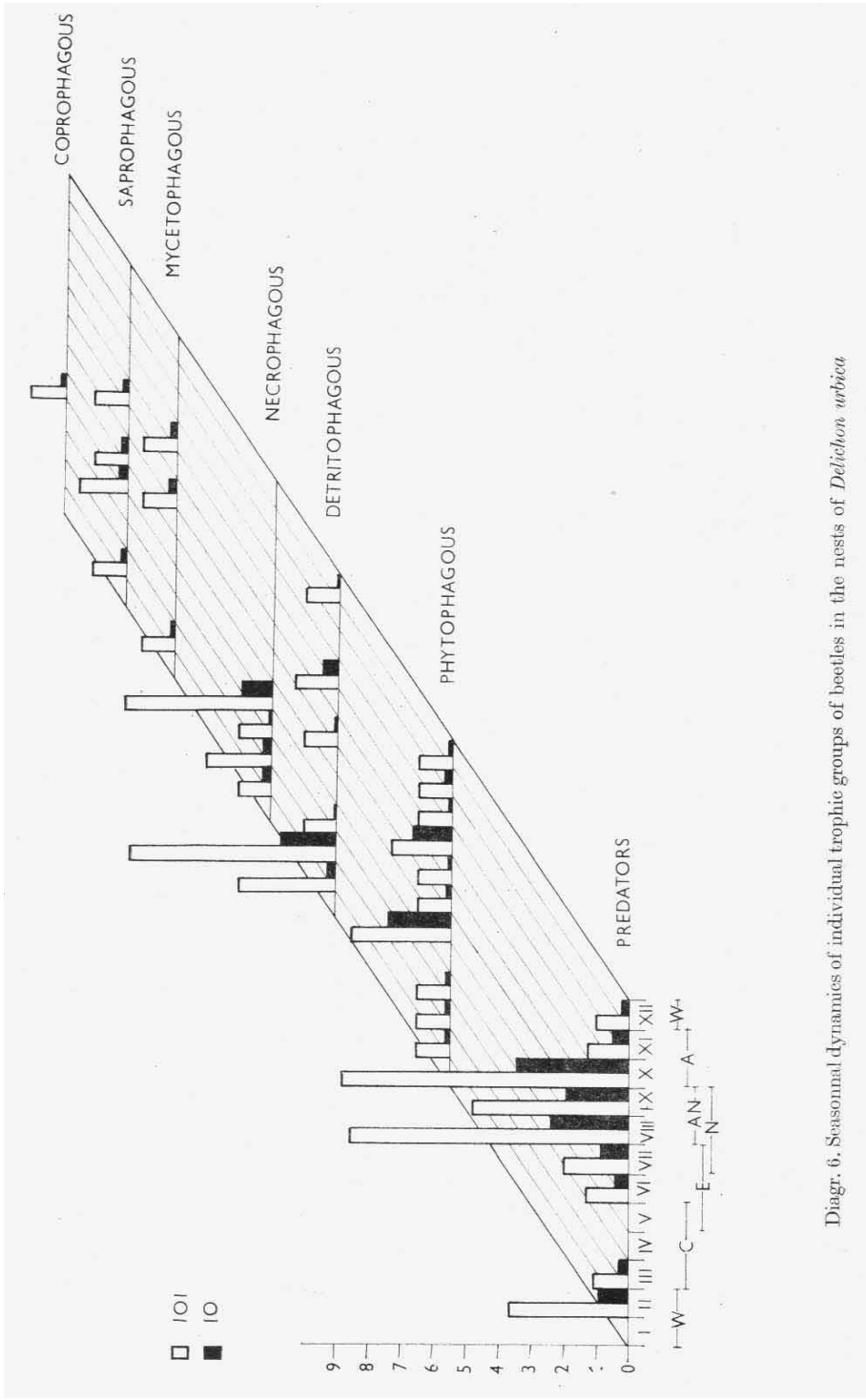


Diagr. 4. Values of chi-square obtained by testing the ration of dominant and subdominant species of beetles in cumulative cath against that present in 121 nests of *Delichon urbica*

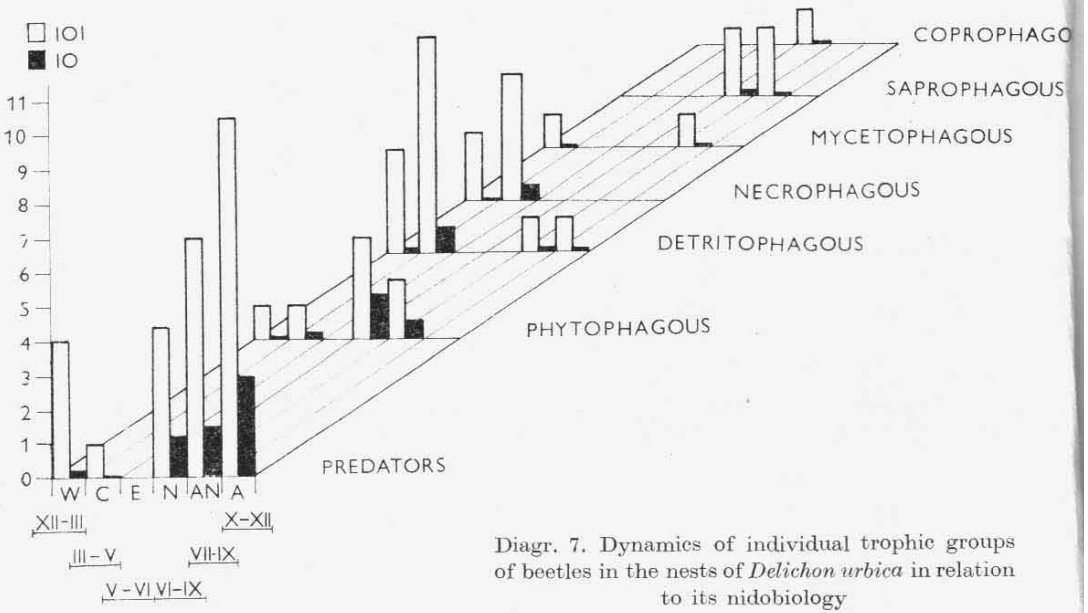


Diagr. 5. Representation of individual trophic groups of beetles in the nests of *Delichon urbica* (P — predators, PH — phytophagous forms, D — detritophagous forms, N — necrophagous forms, M — mycetophagous forms, S — saprophagous forms, CO — coprophagous forms)

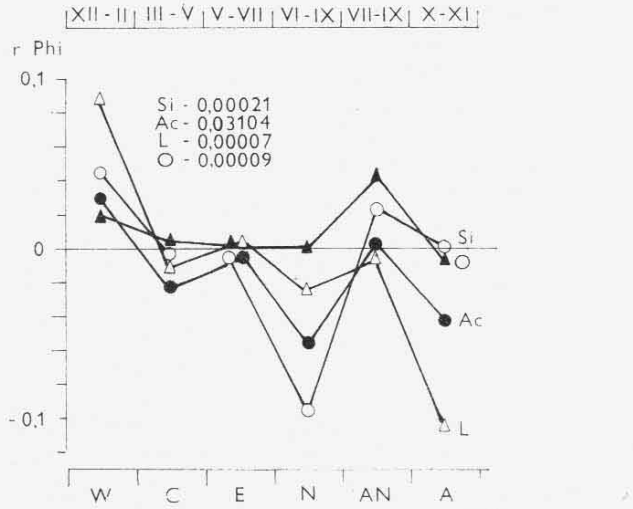
The phytophagous species include six species of *Chrysomelidae,* three species of *Curculionidae,* two species of *Nitidulidae,* one species of *Bruchidae, Anobiidae, Phalacridae* and *Carabidae* (Tab. 1, 2). All phytophagous species in the nests of *Delichon urbica* are current agricultural pests or indifferent species inhabiting the ecosystems of cultural steppe. Their occurrence is purely occasional in the nests of *Delichon urbica* due to their bionomy, and due to the individual occurrence indicated by large differences between I0 and I0I values (Diagr. 6 and 7).



Diagr. 6. Seasonal dynamics of individual trophic groups of beetles in the nests of *Delichon urbica*



Diagr. 7. Dynamics of individual trophic groups of beetles in the nests of *Delichon urbica* in relation to its nidobiology



Diagr. 8. Variation of Phi-association coeficient of predators and other Arthropods in the nests of *Delichon urbica* in relation to its nidobiology and values of this coeficient in the whole material (Si — Siphonaptera, Ac — Acarina, L — larvae (mostly of flies), O — other Arthropods)

Tab. 2. Review of Coleoptera in individual groups of the nests (+ not separated by Hornychová in the original material)

Group of nests	Trophic relations	W	C+	E	N	AN	A	Summ
Number of nests		31	25	6	18	24	18	122
Number of positive nests		11	13	0	10	17	6	57
T. obtusus	Ca	5			8	8	26	47
T. hypnorum	Ca				8	18	15	41
M. aeneus	F				16	4	1	21
P. clavipes	D	1	14			1	1	17
P. quattuordecimpunctata	Ca				4	6	3	13
T. solutus	Ca		1		1	2	8	12
A. pimpinelae	N	2	8					10
P. fur	D	5	4					9
S. testaceus	P	1			1	3	1	6
A. bipunctata	Ca	3				1	1	5
P. caesus	S				3	2		5
C. denticulatus	P				2			2
A. polonicus	N		2					2
C. acutangulus	M	1						1
K. bispulatus	P		1					1
B. pisorum	P		1					1
D. lardarius	N		1					1
P. raptor	D		1					1
A. euphorbiae	P		1					1
P. undulata	P				1			1
A. fimetarius	Sa				1			1
C. septempunctata	Ca				1			1
C. terminantus	S				1			1
Aphtona sp.	P				1			1
P. chrysocephallus	P				1			1
Ernobius sp.	P					1		1
E. minutus	M					1		1
C. pubescens	M					1		1
A. diaperinus	O					1		1
P. cuculata	P				1			1
L. lichenis	P				1			1
A. linearis	P					1		1
C. villosus	M					1		1
P. variegatus	D					1		1
A. aenea	P					1		1
S. hispidulus	P						1	1
C. maculaalba	P	1						1
Total		19	33		51	53	57	213
Numbers of species		8	10	0	16	17	9	37

Abbreviations as in Tab. 1

Detritophagous species are represented by four forms of the family *Ptinidae* and by one species of the family *Tenebrionidae*. All species of the genus *Ptinus* have a rather wide food spectre. They feed on dry or a little decaying substrates

of plant and animal origin. They occur frequently in the nests of a majority of birds (Nordberg, 1936; Hicks, 1962; Jurík, Šustek, 1977) finding there favourable conditions but they are no specific nidicolous forms. The Tenebrionide *Alphitobius diaperinus* has the same food spectre as the Ptinids, but it prefers damper substrates. All species mentioned are important story pests. This fact increases the probability of their penetraiting the nests wich are mostly situated on the buildings.

The necrophagous forms are represented only by three species of the family *Dermestidae*. Their larvae feed on several dry remainders e. g. keratin etc. The imagines occur most frequently on the flowers in May and June. The annual dynamics (Diagr. 6) indicates that only their larvae develope in the nests. The imagines hibernate there and they leave the nests in spring. This phenomenon was observed in the nests of *Passer domesticus*, too (Jurík, Šustek, 1977). Similarly as detritophagous, the necrophagous forms of the material studied occur frequently in the nests of other birds. However the birds' nests are not the only ecological niche occupied. They should not be treated as specific for the nests of *Delichon urbica* and of other birds as well.

The mycetophagous forms are represented by 2 species of the family *Cryptophagidae* and by three species of the family *Lathridiidae* (Tab. 1, 2). All these species are represented only individually in the nests due to the hidden position of nests under the roof margines inhibiting the development of mould in the nests. Similarly as in the above cases, the mycetophagous species registered occur frequently in a large spectre of ecological niches. They are no specific nidicolous forms.

The saprophagous forms are represented by Scarabaeide *Pleurophorus caesus* and by the Hydrophilide *Cercyon terminatus*. *Pleurophorus caesus* is a soil inhabiting saprophagous form rather frequent in the fields surrouding Bratislava (Šustek, unpublished). Its occurrence is apparently occasional, similarly as in the species of *Tachyporus* and in the Coccinelids. *Cercyon terminatus* lives in decaying plant substances immediately in water or in very humid habitats. Its occurrence is occasional.

The coprophagous forms are represented by a single species — *Aphodius fimetarius*, which is a typical inhabitant of cattle excrements and manure. Its development in the excrements of *Delichon urbica* is impossible.

THE DYNAMICS OF OCCURRENCE IN INDIVIDUAL TROPHIC GROUPS

Limited numbers of predators appeared in the nests during February and March. Their occurrence has a decreasing tendency. In April and May the predators were absent from the nests. The occurrence continues during June.

The values of I0 and I0I increase and they culminate in August. The second culmination of predators appears in October after a depression during September. In November and December the occurrence decreases suddenly (Diagr. 6). The dynamics in the relation to the nidobiology of *Delichon urbica* shows that the predators concentrate in the nests with cumulated organic material. The

Tab. 3. Seasonal dynamics of Coleoptera in the nests of *D. urbica*

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Number of nests	7	12	11	9	9	10	10	15	10	10	8	11	122
Number of positive nests	1	6	10	5	0	5	5	9	8	3	2	3	57
T. obtusus		4					4	11	3	24		1	47
T. hypnorum		4	1			2	3	14	8	8	1		47
M. aeneus						13		1	6	1			21
P. clavipes			15						1			1	17
P. quattuordecim-punctata						1	1	6	2	1	2		13
T. solutus			1					3	6	2			12
A. pimpinelae	1	2		7									10
P. fur		3	3	1					2				9
S. testaceus		1				1	1		2		1		6
A. bipunctata		3					1				1		5
P. caesus		1				2	1		1				5
C. denticulatus						2							2
A. polonicus				2									1
C. acutangulus		1											1
K. bispulatus			1										1
B. pisorum			1										1
P. lardarius			1										1
P. raptor			1										1
A. euphorbiae				1									1
P. undulata						1							1
A. fimetarius						1							1
C. septempunctata						1							1
C. terminatus						1							1
Aphtona sp.						1							1
P. chrysocephallus						1							1
Ernobius sp.							1						1
E. minutus							1						1
C. pubescens							1						1
A. diaperinus							1						1
P. cuculata									1				1
L. lichenis									1				1
A. linearis									1				1
C. villosus									1				1
P. variegatus									1				1
A. aenea									1				1
S. hispidulus											1		1
C. maculaalba												1	1
Total	1	19	24	10	0	27	15	35	34	36	6	3	213
Number of species	1	8	8	4	0	12	10	5	15	5	5	3	37

absence of predators in the nests with eggs and the low values of I0 and I0I in the nests during their building (Probably confused last year nests, see the Methods) indicate that the predators hibernate in the nests in limited number leaving them in spring. When compared with the dynamics of predators in the nests of *Passer domesticus* and *Riparia riparia* (Juríik, Šustek, 1977; Šustek, Juríik, 1980) the culmination of predators is rather redarded into late summer and autumn. Large differences in the culmination of *Tachyporus* sp. as dominant forms of this trophical group in free nature (ˢkuhravý, Novák, Starý, 1959; Obrtel, 1968) and in the nests of *Delichon urbica* support the conclusion that they enter the nests occasionally and thay stay there for a longer period. As the matter of fact the dynamics predators in the nests studied is represented by their cumulative numbers. The same is obvious from a comparison of their dynamics with the dynamics of other Arthropods in the nests. No kind of their mutual coincidence is reliable (cf. Hornychová, 1974).

The phytophagous forms occur in the nests in low numbers during the whole year. The two observable peaks of their dynamics correspond to the dynamics of the most numerous species *Meligethes aeneus* (Tab. 3) in the surroundings of the nests. The second peak corresponds to a new generation of *Meligethes aeneus*. The concentration of phytophagous forms in nests with nestlings and in nests abandoned by nestlings is coherent with the timing of these groups of nests (Diagr. 6 and 7).

The necrophagous and detritophagous forms appear in the nests, in large numbers, from February til May. The detritophagous forms occur individually also during following months (Diagr. 6). As seen from diagr. 7 the groups concentrate in the winter nests, where they finish their larval development during late summer, and where they hibernate.

The dynamics of the remaining three groups (myceto-, sapro- and necrophagous) is seen from table 3 and from diagrams 6 and 7. The numbers of individuals belonging to these groups are to limited as to enable us to evaluate their dynamics and its adequate interpretation.

DISCUSSION

From the above analyses it is obvious that the nests of *Delichon urbica* have no fauna to be considered specific for this bird. There is a number of species occurring frequently in the nests of other birds and in a wide selection of other ecological niches as well. The species spectre is largely influenced by the surrounding habitats. The high degree of similarity of species spectre in nests studied with the spectres of fields leads to the conclusion that in a prevalently forest landscape quite different species spectres in the nests

can be expected. Although the trophical relations of beetles in the nests of *Delichon urbica* are similar to relations of beetles in nests of many other birds, the existing differences in the dynamics and the abundance of the individual trophic groups (from approximately 100 nests 1 400 individuals of beetles were obtained in *Passer domesticus*, 2 000 individuals in *Riparia riparia*, contrary to 220 beetles in *Delichon urbica*) in view of absence of any specifically nidicolous form, the question arises if the close relation of *Delichon urbica* to man and the specific situation of its nests are responsible for their fauna. This question is the more interesting that there do not exist several very abundant specific parasites of *Delichon urbica*. This question must remain open as long as more extensive material will be available.

CONCLUSIONS

1. A total of 218 beetles belonging to 40 species were collected in 125 nests of *Delichon urbica*. Large number of species was newly discearned in its nests. The occurrence of these species has no relation to the nidobiology of *Delichon urbica*. Rather large number of similarly "new" species can be expected if extensive materials were available. The number of expected species depending from number of nests can be checked by the integration of formula presented in this paper (Diagr. 3).

2. The number of 60 nests of *Delichon urbica* is sufficient for characterizing the species' spectre in its nests. The number of 15 nests is sufficient to estimate the mutual ratio of dominant and subdominant species. This conclusion appears to be valid only in an agricultural landscape due to the close relation of species spectre of beetles in the nests to its surrounding.

3. The species spectre of beetles in the nests of *Delichon urbica* consists of species inhabiting surrounding habitats. The beetles detected in nests in the frame of our material have rather loose relations to the nests of *Delichon urbica* and to other arthropods inhabiting them. The nests of *Delichon urbica* collected in the agricultural landscape from the buildings contain no specific beetle fauna.

4. Only the predators, the detritophagous and necrophagous forms are partly confined to the nests of *Delichon urbica*. These relations are rather loose. No arthropod group in the nests is prefered by predators.

5. The occurrence of the majority of beetles in the nests of *Delichon urbica* peaks during late summer and during autumn. There is a considerable delay of occurrence maxima comparing the nests of other birds. The presence of beetles in the nests is due to the cumulation of organic material in the nests, and partly due to their occurrence in the surrounding habitats.

majúcich nejaký vzťah k hniezdu, treba vyšetriť asi 90 hniezd a k zachyteniu dostatočne presných pomerov dominantných a subdominantných druhov najmenej 20 hniezd. Vzhľadom na vysoký stupeň ovplyvnenia fauny chrobákov v hniezdach okolitými biocenózami treba platnosť uvedených konštatovaní obmedziť len na ten istý typ krajiny, v akom bol získaný študovaný materiál. Z toho istého dôvodu je pre dokonalé spoznanie fauny chrobákov v hniezdach belorítky obyčajnej v strednej Európe potrebné študovať ďalší materiál z iných typov prostredia.

Authors' addresses: Ing. Zbyšek Šustek, Ústav experimentálnej biológie a ekológie CBEV SAV, Obrancov mieru 3, 885 34 Bratislava, Czechoslovakia. RNDr. Daša Hornychová, Ústredná správa múzeí a galérií, Lodná 2, 815 77 Bratislava, Czechoslovakia

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