

Arthropods in the nests of penduline tit (*Remiz pendulinus*)

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The paper deals with the composition of the arthropods fauna in 135 nests of Penduline Tit (*Remiz pendulinus*) collected in 21 sites in Slovakia during 1989-1992. In these nests the authors found 14 species of spiders, one species of pseudoscorpions, 38 species of mesostigmatic mites, one species of tick, 21 species of beetles, 14 species of flies and three species of fleas. The ecological and especially the trophical relations of the representatives of individual arthropod groups are studied. The differences between the arthropod assemblages in the nests of Penduline Tit and other birds are characterized.

Key words: Arthropods, mesostigmatic mites, ticks, spiders, pseudoscorpions, beetles, flies, fleas, *Remiz pendulinus*, bird nests, Slovakia.

The construction, form and attachment mode of the Penduline Tit (*Remiz pendulinus*) nests differ considerably from the nests of other European birds. Its nests are pouch-like shaped with a tubular entry, their walls consist of the fine plume of the poplar or weed seeds. The nests are usually hanged on the weak terminal twigs on the trees growing along the rivers or around water basins. The knowledge of the arthropods in the Penduline Tit nests is poor. Some data occur only sporadically in the papers of HICKS (1959), PEUS (1960), GAJDOŠ et al. (1991) and AMBROS et al. (1992). The striking differences between the nests of Penduline Tit and of other Passeriformes may result also in considerable differences between the arthropod fauna in the nests. The aim of this paper is to describe the structure of the arthropod assemblages in the Penduline Tit nests and to characterize generally the main differences between them and the arthropod assemblages in the nests of other birds.

Material and methods

Altogether we have collected 135 nests of Penduline Tit from 21 sites in three orographical complexes in South Slovakia (Fig. 1). The nests were collected in the years 1989-1992 in different time after the nidification and aban-

doning the nests. The nests were transported in the plastic bags. The arthropods were extracted from the nests immediately after returning from the field by means of the Tullgren's apparatus.

Locality specification

- I. Borská nížina lowland (code the mapping grid of the Databank of fauna of Slovakia 770)
 - wet meadow crossed by a brook bordered by willows and poplars: Závod, State Nature Reserve Abród (7468), 12 - nests,
 - within - dike space in the floodplain of the river Morava: Malé Leváre (7467) - 8 nests, Gajary (7467) - 2 nests, Vysoká pri Morave (7667) - 2 nests, Zohor (7667) - 3 nests, Devínske jazero (7767) - 2 nests,
 - fish-ponds surrounded by poplars and willows: Jakubov (7567) - 12 nests,
- II. Trnavská pahorkatina collines (801)
 - floodplain of the river Váh: Horná Streda (7373),
- III. Podunajská rovina plain (790)
 - dead arms of the Danube out of the within-dike area: Ivanka pri Dunaji (7869) - 1 nest, Rohovce (7970), 4 - nests, Kútники (8071) - 1 nest, Medvedov (8271) - 1 nest,
 - the arm of the Danube in the within-dike area: Dobrohošť (8070) - 10 nests, Šufany (8070) - 8 nests, Bodíky (8070) - 14 nests, Trstená na Ostrove (8071) - 1 nest,

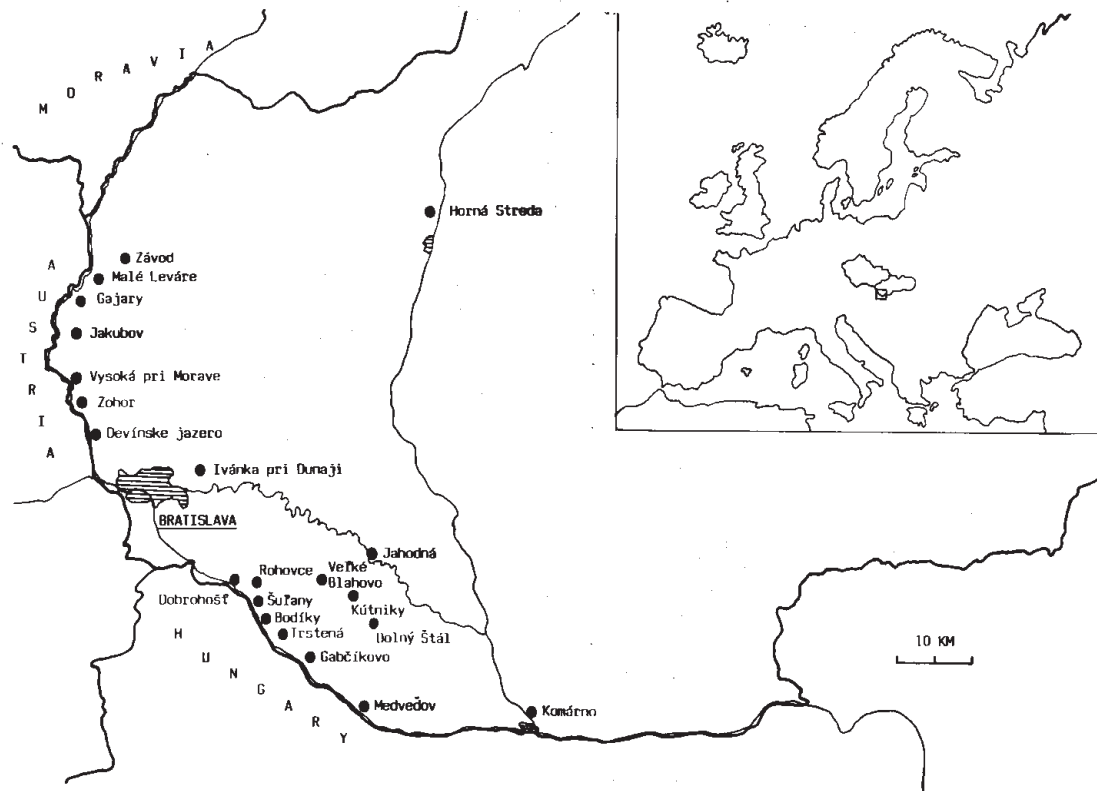


Fig. 1. Location of the sampling sites of the nests of Penduline Tit in South-West Slovakia.

- fish-ponds surrounded by willows and poplars: Veľké Blahovo (7991) - 19 nests, Dolný Štál (8072) - 24 nests
- surroundings of a dead arm and of the Gazdovské rybníky fish-ponds out of the dikes: Gabčíkovo (8171) - 8 nests,
- dead arm of the Little Danube: Jahodná (7972) - 1 nest,
- a floodplain forest along the Váh river: Komárno, State Nature Reserve Apáľi - 1 nest.

In order to economize the place in the tables 1 - 5 we have omitted those localities, where the respective arthropod group did not occur. Therefore the totals of the examined nests given in each table differ each from other.

Results and discussion

I. Spiders

Altogether 49 individuals of 14 spider species were found in the nests of Penduline Tit (Tab. 1), the juvenile individuals of six species could be identified only up to the generic level.

The spiders were found on nine sites, the majority of species and individuals comes from the nests from Veľké Blahovo. It is partly due to the high number of

nests collected on this locality. In other localities the spiders were represented in the nests only sporadically. In 1992 we even did not find any spiders in all localities. From the total of 135 nests, the spiders were found only in 21 nests.

The spiders occurring in the Penduline Tit nests can be classified into three following ecological groups:

- hygrophilous or hemihygrophilous species preferring wet sites: *Donacorchara speciosa*, *Gongylidium rufipes*, *Porrhomma pygmaeum*, *Dyctina uncinata*, *Araneus marmoreus*,
- everywhere frequent species without any specific habitat preference: *Philodromus caespitum*, *Salticus zebraneus*,
- the species preferring the hemixerophilous habitats: *Philodromus marginatus*.

The hygrophilous and hemihygrophilous species predominated in the Penduline Tit nests. They penetrate the nests from the surrounding wet habitats, where they occur frequently. The spider *Enoplognatha ovata* found in a Penduline Tit nest by GAJDOŠ et al. (1991) was not found in our material. A relatively abundant spider living in the bird nests is *Salticus*

Table 1. Abundance of spiders and pseudoscorpions in the Penduline Tit nests

Years	1989			1990							1991		Total	
	Locality			Závod	Jakubov	Dobrohošť	Rohovce	Velké Blahovo	Bodfky	Jahodná	Dolný Štál	Velké Blahovo		Dolný Štál
Ordo	Dobrohošť	Velké Blahovo	Kúttniky											
Species														
Araneae														
<i>Donacochara speciosa</i> (THOR.)												2		2
<i>Gongyidium rufipes</i> (L.)		1							1					2
<i>Porrhoma pygmaeum</i> (BL.)	1													1
<i>Araneus marmoreus</i> CL.	1	1			1									3
<i>Argenna</i> sp.	2													2
<i>Dictyna uncinata</i> THOR.								1						1
<i>Dictyna</i> sp.		2												2
<i>Clubiona</i> sp.		10	1									1		12
<i>Haplodrassus</i> sp.		1												1
<i>Philodromus caespitum</i> (WALCK.)						1								1
<i>Philodromus marginatus</i> (CL.)		1												1
<i>Xysticus</i> sp.		1				1								1
<i>Salticus zebraneus</i> (C.L.K.)		1					1			1				2
<i>Salticus zebraneus</i>	1			4	1	6					2			16
Total	5	18	1	4	1	8	1	1	1	1	2	3	3	49
Pseudoscorpinoidea														
<i>Dactylochelifer latreillei</i> (LEACH)								1						1
Nests number in each locality	7	10	1	6	5	2	3	6	5	1	4	2	6	58
Positive nests number	3	5	1	1	1	2	1	2	1	1	1	1	1	21

zebraneus. GAJDOŠ et al. (1991) found it in the nests of more bird species. The spiders *Porrhoma pygmaeus* and *Dictyna uncinata* occurring in our material were found by GEMYCKI et al. (1985) in the nests of *Turdus philomelos* and *T. merula* in Belarussia.

II. Pseudoscorpions

In our material we have found only one male of the pseudoscorpion *Dactylochelifer latreillei* (Tab. 1).

This species occurs in Central and South Europe in floodplains, under bark, in litter and in bird nests (BEIER, 1963). NORDBERG (1936) found this species in Finland in the nests of *Parus montanus*, *Delichon urbica*, *Hirundo rustica* and *Collumba oenas*. In Slovakia, KRUMPÁL and CYPRICH (1988) observed a high affinity of *Dactylochelifer latreillei* to differently situated nests. Their observation is confirmed also by its finding in the nests of Penduline Tit.

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<i>Argenna</i> sp.	2													2
<i>Dictyna uncinata</i> THOR.								1						1
<i>Dictyna</i> sp.		2												2
<i>Clubiona</i> sp.		10	1									1		12
<i>Haplodrassus</i> sp.		1												1
<i>Philodromus caespitum</i> (WALCK.)						1								1
<i>Philodromus marginatus</i> (CL.)		1												1
<i>Xysticus</i> sp.		1				1								1
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III. Mesostigmatic mites

From the Penduline Tit nests we obtained 58 598 individuals of 38 mesostigmatic mite species (Tab. 2). These species can be classified, on the base of their trophic and topic relations to the hosts and their nest, into following nine ecological groups.

- 1) obligatory haematophags of birds: *Dermanyssus hirundinis*, *D. gallinae* and *Ornithonyssus sylviarum*,
- 2) facultative haematophags of birds: *Androlaelaps casalis*.
- 3) facultative haematophags of mammals: *Androlaelaps fahrenheitzi*,
- 4) nidicolous predators: *Hypoaspis sardoa* and *Cyrtolaelaps chiropterae*,
- 5) plantnicolous predators: *Amblyseius umbraticus*, *A. reductus*, *A. andersoni*, *A. papperi*, *A. bicaudus*, *Anthoseius baker*, *A. rhenanus*, *A. richteri*, *Typhlodromus setubalis* and *Amblyseiella* sp.,
- 6) soil predators: *Blattisocius tarsalis*, *Paragarmania dentritica*, *Ameroseius corbiculus*, *A. lidiae*, *Proctolaelaps pygmaeus*, *Neojordensia laevis*, *Dendrolaelaps*, sp., *Holoparasitus excipuliger*, *Pergamasus septentrionalis* and *P. similis*,
- 7) coprophilous predators: *Macrocheles merdarius*, *M. glaber*, *M. muscaedomesticae*, *Holalaelaps sexclavatus*, *Dendrolaelaps punctum*, *Parasitus fimetorum* and *P. lunaris*,
- 8) saprophags: *Trichouropoda ovalis* and *Dinichus carinatus*.
- 9) coprophags: *Scarabaspis inexpectatus* and *Alliphis halleri*.

The obligatory haematophags of birds *D. hirundinis* and *O. sylviarum* were the most abundant species.

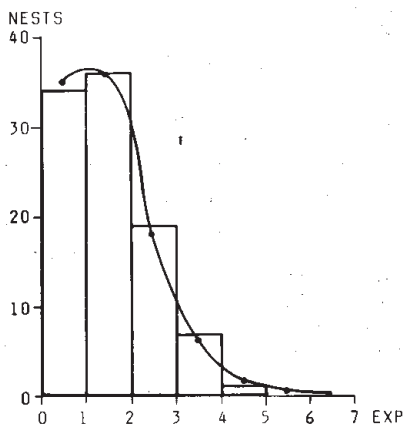


Fig. 2. Distribution of individuals numbers of *Dermanyssus hirundinis* in the Penduline Tit nests (ordinate – number of nests, abscisa – number of individuals, EXP – exponents of 12, parameters of the Poisson's distribution: mean=1.02, variance=0.93, $\chi^2=2.74$).

Together they represented 99.7 % of all mites and only *D. hirundinis* itself represented 92.4 % (54,155 indiv.) of all mites. In some nests *D. hirundinis* reached an extremely high abundance (e. g. 21,441 ind. - Jakubov 23. 8. 1990; 5,952 ind. - Šufany, 3. 9. 1991; 2,519 ind. - Dolný Štál, 26. 7. 1991; 2,432 ind. - Bodíky, 2. 7. 1990) and caused a strong infestation of the nests and nesting birds. The average number of mites in all nests amounted 401.3 while in the positive nests 531.2. These numbers of mites in the individual positive nests have the Poisson's distribution, if the numbers of mites in the nest are classified in to a logarithmic scale. The best fitting of the observed and theoretical values are obtained if 12 is taken as the basis of the logarithmus (Fig. 2). The same results were obtained also if the Poisson's distribution was fitted separately for the material from the Záhorská nížina lowland and Podunajská rovina plain. So, in 77 % of the nests the individuals number did not exceed 144 individuals of *D. hirundinis*.

The second very abundant species, *O. sylviarum* (4,240 indiv.) reached in some nests an extremely high abundance (3,652 indiv. - Vysoká pri Morave, 27. 6. 1991). The average individuals number of *O. sylviarum* in all nests amounted 31.5. while in the positive nests 94.4. The mite *D. gallinae* occurred in the nests very rarely - only one individual in whole material.

To verify the surviving of the obligatory haematophags in the nests until the next nidification period we took 13 nests in Oktober - April. In five of them we found the haematophagous mites (*D. hirundinis* 16 indiv. and *O. sylviarum* 7 indiv. - Zohor, 17. 12. 1991; *D. hirundinis* - 142 indiv.; 4. 3. 1992 and 323 indiv. 8. 4. 1992 - Dolný Štál; 595 indiv. - Malé Leváre, 16.3. 1992, - Medveďov, 8. 4. 1992 and 1 indiv. - *O. sylviarum*). The mites were represented mostly by the protonymphs (44.2 %) and deutonymphs (31.9 %), the adults (3.7 % males, 20.2 % females, among them 2.3 % of the ovigeric females) created only a minor part of the populations. It supports the hypothesis that a part of the obligatory haematophages overwinters in the nests (especially the immature stages).

The obligatory haematophags *D. hirundinis* and *O. sylviarum* have evidently a highly positive relation to the nests of Penduline Tit, they migrate actively into the nests and find there suitable life conditions. They are transported into the nests also passively on the material taken by the birds from the disassembled last-year nests or on their bodies.

The population size and structure of *D. hirundinis* and *O. sylviarum* varied in both orographical complexes and in individual years as follows (Fig. 3).

On the localities in the Podunajská rovina plain the number of *D. hirundinis* increased from 1989 to 1991, except the ovigeric females absent in the nests collec-

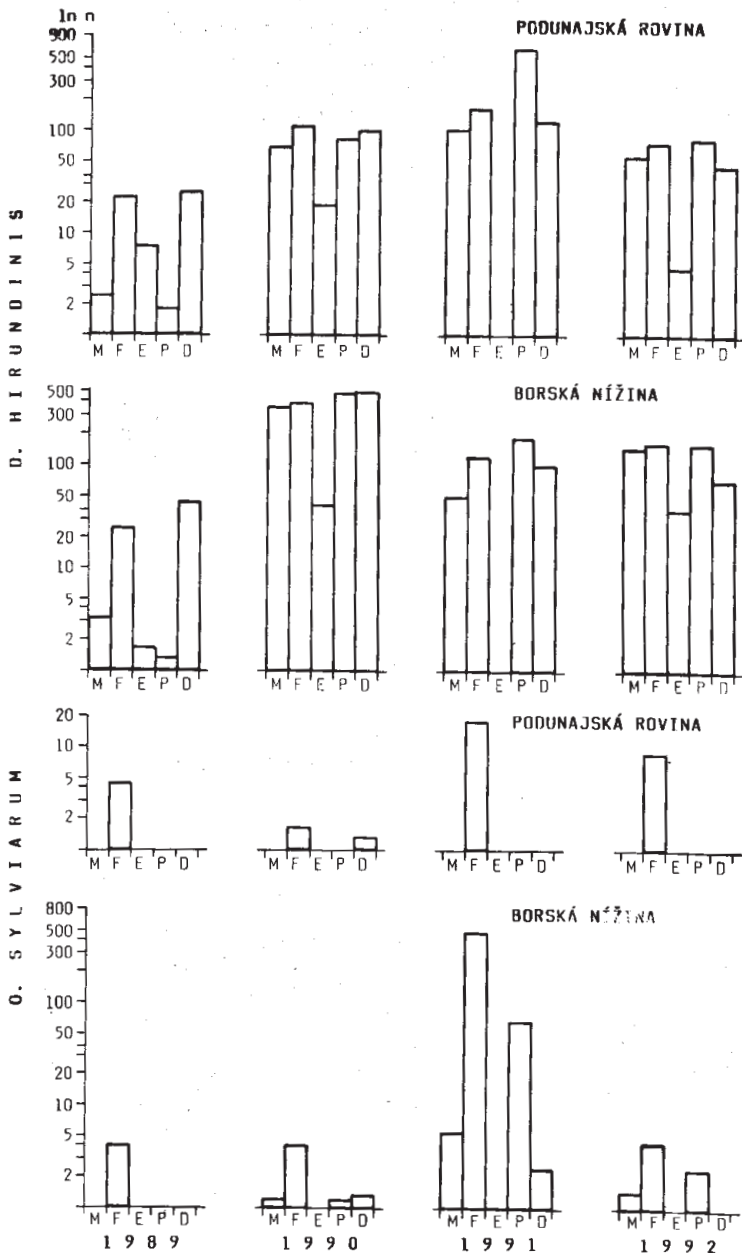


Fig.3. Population structure of two dominant parasitic mites (*D. hirundinis* and *O. sylviarum*) in the nests of Penduline Tit the Podunajská rovina plain and Borská nížina lowland (ordinate – natural logarithm of individual number, abscisa – developmental stages, M – males, F – females, E – females with eggs, P – protonymphs, D – deutonymphs).

ted in 1991. In 1992 the individuals number of mites decreased in spite of the highest positivity of the nests (21 nests). In 1989 the mites occurred in 16 nests and in 1991 in 13 nests. The proportion of the adult males and females and of the immature stages was approximately the same during the investigations, except of

1991 when the proportion of the immature stages was higher considerably.

The species *O. sylviarum* was found in the Podunajská rovina plain only in a small number of nests (7; 3; 10; 9) in individual years. In average it was represented only by a low number of females in all years. In 1990 we found also the deutonymphs.

In the Borská nížina lowland the highest numbers of individuals of *D. hirundinis* were found in 1991 (11 positive nests) and the lowest in 1989 (3 positive nests). In 1991 (5 positive nests) the individuals numbers of all developmental stages decreased and the females with eggs were missing at all. In 1992 (11 positive nests) the average number of males increased and their proportion with the females became more balanced than in 1991. Also in Borská nížina lowland we observed a well-balanced average number of the adults and of the immature stages.

The average number of females and protonymphs of *O. sylviarum* was very high in 1991 (7 positive nests), in 1989 we found only a very low number of females, while in 1990 (5 positive nests) and in 1992 (2 positive nests) we found in a small number all developmental stages.

Other mite species found in the nests form two groups. The first group consists of the species, which prefer other types of niches and occur in the nests only occasionally, but which are able to survive or reproduce there. The second group includes the species, which are not able to survive longer in the nests stay there only temporarily. The relation of the mites to the nests depends on the the degree

in which the nests construction, material and position create similar conditions as in the proper habitats of individual mite species.

The coprophilous mites belong probably into the first group. They are the only group, except the obli-

gatory haematophags, represented in the nests frequently also by the developmental stages. The coprophilous mites (*S. inexpectatus*, *A. halleri*, *M. merdarius*, *M. glaber*, *D. punctum*, *P. fimetorum*, *H. sexclavatus* and *M. muscaedomesticae*) get into the nests probably mostly by means of phoresy on several insects. The soil predators and saprophags get into the nests mostly on the construction material (except the actively migrating species of the genera *Pergamasus* and *Holoparasitus*). The plant inhabiting predators migrate into the nests directly from the twigs or leaves surface.

The species *Dermanyssus hirundinis* and *Ornithonyssus sylviarum* are known to be the obligatory parasites of birds, above all of Passeriformes. The seasonal changes of age structure and population size of *D. hirundinis* in the nests of *Sturnus vulgaris* were studied by BUTENKO (1964). According to his data, the females and deutonymphs predominated during the nidification, while the protonymphs after leaving of the youngs. BORISOVÁ (1972) found that during the presence of the youngs in the nests, the population of *D. hirundinis* consisted mostly of the adult forms among which the females with eggs represented even 94 % of all females. Two weeks after the leaving of the youngs she found all developmental stages in the nests. The number of protonymphs increased gradually. The seasonal changes of the population size of *D. hirundinis* in the nests of *Passer domesticus* studied PHILLIS (1972), who observed the highest number of *D. hirundinis* during hatching of the young. After the abandoning of the nests the population size of *D. hirundinis* decreased on 40 % of their size just after the leaving the nests by the youngs. Our observations about the changes of population structure and size of *D. hirundinis* in the nests of the Penduline Tit after living of the young confirm the data of the cited authors.

IV. Ticks

The only tick species occurring in the Penduline Tit nests was *Ixodes arboricola* (Tab. 2). It is distributed in the palaearctic region and lives as an ectoparasite of birds nesting mostly in the tree hollows. In our material we found four larvae in three nests (2.2 %) in three sites.

The bionomy of *Ixodes arboricola* in Czechoslovakia was studied by ČERNÝ and BALÁT (1961). They found it on 11 host species, viz. *Ficedulla albicollis*, *Parus ater*, *P. coeruleus*, *P. cristatus*, *P. major*, *P. palustris*, *Passer domesticus*, *P. montanus*, *Phoenicurus phoenicurus*, *Sitta europaea*, *Sturnus vulgaris*. All these birds nest in the hollows. FILLIPOVÁ (1977) found *I. arboricola* also in the non hollow-nesting species *Sylvia communis*. SCHILING et al. (1981) found *I. arboricola*, even in a considerable number, also in the

nests of *Falco peregrinus*. However, only in those built in the rock cavities. In the nests in free landscape *I. arboricola* has not been found. HUDDE and WALTER (1988) observed *I. arboricola* in Germany in 12 birds species. All these species were typical hollow-nesting birds, except *Bubo bubo* and *Falco peregrinus*, but also their nests were found in this case in the rock cavities. ČERNÝ (1963) studied reproduction of *I. arboricola* in laboratory conditions. He found that its development (in temperature of 15-20 °C) from the laying eggs to hatching of larvae takes 45-60 days.

Irrespectively of the fact that Penduline Tit is not a hollow-nesting species, the specific construction of its nest might represent a suitable niche for the development of *I. arboricola*. However the small number of individuals of *I. arboricola* found in its nests indicates that such cases will be relative rare.

V. Beetles

Altogether 41 individuals of beetles belonging to 21 species and 16 families were found in the studied nests of Penduline Tit (Tab. 3). The occurrence of beetles in its nests is extremely low when compared with the nests of other bird species (NORDBERG 1938; HICKS 1959, 1962; JURÍK, ŠUSTEK, 1978; ŠUSTEK, JURÍK 1980; ŠUSTEK, HORNÝCHOVÁ, 1983). Among 60 nests the beetles were found only in 22 nests. Also their species composition is very heterogenous. A great part of the beetle species was represented only by one individual. The affinity of the species found in the Penduline Tit nests is very low. Altogether 14 species (63.4 %) may be considered as hospites without any relation to the nests. Their occurrence in the nests is purely occasional and their species composition reflects the composition of the beetle assemblages in the surrounding habitats. The staphylinids *Troglophloeus rivularis*, *Tachinus pallipes*, *Philonthus cephalotes* and the hydrophilid *Cercyon pygmaeus* are typical ripicolous or hygrophilous species. The helodid *Cyphon variabilis* is a frequent species living on the vegetation in wet sites. The lady bird *Coccidula scutellata* is a characteristic species living on the reed. The pythid *Rhinosinus planirostris* leaves in the tree twigs attacked by woodworms (Anobiidae). The garden fleahopper *Longiarsus hycopi* in an oligophag living on *Mentha aquatica*. The weevil *Sitona crinita* is an oligophag on willows.

Seven species (31.8 %), viz. *Siegobium paniceum*, *Dermestes lardarius*, *Ptinus fur*, *Sericoderus lateralis* and all lathridiids find in general a suitable, but not exclusive, food basis in the bird nests and occur there frequently. However, in no case they can be taken as typical nidicolous species. The fungivorous or detritophagous species predominate in this group.

There were found only one obligatory nidicolous species - the histereid *Gnathoncus buyssoni*, repre-

Table 3. Abundance of beetles in the Penduline Tit nests

Species	1989		1990						1991				1992				Total	
	Locality		Malé Leváre	Jakubov	Ivanka pri Dunaji	Dobrohošť	Veľké Blahovo	Bodfky	Jahodná	Závod	Výsoká pri Morave	Šulany	Veľké Blahovo	Dolný Štál	Závod	Malé Leváre		Jakubov
<i>Cercyon pygmaeus</i> ILLIG.									1									1
<i>Gnathoncus buyssoni</i> AUZAT					2													2
<i>Troglophloeus rivularis</i> MOTSCH.	1																	1
<i>Philonthus cephalotes</i> (GRAV.)				1														1
<i>Tachinus pallipes</i> (GRAV.)	1					1												2
<i>Aphodius nitidulus</i> (FABR.)									1									1
<i>Stegobium paniceum</i> (L.)															1			1
<i>Ptinus fur</i> (L.)		1																1
<i>Dermestes lardarius</i> L.																	1	1
<i>Sericoderus lateralis</i> (GYLL.)							3				3							6
<i>Epurea limbata</i> (SAHLB.)						1												1
<i>Enicmus histrio</i> (GYLL.)														1				1
<i>Corticaria linearis</i> (PAYK.)		1												1	1	1		4
<i>Corticaria gibbosa</i> (HERBST)	1			1		2			1	1		1				2		9
<i>Coccidula scutellata</i> (HERBST)								1										1
<i>Cyphon variabilis</i> THUN BG.	1													1		1		3
<i>Adrastus rachifer</i> GEOFFR.														1				1
<i>Rhinosimus planirostris</i> (FABR.)		1																1
<i>Longitarsus lycopi</i> FOU DR.			1															1
<i>Sitona crinata</i> HERBST											1							1
<i>Elleschus infirmus</i> HERBST						1												1
Total	4	3	1	4	1	2	5	1	3	1	4	2	1	2	2	4	1	41
Nests number in each locality	10	3	5	1	2	6	5	1	2	2	4	2	6	2	4	4	1	60
Positive nests number	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	22

sented only by two individuals. *G. buyssoni* lives the nests of majority of bird species, especially of Passeriformes.

In general, there are no significant region-specific differences between the material originating from the

Podunajská rovina lowland and from the Borská rovina lowland.

As to the trophical structure of the beetles in the nests of the Penduline Tit (Fig. 4), the most frequent are the fungivorous (or predominantly fungivorous)

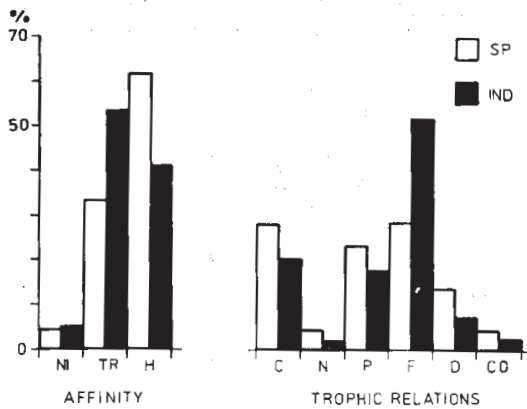


Fig. 4. Relation of the beetles to the Penduline Tit nests (ordinate - percentage of individuals or species, abscissa - ecological relations to the nests, NI - nidicolous, TR - trophic relations, H - hospites, C - carnivores, N - necrophages, P - phytophages, F - fungivores, D - detritophages, CO - coprophages, SP - species, IND - individuals)

species and the carnivorous species. Also the phytophagous species represent a considerable part of the material, but they have no direct relation to the nests and their occurrence in the nests is occasional. The necrophagous, detritophagous and coprophagous species are represented only individually.

When comparing the species composition of the beetles in the nests of Penduline Tit with the nests of other Passeriformes, we find three striking differences. First, there are nearly no characteristic nidicols. Second, the representation of the carnivores and necrophages is much lower than in the nests of other birds in spite of the abundant occurrence of other nidicolous arthropods, especially the mites, which or their dead bodies could serve as a sufficient food basis for both trophic groups of beetles. Third, the representation of some detritophages (more or less pantophagous) is lower in the Penduline Tit nests. The fungivores represented mostly by the minute lathriidids or corylophids are the only thropic group preserving in the Penduline Tit nests the same quantitative representation as in the nest of other bird species.

The most important cause of these differences seems to be the rather dense feltlike structure of the Penduline Tit nest walls and bottom. It reduces the possibility of the free movement and searching for cover of relatively large (ca. 3 mm) beetles with spheric body form and of their larvae in comparison with the nests built of various little twigs, leaves and stalks. An evidence of this hypothesis is the body size structure of the beetles found in the nests of Penduline Tit. The slender or elongate, minute species non exceeding

2 mm in length dominate here considerably. Other possible causes of these differences are the rather specific nest form and mode of their attachment which result in a better ventilation of the nest construction and its lower humidity. Besides it, the specific mode of the nest attachment reduces the possibility of occasional penetration of the beetles ascending on the tree trunks into the Penduline Tit nests. The low humidity in the nests is probably reflected also in an extremely low number of fleas and flea larvae in the Penduline Tit nests (see below). The absence of fleas and of their larvae in almost all nests may be another important cause of the absence of the typical nidicolous histerids (mostly *Gnathoncus* spp., rarely *Carcinops pumilio*) and/or of other nidicolous carnivorous beetles (e. g. *Microglotta pulla*).

VI. Flies

In the nests of Penduline Tit we found altogether 77 individuals of 14 species of flies (Fig. 4). The flies were found in 24 nests (17,8 %) on 13 localities. On the base of the food preference of their larvae the species can be classified into five trophic groups. The species with a wide food spectrum were classified simultaneously to two or more of these groups, viz.

- 1) coprophages: *Fannia canicularis*, *F. manicata*, *Azelia triquetra*, *Musca autumnalis*, *Dasyphora cyanicolor* and *Lucilia sericata*,
- 2) microphages: *Drosophila melanogaster* and *D. phalerata*,
- 3) mycetophages: *D. phalerata* and *F. canicularis*,
- 4) necrophages: *Parapiophila vulgaris*, *Stearibia nigriceps* and *F. manicata*.
- 5) saprophages: *Anisocatopse flavicollis*, *Drosophila funebris*, *F. manicata*, *Muscina prolapsa* and *L. sericata*.

The occurrence of many fly species in the bird nests is a common phenomenon, because the fly larvae find there suitable conditions for their development. Especially the parasites of the birds like Hippoboscids and the representatives of the genus *Protocalliphora*, from the family Calliphoridae, which parasite on the young birds (HICKS 1959, 1962, 1971). Up to the present, the only species of this genus, *Protocalliphora isochroa*, has been found in the Penduline Tit nests. In Poland, BOROWIEC (1979) found the species *Ornithomya fringilina* in the nests of Penduline Tit. The typical nidicolous flies are the species *Fannia canicularis*, *F. manicata* and *M. prolapsa*. Also the species *Parapiophila vulgaris* and *Lucilia sericata* (HICK 1959, 1962, 1971) have already been found in the bird nests. Further species (*A. flavicollis*, *D. funebris*, *D. cyanicolor*), we have found in the Penduline Tit nests, have not been observed in the bird nests, but they are probable able to develop in the nests of various birds species.

Table 4. Abundance of flies in the Penduline Tit nests

Species	1989						1990			1991			1992			Total		
	Dobruška	Rohovec	Velké Blahovo	Bodlky	Kátniky	Komárno	Malečvarě	Jakubov	Velké Blahovo	Dolný Štál	Závod	Zohor	Dolný Štál	Gajary	Jakubov		Sulany	Dolný Štál
<i>Apiloscatopse flavicollis</i> (MEIG.)	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀
<i>Megaselia</i> sp.	-1	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
<i>Drosophila funebris</i> (FABR.)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
<i>Drosophila phalerata</i> MEIG.																		
<i>Drosophila</i> (S.) <i>melanogaster</i> MEIG.																		
<i>Parapiophila vulgaris</i> (FALL.)																		
<i>Stearibia nigriceps</i> (MEIG.)																		
<i>Fannia canicularis</i> (L.)	-1	2/-	2/-	2/-	2/-	2/-	1/-	1/-	1/-	1/-	1/-	1/-	1/-	1/-	1/-	1/-	1/-	1/-
<i>Fannia manicata</i> (MEIG.)																		
<i>Muscina prolapsa</i> (HARRIS)	1/1	1/2	1/2	1/2	1/2	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
<i>Azelia triquetra</i> (WIED.)																		
<i>Musca autumnalis</i> DE GEER																		
<i>Dasyphora cyanicolor</i> (ZEIT.)																		
<i>Lucilia sericata</i> (MEIG.)																		
Total	1/4	-3	4/31	-6	-3	-4	1/5	-1	1/-	-1	-3	-2	-1	1/-	-1	-1	3/-	11/66
Nests number in each locality	7	1	10	3	1	1	3	5	6	4	2	1	6	1	4	4	14	73
Positive nests number	3	1	5	1	1	1	2	1	1	1	1	1	1	1	1	1	1	24

Table 5. Abundance of fleas in the Penduline Tit nests

Years	1989	1990		1992	Total
Locality					
species	Dobrohošť	Jakubov	Gabčíkovo	Dolný Štál	
	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀
<i>Dasyphyllus gallinulae</i> (DALE)			2/-		2/-
<i>Ceratophyllus gallinae</i> (SCHR.)	1/1				1/1
<i>Ceratophyllus garei</i> ROTHs.		1/-		1/-	2/-
Total	1/1	1/-	2/-	1/-	5/1
Nests number in each locality	7	5	2	14	28
Positive nests number	1	1	1	1	4

VII. Fleas

In four Penduline Tit nests (3,0 %) in four localities we have found only six individuals of three flea species, viz. *Dasyphyllus gallinulae*, *Ceratophyllus gallinae* and *C. garei* (Tab. 5).

D. gallinulae is a palaeartic species preferring the nests of the birds nesting on ground or at ground (ROSICKÝ, 1957), but it occurs also in other types of nests (JURÍK, 1974; KRUMPÁL et al., 1984).

C. gallinae is a cosmopolite ectoparasite of poultry and, above all, of Passeriformes (LEWIS, 1975). JURÍK (1976) classed this species into the siphonaptera of the birds nesting in tree crowns, shrubs, cavities and in boxes.

C. garei is a holarctic species. It is the most abundant representative of the siphonaptera of the birds nesting on ground and especially on wet sites (JURÍK, 1975, 1978).

The data about the occurrence of fleas in the Penduline Tit nests are insufficient. Only DALE (1968) found one individual of *C. gallinae* on a Penduline Tit caught at the Neusiedlersee lake. According to our observations, the fleas numbers in the Penduline Tit nests are extremely low. The causes of this will be a subject of further investigations. The species composition of fleas found up to the present corresponds with the host bionomy and with the nesting site.

Conclusions

The arthropods fauna in the Penduline Tit nests differ considerably from the arthropods fauna in the nests of other passerines. The only abundant arthropods in the nests of Penduline Tit are the parasitic mites represented mostly by the species *Dermanyssus hirundinis*, which reaches sometimes even enormous numbers of individuals. Other arthropods occurring frequently in the nests of other birds are represented in the Penduline Tit nests only by a low number of species and individuals. The only exception are the slender minute fungivorous beetles of the family Lathridiidae, which are represented in the Penduline Tit nests approximately at the same level as in the nests of other birds.

The striking differences in the representation of majority of arthropods might be caused probably by two factors - by the better ventilation of the hanged nest and by the dense felt structure of the nest walls reducing the possibility of movement and cover of the relatively large arthropods like some adult spiders or beetles and the larvae of beetles and fleas. The body size of the only abundant arthropods in the Penduline Tit nests (mites and lathridiid beetles) gives an evidence of this hypothesis.

The species composition of majority of the arthropods groups occurring in the nests has no direct relation to the Penduline Tit nests and is strongly influenced by the surrounding habitats.

The reproduction cycle of the obligatory parasitic haematophagous mites *D. hirundinis* and *O. sylvianum* in the Penduline Tit nests is similar as in the nests of other birds.

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