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Arthropods (Pseudoscorpionida, Acari, Coleoptera, Siphonaptera) in the nests of red-backed shrike (*Lanius collurio*) and lesser grey shrike (*Lanius minor*)

Ján KRIŠTOFÍK, Zbyšek ŠUSTEK & Peter MAŠÁN

Institute of Zoology, Academy of Sciences, Dúbravská cesta 9, SK-84206 Bratislava, Slovakia; e-mail: uzaekris@savba.sk

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A total of 79 nests of red-backed shrike and 68 nests of lesser grey shrike were examined. Among four pseudoscorpion species found, *Dactilochelifer latreillei* and *Dinocheirus panzeri* were found in great numbers in the nests of both shrike species. In the nests of red-backed shrike and lesser grey shrike, 20 species of mesostigmatic mites were recorded, *Ornithonyssus sylviarum*, a haematophagous species was highly predominant (82.7%). Other mite species occurred in low numbers. A large difference between the nests of the two bird species was found in their beetle fauna. Of a total of 52 species, 44 occurred in the nest of red-backed shrike, and only 21 species in the nests of lesser grey shrike. Most beetle species were found singly, except for the mycetophagous *Corticarina similata* in the nests of lesser grey shrike, in which it represented 91.3% of beetles and occurred in 54.4% of nests examined. In the nests of red-backed shrike, four flea species were also found. Among them, *Ceratophyllus garei* and *C. borealis* are regular parasites of red-backed shrike, while *Nosopsyllus fasciatus* and *Ceratophyllus hirundinis* are occasional parasites. In contrast, in the nests of lesser grey shrike, only one individual of *Ceratophyllus gallinae* was found.

Key words: pseudoscorpions, mesostigmatic mites, beetles, fleas, bird nests, Slovakia.

Introduction

Red-backed shrike (*Lanius collurio collurio* L., 1758) and lesser grey shrike (*Lanius minor minor* Gmelin, 1788) are migratory bird species that arrive in Central Europe from late April to the first half of May. They leave between August and September, occasionally later. The red-backed shrike builds its nests mostly in shrubs, and rarely in trees or herbs. Its nests consist of plant material – stalks, stems and twigs. Their interior has lot of moss and the walls are lined with fine hair, feathers etc. The nests have a diameter of 10–20 cm, height of 5–15 cm, a nesting cup diameter of 5–9 cm and a depth 2.5–6.5 cm. The breeding season lasts from May to the second half of July. Red backed shrikes breed once, exceptionally twice a year. If a nest is destroyed, replacement nesting may occur. The number of chicks ranges from 1 to 7 (HUDEC, 1983).

The lesser grey shrike nests in trees. The construction material of its nests contains a larger proportion of grasses and herbs than the red-backed shrike. The breeding season lasts from May to early July. The lesser grey shrike breeds once a year. If the clutch is damaged, replacement breeding may occur. Nest size is similar to the red-backed shrike (HUDEC, 1983). The number of chicks ranges from 2–7 (KRIŠTÍN, 1995).

The different nidobiology of both congeneric birds poses a question, whether there is a difference in the composition of arthropods inhabiting the nests. In addition, the lesser grey shrike is a rare species and a deeper knowledge of its nidobiology is necessary. Pseudoscorpions, mites, beetles and fleas become the focus of our attention because of their abundance in the nests studied.

The occurrence of pseudoscorpions in bird nests has been studied by several authors. NORBERG (1934) mentioned one pseudoscorpion species. BEIER (1948) summarised data on the occurrence of pseudoscorpions (5 species) in bird nests in C Europe. BEIER (1963), in his monography on pseudoscorpions, also deals incidentally with their occurrence in bird nests. (BEIER, 1971) also described a new species of pseudoscorpion from the nests of great tits (*Parus major* L., 1758). In Slovakia, KRUMPÁL & CYPRICH (1988) found 16 species of pseudoscorpions in the nests of 34 bird species. Data on the occurrence of pseudoscorpions in nests of the penduline tit (*Remiz pendulinus* L. 1758), sand martin (*Riparia riparia* L., 1758) and European bee-eater (*Merops apiaster* L., 1758) are given by KRIŠTOFÍK et al. (1993, 1994 and 1996, respectively).

Mesostigmatic mites in the nests of red-backed shrike and lesser grey shrike have been the focus of several papers, but there are few data about the structure of mite communities in the nests of the studied species. In Ukraine, PIRYANIK & AKIMOV (1964) found *Ornithonyssus sylviarum* and *Dermanyssus hirundinis* in the feathers of red-backed shrike and lesser grey shrike, while SHUMILO & LUNKASHU (1971) found only *O. sylviarum* in feathers of the lesser grey shrike. In Poland, TRYJANOWSKI et al. (2001) found 31 species of mesostigmatic mites, but did not find any heaematophagous species. Faunistical data on mites in bird nests are also presented by AMBROS et al. (1992) and FENĎA et al. (1998), who examined several nests of red-backed shrike from Slovakia.

The only data on beetles in the nests of red-backed shrike are from TRYJANOWSKI et al. (2001) who found five species in the nests.

There are many data on the occurrence of fleas in the nests of red-backed shrike (SLATER (1926), ROTHSCHILD (1952), SMIT (1957) and SMIT & WRIGHT (1964) – *Dasypsyllus gallinulae gallinulae* (Dale, 1878); SEIDEL (1932,1937), NORDBERG (1934), SKURATOWICZ (1964, 1967), PEUS (1968) and SZABÓ (1977) – *Ceratophyllus garei* Rothschild, 1902; NORDBERG (1934), POMYKAL (1981), CYPRICH & KRUMPÁL (1995) and ROLNÍKOVÁ (2000) – *Ceratophyllus gallinae* (Schrank, 1803); ROSICKÝ (1950, 1952) – *Ceratophyllus fringillae* (Walker, 1856); ROTHSCHILD (1956), DUDICH & MATOUŠEK (1985) – *Ceratophyllus borealis* Rothschild, 1907; RESSL (1963) – *Monophysullus sciurorum sciurorum* (Schrank, 1803); ROLNÍKOVÁ (2000) – *Ceratophyllus hirundinis* (Curtis, 1826)).

No published data exist on arthropods in the nests of the lesser grey shrike. The aim of this paper is to describe the structure of the fauna of pseudoscorpions, mesostigmatic mites, beetles and fleas in the nests of red-backed shrike and lesser grey shrike based on extensive material from nests in Slovakia and adjacent parts of Moravia and Austria and to compare it with the arthropod fauna in the nests of other bird species.

Material and methods

During 1987, 1988, 1990–1995 and 2001, after fledging of the chicks, 79 nests of red-backed shrike were collected at the sites listed in Appendix 1. The nests were built on shrubs (*Rosa* spp., *Crataegus* spp.) at heights of 0.5–3 m.

In 1993–1996 and 2001, 68 nests of lesser grey shrike were collected at the sites listed in Appendix 2. A total of 88.2% of nests were built on fruit trees (pear-, cheery-, nut- and apple-trees) and 11.2% on broad-leaved trees (poplar, locust tree, horse chestnut) at heights of 5–15 m.

The pseudoscorpions, mites, beetles and fleas were extracted from the nests using Tulgren's funnels (NOVÁK, 1969). The pseudoscorpions, mites and fleas were mounted onto permanent slides. The beetles were preserved in alcohol. All of the material is deposited in the Institute of Zoology of the Slovak Academy of Sciences in Bratislava (Slovakia). The data on trophic relations were taken from ROUBAL (1930, 1933, 1939), TICHOMIROVA (1973) and FREUDE et al. (1964a, b, 1974). The quantitative characteristics of the occurrence of parasites (intensity and presence) are used as in MARGOLIS et al. (1982). Similarity of assemblages is expressed by Sörensen's index of species similarity (SCHWERDTFEGER, 1975) and the index of proportional similarity (= Renkonen's index) (BALOGH, 1958). The verbal characteristics of species dominance are used as in SCHWERDTFEGER (1975).

Results and discussion

Pseudoscorpions

In red-backed shrike nests 11 pseudoscorpions pertaining to two species were found: *Neobisium sylvaticum* (C. L. Koch, 1835) of the Neobisiidae family, 1 ♀, 1 tritonymph (TN), (Očová, 6.VII.1993); *Dactilochelifer latreillei* (Leach, 1817) of the Chelifeidae family (1 ♂, Vysoká pri Morave, 2.VIII.1993; 1 ♀, Lehnice, 15.VII.1993; 3 ♂♂, 1 ♀, 1TN, Gabčíkovo, 19.VII.1994; 1 ♂, 1 ♀, Ipeľské Predmostie, 21.VII.1994).

N. sylvaticum is distributed in C and E Europe, its westernmost border reaches to France, the southernmost border to C Italy and Corsica, the northernmost border to C Germany and Poland and its easternmost border reaches the Caucasus. *N. sylvaticum* occurs in forest margins, in litter or moss, between shrubs (BEIER, 1963). Occurrence of *N. sylvaticum* in bird nests appears to be irregular. *D. latreillei* occurs in C and S European floodplains, under bark, in litter and bird nests (BEIER, 1963). It was also found in nests of the great tit, barn swallow (*Hirundo rustica* L., 1758) and stock pigeon (*Columba oenas* L., 1758) (NORDBERG, 1936), penduline tit (KRIŠTOFÍK et al., 1993). KRUMPÁL & CYPRICH (1988) observed a high affinity of *D. latreillei* to differently situated nests. The papers cited above and our observations indicate this species to be nidicolous.

In lesser grey shrike nests, 7 pseudoscorpions belonging to two species were found: *Dinocheirus panzeri* (C. L. Koch, 1837), 1 ♂, 2 ♀♀, 3 TN, (Holice, 5.VII.1994); *Chernes cimicoides* (F., 1793), 1 ♀ (Detva, settlement of Laštok, 19.VII.1996), both of the Chernitidae family.

D. panzeri is distributed in C and N Europe. It occurs in old hollow trees, in litter, in old buildings, deposits, sheds and bird nests (BEIER, 1963; KRUMPÁL & CYPRICH, 1988). Owing to its high affinity to bird nests, it can be classified among the nidiphilous species. *C. cimicoides* is distributed in N, W, C and E Europe. It is a typical forest species living on and under tree bark and rarely in litter (BEIER, 1963). It was found in nest boxes by KRUMPÁL & CYPRICH (1988). Reports of this species in bird nests are sporadic, hence we consider this species to occur rarely in bird nests.

Mites

In the nests of red-backed shrike, 836 individuals of 16 species were found (Tab. 1). Among the 57 nests examined, mites occurred in 29.8% of nests, the average number of mites in each positive nest was 49. The most frequent species were *Ornithonyssus sylviarum* (12.28%), *Dermanyssus hirundinis* (10.53%), *Paragarmania dentritica* (8.77%) and *Pergamasus crassipes* (5.26%). The mean intensity of the most frequent species was: *O. sylviarum* – 88, *D. hirundinis* – 22 and *P. dentritica* – 9.

In the nests of lesser grey shrike, 573 mites of 11 species were found (Tab. 1). Among 68 nests examined, mites were present in 27.9%, the average number per positive nest was 30. The most frequent species were *O. sylviarum* (13.24%), *P. dentritica* (7.35%) and *D. hirundinis* (5.88%). The mean intensity of the most frequent species was: *O. sylviarum* – 55, *P. dentritica* – 8 and *D. hirundinis* – 2.

The mite communities in both *Lanius* species were very similar, particularly from the viewpoint of representation of the predominant species (index of proportional similarity 82.01) and their infestation indices (Tab. 1). In contrast, significant differences were found in the number of species obtained from nests of each *Lanius* species and in the representation of occasionally occurring species (13 species, i.e. 65%, occurred only in one host species), in infestation intensity by the ectoparasitic *D. hirundinis* and in representation of facultative ectoparasites of small mammals.

The mites found in the nests can be classified into ecological groups based on their habitat requirements and trophic relations (KARG, 1993). However, with the exception of the obligate haematophages of the genera *Ornithonyssus* and *Dermanyssus*, all other mites can be considered as occasionally occurring ubiquits, which represent 70% of all species but only 9.87% of individuals. They probably penetrate the nests actively from the soil (large and well mobile species of Parasitidae and Macrochelidae), vegetation (predaceous Phytoseiidae living on plants) or passively with the material used for nest construction (saprophiles and some small species). In the nests of red-backed shrike, the facultative haematophagous mites living on small mammals (*A. fahrenholzi, E. stabularis, H. nidi*) were also found. They were probably brought into the nests with food for the nestlings, which in red-backed shrike also consists of small mammals (HUDEC, 1983). The species *H. lubrica* and *A. casalis* are specialised inhabitants of bird nests, but in this case they were not significantly represented.

There is a considerable difference between both *Lanius* species in placement of nests. The nests of red-backed shrike are found on shrubs and are more accessible for predatory mites (family Parasitidae) capable of active migration than the nests of the lesser grey shrike which nests in tree

Table 1. Abundance, dominance and prevalence of mesostigmatic mites in red-backed shrike and lesser grey shrike nests.

Family Species	EG	Red-backed shrike			Lesser grey shrike		
		N	*D* (%)	*P* (%)	*N*	*D* (%)	*P* (%)
Macrochelidae							
Macrocheles tardus (C. L. Koch, 1841)	EP	–	–	–	1	0.17	1.47
Hypoaspididae							
Hypoaspis lubrica Voigts & Oudemans, 1904	NP	–	–	–	11	1.92	1.47
Laelapidae							
Androlaelaps casalis (Berlese, 1887)	FPB	9	1.07	1.75	1	0.17	1.47
Androlaelaps fahrenholzi (Berlese, 1911)	FPM	1	0.12	1.75	–	–	–
Haemogamasidae							
Eulaelaps stabularis (C. L. Koch, 1840)	FPM	1	0.12	1.75	–	–	–
Haemogamasus nidi Michael, 1892	FPM	2	0.24	3.51	–	–	–
Dermanyssidae							
Dermanyssus hirundinis (Hermann, 1804)	OPB	132	15.79	10.53	9	1.58	5.88
Macronyssidae							
Ornithonyssus sylviarum (Canestrini & Fanzago, 1877)	OPB	619	74.04	12.28	496	86.57	13.24
Phytoseiidae							
Paragarmania dentritica (Berlese, 1918)	EP	48	5.74	8.77	41	7.16	7.35
Anthoseius sp. 1	PP	1	0.12	1.75	1	0.17	1.47
Anthoseius sp. 2	PP	1	0.12	1.75	–	–	–
Ameroseiidae							
Proctolaelaps pygmaeus (J. Müller, 1860)	EP	1	0.12	1.75	–	–	–
Ascidae							
Leioseius bicolor (Berlese, 1918)	EP	1	0.12	1.75	1	0.17	1.47
Rhodacaridae							
Digamasellus punctum (Berlese, 1904)	CP	8	0.96	1.75	–	–	–
Parasitidae							
Pergamasus crassipes (L., 1758)	EP	7	0.84	5.26	–	–	–
Pergamasus norvegicus (Berlese, 1905)	EP	1	0.12	1.75	–	–	–
Parasitus fimetorum (Berlese, 1903)	CP	2	0.24	3.51	4	0.70	1.47
Parasitus lunulatus (J. Müller, 1859)	EP	2	0.24	1.75	–	–	–
Uropodina: Trematuridae							
Trichouropoda orbicularis (C. L. Koch, 1839)	S	–	–	–	7	1.22	1.47
Urodinychidae							
Uroobovella pyriformis (Berlese, 1920)	S	–	–	–	1	0.17	1.47
Total		836	100	29.82	573	100	27.94

Key: N – abundance, D – dominance, P – prevalence, EG – ecological group, OPB – obligatory parasite of birds, FPB – facultative parasite of birds, FPM – facultative parasite of mammals, NP – nidicolous predator, CP – coprophilous predator, EP – edaphic predator, PP – planticolous predator, S – saprophage.

crowns. This may be one of the causes of a large number of mite species occasionally occurring in the nests of red-backed shrike (Tab. 1). However, the different vertical placement of nests of both *Lanius* species did not influence the overall similarity of mite assemblages in their nests. A low qualitative and quantitative representation of free living saprophages and predators in the nests of both *Lanius* species probably results from the fact that the lining of the nest cup is dry and contains less organic detritus than in water fowl (DANIEL & ČERNÝ, 1963; YAKIMENKO et al., 1990) or hollow nesting breeders (BORISOVA, 1972, 1977).

PIRYANIK & AKIMOV (1964) studied representation of gamasid mites in bird nests in Ukraine. They examined 31 nests of red-backed shrike and 8 nests of lesser grey shrike. *D. hirundinis* was found in 20% of the nests of red-backed shrike and in 12.5% of nests of lesser grey shrike, but its abundance was negligible (0.2 and 0.12 ind. per nest examined). *O. sylviarum* was found only in the nests of red-backed shrike showing a prevalence of 19.2% and an infestation intensity of 13.5 ind. In contrast, *A. casalis* was found only in the nests of lesser grey shrike showing a prevalence of 12.5% and an infestation intensity of 0.6 ind.

SHUMILO & LUNKASHU (1971) examined 2,904 birds of 118 species. Among 14 individuals of lesser grey shrike, only one individual (7.1%) was parasitised by haematophagous mites (7 ♀♀, 1 ♂, 3 nymphs of *O. sylviarum*). Much more parasitized were house sparrows [*Passer domesticus*, (L., 1758)] (48.2%), common starlings (*Sturnus vulgaris* L., 1758) (24.5%), wood nuthatches (*Sitta europaea* L., 1758) (22.6%), European greenfinches [*Carduelis chloris* (L., 1758)] (18.5%), barn swallows (18.2%) and blue tits (*Parus caeruleus* L., 1758) (17.3%). In Poland, TRYJANOWSKI et al. (2001) analysed mites from 28 nests of red-backed shrike. When compared to our results, they found more species of free-living mesostigmatic mites (31 species), but they did not find the presence of any obligatory or facultative ectoparasites. Among the dominant species they found edaphic detriticoles *P. pygmaeus* – 24.3%, *Trichouropodu ovalis* – 10.8% (C. L. Koch, 1839), *L. bicolor* – 7.5%, *P. dentritica* – 6.8% and coprophils *P. fimetorum* – 13.2%, *Alliphis siculus* (Oudemans, 1905) – 9.4 % and *Macrocheles glaber* (J. Müller, 1860) – 6.7%.

The comparison of mite assemblages in nests of both *Lanius* species with the assemblages in nests of other bird species, particularly of passerines, shows that the assemblages in the nest of red-backed shrike and lesser grey shrike are poorer in number of species and abundance of specialised haematophagous parasites of birds. For example, in 135 nests of the penduline tit 38 species of mesostigmatic mites were found and haematophagous mites were represented by 99.7% of individuals. The mean intensity of *D. hirundinis* and *O. sylviarum* was 531 and 94, respectively (KRIŠTOFÍK et al., 1993). In 273 nests of the great reed warbler *Acrocephalus arundinaceus* (L., 1758) and reed warbler *Acrocephalus scirpaceus* (Hermann, 1804) 36 species of mesostigmatic mites were found, among which 99.52% were haematophages. The mean intensity of *D. hirundinis* and *O. sylviarum* in the great reed warbler and reed warbler was 1,132 and 523 respectively (KRIŠTOFÍK et al., 2001). In the nests of *Lanius* spp. the group dominance of haematophagous ectoparasites was similar (89.14%), but the mean intensity was a little lower: 30 in lesser grey shrike and 49 in red-backed shrike.

In contrast, the haematophagous *D. hirundinis* and *O. sylviarum* occurred in enormous numbers in nests of the penduline tit (KRIŠTOFÍK & MAŠÁN, 1996), great reed warbler (500 and 14,500 ind, respectively, in 20 nests) and reed warbler (2,000 and 24,000 ind. respectively, in 10 nests) (KRIŠTOFÍK et al., 2001). A mass outbreak of haematophagous mites was not observed in the nests of red-backed shrike or lesser grey shrike. This resulted rather from low parasitisation of these birds by mites than from the construction material and shape of the nests. The highest number (635 ind.) of *O. sylviarum* in one red-backed shrike nest was found by AMBROS et al. (1992). In our material, the largest number of mites in one nest was 276.

Beetles

There was a large difference between the beetle assemblages in the nests of both *Lanius* species (only 5 common species of 60).

The beetle assemblages in the nests of red-backed shrike were very diverse. Out of 79 nests of red-backed shrike 40 (50.6%) were positive for beetles and 94 individuals pertaining to 44 species were identified in them. Almost two thirds of the species (61.4%) were represented only by one individual, about one fifth (20.5%) by 2 individuals and only in 20% of species did the number of individuals range from 3–13. Hence, the values of presence and dominance of individual species were generally very low 1.26–5.06% and 1.06–13.8%.

As to the affinity to nests or to their inhabitants, there was only one species, the carnivorous staphylinid *Haploglossa puncticollis* (dominance 9.57%), which is obligatory nidicolous. Many other species frequently use the nests or the wastes in them as a food resource, but they are not nidicolous and inhabit many other suitable substrates. The necrophagous representatives of dermestids (*Anthrenus pimpinelae* and larvae of *Dermestes* spp. showing a cumulative dominance 14.9%, Tab. 2) feed on feather, keratin particles and food scraps of animal origin. The mycetophagous latridiids (*Corticaria longicollis*, *Corticarina similata*, *Enicmus histrio*, *Latridius bergrothi* and *Stephostethus angusticollis*, cumulative dominance 11.7%, Tab. 2) feed on moulds growing on the wet construction material of nests. A very loose relationship to the nests can be supposed in the detritophagous representatives of anobiids (*Stegobium panicaeum* – a typical store pest), throscids (*Trixagus dermestoides*, *T. elateroides* and *T. obtusus*, all living in litter and frequently ascending on grasses, cumulative dominance 9.6%, Tab. 2). All other species occurred purely occasionally in the nests. This is particularly the case for curculionids (17 species, 38.4%) and chrysomelids (5 species, 11.4%), which are mostly polyphagous or oligophagous defoliators of the trees and shrubs the nests are built on. Their penetration into the nest is made easier, similarly

Table 2. Abundance, dominance and presence of beetles in red-backed shrike and lesser grey shrike nests and their trophic relations.

Family / Species	TR	Red-backed shrike			Lesser grey shrike		
		N	*D* (%)	*P* (%)	*N*	*D* (%)	*P* (%)
Carabidae							
Demetrias atricapillus (L., 1758)	C	1	1.06	1.27			
Lebia cyanocephala (L., 1758)	C				1	0.31	1.47
Phylorhizus crucifer (Lucas, 1846)	C				1	0.31	1.47
Platynus assimilis (Paykull, 1790)	C	2	2.13	1.27			
Histeridae							
Margarinotus carbonarius (Hoffmann, 1803)	C	1	1.06	2.67			
Staphylinidae							
Aleochara bilineata Gyllenhal, 1810	C	1	1.06	1.27			
Atheta crassicornis (F., 1792)	A	2	2.13	2.53			
Atheta nidicola (Johansen, 1914)	A				4	1.24	5.88
Atheta sp.	A	1	1.06	1.27	1	0.31	1.47
Haploglossa puncticollis (Kirby, 1832)	C	9	9.57	5.06	1	0.31	1.47
Oxypoda filiformis L. Redtenbacher, 1849	C	1	1.06	1.27			
Quedius mesomelinus (Marsham, 1802)	C				1	0.31	1.47
Scopaeus minutus Erichson, 1840	C				1	0.31	1.47
Tachyporus hypnorum (F., 1775)	C	1	1.06	1.27			
Throscidae							
Trixagus dermestoides (L., 1766)	D	1	1.06	1.27			
Trixagus elateroides (Heer, 1841)	D	3	3.19	1.27			
Trixagus obtusus (Curtis, 1827)	D	5	5.32	1.27			
Dermestidae							
Anthrenus pimpinelae F., 1775	N	1	1.06	1.27			
Anthrenus sp. (larva)	N				1	0.31	1.47
Dermestes sp. (larvae)	N	13	13.83	1.27			
Anobiidae							
Stegobium paniceum (L., 1758)	D	1	1.06	1.27			
Nitidulidae							
Meligethes erythropus (Marsham, 1802)	P	1	1.06	1.27			
Cucujidae							
Placonotus castaneus (F., 1787)	D	1	1.06	1.27			
Coccinelidae							
Adalia bipunctata (L., 1758)	C				1	0.31	1.47
Coccidula scutelata (Herbst, 1783)	C	1	1.06	1.27			
Scymnus limbatus Stephens, 1831	C	1	1.06	1.27			
Scymnus suturalis Thunberg, 1795	C				1	0.31	1.47
Lathridiidae							
Corticaria longicollis (Zetterstedt, 1838)	M	6	6.38	1.27			
Corticarina similata (Gyllenhal, 1827)	M	2	2.13	2.53	295	91.33	54.41
Cortinicara gibbosa (Herbst, 1793)	M				1	0.31	1.47
Enicmus histrio Joy et Tomlin, 1910	M	1	1.06	1.27			
Lathridius bergrothi (Reitter, 1880)	M	1	1.06	1.27			
Stephostethus angusticollis (Gyllenhall, 1827)	M	1	1.06	1.27	1	0.31	1.47
Anthicidae							
Anthicus antherinus (L., 1761)	D	1	1.06	1.27			
Notoxus monoceros (L., 1762)	D				3	0.93	1.47
Lagriidae							
Lagria hirta (L., 1758)	P	1	1.06	1.27			
Tenebrionidae							
Pentaphylus testaceus (Hellwig, 1792)	D				1	0.31	1.47
Tribolium castaneum (Herbst, 1797)	D				1	0.31	1.47
Chrysomelidae							
Cassida nebulosa L., 1758	P	1	1.06	1.27			
Chaetocnema coccinna (Marsham, 1802)	P	1	1.06	1.27			

Table 2. (continued)

Family / Species	TR	Red-backed shrike			Lesser grey shrike		
		N	*D* (%)	*P* (%)	*N*	*D* (%)	*P* (%)
Lema melanopus (L., 1758)	P	1	1.06	1.27			
Phyllotreta nemorum (L., 1758)	P	1	1.06	1.27			
Phyllotreta procera (L. Redtenbacher, 1849)	P	1	1.06	1.27			
Curculionidae							
Anthonomus pedicularius (L., 1758)	P	2	2.13	2.53			
Anthonomus piri Kollar, 1837	P	1	1.06	1.27			
Anthonomus pomorum (L., 1758)	P	1	1.06	1.27	3	0.93	4.41
Anthonomus sorbi Germar, 1821	P	1	1.06	1.27			
Anthonomus spilotus (L. Redtenbacher, 1849)	P				2	0.62	2.94
Apion frumentarium (L., 1758)	P				1	0.31	1.47
Ceutorrgynchus turbatus Schultze, 1903	P				1	0.31	1.47
Dorytomus ictor (Herbst, 1795)	P	2	2.13	2.53			
Dorytomus longimanus (Forster, 1771)	P	4	4.26	2.53			
Gymnetron antirhini (Paykul, 1800)	P	2	2.13	2.53			
Phylobius sinuatus (F., 1801)	P	2	2.13	1.27			
Phytonomus postica (Gyllenhal, 1813)	P	3	3.19	2.53			
Ranunculiphilus obsoletus (Germar, 1824)	P	2	2.13	1.27			
Sitona hispidulus (F., 1776)	P	2	2.13	2.53			
Sitona lineatus (L., 1758)	P	6	6.38	5.06			
Thamiocolus pubicollis (Gyllenhall, 1837)	P				1	0.31	1.47
Tychius polylineatus (Germar, 1824)	P	1	1.06	1.27			
Total		94	100	50.63	323	100	71

Key: *N* – number of individuals, *D* – dominance, *P* – presence, TR – trophic relations, A – algivores, C – carnivores, D – detritophages, M – mycetophages, A – necrophages, P – phytophages.

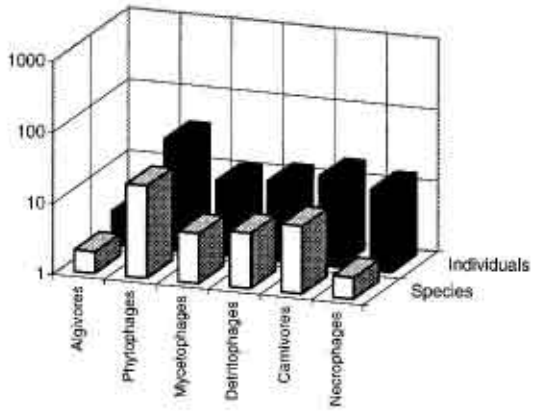

Fig. 1. Trophic groups of beetles in red-backed shrike nests.

as in some mites (see above) by locating the nest on shrubs, low above the ground.

The qualitative and quantitative representation of individual trophic groups of beetles was very similar (index of proportional similarity 89.6%, Fig. 1). The phytophages showed no close relation to the nests predominated by number of species and individuals, followed by carnivores, detritophages and mycetophages having some food bases in the nests. The necrophages were represented only by two species, but their quantitative representation was much higher. The algivores (*Atheta* spp.) were the least numerous group.

The relatively large number of species and heterogeneous structure of beetle assemblages in the nests of red-backed shrike also resulted from the fact that these nests were collected from a large number of sites over an extensive area (see above) showing variable living conditions.

The beetle assemblages in the nests of lesser grey shrike were much poorer in number of species, but more homogenous in their composition. Among 68 nests collected, 48 nests (70.6%) were positive for beetles and 323 individuals pertaining to 21 species were found in them. Most of them [297 individuals (91.9%) belonging to 3 species (14.3%)] were representatives of the mycetophagous latridiids (Fig. 2), among which *C. similata* was eudominant (91.3%) and euconstant (54.4%). These beetles are trophically bound to the moulded wet construction material of the

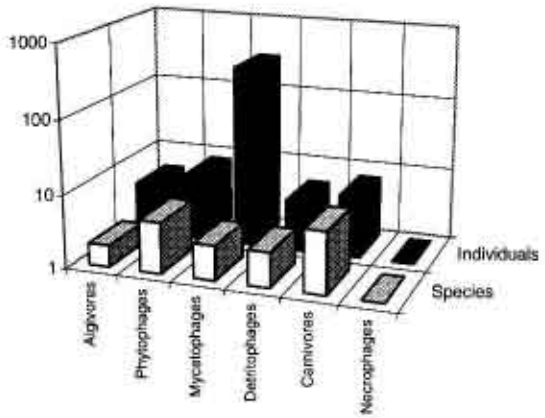

Fig. 2. Trophic groups of beetles in lesser grey shrike nests.

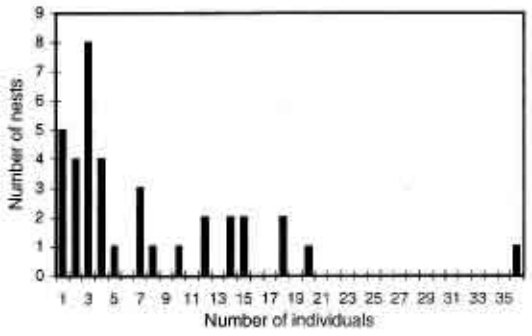

Fig. 3. The number of individuals of *Corticarina similata* in lesser grey shrike nests.

nests. Among other beetles (18 species and 26 individuals) very few species have a close relationship with bird nests. The staphylinids *Atheta nidicola* (4 ind., 1.24%) and *H. puncticollis* (1 ind., 0.31%), which are obligatory nidicoles, inhabit nests of a large number of bird species. Besides these species only the larvae of necrophagous *Anthrenus* sp. and detritophagous tenebrionids *Penthaphylus testaceus* (1 ind., 0.31%) and *Tribolium castaneum* (1 ind., 0.31%) may search for food in the nests. The occurrence of all other beetle species (Tab. 2) can be considered as purely occasional. They are mostly represented by carnivorous species (*Lebia cyanosephala, Phylorhizus crucifer, Scymnus suturalis* and *Adalia bipunctata*) living on plant surfaces or foliophages (all curculionids) living on the trees where nests are built or on surrounding plants (*Notoxus monoceros*).

Quantitative and qualitative representation of individual trophic groups was quite similar (proportional similarity index 22.4%, Fig. 2). Most species were carnivorous followed by phytophages, mycetophages, detritophages and algivores. Most individuals were mycetophages, followed by phytophages, carnivores, algivores and detritophages. The necrophages were negligibly represented in terms of number of species and individuals.

The abundant occurrence of *C. similata* in nests (Tab. 2) and the relatively small and homogeneous area in which most of the nests of lesser grey shrike were collected allowed a more detailed analysis of its distribution in the nests (Fig. 3). *C. similata* was present in 37 (57.4%) of the 68 nests ($\bar{x}$ ± SD: 7.31 ± 7.42 ind., modal value 3 ind.). The number of individuals ranged from 1–36, but in most nests (22, i.e. 59.5%) the number of individuals ranged from 1–5, and in a minority (14, i.e. 37.8%) between 7–20. The highest number (36 individuals) was found in one nest.

Similarity of beetle assemblages in nests of both *Lanius* species was low. There were only 5 common species, the Sörensen's index of similarity being 15% and the index of proportional similarity only 3.99%.

Only TRYJANOWSKI et al. (2001) have published data on beetles in the nests of red-backed shrike and in a total of 28 nests examined they found only three nests with beetles. They extracted only 3 individuals of *T. hypnorum* and one of *Phyllodrepa nigra* (Gravenhorst, 1806), *Meligethes aeneus* (F., 1775), *Corticaria elongata* Gyllenhall, 1827 and *C. gibbosa*. Such results are remarkably poor and suggest some mistakes in collection and/or extraction of the material. In spite of an extremely limited representativeness, this material reveals some tendency for a predominance of mycetophagous latridiids, with a large proportion of occasionally occurring species and an absence of typically nidicolous species in the nests of red-backed shrike. Hence the results of TRYJANOWSKI et al. (2001) concur with our results.

When compared with other bird species, the predominance of latridiids (particularly in the nest of lesser grey shrike) and a generally low number of species and individuals of other beetles with a great proportion of occasionally occurring species was also characteristic in nests of penduline tit (KRIŠTOFÍK et al., 1993, 1995). A great proportion of occasionally occurring species of beetles was also characteristic of nests of house martins (ŠUSTEK & HORNYCHOVÁ, 1983), although their nests supplied a food resource for a large proportion of different detritophagous species. Unlike sand martin nests (ŠUSTEK & JURÍK, 1980;

KRIŠTOFÍK et al., 1994), those of the house sparrow (JURÍK & ŠUSTEK, 1978) and European bee-eater (KRIŠTOFÍK et al., 1996) have a very low proportion of carnivores and obligatorily nidicolous beetles such as *Haploglossa puncticollis* and *Gnathoncus buyssoni*, which may be predators of mites, flea larvae and other small arthropods cohabiting in the nest. Similarly there was a very low level of necrophages (mostly *Anthrenus* and *Dermestes* species) which occur in nests of some bird species in considerable quantities (JURÍK & ŠUSTEK, 1978).

We conclude that the nests of both *Lanius* species host a widely variable beetle fauna which strongly depends on the momentary composition of beetle taxocoenoses in the immediate nest surroundings. The humidity of nest material and conditions for the development of mould attracting mycetophagous latridiids are probably the main factors responsible for the composition of beetle assemblages in *Lanius* nests.

Fleas

Among 71 nests of red-backed shrike there were only 3 nests in which 9 fleas of four species were found: 1 ♂, *Nosopsyllus fasciatus* (Bosc d' Antic, 1800) (Suchohrad, 18.VII.2001), 1 ♂, 2 ♀♀, *Ceratophyllus garei* and 1 ♂, *C. borealis* (Vysoká pri Morave, 8.VII.1993), 1 ♂, 1 ♀, *C. borealis* and 2 ♂♂, *C. hirundinis* (Dobrohošť, 14.VI.1988). *N. fasciatus* mainly parasitizes small mammals (BEAUCORNU & LUNAY, 1990). This flea most likely entered the nests with food, because small mammals are a facultative food of red-backed shrike. Therefore we consider its presence in the nests of red-backed shrike to be accidental.

The holarctic species *C. garei* occurring predominantly in northern areas most usually parasitizes birds of the orders Passeriformes, Lariformes, Anseriformes, which nest on the ground or close to it. *C. garei* prefers humid habitats (BEAUCORNU & LUNAY, 1990) and was found on the body of red-backed shrike and their nests by several researchers (SEIDEL, 1932, 1937; NORDBERG, 1934; SKURATOWICZ, 1964, 1967; SZABÓ, 1977), but always in low numbers. Only PEUS (1968) found 41 individuals in one nest.

To date, the holarctic species *C. borealis* has been found mostly on bodies and in nests of representatives of the orders Lariformes, Falconiformes, Strigiformes and Piciformes (HICKS, 1959, 1962, 1971). ROSICKÝ (1957) claimed that this species occurs in C Europe in the forests of large mountain massifs. Our findings show, in contrast, that this species also occurs in the C European lowlands.

C. hirundinis is distributed in the Palaearctic region up to 100° E. The main host of this flea is the house martin, but it was also found on other bird species, e.g. barn swallow and house sparrow (BEAUCORNU & LUNAY, 1990). Finding this flea in the nests of red-backed shrike should be considered occasional.

According to the literature and our observations, among 8 species of fleas found on the body of red-backed shrike and its nests the species *C. garei, C. borealis, C. gallinae* can be considered as obligatory parasites, *C. frigillae, D. gallinulae gallinulae* as rare parasites and the species *N. faciatus, M. sciurorum sciurorum* and *C. hirundinis* as occasional parasites.

Among 68 nests of lesser grey shrike collected, 1 ♀ of *Ceratophyllus gallinae* was found in one nest (Hriňová, settlement of Horná Riečka, 22.VII.1996). This species is found in the Palaearctic region, but it was unintentionally introduced to North America, New Zealand and Australia. Its major hosts are birds of the order Passeriformes (BEAUCORNU & LUNAY, 1990), but it was also found in the nests of birds of the orders Lariformes, Anseriformes, Galliformes, Gruiformes, Columbiformes, Falconiformes, Strigiformes, and Piciformes, (HICKS, 1959, 1962, 1971). To date, this is the first published record of *C. gallinae* in nests of the lesser grey shrike. Therefore more data are necessary for an adequate evaluation of the parasite/host relationships between *C. gallinae* and lesser grey shrike.

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Appendix 1. Localities of red-backed shrike

Šaštín-Stráže (48°39′ N, 17°09′ E) – 1 nest; Gajary (48°30′ N, 16°56′ E) – 1 nest; Suchohrad (48°25′ N, 16°54′ E) – 4 nests; Vysoká pri Morave (48°18′ N, 16°57′ E) – 7 nests; Zohor (48°18′ N, 16°58′ E) – 1 nest; Bratislava – Vajnory (48°14′ N, 17°14′ E) – 3 nests; Svätý Jur (48°13′ N, 17°14′ E) – 10 nests; Lozorno (48°20′ N, 17°04′ E) – 1 nest; Bratislava – Nature reserve Kopáč (48°06′ N, 17°10′ E) – 2 nests; Dobrohošť (47°59′ N, 17°21′ E) – 25 nests; Bodíky (47°53′ N, 17°29′ E) – 1 nest; Lehnice (48°04′ N, 17°28′ E) – 3 nests; Veľké Blahovo (48°02′ N, 17°36′ E) – 1 nest; Ohrady (47°59′ N, 17°13′ E) – 3 nests; Gabčíkovo (48°51′ N, 17°33′ E) – 7 nests; Chotín (47°49′ N, 18°13′ E) – 1 nest; Štúrovo (47°49′ N, 18°40′ E) – 1 nest; Kamenica nad Hronom (47°50′ N, 18°44′ E) – 1 nest; Ipeľské Predmostie (48°04′ N, 19°04′ E) 1 nest; Stankovany (49°10′ N, 17°33′ E) – 1 nest; Očová (48°37′ N, 19°17′ E) – 1 nest (all localities in Slovakia); Kletnica (48°49′ N, 16°39′ E) – 2 nests (Moravia); Apetlon (47°46′ N, 19°17′ E) – 1 nest (Austria).

Appendix 2. Localities of lesser grey shrike

Rusovce (48°02′ N, 17°06′ E) – 1 nest; Bratislava – Podunajské Biskupice (48°07′ N, 17°14′ E) 1 nest; Malinovo (48°09′ N, 17°18′ E) – 1 nest; Holice (48°00′ N, 17°29′ E) – 1 nest; Veľké Blahovo (48°02′ N, 17°36′ E) – 1 nest; Ďulov Dvor (47°43′ N, 18°10′ E) – 1 nest; Mužla (47°47′ N, 18°38′ E) – 1 nest; Bešeňov (48°03′ N, 18°14′ E) – 1 nest; Dolný Ohaj (48°05′ N, 18°16′ E) – 1 nest; Selice (48°07′ N, 17°58′ E) – 1 nest; Palárikovo (48°02′ N, 18°03′ E) – 1 nest; Detva, settlement of Laštok (48°34′ N, 19°27′ E) – 2 nests; Detva, settlement of Skliarovo (48°35′ N, 19°27′ E) – 11 nests; Detva, settlement of Majerovo (48°35′ N, 19°27′ E) – 1 nest; Detva, settlement of Blato (48°35′ N, 19°28′ E) – 1 nest; Hriňová, settlement of Dolná Riečka (48°35′ N, 19°30′ E) – 13 nests; Hriňová, settlement of Zánemecká (48°35′ N, 19°28′ E) – 8 nests; Hriňová, settlement of Bystré-Vrátka (48°36′ N, 19°29′ E) – 1 nest; Hriňová, settlement of Pivnička (48°36′ N, 19°30′ E) – 6 nests; Hriňová, settlement of Horná Riečka (48°36′ N, 19°31′ E) – 5 nests; Hriňová, settlement of Priehalina (48°36′ N, 19°31′ E) – 1 nest; Hriňová, Malčekova skala hill (48°36′ N, 19°28′ E) – 1 nest; Hriňová (48°35′ N, 19°31′ E) – 6 nests (all Slovakia).