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Arthropods in nests of the Sand Martin (*Riparia riparia* Linnaeus, 1758) in South Slovakia

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The arthropods in abandoned nests of the Sand Martin in two localities in South Slovakia are analysed. They are represented mostly by species penetrating into the nests from the immediate surroundings more or less occasionally, or seeking a suitable cover for wintering there. There are three abundant components of the nest fauna with a close relation to the nests: the mites represented by the species *Hypoaspis lubrica*, *Androlaelaps casalis* and *Dermanyssus hirundinis*, fleas represented almost exclusively by *Ceratophyllus styx* and predators represented by the only species *Haploglossa nidicola*. The abundance of mites and fleas on one hand and of *Haploglossa nidicola* on the other hand exhibits the typical features of the predator/prey relationship, in the individual nests and in time. All major groups of the nest fauna exhibit two abundance maxima in the winter period.

Key words: arthropods, pseudoscorpions, spiders, beetles, flies, fleas, nests, Sand Martin, Slovakia.

Introduction

The arthropods in nests of the Sand Martin were studied by many authors. A world wide review of arthropods occurring in these nest was compiled by Hicks (1959, 1962, 1971). In Europe different arthropod or insect groups were dealt with by Nordberg (1936); Nuorteva and Järvinen (1961); Büttiger (1969); Jurík (1974, 1975, 1978); Borisova (1978); Šustek and Jurík (1980); Jafremava (1986); Kaczmarek (1988) etc. The above authors studied the nests mostly in the vegetation period. Only Mašán and Krištofík (1993) focused on the abandoned nests in the period from August to May. The aim of this paper is to continue in the evaluation of their material and to describe the structure of fauna of arthropods other in mites, in abandoned nests of the Sand Martin and the seasonal dynamics and mutual relations of their dominant groups.

Material and methods

The material from nests of the Sand Martin was collected in nest colonies in two localities in South Slovakia in 1989–1990. The first locality was in a sand quarry surrounded by arable land near to the village Chotín. Fifteen nests were taken there each month from August 1989 to May 1990 (altogether 150 nests). The second locality was in a gravel quarry close to the village of Ivanka pri Dunaji and the airport of Bratislava. The birds nested there in the upper, 1.5 m thick layer of loam. We took ten nests from there each month from September 1989 to May 1990 (altogether 90 nests). All these nests were abandoned. No

Table 1. Survey of spiders found in nests of the Sand Martin in two localities in South Slovakia.

Family Species	Locality Chotín	Ivanka
PHOLCIDAE		
Pholcus opilionoides (SCHR.)	1	
DYSPERIDAE		
Harpactea lepida (C. L. K.)		1
THERIIDAE		
Episinus angulatus (BL.)	1	
Robertus arundineti (O. P. CBR.)	2	1
Robertus sp.	7	1
Theridion tinctum (WALCK.)	1	
LINYPHIIDAE		
Diplostyla concolor (WID.)	4	
Mioxena blanda (SIM.)	1	
Porrhoma micropthalum (O. P. CBR.)	1	
Syedra apetlonensis (WUNDERLICH)	10	
Thyreosthenius parasiticus (WESTR.)		1
ARANEIDAE		
Araneus marmoreus (CL.)		1
DICTINIDAE		
Dictyna sp.	2	
CLUBIONIDAE		
Clubiona sp.	2	2
SALTICIDAE		
Pseudicius encarpatus (WALCK.)	1	
Species number	12	6
Individuals number	33	7

nests were taken in the nidification period of the Sand Martin from June to July. The arthropods were extracted from the nest material by means of Tullgren's apparatus.

Structure of the nest fauna

Pseudoscorpions

One deutonymph of the pseudoscorpion *Lamprochernes* sp. was also found in the nests of the Sand Martin (Chotín February 5, 1990). The representatives of this genus live under tree bark or on decaying plant remains. It also uses phoresy on the body surface of some insects (BEIER, 1963). For this reason we suppose that it has no specific relation to the nests of the Sand Martin.

Spiders

40 spider individuals of 15 species were found in the nests of the Sand Martin (Tab. 1). Three juvenile individuals could be identified only to generic level. According to the ecological requirements, individual species, except for the species *Thyreosthenius parasiticus*, occur in the burrows only occasionally or only seek a suitable cover for wintering there. The spider *Thyreosthenius parasiticus* is a skotophilous species for which the burrows represent its natural ecological niche. However, it is highly probable that this species has no specific relation to the nests of the Sand Martin, in spite of the fact that GAJDOŠ et al. (1991) found it in the nests of other bird's species. The species *Mioxena blanda* and *Syedra apetlonensis* were found for the first time in the territory of Slovakia. The differences in the taxocoenosis structure between both localities are due to the larger extent of the material from Chotín and due to the local occurrence of *Syedra apetlonensis* in this locality.

Bugs

The bugs were represented by the single species *Oeiacus hirundinis* LAM. (Chotín October 13, and December 2, 1989 one male, three females and seven nymphs, Ivanka September 25, 1989 one male). Occurrence of this bug in nests of the Sand Martin is widely known (HICKS, 1959, 1962, 1971; BORISOVA, 1978; KACZMAREK, 1988 etc.). In Slovakia it was found in nests of the Sand Martin in a small number of individuals, but relatively frequently by ORSZÁGH et al. (1993).

Table 2. Survey of beetles found in nests of the Sand Martin in two localities in South Slovakia.

Family Species	Locality Chotín	Ivanka
CARABIDAE		
Trechus quadristriatus (SCHR.)	1	1
Bradycellus collaris PAYK.	1	
Syntomus obscuroguttatus (DUFT.)		2
Syntomus foveatus (FOUCR.)	1	
HISTERIDAE		
Gnathoncus buyssoni AUZAT	3	
STAPHYLINIDAE		
Scopaeus laevigatus (GYLL.)	1	
Hypomedon melanocephalus (FABR.)	2	4
Leptacinus batychrus GYLL.)	2	1
Leptacinus pusilus (STEPH.)	1	
Xantholinus linearis (OLIV.)		1
Heterothops niger KRAATZ	3	
Tachyporus nitidulus (FABR.)	7	24
Tachypotus hypnorum (FABR.)	1	
Tachyporus chrysomelinus (L.)	2	
Drusila canaliculata (FABR.)		1
Haploglossa nidicola FAIRM.	4,688	776
Haploglossa pulla GYLL.	2	
Ousipalia caesula GRAV.	4	
PTINIIDAE		
Acrotrichis intermedia GILMOUR	1	
SCARABAEIDAE		
Oxyomus silvestris (SCOP.)	3	1
CRYPTOPHAGIDAE		
Cryptophagus dentatus HERBST	1	1
Atomaria sp.	1	
LATHRIDIIDAE		
Enicmus minutus (L.)	1	1
DERMESTIDAE		
Anthrenus pimpinelae (FABR.)		2
PTINIDAE		
Ptinus fur L.		1
ANTHICIDAE		
Formicomus pedestris ROSSI		3
TENEBRIONIDAE		
Blaps lethifera MARSH.		1
BRUCHIDAE		
Bruchus pisorum L.		1
CURCULIONIDAE		
Sitona linearis (L.)	1	
Species number	21	16
Individuals number	4,727	821

Beetles

The beetles were represented by 5,548 individuals of 29 species from 13 families. However one species, the staphylinide *Haploglossa nidicola* represented quantitatively almost the whole material (5,464 individuals, 98.49%) in both localities (Tab. 2). All other species, except for the staphylinide *Tachyporus nitidulus* were represented by 1–4 individuals. As to the species number, the richest family were the staphylinids (13 species). They were represented by 11 edaphic species penetrating into the nests material from the soil. Another two species were nidicolous. *Haploglossa nidicola* is a typical inhabitant of nests of the Sand Martin and its congener *H. pulla* (2 individuals) lives in the nests of a large

Table 3. Survey of flies found in nests of the Sand Martin in two localities in South Slovakia.

Family Species	Locality Chotín	 Ivanka
PHORIDAE		
Megaselia scutellaris (WOOD)	328	16
DROSOPHILIDAE		
Drosophila funebris (FABR.)	2	
PIOPHILIDAE		
Parapiophila vulgaris (FALL.)	7	1
FANNIIDAE		
Fannia fuscula (FALL.)		1
MUSCIDAE		
Phaonia incana (WIED.)	1	
MYCETOPHYLIDAE (non det.)	24	15
SCIARIDAE (non det.)	3	1
Species number (excl. Mycetophilide et Sciaridae)	6	5
Individuals number	365	34

number of bird species. The staphylinids were followed by the four, individually represented species of Carabidae. Also these species have no direct relation to the studied nests. Other species of beetles are mostly fungivorous or detritivorous. They can find a suitable food basis in the nests and some of them (*Cryptophagus dentatus*, *Enicmus minutus*, *Ptinus fur*, *Anthrenus pimpinelae*) often occur in small numbers in the nests of other birds. The carnivorous histeride *Gnathoncus buyssoni* is a typical nidicole, cohabiting with *H. pulla* in the nests of many other birds. However, when compared with the nests of other birds, the quantitative representation of all these species in nests of the Sand Martin was extremely low. This indicates that nests of the Sand Martin do not offer suitable conditions for them. The tenebrionid *Blaps lethifera* is known to search for cover in the burrows of different animals. The presence of *Bruchus pissorum* and *Sitona linearis* in the studied nests was purely occasional. Except for the strong difference in the number of individuals of *Haploglossa nidicola* there were no significant differences in both individuals and species number of beetles. The differences in Table 2 are above all due to the rather occasional occurrence of the majority of species and due to the different extent of the material from Chotín and Ivanka.

Flies

Altogether 399 individuals of flies belonging to five species were found in the studied nests. Representatives of the families Mycetophylidae and Sciaridae have not been identified. The larvae of the species *D. funebris*, *P. vulgaris*, *Ph. incana* are also necrophagous. Therefore they may also find suitable conditions for their reproduction in nests of the Sand Martin. The species *F. fuscula* is nidicolous. The representatives of the family Mycetophilidae, Sciaridae and a relatively high number of individuals of *M. scutellaris* began to occur in the nests as early in the second half of October. This indicates that their adults search the nests as a suitable cover for wintering. The typical ectoparasites of birds, the flies of the Hypoboscidae and species of the genus *Protocalliphora* (Calliphoridae) have not been found in our material. Except for the number of individuals of *Megaselia scutellaris* there were no significant differences in number of species or individuals of flies between both localities.

Fleas

Altogether 5,096 individuals of fleas were obtained from the nest material. Among them, 5,054 individuals belonged to the only species *Ceratophyllus styx styx* which is the specific flea for the Sand Martin. In Chotín it occurred in 62.7% of nests while in Ivanka in 75.6% of nests. The remaining 42 individuals of fleas belonged to seven species, not specific for the Sand Martin (Tab. 4). Three species, *Ceratophyllus solutus solutus*, *Ceratophyllus assimilis assimilis* and *Nosopsyllus fasciatus* are ectoparasites of small mammals and they penetrate into nests of the Sand Martin together with their typical hosts or from the burrows of small mammals crossing the burrows of the Sand Martin. The species *Ceratophyllus sciurorum*, *C. gallinae*, *C. garei* and *C. pullatus* are ectoparasites of birds. In our case they might have

Table 4. Survey of fleas found in nests of the Sand Martin in two localities in South Slovakia.

Family Species	Locality Chotín	 Ivanka
CTENOPTHALMIDAE		
Ctenopthalmus solutus solutus JORD. et ROTHS		5
Ctenopthalmus assimilis assimilis (TASCH.)	10	3
CERATOPHYLIDAE		
Nosopsyllus fasciatus (BOSCH.)	2	1
Ceratophyllus sciurorum (SCHR.)	2	
Ceratophyllus gallinae DAMPF	5	9
Ceratophylus garei ROTHS.	2	
Ceratophyllus pullatus JORD. et ROTHS.		3
Ceratophyllus styx styx ROTHS.	2,452	2,602
Species number	6	6
Individuals number	2,473	2,623

penetrated into the burrows mostly with the sparrows (*Passer montanus*), which nested in some, mostly unfinished, burrows of the Sand Martin. Occurrence of unspecific species of fleas in nests of the Sand Martin is relatively common. In Slovakia BABJAKOVÁ et al., (1993) found 18 unspecific species of fleas in nests of the Sand Martin. All species found in our material were included among those 18 species.

Abundance dynamics and mutual relationships of three major components of the nests fauna

Mites

The abundance of mites (for details about structure of the mite taxocoenosis see MAŠÁN and KRIŠTOFÍK (1993)) in Chotín decreased continually from August to October and reached a minimum in November, while in Ivanka it dropped suddenly as early in October and in November it decreased only slightly. In December the abundance of mites increased in both localities, but each of them exhibited an opposite trend in the next three months. In Chotín, the abundance of mites decreased linearly and reached a minimum in March and then increased once more in April and in May they disappeared almost completely. In Ivanka, after the minimum reached in November the abundance of mites increased considerably in December and the increasing trend continued until January. In February the abundance stayed approximately on the same level and, as in Chotín, dropped suddenly in March. In April the abundance of mites increased moderately and in May it reached nearly the same level as in February.

Fleas

The abundance of fleas (*Ceratophyllus styx*) increased moderately in both localities from August to October. In November it exhibited a striking drop. In December it began to increase and culminated in February. This could be caused by a relatively warm weather in this month. In March and April it decreased and reached a minimum in both localities in May, when the adults stay around the burrow openings waiting for the host. The populations in both localities were female dominated during the whole studied period except for August in Chotín. According to JURÍK (1974) *Ceratophyllus styx* has one generation in Czechoslovakia, its larvae appear usually from June to August, and the adults should stay out of nests of the Sand Martin in autumn and in winter. However, this contradicts our observations (Tab. 4, Fig. 1), which show the presence of a high number of adults of *Ceratophyllus styx* in autumn and winter.

In the nidification period of the Sand Martin JAFREMAVA (1986) found that the number of fleas represented 30% of all arthropods in May, while it decreased to 5.6% in June – August. KACZMAREK (1988) studied the abundance of *C. styx* in nests of the Sand Martin in the period of three months after the abandonment of the nests. The abundance of *Ceratophyllus styx* was decreasing continuously from September to November. Their results do not fully agree conformous with our data, because in our case the abundance of *C. styx* increased from August to October and a sudden decrease appeared as early as in November (Fig. 1).

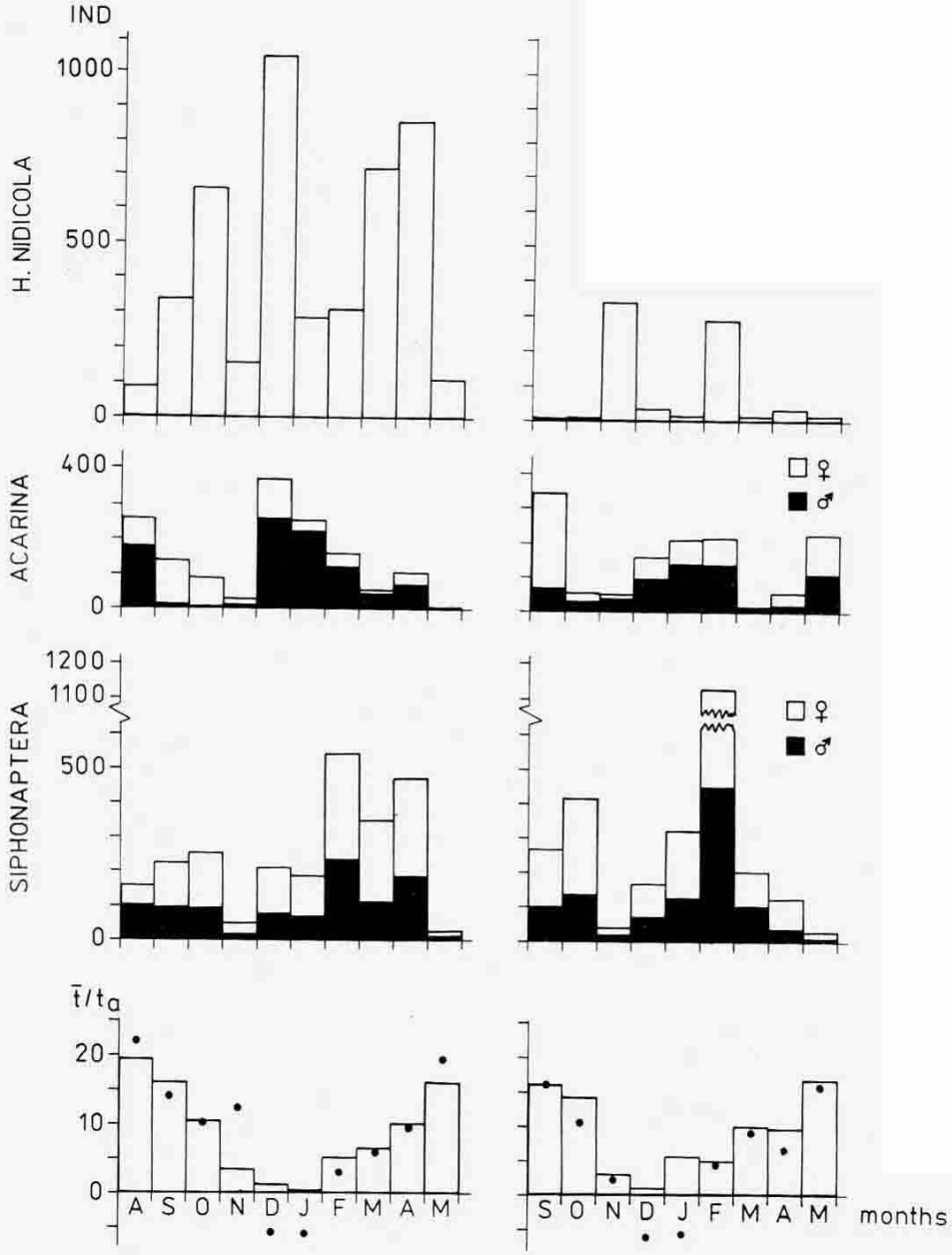

Fig. 1. Average monthly temperature (white columns) and actual temperature on the day of collecting (black dots) and abundance dynamics of fleas, mites and *Haploglossa nidicola* in the nests of *Riparia riparia* in Chotín (left) and Ivanka pri Dunaji (right).

Haploglossa nidicola

The abundance of *Haploglossa nidicola* in Chotín increased nearly linearly from August to October, dropped suddenly in November and strongly culminated in December. In January and February it dropped considerably and a new increase appeared in March and April. In May it reached a minimum. In Ivanka, the abundance of *Haploglossa nidicola* was generally much lower. But in spite of this, there are two striking culminations in November and in February. Both culminations appeared one month earlier than in Chotín, but the time between them is the same. The comparison of our data with those of ŠUSTEK and JURÍK (1980) indicates that the strong decline of abundance of *Haploglossa nidicola* represents a general feature of its seasonal dynamics.

Mutual relations of mites, fleas and *H. nidicola*

The comparison of abundance dynamics of mites, fleas and *H. nidicola* with the average monthly temperature and actual daily temperature in the time of collecting the nests in both localities shows that there is no positive or negative relation with temperature. However, especially comparison of the dynamics of mites and *H. nidicola* indicates that an evident decline in abundance of mites corresponds to the strong increase of abundance of *H. nidicola*. To a considerably smaller evident extent the same relationship can also be detected between *H. nidicola* and fleas. The abundance histograms of *H. nidicola* and of mites and fleas exhibit the typical features of the predator/prey relationships described in a simplified way by the LOTKA-VOLTERA model.

The above facts indicate that the population dynamics of mites, fleas and *H. nidicola* is managed by the intrinsic control factors of each species and, to a considerable degree, by the mutual trophic relations between *H. nidicola* on one hand and mites and fleas on the other. Further, it seems that these relations are strongly dependent on the body size ratio of the predator (*H. nidicola*) and prey (mites and fleas, or flea larvae). This ratio explains (and confirms) the higher prey preference of *H. nidicola* for mites.

Conclusions

The arthropod fauna in the abandoned nests of the Sand Martin consists of three abundant mites *Dermanyssus hirundinis*, *Androlaelaps casalis* and *Hypoaspis lubrica* and of the flea *Ceratophyllus styx*, specific for the Sand Martin. The staphylinid *Haploglossa nidicola* occurring exclusively in the nests is bound to the above parasites trophically. The relations between *H. nidicola* and mites and to a much smaller extent between *H. nidicola* and *C. styx* exhibit the typical features of the predator/prey relation. The abundance dynamics of these three components of the nest fauna are rather independent of the external temperature and are controlled by the intrinsic mechanism of each species and by the described interspecific relations. The presence of other arthropods in the nests is more or less occasional and depends on the composition of the soil and soil surface fauna in the vicinity of the nests. Some species of fleas search for the nests as a suitable cover for wintering. The quantitative representation of some non nidicolous species occurring usually in other birds' nests indicates that these species are also able to develop in nests of the Sand Martin, but they do not find such favourable conditions there as in other bird's nests.

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References

AMBROS, M., KRIŠTOFÍK, J., ŠUSTEK, Z., 1992: The mites (Acari, Mesostigmata) in the birds' nests in Slovakia.– Biológia, Bratislava, **47:** 369–381.

BABJAKOVÁ, A., KRUMPÁL, M., CYPRICH, D., 1993: Výskyt nešpecifických druhov bĺch (Siphonaptera) v hniezdach brehule hnedej (*Riparia riparia* (L.)) na Slovensku.– Tichodroma **5:** 115–121.

BEIER, H., 1963: Ordnung Pseudoscorpionidea, Berlin, 313 pp.

BORISOVA, V. I., 1978: K strukture gnezdovonorovykh cenozov lastochek.– Parazitologiya **12:** 377–382.

BÜTTIKER, W., 1969: Parasiten und Nidicolen der Uferschwalbe (*Riparia riparia* (L.)) in der Schweiz.– Mitt. Schweiz. ent. Ges. **42:** 205–220.

GAJDOŠ, P., KRIŠTOFÍK, J., ŠUSTEK, Z., 1991: Spiders (Araneae) in the birds' nests in Slovakia.– Biológia, Bratislava, **46:** 887–905.

HICKS, E. A., 1959: Check list and bibliography on the occurrence of insects in bird's nests.– Ames, Iowa, 681 pp.

HICKS, E. A., 1962: Check list and bibliography on the occurrence of insects in birds' nests.– Supplement I., Iowa St. J. Sci. **36:** 233–348.

HICKS, E. A., 1971: Check list and bibliography on the occurrence of insects in birds' nests.– Supplement II., Iowa St. J. Sci. **46:** 123–338.

JAFREMAVA, G. A., 1986: Sezonnaya dynamika zgurtavannyau chlenistonogikh u gnezdakh beraboj lastauki.– Vesci Akad. Nauk BSSR, Ser. Biyalogichnykh nauk, **2:** 101–104.

JURÍK, M., 1974: Bionomics of fleas in birds' nests in the territory of Czechoslovakia.– Acta Sci. natur. Acad. Sci. bohemoslov., Brno, **10:** 54 pp.

JURÍK, M., 1975: Quantitative evaluation of the classification of fleas as bird parasites.– Acta Univ. Agric. Brno, Ser. A, **23:** 555–566.

JURÍK, M., 1978: Significance of individual bird species as hosts of fleas (Siphonaptera).– Acta Univ. Agric. Brno, Ser. A, **24:** 111–116.

KACZMAREK, S., 1988: Pasozyty zewnetrzne z gniazd jaskólki *Riparia riparia* (L.).– Wiad. Parazyt. **34:** 347–351.

MAŠÁN, P., KRIŠTOFÍK, J., 1993: Mites and ticks (Acarina: Mesostigmata et Ixodida) from the nests of *Riparia riparia* L. in South Slovakia.– Biológia, Bratislava, **48:** 155–162.

NORDBERG, S., 1936: Biologisch-ökologische Untersuchungen iiber die Vogelnidicolen.– Acta zool. fenn. **21:** 1–168.

NUORTEVA, P., JÄRVINEN, U., 1961: The insect fauna of the nests of the Sand Martin (*Riparia riparia* L.) in Finland.– Ann. ent. fenn. **27:** 197–204.

ORSZÁG, I., KRUMPÁL, M., CYPRICH, D., 1990: Contribution to the knowledge of the Martin Bug – *Oeciacus hirundinis* (Heteroptera, Cimicidae) in Czechoslovakia.– Zbor. Slov. nár. Múz., Prír. Vedy **36:** 36–60.

ŠUSTEK, Z., JURÍK, M., 1980: The beetles (Coleoptera) in the nests of *Riparia riparia* in Czechoslovakia.– Věst. Čsl. spol. zool. **44:** 286–292.

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