

Arthropods (Acari, Siphonaptera, Heteroptera, Psocoptera) associated with *Nyctalus noctula* (Schreber, 1774) (Chiroptera: Vespertilionidae) in Southern Poland

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ABSTRACT. Material and methods. From 101 specimens of *Nyctalus noctula* collected in Southern Poland during winter, 2637 arthropods of 13 species were obtained: Siphonaptera (3 species), Acari (8 species), Heteroptera (one species) and one specimen of Psocoptera. **Results and discussion.** The most numerous species were *Macronyssus flavus* (96.8% of the collection) and *Steatonyssus spinosus* (1.9% of the collection). Females of *N. noctula* were stronger infested than males. In females, the mean infestation by *Macronyssus flavus* was 30.8 and in males 23.5. *Acanthophtirius noctulius* and *Nycteriglyphus tuerkorum* are new to the fauna of Poland.

Key words: *Nyctalus noctula*, arthropods, ectoparasites, faunistic, Poland

Introduction

In Poland, *Nyctalus noctula* is common species but the knowledge of arthropods occurring on this species is poor. Until present, on *N. noctula* the following species have been found in Poland: *Ischnopsyllus elongates* (Curtis), *Nycteridopsylla eusarca* Dampf, *Ceratophyllus gallinae* (Schrank) (Siphonaptera), *Spinturnix acuminatus* (Koch), *Macronyssus flavus* (Kolenati) and *Steatonyssus occidentalis evansi* Micherdziński (Acari) [1–4]. In neighbouring countries (Czech Republic, Germany) arthropod fauna of *N. noctula* is better known. From Germany, at least 19 species of arthropods were found on this host [5–7]. Now, two new species to fauna of Poland were found: *Nycteriglyphus tuerkorum* (Dusbábek) and *Acanthophtiriu noctulius* (Radford) and six species were found on *N. noctula* for the first time in Poland.

Materials and methods

From 101 dead *Nyctalus noctula* (Schreber, 1774) collected at one locality in Oława (Lower Silesia, UTM: XS64), 2637 specimens of arthropods were obtained. Bats were collected from a

crevice in the building on 29 March 2006, during their hibernation period. The crevice was filled with the building foam, which trapped the bats and they were not able to get out. All dead *N. noctula* were deposited in the Department of Zoology and Ecology of Wrocław University of Environmental and Life Sciences (the permission of SR.V. 6631/z/Ntp/11/AM/06). All bats were sexed: 41 females, 53 males and 7 specimens with undetermined sex. The presence of arthropods was determined for all 101 bats (permission of DLOPiK-op/ogiz-4200/IV.D-4/5387/06/wo).

All found arthropods were stored in 75% ethanol, then mounted in Berlese's liquid, and identified under a microscope.

The intensity of parasite infestation was compared between bat sexes (Table 1). The dominance index, mean intensity of infestation and extensity of infestation were estimated (Table 2).

Results

From 101 bats, 2637 arthropods belonging to 13 species (+one undetermined Siphonaptera larva) were collected (Fig. 1, Table 1).

Table 1. Arthropods collected from *Nyctalus noctula*

	ECTOPARASITE SPECIES		<i>Nyctalus noctula</i>			TOTAL N=101	
			NO SEX N=7	FEMALE N=41	MALE N=53		
Acari	<i>Acanthopthirius noctulius</i> (Radford, 1938)	female	—	—	1	1	
		all	—	—	1	1	
	<i>Acarus farris</i> (Oudemans, 1905)	female	1	—	—	1	
		all	1	—	—	1	
	<i>Argas vespertilionis</i> (Latreille, 1802)	L	—	1	—	1	
		all	—	1	—	1	
	<i>Chiroptella muscae</i> (Oudemans, 1906)	L	1	—	1	2	
		all	1	—	1	2	
	<i>Macronyssus flavus</i> (Kolenati, 1856)	female	21	390	380	791	
		male	7	99	110	216	
		PR	15	774	756	1545	
		all	43	1263	1246	2552	
	<i>Nycteriglyphus tuerkorum</i> Dusbábek, 1964	female	1	—	2	3	
		all	1	—	2	3	
<i>Spinturnix acuminatus</i> (C.L.Koch, 1836)	female	1	5	5	11		
	male	—	5	3	8		
	all	1	10	8	19		
<i>Steatonyssus spinosus</i> Willmann, 1936	female	1	20	15	36		
	male	—	1	—	1		
	PR	—	3	10	13		
	all	1	24	25	50		
Insecta	<i>Cimex dissimilis</i> (Horváth, 1910)	female	—	2	—	2	
		all	—	2	—	2	
	<i>Ischnopsyllus hexactenus</i> (Kolenati, 1856)	female	—	1	1	2	
		all	—	1	1	2	
	<i>Ischnopsyllus variabilis</i> (Wagner, 1898)	female	—	1	—	1	
		all	—	1	—	1	
	<i>Nycteridopsylla eusarca</i> Dampf, 1908	male	—	—	1	1	
		all	—	—	1	1	
	Siphonaptera <i>undetermined larva</i>	L	—	1	—	1	
		all	—	1	—	1	
	Psocoptera	—	—	—	1	1	
		all	—	—	1	1	
	TOTAL			48	1303	1286	2637

Explanations: L – larva; PR – protonymph

Siphonaptera

Family Ischnopsyllidae Wahlgren, 1907

1. *Ischnopsyllus hexactenus* (Kolenati, 1856)

Material. 2 female

In Poland, it is the commonest species on bats. It was collected from *Plecotus auritus*, *P. austriacus*, *Barbastella barbastellus*, *Myotis nattereri*, *M. myotis*, *M. dasycneme* and *Eptesicus serotinus* [2, 4, 8]. On *N. noctula* occurs very rarely. First record from *N. noctula* in Poland.

2. *Ischnopsyllus variabilis* (Wagner, 1898)

Material. 1 female

In Poland, this rare species was known only from three localities: Nizina Wielkopolsko-Kujawska, Lower Silesia (Kaczawskie Mts: Wojcieszów Górny) and Białowieża Primeval Forest and collected from *P. pipistrellus* (Schreber, 1774), *E. serotinus* and *P. auritus* [1, 4, 8, 9]. It has been rarely noted on *N. noctula* [10, 11]. In Poland, it is the first record from *N. noctula*.

3. *Nycteridopsylla eusarca* Dampf, 1908

Material. 1 male

In Poland, probably rare species. It was found on *N. noctula* from Pojezierze Pomorskie and Lower Silesia and in the nest of *Delichon urbica* (Linnaeus, 1758) from Kościerzyna (voi. pomorskie) [1, 2, 12, 13]. Its main host is *N. noctula* but it was collected also from *Pipistrellus kuhlii* (Kuhl, 1817), *P. pipistrellus*, *Plecotus auritus*, *M. myotis*, *M. blythii* (Tomes, 1857), *Eptesicus nilssonii* (Keyserling & Blasius, 1839) and *Barbastella barbastellus* [11, 14, 15].

Acari**Family Macronyssidae Oudemans, 1936**4. *Macronyssus flavus* (Kolenati, 1856)

Material. 791 female, 216 male,
1545 protonymph

In Poland, this species was known only from Białowieża [4]. Its main host is *N. noctula*, but sometimes it has been collected from other species of bats. In the Czech Republic it has also been obtained from *B. barbastellus*, *M. daubentonii* (Kuhl, 1817), *M. myotis* and *P. pipistrellus* [16]. In Poland, *M. flavus* occurs probably everywhere where *N. noctula* resides. In March, this species was the most numerous among arthropods obtained from *N. noctula* (96.78% of collection) (98.02% extensity of infestation, 25.78 mean intensity of infestation – range: 1–101).

5. *Steatonyssus spinosus* Willmann, 1936

Material. 36 female, 1 male, 13 protonymph

In Poland, this species was known only from five localities: Książ, Walim, Kamieniec Żąbkowicki (voi. dolnośląskie), Kania n. Grabów (voi. wielkopolskie) and Białowieża (voi. podlaskie) and was collected from *M. myotis*, *B. barbastellus*, *E. serotinus* and *E. nilssonii* [9, 17]. In this collection, this species amounts 1.90% of arthropods. (33.66% extensity of infestation, 1.47 mean intensity of infestation – range: 1–4). From *N. noctula*, for the first time recorded in Poland. This species was collected from many species of bats but on *N. noctula* it used to be found rarely [11].

Family Spinturnicidae Oudemans, 19016. *Spinturnix acuminatus* (C.L. Koch, 1836)

Material. 11 female, 8 male

In Poland, this species was collected hitherto only from *N. noctula* in Białowieża [3]. In this study, only 19 specimens were collected; extensity

of infestation (14.85%) and mean intensity of infestation (1.27; range: 1–3) were very low, but the highest extensity of infestation and mean intensity of infestation were found in summer months 65% in the Czech Republic and 62.1% in Moldova and 4.7 mean intensity of infestation in Moldova [18, 19]. Its main host is *N. noctula*.

Family Argasidae Murray, 18777. *Argas vespertilionis* (Latreille, 1802)

Material. One larva

In Poland, this species is widely distributed and it was collected from 9 species of bats [9, 17, 20–23]. However, it has never been collected from *N. noctula*. Its natural environment are crevices of buildings, caves and tree holes occupied by bats.

Family Myobiidae Megnin, 17788. *Acanthophthirus noctulius* (Radford, 1938)

Material. 1 female, 1 male

This rare species is associated with *N. noctula* and was found also on *N. lasiopterus*. It was known from Belgium, Bulgaria, Germany, Great Britain, Japan and Kirghizstan [6, 24–29]. First record from Poland.

Family Trombiculidae Ewing, 19449. *Chiroptella muscae* (Oudemans, 1906)

Material. 2 larva

In Poland, this relatively rare species was known from Lower Silesia, Kowal (voi. kujawsko-pomorskie) and Białowieża (voi. podlaskie). It was collected from *M. nattereri*, *E. serotinus* and *Vespertilio murinus* Linnaeus, 1758 [4, 9, 22, 30]. Widely distributed in Europe and Asia (Afghanistan, Tajikistan, Korea), it was collected from many bat species, also on *N. noctula*. In Poland, for the first time collected on *N. noctula* and on this host it is probably a rare species.

Family Rosensteiniidae Cooreman, 195410. *Nycteriglyphus tuerkorum* Dusbábek, 1964

Material. 3 female

Until now, this rare species was known only from Czech Republic where it was collected from *N. noctula* and *M. myotis* [11, 31]. First record from Poland. It is also the first record of the family Rosensteiniidae in Poland.

Family Acaridae Latreille, 180211. *Acarus farris* (Oudemans, 1905)

Material. 1 female

This free-living species is very common in Poland; on bats was noted rarely. In the Czech Republic it was found on *M. daubentonii* [11, 32]. The first record from *N. noctula*.

Heteroptera

Family Cimicidae Latreille, 1804

12. *Cimex dissimilis* (Horváth, 1910)

Material. 2 female

In Poland, this rare species was known only from Racot, Turew (voi. wielkopolskie), vicinity of Rzeszów and Puławy (partly as *C. pipistrelli* (Jenyns, 1839) [33, 34]. It was collected from *N. noctula* and obtained from the nest of unidentified bird (Passeriformes). This species is widely distributed in Europe and was found on 10 species of bats (also on *N. noctula*) [11]. *C. dissimilis* is probably synonymous of with *C. pipistrelli* [35] but this species formally was not synonymized with *C. pipistrelli* and this problem is yet not clear, therefore we determined the specimens from Oława as *C. dissimilis*.

Psocoptera

Undetermined species

Material. One specimen

Undetermined specimen was obtained from

N. noctula. Psocoptera are free living and never were found on bats. The presence of this specimen on the body of bat is accidental.

Discussion

The seasonal variability of the fauna of arthropods and fluctuations of their number in following seasons at *N. noctula* was not investigated as yet. Basing on the large collection of *N. noctula* obtained in winter season there were examined the specific depot and the number of arthropods occurred on individuals hibernated in the colony, which occupied the crevice of the building in Oława.

There were ascertained the presence of 13 species of arthropods, but the only one species *M. flavus* appeared in strength and it was eudominants in the colony (96.8%) (Table 2). The numerical participation *M. flavus* on each bats was strongly differentiated and fluctuated within 4–101. Strongly infected individuals (above 60 *M. flavus*) determined 5.9% all of bats, and the least infected (below 21% *M. flavus*) as many as 46.8%. This dependence is the case: 4–20 *M. flavus* – 4 bats, 21–40 – 35 bats, 41–60 – 11 bats, 51–80 – 3 bats, 81–101 – only 3 bats. The high intensity of the infestation *M. flavus* is therefore noted hardly ever. The average intensity of the infestation *M. flavus* in

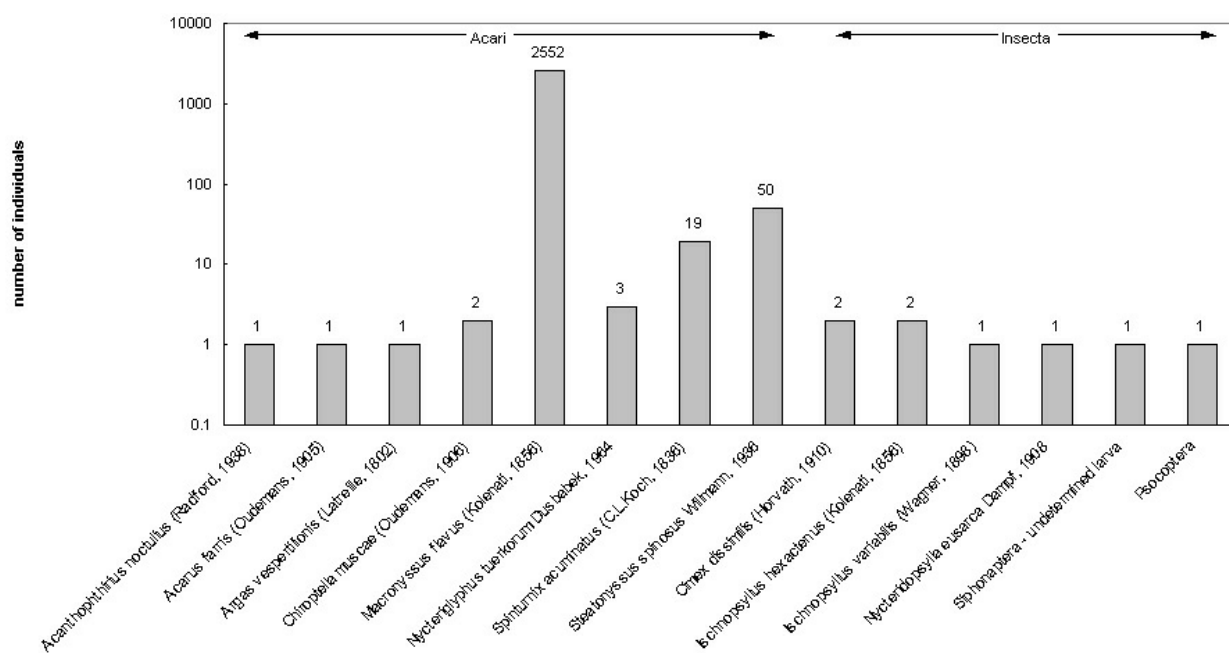


FIG. 1. Number of individual arthropods (in logarithmic scale) collected from *Nyctalus noctula* (n=101 parasitized bats)

Table 1. Indexes of infestation in *Nyctalus noctula*

ECTOPARASITE SPECIES	<i>Nyctalus noctula</i>			
	FEMALE	MALE	ALL	
<i>Acanthophthirius noctulius</i> (Radford, 1938)	D	—	0.08	0.04
	I	—	1.00	1.00
	E	—	1.89	0.99
<i>Acarus farris</i> (Oudemans, 1905)	D	—	—	0.04
	I	—	—	1.00
	E	—	—	0.99
<i>Argas vespertilionis</i> (Latreille, 1802)	D	0.08	—	0.04
	I	1.00	—	1.00
	E	2.44	—	0.99
<i>Chiroptella muscae</i> (Oudemans, 1906)	D	—	0.08	0.08
	I	—	1.00	1.00
	E	—	1.89	1.98
<i>Macronyssus flavus</i> (Kolenati, 1856)	D	96.93	96.89	96.78
	I	30.80 (6–100)	23.61 (4–72)	25.78 (1–101)
	E	100	100	98.02
<i>Nycteriglyphus tuerkorum</i> Dusbábek, 1964	D	—	0.16	0.11
	I	—	2.00	1.50 (1–2)
	E	—	1.89	1.98
<i>Spinturnix acuminatus</i> (C.L.Koch, 1836)	D	0.77	0.62	0.72
	I	0.80 (1–2)	1.33 (1–3)	1.27 (1–3)
	E	19.51	11.32	14.85
<i>Steatonyssus spinosus</i> Willmann, 1936	D	1.84	1.94	1.90
	I	1.60 (1–4)	1.39 (1–3)	1.47 (1–4)
	EI	36.59	33.96	33.66
<i>Cimex dissimilis</i> (Horváth, 1910)	D	0.15	—	0.08
	I	1.00	—	1.00
	E	4.88	—	1.98
<i>Ischnopsyllus hexactenus</i> (Kolenati, 1856)	D	0.08	0.08	0.08
	I	1.00	1.00	1.00
	E	2.44	1.89	1.98
<i>Ischnopsyllus variabilis</i> (Wagner, 1898)	D	0.08	—	0.04
	I	1.00	—	1.00
	E	2.44	—	0.99
<i>Nycteridopsylla eusarca</i> Dampf, 1908	D	—	0.08	0.04
	I	—	1.00	1.00
	E	—	1.89	0.99
Siphonaptera <i>undetermined larva</i>	D	0.08	—	0.04
	I	1.00	—	1.00
	E	2.44	—	0.99
Psocoptera	D	—	0.08	0.04
	I	—	1.00	1.00
	E	—	1.89	0.99

Explanations: D – dominance index [%]; I – mean intensity of infestation (with range);

E – extensity of infestation [%] (differences according to sex of bats are given for individual species of arthropods)

the winter was very high (25.8). Unfortunately for lack of research on the large group of *N. noctula* there is no possibility to find out the numerical changes occurred at this species by the year. There are premises showing, that in other seasons *M. flavus* appear less often than in the period of the host's hibernation. There is no information about it in the literature. Only Arzamasov and Kurskov [36] determined for *N. noctula* 7.8 the average intensity of the infestation and the extensiveness of the infestation 70.7%. Probably the high average intensity of the infestation and the extensiveness of the infestation exists mostly in the period of the bats' hibernation (Table 2).

The second species *S. spinosus* (34% the extensiveness of the infestation, 1.27 the average intensity of the infestation) regarding the number was many times less numerous than *M. flavus* and usually appeared one by one on the host. From one *N. noctula* there were maximally assembled 4 *S. spinosus*. The males *N. noctula* were more strongly infected than the females (Tables 1 and 2). The remaining species of arthropods appeared occasionally and were represented by 1–3 individuals. Among them there are very unique species, such as *Acanthophthirius noctulius* and *Nycteroglyphus tuerkorum*, occurring on this host very rarely (*A. farris*, *C. muscae*) or occurring more numerously in other seasons (*A. vespertilionis*).

The structure of the fauna of arthropods mostly depends on the species of the host, their environments, the bionomics and the ethology of arthropods. Dusbábek [32, 37] mentioned 9 groups of mites associated with bats. This classification does not include other arthropods occurring on bats: Siphonaptera, Cimicidae (Heteroptera) and Nycteribiidae (Diptera). They well comprised in these groups. In accordance with this classification, the participation of collected arthropods on *N. noctula* is as follows:

III. Ectoparasites epizotic (somatic), haematophagic, their specificity is restricted mainly by dependences on hosts: *Acanthophthirius noctulius*, *Spinturnix acuminatus*.

V. Endophilic ectoparasites with transition from a periodic to permanent type of parasitism with obligatory haematophagy: *Ischnopsyllus hexactenus*, *I. variabilis*, *Nycteridopsylla eusarca*, *Macronyssus flavus*, *Steatonyssus spinosus*, *Cimex dissimilis*.

VI. Endophilic temporary or periodic ectoparasites with obligatory haematophagy: *Chiroptella*

muscae, *Argas vespertilionis*.

VIII. Facultative commensals: *Acarus farris*, *Nycteriglyphus tuerkorum*, Psocoptera.

The most numerous there were species of the group V (98.9%), the other groups are represented only by 2 or 3 species. At examined bats, the high domination of this group is the highest in Poland. Among bats from Lower Silesia only in *M. dasycneme* (91.9%) and *M. nattereri* (91.2%) one noted the high numerical participation of arthropods from this group. In the other species of bats the participation of this group was much lower: in *P. austriacus* (77.8%), *M. brandtii* (Eversmann, 1845) (72.4%), *M. myotis* (56.6%), *P. auritus* (58.5%), *M. mystacinus* (48.3%) and in *M. daubentonii* only 20.9% the gathering. Only at *Barbastella barbastellus* dominated arthropods of VI group (49.6%).

Depending on the sites of hibernation, the arthropod fauna can be distinctly different. In *B. barbastellus* that hibernated in buildings (cellars), the mean intensity of infestation was distinctly lower than in bats hibernating in galleries and caves (4.8, 9.2, 17.3, respectively) [30]. According to this, in *N. noctula* that hibernated in buildings the mean intensity of infestation (26.1) was very high.

The mean of intensity of infestation differs according to sex of bats (in relation to individual species of arthropods) (Table 2). In Poland, such phenomenon was found in *B. barbastellus* collected in caves and galleries (4.5 female, 18.0 male) and depended mainly on *Leptotrombidium russicum* (Oudemans, 1903). In *M. daubentonii*, the females were stronger infected by almost all arthropods than males: by *Nycteribia kolenatii* Theodor & Moscona, 1954 (6.5 female, 3.2 male); *Spinturnix andegavinus* (Deunff, 1977) (1.2 female, 0.1 male), in *M. myotis* by *Spinturnix myoti* (Kolenati, 1856) (1.9 female, 0.6 male) [30]. These differences were noted also at *N. noctula*: the females were more strongly infected than the males and it mostly depended on *M. flavus*. The average intensity of the females infecting by *M. flavus* total up 30.8, and the males 23.5. Zahn and Rapp [38] also noticed such differences at *N. noctula* with reference to Macronyssidae (40.0 female, 19.0 male).

Fauna of arthropods *N. noctula* in Poland is poor. Probably it is as result of the limitation of research only to the winter season. There are species of arthropods mostly appearing in other seasons. Zahn and Rapp [38] they ascertained that some rare species of arthropods showed the high number in the limited time. Sarcoptidae occurring sporadically

on *N. noctula*. They were found at 46% bats only in May and at 40% in June. In Great Britain there are also ascertained the short fauna of arthropods (11 species, but without Siphonaptera, Cimicidae and Nycteribidae) [39, 40]. On *N. noctula* from Germany one found 19 species of arthropods, but they appeared in other proportions than in Poland. The most numerous species were also *M. flavus* but his participation in the gathering was only 65.8% [6, 7]. The fauna of arthropods *N. noctula* compared with another species of bats (collecting in winter) is also considerably shorter in Poland. At *M. myotis* one ascertained the presence of 22 species of arthropods, at *B. barbastellus* 21, *M. daubentonii* 20, *M. nattereri* 18 and at *M. dasycneme* of 13 species [30]. Doubtless, further investigations considerably will widen the list of species occurring on *N. noctula* in Poland.

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References

- [1] Skuratowicz W. 1964. Pchły – Aphaniptera. Katalog fauny Polski 31. PWN, Warszawa.
- [2] Skuratowicz W. 1967. Pchły – Siphonaptera. Klucze do oznaczania owadów Polski 29. PWN, Warszawa.
- [3] Haitlinger R., Ruprecht A.L.. 1982. *Spinturnix acuminatus* (Koch, 1836) (Acarina, Spinturnicidae) a new mite species for the fauna of Poland. *Przeegląd Zoologiczny* 26: 171–172.
- [4] Haitlinger R., Ruprecht A.L. 1992. Parasitic arthropods (Siphonaptera, Diptera, Acari) of bats from western part of the Białowieża Primeval Forest. *Nyctalus (N. F.)* 3: 315–319.
- [5] Walter G., Kock D. 1994. Verbreitung und Wirtsarten der Fledermaus-Flöhe Deutschlands (Insecta: Siphonaptera: Ischnopsyllidae). *Senckenbergiana Biologica* 74: 103–125.
- [6] Haitlinger R., Walter G. 1997. Data relating to the distribution and host-specificity of bat infesting mites (Acari, Mesostigmata, Prostigmata, Astigmata) in Germany. *Drosera* 2: 95–112.
- [7] Walter G. 2004. Überblick zum Vorkommen und zur Biologie von Ektoparasiten (Siphonaptera; Cimicidae; Nycteribiidae; Calliphoridae) bei Fledermäusen in Deutschland. *Nyctalus (N.F.)* 9: 460–476.
- [8] Haitlinger, R. 1977: External parasites of the Lower Silesian bats. I. Siphonaptera. *Wiadomości Parazytologiczne* 23: 441–451.
- [9] Haitlinger R., Ruprecht A.L. 1977. Contribution to the ectoparasites fauna of bats from the Białowieża Primeval Forest. *Przeegląd Zoologiczny* 21: 332–334.
- [10] Beaucournu J.C., Lauray H. 1990. Faune de France et regions limitrophes. 76. Les puces (Siphonaptera) de France et du Bassin Méditerranéen occidental. Fédération Française des Sociétés de Sciences Naturelles VIII, Paris.
- [11] Lanza B. 1999. I parassiti die pipistrelli (Mammalia, Chiroptera) dell fauna italiana. Monographie 30. Museo Regionale di Scienze Naturali, Torino.
- [12] Dampf A.M. 1908. Die ost- und westpreussische Flöhfaua. *Schriften der Physikalisch-Ökonomischen Gesellschaft zu Königsberg in Preussen* 48: 388–399.
- [13] Seidel J. 1937. Flöhe (Aphaniptera) Schlesiens. *Abhandlungen der Naturforschenden Gesellschaft zu Görlitz* 1: 99–116.
- [14] Hürka K. 1963. Bat fleas (Aphaniptera, Ischnopsyllidae) of Czechoslovakia. Contribution to the distribution, morphology, bionomy, ecology and systematics. Part I. Subgenus *Ischnopsyllus* Westw. *Acta Faunistica Entomologica Musei Nationalis Pragae* 76: 57–120.
- [15] Hürka K. 1974. Bat fleas (Aphaniptera, Ischnopsyllidae) from west Bohemia. *Folia Musei Rerum Naturalium Bohemiae Occidentalis – Zoologica* 4: 1–24.
- [16] Dusbábek F. 1964a. Parasitische Fledermausmilben der Tschechoslovakei II. Familie Dermanyssidae Kol. 1859 (Acarina: Gamasides). *Československá Parazitologie* 11: 77–125.
- [17] Haitlinger R. 1978. External parasites of the Lower Silesian bats. III. Spinturnicidae, Argasidae, Ixodidae (Acarina). *Wiadomości Parazytologiczne* 24: 475–490.
- [18] Dusbábek F. 1962. Parasitische Fledermausmilben der Tsechoslowakei I. Fam. Spinturnicidae Oudms., 1901 (Acarina, Gamasides). *Časopis České Společnosti Entomologické* 59: 357–380.
- [19] Pinčuk L.M. 1971. Mites of the Phytoseiidae family (Parasitiformes, Gamasoidea) from nests of small mammals in Moldavia. *Parazity Zhivotnych i Rasteny* 7: 93–110.
- [20] Rafalski J. 1954. Występowanie w Polsce kleszczy *Argas vespertilionis* LATR. i *Argas reflexus* FABR. (Arachnida, Ixodides). *Polskie Pismo Entomologiczne* 24: 165–168.
- [21] Skuratowicz W. 1966. Materiały do fauny pcheł (Aphaniptera) Polski. II. *Fragments Faunistica* 13: 201–222.
- [22] Haitlinger R., Ruprecht A.L. 1985. Arthropods collected from Kujawian bats (Acari and Siphonaptera). *Polskie Pismo Entomologiczne* 55: 615–618.
- [23] Siuda K. 1993. Kleszcze Polski (Acari: Ixodida). II

- Systematyka i rozmieszczenie. Polskie Towarzystwo Parazytologiczne, Warszawa.
- [24] Radford C.D. 1938. Notes on some new species of parasitic mites. *Parasitology* 30: 427–440.
- [25] Beron P. 1973. Catalogue des Acariens parasites et commensaux des Mammifères en Bulgarie (à suivre). *Bulletin de l'Institut de Zoologie et Musée (Sofia)* 17: 167–199.
- [26] Beron P. 1974. Catalogue des Acariens parasites et commensaux des Mammifères en Bulgarie. II. *Bulletin de l'Institut de Zoologie et Musée (Sofia)* 38: 105–136.
- [27] Fain A. 1976. Les Acariens parasites des chauves-souris de Belgique. I. Famille Myobiidae (Prostigmata). *Biologisch Jaarboek Dodonaea* 44: 143–162.
- [28] Uchikawa K. 1981. Myobiid mites of the genus *Acanthophthirus* (Acarina: Myobiidae) from Japan (Part 2). *Bulletin of the Natural Science Museum (Tokyo) (Ser. A) (Zool.)* 7: 135–145.
- [29] Rybin S. N., Horaček I., Červenný I. 1989. Bats of southern Kirghizia: distribution and faunal status. In: *European bat research 1987*. (Eds. V. Hanák, I. Horaček, J. Gaisler). Charles University Press, Praha: 421–441.
- [30] Haitlinger R. 1979. External parasites of the Lower Silesian bats. VI. Acarina, Siphonaptera, Diptera (Nycteribiidae). *Wiadomości Parazytologiczne* 25: 119–140.
- [31] Dusábek F. 1964b. Some new species of tyroglyphid mites (Acarina, Tyroglyphidae), parasitic on bats. *Vestník Československé zoologické společnosti* 28: 220–231.
- [32] Dusábek F. 1972. The zone of bat acarinia in central Europe. *Folia Parasitologica* 19: 139–154.
- [33] Jabłońska J. 1964. The species of the family Cimicidae occurring in Poland. *Polskie Pismo Entomologiczne* 34: 185–187.
- [34] Lis B. 2001. New records of rare true-bugs (Hemiptera: Heteroptera) in the Polish fauna. *Przeegląd Zoologiczny* 45: 89–93.
- [35] Krištofík J., Kaňuch P. 2006. First record of *Cimex pipistrelli* (Cimicidae) in Slovakia. *Biologia* 61: 1–2.
- [36] Arzamasov I.T., Kurskov A.N. 1962. K faune ektoparazitov letučich myšej v ustovijach Belorussii. *Doklady AN BSSR* 6: 202–203.
- [37] Dusábek F. 1971. The acarinia zone of bats under condition of Central Europe. Proceedings of the 3rd International Congress of Acarology held in Prague, August 31– September 6, 1971, Praha, 771–774.
- [38] Zahn A., Rupp D. 2004. Ectoparasite load in European vespertilionid bats. *Journal of Zoology* 262: 383–391.
- [39] Baker A., Craven J.C. 2003. Checklist of the mites (Arachnida: Acari) associated with bats (Mammalia: Chiroptera) in the British Isles. *Systematic and Applied Acarology (Special Publications)* 14: 1–20.
- [40] Baker A. 2005. *Psorergatoides nyctali* (Prostigmata: Psorergatidae), a new mite species parasitizing the bat *Nyctalus noctula* (Mammalia: Chiroptera) in the British Isles. *Systematic and Applied Acarology* 10: 67–74.

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