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Associations between different Laelapidae (Mesostigmata: Dermanyssoidea) mites and small rodents from Lithuania

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Abstract

Associations between species of Laelapidae (Mesostigmata: Dermanyssoidea) mites and small rodents have been studied insufficiently. The aim of this study was to investigate infestation patterns of small rodent species by laelapid mites at six locations in Lithuania. A total of 728 rodents were snap- and live-trapped in various locations during 2013–2016. Eight rodent species were identified, namely *Apodemus flavicollis*, *Apodemus agrarius*, *Myodes glareolus, Micromys minutus*, *Mus musculus*, *Microtus oeconomus*, *Microtus arvalis* and *Microtus agrestis*. A total of 343 (47.1%) rodents were found to be infested with up to eight species of parasitic mites from the Laelapidae family (n = 1363): *Laelaps agilis*, *Laelaps hilaris*, *Hyperlaelaps microti*, *Haemogamasus nidi*, *Haemogamasus hirsutus*, *Eulaelaps stabularis, Hirstionyssus sunci* and *Myonyssus gigas*. The dominant species of mite found on rodents was *L. agilis* (89.1%), found on 43.4% of all hosts. Abundance and mean intensity of infestation with mites varied among species of hosts and were highest for *A. flavicollis*. We document new geographical and host records for gamasid mites of eight rodent species in Lithuania.

Keywords Mesostigmata · Laelapidae · Rodents · Lithuania

Introduction

Mites of the suborder Mesostigmata (Acari: Parasitiformes) include numerous highly diverse species. The superfamily Dermanyssoidea, which belongs to this suborder, encompasses 13 families. A large number of described species are represented by the Laelapidae family (consisting of 90 genera and more than 1300 species) (Moro et al. 2005; Beaulieu et al. 2011). Laelapid mites (Mesostigmata: Dermanyssoidea) found on the bodies of small rodents are generally considered a medically important group of arthropods, because some

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of them are considered potential vectors of zoonoses (Poláčiková 2013; Miťková et al. 2015) and, together with small rodents, can play an important role in the distribution of infections of viral, bacterial and protozoan origin (Zemskaya 1973; Tagiltsev and Tarasevich 1982; Guryčová 1998; Mašán and Stanko 2005). Ecologically diverse, the family Laelapidae includes obligate and facultative parasites of mammals. Blood-sucking parasitic mites permanently occur on the bodies of rodents, while facultative parasites occur in the nests of rodents or on rodents themselves (some of them feed on organic matter and on other small arthropods) (Netušil et al. 2013). Several studies have demonstrated that gamasid mites can be implicated in the circulation of several pathogenic agents and it has been suggested that parasitic gamasid mites can become infected with pathogens after a bloodmeal on an infected host or as a result of co-feeding with other infected ectoparasites (Guryčová 1998; Netušil et al. 2013; Miťková et al. 2015).

The abundance of ectoparasites, including mites, strongly depends on the available host community and the abundance of particular rodent species (Poláčiková 2013). Knowledge concerning the diversity and distribution of dermanyssoid mites on small mammals in different geographic locations and host associations is still limited and scarce. However, several reviews and checklists have been produced for European Mesostigmata mites (Eitminavichute 1976, 2003; Heldt 1995; Karbowiak et al. 2000; Mašán 2003, 2007; Mašán and Fend′a 2004, 2010; Kalúz and Fend′a 2005; Kontschán 2006; Gwiazdowicz 2007; Fend′a and Kalúz 2009; Maaz et al. 2018 etc.). Additionally, communities of gamasid mites parasitizing small mammals have been analyzed in many countries of Europe, including Austria (Mahnert 1971, 1972), Slovakia (Ambros 1984; Mašán 2003, 2007; Mašán and Fend′a 2004, 2010; Kalúz and Fend′a 2005; Fend′a and Kalúz 2009), Germany (Willmann 1952; Maaz et al. 2018) and southern Sweden (Edler 1973; Lundqvist and Brinck-Lindroth 1990). Mites infecting small mammals have also been reported in Poland (Willmann 1952; Haitlinger 1976, 1979, 1983a, b, 1986, 1988, 1989, 2009; Harris et al. 2009), while Grinbergs 1959, 1961a, b, c, d) described nine blood-sucking gamasid mites parasitizing small mammals in Latvia.

In Lithuania, information concerning the occurrence and diversity of parasitic mites and their associations with species of small rodents is scarce. Previous studies conducted in Lithuania on the gamasid mites of small rodents have mostly focused on the presence and/or description of species (Podenaite 1979; Paulauskas et al. 2009; Kaminskienė et al. 2017) and detection of pathogens (Radzijevskaja et al. 2018). The aim of this study was to investigate gamasid mites parasitizing small rodents and estimate infestation patterns in mice and voles inhabiting different locations of Lithuania.

Materials and methods

Rodent trapping and sampling

Small rodents were captured in spring and autumn 2013–2016 at six locations in Lithuania (Table 1; Fig. 1). They were captured by using snap and live traps baited with black bread dipped in sunflower oil. With the live traps, a total of 55 traps were used for each trapping session. The traps were exposed for 3 days (one trapping session) and checked two times per day. One trapping session in the autumn was carried out in Guodžiai, Trakai, Nemuno kilpos, Rusnė and Beištrakiai sites. In Curonian spit, two trapping sessions were performed—one in the spring and one in the autumn. Captured rodents were dispatched

Table 1 Number and diversity of collected rodents and prevalence of infestation

Sampling locations	Biotopes	Coordinates	Rodent species								Σ	S	H	c	PI, %
			A. agr	*A. fla*	*M. min*	*M. mus*	*M. agr*	*M. arv*	*M. oec*	*M. gla*					
Curonian Spit	Forest ecotone and meadow	55° 33′ 06.0″ N, 21° 07′ 31.5″ E		282	79		2	4	22	73	462	6^{a}	1.59^{a}	0.43^{a}	58.66
Guodžiai peatland	Peatland	55° 58′ 56.97″ N, 24°36′ 50.86″ E	2	33						23	58	3^{b}	1.16^{b}	0.48^{a}	51.72
Beištrakiai	Scrubs and meadow	54° 54′ 22.3″ N, 24° 20′ 28.6″ E	10	17		12	4				43	4^{b}	1.85^{a}	0.30^{b}	18.60
Trakai	Semi-natural meadow	54° 39′ 24.94″ N, 24° 49′ 29.48″ E	8	8				11			27	3^{b}	1.57^{a}	0.34^{b}	59.26
Nemuno Kilpos	Great Cormorant colony in black alder forest	54° 35′ 19.04″ N, 23° 59′ 49.56″ E	2	21						24	47	4^{b}	1.21^{b}	0.46^{a}	25.53
Rusnė	Flooded meadow	55° 19′ 26.23″ N, 21° 20′ 24.15″ E	70		4		7		7	3	91	5^{a}	1.22^{b}	0.61^{c}	6.59
Total			92	361	83	12	13	15	29	123	728	8	2.17	0.31	47.12

Σ total number of trapped rodents, *S* number of species, *H* Shannon′s diversity index, *c* dominance index, *PI* percentage of hosts carrying mites

Different superscript letters show t-test based significant differences of *S*, *H* and *c* values between sites ($p < 0.05$)

A. agr, striped field mouse *Apodemus agrarius*; *A. fla*, yellow-necked mouse *Apodemus flavicollis*; *M. min*, harvest mouse *Micromys minutus*; *M. mus*, house mouse *Mus musculus*; *M. agr*, short-tailed vole *Microtus agrestis*; *M. arv*, common vole *Microtus arvalis*; *M. oec*, root vole *Microtus oeconomus*; *M. gla*, bank vole *Myodes glareolus*

Fig. 1 Rodent sampling sites in Lithuania: 1—Curonian Spit, 2—Guodžiai peatland, 3—Beištrakiai, 4—Trakai, 5—Nemuno Kilpos, 6—Rusnė

by cervical dislocation and individually placed into marked plastic bags before mites were collected. In three sites (Nemuno kilpos, Rusnė and Curonian spit) both trap types were used. Snap-trapping was done using medium-sized wooden snap traps set in lines of 25 traps, each set 5 m apart. Traps were exposed for 3 days and were checked daily in the early morning to avoid loss of ectoparasites and trapped rodents were placed into marked plastic bags. All trapped rodents were marked, identified to species level and gender. Species were identified morphologically, with specimens of *Microtus* voles identified by their teeth (Pucek 1984; Prūsaitė et al. 1988).

Permission to trap wild small mammals was provided according to Regulation No. 1 (2013-04-10), No. 15 (2014-03-31), No. 22 (2015-04-10) and No. 12 (2016-03-30) of the Ministry of the Environment of the Republic of Lithuania.

Collecting of ectoparasites

Laelapid mites were collected from the small rodents (most of them found in the head area, rarely on paws and tails) and from the plastic bags and then placed into coded microcentrifuge tubes with a 70% ethanol solution and stored at 4 °C until processed. The collected mites were soaked in deionized water and then put on a sterile glass slide in the chloralhydrate medium Liquido de Swan (Swan 1936) for microscope preparations. Mite species were identified morphologically using the appropriate taxonomic keys (Bregetova 1956; Baker 1999; Mašán and Fend'a 2010; Kaminskienė et al. 2017).

Statistical analyses

Host infestation by mites was described using the following parasitological indices (following Bush et al. 1997): *A*—abundance of infestation as the average number of mite per host considering the entire host population sampled; *P*—prevalence of infestation as the percentage of hosts carrying mite species; *I*—intensity of infestation, I_{min} and I_{max}—as minimum and maximum number of mite species per host.

The diversity of the hosts was expressed using number of species, *S*, the Shannon and Weaver diversity index, *H*, on the base of $\log_2$ (further—Shannon′s index), whereas dominance was expressed using the Simpson′s index *c*, both following Krebs 1999). Pairwise host diversity comparisons between all sites were performed using averages, variances and *t* test for the *S*, *H* and *c* indices in PAST software (Hammer et al. 2001).

Using Pearson′s correlation coefficient, we checked whether there was a relationship between host (small rodent) diversity and prevalence of infestation. Data were evaluated with Pearson′s χ^2 test ($\alpha = 0.05$), using IBM SPSS Statistics software v.23 for Windows. We also checked, if mite species co-occurred on the same host more often than expected, using EcoSim v.7.0 software (Gotelli and Entsminger 2001). From eight species of hosts and eight species of mites we calculated the expected co-occurrence index (*C*-index) based on 5000 simulations and compared it to the observed index.

Results

Our samples of hosts from six locations of Lithuania consisted of 728 rodent individuals representing eight species (Table 1). The diversity of rodents in the sampling sites was low ($S = 3$–6; Shannon′s $H = 1.16$–1.85), while the dominance index was high in three sampling locations (Table 1). The number of species and diversity of hosts in two sites, Guodžiai peatland and Trakai, was lower than in the rest of sampling sites. The Rusnė flooded meadows were strongly dominated by *A. agrarius*, while the Curonian Spit forest ecotones and meadows and the Guodžiai peatland were both dominated by *A. flavicollis*. A total of 343 individuals (47.12%) were infested with up to eight species of parasitic mite from the Laelapidae family. We did not find a relationship between the prevalence of infestation and either the diversity of the small rodents in the host community ($r = 0.12$, $t = 0.24$) or dominance ($r = -0.37$, $t = 0.82$, both d.f. = 4, $p > 0.05$).

A total of 1363 specimens of laelapid mites were collected from the infested hosts. Of the parasitic mites, *Laelaps agilis* Koch dominated (89.1% of all mites), followed by *Haemogamasus nidi* Michael (5.5%), *Eulaelaps stabularis* (Koch) (1.8%), *Hyperlaelaps microti* (Ewing) (1.7%), *Myonyssus gigas* (Oudemans) (1.0%), *Laelaps hilaris* Koch (0.7%), *Hirstionyssus sunci* Wang (0.07%) and *Haemogamassus hirsutus* Berlese (0.07%). Both sexes of mites and deutonymphs were found on the rodents. Detailed information is presented in Table 2.

Each of the four rodent species *A. flavicollis, M. glareolus, A. agrarius*, and *M. minutus* was infested with five species of mites. In contrast, *M. oeconomus, M. arvalis, M. agrestis* and *M. musculus* were infested with up to three mite species (Table 3). As simulated and observed co-occurrence indices did not differ significantly [$C = 1.454$ and $C = 1.464$, respectively, $p_{(\text{observed} \leq \text{expected})} = 0.67$, $p_{(\text{observed} \geq \text{expected})} = 0.50$] co-occurrence of mite species on the hosts was evaluated as random.

The values of abundance and infestation with laelapid mites varied between host species and sampling locations (Tables 2 and 3). Two laelapid species (*L. agilis* and *H. nidi*) were recorded as common for all sites, but some species from the Curonian Spit (*M. gigas*) and Trakai (*L. hilaris*) were unique for their respective sites (Table 2). *L. agilis* was the most abundant mite species parasitizing small rodents (Table 3). The mean intensity of infestation with *L. agilis* mites was 3.8 ± 3.64 per host. Rodent infestations with *L. agilis* varied

Table 2 Laelapid mites collected from eight rodent species

Sampling sites	Rodent species / Mite species		*Apodemus flavicollis*	*Myodes glareolus*	*Micromys minutus*	*Microtus arvalis*	*Microtus oeconomus*	*Microtus agrestis*	*Apodemus agrarius*	*Mus musculus*	Total
Curonian spit	*Laelaps agilis*	F	805	71	37	–	13	–	–	–	926
		M	55	8	3	–	2	–	–	–	68
		DN	1	–	–	–	–	–	–	–	1
	Hyperlaelaps microti	F	5	3	3	–	3	2	–	–	16
	Myonyssus gigas	F	7	4	–	–	–	–	–	–	11
		M	1	1	–	–	–	–	–	–	2
		DN	–	1	–	–	–	–	–	–	1
	Eulaelaps stabularis	F	12	4	4	–	–	–	–	–	20
	Haemogamasus nidi	F	22	6	–	–	–	–	–	–	28
		M	1	–	1	–	–		–	–	2
Guodžiai peatland	*L. agilis*	F	92	12	–	–	–	–	2	–	106
		M	2	–	–	–	–	–	–	–	2
	H. nidi	F	10	19	–	–	–	–	–	–	29
		M	–	1	–	–	–	–	–	–	1
	E. stabularis	F	2	–	–	–	–	–	–	–	2
Beištrakiai	*L. agilis*	F	46	–	–	–	–	–	1	–	47
	H. nidi	F	1	–	–	–	–	–	–	1	2
Trakai	*L. agilis*	F	15	–	–	3	–	–	13	–	31
	Laelaps hilaris	F	–	–	–	6	–	–	2	–	8
		M	–	–	–	–	–	–	1	–	1
	H. nidi	F	–	–	–	–	–	–	1	–	1
	H. microti	F	–	–	–	4	–	–	–	–	4

Table 2 (continued)

Sampling sites	Rodent species / Mite species		*Apodemus flavicollis*	*Myodes glareolus*	*Micromys minutus*	*Microtus arvalis*	*Microtus oeconomus*	*Microtus agrestis*	*Apodemus agrarius*	*Mus musculus*	Total
Nemuno Kilpos	*L. agilis*	F	22	–	–	–	–	–	–	–	22
		M	1	–	–	–	–	–	–	–	1
	H. nidi	F	3	8	–	–	–	–	–	–	11
	E. stabularis	F	1	–	–	–	–	–	1	–	2
Rusnė	*L. agilis*	F	–	–	4	–	–	–	7	–	11
	H. microti	F	–	–	–	–	3	–	–	–	3
	H. nidi	F	–	–	–	–	–	–	1	–	1
	Haemogamasus hirsutus	F	–	–	1	–	–	–	–	–	1
	E. stabularis	F	–	–	–	–	–	–	1	–	1
	Hirstionyssus sunci	F	–	–	–	–	–	–	1	–	1
Total			1104	138	53	13	21	2	31	1	1363

F female, *M* male and *DN* deutonymph

Table 3 Infestation of rodents with laelapid mites

Mite species		Host species								
		A. flavicollis	*M. glareolus*	*A. agrarius*	*M. minutus*	*M. oeconomus*	*M. arvalis*	*M. agrestis*	*M. musculus*	Total
	No of collected hosts	361	123	92	83	29	15	13	12	728
	No of infested hosts	235	46	13	28	14	5	1	1	343
L. agilis	N_i	1039	91	23	44	15	3	–	–	1215
	P	62.88	33.33	9.78	31.33	34.48	20.00	–	–	43.41
	A	2.88 ± 0.25	0.74 ± 0.13	0.25 ± 0.11	0.53 ± 0.11	0.52 ± 0.15	0.20 ± 0.11	–	–	1.67 ± 0.13
	I	1–35	1–6	1–7	1–6	1–3	1–1	–	–	1–35
H. nidi	N_i	37	34	2	1	–	–	–	1	75
	P	4.99	8.13	2.17	1.20	–	–	–	8.33	4.40
	A	0.10 ± 0.04	0.28 ± 0.11	0.02 ± 0.02	0.01 ± 0.01	–	–	–	0.08 ± 0.08	0.10 ± 0.03
	I	1–10	1–10	1–1	1–1	–	–	–	1–1	1–10
E. stabularis	N_i	15	4	2	4	–	–	–	–	25
	P	3.60	3.25	2.17	2.41	–	–	–	–	2.88
	A	0.04 ± 0.01	0.03 ± 0.02	0.02 ± 0.02	0.05 ± 0.04	–	–	–	–	0.03 ± 0.01
	I	1–2	1–1	1–1	1–3	–	–	–	–	1–3
H. microti	N_i	5	3	–	3	6	4	2	–	23
	P	0.55	2.44	–	3.61	13.79	20.00	7.69	–	2.20
	A	0.02 ± 0.01	0.02 ± 0.01	–	0.04 ± 0.02	0.21 ± 0.12	0.27 ± 0.15	0.15 ± 0.15	–	0.03 ± 0.01
	I	1–4	1–1	–	1–1	1–3	1–2	2–2	–	1–4
M. gigas	N_i	8	6	–	–	–	–	–	–	14
	P	1.66	3.25	–	–	–	–	–	–	1.37
	A	0.02 ± 0.01	0.05 ± 0.03	–	–	–	–	–	–	0.02 ± 0.01
	I	1–2	1–2	–	–	–	–	–	–	1–2
L. hilaris	N_i	–	–	3	–	–	6	–	–	9
	P	–	–	2.17	–	–	26.67	–	–	0.82
	A	–	–	0.03 ± 0.02	–	–	0.04 ± 0.19	–	–	0.01 ± 0.01

Table 3 (continued)

Mite species		Host species								
		A. flavicollis	*M. glareolus*	*A. agrarius*	*M. minutus*	*M. oeconomus*	*M. arvalis*	*M. agrestis*	*M. musculus*	Total
	I	–	–	1–2	–	–	1–2	–	–	1–2
H. sunci	N_i	–	–	1	–	–	–	–	–	1
	P	–	–	1.09	–	–	–	–	–	0.14
	A	–	–	0.01 ± 0.01	–	–	–	–	–	0.00 ± 0.00
	I	–	–	1–1	–	–	–	–	–	1–1
H. hirsutus	N_i	–	–	–	1	–	–	–	–	1
	P	–	–	–	1.20	–	–	–	–	0.14
	A	–	–	–	0.01 ± 0.01	–	–	–	–	0.00 ± 0.00
	I	–	–	–	1–1	–	–	–	–	1–1

N_i number of mites collected on infested hosts, *P* prevalence of infestation (%), *A* abundance of infestation ± SEM, *I* intensity of infestation, I_{min}–I_{max} (per host) between sampling sites (Fig. 2) and hosts (Table 3). The overall prevalence of infestation with *L. agilis* mites was highest for *A. flavicollis* (62.9%; $\chi^2 = 131.5$ df = 7, $p < 0.00001$, ranging from 0 to 68.1% in different locations), followed by *M. glareolus* (33.3%, ranging from 0 to 46.6%), *M. minutus* (31.3%, ranging from 0 to 50.0%) and *A. agrarius* (9.8%, ranging from 0 to 75.0%) (Fig. 2; Table 3).

Discussion

In the present study we documented new geographical and host records of Laelapidae mites parasitizing eight rodent species in Lithuania. Before this study, the mite species collected from rodents in Lithuania were only reported by Podenaite 1979) in a conference proceeding written in Russian. In the period 1969–1972, a total of sixteen species of Mesostigmata mites were identified (Podenaite 1979). However, the species validity of several of these mite species is problematic and some are synonymous (e.g. *Laelaps pavlovskyi*, *Haemolaelaps glasgowi*; Mašán and Fend'a 2010; Vinarski and Korallo-Vinarskaya 2016). No information on the abundance of the mites on different species of rodents and intensities of infestation with different mite species were reported. Seven mite species, namely *L. agilis*, *L. jettmari* [syn. *L. pavlovskyi* (Zachvatkin)], *H. microti* [syn. *Hyperlaelaps arvalis* (Zachvatkin)], *E stabularis*, *M. gigas*, *H. nidi* and *H. hirsutus*, previously described by Podenaite 1979) were also identified in our study. The species *L. hilaris* and *H. sunci* are reported for the first time from Lithuania. Furthermore, we report several associations between Laelapidae mites and small rodents for the first time from Lithuania.

Laelaps agilis was the dominant mite species, found at all sampling sites and was collected from six species of rodents, but not from *M. agrestis* and *M. musculus*. It was most commonly found on *A. flavicollis*. Likewise, *L. agilis* was also obtained from various species of small mammals in Slovakia, where it was also more frequently found on *A. flavicollis* (Ambros and Kalúz 1987; Mašán and Fend'a 2010; Miťková et al. 2015).

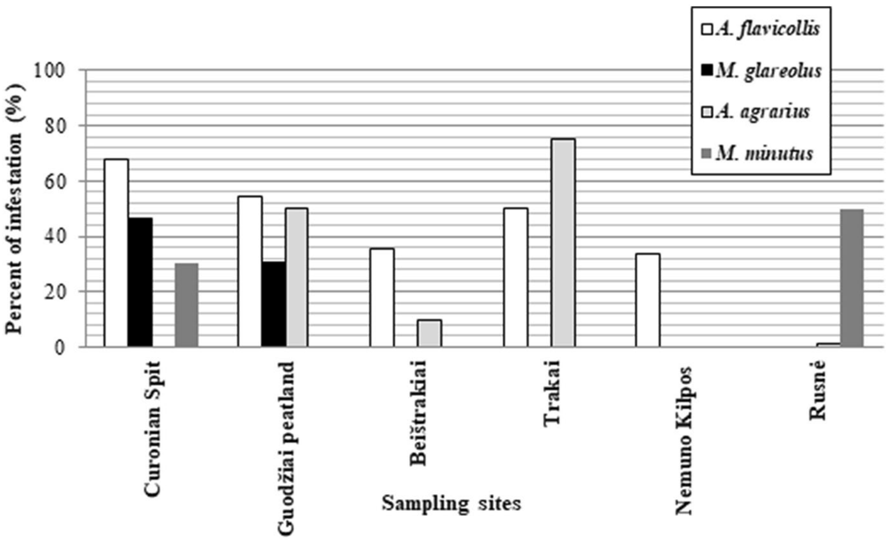

Fig. 2 Infestation rates of four rodent species by *Laelaps agilis* mites at six Lithuanian sampling sites

Hyperlaelaps microti was taken from a variety of host mammals in Slovakia (Mašán and Fend'a 2010), but was most commonly associated with arvicolid rodents. Its primary host in lowlands seems to be *M. arvalis*, while in higher mountainous areas other vicarious species (*M. agrestis* and *Microtus tatricus*) are its main hosts. In the present study, we found *H. microti* in three sampling locations on six rodent species (*A. flavicollis*, *M. glareolus*, *M. minutus, M. arvalis*, *M. oeconomus* and *M. agrestis*) with highest infestations of *M. arvalis* (Table 2).

Eeulaelaps stabularis is found in various microhabitats such as litter, soil, moss and bird nests, but occurs most frequently and abundantly on mammals (Mašán and Fenďa 2010). Turk (1945) and Allred 1969) described *E. stabularis* as the most common mite found in the nests and on the bodies of rodents and insectivores. In the present study, we found low prevalence of infestation of *E. stabularis* on *A. flavicollis*, *A. agrarius*, *M. glareolus* and *M. minutus* in four study sites (see Tables 2 and 3). According to other studies, this species was found on various rodents such as *Apodemus* spp., *Musmusculus* and *Microtus* sp. in Slovakia and Turkey (Garrett and Allred 1971; Ambros et al. 2001). *Eulaelaps stabularis* was also reported from the nests of the mound-building mouse *Mus spicilegus* in Slovakia (Mašán and Stanko 2005) and from gray dwarf hamsters, golden hamsters and European ground squirrels from Turkey (Cicek et al. 2008).

In the present study, *M. gigas* was found only on the Curonian Spit, where it occurred on *A. flavicollis* and *M. glareolus. Myonyssus gigas* is commonly associated with a diverse range of terrestrial mammalian hosts, but its primary host in Slovakia seems to be *A. flavicollis* (Mašán and Fend'a 2010). In Turkey, *M. gigas* was found on *A. sylvaticus* (Garrett and Allred 1971). The facultative parasitic mite *H. nidi* was previously collected from a broad host range, including voles and *Apodemus* mice (Koyumdjieva 1974, 1982; Koyumdjieva and Yaneva 1980; Karg 1993; Mašán and Stanko 2005), and has also been found in soil and litter (Karg 1993). In the present study, we found *H. nidi* on *A. flavicollis*, *A. agrarius*, *M. glareolus* and *M. minutus* at all sampling sites (Tables 2 and 3).

Some authors have reported that *L. hilaris* apparently prefers arvicolid rodents, mainly *M. arvalis* (Mašán and Fend'a 2010; Maaz et al. 2018). In our study, *L. hilaris* were found on *M. arvalis* and also on the murine rodent *A. agrarius*, with higher prevalence on *M. arvalis* (Table 3).

In the present study, only one *H. hirsutus* individual was found on *M. minutus*. Some authors have reported that this mite could be found on a wide range of host species (Bregetova 1949; Mašán and Fend'a 2010).

The obligate parasite *H. sunci* is clearly associated with *Apodemus* mice but not with voles (Mašán and Fend'a 2010; Maaz et al. 2018). Mašán and Fend'a 2010) reported that these mites are found especially on *A. flavicollis* and *A. agrarius* in Slovakia. In the present study, only one *H. sunci* mite was found on an individual of *A. agrarius*. Being strongly dominant in the Rusnė flooded meadows, *A. agrarius* is also becoming one of the most abundant rodent species in various habitats of Lithuania (Balčiauskas et al. 2019a, b). Thus, in the future we may expect higher infestations by this mite species.

In conclusion, the data presented in this paper extend the knowledge on the distribution of laelapid mites and their associations with small rodents.

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