

Ticks (Acari: Ixodida) parasitizing bats in Poland and Slovakia¹

Krzysztof Siuda¹, Michal Stanko², Krzysztof Piksa¹, Andrzej Górz¹

¹Department of Invertebrate Zoology and Parasitology, Institute of Biology, Pedagogical University of Cracow, Podbrzezie 3, 31-054 Kraków

²Department of Vertebrate Ecology, Institute of Zoology, Slovak Academy of Sciences, Löfflerova 10, 04002 Košice, Slovakia

Corresponding author: Krzysztof Siuda, Department of Invertebrate Zoology and Parasitology, Institute of Biology, Pedagogical University of Cracow, Podbrzezie 3, 31-054 Kraków; E-mail: siuda@ap.krakow.pl

ABSTRACT. We summarize the previously published reports and the results of our own research about distribution of ticks parasitizing bats in Poland and Slovakia. Five species of ticks infesting bats were recorded: *Carios vespertilionis*, *Ixodes (E.) vespertilionis*, *I. (P.) simplex*, *I. (I.) ricinus* and *I. (Ex.) trianguliceps*. Two last species were observed only on bats in Poland. *C. vespertilionis*, *I. vespertilionis* and *I. simplex* are specific parasites of bats. *C. vespertilionis* was recorded on 37 sites in Poland and 7 in Slovakia. Fourteen species of bats in Poland and 5 in Slovakia were parasitized by this species. *I. vespertilionis* was collected from 6 bat species both in Poland and Slovakia respectively on 22 and 11 sites, respectively. The remaining species have been reported very rarely.

Key words: ectoparasites, ticks, Argasidae, Ixodidae, Chiroptera, Poland, Slovakia

Introduction

Tick research in Poland has a long tradition. The first reports of ticks parasitizing bats in Poland were mentioned by Jarocki [1] and Waga [2, 3]. Additional data on this subject were contributed by other Polish researchers [4–19]. Among aforementioned works special attention should be given to those of Rafalski [12], who listed collections of *C. vespertilionis* in Poland and to those of Haitlinger and Ruprecht [6, 7] who in their studies enriched the knowledge on tick distribution in south-west and north-east parts of Poland. They also reported the first record of *I. simplex* in Poland. Data on ticks parasitizing bats in Poland were summarised in the monographic work by Siuda [14].

In Slovakia the first information on ticks feeding on bats were provided by Rosický and Havlík [20], Dusbábek [21, 22] Černý [23] and Dusbábek and Rosický [24]. New evidence on single case of *I. vespertilionis* occurrence in another cave is

reported in the past time Mock et al. [25].

Despite numerous works on fauna of ticks parasitizing bats in Poland and Slovakia information about they distribution has not yet been gathered in one complete paper. The objective of this work is to summarize available data.

Materials and methods

The ticks were collected from bats: (1) during catching bats into mist-nets and harp-traps, (2) during hibernation period through direct collection from bats, (3) during survey of summer roosts, (4) and occasionally from the cave walls (in most cases from the area close to bats' colonies). Most of the ticks were collected between 2000 and 2008. Keys to tick species by Siuda [14], Arthur [26], Filippova [27] and Manila [28] were used for determination of the collected specimens. We also reviewed previously published information on ticks infesting bats in Poland and Slovakia.

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Results and discussion

Our data indicate that bats in Poland and Slovakia were parasitized by the following tick species:

Argasidae: *Carios vespertilionis*

Ixodidae: *Ixodes (Eschatocephalus) vespertilionis*, *Ixodes (Pomerantzevella) simplex*, *Ixodes (Ixodes) ricinus* and *Ixodes (Exopalpiger) trianguliceps*. Two latter species were observed only on bats in Poland.

Faunal review

Family Argasidae

Carios vespertilionis Latreille, 1802

C. vespertilionis occurs in the Ethiopian Region, and from some scattered localities in the from Palearctic ranging from the British Isles in west to the oriental region in Korea and Japan in the East,

and from the Sweden in the North. Tick was also reported from the India [29–32]. *C. vespertilionis* was recorded from the following countries neighbouring Poland and Slovakia: Germany, Czech Republic, Austria, Hungary and Ukraine [24, 32–36].

C. vespertilionis was recorded in 36 localities in Poland (including 24 new ones), and 7 in Slovakia (Table 1, 2). In Poland over 400 larvae of this species were collected. It is difficult to determine the number of collected specimen in Slovakia [20, 21] and we give the total number of ticks found both in Slovakia and Czech Republic.

C. vespertilionis is the species of a wide ecological valance occurring in breeding as well as transient colonies, attics, burrows, tree hollows and even caves [29, 30, 36]. Thus it can be expected to occur on significantly larger number of bat species.

Table 1. Localities of *Carios vespertilionis* in Poland

Locality	Geographical coordinates	Host	Source of information
Białowieża	52°42'N 23°52'E	ESE, VMU, PIP	Haitlinger and Ruprecht 1977, 1992
Bieniszew	52°11'N 18°11'E	<i>Myotis</i> sp.	Siuda 1984
Chojnów	51°16'N 15°56'E	MYM, MYS, BAR	Haitlinger 1978
Ciechocinek	52°52'N 18°48'E	MDS	Siuda 1993
Krzyż Wielkopolski	52°53'N 16°1'E	PIN	Rafalski 1954
Kukawy	52°32'N 19°10'E	ESE, PAR	Haitlinger and Ruprecht 1985
Michałówka	51°27'N 22°22'E	PIP	Rafalski 1954
Nietoperzowa Cave	50°13'N 19°44'E	MYM	Waga 1855
Oława	50°94'N 17°30'E	NYN	Haitlinger and Łupicki 2008
Stargard Szczeciński	53°20'N 15°30'E	PIP	Skuratowicz 1966
Stary Sącz	49°34'N 20°39'E	ESE	Siuda 1984
Wałbrzych	50°46'N 16°17'E	MYM, MYS, BAR	Haitlinger 1978
Wojcieszów Górny	50°58'N 15°55'E	MYM, MYS, BAR	Haitlinger 1978, new specimen leg. A. Nowosad
Cave in Boracza	49°35'N 19°9'E	ENI	New locality, leg., K. Kurek, P. Orysiak
Czarna Cave	49°14'N 19°52'E	MYS, ENI	New locality, leg., K. Piksa
Dymiąca Piwnica Cave	49°34'N 19°33'E	MYB	New locality, leg., K. Piksa
Grochowce	49°44'N 22°45'E	PAR	New locality, leg., K. Piksa
In Ociemne Cave	49°26'N 20°25'E	PIP	New locality, leg., K. Piksa
Jasna Cave	49°45'N 21°46'E	MYM	New locality, leg., K. Piksa
Jodłowa	49°52'N 21°18'E	species indeterminata	New locality, leg., M. Szukała
Lipowa	50°20'N 19°29'E	MYB, MYS	New locality, leg., K. Kurek
Lipowa – Jański	50°20'N 19°29'E	MYB	New locality, leg., K. Kurek
Lodowa in Ciemniak Cave	49°14'N 19°54'E	MYS, VMU, ENI	New locality, leg., K. Piksa
Łęczczok Reserve	50°06'N 18°15'E	PPY	New locality, leg., K. Kurek, R. M. Mysłajek
Międzyrzecz	52°26'N 15°35'E	PAR	New locality, leg., anonymous
Młynary	54°12'N 19°43'E	ESE	New locality, leg., K. Kurek, A. Tereba
Morasko	52°29'N 16°54'N	ESE	New locality, leg., H. Ferenc
Mroczna in Kornuty Cave	49°35'N 21°21'E	MYB, ENI	New locality, leg., K. Piksa
Mułowa Pass	49°14'N 19°55'E	ENI	New locality, leg., K. Piksa
Niedźwiedzia Cave	49°31'N 20°47'E	MYM, PAR	New locality, leg., K. Piksa
Ostre	49°39'N 19°40'E	MYB, MYS, VMU	New locality, leg., K. Kurek, P. Orysiak
Pod Wantą Cave	49°14'N 19°55'E	MYS	New locality, leg., K. Piksa
Romanka Reserve	49°33'N 19°14'E	ENI	New locality, leg., K. Kurek, P. Orysiak
Szczelina Chochołowska Cave	49°15'N 19°49'E	MYS	New locality, leg., K. Piksa
Wielka Litworowa Cave	49°14'N 19°55'E	MYS	New locality, leg., K. Piksa
Wysoka	52°23'N 15°28'E	MYS	New locality, leg., E. Bargowska
Zbójcka in Łopień Cave	49°33'N 20°16'E	MYB, MYS, MYN, ENI	New locality, leg., K. Piksa

Table 2. Localities of *Carios vespertilionis* in Slovakia

Locality	Geographical coordinates	Host	Source of information
Ardovo Cave	48°31'N 21°16'E	species indeterminata ¹	Dusbábek 1963
Čičov	47°46'N 17°46'E	See above ¹	Dusbábek 1963
Čertová diera Cave	48°29'N 20°28'E	See above ¹	Dusbábek 1963
Jasovska Cave	48°31'N 21°26'E	See above ¹	Dusbábek 1963
Izbica Cave	48°49'N 19°27'E	PIP	Dusbábek 1963
Domica Cave	48°29'N 21°29'N	No data about hosts	Rosický and Havlík 1952
Silická planina Plateau	48°35'N 21°32'E	No data about hosts	Rosický and Havlík 1952

¹Dusbábek (1963) presented only list of host species from all localities of Slovakia: *Pipistrellus pipistrellus*, *Rhinolophus euryale*, *Myotis myotis*, *Myotis mystacinus*, *Vespertilio murinus*

Our data corroborate this hypothesis. Occurrence of this species was recorded in 14 of 25 Poland's bat species [c.f. 37–39], and in 5 of 28 [c.f. 40–42] Slovak bat species both from the cave-dwelling and forest bats.

Family Ixodidae

Ixodes (Eschatocephalus) vespertilionis Koch, 1844

Species widely distributed through Europe, Africa and Asia. The European range covers almost entire continent (except Scandinavia and north-east territories) and the British Isles [26, 30, 43, 44]. Occurrence of *I. vespertilionis* was also confirmed from: Germany, Czech Republic, Austria, Hungary, and Ukraine [22, 24, 32–36, 44–46].

The tick is the oligoxenous parasite of bats. Inhabits caves, dungeons and similar bat shelters. During non-parasitic phase it lives mostly in dark, humid (above 60%) parts of the shelters, usually far from the entrances. Recognition of this species as a cave animal remains controversial [47]. Undoubtedly during the non-parasitic period the ticks inhabit caves only where engorged specimens drop off the host and following that the female lays eggs. Males live there permanently.

In total over 80 specimens (from all developmental stages) of *I. vespertilionis* were collected. In Poland the species was reported from 22 localities including 16 new ones (Table 3). All above localities, except one – Samogoszcz (Mazowsze, central Poland) are located in southern Poland, in the territory of Kraków-Częstochowa Upland and Carpathian Mountains i.e., territories with many caves.

All ticks (with the exception of records in Samogoszcz) were found on hibernating bats in caves or from bats caught close to caves openings, or collected directly from the cave walls close to places where bats were. In Slovakia this tick was reported from 13 caves including 7 new ones (Table 3). Together 3 females, 5 males, 2 nymphs and 3 larvae

were collected from new localities. Unfortunately giving the exact number of ticks collected in Slovakia is impossible as Dusbábek [21] gives total number of ticks found both in Slovakia and Czech Republic.

Regarding the fact, that *I. vespertilionis* is rather stenotypic species which development runs mainly in caves or in cave-like shelters [36, 47] it is found on typical cave-dwelling bats i.e., bat species, which hibernate in caves or occur in caves during their activity period (e.g., during swarming). Therefore in Poland and Slovakia this tick was collected only from cave-dwelling bats (6 species both in Poland and Slovakia) no single case of this tick infesting typical forest-bats was reported.

Ixodes (Pomerantzevella) simplex Neumann, 1906.

The localities of this species are scattered in the Palearctic, Ethiopian, Oriental and Australian regions [44]. In countries neighbouring Poland and Slovakia it was reported from Germany, Czech Republic, Hungary [21, 33, 35, 44].

The parasite dwells in burrows and nests. It inhabits caves especially ones with the summer colonies of *Miniopterus schreibersi* (Kuhl, 1819) [48].

This tick is a very rarely collected in Poland and Slovakia. It was reported in Poland in cave Diabla Dziura in Bukowiec (2 female, one larvae) and in Čertová diera Cave (one larvae) in Slovakia (Table 4). The few records were connected to the fact that the main host of these ticks is *M. schreibersi* [47], exceptionally *Myotis myotis* (Borkhausen, 1797) [33].

M. schreibersi does not occur in Poland [c.f. 38] and is a rare species in Slovakia [48]. The close relationship between these species is the reason that the main host *I. simplex* was so rarely found.

Ixodes (Exopalpiger) trianguliceps Birula, 1895

This the West Palearctic species was reported

Table 3. Localities of *Ixodes vespertilionis* in Poland and Slovakia

Locality	Geographical coordinates	Host	Source of information
Poland			
Diabla Dziura in Bukowiec Cave	49°44'N 20°51'E	RHH	Kowalski 1954, new specimens leg. K. Piksa
Nietoperzowa Cave	50°13'N 19°44'E	species indeterminata	Siuda et al. 1992
Raclawicka Cave	50°12'N 19°41'E	On the wall, MEM	Skalski 1973, new specimens leg. K. Piksa
Studnisko Cave	50°45'N 19°16'E	MYM	Siuda et al. 2002
Wiercica Cave	50°40'N 19°24'E	On the wall	Skalski 1973
Złoty Potok	50°43'N 19°27'E	RHH	Waga 1857
Czarci Dół Cave	49°33'N 20°16'E	RHH	New locality, leg., K. Piksa
Drwali (Słowiańska) Cave	49°32'N 21°41'E	RHH, MYM	New locality, leg., K. Piksa
In Ociemne Cave	49°26'N 20°25'E	RHH	New locality, leg., K. Piksa
Maurycego Cave	50°43'N 19°16'E	MDA	New locality, leg., T. Postawa
Mrocza in Kornuty Cave	49°35'N 21°21'E	RHH	New locality, leg., K. Piksa
Nasiczne Cave	49°11'N 22°37'E	MYM	New locality, leg., K. Piksa
Niedźwiedzia Cave	49°31'N 20°47'E	RHH	New locality, leg., K. Piksa
Oblica Cave	49°33'N 20°47'E	MEM	New locality, leg., K. Piksa
Partyzancka Cave	49°41'N 19°38'E	MYM	New locality, leg., K. Piksa
Roztoczańska Cave	49°29'N 20°41'E	RHH, MYM	New locality, leg., K. Piksa
Samogoszcz	51°46'N 21°29'E	MYB	New locality, leg., K. Sachanowicz
Świętego Szczepana Cave	49°31'N 20°47'E	MYM	New locality, leg., K. Piksa
Tam gdzie wpadł Grotolaz Cave	49°32'N 21°43'E	RHH	New locality, leg., K. Piksa
In Tomaszówki Dolne Cave	50°13'N 19°44'E	MEM, MYB, MDA	New locality, leg., R. Wiertel, K. Piksa
Zbójcka in Łopień Cave	49°33'N 20°16'E	RHH, MYM, MBE	New locality, leg., K. Piksa
Złotniańska Cave	49°30'N 20°45'E	MYB	New locality, leg., K. Piksa
Slovakia			
Ardovo Cave	48°31'N 21°16'E	species indeterminata ²	Dusbábek 1963,
Čertova diera Cave	48°29'N 20°28'E	See above ²	Dusbábek 1963
Drienovec	48°37'N 20°57'E	See above ²	Dusbábek 1963
Ludmila Cave	48°33'N 20°27'E	See above ²	Dusbábek 1963
Líščia diera hole	48°28'N 20°27'E	See above ²	Dusbábek 1963
Michňová cave	48°42'N 19°53'E	On the wall	Mock et al. 2007
Ardovo Cave	48°31'N 21°16'E	On the wall	New locality, leg., L. Kováč
Diviačia abyss	48°35'N 20°26'E	On the wall	New locality, leg., Z. Jerg
Giant abyss	48°34'N 20°41'E	In ground trap	New locality, leg., V. Papáč
Jasovská Cave	48°41'N 20°58'E	On the wall	New locality, leg., A. Mock and H. Fulín
Krasnohorská Cave	48°37'N 20°35'E	Surface of the cave lake	New locality, leg., L. Kováč and A. Mock
Majkova Cave	48°33'N 20°33'E	On the wall	New locality, leg., A. Mock
Slaninova Cave	48°37'N 20°52'E	RHH	New locality, leg., M. Fulín

²Dusbábek (1963) presented only list of host species from all localities of Slovakia: *Rhinolophus euryale*, *R. hipposideros*, *Myotis myotis*, *M. blythii*, *Miniopterus schreibersi*, *Plecotus auritus*

from almost all of Europe [32, 44]. In countries neighbouring Poland and Slovakia *I. trianguliceps* was reported from Germany, Czech Republic, Hungary, Ukraine, Byelorussia and Lithuania [24, 27, 32–35, 44].

I. trianguliceps is a polyphagous parasite living outside nests, its main hosts are small mammals, rarely birds feeding on the ground, and lizards.

In Poland *I. trianguliceps* occurs all over the country. Most of the localities are concentrated in the south of Poland on the sub-mountain and mountain territories [14, 49]. Some localities of this tick are known also from the Baltic coast [14]. There is

common parasite of small mammals (mainly shrews) in mountain and submountain areas of Slovakia [50, 51], but it is very rare in lowlands [52].

The only case of parasitizing bats by one larva of *I. trianguliceps* was recorded in *M. myotis* (Table 4). This species of bat in continental Europe, feeds on, above all, the flightless ground-dwelling arthropods, particularly species from Carabidae [53–56]. As the bat feeds from the ground this is the only way it can be attacked by this tick. Finding the tick on bats confirms the opinion of [27] that *I. trianguliceps* is outside nest-dwelling parasite.

Table 4. Localities of *Ixodes simplex*, *Ixodes ricinus* and *Ixodes trianguliceps* parasitizing bats in Poland and Slovakia

Locality	Geographical coordinates	Host	Source of information
<i>Ixodes simplex</i>			
Poland			
Diabla Dziura in Bukowiec Cave	49°44'N 20°51'E	MYM	Haitlinger and Ruprecht 1985
Slovakia			
Certová diera Cave	48°29'N 20°28'E	MIS	Dusbábek 1963, Černý 1972
<i>Ixodes ricinus</i>			
Poland			
Drwali (Słowiańska) Cave	49°32'N 21°41'E	MYM	New locality, leg., K. Piksa
Ostre	49°39'N 19°40'E	MBE	New locality, leg., K. Kurek
Poznań Cytadela	52°25'N 16°58'E	MYM	New locality, leg., A. Nowosad
<i>Ixodes trianguliceps</i>			
Poland			
Pluczki Dolne	51°6'N 15°33'E	MYM	Haitlinger 1978

The following acronyms for bats were used [60]: RHH – *Rhinolophus hipposideros*, MYM – *Myotis myotis*, MBE – *M. bechsteinii*, MYN – *M. nattereri*, MEM – *M. emarginatus*, MYS – *M. mystacinus*, MYB – *M. brandtii*, MDA – *M. daubentonii*, MDS – *M. dasycneme*, VMU – *Vespertilio murinus*, ENI – *Eptesicus nilssonii*, ESE – *E. serotinus*, PIP – *Pipistrellus pipistrellus*, PPY – *P. pygmaeus*, PIN – *P. nathusii*, NYN – *Nyctalus noctula*, PAR – *Plecotus auritus*, BAR – *Barbastella barbastellus*, MIS – *Miniopterus schreibersii*

Ixodes (Ixodes) ricinus (Linnaeus, 1758)

It is West Palearctic species [43, 44], one of the most common tick species reported in Poland, Slovakia, and all over the Central Europe, with a high ecological plasticity [14, 22, 32, 44, 46].

Outside nest dwelling, polyphagous parasite, infesting many species of reptiles, birds and mammals. Often attacking humans.

Three cases of *I. ricinus* parasitizing bats in Poland were reported (Table 3). No reports from Slovakia were made. The host for this ticks species was *M. myotis* and *Myotis bechsteinii* (Kuhl, 1817). Most probably, like in previously described tick species, tick attacked greater mouse eared bat and Bechstein's bat while feeding on the ground. *M. bechsteinii* is a typical gleaning bat species, picking the food mainly from the vegetation or sometimes from the ground [57] and similarly to *M. myotis* was infested probably while feeding.

Moreover Haitlinger [4] reported the collection of two larvae of genus *Ixodes* from *Myotis dasycneme* and *Myotis mystacinus* in Wojcieszów Górny in Lower Silesia, Poland.

The aim of this paper was to overview the state of the knowledge on the distribution of ticks parasitizing bats in Poland and Slovakia. It is a good reference, starting point, for the further, more detailed studies on the prevalence, extensity and intensity of tick infestation of bats and the significance of these parasites in transmitting pathogens of bat diseases.

Further studies especially on the latter issue may reveal many interesting results [c.f. 58, 59].

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