

ARTHROPODS
Invasions and their control

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Czesław Błaszak

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***Spinturnix acuminatus* (C.L. Koch, 1836), against the parasitofauna of the Noctule bat *Nyctalus noctula* (Schreber, 1774)**

Joanna N. Izdebska¹, Sławomira Fryderyk¹, Mateusz Ciechanowski²

¹Laboratory of Parasitology and General Zoology, Department of Invertebrate Zoology, University of Gdańsk, Piłsudskiego 46, 81-378 Gdynia, Poland; e-mail: biojni@ug.edu.pl

² Etology and Vertebrate Ecology Unit, Department of Vertebrate Ecology and Zoology, University of Gdańsk, Legionów 9, 80-441 Gdańsk, Poland; e-mail: matciech@kki.net.pl

Abstract

Parasitofauna of one of the largest species of the bat living in Poland: the Noctule bat *Nyctalus noctula* (Schreber, 1774) (Chiroptera, Vespertilionidae) is an example of such incomplete, fragmentary knowledge. Not long ago a list of ectoparasites of the Noctule bat recorded in Poland included 17 species, that usually were observed during the studies on one group of arthropods; still, most of these observations are from the southern Poland and the Białowieża Forest. Therefore 39 individuals of *Nyctalus noctula* from Pomerania were examined for ectoparasites. Within 9 species of parasitic arthropods noted on the Noctule bat, *Demodex* sp. is the first record of Demodecidae representative on this bat species; moreover 3 species of the mites were noted in Poland for the first time. Among them the dominant was *Spinturnix acuminatus*, specific parasite of the Noctule bat.

Introduction

Our knowledge on ectoparasitofauna of bats is fragmentary. Most reports related to species composition of arthropods found in the hair or on the skin, or their world distribution (e.g., Rafalski 1954, Jabłońska 1964, Harmata 1967, Haitlinger 1978a, Haitlinger and Ruprecht 1977, 1982, 1985, Haitlinger 1988, Nowosad 1987, 1990, Wiertel 1996, Bartkowska 1999, Ferenc and Skoracki 2000, Siuda et al. 2000, Ferenc et al. 2001). There are considerably less data available concerning biology of parasites, population structure, seasonal dynamics, course and mechanism of parasitic infestation, topical preferences, range of host specificity, parasite co-occurrence, and finally etiology and pathogenesis of possible parasitosis symptoms (e.g., Haitlinger 1977, 1978b, 1978c, 1978d, 1979a, 1979b,

Skuratowicz 1988, Siuda 1993, Cicek 2007, Haitlinger and Łupicki 2008). Sometimes even information whether recorded animals are indeed parasites is lacking.

Whereas entomo- and acarofauna of bats is not only very diverse, but also shows several specific adaptations to parasitism within huge number of microhabitats created by the body of the bats due to exceptional adaptations to flight and functioning within different types of ecosystems and environmental conditions. The batflies (Nycteribiidae), flies associated only with bats, are typical parasitofauna of these mammals. Nycteribiidae (Diptera, Hippoboscoidea) are flattened, spiderlike flies without eyes or wings, and are seldom encountered by general collectors, as they almost never leave the bodies of their hosts; both males and females take blood meals, thus they qualify as real parasites. Most species are highly host-specific. Nycteribiidae (Diptera, Hippoboscoidea) are flattened, spiderlike flies without eyes or wings, and are seldom encountered by general collectors, as they almost never leave the bodies of their hosts; both males and females take blood meals, thus they qualify as real parasites. Most species are highly host-specific. The family is primarily found in the Old World tropics; a few species occur in the Neotropics and in Europe; in Poland 9 species of the batflies were recorded (Nowosad 2007, Petersen et al. 2007).

Several species of mites are also parasites of bats – as many as 21 families of parasitic mites occur exclusively on bats, e.g. Spinturnicidae (ecto- and endoparasites), or Gastronyssidae (endoparasites of bat's stomach). Moreover representatives of different groups of parasites typical for mammals are recorded on bats (e.g., Ixodidae, Argasidae, Trombiculidae, Demodecidae, Psorergatidae, Myobiidae, Cheyletidae, Leeuwenhoekiiidae, Sarcoptidae, Labidocarpidae, Listrophoridae, Chirodiscidae, Teinocoptidae, Bakerocoptidae, Chirorhynchobiidae, Dermanyssidae, Laelapidae, Macronyssidae, Spelaeorhynchidae). These mites show high ecological diversity – they cling to the hair (Myobiidae, Labidocarpidae, Listrophoridae), the body skin (Ixodidae, Macronyssidae, Trombiculidae), live in superficial layer of epidermis (Sarcoptidae). Particularly interesting are mites (Spinturnicidae, Teinocoptidae) adapted to life on the surface of the wing membrane of the bats and Demodecidae living in various skin appendages – hair follicles, different types of glands, which unusual adaptations to colonize these microenvironments were described in tropical bats (e.g., Boczek and Błaszak 2005, Izdebska 2005, 2006).

When compared with extensive world literature on this subject, our knowledge on parasitofauna of indigenous species of bats is incomplete. This particularly applies to one of our largest species, the Noctule bat *Nyctalus noctula* (Schreber, 1774) (Chiroptera, Vespertilionidae). Not long ago a list of arthropods of the Noctule bat recorded in Poland included 9 species, lately it was extended to 17 (Haitlinger and Łupicki 2008). However most of these data are from the southern Poland and the Białowieża Forest, while there is lack of information on parasitofauna of the noctule bats from the northern Poland. Moreover most of these data are on species composition or infestation parameters, while information on biology, topical and host specificity and related to them adaptations is scarce.

Material and methods

Therefore 39 individuals of *Nyctalus noctula* (Schreber, 1774) from Redzikowo (Pomerania; UTM: XA33) were examined for ectoparasites. The Noctule bat is a species of bat common throughout Europe, Asia, and North Africa; noctule bats often hibernates in hollow trees, in buildings, especially in wall crevices (behind concrete panels) and in ventilation shafts (Sachanowicz and Ciechanowski 2005). The examined bats were found dead (they froze in the gutter, in November 2007) and were stored as a frozen block (Fig. 1).



Fig. 1
The Noctule bats froze in the gutter and were stored as a frozen block

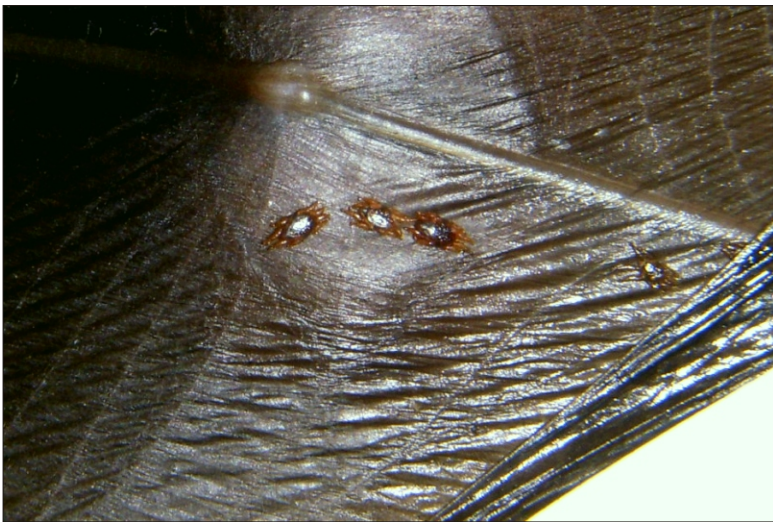


Fig. 2
Spinturnix acuminatus occurring
on membrane of Noctule bat

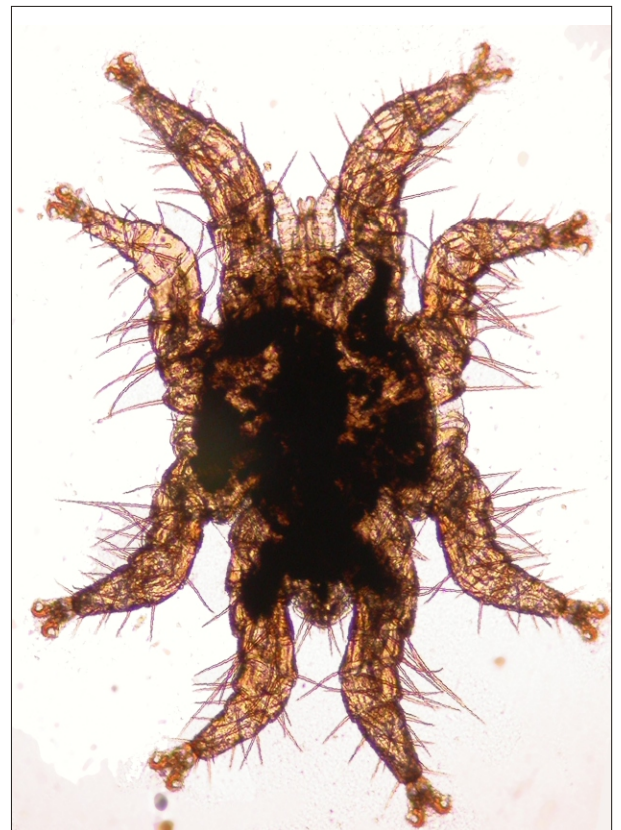


Fig. 3
Spinturnix acuminatus

Standard procedure to detect *Phthiraptera* in the hair of mammals (Kadulski and Izdebska 2006) was applied: the hair and skin surface were precisely examined with a magnifying glass of a large surface and stereoscopic microscope. Spinturnicidae mites were removed from the wing membranes by the means of tweezers. Collected arthropods specimens were conserved and preserved in 70% ethanol solution, then permanent slides were prepared using Faure's mountant. Material was deposited in the collections of the Department of Invertebrate Zoology, University of Gdańsk, in Gdynia.

Results and discussion

Therefore 39 individuals of *Nyctalus noctula* from Pomerania were examined for ectoparasites. Within 9 species of parasitic arthropods noted on the Noctule bat, *Demodex* sp. is the first record of Demodecidae representative on this bat species (Table 1); moreover 3 species of the mites were noted in Poland for the first time (Izdebska et al. 2009, in print); among them the dominant was *Spinturnix acuminatus* (syn. *S. acuminata*) (C.L. Koch, 1836) (material – 52 female, 41 male; prevalence – 53.8%, mean intensity – 4.4 ind., range 1-14).

It is difficult to determine whether the fact that the examined bats were found dead (they froze in the gutter) and were stored as a frozen block (Fig. 1) had any influence on the qualitative and quantitative composition of their parasitofauna. Some parasites could fall out from the dead hosts or they could pass to other, still living individuals (half of the bats trapped in the gutter was rescued). This could be the reason why the dominant species in this population of the bats was *Spinturnix acuminatus*, that strongly clung to the wing membrane.

In the examined bats, specimens of *S. acuminatus* clung to both external and inner surface of the wing membrane, they were particularly numerous in the central part of the membrane and close to the wing tip, while more sparse at the base of wings (Fig. 2, 3). In Poland this species was collected only from *N. noctula* in Białowieża, 6 and 5 specimens (Haitlinger and Ruprecht 1982, 1992) and Lower Silesia, 19 specimens (prevalence 14.85 %, mean intensity – 1.27 ind., range 1-3) (Haitlinger and Łupicki 2008).

There have been 8 species of Spinturnicidae mites observed in Polish fauna (including one species with two subspecies) till now (Ferenc and Skoracki 2000, Ferenc and Mysłajek 2003). Mites of the family Spinturnicidae are obligatory permanent ectoparasites occurring on wing membranes, lids and in an anal orifice of bats. These are mobile ectoparasites completing their entire life cycle on bat wings and tail membranes. All developmental stages are haematophagous (e.g., Morand et al. 2006, Christie et al. 2007). Highly advanced adaptations to parasitism and a strongly marked host specificity suggest that spinturnicid mites and their hosts could evolve parallelly. *S. acuminatus* is a typical, even specific parasite of the Noctule bat, occasionally recorded on other species of bats. Duschbabek (1971) has already suggested coevolution of the mites of *acuminata* group and their hosts. This thesis could be supported by recent molecular studies (Bruyndonckx et al. 2009).

Table 1
Parasitic arthropods of *Nyctalus noctula* in Poland

	SPECIES OF PARASITE	RECORDS	LOCATION
INSECTA	<i>Ischnopsyllus hexactenus</i> (Kolenati, 1856)	Haitlinger and Łupicki (2008)	Oława (Lower Silesia)
	<i>Ischnopsyllus variabilis</i> (Wagner, 1898)	Haitlinger and Łupicki (2008)	Oława (Lower Silesia)
	<i>Ischnopsyllus elongatus</i> (Curtis, 1829)	Niewiadomska (1953) Skuratowicz (1964, 1988) Bartkowska 1999	Las Wolski k. Krakowa (Krakowsko-Wieluńska Upland) Wielkopolsko-Kujawska Lowland, Białowieża Forest Roztocze Upland
	<i>Ischnopsyllus intermedius</i> (Rothschild, 1898)	Skuratowicz (1988)	Wielkopolsko-Kujawska Lowland, Białowieża Forest
	<i>Nycteridopsylla eusarca</i> Dampf, 1908	Dampf (1908, 1908) Seidel (1937) Haitlinger and Łupicki (2008)	Pomeranian Lake District Lower Silesia Oława (Lower Silesia)
	<i>Ceratophyllus gallinae</i> (Schrank, 1803)	Skuratowicz (1988)	Wielkopolsko-Kujawska Lowland
	<i>Cimex pipistrelli</i> (Jenyns, 1839)	Jabłońska (1964)	Racot (Wielkopolsko-Kujawska Lowland)
	<i>Cimex dissimilis</i> (Horváth, 1910)	Haitlinger and Łupicki (2008)	Oława (Lower Silesia)
ACARI	<i>Macronyssus flavus</i> (Kolenati, 1856)	Haitlinger and Ruprecht (1992) Haitlinger and Łupicki (2008) Izdebska, Fryderyk, Ciechanowski (2009)	Białowieża Forest Oława (Lower Silesia) Redzikowo (Pomerania)
	<i>Steatonyssus periblepharus</i> (Kolenati, 1858)	Haitlinger and Ruprecht (1992) Izdebska, Fryderyk, Ciechanowski (2009)	Białowieża Forest Redzikowo (Pomerania)
	<i>Steatonyssus occidentalis evansi</i> Micherdziński, 1980	Haitlinger and Ruprecht (1992)	Białowieża Forest
	<i>Steatonyssus spinosus</i> Willmann, 1936	Haitlinger and Łupicki (2008) Izdebska, Fryderyk, Ciechanowski (2009)	Oława (Lower Silesia) Redzikowo (Pomerania)
	<i>Spinturnix acuminatus</i> (Koch, 1836)	Haitlinger and Ruprecht (1982, 1992) Haitlinger and Łupicki (2008) Izdebska, Fryderyk, Ciechanowski (2009)	Białowieża Forest Oława (Lower Silesia) Redzikowo (Pomerania)

<i>Steatonyssus noctulus</i> Rybin, 1992	Izdebska, Fryderyk, Ciechanowski (2009)	Redzikowo (Pomerania)
<i>Argas vespertilionis</i> (Latreille, 1802)	Haitlinger and Łupicki (2008)	Oława (Lower Silesia)
<i>Acanthophthirius noctulius</i> (Radford, 1938)	Haitlinger and Łupicki (2008) Izdebska, Fryderyk, Ciechanowski (2009)	Oława (Lower Silesia) Redzikowo (Pomerania)
<i>Chiroptella muscae</i> (Oudemans, 1906)	Haitlinger and Łupicki (2008)	Oława (Lower Silesia)
<i>Nycteriglyphus tuerkorum</i> Dusbábek, 1964	Haitlinger and Łupicki (2008)	Oława (Lower Silesia)
<i>Notoedres chiropteralis</i> (Trouessart, 1896)	Izdebska, Fryderyk, Ciechanowski (2009)	Redzikowo (Pomerania)
<i>Psorergatoides nyctali</i> , Baker 2005	Izdebska, Fryderyk, Ciechanowski (2009)	Redzikowo (Pomerania)
<i>Demodex sp.</i>	Izdebska, Fryderyk, Ciechanowski (2009)	Redzikowo (Pomerania)

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