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Local host-parasite co-extinction: the bent-wing bat *Miniopterus schreibersii* (Chiroptera: Miniopteridae) and *Spinturnix psi* (Mesostigmata: Spinturnicidae) in Crimea

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The parasitic spinturnicid mite *Spinturnix psi* was found on alcohol-preserved museum specimens of the common bent-wing bat *Miniopterus schreibersii* from Crimea. This is a case of a local host-parasite co-extinction since the Crimean population of this bat was exterminated in the middle of 20th century and the parasite does not inhabit other bat species in Crimea.

Key words: *Spinturnix*, *Spinturnicidae*, Crimea, *Miniopterus schreibersii*, museum collection

Introduction

Mites of the family Spinturnicidae (Acari: Mesostigmata: Gamasina) are permanent bat ectoparasites. The genus *Spinturnix* von Heyden is the most diverse in the family, with more than 50 named species, mostly associated with Old World bats. Many *Spinturnix* species are mono- or oligoxenous, but some species are polyxenous (Rudnick 1960). Spinturnicid mites usually occur on the patagium and other hairless parts of bat skin. Sometimes spinturnicid remain attached to the host even after the bat's death, providing an excellent opportunity to collect these mites from alcohol-preserved bats in bulk museum collections.

The common bent-wing bat *Miniopterus schreibersii* (Kuhl, 1817) (Chiroptera: Miniopteridae) has mostly a Mediterranean distribution, inhabiting North-West Africa, southern Central and Eastern Europe to the Carpathians, and in the Caucasus (Appleton et al. 2004). Most experts agree that the Crimean population of *M. schreibersii* was completely exterminated by humans in the middle of the 20th century (Dulitskiy 1974; Strelkov 1974; Beskaravayniy, Shevchenko 1989), but see (Smirnov et al. 2017). Currently, data on ectoparasites of this species from the Crimean Peninsula are lacking, however, some museums have alcohol-preserved specimens of *M. schreibersii*, allowing an *ex post facto* survey of the parasite fauna of the common bent-wing bat in Crimea.

MATERIALS AND METHODS

Studied bat specimens were collected in June, 1933 in caves of the Central Crimea (other collection details are unknown), preserved in alcohol, and deposited in the Zoological Museum of Moscow State University (collection numbers: ZMMU S-150234 – 150235). In 2020, we carefully examined these specimens (n=5) and found two mites of the genus *Spinturnix*, which were still attached to their bat hosts (so, potential museum-cross contamination can be excluded). Mite specimens were cleared in 5% KOH for 24 hrs, washed in distilled water, and mounted on a permanent microscopic slide in Faure-Berlese's mounting medium (Whitaker 1988). Morphological identification was done by MO using the following references: Rudnick (1960), Stanyukovich (1997). Photographs were taken with a digital camera AxioCam ICc5 (Zeiss, Germany) attached to a compound microscope AxioImager A2 (Zeiss, Germany) equipped with phase-contrast and DIC optics. All measurements are given in micrometres (μm). Slide-mounted specimens were deposited in the collection of the Tyumen State University's Museum of Zoology (Russia).

Notes on hosts. Individuals belonging to the Schreiber's bat *Miniopterus schreibersi* (*sensu lato*) from Easter Russia (Medvedev et al. 1991) were identified as the eastern bent-wing bat *Miniopterus fuliginosus* (Appleton et al. 2004). Specimens of *Miniopterus schreibersi* from Caucasus (Gadzhiev, Dubovchenko 1966; Arutyunyan, Ogajanyan 1974) were identified as *Miniopterus* sp. (since there are two species in this area – Furman et al. 2010). Individuals from China was identified as *Miniopterus schreibersi* (Baker, Delfinado 1964), but this species does not inhabit this country (Appleton et al. 2004). Specimens of *Miniopterus schreibersi* from Australia (Domrow 1972) have been attributed to *Miniopterus orianae* (Jackson, Groves, 2015).

RESULTS AND DISCUSSION

Spinturnix psi (Kolenati, 1856)

Differential diagnosis

The female of *Spinturnix psi* has 40-50 hysterosomal setae like *Spinturnix bregetovae* Stanyukovich 1995. *Spinturnix psi*, however, differs in the number of paired pores on the dorsal shield (11 in *psi vs* 12 in *bregetovae*) (Fig. 1A), in the characteristic shape of the tritosternum (large, jar-shaped in *psi vs* not visible in *bregetovae*) (Fig. 1B). Also, the female of *Spinturnix psi* has serrated setae on legs I-II (*vs* smooth setae in *bregetovae*) (Rudnick, 1960; Stanyukovich, 1997).

The male of *Spinturnix psi* has 6-8 hysterosomal pairs of setae (similarly to *Spinturnix kolenatii* Oudemans, 1910), but *S. psi* has 5 pairs of marginal setae surrounding the shiled-shaped sternal shield, the latter has a small posteriocentral projection (vs 3 pairs of setae on the bottle-shaped sternal shield, lacking a posteriocentral projection) (Fig. 2).

Measurements of the idiosoma, dorsal and sternal shields of *Spinturnix psi* are given in Table 1.

Material. ♀ (with intrauterine larva) and ♂ from *Miniopterus schreibersii* (Chiroptera: Miniopteridae); caves, Simferopol city, Crimea, approximate coordinates 44° 50' N 34°20' E; 1-31 VI 1933; leg. Rzhevskiy.

	No locality (Rudnick, 1960)	Armenia (Arutyunyan, Ogajanyan, 1974)	Philippines (Delfinado, Baker, 1963)*	Crimea (this paper)
		Females		
Idiosoma, length	792-1064	840-960	720	982
Idiosoma, width	630-819	670-710	600	742
Dorsal shield, length	-		-	576
Dorsal shield, width				418
Sternal shield, length	-		-	164
Sternal shield, width				178
		Males		
Idiosoma, length	623-749	680-900	640	702
Idiosoma, width	504-609	570-700	400	595
Dorsal shield, length	-		-	564
Dorsal shield, width				452
Sternogenital shield, length	-		-	304
Sternogenital shield, width				190

* as *Spinturnix verutus* (= *Spinturnix psi*, synonymized by Domrow, 1972)

Table 1. Measurements of *Spinturnix psi*.

Таблица 1. Промеры *Spinturnix psi*.

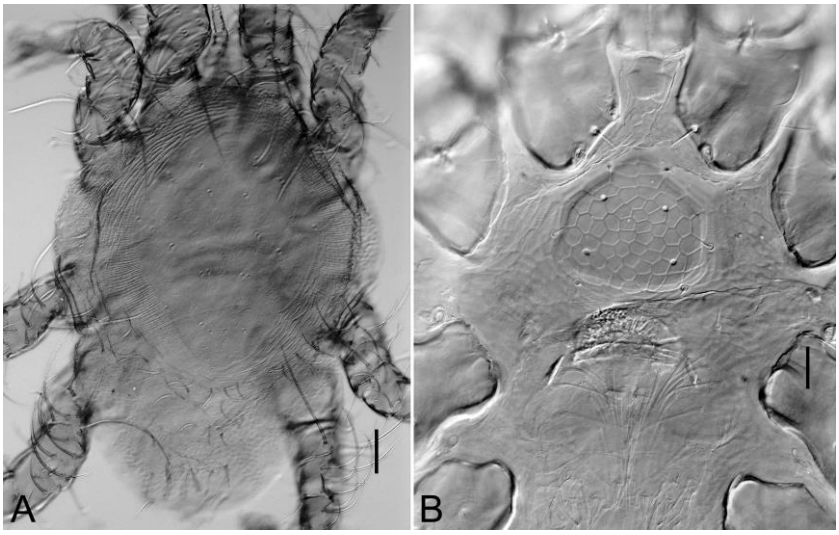

Fig. 1. *Spinturnix psi* (Kolenati, 1856), ♀: A. dorsal view, scale bar = 100 µm; B. sternal shield, scale bar = 50 µm.

Рис. 1. *Spinturnix psi* (Kolenati, 1856), ♀: A. вид с досальной стороны, масштаб = 100 µm; B. стернальный щиток, масштаб = 50 µm.

Distribution. Serbia (type locality) (Rudnick 1960), Spain (Estrada-Peňa, Serra-Cobo 1991; Imaz et al. 1999), France (incl. Corsica) (Hirst 1927, Rudnick 1960), Italy (Sardinia) (Rudnick 1960), Montenegro (Burazerović et al. 2017), Bosnia and Herzegovina (Burazerović et al. 2017), Bulgaria (Beron, Kolebinova 1964), Romania (Beron, Kolebinova 1964), Hungary (Beron 1965), Slovakia (Krištofík, Danko 2012), Ukraine (Stanyukovich 1997), Russia (Far East) (Medvedev et al. 1991), Georgia (Stanyukovich 1997), Armenia (Arutyunyan, Ogajanyan, 1974), Azerbaijan (Gadzhiev, Dubovchenko 1966), Turkey (Toprak 2012), Iran (Benda et al. 2012), Lebanon (Benda et al. 2016), Israel (Costa 1966), Jordan (Benda et al. 2010), Afghanistan (Dusbábek 1970), China (incl. Hongkong, Taiwan) (Rudnick 1960; as *Spinturnix psi* and as *Spinturnix verutus* – Baker, Delfinado 1964; Prasad 1969; Pan, Teng 1973), Japan (Rudnick 1960), South Korea (Rudnick 1960), India (Rudnick, 1960; Hiregaudar, Bal 1955), Thailand (Prasad, 1969), Malaysia (Domrow, Nadchatram 1978), Indonesia (Rudnick 1960), Papua New Guinea (as *Spinturnix psi* and as *Spinturnix verutus* – Baker, Delfinado, 1964; Prasad 1969; Domrow 1972, Domrow, Nadchatram 1978), Philippines (as *Spinturnix verutus* – Delfinado, Baker 1963; Corpuz-Raros, Lit 2015), Australia (Domrow 1972), Algeria (Rudnick 1960), Madagascar (Rudnick 1960), Crimea (our data, first record).

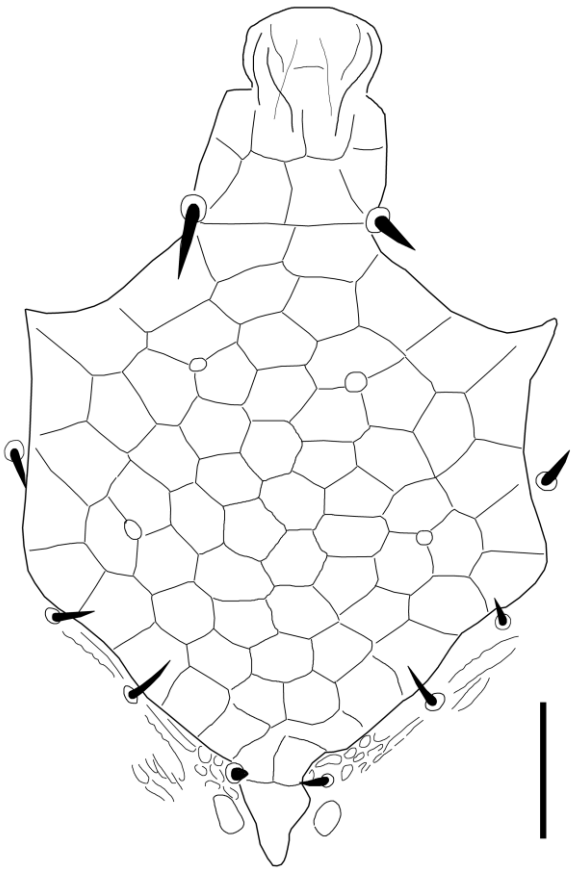

Fig. 2. *Spinturnix psi*, ♂, sternal shield, scale bar = 50 µm.

Рис. 2. *Spinturnix psi*, ♂, стернальный щиток, масштаб = 50 µm.

Hosts. *Miniopterus schreibersii* (Rudnick 1960; Baker, Delfinado 1964; Domrow 1972; Stanyukovich 1997; this paper), *Miniopterus fuliginosus* (as *Miniopterus schreibersii* – Rudnick 1960; Medvedev et al. 1991), *Miniopterus pallidus* (Benda et al. 2010, 2012), *Miniopterus orianae* (as *Miniopterus schreibersii* – Domrow 1972), *Miniopterus australis* (Domrow 1972), *Miniopterus tristis* (Corpuz-Raros, Lit 2015), *Miniopterus* sp. (Prasad 1969; as *Miniopterus schreibersii* – Baker, Delfinado 1964; Gadzhiev, Dubovchenko 1966; Arutyunyan, Ogajanyan 1974), *Myotis blythii* (Arutyunyan, Ogajanyan 1974), *Myotis myotis* (Beron 1965), *Myotis capaccinii* (Benda et al. 2012, 2016), *Myotis macrotarsus* (Corpuz-Raros, Lit 2015), *Myotis* sp. (Baker, Delfinado 1964), *Pipistrellus papuanus* (Domrow 1972), *Pipistrellus* sp. (Prasad 1969), *Hypsugo savii* (Benda et al. 2016), *Hipposideros* sp. (Prasad

1969), *Rhynolophus mehelyi* (Arutyunyan, Ogajanyan 1974), *Rhinolophus megaphyllus* (Domrow 1972).

Remarks. A record from Crimea in *Acarorum Catalogus VI* (Beron 2020, p. 210) was not confirmed by the literature (Vshivkov 1963; Stanyukovich 1997; Orlova, Orlov 2018).

Five species of the genus *Spinturnix* have been previously reported for Crimea: *Spinturnix myoti* (Kolenati, 1856), *Spinturnix kolenatii* Oudemans, 1910, *Spinturnix acuminata* (C.L. Koch, 1836), *Spinturnix helvetiae* Deunff, Keller, Aellen, 1986, *Spinturnix emarginata* (Kolenati, 1856) (Vshivkov 1963; Stanyukovich 1997; Orlova, Orlov 2018). Our finding of the sixth species shows that ectoparasites of Crimean bats are insufficiently studied and need further research.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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SUMMARY

Орлова М.В., Климов П.Б. 2020. Пример локального со-вымирания хозяина и паразита: обыкновенный длиннокрыл *Miniopterus schreibersii* (Chiroptera: Miniopteridae) и гамазовый клещ *Spinturnix psi* (Mesostigmata: Spinturnicidae) в Крыму. – Plecotus et al. **23:** 80–87.

Паразитические гамазовые клещи-спинтурнициды, принадлежащие виду *Spinturnix psi* (Acari: Gamasina: Spinturnicidae) были обнаружены на влажных музейных препаратах обыкновенного длиннокрыла *Miniopterus schreibersii* (Miniopteridae) из Крыма. Это случай со-вымирания паразита и хозяина, поскольку крымская популяция летучих мышей была истреблена в середине XX века, а на других видах летучих мышей в Крыму данные клещи не паразитируют.

Key words: *Spinturnix*, *Spinturnicidae*, Крым, обыкновенный длиннокрыл, музейные коллекции