

Parasitologie

NEW DATA ON INSECTA AND ACARINA PARASITIZING BATS (MAMMALIA: CHIROPTERA) IN NUMIDIA, EASTERN ALGERIA

par

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New data on ectoparasites collected from bats (Mammalia: Chiroptera) in Numidia, eastern Algeria, are presented. Four species of Acarina (Ixodidae and Spinturnicidae) and six species of Insecta (Diptera and Siphonaptera) were recovered from twelve bat species. *Steatonyssus occidentalis*, a mesostigmatid mite, is added to the list of Algerian bat parasites. Two new hosts of bat flies are reported for Algeria: *Rhinolophus blasii* is a new host for *Nycteribia schmidlii* and *Miniopterus schreibersii* is a new host for *Nycteribia latreillii*.

Keywords: Bats, Ectoparasites, Numidia, Algeria;

Nouvelles données sur les Insecta et les Acarina, ectoparasites des chauves-souris (Mammalia : Chiroptera) en Numidie orientale, Algérie

Des nouvelles données sur les ectoparasites de chauves-souris (Mammalia: Chiroptera) en Numidie, dans l'est de l'Algérie, sont présentées. Dix espèces d'ectoparasites, dont quatre espèces d'Acarina (Ixodidae et Spinturnicidae) et six espèces d'insectes appartenant à deux ordres (Diptera et Siphonaptera) ont été retrouvées chez douze espèces de chauves-souris. De nouveaux ectoparasites de chauves-souris d'Algérie sont ajoutés à la liste existante. Ces données incluent *Steatonyssus occidentalis*, un acarien méso-stigmatid qui n'a pas été signalé auparavant en Algérie. De nouvelles données pour

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les hôtes de mouches des chauves-souris ont été signalées en Algérie, *Rhinolophus blasii* en tant que nouvel hôte pour *Nycteribia schmidlii* et *Miniopterus schreibersii* en tant que nouvel hôte pour *Nycteribia latreillii*.

Mot-clés : Chauve-souris, ectoparasites, Numidie, Algérie.

Introduction

Several taxa of arthropods are ectoparasites of bats including Siphonaptera, Diptera, Hemiptera and Acarina. Among Diptera, the family Nycteribiidae occurs primarily in the Old World and presents a high degree of specialization. According to DICK & PATTERSON, (2006), this family consists of about 275 species worldwide, of which five genera and 14 species occur in the Mediterranean area (HŮRKA, 1964; THEODOR, 1967). The family Streblidae comprises 227 species that occur around the world (DICK & PATTERSON, 2006), with four species and three genera in the Mediterranean area (HŮRKA & SOÓS, 1986). In Algeria, the first data on bat parasites of the families Nycteribiidae and Streblidae were provided by FALCOZ (1923) and later by SÉGUY (1933). AELLEN (1955) provided occurrence and host preference data for both families. Other studies included records of both families from bats collected in Algeria (AMR & QUMSIYEH, 1993; BENDJEDDOU *et al.*, 2013, 2017), giving a list of five species for Algeria.

Fleas (Siphonaptera) are highly-specialized, diverse, obligate haematophagous ectoparasites of mammals and birds with a unique parasitic strategy. Species of family Ischnopsyllidae are obligatory parasites of bats. Three species (*Nycteridopsylla longiceps*, *Rhinolophopsylla unipectinata arabs* and *Ischnopsyllus octactenus*) were recorded from bats in Algeria (ANCIAUX DE FAVEAUX, 1976; BENDJEDDOU *et al.*, 2013, 2017).

Ticks and mites are very important ectoparasites of mammals, birds and reptiles worldwide. In Algeria, tick research has a long tradition, but has been devoted to hosts other than bats. Only recently have ticks and mites associated with bats been studied in Algeria (BENDJEDDOU *et al.*, 2013, 2016, 2017). Spinturnicid mites were first reported in Algeria by DEUNFF (1977) and UCHIKAWA *et al.* (1994).

In the course of extensive collection of bats in Numidia, eastern Algeria, twelve bat species were obtained. The present study documents the ectoparasites associated with these bats.

Materials and methods

Study area

Numidia is located in eastern Algeria, bordered in the north by the Mediterranean Sea. The western boundary is marked by the Seybouse wadi. The eastern and southern borders are limited by the Tellian Atlas, coinciding with the Algerian-Tunisian border. To the southern, it is bordered by the Aures Mountains.

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This region mainly belongs to two bioclimatic areas: the subhumid and humid zones, which give it a significant atmospheric humidity allowing the development of a rich flora within a number of ecosystems (BENNADJA *et al.*, 2013). However, the southern part of this region belongs to the semi-arid bioclimatic area.

This study was carried out at the following localities in Eastern Numidia (Figure 1):

- ruine du Chenal: artificial cave in remnant of the old French bastion, near the sea in El Kala ;
- Ghar Djemaa: a cave with an entrance 3 m high, 5 m wide, and about 30 m deep. The surrounding area is an open rocky habitat ;
- grotte de Youkous: a small cave with 5 m high, 5 m wide and about 10 m deep. The surrounding area has mixed vegetation and corresponds in part to abandoned agricultural land ;
- gorges de Ghouffi: open habitat with rocky areas and caves ;
- Chaabt Ouled Chelih (Batna) and El Hamma (Khanchla): closed and urbanized habitat, which is entirely artificial ;
- Chelia: semi-open habitat in a Cedar forest ;
- Seraïdi: semi-open habitat with an abundance of freshwater resources and grassy areas ;
- Ain Seynour: semi-open habitat, characterized by complete absence of undergrowth. It consists mainly of cork oak forest.

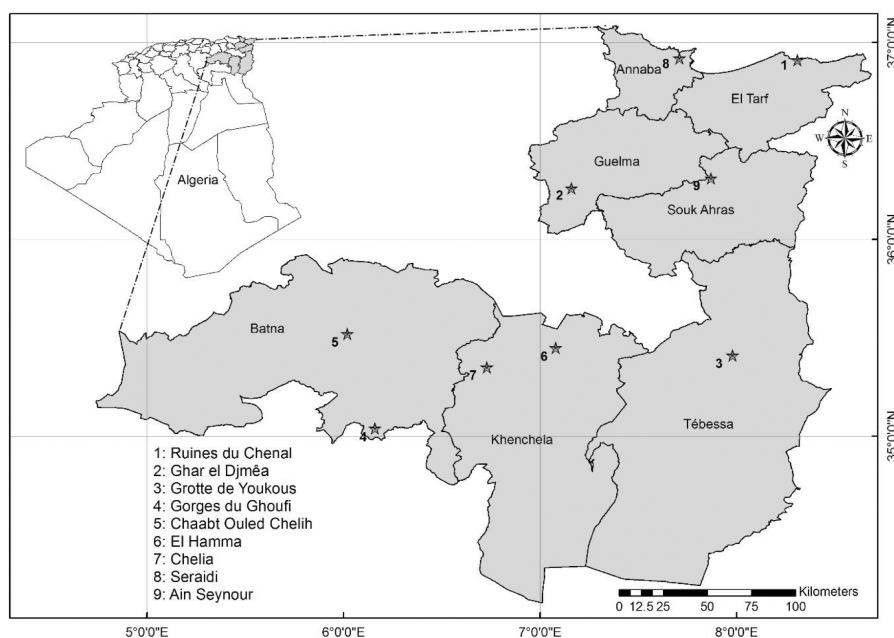


Figure 1

Map of Algeria showing study areas.
Carte de l'Algérie représentant les sites d'étude.

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Tableau 1

List of bat species collected and their localities.
Liste des chauves-souris collectées et leurs localisations.

Family	Species	Number	Locality
Vespertilionidae	<i>Eptesicus isabellinus</i>	32	5, 6, 8, 9
	<i>Myotis capaccinii</i>	14	3
	<i>Myotis emarginatus</i>	10	2
	<i>Myotis punicus</i>	27	1, 2
	<i>Pipistrellus kuhlii</i>	45	4, 5, 6, 8
	<i>Pipistrellus pipistrellus</i>	13	6
	<i>Plecotus gaisleri</i>	2	4
Rhinolophidae	<i>Rhinolophus blasii</i>	29	1, 2, 3, 7
	<i>Rhinolophus Euryale</i>	12	1
	<i>Rhinolophus ferrumequinum</i>	27	1, 2
	<i>Rhinolophus mehleyi</i>	9	2
Miniopteridae	<i>Miniopterus schreibersii</i>	10	1, 2

Ectoparasite sampling

Bats were collected between 2015 and 2016 at different localities in Numidia, eastern Algeria (Figure 1). Hand-nets were used to capture bats from cave roosts, while mist-nets were used in open habitats. Bats were identified according to DIETZ & VON HELVERSEN (2004) and DIETZ (2005). Each captured bat was examined and its ectoparasites were stored and labelled in a vial containing 75% alcohol. "N" and "NP" designate the number of bats examined and the number of infested bats, respectively. Collected parasites were cleared and mounted, using Hoyer's medium for mites and Canada balsam for ticks and the other insects, on microscopic slides and were identified according to HOPKINS & ROTHSCCHILD (1956) and BEAUCOURNU & LAUNAY (1990) for Siphonaptera, RUDNICK (1960), RADOVSKY (1967), DUSBÁBEK (1962) and STANYUKOVICH (1997) for mites, THEODOR (1967) for Nycteribidae, and HŮRKA (1982) for Streblidae.

In total, 230 bats, representing four families and 12 species, were collected from twelve localities within Numidia (Table 1, Figure 1).

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Results

The different species of ectoparasites found on the examined bats are listed below.

Class Arachnida

Family Ixodidae

- *Ixodes vespertilionis* Koch, 1844

Material examined: 1 male collected on *Rh. ferrimequinum*, at Ruines du chenal, 16 May 2015. 7 larvae collected on *Rh. euryale*, at Ghar el Djmeâ, 27 October 2015. 3 larvae collected from *M. schreibersii*, at Ghar el Djmeâ, 27 October 2015. 2 larvae collected on *M. punicus*, in Grotte de Youkous, 21 January 2015. 6 larvae collected on *Rh. blasii*, in Grotte de Youkous, 21 January 2015. 3 larvae collected on *M. capaccini*, in Grotte de Youkous, 13 November 2015.

Remarks. The long-legged bat tick is distributed in Eurasia, Africa and Australia (KOLONIN, 2007). It parasitizes many bat species of the families Rhinolophidae and Vespertilionidae (KRISTOFÍK & DANKO, 2012). BENDJEDDOU *et al.* (2016) studied the seasonal infestation of *I. vespertilionis* on *M. punicus* at two sites in north-eastern Algeria. They also recorded this tick from three other Algerian bat species, *M. emarginatus* and *M. capaccini* (BENDJEDDOU *et al.*, 2017). In the present study, we record as additional hosts for this tick in Algeria the bat species *Rh. ferrimequinum* and *M. schreibersii*.

Family Spinturnicidae

- *Eyndhovenia euryalis* (Canestrini, 1884)

Material examined: 2 females collected on *Rh. blasii*, at Ghar el Djmeâ, 25 December 2016. 3 nymphs collected on *Rh. mehleyi*, in Ghar el Djmeâ, 25 December 2016.

Remarks. This mite was reported earlier on *Plecotus gaisleri* and *Rhinolophus blasii* (BENDJEDDOU *et al.*, 2017). It was first reported in Algeria by DEUNFF (1977) and is distributed across Europe, reaching China and Australia (KRIŠTOFÍK & DANKO, 2012). We here record *Rh. mehleyi* as a new host for this mite species.

- *Spinturnix myoti* (Kolenati, 1856)

Material examined: 13 females and 42 nymphs collected on *M. emarginatus*, at Ruines du Chenal, 27 May 2015. 7 females and 52 nymphs, collected on *M. punicus*, at Ruines du Chenal, 27 May 2015.

Remarks. This bat mite has a wide range of distribution in Europe, North Africa and Asia (KRIŠTOFÍK & DANKO, 2012). It is mostly associated with bats of the genus *Myotis*, but has been reported from other genera as well (STANYUKOVICH, 1997). This mite species was reported from *M. punicus* in Algeria and Libya (BENDJEDDOU *et al.*, 2013, 2017; BENDA *et al.*, 2014).

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- *Steatonyssus occidentalis* (Ewing, 1933)

Material examined: 4 Nymphs collected on *E. isabellinus*, in Chaabt Ouled Chelih, 16 March 2015. 3 Nymphs collected on *P. kuhlii*, in Chaabt Ouled Chelih, 16 March 2015.

Remarks. The species of the genus *Steatonyssus* are considered as dendrophilous oligoxenic parasites and their hosts are usually tree dwelling bat species (BENDA *et al.*, 2004). These mites are cosmopolitan species and their host range includes other species of the families Vespertilionidae and Miniopteridae (LANZA, 1999). This is a new record for the bat mites of Algeria.

Order Siphonaptera

- *Ischnopsyllus octactenus* (Kolenati, 1856)

Material examined: 3 females collected on *P. kuhlii*, at EL Hamma, 3 June 2015. 2 females collected on *P. pipistrellus*, at Seraidi, 3 June 2015. 2 females collected on *P. kuhlii*, at Ain Seynour, 15 May 2015. 3 females collected on *E. isabellinus*, at Ain Seynour, 15 May 2015. 2 females and 2 males collected on *E. isabellinus*, at Ain Seynour, 5 June 2016.

Remarks. This is a western Palaearctic species with a distribution extending from Morocco, Spain and Great Britain to Middle Asia (HŮRKA, 1997). In Algeria, it was reported previously from *P. pipistrellus*, *H. savii* and *P. kuhlii* (BENDJEDDOU *et al.*, 2013, 2017). This flea was reported from *P. kuhlii* in Tunisia (BEAUCOURNU & KOCK, 1996). It is mostly associated with bats of the genus *Pipistrellus* (BEAUCOURNU & LAUNAY, 1990).

Order Diptera

Family Streblidae

- *Brachytarsina flavipennis* Macquart, 1851

Material examined: 7 females collected on *Rh. blasii*, at Ruines du chenal, 16 May 2015. 5 females and 4 males collected on *Rh. euryale*, at Ruines du chenal, 16 May 2015. 6 males collected on *Rh. blasii*, at Ghar el Djmeâ, 21 December 2016. 5 females collected on *Rh. ferrumequinum*, at Ghar el Djmeâ, 21 December 2016. 3 females collected on *Rh. blasii*, in Grotte de Youkous, 11 April 2015.

Remarks. The main hosts for this bat fly are species of the genus *Rhinolophus*, but it is also frequent on members of the genus *Myotis* (HŮRKA, 1962; SCHEFFLER, 2012). This parasite was previously reported in Algeria from *Rhinolophus* species, *M. capaccinii*, *M. punicus*, *M. schreibersii* and *T. aegyptiaca* (ANCIAUX DE FAVEAUX, 1976; AMR & QUMSIYEH, 1993; BENDJEDDOU *et al.*, 2013, 2017).

Family Nycteribiidae

- *Phthiridium biarticulatum* Hermann, 1804

Material examined: 2 females collected on *Rh. blasii*, at Ruines du Chenal, 16 May 2015. 3 females collected on *Rh. euryale*, at Ruines du Chenal, 16 May 2015. 1 male collected on *Rh. blasii*, at Ghar el Djmeâ, 21 December 2016. 2 females collected on *Rh. ferrumequinum*, at Ghar el Djmeâ, 21 December 2016. 3 females and 1 male collected on *Rh. blasii*, at Chelia, 21 May 2016.

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Remarks. This circum-Mediterranean bat fly is associated with cave dwelling bats and known to prefer those of the genus *Rhinolophus* (ŠEVČÍK *et al.*, 2013). It was previously collected from *Rh. blasii*, *Rh. euryale*, *Rh. ferrumequinum* and *Rh. mehelyi*, as well as from *M. schreibersii*, *M. capaccinii* and *M. punicus* (AMR & QUMSIYEH, 1993; BENDJEDDOU *et al.*, 2013, 2017).

- *Nycteribia pedicularia* Latreille, 1805

Material examined: 2 females collected on *Rh. blasii*, at Ruines du Chenal, 16 May 2015. 3 females collected on *Rh. euryale*, at Ruines du Chenal, 16 May 2015. 1 male collected on *Rh. blasii*, at Ghar el Djmeâ, 21 December 2016. 2 females collected on *Rh. ferrumequinum*, at Ghar el Djmeâ, 21 December 2016. 3 females and 1 male collected on *Rh. blasii*, at Chelia, 21 May 2016.

Remarks: This bat fly is known to parasitize bat species such as *M. emarginatus*, *M. capaccinii*, *Rh. blasii*, *Rh. ferrumequinum* and *T. teniotis* (THEODOR & MOSCONA, 1954; HŮRKA, 1964; WALTER & EBENAU, 1997). In Algeria, it has been found on *M. schreibersii*, *Rh. euryale*, *Rh. mehelyi* and *M. punicus* (AMR & QUMSIYEH, 1993; BENDJEDDOU *et al.*, 2017).

- *Nycteribia latreillii* (Leach, 1817)

Material examined: 2 females and 3 males collected on *M. schreibersii*, at Ghar el Djmeâ, 21 January 2015. 3 females and 1 male collected on *M. emarginatus*, at Ghar el Djmeâ, 21 January 2015.

Remarks: *Nycteribia latreillii* has a wide range of distribution across southwestern Asia to continental Europe and North Africa (HŮRKA, 1964). In Europe, this bat fly is associated with *M. myotis* and *M. blythi* (HŮRKA, 1964), but has been found on other hosts, such as *M. capaccinii*, *M. schreibersii*, *Rh. euryale*, *Rh. ferrumequinum*, *Rh. mehelyi*, *M. emarginatus* and *Rh. hipposideros* (HŮRKA, 1964; THEODOR, 1967; KRIŠTOFÍK & DANKO, 2012; ŠEVČÍK *et al.*, 2013). In North Africa, *N. latreillii* was found on *M. schreibersii* in Morocco and Tunisia, and *M. punicus* in Libya (HŮRKA, 1982). In Algeria, it was first recorded by BENDJEDDOU *et al.* (2017) in association with five bat species (*M. emarginatus*, *M. capaccinii*, *M. punicus*, *Rh. blasii* and *P. gaisleri*). *M. schreibersii* is a new host for this bat fly in Algeria.

- *Nycteribia schmidlii* Schiner, 1853

Material examined: 3 females and 2 males collected on *Rh. blasii*, at Chelia, 21 May 2016.

Remarks: This bat fly is distributed in southern Europe, North Africa and the southern states of the former Soviet Union, reaching Afghanistan (HŮRKA, 1964). It was reported on *A. tridens* in Palestine (THEODOR & MOSCONA, 1954) and from *M. schreibersii* in Turkey (ALBAYRAK, 2003). In Algeria, it was found on *M. schreibersii* (FALCOZ, 1923; AMR & QUMSIYEH, 1993), *Rh. mehelyi* (FALCOZ, 1923; AMR & QUMSIYEH, 1993), *Rh. ferrumequinum* (THEODOR & MOSCONA, 1954), *M. blythi* (ROTROU, 1939; AELLEN, 1955; AMR & QUMSIYEH, 1993), and *Rh. clivosus* and *R. cystops* (BENDJEDDOU *et al.*, 2017). In this study, we report *Rh. blasii* as a new host for this bat fly.

Conclusion

The present study provided a total of 236 ectoparasites, representing 10 species, recovered from twelve bat species. We identified five species of bat flies; *Brachytarsina flavipennis*, *Nycteribia schmidlii*, *Nycteribia latreillii*, *Nycteribia pedicularia* and *Phthiridium biarticulatum*. The order Siphonaptera was represented by *Ischnopsyllus octactenus*. Finally, one ixodid tick (*Ixodes vespertilionis*) and three species of mesostigmatid mites (*Spinturnix myoti*, *Eyndhovenia euryalis* and *Steatonyssus occidentalis*) were collected (Table 2).

Tableau 2

Ectoparasites recovered from twelve species of bats in Numidia

(N: number of bats examined. NP: number of bats infested).

Ensemble des ectoparasites collectés sur les douze espèces de chauves-souris examinées en Numidie

(N : nombre des chauves-souris examinées, NP : nombre de chauves-souris infestées).

Parasite species	Order	Bat-hosts species	N	NP
<i>Ixodes vespertilionis</i>	Ixodida	<i>Rh. Blasii</i>	29	1
		<i>Rh. Ferrimequinum</i>	27	2
		<i>Rh. Euryale</i>	12	1
		<i>M. capaccini</i>	14	3
		<i>M. punicus</i>	27	1
		<i>M. schreibersii</i>	10	1
<i>Eyndhovenia euryalis</i>	Mesostigmata	<i>Rh. Blasii</i>	29	1
		<i>Rh. Mehleyi</i>	9	2
<i>Spinturnix myoti</i>	Mesostigmata	<i>M. emarginatus</i>	10	3
		<i>M. punicus</i>	27	8
<i>Steatonyssus occidentalis</i> *	Mesostigmata	<i>E. isabellinus</i>	32	2
		<i>P. kuhlii</i>	45	1
<i>Ischnopsyllus octactenus</i>	Siphonaptera	<i>P. kuhlii</i>	45	3
		<i>P. pipistrellus</i>	13	5
		<i>E. isabellinus</i>	32	4
<i>Brachytarsina flavipennis</i>	Diptera	<i>Rh. blasii</i>	29	5
		<i>Rh. euryale</i>	12	3
		<i>Rh. ferrumequinum</i>	27	4
<i>Phthiridium biarticulatum</i>	Diptera	<i>Rh. blasii</i>	29	3
		<i>Rh. euryale</i>	12	2
		<i>Rh. ferrumequinum</i>	27	3
<i>Nycteribia pedicularia</i>	Diptera	<i>Rh. blasii</i>	29	4
		<i>Rh. euryale</i>	12	1
		<i>Rh. ferrumequinum</i>	27	2
<i>Nycteribia latreillii</i>	Diptera	<i>M. schreibersii</i>	10	3
		<i>M. emarginatus</i>	10	3
<i>Nycteribia schmidlii</i>	Diptera	<i>Rh. blasii</i>	29	2

* New record for Algeria.

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