

A New Species of Chigger Mite (Acari: Trombiculidae) from Rodents in Southwest China

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Abstract: This paper describes a new species of chigger mite (Acari: Trombiculidae), *Gahrlipeia cangshanensis* n. sp., from rodents in southwest China. The specimens were collected from Yunnan red-backed voles, *Eothenomys miletus* (Thomas, 1914), and a Chinese white-bellied rat, *Niviventer confucianus* (Milne-Edwards, 1871) in Yunnan Province. The new species is unique mainly in its number of dorsal setae (n=21), and it has the following features: fT (formula of palpotarsus) = 4B (B = branched), fp (formula of palpal seta) = B/N/N/N/B (N = naked), a broad tongue-shaped scutum with an almost straight posterior margin, and 17 PPLs (posterior posterolateral seta) with a length of 36-43 µm. This chigger mite may also infect other rodent hosts and may be distributed in other localities.

Key words: *Gahrlipeia cangshanensis*, new species, chigger mite, Acari, Trombiculidae, China

INTRODUCTION

Chigger mites (trombiculid mites) belong to the family Trombiculidae in the subclass Acari of the class Arachnida. More than 3,000 species have been recorded globally, and more than 400 species have been recorded in China [1]. In the life cycle of chigger mites, only their larvae are parasitic. Larvae are ectoparasites on other animals [1-4]. Specimens of chigger mites are mostly collected from their hosts; therefore, the taxonomic identification is based mainly on larval characteristics [5-8].

Ewing [9] first reviewed the superfamily Trombiculidae Ewing, 1944, which included 2 families; Trombiculidae Ewing, 1929 and Leeuwenhoekiidae Womersley, 1944 [1]. In China, the family Trombiculidae consists of the subfamily Trombiculinae Ewing, 1929 and Gahrlipeinae, 1952, whereas Leeuwenhoekiidae consists of the subfamily Leeuwenhoekiinae Womersley, 1944 and Apoloniinae Wharton, 1947. The subfamily Gahrlipeinae includes the genera *Walchia* Ewing, 1931, *Schoengastiella* Hirst, 1915, *Gahrlipeia* Oudemans, 1912, *Intermedia*

lia Yu et al., 1979, and *Wuella* Wang, 1997 [10]. In the process of identifying specimens of chigger mites collected from small mammals in Yunnan Province, southwest China, we found a new species of the genus *Gahrlipeia*. This paper describes this new chigger mite species, *Gahrlipeia cangshanensis* n. sp.

MATERIALS AND METHODS

The specimens were collected from the Yunnan red-backed vole (also called the Yunnan Chinese vole or large oriental vole) *Eothenomys miletus* (Thomas, 1914) in the family Cricetidae (order Rodentia), and the Chinese white-bellied rat (also called the white-bellied rat or sulphur bellied rat) *Niviventer confucianus* (Milne-Edwards, 1871) in the family Muridae (order Rodentia). These 2 rodent hosts, together with other small mammals in the order Soricomorpha and Scandentia, were trapped in the Cangshan Mountains (100°11' E, 25°36' N, 2,250 m) in Yunnan Province, southwest China, between April and May in 2010. Small mammals were trapped in 3 different habitats; 1) farmlands, 2) woodlands, and 3) scrublands using live-traps (Guixi Mousetrap Apparatus Factory, Guixi, Jiangxi, China). Live-traps were set in the evening and then checked the following morning. The trapped small mammals were placed in white cloth bags and brought to the laboratory, and then chigger mites were collected from them. In the laboratory, small

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Table 1. List of small mammal species from the Cangshan Mountains in Yunnan Province of southwest China that were examined for ectoparasites between May and August 2010

Order	Species name (total 29 species)
Rodentia (14 species)	<i>Mus pahari</i> Thomas, 1916; <i>Rattus norvegicus</i> (Berkenhout, 1769); <i>Apodemus ilex</i> Thomas, 1922; <i>Apodemus chevrieri</i> Milne-Edwards, 1868; <i>Apodemus latronum</i> Thomas, 1911; <i>Niviventer excelsior</i> (Thomas, 1911); <i>Niviventer confucianus</i> (Milne-Edwards, 1871); <i>Niviventer fulvescens</i> (Gray, 1847); <i>Eothenomys custos</i> (Thomas, 1912); <i>Eothenomys miletus</i> (Thomas, 1914); <i>Eothenomys olitor</i> (Thomas, 1911); <i>Eothenomys eleusis</i> (Thomas, 1911); <i>Berylmys bowersi</i> (Anderson, 1879); <i>Dremomys pernyi</i> (Milne-Edwards, 1867).
Soricomorpha (14 species)	<i>Scaptonys fuscicaudus</i> (Milne-Edwards, 1872); <i>Nasillus gracilis</i> (Thomas, 1911); <i>Anourosorex squamipes</i> (Milne-Edwards, 1872); <i>Blarinella quadraticauda</i> (Milne-Edwards, 1872); <i>Crocidura dracula</i> (Thomas, 1912); <i>Crocidura horsfieldi</i> (Thomas, 1856); <i>Crocidura attenuata</i> (Milne-Edwards, 1872); <i>Sorex excelsus</i> (Allen, 1923); <i>Sorex radulus</i> (Thomas, 1922); <i>Sorex bedfordiae</i> (Thomas, 1911); <i>Sorex cylindricauda</i> (Milne-Edwards, 1871); <i>Soriculus leucops</i> (Horsfield, 1855); <i>Soriculus nigrescens</i> (Gray, 1842); <i>Soriculus macrurus</i> (Hodgson, 1863).
Scandentia (1 species)	<i>Tupaia belangeri</i> (Wagner, 1841).

mammals were placed in a plastic pail and anesthetized with ether. All research was approved by the local wildlife service authority in Dali Prefecture, Yunnan Province, China. The capture and use of animals was also approved by the Institute of Pathogens and Vectors, Dali University.

Chigger mites, together with other ectoparasites (fleas, sucking lice, and gamasid mites), were collected from each host over a large white plate [1-13]. Specifically, chigger mites were collected from the auricles and external auditory canals of each host's ears, where chigger larvae are usually attached, using a curette and a lancet [1,3]. Chigger mites were stored individually in vials containing 70% ethanol [1,10-12]. Between examining each small mammal, the white plate and other instruments were cleaned using disposable paper towels to reduce the chance of cross-contamination. Living small mammal hosts were identified based on external morphology, measurements, and visible characters of dentition. Small mammals were sacrificed, and their species identity was determined by examining their skulls in cases where we could not determine the species while they were alive [14]. Chigger mites were mounted on glass slides in Hoyer's medium and were identified to species using a light microscope [1,3].

Specimens of the new chigger mite species were measured, photographed, and drawn from the microscope images. The terminology and nomenclature used in the morphological descriptions followed Wen et al. [16-18]. Voucher specimens of the new species, including the holotype and paratypes, were deposited in the specimen repository of the Institute of Pathogens and Vectors (Dali University) together with their representative small mammal hosts.

RESULTS

Overall, 379 of the small mammals that we trapped in the Cangshan Mountains were examined and identified to species. These small mammals belonged to 29 genera in the orders Rodentia, Soricomorpha, and Scandentia (Table 1). A total of 6,466 chigger mites, consisting of 121 species, were collected from all the trapped small mammals. Of the 6,466 mites, 5 individual mites were identified as a new species, *Gahrlipeia cangshanensis*, n. sp. Four mites of the new species were collected from Yunnan red-backed voles (*E. miletus*) and 1 mite was collected from the Chinese white-bellied rat (*N. confucianus*). No specimens of the new species were collected from the remaining 27 species of small mammals.

DESCRIPTION

Gahrlipeia cangshanensis n. sp. larva (Figs. 1-5)

Materials examined

The holotype, 1 larva, from the Yunnan red-backed vole, *E. miletus*, was collected in the Cangshan Mountains (100°11' E, 25°36' N, 2250 m) in Yunnan Province, southwest China. Of the 4 paratypes (4 larvae), 3 were collected from *E. miletus*, and 1 was collected from the Chinese white-bellied rat, *N. confucianus*, in the same region. The holotype and paratypes were deposited in the specimen repository of the Institute of Pathogens and Vectors, Dali University, Yunnan Province, China.

Holotype description

Idiosoma: Medium sized (232.5 × 377.5 μm), partially engorged specimen; eyes 1 pair, 5 μm in diameter, free of cuticle;

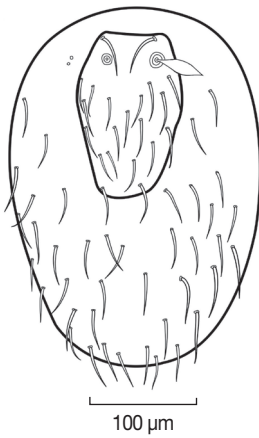


Fig. 1. Dorsal idiosoma of *Gahrlepiea cangshanensis* n. sp. (larva).



Fig. 2. Ventral idiosoma of *Gahrlepiea cangshanensis* n. sp. (larva).

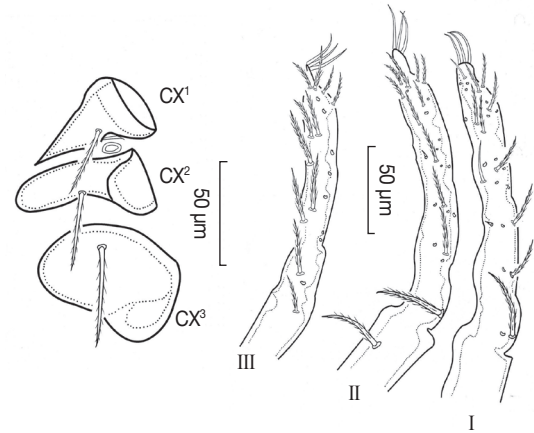


Fig. 3. The legs of *Gahrlepiea cangshanensis* n. sp. (larva). I, II, and III: distal segments of leg 1, leg 2, and leg 3. CX¹-CX²-CX³: the coxa 1, coxa 2, and coxa 3 of the legs.

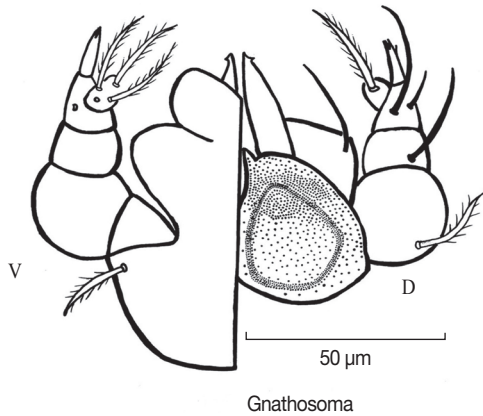


Fig. 4. The gnathosoma (Gn) of *Gahrlepiea cangshanensis* n. sp. (larva). D, dorsal view; V, ventral view.

humeral setae 1 pair, length 44-45 μm ; approximately 40 dorsal idiosomal setae, length 34-45 μm , arranged in irregular rows; sterna setae 2 pairs, formula of sternal seta (fst)=2.2; anterior length 42 μm ; formula of dorsal setation (fDS)=2.2.6.4.10.6.4.4.2; posterior length 36 μm ; 58 ventral setae (VS), length 22.5-37.5 μm ; 40 dorsal setae (DS), length 28-43 μm ; total idiosomal setae 118.

Gnathosoma: Formula of palpal seta (fp)=B/N/N/N/B (B means "branched", while N means "naked"); formula of palpotarsus (fT)=4B; palpal claw 3-pronged, length 12 μm ; galeala N; cheliceral blade (length 32 μm), broad at base, with serrated tricuspid cap; gnathobase punctate, bearing 1 barbed setae.

Scutum: broad and tongue-shaped, with an almost straight

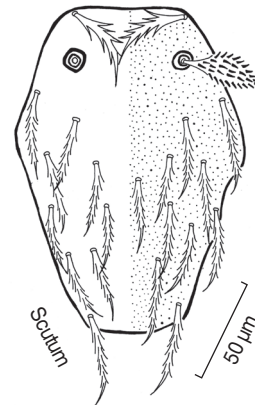


Fig. 5. The scutum (dorsal shield) of *Gahrlepiea cangshanensis* n. sp. (larva).

posterior margin. SD/PW=158 μm /90 μm =1.76; posterolateral angles rounded. PPLs=17 in numbers. SB near mid-point of AP; PL>AL. Sensillae clavate with barbs on shaft and expanded distal portion. Scutal measurements of the holotype and 2 paratypes with means in parentheses: AW (53 μm); PW (90 μm); SB (52 μm); ASB (26 μm); PSB (132 μm); AP (42 μm); AL (37 μm); PL (41 μm); sensilla (34 \times 15 μm). Here, SD= scutum distance; PW= posterolateral seta width; SB= sensillary base distance; AP= distance between anterolateral seta and posterolateral seta; PL= posterolateral seta; AL= anterolateral seta; AW= anterolateral seta width; ASB= antero-sensillary base distance; PSB= postero-sensillary base distance.

Legs: Leg I is 7-segmented. Legs II and III are 6-segmented,

Table 2. The measurements (means) of 1 holotype and 4 paratypes (μm)

No.	AW	PW	PPW	SB	ASB	PSB	SD	AP	AL	PL	PPL	Sensilla
1	53	90	53	52	26	132	158	42	37	49	41	3+32+15
2	52	85	55	53	33	145	178	43	13+	×	×	×
3	54	90	55	53	25	139	164	40	39	50	46	×
4	50	83	55	50	24	131	155	40	39	52	48	×
5	52	96	71	52	23	132	155	41	42	51	38	×

AW=anterolateral seta width; PW=posterolateral seta width; PPW=posterior posterolateral seta width; SB=sensillary base distance; ASB=antero-sensillary base distance; PSB=postero-sensillary base distance; SD=scutum distance; AP=distance between anterolateral seta and posterolateral seta; AL=anterolateral seta; PL=posterolateral seta; PPL=posterior posterolateral seta.

terminating in a pair with a claw and claw-like empodium. Leg I: 240-248 μm ; coxa with 1 branched seta (1B); trochanter 1 B; basifemur 0; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 1 tibialae; tarsus (58 \times 20 μm), 12B, 1 spur. Leg II: SIF=4B-N-3-1100-0000; fP=B/N/N/N/B; IP=841-863 μm . Fsp=7.6.6; Oc=1/1; fcx=1.1.1; fst=2.2; fDS=40; fSc: 2AL+2PL+17PPL=21; NDV=118. Here, IP=index of poda; SIF=synthetic identification formula; fP=formula of poda; fsp=formula of segmented poda; Oc=ocellus; fcx=formula of coxa; fst=formula of sternal seta; fDS=formula of dorsal setation; fSc=formula of scutum setation; P=poda; NDV=numbers of dorsal and ventral setae.

The measurements (means; μm) of the holotype and 4 paratypes are shown in Table 2.

Diagnosis

The new species is mainly characterized by the 21 dorsal setae. It has the following features: the scutum length is longer than the breadth, it neither has an anteromedian projection nor an anteromedian seta. Leg I is 7-segmented, legs II and III are 6-segmented. On the scutum, no inter-medial setae between sensilla. IP=500-1,120 μm . The scutum is broad and tongue-shaped, with almost straight posterior margin. fT=4B. The sensillae clavate has barbs on the shaft and an expanded distal portion.

Distribution

Larvae of the new species was found in 2 species of rodents (*E. miletus* and *N. confucianus*) in the Cangshan Mountains of Yunnan Province, southwest China.

Remarks

The color of a living larvae is unknown. Idiosoma subrotund. The scutum is obviously seen in the dorsal view. AL and PL pinnae are sparse, PPLs with thin and sharp-tipped barbs. Sen-

sillae fusiform with large proximal crunobe. Ocellus (Oc) are small. DS=40 in numbers and VS=58 in range. fP=B/N/N/N/B, chelostyle with usual tricuspid cap, dorsal and ventral teeth. Leg solenidiontaxy normal.

DISCUSSION

The new species (*Gahrlipeia cangshanensis* n. sp.) has the common features of the genus *Gahrlipeia*. Specifically, its scutum lacks anteromedian seta and anteromedian projections. The scutum is broad and tongue-shaped, with an almost straight posterior margin. Leg I is 7-segmented, whereas legs II and III are 6-segmented. However, the new species also has some prominent differences from other species of *Gahrlipeia*. The unique features of this new species include no inter-anteromedian seta on the scutum, 21 dorsal setae [1,9,16-19], and fT=4B.

In this paper, the new species was collected only from 2 species of rodents (*E. miletus* and *N. confucianus*) in the Cangshan Mountains in Yunnan Province. Since our collection was confined to this limited area and only 5 individuals of the new species were collected, we are unable to know how many hosts can harbor this new species and its geographical distribution at present.

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CONFLICT OF INTEREST

We declare no conflict of interest related with this study.

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