

A new genus and species of bat chiggers (Acariformes: Trombiculidae) from Kenya

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Original research

ABSTRACT

A new genus and species of chigger mites, *Minteracarus mombasa* n. gen., n. sp., has been described from the heart-nosed bat, *Cardioderma cor* (Peters) (Chiroptera: Megadermatidae) in Mombasa, Kenya. The description was based on the material identified as a new species of the genus *Trombicula* Berlese, 1905 by P.H. Vercammen-Grandjean, but remained undescribed until the present.

Keywords chiggers; parasites of bats; taxonomy; Africa

Zoobank <http://zoobank.org/E08F06DE-62D8-45C9-9C89-6BE882BD92E0>

Introduction

According to Zajkowska *et al.* (2018), 397 species belonging to 72 genera of Trombiculidae were recorded on bat hosts and 18 genera of chiggers are considered as specific parasites of Chiroptera. Three of these 18 genera — *Audytrombicula* Vercammen-Grandjean, 1963, *Tectumpilosum* Feider, 1983, and *Vergrandia* Yunker & Jones, 1961 — are monotypic. Two new monotypic genera of bat chiggers were described recently — *Bramkeria* Bassini-Silva, Jacinavicius & Ochoa, 2021 and *Batmanacarus* Bassini-Silva, Jacinavicius & Ochoa, 2021. In general, chiggers specific to bat hosts include a set of forms with unclear taxonomic position (Daniel & Stekolnikov 2003a, b; Stekolnikov & Quetglas 2019). It is difficult to establish, which of their morphological characters suggest a monophyly rather than a parallel evolution. It concerns, for example, a reduction of the posterior scutal angles resulting in an extrascutal insertion of the posterolateral setae (peniscutum), reduction of eyes, and the number of palpal tarsal setae (from four to seven). An attempt of Vercammen-Grandjean (1968) to unite a series of different forms under the name *Myotrombicula* Womersley & Heaslip, 1943 seems improper; probably, a fractional classification would be more adequate.

During my revision of the personal collection of Vercammen-Grandjean deposited in Muséum d'histoire naturelle de Genève (MHNG, Geneva, Switzerland) I found a provisional type series (holotype and six paratypes) of a species labeled as *Trombicula* (*T.*) *mombasa* (*nomen nudum*). In the catalogue of types (Stekolnikov 2019), I placed it presumably in the genus *Grandjeana* Koçak & Kemal, 2009. However, a thorough study revealed that this species could not be placed in any of the known chigger genera. Therefore, I describe it here as a new genus and species.

These specimens were stored among the materials collected from different hosts in Mombasa (Kenya) by Minter, which included a series of chigger species with provisional names given by Vercammen-Grandjean — *Arabacarus mombasai* (*nomen nudum*), *Helenicula lionoti* (*nomen nudum*), *Microtrombicula stenaspida* (*nomen nudum*), *Myotrombicula cor* (*nomen nudum*), *Myotrombicula tricoxalae* (*nomen nudum*), and *Sasatrombicula cardioderma* (*nomen nudum*). With the exception of first two species, these chiggers were collected from

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bat hosts (Stekolnikov 2019). Their further examination is required to describe them as new species or to establish their identity with previously described species.

Material and methods

I examined the microscope slides in MHNG under a microscope Zeiss Axioscop (Carl Zeiss AG, Oberkochen, Germany) with a differential interference contrast. Drawings were made using a drawing tube; measurements were taken by an ocular micrometer. Calibration was done with the use of a stage micrometer. The label of the holotype was photographed using a Canon EOS 600D camera (Canon Inc., Tokyo, Japan). The terminology, abbreviations, and diagnostic formulas are used in the present work following Goff *et al.* (1982).

Minteracarus n. gen.

Zoobank: [BFBE06BC-8911-4A5B-8D74-E80B3DFA7ABC](https://zoobank.org/BFBE06BC-8911-4A5B-8D74-E80B3DFA7ABC)

Diagnosis

SIF = 5B1N-N-2-3111.0000; fsp = 7.7.7; fCx = 1.1.1; fSt = 2.2; fPp = B/B/NBB. Idiosoma slightly contracted medially in engorged specimens; eyes absent; first two rows of dorsal idiosomal setae double or triple, total number of idiosomal setae exceeds 150. Cheliceral blade with tricuspid cap; galeal (deutorostr) seta nude; palpal claw (odontus) slender, with two small apical prongs; palpal tarsus with heavily branched dorsal seta of about same width and length as palpal claw, four setae bearing few branches, one nude seta, and large curved basal tarsala (ω) longer than palpal tarsus. Scutum small, bell-shaped, with puncta and prominent anterolateral shoulders; PL setae extrascutal; sensilla flagelliform, branched. Legs I and II with one pretarsala (ζ); subterminala (ζ) and nude parasubterminala (z) present; tarsalae I and II (ω) of about equal shape and length; famulus I (ε) distal to tarsala I; famulus II (ε) near and slightly proximal to tarsala II; microgenuala and microtibiala I (κ) long and thick, setiform; tibialae I (φ) very thick and long (longer than tarsala I), curved, striated; three long genualae I (σ); two tibialae II (φ), one genuala II (σ), one tibiala III (φ) and one genuala III (σ), mastisetae absent.

Type species

Minteracarus mombasa n. sp., designated here.

Etymology

The genus is named in honour of Dr. Donald M. Minter (The London School of Hygiene and Tropical Medicine) who collected the material of the new genus and species in Kenya in 1963.

Differential diagnosis

The new genus seems unique within the family Trombiculidae by the shape of both tibialae I (φ), which are very thick and long, longer than tarsala I (ω), and clearly striated. The presence of very long and thick microgenuala and microtibiala I (κ), comparable by their size with usual tibialae (φ) and genualae (σ), is also a rare character.

Minteracarus is similar to the monotypic genus of bat chiggers from Jamaica *Bramkeria* Bassini-Silva, Jacinavicius & Ochoa, 2021 by the extrascutal PLs, absence of eyes, presence of anterolateral shoulders of scutum, by the setation of legs, presence of nude setae on palpal tarsus, slender palpal claw with small apical prongs, and by a large number of idiosomal setae, with double or triple first two rows clearly separated from posterior dorsal idiosomal setae. However, *Minteracarus* differs from *Bramkeria* by the presence of six non-specialized palpal tarsal setae including dorsal seta of about same width as palpal claw, whereas other setae are much thinner, vs. seven palpal tarsal setae of about same width, all clearly thinner than the

palpal claw; by two-pronged palpal claw vs. three-pronged; branched sensilla vs. nude; most of palpal setae branched vs. nude (fPp = B/B/NBB vs. N/N/NNN); and by the shape of scutum, with rounded posterior margin and AM placed at level of ALs, vs. concave posterior margin and AM placed anterior to ALs.

The new genus is also similar to the monotypic genus of bat chiggers from Cuba *Tectumpilosum* Feider, 1983, from which it differs by the presence of extrascutal PLs, six palpal tarsal setae vs. seven, two-pronged palpal claw vs. three-pronged, and by the rounded posterior scutal margin vs. slightly concave. The first row of dorsal idiosomal setae in *Tectumpilosum* is double, but all other rows are simple and distinct, with the following numbers of setae: 8-6-4-2-2; NDV = 82.

Minteracarus mombasa n. sp.

Zoobank: 969EC25B-FAA0-4F94-B996-7C0E8F97E9BF

(Figures 1, 2)

Grandjeana (?) mombasa (nomen nudum): Stekolnikov 2019: 36.

Diagnosis

SIF = 5B1N-N-2-3111.0000; fCx = 1.1.1; fSt = 2.2; fPp = B/B/NBB; DS = 100 – 119, V = 63 – 81, NDV = 166 – 194; Ip = 681 – 763; PL ≥ AM ≥ AL; eyes absent; scutum bell-shaped, with moderate puncta, with prominent anterolateral shoulders; PLs situated off scutum; sensilla flagelliform, with 3 – 4 long branches in distal half. Measurements given in Tables 1 and 2.

Description of larva

Idiosoma — (Figure 1) — Slightly contracted medially in engorged specimens; eyes absent; two pairs of humeral setae densely covered with long barbs; 1st posthumeral row (C excluding humeral setae) triple, with 35 – 41 setae; 2nd posthumeral row (D) double, sometimes triple in

Table 1 Morphometric (AW – TaIIIW, μm) and meristic (DS – NDV) traits of *Minteracarus mombasa* n. sp. (N = 7). Abbreviations: AW – distance between anterolateral scutal setae; PW – distance between posterolateral scutal setae; SB – distance between sensillary (trichobothrial) bases; ASB – distance from the level of sensillary bases to extreme anterior margin of scutum; PSB – distance from the level of sensillary bases to extreme posterior margin of scutum; SD – length of scutum (ASB + PSB); AP – distance between antero- and posterolateral scutal seta on one side; AM – length of anteromedian scutal seta; AL – length of anterolateral scutal setae; PL – length of posterolateral scutal setae; S – length of sensilla (trichobothria); H – length of humeral setae; D_{min} – length of the shortest dorsal idiosomal seta; D_{max} – length of the longest dorsal idiosomal seta; V_{min} – length of the shortest ventral idiosomal seta; V_{max} – length of the longest ventral idiosomal seta; pa – length of leg I (including coxa, excluding claws); pm – length of leg II (including coxa, excluding claws); pp – length of leg III (including coxa, excluding claws); Ip – sum of leg lengths (pa + pm + pp); TaIIIL – length of leg tarsus III; TaIIIW – width of leg tarsus III; DS – number of dorsal idiosomal setae (excluding scutal); V – number of ventral idiosomal setae (excluding coxal and sternal); NDV = DS + V.

	Range	Mean	Holotype		Range	Mean	Holotype
AW	40-46	42	41	D _{min}	21-24	22	23
PW	77-106	87	87	D _{max}	32-38	36	32
SB	16-20	18	18	V _{min}	18-24	22	23
ASB	24-28	26	28	V _{max}	26-31	29	29
PSB	15-17	16	17	pa	246-278	268	277
SD	40-44	43	44	pm	211-237	225	237
AP	29-41	34	33	pp	223-251	242	249
AM	32-37	35	37	Ip	681-763	735	763
AL	31-39	35	31	TaIIIL	63-75	69	73
PL	34-37	36	37	TaIIIW	15-17	16	15
S	60-60	60	60	DS	100-119	109	113
H	41-43	42	43	V	63-81	71	66
				NDV	166-194	179	179

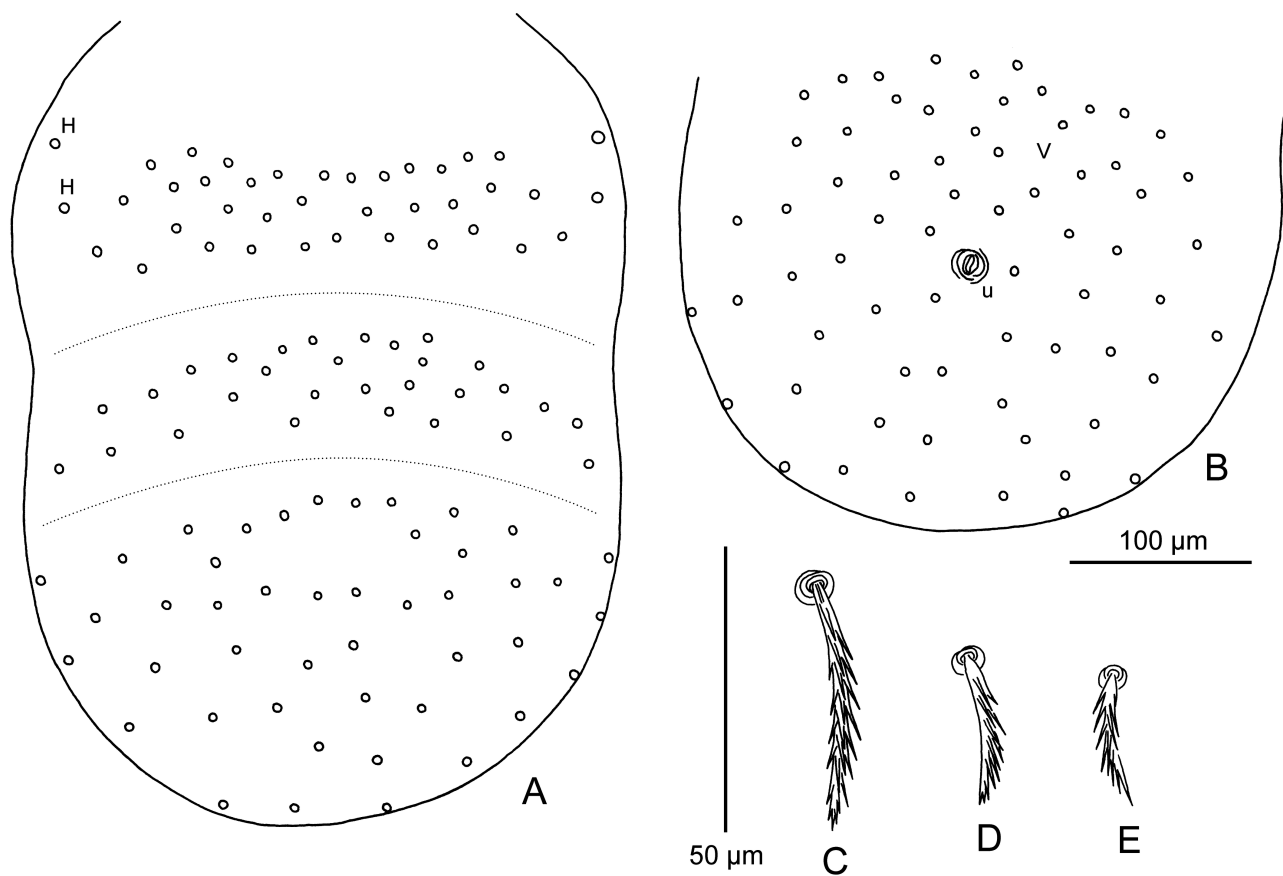


Figure 1 *Minteracarus mombasa* n. sp., holotype: A – arrangement of dorsal idiosomal setae; B – arrangement of ventral idiosomal setae; C – humeral seta; D – dorsal idiosomal seta of 1st posthumeral row (C); E – preanal seta. Abbreviations: H – humeral setae; u – uropore (anus); V – ventral idiosomal setae. Borders between rows showed by dotted lines. Scale bars: A, B – 100 µm; C – E – 50 µm.

medial part, with 23 – 30 setae; distribution of other 36 – 47 setae by rows unclear; 1st and 2nd rows clearly isolated from each other and from posterior setae; total 100 – 119 short, heavily barbed dorsal idiosomal setae; four sternal and 63 – 81 ventral idiosomal setae, NDV = 166 – 194.

Gnathosoma — (Figure 2B, C) — Cheliceral base with sparse puncta; cheliceral blade with tricuspid cap; gnathobase (infracapitulum) with sparse puncta and one pair of branched

Table 2 *Minteracarus mombasa* n. sp., lengths of specialized leg setae, µm (N = 4).

	Range	Mean
Tarsala I (ω)	20-22	21
Tarsala II (ω)	18-18	18
Distal tibiala I (φ)	23-27	25.5
Proximal tibiala I (φ)	22-22	22
Microtibiala (κ)	8-11	9.5
Microgenuala (κ)	8-8	8
Lateral genuala I (σ)	19-19	19

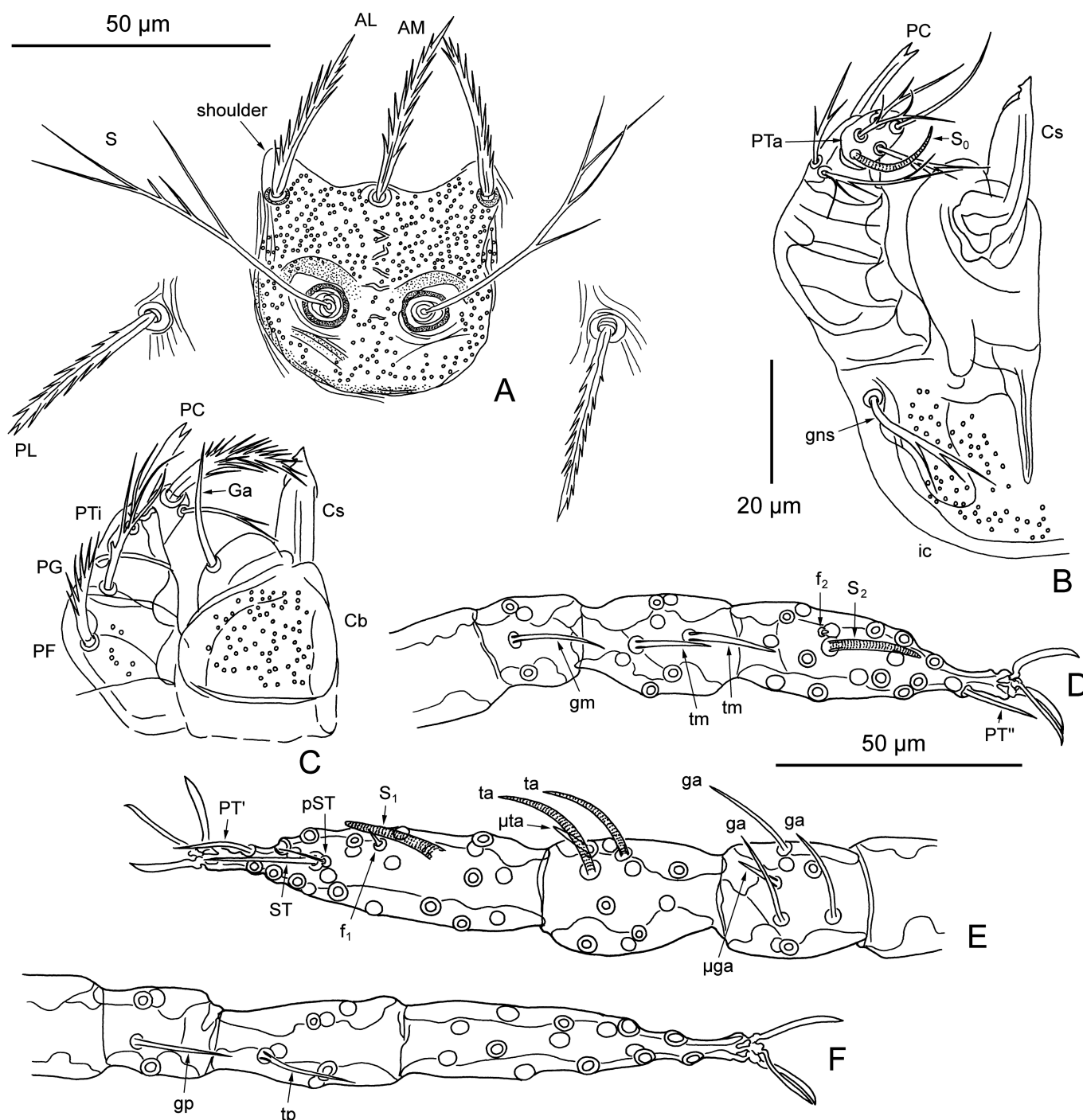


Figure 2 *Minteracarus mombasa* n. sp.: A – scutum (holotype); B – ventral aspect of gnathosoma (paratype L:7263/2); C – dorsal aspect of gnathosoma (paratype L:7263/2); D – genu, tibia, and tarsus of leg II (holotype); E – genu, tibia, and tarsus of leg I (holotype); F – genu, tibia, and tarsus of leg III (holotype). Abbreviations: AL – anterolateral scutal seta; AM – anteromedian scutal seta; Cb – cheliceral base; Cs – cheliceral blade; f_1 – famulus I (ε); f_2 – famulus II (ε); Ga – galeal (deutorostral) seta; ga – genuala I (σ); gm – genuala II (σ); gns – gnathocoxal (tritorostral) seta; gp – genuala III (σ); ic – infracapitulum (gnathobase, gnathocoxa); μ ga – microgenuala I (κ); μ ta – microtibiala I (κ); PC – palpal claw (odontus); PF – palpal femur; PG – palpal genu; PL – posterolateral scutal seta; pST – parasubterminala (z); PT' – pretarsala I (ζ); PT'' – pretarsala II (ζ); PTa – palpal tarsus; PTi – palpal tibia; S – sensillum (trichobothrium); S_0 – palpal tarsala (ω); S_1 – leg tarsala I (ω); S_2 – leg tarsala II (ω); ST – subterminala (ζ); ta – tibiala I (φ); tm – tibiala II (φ); tp – tibiala III (φ). Scale bars: A – 50 μ m; B, C – 20 μ m; D – F – 50 μ m.



Figure 3 Microscope slide with the holotype of *Minteracarus mombasa* n. sp.

gnathocoxal (tritorostral) setae; galeal (deutorostral) seta thick and nude; palpal claw (odontus) slender, with two short subequal prongs; palpal femur with few puncta and strong branched seta; palpal genu with branched seta; dorsal palpal tibial seta nude, lateral and ventral palpal tibial setae branched; palpal tarsus with 6 non-specialized setae, including 1 very thick, heavily barbed dorsal seta and 5 thin setae (4 bearing few branches and 1 nude), and long curved basal tarsala (ω).

Scutum — (Figure 2A) — Small, bell-shaped, with moderate puncta, with prominent anterolateral shoulders; anterior scutal margin sinuous, lateral margins with superimposed cuticular striations, posterior margin rounded; AM at level of ALs; PLs situated off scutum; all scutal setae covered with strong pointed barbs; sensilla flagelliform, with 3 – 4 long branches in distal half; arched crests present anterior to sensillary bases.

Legs — (Figure 2D – F) — All 7-segmented (with divided femur), with 1 pair of claws and claw-like empodium. Leg I: coxa with 1 branched setae (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae (σ), long setiform microgenuala (κ); tibia 8B, 2 very long, curved, striated tibialae (ϕ), long setiform microtibiala (κ); tarsus 21B, tarsala (ω), famulus (ϵ) distal to tarsala, subterminala (ζ), nude parasubterminala (z), pretarsala (ζ). Leg II: coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala (σ); tibia 6B, 2 tibialae (ϕ) in tandem; tarsus 16B, tarsala II (ω), famulus (ϵ) near and slightly proximal to tarsala, pretarsala (ζ). Leg III: coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala (σ); tibia 6B, tibiala (ϕ); tarsus 14B.

Type material

Larval holotype (MHNG) (Figure 3), L:7263/1, ex ear of *Cardioderma cor* (Peters) (Chiroptera: Megadermatidae), KENYA, Mombasa, collected 7 Feb. 1963 by D.M. Minter, identified in 1972 by P.H. Vercammen-Grandjean; six paratypes (MHNG), L:7263/2 – 7, with same data as holotype.

Etymology

I retain the name given this species by Vercammen-Grandjean, which refers to the type locality, the city of Mombasa.

Remarks

The new species resembles an Ethiopian bat chigger *Grandjeana kanuchi* Kalúz & Ševčík, 2015 by the shape of scutum; therefore, Stekolnikov (2019) putatively placed it to the genus *Grandjeana*. However, *Minteracarus* differs from *Grandjeana* by the presence of six non-specialized setae on palpal tarsus vs. five, presence of subterminala and parasubterminala on leg tarsus I (absent in *Grandjeana*), and the presence of one pretarsala on leg tarsus I (vs. two in *Grandjeana*).

The date of collection was reconstructed by me from the slide number given by Vercammen-Grandjean (Stekolnikov 2019).

Discussion

Many of the traits characterizing *Minteracarus* **n. gen.** are scattered among the taxa of chiggers specific to bats and could be connected with the parasitism on these hosts. Thus, extrascutal PLs (peniscutum) are characteristic of the genera *Trisetica* Traub & Evans, 1950, *Audytrombicula* Vercammen-Grandjean, 1963, *Nycterinastes* Brennan & Reed, 1973, *Octasternala* Brown, 1990, and *Bramkeria*. Peniscutum is also present in some species of *Trombigastia* Vercammen-Grandjean & Brennan, 1957 (Vercammen-Grandjean & Fain 1958), in *Trombicula* (*Anomalaspis*) *rhinopomae* Vercammen-Grandjean, 1963 (species *incertae sedis*), and in *Chiroptella* (*Neosomia*) *audyi* (Vercammen-Grandjean & Nadchatram, 1965). In *Grandjeana*, different stages of “peniscutalization” are observed, including asymmetrical intermediate variants (Vercammen-Grandjean & Nadchatram 1963; Kalúz & Ševčík 2014, 2015). The absence of eyes is a characteristic of *Alexfainia* Yunker & Jones, 1961, *Tectumpilosum*, *Bramkeria*, and most *Perates* Brennan & Dalmat, 1960. A slender palpal claw with small apical prongs is present in the genera *Trisetica* (Stekolnikov & Quetglas 2019) and *Bramkeria*, in some species of *Myotrombicula*, *Perates* (Vercammen-Grandjean 1968), *Trombigastia* (Vercammen-Grandjean & Fain 1958), and *Chiroptella* Vercammen-Grandjean, 1960 (Nadchatram 1966).

Myotrombicula dusbabeki Daniel & Stekolnikov, 2003 shows the following characters common with *Minteracarus*: (1) absence of eyes, (2) slender palpal claw, (3) presence of multiple idiosomal setae (NDV = 243) with first two rows double and separated from other setae, (4) presence of one heavily branched dorsal seta on the palpal tarsus, almost as thick as palpal claw, whereas other palpal tarsal setae are much thinner, nude or having a few branches, (5) tibialae I longer than tarsala I (although much thinner). First three of these traits are also characteristic of *Bramkeria* and probably do not suggest an evolutionary closeness that might be assumed for the last two characters.

The setation of legs (not taking into account the shape of setae) in *Minteracarus* is usual for chigger mites (probably, plesiomorphic) and lets to separate this genus from the genera of bat chiggers having specific (autapomorphic) formulas of leg setation, such as *Grandjeana* (characterized by the presence of two pretarsalae I and the absence of leg subterminala), *Sasatrombicula* Vercammen-Grandjean, 1960 and *Chiroptella* Vercammen-Grandjean, 1960 (presence of additional genuala or mastigenuala III).

The shape of scutum is one of the most useful characters for the discrimination of chigger genera. Excluding from consideration the peniscutalization, we get such traits as the presence/absence of anterolateral shoulders (projections of the scutum anterior to ALs), the insertion of AM at level, anterior or posterior to AL, and the shape of posterior scutal margin (concave, straight, convex, angulate, rounded). By the shape of scutum, *Minteracarus* is most similar to *Myotrombicula* (*Perates*) *macrozota* (Brennan & Jones, 1960), which has prominent, acute anterolateral shoulders, AM situated at level of ALs, and convex, rounded posterior scutal margin (Vercammen-Grandjean 1968). *Tectumpilosum* also has prominent shoulders and AM situated at level of ALs, but its posterior scutal margin is slightly concave (Daniel & Stekolnikov 2003a); *Bramkeria* has rather small shoulders, AM situated anterior to ALs, and concave posterior scutal margin (Bassini-Silva *et al.* 2021). *Sasatrombicula* and *Trombigastia* have no shoulders (ALs are inserted in the scutal angles).

Therefore, the new genus seems most close to *Myotrombicula* in the sense of Vercammen-Grandjean (1968), i.e. including *Perates* as a subgenus. However, its status as a separate monotypic genus is undoubted.

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