Folia Parasitologica 2016, 63: 005
doi: 10.14411/fp.2016.005

Folia Parasitologica
http://folia.paru.cas.cz

Research Article OPEN ACCESS

A new mite species *Schizocoptes daberti* sp. n. (Acariformes: Chirodiscidae) from *Chrysochloris stuhlmanni* Matsche (Afrosoricida: Chrysochloridae) in the Democratic Republic of the Congo

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Abstract: A new mite species *Schizocoptes daberti* sp. n. (Acariformes: Chirodiscidae) from *Chrysochloris stuhlmanni* Matsche (Afrosoricida: Chrysochloridae) from the Democratic Republic of the Congo is described. It differs from the closely related species *S. conjugatus* Lawrence, 1944 in both sexes by distance *si–si* at least twice longer than *si–se* (*vs* these distances are subequal in *S. conjugatus*); in females by setae *cp* 30–40 µm long (*vs* about 65 µm long), and in males by the very weakly sclerotised posterior parts of the hysteronotal shield (*vs* strongly sclerotised), setae *d1* situated anterior to the hysteronotal shield (*vs* at the hysteronotal shield), and by opened coxal fields III (*vs* closed). An amended generic diagnosis, including description of immature stages, and a key to named species of *Schizocoptes* Lawrence, 1944 are provided.

Keywords: acari, Africa, fur-mites, golden-moles, parasitology, systematics, identification key

Mites of the family Chirodiscidae Trouessart, 1892 (Acariformes: Sarcoptoidea) are permanent ectoparasites inhabiting the fur of mammals belonging to seven placental and marsupial orders. These mites are highly host-specific being mono- or stenoxenous parasites. To date more than 230 species in 26 genera and four chirodiscid subfamilies have been described (Bochkov 2010). The subfamily Schizocoptinae consists of two species of the genus *Schizocoptes* Lawrence, 1944 associated with golden moles (Afrosoricida: Chrysochloridae) in Africa (Fain 1971). The external morphology of these mites, especially of their gnathosoma and legs I and II, has been only superficially described, and homology of leg setae of *Schizocoptes* with those of other Psoroptidia has not been confirmed. Here, I present an amended diagnosis of the subfamily Schizocoptinae based on investigation of type and freshly collected specimens using light and scanning electron microscopy, together with a key to all three species.

MATERIALS AND METHODS

Mites were collected by the author from fur of ethanol preserved hosts with fine forceps under a dissection microscope, placed in 96% ethanol and then mounted in Hoyer's medium according to standard methods (Evans 1992).

Drawings were made with a Leica microscope equipped with differential interference contrast optics and a camera lucida. Morphological structures of mites were also examined with a Quanta 250 scanning electron microscope. For SEM imaging mites were placed in hexamethyldisilazane for 10 minutes, dried and then sputter-coated with platinum. In the description below, the idiosomal setation by Griffiths et al. (1990) is followed with modifications for coxal setae (Norton 1998). Leg setation follows Grandjean (1939). All measurements are in micrometres (µm) and were taken as follows: body length = length from an imaginary line drawn between the palpal apices to the posterior margin of the body; idiosomal width = lateral width at the level of setae *cp*; length of dorsal shields = maximum length, measured along the median line of the shields; length of the posterior legs = length from the most proximal point of the trochanter to the apex of the tarsus, excluding pretarsus. Host systematics follows Bronner and Jenkins (2005).

The following abbreviations of institutions and reference numbers are used: IPCAS – Institute of Parasitology, Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic; IRSNB – Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; KZNM – KwaZulu-Natal Museum, Pietermaritzburg, South Africa; MRAC – Royal Museum for Central Africa, Tervuren, Belgium; UMMZ – Museum of Zoology, the University of Michigan, Ann Arbor, USA; ZISP – Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia.

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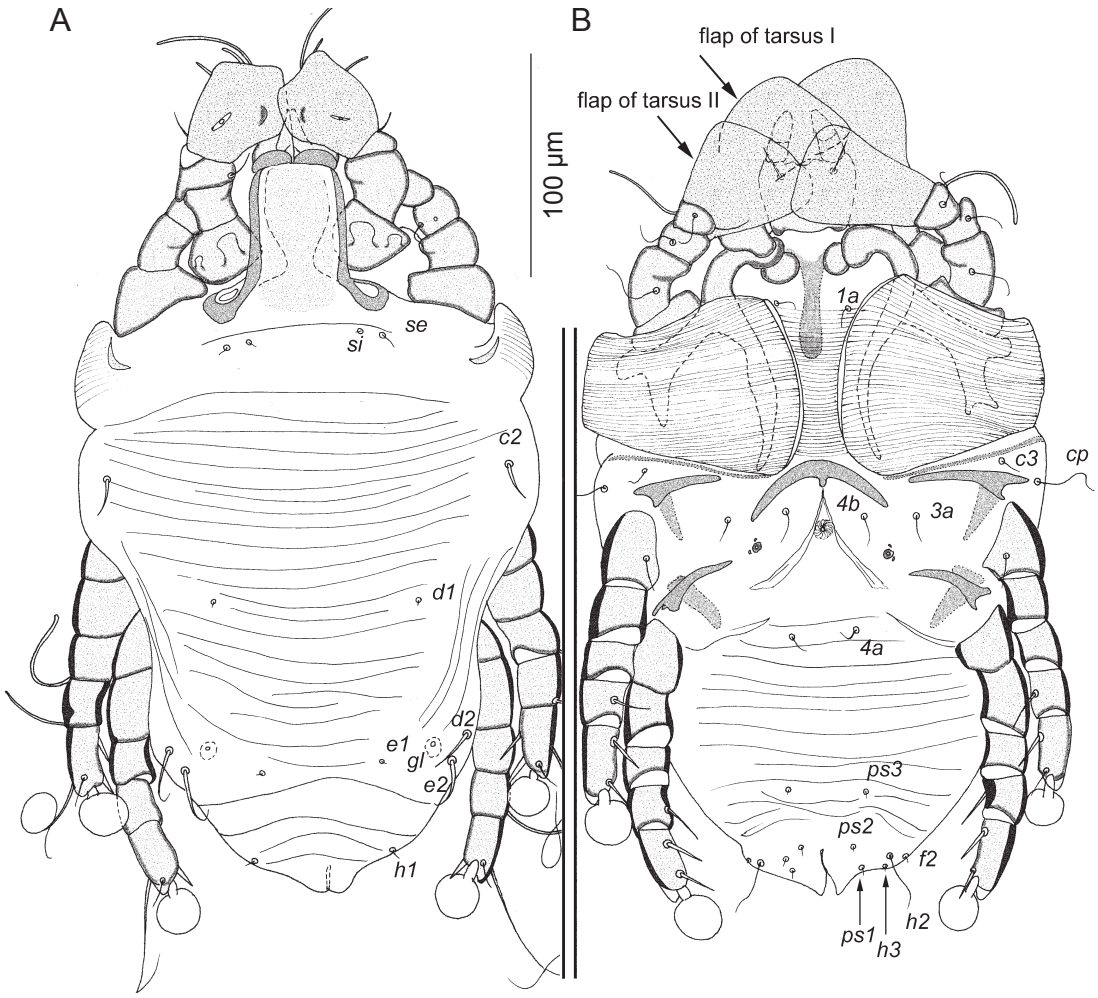

Fig. 1. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, female, holotype (ZISP T-Ch-29). **A** – dorsal view; **B** – ventral view.

RESULTS

Family **Chirodiscidae** Trouessart, 1892

Subfamily **Schizocoptinae** Fain, 1970

Genus ***Schizocoptes*** Lawrence, 1944

Lawrence 1944: 302 (Listrophoridae); Fain 1970: 299, 1971: 196.

Type species: *Schizocoptes conjugatus* Lawrence, 1944, by original designation.

Subfamily and genus description. Both sexes. Dorsal lobes of gnathosoma distinctly developed. Subcapitulum bearing setae *elcp* and *subc*. Palps two-segmented. Apical palpal membranes distinctly developed covering almost entire palp ventrally. Palpal setae *dTi*, *l''Ti*, *dTa*, 2 tarsal eupathidia and solenidion *ω* present. Idiosoma flattened dorsoventrally, transversely striated. Propodonotal shield present. Laterocoxal organ *scx* absent. Hysteronotal gland openings (*gl*) easilly discernible. Setal bases *d2* and *e2* situated close to each other. Coxal fields II large, transversely striated. Genital papillae of each side sharing common opening. Coxal apodemes Ia fused in a Y-shaped structure. Coxal apodemes IIa-IVa free. Apodemes IIIb and IVb absent. Idiosomal setae present: *si*, *se*, *c2*, *c3*, *cp*, *d1*, *d2*, *e1*, *e2*, *f2*, *h1*, *h2*, *h3*, *ps1*, *ps2*, *ps3*, *1a*, *3a*, *4a*, *4b*, and *g* (absent in female). Legs I with 4 articulated segments (tibia and tarsus fused), legs II with 5 articulated segments, without pretarsus; legs III and IV with 5 articulated segments and well-developed pretarsi. Legs I and II with large flaps at apical segment. Trochanters I with dorsal membraneous projection. Leg setation. Leg I: trochanter without setae, femur with seta *vF*, genu with setae *cG* and *mG*, and strongly reduced solenidion *σ1*, tibiotarsus with 3 setae (not readily homologised), and 2 solenidia *φ*, *ω1*; leg II: trochanter without setae, femur with seta *vF*, genu with setae *cG* and *mG*, and strongly reduced solenidion *σ*, tibia with solenidion *φ* and seta *gT*, tarsus with solenidion *ω1* and 5 setae (non-homologised); leg III: trochanter with seta *sR*, genu with solenidion *σ*, tibia with solenidion *φ* and seta *kT*, tarsus with 6 setae (*d*, *e*, *f*, *s*, *r*, *w)*; leg IV: tibia with solenidion *φ* and seta *kT*, tarsus IV with 5 setae (*d*, *e*, *f*, *r*, *w)*.

Female (Figs. 1, 2, 4A–C, 9C–F). Hysteronotal shield absent. Epigynum well-developed, arch-like. Setae *d*III and IV filiform, whip-like, longer than respective tarsi.

Male (Figs. 3, 4D, 9A,B). Hysteronotal shield represented by 3 pieces: large and distinctly sclerotised anterior part and a pair of variably sclerotised posterior parts.

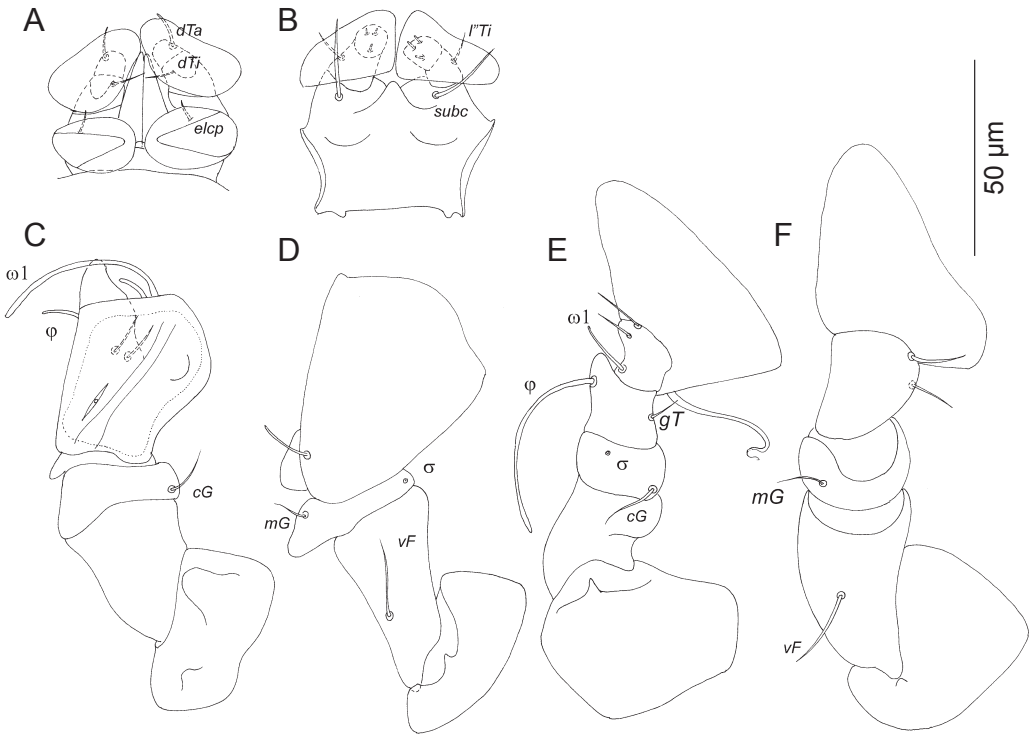

Fig. 2. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, details of female, paratype (ZISP AVB 07-0306-001). **A**, **B** – gnathosoma in dorsal and ventral view, respectively; **C**, **D** – leg I in dorsal and ventral view, respectively; **E**, **F** – leg II in dorsal and ventral view, respectively.

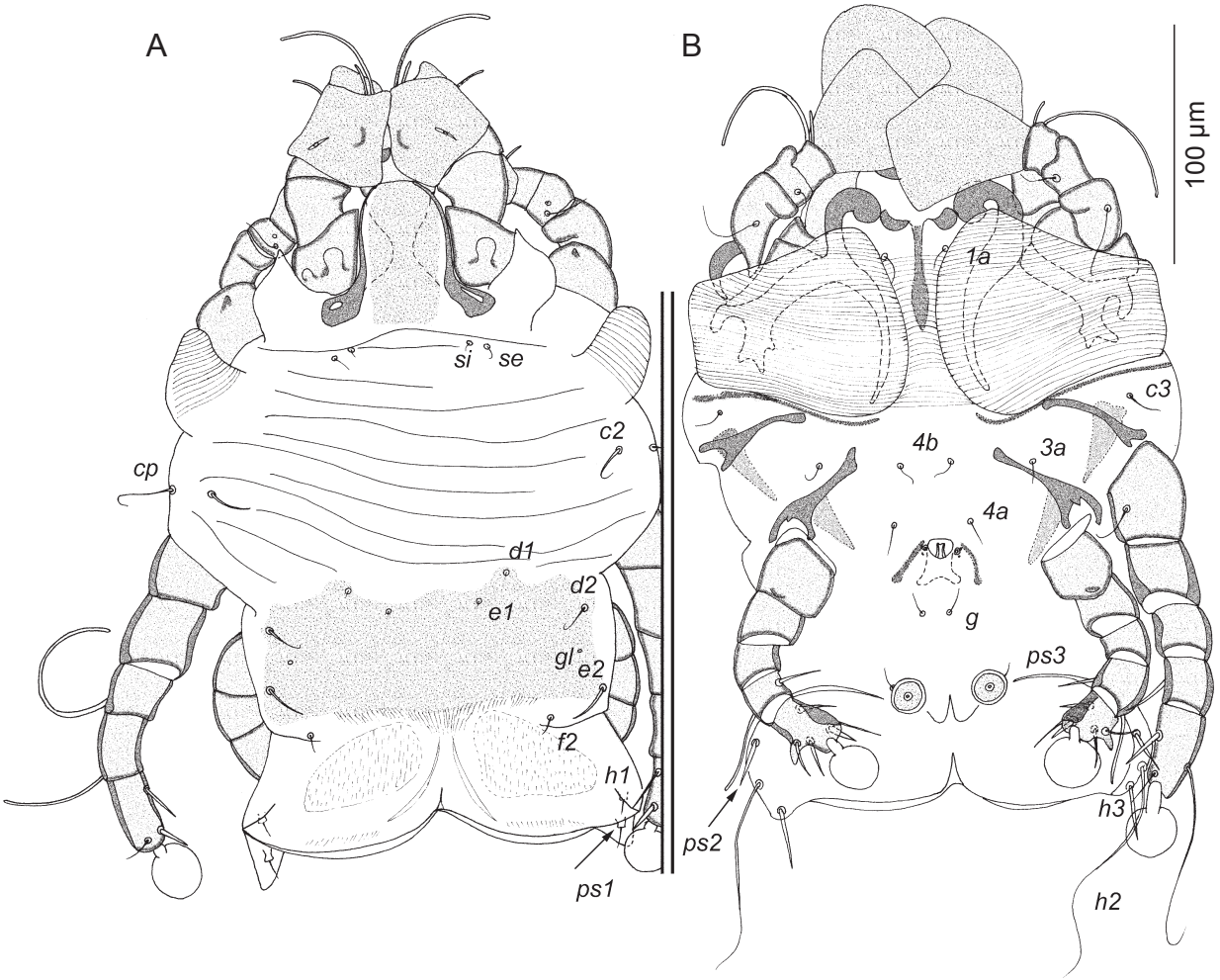

Fig. 3. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, male, paratype (ZISP AVB 07-0306-001). **A** – dorsal view; **B** – ventral view.

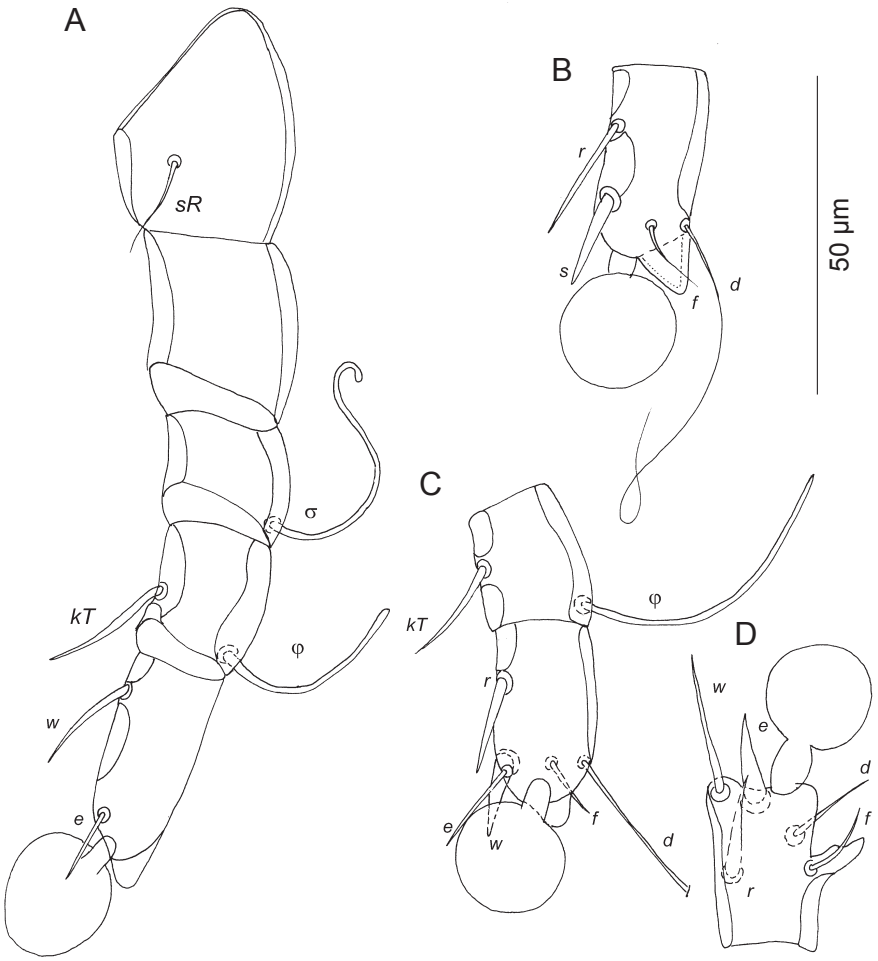

Fig. 4. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, details of legs of adults, paratypes (ZISP AVB 07-0306-001). **A** – leg III of female in ventral view; **B** – tarsus III of female in dorsal view; **C** – tibia and tarsus III of female in ventral view; **D** – tarsus IV of male in ventral view.

Opisthosomal lobes distinctly developed. Adanal suckers present. Adanal sclerites absent. Legs III slightly longer than legs IV. Tarsi III and IV slightly longer than respective tibiae. Tarsus IV with dorsomedian projection. Setae *d*III filiform, whip-like, longer than respective tarsi. Setae *d*IV and *e*IV setiform.

Description of immature stages (based on *S. daberti* sp. n.). **Larva** (Fig. 5). Gnathosoma as in adults. Propodonotal shield present. Setae *si*, *se*, *c2*, *cp*, *c3*, *d1*, *d2*, *e1*, *e2*, *h1*, *h2* represented by microsetae, setae *1a* and *3a* present. Legs I–III as in adults.

Male protonymph (Fig. 6). One pair of genital papillae and setae *ps3* (microsetae) added on idiosoma. Legs IV added; tarsus IV bearing setae *d* (whip-like), *w*, and *r*.

Female protonymph. Unknown.

Male tritonymph (Fig. 7). Setae *f2*, *ps1*, *ps2*, *4a*, *4b*, and second pair of genital papillae added; genital papillae sharing common opening. Solenidia *σ*, *φ*, and tactile setae *e*, *f*, *s* added on tarsus IV.

Female tritonymph (Fig. 8). Idiosoma with hysteronotal shield. Coxal apodemes Ia weakly sclerotised. Coxal fields II without striated membrane; apodemes IIa present. Coxal apodemes IIIa and IVa absent. Set of idiosomal setae as in male tritonymph but setae *3a*, *4a*, and *4b* absent. Second pair of genital papillae added, genital papillae sharing common opening. Legs III and IV represented by small tubercles bearing 2 microsetae each.

Species included: *Schizocoptes chrysochloris* Fain, 1970, *S. conjugatus* Lawrence, 1944 and *S. daberti* sp. n.

Hosts: Golden moles (Afrosoricida: Chrysochloridae).

Site: Fur.

Schizocoptes conjugatus Lawrence, 1944

Lawrence 1944: 303, fig. 4; Zumpt 1961: 312; Fain 1970: 299, 1971: 197, figs. 246–251 (types in KZNM, not examined).

Hosts and distribution: This species was described from *Chrysospalax villosus* (Smith) (Chrysochloridae) in South Africa (Lawrence 1944). It was recorded from *Chrysospalax trevelyani* (Günther) from the same country by Zumpt (1961). Fain (1971) also reported this mite from *Chrysochloris stuhlmanni* Matsche and *Amblysomus hottentotus* (Smith) (Chrysochloridae) from the Democratic Republic of the Congo and South Africa, respectively. We re-examined Fain's specimens from *C. stuhlmanni* and think that they are conspecific with *Schizocoptes daberti* sp. n. described below. A few specimens from *A. hotten-*

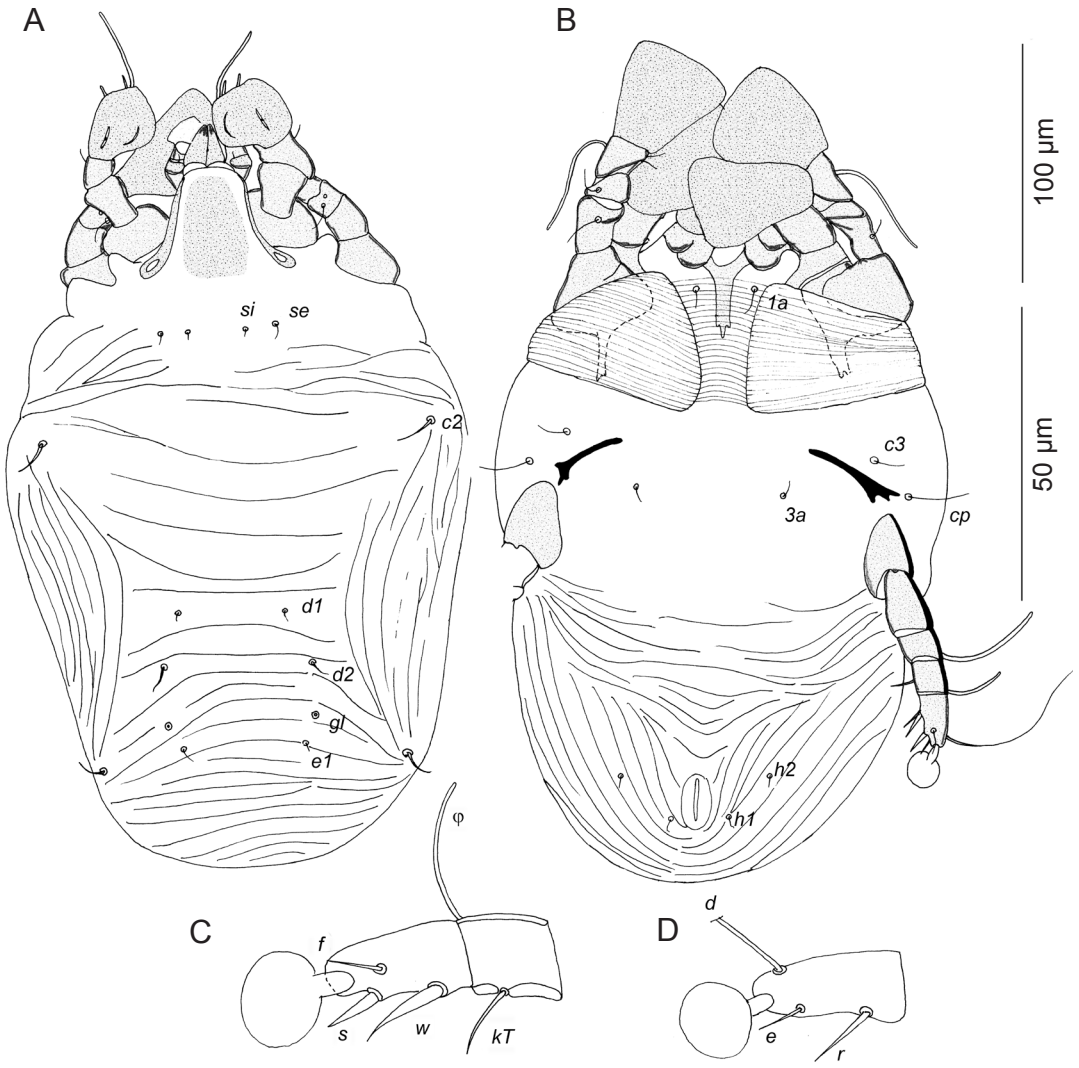

Fig. 5. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, larva, voucher (ZISP AVB 07-0305-006). **A** – dorsal view; **B** – ventral view; **C** – tibia and tarsus III in ventral view; **D** – tarsus III in dorsal view. Scale-bars: A, B = 100 µm; C, D = 50 µm.

totus housed in IRSNB and examined in this study probably belong to an undescribed species of *Schizocoptes* but more material from this host is necessary to confirm this assumption.

Schizocoptes chrysochloris Fain, 1970

Fain 1970: 299, 1971: 200, figs. 252, 253.

Type material examined: Male holotype (MRAC 139971) from *Chlorotalpa leucorhina* (Huet) (Chrysochloridae), Democratic Republic of the Congo: Bas-Congo (Bas-Zaire) Province, Inkisi River, 05°08'S; 15°04'E, date unknown, coll. A. Fain.

Voucher specimens examined: 7 males, 10 females and 2 larvae (ZISP AVB 07-0305-005) from *Chlorotalpa leucorhina* (MRAC 227359), Democratic Republic of the Congo: other data unknown; 4 males, 13 females and 3 larvae (ZISP AVB 07-0306-002) from the same host (IRSNB 13111), Democratic Republic of the Congo: Katanga Province, Kalinda stream, 11°11'29"S; 22°18'3"E, 12 December 1957, coll. unknown; 4 females and 1 male tritonymph (ZISP AVB 13-0129-005) from the same host (MRAC 18205), Democratic Republic of the Congo: Bas-Congo (Bas-Zaire) Province, Bamba Kilenda, 04°55'15"S; 15°29'48"E, date and collector unknown.

Hosts and distribution: This species was described from *Chlorotalpa leucorhina* from the Democratic Republic of the Congo (Fain 1971). I recollect it repeatedly from the same host and country (present paper).

Schizocoptes daberti sp. n. Figs. 1–9

ZooBank number for species:
urn:lsid:zoobank.org:act:D259B4FB-2D5A-4BCA-9D95-8151EC213CFA

Fain 1971: 198 (misidentification as *Schizocoptes conjugatus*).

Female (holotype, Figs. 1, 2, 4A–C; 9C–F). Body 335 long (330–345 in 10 paratypes), 200 wide (195–205). Idiosoma 300 long (295–315). Distance *si–si* 50 (48–55), distance *si–se* 17 (15–19). Epigynal arch 92 wide (89–95). Lengths of idiosomal setae: *c2* 18 (17–20), *cp* 35 (33–37), *c3* 13 (11–13), *d2* 30 (28–32), *e2* 33 (30–35), *h2* 25 (23–30), *1a*, *3a*, *4a*, and *4b* 12–15; other setae very short, 2–3. Legs III and IV 115–130 long; tarsi III and IV about

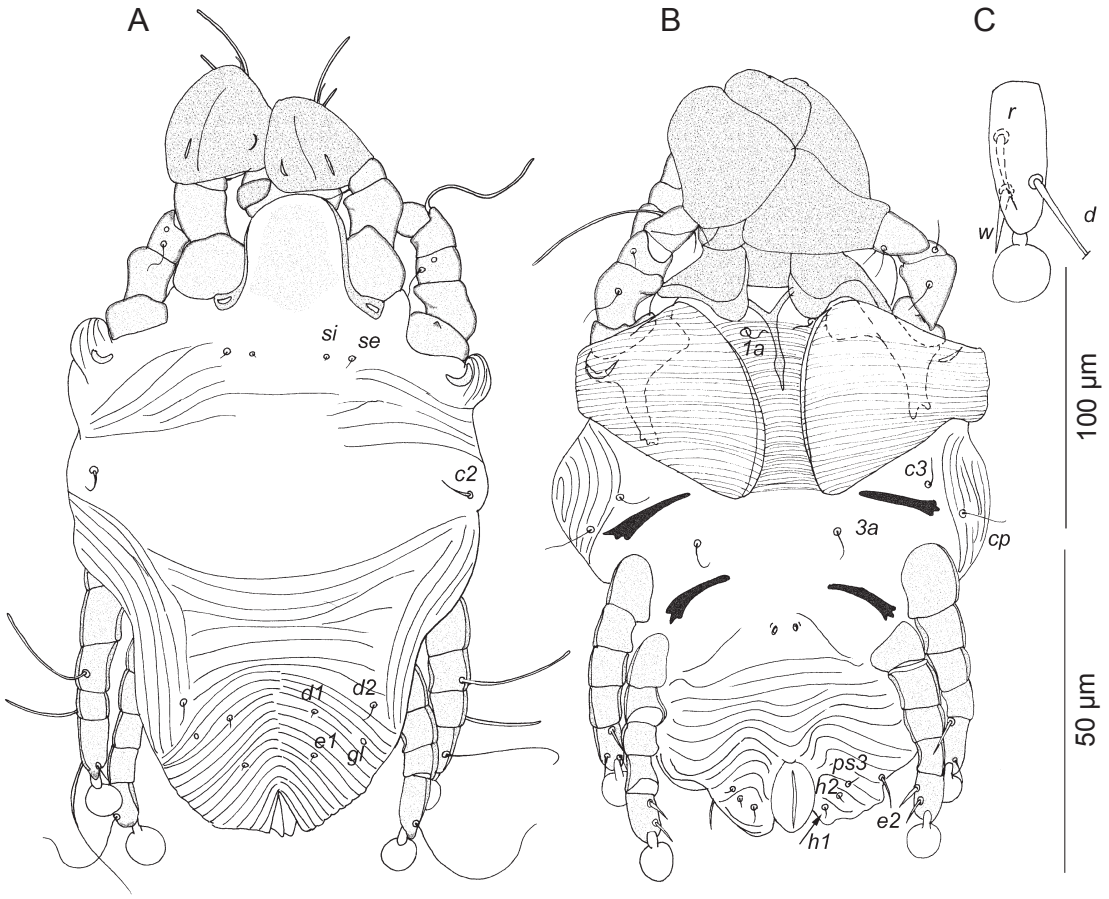

Fig. 6. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, male protonymph, voucher (ZISP AVB 07-0305-006). **A** – dorsal view; **B** – ventral view; **C** – tarsus IV in dorsal view. Scale-bars: A, B = 100 µm; C = 50 µm.

35 long. Lengths of leg solenidia: *σ*III 58 (55–60), *φ*III 30 (30–35), and *φ*IV 50 (48–54).

Male (4 paratypes, Figs. 3, 4D, 9A,B). Body 310–330 long, 190–200 wide. Idiosoma 290–310 long. Distance *si–si* about 50, distance *si–se* 8–11. Anterior part of hysteronotal shield about 50 long and 135 wide; posterior parts about 25 long and 50 wide each, very weakly sclerotised, almost indistinct, distance between posterior parts about 25. Setae *d1* situated on hysteronotal shield. Coxal fields III opened. Aedeagus 6–8 long. Diameter of adanal suckers about 15. Lengths of idiosomal setae: *c2* and *d2* about 20, *cp* 30–35, *e1* and *d1* 2–5 long, *e2* 21–24, *h2* 100–115, *h3* and *ps2* about 20, *c3*, *1a*, *3a*, *4a*, *4b* 7–10, *f2*, *h1*, *ps1*, and *ps3* 7–10. Legs III about 150 long, tarsus III about 35 long. Leg IV about 110 long; tarsus IV about 25 long with fleshy distinct dorsomedian projection as long as ½ of segment width. Lengths of leg solenidia: *σ*III about 85, *φ*III and *φ*IV about 35**.**

Immature stages: See subfamily/generic diagnosis.

Type host: Stuhlmann's golden mole *Chrysochloris stuhlmanni* Matsche (Afrosoricida: Chrysochloridae).

Type locality: Democratic Republic of the Congo: South Kivu, Plantation Lemera (02°08'19"S; 28°50'28"E).

Type material: Female holotype (ZISP T-Ch-29), 4 male and 10 female paratypes (ZISP AVB 07-0306-001), 1 female paratype in IPCAS 2038; 1 male and 1 female paratypes in MRAC MT.191303, 1 male and 1 female paratypes in UMMZ (BMOC 16-0201-001), host (MRAC 27229), date and collector unknown.

Voucher specimens examined: 5 males and 8 females (ZISP AVB 07-0305-003) from *Chrysochloris stuhlmanni* (MRAC 37102), Democratic Republic of the Congo: Kivu, Virunga (Albert) National Park, 00°55'00"S; 29°10'00"E, date and collector unknown; 1 male and 8 females (ZISP AVB 07-0305-004) from same host (MRAC 37101), same location as previous, date and collector unknown; 3 males, 17 females, 2 male tritonymphs, and 1 female tritonymph (ZISP AVB 13-0129-004) from same host (MRAC 27924), Democratic Republic of the Congo: Kivu, other data unknown; 5 males, 5 females, 3 male tritonymphs, 1 male protonymph, and 3 larvae (ZISP AVB 07-0305-006) from same host (IRSNB 13498), Democratic Republic of the Congo: Orientale Province, Tshopo District, Isangi Territory, Yangambi, 00°46'3"N; 24°26'29"E, November 1938, coll. unknown.

Etymology: This species is named in honour of the well-known Polish acarologist Jacek Dabert (Adam Mickiewicz University, Poznań, Poland).

Differential diagnosis: See a key below.

Key to species of the genus *Schizocoptes* Lawrence, 1944

1 *Female*: setae *h2* not longer than 30; setae *cp* far from reaching level of setal bases *d2*. *Male*: setae *cp* far from reaching level of setal bases *h2*; setae *e2* 2–2.5 times longer than *f2*; setae *h3* and *ps2* subequal; dorsomedi-

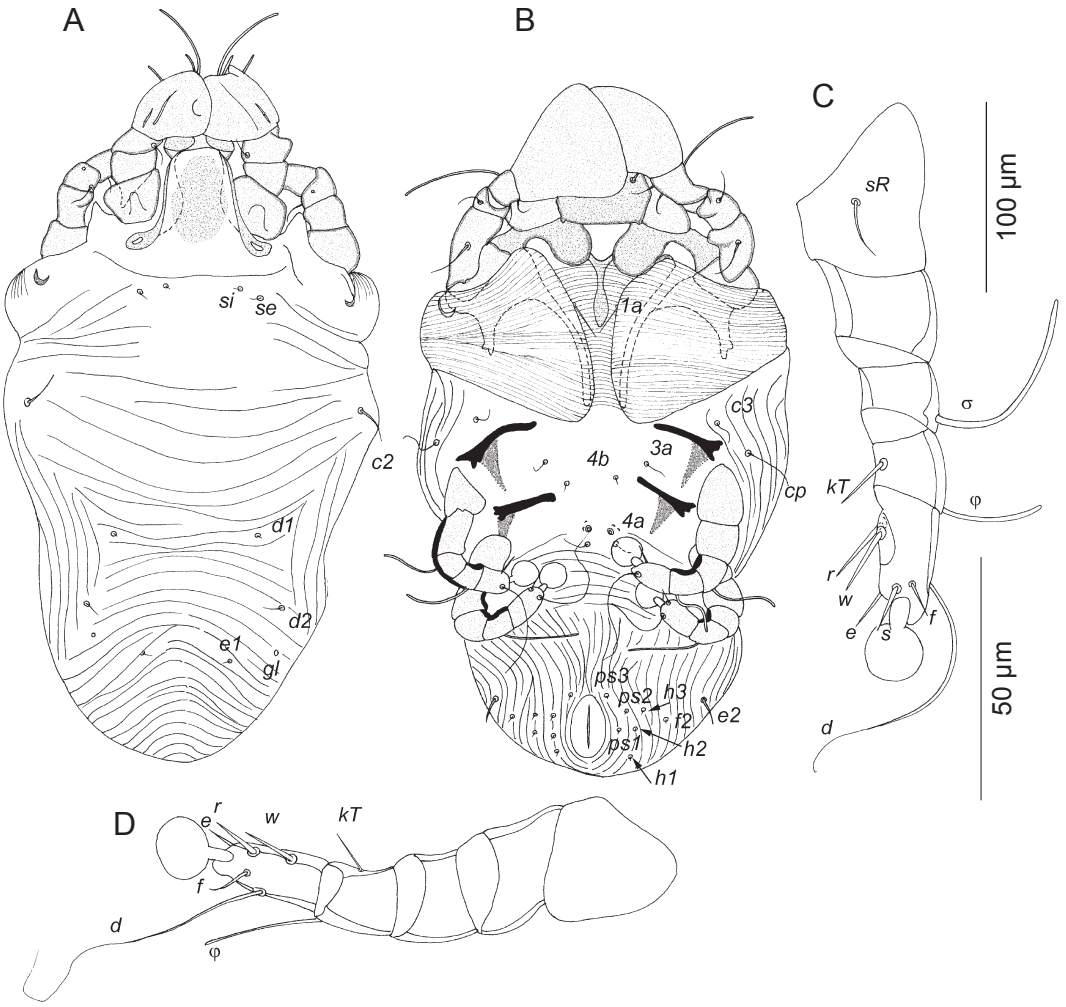

Fig. 7. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, male tritonymph, voucher (ZISP AVB 13-0129-004). **A** – dorsal view; **B** – ventral view; **C** – leg III in ventral view; **D** – leg IV in ventral view. Scale-bars: A, B = 100 µm; C, D = 50 µm.

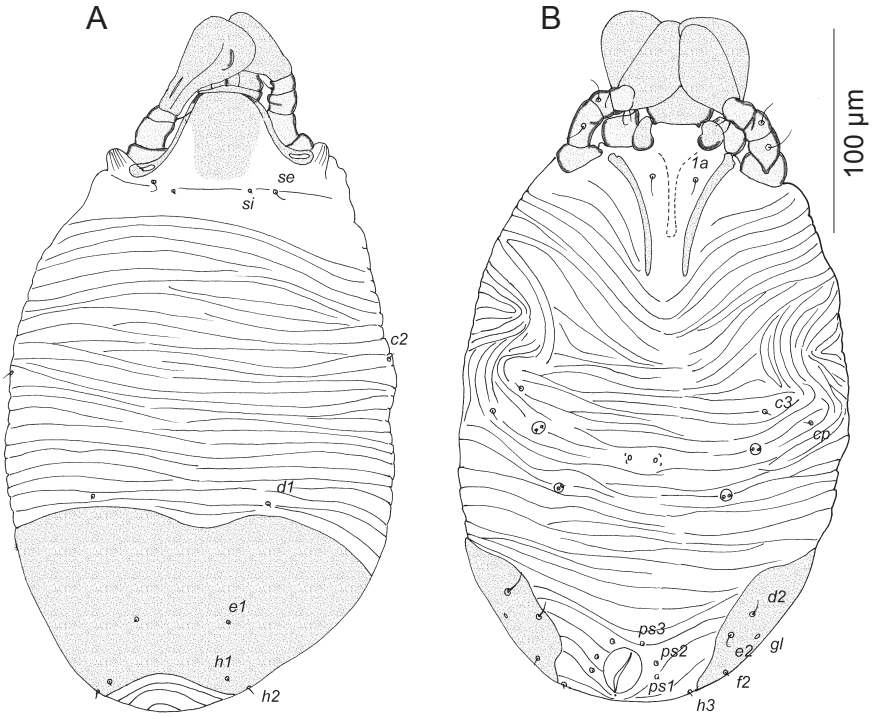

Fig. 8. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, female tritonymph, voucher (ZISP AVB 13-0129-004). **A** – dorsal view; **B** – ventral view.

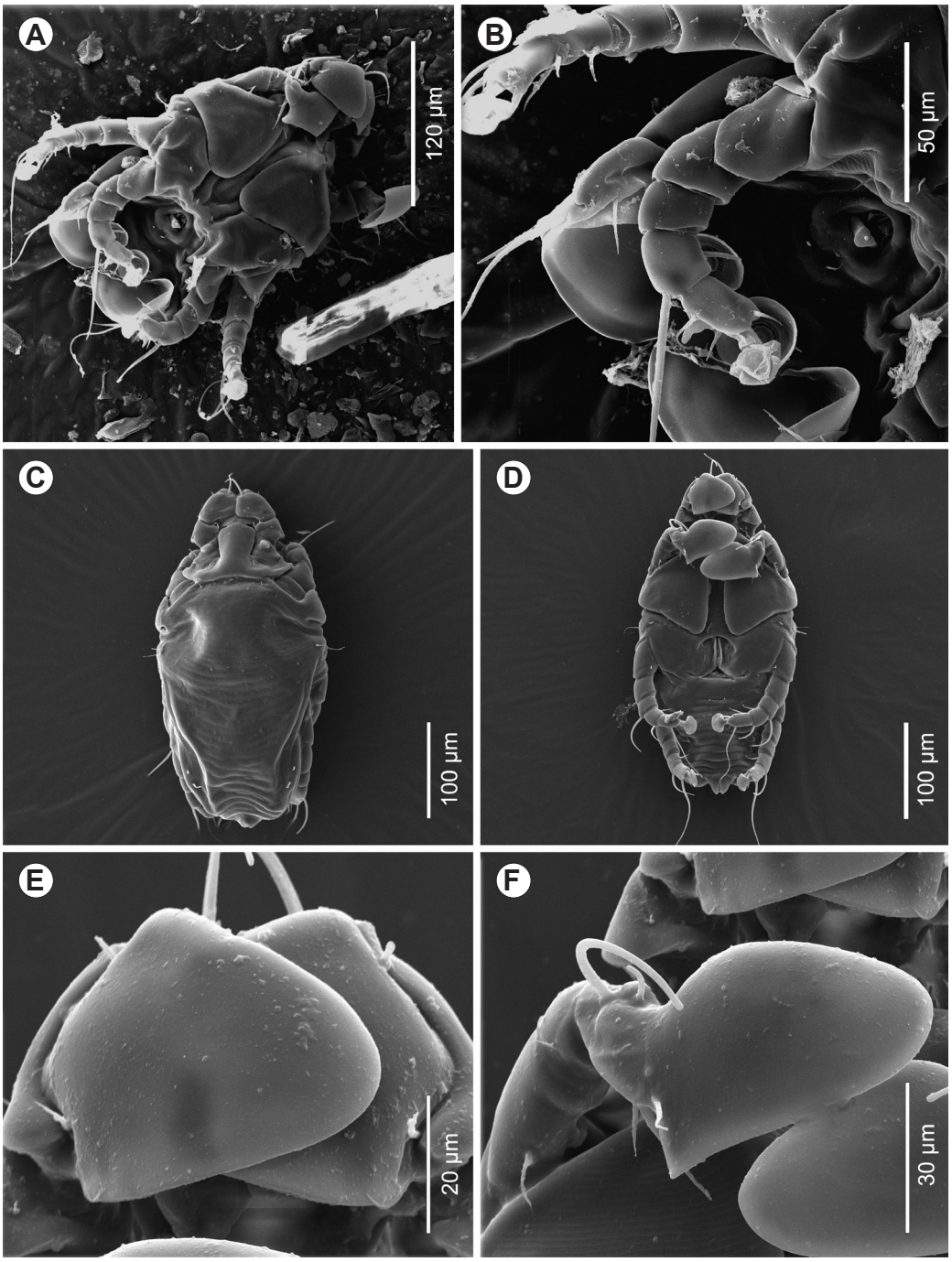

Fig. 9. *Schizocoptes daberti* sp. n. from *Chrysochloris stuhlmanni* Matsche, scanning electron micrographs. **A** – male in ventral view; **B** – hysterosoma of male in ventral view; **C**, **D** – female in dorsal and ventral view, respectively; **E** – leg I of female in ventral view; **F** – leg II of female in ventral view.

an projection of tarsus IV as long as 1/2 of segmental width 2

– *Female*: setae *h2* much longer than 30; setae *cp* almost reaching level of setal bases *d2*. *Male*: setae *cp* almost reaching level of setal bases *h2*; setae *e2* more than 3 times longer than *f2*; setae *h3* about 2.5 times longer than *ps2*; dorsomedian projection of tarsus IV as long as 1/4 of segmental wide .... *S. chrysochloris* Fain, 1970

2 *Both sexes*: distances *si–se* and *si–si* subequal. *Female*: setae *cp* about 65 long. *Male*: posterior parts of hysteronotal shield distinctly sclerotised; setae *d1* situated on hysteronotal shield; coxal fields III closed .... *S. conjugatus* Lawrence, 1944

– *Both sexes*: distance *si–si* at least twice longer than *si–se*. *Female*: setae *cp* 30–40 long. *Male*: posterior parts of hysteronotal shield very weakly sclerotised; setae *d1* situated anterior to hysteronotal shield; coxal fields III opened ..... ***S. daberti* sp. n.**

Acknowledgements. This research was supported by the Polish National Science Centre (Grant No. NCN 2014/15/B/NZ8/00208) to Andre V. Bochkov.

REFERENCES

Bochkov A.V. 2010: A review of mammal-associated Psoroptidia (Acariformes: Astigmata). Acarina 18: 99–260.

Bronner G.N., Jenkins P.D. 2005: Order Afrosoricida. In: D.E Wilson and D.M. Reeder (Eds.), Mammal Species of the World. Third Edition. Johns Hopkins University Press, Baltimore, pp. 70–81.

Evans G.O. 1992: Principles of Acarology. CAB International, Wallingford, 563 pp.

Fain A. 1970: Diagnoses de nouveaux lobalgides et listrophorides (Acarina: Sarcoptiformes). Rev. Zool. Bot. Afr. 81: 271–300.

Fain A. 1971: Les listrophorides en Afrique au sud du Sahara (Acarina: Sarcoptiformes). II. Familles Listrophoridae et Chirodiscidae. Acta Zool. Pathol. Antverp. 54: 1–231.

Grandjean F. 1939: La chaetotaxie des pattes chez les Acaridiae. Bull. Soc. Zool. France 64: 50–60.

Griffiths D.A., Atyeo W.T., Norton R.A., Lynch C.A. 1990: The idiosomal chaetotaxy of astigmatid mites. J. Zool. (London) 220: 1–32.

Lawrence R.F. 1944: A new parasitic mite from the golden mole. Proc. Zool. Soc. London 113: 32–36.

Norton R.A. 1998: Morphological evidence for the evolutionary origin of Astigmata (Acari: Acariformes). Exp. Appl. Acarol. 22: 559–594.

Zumpt F. (Ed.) 1961: The Arthropod Parasites of Vertebrates in Africa South of the Sahara (Ethiopian Region). Vol. I (Chelicerata). South African Institute for Medical Research, Johannesburg, South Africa, 457 pp.

Received 17 December 2015 Accepted 21 January 2016 Published online 9 February 2016

Cite this article as: Bochkov A.V. 2016: A new mite species *Schizocoptes daberti* sp. n. (Acariformes: Chirodiscidae) from *Chrysochloris stuhlmanni* Matsche (Afrosoricida: Chrysochloridae) in the Democratic Republic of the Congo. Folia Parasitol. 63: 005.