

Further additions to the Ceratocanthidae fauna of the Eastern Arc rainforests of Tanzania

(Coleoptera: Scarabaeoidea: Ceratocanthidae)

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Abstract

Three new flightless species of *Philharmostes* KOLBE (Coleoptera: Ceratocanthidae) are described from the Eastern Arc rainforests of Tanzania: *P. grebennikovi* (West Usambara Mts.), *P. ornatus* (Uluguru Mts.), and *P. pseudumbratilis* (West Usambara Mts.). *Philharmostes grebennikovi* is especially remarkable since it is the smallest known Ceratocanthidae and is quite distinct from East African *Philharmostes*, and more similar to the South African representatives of this genus.

Key words: Coleoptera, Scarabaeoidea, Ceratocanthidae, *Philharmostes*, taxonomy, new species, Tanzania.

Introduction

The Afrotropical/Madagascan genus *Philharmostes* KOLBE, 1895 (Coleoptera Scarabaeoidea Ceratocanthidae) is represented in the Eastern Arc rainforests of Kenya and Tanzania by four endemic species (*P. integer* KOLBE, 1895, *P. basilevskii* PAULIAN, 1977, *P. umbratilis* PETROVITZ, 1968, and *P. werneri* BALLERIO, 2001). These species form a relatively homogeneous group within the genus as discussed in BALLERIO (2001).

The Eastern Arc rainforests of Tanzania and Kenya are a hot spot of biodiversity with a high degree of endemism (LOVETT & WASSER 1993, BURGESS et al. 1998). These rainforests consist of a series of isolated patches of forest ranging from the Taita Hills in southern Kenya southwards to the Udzungwa Mountains (and slightly further) in southern Tanzania. Little is known on the Ceratocanthidae occurring in these areas, mainly because few forest patches have been properly prospected in order to find these beetles. Even the forests already examined, such as the Usambaras and the Ulugurus, can yield novelties, as demonstrated by the rich collecting made by Vasily Grebennikov during a short expedition carried out in October 2002. The purpose of this paper is to describe the three new species of *Philharmostes* collected by Grebennikov during his expedition.

Methods and acronyms

For methods and terminological conventions I refer to my previous papers (BALLERIO 2000a, b, 2001). The terminology of the ceratocanthid elytron, introduced by PAULIAN (1977), is shown in Fig. 1.

The habitus photographs (Figs. 4 - 6) were obtained with the auto-montage system by Syncroscopy.

Acronyms and abbreviations:

EL	maximum elytral length
EW	maximum total elytral width
HL	maximum head length
HW	maximum head width
L	length
PL	maximum pronotum length
PW	maximum pronotum width
W	width
ABCB	A. Ballerio private collection, Brescia (Italy)
MRAC	Musée Royal de l'Afrique Centrale, Tervuren (Belgium)
TMSA	Transvaal Museum, Pretoria (South Africa)

Taxonomy

Philharmostes grebennikovi sp.n.

TYPE LOCALITY: Grant's Lodge, Lushoto district, West Usambara Mountains, Tanzania.

TYPE MATERIAL: **Holotype** ♂ (MRAC) [dissected and glued on a card]: "Tanzania: W. Usambara Mts., Oct. 03-08.2002, H-1660 m., Lushoto distr. Grant's Lodge, Mkuzu riv., 3-4 km upstream of Kifungilo, V. Grebennikov leg.". **Paratypes**: 2 ♂♂ [all dissected] with the same data as the holotype (ABCB).

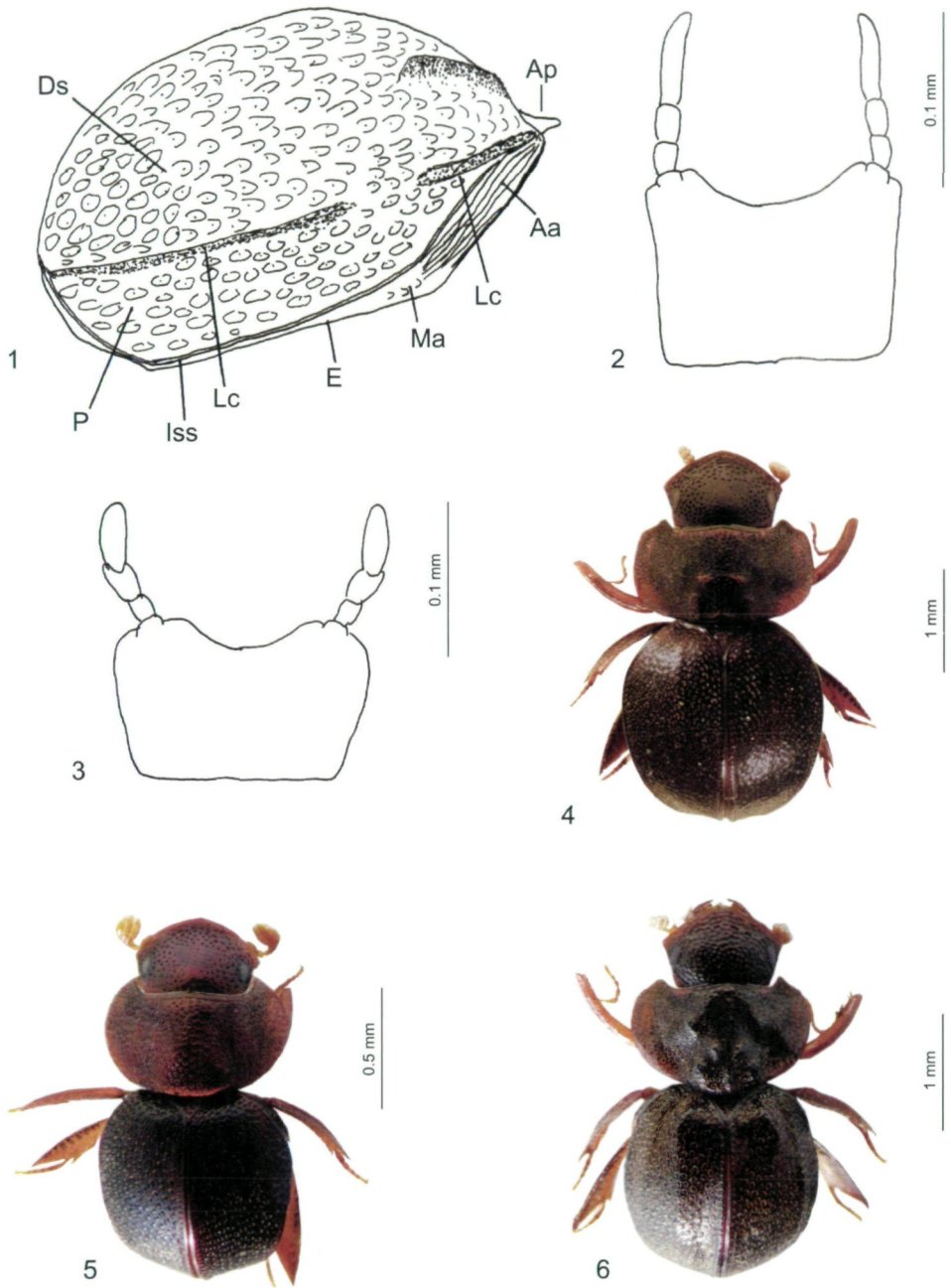
DESCRIPTION: HL: 0.42 mm; HW: 0.72; PL: 0.60; PW: 1.08; EL: 1.10; EW: 1.14 mm. Body moderately convex (Fig. 5); shiny, evenly black with pronotum and head lighter (reddish/brown); sternum and tarsi reddish brown, antennae yellowish. Completely glabrous (80x). Flightless.

Head: W/L ratio = 1.59; apical margin triangular with angle blunt and obtuse (about 150°) and sides weakly curved; genae weakly produced outwards, acute; genal canthus complete, relatively narrow, fused with the occipital portion of head. Dorsal ocular area reduced (interocular distance about 15 times the maximum width of the dorsal ocular area), ventral ocular area not reduced. Head surface weakly convex, disc almost impunctate, sides of disc covered with small comma-shaped punctures (with the inner side facing the disc); punctures sparse (their distance usually larger to their diameter), larger laterally.

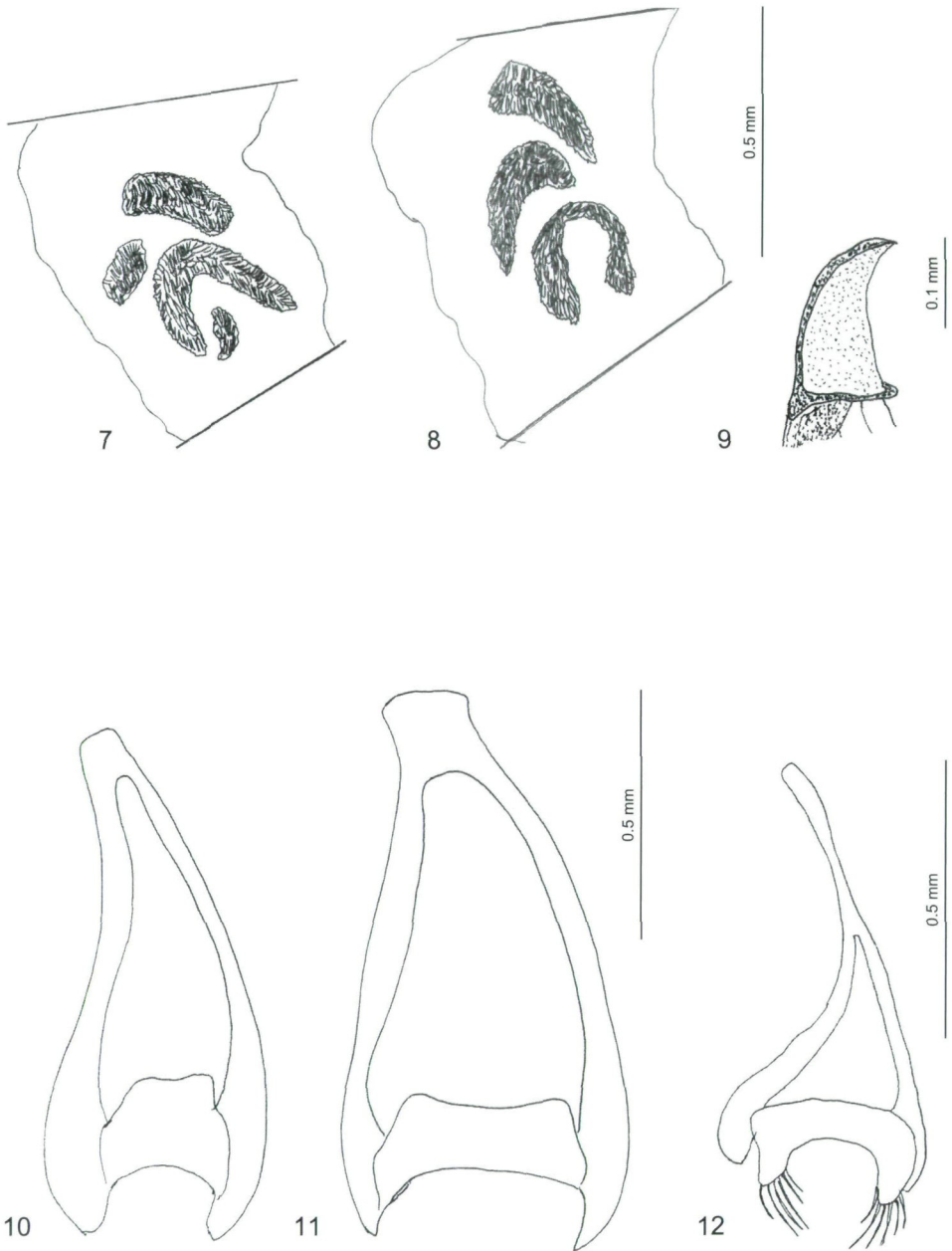
Pronotum: relatively short (W/L ratio = 1.85), apical angles triangular, apical margin completely beaded, sides of pronotum and base with a very fine bead. Base of pronotum semicircular. Pronotum moderately convex, surface regular, without carinae or depressions. Entire pronotal surface strongly punctate. Punctures large, horseshoe-shaped; distance between punctures inferior to their diameter, horseshoe opened apically or laterally, base with few smaller punctures with horseshoe completely closed.

Scutellum: completely covered by punctures with horseshoe opening towards apex.

Elytra: subsquared (W/L ratio \approx 0.97), moderately convex, humeral callus indistinct. Whole dorsal surface of elytra covered by deep, large punctures; proximal and median third with punctures small near the base (comma-shaped) and larger (horseshoe-shaped) apical to the scutellum base, distance between punctures inferior to their diameter; horseshoe opened dorsally, horseshoes closing gradually toward elytral apex, distal third with large ocellate punctures. Lateral carina sharp, complete. Inferior sutural stria present. Marginal area extremely small, almost completely replaced by the articular area bearing about 5-7 visible ridges. Pseudepipleuron punctate like the dorsal surface of elytra. Wings completely absent.



Figs. 1 - 3: 1) lateral view of the clytron of *Philharmostes ornatus* sp.n., Aa articular area, Ap articular process, Ds dorsal surface, E Epipleuron, Iss inferior sutural stria, Lc lateral carina, Ma marginal area, P pseudepipleuron, 2 - 3) outline of labium of 2) *P. grebennikovi* sp.n., and 3) *P. ornatus* sp.n.
 Figs. 4 - 6: Habitus of 4) *Philharmostes pseudumbratilis* sp.n.; 5) *P. grebennikovi* sp.n.; 6) *P. ornatus* sp.n.



Figs. 7 - 9: Sketch of a portion of the internal sac showing pseudosclerites, 7) *Philharmostes ornatus* sp.n., 8) *P. pseudumbratilis* sp.n., paramere in lateral view 9) *P. grebennikovi* sp.n.

Figs. 10 - 12: Outline of male genital segment, 10) *Philharmostes ornatus* sp.n., 11) *P. pseudumbratilis* sp.n., 12) *P. grebennikovi* sp.n.

Antennae short, made of ten antennomeres, scape relatively short, securiform, pedicellum rounded, funicle short, with antennomeres remarkably wider than long, club as long and almost as wide as funicle made of three small setose antennomeres. Labrum distally weakly depressed (subtruncate); proximally fringed with few long, fine setae. Mentum with ventral surface completely flat, subrectangular, emarginate in the middle of anterior edge; labial palpi (including palpiger) made of four palpomeres, second palpomere about as long as third palpomere, third palpomere more inflated than the other palpomeres and shorter than the fourth, fourth elongate, longer than palpomeres 1-3 (Fig. 2), outer ligular lobes short and weakly developed. Mandibles with acutely pointed apiculus, without small secondary tooth close to apical portion of apiculus.

♂♂ have the inner apical spur of mesotibiae slightly bent inwards. Female unknown.

Male genitalia: aedeagus with parameres elongate and weakly sclerotized (Fig. 9), slightly asymmetrical, dorso-basally without any setose apophysis. Temones present; basal section slightly twisted and elongate, about four times as long as parameres. Internal sac about twice as long as the tegmen, without pseudosclerite or sclerite. Genital segment short with branches joining together forming a distinct manubrium, base strongly bilobed, each lobe fringed with long setae (Fig. 12).

IDENTIFICATION: With its small size and apical angles of pronotum not truncate, this species is unmistakable within the known East African *Philharmostes*.

DISTRIBUTION AND HABITAT: The type locality lies in the Western Usambara Mountains (north-eastern Tanzania) and consists of a small patch of primary forest (about two square kilometers) located in a hill slope on the left side of the Mkuzu river (a stream flowing near the village of Kifungilo). The area is surrounded by many human settlements and is under serious threat (Grebennikov pers. comm.). The type series was collected by sifting about 10 kg of leaf litter through a Winkler funnel.

ETYMOLOGY: I am pleased to name this interesting species after its collector, Vasily Grebennikov, renowned specialist of Coleoptera larvae.

REMARKS: *Philharmostes grebennikovi* sp.n. is the smallest Ceratocanthidae known thus far. It is a very puzzling species and seems quite isolated within the other East African *Philharmostes*. After examination of all known species of *Philharmostes* and many more undescribed ones (mainly from Madagascar), most similarities in character states were found with the South African species of *Philharmostes* (*P. zuluensis* HESSE, 1948, *P. disparilis* HESSE, 1948, and *P. interruptus* HESSE, 1948) and with *P. badius* (PETROVITZ, 1967), widely distributed through the Guineo-Congolian rainforests block. The above taxa share the following character states not found in other East African *Philharmostes*: a) apical angles of pronotum triangular (not truncate), b) labial palpi with last segment elongate, c) apical margin of pronotum completely beaded, d) male genitalia with parameres elongate and without setose apophysis, e) male genitalia with internal sac lacking pseudosclerite, f) male genitalia with genital segment having a long manubrium, and g) male genitalia with genital segment with a strongly bilobed base. The 10-segmented antennae of *P. grebennikovi* will distinguish this species from all other species sharing the above character states (all other species have 9-segmented antennae). *Philharmostes grebennikovi* also has completely glabrous facies as does the South African species; *P. badius* has ocellate punctures, with the ocellum bearing a short seta.

Philharmostes ornatus sp.n.

TYPE LOCALITY: Between Tchenzema village and Lukvangule Plateau, Uluguru Mountains, Tanzania.

TYPE MATERIAL: **Holotype** ♂ (MRAC) [dissected and glued on a card]: "Tanzania: Uluguru Mts., Oct. 19-21.2002, H-2200 m., W. Slope between Tchenzema vil. and Lukvangule Plateau, V. Grebennikov leg.". **Paratypes**: 1 ♂ and 1 ♀ [all dissected] with the same data as the holotype (ABCB).

DESCRIPTION: HL: 0.90 mm; HW: 1.44 mm; PL: 1.26 mm; PW: 22.10 mm; EL: 2.28 mm; EW: 2.31 mm.

Body moderately convex (Fig. 6); shiny, evenly bronze green with faint metallic sheen; sternum and tarsi reddish brown, antennae yellowish; short setae (invisible at low magnification, e.g. 25x) in the middle of dorsum upturned by comma- or horseshoe-shaped punctures. Flightless.

Head: W/L ratio = 1.56; apical margin triangular with angle blunt and obtuse (about 150°) and sides almost rectilinear; genae weakly produced outwards, acutely pointed; genal canthus complete, relatively narrow, fused with the occipital portion of head. Dorsal ocular area with interocular distance about nine times the maximum width of the dorsal ocular area. Head surface slightly convex, completely covered by deep comma-shaped punctures (with the inner side facing the disc), thick (their distance subequal or inferior to their diameter), punctures in the disc small and almost circular, punctures at the apex larger than the former, the ones near the apical margin often fused with each other.

Pronotum: relatively short (W/L ratio = 1.66), apical angles moderately truncate; apical margin distinctly beaded medially; sides of apical margin, pronotum, and base with a very fine bead. Base of pronotum semicircular with area adjacent to scutellum distinctly protuberant towards apex. Disc strongly raised; basally with two distinct, short, lateral carinae; medially with one further raised area at each side; sides of pronotum basally with a depressed area bordering the disc. Entire pronotal surface strongly punctate. Punctures on disc ocellate, relatively large, distance between punctures inferior to their diameter, sides of pronotum with ocellate punctures as on disc.

Scutellum: completely covered by punctures as on pronotum.

Elytra: subsquared (W/L ratio \approx 1), convex, a distinctly raised longitudinal carina between scutellum and humeral callus (Fig. 1), starting near the apex of scutellum and gently ending near the proximal third of each elytron (in the female paratype this carina is distinctly less sharp than in the other specimens). Whole dorsal surface of elytra covered by deep punctures, proximal and median third with thick horseshoe-shaped punctures, small near the base and larger after the end of scutellum, distance between punctures inferior to their diameter, horseshoe opened towards apex, horseshoes closing gradually toward elytral apex forming large ocellate punctures in distal third.

Lateral carina sharp, shortly interrupted just after the end of scutellum and ending just before the elytral suture. Inferior sutural stria present. Marginal area very reduced. Articular area marked by 5-6 visible ridges. Pseudepipleuron punctate like the dorsal surface of elytra, but punctures with horseshoe closed. Wings completely absent.

Antennae short, made of ten antennomeres, scape relatively short, securiform, pedicellum rounded, funicle short, antennomeres considerably wider than long, club as long and almost as wide as funicle, club made of three small setose antennomeres. Labrum distally weakly depressed (subtruncate), proximally fringed with few long fine setae. Mentum with ventral surface completely flat, subrectangular, emarginate in the middle of anterior edge; labial palpi (including palpiger) made of four palpomeres, second palpomere about as long as third palpomere, third palpomere more inflated than the other palpomeres and shorter than the fourth, fourth elongate-ovoidal (subpyriform) (Fig. 3), outer ligular lobes short and weakly developed. Mandibles with acutely pointed apiculus, without small secondary tooth close to apical portion of apiculus.

Sexual dimorphism: ♂♂ have the inner apical spur of mesotibiae slightly bent inwards, while in the ♀♀ both apical spurs are straight.

Male genitalia: aedeagus with parameres short and weakly sclerotized, subrectangular, slightly asymmetrical; dorso-basally with a short apophysis along anchoring point with basal section, attached to basal section; fringed distally with few medium-sized, erect setae. Temones present; basal piece slightly twisted, elongate, about four times as long as parameres; internal sac about twice as long as the tegmen, armed with four dark patches of coarse spicules (Fig. 7). Genital segment short with branches joining together without forming a distinct manubrium (Fig. 10).

Female genitalia: vaginal palpi elongate and setose, bursa copulatrix with two symmetrical echinulate subcircular small plates.

IDENTIFICATION: *Philharmostes ornatus* is the only known *Philharmostes* to have pronounced cariniform processes near the base of elytra, between the scutellum and the humeral callus. *Philharmostes integer* and *P. weneri* have only a small protuberance between humeral callus and scutellum, while *P. ornatus* has a distinct carina, moreover both these species have a complete lateral carina, while in *P. ornatus* the carina is shortly interrupted.

DISTRIBUTION AND HABITAT: The type locality is in the Uluguru Mountains (eastern Tanzania). The samples were taken near the upper edge of a relatively undisturbed primary rainforest along the trail set on a steep western slope in the southern part of Uluguru mountains, near the Lukvangule Plateau. As with West Usambaras, the forest in Ulugurus suffers markedly under the constant human pressure and the villagers are routinely observed carrying illegally collected firewood from the forest (Grebennikov, pers. comm.). The type series was collected by sifting four samples of leaf litter (about 10 kg in total) through a Winkler funnel.

ETYMOLOGY: *ornatus* (= decorated), referring to the pronounced sculpturings of pronotum and elytra.

REMARKS: *Philharmostes ornatus* sp.n. shows a series of unique features among all other East African *Philharmostes*, i.e. the sharp cariniform process at the base of elytra, the deep large punctures of head and the broadly rounded pronotal base and sides (while in all other previously known species the pronotum is short and transverse), however some key characters such as the male and female genitalia and the mouthparts fall quite well within the aforesaid group of species.

Philharmostes pseudumbratilis sp.n.

TYPE LOCALITY: Grant's Lodge, Lushoto district, West Usambara Mountains, Tanzania.

TYPE MATERIAL: **Holotype** ♂ (MRAC) [dissected and glued on a card]: "Tanzania: W. Usambara Mts., Oct. 03-08.2002, H-1660 m., Lushoto distr., Grant's Lodge, Mkuzu riv., 3-4 km upstream of Kifungilo, V. Grebennikov leg.". **Paratypes**: 3 ♂♂ and 1 ♀ [all dissected] with the same data as the holotype (ABCB, TMSA).

DESCRIPTION: HL: 0.75 mm; HW: 1.25 mm; PL: 1.00 mm; PW: 1.87 mm; EL: 2.00 mm; EW: 2.05 mm.

Body moderately convex (Fig. 4); shiny, evenly dark brown with bronze faint; sternum and tarsi reddish brown, antennae yellowish. Almost glabrous. Flightless.

Head: W/L ratio = 1.66; apical margin triangular with angle blunt and obtuse (about 150°) and sides almost rectilinear; genae weakly produced outwards, acutely pointed; genal canthus complete, relatively narrow, fused with the occipital portion of head. Dorsal ocular area reduced with interocular distance about 18 times the maximum width of the dorsal ocular area. Head surface slightly convex, disc almost impunctate, laterally with deep punctures separated by

distances larger than their diameters, punctures at the apical margin often fused to form transverse lines.

Pronotum: short and transverse (W/L ratio = 1.82), apical angles distinctly truncate, apical margin distinctly beaded at middle, sides of apical margin, sides of pronotum and base with a very fine bead. Disc with slight symmetrical smooth sculpturing at basal third. Entire pronotal surface punctate. Punctures medium-sized, distance between punctures inferior to their diameters, horseshoe-shaped punctures with horseshoe opened apically at distal third, laterally at sides and closed on disc.

Scutellum: completely covered by punctures as on pronotum.

Elytra: subsquared (W/L ratio \approx 1); moderately convex, fore angles gently and regularly rounded. Entire dorsal surface of elytra covered with deep punctures, proximal and median third with thick horseshoe-shaped punctures, small near the base and larger apical to the scutellum, distance between punctures inferior to their diameter, horseshoe opened towards apex, closing gradually toward elytral apex forming large ocellate punctures in distal third. Some longitudinal, irregularly comma-shaped punctures in the area near the suture, just after the end of scutellum.

Lateral carina moderately sharp, complete. Inferior sutural stria present. Marginal area almost completely replaced by articular area. Articular area marked by five visible ridges. Pseudepipleuron punctate like the dorsal surface of elytra, horseshoe-shaped punctures apically with openings very small. Wings completely absent.

Antennae short, made of ten antennomeres, scape relatively short, securiform, pedicellum rounded, funicle short, antennomeres considerably wider than long, club as long and almost as wide as funicle, club made of three small setose antennomeres. Labrum distally weakly depressed (subtruncate), proximally fringed with few long fine setae. Mentum with ventral surface completely flat, subrectangular, emarginate in the middle of anterior edge; labial palpi (including palpiger) made of four palpomeres, second palpomere about as long as third palpomere, third palpomere more inflated than the other palpomeres and shorter than the fourth, fourth elongate-ovoidal (subpyriform), outer ligular lobes short and weakly developed. Mandibles with acutely pointed apiculus, without small secondary tooth close to apical portion of apiculus.

Sexual dimorphism: $\sigma\sigma$ have the inner apical spur of mesotibiae slightly bent inwards, while in the ♀♀ both apical spurs are straight.

Male genitalia: aedeagus with parameres short and weakly sclerotized, subrectangular, slightly asymmetrical; dorso-basally with a short apophysis along anchoring point with basal section, attached to basal section; fringed distally with few medium-sized, erect setae. Temones present; basal piece slightly twisted, elongate, about four times as long as parameres; internal sac about twice as long as the tegmen, armed with three dark patches of coarse spicules (Fig. 8). Genital segment short with branches joining together without forming a distinct manubrium (Fig. 11).

Female genitalia: vaginal palpi elongate and setose, bursa copulatrix with two symmetrical echinulate subcircular small plates.

IDENTIFICATION: Similar to *Philharmostes umbratilis*, from which it can be separated by the complete lateral carina of elytra. The complete lateral carina, within the East African *Philharmostes* is shared with *P. werneri*, *P. basilevskii*, and *P. integer*. The new species can be separated from *P. integer* using the large dorsal ocular area of the latter, from *P. werneri* using the much deeper puncturation, the sharper lateral carina and the very reduced dorsal ocular area of the latter and from *P. basilevskii* using the completely different surface sculpturing of head, pronotum, and elytra and the long setae on elytra and pronotum of the latter.

DISTRIBUTION AND HABITAT: see under *Philharmostes grebennikovi* sp.n.

ETYMOLOGY: *pseudo-* (= false) and *umbratilis*, referring to its close resemblance to *Philharmostes umbratilis*.

Acknowledgements

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