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A new species of *Grosphus* Simon, 1880 (Scorpiones: Buthidae) from the Southwest of Madagascar

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(with 9 figures)

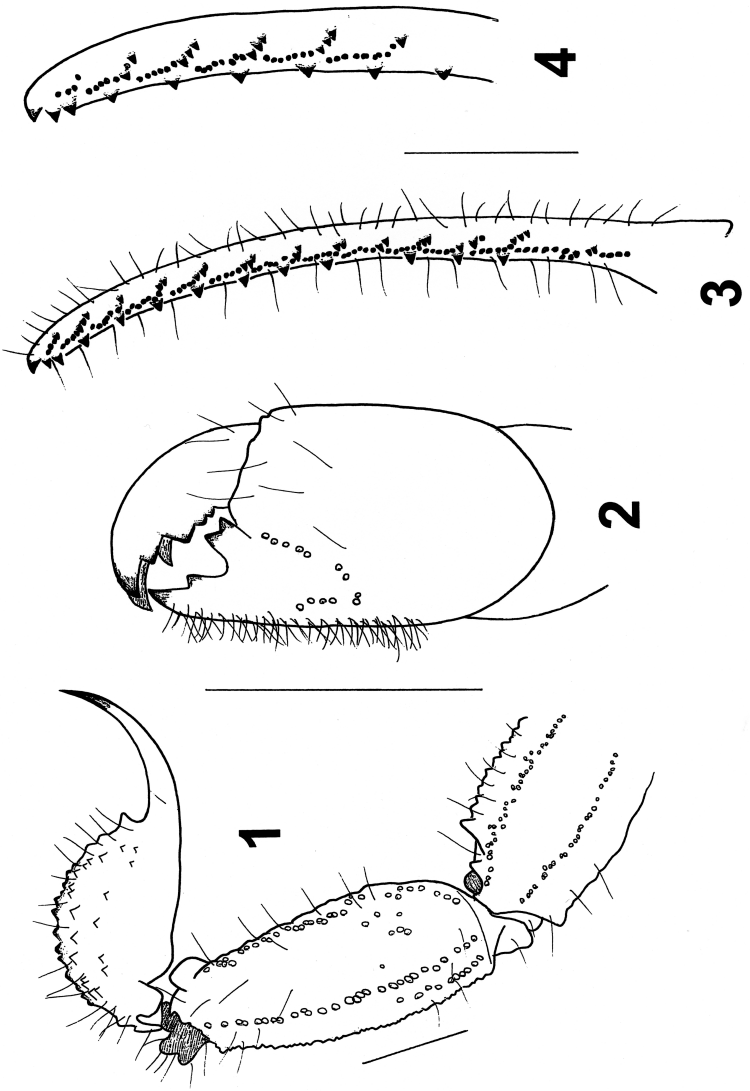
Abstract

The southwestern portion of Madagascar appears to have one of the highest levels of scorpion diversity on the island and in two previous publications an analysis of the known species of *Grosphus* from this region was presented. One more new species, *Grosphus bicolor* sp. n. is described from dry spiny bush in inland region, between Ranohira and Llakaka.

K e y w o r d s: Scorpiones, *Grosphus bicolor* sp. n., SW Madagascar.

Introduction

As already discussed in previous publications (Lourenço *et al.* 2007a,b), the southwestern portion of Madagascar has a rich scorpion diversity as compared to other portions of the island. Recent detailed inventory work in the southwest has revealed several new species (Lourenço & Goodman 2006a,b), in particular those belonging to the genus *Grosphus* (Lourenço 2004, Lourenço & Goodman 2006c, Lourenço *et al.* 2004, Lourenço *et al.* 2007a). These new insights provides further support that southwestern Madagascar holds a rich and complex scorpion fauna.



Figs 1-4. *Grosphus bicolor* sp. n., holotype ♂: **1**. metasomal segments IV-V and telson, lateral aspect; **2**. chelicera, dorsal aspect; **3**. cutting edge of movable finger, with the rows of granules; **4**. extremity of the movable finger with granulation. (Scale bars = 1 mm).

In the present note, one new species, associated with the *G. grandidieri* Kraepelin, 1900 and to some degree with *G. flavopiceus* Kraepelin, 1901, is described from the more inland region between Ranohira and Llakaka, in the southwestern Madagascar. The holotype was collected in dry spiny bush, resting on red soil.

Methods

Illustrations and measurements were produced using a Wild M5 stereo-microscope with a drawing tube (*camera lucida*) and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Vachon (1952) and Hjelle (1990).

Taxonomic account

Family Buthidae C. L. Koch, 1837
Genus *Grosphus* Simon, 1880

Grosphus bicolor sp. n.
(Figs 1-9)

TYPE MATERIAL: H o l o t y p e, male. Madagascar, southwestern region, inland zone, between Ranohira and Llakaka, September 2004, coll. W. R. Lourenço.

ETYMOLOGY: The specific name refers to the two colour patterns of the new species.

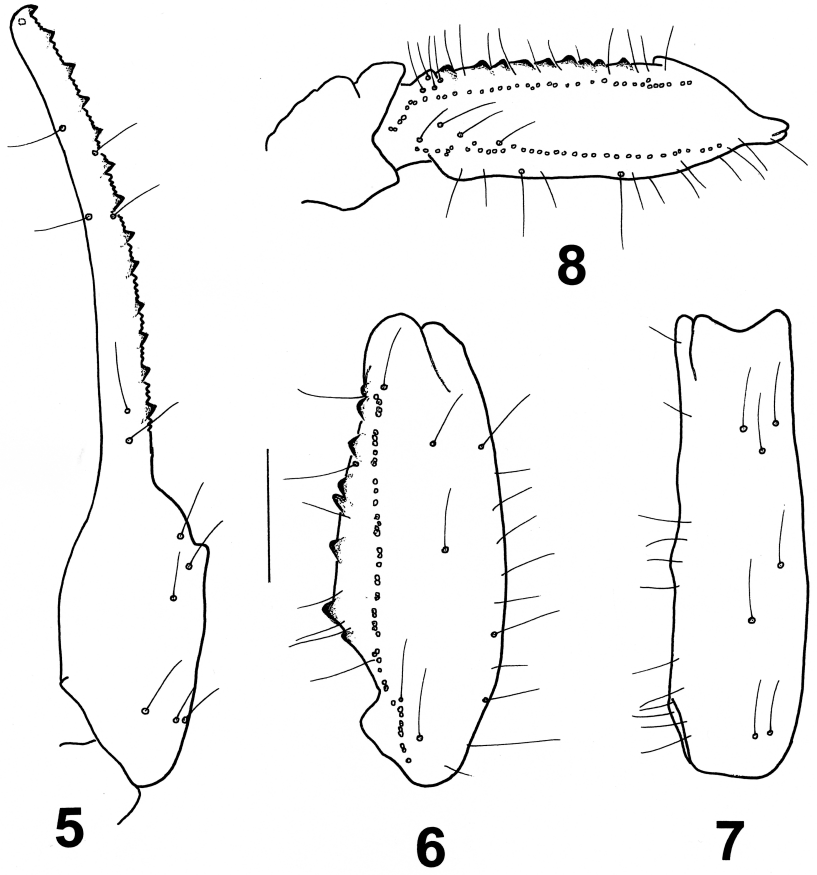
DIAGNOSIS: Scorpions of moderate to small size, when compared with other species of the genus; male with 29.9 mm in total length (see measurements after the description). Several characters suggest, however that the specimen is a juvenile. General coloration of carapace, tergites and metasoma brown to dark brown, almost blackish; two longitudinal yellow stripes over tergites; venter yellow to pale yellow; only sternite VII is dark; pedipalps yellow with only the base of chela hand and fingers infuscated; legs pale yellow with longitudinal infuscations. Disposition of granulations on the dentate margins of the pedipalp chela fixed and movable fingers, arranged in 13-14 rows. Pectinal teeth count 36-36 for the male; basal middle lamellae of each pecten not dilated. Trichobothriotaxy type *A* with an *alpha-α* disposition for the dorsal trichobothria of femur (Vachon 1974, 1975). The pattern of coloration and pigmentation is diagnostic for this species; see “Remarks”.

DESCRIPTION: Based on male holotype.

COLORATION. Generally brown to dark brown with appendages yellow. Prosoma: carapace brown with yellow zones on furrows; eyes surrounded by blackish pigment. Mesosoma tergites uniformly brownish, as for carapace, with two longitudinal yellow stripes. Metasomal segments and vesicle uniformly brown to dark brown, almost blackish; aculeus with brownish-yellow base and reddish tip. Venter: coxapophyses, sternum and genital operculum yellow; pectines pale yellow. Chelicerae yellow with a dark variegated pigmentation along entire surface; fingers yellowish-brown with teeth reddish.

Pedipalps: femur and patella yellow; chela with diffused infuscations on hand and fingers; rows of granules on fingers reddish. Legs pale yellow with longitudinal infuscations.

MORPHOLOGY. P r o s o m a: Carapace moderately granular; anterior margin with a moderate median concavity. All carinae weak; furrows moderately developed. Median ocular tubercle anterior to the centre of carapace; median eyes separated by approximately one ocular diameter. Three pairs of lateral eyes. Sternum sub-triangular in shape. M e s o s o m a: tergites with a weak to moderate granulation. Median carina moderately developed in tergites III-



Figs 5-8. *Grosphus bicolor* sp. n., holotype ♂. Trichobothrial pattern: **5**. chela, dorso-external aspect; **6-7**; patella, dorsal and external aspects; **8**. finger, dorsal aspect (scale bars = 1 mm).

VII; weak on I-II. Tergite VII pentacarinate. Venter: genital operculum consisting of two suboval plates. Pectines: pectinal tooth count 36-36 in male; basal middle lamellae of each pecten not dilated in male. Sternites smooth, with moderately elongated spiracles; III-VI with two longitudinal furrows; VII with four vestigial carinae; setation moderate. M e t a s o m a l segments I to III with 10 carinae, moderately crenulate; segment IV with 8 carinae, moderately crenulated; segment V with 5 carinae. Dorsal carinae on segments I-IV with one posterior spinoid granule. Intercarinal spaces weakly granular. Telson with strong granulations on the ventral aspect; aculeus strongly curved and slightly shorter than the vesicle; subaculear tooth reduced and conic in shape; what suggests that the specimen is not an adult. C h e l i c e r a l dentition characteristic of the family Buthidae (Vachon, 1963); two distinct basal teeth present on the movable finger; ventral aspect of both fingers and of manus with dense, long setae. P e d i p a l p s: femur pentacarinate; patella with a dorsointernal carina and with several spinoid granules on the internal face; chela almost smooth, without carinae; all segments moderately to weakly granular. Movable and fixed fingers with 13-14 oblique rows of granules in male. Trichobothriotaxy; orthobothriotaxy *A-α* (Vachon, 1974, 1975). L e g s: tarsus with very numerous, brush-like, setae ventrally. Tibial spurs present on legs III and IV; pedal spurs present on legs I to IV; all spurs strong.

REMARKS. The taxonomy of the genus *Grosphus* (family Buthidae), the taxon endemic to Madagascar, is based mainly on two characters -- external coloration patterns and, in females, the morphology of the basal middle lamellae of pectines. This last character has been considered by scorpion taxonomists as a species-specific feature, with little intraspecific variation (Fage 1929). However, recent detailed investigations have shown that in some cases closely related species have similar basal middle lamellae morphology (Lourenço 2003, Lourenço & Goodman 2003, 2006, Lourenço *et al.* 2004, Lourenço *et al.* 2007a,b).

The new species shows affinities with both *Grosphus grandidieri* and *G. flavopiceus*, although this last species is only present in the Northern range of Madagascar. The clear differences with *G. grandidieri* are based on the coloration and pigmentation patterns. In *G. grandidieri*, appendages are globally dark to blackish (see Lourenço *et al.* 2009), whereas in the new species these are yellow to pale yellow with diffused infuscations on the legs. The pedipalps in *G. flavopiceus* are also yellow, but the body of this species is yellow with confluent infuscations. In the new species, the body and metasoma are very dark almost blackish.

Morphometric values (in mm) of the male holotype. Total length, 26.4 (29.9*). Carapace: length, 3.3; anterior width, 2.4; posterior width, 3.2. Mesosoma length, 9.1. Metasomal segments. I: length, 2.1; width, 1.7; V: length, 3.7; width, 1.6; depth, 1.5. Telson length, 3.5. Vesicle: width, 1.2; depth, 1.2. Pedipalp: femur length, 3.1, width, 1.0; patella length, 3.7, width, 1.3; chela length, 5.8, width, 1.0, depth, 0.9; movable finger length, 4.2. (* Including telson length).

Other scorpions found in the same region (SW of Madagascar, inland zone, beween Ranohira and Llakaka, September 2004, coll. W. R. Lourenço):

Grosphus hirtus Kraepelin, 1900: 4 males, 4 females, juvenile.

Tityobuthus petrae Lourenço, 1996: male, female.

Opisthacanthus madagascariensis Kraepelin, 1894: 2 males, female.

Ecology

The southwestern and southern portions of Madagascar are the most arid zones on the island and have a very pronounced dry season. Along the west coast in a southern direction and at its southern limit eastwards to Amboasary Sud, there is a pronounced clinal decrease in annual rainfall from 496 mm at Morombe, 390 mm at Toliara, 411 mm at Androka, 483 mm at Tsiombe, and 491 mm at Amboasary Sud (Chaperon *et al.* 1993). At more inland localities, annual rainfall at Manja is 875 mm, at Benenitra is 668 mm, and at Bezaha of 582 mm (Chaperon *et al.* 1993). Following this cline, the shift in rainfall gives rise to changes in vegetational types that range from close to the southern limit of Western Dry Forest (forest type terms follow Moat and Smith 2007) in the Forêt de Beronto and South Western Dry Spiny Forest-Thicket in various states of degradation at most of the other sites.

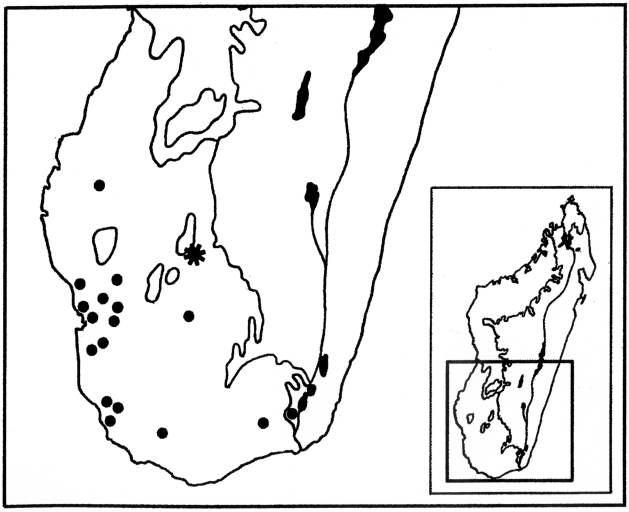


Fig. 9. Southern portion of Madagascar with the type locality of *Grosphus bicolor* sp. n. (black asterisk) and the known distribution of *Grosphus grandidieri* Kraepelin (black circles).

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