Boletín Sociedad Entomológica Aragonesa, nº **44** (2009) : 35–38.

SCORPIONS FROM THE COMOROS ARCHIPELAGO: DESCRIPTION OF A NEW SPECIES OF *GROSPHUS* SIMON (SCORPIONES, BUTHIDAE) FROM MAYOTTE (MAORE)

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Abstract: A new species, *Grosphus mayottensis* **sp. n.**, is described from the isolated volcanic island of Mayotte (Maore) in the Comoros archipelago. With this description, the total number of species in this genus, which previously was known only from Madagascar, is 20. Some ideas are presented on the possible means of dispersion of *Grosphus* from Madagascar to Mayotte, which is best explained by rafting on floating vegetation.
Key words: Scorpiones, Buthidae, *Grosphus*, new species, taxonomy, Mayotte, Comoros Archipelago.

Escorpiones de las islas Comores: descripción de una especie nueva de *Grosphus* Simon (Scorpiones, Buthidae) de Mayotte (Maore)
Resumen: Se describe una especie nueva, *Grosphus mayottensis* **sp. n.**, de la remota isla volcánica de Mayotte (Maore), en el archipiélago de las Comores. Con esta descripción el número total de especies del género, que anteriormente se conocía sólo de Madagascar, asciende a 20. Se aportan algunas ideas sobre los posibles medios de dispersión usados por *Grosphus* from Madagascar para llegar a Mayotte, y se apunta como mejor explicación la vegetación flotante.
Palabras clave: Scorpiones, Buthidae, *Grosphus*, especie nueva, taxonomía, Mayotte, archipiélago de las Comores.

Taxonomy/Taxonomía: *Grosphus mayottensis* **sp. n.**

Introduction

Although measures of species richness of the scorpion faunas of western Indian Ocean islands, in particular that of Madagascar, have experienced an extraordinary increase in recent years (Lourenço, 1996, 2003, 2005), those of Comoro Archipelago, located to the northwest of Madagascar, remain practically unknown. The only scorpion reported from the Comoros is the ubiquitous *Isometrus maculatus* (DeGeer, 1778) (Gysin & Corroller, 1968; Vachon, 1972; Jocqué, 1999; Louette *et al*., 2004).

The recent study of some specimens deposited in the Musée Royal de l'Afrique Centrale, Tervuren, Belgium, allows confirmation of the presence of *Isometrus maculatus* in the Comoro Archipelago. Moreover, one specimen of *Isometrus* in that collection and obtained on Grande Comore (Ngazidja), shows an atypical pigmentation pattern and will be the subject of further investigation. It seems that some populations of *I. maculatus* include depigmented individuals (Gysin & Corroller, 1968) such as the specimen from Grande Comore.

Finally, a new species of *Grosphus*, associated with the *G. madagascariensis/G. hirtus* group, and in particular to *G. goudoti* Lourenço & Goodman, 2006, from Madagascar (Lourenço & Goodman, 2006; Lourenço *et al*., in press) is described from a site on Mayotte (Maore). This new species represents the first record of a *Grosphus* found outside Madagascar and its near-shore islands.

Material and methods

Illustrations and measurements were made with the aid of 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 are after Vachon (1974) and morphological terminology mostly follow Vachon (1952) and Hjelle (1990).

Taxonomic Treatment

Family BUTHIDAE C. L. Koch, 1837

Genus *Grosphus* Simon, 1880

***Grosphus mayottensis* sp. n.**
Fig. 1-7.

Unidentified scorpion: Jocqué, 1999: figure 134, page 163.

MATERIAL EXAMINED: Comoro Archipelago, Mayotte (Fourny leg.), 1995, 1 female holotype, deposited in the Musée Royal de l'Afrique Centrale, Tervuren.

ETYMOLOGY: Specific name refers to the island where the new species was collected.

DIAGNOSIS: Scorpion of medium to large size with a total length of 65 mm. General coloration reddish-brown to dark-brown. Morphological characters indicate that *G. mayottensis* sp. n. is related to the *G. madagascariensis/G. hirtus*

group, and in particular to *G. goudoti*. *Grosphus mayottensis* sp. n. can be readily distinguished from *G. goudoti* by the following characters: (i) notably darker coloration of the carapace, tergites, ventral aspect and metasoma; (ii) presence of conspicuous dark spots on femur and patella of pedipalp; (iii) basal middle lamellae of pectines with a triangular shape, rather than oval as in *G. goudoti*; (iv) dorsal carinae of metasomal segments II to IV with only one inconspicuous posterior spinoid granules; and (v) fewer marked carinae on metasomal segments.

DESCRIPTION based on female holotype. Measurements in Table I.

Coloration. Basically reddish-brown to dark-brown. Prosoma: carapace dark-brown; eyes surrounded by black pigment. Mesosoma: reddish-brown with dark strips on the posterior margins of tergites. Metasoma: segments I to V reddish-brown; all segments with some vestigial dark pigmentation on carinae. Telson reddish with dark zones over ventral granulations; aculeus reddish-yellow. Venter: coxapophysis, sternum, genital operculum and pectines with an intense variegated reddish-brown pigmentation; sternites dark reddish-brown. Chelicerae reddish-yellow with dark variegated pigmentation over the entire surface; fingers reddish-brown; teeth reddish. Pedipalps: yellowish to reddish-yellow; postero-distal zones of femur and patella with dark brown spots; chela fingers dark-brown. Legs dark reddish-brown with diffused yellow variegated spots.

Morphology. Carapace covered with an intense granulation; granules of small size; anterior margin almost straight, with a very weak median concavity. All carinae weak; furrows moderately developed. Median ocular tubercle anterior to the centre of carapace; median eyes separated by one and half ocular diameters. Three pairs of lateral eyes. Sternum sub-triangular in shape. Mesosoma: tergites with a moderately to strongly marked granulation. Median carina moderately developed in all tergites. Tergite VII pentacarinate. Venter: genital operculum consisting of two semi-triangular plates. Pectines: pectinal tooth count 17-18 basal middle lamellae of each pecten dilated and with a triangular shape. Sternites smooth, with elongated spiracles; VII with four weak carinae. Metasoma: segments I and II with 10 carinae, moderately crenulate; segment III and IV with 8 carinae, weakly crenulate. Segment V with 5 carinae. Dorsal carinae on segments II to IV with one inconspicuous posterior spinoid granule. Intercarinal spaces strongly granular; granules of very small size. Telson strongly granular over latero-ventral and ventral surfaces; granules of small size; dorsal surface smooth; aculeus moderately curved and shorter than the vesicle; subaculear tooth absent. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); two distinct but reduced basal teeth present on the movable finger; ventral aspect of both fingers and of manus with dense, long setae. Pedipalps: femur pentacarinate; patella with dorsointernal and ventralinternal carinae and with some strong spinoid granules on the internal face; chela smooth, without carinae. Fixed and movable fingers with 12-13 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A-α (Vachon, 1974, 1975). Legs: tarsus with numerous short thin setae ventrally. Tibial spurs present on legs III and IV; pedal spurs present on legs I to IV; all spurs strong.

Table I. Comparative morphometric values (in mm) of the female holotype of *Grosphus mayottensis* sp. n., and of the female of *G. goudoti*.

	G. mayottensis sp. n.	*G. goudoti*
Total length	64.3	55.8
Carapace:		
- length	7.8	7.4
- anterior width	5.6	5.3
- posterior width	8.3	8.3
Metasomal segment I:		
- length	5.5	4.3
- width	4.7	3.9
Metasomal segment V:		
- length	9.2	7.9
- width	4.3	3.6
- depth	3.8	3.6
Vesicle:		
- width	3.6	3.6
- depth	3.3	3.6
Pedipalp:		
- Femur length	7.2	6.3
- Femur width	2.3	2.2
- Patella length	8.2	7.6
- Patella width	3.1	3.2
- Chela length	12.9	12.7
- Chela width	2.9	3.2
- Chela depth	2.8	2.8
Movable finger:		
- length	8.0	8.0

Male unknown.

ECOLOGY. No details are known about the precise locality or ecological setting the holotype was found. On the basis of a caption associated with an illustration of this species, it is seemingly rare on Mayotte (Jocqué, 1999, p. 163, Figure 134).

Possible means of dispersion of *Grosphus* from Madagascar to the Comoro Islands

All of the islands making up the Comoro Archipelago are of *in situ* volcanic origin, ranging from Grande Comoro, which is the youngest at 0.13-0.5 Myr, to Mayotte, the oldest at 7.7-15 Myr (Emerick & Duncan, 1982; Nougier *et al.*, 1986). There is no evidence that these landmasses have been connected to other potential source areas, such as Madagascar or continental Africa, since they erupted out of the sea (Louette *et al*., 2004). Hence, the only logical explanation for their occurrence on Mayotte is human introduction or over water dispersal.

The suggestion of anthropogenic agency can be ruled out based on two combined lines of evidence: 1) human colonization of Madagascar dates from only several thousand years ago (Burney *et al*., 2004) and the Comoros even more recently (Wright, 1984; Vérin, 1994) and 2) based on numerous taxonomic studies of Malagasy *Grosphus* (Lourenço & Goodman, 2006; Lourenço *et al*., in press), *G. mayottensis* sp. n. is morphologically distinct and insufficient time has passed for speciation. In contrast, the occurrence of *Isometrus maculatus* in the Comoro archipelago may well be associated with human introduction.

Numerous flying animals of Malagasy origin are known from the Comoros Archipelago (e.g., Warren *et al.*, 2003; Pasquet *et al.*, 2007; Weyenth *et al*., 2008) and over water flight is clearly in the capacity of these organisms. More important for the current discussion is there are a

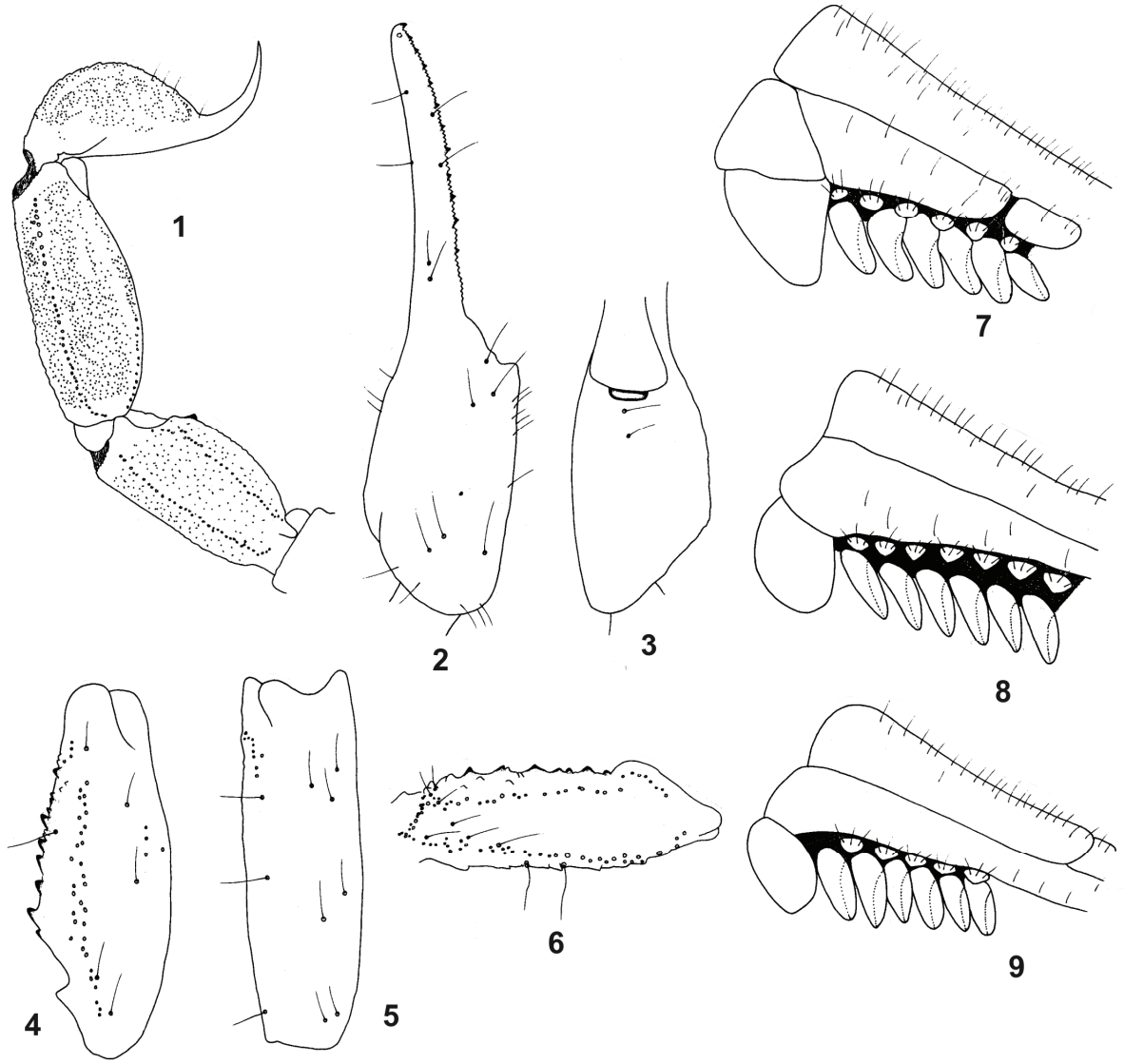

Fig. 1-6. *Grosphus mayottensis* sp. n., female holotype. **1.** Metasomal segments IV-V and telson, lateral aspect. **2-6.** Trichobothrial pattern. **2-3.** Chela dorso-external and ventral aspects. **4-5.** Patella, dorsal and external aspects. **6.** Femur, dorsal aspect. **Fig. 7-9.** Proximal region of female pecten, showing the shape of the basal middle lamella. **7.** *Grosphus mayottensis* sp. n., female holotype. **8-9.** Idem, for *G. goudoti* and *G. simoni*.

number of terrestrial animals in the Comoros, which based on molecular and phylogenetic studies are of Malagasy origin (e.g., Raxworthy *et al.*, 2002; Vences *et al.*, 2003). The best explanation for their occurrence in the Comoros is an ancestral form rafting from Madagascar on floating vegetation and subsequent successful colonization. Further, an exceptional botanical example, which may be in parallel to the colonization of *Grosphus* on Mayotte, can be found amongst baobabs of the genus *Adansonia.* Until recently, the species *A. madagascariensis* was only known from the northwestern dry forests of Madagascar. A long established population of this species was recently found on the southern littoral zone of Mayotte (Charpentier, 2005), the section directly facing the northwestern coast of Madagascar, where this baobab can be found growing next to the sea (Baum, 1995). A reasonable explanation for this plant to have arrived on Mayotte is the large globose fruits floated across the sea from Madagascar to Mayotte, which is the direction of the dominant sea currents, washed up on the coast and germinated. The possibility that scorpions are capable of crossing open water on floating vegetation is enhanced by the fact that several Malagasy *Grosphus* are known to live under tree bark (Lourenço, unpublished data), which would be a further adaptation for survival under these harsh conditions. Hence, the arrival on Mayotte of the ancestral form of *G. mayottensis* from Madagascar, islands separated by a straight distance of about 300 km and sea depths of up to 3.6 km, in some sort of vegetational mass, perhaps under the bark of a floating tree, is certainly in the realm of possibility. Phylogenetic research on *G. mayottensis,* particularly differentiation from its closest relative on Madagascar, would provide interesting insight into its colonization. Given that the age of Mayotte is known, this would provide bounds for molecular clock analyses, and might be insightful into the evolutionary history of this animal and rates of genetic differentiation in members of this genus.

Acknowledgements

We are most grateful to Dr. Rudy Jocqué, Musée Royal de l'Afrique Centrale, Tervuren, for facilitating the study of the Comorian material.

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