The species of *Grosphus* Simon (Scorpiones, Buthidae) distributed in the northern and eastern regions of Madagascar with the description of a new species

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Abstract

The northern portion of Madagascar appears to have one of the highest levels of scorpion diversity on the island. In the present note, we present a synopsis of recognized species of *Grosphus* distributed in the northern and eastern regions of Madagascar. One new species is described from Montagne des Français in close vicinity to Antsiranana (Diego Suarez). Some comments on ecological aspects of these taxa are also provided.

Key words: Scorpiones, Buthidae, *Grosphus*, new species, taxonomy, Madagascar, northern-eastern regions

Résumé

La région nord de Madagascar présent un des taux de diversité scorpionique parmi les plus importants de tout l'île. Dans le présent article une synopsis de toutes les espèces connues du genre *Grosphus*, distribuées dans les régions Nord et Est de l'île est proposée. Au total, 9 espèces et une sous-espèce sont concernées : *G. madagascariensis* (Gervais, 1843), *G. hirtus* Kraepelin, 1900, *G. hirtus garciai* Lourenço, 2001 (nouveau statut taxonomique), *G. flavopiceus* Kraepelin, 1900, *G. ankarafantsika* Lourenço, 2003, *G. ankarana* Lourenço & Goodman, 2003, *G. simoni* Lourenço, Goodman & Ramilijaona, 2004, *G. darainensis* Lourenço, Goodman & Ramilijaona, 2004, *G. mandena* Lourenço, 2005 et *G. goudoti* Lourenço & Goodman, 2006. Une nouvelle espèce, *Grosphus* sp. n. de la Montagne des Français dans la région d'Antsiranana (Diego Suarez) est également décrit. Des commentaires sur l'écologie et la répartition géographique de la plupart de ces espèces sont aussi proposés.

Mots clés : Scorpiones, Buthidae, *Grosphus*, nouvelle espèce, taxonomie, Madagascar, régions nord et est

Introduction

In the last 10 years, a considerable number of new scorpion species of the genus *Grosphus* have been described from Madagascar (Lourenço, 1996, 1999, 2001, 2003, 2004; Lourenço & Goodman, 2003; Lourenço *et al*., 2004). In several cases, these descriptions have been based on few specimens, and sometimes on single individuals. In recent publications, attempts to clarify the precise status of several species have been undertaken, particularly for taxa occurring in the southeast (Lourenço *et al*., 2007a, 2007b).

The species taxonomy of *Grosphus*, endemic to Madagascar, is based mainly on two characters: 1) the coloration pattern and 2) the morphology of the basal middle lamellae of female pectines. This last character has been classically considered by scorpion taxonomists to show species-specific aspects with little intraspecific variation. However, investigations that are more detailed have revealed that in some cases closely related species have similar basal middle lamellae morphology (Lourenço, 2003; Lourenço & Goodman, 2003, 2006; Lourenço *et al*., 2004, 2007a). This aspect was particularly notable for several species of *Grosphus* distributed in the southwest and north.

In the present note, we propose a synopsis of the known species of *Grosphus* distributed in portions of northern and eastern Madagascar and the description of a taxon new to science from near Antsiranana (Diego Suarez). Some ecological information about the collection sites and possible species distribution patterns are also presented.

Material and methods

Illustrations and measurements were produce using a Wild M5 stereomicroscope with a drawing tube and

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an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology is after Vachon (1952) and Hjelle (1990).

Taxonomic Treatment

Family Buthidae C. L. Koch, 1837

Genus *Grosphus* Simon, 1880

Checklist of known species from northern and eastern Madagascar

Grosphus madagascariensis (Gervais, 1843)
Grosphus hirtus Kraepelin, 1900
Grosphus hirtus garciai Lourenço, 2001 - new status -
Grosphus flavopiceus Kraepelin, 1900
Grosphus ankarafantsika Lourenço, 2003
Grosphus ankarana Lourenço & Goodman, 2003
Grosphus simoni Lourenço, Goodman & Ramilijaona, 2004
Grosphus darainensis Lourenço, Goodman & Ramilijaona, 2004
Grosphus mandena Lourenço, 2005
Grosphus goudoti Lourenço & Goodman, 2006
Grosphus tavaratra sp. n. (described herein)

Grosphus madagascariensis

Scorpions of medium size, ranging from 45 to 60 mm in total length. General coloration reddish-brown to dark brown. Metasomal segments reddish-brown; segments IV and V slightly darker. All segments longer than wide with carinae strongly marked and with 10-10-10-8-5 carinae: dorsal carinae on segments II to IV with at least one posterior spinoid granule strongly developed. Subaculear tooth weak to vestigial. Dentate margins of pedipalp-chela fixed and movable fingers composed of 11 to 13 oblique rows of granules. Pectines with 18 to 20 teeth in males, 15 to 17 in females; basal middle lamellae of female pectines dilated and with an oval shape. See Lourenço & Goodman (2006) for a detailed redescription of this species.

Distribution.--Given that the identifications presented in some older publications that refer individuals to this taxon are doubtful, without a detailed review of existing material it is difficult to accurately summarize this species distribution. Based on verified specimens it is known to occur at the following localities in the eastern rain forest belt (south to north): Kianjavato (Fianarantsoa), Parc National (PN) de Ranomafana (Fianarantsoa), Réserve Spéciale (RS) de Périnet (forêt d'Analamazaotra), "Tananarive region", Masoala Peninsula, Baie d'Antongil, Massif d'Anjanaharibe-Sud, Massif de Marojejy [=PN de Marojejy], Massif de Manongarivo, and Nosy Be (RS de Lokobe).

Ecology.--This species appears to be limited to humid forest formations (Fage, 1929; Lourenço & Goodman, 2006) and includes zones such as the Masoala Peninsula, which is the wettest area on the island, receiving on average annual rainfall of close to 6 m (Kremen, 2003). This species' elevation distribution spans the gamut from lowland to montane forests.

Grosphus hirtus

Scorpions of medium size, ranging from 40 to 50 mm in total length. General coloration yellowish to reddish-yellow with variegated brownish spots over the body and appendages. Metasomal segments I to III yellowish; IV reddish-yellow; V reddish; all segments with variegated dark pigmentation. Segments I wider than long; segments II to V longer than wide; carinae strongly marked and with 10-10-10-8-5 carinae: dorsal carinae on segments II to IV with one posterior spinoid granule strongly developed. Subaculear tooth vestigial. Dentate margins of pedipalp-chela fixed and movable fingers composed of 11 to 12 oblique rows of granules. Pectines with 17 to 19 teeth in males, 14 to 16 in females; basal middle lamellae of female pectines dilated and with an oval to semi-square shape. See Lourenço & Goodman (2006) for a detailed redescription of this taxon.

Distribution.--As with *Grosphus madagascariensis*, a portion of the published records of *G. hirtus* probably represent misidentifications and in order to properly delineate this species' distribution a review of available material is needed. Confirmed localities include (from south to north): PN de Bemaraha, PN de Namoroka, RS d'Ambohijanahary, RS d'Ambohitantely, PN d'Ankarafantsika, Ankoririka (Mahajanga), Ambilobe, Forêt d'Ampondrabe (Antsiranana), Anabohizo (Antsiranana), PN de la Montagne d'Ambre, Diego region, and Îlot Baie de Diego. Hence, this species is known from the provinces of Antsiranana, Mahajanga, and Antananarivo.

Ecology.--*Grosphus hirtus* is most frequently found in dry deciduous forest formations (Fage, 1929; Lourenço & Goodman, 2006), which in many cases are on sandy substrates. However, it is also known from several montane zones with humid forests (e.g., Ambohitantely). Based on the localities presented here for *G. hirtus* and *G. madagascariensis*, these

two taxa are not known to occur in sympatry. This situation may indeed change with verification of available specimens and further field inventories.

Grosphus hirtus garciai, new taxonomic status

Scorpions of small to moderate size, ranging from 28 to 32 mm in total length. General coloration yellowish to reddish-yellow with variegated brownish spots over the body and appendages. Metasomal segments I to V reddish-yellow; all segments with variegated brownish pigmentation. Segments I with the length similar to the wide; segments II to V longer than wide; carinae moderately marked and with 10-10-8-8-5 carinae: dorsal carinae on segments I to IV with one moderately pronounced posterior spinoid granule. Subaculear tooth weakly pronounced. Dentate margins of pedipalp-chela fixed and movable fingers composed of 11 to 13 oblique rows of granules. Pectines with 18 to 20 teeth in males, 16 to 17 in females; basal middle lamellae of female pectines dilated and with an oval to semi-square shape. For the original description of this species see Lourenço (2001).

Grosphus hirtus garciai was originally described based on specimens collected in the RS d'Ankarafantsika, which is now a Parc National, where *G. hirtus* was also subsequently confirmed to occur (Lourenço & Goodman, 2006). Based on new material, it is clear that many morphological characteristics are identical between *G. hirtus* and *G. garciai.* These two animals seem to differ only by size – the former being larger than the latter. For this reason, it would appear that *G. garciai* is a local isolated population of *G. hirtus* and we demote it to the level of subspecies, *G. hirtus garciai*.

Distribution.--Only known from the type locality, Province de Mahajanga, PN d'Ankarafantsika, Station Forestière d'Ampijoroa, 16°18'45.2"S, 46°48'54.2"E.

Ecology.--*Grosphus hirtus garciai* has been recorded in the dry deciduous forest formations on sandy substrates within the PN d'Ankarafantsika. Here annual precipitation ranges from 1000 to 1500 mm, most of which falls between November and April (Nicoll & Langrand, 1989). At this locality, the month of January experiences the greatest rainfall, with slightly less than 50% of the annual total. A very pronounced dry and cool period occurs between May and September. During this latter period, little to no rain falls and the forest experiences a pronounced dehydration. Monthly mean temperatures across the year at Ankarafantsika range from 17° to 35°C, and the annual average temperature is 26°C.

Grosphus flavopiceus

Scorpions of large size, ranging from 85 to 90 mm in total length. General coloration reddish-yellow to gray-yellowish or gray-reddish. Metasomal segments I to III yellowish; IV reddish-yellow; V reddish-brown. Segments I to V longer than wide; carinae moderately to strongly marked and with 10-10-8-8-5 carinae: dorsal carinae on segments II to IV without any posterior spinoid granule. Subaculear tooth absent. Dentate margins of pedipalp-chela fixed and movable fingers composed of 12 to 13 oblique rows of granules. Pectines with 27 to 32 in males, 24 to 30 in females; basal middle lamellae of female pectines dilated and with a conic shape, covering the first 1 or 2 proximal teeth. See Lourenço (1996) for a detailed redescription of this species.

Distribution.--As with the previous two taxa, there are certain questionable published records of *Grosphus flavopiceus* from different portions of the island. Sites with verified records include (south to north): antsingy area of Bekopaka [=PN de Bemaraha], PN de Bemaraha, Nosy Lava (Analalava), Ambilobe, Forêt d'Andavakoera (Antsiranana), Forêt d'Analamerana (Antsiranana), Montagne des Français, and Forêt d'Orangea (Ramena).

Ecology.--The regions where *Grosphus flavopiceus* is known from are exclusively composed of dry forests (Fage, 1929; Lourenço, 1996). The vast majority of these sites are at elevations below 50 m.

Grosphus ankarafantsika

Scorpions of medium size, ranging from 37 to 50 mm in total length. General coloration yellowish with some dark zones on the body. Carapace with an inverted blackish triangular spot between median and lateral eyes. Metasomal segments yellowish with vestigial dark pigmentation on the ventral carinae. Segments I to V longer than wide; carinae moderately marked and with 10-10-8-8-5 carinae: dorsal carinae on segments I to IV without any posterior spinoid granules. Subaculear tooth absent. Dentate margins of pedipalp-chela fixed and movable fingers composed of 10 to 11 (females) 11 to 12 (males) oblique rows of granules. Pectines with 27 to 31 teeth in males, 24 to 27 in females; basal middle lamellae of female pectines dilated and with an elongated and curved shape, covering the first 3-4 proximal teeth. For a detailed description of this taxon, see Lourenço (2003).

Distribution.--Only known from the type locality, Province of Mahajanga, PN d'Ankarafantsika [formerly

a Réserve Spéciale], Station Forestière d'Ampijoroa, Jardin Botanique A.

Ecology.--This species is only known from a site in the Jardin Botanique A, within the Station Forestière d'Ampijoroa, characterized by its sandy soils and xerophytic vegetation.

Grosphus ankarana

Scorpions of large size, ranging from 100 to 115 mm in total length. General coloration reddish-yellow to gray-yellowish or gray-reddish. Metasomal segment I gray-yellowish; segments II-IV reddish-yellow; segment V reddish. Segments I to V longer than wide; carinae moderately to strongly marked and with 10-10-8-8-5 carinae: dorsal carinae on segments I to IV with one or two posterior spinoid granule. Subaculear tooth absent. Dentate margins of pedipalp-chela fixed and movable fingers composed of 14 to 15 oblique rows of granules. Pectines with 36 to 41 teeth in males, 31 to 35 in females; basal middle lamellae of female pectines strongly dilated, conic, elongated and curved, covering the 3 to 4 proximal teeth. See Lourenço & Goodman (2003) for the original description of this species.

Distribution.--Only known from two localities associated with specimens used in the original description: 1) RS d'Ankarana, 2.6 km E Andrafiabe (village), near Andrafiabe Cave, 12°55.9'S, 49°03.4'E and 2) RS d'Ankarana, Campement des Anglais (Anilotra), 12°54.5'S, 49°06.6'E.

Ecology.--The two sites this species is known from possess dry deciduous forests, generally associated with limestone formations known as *tsingy*. Both of these sites are within the Ankarana Massif and a short distance from one another.

Grosphus simoni

Scorpions of medium size, ranging from 54 to 65 mm in total length. General coloration reddish-yellow to yellowish. Metasoma: all segments reddish with some vestigial dark pigmentation on the ventral carinae. Segments I to V longer than wide; carinae moderately to strongly marked and with 10-10-10-8-5 carinae: dorsal carinae on segments II to IV with 2-6 strong posterior spinoid granules. Subaculear tooth absent. Dentate margins of pedipalp-chela fixed and movable fingers composed of 12 to 13 oblique rows of granules. Pectines with 15 to 17 teeth in males, 13 to 14 in females; basal middle lamellae of female pectines dilated and with an oval shape (Table 1). For a detailed description of the species see Lourenço *et al.* (2004).

Distribution.--Originally only known from localities associated with the original description: Province de Toamasina, Forêt de Plateau de Makira, Forêt de Sahantaha, 7.7 km SW Soanafindra, 5°13.6'S, 49°31.8'E, 300-1000 m and Province de Mahajanga, Station Forestière d'Ampijoroa, 16°19.4'S, 46°48.4'E, 160 m. Specimens were recently collected in November 2004 at Province de Mahajanga, RS de Marotandrano, forêt d'Anjiambolo, 12 km SSE of Marotandrano (village), along Anjiambolo River, 16°16.8'S, 48°48.1'E, 950 m, humid forest; these specimens include VS-420 (1 male), VS-422 (1 male), VS-425 (1 male), VS-426 (1 male), and VS-428 (1 female) (divided between the Muséum national d'Histoire naturelle, Paris, and Field Museum of Natural History, Chicago).

Table 1. Variation of the number of pectinal teeth of *Grosphus simoni*.

Number of teeth	Male-pectines	Female-pectines
14	0	2
15	3	0
16	8	0
17	1	0

Ecology.--The vegetation of the Anjiambolo Forest includes aspects typical of eastern humid forest, but with dry forest elements. During the six days of November the inventory of this forest took place, the average minimum and maximal daily temperatures were 20°C and 22.6°C (respectively) and no precipitation was recorded. Given that Anjiambolo is near the transitional zone between eastern humid forest and western dry deciduous forest, it is presumed to act as a biogeographic crossroads between the organisms living in these different ecosystems.

Grosphus darainensis

Scorpions of medium size, with a total length of 50 mm. General coloration yellowish to reddish-yellow with some discrete dark zones on the body; carapace yellowish with an inverted slightly dark triangular zone between median and lateral eyes. Metasomal segments I to III yellowish; IV reddish-yellow; V reddish; IV and V with some vestigial dark pigmentation on the ventral carinae. Segments I to V longer than wide; carinae moderately marked and with 10-10-8-8-5 carinae: dorsal carinae on segments II to IV with one small posterior spinoid granule. Subaculear tooth absent. Dentate margins of pedipalp-chela fixed and movable fingers composed of 12 to 13 oblique rows

of granules. Pectines with 17 to 18 teeth in male. For a detailed description of this taxon, see Lourenço *et al.* (2004).

Distribution.--Only known from the type locality: Province of Antsiranana, Forêt de Bobankora, east side, 12 km E SE of Daraina, 13°12.7'S, 49°46.3'E, 100-350 m.

Ecology.--The type locality site is in the lower portion of the Bobankora Massif, which rises to slightly more than 600 m (Goodman & Wilmé, 2006). The portion of the massif where the specimens were collected is characterized by dry deciduous forest.

Grosphus mandena

Scorpions of medium size, ranging from 50 to 55 mm in total length. General coloration reddish-yellow to yellowish, darker in females; carapace with one inverted dark triangle extending from the median eyes to lateral eyes. Metasoma: all segments reddish to dark reddish. Segment I with length similar to the wide; other segments longer than wide; carinae moderately to strongly marked and with 10-10-8-8-5 carinae: dorsal carinae on segments II to IV with one strong posterior spinoid granule. Subaculear tooth represented by a minute granule. Dentate margins of pedipalp-chela fixed and movable fingers composed of 12 to 13 oblique rows of granules. Pectines with 18 to 20 teeth in males, 14 to 17 in females; basal middle lamellae of female pectines dilated and with a semi-oval shape. For the detailed original description of this taxon, see Lourenço (2005).

Distribution.--Originally only known from the littoral forest type locality: Province of Toliara, Mandena, Tolagnaro (Fort Dauphin). New material of this taxon has been recently collected: Province of Fianarantsoa, near Farafangana, Mahabo-Magnanivo, Forêt d'Analamena-Andranomainty, 22º09'59.9"S, 47º44'33.0"E, 5 m, 19-24 November 2004, in littoral forest on sand (SMG-14475, 14476, 14477); Province of Fianarantsoa, near Farafangana, Mahabo-Magnanivo, Forêt d'Analazaha-Ampitavagnanima, 23º11'09.1"S, 47º42'59.7"E, 5 m, 12-17 November 2004, in dense littoral forest on sand (SMG-14478, 14482, 14484) (specimens divided between the Muséum national d'Histoire naturelle, Paris, and Field Museum of Natural History, Chicago).

Ecology.--This species is known from two littoral forest areas, Mahabo-Magnanivo and Mandena, separated from one another by about 225 km distance. Littoral forest habitat was once much more widespread across the eastern coastal zone, but has been largely destroyed by human actions (Consiglio *et al*., 2006). Before these perturbations, it is presumed that there was a nearly continuous band of coastal littoral forest from the Tolagnaro area north to at least Farafangana. This would explain the currently disjunct distribution of this species.

Grosphus goudoti

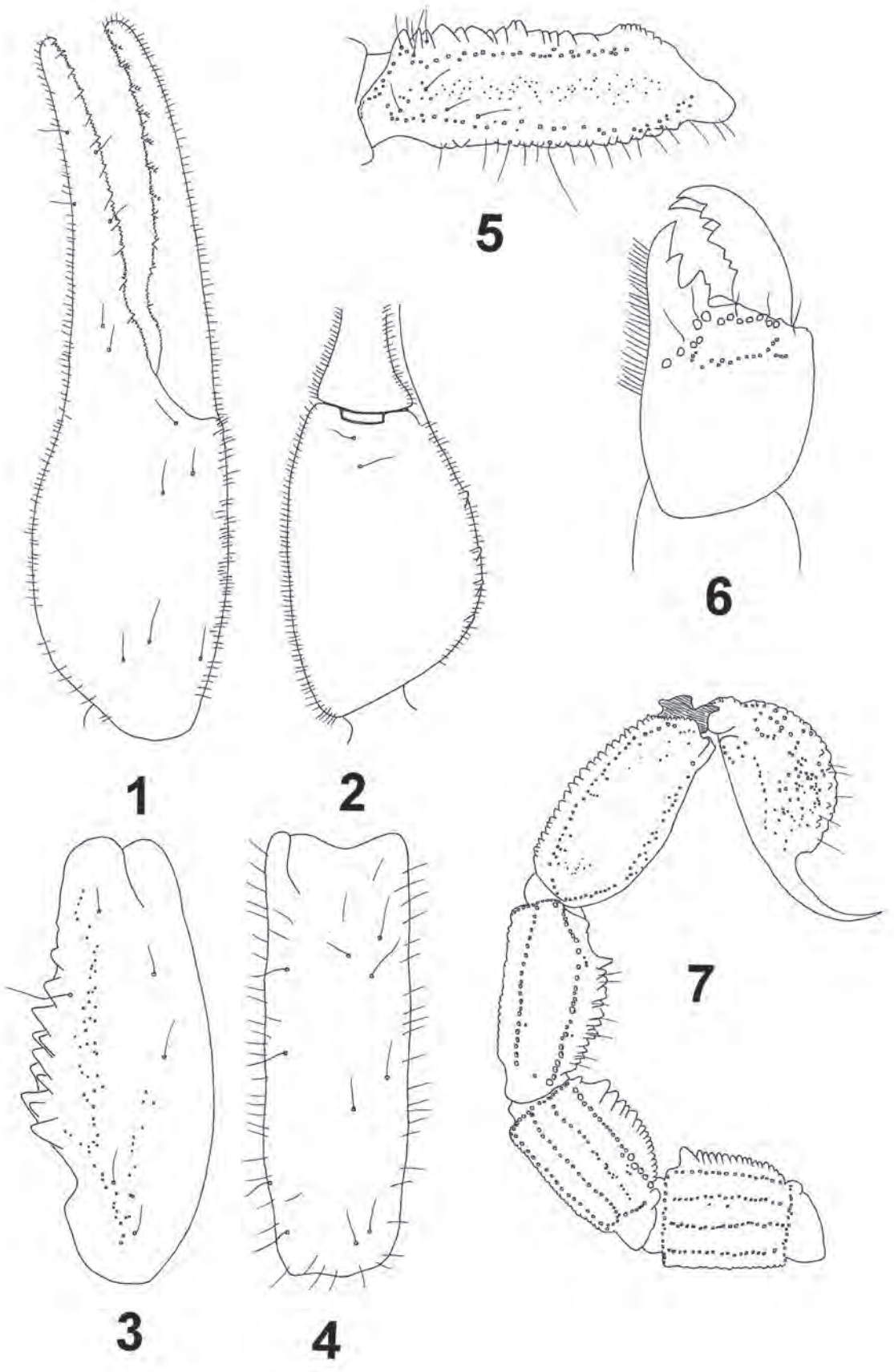
Scorpions of medium size, ranging from 55 to 65 mm in total length. General coloration reddish-brown to dark brown; carapace with one inverted black triangle stretching from the lateral eyes to the median eyes. Metasoma: segments I to III reddish-brown; IV-V dark brown, with some vestigial dark pigmentation on carinae. Segments I to V longer than wide; carinae moderately marked and with 10-10-8-8-5 carinae: dorsal carinae on segments II to IV without any posterior spinoid granules. Subaculear tooth vestigial. Dentate margins of pedipalp-chela fixed and movable fingers composed of 11 to 12 oblique rows of granules. Pectines with 19 to 22 teeth in males, 17 to 19 in females; basal middle lamellae of female pectines dilated and with an semi-oval shape (Table 2). For the detailed original description, see Lourenço & Goodman (2006).

Table 2. Variation of the number of pectinal teeth of *Grosphus goudoti.*

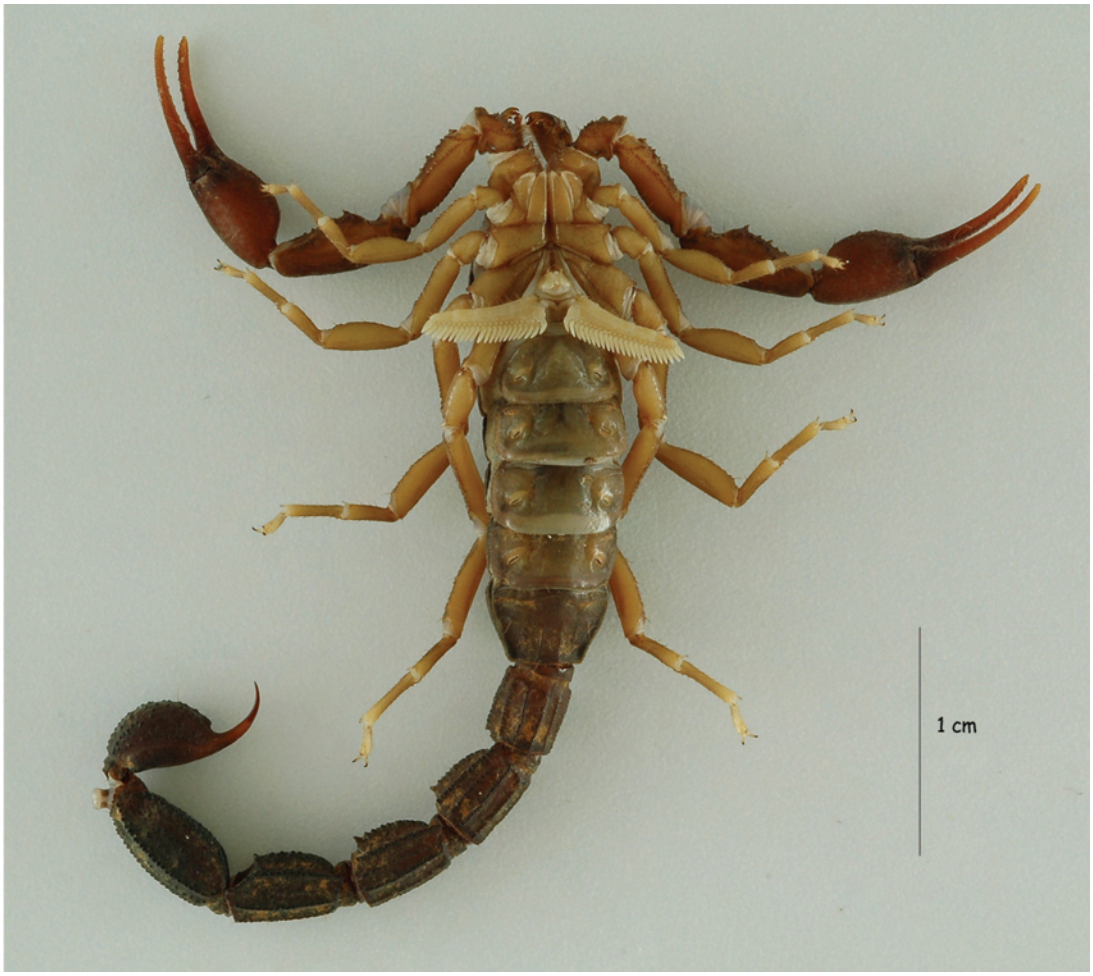
Number of teeth	Male pectines	Female pectines
17	0	7
18	0	4
19	4	3
20	12	0
21	17	0
22	3	0

Distribution.--Originally only known from the type locality: Province d'Antsiranana, Forêt de Bobankora, Versant ouest, 11 km E of Daraina, 13°13.414'S, 49°45.586'E, 350-550 m. New material of this taxon has recently been collected at Province d'Antsiranana, Ambondrobe, 41.1 km 175° Vohemar, 10 m (13°4292'S, 50°0610'E), 29 November–1 December 2004, littoral rainforest – BLF-11097: 17 males, 7 females (California Academy of Sciences, San Francisco).

Ecology.--The type specimen was obtained in the Bobankora Forest. The lower portion of this massif, below 350 m, has dry deciduous forest, and the middle to upper section, 350 to 607 m, has mixed deciduous and humid forest. The type series was obtained in the transitional forest between 350 and 550 m. *Grosphus darainensis* is known from this same massif, but in the zone from 100 to 350 m. The new series from Ambondrobe, referable to this taxon, was collected



Figures 1-7. *Grosphus tavaratra* sp. n. Male holotype. 1-7. Trichobothrial pattern. 1-2. Chela dorso-external and ventral aspects. 3-4. Patella, dorsal and external aspects. 5. Femur, dorsal aspect. 6. Chelicera, dorsal aspect. 7. Metasomal segments II to V and telson, lateral aspect.



Figures 8-9. *Grosphus tavaratra* sp. n. Male holotype. Habitus, dorsal and ventral aspects.

at a site with a notably different biotope than the Bobankora Forest. At Ambondrobe, the forest rests on sand and is close to sea level. The sites of Bobankora and Ambondrobe are approximately 25 km from one another.

Grosphus tavaratra, new species (Figs. 1-9)

Madagascar, Province d'Antsiranana, Montagne des Français, 12°22'S, 49°22'E, 140 m, 14 September 2001, under bark in dry bush forest (W. R. Lourenço). Male holotype. Deposited in the Muséum national d'Histoire naturelle, Paris.

Etymology.--The specific name is derived from the Malagasy and means "from the north".

Diagnosis.--Description based on male holotype, female unknown. Measurements in Table 3. Scorpions of small to medium size, with a total length of 45 mm. General coloration yellowish-brown to dark-brown. Segments I to V longer than wide, with 10-10-10-8-5 carinae strongly marked: dorsal carinae on segments II to IV with at least one posterior spinoid granule well developed. Subaculear tooth weak to vestigial. Dentate margins of pedipalp-chela fixed and movable fingers composed of 11 to 13 oblique rows of granules. Pectines with 22 to 23 teeth in male holotype (diagnostic character). External trichobothria e_1 of femur distal in relation to dorsal trichobothria d_5.

General morphological characters indicate that *Grosphus tavaratra* is close to the *G. madagascariensis/G. hirtus* group, and in particular of *G. madagascariensis*, but it can be readily distinguished from this latter species by the following characters: (i) a paler overall coloration of the body and appendages; legs yellowish with diffused gray spots; (ii) pectinal tooth count 22 to 23, whereas in *G. madagascariensis* pectinal tooth counts range from 15 to 20 (males and females). Pectinal tooth counts greater than 20 have not been hitherto observed in several hundred specimens examined of this genus.

General coloration: yellowish-brown to dark-brown. Carapace and tergites brownish; presence of an inverted yellowish triangle on the anterior zone of the carapace from the lateral eyes to the median eyes;

Table 3. Comparative morphometric values (in mm) of male and female *Grosphus madagascariensis* and *G. hirtus*, and of the male holotypes of *G. goudoti*, *G. simoni,* and *G. tavaratra* sp. n.

	G. madagascariensis		*G. hirtus*		*G. goudoti*	*G. simoni*	*G. tavaratra* sp. n.
	M	**F**	**M**	**F**	**M**	**M**	**M (holotype)**
Total length	45.4	52.5	38.9	48.8	59.8	54.2	45.5
Carapace:							
- length	5.5	6.2	4.8	6.1	7.2	6.4	5.8
- anterior width	4.0	4.4	3.4	4.3	5.3	4.8	4.2
- posterior width	6.6	7.6	5.8	6.9	7.9	6.9	6.6
Metasomal segment I:							
- length	3.5	4.1	2.8	3.3	5.2	4.5	3.5
- width	3.1	3.7	3.1	3.9	4.1	3.4	3.2
Metasomal segment V:							
- length	6.5	6.8	5.2	6.6	8.4	7.7	6.6
- width	3.1	3.2	2.7	4.1	3.4	3.2	3.0
- depth	3.0	3.3	2.8	3.5	3.4	3.3	3.2
Vesicle:							
- width	2.7	3.0	2.4	3.3	3.3	2.8	2.9
- depth	2.6	2.9	2.2	3.1	3.3	2.9	3.0
Pedipalp:							
- Femur length	5.4	5.6	4.2	5.2	7.3	6.2	5.1
- Femur width	1.7	1.9	1.4	1.8	2.2	1.9	1.7
- Patella length	6.2	6.8	4.9	6.1	8.4	7.1	6.2
- Patella width	2.5	2.6	2.1	2.7	2.9	2.7	2.4
- Chela length	10.3	10.8	8.3	9.7	14.3	11.9	10.8
- Chela width	2.8	2.5	2.5	2.5	3.9	3.1	2.9
- Chela depth	2.5	2.4	2.3	2.4	3.5	2.8	2.8
Movable finger:							
- length	5.9	6.6	4.6	6.0	8.2	6.8	6.5

eyes surrounded by black pigment. Metasoma: all segments brownish to reddish-brown, with segments IV and V slightly darker; carinae blackish-brown. Telson reddish-brown; aculeus with yellowish base and reddish-brown tip. Venter: coxapophysis and sternum yellowish; genital operculum and pectines pale yellow; sternites greenish-yellow. Chelicerae yellowish with dark variegated pigmentation; fingers reddish-brown with the teeth reddish. Pedipalps yellowish-brown to reddish-brown with vestigial variegated spots; legs yellowish with diffused fuscous spots.

Morphology: Carapace strongly granular; anterior margin almost straight with a very discrete median concavity. All carinae moderate to weak; furrows moderately developed. Median ocular tubercle anterior to the center of carapace; median eyes separated by one ocular diameter. Three pairs of lateral eyes. Sternum between sub-triangular and sub-pentagonal in shape. Mesosoma: tergites with minute but moderately intense granulation. Median carina moderately developed in all tergites. Tergite VII pentacarinate. Venter: genital operculum consisting of two semi-triangular plates. Pectines: pectinal tooth count 23-22; basal middle lamella not dilated in male. Sternites smooth, with weakly elongated stigmata. Metasoma: all segments longer than wide, with carinae strongly marked; segments I to III with 10 carinae, crenulate; segment IV with 8 carinae, crenulate. Segment V with five carinae. Dorsal carinae on segments II to IV with at least one posterior spinoid granule strongly developed. Intercarinal spaces moderately granular. Telson with granules over latero-ventral and ventral surfaces; its dorsal surface smooth; aculeus moderately curved and shorter than the vesicle; subaculear tooth weak to vestigial. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); two distinct small 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 ventrointernal carinae and with several spinoid granules on the internal face; chela almost smooth, with isolated granules on the internal face. Fixed and movable fingers with 11 to 13 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A-α (alpha) (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.

Ecology.--*Grosphus tavaratra* is known from a single specimen obtained in the limestone karst of Montagne des Français, within a few kilometers of Antsiranana, the northern provincial capital. This massif holds dry deciduous forest, which has been heavily degraded in recent years. The zone receives little in the way of precipitation and there are few permanent water sources on Montagne des Français. The closest weather station to the massif is at Antsiranana, which has annual precipitation of less than 1,000 mm and a very pronounced dry season of seven to eight months (Donque, 1975). This specimen was obtained on the north flank of the massif in a zone with partially degraded natural dry deciduous forest, an open canopy, and at the base of steep cliffs. One of the prominent trees growing in the area is the locally endemic baobab *Adansonia suarezensis.* Other species of scorpions known to occur on the Montagne des Français include: *Grosphus flavopiceus*, *G. hirtus*, *Heteroscorpion kraepelini* Lourenço & Goodman, 2006, and *Microcharmus duhemi* Lourenço, Goodman & Fisher, 2006.

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