

SCORPIONS OF SOUTH-WESTERN MADAGASCAR. A NEW SPECIES OF *GROSPHUS* SIMON, 1880 (SCORPIONES, BUTHIDAE)

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Abstract: *Grosphus polskyi* sp. n. is described from Ifaty, Toliara province, south-western Madagascar. The holotype was collected under dead and fallen leaves of a baobab (*Adansonia*) in dry spiny bush resting on red sandy soil. Some details are presented on the ecological setting of this site. With this description, the total number of species in this endemic genus is now 19. The south-western portion of Madagascar appears to have one of the highest levels of scorpion diversity on the island.

Key words: Scorpiones, Buthidae, *Grosphus*, new species, taxonomy, Madagascar.

Escorpiones del suroeste de Madagascar. Una nueva especie de *Grosphus* Simon, 1880 (Scorpiones, Buthidae)

Resumen: Se describe *Grosphus polskyi* sp. n. de Ifaty, provincia de Toliara, suroeste de Madagascar. El holotipo se colectó bajo las hojas caídas, secas, de un baobab (*Adansonia*), en matorral espinoso seco sobre suelo rojo arenoso. Se presentan algunos detalles sobre las características ecológicas de la localidad. Con esta descripción, el número total de especies de este género endémico es ahora 19. El suroeste de Madagascar parece tener uno de los niveles más altos de la isla en cuanto a diversidad de escorpiones.

Key words: Scorpiones, Buthidae, *Grosphus*, nueva especie, taxonomía, Madagascar.

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

Introduction

It is now well known that Madagascar is one of the most biologically diverse regions on the Earth (Goodman & Benstead, 2003). Although patterns of species richness may vary across portions of the island, certain regions exhibit notably high levels of endemism. In the case of scorpions, the northern region, near Antsiranana, has been previously defined as the possible epicenter of diversity in Madagascar (Lourenço, 1996), however, other regions with high diversity include the southeast, southwest, and certain zones of the Central Highlands (Lourenço, 2000, 2003a, 2005a). Recent detailed inventory work in the southwest region of Madagascar revealed several new species to science (Lourenço, 2004; Lourenço & Goodman, 2006a,b) and suggested that this region may hold a very rich and complex scorpion fauna.

The taxonomy of *Grosphus* (Family Buthidae), which is endemic to Madagascar, is based mainly on two characters: the pattern of coloration and the morphology of the basal middle lamellae of the female pectines. This last character has been considered by scorpion taxonomists to show species specific aspects with little intraspecific variation. However, investigations that are more detailed have shown that in some cases closely related species have similar basal middle lamellae morphology (Lourenço, 2003b; Lourenço & Goodman, 2003, 2006c; Lourenço *et al.*, 2004). On the basis of basal middle lamellae characters some populations closely associated to broadly distributed species, such as *G. madagascariensis*, *G. limbatus*, and *G. bistriatus*, remained until recently undescribed (Lourenço, 2003b, 2005b; Lourenço & Goodman, 2006c; Lourenço *et al.*, 2004). Fur-

ther, particularly during the early stages of systematic work on this genus, problems of incorrect species identification remain possible between morphologically similar taxa.

In the present note, one new species, closely associated with the *G. madagascariensis*/*G. hirtus* group, is described from the spiny bush near Ifaty, Province of Toliara, southwestern Madagascar.

Taxonomic Treatment

Since the new species is closely related to *Grosphus hirtus* Kraepelin, 1900, we redefine the morphological characters herein of one male and one female from the southern most site where this species has been collected. It is important to emphasize that several localities mentioned by Lourenço (1996) for *G. hirtus* were subsequently shown to be cases of misidentifications previously undescribed taxa (cf. Lourenço, 2005b).

Family **BUTHIDAE** C.L. Koch, 1837

Genus ***Grosphus*** Simon, 1880

Grosphus hirtus Kraepelin, 1900 (Figs. 1-14)

Grosphus hirtus Kraepelin, 1900: 15.

Grosphus hirtus Fage, 1929: 645.

Grosphus hirtus Lourenço, 1996: 11.

Grosphus hirtus Lourenço & Goodman, 2006c: 251

MATERIAL used for this redescription. Madagascar, Province of Mahajanga, Parc National Tsingy de Bemahara, 2.5

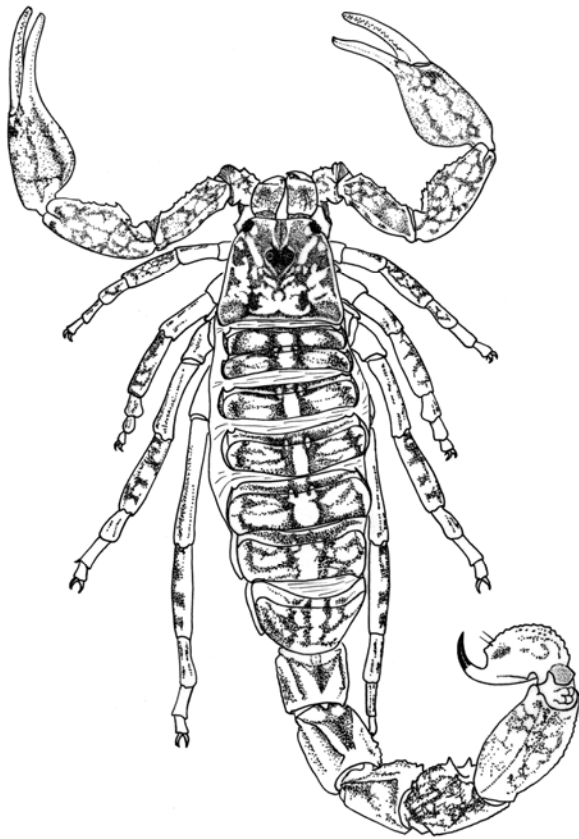


Fig. 1. Habitus of *Grosphus hirtus*, male from Parc National Tsingy de Bemahara.

Table I. Comparative morphometric values (in mm) of the male and female of *G. hirtus* from Parc National Tsingy de Bemahara and of the male holotype of *G. polskyi* sp. n.

	<i>G. hirtus</i>		<i>G. polskyi</i> sp. n. (♂)
	♂	♀	
Total length	34.3	31.8	32.6
Carapace:			
- length	4.1	4.3	3.9
- anterior width	3.1	3.3	2.7
- posterior width	4.9	5.3	4.4
Metasomal segment I:			
- length	2.4	2.4	2.3
- width	2.8	2.9	2.3
Metasomal segment V:			
- length	4.8	4.6	4.3
- width	2.6	2.5	2.2
- depth	2.4	2.4	2.2
Vesicle:			
- width	2.2	2.2	2.0
- depth	1.9	2.0	1.9
Pedipalp:			
- Femur length	3.7	3.5	3.5
- Femur width	1.2	1.3	1.2
- Patella length	4.4	4.3	4.3
- Patella width	1.8	1.9	1.8
- Chela length	7.5	7.0	7.2
- Chela width	2.3	1.8	2.3
- Chela depth	2.1	1.6	2.0
Movable finger:			
- length	4.2	4.4	3.8

km (62°) ENE-Bekopaka, Ankidrodroa, 100 m alt., 11-15/XI/2001 (19°7'56"S – 44°48'53"E) (B. L. Fisher *et al.*) tropical dry forest on *tsingy*, (BLF-4342) – CAS [California Academy of Sciences]. 1 male, 1 female.

DESCRIPTION based on male and female.

Measurements in Table I.

Scorpion of medium **size** with a total length of 34 mm for the male and 32 mm for the female (specimens smaller in size than those of northern populations – see Lourenço & Goodman, 2006c). General **coloration** yellowish to reddish-yellow with variegated brownish spots over the body and appendages. Carapace yellowish with spots more marked on anterior and lateral edges; eyes surrounded by black pigment. Mesosoma: yellowish, with confluent dark zones on the posterior edge of tergites. Metasoma: segments I to III yellowish; IV reddish-yellow; V reddish; all segments with variegated dark pigmentation; dorsal face of segments I to IV with a triangular spot. Telson reddish with vestigial spots over carinae; aculeus with yellowish base and dark reddish tip. Venter: coxapophysis, sternum, genital operculum, and pectines yellowish; sternites dark yellow, with V to VII intensely spotted. Chelicerae yellowish with dark variegated pigmentation throughout; fingers dark-brown with reddish teeth. Pedipalps: reddish-yellow with variegated brownish spots. Legs yellowish with diffused brownish spots.

Morphology. Carapace weakly granular in male; moderately granular in female; anterior margin almost straight, with a weak median concavity. All carinae and furrows weakly developed. Median ocular tubercle anterior to the center of carapace; median eyes separated by one ocular diameter. Three pairs of lateral eyes. Sternum sub-triangular in shape. Mesosoma: tergites with thin but intense granulation, better marked in female. Median carina moderately developed in all tergites. Tergite VII pentacarinata. Venter: genital operculum consisting of two subtriangular plates. Pectines: pectinal teeth count 19-18 in male and 18-17 in female (see Lourenço & Goodman [2006c] for discussion of variation); basal middle lamellae not dilated in males, but strongly dilated in females. Sternites smooth, with weakly elongated stigmata; VII with two vestigial carinae and a few granulations. Metasoma: segment I wider than long; segments I to III with 10 carinae, crenulate. Segment IV with 8 carinae, crenulate. Segment V with 5 carinae, crenulate. Dorsal carinae on segments II to IV with one strong posterior spinoid granule. Intercarinal spaces strongly granular. Telson with a strong granulation over latero-ventral and ventral surfaces; its dorsal surface smooth; aculeus weakly curved and shorter than the vesicle; subaculear tooth vestigial but more notably marked in female. Cheliceral 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. Pedipalps: femur pentacarinata; patella with a dorsointernal carina and with several spinoid granules on the internal face; chela smooth, without carinae. Fixed and movable fingers with 11/12 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 moderate to strong.

TAXONOMIC REMARKS. Although some differences, mainly on the overall size of the specimens, can be observed between elements of northern, central, and western populations of *Grosphus hirtus*, certain characters are invariable between animals from these regions. This is particularly true for the pigmentation pattern: yellowish to reddish-yellow

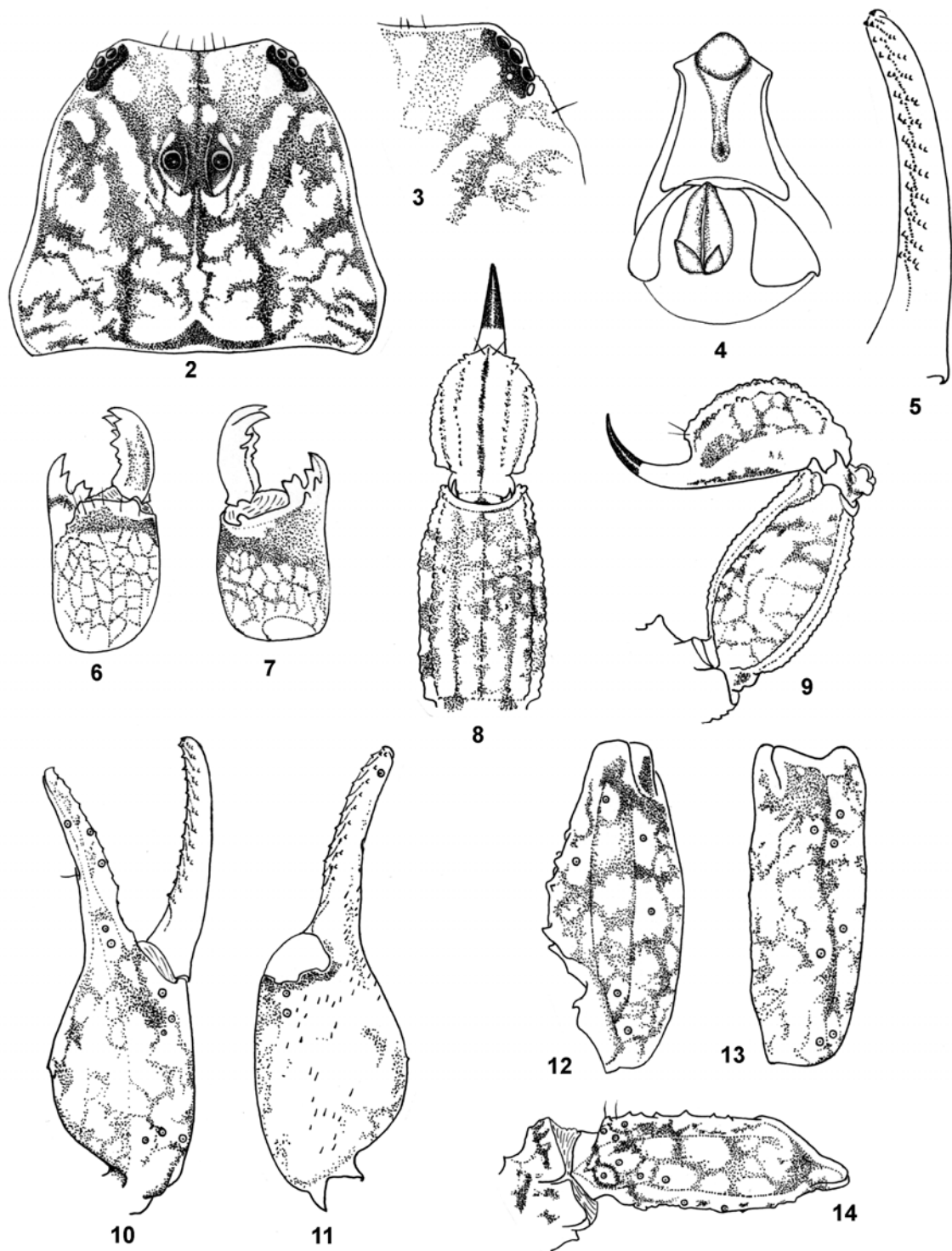


Fig. 2-14. *Grosphus hirtus*, male from Parc National Tsingy de Bemahara. 2. Carapace. 3. Detail of lateral eyes. 4. Sternum and genital operculum. 5. Cutting edge of movable finger, showing rows of granules. 6-7. Chelicera, dorsal and ventral aspects. 8-9. Metasomal segment V and telson, ventral and lateral aspects. 10-14. Trichobothrial pattern. 10-11. Chela dorso-external and ventral aspects. 12-13. Patella, dorsal and external aspects. 14. Femur, dorsal aspect.

with variegated brownish spots over the body and appendages. In addition, morphometric values observed for metasomal segment I, being wider than long, is constant. This character is critical for distinguishing *G. hirtus* from *G. madagascariensis*, in which the width metasomal segment I is shorter than the length. The new species described here has a comparatively pale general coloration, with only vestigial pigmentation and the measurements for metasomal segment I length and width are equal.

ECOLOGY. The zone these two specimens were collected and the remaining forest of the Bemahara region in general, contain dry deciduous forest resting on a very particular eroded limestone base known as *tsingy*. The Bemaraha calcareous plateau holds several types of natural plant formations ranging from dry deciduous and semi-deciduous forests to sub-humid forest. Deep canyons carved into the massif, known as *kizo*, combine more mesic conditions and lower levels of direct sunshine to permit the development of

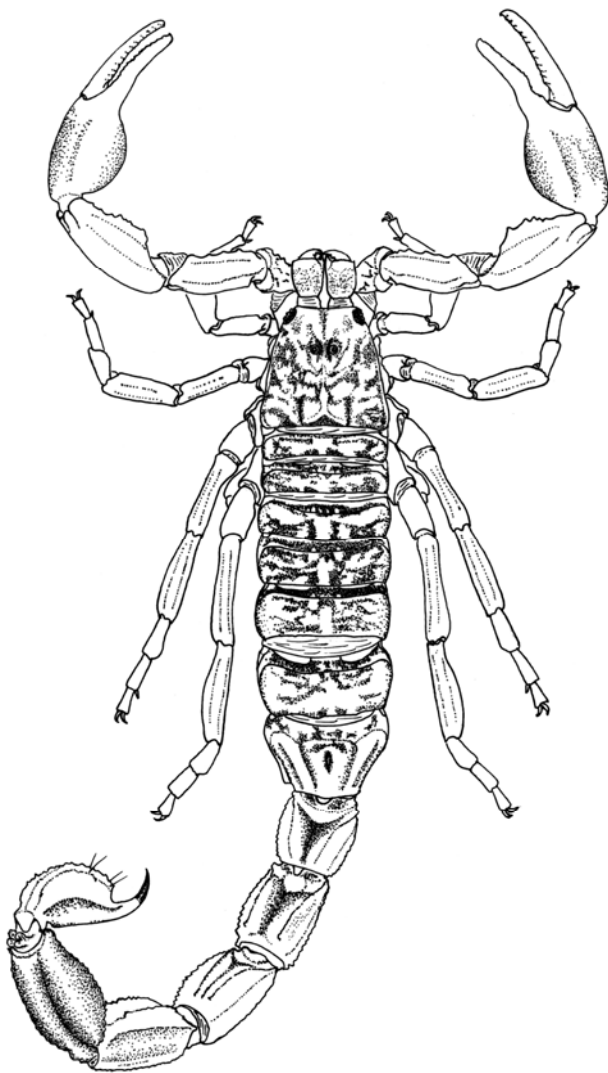


Fig. 15. Habitus of *Grosphus polskyi* sp. n., male holotype.

a relatively dense sub-humid forest. The local floral communities at these sites lack adaptations to drought, as in other more exposed areas of the *tsingy* that hold a remarkably different flora than that found in the deep canyons (Rabarison, 2000; Rajeriarison *et al.*, 2000).

There are two distinct climatic periods in the Bemahara region -- the wet season from November to April and the dry season from May to October. Maximum monthly temperatures are recorded in October (max. 41°C) and highest rainfall is normally in February with records of up to 456 mm (Kofoky *et al.*, in press).

The scorpion fauna of the Bemahara is composed of *Grosphus hirtus*, *G. flavopiceus*, Kraepelin, 1900, *Tityobuthus pococki* Lourenço, 1995, *T. judsoni* Lourenço, 1996, *Microcharmum bemahara* Lourenço, Goodman & Fisher, 2006, and *Opisthacanthus madagascariensis* Kraepelin, 1894.

Grosphus polskyi sp. n.

Figs. 15-27.

MATERIAL EXAMINED: Madagascar, Province de Toliara, Ifaty (23°10'80"S – 43°37'00"E), "dry spiny bush forest, dominated by baobabs (*Adansonia za*) resting on red sand

soil," 30 m (W. R. Lourenço), IX/2004, male holotype, deposited in the Muséum national d'Histoire naturelle, Paris.

ETYMOLOGY: Patronym in honor of Mr. Michael Polsky for his important contributions and aid with the advancement of Malagasy conservation biologists.

DIAGNOSIS: Scorpions of small size with a total length of 32.6 mm. General coloration reddish-yellow with some diffused brownish variegated pigmentation on the carapace and tergites. Certain morphological characters (overall size, carination pattern, pectinal tooth count) indicate that *G. polskyi* sp. n. is close to the *G. madagascariensis*/*G. hirtus* group, and in particular to *G. hirtus*. However, it can be readily distinguished from this last species by the following characters: (i) a much paler overall coloration with some diffused brownish pigmentation, restricted to the carapace and tergites, (ii) metasomal segment I with a length equal to its width (see Table I), (iii) dorsal carinae of metasomal segments II to IV with only some inconspicuous posterior spinoid granules, and (iv) a subaculear tooth moderately marked.

DESCRIPTION based on male holotype.

Measurements in Table I.

Coloration. Basically reddish-yellow. Prosoma: carapace yellowish marbled with diffused brownish pigments; eyes surrounded by black pigment. Mesosoma: yellowish with diffused brownish strips on the posterior margins of tergites. Metasoma: segments I to III yellowish; IV-V reddish-yellow; all segments with some vestigial dark pigmentation on carinae. Telson reddish-yellow with dark pigments over ventral granulations; aculeus with yellowish base and reddish tip. Venter: coxapophysis, sternum, genital operculum, and pectines yellowish; sternites yellow; VII with some diffused brownish spots. Chelicerae yellowish with dark variegated pigmentation over the entire surface; fingers yellowish; teeth reddish-brown. Pedipalps: yellowish; rows of granulations on chela fingers dark reddish. Legs yellowish without any spots.

Morphology. Carapace covered with a thin but intense granulation; anterior margin almost straight, with a very weak median concavity. All carinae 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 sub-triangular in shape. Mesosoma: tergites with thin but intense granulation. Median carina weakly developed in all tergites. Tergite VII pentacarinata. Venter: genital operculum consisting of two semi-oval plates. Pectines: pectinal tooth count 19-18 basal middle lamellae of each pecten not dilated in male. Sternites smooth, with moderately elongated spiracles; VII with vestigial carinae and some granulations. 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 some inconspicuous posterior spinoid granules. Inter-carinal spaces moderately granular. Telson moderately granular over latero-ventral and ventral surfaces; its dorsal surface smooth; aculeus moderately curved and shorter than the vesicle; subaculear tooth moderately marked. Cheliceral dentition characteristic of the family Buthidae (Vachon,

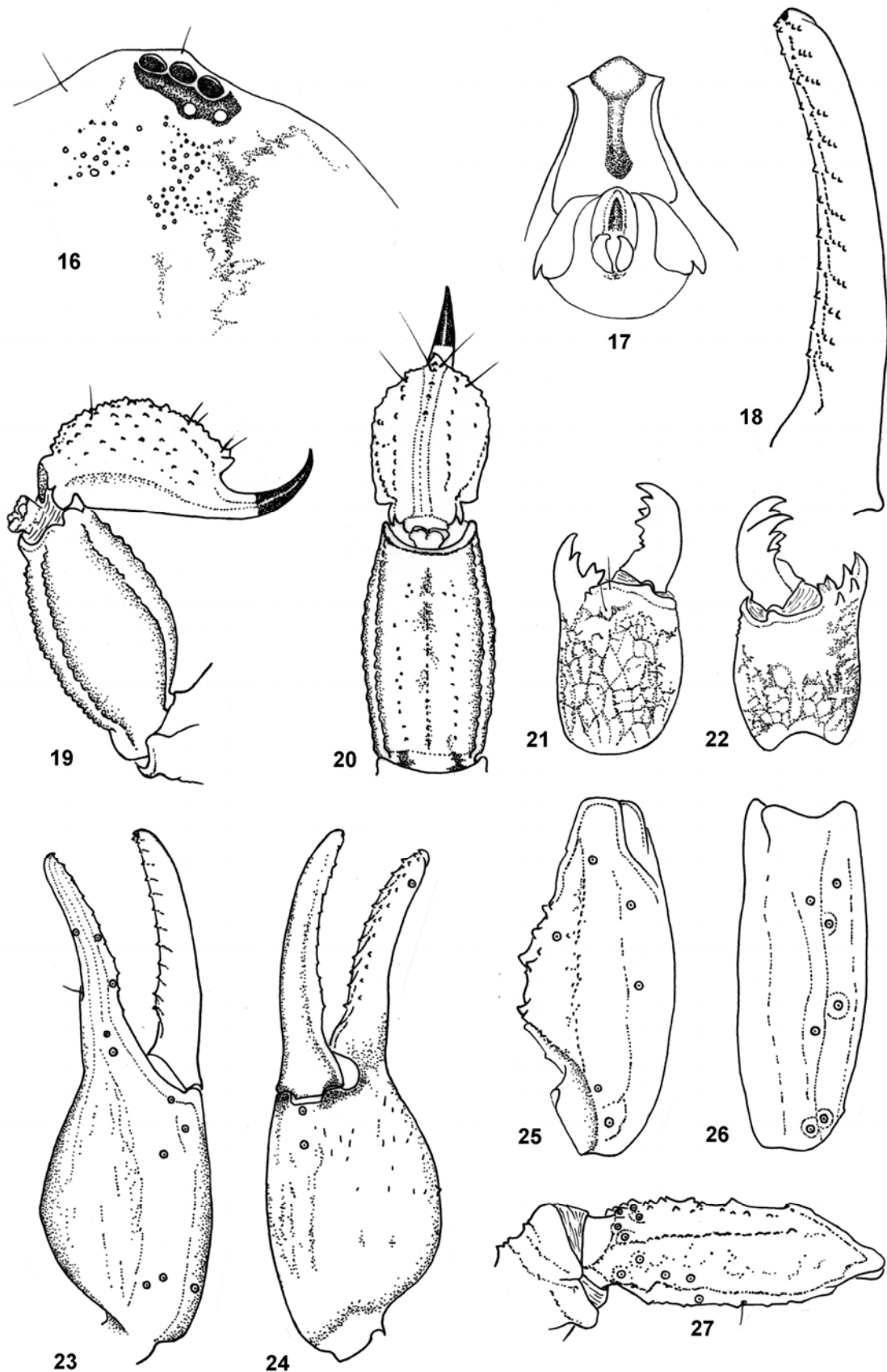


Fig. 16-27. *Grosphus polskyi* sp. n., male holotype. 16. Detail of lateral eyes. 17. Sternum and genital operculum. 18. Cutting edge of movable finger, showing rows of granules. 19-20. Metasomal segment V and telson, lateral and ventral aspects. 21-22. Chelicera, dorsal and ventral aspects. 23-27. Trichobothrial pattern. 23-24. Chela dorso-external and ventral aspects. 25-26. Patella, dorsal and external aspects. 27. Femur, dorsal aspect.

1963); two distinct basal teeth present on the movable finger; ventral aspect of both fingers and of manus with dense, long setae. Pedipalps: femur pentacarinat; 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 moderately marked.

FEMALE unknown.

ECOLOGY. A very distinct vegetational community occurs in the extreme southwestern portion of Madagascar, associated with a vast lowland zone between the Fiherenana and Mangoky rivers, which is often referred to as the Mikea Forest (Seddon *et al.*, 2000). A zone 32 km north of Toliara, near the village of Ifaty and known variously as “PK 32” or the Réserve de Domergue, has been a known site of biological interest for decades (Domergue, 1983) and falls within the region of the Mikea Forest. The forests of PK 32 have suffered considerably from tree extraction for timber products and charcoal over the past decades. Over the past few years, this forest block has received greater levels of protection associated with increased visits by ecotourists, which provides an important economic incentive for its preservation. In degraded portions of the forest, baobab trees (*Adansonia za*) have not been extensively removed and form a dominant aspect of the remaining woody vegetation.

The Mikea Forest is part of the western phytogeographic region (Humbert, 1955) and extends along a length of about 200 km, a width of 30–40 km, and across an elevational zone from sea level to 200 m (Petit, 1998). The vegetational formations include sparse coverage of coastal dunes, marshes and lakes (often temporary during the rainy season), and a large area of dry spiny bush with considerable floristic diversity. This level of heterogeneity is rather notable, with often very sharp ecotones, and is related to climatic and edaphic factors (Du Puy & Moat, 1996). The Ifaty forests, and the Mikea Forest at large, hold a considerable number of endemic plants and animals, with high levels of endemism and microendemism (Razanaka, 1995; Seddon *et al.*, 2000; Raselimanana & Goodman, 2004).

The meteorological conditions in this region are notably semi-arid, with a very pronounced dry season (Chaperon *et al.*, 1993). Annual rainfall varies from 300 to 900 mm and the average monthly temperatures range from 15 to 24 °C. In general, the rainy season is between December and March, but is notably irregular. Across the Mikea Forest, there is a notable decrease in annual precipitation from north to south and from the interior towards the coast (Donque, 1972).

The holotype was collected under the fallen and dead leaves at the base of a baobab tree (*Adansonia za*). There was little in the way of vegetational litter covering the red sandy soil, and fallen dried leaves and fruits were accumulated the tree’s trunk.

Other species of scorpions known to occur in the Ifaty area, as well as spiny bush habitat to the north and south, include *G. grandidieri* Kraepelin, 1900, *G. intertidalis* Lourenço 1999, *G. annulatus* Fage, 1929, *G. olgae* Louren-

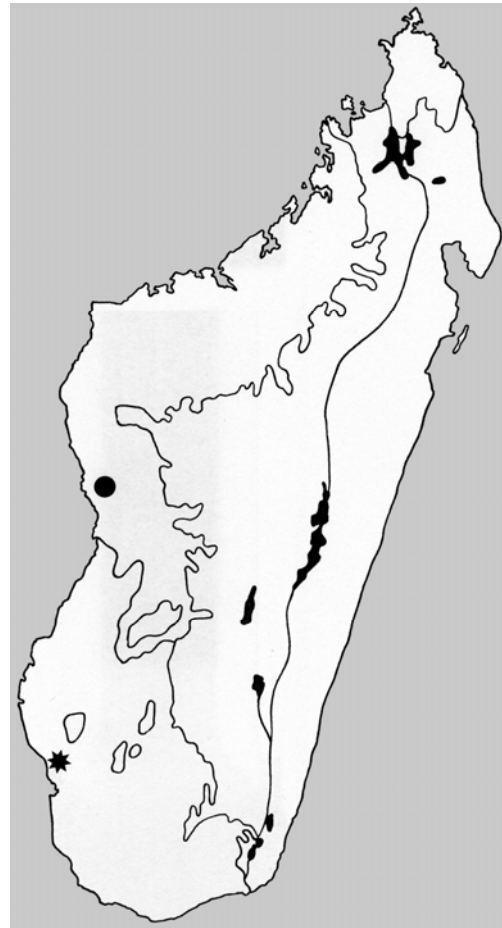


Fig. 28. Map of Madagascar with indication of the southern most site where *G. hirtus* have been collected, and the locality of the new *Grosphus* species. *Grosphus hirtus* (black circle), and *Grosphus polskyi* sp. n. (black star).

ço, 2004, *Neogrosphus griveaudi* (Vachon, 1969), *Pseudouroplectes maculatus* Lourenço & Goodman, 2006, *P. betschi* Lourenço, 1995, *Opisthacanthus maculatus* Lourenço & Goodman, 2006, and *Palaeocheloctonus pauliani* Lourenço, 1996.

NEW COMPOSITION OF THE GENUS *GROSPHUS* SIMON, 1880 – 19 SPECIES

- Grosphus madagascariensis* (Gervais, 1843)
- Grosphus limbatus* (Pocock, 1889)
- Grosphus hirtus* Kraepelin, 1900
- Grosphus grandidieri* Kraepelin, 1900
- Grosphus flavopiceus* Kraepelin, 1900
- Grosphus bistriatus* Kraepelin, 1900
- Grosphus annulatus* Fage, 1929
- Grosphus feti* Lourenço, 1996
- Grosphus intertidalis* Lourenço, 1999
- Grosphus garciai* Lourenço, 2001
- Grosphus ankarafantsika* Lourenço, 2003
- Grosphus ankarana* Lourenço & Goodman, 2003
- Grosphus olgae* Lourenço, 2004
- Grosphus mahafaliensis* Lourenço, Goodman & Ramilijaona, 2004
- Grosphus darainensis* Lourenço, Goodman & Ramilijaona, 2004
- Grosphus simoni* Lourenço, Goodman & Ramilijaona, 2004
- Grosphus mandena* Lourenço, 2005
- Grosphus goudoti* Lourenço & Goodman, 2006
- Grosphus polskyi* sp. n.

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