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Chapter 9. Scorpions of the Réserve Spéciale de Manongarivo, Madagascar

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ABSTRACT

LOURENÇO, W. R. (2002). Scorpions of the Réserve Spéciale de Manongarivo, Madagascar. *Boissiera* 59: 329-337.

Despite the fact that no specific inventory on the scorpion fauna of the Réserve Spéciale de Manongarivo has been carried out, a significant number of taxa are already known for this reserve, including some endemics. The four families known to Madagascar are represented in the reserve: Buthidae, Microcharmidae, Heteroscorpionidae, and Ischnuridae. Six of the 11 known genera to occur on Madagascar are also represented: *Grosphus*, *Tityobuthus*, *Microcharmus*, *Neoprotobuthus*, *Heteroscorpion*, and *Opisthacanthus*. Eight species of scorpion have been recorded in the reserve.

VERSION ABRÉGÉE EN FRANÇAIS

LOURENÇO, W. R. (2002). Les scorpions de la Réserve Spéciale de Manongarivo, Madagascar. *Boissiera* 59: 329-337.

Malgré l'absence d'inventaires spécifiques de la faune des scorpions de la Réserve Spéciale (RS) de Manongarivo, celle-ci présente un nombre significatif de taxons, voire même quelques éléments endémiques. Les quatre familles répertoriées pour Madagascar y sont présentes: Buthidae, Microcharmidae, Heteroscorpionidae et Ischnuridae. Six genres sur onze connus pour l'île sont représentés: *Grosphus*, *Tityobuthus*, *Microcharmus*, *Neoprotobuthus*, *Heteroscorpion* et *Opisthacanthus*, avec un total de huit espèces.

La famille des Buthidae est représentée par deux genres, *Grosphus* et *Tityobuthus* et par trois espèces *G. madagascariensis*, *G. flavopiceus* et *T. baroni*. D'après les données disponibles à l'heure actuelle, *G. flavopiceus* et *T. baroni* sont apparemment des espèces distribuées dans la partie Nord de Madagascar, tandis que *G. madagascariensis* présente une large répartition sur l'ensemble de l'île.

La famille des Microcharmidae est un élément typique de la région Nord de Madagascar où elle est endémique. Dans la RS de Manongarivo elle est représentée par les deux seuls genres connus de cette famille, *Microcharmus* et *Neoprotobuthus*. Les deux espèces de *Microcharmus* connues de cette région sont endémiques; de même le genre *Neoprotobuthus* n'est connu que de la RS de Manongarivo. Quatre autres espèces du genre *Microcharmus* sont connues pour Madagascar, deux de la Réserve Naturelle Intégrale de Lokobe à Nosy Be et deux autres du Parc National (PN) de Marojejy.

La famille des Heteroscorpionidae est également endémique à Madagascar. Elle est représentée par un seul genre et par deux espèces dans des habitats de forêt. *Heteroscorpion opisthacanthoides* est présent dans la région Nord-Ouest de Madagascar y compris à Nosy Be et Nosy Komba, cependant il est possible que sa distribution d'origine ait été réduite à cause de la destruction de la forêt. Très récemment une deuxième espèce, *H. goodmani* a été décrite du PN d'Andohahela dans l'extrême sud-est de l'île. L'actuelle distribution disjointe

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des deux espèces connues, pourrait suggérer une distribution passée presque continue tout au long des formations primaires des forêts humides de l'île.

La famille des Ischnuridae est représentée à Madagascar par deux genres, *Opisthacanthus* et *Palaeocheloctonus* et par trois espèces. *Opisthacanthus* est le seul genre non endémique présent dans l'île (voir note 2, p. 336).

Les deux espèces du genre *Opisthacanthus* présentes à Madagascar ont des répartitions assez étendues sur l'île. *O. madagascariensis* est distribué sur les régions Nord et Ouest, tandis qu'*O. punctulatus* est trouvé dans les régions du sud et de l'Est. Les modèles de distribution géographique présentés par ces deux espèces ne sont pas encore précisément définis et d'autres études sont encore nécessaires.

Au cours de la décennie passée, des méthodes de collecte plus sophistiquée telles les pièges au sol ("pitfall traps"), l'extraction par le Winkler ou la détection avec l'aide d'une lumière ultraviolette ont largement remplacé la seule technique de chasse à vue ("rock-rolling"), ce qui a conduit à la découverte d'importants taxons nouveaux (espèces, genres et même familles), particulièrement dans les cas des micro-scorpions. L'utilisation de manière systématique de telles méthodes, aboutira vraisemblablement à une multiplication du nombre de taxa connus à l'heure actuelle par un facteur de deux à trois.

KEY-WORDS: Manongarivo – Scorpions – Buthidae – Microcharmidae – Heteroscorpionidae – Ischnuridae.

Introduction

Despite the fact that no specific inventory of the scorpion fauna of the Réserve Spéciale (RS) de Manongarivo has been carried out, an assortment of specimens are available. This material indicates the presence of some remarkable genera and species in the reserve, and also to the Sambirano region including Nosy Be, Nosy Komba, and highland areas above 800 m elevation (LOURENÇO, 1995; 1996a; 1996b; 1999; 2000).

In this note the known scorpion fauna of RS de Manongarivo is described and a short diagnosis of each taxon is given. Further, the importance of the scorpion fauna present on the Manongarivo Massif is briefly discussed.

Key to families and genera

1. Scorpions without trichobothria on the ventral aspect of pedipalp tibia 2
(1). Scorpions with trichobothria on the ventral aspect of pedipalp tibia 5
2. Sternum with a triangular shape; spiracles always slit-like: Buthidae 4
(2). Sternum with a sub-pentagonal or pentagonal shape; spiracles semi slit-like or oval to round: Microcharmidae 3
3. Spiracles oval to round ..... ***Microcharmus***
(3). Spiracles semi slit-like ..... ***Neoprotobuthus***
4. Seven to nine rows of granules on movable fingers of pedipalp chela; subaculear tooth present and strong ..... ***Tityobuthus***
(4). Eleven to fourteen rows of granules on movable fingers of pedipalp chela; subaculear tooth absent ..... ***Grosphus***

5. Three pairs of lateral eyes; two parallel ventral keels on metasomal segments .....Ischnuridae; ***Opisthacanthus***

(5). Two pairs of lateral eyes; one single ventral keel on metasomal segments .....Heteroscorpionidae; ***Heteroscorpion***

Clés des familles et des genres

1. Scorpions sans trichobothries sur la face ventrale du tibia des pédipalpes 2

(1). Scorpions avec des trichobothries sur la face ventrale du tibia des pédipalpes 2

2. Sternum de forme triangulaire; stigmates toujours linéaires: Buthidae 4

(2). Sternum de forme sub-pentagonale ou pentagonale; stigmates semi-linéaires ou ovale/arrondi: Microcharmidae 3

3. Stigmates ovales ou arroundis .....***Microcharmus***

(3). Stigmates semi-linéaires .....***Neoprotobuthus***

4. Sept à neuf séries de granules aux doigts mobiles des mains des pédipalpes; épine sous-aiguillonaire présente et robuste .....***Tityobuthus***

(4). Onze à quatorze séries de granules aux doigts mobiles des mains des pédipalpes; épine sous-aiguillonaire absente .....***Grosphus***

5. Trois paires d'yeux latéraux; deux carènes ventrales parallèles sur les anneaux du metasoma .....Ischnuridae; ***Opisthacanthus***

(5). Deux paires d'yeux latéraux; une seule carène ventrale sur les anneaux du metasoma .....Heteroscorpionidae; ***Heteroscorpion***

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

Genus ***Grosphus*** Simon, 1880

Geographical distribution: Madagascar

Grosphus madagascariensis (Gervais, 1844)

Diagnosis – Scorpions of medium size, adults ranging from 55 to 65 mm in total length. The general coloration varies from reddish-brown to dark brown and blackish, without any particular dark spots. All segments are in general moderately granulated. Keels in the metasomal segments strongly crenulate; dorsal keels with a spinoid granule posteriorly. Dentate margins of pedipalp-chela fingers with 12 oblique rows of granules, without supernumerary granules. Pectine teeth ranging in number from 18 to 20 in males and 16 to 18 in females. Metasomal segments parallel in both males and females. Basal middle lamellae strongly dilated in females with an oval shape.

Geographical distribution. – This species is widely distributed in Madagascar, mainly in the northern and eastern portions of the island, but also known from several sites in the central highlands and south to the Isalo region.

Habitat. – Specimens from the RS de Manongarivo have been taken in montane forest between 1175 and 1240 m. One individual was found under a rotten branch resting on the ground

and others in leaf litter or in pitfall traps sunk into the ground. This species is known to occur in a wide variety of forested and non-forested habitats on the island.

Grosphus flavopiceus Kraepelin, 1900 (Fig. 9-1)

Diagnosis. – Scorpions of large size, adults ranging from 85 to 90 mm in total length. The general coloration can range from yellowish-brown to reddish-orange brown; metasomal segments I to III yellowish; IV and V and vesicle reddish-brown. All segments are in general moderately to strongly granulate, except for the metasomal segments, which are smooth. Dentate margins of pedipalp-chela fingers composed of 13 oblique rows of granules, without supernumerary granules. Pectine teeth ranging in number from 25 to 32: 27 to 32 in males and 25 to 29 in females. Metasomal segments parallel in both males and females and slightly elongated in males. Basal middle lamellae strongly dilated in females with a conic shape and larger than the 3 to 4 anterior teeth.

Geographical distribution. – This species is known from zones that tend to be dry to only seasonally moist in the Province d'Antsiranana (from Ambanja east to the Forêt d'Analamerana), Betafo in the central highlands, and south to the Bemaraha region. Specimens of *G. flavopiceus* from Manongarivo held in the Muséum National d'Histoire Naturelle, Paris, collection do not have any precise locality information.

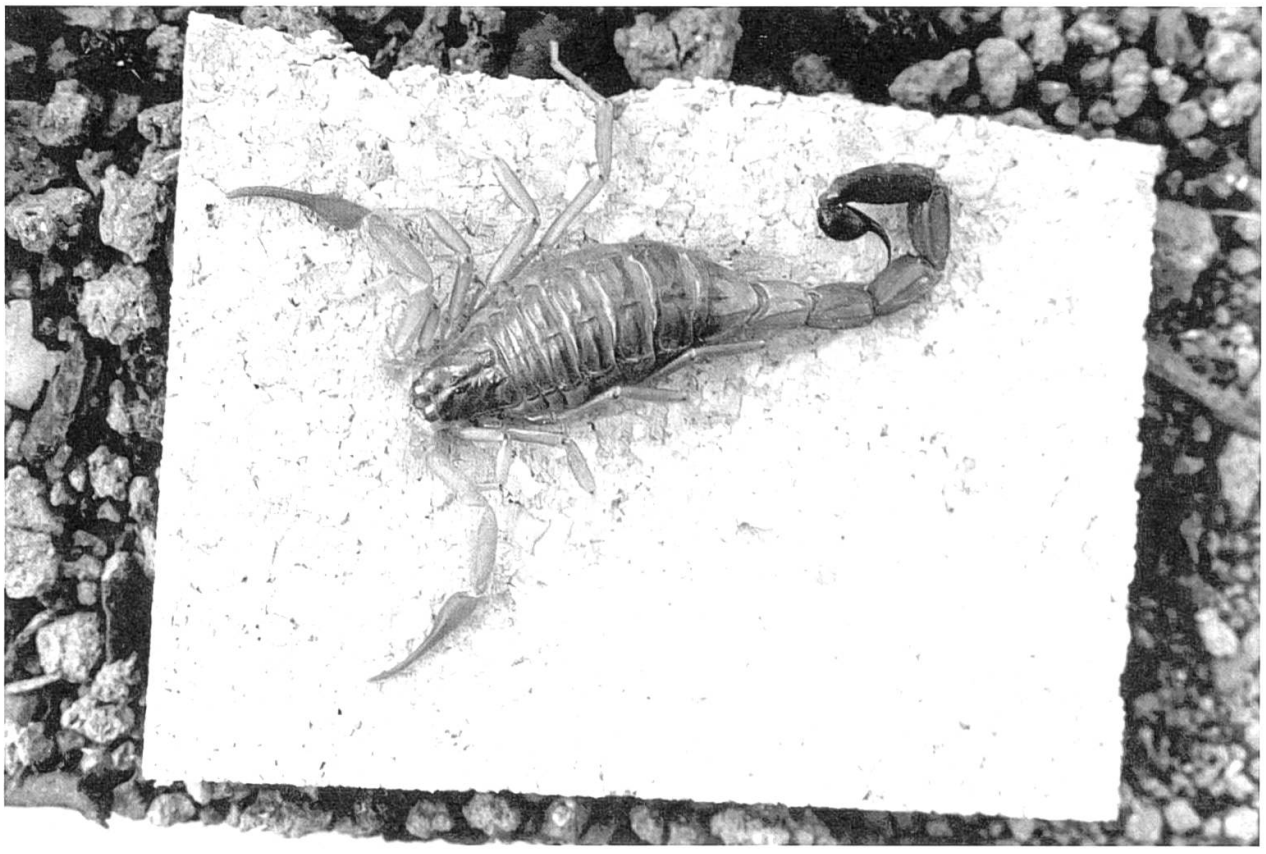

Fig. 9-1. – ***Grosphus flavopiceus.*** Living adult female. — *Femelle adulte vivante.*

Genus ***Tityobuthus*** Pocock, 1893

Geographical distribution: Madagascar

Tityobuthus baroni (Pocock, 1890)

Diagnosis. – Scorpions of small size, between 25 to 30 mm in total length. General coloration from yellowish to reddish, with several darker spots; ventral aspect feebly spotted; chelicera with reticular spots in the central zone. All metasomal segments with keels from moderately crenulate. Vesicle slender with a spinoid subaculear tooth. Dentate margins of pedipalp-chela fingers with 7/8 longitudinal rows of granules, without supernumerary granules. Legs IV with a very reduced tarsal spur, which is often absent. Pectines with fulcra, and with teeth ranging in number from 19 to 22. Metasoma and pedipalps, in general, longer in males than females. Trichobotriotaxy of type A-α.[1]

Geographical distribution. – This species is known from a variety of habitats on Madagascar from dry habitats near Antsiranana, humid forests of the east from Maroantsetra south to Soanierana Ivongo, and islands off the northwest coast (e.g. Nosy Be). Specimens from Manongarivo held in the Muséum National d'Histoire Naturelle, Paris, collection are without any locality details.

Family **Microcharmidae** Lourenço, 1996

Genus ***Microcharmus*** Lourenço, 1995

Geographical distribution: Madagascar

Note. – *Microcharmus* species are among the world's smallest known scorpions and all are forest dwelling, living in the organic soil.

Microcharmus cloudsleythompsoni Lourenço, 1995

Diagnosis. – Scorpions of small size, 12-13 mm in total length. General coloration light yellowish without spots; only medium and lateral eyes are blackish. Three pairs of lateral eyes. Sternum sub-pentagonal to pentagonal. Keels and granulation on carapace and tergites from moderate to feeble. First four metasomal segments with keels from moderate to strongly crenulate; dorsal keels with a small posterior spinoid granule; segment V round with feebly marked keels. Sternites with oval spiracles. Dentate margins of pedipalp-chela fingers with 6-7 longitudinal rows of granules, without supernumerary granules. Legs III and IV without tarsal spurs. Pectines small, without fulcra, and with 10 teeth. Chelicera with the dentition of the Buthoidea, but with the two basal teeth small and almost fused. Trichobotriotaxy of type A-α, orthobothriotaxic.

Geographical distribution. – Only known from the type locality. Province d'Antsiranana, 22 km SW of Ambanja, Djangoa. This site is in the western foothills of the Manongarivo Massif. The only known specimen is in the Muséum National d'Histoire Naturelle, Paris, collection.

Microcharmus madagascariensis Lourenço, 1999

Diagnosis. – Scorpions of small size, 11 to 13 mm in total length. General coloration yellowish with several brown to dark brown spots over the body, pedipalps legs and chelicera.

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[1]Identification of the species of *Tityobuthus* is difficult. It is largely based on the pigmentation patterns of the chelicerae. Most of the species are rare and generally only a single or a few specimens are known of each. With the exception of *T. baroni*, all of the species are endemic to small areas and sometimes to a single locality. The geographic distribution must therefore to be taken in consideration as a parameter in identification.

Ventral aspect less marked by spots. Three pairs of lateral eyes. Sternum sub-pentagonal to pentagonal. Carapace and tergites with feebly marked keels; granulation from moderate to feeble. First four metasomal segments with keels from moderate to strongly crenulate; dorsal keels with a small posterior spinoid granule; segment V round with feebly marked keels. Sternites with semi-oval spiracles. Dentate margins of pedipalp-chela fingers with 6/7 longitudinal rows of granules. Legs III and IV without tarsal spurs. Pectines small, without fulcra, and with 10-11 teeth. Chelicera with the dentition of the Buthoidea, but with the two basal teeth small and almost fused. Trichobotriotaxy of type A-α, orthobothriotaxic.

Geographical distribution. – Only known from the type locality. Province d'Antsiranana, RS de Manongarivo, 12.8 km SW Antanambao, 13°58.6'S, 48°25.4'E, at 780 m. The specimen was taken in lowland forest.

Genus ***Neoprotobuthus*** Lourenço, 2000

Geographical distribution: Madagascar

Neoprotobuthus intermedius Lourenço, 2000

Diagnosis. – Scorpions of small size, between 20 to 25 mm in total length. General coloration yellowish with several brown to dark brown spots over the body pedipalps, legs and chelicera. Medium and lateral eyes blackish. Ventral aspect with only diffuse spots. Three pairs of lateral eyes. Sternum sub-pentagonal. Carapace with very feeble keels; tergites with one axial keel moderately marked; granulation in both carapace and tergites moderate. First four metasomal segments with keels from moderate to strongly crenulate; dorsal keels with a small posterior spinoid granule; segment V round with feebly marked keels. Sternites with small slit-like spiracles. Dentate margins of pedipalp-chela fingers with 8 longitudinal rows of granules, without supernumerary granules. Legs III and IV with tarsal spurs. Pectines very small, without fulcra, and with 10 teeth. Chelicera with the dentition of the Buthoidea, with the two basal teeth small but well distinct. Trichobotriotaxy of type A-α, orthobothriotaxic.

Geographical distribution. – Only known from the type locality. Province d'Antsiranana, RS de Manongarivo, 14.5 km SW Antanambao, 14°0.0'S, 48°25.7'E, 1240 m, primary montane forest, and taken in pitfall traps.

Note. – The genus *Neoprotobuthus* represents a possible link between the families Microcharmidae and Buthidae.

Family **Heteroscorpionidae** Kraepelin, 1905

Genus ***Heteroscorpion*** Birula, 1903

Geographical distribution: Madagascar

Heteroscorpion opisthacanthoides (Kraepelin, 1895)

Diagnosis. – Scorpions of large size, with from 120 to 180 mm in total length. General coloration ranging from reddish-brown to dark brown; legs and sternites paler; immature paler, more to yellowish. Carapace with one strong anterior concavity; two pairs of lateral eyes. Body rather bulky in females but very slender in males which have a very long metasoma. Metasomal segments almost square with a single ventral keel. Pectines with 12-15 teeth. Pedipalps strong in both sexes; chela large and flattened; tibia with a very strong apophysis on the anterior margin; chela fingers with the granules disposed more or less randomly; some small accessory granules

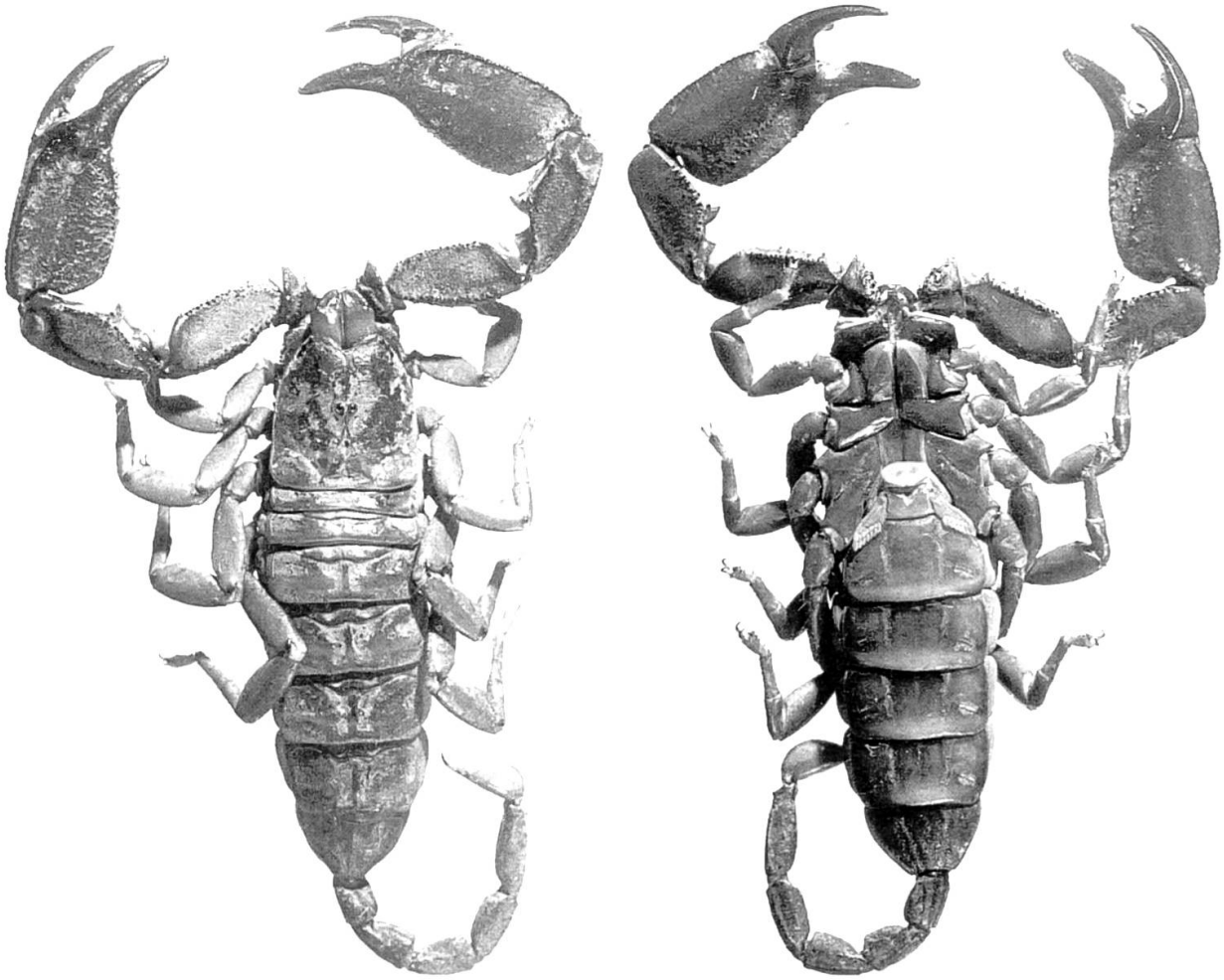

Fig. 9-2. – ***Opisthacanthus madagascariensis.*** Female holotype, dorsal and ventral aspects. — *Holotype femelle, vues dorsale et ventrale.*

present. Legs with two series of spines in the tarsi. Trichobothrial pattern: type C, neobothriotaxic. Hemispermatophore: distal lamina with simple lateral keels, and a strong hook.

Geographical distribution. – Northwest Madagascar, including the Sambirano, Nosy Be, and Nosy Komba. Specimens of *H. opisthacanthoides* from Manongarivo are held in the Muséum National d'Histoire Naturelle, Paris, and lack precise details of collection locality.

Note. – This is the largest species of scorpion occurring in Madagascar.

Family **Ischnuridae** Simon, 1879

Genus ***Opisthacanthus*** Peters, 1861

Geographical distribution: Madagascar, Africa and Neotropical region[2]

Opisthacanthus madagascariensis Kraepelin, 1894 (Fig. 9-2)

Diagnosis. – Scorpions of medium to large size, from 85 to 100 mm in total length. General coloration ranges from reddish-brown to very dark brown; immature much paler, globally yellowish. Body rather bulky, with strong pedipalps and a very weak metasoma. Legs with two series of spines on the tarsi; 3 internal and 3 external. Pedipalp very long; chela large and flattened; tibia with a very strong apophysis on the anterior margin; chela fingers with the granules disposed in two longitudinal parallel series, which may be joined at the base; supernumerary granules absent. Pectines with 5 to 9 teeth. Trichobothrial pattern: type C, orthobothriotaxic. Hemispermatophore: distal lamina with a very complex lateral keel.

Geographical distribution. – Broad distribution from the Province d'Antsiranana (Forêt d'Analamerana), west and then south through the Province de Mahajanga to the Bemaraha region and south of the Mangoky River. Specimens of *Opisthacanthus madagascariensis* from Manongarivo are held in the Muséum National d'Histoire Naturelle, Paris, collection, but lack precise collection details.

The importance of the known scorpion fauna of the Réserve Spéciale de Manongarivo

Although the RS de Manongarivo and nearby areas have not been the subject of any extensive scorpion inventory work, the preliminary results attest to the importance of its fauna. All of the four families of scorpions known on Madagascar are represented in the RS de Manongarivo area.

The family Buthidae is represented by two genera, *Grosphus* and *Tityobuthus* and three species, *G. madagascariensis*, *G. flavopiceus,* and *T. baroni*. On the basis of current information, *G. flavopiceus* and *T. baroni* are apparently restricted to more-or-less the northern portion of the island, whereas *G. madagascariensis* has a broad distribution.

The family Microcharmidae is a typical element of the northern portion of Madagascar and is endemic. It is represented in RS de Manongarivo by the two named genera, *Microcharmus* and *Neoprotobuthus*. The two species of *Microcharmus* known in the area are both endemic; also the genus *Neoprotobuthus* has only been found in the RS de Manongarivo. Four other species of

[2]The genus *Opisthacanthus* is particular in its very broad geographical distribution. It is one of the few genera of scorpions presenting a Gondwanian-type distribution (Lourenço, 1985), with species in Madagascar, Africa, South America, the Caribbean region, and on the Cocos Islands (Costa Rica).

Microcharmus occur on Madagascar, two from Réserve Naturelle Intégrale (RNI) de Lokobe on Nosy Be, and two from the Parc National (PN) de Marojejy.

The family Heteroscorpionidae is also endemic to Madagascar, and represented in forested habitat by only one genus and two species. *Heteroscorpion opisthacanthoides* is present in northwest Madagascar, including Nosy Be and Nosy Komba, however it is possible that its distribution was reduced as consequence of the forest destruction. More recently a second species, *H. goodmani,* was described from the PN d'Andohahela in the extreme southeast. The disjunct range of the two known species could suggest a more or less continuous distribution of this genus in the recent past, over the original primary rain forest formations of the island.

The family Ischnuridae is represented in Madagascar by two genera, *Opisthacanthus* and *Palaeocheloctonus* and three species. *Opisthacanthus* is the only non-endemic genus in Madagascar (see note 2). The two species of this genus present in Madagascar have broad geographical ranges over the island. *O. madagascariensis*, is distributed over the northern and western portions, whereas the *O. punctulatus* is found in the southern and eastern regions. The precise patterns of geographical distribution of the two species are not yet clear and more precise studies are required.

In general over the past decade the use of more sophisticated methods of collecting such as pitfall traps, extraction by Winkler or detection with ultra-violet light, rather than the traditional rock-rolling technique, has lead to the discovery of important new taxa (new genera and species). This is particularly true for the micro-scorpions. Continued use of these methods will probably result in a multiplication of the described Malagasy scorpion fauna by a factor of two or even three.

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