

Notes on the postembryonic development of *Heteroscorpion opisthacanthoides* (Kraepelin, 1896) (Scorpiones, Heteroscorpionidae) from the Island of Nosy Be in the North of Madagascar

WILSON R. LOURENÇO and JOHN L. CLOUDSLEY-THOMPSON

(With 4 figures)

Abstract

Among several specimens of *Heteroscorpion opisthacanthoides* (Kraepelin, 1896) (Scorpiones, Heteroscorpionidae) collected in the North of Madagascar during the early 1980s, two females gave birth in captivity to respectively 16 and 18 offsprings. Some individuals from one parent survived up to the second or third instars, but none was raised to maturity. The duration of the first and second instars averaged 14, and 108 days. These partial developmental periods are comparable with those observed in other species of scorpion, especially of the family Liochelidae, the genus *Opisthacanthus* Peters, 1861. Morphometric values for the different instars have been obtained both from the individual offspring, and also from specimens collected in nature. Based on these data, the average growth factor per molt for each structure was then calculated from the pooled data.

Introduction

During field trips to Madagascar during the early 1980s, colleagues from the Natural History Museum, Paris, collected several living adult and juvenile scorpions on the Island of Nosy Be in the North range of Madagascar. Some of these belonged to the species *Heteroscorpion opisthacanthoides* (Kraepelin, 1896). During that period, the senior author was preparing his doctoral dissertation, based mainly on the study of scorpions of the family Ischnuridae (Lourenço 1985); the genus *Heteroscorpion* Birula, 1903 was then regarded as belonging to this family. Although several publications dealing with the scorpion fauna of Madagascar have appeared in recent years (e.g. Lourenço 1995, 1996, 2001, Lourenço & Goodman 2002), very few studies have yet been carried out on the biology of Madagascan species (Lourenço & Cloudsley-Thompson 1998). Information about the development of scorpions has increased considerably during the last 30 years (Polis & Sissom 1990, Lourenço 1991, 2002), but nothing is yet known regarding the species of the family Heteroscorpionidae which is endemic to Madagascar. It seems therefore worthwhile to describe some observations on the postembryonic development of *H. opisthacanthoides* and to compare these with the available data concerning species of the genus *Opisthacanthus*, which belongs to the family Liochelidae.

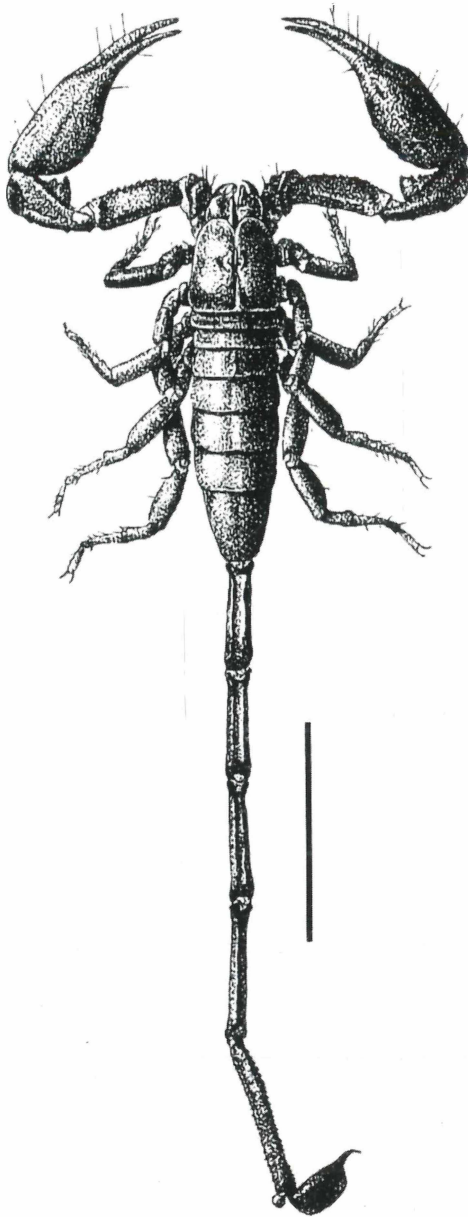


Fig. 1. Adult male of *Heteroscorpion opisthacanthoides* (Kraepelin). (The strongly marked sexual dimorphism, caused mainly by the allometric growth, is shown in male metasoma. Scale bar = 30 mm).

Material and methods

Scorpions were reared by standard methods in plastic terraria of different sizes. These contained a layer of soil, 2-3 cm in depth, as well as a few pieces of bark and a small Petri dish containing water. Food, consisting of crickets, spiders and *Tenebrio* larvae, was provided once every 7 to 10 days. Temperatures ranged from 24 to 27 °C and humidity was maintained at saturation level. After each molt, the exuvia were removed from the terraria. Morphometric growth values were measured both on dead specimens and on these exuvia. Three parameters were recorded: carapace length, length of the metasomal segment V, and length of the movable finger (Lourenço 1979a,b, 2002). The growth factor (Dyar's constant) between succeeding instars was determined for each structure on each individual by dividing the dimension at one instar by the dimension at the previous instar. The average growth factor per molt for each structure was then calculated from the pooled data.

The available voucher material (Island of Nosy Be, Locobé Reserve, 6-7 February 1983, coll. W. R. Lourenço, 18. specimens) has been deposited in the Zoologisches Museum, Hamburg (ZMH Acc. No. A26/03).

Taxonomic position of the family *Heteroscorpionidae* and of *H. opisthacanthoides*

Family *Heteroscorpionidae* Kraepelin, 1905

Genus *Heteroscorpion* Birula, 1903

Large scorpions, with adult females reaching 60 to 145 mm in length and males 90 to 185 mm. Sexual dimorphism is strongly marked, mainly by the allometric growth, shown in males (Fig. 1). Two pairs of lateral eyes. Metasomal segments I to IV very much flattened laterally with a single ventral median carina. Telson weakly elongated in both sexes. Dentate margin of fingers with numerous granules arranged randomly on their basal 2/3rds and forming two vestigial parallel series of granules on the distal portion; a few stronger accessory granules may also be present. Trichobothriotaxy of type C, neobothriotaxic majorante (+), plethotaxic in one species on the patella and chela (chela + fixed finger). Hemispermatophore lamelliform. Venomous glands simple (Lourenço & Goodman 2002).

Geographical distribution of the family: endemic to Madagascar.

Heteroscorpion opisthacanthoides (Kraepelin, 1896)

Large scorpions, with adult females reaching 110 mm in length and males to 140 mm. Coloration, basically reddish-brown with legs paler than the body. Trichobothriotaxy of type C, neobothriotaxic majorante (+); patella with 17-19 external trichobothria, and 10-11 ventral trichobothria; chela (chela + fixed finger) with 8-9 ventral trichobothria. Hemispermatophore lamelliform. Venomous glands simple.

Habitat: humid lowland forest. Geographical distribution in Madagascar: Northwestern region, Province d'Antsiranana (Diego-Suarez), Nosy Be, Nosy Komba, and Ambilobe region.

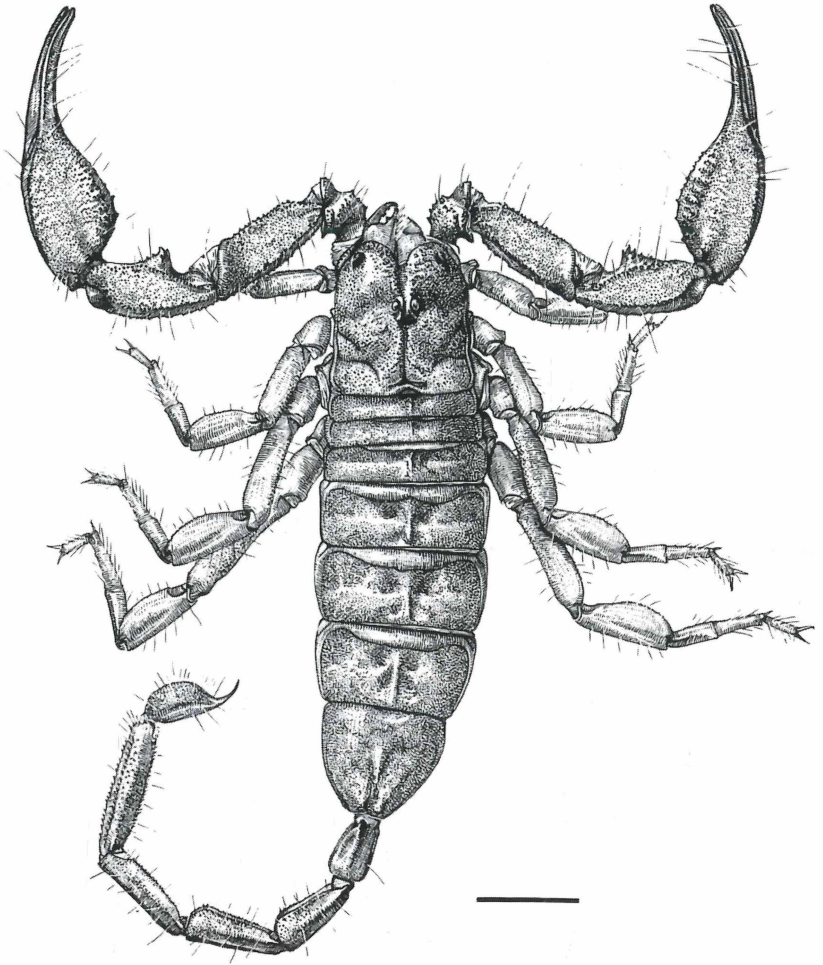


Fig. 2. *Heteroscorpion opisthacanthoides* (Kraepelin), ♀. (Scale bar = 10 mm).

Developmental period

Among other specimens, two adult females of *H. opisthacanthoides* were brought to the former Laboratory of Zoology (Arthropods) in Paris and gave birth to 16 and 18 offsprings respectively on April and May 1983. The young scorpions molted for the first time respectively after 13 and 15 days (average 14) on their mothers' backs. Only three from the batch of 30 survived until the third instar. These molted at an average age of 108 days.

None of the specimens achieved the fourth or subsequent instars.

The time spent in postembryonic development and the duration of the instars necessary to reach adulthood in *H. opisthacanthoides* remain unknown. However, the values observed for the first two instars are not greatly different from those previously observed in some species of *Opisthacanthus* (Lourenço 1985, 2002). Life span is, however, probably longer than what has been observed in liochelid species (Lourenço 2002).

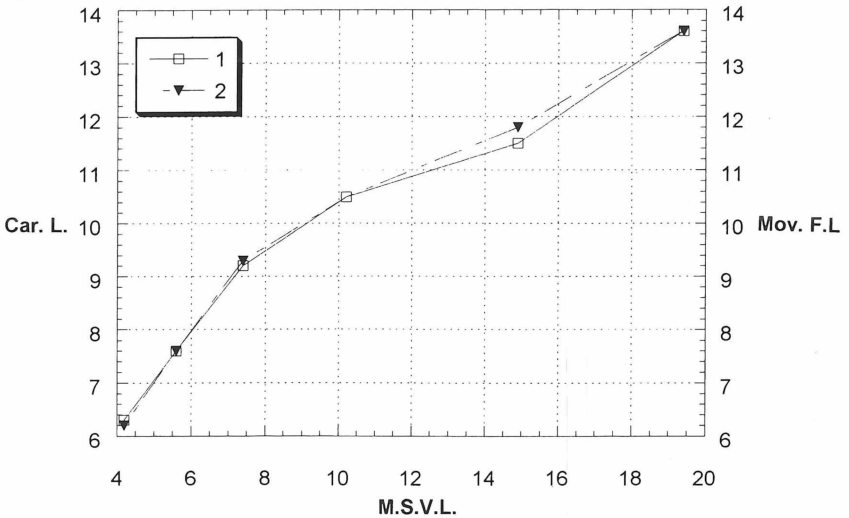
The theoretical morphometric growth values for the development of arthropods, as defined by Dyar (1890) and Przibram & Megusar (1912), is 1.26. The growth parameters based on morphometric values measured both in individuals raised in laboratory and those collected in the field are shown in Table I and Figs. 3-4. Three parameters were considered: carapace length, metasomal segment V length, and movable finger length. The results obtained are not significantly different from those previously observed in species of *Opisthacanthus* (see Lourenço 1985), with the exception of the growth values show by males of *H. opisthacanthoides*, particularly in the last two instars. These values are markedly different in consequence of remarkable allometric growth of the metasoma of the males compared to those of the females.

Table I. Average morphometric values (in mm) for juvenile and adult instars of both males and females of *H. opisthacanthoides* Kraepelin. Values marked * have been estimated.

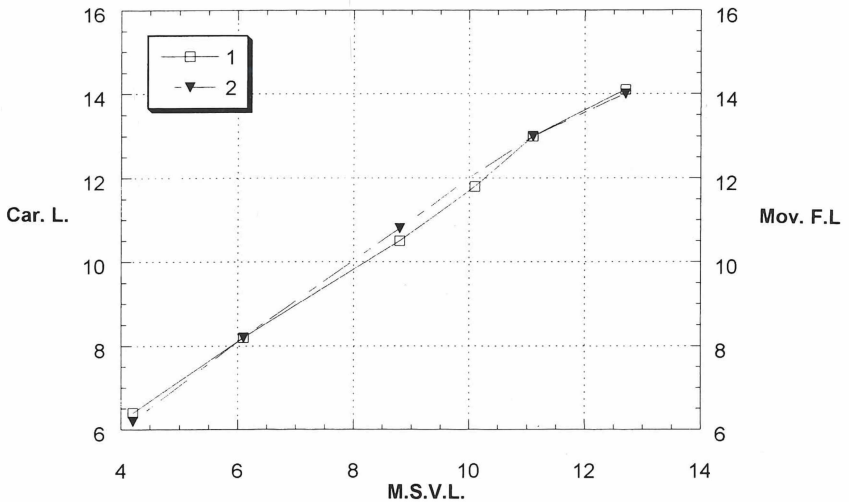
Males				
	Car. L.	M.S.V.L.	Mov. F.L.	G.V.
Instar II	6.3	4.2	6.2	
Instar III	7.6	5.6	7.6	1.21/1.33/1.23
Instar IV*	9.2	7.4	9.3	1.21/1.32/1.22
Instar V	10.5	10.2	10.5	1.14/1.37/1.13
Instar VI	11.5	14.9	11.8	1.10/1.46/1.12
Instar VII (adult)	13.6	19.4	13.6	1.18/1.30/1.16
			AGV	<u>1.17/1.36/1.17</u>
Females				
	Car. L.	M.S.V.L.	Mov. F.L.	G.V.
Instar II	6.4	4.2	6.2	
Instar III	8.2	6.1	8.2	1.28/1.45/1.32
Instar IV*	10.5	8.8	10.8	1.28/1.44/1.32
Instar V*	11.8	10.1	12.1	1.12/1.15/1.12
Instar VI	13.0	11.1	13.0	1.10/1.10/1.07
Instar VII	14.1	12.7	14.0	1.08/1.14/1.08
			AGV	<u>1.17/1.26/1.18</u>

(Car. L. = carapace length. M.S.V.L. = metasomal segment V length. Mov. F.L. = movable finger length. G.V. = growth values. AGV = average growth values).

3 *Growth parameters of H. opisthacanthoides (male)*



4 *Growth parameters of H. opisthacanthoides (female)*



Figs 3-4. The distribution of morphometric values in *Heteroscorpion opisthacanthoides* (Kraepelin) for: **3** - male juvenile and adult instars; **4** - female juvenile and adult instars. (Car. L. = carapace length; M.S.V.L. = metasomal segment V length; Mov. F.L. = movable finger length. 1 = Car.L. vs. M.S.V.L. 2 = Mov. F.L. vs. M.S.V.L.)

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Authors' addresses:

Dr. W. R. LOURENÇO, Département de Systématique et Evolution, Section Arthropodes (Arachnologie), Muséum National d'Histoire Naturelle, 61 rue de Buffon, 75005 Paris, France (e-mail: arachne@mnhn.fr). — Prof. Dr. J. L. CLOUDSLEY-THOMPSON, 10 Battishill Street, Islington, London N1 1TE, United Kingdom.

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Autor(en)/Author(s): Lourenco Wilson R., Cloudsley-Thompson John L.

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