

## Notes on the postembryonic development of *Tityus melanostictus* Pocock, 1893 (Scorpiones, Buthidae) from Trinidad

WILSON R. LOURENÇO, ERIC YTHIER & JOHN L. CLOUDSLEY-THOMPSON

(with 4 figures)

### Abstract

Biological observations were made on *Tityus melanostictus* Pocock, 1893, based on specimens from the region of Cumana, Trinidad. The total duration of embryonic development can only be estimated as 2.5 to 3 months, while the molts necessary for the acquisition of the different juvenile instars and adulthood took place at ages that averaged: 4, 48, 119, 211, 265 and 330 days. These developmental periods are not greatly different from those in other average sized and smaller species of *Tityus*; however, they are shorter than those previously observed in the larger species of the genus. Morphometric growth values of the different instars are smaller than those of other known species of *Tityus*.

**Key words:** Scorpiones, *Tityus melanostictus*, Trinidad, forest, life history.

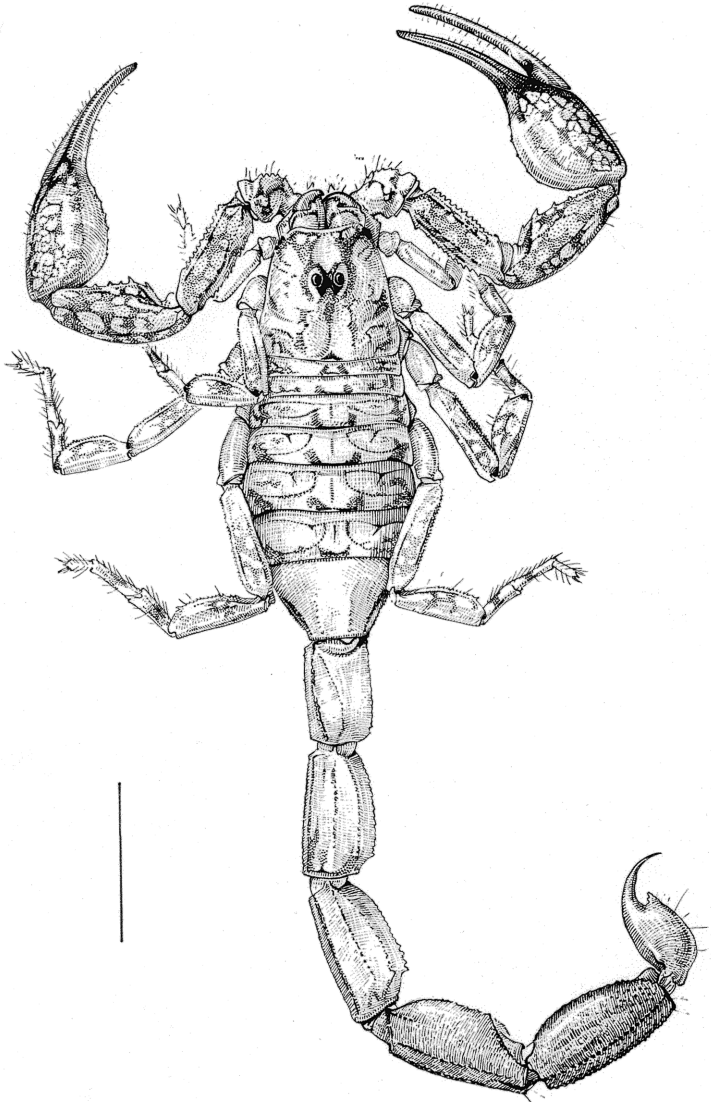
### Introduction

*Tityus melanostictus* Pocock, 1893 was originally described from Trinidad, without reference to a precise locality (Pocock 1893, Lourenço & Eickstedt 1987). This species has a restricted area of distribution limited to Trinidad, Tobago and the North of Venezuela (Lourenço & Eickstedt 1987, Gonzalez-Sponga 1996, Prendini 2001). Since the middle 1970s, biological observations have been made on several species of *Tityus* by the senior author (see Lourenço 2002). Nevertheless, observations on the entire life cycles of most species of this genus remain unavailable. Precise data are, however, now available for *T. melanostictus* with respect to the postembryonic development of the species, and these are summarised below.

### Material and methods

The material was collected in the Cumana region, Trinidad, on 1 July 2006 by E. Ythier.

The 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 and cockroaches was provided once every 7 to 10 days. Temperatures ranged from



**Fig. 1.** Habitus of *Tityus melanostictus* Pocock. Adult male (from Lourenço 1984). (Scale bar = 5 mm).

24 to 27°C and the humidity was maintained at 60-70%. After each moult, the exuvia were removed from the terrarium. Morphometric growth values were measured from individuals that died in captivity and from exuvia. Three parameters were recorded: carapace length, the length of the metasomal segment V, and of the movable finger (Lourenço 1979, 2002). The growth factor (Dyar's constant) between succeeding instars was determined for each individual from each of these three structures (by dividing the dimension at one instar stage by the dimension of the previous instar stage). The average growth factor per moult for each structure was then calculated from the pooled data.

The available voucher material from the laboratory-reared specimens is now deposited in the Zoologisches Museum Hamburg (ZMH Acc. No. A25/08).

### Characteristics of *Tityus melanostictus*

These scorpions are rather small compared with other species in the genus *Tityus* C. L. Koch, 1836. They range from 38 to 45 mm in total length. General coloration, yellowish to slightly reddish-yellow with brownish spots over the body and appendix (Fig. 1). A precise redescription has been published by Lourenço & Eickstedt (1987).

Population densities of several known *Tityus* spp. appear to be high, and *T. melanostictus* seems to be fairly common in Trinidad and Tobago, although it is less abundant than *T. trinitatis* Pocock, 1897, another species of *Tityus* also present in the islands (Lourenço & Huber 1999). The diel behaviour of *T. melanostictus*, both in the field and in the laboratory, is characteristic of a species dwelling in forests (see Cloudsley-Thompson 1981). The scorpions move slowly and only leave their retreats at night. Their predatory technique is of the sit-and-wait type. They wait motionless with the pedipalp fingers opened. Cannibalism seems to be uncommon in areas of primary forest, but may perhaps occur in disturbed regions where scorpion populations normally increase faster. Observations carried out by Prendini (2001) on the species suggested

**Table 1.** Average morphometric values (in mm) for juvenile and adult instars of both males and females of *Tityus melanostictus* Pocock.

	Car. L.	M.S.V.L.	Mov. F.L.	G.V.	No
Instar I	-	-	-		
Instar II	1.9	1.8	2.0	*	
Instar III	2.5	2.4	2.7	1.31/1.35/1.33	14
Instar IV	2.8	2.9	3.4	1.12/1.26/1.21	12
Instar V	3.2	3.2	3.7	1.14/1.09/1.10	11
Instar VI	3.6	3.8	4.5	1.12/1.22/1.19	06
Instar VII (adult)	4.4	4.8	5.6	1.22/1.24/1.26	04

AGV 1.18/1.23/1.22

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.

\* Growth values between instars I and II can be considered as atypical due to very strong morphological differences between juveniles of these instars. For this reason these values are not considered in the final calculation. No = number of individuals measured, including exuvia.



**Figs 2-3.** *Tityus melanostictus* Pocock: **2.** mating behaviour; **3.** female with offspring (pre-juveniles, instar I).

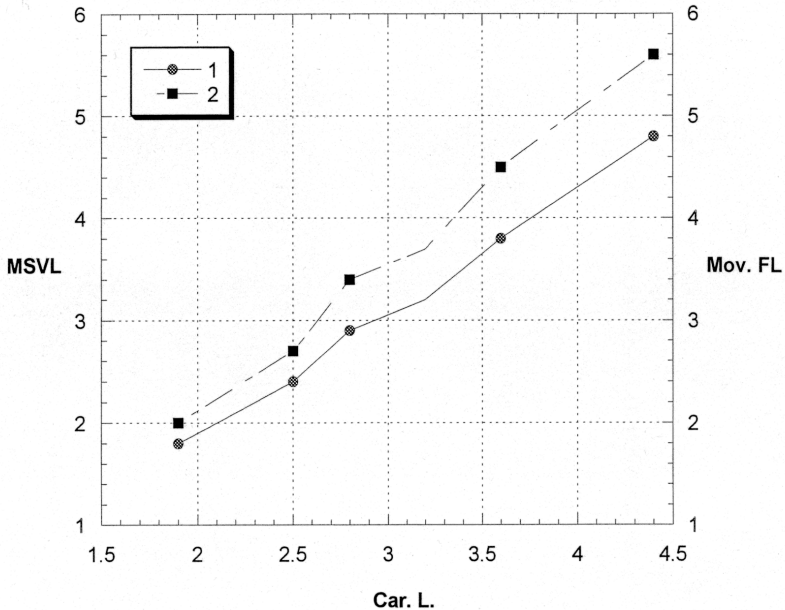
arboreal behaviour, since most specimens were observed motionless on tree branches, at least 1 m above ground level. *T. melanostictus* is found in sympatry with *Ananteris cussinii* Borelli, 1910, *Microtityus rickyi* Kjellesvig-Waering, 1966, *T. trinitatis* Pocock, 1897, *T. clathratus* C. L. Koch, 1844 and *T. tenuicauda* Prendini, 2001. *M. rickyi* is the only other species from Trinidad and Tobago on which observations have been carried out on the life cycle (Lourenço et al. 1999). The available voucher material of the latter species is also deposited in the Zoologisches Museum Hamburg.

### Developmental period

Three females and one male specimen of *Tityus melanostictus* were collected in Cumana, Trinidad on 1 July 2006. They were brought to the laboratory, in France, and on the 15 July one female gave birth to 14 offspring. The full embryonic development was not observed and can only be assumed to be similar to that of other small size species of *Tityus* (i.e. 2.5 to 3 months - Lourenço 2002). After being carried on their mother's back for 4 days, the first moult of the young scorpions was on 19 July 2006 (Figs 2-3). Juveniles began to disperse from their mother's back at the age of 7-8 days. Subsequent molts took place at different ages. The average number of days occupied by each were as follows: The second molt took place between 1 and 2 September 2006 (48 days), the third between 1 and 12 November 2006 (119 days), the fourth between 28 January and 12 February 2007 (211 days), the fifth between 29 March and 4 April 2007 (265 days) and the sixth molt between 30 May and 12 June 2007 (330 days).

The time spent in postembryonic development and the duration of the instars necessary to reach adulthood in *T. melanostictus* are not greatly different from those observed in other average sized species of *Tityus*, but are shorter than those previously observed in larger species of the genus (Lourenço 2002, Lourenço & Cloudsley-Thompson 1999, Lourenço et al.

### Growth parameters of *T. melanostictus*



**Fig. 4.** The distribution of morphometric values (in mm), in juvenile and adult instars of *Tityus melanostictus* Pocock (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 = Car. L. vs. Mov. F.L.).

2000). Of the four scorpions that reached adulthood, two died shortly afterwards, whereas the two others are still alive at the time of writing this note (December, 2007). Consequently the duration of life span in *Tityus melanostictus* can only be assumed with certainty as being similar to that observed in many other small species of buthids (Lourenço 2002).

The theoretical morphometric growth factor for arthropods, as defined by Dyar (1890) and Przibram & Megusar (1912), is 1.26. Growth parameters based on morphometric values, measured both on dead individuals and on exuvia, are shown in Fig. 4. Three parameters were considered: the length of the carapace, of the movable finger, and of metasomal segment five. The results obtained for morphometric growth values of the different instars in *T. melanostictus* are smaller than those obtained for most other species of *Tityus* (Lourenço 1979, 1992, 2002, Lourenço & Eickstedt 1988, Lourenço & Cloudsley-Thompson 1998, 1999, Lourenço et al. 2000).

Variability in the developmental period was only observed in some individuals. A few of these passed through an extra instar before they become adult. In such cases the adults were larger than usual. The existence of both small and large adults and, in particular, of small and large males has previously been observed in *T. fasciolatus* Pessôa, 1935, a savannicolous species (Lourenço 1979, 1995).

## References

- Cloudsley-Thompson, J. L. 1981: A comparison of rhythmic locomotory activity in tropical forest Arthropoda with that in desert species. – *J. arid Environ.*, **4**: 327-334. London.
- Dyar, H. 1890: The number of molts in Lepidopterous larvae. – *Psyche*, **5**: 420-422. Cambridge.
- González-Sponga, M. A. 1996: Guía para identificar escorpiones de Venezuela. – Cuadernos Lagoven, 204 pp. Caracas.
- Lourenço, W. R. 1979: La biologie sexuelle et développement psotembryonnaire du scorpion Buthidae: *Tityus trivittatus fasciolatus* Pessôa, 1935. – *Rev. Nordestina Biol.*, **2** (1-2): 49-96. João Pessôa.
- Lourenço, W. R. 1984: Analyse taxonomique des scorpions du groupe *Tityus clathratus* Koch, 1845 (Scorpiones, Buthidae). – *Bull. Mus. natn. Hist. nat.*, 4<sup>e</sup> sér., **6** (A-2): 349-360. Paris.
- Lourenço, W. R. 1992: Biogéographie évolutive, écologie et les stratégies biogéographiques chez les Scorpions néotropicaux. – *C. R. Séan. Soc. Biogéogr.*, **67** (4): 171-190. Paris.
- Lourenço, W. R. 1995: *Tityus fasciolatus* Pessôa, Scorpion Buthidae à traits caractéristiques d'une espèce non-opportuniste. – *Biogeographica*, **71** (2): 69-74. Paris.
- Lourenço, W. R. 2002: Reproduction in scorpions, with special reference to parthenogenesis. – Pp. 71-85, In: S. Toft & N. Scharff (eds.), *European Arachnology 2000*. Aarhus University Press. Aarhus.

- Lourenço, W. R. & Cloudsley-Thompson, J. L. 1998: A note on the postembryonic development of the scorpion *Tityus bastosi* Lourenço, 1984. – News. Brit. arachnol. Soc. **83**: 6-7. London.
- Lourenço, W. R. & Cloudsley-Thompson, J. L. 1999: Notes on the ecology and postembryonic development of *Tityus insignis* (Pocock, 1889) (Scorpiones, Buthidae) from the Island of St. Lucia in the Lesser Antilles. – Biogeographica, **75** (1): 35-40. Paris.
- Lourenço, W. R. & Eickstedt, V. R. D. 1987: Contribuição ao conhecimento taxonômico dos escorpiões associados ao grupo *Tityus melanostictus* Pocock, 1893 (Scorpiones, Buthidae). – Mem. Instit. Butantan, **49** (3): 87-95. São Paulo.
- Lourenço, W. R. & Eickstedt, V. R. D. 1988: Notes sur le développement post-embryonnaire de *Tityus strandi* (Scorpiones, Buthidae). – J. Arachnol., **16**: 392-393. Lawrence.
- Lourenço, W. R. & Huber, D. 1999. Additions to the scorpion faunas of Trinidad and Tobago. – Rev. suisse Zool., **106** (1): 249-267. Geneva.
- Lourenço, W. R., Huber, D. & Cloudsley-Thompson, J. L. 1999. Notes on the postembryonic development of two species of *Microtityus* Kjellesvig-Waering from Trinidad and Dominican Republic (Scorpiones, Buthidae). – Acta Biol. paranaense, **28** (1-4): 1-9. Curitiba.
- Lourenço, W. R., Huber, D. & Cloudsley-Thompson, J. L. 2000. Notes on the ecology, distribution and postembryonic development of *Tityus cambridgei* Pocock, 1897 (Scorpiones, Buthidae) from French Guyana and Oriental Amazonia. – Entomol. Mitt. zool. Mus. Hamburg, **13** (162): 197-203. Hamburg.
- Pocock, R. I. 1893: Contributions to our knowledge of the arthropod fauna of the West Indies. I. Scorpiones and Pedipalpi. – J. Linn. Soc., **24**: 373-409. London.
- Prendini, L. 2001. Further additions to the scorpion fauna of Trinidad and Tobago. – J. Arachnol., **29**: 173-188. Lawrence.
- Przibram, H. & Megusar, F. 1912: Wachstumsmessungen an *Sphodromantis bioculata* Burm. 1. Länge und Masse. – Archiv für Entwicklungsmechanik der Organismen (Wilhelm Roux), **34**: 680-741. Leipzig.

#### Authors' addresses:

Dr. W. R. LOURENÇO, Muséum national d'Histoire naturelle, Département de Systématique et Evolution, USM 0602, Section Arthropodes (Arachnologie), CP 053, 57 rue Cuvier 75005 Paris, France; (e-mail: arachne@mnhn.fr);

Eric Ythier M.Sc., SynTech Research, 613 route du Bois de Loyse, 71570 La Chapelle de Guinchay, France, (e-mail: eythier@syntechresearch.com);

Prof. John L. Cloudsley-Thompson, 10 Battishill Street, Islington, London N1 1TE, United Kingdom.