SHORT COMMUNICATION

CONFIRMATION OF PARTHENOGENESIS IN *TITYUS TRIVITTATUS* KRAEPELIN 1898 (SCORPIONES, BUTHIDAE)

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ABSTRACT. The parthenogenesis in *Tityus trivittatus* Kraepelin 1898, is confirmed for the first time, based on the progeny of three virgin females raised in isolation since their birth. The possible and occasional introduction of this species into Uruguay is discussed.

Keywords: Scorpions, asexual reproduction, Uruguay

Just seven species of scorpions, from a total of approximately 1500 known (Fet et al. 2000), have been documented as parthenogenetic. Of these seven species, six belong to the family Buthidae: *Hottentotta hottentotta* (Fabricius 1787), *Ananteris coineaui* Lourenço 1982 (following Lourenço 1994 and Lourenço & Cuellar 1999, respectively) and four species of the neotropical genus *Tityus* Koch 1836: *T. serrulatus* Lutz & Mello 1922, *T. uruguayensis* Borelli 1901, *T. colombianus* (Thorell 1876) and *T. metuendus* Pocock 1897 (Matthiesen 1962; Zolessi 1985; Lourenço 1991 & Lourenço & Cuellar 1999, respectively). However, the unisexual condition of populations of *T. uruguayensis* has been disputed (Toscano-Gadea 2001). The remaining species belongs to Ischnuridae: *Liocheles australasiae* (Fabricius 1775) according to Makioka & Koike (1984, 1985), Makioka (1992, 1993) and Yamazaki et al. (2001). In general, this kind of asexual reproduction can be considered unusual (conversely, see Lourenço 2000).

Tityus trivittatus Kraepelin 1898 is a medium-sized scorpion, growing up to 65 mm long, presenting an orange-yellow or reddish coloration, with three dark brown longitudinal bands that go from tergite I to IV (a detailed description was included in Maury 1970, 1997). The distribution of this species includes Argentina, Paraguay, Brazil and Uruguay; bisexual populations are found in Paraguay, Brazil and northern Argentina (Maury 1970, 1997).

Knowledge of the biology of this species is important due to the possible medical significance of its venom, its synanthropic character and its apparent proclivity for asexual reproduction. The possibility of parthenogenesis in *Tityus trivittatus* was first suggested by Maury (1970, 1997) and later by Peretti (1994, 1997). Maury (1970) suggested that this species is parthenogenetic after finding a disproportionate sex-ratio of 1 male: 145 females. In 1997, the same author surveyed 236 individuals, finding only two males. He also held in isolation two individuals captured in the city of Buenos Aires, Argentina, which gave birth to 8 and 13 young scorpions, respectively, after molting into adulthood. Thus, there is strong indirect evidence of the existence of facultative parthenogenesis in this species. However, as females of *Tityus* can molt after giving birth (Toscano-Gadea 2001), and eventually maintain sperm in their reproductive tract, the progeny obtained by Maury would not necessarily be an evidence of parthenogenesis. Later on, Maury (1997) tried to raise this species in captivity but failed, due to difficulties presented in the breeding. Even raised under strict temperature, humidity and feeding conditions, the scorpions rarely survived for more than the second or third instar.

The objective of this study was to test the parthenogenetic condition of *T. trivittatus* through successive generations and describe the development in captivity of the progeny.

In 1999, one female of *T. trivittatus* was captured in the city of Córdoba, Argentina and donated to the author by Dr. Alfredo Peretti. This female gave birth to sixteen young scorpions in January 2000 and died in February 2001, with eleven scorpions ready to be born. The second instar juveniles were separated from their mother after the first molt, approximately sixteen days after their birth, and from that moment on, were kept in individual Petri dishes

Table 1.—Duration of each juvenile stage in *T. trivitattus* Kraepelin 1898. All the individuals first molted 14–18 days after their birth. The numbers that appear under the second, third and fourth molt columns correspond to intermolt periods. Only the individuals that survived after the second molt were considered. The (—) represents no data available.

Number of the individual	First molt	Second molt	Third molt	Fourth molt
1	14–18 days	299 days	391 days	—
2	14–18 days	297 days	399 days	361 days
3	14–18 days	343 days	349 days	Died; 6 Oct. 2001
4	14–18 days	304 days	Died; 12 Feb. 2001	—
5	14–18 days	342 days	Died; 4 Nov. 2001	—
6	14–18 days	347 days	Died; 12 Feb. 2001	—
7	14–18 days	324 days	Died; 17 April 2001	—
8	14–18 days	295 days	410 days	345 days
9	14–18 days	342 days	368 days	—
Mean	16 days	321.4 days	383.4 days	353 days

of 8.5 cm diameter and 1 cm height. I used flattened soil as substrate (with stones providing refuges) and a fresh water supply. After the second molt, they were placed in bigger containers (9.5 cm diameter x 11 cm height), with the same substrate. In both containers, the substrate was changed every 30–45 days. The alimentation consisted principally of juvenile and adult spiders: *Schizocosa malitiosa* (Tullgren 1905), *Lycosa thorelli* (Keyserling 1877) and *Metaltella simoni* (Keyserling 1877), cockroaches: *Periplaneta americana* (Linnaeus), *Blatta* sp. and *Blattella* sp., and green grasshoppers belonging to the family Decticinidae. All juvenile scorpions were fed at the same time, with the same kind of prey, at least every 15 days. The remnants of prey were immediately taken away to avoid the appearance of fungi and mites. The containers were kept in a room with natural illumination and a temperature of 23.9 °C ± 5.0. The humidity varied from 60–80 %. The female and the individuals that died during their development were deposited in the Arachnological Collection of the Sección Entomología of Facultad de Ciencias, Montevideo.

The results of the juvenile stage duration are shown in Table 1. Seven individuals died before the second molt, four died after the second and one individual died after the third molt. Of the remaining 4, one female (number one) gave birth to twelve offspring after the third molt, produced a second clutch and then died. When she was dissected, only ovaries were found. Two other females (numbers two and eight) gave birth to six and 11 offspring, respectively, after the fourth molt. The remaining individual (number nine), is alive after three molts, without any progeny yet (Table 2). From these data, we are able to confirm the thelytokous parthenogenesis in *T. trivittatus*. This species should be added to the list of parthenogenetic scorpions, increasing the number to eight in this order.

In addition, the second clutch of female number one confirmed the capacity of multiple parturition in *T. trivittatus*, already pointed out by Peretti (1997). According to Polis & Sissom (1990), this peculiarity is shared with the parthenogenetic *T. serrulatus* but probably not with *T. uruguayensis* (Toscano-Gadea 2001 and unpub. data).

Approximately 95% of all living species reproduce sexually (Lourenço 2000). However, parthenogenesis would offer advantages for the species that practice it, namely the foundation of a new population by only one individual and rapid colonization of new habitats (San Martín & Gambardella 1966; Cuellar 1977, 1994; Maury 1997; Lourenço & Cuellar 1995, 1999; Lourenço 2000). *Tityus trivittatus* would appear to be a good colonizer in new environments, based on the possibility of unisexual reproduction, but also because of their ability to reproduce after fewer molts (three or four) than other *Tityus* species as *T. serrulatus* and *T. uruguayensis* which need five molts to become adults (Matthiesen 1962; Zolessi 1985).

The presence of *T. trivitattus* in Uruguay was pointed out by Maury (1997) based on three individuals collected in Colonia, Uruguay (''Estancia del Dr. Rebuffo'', 15 km from Colonia City, II-1985, D.J. Carpintero coll.) a neighboring province of Buenos Aires, Argentina, separated only by a narrow section of the Río de la Plata. If we consider the abundant information about scorpions that colonize new areas by anthropogenic means (Goyffon 1992; Lourenço et al. 1994; Lourenço & Cuellar 1995; Toscano-Gadea 1998) and the great quantity of tourists from Argentina that visit the city of Colonia from December–March (similar period of major activity for this species according Maury (1997)) we consider reasonable that this species could have entered Uruguay by human transport. Conversely, there have not been any new records

Table 2.—Development of the progeny of the female *T. trivitattus* Kraepelin 1898, born on the 10th of January 2000. The question mark in the last column for individual number 9 represents no progeny at the present. Only the individuals that survived after the second molt were considered. The (—) represents no data available.

Individual #	First molt	Second molt	Third molt	Fourth molt	Observations
1	14–18 Jan. 2000	12 Nov. 2000	8 Dec. 2001	—	Gave birth to twelve scorpions 1 Jan. 2003 and seven in 3 Mar. 2003
2	14–18 Jan. 2000	10 Nov. 2000	15 Dec. 2001	12 Dec. 2002	Gave birth to six scorpions 9 Mar. 2003
3	14–18 Jan. 2000	26 Dec. 2000	11 Dec. 2001	—	Died; 6 Oct. 2001
4	14–18 Jan. 2000	17 Nov. 2000	—	—	Died; 12 Feb. 2001
5	14–18 Jan. 2000	25 Nov. 2000	—	—	Died; 4 Nov. 2001
6	14–18 Jan. 2000	30 Nov. 2000	—	—	Died; 12 Feb. 2001
7	14–18 Jan. 2000	7 Dec. 2000	—	—	Died; 17 April 2001
8	14–18 Jan. 2000	7 Nov. 2000	23 Dec. 2001	4 Dec. 2002	Gave birth to eleven scorpions 15 Feb. 2003
9	14–18 Jan. 2000	21 Dec. 2000	25 Dec. 2001	—	?

for this species in Uruguay during the last 18 years, and never in the departaments of Maldonado and Rocha, that are the most visited by tourists. Finally, the introduction of this species in Uruguay seems to have been occasional, and the transport method, for the moment, an enigma.

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