96. Parthenogenesis in the Viviparous Scorpion, *Liocheles australasiae*^{*)}

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In scorpions, occurrence of parthenogenesis has been known in the ovoviviparous species, *Tityus serrulatus*,¹⁾ but has never been reported in viviparous species. On the basis of observations on several aspects of sex and reproduction in the viviparous scorpion, *Liocheles australasiae*, we came to the conclusion that thelytokous parthenogenesis takes place in this species.

Materials and methods. During a period from July, 1977, through October, 1983 (Table I), we collected, in different seasons, a total of 156 live specimens of *Liocheles australasiae* in the Iriomote Island, one of the Ryukyu Islands, Japan. These animals were examined for sex by studying external sexual characteristics, internal sex organs and/or histological features of the gonads. Some of them were kept alive in separate glass tubes with live termites as food.

Results. 1) Sex of the specimens. Larger individuals were mostly pregnant females (Table I). They had swollen ovarian diverticula protruding outwards from the ovarian tubes, each with an embryo within (Fig. 1). These swollen diverticula were visible from the outside of the body through the semitransparent fore-abdominal ventral plates. A few of the larger individuals were post-partum females bearing empty ovarian diverticula (Fig. 2) and the remaining specimens were mostly nymphal females having numerous oocytes in the ovarian tubes (Fig. 3). By contrast, in small young nymphs with thread-like rudimental gonads carrying a large number of germ cells (Fig. 4), sexes were not distinguishable.

No individuals had the distinct male gonads and no spermatozoa could be detected in any region of the female reproductive systems.

2) Pregnancy in isolated individuals. Most of the pregnant females gave birth to nymphs during the rearing. About a week after the parturition, all of the females became pregnant again. In six females, the next parturition took place about one year or more after

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Table I. Sex of specimens of *Liocheles australasiae* dealt with in this paper

Date of collection	Number of specimens					Total
	Adult female		Nymphal female	Young nymph*	Adult or nymphal male	
	Pregnant	Non-pregnant				
4 Jul. 1977	7	0	5	0	0	12
4 Jul. 1978	19	1	7	0	0	27
29 Nov. 1979	34	1	13	4	0	52
14 Mar. 1982	8	0	2	0	0	10
18 Jun. 1982	14	0	7	2	0	23
17 Nov. 1982	16	1	5	1	0	23
15 May 1983	1	0	1	1	0	3
13 Oct. 1983	4	0	1	1	0	6
Total	103	3	41	9	0	156

* Sex not determinable.

Figs. 1-4. 1: Ovary with swollen ovarian diverticula (sd). od, oviduct; ot, ovarian tube. Scale: 1 mm. 2: Ovary immediately after parturition. ed, empty ovarian diverticula; od, oviduct; ot, ovarian tube; p, pectine. Scale: 1 mm. 3: Young ovarian tube (ot) with two oocytes (oc). Haematoxylin-eosin staining. Scale: 20 μ m. 4: Young gonad (g) containing some undifferentiated germ cells (gc). Haematoxylin-eosin staining. Scale: 20 μ m.

the first and this was followed by pregnancy. In these females, therefore, pregnancies were repeated at least three times. Moreover, three subadult females molted into adults, and about a month after the molting, all of them were found to be pregnant.

In these females, pregnancy undoubtedly occurred under the isolated conditions, without any participation of males. No spermatozoa could be found in any part of the reproductive systems of these females.

Discussion. It is highly probable that the present specimens, collected from a localized region of the Iriomote Island in various seasons of the year and composed of a good many individuals at various developmental stages, may represent a natural population of *L. australasiae* in the island. The occurrence of pregnancy in females in the absence of males in our collection (Table I), therefore, strongly suggests that thelytokous parthenogenesis also takes place under natural conditions. Occurrence of pregnancy in isolated females also appears to make it evident that they became pregnant parthenogenetically. It is improbable that the females had received sperm before they were collected, because spermatozoa were never detected in any part of their reproductive systems and no males were found in the collection. In conclusion, thelytokous parthenogenesis takes place at least in the population of *L. australasiae* herein dealt with.

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Reference

- 1) Matthiesen, F. A. (1962): *Evolution*, **16**, 255-256.