Notes on reproduction of the snake-eyed skink, *Ablepharus kitaibelii* (Squamata: Scincidae) from Israel

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The snake-eyed skink, *Ablepharus kitaibelii* is widely distributed in the Old World including most of eastern and southern Europe, Turkey and middle eastern countries (Uetz & Hosek, 2012). Reports on its reproduction include clutches of 2-4 eggs in Bulgaria and Greece (Beshkov & Nanev, 2006; Valakos et al., 2008); 4-5 eggs in Romania (Fuhn & Vancea, 1961), 2-5 eggs in Turkey (Baran & Atatür, 1998) and a maximum of 3 eggs per clutch in Israel (Bar & Haimovitch, 2011). The purpose of this paper is to present data on reproduction of *A. kitaibelii* in Israel, including the first histological information on the testicular cycle. Minimum sizes for male and female reproductive activity in Israel are presented. Information on the reproductive cycle including period of sperm production, timing of yolk deposition and number and sizes of clutches provides important information in formulating conservation policies for lizard populations.

Due to the difficulty in justifying collections of monthly lizard samples, utilization of museum collections for obtaining reproductive data has become increasingly important.

A sample of 46 adult *A. kitaibelii* was borrowed from the herpetology collection of the National Collections of Natural History at Tel Aviv University (TAUM), Tel Aviv, Israel consisting of 21 males (mean SVL = 30.2 mm ± 3.9 SD, range = 23-38 mm), 21 females (mean SVL = 33.7 mm ± 2.8 SD, range = 31-42 mm) and 4 sub-adult females (mean SVL = 27.5 mm ± 0.58 SD, range = 27-28 mm) collected during 1942-2003 was examined (Appendix).

Lizard body sizes (snout-vent length) were measured to the nearest mm using a plastic ruler. For histological examination, the left testis was removed from males and the left ovary was removed from females. Enlarged follicles (> 3 mm length) or oviductal eggs were counted (in situ). Tissues were embedded in paraffin and cut into sections of 5 µm. Slides were stained with Harris' hematoxylin followed by eosin counterstain (Presnell & Schreibman, 1997). The slides of testes were examined to determine the stage of the spermatogenic cycle while the slides of ovaries were examined for the presence of yolk deposition or corpora lutea. Histology slides were deposited in TAUM. An unpaired t-test was used to compare *A. kitaibelii* male and female mean body sizes (Instat, vers. 3.0b, Graphpad Software, San Diego, CA).

Three stages were noted in the testicular cycle (Table 1): (1) regressed in which the seminiferous tubules contain mainly spermatogonia with interspersed Sertoli cells; (2) recrudescence in which the proliferation of germ cells for the next period of sperm formation has commenced. Primary spermatocytes predominate; (3) spermiogenesis in which the lumina of the seminiferous tubules are lined by sperms and/or clusters of metamorphosing spermatids. Spermiogenesis occurs during the spring and was also observed in one male from November (Table 1). Two males from March had not commenced spermiogenesis and exhibited recrudescence. Epididymides were not sectioned but all were enlarged in males undergoing spermiogenesis and presumably contained sperm. The smallest reproductively active male (spermiogenesis in progress) measured 23 mm SVL (TAUM 2967) and was collected in March. Twenty-three mm may be an approximation for minimum reproductive size as no males smaller than this size were examined.

The mean SVL of *A. kitaibelii* females was significantly larger than that of males (unpaired t-test, t = 3.1, df = 38, P = 0.004). Four stages were observed in the ovarian cycle (Table 1): (1) quiescent, in which there is no yolk deposition; (2) early yolk deposition, in which vitellogenic granules are accumulating within some follicles; (3) enlarged pre-ovulatory ovarian follicles > 3 mm; (4) oviductal eggs (eggs in oviducts). Reproductively active females were present in March, April and

Males				
Month	N	Regression	Recrudescence	Spermiogenesis
February	1	1	0	0
March	9	0	2	7
April	9	1	0	8
May	1	0	0	1
November	1	0	0	1

Females					
Month	N	Quiescent	Early yolk deposition	Follicles > 3 mm	Oviductal eggs
February	1	1	0	0	0
March	5	4	1	0	0
April	12	6	2	2	2
May	1	1	0	0	0
July	1	1	0	0	0
September	1	1	0	0	0

Table 1. Monthly stages in the testicular cycle of 21 *A. kitaibelii* males and 21 females from Israel.

Month	N	Quiescent	Early yolk deposition	Follicles > 3 mm	Oviductal eggs
February	1	1	0	0	0
March	5	4	1	0	0
April	12	6	2	2	2
May	1	1	0	0	0
July	1	1	0	0	0
September	1	1	0	0	0

Table 2. Monthly stages in 21 *A. kitaibelii* females from Israel.

June. There was no evidence (oviductal eggs or corpora lutea and concomitant yolk deposition in the same female) to indicate *A. kitaibelii* produces multiple clutches. Mean clutch size (n = 4) is 1.5 ± 0.58 SD, range = 1-2. The smallest reproductively active female (TAUM 2530) measured 33 mm SVL (enlarged ovarian follicle > 3 mm) and was collected in June. I arbitrarily selected 30 as the minimum size for reproductive maturity in females and considered 3 females of 27, 27 and 28 mm SVL as subadults.

My sample size is too small for a definitive description of the *A. kitaibelii* reproductive cycle in Israel. Nevertheless, some conclusions can be made. Reproduction occurs in the spring in Israel as has also been reported to occur in Northern Cyprus (Göcmen et al., 1996), Bulgaria (Stojanov et al., 2011) and Greece (Valakos et al., 2008). Sperm formation commences in late autumn in Israel as one male from November was undergoing spermiogenesis. There was no evidence that females produce multiple egg clutches in the same reproductive season, although this may have resulted from my small sample size. In view of the extensive range of *A. kitaibelii* (Uetz & Hosek, 2012) subsequent study of populations from other areas in its range are warranted to ascertain if there is geographic variation in reproduction.

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APPENDIX

Ablepharus kitaibelii from Israel examined by District: Center, (TAUM) 736, 11436; Haifa, (TAUM) 746, 4936, 5154, 5155, 13789; Jerusalem, (TAUM) 12372, 14869; Northern, (TAUM) 732, 734, 739, 740, 743, 747, 749, 1437, 2528-2531, 2904, 2966- 2968, 3859, 3883, 6026, 6057, 6060, 6062, 11143, 12073, 12371, 12688, 12968, 13406, 15710; Southern, (TAUM) 5980, 8504, 8951, 12960, 13781; Tel Aviv, (TAUM) 3957, 3958, 9375.

Body-bending behaviour: a new instance in a terrestrial snake from Brazil

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Snakes exhibit a wide range of antipredator tactics including cryptic colouration, immobility, struggling, cloacal discharging, sound production, S-coil posture, vibrating the tail, actively breaking the tail, exuding blood from the eyes, feigning death, biting and spitting venom (Greene, 1997). In addition, a defensive behaviour called body-bending has been described for the first time for two species of arboreal colubrids, *Pseustes poecilonotus* and *P. sulphureus* (Beebee, 1946; Abuys, 1986). This behaviour was then interpreted as a defensive tactic in which, by bending its body, a snake can increase the resemblance it may already have to some portions of its habitat as bent sticks and lianas that are often found among branches in the canopy or on the forest floor,