Spermatogenesis Timing in a Population *Ophisops elegans* (Sauria: Lacertidae), Western Iran

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Abstract.- During biological activity, specimens of *Ophisops elegans* were collected in western Iran, from March to November. Testis were removed and H&E techniques were used for histological study. The results show three phases in spermatogenesis timing as follows: (a) active phase, spermatogenesis in all specimens is active, (b) transitional phase, spermatogenesis in many specimens are active an in other is inactive, and finally (c) inactive phase, spermatogenesis in all specimens is inactive.

Keywords.- Spermatogenesis timing, testicular cycle, *Ophisops elegans*, Zagros mountains, western Iran.

Introduction

Lizards show two type of spermatogenesis; continuous and alternate (Torki, in press a, b). In the continues type, spermatogenesis is year-round and spermatozoa are foudn in the lumen of the seminiferous all year (e.g., Hernandez-Gallegos et al., 2002; Sherbrooke, 1975; Vieira et al., 2001). In contrast, the alternate type of spermatogenesis occurred during a well defined period in which spermatozoa were not found in the lumen of seminiferous (Castilla and Bauwens, 1990; Fitch, 1970; Torki, 2006, in press a, b, c). Continuous spermatogenesis occurs in tropical regions (Fitch, 1970; Hernandez-Gallegos et al., 2002; Vieira et al., 2001), this region limited by author into ITCZ region (Torki, 2006). Alternate spermatogenesis occurred in non-tropical regions, especially in temperate zones (Castilla and Bauwens, 1990; Torki, 2006). In the temperate-zone, the male testicular cycle is divided into two well-defined phases as follows: (a) the regenerative phase that occurs in the spring and is characterized by sustained sperm production, and (b) the degenerative phase, that begins in late summer, where a break in spermatogenesis is observed (Castilla and Bauwens, 1990; Fitch, 1970; Lofts, 1987; Torki, in press b). Likewise, tropical species in seasonal habitats also display, if less pronounced, a regenerative phase during the wet (reproductive) season

Table 1. shows descriptive statistics of five characters in *Ophisops elegans*. SVL (mm), TV (0.1 mm^3), GS and LS (μm), spermatozoa (1 is present, 0 sabsent, 0.67 and 0.40 is transition phase). Sp: mean of Spermatozoa observed in the lumen.

Month		SVL	TV	GS	LS	Sp
March	N	9	9	9	9	9
	Mean	43.2	211.5	56.55	79.88	1
April	N	10	10	10	10	10
	Mean	42.93	158.1	48.5	63.6	1
May	N	10	10	10	10	10
	Mean	42.05	133.6	40	45.6	1
June	N	9	9	9	9	9
	Mean	41.77	71.41	24.22	39.22	0.67
July	N	10	10	10	10	10
	Mean	43.19	46.42	23.2	32	0.4
August	N	8	8	8	8	8
	Mean	44.2	42.68	12.5	7.5	0
September	N	10	10	10	10	10
	Mean	43.9	40.81	6.2	1.1	0
October	N	9	9	9	9	9
	Mean	44.77	38.13	6.33	0	0

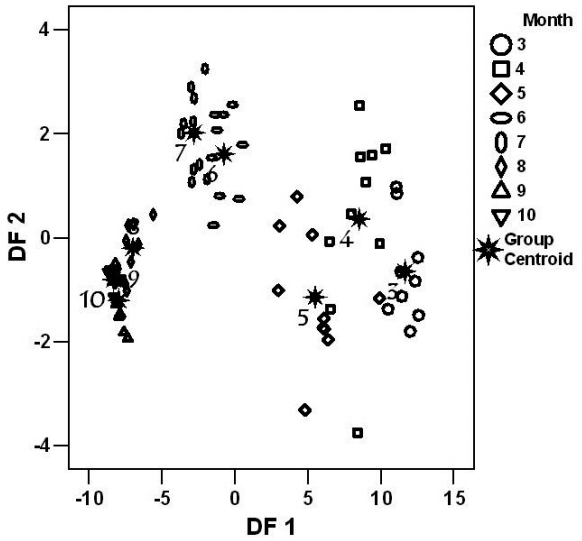

Figure 1. Shows phase significant during degeneration period based on DF analysis.

and a degenerative phase during the dry (non-reproductive) season (Marion and Sexton, 1971; Wilhoft and Reiter, 1965).

Spermatogenesis of some lizards in Iranian plateau especially in Zagros Mountains described by author (Torki, 2006, in press a, b, c), and shows alternation spermatogenesis in Zagros Mountains. In this study, my purpose is determination spermatogenesis timing in *Ophisops elegans* in Zagros Mountains.

Materials and Methods

Seventy-five mature male specimens of *O. elegans* were collected by hand north of Lorestan province. The size of males *O. elegans* is between 38.9 < SVL < 47.2 mm. *O. elegans* go to hibernation period from Oct. to Feb. (Torki, 2005). Testis were removed from each individual by dissection, during each month from after hibernation to before hibernation. Snout-vent lengths (to the nearest

Table 2. Shows Tukey HSD test (α = 0.05) for determination significant phase.

Month	N	Subset for alpha = .05		
		1	2	3
August	8	0		
September	10	0		
October	9	0		
July	10		0.4	
June	9		0.67	0.67
March	9			1
April	10			1
May	10			1
Sig.		1	0.38	0.11

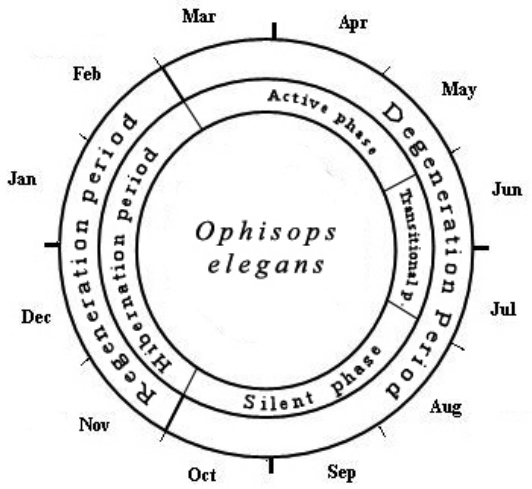

Figure 2. Show annual period and phase in spermatogenesis of *O. elegans* in western Iran, central Zagros.

0.5 mm) were measured for each lizard. In each lizard maximum length and width of the left testis was measured (with electronic calipers to the nearest 0.01 mm) and Testis Volume (TV) and estimated TV (0.1 mm^3) using the ellipsoid formula; $v = 4/3\pi\ abc$, where v is volume, a and c are equal to half testicular height, and b is half testicular length (Vieira et al., 2001; Torki, 2006). For histological analysis, testes were fixed and the epididymis was fixed in 3.7% formalin, dehydrated in a graded series of ethanol, cleared in xylem, and embedded them in paraffin. Sections were stained with hematoxylin-eosin (H&E) and were observed with an Zeiss Axiophoto microscope. For each individual, two characters (μm) were measured: the Lumen of Seminiferous (LS) diameter, Germinative Seminiferous (GS) diameter. For data collecting, using the mean of twenty transversally oriented tubules at the same section, next to the core of the testes. Measurements were taken with an ocular micrometer, to the nearest 1 μm. Same as author study (Torki, 2006, in press a, b, c), Tukey HSD test and Canonical Discriminant Functions Analysis (DFA) to show phases significance were used.

Results

Description of GS, LS, and SVL are shown in Table 1; 82% of testis volume from Mar. to Oct. decreased. Based on Tukey test (α = 0.05) (Table 2) spermatogenesis timing of *O. elegans* divided into three phases: phase (1) from Mar. to Jun., phase (2) from Jun. to Jul., and phase (3) from Jul. to Oct. But based on DF analysis distinguishable three phases (Fig 1) as follows: phase (1) from Mar. to May, phase (2) during Jun.-Jul., and phase (3) from Aug. to Oct. occurs. On the other hand, based on histological survey the three phase distinguishable as

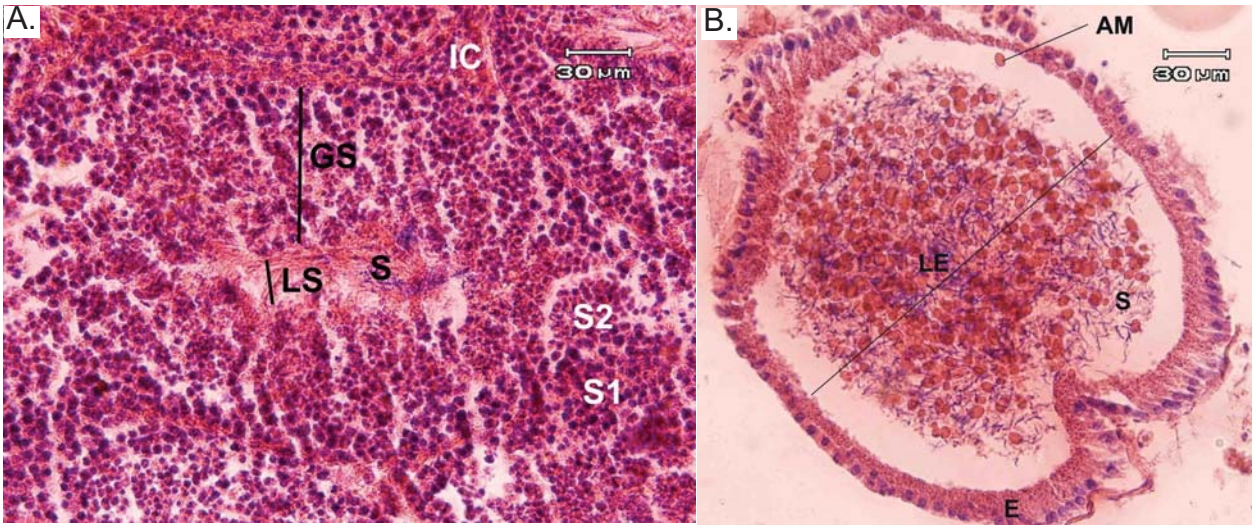

Figure 3. Light microscopy shows active phase, histological section of (a) seminiferous, (b) epididymis. LE, Lumen of Epididymis, E: Epididymis layer, LS: Lumen of Seminiferous, GS: Germinative layer of Seminiferous, S: Spermatozoa, S1: primary Spermatocytes, S2: secondary Spermatocytes, AM: Amorphous Material, IC: Interstitial tissue Cell.

follows: phase (1) from Mar. to Jul., phase (2) during Jun. to Jul., and phase (3) from Aug. to Oct.

Discussion

In this study, there was no significant relationship between SVL*Month ($p > 0.05$), because adult specimens were collected. Based on statistical and histological study, I presented three phases (Fig. 2) during the degeneration period in *O. elegans*; active, transitional and inactive phase. (a) Active phase: because spermatozoa in the lumen of seminiferous and epididymis are found (Fig. 3), this phase occurred from Mar. to May. (b) Transitional phase: because spermatozoa in many specimens found in lumen of seminiferous and epididymis and in other specimens not found, this phase occurred from Jun. to Jul. (c) Inactive phase: because in all specimens lumen of seminiferous and epididymis is without spermatozoa, this phase occurred during pre-hibernation or from Aug to Oct. Same as *O. elegans*, *Trapelus lessonae* show three phases (Torki, 2006, In Press c). Two species (*O. elegans* and *T. lessonae*) show synchronism in three phases during degeneration period. In both species (*T. lessonae* and *O. elegans*) spermatogenesis activity occurred during post-hibernation. In contrast, in the agama, *Laudakia nupta* spermatogenesis occurred after post hibernation in late spring and early summer (Torki, In Press b). Body length of *T. helenae* is lowest than other taxa and body length in *L. nupta* is biggest other taxa and *O. elegans* with *T. lessonae* is between to other. Based on timing of spermatogenesis activity and body length, three types of activities of spermatogenesis timing in lizards inhabitant Zagros Mountains as follows: (a) early active spermatogenesis, that occurred in lowest body length, (b) late spermatogenesis that occurred in highest body length, and finally normal active spermatogenesis that occurred in *T. lessonae* and *O. elegans*. Three taxa (*L. nupta*, *T. lessonae* and *O. elegans*) are sympatric; therefore, divergeny in timing spermatogenesis occurred due to body length. This is pronounced confirmed by *T. helenae* as a lowest body length. Torki and Rastegar-Pouyani briefly report affects of body size to timing of spermatogenesis (2006). However timing of spermatogenesis is many lizards is different, but histological structure in these lizards is similar (Gharzi and Torki, 2006 a). Nevertheless, in many lizards timing of spermatogenesis activity occurred due to climate condition (e.g., Duvall et al., 1982; Fitch, 1970; Whittier et al., 1987). Nevertheless, climate condition and geographic position are two main factors that strongly regulated spermatogenesis timing in lizards (Gharzi et al., 2006; Torki, 2005 b, in press a). On the other hand, geographic variation in timing spermatogenesis activity occurred due to climate gradient or latitude gradient (Gharzi and Torki, 2006 b; Torki, in press a). In many lizards such as genus *Trapelus* divergeny in spermatogenesis activity occurred in *T. lessonae* and *T. agilis*, is related to climate condition. In additional, speciation process due to dispersal or vicariance evidence in two taxon of genus *Trapelus* are important factors for the divergeny in timing of spermatogenesis activity (Torki, 2006).

Literature Cited

Castilla, A. M. and D. Bauwens.1990. Reproductive and fat body cycles of the lizard, *Lacerta lepida*, in central Spain. Journal of Herpetology 24: 261–266.

Duvall, D., L. J. Guillette (Jr.) and R. E. Jones. 1982. Environmental control of reptilian reproductive cycles. p. 201–231. In: C. Gans & H. Plough (Eds.), Biology of Reptiles. (Vol. 13) New York.

Gharzi, A., H. Moradi and F. Torki. 2006. Cold-climate and testicular cycle regulation in lizards. Joint meeting of Ichthyologist and Herpetologist. 12-16 Jul 2006, New Orleans, Abstract. Internet: http://www.dce.ksu.edu/jointmeeting/archive/2006/abstract_list.shtml. E-K, pp 41–42.

Gharzi, A. and F. Torki, 2006a. A histological description of testicular tissue in lizards of central Zagros. 14th Iranian Biology conference and the secondary International conferences of Biology. Tarbiat-Modares University, Iran. http://www.modares.ac.ir/IBC2006/asami1.htm

Gharzi, A. and F. Torki. 2006b. The effects of climate and latitude on reproductive cycle of lizards. 14th Iranian Biology conference and the secondary International conferences of Biology. Tarbiat-Modares University, Iran. http://www.modares.ac.ir/IBC2006/asami1.htm

Fitch, H.S. 1970. Reproductive cycles in lizards and snakes. Miscellaneous Publication of the Museum of Natural History, University of Kansas 52: 1–247.

Hernandez-Gallegos, O., F. R. Mendez-de la Cruz, M. Villagran-Santa Cruz, and R. M. Andrews. 2002. Continuous spermatogenesis in the lizards *Sceloporus bicanthalis* (Sauria: Phrynosomatidae) from high elevation habitat of central mexico. Herpetologica 58(4): 415–421.

Lofts, B. 1987. Testicular functions. In: Hormones and Reproduction in Fishes, Amphibians, and Reptiles, pp. 283–325. Norris, D.O., Jones, R.E., Eds, New York, Plenum Press.

Marion, K. R. and C. J. Sexton. 1971. The reproductive cycle of the lizard *Sceloporus malachiticus* in Costa Rica. Copeia 1971: 517–526.

Sherbrooke, W. C. 1975. Reproductive cycle of a tropical lizard, *Neusticurus ecpleopus* Cope, in Peru. Biotropica 7: 194–207.

Torki, F. 2005a. Annual cycle of sexual system of male *Ophisops elegans* considering hibernation, morphology, and histological. 5th conference of Ichthyology and Herpetology. Florida-San Diego, USA. Internet: http://www.asih.org/meetings/2005/abstracts2005pt4.pdf

Torki, F. 2005b. Relation between climate condition and reproduction in reptiles. In Farsi, Internet: http://biologist.edu.tf

Torki, F. 2006. Spermatogenesis of the agama *Trapelus lessonae* in the central Zagros Mountains, Iran. Zoology in the Middle East 38:21–28.

Torki, F. In Press a. Influence of climate gradient on timing of spermatogenesis in *Trapelus lessonae* (Sauria: Agamidae) in the Zagros Mountains, Iran. Hamadryad.

Torki, F. In Press b. Regeneration of testicular tissue during degeneration period of testicular cycle in *Laudakia nupta*. Hamadryad.

Torki, F. In Press c. The role of hibernation on testicular cycle and testicular activation during dormancy in the hibernate lizard *Trapelus lessonae* (Reptilia: Agamidae) in nature. Salamandra.

Torki, F. and N. Rastegar-Pouyani. 2006. Relation between Body Size and Spermatogenesis Timing in Hibernate Lizards. 14th Iranian Biology conference and the secondary International conferences of Biology. Tarbiat-Modares University, Iran. http://www.modares.ac.ir/IBC2006/asami1.htm

Vieira. G. H. C., H., C. Wiederhecker, G . R. Colli and S. N. Bao. 2001. Spermiogensis and testicular cycle of the lizard *Tropidurus torquatus* (Squamata, Tropiduridae) in the Cerrado of central Brazil. Amphibia-Reptilia 22: 217–233.

Whittier, J. M., J. T. Manson, D. Crews and P. Licht. 1987. Role of light and temperature in the regulation of reproduction in the red-sided garter snake, *Thamnophis sirtalis parietalis*. Canadian Journal of Zoology 65: 2090–2097.

Wilhoft, D. C. and E. O. Reiter. 1965. Sexual cycle of the lizard, *Leiolopisma fuscum*, a tropical Australian skink. Journal of Morphology 116: 379–388.

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