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Preliminary Observations on the Reproductive Cycle of Female Tegu Lizards *(Tupinambis teguixin)*

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NOTE:

PRELIMINARY OBSERVATIONS ON THE REPRODUCTIVE CYCLE OF FEMALE TEGU LIZARDS *(Tupinambis teguixin)*

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The black tegu lizard, *Tupinambis teguixin* (Linnaeus 1758), is a common element in the wild all throughout Southamerica except for Chile. This teiid lizard was outstood by earlier travellers such as Sir Charles Waterton who reported for the first time about the delicate food, resembling chicken flesh and frequently consumed by local natives.

Despite its relative abundance and both the intense economical and social importance of tegus, as well as its situation in the food web, the reproductive biology of tegus was, until recently, largely unknown.

Tegus support lethargy during periods of lowered ambient temperature, in temperate areas of Southamerica, say late April to early September. After emergence from hibernating sites (burrows) social interactions take place, being females courted and mated during October - November and eggs laid in November - December (Donadío and Gallardo, 1984; Mercolli and Yanosky, 1989). Although a large literature exists on the breeding cycle, including descriptions of nests, eggs and related ecology and behavior (Mercolli and Yanosky, in review), no information is available on the gross or macroscopic anatomy of reproductive organs.

Milstead (1961) informed a possible second clutch following a first one in the same breeding season for he found 32 oviductal eggs and approximately "50 enlarged follicles", and Anderson and Vitt (1990) established female tegu lizards reach sexual maturity at 210 mm snout - vent length (SVL), because of the presense of "enlarged vitellogenic follicles".

Our experience does not agree with Milstead or Anderson and Vitt findings. We can state that female tegus in Formosa are not mature until 30 cm SVL and the presence of "enlarged (in development) vitellogenic follicles" in female ovaries can not be used as either an indicator of sexual maturity or the following of a second clutch in a particular given breeding season. We have had the opportunity to observe hunted females for hide trading for four years in eastern Formosa, although no systematic study was done. In this case we used the 1990 - hunting season to buy a female just killed to analyse her ovary. The female here described was caught in the locality of Villafañe in October and freshly - dissected was brought to the laboratory for analysis.

It is our aim to report about our knowledge trough fragmentary and scarce, that will provide some information on macroscopic feature of ovaries, and some inferences from basic knowledge for related species.

GROSS OVARY DESCRIPTION

During September - October, before eggs are laid, female ovaries are composed of large yellow vitellogenic follicles 23 - 25 mm in diameter and 8 - 9 g in mass (Fig. 1). In a comparative was, just laid eggs average 17 g in mass and are 42 mm long x 27 mm wide (Yanosky, and Mercolli, 1990 a).

During this period, the oviduct is richly vascularized and hypertrophied, and vascularization greatly reaches each follicle. For a given female we have found the left ovary supporting 17 follicles averaging 23,33 + 1,5 mm in diameter and 8,11 + 1,02 g in mass, and 8 + 0,9 g (Table 1, Figure 1). Follicle mass between the two ovaries resulted insignificantly different (t - test, $t = 3,2$; 34 dF; $p < 0,002$).

Carefull analysis of ovaries can highlight, at least, three more types of follicles depicted in Table 1. The measure and counting of small previtellogenic follicles has been made under a dissecting microscope and they cannot be detected at first sight. We have also found some follicles averaging 3 - 5 mm in diameter, dark - colored and flattened that could integrate the group of atresic follicles.

The classification of four groups clearly differentiated by size are also grouped in different parts of the ovary as outlined in figure 2. Follicles appear to be bunchy or clustered, and mature follicles are linked to the central body mass through a "stem" from which they are hanging. Small and intermediatesized follicles are located in a mass composed of connective tissue and they are difficult to remove from that stroma.

DISCUSSION

Tegus as most reptiles exhibit polyautochronic ovulation, in which both ovaries ovulate many eggs simultaneously in a given clutch / season, and a dissociated reproductive pattern in which mating occurs in the spring after emegerce from hibernation.

The case reported here could indicate that *Tupinambis teguixin* could be, at least, partially polyallochronic, say one ovary gives rise to more eggs than the contralateral ovary. Because this lizard exhibits only one clutch yearly just after spring emergence, it is feasible to think that the female described before was going to lay that season 36 eggs, the next season 36 eggs again (estimated by the 16 plus 20 "enlarged (in development)" vitellogenic follicles, the third reproductive season 34 eggs (due to 10 plus 24 intermediate - sized follicles) and the fourth reproductive season 40 eggs (due to 18 plus 22 small pervitellogenic follicles) (Table 1).

The supposition exposed here has been inferred preasuming that all the follicles present will mature and without considering a possible atretic process, for which we can say that each ovary contains, at least, four size - classes of follicles: less than 1 mm, 1 mm, 1 to 7 mm, and the current year's crop of preovulatory follicles of 23 - 25 mm in diameter. The same has been found for the american alligator by Lance (1989) and for painted turtles by Etches and Petitte (1990) with one size - class less. This suggests that it takes, at least, four years for a differentiated oocyte to grow to preovulatory diameter and, in general, that the four classes represent the subsequent 3 or 4 clutches of the next breeding season.

Sexual interactions such as courtship are composed of conspicuous displays and they occur about one month later of hibernation emergence, with oviposition some weeks later both in captivity and in the wild (Mercolli and Yanosky, 1989). After this particuliar period, mated females appear to render unattractive for the rest of the warm months before next hibernation (some 5 months).

Vitellogenesis would begin early in the spring and a set of follicles mature are ovulated waiting for fecundation. The second category in size appears also to begin vitellogenesis growth but we suppose they stay in a dormant state up to the next breeding season. We have found no induction of ovulation with the treating on females with gonadotroping releasing hormone (Receptal, Hoechst) (Mercolli and Yanosky, in review) although further studies are required to affirm that ovulation cannot be induced with GnRHs. It seems that the exposure to cold temperatures plays an important role in reproduction. The proximal environmental cue for timing reproduction appears to be the onset of warm ambient temperatures after prolonged exposure to cold ones as stated by Crews (1990) for the redsided garter snake.

We hipothesize that a set of follicles are always in the ovaries, four size - classes are, at least, visible by direct or microspial obsevation of the gonads before oviposition. After this activity, the follicles that will ovulate the next season continue vitellogenic growth, and the others, those 1 mm and less than 1 mm in diameter are recruited for development.

A major gap in knowledge of tegu biology occurs in aspects related with reproduction, but we have shown that the presence of follicles in development do not indicate that a clutch would quickly take place. Actually they appear to become "dormant" till next onset of warm days after a "prolonged" refractory period.

Anyone with experience on tegus cannot accept sexual maturity at 20 cm SVL tegu females. In spite of this, Anderson and Vitt (1990) have found follicles in development in females what could be indicating that these follicles could develope in early age waiting for some enviromental cue to really mature.

Tegu males have scale buds on both sides of the cloaca which are useful for sexing animals. In Yanosky and Mecolli (1990 b) we reported that these buds "do not appear or differentiate until juveniles are 20 - 21.5 cm SVL", and this length is reported by us as the first ontogenetic dimorphic character. It has also been cited by Anderson and Vitt (1990), as the size when female tegus reach maturity inferred by follicles in development. According to this we suppose that something is happening to female tegu bodies at 20 - 21.5 mm SVL, that could be associated with the differentiation of some follicles, but this does not indicate they are actually mature!

In a tegu farming operation, both commercially or consevationally aimed, the question repeatedly asked is how can we get our animals to produce more then a clutch per year? Whether or not they could be induced to nest more than once in a given season is unknown.

If tegus are similar to other reptiles and birds, they go through a refractory peirod after ovulation (Lance, 1987). This refractory period could mean a period of reduced temperature and a reduced photo period required for a second cycle to initiate. Donadío *et al.* (1990) have reported on the first record of sexual maturity in captive conditions which was held when twenty months old with both lethargic periods (winter) artificially suppressed for the other macoteiid lizard occurring in Argentina, *T. rufescens*.

We have also suppressed lethargy in the culture of tegus (Yanosky and Mercolli, 1990 c) and we have demonstrated the biological and economical feasibility of this suppression with the production of bigger animals in shorter time. But, what happens in ovaries if the so-colled refractory perod is, then, suppressed? The ovary reaches maturity at a certain body length, but if environmental cue such as the onset of warm days do not exist, the recuited follicles will not mature, or what will be most interesting, the ovary will be continuously recuiting follicles to ovulation (being cold days the cause for stopping vitellogenic growth).

Much information is needed on the reproductive cycle of tegus. We have dedicated this paper to females, but of most importance are males, since we can conclude that no females are receptive but can certainly be and males are not prepared to mate. This alternative thought is not ilogical for we have incipient data for testis appear to be big during September - October, but all animals studied by us in the following months have showed testis to volumentrically regress. This is a topic that will be researched and held in the future.

CONCLUSION

Preliminar analysis of a female ovary indicates that a set of follicles are always present in the ovaries. We here have described four size - classes of follicles before oviposition and it is our belief that follicles in development (commonly known as "enlarged follicles") can not be used to establish sexual maturity neither state that a second clutch will be produced in a particular given season.

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Table 1: Four groups of oocytes found in a given female 38,6 cm. S-V long.

Size - Class	Color	Size (mm)	Nº of oocytes	
			left ovary	right ovary
SMALL	White	1	22	18
INTERMEDIATE	White	1	24	10
IN DEVELOPMENT	Yellow	1-7	20	16
PREOVULATORY	Yellow	23-25	17	19

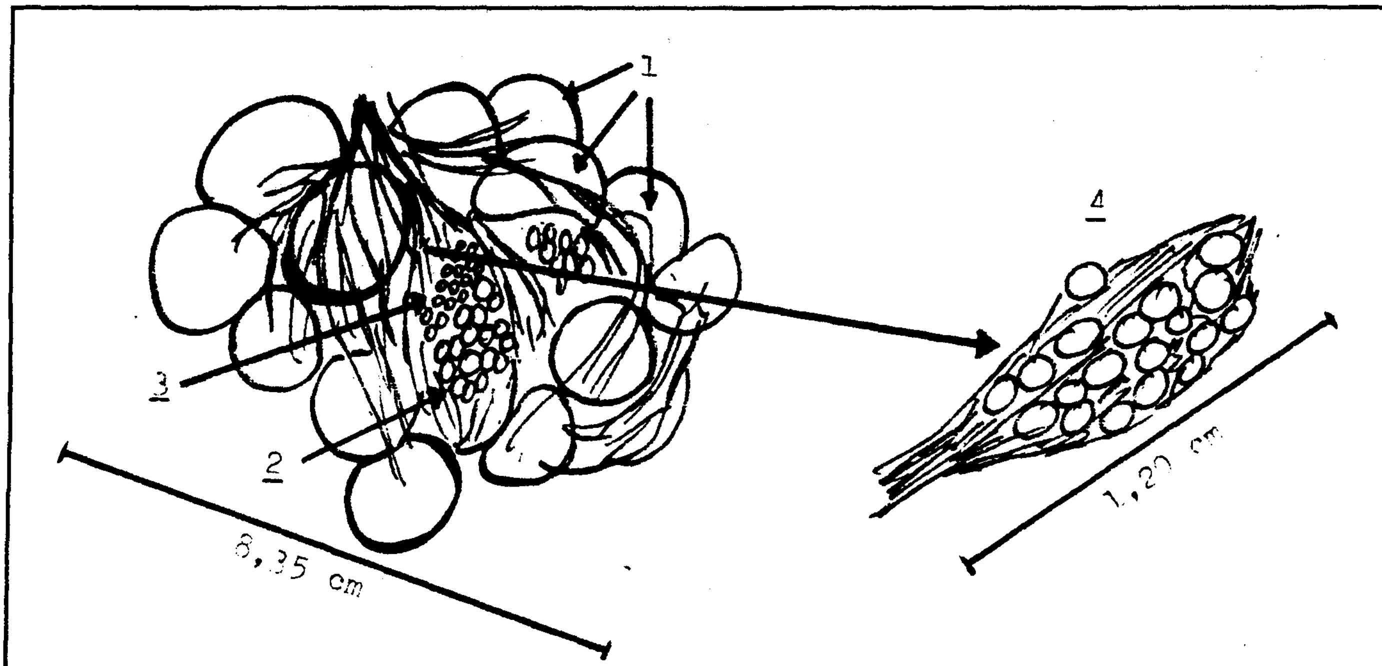

Fig. 2: An outline of what has been found in one side ovary with the current year's crop of preoculatory follicles of 23 - 25 mm. in diameter (1), follicles in development (20), intermediate - sized previtellogic follicles (3) and increased outline for the smallest previtellogenic follicles.

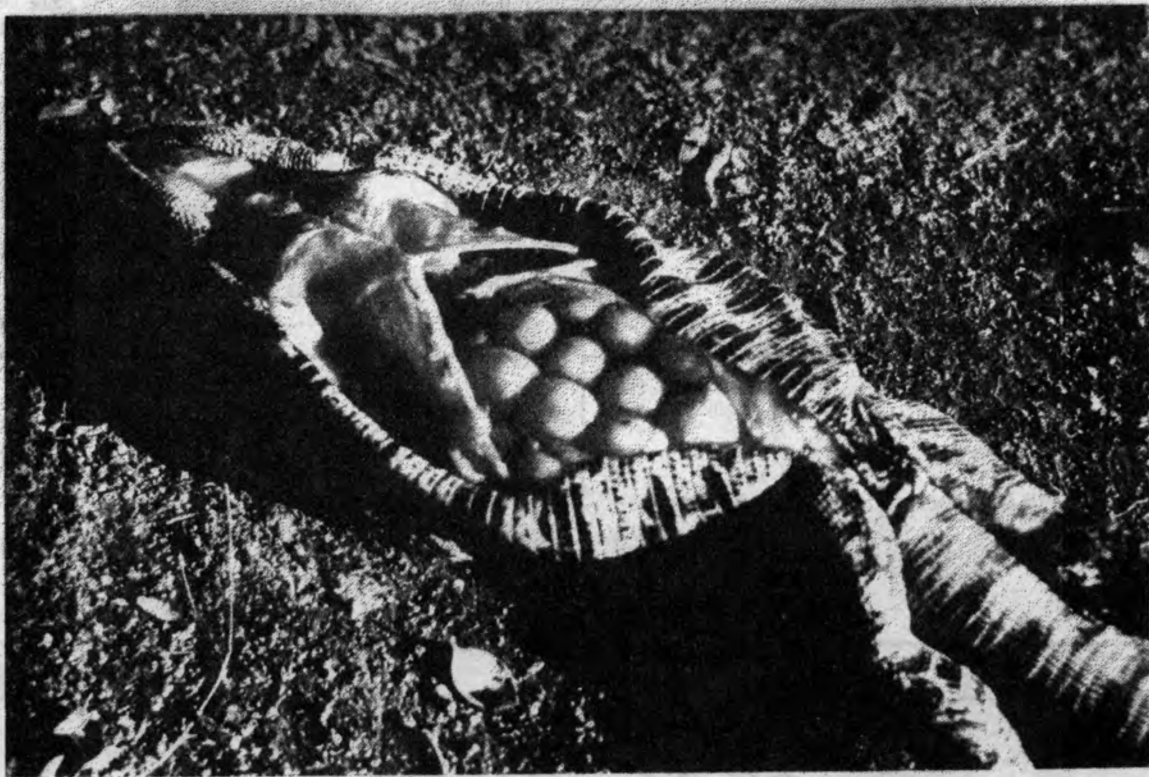

Fig. 1 : A female showing shelless large follicles during October (early spring) at El Bagual Ecological Reserve (Formosa, Argentina).