

Notes on reproduction of Peters' Leaf-toed Gecko, *Phyllodactylus reissii* (Squamata, Gekkonidae), from Peru

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Species of *Phyllodactylus* occur in semiarid to arid regions along the Pacific coast in extreme southern California, Baja California and western Mexico through Central America, some of the Caribbean Islands, northern Colombia, southern Venezuela, the Galapagos Islands, northwestern Peru and northern Chile (Dixon 1973, Savage 2002). Peter's Leaf-toed Gecko, *Phyllodactylus reissii* (Gekkonidae) is known from southern Ecuador and northwestern Peru from sea level to ca. 2000 m (Dixon and Huey 1970). Its primary habitat appears to be arid tropical scrub west of the Andes and cacti dominated areas of the northern interandean basins of Peru (Dixon and Huey 1970). To my knowledge, the only information on its reproductive biology is a report of egg clutches in Dixon and Huey (1970). The purpose of this note is to add information on the reproductive biology of *P. reissii* from a histological examination of gonadal material from museum specimens. The first information on the testicular cycle is presented. Information on reproduction of *P. reissii* is compared with that

of other species of *Phyllodactylus* from Mexico and South America.

Ninety-one *P. reissii* from Peru were examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, USA. The sample consisted of 50 females (mean SVL = 54.4 mm \pm 6.6 SD, range: 40-67 mm), 35 males (mean SVL = 56.7 mm \pm 4.7 SD, range: 48-67 mm) and 6 neonates (mean SVL = 26.8 mm \pm 2.3 SD, range: 23-30 mm). Lizards were collected 1968 and 1976. Museum catalogue numbers of examined specimens are given in the Appendix I by Peruvian Department.

For histological examination, the left testis and epididymis were removed from males and the stages in the testicular cycle were identified. The left ovary was removed from females for histological examination to check for the presence of vitellogenesis (yolk deposition). Enlarged follicles (> 4 mm diameter) or oviductal eggs were counted. Tissues were embedded in paraffin and cut into sections at 5 μ m. Slides were stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber 1997). An unpaired t-test was used to compare *P. reissii* male versus female mean body sizes (Instat vers. 3.0b, Graphpad Software, San Diego, CA).

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An unpaired *t*-test revealed there was no significant size difference between mean male and female body sizes (SVL). The only stage observed in the testicular cycle of *P. reissii* was spermiogenesis (= sperm formation) in which the borders of the seminiferous tubules are lined by rows of metamorphosing spermatids and spermatozoa are abundant. The histology of the seminiferous tubules undergoing spermiogenesis was similar to that observed by Goldberg (1974). All epididymides contained sperm. *Phyllodactylus reissii* males examined by month were November (N = 20), December (10), May (4), June (1). The smallest reproductively active males measured 48 mm SVL and were from November (LACM 48769) or December (LACM 48793, 48796).

Five stages were observed in the ovarian cycle (Table 1). Reproductively active females were found in November, December, and May. The presence of females from November and December with oviductal eggs and concomitant yolk deposition as well as females from May with corpora lutea from a previous clutch and concomitant yolk deposition for a subsequent clutch indicate *P. reissii* females produce multiple clutches in the same year. Ovarian histology was similar to that in Goldberg (1973, 1976). Mean clutch size for 27 *P. reissii* females was 1.70 ± 0.47 SD, range: 1-2. The smallest reproductively active female (in early yolk deposition) measured 40 mm SVL (LACM

48821) and was from December; another slightly larger female (in early yolk deposition) from the same month (LACM 48797) measured 43 mm SVL.

Six presumably neonates (SVL range: 23-30 mm) were collected. Five were from November and one was from May.

Clutch sizes of *Phyllodactylus* from Peru are listed in Dixon and Huey (1970) and include one egg produced by *Phyllodactylus angustidigitus*, *Phyllodactylus gerrhopygus*, *Phyllodactylus inaequalis*, *Phyllodactylus interandinus*, *Phyllodactylus kofordi*, *Phyllodactylus lepidopygus*, *Phyllodactylus microphyllus*, and *Phyllodactylus johnwrighti* and two eggs produced by *P. reissii*. Gravid *P. kofordi* and small juveniles were found in July, August, November and December (Dixon and Huey 1970).

Ramírez-Sandoval *et al.* (2006) studied *Phyllodactylus lanei* at Jalisco, Mexico, where this species has an extended reproductive season; females produce multiple clutches. Testes of maximum sizes occurred in August to March, declined beginning in April and were at a minimum in July. Maximum egg production occurred during January to April.

In the Isthmus of Tehuantepec, Oaxaca, Mexico, some females of *Phyllodactylus muralis* and *Phyllodactylus tuberculatus* contained mature eggs in all seasons of the year (Dixon 1964). Neonates were collected January,

Table 1 - Monthly stages in ovarian cycle of 50 *Phyllodactylus reissii* from Peru. Values shown are the numbers of females exhibiting each of the five conditions. *Sample includes 1 female with oviductal eggs and concomitant yolk deposition. **Sample includes 4 females with oviductal eggs and concomitant yolk deposition.

Month	N	No yolk deposition	Early yolk deposition	Follicles > 4 mm length	Oviductal eggs	Corpora lutea and yolk deposition
November	19	3	4	4	8*	0
December	17	1	6	3	7**	0
May	12	5	0	1	4	2
June	2	2	0	0	0	0


February, April, June, August and December suggesting some reproduction occurs throughout the year (Dixon 1964). Thus, the above three *Phyllodactylus* species from Mexico and *P. kofordi* from Peru (Dixon and Huey 1970) exhibit extended periods of reproduction. The presence of presumably neonates of *P. reissii* in my samples from November and May also suggests an extended reproductive cycle.

In contrast, Goldberg (1997) reported that *Phyllodactylus xanti* from southern California exhibited a “typical temperate” reproductive cycle in which spermiogenesis occurred in spring, regression in summer and recrudescence (= recovery) took place in autumn. Females with oviductal eggs were found in May. This timing has been reported in the reproductive cycles of other lizards from various lizard families in California including the anguid *Gerrhonotus multicarinatus* (Goldberg 1972), phrynosomatids *Sceloporus occidentalis* (Goldberg 1974), *Sceloporus vandenburgianus* (Goldberg 1975), *Uta stansburiana* (Goldberg 1977), *Phrynosoma coronatum* (Goldberg 1983), scincid *Eumeces skiltonianus* (Goldberg 2005), teiid *Aspidoscelis tigris* (Goldberg 1976), and xantusiid *Xantusia riversiana* (Goldberg and Bezy 1974). This timing of events in the yearly reproductive cycle allows mating during spring, egg laying (except for viviparous *X. riversiana*) and appearance of young in mid-to-late summer when food is abundant. The above strategy allows growth and fat deposition so young may enter hibernation with sufficient reserves to survive the winter.

Because my samples do not include all months, I cannot characterize the complete reproductive cycle of *P. reissii*, nevertheless, some observations can be made. It is apparent that more than one egg clutch can be produced in the same year and that females produce 1-2 eggs per clutch. My finding of reproductively active *P. reissii* in both summer and autumn suggests an extended reproductive period, perhaps, similar to that of *P. muralis*, *P. tuberculatus* and *P. lanei* from Mexico (Dixon

1964, Ramírez-Sandoval *et al.* 2006) and *P. kofordi* from Peru (Dixon and Huey 1970). Examination of additional monthly samples of *P. reissii* is needed before the timing of all events in the reproductive cycle can be ascertained.

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References

- Dixon, J. R. 1964. The systematics and distribution of lizards of the genus *Phyllodactylus* in North and Central America. *New Mexico State University, Scientific Bulletin* 64-1: 1-139.
- Dixon, J. R. 1973. *Phyllodactylus* Gray Leaf-toed geckos. *Catalogue of American Amphibians and Reptiles* 141: 1-2.
- Dixon, J. R. and R. B. Huey. 1970. Systematics of the lizards of the gekkonid genus *Phyllodactylus* of mainland South America. *Los Angeles County Museum, Contributions in Science* 192: 1-78.
- Goldberg, S. R. 1972. Reproduction in the southern alligator lizard *Gerrhonotus multicarinatus*. *Herpetologica* 28: 267-273.
- Goldberg, S. R. 1973. Ovarian cycle of the western fence lizard, *Sceloporus occidentalis*. *Herpetologica* 29: 284-289.
- Goldberg, S. R. 1974. Reproduction in mountain and lowland populations of the lizard *Sceloporus occidentalis*. *Copeia* 1974: 176-182.
- Goldberg, S. R. 1975. Reproduction in the sagebrush lizard, *Sceloporus graciosus*. *American Midland Naturalist* 93: 177-187.
- Goldberg, S. R. 1976. Reproduction in a mountain population of the coastal whiptail lizard, *Cnemidophorus tigris multiscutatus*. *Copeia* 1976: 260-266.
- Goldberg, S. R. 1977. Reproduction in a mountain population of the side-blotched lizard, *Uta stansburiana* (Reptilia, Lacertilia, Iguanidae). *Journal of Herpetology* 11: 31-35.
- Goldberg, S. R. 1983. Reproduction of the coast horned lizard, *Phrynosoma coronatum*, in southern California. *Southwestern Naturalist* 28: 478-479.

- Goldberg, S. R. 1997. *Phyllodactylus xanti* (Leaf-toed Gecko). Reproduction. *Herpetological Review* 28: 152–153.
- Goldberg, S. R. 2005. Reproductive cycle of the western skink, *Eumeces skiltonianus* (Sauria, Scincidae), in southern California. *Texas Journal of Science* 57: 295–301.
- Goldberg, S.R. and R. L. Bezy. 1974. Reproduction in the island night lizard, *Xantusia riversiana*. *Herpetologica* 30: 350–360.
- Presnell, J. K. and M. P. Schreibman. 1997. *Humason's Animal Tissue Techniques*, 5th Ed. Baltimore. The Johns Hopkins University Press. 572 pp.
- Ramírez-Sandoval, E., A. Ramírez-Bautista and L. J. Vitt. 2006. Reproduction in the lizard *Phyllodactylus lanei* (Squamata: Gekkonidae) from the Pacific Coast of Mexico. *Copeia* 2006: 1–9.
- Savage, J. M. 2002. *The Amphibians and Reptiles of Costa Rica. A Herpetofauna Between Two Continents, Between Two Seas*. Chicago. University of Chicago Press. 934 pp.

Appendix I – Material Examined

Phyllodactylus reissii from Peru (listed by Department) examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM).

Amazonas 48741, 48746, 48749, 48750, 48753-48756, 48758, 48759, 48762-48764, 48766, 48769, 48771, 48786; Cajamarca

48723-48728, 48730-48732, 48734-48737; Lambayeque 48709-48713, 48715-48721, 48773, 48813, 48821, 48823-48829, 123080, 123082-123089, 123091-123097, 123100, 123102, 123117, 123120; Piura 48780, 48781, 48783, 48785, 48802-48805, 48807, 48809, 48810; Tumbes 48787, 48788, 48790-48793, 48796, 48797.