

Sexual dimorphism, reproductive cycle, and fecundity of the water snake *Ptychophis flavovirgatus* (Serpentes, Colubridae)

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The live-bearing water snake *Ptychophis flavovirgatus* Gomes, 1915 presents a disjunct distribution in the highlands of southeastern (21°47'N, 22°36'S, 46°21'E, 46°33'W) and southern (24°31'N, 31°34'S, 49°56'E, 53°22'W) Brazil, occurring in regions with open vegetation associated with Araucaria forests (Porto and Caramaschi 1988). The climate of these areas is highly seasonal, with higher temperatures in the rainy season and lower temperatures in the dry season (Nimer 1989).

Ptychophis flavovirgatus belongs to the monophyletic Tachymenini, which includes seven genera (Bailey 1967) with a wide variety of ecological traits (Bernarde *et al.* 2000). Apart from anecdotal reports (Amaral 1978, Lema and Deiques 1992, Lema 2002) no information is available on natural history of this snake. We present herein data on sexual dimorphism, fecundity, and reproductive cycle of females based upon the dissection of 49 specimens of *P. flavovirgatus* from southeastern and southern

Brazil housed in the collections of the Instituto Butantan (IB), Museu de História Natural do Capão da Imbuia (MHNCI), Museu Nacional do Rio de Janeiro (MN), and Museu de Ciências da Pontifícia Universidade Católica do Rio Grande do Sul (MCP).

For each preserved specimen the following data set was taken: snout-vent length (SVL), tail length and head length to the nearest 0.5 mm. For females the length of the largest vitellogenic follicle and the presence or absence of oviductal embryos were recorded. Criteria for determined sexual maturity were based in Shine (1977a, b).

The mature males averaged 363.0 mm SVL (SD=79.6, range 232–495 mm, N=20) and mature females averaged 367.0 mm SVL (SD=40.4, range 324–430 mm, N=12). The body size of males and females were not significantly different (Mann-Whitney, U=119, P=0.96, N=32). Covariance analysis (ANCOVA) showed no differences in relative tail length or head size between sexes (F=0.11, P=0.73, N=33; F=4.12, P=0.06, N=24, respectively). Absence of sexual dimorphism is also recorded for *Gomesophis brasiliensis* (Oliveira *et al.* 2003), the probable sister species of

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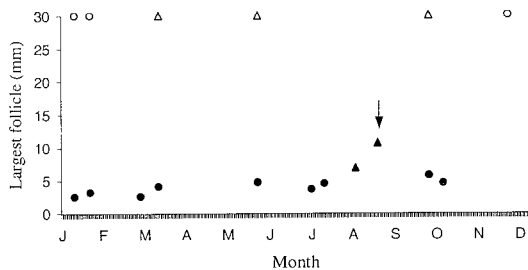


Figure 1 - Seasonal variation in the diameter of ovarian follicles of *Ptychophis flavovirgatus*. Full circles = previtellogenic follicles, full triangles = vitellogenic follicles, open circles = early embryos (SVL < 110 cm), open triangles = fully-development embryos (SVL > 110 cm). Arrow indicates a hatchling literature record.

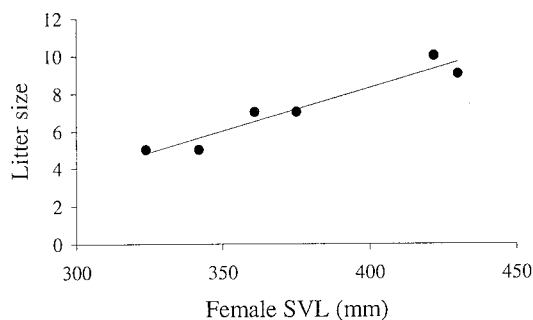


Figure 2 - Relationship between female snout-vent length (SVL) and litter size in *Ptychophis flavovirgatus* ($r = 0.96$, $P < 0.05$, $n = 6$).

Ptychophis flavovirgatus (Franco 1999). Two additional species within the Tachymenini, *Tomodon dorsatus* and *Thamnodynastes strigatus*, display pronounced sexual dimorphism (Bizerra 1998, Bizerra *et al.* in press).

Two females of *P. flavovirgatus* contained vitellogenic follicles in August and September (late dry season) (Figure 1). Six females with oviductal embryos were collected from October to June (rainy season and early dry season) (Figure 1). In December and January embryos were in early stages of development and from March to October embryos were fully developed (Fi-

gure 1). The number of oviductal embryos was 5-10 (average 7.15, $SD=2.04$, $N=6$) and was positively correlated with female body size (Figure 2). A previous study reported 11 newborn hatchlings in August (dry season) (Porto and Caramaschi 1988).

Thus, *P. flavovirgatus* shows seasonal reproductive pattern: vitellogenesis restricted to the late dry season and parturition at the end of the dry season and at the onset of the rainy season. Vitellogenesis starting in dry season has been reported in most other South American snakes studied so far (e.g. Martins and Oliveira 1999, Marques and Sazima 2004), including the Tachymenini *Gomesophis brasiliensis* and *T. dorsatus* (Oliveira *et al.* 2003, Bizerra *et al.* in press). Recruitment of juveniles during late dry season and onset of rainy season is apparently widespread within Tachymenini (Bizerra 1998, Bizerra *et al.* in press, present study), except for *G. brasiliensis*, whose neonates are born at the late of the rainy season and at the onset of the dry season (similar to other South American snakes; Martins and Oliveira 1999, Marques and Sazima 2004, Oliveira *et al.* 2003). The available data for Tachymenini indicates differential reproductive strategies between the putative sister species *G. brasiliensis* and *P. flavovirgatus* (Franco 1999), notwithstanding the fact that these two species seems to be similar in relation to microhabitat use (Lema and Deiques 1992, Marques *et al.* 2001). Thus, other ecological and/or physiological traits probably are involved in the reproductive differences mentioned above.

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