

Short Communication

Size Matters: First record of minimum male size at maturity and mating of free-ranging, endangered Indian Python *Python molurus*

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ABSTRACT

Indian python *Python molurus* (Linnaeus, 1758) is one of the world's giant snakes with maximum lengths measured six to eight meters. Nevertheless, information on the size at maturity of *P. molurus* is not available. On February 9, 2019, 12:56 pm, one female and two males were observed during the group mating in Moyar River Valley Landscape, Southern India. We report the first observation on smallest male measuring 198 cm total length, 172 cm snout-vent length and weighing 3.3 kg mated with a radio-tagged larger female. At the end of the mating event everted hemi penis were observed in the male pythons. Our observation on the mating and morphology details of *P. molurus* gives the first glimpse of juvenile the male maturity that representing the youngest known free-ranging matured male of this poorly studied species in its distribution range.

Keywords: Courtship, Life-history traits, Reproduction, Sexual maturity, Snakes, Morphometry.

INTRODUCTION

Indian python *Python molurus* (Linnaeus, 1758) is one of the world's giant snakes with maximum lengths measured six to eight meters (Bellosa, 2003; Reed & Rodda, 2009) with clutch sizes varies from eight to 107 (Daniel, 1983, Ramesh & Bhupathy, 2010). The large size of this species may be its primary ecological adaptation (Reed & Rodda, 2009). Despite the vast geographic distribution, data on biology, patterns of growth, maturation, reproduction, and natural history limited in *P. molurus*. Mainly, mating records of this species are scanty due to secretive habits (Ramesh *et al.*, 2019). In India, the mating of *P. molurus* takes place between December and February (Ramesh *et al.*, 2019, Ramesh & Bhupathy, 2010).

Size and age at maturity are dominant life-history traits, as they shape lifetime fecundity. These constitute the outcome from complex interactions among environmental pressures and individual characteristics (Fornasiero *et al.*, 2016). The maturity of juveniles is challenging to measure in the wild populations, and thus they are rarely evaluated, especially in reptiles due to the secretive nature of young ones (Fornasiero *et al.*, 2016). *Python molurus* is a large, heavy-bodied non-venomous ambush snake (Bhupathy, 1990; Bhupathy *et al.*, 2014); found in large, undisturbed stretches of diverse habitats in the Indian sub-continent (Ramesh, 2012, Whitaker, 1993; Bhupathy & Vijayan, 1989). *Python molurus* listed as Schedule I -species of the Indian Wildlife Protection Act-1972. The IUCN Red List of Threatened Animals has yet to assess this species status. This snake also included under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) list after severe habitat loss

and abuse by the skin, pet and meat trade (Whitaker, 1993). Combined with rapid developmental activities in forests, making this species living in fragmented environments across the country. Hence, immediate attention is required to obtain sufficient ecological data to prepare plans to protect this endangered species (Koo *et al.*, 2018).

Python molurus are generally solitary species, combined in pairs only during mating (Ramesh *et al.*, 2019). The rate of growth in nature is not known, and records of growth in captivity vary greatly (Acharjyo & Misra, 1976; Acharjyo & Mishra, 1980; Rathinasabapathy & Kalaiarasan, 1993; Vyas, 1995, 1998). *Python molurus* growth rates are obviously influenced by the conditions under which the snake lives (Smith, 1943). Females appear to attain significantly larger body sizes than conspecific males in most python species (Shine and Slip, 1990) and this statement appears to be valid for the *P. molurus* (Ramesh, 2012). The complete reproductive biology of this species is little known under natural condition in its native distribution range (Ramesh, 2012; Ramesh & Bhupathy, 2010). Particularly, no data on the minimal size for male sexual maturity exist from the wild *P. molurus*.

The pythons reach sexual maturity in three years in captivity (Acharjyo & Mishra, 1980; Vyas, 1995, 1998). Captive individuals attain sexual maturity when it is of two to three years provided if it can reach a suitable body weight (Bhupathy, 1993). Acharjyo & Mishra (1980) presumed that the male pythons require a long time to reach sexual maturity than females. Vyas (1998) reported from captive observation that male pythons mature when it reached about 235cm total body length with weight about 5.2 kg and 67.09 month after hatching. Perhaps, it is not clear as to what could be the

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suitable body weight at which a python can become a sexually matured animal. General belief is that increasing body weight is dependent on the availability of food, suitable environmental and physiological conditions (Smith, 1943; Fitch, 1970; Yaron, 1972; Fox, 1977; Ross, 1978; Acharjyo & Mishra, 1980). Based on our observation for the first time in this paper we are reporting the smallest matured male recorded thus far in the wild from southern India.

MATERIALS AND METHODS

Study area

The Segur plateau and adjoining Moyar valley is located between 11.700° N, 76.590°E and 11.470°N, 77.140°E, elevation ranges between 209 and 1950 m. which extend over an area of 500 km² with open scrub forest. The approximate length of the valley is 50 km falling within the Tamil Nadu and Karnataka states in Southern India. The Moyar Valley is located at the centre of the Nilgiri Biosphere Reserve, with Mudumalai Tiger Reserve on the western side and Sathyamangalam Tiger Reserve (STR; Figure. 1) on the eastern side. STR, is the largest Tiger Reserve of Tamil Nadu, which was established in 2013 (Sathya & Jayakumar, 2017). The reserve situated at the altitude ranging from 352 to 412 msl. It receives a mean annual rainfall of 850 mm and the mean minimum and maximum temperatures were 21 and 28°C, respectively (Nikhil, 2019). The distinctiveness of the landscape is the connection with the Western and Eastern Ghats, considered as the Global Biodiversity Hotspot of the world (CBD, 2014).

Field survey

During the Python telemetry study in Sathyamangalam and Mudumalai Tiger Reserves, field surveys were conducted between 2017 and 2020. On 9 February 2019, at 12:56 pm we witnessed our radio-tagged (IP4) large female *P. molurus* (Figure. 2) mating with two small males at Sathyamangalam Tiger Reserve (Figure 1; 11.57431° N, 76.88327° E; 376 m), Tamil Nadu, Southern India. At the end of the mating event, everted hemipenis were observed in the male pythons. After the mating process, we captured both the males to implant transmitters for our ongoing telemetry study. Those two male *P. molurus* were scored for their size, weight and additionally other environmental parameters were also recorded during the survey. Further, secondary data on *Python molurus* growth, male and female maturity data obtained from published literature to compare the present findings. Total body length of the pythons provided here for the purpose of comparison and snout to vent length (SVL) details are provided additionally wherever available from the literature.

RESULTS

Morphometric details of the two small male pythons are (i) SVL = 172 cm, Total Length = 198 cm, Weight = 3.3 kg and (ii) SVL = 194.5 cm; Total length = 222 cm; Weight = 5.1 kg. Radio-tagged (IP4) large female involved in the mating as follows SVL = 342 cm; Total Length = 370 cm; Weight = 36.25 kg. Published information on small matured male and female *P. molurus* data and present observation details are provided in the

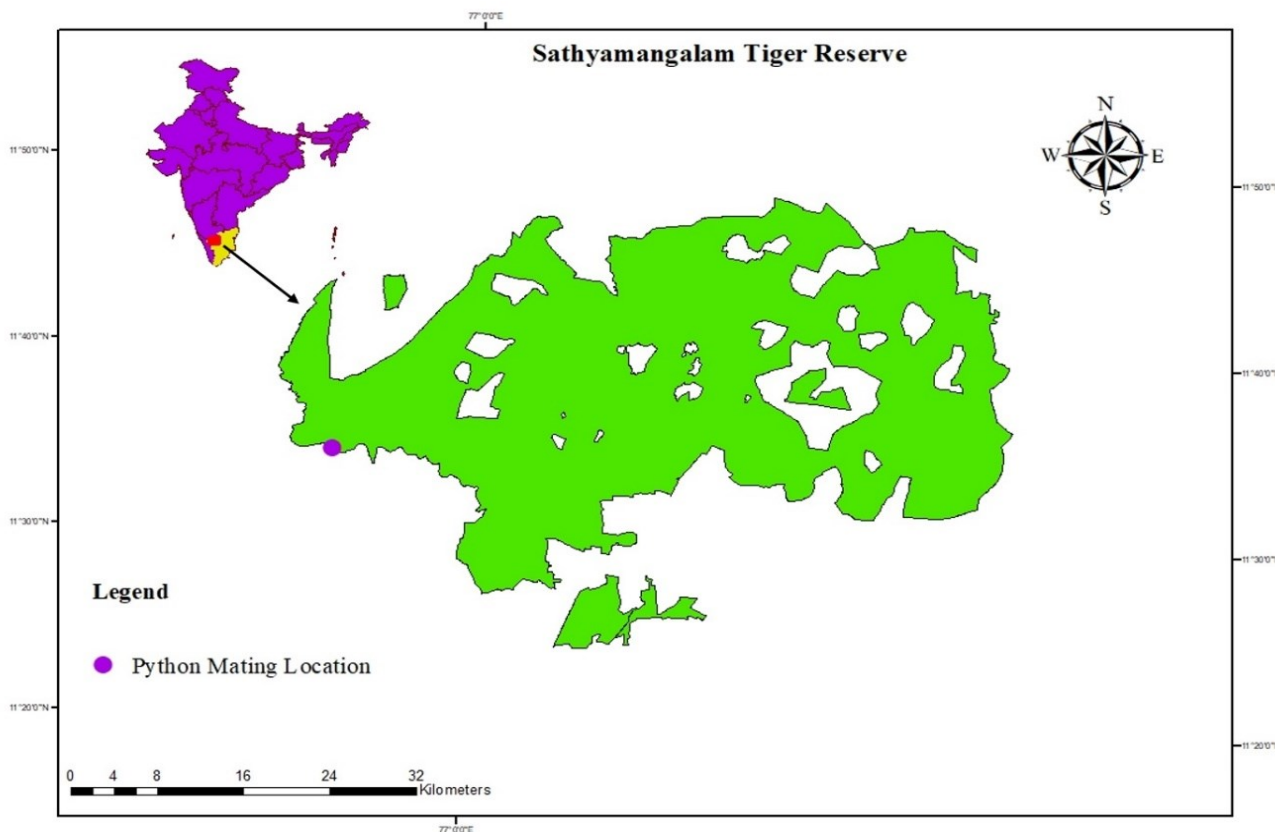


Figure 1. Location of mating event of *Python molurus* in Moyar River Valley Landscape, at Sathyamangalam Tiger Reserve, Southern India

Table 1. Smaller male and female age at maturity of *P. molurus* reported from various sources from in its native distribution

Sl. No	Sex	Snout Vent Length (cm)	Total Body Length (cm)	Weight (Kg)	Age at maturity (Months)	Authors	Remarks
1	Female	-	255	-	36	Pope, 1961	Captivity
2	Female	-	219.0	5.0	43.11	Vyas, 1998	Captivity
3	Female	-	208.5	5.5	42.24	Vyas, 1998	Captivity
4	Female	-	243.0	7.3	55.28	Vyas, 1998	Captivity
5	Female	-	225.5	6.1	67.09	Vyas, 1998	Captivity
5	Female	196	218.0	-	~ 36	Bhupathy, 1993	Wild
6	Male	-	235.0	5.2	67.09	Vyas, 1998	Captivity
7	Male	194.5	222	5.1	~ 30	Present observation	Wild
8	Male	172	198	3.3	~18	Present observation	Wild

Table. 1. Female python (IP4) is much larger in size than the males and seems compatible for mating process. The female python was undergoing an ecdysis process, and no overt male-male agonistic behaviour observed throughout these bouts of courtship. During mating, the atmospheric temperature was around 33.3° C, and relative humidity was 54.5 %. Major plants found around was *Cordia monoica* and *Prosopis juliflora*. The location was 50 meters away from the waterbody in a dried canal with lots of dry leaves and sticks at the scrub jungle (Figure. 3).



Figure 2. The group mating of *Python molurus*. One female and two small male snakes were observed in accompaniment during mating process.



Figure 3. The surrounding and environment where the mating event of *Python molurus* occurred

DISCUSSION

The males of *P. molurus* were reported to reach maturity at the age of four in captivity, with mean body length 248.75 cm (range 235-266 cm total length), that is substantially longer than this individual recorded herein (Acharjyo & Misra, 1976). Further, Acharjyo & Misra (1980) recorded two females kept out of doors in Orissa, India, matured at the age of three years and 7.5 months. Later, Dattatri (1990) found that a female *P. molurus* attained 215 cm in 28 months in captivity. Bhupathy (1993) reported smaller matured female *P. molurus* (196 cm = SVL; 218 cm = total length) from Rajasthan, India, which is the only data on sexual maturity reported from the wild. *Python molurus* is sexually dimorphic in size (Ramesh, 2012). Vyas (1995) observed in captivity that growth of female pythons was more rapid than that of males. However, the growth rate of wild *P. molurus*, are unknown but are presumably slower.

Information on sexual maturity of similar species, i.e., Burmese pythons *Python bivittatus* (Kuhl, 1820) is available from captive observations (Reed & Rodda, 2009; Frye & Mader, 1985; Wall, 1998; Pope,



Figure 4. Smallest known matured free ranging male *Python molurus* (198 cm total length) in Sathyamangalam Tiger Reserve, Southern India.

1961). Ross (1978) reported a few occasion where female *P. bivittatus* produced fertile eggs at 18 months of age. A demographic analysis of Florida *P. bivittatus* suggests that females reportedly reach maturity at 260 cm total length (Reed and Rodda, 2009) by two years of age (Willson *et al.*, 2011). The smallest report on a mature female from Florida was 210 cm total length, 185 cm in SVL, and 5.1 kg in mass (Willson *et al.*, 2014). However, published information on male maturity and mating in the wild available neither on *P. molurus* nor on *P. bivittatus*.

Pope (1961) indicated that males might mature in two years, and females mature in three years. They can reach three meters in length by one year of age if overfed and can reach sexual maturity at 18 months to two years. Generally, sexual maturity in reptiles is often related to size rather than age (Fyre, 1981). Frye & Mader (1985) reported five-month after hatching, the presence of numerous mature spermatozoa within the lumen of the ductus deferens in male *P. bivittatus* total length of about 170 cm and weight of approximately 1.5 kg in captive condition. With proper growth, sexual maturity reached at two and a half years to three years (Acharjyo & Mishra, 1980; Frye & Mader, 1985; Vyas, 1995, 1998). It is likely to hasten the growth when captive pythons are overfed; they can easily attain body lengths greater than 200 cm in one year (Ross & Marzec, 1990). These latter rates are a reasonable expectation for typically fed pythons (Wall, 1998)

Data on growth rates in captive *P. molurus* is available (Acharjyo & Misra, 1976, Acharjyo & Mishra, 1980; Rathinasabapathy & Kalaiarasan, 1993; Vyas, 1995, 1998). Hatching occurs mostly during the southwest monsoon, i.e., between July and August (Ramesh & Bhupathy, 2010). The current record of the smallest sexually matured male with other information taken together, we presume that this smallest male (IP8- Figure. 4) might have attained reproductive maturity at around eighteen months. Hence, it is evident that at least some *P. molurus* in India may reach maturity rapidly.

CONCLUSION

For the first time, our observation provides an essential addition to the knowledge on body size, weight, and age at maturity of wild *P. molurus* in its native distribution range. Small size with high reproductive potential of endangered *P. molurus* is likely reliable drivers that indicate this species to thrive in a rapidly modifying environment in its native distribution range. However, presumably rapid maturity and reproduction in similar male *P. bivittatus* in the wild could pose a high threat due to the invasion of the natural ecosystem of Florida, USA (Wilson, 2017; Reed *et al.*, 2012). Because of the potential threat that *P. bivittatus* poses, this record heightens concern for the endemic and endangered fauna in Florida. Meanwhile, this new data on the male maturity of *P. molurus* will aid in conservation efforts in India. For example, if a zoo raises a *P. molurus* for about two years and up to 172 cm (SVL) size is enough for captive breeding in zoos. It will make that male a breeding seed stock. Further, detailed research required on the variation in the life-history traits of these species. We believe that this information can help plan conservation measures appropriately in these species at respective environmental conditions.

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