

Notes on four *Psammodynastes pulverulentus papenfussi* Zhao, 1995 (Squamata: Colubridae) litters from eastern Taiwan

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The mock viper, *Psammodynastes pulverulentus* (Boie, 1827), has a very wide natural distribution that extends from India and Nepal, southwards to the Philippines and eastwards to southwestern China, Hong Kong, and Taiwan (Pope, 1935; Rasmussen, 1975). Zhao (1995) assigned specimens from Taiwan to the sub-species *Psammodynastes pulverulentus papenfussi* (Fig. 1), based on their higher ventral and subcaudal scale counts. In Taiwan *P. p. papenfussi* is fairly common all over the island (Kuntz, 1963; Lue, Tu and Shang, 2002). Some authors describe the reproductive mode of this species as ovoviviparous (Zhao, 1995; 2006), while others regard it as viviparous (Lue, Tu and Shang, 2002; Shang, Li and Yang, 2009). In this report we follow distinctions as stated by Blackburn (1982), and use the term viviparous. Herein we provide a description of four litters from *P. p. papenfussi* specimens collected in eastern Taiwan.

In April and May 2013, four gravid *P. p. papenfussi* female specimens were collected from the vegetation along a path in Xitou, Shoufeng Township, Hualien County, eastern Taiwan (the exact location was not recorded). The snakes were kept individually in cages (length x width x height = 43 cm x 25 cm x 23 cm) in order for us to gather information concerning their clutches. A mixture of fir tree bark and sphagnum moss was used as a substrate for the cages, and each cage contained a small water bowl, a perch (a small

branch) and a shelter (a clay pot, broken in half and laying on its side). The cages were placed in a room, near a window, to allow natural day/night cycles, but without direct sunlight. To avoid desiccation the interior of the cages were sprayed with water every two to three days. The snakes were fed every five to seven days with wild-caught sub-adult Swinhoe's tree lizards (*Japalura swinhonis* Günther, 1864). In June 2013, all four females gave birth (Table 1). On June 5th, female No.1 laid 4 eggs (Fig. 2), all about 1 cm long and 0.6 cm wide, and with a combined weight of 2 g. The eggs were smaller than those described by Pope (1929), and no embryonic development could be noted, so we concluded that they were infertile. In the females described herein, delivery took place within a three-day period. The litter sizes (number of neonates) ranged from 6 to 10 (mean \pm SD = 8.3 ± 2.1) neonates. The number of neonates in each litter was recorded (litter size), and their combined weight was weighed to the nearest 1 g with a digital scale. The females were weighed individually to the nearest 1 g as soon as possible after delivery, to obtain



Figure 1. The mock viper (*Psammodynastes pulverulentus papenfussi*) is a fairly common snake species in Taiwan, and is usually associated with wooded habitats in the vicinity of water (photographed by Simon Dieckmann).

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Table 1. The collection and delivery dates (year-month-day), as well as the female post-delivery body mass (in g), the litter size, and relative litter mass of four *Psammodynastes pulverulentus papenfussi* female specimens from Taiwan. The numbers of dark and light color form neonates are given in parenthesis (dark/light) along with the litter size.

No.	Collection date	Delivery date	Post-delivery body mass	Litter size	Relative litter mass (%)
1	2013-04-20	2013-06-21	21	6 (3/3)	57.1
2	2013-04-22	2013-06-19	35	10 (5/5)	54.3
3	2013-04-28	2013-06-20	36	7 (3/4)	41.7
4	2013-05-02	2013-06-22	46	10 (7/3)	47.8



Figure 2. Four infertile eggs laid on June 05, by *Psammodynastes pulverulentus papenfussi* female No.1. Each square in the background has a dimension of 1 x 1 cm (photographed by Jean-Jay Mao).



Figure 3. One of the *Psammodynastes pulverulentus papenfussi* litters described herein. Note the color variations of the neonates (photographed by Simon Dieckmann).

the maternal post-delivery body mass (PDBM). The relative clutch mass (RCM) is an indication of the degree a gravid female is physically burdened by her clutch (Shine, 1980). For this study we replaced clutch mass with litter mass in the RCM formula of Shine

(1980) to determine the relative litter mass (RLM): $RLM = (\text{the total litter weight} / \text{PDBM}) \times 100$. The RLM ranged from 41.7 to 57.1% (mean \pm SD = 50.2 \pm 6.9). No attempts were made to sex the neonates, so no sex ratio description can be made. On July 09, 2013, the females and their neonates were released back into the wild in the localities where the females were collected.

Pope (1929) reported five litters (reported as clutches), consisting of three to ten neonates (reported as eggs), and described the dimensions of two eggs as 13 x 9 mm and 13.5 x 6 mm. Pope (1935) reported that the litter sizes of *P. p. papenfussi* ranges from three to ten, with an average of six, and made reference to a hatchling collected in June and other gravid females collected in August and October. However, no RLM descriptions were made. The coloration of *P. p. papenfussi* adults is quite variable, and we noted color variation even among neonates from the same clutch (Fig. 3), indicating that such variations is not an ontogenetic shift, and neither does it correspond to geographical distribution. Rasmussen (1975) noted that there is a color variation between the sexes from the same locality, and that females tend to be darker. Since the genders of the neonates were not determined, we cannot verify this, and suggest that future studies should attempt to determine whether the sexes are dimorphic in coloration.

The reproductive biology of a species is a crucial aspect of its natural history, and an understanding of the natural history and field ecology of herpetofauna is essential for successful conservation and management programs (Bury, 2006). To our knowledge this is the first reported RLM description of *P. p. papenfussi* from Taiwan. Studies to determine the gestation period and annual number of clutches produced, as well as the extent of the breeding season, preferably from different localities and altitudes, are needed to develop a comprehensive understanding of the reproductive biology of this species.

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