

1 A description of an Indo-Chinese rat snake (*Ptyas korros* [Schlegel, 1837])  
2 clutch, with notes on an instance of twinning

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15 The Indo-Chinese rat snake (*Ptyas korros* [Schlegel, 1837]), also sometimes  
16 referred to as the gray rat snake, has a wide natural distribution, extending from parts of  
17 India, east through southeast Asia (excluding the Philippines), to China and Taiwan  
18 (Pope, 1935; Kuntz, 1963; Orlov, Murphy and Papenfuss, 2000). In Taiwan, *P. korros* is a  
19 fairly common species and tends to inhabit grassy and wooded foothill areas all over the  
20 island (Kuntz, 1963; Lue, Tu and Shang, 2002). Herein we describe a clutch from a *P.*  
21 *korros* specimen from Taiwan.

22 On March 30, 2013 a pair of *P. korros* that was collected from the wild in August  
23 2011, was observed mating while in captivity, and on May 22, 2013, the female

24 oviposited. The clutch size and other information pertaining to the eggs are summarized  
25 in Table 1. After the length, width and weight (total clutch mass) of the eggs (Fig.1) were  
26 recorded, they were placed inside an incubator. The incubation temperature varied from  
27 ca. 28 C° during the day, to ca. 24 C° during the night. The relative clutch mass was  
28 calculated using the formula: (the total clutch weight / the maternal post-oviposition  
29 weight) X 100 (Shine, 1980). After an incubation period of 55 days, four of the six *P.*  
30 *korros* eggs successfully hatched. To avoid injury to the hatchlings (Fig.2), no attempts  
31 were made to measure their lengths, but their weights were recorded and it was  
32 determined that they were three females and one male. The two remaining eggs that  
33 failed to hatch were kept in the incubator for two additional days, after which they were  
34 removed and dissected. It was found that one was infertile, while the other contained two  
35 dead neonates (twins); one (no weight was recorded) considerably smaller than the other  
36 (weight = 2 g).

37         The embryos of reptilian twins seldom survive and hatch successfully (Schmidt,  
38 1995), so our finding is not out of the ordinary. Twinning may take place, if in the early  
39 stages of embryonic development, the embryo is separated into two independent embryos  
40 (single-egg twins), or if two ova, each with its own yolk sac, are enclosed within the  
41 same eggshell (two-egg twins) (Schmidt, 1995). Two-egg twins usually have eggs that  
42 are slightly larger than other normal eggs from the same clutch. So, since none of the *P.*  
43 *korros* eggs described herein was substantially larger than the others, and because the  
44 twin neonates did not survive, they were most likely single-egg twins.

45         Tu (2004) and Zhao (2006) stated that *P. korros* in China and Taiwan usually  
46 oviposit from May to June (early to mid summer in the northern hemisphere). Lin et al.

47 (2012) found that *P. korros* females from three localities in China oviposited from mid-  
48 June to mid-July, and that individuals from lower latitude localities oviposited earlier  
49 than females from higher latitude localities. Considering the proximate position of  
50 Taiwan in relation to mainland China, our findings suggest that *P. korros* females from  
51 Taiwan oviposit earlier than those reported by Lin et al. (2012) due to the lower latitude  
52 of the island. Whether there are variations in the time when *P. korros* females from the  
53 northern and southern parts of Taiwan oviposit requires further study.

54 Tu (2004) stated that in Taiwan *P. korros* females usually produce clutches of  
55 eight to 12 eggs. Zhao (2006) stated that *P. korros* clutches usually consists of ca. nine  
56 eggs, and Pope (1935) reported one to nine eggs per clutch from specimens from other  
57 parts of the range of this species. In the study by Lin et al. (2012), clutch sizes ranged from  
58 four to 17. The results of the study also suggested that *P. korros* females adjust their  
59 clutch sizes rather than egg sizes according to available energy (Lin et al., 2012). The  
60 clutch size described herein falls within the ranges described by Pope (1935), and Lin et  
61 al. (2012), and is thus not out of the ordinary.

62 Tu (2004) provided no egg size descriptions, but based on the descriptions  
63 reported by Pope (1935) and Lin et al. (2012), the egg sizes can vary from 31.7-48.2 mm in  
64 length and 16.3-23.5 mm in width. The sizes of the eggs described herein are thus normal.  
65 Lin et al. (2012) noted some geographic variations in the shapes of the eggs of *P. korros*.  
66 More descriptions are required to determine to what extent the eggs of *P. korros* from  
67 populations in Taiwan differ from those from other populations.

68 The only clutch mass descriptions we found were those made by Lin et al. (2012)  
69 for *P. korros* females from three localities in China. Although the total clutch mass and

70 relative clutch mass described herein are within the ranges reported by Lin et al. (2012),  
71 they are much smaller than the mean values reported in that study. Further study is thus  
72 suggested to determine the extent of the clutch masses and relative clutch masses of *P.*  
73 *korros* females from Taiwan.

74 In a study by Du and Ji (2002) it was found that in *P. korros* an increase in  
75 incubation temperature resulted in a significant decrease in the incubation period, and  
76 affected the body sizes of the hatchlings, but it had no effect on deformity incidence  
77 rates, sex ratios or hatching success rates. The incubation period from our study is similar  
78 to that (ca. 50 days) reported by Tu (2004) and that reported by Du and Ji (2002) for eggs  
79 incubated at 30 C°. The incubation period results of our study can thus be considered  
80 normal and it is unlikely that the incubation temperature was responsible for the  
81 twinning.

82 To our knowledge, this is the first description of a relative clutch mass and a  
83 reported instance of twinning in *P. korros* from Taiwan. Our report also indicates some  
84 aspects of the reproductive biology of *P. korros* in Taiwan that require further study.

85

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111 Table headings.

112 Table 1. A summary of the information pertaining to reproduction in the *Ptyas korros*  
113 female specimen described herein. Where applicable the mean and standard deviation  
114 values are given in parenthesis (mean  $\pm$  SD).

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**Maternal post oviposition body mass (g)**

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<b>Clutch size</b>	6
<b>Egg length (mm) (n=6)</b>	38 - 40 (38.8 ± 1.0)
<b>Egg width (mm) (n=6)</b>	18 - 20 (19.0 ± 0.9)
<b>Total clutch mass (g)</b>	51
<b>Relative clutch mass</b>	25.37%
<b>Incubation period</b>	55 days
<b>Hatchling body weight (g) (n=4)</b>	6-8 (7.3 ± 1.0)

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117 Captions for figures

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122 Figure 1: The six Indo-Chinese rat snake (*Ptyas korros*) eggs described herein, prior to  
123 being placed inside the incubator (photographed by Simon Dieckmann).

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126 Figure 2: One of the Indo-Chinese rat snake (*Ptyas korros*) hatchlings described herein

127 (photographed by Simon Dieckmann).