

Preliminary observations on the ovipositional behavior of the Peninsular Rock Agama *Psammophilus dorsalis* (Gray, 1831) from Savandurga forest area of Southwestern Karnataka, India.

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The Peninsular Rock Agama (*Psammophilus dorsalis*) is a common rock dwelling lizard with a widespread distribution throughout the Indian peninsula of elevations up to 1829 m (Daniel, 2002). This species is characterized by a large head which is laterally elongated and dorso-ventrally depressed. The cheeks are swollen only in adult males and their snout is longer than their orbit. This species shows distinct sexual dimorphism, with males being larger than females. Males are brightly colored only during the breeding season while females show cryptic coloration and often resemble the color of the rocks on which they are found (Smith, 1935). These lizards are known to breed from April to August (Sarkar and Shivanandappa, 1989; Shanbhag, 2002). About eight eggs are known to be present in the ovaries of gravid females (Daniel, 2002). However, information on the ovipositional behavior of *P. dorsalis* is nonexistent. This note provides a detailed description of the ovipositional behavior of a single gravid female *P. dorsalis* observed in Savandurga Forest area, southwestern Karnataka, India.

The female was observed digging a burrow between two rocks (Fig. 1A) (separated by a distance of 0.6 m) between 1115-1305 h on July 1st 2012. The rocky formations were in the midst of a dry deciduous forest within the Savandurga forest areas, Karnataka (12° 55.16' N, 77° 18.25' E; 851 m elevation). The atmospheric temperature (measured using a laboratory thermometer,

mercury filled-ZEAL®) was 24° C at 1115 h and the weather was cloudy during the observations made by the author. All observations were made by the observer located about 3 m away from the lizard. The soil in the area where the eggs were laid was predominantly sandy.

Before ovipositioning, a male *P. dorsalis* was present at the same location with its anterior part of the body arched up on one of the rocks about two feet from the nest site. It took cover regularly along the side of that rock when disturbed on spotting the observer initially but got back to its position on the rock after about 6 min. After egg-laying both individuals were captured using a noose, measured using a one meter flexible tape and weighed using a 250 ± 5 g spring balance (Salter®). The female measured, snout to vent length=85 mm, tail= 210 mm, total= 295 mm and mass=30 g and the male measured, snout to vent length=95 mm, tail= 172 mm, total= 267 mm and mass=45 g.

The ovipositional behavior was as follows (Table 1): The female *P. dorsalis* was excavating a burrow with its right fore-limb, scraping the mud out with its claws. Initially, the head was held above the ground but as the burrow got deeper than about 2 cm (visual approximation) the head gradually went into the burrow. The lizard continued digging using both right and left forelimbs alternately for about 10-25 sec. In this period, the lizard would lift its head and scan the surroundings for 6-15 sec, possibly for predators.

As the burrow was excavated, the hind limbs were not spread to its widest limits but the abdomen was raised from the ground. It took about 50 min for the completion of the burrow. The lizard now turned 180° with respect to its initial position of head towards the burrow to vent being over the burrow for laying eggs (Fig. 1B). The hindlimbs were placed on the circumference of the circular burrow as it started to lay eggs. A total of 10

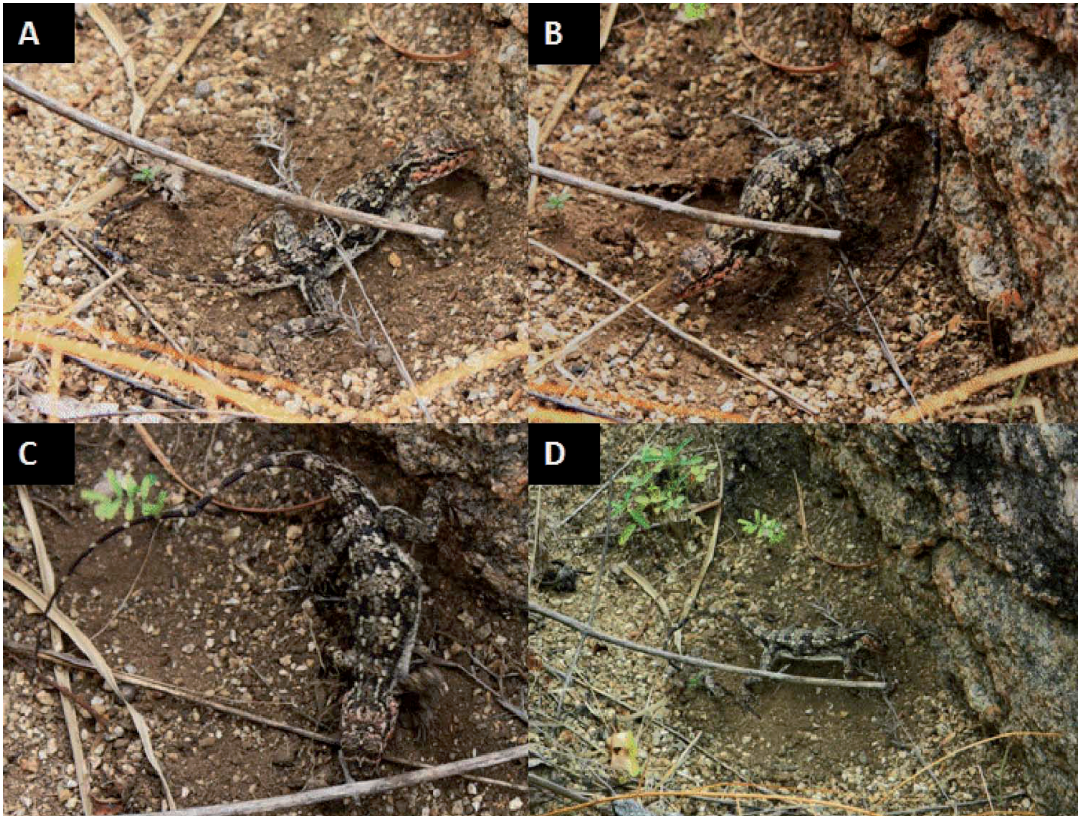


Figure 1: A- *Psammophilus dorsalis* excavating the burrow, B- Commencement of egg laying, C- Closing its burrow and D- Compacting its burrow.

eggs were laid over a time span of 25 min. The first egg was laid 70 sec. after completion of digging and the second egg was laid about 90 sec. after the first. The inter egg laying interval (IELI- time from egg being dropped from cloaca to the beginning of the next egg about to be laid) varied from 90-120 sec. with an average of 98.5 sec. It appeared that IELI decreased with the increasing number of eggs laid. The respiration rate (ocular observation of inhaling and exhaling) was about constant. The lizard appeared to hold its breath for a very short time when the eggs were being laid after which a deep breath was taken. The lizard's abdomen was raised while the eggs were being laid.

After ovipositioning, the lizard got back to its original position (snout and forelimbs facing the mouth of the burrow) and began to compact the burrow by pushing the mud surrounding the burrow using its forelimbs (Fig. 1C). It used its right forelimb 66 times and its left forelimb 75 times for a time period of about six to

nine sec. While compacting, a faint 'knocking' sound was heard as the lizard butted the nest using its snout and while doing so, the lizard would pause and scan its surroundings for 10-15 sec. The burrow was 'snout butted' (Fig. 1D) eight times before the lizard climbed up the rock adjacent to the nest. The whole process of compacting took around 33 min for completion. The lizard then moved up onto one of the rocks and stayed there for about 2 min and then left its nest site.

After the lizard moved away from its nest site and its morphometrics was collected, the details on the nest and the eggs were recorded after which the eggs were replaced in the burrow and packed with the mud around. Care was taken to replace the eggs in as similar to the undisturbed nest as possible. The burrow measured 120 mm in diameter and 82 mm in depth. The clutch contained 10 eggs of which the smallest measured 13.72 mm in length with a width of 9.37 mm and the largest showed length of 14.96 mm and width of 9.76 mm (Fig.

Table 1: Ethogram of the ovipositional behaviour of the Peninsular rock agama (*Psammophilus dorsalis*).

Ovipositional activity	Code	Time	Operational definition
Excavation of burrow	Eb	10-25s	Digging of burrow i.e nest cavity in short intervals of time using its forelimbs (right and left alternately) and hindlimbs.
Scanning its surrounding	Ss	6-15s	During intervals of digging and compacting, the lizard would rest and scan the area around it possibly for predators. This is usually done by tilting its head.
Turns 180° with respect to the nest	T180	3-4s	Turns 180° with respect to the nest aligning its cloacal aperture over the opening of the burrow to lay eggs.
Laying of eggs	Le	25min	Eggs were laid in a time period of 25min accompanied by holding of breath and raising abdomen during the process.
Returns to its digging position	R180	3-4s	Returns to its original position after egg laying
Compacting the nest	Cn	15-20s	Uses forelimbs and hindlimbs to pull in mud over the eggs and uses the tip of its snout to compact the mud.
Social behavior	Code	Time	Operational definition
Head bobs	Hb	-	Use of visual cues for communication observed after ovipositioning.

2). The average length and width of all the eggs was 12.5 mm and 9 mm (measured using standard analog vernier caliper to the nearest 0.05 mm). The temperature inside the burrow was 23.8° C. The eggs were photographed and the eggs were deposited back into the nest and care was taken to reconstruct the nest to its original state after which the author moved away.

From the observation described above, it is clear that this lizard primarily uses its forelimbs for both digging and closing the burrow (nest cavity) for ovipositioning although there have been reports for the use of hind limbs in *Calotes sp.* for both the processes mentioned above (Gabadage, 2009). It appears that the individual observed used its right forelimb more than its left. However, this point may be validated with observations on few more individuals. The presence of a male near the nesting site may only be incidental; the opposite would need further validation through observations.

P. dorsalis is a common agamid across the peninsular India and there are numerous studies largely on the behavioral ecology of this species. Detailed studies on the thermoregulatory behavior in a gravid female (Veeranagoudar et al., 2010), social behavior of this species with respect to the use of visual cues (Radder et al., 2006) and anecdotal observations on the

predation behavior have been made (Sreekar et al., 2010). However, basic natural history or descriptive ecological studies on the habitat quality/suitability, diet composition, effects of anthropogenic disturbance and habitat modification on this species have not been undertaken. The observation on oviposition is a small addition to the existing information of this species.

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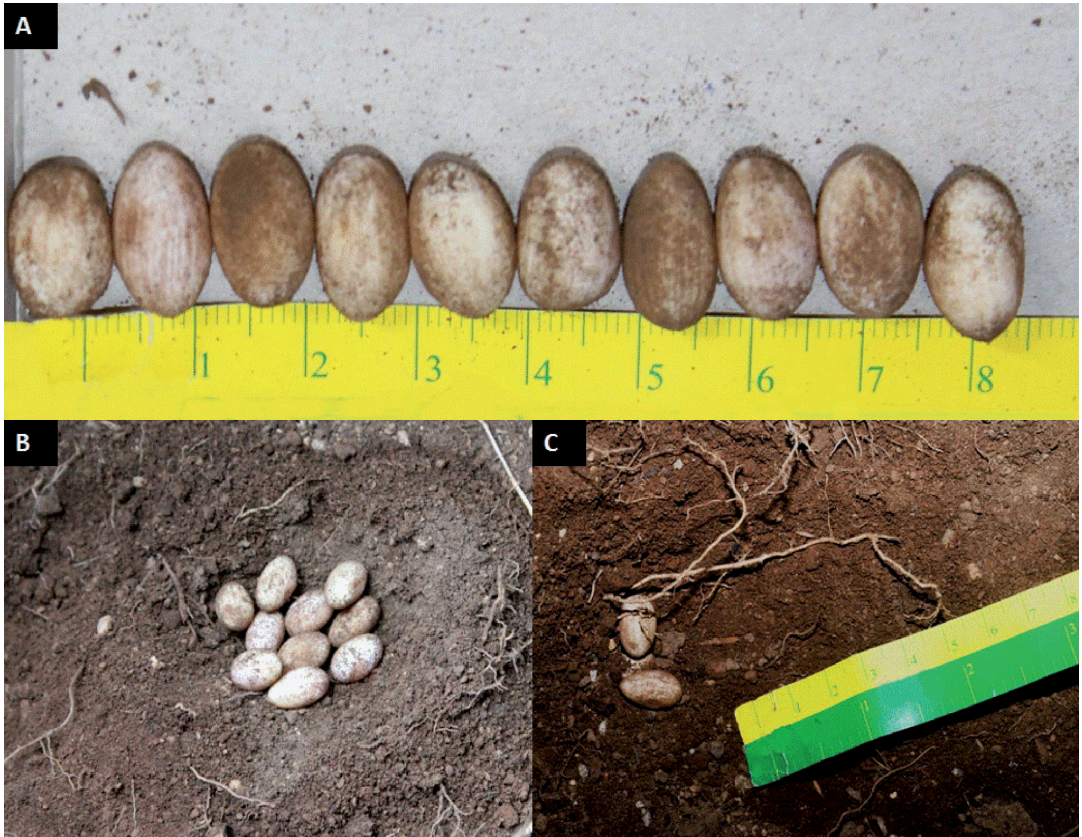


Figure 2: A- The 10 eggs laid by the female lizard with scale, B- The depth of the burrow (82 mm), C- The 10 eggs in the nest.

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