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Quid Pro Quo: A Documented Case of Cannibalism in the Red-Bellied Black Snake *Pseudechis porphyriacus* in Lamington (Queensland, Australia)

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Abstract: The red-bellied black snake (*Pseudechis porphyriacus*) is a member of the Elapidae family and is distributed on the east coast of Australia. The species is known to feed on a variety of ectothermic prey, including frogs and lizards. It is also known to be ophiophagous (snake-feeding), and stomach-content analyses suggest that *P. porphyriacus* also exhibits cannibalistic behavior, yet this extreme case of ophiophagy has rarely been documented. Here, a case of cannibalism in *P. porphyriacus*, which was observed in Lamington (Queensland, Australia), has been photographically documented and is described.

Keywords: Elapidae; ophiophagy; natural history; feeding ecology

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Australia abounds with a globally unique diversity of elapid snakes, many of which are amongst the most toxic serpents known to man [1]. A particularly enigmatic group of Australian elapids are the black snakes of the genus *Pseudechis*, a group of large snakes currently consisting of nine generally accepted species [2]. Members of *Pseudechis* are venomous and capable of delivering bites to cause severe envenoming leading to morbidity and death [3]. The genus further contains some of Australia's most prominent snakes, including the king brown or mulga snake (*Pseudechis australis*) and the Collett's snake (*Pseudechis colletti*) [2]. Another member of this genus that receives noteworthy recognition among the broader public is the red-bellied black snake (*Pseudechis porphyriacus*).

Pseudechis porphyriacus is certainly best known for its characteristic appearance. It is a large snake that displays a black dorsal coloration [1]. Laterally, it exhibits an intense deep-red colored band adjacent to a bright pastel-colored ventral side. The common name, red-bellied black snake, has been assigned to *P. porphyriacus* thanks to this enigmatic and somewhat unique red lateral band adjacent to the otherwise dark black side. As with other members of *Pseudechis*, *P. porphyriacus* is venomous. Its venom contains a range of toxins, such as phospholipase A_2 and factor-Xa-like toxins and causes an array of envenoming symptoms in humans and domestic animals. These include local effects (e.g., swelling), systemic effects (e.g., nausea and vomiting), coagulotoxicity (anticoagulative effects), and myotoxicity [3–7]. Albeit most *P. porphyriacus* envenomings being of moderate severity, fatalities are known and bites should be considered a medical emergency [4,8,9]. The red-bellied black snake is distributed across the Australian east coast and inhabits moist habitats that are associated with water bodies, such as streams and ponds [1]. It is a well-known predator, particularly of ectothermic prey. The species has been reported to primarily feed on frogs but also to hunt for reptiles, small mammals, birds, and even fish [10,11]. It is also known as an occasionally ophiophagous (snake-feeding) species, and the literature sporadically mentions that red-bellied black snakes engage in

cannibalism [1,10]. However, documented cases of the latter are scarce, and cannibalism in red-bellied black snakes is usually only mentioned as a sidenote. Here, a case of cannibalism between two individuals of *P. porphyriacus* is reported, which was observed and photographically documented on 13th of March in Lamington National Park, Queensland (Australia).

The author spotted a large *P. porphyriacus* individual during a walk through the national park at 14:39 h. The relatively large specimen of approximately 150 cm was hiding in the crevices of an artificial stone wall around 50 m away from a public parking space. The wall had been set up on the right-hand side of the footpath the author was following. Initially, only some parts of the snake's body were visible, excluding the head. Meanwhile, the observed animal was moving stationary exhibiting the pulsative movements and signs of physical work usually associated with feeding on larger prey. Hence, the author opted not to continue his walk and instead further observed and documented the situation from a distance through his Canon EOS 650D with a 50–200 mm telezoom objective. After ca. 5 min, the observed animal retracted its head from the crevices, revealing that it was indeed feeding on prey, probably a snake based on the few visible details. Further retraction of the snake's head allowed the author to examine the identity of the prey item further, thereby revealing that the observed snake was currently feeding on what appeared to be a fellow red-bellied black snake (Figure 1). An increase in the zoom validated this, as the preyed-upon snake was clearly identifiable through its characteristic black–red coloration (Figure 2).

Figure 1. A case of cannibalism in red-bellied black snakes (*Pseudechis porphyriacus*). On 13 March 2023, the author spotted this large specimen feeding on a conspecific individual in a stone wall ca. 50m from a parking space in Lamington National Park (Queensland, Australia). The animal was then observed henceforth for ca. 25 min. (Image taken with a Canon EOS650 equipped with a Canon 50–250 mm objective).

Figure 2. Detailed image of the head section of the observed specimen while feeding on its prey. Superbly visible are the pronounced venom glands at the posterior part of the head and the pholidosis across the head. The prey snake can be clearly identified as another *P. porphyriacus* as per the characteristic black–red color pattern displayed. (Image taken with a Canon EOS650 equipped with a Canon 50–250 mm objective).

After ca. 10 min of observation, the feeding snake started to retract fully from the stone wall and dragged its prey with it on the open space of the foodpath. Interestingly, this revealed not only the significant size of the observed snake but also its prey, which was seemingly of almost the same size (Figure 3). Accordingly, the observed individual had to exert tremendous efforts to feed on its prey which manifested in noticeable exhaling and scraping sounds. The overpowered prey was still alive during the feeding process, which was evident from its repeated attempts to escape its situation. At least on four instances, three of which took place on the footpath, the prey snake started to engage in longitudinal rolling. However, in all cases it was overpowered by its predator who, after brief pausing of the feeding motion, continued to swallow it (Figure 4). After ca. 25 min, around three-quarters of the prey snake were consumed and the initially observed snake retracted with its prey into the dense understory next to the footpath where the author lost his sight of it.

Figure 3. The large prey. After ca. 10 min of observation time, the observed specimen started to retract from the stone wall and moved, while feeding, onto the plain footpath adjacent to it. Therefore, it simultaneously retrieved its prey from the crevices. Surprisingly, both snakes were of almost the same size. (Image taken with a Canon EOS650 equipped with a Canon 50–250 mm objective).

Figure 4. Prey resistance. During the whole observation, the prey-individual was seemingly alive and tried to resist the feeding. This was undertaken by repeated attempts of longitudinal rolling as captured on this photograph. However, although multiple such attempts were made, the prey-snake was always overpowered by its predator. (Image taken with a Canon EOS650 equipped with a Canon 50–250 mm objective).

The predator–prey interactions of snakes are difficult to observe in situ, especially for shy and elusive species such as the red-bellied black snake [11]. The observations made herein are thus interesting to better understand the feeding ecology of these snakes and

some new insights can be derived from them. For instance, it is noteworthy that both snakes were seemingly of equal size and also that the preyed-upon individual was alive throughout the observation and tried to escape from its predator. This shows that even large individuals of *P. porphyriacus* may fall victim to cannibalism and supports that members of this species are resistant to the venoms of their conspecifics. Most importantly, this work provides the first detailed, verbalized, and photographed documentation of cannibalism in red-bellied black snakes. Members of this species are known to be ophiophagous and some snakes, including cat snakes (*Boiga irregularis*) and black-bellied swamp snakes (*Hemiaspis signata*), have been reported as prey items [1,10]. The species is occasionally reported as cannibalistic, but detailed documentation has largely been missing so far. This may be caused due by cannibalism, although being engaged in it could be a relatively rare feeding strategy in *P. porphyriacus*. The study of Shine (1987) investigated the stomach contents of 238 *Pseudechis* specimens deposited in museum collections [10] including 135 *P. australis* and 103 other *Pseudechis* (*Pseudechis butleri*, *Pseudechis colletti*, *Pseudechis guttatus*, *Pseudechis papuanus*, *and Pseudechis porphyriacus*). The study found that, of all of the species looked at, only *P. porphyriacus* performed cannibalism [10]. However, of all of the examined individuals of that species, only a single snake from Queensland contained a conspecific in its stomach and thus was cannibalistic [10].

In conclusion, this study provides valuable insights into the feeding ecology and predatory behavior of the red-bellied black snake (*P. porphyriacus*). The observed cannibalistic event highlights the potential vulnerability of even large individuals to intraspecific predation. While cannibalism appears as a relatively rare feeding strategy in this species, further research is needed to fully understand the prevalence and significance of this behavior. It needs to be pointed out, however, that the hunting process itself was not observed herein. Therefore, it is unclear whether the observed case of cannibalism stems from a targeted attack or from elsewhere (e.g., two snakes originally targeting the same prey item as often observed from snakes in captivity). The findings of this study contribute to the broader understanding of predator–prey interactions in snakes and emphasize the importance of detailed documentation and observation to uncover rare and elusive behaviors.

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