

Defensive Hemipenis Display in the Kukri Snake *Oligodon cyclurus*

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Oligodon cyclurus is a widespread and common Asian colubrid species. In Thailand, it is frequently found in most of the center and the north-east of the country (Taylor, 1965; Cox, 1991). Like many other species of the genus, *O. cyclurus* exhibits a defensive caudal display (Greene, 1973, 1988). In addition, it is an extremely irascible snake which will strike repeatedly at anything within or near its striking range at the slightest provocation (Smith, 1943; Taylor, 1965). We report on an unusual defensive behavior pattern observed in four specimens of this species.

A young male specimen of *O. cyclurus* (SVL 265 mm, TL 305 mm, weight 10.0 g) was captured on 27 July 1990 in Bangkok. It was maintained in a 40 × 20 × 20 cm cage in an open, well-ventilated garage exposed to normal Bangkok climatic conditions.

On 13 August 1990, the specimen was taken into the open for photographic purposes. As usual, the snake tried to escape, and thrashed and struck wildly whenever it was restrained or its escape path was blocked. Simultaneously, it raised the tail and the rear part of the trunk. The tail was rolled into a spiral, exposing the immaculate white underside of the tail and of the posterior part of the trunk. During this display, the bright, pinkish red hemipenes were repeatedly extruded to a varying degree for a few seconds (Fig. 1A). The tail-up position and hemipenis extrusion were never maintained for more than a few seconds at a time. Hemipenis extrusion and withdrawal was generally slow. This behavior was observed repeatedly, whenever the snake was provoked. Due to the immaturity of the specimen, the hemipenes were small (approximately 3 mm), but because of the color contrast between them and the white ventral surface, their extrusion was conspicuous.

Two adult males were captured in Bangkok in December 1990. During capture, the first of these two snakes (SVL 460 mm, TL 560 mm, weight 68.2 g) exhibited the usual spiraling of the tail, and the hemipenes were extruded, the behavior being similar to that of the juvenile specimen. The hemipenes of this specimen measured approximately 10 mm, and their color was crimson. The increased size and darker color made their extrusion more conspicuous against the immaculate white ventral color. However, this specimen was less prone to extruding its hemipenis when restrained than was the juvenile specimen. This snake did not strike wildly, but bit a gloved hand when picked up.

The second adult male, measuring approximately 600 mm in total length, was captured at night in Bangkok. In the poor light available, the white underside of the tail was clearly visible, but hemipenis extrusion

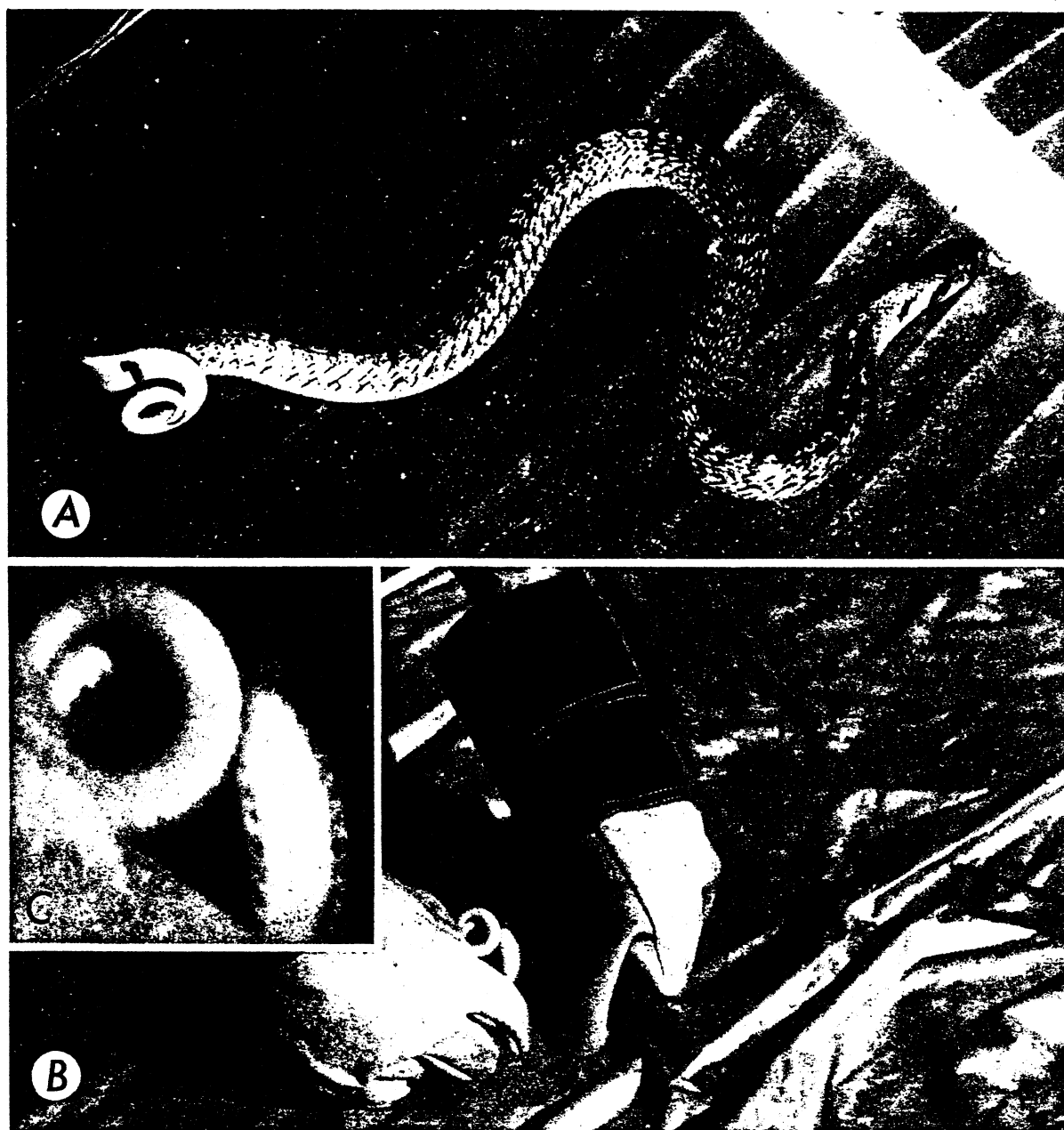


FIG. 1. Hemipenis extrusion in the defensive display of *Oligodon cyclurus*: (A) Juvenile specimen in defensive position, after handling. Everted hemipenes are clearly visible. (B) Adult male (third specimen) everting hemipenis while being handled. (C) Enlargement of everted hemipenis from Fig. 1B.

was not noted. Daytime handling of this specimen revealed a hemipenis display similar to that of the second specimen (Fig. 1B, C), but the display was not observed very regularly.

A further juvenile specimen, captured in Bangkok in September 1991 (TL approximately 350 mm), very readily extruded its hemipenes when restrained.

Our sample indicates a decrease in the likelihood of hemipenis extrusion with size or age: both adults were far less likely to evert their hemipenes when handled than were the two juveniles. This behavior could not be elicited reliably in the adults, whereas the juveniles almost invariably extruded their hemipenes when handled.

Defensive tail displays are widespread among most

snake families, both in entirely inoffensive species, and in highly aggressive or venomous species (Greene, 1973). In the widespread Asian colubrid genus *Oligodon*, tail displays have been reported in *O. arnensis*, *O. bitorquatus*, *O. cyclurus*, *O. quadrilineatus*, *O. subgriseus*, *O. taeniatus*, *O. taeniolatus*, and *O. violaceus* (Greene, 1988). In all species the display consists of the raising of the tail and the posterior part of the body, exhibiting the often brightly-colored underside of the tail (e.g., salmon pink in *O. taeniatus*, pers. obs.), and rolling the tail into a horizontal spiral. However, hemipenis displays have not hitherto been noted in any species of *Oligodon*.

The only previous reports of hemipenis displays in snakes refer to the highly venomous South American

coral snake *Micrurus frontalis* (Allen, 1940; Azevedo, 1960). In this species, the tail is raised, curled, and waved laterally from side to side, and sometimes used for mock strikes. At the same time, the hemipenes are extruded rapidly, either singly, or more rarely simultaneously. In *O. cyclurus*, the hemipenes were extruded or withdrawn simultaneously and slowly: there was no conspicuous movement near the vent, and the extrusion of the hemipenes was noticeable primarily due to the color contrast. The color contrast may enhance a possible aposematic effect of the flashes of white color caused by the underside of the tail being waved about. This would be restricted to situations where the animal is uncovered during the day by a potential predator; during the night, when these snakes forage in the open, the hemipenis display would be invisible, or at least inconspicuous, unlike the white underside of the tail. The colors involved in the contrast are the same as in *M. frontalis*, but in reverse: in the latter species, the hemipenis is white (Azevedo, 1960), whereas the color of the body around the vent is red (see photographs in Schmidt and Inger, 1957, and Campbell and Lamar, 1989).

The function of a defensive display of the hemipenes is unclear. Allen (1940) and Azevedo (1960) surmised that the projection of the hemipenes may suggest that a defensive tool, such as a stinger, is being brought into play; Azevedo attributes the myth circulating in the native population of southern Brazil that coral snakes sting with their tails, to the hemipenis display. We are not aware of a popular belief in Thailand that *O. cyclurus* stings with its tail.

If the hemipenis extrusion does successfully mimic a stinger, it could have the effect of diverting a predator's attack to the apparently dangerous end of the snake, leaving the snake free to bite its opponent. This could be effective in both snakes: *Micrurus frontalis* is highly venomous, and *Oligodon cyclurus* is capable of inflicting considerable injuries with its large posterior maxillary teeth. Additional effects from its Duvernoy's gland secretions are possible (see below), but undocumented.

Greene (1988) surmised that hemipenis eversion might be an epiphenomenon of fright. This is possible in both cases, although unlikely in *Micrurus frontalis*, since the movements of the hemipenes in that species appear to be quite deliberate, judging by the published descriptions. In *Oligodon cyclurus*, this hypothesis may be more tenable, since there is no conspicuous movement of the hemipenes. This makes them much less noticeable, and therefore less potentially threatening. The fact that our juvenile specimens very readily displayed their small, relatively inconspicuous hemipenes, whereas the two adult males were more reluctant to extrude their much larger, more conspicuous, and therefore potentially more effectively aposematic, hemipenes, also supports the epiphenomenon hypothesis. However, the fact that hemipenis eversion appears to be a common component of the defensive repertoire of this species suggests that it has some function.

If the hemipenis display of *O. cyclurus* does not fulfill an aposematic role, it is difficult to avoid the conclusion that hemipenis extrusion would be disadvantageous for the animal. Caudal displays by snakes are usually interpreted as attracting attention to a robust or expendable part of the animal, with

varying apparent effectiveness (Greene, 1973). However, this cannot explain the behavior described here, since the hemipenes of a snake must be among the least robust parts of the animal, and, since they are essential for reproduction, they are also among the least expendable. Unless the hemipenes are effective as an aposematic device to significantly enhance the chance of the snake escaping, capable of further reproductive activity, then their display would be counterselected, since it leaves them exposed to injury by a predator. This hypothesis is supported by the fact that *O. cyclurus* is only the second snake species reported to evert its hemipenes for defense rather than reproduction.

More studies are needed to investigate the frequency of occurrence of this phenomenon in *O. cyclurus* and other species of the genus, and to determine the effect of hemipenis displays on potential predators of these snakes.

The authors would like to reaffirm Taylor's (1965) observation that this species is capable of causing slashing wounds, producing much bleeding, with its posterior maxillary teeth, even while being held by the neck. During one capture of the first adult male, the second author received a severe bite in this manner, which bled profusely for a number of hours. The wound was clearly a laceration, rather than a puncture wound, as would be produced by other snakes. A scar was clearly visible three months after the bite, and other persons bitten by this species still carry scars five years after the bite (Piboon Juntakune, pers. comm.). Even leather gloves offer little protection against the bites of these snakes (Trutnau, 1988). Considerable care should be taken with members of this genus, as damage to tendons, nerves or important blood vessels, especially in digits, are a distinct possibility after bites of larger specimens. The vernacular name "Kukri snakes," which refers to the knives used by Gurkha soldiers, is clearly appropriate for this genus.

The bleeding caused by bites of this snake lasts much longer than bleeding from a normal cut. Several studies have shown the presence of Duvernoy's glands in several species of *Oligodon* (Taub, 1967; Gabe and Saint Girons, 1969). Although nothing is known about their venoms, the excessive bleeding observed after bites suggests an anticoagulant activity of the Duvernoy's gland secretions of this species. National Park staff at Nam Nao National Park, northeastern Thailand, informed us that a bite by another large *Oligodon*, *O. dorsolateralis*, caused considerable swelling of the affected hand, as well as excessive bleeding (pers. comm.).

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