

## Winding to and fro: constriction in the snake *Anilius scytale*

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**S**NAKES from different phylogenetic lineages use constriction to subjugate and handle prey, an apparently ancient behaviour (Greene & Burghardt, 1978). This feeding strategy is widespread in alethinophidian snakes from many clades, including both non-caenophidians such as *Cylindrophis*, *Loxocemus*, and Boidae, and caenophidians including *Acrochordus* and several species of Colubridae and a few Elapidae (Willard 1977; Greene & Burghardt, 1978; Shine 1985). The aniliids and cylindrophids are possible sister taxa comprising a clade that is sister to all other alethinophidians (e.g. Scanlon & Lee, 2000, but also e.g. Vidal et al., 2007 for alternative phylogeny), and their feeding biology is thus relevant to understanding the origins and evolution of constriction. Aniliids and cylindrophids both feed on elongate vertebrates. Constriction is known for at least one cylindrophid but has not been reported for the only aniliid, the Neotropical *Anilius scytale* (Greene, 1983). The scarce data on feeding behaviour of *A. scytale* would indicate that this is a non-constricting species (see Savitzky, 1980). However, the only available record on prey subjugation by *A. scytale* is based on an observation with a very small prey item and these often induce no constricting behaviour in snakes known to otherwise constrict (see Greene, 1983). *Anilius scytale* is recorded as occurring in water and both waterlogged and drier soil, but very little is known about its habits (Martins & Oliveira, 1998), although it is known to feed on elongate prey such as eels and caecilians (Beebe, 1946; Cunha & Nascimento, 1978; Martins & Oliveira, 1998).

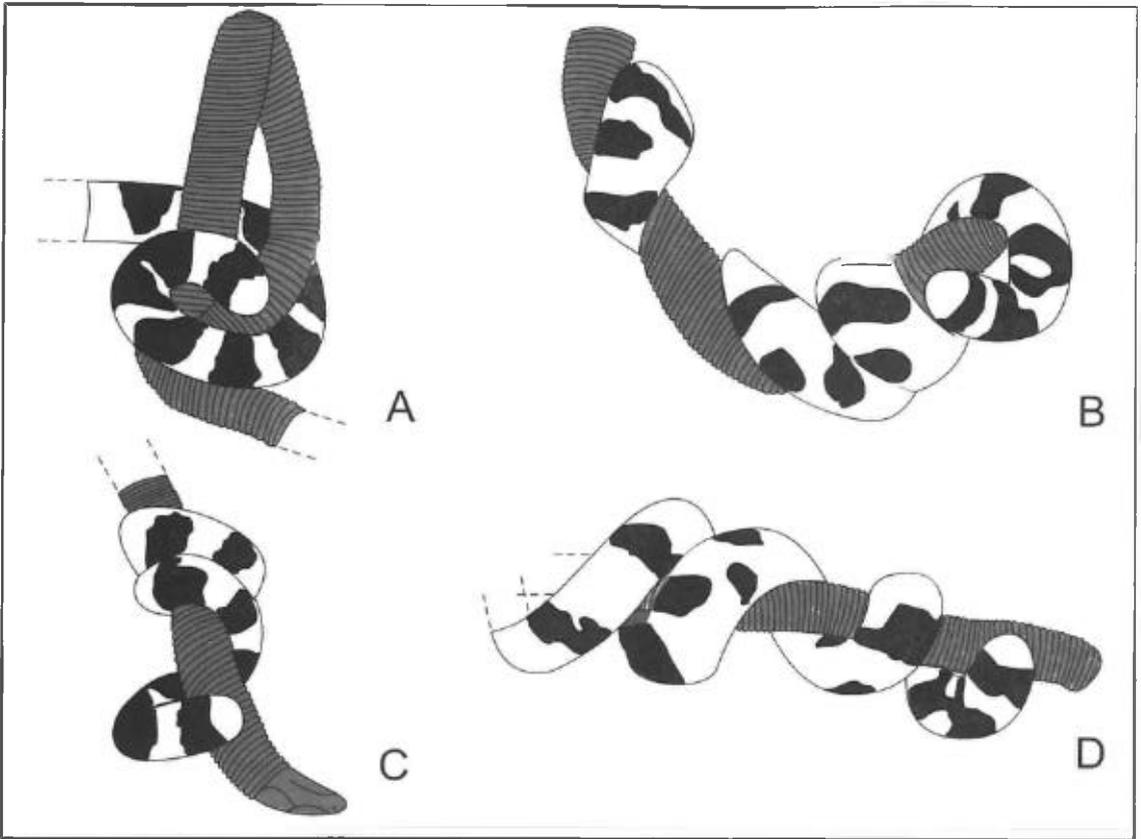
A specimen of *A. scytale* caught in a hydroelectric rescue at Palmas, Tocantins, central Brazil (11°S, 48°W) (40 cm SVL) was placed in a plastic container and offered a small elongate fish, the cobitid *Misgurnus* sp. The snake grasped the fish and began a coil (Figure 1) but did not

proceed and released the prey. This observation gave us the clue that the snake might constrict larger, elongate prey such as amphisbaenians. Thus, we housed another specimen of *A. scytale* (52 cm SVL, collected from the same locality) in a 50 x 25 x 30 cm terrarium with soil and water at room temperature (24–30°C) and offered an *Amphisbaena* sp. individual (22 cm TL) as a potential prey. The whole feeding sequence was video-taped, and some stills were selected to make the pictures used here to illustrate four phases of the constriction behaviour. The complete video-taped sequence is on a DVD housed at Laboratório de Ecologia e Evolução of Instituto Butantan.

The whole feeding sequence occurred on the soil surface. After set free in the terrarium the amphisbaenian was bitten by the snake on the anterior part of its body, the snake keeping its grip for 25 sec. After this, the snake held the prey with anterior, horizontal coils with its right body side in contact with the prey (Figure 2A). As the prey twisted around its long axis (a habitual defensive movement) the snake loosened its coil hold on the prey and immediately constricted the prey again,

**Figure 1.** The snake *Anilius scytale* (SVL = 40 cm) bites and begins a potential constriction movement on a cobitid fish, *Misgurnus* sp.





**Figure 2.** Constriction sequence on an amphisbaenian, *Amphisbaena* sp. (TL = 52 cm) by the snake *Anilius scytale* (SVL = 22 cm). A – After the initial bite, use of anterior, horizontal coils, with the right side of the snake in contact with the prey; B – posterior and horizontal coils with right side in contact with prey; C – anterior and horizontal coil with left side in contact with prey; D – anterior and horizontal coils with left side in contact with prey. Only the head end of the snake is shown. Based on still frames of a video-tape.

this time with posterior, horizontal coils, keeping its right side in contact with the prey (Figure 2B). After a second coil loosening, the snake constricted the prey again with anterior, horizontal coils, but this time with its left side in contact with the prey (Figure 2C). In the fourth and last constricting action (again after loosening the coil grip) the snake constricted the prey with mixed (anterior and posterior) horizontal coils, again using its left side to contact the prey (Figure 2D). The snake sometimes wrapped its lower body around the prey's posterior body, with irregular and overlapping coils. The snake proceeded to bite and constrict the amphisbaenian for about 30 min,

in which time the prey died. Thereafter the snake released its bite and coils around the prey, and swallowed it head-first.

The constriction employed by *A. scytale* varied both in the coil composition (anterior-posterior) and laterality (right-left). The coil composition is usually invariable for a given taxon (Greene & Burghardt, 1978), whereas the body side wrapped around the prey is variable both at the specific and individual level, but the coil is applied only once during a predatory event and thus remains invariable till the end of the ingestion (Lopes *et al.*, 1991). Constriction modes vary from lineage to lineage, but there seems to be a pattern within these. For instance, non-caenophidians (*Cylindrophis*, *Loxocemus*, and boids) generally constrict with anterior, horizontal coils (Greene & Burghardt, 1978), while colubrid and elapid constriction is more variable but generally consistent within a given genus (Shine & Schwaner, 1985). Our data indicate that *A. scytale* has no fixed constriction pattern, but more episodes and more individuals need to be

observed. If confirmed, absence of a consistent pattern might represent an ancestral condition that would indicate that constriction in snakes originated as a more or less irregular behaviour, and eventually evolved to a more stable pattern (such as the presently seen in *Cylindrophis*, *Loxocemus*, and boids). The absence of a well defined constriction pattern in *Anilius* might be considered supporting evidence for the hypothesis that Cylindrophidae is more closely related to Caenophidia than Aniliidae (e.g. Slowinsky & Lawson, 2002; Lawson *et al.*, 2004; Vidal *et al.*, 2007). On the other hand, the changes recorded during the observed feeding episode might not be considered to be a fully developed constriction but simply behavioural adjustments of the predator to a vigorous and constantly twisting prey. Even if this is the case, this would not invalidate the possible phylogenetic conclusion. Our observations are based on a single individual and a single predation event, and additional records would test our interpretations.

The behaviour we recorded for *Anilius* suggests that some form of constriction is widespread in non-caenophidian alethinophidians. The apparent exceptions include Uropeltidae and Xenopeltidae (no data are available for Anomochilidae). The former feed on earthworms (Greene, 1997) and constriction is probably not needed to subjugate such prey. Thus, constriction may be a trait that vanished in some non-caenophidian groups as well as in some caenophidians.

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