

Eyes bigger than the stomach? A record of the Eastern Montpellier snake, *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827), preying on an adult glass lizard, *Pseudopus apodus* (Pallas, 1775)

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The Eastern Montpellier snake, *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827), is found across northern Africa, around the eastern part of the Mediterranean and through southeastern Europe. As opposed to the Western Montpellier snake, *M. monspessulanus* (Hermann, 1804), there is little literature published on the diet of *M. insignitus*. These venomous snakes are active predators and regarded as generalists, feeding on large insects, amphibians, small mammals, birds, snakes (including cannibalistically), as well as lizards (Haan, 1999; Speybroeck et al., 2016; Safaei-Mahroo et al., 2017).

Some species of snakes are known to predate and even specialise on elongated animals. As snakes are gape-limited predators, consuming elongated prey items such as other snakes can be an effective method of maximising energy intake in a single predation event. This was supported by Wiseman et al. (2019), who found that for California Kingsnakes, *Lampropeltis californiae* (Blainville, 1835), snakes and elongated lizards (e.g., from the family Anguidae) provided the highest payoff per item. However, this can bring anatomical challenges. In cases of ophiophagy, the prey items, especially comparably large ones, are often folded in a concertina-form, as described by Jackson et al. (2004). This is possible partially due to the high lateral flexibility possessed by snakes. A morphologically comparable food item to a snake is a legless lizard, like most species from the family Anguidae, which possess elongated, yet limbless bodies. Unlike snakes, however, these lizards have restricted lateral flexibility, putatively attributed to the presence of osteoderms and the differences in vertebral structure. It is therefore not possible for ingested lizards to be laterally folded in the same manner as seen when snakes are ingested.

The observation took place on 11 April 2016 at 12:36 h, on the island of Corfu, Greece (39.7790°N, 19.9335°E; elevation 12 m). A large *M. insignitus* was seen moving through tall grass and was subsequently caught. Only after securing the snake, did it become apparent it had consumed a significantly-sized meal, as the tail of its prey item still protruded from its mouth (Fig. 1A). The snake then regurgitated a dead and partially digested adult *Pseudopus apodus* (Pallas, 1775) (Fig. 1B, C). The snake had a snout–vent length (SVL) of 119 cm and a total length (TL) of 156 cm, whilst the prey item had a TL of approximately 104 cm. An additional observation for *M. insignitus* was recorded on 25 April 2017 at 18:03 h, in Macedonia, Greece (40.6908°N, 23.4712°E; elevation 50 m), of an adult road-killed specimen that had ingested a dice snake, *Natrix tessellata* (Laurenti, 1768) (Fig. 1D).

The record of an *M. insignitus* individual with SVL 119 cm and TL 156 cm is one of the longest recorded in Europe. Although the closely-related *M. monspessulanus* is known for regularly reaching lengths of over 200 cm (review in Haan, 1999), there are only few records for *M. insignitus* describing maximum total lengths of over 150 cm (Anderson, 1898; Haan, 1999; Pulev et al., 2018).

Elongated prey items including lizards and snakes are often compressed (e.g., snakes – Jackson et al., 2004; lizards – Plettenberg-Laing, 2020). In cases of ophiophagy, the predating snake will swallow its prey through which the vertebral column is forced into waves (concertina-style folding), allowing for the shortening of the food item's body axis and such prey will thus fit in to the gastrointestinal tract of a snake of similar size (Jackson et al., 2004). It had been approximately 24 h since ingestion of the food item, estimated by investigating the stage of digestion of the lizard's anterior end (Fig. 1C). The snake was active when caught, likely disturbed during thermoregulation. Due to the relative length of the prey item, the predating snake would have had to spend multiple days with the lizard's tail protruding out of its mouth, if the prey item were to be

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Figure 1. (A) An adult *Malpolon insignitus* from Corfu (Greece), with the tail of a partially digested *Pseudopus apodus* protruding from its mouth. (B) The same snake adjacent to the regurgitated *P. apodus*. (C) The partially-digested anterior end of the predated *P. apodus*. (D) An adult road-killed *M. insignitus* from Macedonia (Greece) which had ingested a subadult dice snake, *Natrix tessellata*, which was partially extruded from the gastrointestinal tract of the predating snake. Photos by Anthony Plettenberg-Laing.

fully digested. Unlike snakes, glass lizards (*P. apodus*) and other members of the family Anguillidae have limited lateral flexibility. The undigested and rigid stomach contents would therefore directly impact a snake's two key defence behaviours, fight or flight. It would not be able to bite in defence as it can neither gain contact with aggressor's skin nor fully close its mouth. The rigid lizard's body would also remain in the oesophagus and act as a limiting factor for the snake's mobility, thus restricting its ability to escape potential predators.

There are few published records of *P. apodus* being preyed upon by snakes (e.g., Jovanović, 2009; Kukushkin, 2013; Stille and Stille, 2017; Plettenberg-Laing and Mee, 2020), but only Safaei-Mahroo et al. (2017) previously observed an adult being predated on. Kolanek et al. (2020) reported a smooth snake, *Coronella austriaca* (Laurenti, 1768), dying after ingesting a slow worm, *Anguis fragilis*, a member of the family Anguillidae. The predating snake had an SVL of 34 cm whilst the prey item had a total length of 18.3 cm, therefore a length ratio of 1:0.5 was significantly smaller than the ratio recorded in the observation here of 1:0.9. The unsuccessful predation of the comparably smaller individual reported by Kolanek et al. (2020) further emphasises the magnitude of the predator-prey interaction reported here.

The observation of a dice snake, *N. tessellata*, as a prey item for *M. insignitus* had been previously recorded in Iran (Safaei-Mahroo et al., 2017). The genus *Natrix* is not new to being prey of *Malpolon* species, with multiple records known of *M. monspessulanus* predating on both *N. natrix* and *N. maura* (Haan, 1999).

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