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Remarks on the diet of *Dolichophis caspius* (Gmelin, 1789) from Greece

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The Caspian whipsnake, *Dolichophis caspius* (Gmelin, 1789) is one of the largest snakes in Europe, with the range spanning from the Balkans through to south-west Asia (Arnold and Ovenden, 2004). This species is diurnal and hunts its prey predominantly during the day. Available diet-related literature describes them to be generalists (Arnold and Ovenden, 2004; Speybroeck et al., 2016), consuming a variety of vertebrates including other reptiles. Arnold and Ovenden (2004) described that adult *D. caspius* occasionally eat small snakes, for which there are several recorded accounts in the scientific literature supporting ophiophagy in adult individuals (e.g. *Natrix natrix*, Scerbak and Böhme, 1993; Cattaneo, 2001; *Montivipera xanthina*, Cattaneo, 2012; *Elaphe dione*, Dorward, 2014; *Natrix tesselatta*, Doronin, 2019). There are also records of ophiophagy for the closely related *D. jugularis* (e.g. Mienis, 1986; Göçmen et al., 2008).

Three predation records are described here in chronological order, further improving the understanding of the diet of *D. caspius*. Measurements of both prey and predator were taken using a measuring tape aligned along the ventral bodyside. For *D. caspius*, measurements are given for their snout-vent length (SVL). We avoided using whole body measurement (snout-tail tip length) because in snakes tails have variable lengths due to both ontogenetic and sexual variance, whilst in *Dolichophis*, also due to possible cases of pseudo-autotomy (Crnobrnja-Isailović et al. 2016). As the prey items must be wholly ingested, we measured both its total lengths (TL) and SVLs.

The first observation took place on 23 April 2017 at 14:37 h, in Western Thrace, Greece (40.9998° N, 25.3105° E; 8 m a.s.l.). A juvenile *D. caspius* was observed basking at the roadside and was subsequently caught and upon disturbance, proceeded to regurgitate a juvenile *Lacerta trilineata* (Fig. 1A). The snake had a SVL of 37. 9 cm, whilst the lizard's total length was 25.6 cm (SVL 7.8 cm).

The second observation is from 24 April 2017 at 19:14 h, in Macedonia, Greece (40.6918° N, 23.4790° E, 45 m a.s.l.). This juvenile *D. caspius* specimen had been hit by a vehicle, estimated to be within a few hours of its discovery. Its swollen dorsal side indicated that an elongated prey item had been consumed (Fig. 1B). A small incision was made and a partially digested *N. tesselatta* was extracted (Fig. 1C). The predating snake had an approx. SVL of 37 cm, whilst due to the digestion of the anterior end of the ingested *N. tesselatta*, only an estimated total length of 25 cm could be recorded.

The third observation is from 25 April 2017 at 19:39 h, in Macedonia, Greece (40.6922° N, 23.4510° E, 43 m a.s.l). This adult male *D. caspius* specimen had been freshly hit by a vehicle, similarly to the previous record. A section of its gastrointestinal tract protruded from its wound, which upon investigation held a juvenile *Pseudopus apodus* (Fig. 1D), which had been swallowed tail-first. The male *D. caspius* had a SVL of approx. 113 cm whilst the lizard's total length was approx. 33 cm (SVL 21 cm).

Previous research also showed reptiles to be regularly predated on by *D. caspius,* e.g. Scerbak (1966) found that most food items ingested by *D. caspius* (n=18) in Crimea were reptiles (26.6%), followed by mammals (17.6%). In Astrakhan, Russia, Bannikow et al. (1977) found that the lizard genera *Eremias* and *Lacerta* made up 31.5% and 22.5% respectively, of the stomach contents of the *D. caspius* examined. At 31.5%, the mammal *Spermophilus pygmaeus* matched *Eremias sp.* as the most common food item found by Bannikow et al. (1977) in the stomach contents of *D. caspius*.

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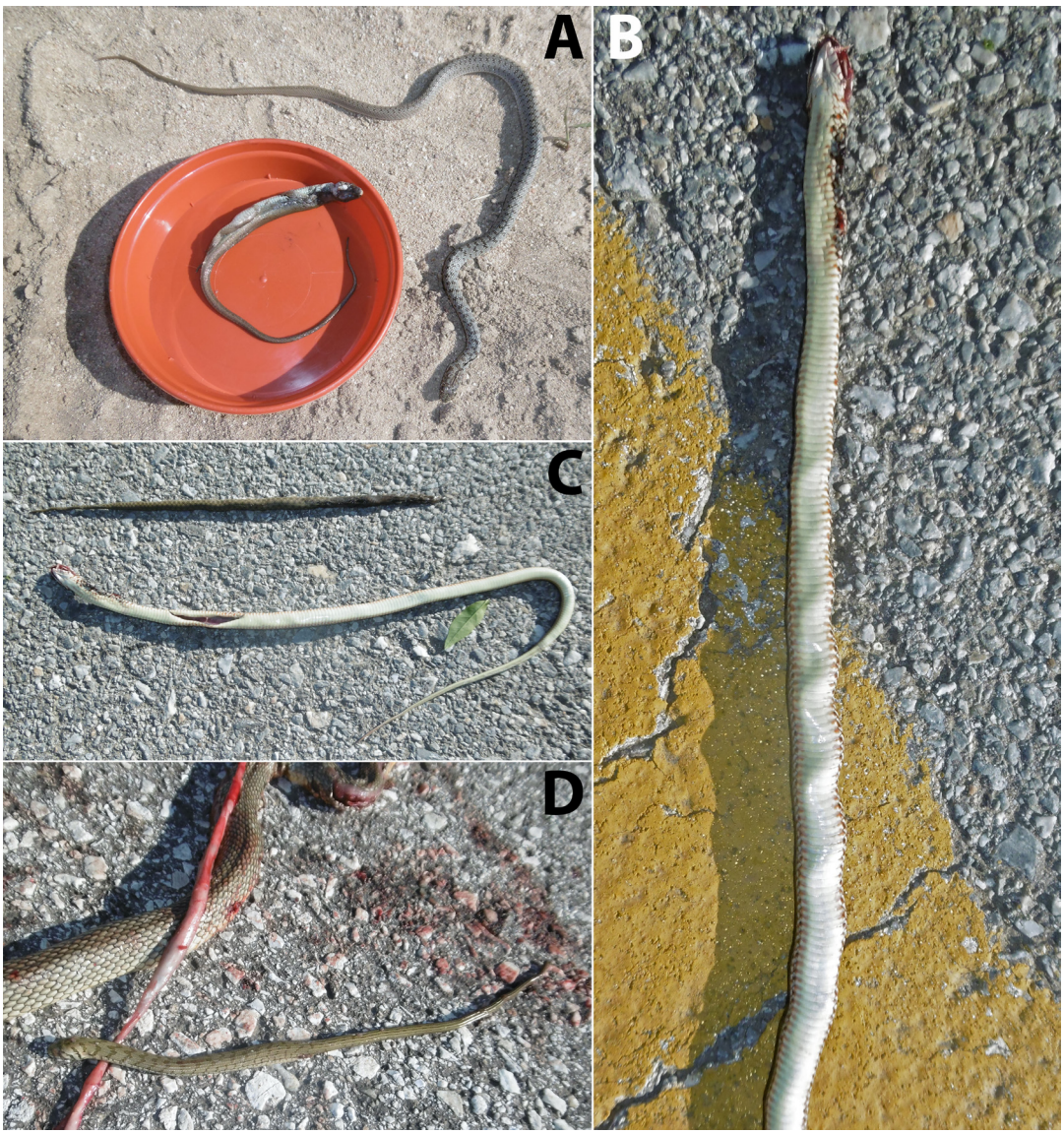

Figure 1. Three *D. caspius* specimens with various prey items. A – a juvenile *D. caspius* adjacent to a regurgitated *Lacerta trilineata*. B – a roadkill juvenile *D. caspius* with a visible laterally-compressed elongated food item. C – An extracted *Natrix tesselatta* from the adjacent *D. caspius*, as seen in Fig 1B. D – A juvenile *Pseudopus apodus* extracted from the gastrointestinal tract of an adult male *D. caspius*. Photos by Anthony Plettenberg-Laing.

The three accounts of reptilian predation by *D. caspius* recorded herein are in line with previous reports and suggest that although *D. caspius* is a generalist species, reptiles make up a significant part of its diet. It has been previously stated that adult *D. caspius* prey on small snakes (Arnold and Ovenden, 2004), but as seen by the second observation described here, ophiophagy is not restricted to adult snakes, as a juvenile *D. caspius* consumed a *N. tesselatta* 68% of its SVL length.

The predation of a juvenile *P. apodus* may not seem like an unexpected food item for a snake, yet a thorough search using online databases combined with crowdsourced requests on social media found another two published records in literature of glass lizards,

P. apodus, being predated on by *D. caspius* (Jovanović, 2009; Kukushkin, 2013).

Alongside providing further data on the diet of *D. caspius*, the comparably small size of the *P. apodus* compared to the size of the predating snake is also notable. A correlation has been supported to exist between the size of a snake and its prey item (Arnold, 1993), with the trend being that larger snakes eat larger prey. King (2002) found that larger snakes drop small prey from their diets, the putative driving factor being energy consumption and risk pay-off, whether subduing a small prey item and exposing the predator itself to potential predators is worth the energy obtained from the prey. The records reported in this paper however show a broad range of comparative morphometrical differences between these predator-prey interactions, from a ratio of 3.5:1 (in *D. caspius* and *P. apodus*, similar to that found by Jovanović (2009)) to 1.5:1 (in *D. caspius* and *L. trilineata*). The predation of comparably small prey items by adult *D. caspius* could simply be opportunistic encounters as both the record from Jovanović (2009) and the one reported here are of *P. apodus*, a diurnally active species like the predating *D. caspius*. Alternatively, it could suggest that other factors may be involved in prey choice in *D. caspius*, requiring further research. These observations shine further light on the presence of reptiles in the diet of one of Europe's largest snake species, supporting their generalist, varied, and likely opportunistic diet.

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