

Further evidence of ophiophagy, including cannibalism, by the western whip snake *Hierophis viridiflavus* in Italy

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The western whip snake *Hierophis viridiflavus* Lacépède, 1833, has two subspecies, the nominate one, occurring in Spain, France, Corsica and Sardinia, and *H. v. carbonarius* Bonaparte, 1833, that is widespread in the Italian peninsula and Sicily (Speybroeck et al., 2020). The species occupies many habitat types where it feeds on a broad range of prey that varies widely, depending on geographical area and habitat type (Vanni & Zuffi, 2010; Capula et al., 2014). Ophiophagy, including the consumption of vipers and cannibalism, is a relatively frequent feeding habit, and has been related to reduced availability for prey such as lizards and rodents, combined with high abundance of conspecific or other species of snake (Capula et al., 2014). There is detailed documentation of only three cases of cannibalism by *H. viridiflavus* including one case of oophagy (Schmidlin et al., 1996) and two involving cannibalised adult snakes (Naulleau, 1987; Capula et al., 2014). In addition, there is a video (Tiglio, 2013) shot in Sicily showing a black adult swallowing a smaller sub-adult tail first. Here we report four field observations of ophiophagy, three of cannibalism and an attempted predation of an Italian Aesculapian snake *Zamenis lineatus*. The observations were made at four different Italian sites (one in Tuscany and three in Sicily). The snakes were not captured, so it was not possible to take morphometric data.

The first case is of a black adult attempting to swallow another black adult (Fig. 1) of about the same size (estimated to be at least 1 m). This was observed at 17.56 h for 30 to 40 minutes on 4 June 2020 at Tremestieri (Messina municipality, Messina province, Sicily, Italy, 38° 08'37.1" N, 15° 31'21.8" E, about 30 m a.s.l.) in a moderately urbanised area. After various attempts to escape, the grasped individual became immobilised with its head held firmly and the two individuals tightly entwined. At this time, very gradually and very slowly, the first snake started to swallow the anterior part of the second one beginning from the head with typical lateral, alternate movements of the head, apparently to facilitate the swallowing; about 10 centimetres of the body of the other individual was swallowed in about 20–30 minutes. Then the swallowed snake was regurgitated, apparently due to external disturbance.

The second case of attempted cannibalism involved a large adult (>1 m) with the typical colour pattern of the nominate subspecies, swallowing a smaller sub-adult specimen (Fig. 2) at the locality Isola d'Elba, Monte Lentisco (Rio dell'Elba



Figure 1. Cannibalistic behaviour by an adult *Hierophis viridiflavus* which is swallowing an adult conspecific in Tremestieri (Messina province, Sicily, Italy)

municipality, Livorno province, Tuscany, Italy, 42° 51'44.96" N, 10° 24'38.93" E, about 120 m a.s.l.) along a dirt road at the edge of holm oak shrubs. The observation lasted more than 15 minutes. The adult was surprised while swallowing the other sub-adult conspecific with the body of the former firmly anchored to a large stone, giving vigorous yanks, and the other one trying to escape by anchoring itself to a small plant (*Rosmarinus*). The field observation documented only the start of the swallowing then, unfortunately, the observation was interrupted to avoid disturbance by observers. At the site, there were potential rich trophic sources of other reptiles (e.g. *Tarentola*, *Hemidactylus*, *Podarcis*), a good bird fauna and many small mammals.

The third case of cannibalistic behavior was of a juvenile specimen swallowing another conspecific juvenile on 14 September 1985 at the locality Parco Archeologico Valle dei Templi (Agrigento province, Sicily, Italy, 37° 17'27.67" N, 13° 35'39.29" E, 100 m a.s.l.), in an open xeric habitat. The swallowing snake was about 50 cm long and the conspecific being swallowed less than that. It was only possible to take a picture (Fig. 3) that, albeit poor, clearly shows the smaller



Figure 2. An adult *Hierophis viridiflavus* swallowing a sub-adult conspecific at the Isola d'Elba (Livorno province, Tuscany, Italy)



Figure 3. A juvenile *Hierophis viridiflavus* swallowing a juvenile conspecific at the Parco Archeologico Valle dei Templi (Agrigento province, Sicily, Italy)

juvenile almost completely swallowed, with only the tail protruding.

In the case of attempted ophiophagy, a melanistic adult *H. viridiflavus* was attempting to consume a similar sized (approx. 1 m) *Zamenis lineatus* (Fig. 4). This behavior was observed on 1 May 2021 at the locality Le Vigne (Biancavilla municipality, Etna volcano, Catania province, Sicily, Italy, 37° 39' 16.48" N, 14° 54' 44.09" E, about 800 m a.s.l.), in an open habitat within a context of mixed woody formations (*Quercus* sp. and *Pinus* sp.), and remains of cultivated areas. The two individuals were observed tightly intertwined, with the *Z. lineatus* trying to constrict *H. viridiflavus*, this was apparently a successful defense as after a few minutes of observation the two snakes separated and disappeared.

The known cases of ophiophagy available in the literature for *H. viridiflavus* together with our new records are summarised in Table 1. The addition of cannibalism by a juvenile specimen makes it clear that this behaviour may be shown from an early age. The attempted predation of *Z. lineatus* is the first record for this species although there is a known case of an adult *H. viridiflavus* preying upon a juvenile *Zamenis longissimus* (Capula et al., 2014). Occasional feeding by cannibalism and ophiophagy are not unusual in snake



Figure 4. Attempted predation of an adult *Zamenis lineatus* by a similar sized *Hierophis viridiflavus* at Etna volcano (Biancavilla municipality, Catania province, Sicily, Italy). After a few minutes of being observed the snakes separated and disappeared.

species with wide ranging diets and from time to time the tables may be turned as *H. viridiflavus* has been observed as the prey species for *Malpolon monspessulanus* in north-western Italy (Ottonello et al., 2006) and *Coronella austriaca* in northern Italy (Di Nicola et al., 2020).

Table 1. Summary of known records of ophiophagy, including cannibalism, in *Hierophis viridiflavus*

Prey species	Approximate life stage	Type of observation	Country	Reference
<i>Hierophis viridiflavus</i>	eggs	gut content	France	Schmidlin et al. (1996)
<i>Hierophis viridiflavus</i>	adult	gut content	France	Naulleau (1987)
<i>Hierophis viridiflavus</i>	adult	museum sample	Italy	Capula et al. (2014)
<i>Hierophis viridiflavus</i>	adult	field observation	Italy	This study
<i>Hierophis viridiflavus</i>	adult	field observation	Italy	This study
<i>Hierophis viridiflavus</i>	juvenile	field observation	Italy	This study
<i>Hierophis viridiflavus</i>	sub-adult	field observation	Italy	Tiglio (2013)
<i>Zamenis lineatus</i>	adult	field observation	Italy	This study
<i>Zamenis longissimus</i>	juvenile	gut content	Italy	Capizzi et al. (2008)
<i>Vipera aspis</i>	adult	field observation	France	Duron & Acolat (1957)
<i>Vipera aspis</i>	adult	field observation	Italy	Capula et al. (2014)
<i>Vipera aspis</i>	adult	museum sample	Italy	Vanni & Lanza (1977); Filippi (1994)
<i>Vipera aspis</i>	adult	field observation	Italy	Capula et al. (2014)

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REFERENCES

- Capizzi, D., Capula, M., Rugiero, L. & Luiselli, L. (2008). Dietary patterns of two sympatric Mediterranean snakes (*Hierophis viridiflavus* and *Zamenis longissimus*) along a gradient of habitat alteration. *The Herpetological Journal* 18: 141–146.
- Capula, M., Grano, M., Cattaneo, C. & Contini, F. (2014). Ophiophagy in *Hierophis viridiflavus* (Lacépède, 1789) (Serpentes, Colubridae): More than occasional? *Scripta Herpetologica. Studies on Amphibians and Reptiles in honour of Benedetto Lanza*: 49–54.
- Di Nicola, M.R., Zecchin, L., D'Amico, M. & Faraone, F.P. (2020). Ophiophagy in *Coronella austriaca*: first case of predation on *Hierophis viridiflavus* and first direct observations of predation on *Vipera aspis*. *Herpetology Notes* 13: 1107–1110.
- Duron, P. & Acolat, L. (1957). La couleuvre verte et jaune (*Zamenis viridiflavus* Lacépède) peut contribuer à la destruction des Vipères. *Annales scientifique de l'Université de Besançon, Zoologie et Physiologie* 6: 179–183.
- Filippi, I. (1994). Io sto con le vipere. Ricerche sui rettili italiani. *Ediemme Editrice*, Firenze. 235 pp.
- Naulleau, G. (1987). Les Serpents de France: Couleuvre verte et jaune. *Revue Francaise d'Aquariologie Herpetology* 11: 32–35.
- Ottonello, D., Oneto, F., Salvidio, S. & Lamagni, L. (2006). Il Colubro lacertino, *Malpolon monspessulanus*, nell'Italia Nord Occidentale: distribuzione, dieta e morfometria. Atti del 6° Congresso Nazionale della Societas Herpetologica Italica (Roma, 27.IX-1.X.2006): 173–181.
- Schmidlin, L., Bonnet, X. & Tege, C. (1996). Natural history notes: *Coluber viridiflavus* (European whip snake). Cannibalism. *Herpetological Review* 27: 143.
- Speybroeck, J., Beukema, W., Dufresnes, C., Fritz, U., Jablonski, D., Lymberakis, P., Martínez-Solano, I., Razzetti, E., Vamberger, M., Vences, M., et al. (2020). Species list of the European herpetofauna – 2020 update by the Taxonomic Committee of the Societas Europaea Herpetologica. *Amphibia-Reptilia* 41: 139–189.
- Tiglio, S. (2013) Biacco cannibale (*Hierophis viridiflavus*) - Serpente - Cannibalismo - Cannibal snake – Cannibalism. YouTube video https://www.youtube.com/watch?v=_VglGQo0wlo.
- Vanni, S. & Lanza, B. (1977). Predation by the European whip snake, *Coluber viridiflavus* Lacépède, on the asp viper, *Vipera aspis* (Linnaeus). *Natura, Società Italiana di Scienze naturali, Museo civico di Storia Naturale e Acquario civico di Milano* 68: 285–289.
- Vanni, S. & Zuffi, M.A.L. (2010). *Hierophis viridiflavus* (Lacépède, 1789). In *Fauna d'Italia*, vol. XLV, Reptilia Corti C., Capula M., Luiselli L., Razzetti E., Sindaco R. (eds.), Calderini-II Sole 24 Ore, Bologna 2011: 509–516.

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