Herpetology Notes, Volume 18: 607–611 (published online on 12 July 2025)

Head hiding behaviour in the Eastern Montpellier Snake, *Malpolon insignitus fuscus* (Fleischmann, 1831)

Alessandro Paterna[1]

The Eastern Montpellier Snake, *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827), is a psammophiid distributed in Eastern Europe, North Africa and the Middle East (Wallach et al., 2014). This species includes two subspecies, the nominal *M. i. insignitus* (Geoffroy Sant-Hilaire, 1827) which occurs in the southern part of its range, from Morocco to Syria (De Haan, 1999), and the subspecies *M. i. fuscus* (Fleischmann, 1831) which occurs in the northern Mediterranean region, from the Balkan Peninsula to the Caucasus, Russia, Kazakhstan, Turkey, Iran (Kreiner, 2007). This snake can reach large dimensions, with males growing up to two meters, and has a broad dietary spectrum, which also includes snakes (Carranza et al., 2006; Safaei-Mahroo et al., 2015). *Malpolon* snakes are rear-fanged, or rather, opisthoglyphous, possessing grooved posterior maxillary fangs located in correspondence with a venom gland. These structures have a role in predation and digestion of prey, but the effects of their venom in humans following their bite are also known (Weinstein et al., 2011; Ballouard at al., 2022).

An adult male of *M. i. fuscus* originally from southern Balkans was adopted by the OPHIS Museo Paleontologico e Centro Erpetologico from a private individual in the fall of 2024. The specimen is housed in a terrarium (130 x 90 x 90 cm: length, depth, height respectively) set up in a semi-naturalistic way, and fed with thawed chickens and rodents. In more than one occasion, during handling or inspection phases, the specimen performs a defence mechanism in which it hides its head under a body coil. The snake bends the neck laterally at the position of the first cervical vertebrae, setting the head parallel and on the same level to the neck, and then pushes the rostrum underneath the ventral scales of the cervical region (Fig. 1A). Occasionally a second coil may overlie the head that is not completely hidden. In most cases the specimen covers the eyes and the rostro-frontal portion of the head, and sometimes it covers the fronto-parietal portion instead leaving the rostrum exposed (Fig. 1B). This manoeuvre is also performed when the snake is lifted and the anterior portion of its body is in suspension. When the snake is lying on the ground, once it has assumed this position, it remains motionless until the threat has disappeared, or until it is tactilely stimulated again.

Head-hiding is considered a cryptic antipredator response to preserve the head from injuries and is displayed by snakes cornered by predators (Greene, 1988; Mori and Burghardt, 2004). This manoeuvre is commonly used by the kraits *Bungarus fasciatus* and *B. ceylonicus* (De Silva, 1979) and has been documented in snakes belonging to several families, with different variations of this behaviour occurring within different species. The cases described in the literature and studies dedicated to this phenomenon refer mainly to species from the New World, whilst case studies regarding European snakes are scarce. This behaviour has been observed in the genus *Micrurus* for elapids, *Bothrops* and *Crotalus* for viperids, and in the colubroids of the genera *Atractus*, *Boiruna*, *Clelia*, *Coluber*, *Dipsas*, *Drepanoides*, *Drymarchon*, *Echinanthera*, *Erythrolamprus*, *Gomesophis*, *Helicops*, *Imantodes*, *Leptodeira*, *Mussurana*, *Natrix*, *Oxyrhopus*, *Paraphimophis*, *Philodryas*, *Pseudoboa*, *Pseudoeryx*, *Ptychophis*, *Rhabdophis*, *Rhachidelus*, *Simophis*, *Siphlophis*, *Sordellina*, *Spilotes*, *Storeria*, *Taeniophallus*, *Thamnodynastes*, *Tantilla*, *Thamnophis*, *Tomodon*, *Tropidodryas*, *Xenodon*, *Xenopholis* (Herzog and Burghardt, 1986; Schieffelin and de Queiroz, 1991; Keogh and DeSerto, 1994; Martins, 1996; Mori and Burghardt, 2008; Gregory, 2016; Rabosky et al., 2021; Tozetti et al., 2021; De Oliveira Meneses et al., 2022; Shedd et al., 2023). In some snakes, such as *Thamnophis* and *Cylindrophis*, head hiding can be accompanied by movements of the tail, aimed at diverting the predator's

[1] OPHIS Museo Paleontologico e Centro Erpetologico, via bivio Putignano 3, Teramo, 64100 Teramo, Italy.
E-mail: alessandro.paterna@ophis.info

Figure 1. Phases of the head hiding behaviour in the eastern Montpellier snake *Malpolon insignitus fuscus*. (A) Adult male portrayed at OPHIS on 21/10/2024. (B) Same individual in A, portrayed on 23/10/2024. Photos by Alessandro Paterna.

attention away from the head (Mertens, 1946; Arnold and Bennet, 1984). Head concealment is often associated with another form of defence: "balling" or "body-ball". This more archaic mechanism generally occurs in boids and in other more basal families (Greene, 1997; Tozetti et al., 2021), where the snake rolls itself into a ball, hiding its head inside the coils (Bustard, 1969). Some authors have compared balling to thanatosis, i.e. feigning death (Bustard, 1969), and in my personal experience in studying the natricids *Natrix helvetica* and *Natrix natrix*, I have observed that individuals sometimes hide their heads under their coils when being manipulated during thanatosis. Similarly, I observed head concealment in other European species, such as *Hierophis viridiflavus* (Fig. 2A–D), where it mainly occurs in hatchlings and juvenile specimens. Tozetti et al. (2021) hypothesise that the head hiding behaviour was selected over balling in most recently derived families, such as elapids and viperids, as it might allow the species that developed venom delivery systems to strike more actively. To

Figure 2. Head hiding behaviour in different *Hierophis viridiflavus* hatchlings from a communal nesting site (Paterna, 2015) in Abruzzo, Italy. (A, B) Frontal region of the head concealed by distal or caudal coils. (C) Head concealed by more body coils. (D) Snout concealed by a dorsal coil. Photos by Alessandro Paterna.

these we can reasonably add the psammophiids, as in the present case, and the other colubroids, which include rear-fanged species and which can inoculate the secretions of the venom glands through prolonged bites or chewing (Paterna, 2023, 2024). The same occurs in the Eastern Montpellier snake, which is in fact a very active snake that usually, when a possible threat is detected, quickly flees and will defend itself fiercely by biting when disturbed. In my experience I have not observed other specimens of this species performing head hiding as the most common reaction to a threat in this species is hissing and/or biting. In search for further similar cases I inspected the photographic material present on the citizen science iNaturalist platform: I found some shots immortalising specimens of *M. insignitus* and *M. monspessulanus* in postures like the ones described here. Even on iNaturalist, such cases are rare if compared to the total amount of material available, just like the hooding behaviour, while photos portraying subjects coiled up on themselves are more frequent. However, since the records are not contextualised, they cannot be attributed with certainty to cases of head hiding.

Head concealment (which may be infrequent or rarely observed) is likely triggered by ecological and environmental factors as well as the health status of the individual, and may be "awakened" and manifest itself in specific stress scenarios (Johnson et al., 2017; De Oliveira Meneses, 2022). In the case of *M. i. fuscus*, this defensive manoeuvre originates from a nuchal movement, and mainly involves the cervical region. The pose adopted in these cases may also recall the death-pose of many snakes, where the contraction of the ligaments and muscles in the neck can give the carcasses this posture. It is not to be excluded that this expedient, in addition to the function of protecting the head, could also have a thanatotic root. In fact, nuchal/cervical folds of this type are performed during thanatosis by snakes of the genera *Natrix* and *Heterodon*, and additionally thanatosis has been documented in the sister taxon *M. monspessulanus* (Sannolo et al., 2014). Thanatosis may also occur consequently of the head concealment in case of prolonged threat (Ugalde et al., 2023). In most species

that perform head hiding behaviour, the head is generally covered or inserted under one or more coils that are more often caudal (Fig. 2A–D) than what observed in *M. insignitus*, even in a random manner, producing a clear distinction between the two defence forms. A further use of head concealment could be functional towards another type of predator, namely snakes. Both *Malpolon* and *Hierophis* are ophiophagous genera (Capula et al., 2014; Safaei-Mahroo et al., 2017; Vaccaro et al., 2023), and hiding the head between the coils could represent a resistance to being swallowed, which generally starts from the head of the prey. This work was written with the aim of representing an input for a new direction of study, that is, to better investigate the different types of head hiding behaviour implemented by different species and groups of snakes, especially from the Old World. Head concealment among caenophidian snakes could likely be more widespread than described.

Acknowledgments. I thank Rainer Fesser for his revision of the original manuscript.

References

Arnold, S.J., Bennet, A.F. (1984): Behavioural variation in natural populations. III: Antipredator displays in the garter snake *Thamnophis radix*. Animal Behaviour **32**: 1108–1118.

Ballouard, J.M., Schmitt, C., Bonnet, X., Renet, J., Caron, S., Reynoard, J., de Haro, L., Deso, G. (2022): Envenomation by Montpellier snake, *Malpolon monspessulanus* following prolonged bites. Wilderness and Environmental Medecine **33**(2): 252–254.

Bustard, H.R. (1969): Defensive behavior and locomotion of the Pacific boa, *Candoia aspera*, with a brief review of head concealment in snakes. Herpetologica **25**(3): 164–170.

Capula, M., Grano, M., Cattaneo, C., Contini, F. (2014): Ophiophagy in *Hierophis viridiflavus* (Lacépède, 1789) (Serpentes, Colubridae): More than occasional? In: Scripta Herpetologica. Studies on Amphibians and Reptiles in Honour of Benedetto Lanza, p. 49–54. Capula, M., Corti C. Eds., Latina, Italy, Edizioni Belvedere.

Carranza, S., Arnold, E.N., Pleguezuelos, J.M. (2006): Phylogeny, biogeography, and evolution of two Mediterranean snakes, *Malpolon monspessullanus* and *Hemorrhois hippocrepis* (Squamata, Colubridae), using mtDNA sequences. Molecular Phylogenetics and Evolution **40**(2): 532–546.

De Haan, C.C. (1999): Die Europäische Eidechsennatter *Malpolon monspessulanus* (Hermann, 1804). In: Handbuch der Reptilien und Amphibien Europas, Vol. 3/IIA, Serpentes II: Colubridae 2, p. 661–756. Bohme, W. Eds., Aula-Verlag, Wiesbaden.

De Oliveira Meneses, A.S., Fernandes, M., Torres Cardoso, A.G., Albuquerque Brandão, R. (2022): Esconder la cabeza en *Xenopholis undulatus* (Dipsadidae) en el Brasil central. Revista Latinoamericana De Herpetología **5**(1): 194–196.

De Silva, A. (1979): The Ceylon krait, record of a large specimen. Loris **15**(2): 97–98.

Greene, H.W. (1988): Antipredator mechanisms in reptiles. In: Biology of the Reptilia, p. 1–152. Gans, C., Huey R.B. Eds., New York, USA, Alan Liss.

Gregory, P.T. (2016): Responses of natricine snakes to predatory threat: A mini-review and research prospectus. Journal of Herpetology **50**(2): 183–195.

Herzog, H.A., Burghardt, G.M. (1986): Development of antipredator responses in snakes: I. Defensive and open-field behaviors in newborns and adults of three species of garter snakes (*Thamnophis melanogaster*, *T. sirtalis*, *T. butleri*). Journal of Comparative Psychology **100**(4): 372–379.

Johnson, A.K., Medica, P.A. (2017): *Crotalus oreganus lutosus* (Great Basin Rattlesnake) defensive behavior / head hiding and tongue display. Herpetological Review **48**(1): 209–210.

Keogh, J.S., DeSerto, F.P. (1994): Temperature dependent defensive behavior in three species of North American colubrid snakes. Journal of Herpetology **28**: 258–261.

Kreiner, G. (2007): The Snakes of Europe. Frankfurt AM Main. Edition Chimaira.

Martins, M. (1996): Defensive tactics in lizards and snakes: the potential contribution of the Neotropical fauna. In: Anais do XIV Encontro Anual de Etologia. Sociedade Brasileira de Etologia, p. 185–199. Del Claro, K. Eds., Brasil, Universidade Federal de Uberlandia.

Mertens, R. (1946): Die warn- und droh-reaktionen der reptilien. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft **471**: 1–108.

Mori, A., Burghardt, G.M. (2004): Thermal effects on the antipredator behaviour of snakes: a review and proposed terminology. Herpetological Journal **14**: 79–88.

Mori, A., Burghardt, G.M. (2008): Comparative experimental tests of natricine antipredator displays, with special reference to the apparently unique displays in the Asian genus, *Rhabdophis*. Journal of Ethology **26**: 61–68.

Paterna, A. (2015): Morphological traits of hatchlings of the western whip snake *Hierophis viridiflavus* (Lacépède, 1789) from a central Italian population. Russian Journal of Herpetology **22**: 179–187.

Paterna, A. (2023): The role of modifed teeth in the function of prolonged bites in *Hierophis viridifavus* (Serpentes: Colubridae). Phyllomedusa **22**: 121–130.

Paterna, A. (2024): Analyzing and comparing the buccal anatomy of European colubroid snakes: A reassessment of dentition models. Phyllomedusa **23**(2): 111–124.

Rabosky, A.R., Moore, T.Y., Sánchez-Paredes, C.M., Westeen, E.P., Larson, J.G., Sealey, B.A., Balinski, B.A. (2021): Convergence and divergence in anti-predator displays: A novel approach to quantitative behavioural comparison in snakes. Biological Journal of the Linnean Society **132**: 811–828.

Safaei-Mahroo, B., Ghaffari, H., Salmabadi, S., Kamangar, A., Almasi, S., Kazemi, S.M., Ghafoor, A. (2015): Eastern Montpellier snake (*Malpolon insignitus fuscus*) ophiophagy behavior from Zagros Mountains. Russian Journal of Herpetology **24**(1): 69–72.

Sannolo, M., Gatti, F., Scali, S. (2014): First record of thanatosisbehaviour in *Malpolon monspessulanus* (Squamata: Colubridae). Herpetology Notes **7**: 323.

Schieffelin, C.D., de Queiroz, A. (1991): Temperature and defense in the common garter snake: warm snakes are more aggressive than cold snakes. Herpetologica **47**: 230–237.

Shedd, J.D., Ross, E.A, Steuer, N. (2023): *Charina bottae* (northern rubber boa). Defensive behavior. Herpetological Review 54(2): 309.

Tozzeti, A.M., Morato, S.A.A., Bérnils, R.S., Loebmann, D., Toledo, L.F., Gray, R., Entiauspe-Neto, O.M. (2021): Evolutionary dynamics shape two passive defensive mechanisms in Neotropical snake radiations. Phyllomedusa **20**(1): 3–13.

Ugalde, M., Salles, T., Marinho, A. (2023): Acting for a living: First record of death-feigning for *Dryophylax nattereri* (Mikan, 1820) (Snakes: Dipsadidae). North-Western Journal of Zoology **19**(1): 106–108.

Vaccaro, A., Altadonna, G., Turrisi, G.F. (2023): Further evidence of ophiophagy, including cannibalism, by the western whip snake *Hierophis viridiflavus* in Italy. The Herpetological Bulletin **163**: 21–23.

Wallach, V., Williams, K.L., Boundy, J. (2014): Snakes of the World: A catalogue of living and extinct species. New York, CRC Press.

Weinstein, S.A., Warrell, D.A., Keyler, D.E. (2011): Venomous Bites from Non-Venomous Snakes: A Critical Analysis of Risk and Management of "Colubrid" Snake Bites. Philadelphia, Pennsylvania, Elsevier.

Accepted by Anamarija Žagar