

## SHORT COMMUNICATION

# Comments on Guimarães & Sawaya. Pretending to be venomous: is a snake's head shape a trustworthy signal to a predator?

Janne K. Valkonen<sup>1</sup> and Johanna Mappes

Centre of Excellence in Evolutionary Research, Department of Biological and Environmental Science, P.O. Box 35, 40014 University of Jyväskylä, Finland  
(Accepted 26 September 2011)

**Key Words:** defence, head triangulation, mimicry, morphology, plasticine replicas, predation, snakes

Several species of non-venomous snake are known to flatten their heads when disturbed, and this behaviour has been suggested to be a mimicry of vipers (Arnold & Ovenden 2002, Hailey & Davies 1986, Young *et al.* 1999). Using plasticine models, Guimarães & Sawaya (2011) tested the antipredatory function of a triangular head shape in snakes. Their article presents the first published empirical experiment testing the adaptive significance of vipers' triangular head shape. Guimarães & Sawaya (2011) found no support for the viper mimicry hypothesis. Accordingly, they concluded that 'the shape of [the] head seemed not to confer advantage itself'. Although the use of plasticine models is a generally accepted method of testing predation pressure on snakes, we argue that the experiment may have failed to find the antipredatory function of triangulation due to the pooling of attacks by mammalian and avian predators. Mammals generally rely on olfactory cues during foraging. Plasticine has a strong odour which does not resemble the odour of any prey species. It is thus unlikely that mammals would treat snake replicas as true snakes.

We also conducted experiments testing the antipredatory function of the wide, viperid head shape in Coto Doñana National Park in southern Spain (Valkonen *et al.* 2011a). In contrast to the findings of Guimarães & Sawaya (2011), our results demonstrate that the triangular head shape typical of vipers can act as a warning signal to predators. We compared the predation pressure by free-ranging predators on plasticine snake replicas with triangular-shaped heads to the pressure on replicas with narrow heads. Plain snakes with narrower,

colubrid-like heads suffered significantly higher predation by raptors than snakes with triangular-shaped heads. The number of attacks by mammalian predators was generally higher than raptor attacks but there was no difference in attack rate between treatments. During the experiments, we often observed mammalian predators (e.g. red fox, *Vulpes vulpes* Linn.) following our tracks along the transect lines and non-selectively biting almost all snake replicas in the area.

Based on experience and observations from experiments with similar methods (Niskanen & Mappes 2005, Valkonen *et al.* 2011a, 2011b), we argue that the 'attacks' by mammalian predators on plasticine snake replicas do not reflect true predation behaviour on snakes but rather curiosity and/or mineral- or fat-seeking. Thus, it is important not to pool data from different types of predators but to analyse mammalian and avian attacks separately. Although many mammals are likely important predators of snakes and they have played an important role in the evolution of snakes' antipredatory strategies, the use of plasticine may not be a valid method for testing the survival value of visual signals against mammalian predators.

## LITERATURE CITED

- ARNOLD, E. N. & OVENDEN, D. V. 2002. *Reptiles and amphibians of Europe*. Princeton University Press, Princeton.
- GUIMARÃES, M. & SAWAYA, R. J. 2011. Pretending to be venomous: is a snake's head shape a trustworthy signal to a predator? *Journal of Tropical Ecology* 27:437–439.
- HAILEY, A. & DAVIES, P. M. C. 1986. Effects of size, sex, temperature and condition on activity metabolism and defence behaviour of

<sup>1</sup> Corresponding author. Email: janne.k.valkonen@jyu.fi

- the viperine snake, *Natrix maura*. *Journal of Zoology* 208:541–558.
- NISKANEN, M. & MAPPES, J. 2005. Significance of the dorsal zigzag pattern of *Vipera latastei gaditana* against avian predators. *Journal of Animal Ecology* 74:1091–1101.
- VALKONEN, J. K., NOKELAINEN, O. & MAPPES, J. 2011a. Antipredatory function of head shape for vipers and their mimics. *PloS ONE* 6(7): e22272.
- VALKONEN, J. K., NISKANEN, M., BJÖRKLUND, M. & MAPPES, J. 2011b. Disruption or aposematism? Significance of dorsal zigzag pattern of European vipers. *Evolutionary Ecology* 25:1047–1063.
- YOUNG, B. A., LAOR, J. & SOLOMON, J. 1999. The comparative biomechanics of an ophidian defensive behaviour: head triangulation in hognose snake (*Heterodon*) and an egg-eating snake (*Dasypeltis*). *Journal of Zoology* 248:169–177.