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NATURAL HISTORY NOTE

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Unusual posture of a male northern viper *Vipera berus* – a more efficient way to bask?

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The northern viper (*Vipera berus*) is widely distributed across Europe, central and eastern Asia and, being exceptionally tolerant of cold climates, is even found north of the Arctic Circle (Andersson, 2003). This northerly distribution is made possible, at least in part, by an exceptional ability to thermoregulate achieved by adopting optimal postures to absorb energy directly from sunlight, to the extent that *V. berus* has been referred to as a "posturing heliotherm" (Spellerberg, 1976). Here, we described for the first time the unusual posture of a male *V. berus* observed in a sand dunes area in north Wales.

On the 2nd April 2021, while surveying for vipers in the sand dune systems along the coast of Rhosneigr, Wales, we observed a male *V. berus* moving uphill through the vegetation at about 5 m from the path where we were standing. The air temperature was between 8°-10° C and a moderate breeze was blowing (approx. 33 km/h). After five minutes from the initial encounter, the animal started wrapping itself around a patch of grass, while slowly turning on its back. At the end of this process, the dark ventral surface of the animal was exposed at almost 90° to the sun (Fig. 1). The observation started around 12:20 h and the behaviour was still observable at 13:56 h when we left the site. During this time, the individual kept this position while slowly moving, thus exposing different sections of the ventral surface.

There are several potential explanations for the observed behaviour. First, the rotation of the body could have resulted from neurological damage. This seems unlikely as the animal appeared in good health and was initially observed moving smoothly through the vegetation at a quite steep angle, without showing any locomotory impediments. Second, our close proximity to the animal might have provoked it to feign death (thanatosis). Such behaviour has been observed previously (Hodges, 2013) but has few similarities with that described here and given that we were a few meters from the specimen it seems unlikely that our presence would have triggered such a response. Finally, it may simply be a basking behaviour that takes advantage of the viper's dark ventral colouration. According to the thermal melanism hypothesis, darker individuals living in cold climates would be able to increase their body temperature at a faster rate than light-coloured specimens (Trullas et al., 2007) and the thermal advantages proposed by this hypothesis have been supported in various studies on European vipers (Capula & Luiselli, 1994; Capula, Luiselli & Monney, 1995; Castella et al., 2013; Martínez-Freiría et al., 2020). Furthermore, a recent study has highlighted the overlooked adaptive role of the ventral colouration of vipers in heat transfer (Goldenberg et al., 2021). In this regard, our focal individual had, apart from its dark zig-zag stripe, a light dorsal background colouration, while its ventral scales were almost black. If this behaviour genuinely is basking then it would appeared to be the first time that it has been described in any snake, although this behaviour has been suggested for a similar posture taken by a lizard species, the slow worm *Anguis fragilis* (Hails & Strine, 2016).

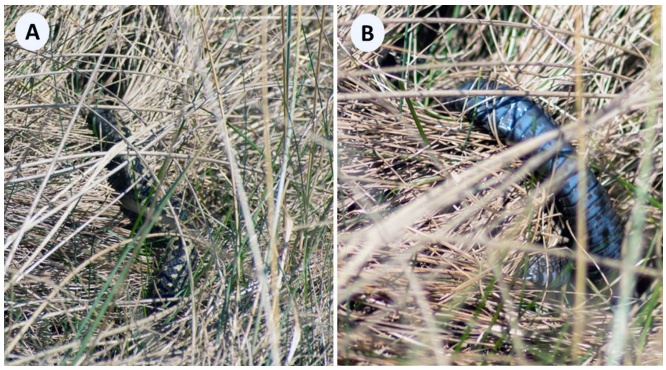

Figure 1. A male *Vipera berus* that rolled on to its back, so exposing its dark ventral surface to direct sun light – **A.** The male before it had rolled onto its back, **B.** The male on its back with ventral surface exposed to the sun

It seems likely that we have observed a previously unreported basking posture of *V. berus*; effectively a new posture for the posturing heliotherm (Spellerberg, 1976). Early spring represents a critical period for male northern vipers, during which basking efficiency is physiologically critical to both spermiogenesis and moulting that must be completed before mating can proceed (Nilson, 1980). Exposing its dark ventral surface to direct sunlight would have allowed this individual to warm up more rapidly, giving it a reproductive advantage over its conspecifics.

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