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SHORT COMMUNICATION

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# Not so fast: Two observations concerning slow worm *Anguis fragilis* antipredator behaviour

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Slow worms *Anguis fragilis* are a legless lizard of the family Anguidae which is common and widespread in Britain and mainland Europe (Arnold & Ovenden, 2002; Inns, 2009). Despite substantial literature on the ecology of slow worms (e.g. Beebee & Griffiths, 2000; Smith, 1990), there are relatively few published reports describing predation attempts on the species and the effectiveness of antipredator defences. Although a wide range of animals may occasionally prey upon slow worms, the major predator groups on slow worms are likely birds and reptiles (Martín & López, 1990; Smith, 1990; Vacher & Wendling, 2019). Described antipredator behaviours include caudal autotomy, crypsis, rapid escape by burrowing or fleeing into nearby vegetation and immobility (Beebee & Griffiths, 2000; Capula et al., 1997; Smith, 1990).

Here I describe a successful predation attempt on a slow worm despite use of caudal autotomy, and also provide a record of association with ants alongside a proposal that this serves an antipredator function.

While teaching on an undergraduate field course at Mumbles Hill Nature Reserve (51.569259, -3.984648) on 22 April 2021, a student alerted me to an adult female slow worm on an open section of short grass and bare soil which was being attacked by a magpie *Pica pica*. The attack took place ca. 13:30 h on a sunny and dry, but relatively cool day (temperature ca. 14 °C). The magpie noticed the exposed slow worm, flew down, and started pecking at it focusing on the front half of the body. After a few seconds the slow worm shed its tail, but this did not effectively distract the magpie, which continued its attack. Within a minute or so the magpie had grasped the slow worm (minus tail) in its beak and flew off to a nearby tree where I presume it was consumed. The magpie would not have been feeding chicks at this time of year (they lay first clutches in mid-April to early-May and the eggs take 20–22 days to hatch; Madge, 2009). The isolated tail continued to wriggle with slowly decreasing activity for ca. 5 minutes. Soon after the tail stopped moving, the same magpie came and carried off the tail to a nearby tree.

Although magpies are known as predators of slow worms (e.g. see predation of a juvenile slow worm in this video https://www.youtube.com/watch?v=GbN-GPgD0zI) there appear to be few described observations and slow worms rarely appear in studies of magpie diets. Hence this observation contributes a new record to the literature of a successful predation event by a magpie on an adult slow worm and an unsuccessful deployment of a major antipredator defence by slow worms (caudal autotomy). It is notable here that the predation event occurred on open ground, which might explain the failure of autotomy to prevent predation, since escape following autotomy would be facilitated by thick vegetation to hide in (particularly if the tail was more exposed than the body). However, as the magpie was very focused on the body (not the tail) throughout, it is unclear whether this would have prevented predation in this instance.

On 25 May 2023 at 17:41 h, I uncovered two slow worms while carrying out a routine check of a 0.5 x 0.5 m corrugated roofing tile made of bitumen-soaked organic fibres placed in Three Crosses (51.628867, -4.061703) as an artificial refugium. For several months this refugium was home to an active colony of small black ants (presumed to be *Lasius niger*), and these were still occupying the refugium when the slow worms were under it (Fig. 1). I have commonly found ants nests under artificial refugia that

**Figure 1.** Two slow worms, a subadult (above) and a large juvenile (below) found under an artificial refugium alongside an ant nest (bottom)

are also occupied by slow worms, such that this does not seem to be a rare event. Moreover, several previous reports mention associations between slow worms and ants under reptile refugia, which has variously been attributed to a food source (though rarely; Parry, 2023a), or shared habitat requirements and use of ant tunnels for burrowing (Beebee & Griffiths, 2000; McInerny, 2014).

Despite rare records of slow worms feeding on ant larvae (Parry, 2023a), the specific use of ant nests as a feeding resource currently seems unlikely. Although slow worms appear capable of feeding on a wide range of prey, including occasional records of vertebrates (Capizzi et al., 1998; Gleed-Owen, 2012), the diet is heavily biased towards molluscs and earthworms in most populations investigated, with hymenopterans in general and ants specifically almost never a major diet component (Beebee & Griffiths, 2000; Capizzi et al., 1998; Mollov, 2010; Pedersen et al., 2009; Smith, 1990). Hence, the lack of ants as prey of slow worms, and a degree of specialism on molluscs and earthworms which don't have a particular association with ant nests, makes it very unlikely that any association of slow worms and ant nests is related to feeding.

I have yet to encounter the proposal that slow worms might be actively seeking out shelters occupied by ants as a defensive behaviour, but this is an idea which I believe is very plausible. First, Smith (1951) reported that slow worms are often found in association with the nests of multiple species of ants, often under stones, and emphasised that they are not common prey items of slow worms. Second, McInerny's (2014) observation that slow worms specifically (despite this study also considering northern vipers *Vipera berus* and common lizards *Zootoca vivipara*) often co-occurred under refugia with ants is consistent with my own casual observations; slow worms seem to share refugia with ant nests more commonly than other reptiles. Third, slow worms possess osteoderms under their skin which provide a degree of armour that presumably protects against predators (Beebee & Griffiths, 2000; Parry, 2023b; Williams et al., 2022). Fourth, ants are widely recognised as formidable prey that possess effective defences such as venomous stings or combining biting with spraying formic acid into wounds, sufficient to deter predators including lizards and birds (Cloudsley-Thompson, 1995; Dornhaus & Powell, 2010; Hasegawa & Taniguchi, 1993). Finally, other lizards with osteoderms have been found to specifically flee to shelters containing ants (Arbuckle, 2008). The latter report found five-lined skinks *Plestiodon fasciatus* showing preferential fleeing to natural cover objects housing ants, and although no analysis was performed in that note a binomial test on the presented data does reveal a significant association ($P = 0.0001$).

Taken together, I propose that ants potentially present a general opportunity for boosting the defence of lizards which have sufficient armour to avoid being harmed themselves by the ants. I suggest that additional investigation of this possibility is worthwhile, for instance by quantifying whether slow worms are more likely than other reptiles to use refugia occupied by ant's nests, whether slow worms co-occurring with ants are slower to flee once uncovered (consistent with a perceived reduction in risk), or whether reptile behaviour during interactions with ants differs between slow worms and other species. Such questions have the potential to reveal insights into the wider ecological context within which reptiles function.

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