

An ambusher's arsenal: chemical crypsis in the puff adder (*Bitis arietans*)

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Abstract

Ambush foragers use a hunting strategy that places them at risk of predation by both visual and olfaction-oriented predators. Resulting selective pressures have driven the evolution of impressive visual crypsis in many ambushing species, and may have led to the development of chemical crypsis. However, unlike for visual crypsis, few studies have attempted to demonstrate chemical crypsis. Field observations of puff adders (*Bitis arietans*) going undetected by several scent-orientated predator and prey species led us to investigate chemical crypsis in this ambushing species. We trained dogs (*Canis familiaris*) and meerkats (*Suricata suricatta*) to test whether a canid and a herpestid predator could detect *B. arietans* using olfaction. We also tested for chemical crypsis in five species of active foraging snakes, predicted to be easily detectable. Dogs and meerkats unambiguously indicated active foraging species, but failed to correctly indicate puff adder, confirming that *B. arietans* employs chemical crypsis. This is the first demonstration of chemical crypsis anti-predatory behaviour, though the phenomenon may be widespread among ambushers, especially those that experience high mortality rates owing to predation. Our study provides additional evidence for the existence of an ongoing chemically mediated arms race between predator and prey species.

1. Background

Successful heterotrophic organisms tread a fine line between finding sufficient food while limiting energy expenditure and avoiding predation. Several successful foraging strategies exist, including, at one ecological extreme, ambush foraging [1 – 3]. This foraging mode is characterized by a reliance on concealment and stealth to capture prey and avoid predation. Ambush foraging is taxonomically widespread, occurring in many animal taxa as phylogenetically diverse as spiders and felids. It is associated with infrequent movement [2], and usually requires extended periods of immobility while waiting for feeding opportunities [4,5]. Unsurprisingly, typical ambush foragers exhibit a diversity of ecological, morphological and physiological adaptations that maximize fitness in this context [6 – 8], and tend to be adapted to making a lunge, strike or short, rapid pursuit after passing prey [2]. Many also respond to danger by remaining concealed instead of fleeing from predators [9].

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