

Observations on Antipredator Adaptations of the Central Newt (*Notophthalmus viridescens louisianensis*) in Northeastern Illinois

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ABSTRACT

1. Terrestrial newts, *Notophthalmus viridescens louisianensis*, were collected in northeastern DuPage County, Illinois.
2. All newts remained motionless when first uncovered, although some attempted to escape by actively crawling when handled. Two individuals, however, became especially immobile when first detected or upon being handled. Immobility was not elicited by handling after two days of captivity.
3. Central newts are apparently unpalatable to raccoons. A newt was offered to a group of free-ranging raccoons habituated to humans, and it was repeatedly rejected unharmed.
4. An arched back response was displayed in the field by four of twelve newts in one sample. This behavior was not observed in captive specimens.

INTRODUCTION

Antipredator adaptations may vary among geographically separate populations of the same salamander species (e.g., Ducey and Brodie, 1983; Dowdy and Brodie, 1989; Brodie and Brodie, 1991). It is of value, therefore, to catalog adaptations displayed by individual populations. The purpose of this note is to report observations on antipredator mechanisms in a population of central newts (*Notophthalmus viridescens louisianensis*) in northeastern Illinois. These observations were made incidental to surveys of the herpetofauna of the study area (Cochran, 1989 a,b; Ludwig et al., 1990), with an emphasis on the central newt (Cochran, 1988).

Notophthalmus viridescens possesses a variety of antipredator adaptations (see Brodie, 1983 for a review), but most work has focused on the eastern subspecies (*N. v. viridescens*). Because terrestrial phases of *N. v. louisianensis* are more cryptically colored, less abundant, and more secretive (nocturnal) than those of *N. v. viridescens* (Huheey and Brandon, 1974), Brandon et al. (1979) initially expected that the former would be less toxic. However, they reported that *N. v. louisianensis* were essentially as toxic as *N. v. viridescens*, that chickens found *N. v. louisianensis* from southern Illinois unpalatable, and that *N. v. louisianensis* engaged in tail displays and arched body (unken) responses that exposed their aposematic ventral coloring. Vogt (1981) depicted a curled tail display by a *N. v. louisianensis* from Wisconsin.

METHODS

Data were collected by the two authors independently. All newts examined by the senior author were collected by hand during daytime searches in August and September, 1980-1991, in oak/hickory forest and shrubby old field habitat near a wooded, semi-permanent wetland in DuPage County, Illinois (Cochran, 1988, 1989 a). Newts were measured for total length (TL) and body length (BL), defined as the distance from the tip of the snout to the posterior margin of the insertion of the hind limbs. Newts examined by the junior author were located during the period 1987-1991. They were collected in forested habitat around wetlands within 1 km to the north of habitat surveyed by Cochran (1988).

Nine newts collected 2 September 1982 (TL: 47-81mm; BL: 21-39mm) were held individually in disposable plastic drinking glasses until used in the experiments described below. Two were subsequently preserved as voucher specimens in the University of Wisconsin-Madison Zoology Museum (UWZM-H 22588-9); the remainder were released at their original sites of capture on 4 September 1982.

To test for palatability to a generalist predator, a single newt (TL: 72mm; BL: 34mm) was offered to a group of free-ranging raccoons (*Procyon lotor*) conditioned to appear each evening for bread and table scraps. Because newts are rare in DuPage County (Cochran, 1988; Ludwig et al. 1990), only one individual was risked. The newt was placed in a white enamel pan with enough water to cover the bottom of the pan (but not the newt). Racoon were enticed to feed from the pan by tossing slices of bread into it from a distance of one meter. Because this trial was staged in a residential yard within 200 meters of the area in which the newts were collected, it is conceivable that at least some of the racoons had prior experience with newts. However, because newts are relatively uncommon and their population apparently fluctuates (Cochran, 1988), it is also conceivable that at least some of the racoons were naïve with respect to newts.

On 4 September 1982, each of the nine captive newts was placed on brown paper substrate and pinched with a forceps just anterior to the pelvic girdle in an attempt to elicit an arched body or tail display. Immediately thereafter, it was rolled between a thumb and forefinger in an attempt to induce immobility.

RESULTS

The coloration of central newts from DuPage County was more cryptic than that of the eastern subspecies, but it included some aposematic elements. Red or reddish orange

spots were arranged in two dorsolateral rows, and the ventral surface was yellow or orange. Spots were more prevalent in efts than in adults.

Central newts in their terrestrial phase were apparently unpalatable to raccoons. On five occasions, the newt offered to the racoons was picked up by a racoon in both forepaws, sniffed or tasted, and rejected unharmed. On one occasion, the newt was picked up with some bread and held while the racoon ate only the bread around it. Several times the newt was detected by touch as a racoon felt with its forepaws along the bottom of the pan, then sniffed and rejected.

All 52 newts collected by the senior author during this study remained motionless when first uncovered and were often difficult to detect against the substrate. Many attempted to escape by actively crawling or struggling when handled. Two individuals, however, became especially immobile when first detected or shortly thereafter. A newt (TL: 45mm; BL: 22mm) discovered beneath a board at midday on 24 August 1981 (air temperature: 29°C) lay unmoving on its side and appeared dead. It did not move for some time after being picked up. On 2 September 1982, a newt (TL: 47mm; BL: 21mm) became immobile several times while being measured subsequent to its capture, ceasing motion for several seconds when manipulated between two fingers. During each period of immobility, the newt's gular motion was more shallow than during typical breathing; after some time it would suddenly "spring to life" and begin moving. However, neither this newt nor eight others collected the same day displayed immobility when tested after two days of captivity.

Arched back and tail displays were not observed during this study when newts were tested in captivity and were elicited on only one occasion in the field. On 16 September 1987, four of twelve newts located by the junior author immediately struck the arched back posture observed in *Taricha* and *Notophthalmus*. In addition, a newt collected by the senior author on 18 August 1991 curled its tail forward against its left side in what may have been a defensive posture.

DISCUSSION

Terrestrial *N. viridescens louisianensis* from northeastern Illinois share defensive adaptations with conspecifics from other portions of the species' geographic range. These include unpalatable skin secretions, aposematic coloration, immobility, and an arched body display. All of these were included by Brodie (1983) within a single suite of correlated antipredator mechanisms.

Racoons rejected the *N. v. louisianensis* offered to them in this study. Hurlbert (1970) found that some racoons would eat *N. v. viridescens* after rubbing them on the substrate or scrubbing them in water. In the present study, feeding behavior of individual racoons may have been affected by the presence of conspecifics competing for the same food. Foods that can be eaten quickly without manipulation (e.g., bread) may be preferred under such circumstances. However, even though the racoons in this study may have been feeding in a more hasty manner than typical, those that handled the newt did not injure it; racoons are well known for their soft, delicate touch (North, 1966; personal observations).

The observations reported herein are consistent with those of Brodie et al. (1974), who stressed that defensive behaviors of salamanders may be more easy to elicit in the field than after even short periods of captivity. In the present study, immobility and the arched back display were observed only in the field. This underscores the importance of field observations, especially for uncommon taxa that cannot be collected in numbers adequate to support planned laboratory experiments with large sample sizes. The central newt in northeastern Illinois falls into this category.

While not directly related to the topic of antipredator adaptations, several of our observations during this study substantiate or extend earlier conclusions about the ecology of central newts at this location (Cochran, 1988). First, we noted snail shells in each of six fecal pellets released by five newts shortly after their capture. This confirms the importance of snails in the diet of newts at this site. Second, adult newts in our study area appear to be more terrestrial than those at other locations in DuPage County where they are known to occur, at least during late summer. Whereas adults at other sites can be seined from aquatic habitats during the summer, adults in our study area occur in terrestrial habitat during July, August, and September. Cochran (1988) was unable to find newts during terrestrial surveys in June (1985-1987), and additional terrestrial surveys by the senior author in late June of 1989 and 1990 were also unsuccessful. Perhaps adults linger in the aquatic habitats used for breeding until conditions begin to deteriorate in mid-summer. The junior author has intercepted adult newts migrating to breeding ponds in the spring, an indication that they overwinter in terrestrial habitat.

ACKNOWLEDGEMENTS

The senior author thanks Mary Lou and Nick DeNicolo for their hospitality and Joseph and Andrew Cochran for assistance in the field. The junior author thanks Daniel R. Ludwig of the Forest Preserve District of DuPage County for comments on the manuscript and for supporting his involvement with herpetological surveys in DuPage County. He is also grateful to R.A. Brandon of Southern Illinois University for discussion of the variability in life history of *Notophthalmus viridescens*.

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