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CHEMO-SENSING IN THE MOUNTAIN DUSKY SALAMANDER (*DESMOGNATHUS OCHROPHAEUS*)

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ABSTRACT

Our experiment examined the reaction of the mountain dusky salamander to the chemical cues of amphipods, isopods, crayfish, and caddisfly larvae. We hypothesized that the salamanders would become more active and cross more lines in the experimental tanks when scents from amphipods and isopods were introduced than from scents of crayfish and caddisfly larvae. This is because amphipods and isopods are normal food sources for these salamanders. Crayfish are more likely to be a predator to these salamanders and caddisfly larvae are protected by stone casings and therefore would not be as easily accessible to the salamanders. We tested this hypothesis on six salamanders from Warm Springs in Huntingdon, Pennsylvania. Sixteen trials were run on each of the six salamanders, three for each scent plus one control trial at the beginning of each new scent. The results showed that the only significant difference between the control and a particular scent was that of the isopods ($P = 0.005$).

Keywords: amphipod, caddisfly larvae, chemo-sensing, crayfish, Desmognathus ochrophaeus, *isopods, salamander*

INTRODUCTION

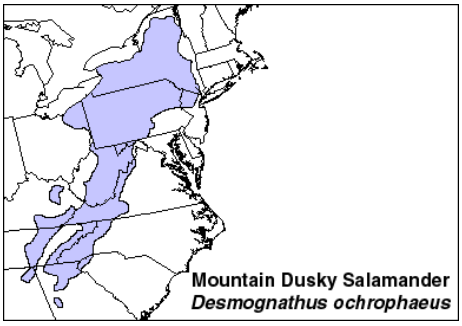

Figure 1. Distribution of the Mountain Dusky Salamander (Crother, 2000).

The Mountain Dusky Salamander is found from the Adirondack Mountains in Quebec southward to eastern Tennessee and extreme southwestern Virginia (Petranka, 1998; Figure 1). They occur often in dense populations from below 300m to 2000m. At lower elevations populations tend to be concentrated in the vicinity of seepage areas, springs and small streams (Tilley, 1973). The salamander is primarily nocturnal and carnivorous taking in insects and small invertebrates, including isopods and amphipods. Mountain Dusky Salamander larvae are lung-less and their respiration occurs through gills.

Aquatic larvae feed on small aquatic arthropods and their larvae, including spiders, flies, and mosquitoes. Adult salamanders feed on adult and immature terrestrial arthropods, terrestrial gastropods, aquatic insects and aquatic snails (Tsang, 2003). *Desmognathus ochrophaeus* has been shown to demonstrate chemo-sensing responses to cues from predator snakes (Cupp 1994). We tested to see if Mountain Dusky Salamanders would also have a chemo-sensing response to cues from potential food sources like those found in

response to predators. We tested whether the salamanders would move more in response to typical prey chemical scents, such as amphipods and isopods, than to the chemical scents of non-food sources such as crayfish and caddisfly larvae.

METHODS AND MATERIALS

During March 2004, we collected six salamanders from Warm Spring in Huntingdon, Pennsylvania and starved them for three days. For the experiment, we placed each salamander in a separate ten gallon aquarium. We filled the aquarium with water until it reached a height of ~3.8 cm. The water that was used for each trial was from Petersburg Spring where it emerged from the ground in order to ensure that there was no contamination of the water. White grids with blocks that were five square centimeters were placed underneath the aquariums (Figure 2).

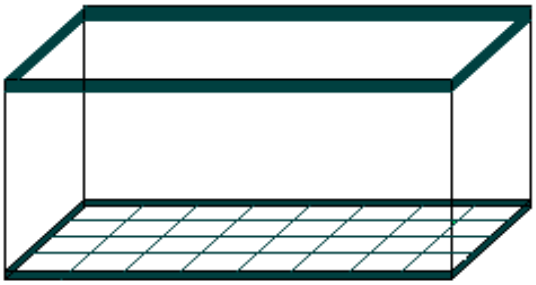

Figure 2: Ten gallon aquarium for the salamanders with the grid placed underneath.

We used four scents to test the chemo-sensing of the salamanders for each scent. We prepared the scents by grinding the organisms with mortar and pestle in the Petersburg Spring water. The scents used were amphipods (from Warm Spring), isopods (from Blue Spring), crayfish (from Warm Spring), and caddisfly larvae (from Warm Spring and Blue Spring). Prior to injecting the scent, each experimenter sat near the tank for ten minutes to allow the salamander to become acclimated to his or her presence.

Petersburg Spring water dyed with green food coloring was used as controls for all trials was. This was to ensure that the salamanders were not just reacting to the sight of the injected scents. One cubic centimeter of the control was injected and the numbers of lines that a salamander crossed were counted for a total of 10 min. We administered the scent three blocks from the salamander's head. A line was considered to be crossed if the salamanders last set of gills or anterior end of the appendicular skeleton was over the line. After the control, each scent was injected into the tanks three different times. The water in the tanks was changed between each trial. Once the trials were completed for the day, we placed the salamanders back in an alternate habitat from those salamanders which were not yet tested. We repeated this process until all the trials were complete. At the end of the experiment we released the salamanders back into Warm Spring.

RESULTS

The salamanders showed no significant difference in activity in response to the crayfish, caddisfly larvae, or amphipod scents and their respective control. The only significant difference between the scents and the control was found with the isopods (Tables 1 and 2). This shows that the Mountain Dusky Salamanders were more active in the presence of the isopod scent.

Table 1. Two-sample T-test for the control and each scent given to the salamander.

Two-Sample T-test		
	T-value	P-value
control vs. isopod	-3.6	0.005
control vs. crayfish	-0.23	0.821
control vs. caddisfly larvae	-0.83	0.428
control vs. amphipod	-1.1	0.303

Table 2.Summary data from our experimental trials.

	Salamander 1	Salamander 2	Salamander 3	Salamander 4	Salamander 5	Salamander 6	Standard Deviation
Isopod							
control	18.00	24.00	31.00	22.00	32.00	23.00	5.44
average	61.67	31.33	104.00	92.67	46.00	61.67	27.55
Crayfish							
control	0.00	4.00	0.00	119.00	17.00	30.00	45.93
average	23.67	24.00	21.67	89.67	31.33	10.33	28.37
Caddisfly							
control	71.00	23.00	131.00	88.00	53.00	28.00	40.49
average	91.00	86.33	99.00	82.67	100.67	28.00	27.02
Amphipod							
control	0.00	4.00	151.00	88.00	136.00	20.00	67.71
average	0.00	27.00	234.00	126.00	90.67	175.33	88.61

DISCUSSION

Our hypothesis that the salamanders would cross more lines in the presence of amphipod/isopods scents than crayfish/caddisfly larvae scents is partially supported by our results. The isopod treatment was found to be significantly different from the control. This means that the salamanders did respond more to a scent that was a typical food source for them. We hypothesized that the salamanders would not cross as many lines compared to the control when presented with a crayfish or caddisfly larvae scent because they are not a normal food source for the salamander. The results were inconclusive for the other treatment groups because none were found to be significantly different from their control trial. In the case of the crayfish, if they are shown to be a predator then the results could be conclusive. It has been found that Mountain Dusky Salamanders remain immobile when uncovered, making themselves less conspicuous to predators (Petranka, 1998). The trials with the amphipod scent were not significantly different from its control trial and did not agree with our hypothesis.

During collection all salamanders were checked to ensure that they were still in their aquatic form and had gills. However, during the course of lab experimentation one of the salamanders was observed to have gone through metamorphosis. Therefore, this salamander spent most of its time leaned up against the glass of the aquarium out of the water so that it could breathe, and consequently was not exposed to the scent presented in the water. The data from this individual was used except for the amphipod treatment group when it had been discovered that metamorphosis had occurred.

Further studies need to be done to test the chemo-sensing ability of salamanders in response to predators and prey. One possible experiment that could be done would be observing the direction of the movement of the salamander where the scent was applied.

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