



# Response of male *Centruroides vittatus* to aerial and substrate-borne chemical signals

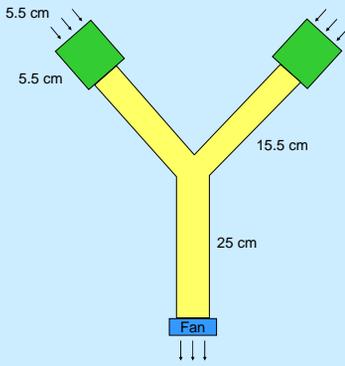


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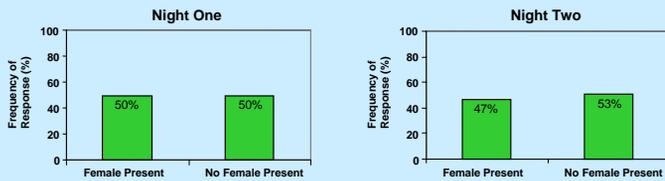
## Aerial

### 1 Aerial Test Apparatus



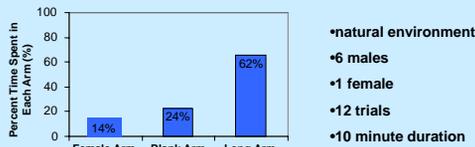
Plexiglas Y-shaped arena designed to test for transference of air-borne chemical information. A fan was placed at the end of the long arm to draw air through the tubes and the maze. A sheet of Plexiglas was placed over the top of the maze to direct and confine airflow through the maze. The arena was placed on a 'lazy-susan' turntable to allow for rotation, controlling for room and/or Earth-related cues.

### 2 Males showed no response to air-borne female chemicals



Experimental Protocol: Prior to the first trial, the first female was placed in the cube on the left maze arm. Each trial was initiated by dropping a male scorpion into the end of the long arm. Males were allowed five minutes to move into the left or right arm of the arena. We considered a trial complete when the male scorpion entered either arm of the arena or the five minutes had ended. These experiments were scored by recording the time and direction of the male scorpions' movement into either the left or right arm of the Y-shaped arena. The animal choices were then scored relative to the arm containing the female. For Night One trials, 16 males were tested against four stimulus females. The female and the female's arm position were changed every four trials. For Night Two trials, 15 males were tested against one stimulus female. The arm position of the female was changed every four trials.

### 3 Males showed no bias in movement relative to female arm of test chamber



- natural environment
- 6 males
- 1 female
- 12 trials
- 10 minute duration

To create a more natural environment, the arena floor and female cube were covered with the dirt from their home containers. Before a trial, a male scorpion was placed at the end of the long arm. During each trial, the male was allotted ten minutes to move freely throughout the arena. Each of six males were tested twice. For the first six trials, the female-containing cube was connected to the left arm with the blank cube connected to the right arm. The cubes were exchanged between the arms for the second set of six trials. The amount of time each male scorpion spent in the long arm, the left arm, and the right arm of the Y-maze was scored for the allotted ten minutes. These results were then calculated relative to the placement of the female.

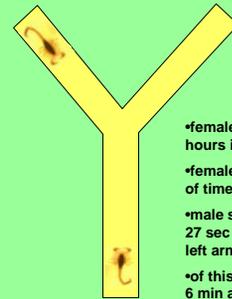
## Introduction

Sex pheromones are special signaling molecules that are important in directing mating behaviors between members of a species. Many animals use pheromones to attract mates, although the chemistry and mode of transmission varies among species (Pollard 1994, Birch & Haynes 1982). Previous work has shown that males of some scorpion species detect and respond to substrate-borne chemicals left by females (Gaffin & Brownell 1992, Krapf 1986, Melville et al. 2000). However, very few scorpion species have been tested for pheromonal communication and essentially no information exists concerning air-borne chemical communication in scorpions.

In this study, we investigated the response of male striped scorpions, *Centruroides vittatus*, to air- and substrate-borne female chemical cues. Using a Y-shaped behavioral choice chamber, we tested scorpions' use of odor to detect potential mates. A second behavioral choice arena was constructed to test male scorpions' responses to female pheromones by direct substrate contact.

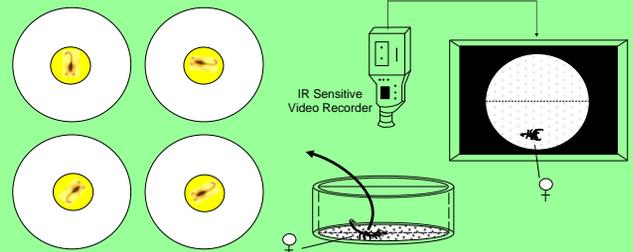
## Substrate-Borne

### 4 Preliminary trial showed male bias toward female deposits



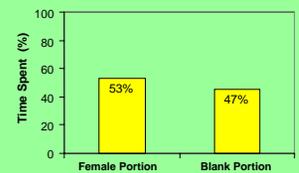
- female confined for 24 hours in left arm
- female spent majority of time in back corner
- male spent 7 min and 27 sec of 10 min trial in left arm
- of this total, male spent 6 min and 10 sec in back corner

### 5 Substrate Test Apparatus



Each behavioral arena consisted of a Plexiglas ring (13.5 cm diameter, 7 cm tall). A piece of circular filter paper formed the floor substrate of each arena. Cardboard partitions were constructed to divide each ring into two equal halves. A plastic cylinder was used as a placement device for the males in the center of the rings. A sheet of Plexiglas was placed over the top of the four rings to enclose the females and eliminate extraneous cues. Four arenas were filmed simultaneously from above using an infrared equipped video camera.

### 6 Males showed no tendency to detect female substrate-borne chemical deposits



- 11 females
- 4 males

Prior to each trial, four females were placed in the lower half of each of the four rings for a 24-hour period. After the females were removed, the four males were dropped into the center of the arenas to initiate the trial. During each trial, the male scorpions were allotted ten minutes to move freely within the arenas. The amount of time each male scorpion spent in the upper and lower portion of the ring was scored for the allotted ten minutes. The amount of time the male spent in the "female" portion was compared to the time spent in the "non-female" portion.

## Conclusions

- Under the conditions of these tests, male *C. vittatus* showed no response to air-borne cues from female conspecifics.
- Although a preliminary test indicated some male response to substrate-borne female signals, males showed no tendency to move to portions of behavioral test chambers previously occupied by female conspecifics.

## Future Research

- Conduct experiments during prime mating season
- In aerial transmission tests, allot more time for male scorpion to adjust
- In substrate-borne transmission tests, randomize location of female

### Literature cited

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