VISUAL MATE DETECTION IN A TERRITORIAL MALE BUTTERFLY (ASTEROCAMPA LEILIA): EFFECTS OF DISTANCE AND PERCH LOCATION

by

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Summary

We experimentally investigated proximate factors influencing the visual detection of flying conspecifics by male butterflies (*Asterocampa leilia*) engaged in a sit-and-wait mate-searching tactic. Model butterflies were presented to perched males in the field using an apparatus that permitted us to control the path and speed of a model while varying minimum distance of the model from the male, height of the model above the ground, and model size. The dependent variable in all cases was whether or not the male left his perch and pursued the model. Males responded to normal-size models up to but not beyond distances of 3 m, and, because doubling the model surface area increased the distance at which males responded, we conclude that males do not detect conspecifics if they are more than 3 m away. At distances of 2 m or less males perched on the ground were more likely to detect conspecifics than males perched off the ground. This is likely to be due to differences either in the background against which the perched male typically views conspecifics or how large an angle conspecifics subtend from a perched male's perspective. These results suggest that thermally-driven changes during the activity period in perch preferences have consequences for success in mate detection that may be evolutionarily significant.

Keywords: vision, mate detection, butterfly.

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Introduction

Many insects use a sit-and-wait tactic to search for mates or prey (Atkins, 1980; Thornhill & Alcock, 1983). To test ideas about the evolution and adaptive features of the behavior and morphology of animals engaged in this tactic requires information about the structure of the visual system and how it performs in detection tasks in ecologically realistic contexts. While many studies report inferences about visual system performance from information about eye optics and electrophysiology (for review, Warrant & McIntyre, 1993; Land, 1997) there are few that ask questions in a field setting about object detection and the ecological factors that affect it (*e.g.* Kirschfeld & Wenk, 1976; Vallet & Coles, 1993; Layne *et al.*, 1997; Land, 1999). Hence, we conducted a field experiment to evaluate proximate factors that influence the detection of mates and competitors in a sit-and-wait context.

The animal we studied is a common nymphalid butterfly of the Sonoran Desert, the empress leilia (*Asterocampa leilia*). Males in this species occupy and defend perching sites on or adjacent to the larval foodplant, the desert hackberry (*Celtis pallida*) (Austin, 1977; Rutowski & Gilchrist, 1988) where they wait for females to appear. When a perched male sees a passing conspecific he quickly leaves his perch and gives chase. Females are pursued and courted while intruding males are chased from the area. The responsiveness of the males, consistency with which some perching sites are occupied, and the long breeding season of this species (March to October) makes this system ideal for experimentation in the field.

Our interest in visual system performance in this species stemmed from the observation that during the course of the morning, males change from perching in relatively open areas on the ground to perching an average of 0.87 m off the ground on vegetation facing toward open areas (Rutowski *et al.*, 1991). This change in perch preference is driven by changes in thermoregulatory needs (Rutowski *et al.*, 1994) and results in changes in the position of the male's visual system relative to the potential flight paths of conspecifics (Rutowski *et al.*, 1991; Rutowski, 2000). Moreover these changes in perch preference are accompanied by changes in the preferred body orientation of males. We wished to find out if these thermally-driven changes in perch choice and body orientation lead to differences in the likelihood that males will detect passing conspecifics, and so to see if, "thermoregulatory behavior could interfere with responses to mates, prey, conspecifics, *etc.*" (May, 1985).