AGGRESSIVE BEHAVIOR IN THE BUTTERFLY *ANARTIA JATROPHAE*

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Abstract: Territoriality has been observed in many butterfly species, but the resources being defended are often unclear. We observed aggressive interactions of the nymphalid butterfly, *Anartia jatrophae,* to assess its territorial behavior. We marked individuals, released them into a well-defined patch of flowers, and recorded interactions in the patch. *A. jatrophae* individuals interacted aggressively with conspecifics and other organisms. Each individual's aggressive interactions were concentrated within specific areas of the habitat. Apparent mating behavior and lack of foraging point to reproductive resources (females) as the basis for *A. jatrophae* aggressive behavior and territoriality.

Key Words: resource defense, territoriality

INTRODUCTION

Male defense of territories is common in butterflies (Cordero 1996). Territoriality has been studied extensively in temperate species, especially those in the family Nymphalidae (Cordero 1996), and in various tropical taxa (Freitas et al. 1995). The reasons for territoriality in butterflies are not well understood because defensive behavior may occur in regions without apparent nutritional resources. Instead, enhanced mating success has been proposed as the most common benefit of butterfly territoriality (Freitas et al. 1995, Cordero 1996).

We observed and recorded aggressive behavior of individually-marked *Anartia jatrophae* (Lepidoptera: Nymphalidae) individuals within a patch of *Justicia comata* (Acanthaceae) flowers near the OTS field station at Palo Verde National Park, Costa Rica. We hypothesized that aggressive interactions of *A. jatrophae* individuals would be localized spatially, defining recognizable territories. We also investigated whether interactions were associated with foraging, mating behavior, or both.

METHODS

On 13 January 2005, we netted all *A. jatrophae* in a 10 m x 15 m area with abundant *J. comata* plants in secondary forest bordering the marsh, ca. 1 km east of the field station. The area, bounded naturally on three sides by trees, shrubs, and a dirt trail, was divided into four equal triangular quadrants of 37.5 m^2 each, using string. The 27 butterflies captured within the patch were given unique color markings using permanent markers, and released back into the patch at 1030. We were unable to distinguish between the sexes. We observed butterflies within the patch from 1030 - 1130 and 1445 - 1515 for a total of 2.5 h. For each butterfly interaction, we recorded the type of interaction (aggressive

a.

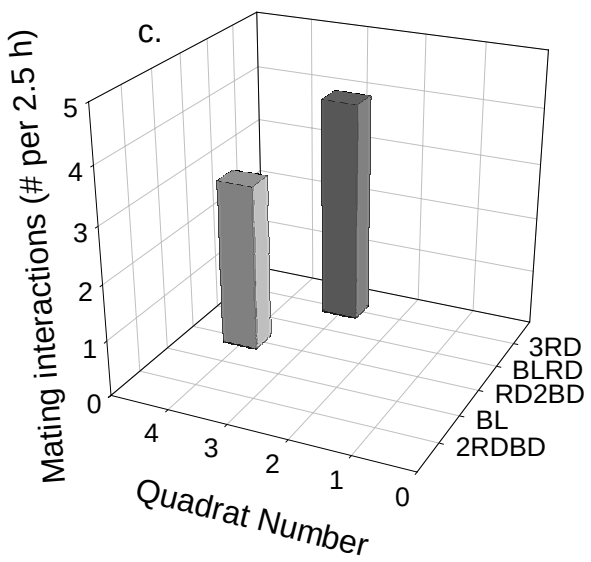

Figure 1. Number of a) aggressive interactions with conspecifics, b) aggressive interactions with other butterfly species, and c) mating interactions by marked *A. jatrophae* by quadrat number within a patch of *J. comata* flowers in Palo Verde National Park, Costa Rica. Individuals were given unique color marks, e.g. 3RD refers to 3 red dots, BLRD refers to blue line and red dot, etc. Data shown are for the five individuals that consistently remained within the patch and which had the most interactions.

or apparent mating behavior), the aggressor butterfly, the aggressed butterfly, the perceived victor, and quadrant number in which the interaction occurred.

We used a contingency analysis to compare the frequencies of aggressive interactions between quadrants for *A. jatrophae* individuals.

RESULTS

Most marked individuals immediately left the plot or were only seen infrequently. Five marked individuals remained consistently, however, and we quantified aggressive behavior in these individuals. These *A. jatrophae* interacted aggressively with conspecifics, as well as with other species of butterflies, moths, bees, and hummingbirds. Each individual's aggressive interactions were concentrated in certain quadrants ($X^2 = 84.95$, df = 12, $P < 0.0001$; Fig. 1a, b), and only the two individuals with the most intraspecific aggressions engaged in mating interactions

(Fig. 1c). Quadrants 2 and 3 were each dominated by one individual throughout our observations. Quadrant 4 was dominated by individual RD2BD (marking of red dot, 2 blue dots) until this individual was killed by an arachnid; after that, BL (marking of blue line) dominated this quadrant. Quadrant 1 was not dominated by any one individual.

DISCUSSION

Each *A. jatrophae's* aggressive interactions were concentrated in specific quadrants, suggesting territoriality in these butterflies. We did not observe any *A. jatrophae* feeding on *J. comata* during our study, though *J. comata* is a known food resource (DeVries 1987). Thus, flower resources did not appear to be the basis for the territoriality that we observed in this study.

We observed two types of interactions between *A. jatrophae*. Butterflies either rapidly circled in the air, violently batting their wings, or one butterfly slowly approached the other from behind, with both fluttering together, sometimes landing together. These two types of interactions were very distinct. We assume that they represent aggression and mating behavior, respectively (Freitas et al. 1995, Cordero 1996). The seven mating-type interactions observed always involved one of our marked individuals and an unmarked one. Thus, we assume the territorial individuals were all male. Since we witnessed several mating-type interactions but no foraging, we suggest that *A. jatrophae* defended areas primarily for mating purposes.

The capture and marking may have caused confusion and stress to the butterflies resulting in most of the marked individuals leaving the plots. Each released individual that stayed in the plot established dominance and defended one primary quadrant during our 2.5 h observational period. It is unknown for how long *A. jatrophae* defend territories. We suggest that it would be useful to follow individuals for longer time periods to measure the ephemeral nature of territories as well as to determine where and when they forage.

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