Role of Conspecific Silk in Forest Tent Caterpillar (*Malacosoma disstria*) Group Behavior

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ABSTRACT: Group living, prevalent in many lepidopterans, has many benefits and costs to fitness. In caterpillars, the use of silk trails often mediates group living. This study focused on forest tent caterpillars (*Malacosoma disstria*) to determine the effectiveness of silk produced by conspecifics in attracting other caterpillars. Ten forest tent caterpillars were placed in Petri dishes containing a leaf with silk on one side and a leaf without silk on the other side. The caterpillars did not seem to prefer either side, though the caterpillars that produced silk during the observation period seemed to lean toward the side with silk. Although our sample size was small, this would suggest that caterpillars utilize cues left by other individuals of their species.

INTRODUCTION: Group living confers fitness benefits but also incurs costs (Despland & Huu 2007). Many lepidopterans spend their larval stages as colonies, which may speed up their development (Shiga 1976; Rothman 1997). Gregarious caterpillars often maintain group cohesion, as well as recruit others to food sources, via silk trails marked with pheromone. Competition and increased pathogen transmission are some of the costs involved with this sociality, however (Despland & Huu 2007).

Forest tent caterpillars establish colonies of up to several hundred individuals. They are nomadic foragers, but travel in colonies between feeding and resting in temporary silk bivouacs. Traveling forest tent caterpillars leave continuous silk trails marked with a non-volatile pheromone, which serve as paths for conspecifics to follow (Despland & Huu 2007). Silk mats produced by these caterpillars are used for aggregation sites between feedings (Fitzgerald &

Costa 1986). Young *M. disstria* colonies are very cohesive, but disperse as larvae age (Despland & Huu 2007).

In our experiment we investigated the effectiveness of silk in attracting *M. disstria*. We specifically compared caterpillar visits between leaves that contained silk produced by conspecifics and those that had no silk. We predicted caterpillars would generally prefer leaves that had silk over those that did not.

METHODS: Twelve forest tent caterpillars were collected. Each caterpillar was left overnight in a Petri dish containing a 4 cm x 6 cm patch of basswood leaf. The next day, 10 additional caterpillars were collected. Each of these caterpillars was set in a Petri dish. One half of the Petri dish contained a leaf patch with silk from another caterpillar (variable), and the other half contained an equally sized leaf patch with no silk (control). Each caterpillar was observed every half hour for five hours. The position of the caterpillar was marked as either on the control or variable side of the dish and either on the plate itself or on a leaf. After the testing period, it was noted whether a caterpillar had produced silk. Means were calculated for variable vs. control and for plate vs. leaf position. T-tests were used to see if apparent preferences were significantly different from spending equal time in each position.

RESULTS: Overall, the distribution of caterpillars showed no preference for either side (T=0.868, df=9, P=0.408; Fig. 1a). Caterpillars that did not produce silk showed no preference for either side (T=-0.647, df=3, P=0.564; Fig. 1a). However, there was a trend, though not significant, that suggested caterpillars that spun silk preferred the variable side (T=1.843, df=5, P=0.125; Fig. 1a). There was no significant difference in whether caterpillars preferred to lie on the plate or on a leaf (T=0.165, df=9, P=0.872; T=0.202, df=5, P=0.848; T=0, df=3, P=1.0; Fig. 1b).

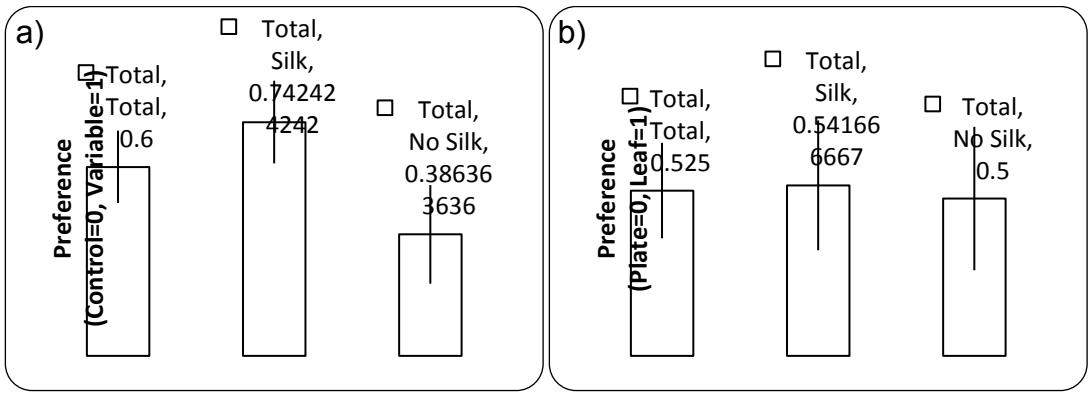

Figure 1: Caterpillar preferences for total sample size, individuals who spun silk, and individuals who did not spin silk. Caterpillars lying on the control half of the plate were recorded as "0", and caterpillars on the variable half of the plate were recorded as "1" (a). Similarly, caterpillars lying on the Petri dish itself were recorded as "0", and caterpillars on a leaf were recorded as "1" (b). An average value of "0.5" indicates no preference. Error bars represent standard error.

DISCUSSION: This study yielded no significant results. However, we see a tendency for caterpillars that produce silk to stay on the side of the dish containing silk from a conspecific. This finding likely reflects caterpillars' tendency to aggregate on silk mats between foraging (Fitzgerald & Costa, 1986). This aggregation is believed to help caterpillars avoid predation, thermoregulate and facilitate foraging (Fitzgerald & Costa, 1986). This experiment was afflicted with a small sample size, made worse by the unfortunate fact that not all caterpillars produce silk mats in their new temporary residences. Furthermore, a previous study has suggested that caterpillars' reliance on silk decreases with larval development (Despland & Huu 2007). In our study we did not control for larval stage, which may explain why some caterpillars showed no preference for the silk leaf. With this information, future studies could be carried out to further illuminate the slight trends seen in our data.

REFERENCES:

Despland, E. & Huu, A.L. 2007. Pros and cons of group living in the forest tent caterpillar: separating the roles of silk and of grouping. *Entomologia Experimentalis et Applicata*, **122**, 181-189.

Fitzgerald T.D. & Costa, J.T. 1986. Trail and foraging behavior of young colonies of forest tent caterpillars (Lepidoptera: Lasiocampidae). *Annals of the Entomological Society of America*, **79**, 999-1007.

Rothman, L. D. 1997. Immediate and delayed effects of a viral pathogen and density on tent caterpillar performance. *Ecology*, **78**, 1481-1493.

Shiga, M. 1976. Effect of group size on the survival and development of young larvae of *Malacosoma neustria testacea* Motschulsky (Lepidoptera: Lasiocampidae) and its role in the natural population. *Kontyu*, **44**, 537-553.