DO RARE SPECIES OF FLOWER RECEIVE MORE POLLINATOR VISITS IN THE PRESENCE OF A COMMON FLOWER SPECIES?

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Abstract: Pollination facilitation occurs if pollination success of one plant increases as number of neighboring flowers, regardless of species, increases. In eight flower patches at Palo Verde National Park, I recorded the number of visits to flowers before and after removal of the dominant species, *Justicia comata*. I hypothesized that *J. comata* facilitates the pollination of locally rare flower species. I found the rare flowers did experience more visits in the presence of *J. comata.* The percent of insects that stopped at a patch increased with flower density and with increased percentage of *J. comata*. Flower visits to *J. comata* increased proportionately with the percentage of *J. comata* in study plots.

Key Words: Justicia comata, *pollination, pollinator facilitation*

INTRODUCTION

Facilitation occurs when one species of flower benefits from the presence of other species. Increasing densities of flowers, regardless of species, may help attract pollinators, which may benefit all flowers in a patch (Feinsinger 1991). I therefore hypothesized that rare flowers would be visited by more pollinators when they are surrounded by more abundant flowers of another species.

I studied this in the open habitats along the air strip and road of Palo Verde National Park, Costa Rica. *Justicia comata* (a low-growing shrub, with a small, purple, insect pollinated flower) is the dominant flower species in this area. Flower patches varied in size, species composition, and flower density but most patches contained relatively high abundance of *J. comata*.

METHODS

On 13 January 2005, I chose eight plots in the fields along the roadside and air strip within 1 km of the OTS field station at Palo Verde National Park. The 4 m^2 plots contained various densities of flowers, but *J. comata* was the dominant flowering species in each. Species composition and abundances were recorded for each plot. During a 10-min observation period, I counted the number of flowers of each species visited by pollinators. I also recorded the number of insects that flew over the patch so I could calculate the percent of insects that stopped at flowers in the patch. I then removed the *J. comata* blossoms and conducted another similar 10-min observation within 20 min of the flower removal.

I used a matched pair analysis to compare the number of visits to flowers before and after removal of *J. comata.* I conducted a regression analysis comparing the percent of insects stopping at a patch num-

ber of insects stopping/number of insects flying over x 100) to both the total number of flowers in the patch and the percent of the *J. comata* flowers in the patch.

To remove any effect of total number of flowers on pollinator visits, I calculated the residuals from the regression of percent visits to *J. comata* on total number of flowers in the patch. I regressed the residuals on the percent *J. comata* in the patch. All statistics were calculated using JMP 5.0.1.

RESULTS

The mean number of non- *J. comata* flowers visited by pollinators dropped from 8.0 ± 8.6 visits before the removal of *J. comata* to 1.43 ± 2.3 visits after removal. This change was marginally significant (t = -2.07, df = 7, P = 0.08). As flower density increased, the percent of insects that stopped at a patch also increased (r^2 = 0.18, df = 15, P = 0.09; Fig. 1). As the percent of *J. comata* in the patch increased, the percent of insects that stopped significantly increased (r^2 = 0.53, df = 15, P = 0.0009; Fig. 2). Individual pollinators often visited more than one flower species in the plot. The percent of pollinator visits to *J. comata* increased directly with the percent of *J. comata* in the patch (r^2 = 0.62, m = 0.78, P = 0.002; Fig. 3). The slope of this line was not significantly different from the theoretical slope of one (95% confidence interval for slope = -0.004 to 1.56).

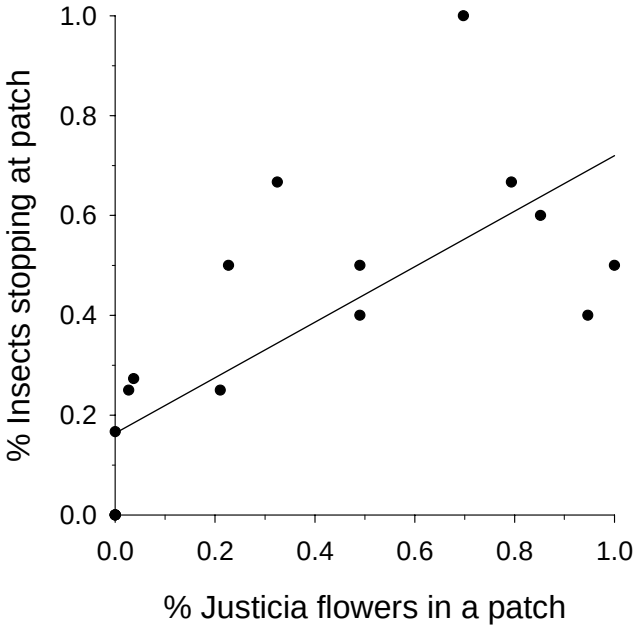

Figure 2. Percent of insects flying over a patch that stopped vs percent *Justicia comata* flowers in the patch. As flower density increased the percent of insects that stopped at a patch also increased.

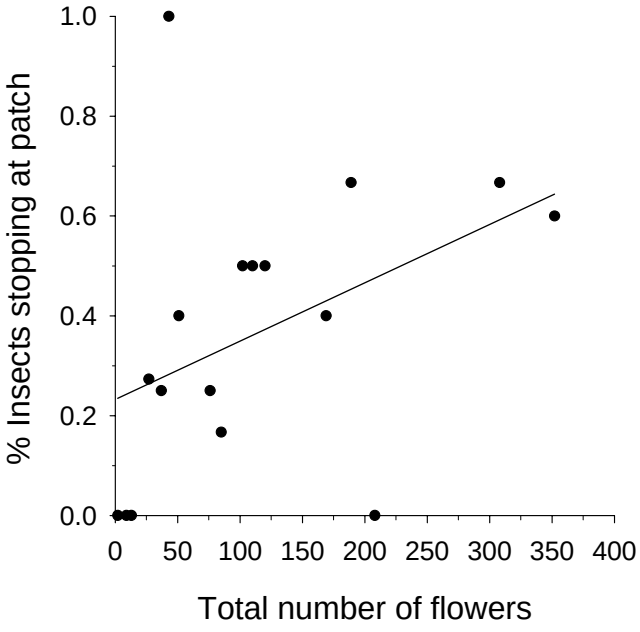

Figure 1. Percent of insects flying over a patch of flowers dominated by *Justicia comata*, that stopped vs total number of flowers in a patch. Patches were observed in open habitats at Palo Verde, Costa Rica.

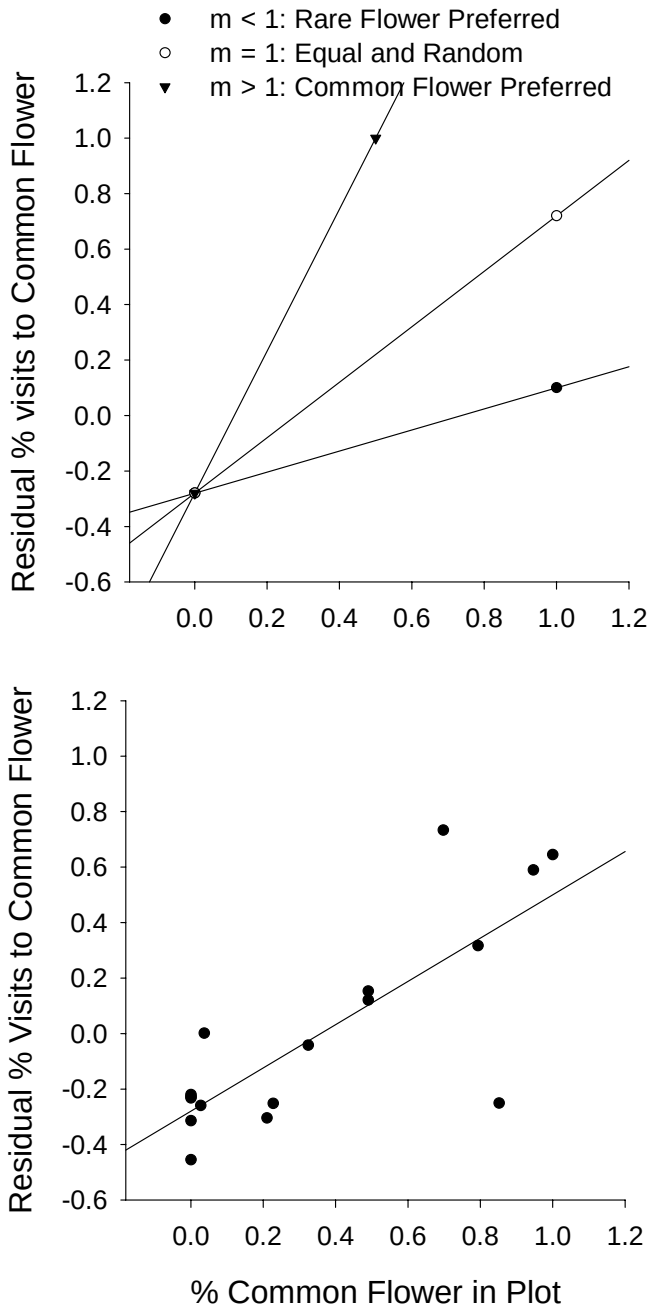

Figure 3. Percent of total visits by *Justicia comata* with the effect of number of flowers removed. Top panel presents three theoretical results. A slope of 1 indicates a random selection of flowers by pollinator. Slope > 1 would indicate disproportionate selection of *J. comata*. Slope < 1 would indicate unequal selection of a rare flower species. Bottom panel shows the experimental slope of 0.78 derived from field data in this study. This slope was not significantly different from 1 (see text).

DISCUSSION

A patch with many flowers, regardless of species, attracted more pollinators than a patch with few flowers. Additionally, the percentage of insects that stopped at a patch greatly increased as the percentage of *J. comata* flowers increased. It seemed that pollinators cued in on high *J. comata* densities and visited patches with the most *J. comata* flowers. Once a pollinator decided to stop at a particular patch it would not visit just one flower species, but would visit many different flower species. Locally rare flowers might then receive more pollination visits in a patch of one dominant species than it would in a patch with similar density but with greater species diversity. These findings suggest that *J. comata* could facilitate the pollination success of other less common species by increasing the number of pollinator visits received by these less common flowers.

LITERATURE CITED

Feinsinger, P. and H. M. Tiebout III. 1991. Do tropical bird-pollinated plants exhibit density-dependent interactions? Field experiments. Ecology, 72: 1953-1963.