MORNING NECTAR PRODUCTION IN *JUSTICA COMATA*

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Abstract. A flower that can continually produce nectar and replenish nectar supply increases its chance of multiple pollinator visits and successful pollination. For a one day flower such as *Justica comata*, continuous nectar production during peak foraging hours is important to attract multiple visitors, since the flower will not be open another day. We tested the nectar production of *J. comata* flowers to determine if the nectar was produced over night, before the flowers opened, or continuously throughout the morning. We found that in covered plants protected from foraging nectar accumulation increased throughout the morning. Nectar levels measured in uncovered plants showed two trends: high nectar levels due to accumulation and an increasing number of low nectar levels, presumably due to foraging.

Key Words: Justica comata, *nectar production*

INTRODUCTION

Continuous nectar production and replenishment by a flower increases the chance of multiple visits and pollination success. For a one day flower, continuous nectar production throughout pollinator foraging hours is the only way to attract multiple visitors, since the flower will not be open another day. Very little is known about the nectar production of the flowering herb *Justica comata.* In a pilot study, we observed that the flowers opened and senesced in the same day, and that nectar did not seem to accumulate in flowers protected from foraging during the afternoon. We also observed both hummingbirds and bees foraging upon the tubular flowers. The greatest foraging activity occurred early in the morning.

Given the short life of these flowers, we predicted that nectar production in *J. comata* should continue throughout the morning. By continuing to produce nectar after opening when foragers are most active, the flower maintains pollinator attraction.

METHODS

This research was conducted at Palo Verde National Wildlife Refuge on 12 January 1997. The afternoon before testing, the first four stands of at least six plants of *J. comata* were chosen as the sampling sites. Within each stand, six plants were selected with the criteria that the plants must have at least 10 unopened flowers. The plants were divided among four stands to remove any local effects within a stand. The unopened flowers of the 24 individuals were marked with a black felt pen. In order to prevent forager nectar depletion, each plant was covered with fabric tied off at the base of the stem. These plants were left bagged overnight.

The next morning, beginning at 06:45, the nectar content of the flowers was measured. Nectar was quantified by removing the flower from the plant and collecting the nectar into a 10 µl capillary tube. Using this procedure, we haphazardly sampled one flower from each of the six focal plants and one flower from uncovered plants per stand and successively moved through the four stands four times. We did not keep track of individual plants because at a given site, we did not necessarily sample the same plant. By repeating the sampling procedure four times we measured amounts of nectar per flower through a two hour span. A T/C Hand Refractometer ™ was used to measure the sucrose concentration of the flower nectar. The sucrose concentration was measured to ensure that sucrose concentration levels stayed constant throughout the sampling period. An increase in sucrose concentration in the covered flowers would indicate the evaporation of the water in the nectar. Evaporation of water from the flowers would result in a decrease in nectar volume which would affect our results.

Regressions were performed on time series data from the covered samples in order to determine the change in amount of nectar over the two hours of the experiment.

RESULTS

For the covered flowers that were protected from nectar feeders, the nectar levels increased significantly throughout the two hour testing period

(R2=0.076, P=0.006; Fig. 1). There was no significant increase, however, in the unbagged (control) flowers (R2=0.0002, P= 0.91; Fig. 2).

We categorized our nectar measurements by the height of the column in the capillary tube: 0-10mm, 10-20mm, and >20mm. We also separated the total time of testing into thirds, and charted each nectar category for each time period (Figs 1 and 2). For the uncovered flowers, the nectar measurements later in the morning were either high or low with few intermediate values (Fig. 2).

Finally, the sugar concentration remained at a relatively constant level of 20% throughout the experiment, indicating that evaporation was not occurring.

DISCUSSION

Observations indicated that *J. comata* flowers are short-lived, opening and senescing in the same day. Compared to the covered flowers, the uncovered flowers had no increases in nectar accumulation. The sample of uncovered flowers did not show an upward trend in nectar production because the measurements for the uncovered flowers were either very low (likely due to foraging) or high (due to the continual nectar production of unvisited flowers). Because nectar concentrations were relatively constant throughout the morning and did not differ between the bagged and unbagged treatments, we cannot attribute changes in nectar quantity to evaporation. In other words, low nectar levels can only be explained by foraging of the pollinators.

Our hypothesis that J. comata produces nectar in the morning after budding was supported by the nectar increase over the course of two hours in the morning. In future work, we would recommend marking individual flowers to more closely track the overall nectar production of each plant. An interesting idea for a follow-up study would be to measure the amount of nectar removed by each species of *J. comata* forager by quantifying nectar before and after the forager visits the flower.

LITERATURE CITED

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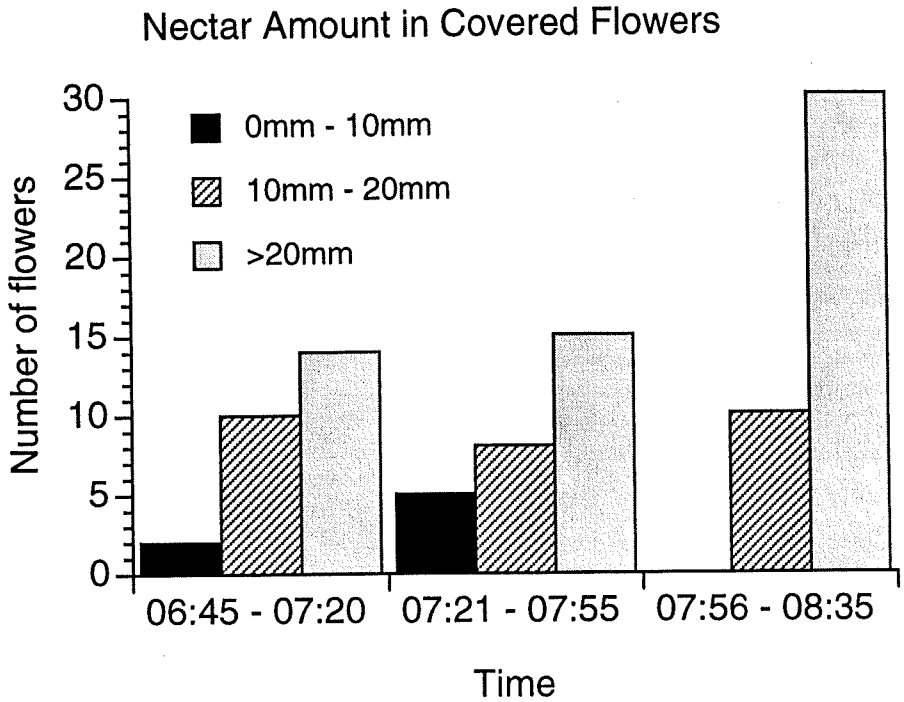

FIG. 1. Frequency of covered flowers in three nectar level catagories for three time periods. Without visitation of nectar feeders, nectar accumulates throughout the morning.

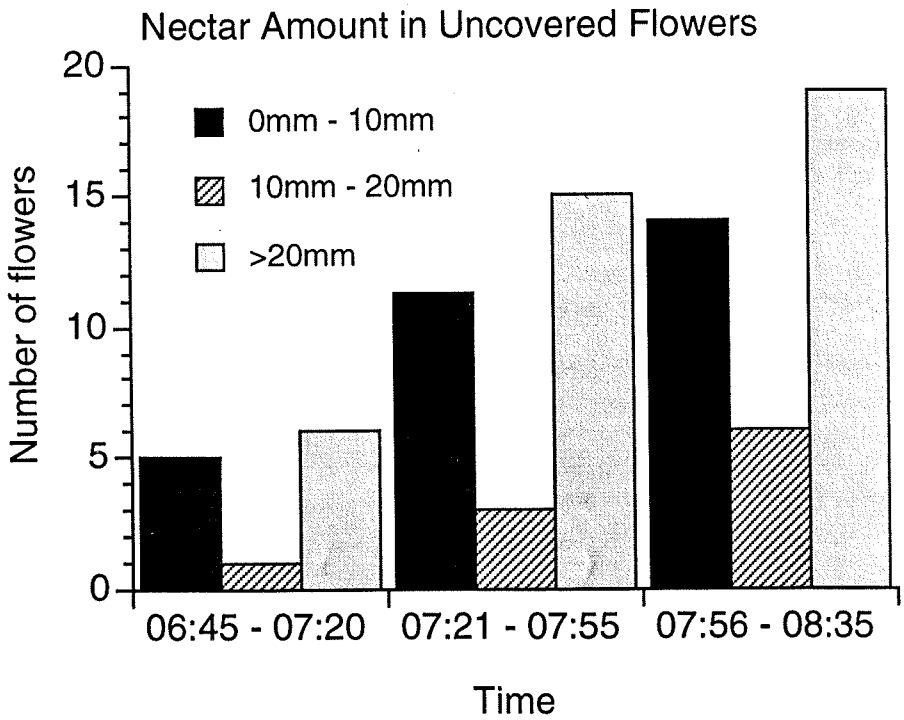

FIG. 2. Number of uncovered flowers in three nectar levels for three time periods. Throughout the morning, nectar is depleted in visited flowers.