The Importance of Location in Pollination

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Introduction

In nature, each individual in a species is given a set of traits which may or may not make the individual more fit than its competitors in its given environment. The term fit, in this case, refers to an individual's ability to reproduce viable offspring. Many of these traits, such as color and height, are heritable and can contribute to the overall evolution of the species. Others are not heritable and will only arise by chance. One such feature, in plants, is the location of an individual relative to other species. Even though this feature may not be heritable, it is important to understand any influence it may have on the individual fitness of a plant as it may assist passing along heritable traits.

This study explored the effect of a plant's location, relatively to other plants, on the volume as well as the variety of pollinators it receives. The variety of pollinators determines the odds a pollinator, with compatible morphology to pick up and transfer pollen, encounters the plant. The volume has a direct relationship with the probability that a pollinator will successfully complete the pollen transfer.

It is thought, by this investigation, that an individual plant's location, relative to other species, affects the volume of pollinators it receives. It is also thought that relative location affects the variety of pollinators a plant receives. The previous two statements are considered as the alternative hypothesizes. The null hypothesizes are the counterpoints to these statements. An individual plant's location, relative to other species, does not affect the volume of pollinators it receives. Also, an individual's relative location does not affect the variety of pollinators a plant receives.

Methods

Three group members participated in the study. Three species of plants were selected for observation; Golden Rod, Queen Anne's Lace, and Purple Aster. The relative location of each individual was placed into one of three classifications; a plant that is, close to a cluster of individuals of the same species, close to a cluster of individuals of other species, or isolated from species that reproduce by pollination through means of animals. Each team member was assigned to collect data on one of the three species. A day and time was selected where the data for each species would be collected simultaneously to prevent any difference in weather. Any deviation from common weather conditions for each data set would result in confounding variables.

The data were collected in the Nature Preserve of Binghamton University, Friday the 24th, 2010 from 13:23 to 14:43 Eastern Time. The weather was sunny with occasional gusts of wind. According to The National and Local Weather Forecast, the temperature for the region on this day ranged from 18 to 31 Centigrade (2010). The area within the preserve may be classified as a field in the herb stage of succession. The location, time, weather, and season are important factors in the activity of local pollinators.

Each team member found three individuals from his species. Each individual conformed to a different classification of location and was observed for twenty minutes. This resulted in an hour of observation for each species. During the observation period, the number of species and the number of individuals from a pollinating species that visited each individual plant was recorded. These were to be considered as the variety and volume of pollinators that visit each plant, respectively.

Results

The initial review of the data, as displayed in Table 1, revealed no clear dependence of volume or variety on an individual's location. While each species numerically received the most pollinators when next to individuals of the same species, it was uncertain if these differences were statistically significant. There was also no clear pattern of distribution for the variety of pollinators an individual received based on its location.

To obtain a better understanding of the results, the data were separated into two separate charts. The first chart, Table 2, reflects the volume of pollinator each species received in each location. The second chart, Table 3, reflects the variety of pollinators each species received in each location. A Chi-Square test for independence was performed on each data set. The numerical result of the test can be found in Appendix A.

On both sets of data, it was found that the null hypothesis could not be rejected with a confidence level greater than or equal to 95%. Thus, this investigation failed to reject the null hypothesis on both accounts and concluded two things. First, the volume of pollinators a plant receives is not dependent on its location relative to other plants. Second, the variety of pollinators a plant receives is not dependent on its location relative to other plants.

QAL = Queen Anne's Lace BB = Bumble Bee
GR = Golden Rod SB = Small Bee
PA = Purple Aster HB= Honey Bee

Table 1
Total Data

Species	Next to Other Species			Isolated	Next To Same Species		
QAL	0			0	Beetle 1	Ant 2	Caterpillar 1
GR	BB 7	Fly 2	SB 3	BB 3	BB 14	Fly 1	SB 2
PA	HB 5			HB 1	HB 5	BB 2	Fly 1

Table 2
Volume of Pollinators

Species	Next to Other Species	Isolated	Next To Same Species	Total
QAL	0	0	4	4
GR	12	3	17	32
PA	5	1	8	14
Total	17	4	29	50

Table 3
Variety of Pollinators

Species	Next to Other Species	Isolated	Next To Same Species	Total
QAL	0	0	3	3
GR	3	1	3	7
PA	1	1	3	5
Total	4	2	9	15

Discussion

The two conclusions of this study have implications. One such implication is that the effects of heritable traits on the fitness of a plant are not overshadowed by the non-heritable trait of relative location. This plays a great role in evolution of a population.

There are several factors, within this study, that might have skewed the results, however. Much of the population of each species had already died earlier in the season. This greatly reduced the sample size available to the investigation. Also, the physical features of each individual may not be consistent with what is typical of the population.

The impact of this study is hindered by the conditions in which it was performed. Another study, a professional endeavor, was performed indoors with controlled conditions and individuals (Keasar, Motro, Shur, & Shmida, 1996). A separate study also only studied one plant and one animal species (Labouche, & Bernasconi, 2010). This approach could be adapted to study how one species of plant and one species of pollinator behave when the plant is placed in different relative location. Overall, this study is best used as a pilot for more in depth and controlled research.

References

Labouche, A., & Bernasconi, G. (2010). Male moths provide pollination benefits in the Silene latifolia-
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