

Katie Koch  
Echinacea proposal  
10-June-2010

Question: How efficient are bees at pollinating *Echinacea angustifolia*

Background: *Echinacea angustifolia* is a self incompatible species relying heavily on insect pollination. Bees can carry a significant amount of pollen and the pollen they carry is not all from the same species of plant. It would be a worthwhile study to assess how well individual bees are at pollinating *Echinacea*. It may not be the amount of visits *Echinacea* receives, but it may be a matter of which bees are paying a visit. As stated in a previously published paper, "Within twenty-four hours after cross-pollination, styles and stigmas shrivel and pull down into the corolla tube but if cross pollination does not occur, a style's turgidity can persist for up to 10 days" (Wist, Tyler 2005). If a style shrivels, that is evidence that at least one pollen tube reached the style base to induce shriveling. By allowing only one insect visit per virgin inflorescence, I can observe how well that bee is at pollinating *Echinacea angustifolia* by counting the number of persistent as well as shriveled styles 24 hours after the single insect visit. Presumably, bees carrying pollen will pollinate the head of *Echinacea* wherever it lands. This study is worthwhile because if we know how efficient certain bees are at pollinating *Echinacea angustifolia*, scientists can infer how well *Echinacea* will reproduce each year based on the fluctuations of bee populations.

Hypothesis: The bees that most commonly visit *Echinacea* such as *Melissodes*, *Augochlorella*, and *Agapostemon* will be more efficient at pollinating *Echinacea angustifolia* because they are present in higher numbers than some of the less common bees in Minnesota. Specifically out of the three most common, *Melissodes* will be the most efficient because it is larger and *Agapostemon* will be the least efficient since it is a small bee.

Methods:

This experiment will be conducted in the common garden.

Many virgin inflorescences will be bagged (throughout the season) so that no insect is allowed on the stigmas and anthers. Two rows of untouched styles will be allowed to mature before a single insect visit. Emerged styles will be used for experimentation/observation at the base, middle, and top of the head (cone).

Once two rows of styles emerge, the bags will be opened to allow a single insect visit. Acrylic paint will be used to mark all the ray florets. There will be 4 colors used, a different color for each cardinal direction. The paint markings are for recording where the insect landed exactly for later observation.

For insect identification- there will be a video camera to record the single insect visit to review for later identification and/or the insect will be caught.

24 hours later, the number of persistent and shriveled 1 and 2 day old styles will be counted.

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Materials:

Net, jars with lids, clipboard, 5 m measuring tape, flags, stop watch, acrylic paint, video camera

Data Collection: The height of each bagged plant will be recorded, the inflorescence number, the number of persistent and shriveled 1 day and 2 day old styles, the direction of landing on the inflorescence, time of visit, duration of visit, and the bee species.

| Virgin Inflorescence | Height of plant (cm) | Bee species | Direction of landing | Time of visit | Duration of visit | # persistent 1 day old | # shriveled 1 day old | # persistent 2 day old | # shriveled 2 day old |
|----------------------|----------------------|-------------|----------------------|---------------|-------------------|------------------------|-----------------------|------------------------|-----------------------|
| 1                    |                      |             |                      |               |                   |                        |                       |                        |                       |
| 2                    |                      |             |                      |               |                   |                        |                       |                        |                       |
| 3                    |                      |             |                      |               |                   |                        |                       |                        |                       |
| 4                    |                      |             |                      |               |                   |                        |                       |                        |                       |
| Etc.                 |                      |             |                      |               |                   |                        |                       |                        |                       |

Other:

This experiment is to exclusively test pollinator efficiency by counting the number of shriveled and persistent styles. It is not accounting for foreign pollen to the *Echinacea* plant. Foreign pollen that cannot fertilize the ovule will still produce a pollen tube down the style, thus causing it to shrivel just as *Echinacea* pollen would. There must be some way to distinguish the foreign pollen from the *Echinacea* pollen. This could be done for future research.