



# Bees and Brassicas:

## A Partnership in Survival

*Symbiosis* is the close association of two or more dissimilar organisms. Such associations can be beneficial to both organisms (*mutualistic*) or detrimental to one (*parasitic*). Symbiotic relationships among species occur frequently in nature. When the two or more species in a symbiosis evolve reciprocally, in response to each other, they are said to *coevolve*. Under close examination each symbiosis stands out as an example of the miraculous complexity which has evolved in our everyday world. The coevolution of brassicas and bees, each dependent upon the other for survival, is such a relationship.

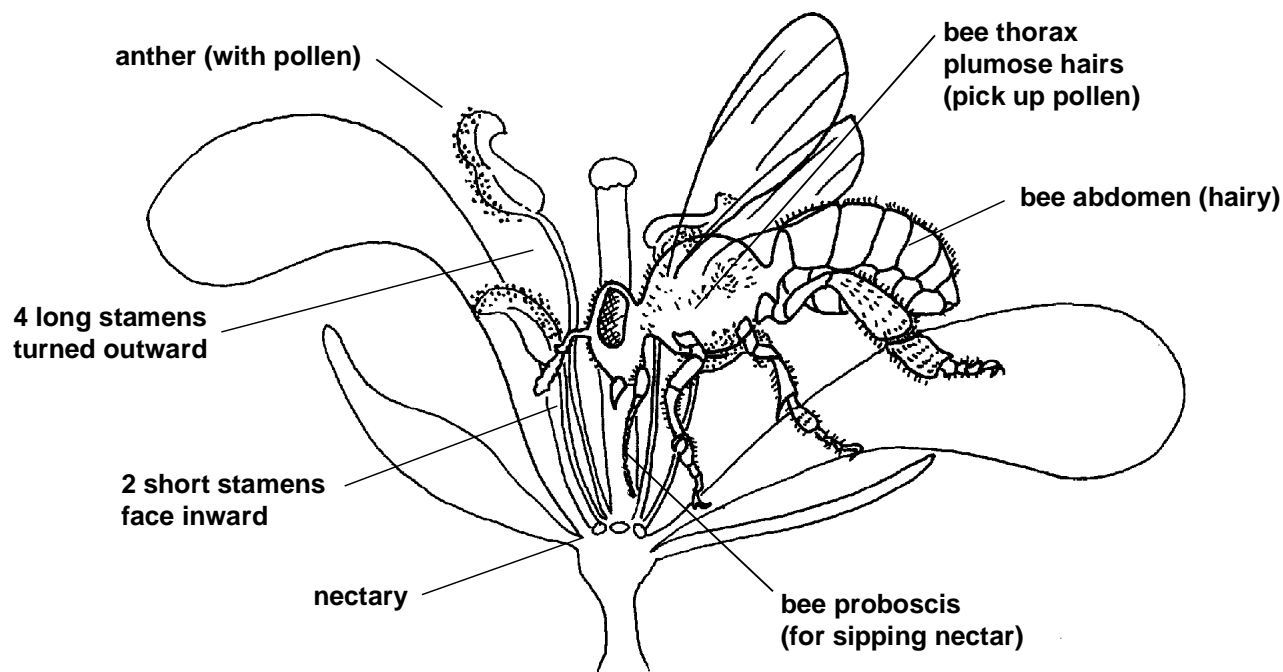
What is a flower? In our eyes it is something to enjoy. For bees and other nectar-gathering insects, it is a source of food. For the plant, flowers are vital organs of reproduction containing both male and female gametes.

Within each brassica flower the male and female parts are just millimeters apart so that when pollen from anthers falls onto the stigma, pollination may occur.

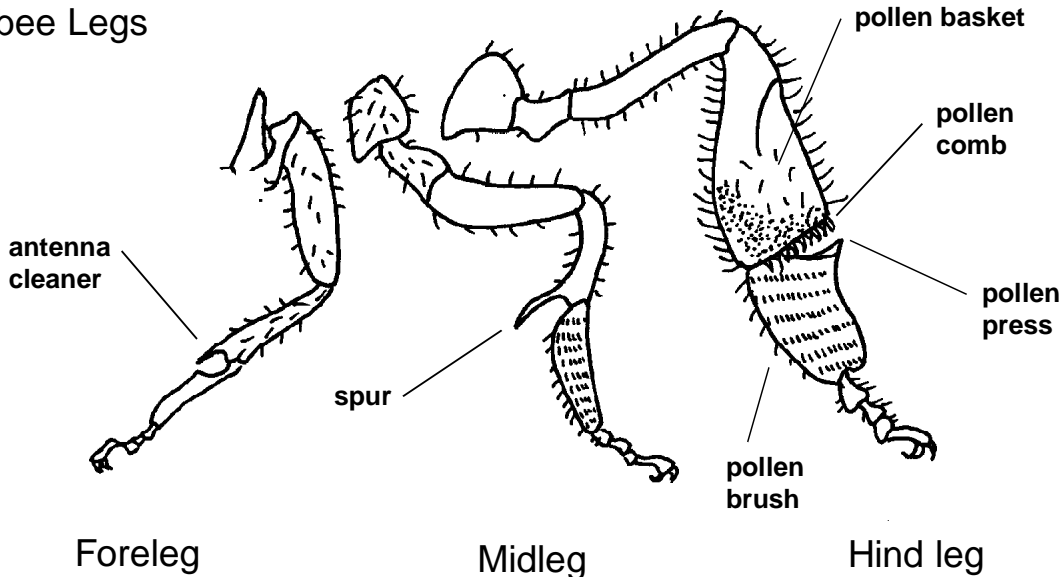
For many brassicas, however, the act of pollination does not insure fertilization and seed formation. Some brassica species contain special recognition compounds, *glycoproteins*, which are unique to each plant. These compounds enable the plant to recognize “self,” causing the abortion of the plant’s own pollen. The prevention of fertilization of “self” pollen is called *self-incompatibility*. In order for fertilization to occur pollen must travel from one brassica plant to the stigma of an entirely different brassica (*cross-pollination*). In this way brassicas ensure that their genes will be well mixed throughout the population.

The pollen itself is heavy and sticky—unable to be easily wind-borne. For brassica plants, bees are marvelously coevolved pollen transferring devices. Bees are members of the insect family Apidae, which are unique in that their bodies are covered with feather-like hairs. The bright yellow flower petals act as both beacon and landing pad for the bees, attracting them to the flower and guiding them to the nectaries. The bee drives its head deep into the flower to reach the sweet

### Brassica Flower and Honeybee



## Honeybee Legs



liquid (*nectar*) secreted by the nectaries and brushes against the anthers and stigma. Quantities of pollen are entrapped in its body hairs. As the bees work the brassica fields, moving from plant to plant, cross-pollination occurs and genetic information is widely transferred.

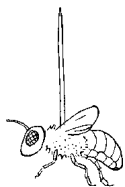
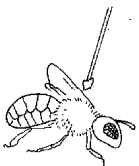
Bees depend on the flower for their survival. Sugars in the nectar provide carbohydrates to power flight and life activities. Pollen is the primary source of proteins, fats, vitamins, and minerals to build muscular, glandular, and skeletal tissues. The average colony of bees will collect 44 to 110 pounds of pollen in a season. *Royal jelly*, a glandular secretion of the workers, rich in pollen protein is fed to the young larvae and to the queen.

A worker bee foraging for pollen will hover momentarily over the flower as she uses her highly adapted legs for pollen collection. The fore

leg is equipped with the *antenna cleaner*; a deep semi-circular notch with a row of small spines. This is quickly passed over the antenna. Using the large flat *pollen brushes* on the midlegs, the bee quickly brushes the sticky pollen from her head, thorax and forelegs. The pollen is transferred to *pollen baskets* by special adaptive features of the hind legs. First the pollen captured on the midleg brushes is raked off by the *pollen combs* onto the *pollen press*. This press is a deep notch located in the joint just below the pollen basket. Flexing the leg, the bee packs the pollen into the baskets which are enclosed spaces on the upper hindleg formed by a concave outer surface fringed with long curved hairs. When the baskets are filled, the worker bee returns to the hive with her supplies to feed the colony—nectar in her honey stomach, pollen in her baskets. In the process the continuation of a new generation of brassicas is ensured through her pollination activities.

## Making beesticks: Day 12

Add a drop of glue to fix the bee to the toothpick.  
Push toothpick into the top of the thorax (middle section) of the bee.



Let beesticks dry overnight.

## Pollinating: Days 13 to 16

Pollinate with beesticks by brushing the bee over flowers to pick up and distribute pollen.



Transfer pollen back and forth among different plants (*cross-pollinate*).

Fast Plants do not self-pollinate.

