Fast Plants and Families I

One of the essential attributes of living organisms is *variation*. Understanding how variation is generated and maintained is central to an understanding of biology and is an important theme in the study of genetics. A *"family approach"* to investigating with rapid cycling *Brassica rapa*, Rbr (Fast Plants), provides a rich and understandable introduction to the complexities underlying biological variation.

Preparing the "mother"

The time to establish Fast Plant families is just as the generation is coming to an end and the plants are drying (35-40 days after planting) (Figure 1).

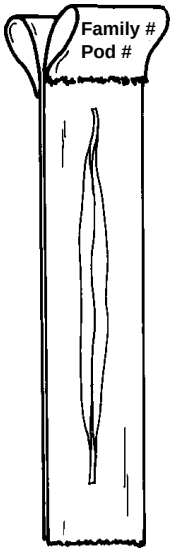

Figure 2

Rather than harvesting and combining the seeds from all the dried fruits (pods), each dried pod can be gently removed from the plant and placed between folded clear adhesive tape (see Figure 2), being careful not to lose any seeds. In this way, you can preserve the seed containing the embryo which is part of the maternal parent (mother) that produced the seed. Since each of the seeds are offspring of a common maternal parent, they are siblings within a family. Pods from each plant can be color coded with a marking pen to identify them as having the same "mother." The following explorations will provide you and your students with many questions to investigate how variation is generated and maintained.

Note: If the students have a whole plant with mature seed pods, the plant itself would be viewed as the "mother," and all pods from the same plant have the same family number. Use the "Family Data Chart." If they begin only with harvested seed pods, the pods themselves can be viewed as "mother." Use the "Pod Data Chart."

Activity ideas

Looking at the seed pod, protected between the layers of clear tape, various features of the maternal parent

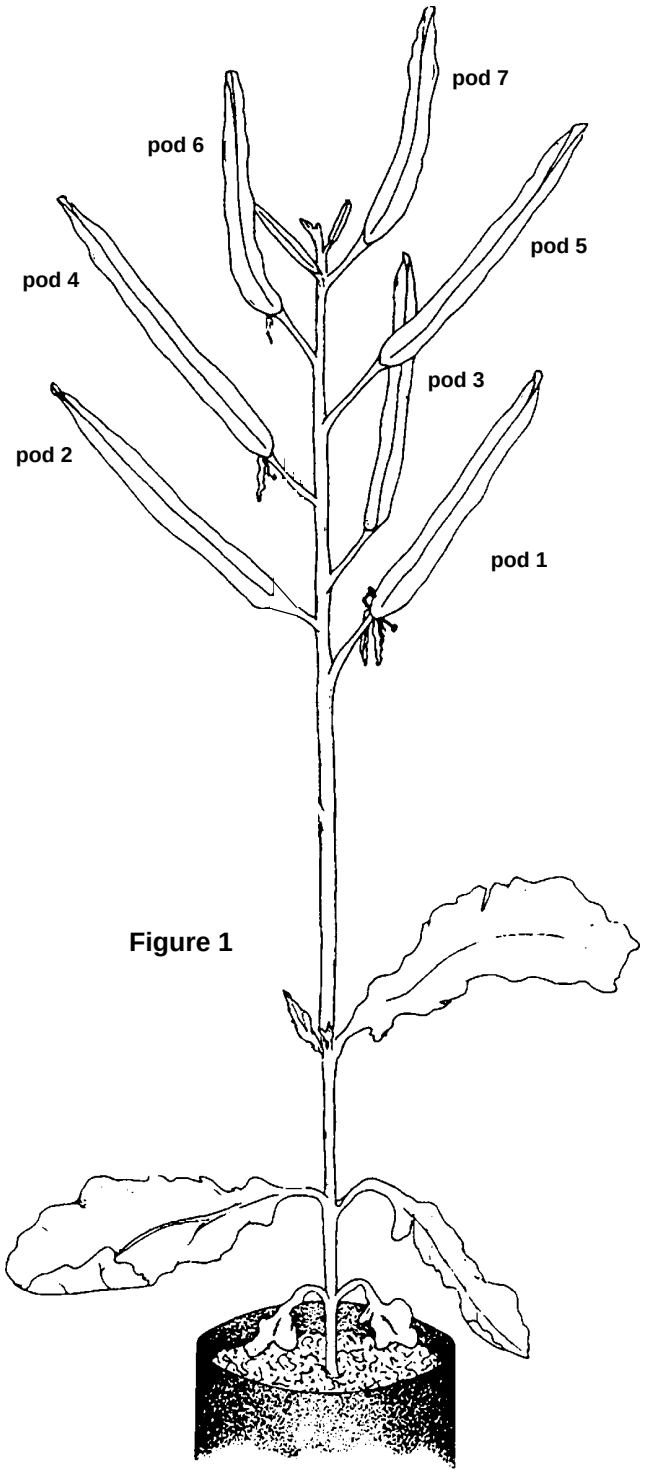

Figure 1

(such as pod, style and ovary length) (Figure 3) can be observed, measured and recorded on the chart. A 5X magnifying lens is helpful in making observationsand careful measurements. After recording characteristics of the “mother,” the pod can be thoroughly crushed within the tape. As the tape is peeled open, the seeds will stick to the adhesive. The seeds should also be observed carefully with a magnifier and then counted and their number recorded.

Sibling seeds can be sown in minipots, with one pair of plants in one pot growing under the “standard" conditions in the classroom, and the other under “experimental” environmental conditions, perhaps at the student’s home. Be sure that the “experimental” conditions are recorded. By measuring each sibling plant in each environment, a large amount of information (data) on individuals can be obtained. These data can be used in many ways to examine variation within, between and among individuals, families and populations of Fast Plants. Mathematics and statistics can be applied to the data to help understand the variation. The data can be presented graphically in many ways. By observing the variation among individuals of a population or family, students will be able to explore the influences of environment on the growth and form of plants.

By beginning the exploration with seeds from a common mother, many interesting ideas can be pursued. Important questions relating to origins of the parents and the make-up or structure of the family can be investigated (e.g. do all sibling have a common father as in a “nuclear family?”). Characteristics that vary among individuals in the population such as plant height, number and length of the pod, length of the style, number of hairs on the plant, and color of the parts, will be observed. By crossing individuals within or between families (controlling the pollinations), heredity of such characteristics can be investigated experimentally.

Pods from each plant could be color coded with a marking pen to identify them as having the same “mother.” The progeny (seeds) from two maternal plants (e.g. red and blue) could be planted and grown in two separate populations. Characteristics of the two families could be measured and compared. For example, the length of the style of the seed pods could be compared. Is the style length of all the seed pods on each maternal plant similar? If you intermate progeny of the “red” mother, will the style lengths of these progeny be similar to that of the original red mother? What about the “blue” family? What would happen to style length if you crossed a "red" plant with a "blue" plant?

Such experiments will provide both you and your students with a rich introduction for understanding some of the principles underlying the study of genetics.

Experiments with Fast Plants which examine both the role of heredity and the environment in the expression and maintenance of variation will deepen a student’s understanding of variation as an important attribute of life.

Questions that might be considered

- In how many ways can you describe the pod (the mother)? Are the pods from one plant more like each other than they are like the pods from other plants? What about the siblings from a single pod?
- Do all the seeds in a pod have the same father?
- How much variation is there within and between families of Fast Plants?
- How much does the environment affect the variation in Fast Plants, e.g. the number of seeds per pod, style length, plant height, days to first flowering, etc?
- Is there any relationship between the length of the seed pod and its position on the maternal plant?

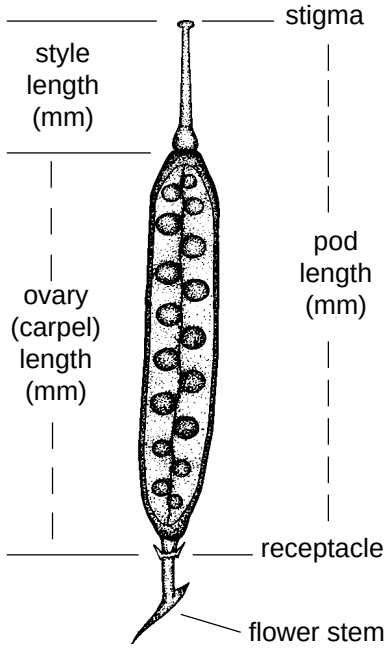

Figure 3

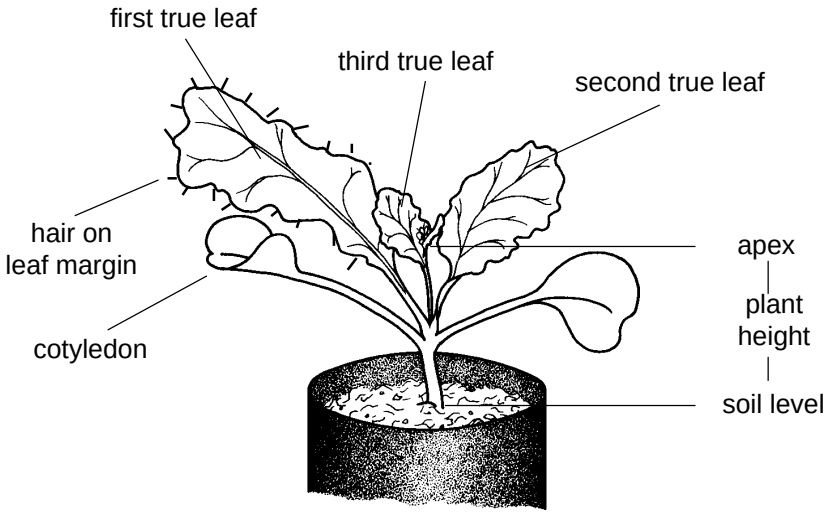

Figure 4

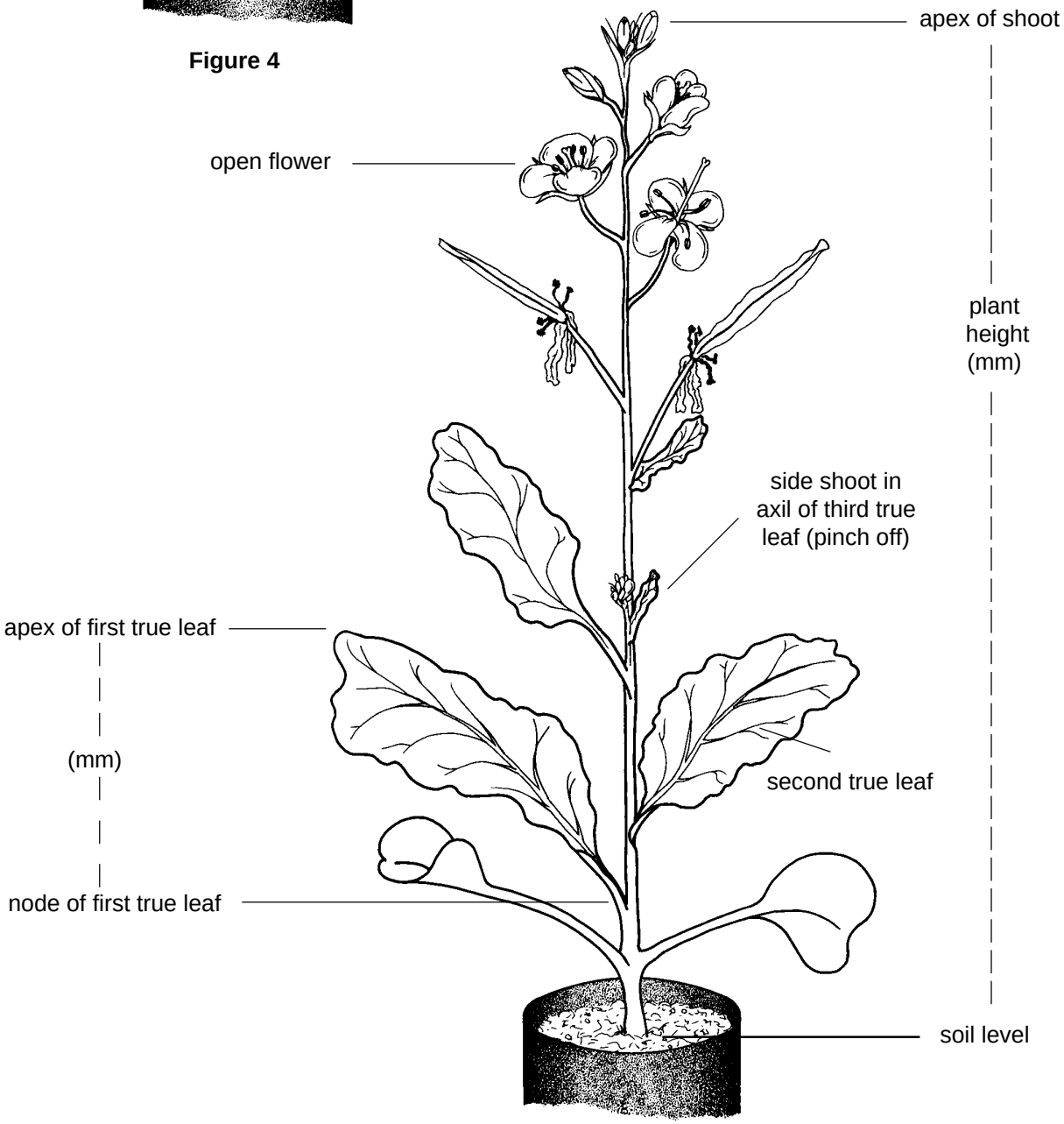

Figure 5