GOLDENROD PLANT AND INSECT RELATIONSHIPS

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ABSTRACT

There are many complex interactions between organisms in an ecosystem. This experiment focused on the interactions between the Goldenrod plant, its gall inducer, *Eurosta solidaginis* larva and its enemies, the *Eurytoma gigantea* and *Morellistena unicolor*. It also analyzed the relationship between plant density, plant height, size of the galls and total number of galls produced per plant. Firstly, the findings showed that the number of galls increased with an increase in plant density. Secondly, the number of galls significantly varied between habitat and soil texture. Thirdly, the height of the Goldenrod plant decreased with increasing gall numbers. Finally, the size of the galls were bigger in plants that had multiple galls compared to single galls.

RESEARCH QUESTIONS

1. Is there a correlation between plant density and number of galls per plant? How does this differ among sites?
2. Is there a correlation between plant height and the number of galls?
3. Is average gall size smaller when there is more than one gall per plant than when there is only one?
4. Is the average gall size significantly different for galls with *Eurosta* and galls with one of its insect enemies?

MATERIALS AND METHOD

The Goldenrod samples were collected in mid November from four different sites in north of Toronto: Minesing (ditch), Minesing (upland), North Glengarry and Glengarry Notch. In total, 13 sites were sampled. The sampling area was measured using a quadrat of 1 m by 1 m. The plants were cut using garden snippers, about 2 cm from the ground. From each site, five complete plants with galls and five complete plants without galls were collected. Then they were stored in a cold environment. Using a meter stick, the height of each plant and the position of the gall on the stem was measured. The diameter of the stem at the base and the width of the galls were measured using calipers and recorded. The galls were dissected using a scalpel and their contents were examined under a dissecting microscope. Records of any bird damages and parasitoid damages were noted.

RESULTS

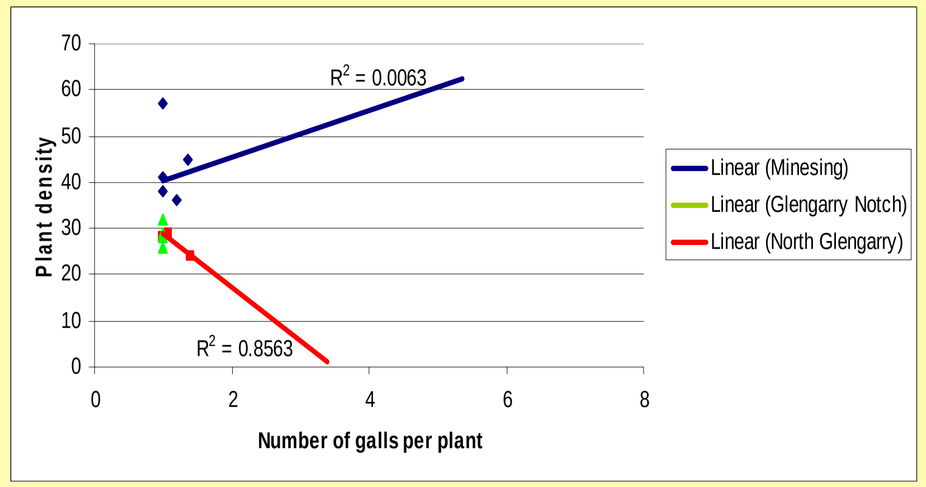

Figure 1: This graph illustrates the correlation between the Goldenrod plant density and the number of galls per plant. It also show the differences between the three different sites sampled.

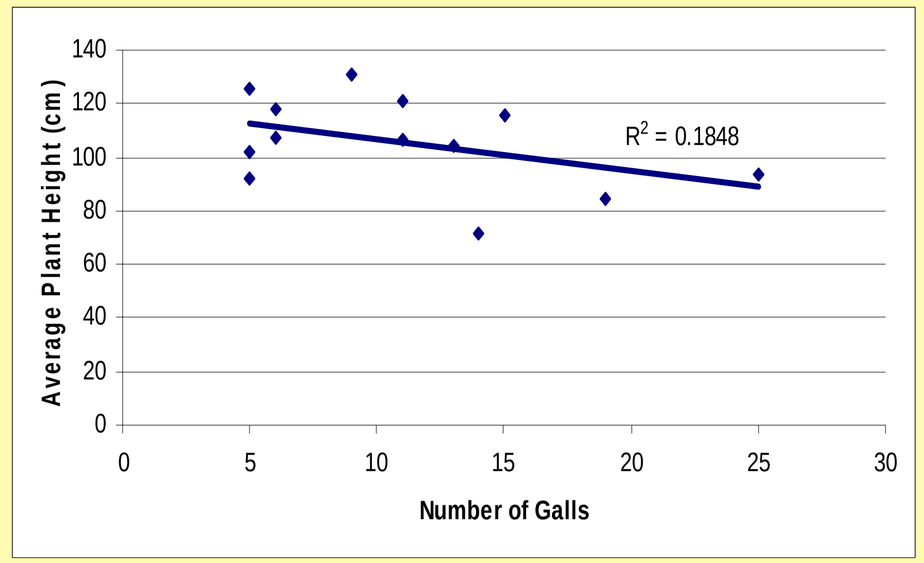

Figure 2: This graph depicts the correlation between the average height of the plant calculated per sample and the total number of galls found in that sample. A sample consists of 5 plants and a total of 13 samples were analyzed.

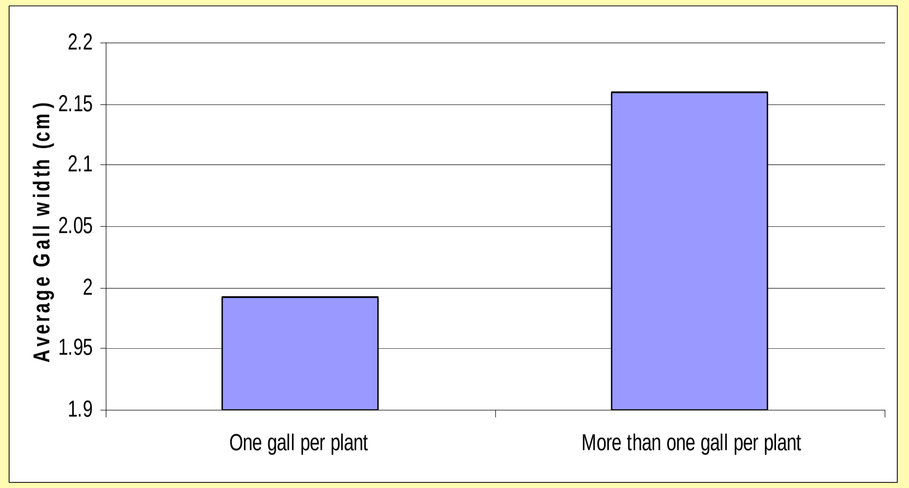

Figure 3: The bar graph depicts the relationship between average gall width and the total number of galls per Goldenrod plant. It shows the differences in gall size when a plant has one gall per plant and more than one gall per plant.

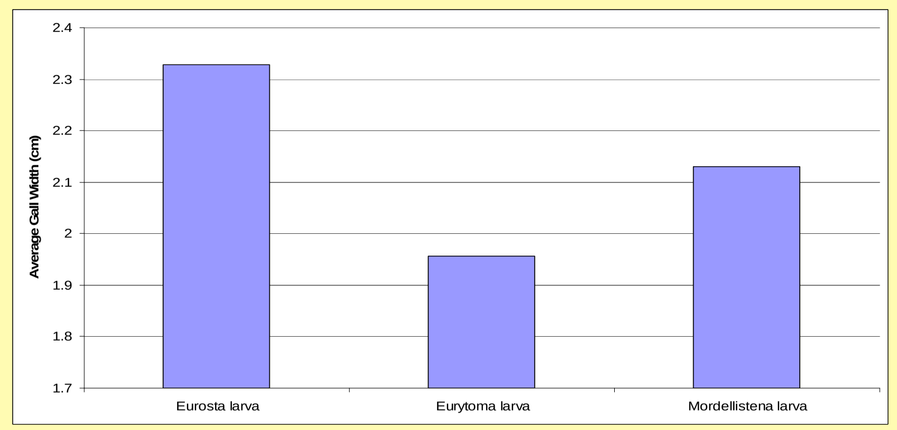

Figure 4: The bar graph illustrates the differences in the average gall size, measured as gall width, when it is occupied by *Eurosta* larva and its enemies, the *Eurytoma* larva and *Mordellistena* larva.

CONCLUSION

The complex interactions among the Goldenrod plant, the galls induced by the *Eurosta* larva, the *Eurosta* larva itself and its enemies were demonstrated through this experiment. The findings indicated that these interactions can change based on the location and habitat in which these plants thrive. The correlation between plant density and the number of galls per plants varied greatly between the three different sites, Minesing, Glengarry Notch and North Glenggary. The number of galls increased with increasing plant density in Minesing, since the gall induction caused further stem production (Curtsinger et al., 2008).

In North Glengarry, the number of galls was dependent on whether the soil was well drained and allowed higher larval survival rates to produce the galls (Wise et al., 2006). It was also found that the as the number of galls increased, plant height decreased, as it causes damage to the stems of the plant. However, the decrease in plant height can be influenced by resource availability and competition as well (Fay et al., 1996). The average gall size was found to be larger in plants with more than one gall compared to plants with only one gall. This was explained by the fact that there are specific genotypes of goldenrod that are more stress tolerant compared to other genetoypes. These stress tolerant genotype plants are more suitable hosts and are targeted more often than the less stress tolerant genotypes (Cronin and Abrahamson, 1999). Furthermore, this experiment demonstrated the selection pressures that are involved in the determination of gall size. Typically, small galls are most susceptible to parasitoid oviposition and larger galls are targeted and eaten by bird predators (Weis et al., 1985). Thus a stabilizing selection occurs to induce ball shaped galls that are typically intermediate in size.

FUTURE DIRECTIONS

Further study in various other habitats could give a different perspective and understanding of the interactions in this system.