Comparing the Effects of EcoExempt and Chemical Permethrin on Spirogyra

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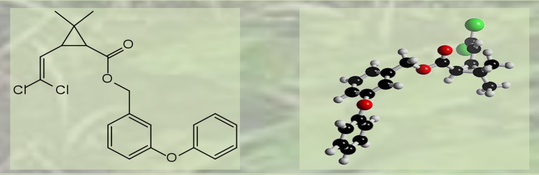
ABSTRACT

The principle objective of the experiment was to view the effects of pesticides, chemical permethrin and eco-friendly EcoExempt, based on plant life in the wetlands. In order to test the hypothesis, controlled environments were set up in the lab that contained measured amounts of algae, water, and different concentrations of pesticides. After the environments sat for a week, the algae was taken out and measured in comparison to the initial values. It was found that the algae in the permethrin solutions had a decreasing mortality rate as the concentration level grew. In the ExoExempt solutions, the mortality rate remained relatively constant for each concentration. The conclusion for the permethrin solutions was that the nitrogen present in the permethrin molecules promoted plant growth. The conclusion for the EcoExempt is that it has no effect on the algae at all, because it neither promoted nor demoted plant growth.



Lewis Dot structure (Left) and Molecular representation (Right) of permethrin.
Figure 1

INTRODUCTION

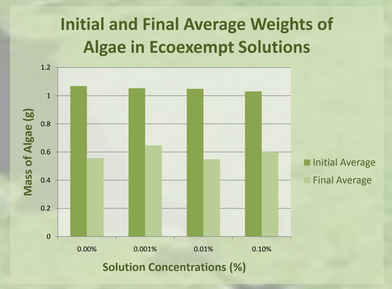
Permethrin, a common pesticide, is "registered for use on numerous food/feed crops, livestock and livestock housing, modes of transportation, structures, buildings (including food handling establishments), and for residential uses" (Office of Pesticide Programs, 2011). Ecological studies have "detected levels of turf pesticides in surface waters that exceed water quality guidelines or maximum concentrations for protection of aquatic species" (Haith, 2010). This information suggests for further investigation of the usage of permethrin or replacing it with a more eco-friendly alternative. This experiment examines the potential negative effects of these pesticides on plant life in aquatic ecosystems. Negative effects that this chemical has on plant life in these environments could harm the whole ecosystem. Alternatives to chemical permethrin are available and claim to be environmentally friendly. It was hypothesized the chemical form of permethrin would do more damage than the Eco- friendly pesticide. This hypothesis was made under the assumption "Eco-friendly" is commonly defined as having little or no effect on all of the plants and animals.

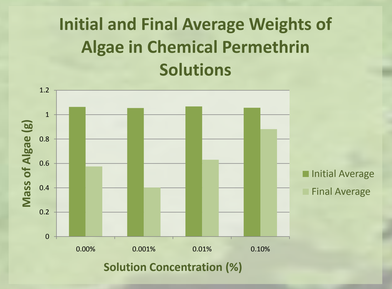
MATERIALS AND METHODS

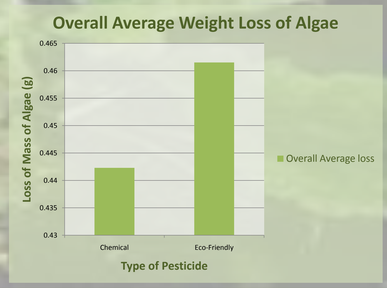
Figure 2

To test the effects of Permethrin and EcoExempt (an eco-friendly version) on the environment, for each chemical four concentrations of solution were created: control, 0.1, 0.01, and 0.001%, to simulate polluted runoff. For each environment, 400 mL of solution were placed in separate 850 mL volume glass containers (Figure 2). Each solution and control environment had three replicates for accuracy. *Spirogyra sp.* was collected from the Lake Waco Wetlands to see the effects of the pesticides on an organism there. The *Spirogyra sp*. was massed and an approximately one gram sample was added to each sample environment. After 8 days, the *Spirogyra sp.* was filtered from the solutions using a funnel and filter paper (Figure 3). The mass of the *Spirogyra sp.* and filter paper were taken, then the weight of the wet filter paper was subtracted. Any loss of mass was considered a negative effect of the chemical used, and any growth was considered not harmful to *Spirogyra sp*.

RESULTS







CONCLUSION AND DISCUSSION

According to a study done in California wetlands, levels of permethrin found in water runoff can range up to 0.094 micrograms per liter (Bacey, Starner, and Spurlock 2). This experiment examined if there was a difference between the chemical permethrin and EcoExempt. All but one sample in the experiment showed loss in mass from initial recordings.

Growth of algae in 0.001% permethrin samples can be attributed to the presence of the nitrogen in the permethrin molecule. In the study in California, aquatic plants showed a high mortality rate in lower concentrations of permethrin. However, this was due to presence of herbicides in the same runoff sample. In this study, we can deduce that permethrin is not the direct cause of plant mortality. There were no herbicides in the samples, so any loss of mass in the controls was due to lack of nutrients. As permethrin was added in higher concentrations, samples showed lower mortality, proving permethrin contains nutrients.

The initial understanding of "eco-friendly" in this experiment has been affirmed because EcoExempt had little to no effect on the algae. The control sample and EcoExempt concentration samples lost similar mass. This indicates that any loss is due to the lack of nutrients and, therefore, arbitrary. This can either be considered helpful or harmful. While EcoExempt does not hurt the plant by adding toxins, it does not help the plant by adding nutrients either.

The hypothesis was proven incorrect. Testing showed EcoExempt lost more mass of algae than chemical permethrin did. This was due to nutrients found in chemical permethrin, contrary to the initial belief that permethrin would be toxic. Further testing should be done to determine if permethrin can add too many nutrients to be detrimental. If this is the case, then EcoExempt could be a better choice.

Chemical High 1 Before
EcoExempt High 1 Before
Chemical High 1 After
EcoExempt High 1 After
Figure 3

LITERATURE CITED

Bacey, Starner, and Spulock, (2004)."The Occurrence and concentration of Esfenvalerate and Permethrin in Water and Sediment in the Sacramento and San Joaquin Watersheds," *California Protection Agency*, p.2-3.
Haith, Douglas A, (2010) "Ecological Risk Assessment of Pesticide Runoff from Grass Surfaces." *Environmental Science and Technology* Vol. 44 Issue 16, p6496-6502.
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