


-COMPOST-


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Composting is a very important part of providing nourishment to soil, and thus is a vital role for small farms. This project was intended to discover if harmful or beneficial insects to crops are found in compost. The first priority was to find these insects, and then determine their trophic roles in the compost. Jars were used hold and transport the specimens, and a butterfly net was used to catch the flies. All of the samples were collected from varying types of compost piles on Briermere farms in Riverhead, New York. Afterwards, DNA extraction and PCR amplification were performed for each sample. Of the twenty completed samples, only eleven were suitable for sequencing. Each of the eleven species were identified and sequenced. The species collected from the compost were all beneficial, common insects. Most of the samples were either identical or closely related so therefore they all originate in places that are within the vicinity of each other.

Introduction

Composting has been an imperative aspect to many constituents of agriculture on Long Island. There is a commerce aspect to composting, as many farms and landscapers use it, as well as small gardeners. With the inundation of organic farms to Long Island, the emphasis of natural, chemical-free compost has been never been higher. With the confluence of all these accentuations on natural compost, it must be further researched.

This is why there may be a need for a biodiversity study of insects in contrasting nitrogen levels of compost. It is mostly known in general what insects reside in compost, but with locations specifically on Long Island increasingly partaking in composting, a study focusing on particular species either native or invasive to Long Island will reveal multiple questions and answers that may be beneficial to local agricultural businesses.

There is are many idiosyncratic food chains in compost piles, mostly derived from decomposers. Microorganisms (bacteria, actinomycetes, fungi, and protozoa) are the base of the food chain. They break down organic material, and release energy as heat through reactions and movement, creating a warm environment (around 20-55 degrees Celsius) for mesophilic macroorganisms. These macroorganisms, particularly nematodes and earthworms, engage in physical decomposition of organism material, as well as feed on microorganisms (Sowbugs, springtails, flies, millipedes, slugs, snails and mites also break down compost). Nematodes are very populous in compost, numbering in millions to a few ounces of material. Predatory macroorganisms are present in compost as well (spiders, centipedes, and several varieties of beetles), and feed either on nematodes, or sowbugs and springtails.

This ecosystem varies with nitrogen content however, and the population or even appearance of different species is contingent with several factors to change. Moisture level may directly affect the appearance of fruit flies, mosquitoes, and other species of springtails. Nitrogen level will directly affect the presence of fungi, which in turn will alter the populations of fungivores (slugs, nematodes and springtails) in compost. Organic materials containing nitrogen particularly heats the compost heap when chemically broken down. This demonstrates how nitrogen would alternatively affect the environment in compost.

Discovering insects' niches outside of the compost is also an informative aspect to this project. Insects commonly found in compost may also be a pest species to several agricultural crops. *Drosophila melanogaster* and *Musca domestica* are common flies found around compost, but also are a nuisance to nearby agricultural operations. Farms, being the major contributor to compost production would appreciate any revealing details about possible pest species being harbored in compost, considering that they would be most directly affected by these species.

Materials

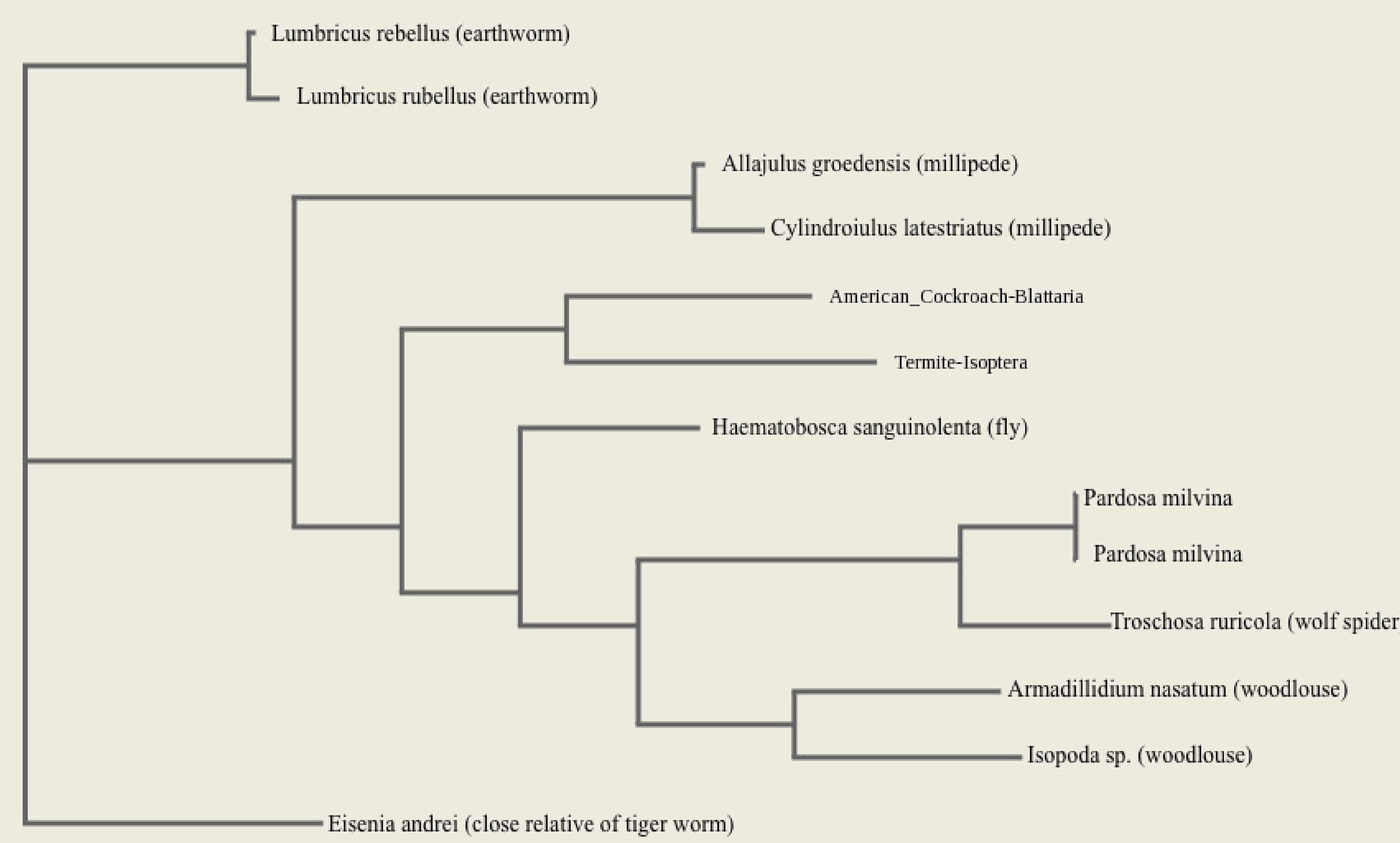
Collection took place twice on March 19th and April 10th at Bennett's family farm (Briermere Farm). Since the compost pile at Briermere Farm is composed mostly of leaves and grass clippings from around Suffolk County, if we used any other type of compost it would result in different data. The samples were collected from various varieties of compost however, as we wanted an array of data that could be applied relatively broadly. Collecting the different insects could be accomplished in various ways. Insects were collected manually (with sterile gloves on), and placed in glass jars. Insects were collected using a standard butterfly net. This was used in a relatively simple procedure, by swaying the net over the compost, then checking to see what insects were inside.

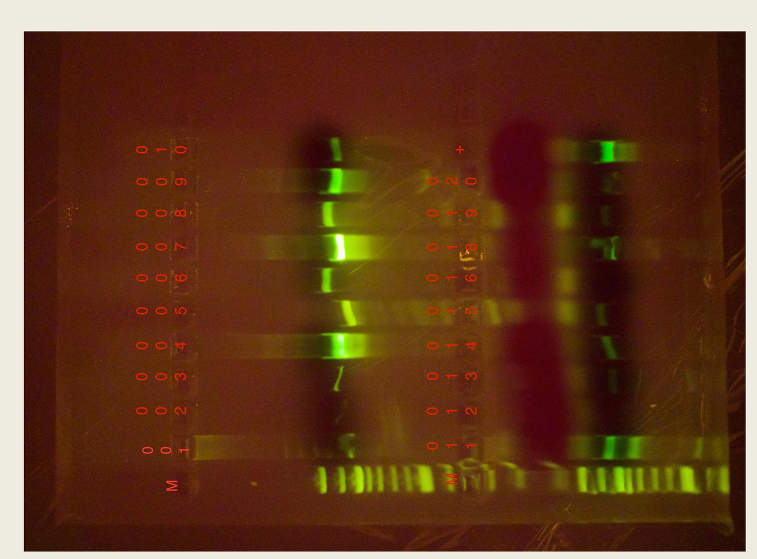
Using samples removed from the different species, DNA isolation and amplification was performed, and the PCR (polymerase chain reaction) products were analyzed. DNA isolation was used to extract DNA from the cells. The DNA that was separated from the rest of the cell fragments helped clean up the DNA. The next step was amplifying the DNA. This produced multiple copies of the sample to perform experiments on. Before sending the samples out for sequencing, it was crucial that the PCR was successful using Gel Electrophoresis. The DNA bands of the samples were compared to the 648 nucleotides of the CO1 gene.

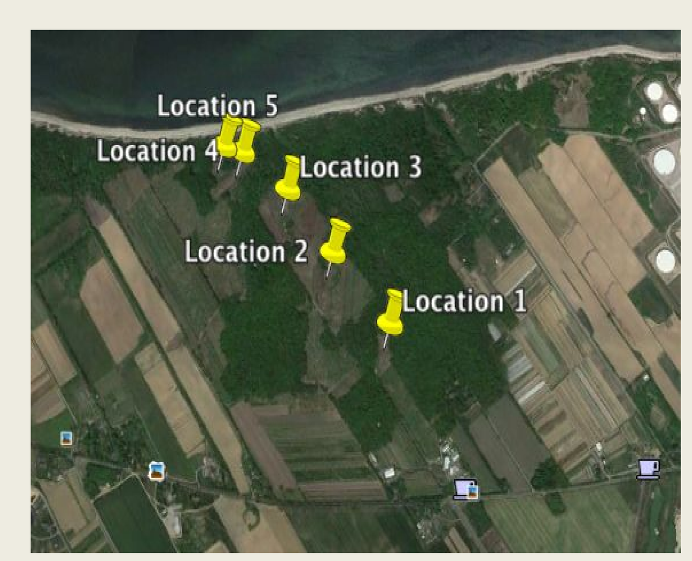
Results

Twenty samples were collected (001-020), and eleven of those samples were fit for sequencing:

NSR-001- Isopoda sp. (woodlouse)
NSR-003- Lumbricus rebellus (earthworm)
NSR-004- Haematobosca sanguinolenta (fly)
NSR-005- Troschosa ruricola (wolf spider)
NSR-006- Lumbricus rubellus (earthworm)
NSR-007- Eisenia andrei (close relative of "tiger" worm)
NSR-008- Pardosa milvina (relative of wolf spider)
NSR-009- Armadillidium nasatum (woodlouse)
NSR-010- Cylindroiulus latestriatus (millipede)
NSR-014- Allajulus groedensis (millipede)
NSR-018- Pardosa milvina (relative of wolf spider)







Initially, our expectation was to find invasive species using the warm, moist temperatures of the compost as a haven from the colder temperatures of the winter. But, because of the absence of any invasive species in the compost we collected from, a small-farm owner does not need to take actions to prevent the possibility of them becoming prevalent in the varying types compost. Multiple mutualistic and commensalistic species, some being beneficial to the quality of the compost, were found, and many proved to contribute to the decomposing process of compost, indicating that measures could be taken to increase their population.

There are multiple methods to continue researching this; one effective approach could be to look at the different plants and/or fungi apparent in the compost that could potentially be invasive, not just the insects.

Many improvements could be made to the experiment such as refining the methods used in DNA barcoding in order to make sure the maximum amount of samples are available for identification. Another improvement could be to use a larger sample size to realistically determine the trophic roles of insects in a compost pile. Only a few samples cannot display an accurate representation of how these organisms interact with each other in the compost pile. Furthermore, to continue the research on this project we could see how organisms in the compost pile interact with other nearby species, therefore allowing for some impact to be made on either one. We could also measure the exact nitrogen content of a compost pile, and see if any organisms inside are increasing this nitrogen content by decomposing material more quickly. Such organisms would be advantageous to the decomposition process compost.

Acknowledgements and References

Westhampton Beach High School
Jeffry Petracca- *Head of Bugs and Butterflies Exhibition at the Long Island Aquarium in Riverhead*
Frank Diehl- *Student Research Advisor*
Jok Kommer- *Marine biology Teacher at WHBHS*