

Vertical Gardening- Learning through Shovelling

An Aim of developing a space for climber plants and research into the barriers to and priorities for the development and growth of the plants.

Objectives:

- To identify key barriers to and priorities for the development and growth of the plants.
- To use identify the parasitic biological organisms that disrupt the plant's normal growth and health.

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TimeLine: 1- 2 Months

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Fig 0.1: Seeds planted at home

The beginning of the journey: Plants, through the process of photosynthesis, produce food for themselves, this is stored in the leaves as starch. A plant thrives when everything is in balance (food, nutrients, water, environment, and pests). By experimenting with these we happened to get ourselves at the best conclusions and positions for the Vertical Gardening. First, it was by planting the plants in school but due to uncertain circumstances the plants did not flourish, so we thought of planting seeds at home after 1 week they were brought to school and replanted. first started with the experiment of the types of plants, a trial from the midst of plants from Ipomoea tricolor (Morning Glory), Money plants, to pumpkins and tomatoes. until we reached our conclusion of starting with 2 Ipomoea tricolor (Morning Glory) saplings and the rest pumpkins. Then we moved on to experimenting with the plant's environmental conditions, at first hanging them with ropes while later cutting gallon bottles and setting up a stand for better support. Finally once planted the Ipomoea tricolor (Morning Glory) grew very well for two weeks, but some of the pumpkins had to be replanted as they had been destroyed by factors such as sunlight, water pressure, and depth of seed, once this was in place new obstacles had arisen, the plants leaves started looking rather different, and here is where we witnessed an artwork of a parasite not from these parts an insect larvae belonging to the leafminer family.

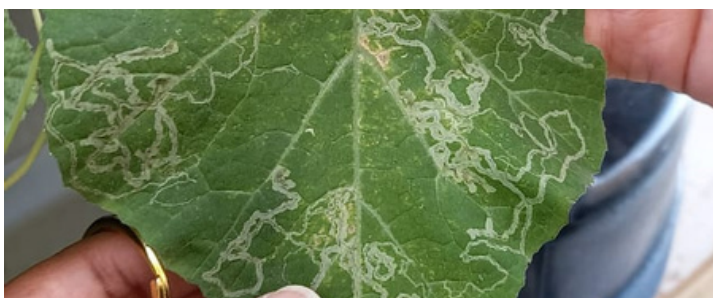


Fig 0.2 Showing a pumpkin leaf infected with leaf miners



Fig 0.3 Plants replanted in school

1 Introduction

Plants have many ways to protect themselves against the forces around them, such as the environment and pests. Yet sometimes these defenses don't work. Leaf miners in this case appeared on the plants at a very early age, some were even found on the cotyledons of a seedling, most of these tiny creatures, or indeed all were found in the plants belonging to the family Cucurbitaceae. Each plant after being planted in the Plastic gallon bottle cups were kept in a safe place away from direct sunlight and children for a duration of 2 weeks, within these two weeks the plants had been watered and monitored on a daily basis.



Fig 1.1 Vertical Gardening team planting and check up on plants

However, these leafminers happen to appear after a short period of time once shifted to the fenced region.

Leafminers are a group of insects that have adapted to live and feed exclusively in the leaves of plants, producing tunneling injuries followed by black trails, which are the waste products from the larvae. This group includes larvae of moths (Lepidoptera), beetles (Coleoptera), sawflies(Hymenoptera), and flies(Diptera). The Areas mined by these insects die and dry out.

Most leaf-miner burrows or tunnels are referred to as serpentine mines, consisting of thin, winding, whitish trails, or as blotch mines, which are broad and whitish or brownish in color. Although leaf miners do not usually cause significant injury, they do mar the appearance of ornamental trees and shrubs.

The Species that has infested our plants, belong to the flies and is called The vegetable leafminer, *Liriomyza sativae*. These tiny insects lay an egg on the underside of a leaf that measures approximately 0.25 by 0.12 mm, being translucent and white in color, giving birth to translucent larvae which at later stages becomes yellowish-orange in color. The pupae are oval and at first Yellowish-orange in color turning to a darker golden brown when the adults are nearly ready to emerge. The adults are up to 1.7 mm long, yellow and black in color with females being larger than males;

After three moultings, the larva cuts an incision, usually in the upper leaf surface, and falls to the ground where it pupates. The cycle is complete depending exclusively on temperature.

Gardeners only need to remove the damaged leaves by hand. Since leaf miners are tucked inside the leaf, insecticides aren't very effective and can hurt beneficial pest predators like wasps, spiders and ladybugs.

Due to the warm and arid weather of the UAE, these insects have very well adapted themselves to living here, they were of course brought here in plants, it is originally known to be found in America and now spread in many parts of Africa, Asia, and the Pacific region.

They cannot survive cold weather, same as their food plants like Cucurbitaceae can't.

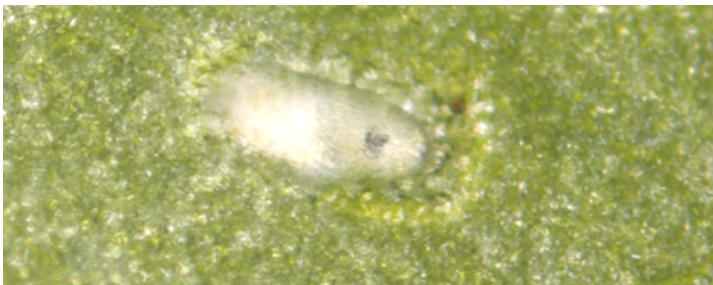


Fig 1.2 Leaf miner egg under the leaf epidermis about to emerge



Fig 1.3 Vegetable leaf miner feeding on the nutrients in the leaf



Fig 1.4 Leaf miner pupa (right) freshly pupates, Pupa (left) containing adult insect



Fig 1.6 Plants brought to fenced area

2 Experimental methods

2.1 Temperature

To check how these insects grow and thrive at different temperatures, 2 samples of leaf each containing some 4 larvae were placed in 2 different temperatures, one at room temperature (26-27 °C) and one placed outside (15-23 °C).

After three molts, the larva had cut a slit, which is usually on the upper leaf surface, and had fallen at the bottom of the container as a pupa. The container with room temperature had all 4 larvae pupated in a matter of 3 days, the pupal stage had lasted for about eight days and then had turned to adults, whereas the container outside, had a slower rate, here all 4 larvae had pupated in some 5-6 days and later 10-12 days to turn into adults, the whole cycle takes twenty-five days.



Fig 1.5 Female vegetable leaf miner (*Liriomyza sativae*)

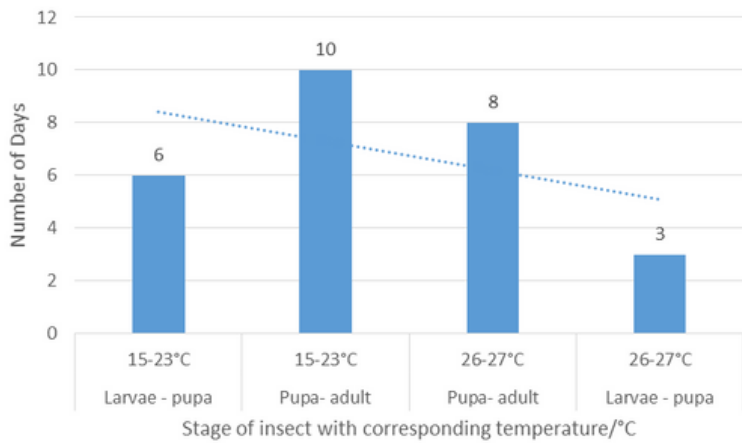


Fig 2.1 Graph showing the effects of temperature on development of leaf miner

2.2 Cutting the nutrient supply of plant

Here once again the leaves were taken but in this case, 1 leaf was cut off from the parent plant and one leaf remained attached to the parent plant. The leaf cut-off soon started to wither and dry up, and so the larvae inside had to also pupate faster, within just 1- 5 days, while the one attached to the plant had taken up to 8 days to complete its larvae stage and to pupate.

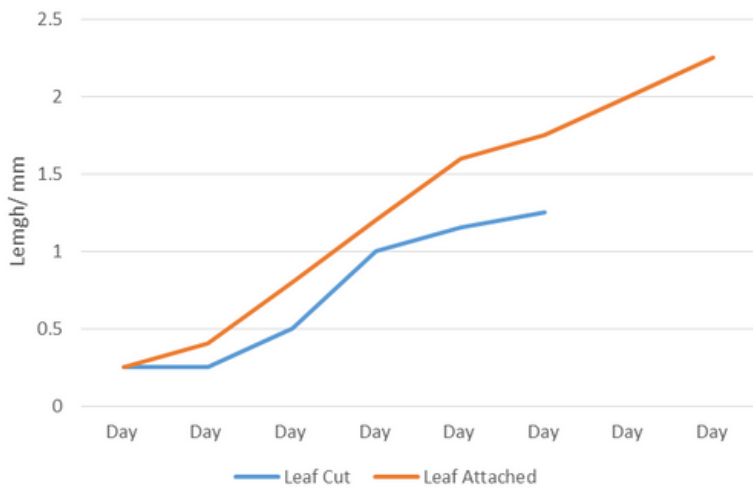


Fig 2.2 Graph showing the effects of nutrients on development of leaf miner

3 Results and discussion

3.1 Temperature on development

Here we witnessed, that the vegetable leaf miners require moderately warm temperatures to flourish and develop faster and that the colder the temperature the slower the rate of development, and the longer it takes to reach from larvae to pupa to adult.

3.2 Effects of leaf condition on larvae

In this case, the leaf that was attached took longer to pupate and there were much more lucky chances that the pupa will reach adulthood, however, the one cut off from the parent plant, had slowly withered and dried up resulting in the larvae to pupate faster, however not all reached adulthood.



Fig 4.1 plants after 1 week of progress

4 Conclusions

The objective of this paper was to test the conditions in which a leaf miner such as *Liriomyza sativae* can survive and also to find out the different environmental conditions plants from the Cucurbitaceae can survive and thrive.

We observed the development of the vegetable leaf miner, while at the same time, witnessing how conditions like temperature and nutrients affect their growth. Here we also reached a conclusion that if kept under control, leaf miners cannot destroy their host plant, and yet in rare cases, they spread at a high rate, and as they live under the epidermis of the leaf the only way to get rid of them is to use neem oil or simply cut off the infected leaves.



Fig 4.2 Dead larvae, killed by natural pesticide neem oil

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