HOST PREFERENCE AND INFESTATION INTENSITY OF VEGETABLE LEAF MINER, *Liriomyza* spp.

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CHAPTER I

INTRODUCTION

The leaf miner (*Liriomyza* sp) belongs to the Agromyzidae family is a well-known group of small, morphologically similar whose larvae feed internally on plants, often as leaf and stem miners. Nearly all species are very host-specific but a few highly polyphagous species have become important pests of agriculture and horticulture in many parts of the world. These key species: *Liriomyza chinensis, L. huidobrensis, L. sativae, L. trifolii* and *L. strigata* are present in the worldwide countries except some countries (Minkenberg 1988; Spencer 1989). Leaf miner (*Liriomyza* sp.*)* belonging to the genus *Liriomyza* is considered pest in many crops due to its damage to the leaves (Robert 1999). Now-a-days it is a serious vegetables pest in Bangladesh. Leaf miner attack both leaves and fruits. After winter when temperature increased incidence of leaf miner increased. *Liriomyza* includes 300 species distributed worldwide, with 23 of them being considered economically important (Kang *et al* 2009, Parrella 1987). The leaf miner fly *Liriomyza huidobrensis* Blanchard, originally from the neotropics, was reported in Mexico, and Central and South America, but has rapidly disseminated to other countries in Europe, Africa and Asia (Larrain 2003, Mujica and Cisneros 2001). During the last 20 years, the leaf miner fly has been considered a key pest in Peru, Bolivia, Brasil, Chile and Argentina. It is a polyphagous insect, affecting many host plants including horticultural crops and all associated weeds (Mujica and Cisneros 2001). Since the early 1990s, there has been a rapid movement of *L. huidobrensis* and *L sativae* eastward through tropical and sub-tropical areas of Asia, resulting in much crop loss and excessive use of broad-spectrum insecticides (Rauf *et al*. 2000). *Liriomyza huidobrensis* is the dominant agromyzid at higher elevations (>1000 m) in tropical Asia and has caused much damage to potato in particular (Rauf *et al*. 2000; Shepard *et al.* 1998; Sivapragasam & Syed 1999; Spencer 1989) while *L. sativae* is the dominant pest in lowland areas (Andersen *et al.* 2002; Rauf *et al*. 2000; Spencer 1989). In Southeast Asia, several invasive,

polyphagous *Liriomyza* species are becoming major pests in vegetable growing areas (Sivapragasam and Syed 1999, Shepard *et al.* 1998).The developmental threshold for eggs, larvae and pupae are estimated at 9 to 12°C. The development time required by the egg, larval and pupal stages is about seven to nine days at warm temperatures (25 to 30°C). Both egg-larval and pupal development times lengthen to about 25 days at 15°C temperature and 60 % to 75 % humidity. At optimal temperatures (30°C), the vegetable leaf miner completes development from the egg to adult stage in about 15 days. Vegetable leaf miner attacks a large number of plants, but seems to favor those in the plant families (Cucurbitaceae, Leguminosae, and Solanaceae) (Rauf *et al.*, 2000).

Preferable host crop of leaf miner are bean, citrus, pea, lettuce, garden dahlia, Amaranth, carrot, cabbage, turnip, radish, spinach, cucurbit, tomato, potato and cruciferous crops. Different species of leaf miners might gradually become a serious pest of cultivated crops, due to high fecundity, short generation time, a wide range of host plants and their dispersal ability (Parrella, 1987). Punctures caused by females of different species of leaf miners during the feeding and oviposition processes can result in a stippled appearance on foliage, especially at the leaf tip and along the leaf margins (Parrella, 1987). However, the major form of damage is the mining of leaves by larvae, which results in destruction of leaf mesophyll. The mine becomes noticeable about three to four days after oviposition and becomes larger in size as the larva matures. In Bangladesh sufficient information on the host and infestation intensity of leaf miner is not available so far and no in-depth studies have been made. Considering the above perspective the study has been undertaken with fulfilling the following objectives.

i. To explore the probable host of vegetable leaf miner, *Liriomyza* sp. in natural condition

ii. To determine the infestation intensity of vegetable leaf miner in different host plant

CHAPTER II

REVIEW OF LITERATURE

The incidence of the pest occurs almost relevant information pertaining to origin, distribution and seasonal abundance, host range, host preference, nature of damage of these pest and yield loss due to their attack are given below:

2.1 Taxonomy of vegetable leaf miner

Harris and Tate (1933) stated the taxonomic classification of vegetable leaf miner.

Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Subphylum: Uniramia
Class: Insecta
Order: Diptera
Family: Agromyzidae
Genus: *Liriomyza*
Species: *Liriomyza sp.*

2.2 Species of vegetable leaf miner

Hedrick (1972) reported the several species, which were as

Liriomyza chinensis (Kato, 1949)

Liriomyza huidobrensis (Blanchard, 1926)

Liriomyza sativae (Blanchard, 1938)

Liriomyza strigata (Meigen 1830)

Liriomyza trifolii (Burgess, 1880)

2.3 Origin and distribution

It is difficult to give accurate distributional notes on *L. sativae* at present, as there is every evidence that the fly is rapidly expanding its presence and colonizing most habitats to which it is introduced. Xie *et al.* (1997) gave an example about its present status in China, where it is widespread (Institute of Zoology, Beijing, China; report in preparation). Originally recognized as present in Sanya, Hainan Provinces in 1993 and it has quickly spread north and

west to most Provinces since that time, causing serious damage in some areas. This is probably the true situation in most countries where it has been introduced. It will take some years before a more settled picture can be given, where a combination of natural climatic restrictions and man's effort at eradication will stabilize the flies' progress. *L. sativae* has been identified as an A1 risk in the Netherlands (OEPP/EPPO, 1984) and the UK (EPPO, 1984).

Martinez and Etienne (2002) reported that *L. trifolii* has not yet been reported from many countries where it is actually present. It is generally recognized that all the countries bordering the Mediterranean have *L. trifolii* in varying degrees and that it occurs in all mainland states of the USA. *L. trifolii* has been recorded from the Juan Fernandez Islands .EFSA (2012) stated that *L. trifolii* is apparently unable to overwinter in the open in the north EuroPean EPPO countries. However, the current regulations to prevent entry and spread in non-Mediterranean areas were found to be only partially effective, as interceptions are still being reported.

2.4 Host range

Mirjalili *et al. (2012)* reported that the leaf miner (*Liriomyza* sp.) is the first threat to the wellbeing of a lovage plant. These pests are tiny black flies, 0.1 in long, with yellow stripes. Their larvae develop from eggs laid on the underside of the leaves. In the spring, the larvae tunnel inside the leaves and stems, damaging tissues and spreading rot diseases.

Radcliffe (1982) said that leaf miner (Agromyzidae) is important insect pests worldwide. Of greatest economic importance are the highly polyphagous pea leaf miner vegetable leaf miner, *Liriomyza trifolii* (Burgess) a serpentine leaf miner, *Liriomyza sativae* (Blanchard). These species tend to have overlapping host ranges, and several species may occur within the same field. *Liriomyza* species attack a wide variety of vegetable and horticultural crops, including potatoes and many other field and greenhouse crops. Pea leaf miner is the most destructive leaf miner on potato, but American serpentine leaf miner is an important potato pest in Africa, from Senegal to Kenya and Mauritius.

Chung (2012) said that leaf mining hispids, *Coelaenomen oderaelaeidis* Mlk. (Coleoptera: Hispidae), is the most important oil palm pest in West Africa . The larva mine the leaves causing serious damage to the fronds. The mining activity results in longitudinal galleries. In severe attack the greater part of the leaf tissue are destroyed. The adult beetles also are responsible for some amount of leaf destruction. The typical appearance of infested palms in the young fronds are green and the remaining older fronds are grey-brown and desiccated.

Kelageri *et al.(2008*) told that large scale movement of materials such as vegetables, fruits, ornamentals, planting materials, seeds, packaging material etc., between countries invites the danger of the accidental introduction of insect pests .

Duke (1981) carried out an observation, several polyphagous leaf miners are likely to attack vegetable crops, and sometimes Tomato crops that usually tolerate the presence of these pests. These insects are classified in the order Diptera and the family Agromyzidae. The main species of leafminer found in Europe include the tomato leaf miner *(Liriomyza bryoniae* Kaltenbach, often erroneously referred as *'Liriomyza strigata* [Meigen]), the American leaf miner *(Liriomyza trifolii* Burgess), the South American leaf miner *(Liriomyza huidobrensis* Blanchard and *Liriomyza strigata* Meigen), and the horticultural leaf miner *(Chromatomyiahorticola* . Many chlorotic punctures are first observed on the leaf; they may be very numerous and are made by females with their ovipositor. Mines appear later on the leaflets. The most affected leaves, sometimes carrying as many as 20 larvae per leaf may turn yellow, wilt, and dry out. The photosynthetic activity, the plant growth, and the yields can be greatly reduced as a result of an infestation. The population control of these pests is often problematic due to their possible resistance to several insecticides which also eliminate beneficial biocontrol agents (para-sitoid Hymenoptera). During very heavy infestations, particularly in the tropics, fruits may show some burns .because the many mined and deformed leaves no longer protect them from sunlight.

De la Mora *et al. (2008)* reported that shaded coffee agroecosystems traditionally have few pest problems potentially due to higher abundance and diversity of predators of herbivores. However, with coffee intensification (*e.g.* shade tree removal or pruning), some pest problems increase. For example, coffee leaf miner outbreaks have been linked to more intensive management and increased use of agrochemicals. Parasitic wasps control the coffee leaf miner, but few studies have examined the role of predators, such as ants, that are abundant and diverse in coffee plantations. Here, we examine linkages between arboreal ant communities and coffee leaf miner incidence in a coffee plantation in Mexico. We examined relationships between incidence and severity of leaf miner attack and: (1) variation in canopy cover, tree density, tree diversity, and relative abundance of *Inga* spp. shade trees; (2) presence of *Azteca instabilis*, an arboreal canopy dominant ant; and (3) the number of arboreal twig-nesting ant species and nests in coffee plants. Differences in vegetation characteristics in study plots did not correlate with leaf miner damage perhaps because environmental factors act on pest populations at a larger spatial scale. Further, presence of *A. instabilis* did not influence presence or severity of leaf miner damage. The proportion of leaves with leaf miner damage was significantly lower where abundance of twig-nesting ants was higher but not where twig-nesting ant richness was higher. These results indicate that abundance of twig-nesting ants in shaded coffee plantations may contribute to maintenance of low leaf miner populations and that ants provide important ecosystem services in coffee agro-ecosystems.

Stegmaier (1966) reported vegetable leaf miner attacks a large number of plants, but seems to favor those in the plant families Cucurbitaceae, Leguminosae, and Solanaceae family nearly 40 hosts from 10 plant families in Florida.

Schuster *et al*. (1991) said that among the numerous weeds infested, the nightshade, *Solanum americanum*; and Spanish needles, *Bidens alba*; are especially suitable hosts in Florida Vegetable crops known as hosts in Florida include bean, eggplant, pepper, Potato, squash, Tomato, and watermelon.

Oatman (1959) reported in California, a similar host range, but also noted suitability of Cucumber, beet, pea, lettuce and many other composites. Celery is also reported to be attacked, but to a lesser extent by this leaf miner species than by American leaf miner, *Liriomyza trifolii* (Burgess).

Kawate and Coughlin (1995) founded in Hawaii, damage to onion foliage is a problem for the marketing of scallions (green onions) by the leaf miner.

Spencer (1981) observed that vegetable leaf miner was formerly considered to be the most important agromyzid pest in North America but this distinction is now held by *Liriomyza trifolii.*

Spencer (1990) said that *Liriomyza trifolii and Liriomyza huidobrensis* are highly polyphagous and has been recorded from 25 families and 14 families respectively and *Liriomyza sativae* is a polyphagous pest of many vegetable and flower crops

Spencer (1989) said that the most important crops attacked are beans, celery, chrysanthemum, cucumber, gerbera, gypsophila, lettuce, onion, potato and tomato as well as peanuts, soybeans, lentils, lupins, faba beans and chickpeas by *Liriomyza trifolii* .

Spencer (1989) odserved that the most important crops attacked are beet, spinach, peas, beans, potatoes and cut flowers (most commonly gypsophila, more rarely carnations and chrysanthemum) as well as lupins, field peas and faba beans by *Liriomyza huidobrensis* .

(Spencer 1989) said that it has been recorded from nine plant families, although its preferred hosts tend to be in the Cucurbitaceae, Fabaceae and Solanaceae families as well as peanuts by *Liriomyza sativae*.

2.5 Seasonal abundance

Singh and Azam (1986) recorded that leaf miner population attained three Peaks in a year in Indian sub-continent. At Udheywalla mean percentage infestation of three consecutive years inferred that there were three Peaks that synchronized with the new vegetative phase. There was a sharp increase in CLM incidence per shoot at the end of March resulting in the first annual Peak during the fortnight of April with an infestation of 31.5 per cent. Thereafter, an

abrupt decline was observed until May when a mild infestation of 4.3 per cent was observed. Infestation increased again in July resulting in weak Peak during the first fortnight of again from September to November in the former western Punjab. Maximum infestation was recorded during the end of February on acid lime in Andhra Pradesh.

Batra and Sandhu (1981) recorded severe attack of the pest during rainy season which was not observed in the present study, possibly due to the mortality of larvae from heavy rainfall and the non-availability of new during that period. A third peak after mid September coincided with the availability of new decrease in temperature and increase in relative humidity. However, the severity of the infestation was more pronounced on spring (April) rather than on autumn (September). Relative humidity that was highest during rainy and winter seasons had a negative impact on population build up of *P. citrella*.

Liriomyza sativae is found in Asia (China, India, Indonesia, Iran, Israel, Japan, Jordan, Malaysia, Oman, Philippines, Saudi Arabia, Sri Lanka, Thailand, Timor Leste, Turkey, Uzbekistan, Vietnam, and Yemen.

2.6 Life cycle of leaf miner

Johnson (1980a) reported that the developmental thresholds for eggs, larvae, and pupae are estimated at 9 to 12°C. The combined development time required by the egg and larval stages is about seven to nine days at warm temperatures (25 to 30°C). Another seven to nine days is required for pupal development at these temperatures. Both egg-larval and pupal development times lengthen to about 25 days at 15°C. At optimal temperatures (30°C), the vegetable leaf miner completes development from the egg to adult stage in about 15 days.

2.6.1 Egg: Johnson (1980a) said that the white, elliptical eggs measure about 0.23 mm in length and 0.13 mm in width. Eggs are inserted into plant tissue just beneath the leaf surface and hatch in about three days. Flies feed on the plant secretions caused by oviposition, and also on natural exudates. Females often make feeding punctures, particularly along the margins or tips of leaves, without depositing eggs. Females can produce 600 to 700 eggs over their life

span, although some estimates of egg production suggest that 200 to 300 is more typical. Initially, females may deposit eggs at a rate of 30 to 40 per day, but egg deposition decreases as flies grow older.

2.6.2 Larva: Parrella (1987) stated that there are three active instars, and larvae attain a length of about 2.25 mm. Initially the larvae are nearly colorless, becoming greenish and then yellowish as they mature. Black mouthparts are apparent in all instars, and can be used to differentiate the larvae. The average length and range of the mouthparts (cephalopharyngeal skeleton) in the three larval feeding instars is 0.09 (0.6-0.11), 0.15 (0.12-0.17), and 0.23 (0.19-0.25) mm, respectively. The mature larva cuts a semicircular slit in the mined leaf just prior to formation of the puparium. Almost invariably, the slit is cut in the upper surface of the leaf. The larva usually emerges from the mine, drops from the leaf, and burrows into the soil to a depth of only a few cm to form a puparium. A fourth larval instar occurs between puparium formation and pupation, but this is generally ignored by authors .

2.6.3 Pupa: Parrella (1987) observed that the reddish brown puparium measures about 1.5 mm in length and 0.75 mm in width. After about nine days the adult emerges from the puparium, principally in the early morning hours, and both sexes emerge simultaneously. Mating initially occurs the day following adult emergence, but multiple matings by both sexes have been observed, and up to a month post- emergence.

Chen & Kang (2005 a, b) studied of overwintering of *L. sativae* pupae in China found no indication of pupal diapause and suggested the -2°C isotherm of the minimum mean temperature of January was the overwintering range limit for *L. sativae* .

2.6.4 Adult: Johnson (1980b) said the adults are principally yellow and black in color. The shiny black mesonotum of *Liriomyza sativae* is used to distinguish this fly from the closely related American serpentine leafminer, *Liriomyza trifolii* which has a grayish black mesonotum. Also, the black hind margin of the eyes serves to distinguish this insect from *Liriomyza trifolii*, which has eyes with yellow hind margins. Females are larger and more

robust than males, and have an elongated abdomen. The wing length of this species is 1.25 to 1.7 mm, with the males averaging about 1.3 mm and the females about 1.5 mm. The small size of these flies serves to distinguish them from Pea leaf miner, *Liriomyza huidobrensis* (Blanchard), which has a wing length of 1.7 to 2.25 mm. The yellow femora of vegetable leaf miner also help to distinguish these species, as the femora of Pea leaf miner are dark. Flies normally live only about a month. Flies are uncommon during the cool months of the year, but often attain high, damaging levels by mid-summer. In warm climates they may breed continuously, with many overlapping generations per year.

The biology of *Liriomyza sativae* is not well documented because until fairly recently it was confused with other similar flies, but important elements have been studied by Parkman *et al*. (1989), Petitt and Wietlisbach (1994), and Palumbo (1995). The work by Oatman and Michelbacher (1958) probably refers to *Liriomyza sativae*. Keys for the identification of agromyzid leafminers can be found in Spencer and Steyskal (1986).

2.7 Nature of damage

Adult female of a leaf miner laid eggs externally on the leaves or just beneath the epidermis of the leaves. After the hatching of eggs the larvae enter in to the leaves and produce mines between the layers of epidermis and feed on the internal tissues of the leaves for some days or for their total larval life. The mines which are produced by the larvae may have a variety of shapes, these mines may be narrow, linear, spiral or blotch type which are always visible from the outside of the leaves. Vegetables are very important for human life as they provide nutrition to human body. Leaf miners have become serious insect pests of different vegetables and many others alternative host plants in Vietnam. In the recent years leaf miners have become a major threat to vegetables in Turkey. *Liriomyza* species of leaf miner can damage to the plants in both ways either directly or indirectly. In case of direct damage the larvae feed on the parenchyma tissues of the leaves by producing various Shape of

mines and cause nearly 62% reduction in the photosynthetic activities of the plants. While in case of indirect damage both adult males as well as adult females feed on the plants without making mines to the plants. An adult female may act as a vector of various diseases during its oviposition. It has been reported that the *Liriomyza trifolii* (Burgess) feed on nearly 79 various species of plants in India. *Liriomyza huidobrensis* (Diptera: Agromyzidae) is a polyphagous leaf miner and 91% depends on vegetables ornamentals and cultivated host plants for their survival (Anon. 2008)

Foliage punctures caused by females during the acts of oviposition or feeding may cause a stippled appearance on foliage, but this damage is slight compared to the leaf mining activity of larvae. The irregular mine increases in width from about 0.25 mm to about 1.5 mm as the larva matures, and is virtually identical in appearance and impact with the mines of *Liriomyza trifolii*. Larvae are often easily visible within the mine where they remove the mesophyll between the surfaces of the leaf. Their fecal deposits are also evident in the mines. The potential impact of the mining activity is evident from the work of Sharma et al. (1980), who studied the value of treating squash with insecticides in California. These authors reported 30 to 60% yield increases when effective insecticides were applied, but as is often the case with leaf miners, many insecticides were not effect.

CHAPTRT III

MATERIALS AND METHODS

The study on host preference and infestation intensity of vegetable leaf miner was conducted at Sher-e-Bangla Agricultural University (SAU) campus from December 2016 to April 2017. The materials and methods followed are described under the following sub-headings:

3.1 Duration of the study

The experiment included field survey of leaf miner practices was conducted during December, 2016 to April, 2017.

3.2 Experimental site

The experiment was conducted at the central farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh, which is situated in $23^0 74^/$N latitude and $90^0 35^/$E longitude (Anon., 1989).

3.3 Weather condition

The climate of experimental site was subtropical, characterized by the winter season from December to April.

3.4 Soil characteristics

The soil of the experimental area belongs to the Modhupur Tract (UNDP, 1988) corresponding AEZ No. 28. The soil of the experimental area is shallow red brown terrace brown.

3.5 Data collection

Data were collected from different plant species at seven (7) intervals available in Sher-e-Bangla Agricultural University experimental field during the study December 2016 to June 2017. List of plant species observed during the survey period are shown in Table 1.

Table 1. List of plants observed at SAU campus to explore hosts of vegetable leaf miner

SL. NO.	NAME OF HOST PLANTS	SCIENTIFIC NAME
01	Cucumber	*Cucumis sativus*
02.	Country bean	*Lablab purpureus*
03.	Bush bean	*Phaseolus vulgaris*
04.	Tomato	*Solanum lycopersicum*
05.	Bottle gourd	*Lagenaria siceraria*
06.	Sweet gourd	*Cucurbita maxima*
07.	Tomatilo	*Physalis philadelphica*
08.	Mustard	*Brassica juncea*
09.	Pea	*Pisum sativum*
10.	Tita begun	*Solanum nigrum*
11.	Potato	*Solanum tuberosum*
12.	Brinjal	*Solanum melongena*
13.	Amaranth	*Amaranthus gangetieum*
14.	Red amaranth	*Amarabthus spinosus*

3.5.1 Plant infestation

Data were collected at seven (7) days interval from each host plant. Leaves of each host plants were observed visually to find out the leaf miner infestation. Plants with leaf miner infested leaves were considered as infested plants and those with no leaf infestation were deemed as healthy plants. Forty (40) plants of each host species were selected randomly and leaf miner infestation was observed visually. From this data percent plant infestation was calculated using the following formula:

$$\% \text{ plant infestation} = \frac{\text{Number of infested host plants}}{40} \times 100$$

3.5.2 Leaf infestation

Leaves with leaf miner infestation symptoms were considered as infested leaves and those without infestation symptoms were counted as healthy leaves. Leaf miner infested symptoms on cucumber (plate 1), country bean (plate 2), bush bean (plate 3), tomato (plate 4), mustard (plate 5), bottle gourd (plate 6), sweet gourd (plate 7), tomatillo (plate 8), pea (plate 9) and tita begun (plate 10) leaves have been shown in 10 plates. Healthy and leaf miner infested leaves from each of the infested plants were counted and recorded separately in each field survey day. From this data percent plant infestation was calculated using the following formula:

$$\% \text{ leaf infestation} = \frac{\text{Number of infested leaves infested plant}^{-1}}{\text{Total number of leaves plant}^{-1}} \times 100$$

3.5.3 Number of leaf miner larvae per infested leaves

One zigzag mine on leaves was considered as one larval infestation. Thus total number of leaf miner mines per infested leaf was considered total number of leaf miner larvae per leaf. Larval mines of 10 randomly selected infested leaves of each host species were counted and recorded in each survey day. From this data the average number of larvae per leaf of each host species was calculated.

Plate 1. Infested leaf of cucumber.

Plate 2. Infested leaf of country bean.

Plate 3. Infested leaf of bush bean.

Plate 4. Infested leaf of tomato.

Plate 5. Infested leaf of mustard.

Plate 6. Infested leaf of bottle gourd.

Plate 7. Infested leaf of sweet gourd.

Plate 8. Infested leaf of tomatillo.

Plate 9. Infested leaf of pea.

Plate 10. Infested leaf of tita begun.

3.6 Data Analysis

The data on various parameters obtained from the experiment were processed and analyzed in Microsoft Office Excel program. Graphs were also prepared in the same program.

CHAPTER IV

RESULTS AND DISCUSSION

The study was aimed to find out the host preference and infestation intensity of vegetable leaf miner *Liriomyza* sp. Data on leaf miner infested host plants, leaf infestation and number of leaf miner larvae per leaf of different host plants have been presented in tables and graphs. The results have been presented and discussed and all possible interpretations were given under following headings:

4.1 Host plants of leaf vegetable leaf miner

List of leaf miner, *Liriomyza* sp. infested host plants at Sher-e-Bangla Agricultural University (SAU) campus is shown in Table 2. Out of 14 available plant species observed, ten (10) plant species were found to infest by vegetable leaf miner during the survey period. Leaf miner infestation was occurred on cucumber, country bean, bush bean, tomato, mustard, bottle gourd, sweet gourd, tomatillo, pea and tita begun. No infestation of leaf miner was observed on potato, brinjal, amaranth and red amaranth.

Table 2. List of plant species infested by vegetable leaf miner at SAU campus

Sl. No.	Common Name	Scientific Name
01.	Cucumber	*Cucumis sativus*
02.	Country bean	*Lablab purpureus*
03.	Bush bean	*Phaseolus vulgaris*
04.	Tomato	*Solanum lycopersicum*
05.	Bottle gourd	*Lagenaria siceraria*
06.	Sweet gourd	*Cucurbita maxima*
07.	Tomatilo	*Physalis philadelphica*
08.	Mustard	*Brassica juncea*
09.	Pea	*Pisum sativum*
10.	Tita begun	*Solanum nigrum*

4.2 Vegetable leaf miner infestation on cucumber

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on cucumber have been presented in Table 3. The data indicate that percent cucumber plant infestation by leaf miner varied from 0.0 to 25.0% from December to April. No plant infestation (0.0%) was observed in December as against the highest percent infestation (25.0%) in February and March. After that percent plant infestation was decreased (20.0%) in April. Leaf infestation in infested plant was also varied from 0.0 to 100.0% during this period. No leaf infestation (0.0%) was found in December and 100.00% leaf infestation was recorded in February and remained constant after that. Number of larvae per infested plant was varied from 10.0 to 17.0 during January to April. The highest number of larva per infested leaf (17.0 larva/leaf) was found in April.

Table 3. Cucumber plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/ infested leaf
December	40	0. 0 ± 0.00	40	0. 0 ± 0.00	0. 0 ±0.00
January	40	19.6 ± 0.80	40	82. 0 ± 19.39	10. 0 ± 4.12
February	40	25. 0 ± 0.00	40	100. 0 ± 0.00	15.5 ± 1.11
March	40	25. 0 ± 0.00	40	100. 0 ± 0.00	16.25 ± 0.43
April	40	20. 0 ± 0.98	40	100. 0 ± 0.00	17. 0 ± 0.00

Data are the average of four observations per month

The plant infestation by vegetable leaf miner from December 2016 to April 2017 has been shown in Figure 1. It was observed that plant infestation by leaf miner was started from January and gradually increased with the age of the crop and reached peak at February.

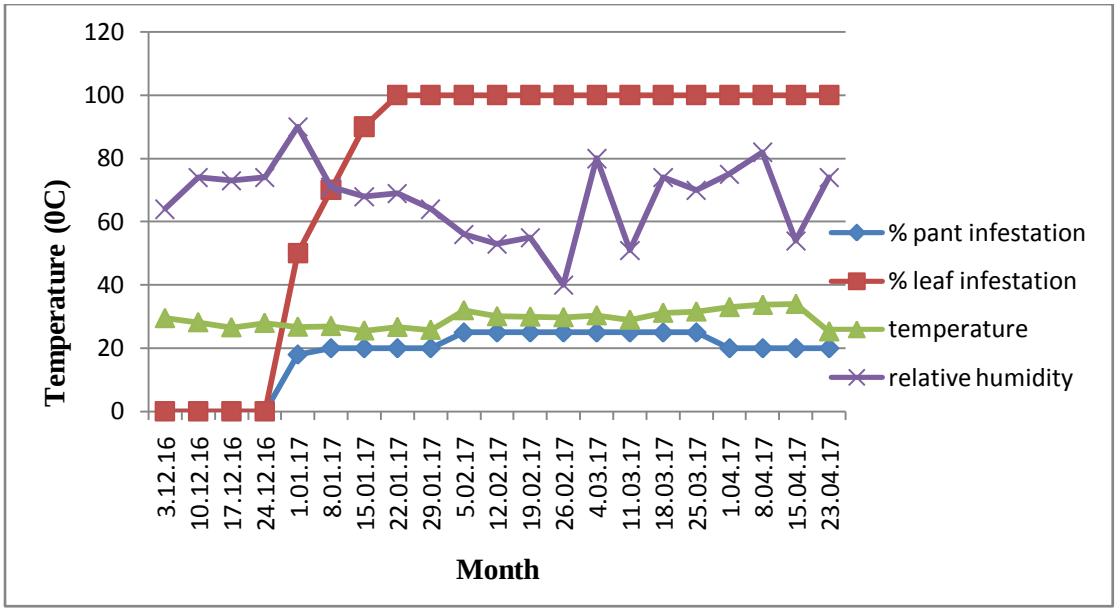

Figure 1. Trends of cucumber plant and leaf infestation by vegetable leaf miner at SAU experimental fields.

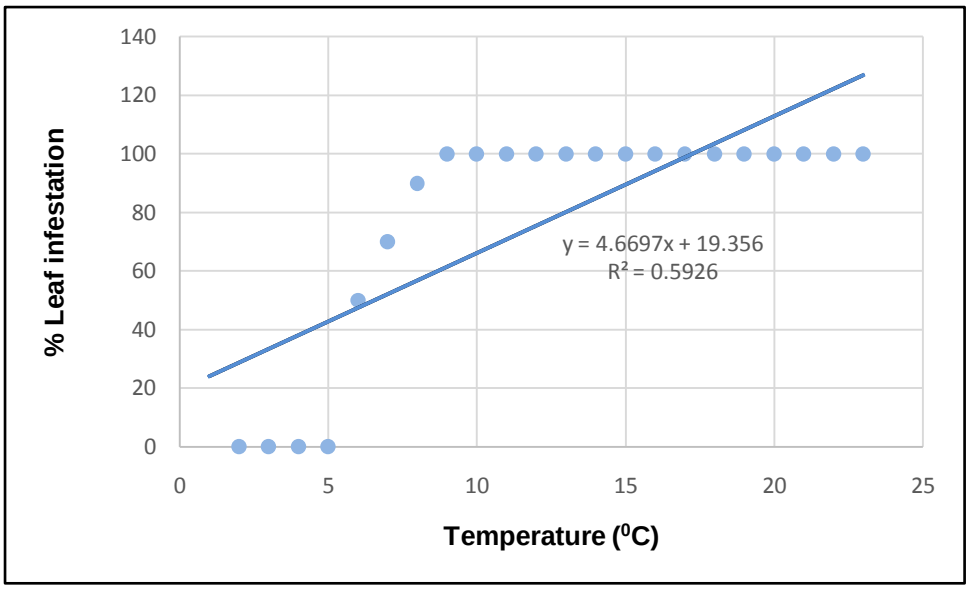

Figure 2. Relationship between percent cucumber leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of cucumber has been shown in figure 2. Positive relationship was observed between the parameters. The regression equation y=4.6697x +19.356 gave a good fit to the data and the co-efficient of determination (R^2 = 0.5926) had a

significant regression co-efficient. From this figure it was observed that percent plant infestation increased with increasing temperature.

4.2 Vegetable leaf miner infestation on country bean

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on country bean have been presented in Table 4. The data indicate that percent country bean plant infestation by leaf miner varied from 0.0 to 25.0% from December to April. No plant infestation (0.0%) was observed in December as against the highest percent infestation (25.0%) in February and March. After that percent plant infestation was decreased (20.0%) in April. Leaf infestation in infested plant was also varied from 0.0 to 100.0% during this period. No leaf infestation (0.0%) was found in December and 100.00% leaf infestation was recorded in march and remained constant after that. Number of larvae per infested plant was varied from 5.20 to 10.66 during January to April. The highest number of larva per infested leaf (10.66 larva/leaf) was found in April.

Table 4. Country bean plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/leaf
December	40	0 .0 ±0.00	40	0. 0 ±0.00	0. 0 ±0.00
January	40	8.8±8.55	40	28. 0 ±17.88	5.20 ± 4.40
February	40	25. 0 ±0.00	40	80. 0 ±21.60	5.25 ±2.21
March	40	25. 0 ±0.00	40	100. 0 ±0.00	4.54±3.10
April	40	20. 0 ±5.30	40	100. 0 ±0.00	10.66 ±0.89

Data are the average of four observations per month

The plant infestation trend by leaf miner from December 2016 to April 2017 has been shown in Figure 3. It was observe that plant infestation by leaf miner was started from January (1.01.16) .and gradually increase with the age of the crop and peak at February (5.02.16).

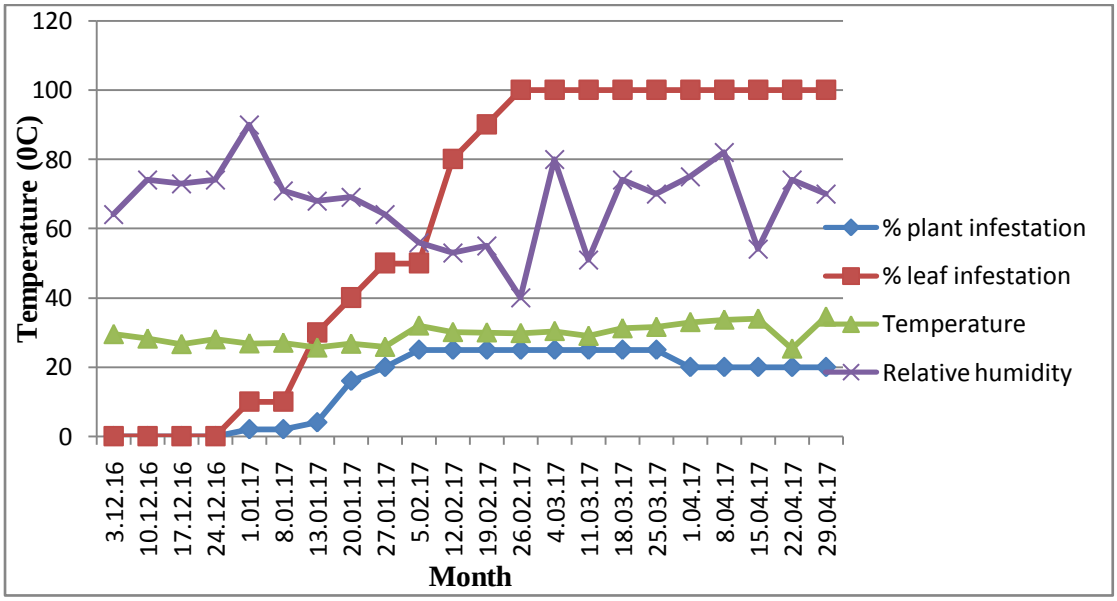

Figure 3 Trends of country bean plant and leaf infestation by vegetable leaf miner at SAU experimental fields.

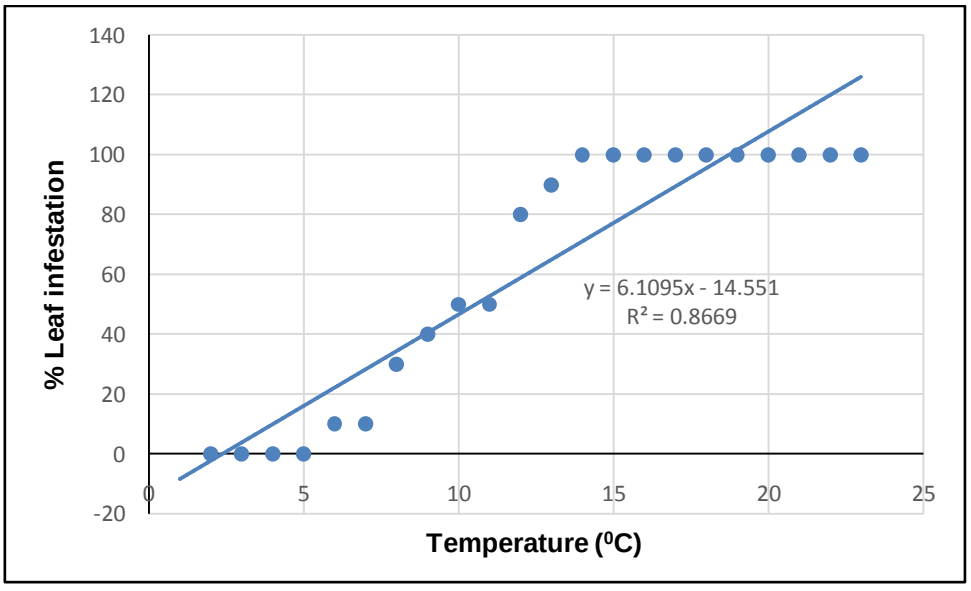

Figure 4. Relationship between percent country bean leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of country bean has been shown in figure 4. Positive relationship was observed between the parameters. The regression equation y=6.1095x 14.55119.356 gave a good

fit to the data and the co-efficient of determination (R2 = 0.8669) had a significant regression co-efficient. . From this figure it was observed that percent plant infestation increased with increasing temperature.

4.3 Vegetable leaf miner infestation on bush bean

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on bush bean have been presented in Table 3. The data indicate that percent bush bean plant infestation by leaf miner varied from 0.0 to 25.0% from December to April. No plant infestation (0.0%) was observed in December as against the highest percent infestation (25.0%) in February to april. Leaf infestation in infested plant was also varied from 0.0 to 100.0% during this period. No leaf infestation (0.0%) was found in December and 100.00% leaf infestation was recorded in February and remained constant after that. Number of larvae per infested plant was varied from 2.73 to 11.12 during January to April. The highest number of larva per infested leaf (11.12 larva/leaf) was found in April.

Table 5 Bush bean plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/leaf
December	40	0. 0 ±0.00	40	0. 0 ±0.00	0. 0 ±0.00
January	40	7.6±5.42	40	34. 0 ±28.71	2.73±0.11
February	40	25.0±0.00	40	100. 0 ±0.00	8.66±0.39
March	40	25. 0 ±0.00	40	100. 0 ±0.00	10.86 ±0.49
April	40	25. 0 ±0.00	40	100. 0 ±0.00	11.12±0.36

Data are the average of four observations per month

The Plant infestation trend by leaf miner from December 2016 to April 2017 has been shown in Figure 5.It was observe that plant infestation by leaf minerwas started from January (8.01.16) and gradually increase with the age of the crop and Peak at February (5.02.16).

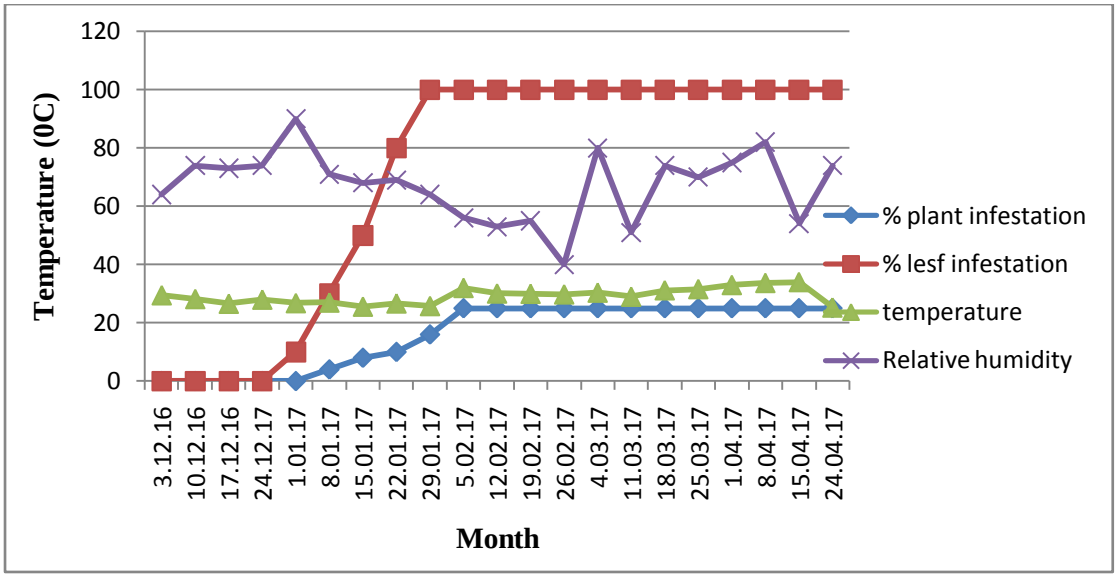

Figure 5. Trends of bush bean plant and leaf infestation by vegetable leaf miner at SAU experimental fields

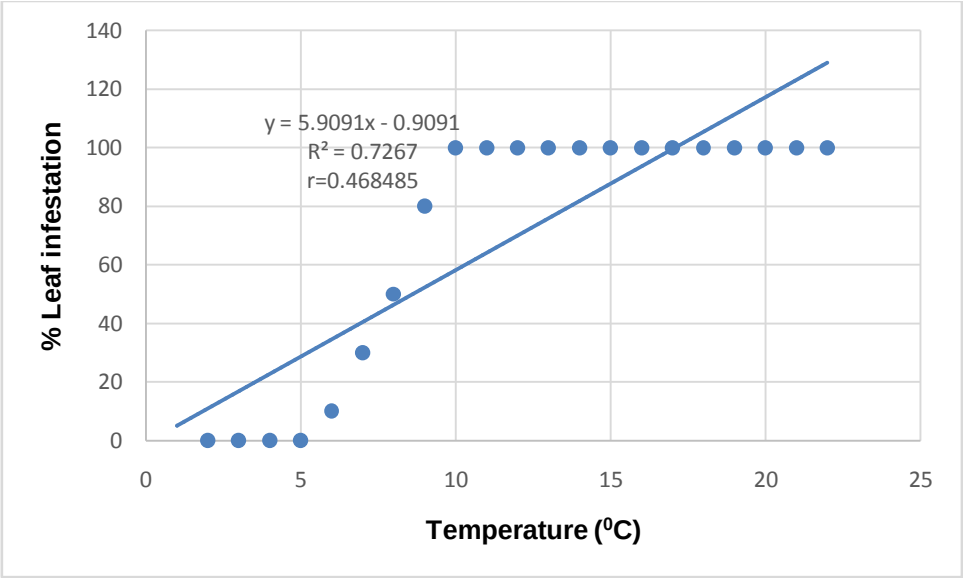

Figure 6. . Relationship between percent bush bean leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of bush bean has been shown in figure 6. Positive relationship was observed between the parameters. The regression equation y=5.5091x -0.9091 gave a good fit to the data and the co-efficient of determination (R2 = 0.0.7267) had a significant

regression co-efficient. From this figure it was observed that percent plant infestation increased with increasing temperature.

4.4 Vegetable leaf miner infestation on tomato

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on tomato have been presented in Table 3. The data indicate that percent tomato plant infestation by leaf miner varied from 0.0 to 25.0% from December to April. No plant infestation (0.0%) was observed in December as against the highest percent infestation (25.0%) in March. After that percent plant infestation was decreased (20.0%) in April. Leaf infestation in infested plant was also varied from 0.0 to 90.0% during this period. No leaf infestation (0.0%) was found in December and 90.00% leaf infestation was recorded in april .Number of larvae per infested plant was varied from 1.4 to 4.1during January to April. The highest number of larva per infested leaf (4.1larva/leaf) was found in April.

Table 6. Tomato plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/leaf
December	40	0. 0 ±0.00	40	0. 0 ±0.00	0. 0 ±0.00
January	40	3.2±3.3.00	40	10±8.90	1.4±1.15
February	40	15.625±8.26	40	47.5±12.30	2.50±1.70
March	40	25. 0 ±0.00	40	72.5±50	3.33±0.64
April	40	20. 0 ±0.56	40	90±0.OO	4.1±0.89

Data are the average of four obtaining per month

The plant infestation trend by leaf miner from Dec ember 2016 to April 2017 has been shown in Figure 7. It was observe that plant infestation by leaf miner was started from January (15.01.16) and gradually increase with the age of the crop and Peak at February (26.02.16).

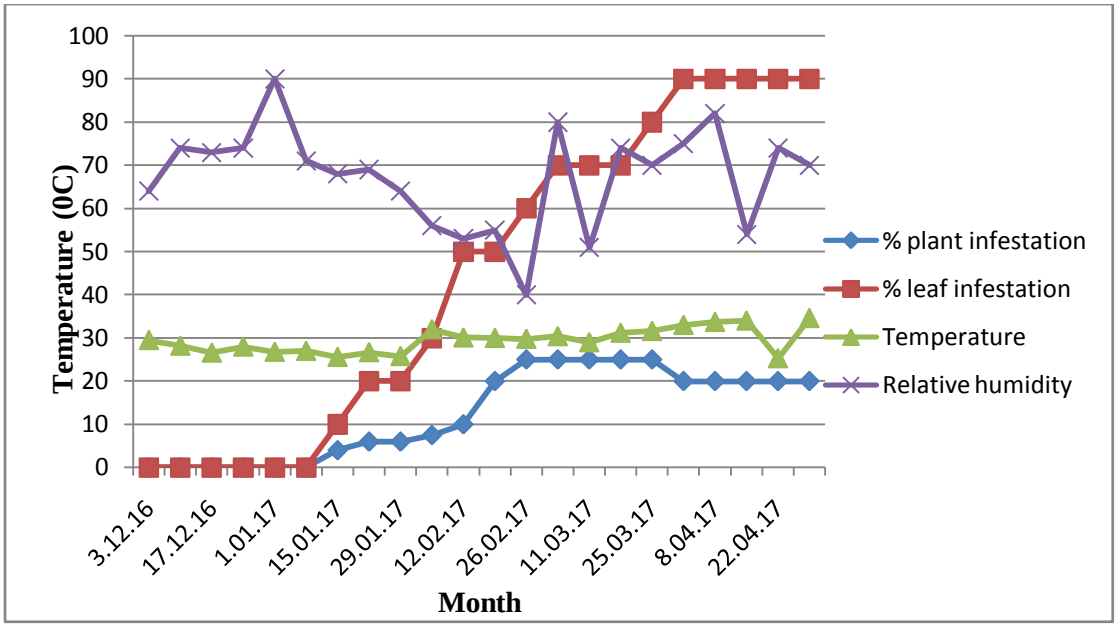

Figure 7. Trends of tomato plant and leaf infestation by vegetable leaf miner at SAU experimental fields

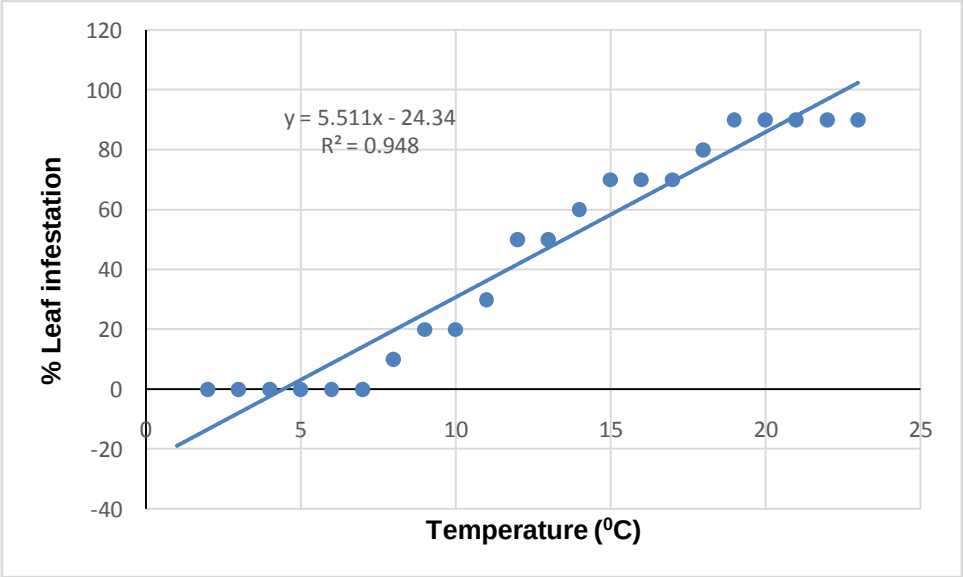

Figure 8. Relationship between percent tomato leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of tomato has been shown in figure 8. Positive relationship was observed between the parameters. The regression equation y=5.511x -19.356 gave a good fit to the data and the co-efficient of determination (R2 = 0.948) had a significant

regression co-efficient. From this figure it was observed that percent plant infestation increased with increasing temperature.

4.5 Vegetable leaf miner infestation on mustard

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on mustard have been presented in Table7. The data indicate that percent mustard plant infestation by leaf miner varied from 0.0 to 40.0% from December to march. No plant infestation (0.0%) was observed in December as against the highest percent infestation (40.0%) in March. Leaf infestation in infested plant was also varied from 0.0 to 100.0% during this period. No leaf infestation (0.0%) was found in December and 30.00% leaf infestation was recorded in march. Number of larvae per infested plant was varied from 0.6 to 4.0 during January to march. The highest number of larva per infested leaf (4.0 larva/leaf) was found in March.

Table 7. Mustard plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/leaf
December	40	0. 0 ±0.00	40	0. 0 ±0	0±0
January	40	2. 0 ±1.78	40	12±9.71	0.6±0.42
February	40	6.875±2.36	40	25±5.7	2.75±0.95
March	40	40. 0 ±4.60	40	30±0.36	4. 0 ±0.31

Data are the average of four obtaining per month

The Plant infestation intensity by leaf miner December 2016 to March 2017 shown on Figure 9. It was observe that plant infestation was started by leaf miner from January (22.01.16) and gradually increase with the age of the crop and Peak at February (15.03.16).

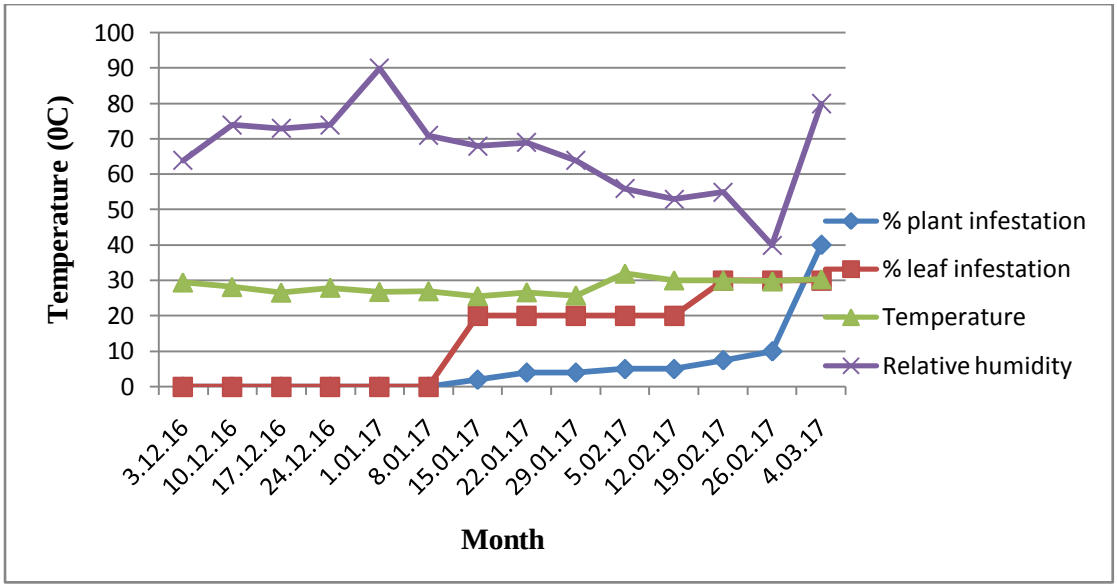

Figure 9. Trends of mustard plant and leaf infestation by vegetable leaf miner at SAU experimental fields

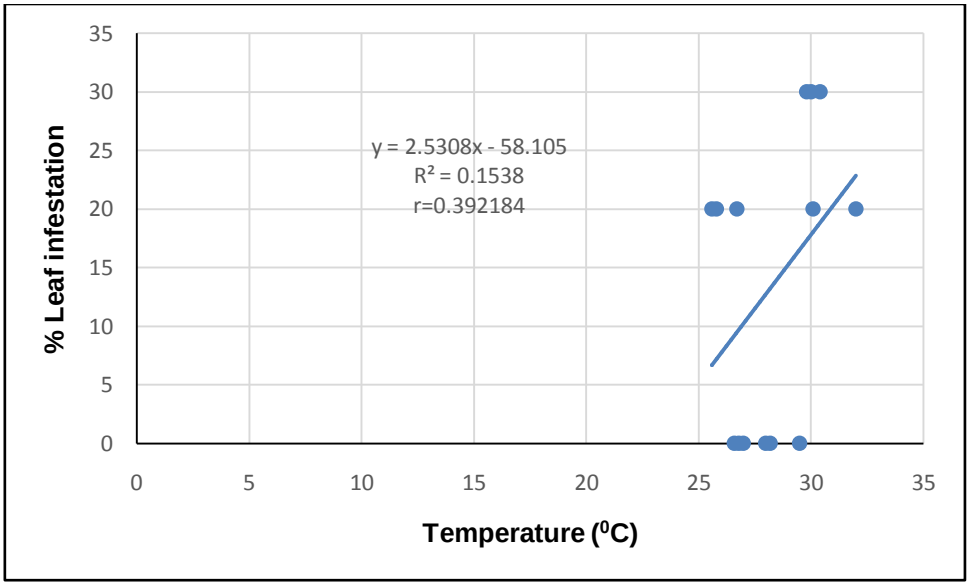

Figure 10. . Relationship between percent mustard leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of country bean has been shown in figure 10. Positive relationship was observed between the parameters. The regression equation y=2.5308x -58.105 gave a good fit to the data and the co-efficient of determination (R2 = 0.1538) had a significant

regression co-efficient. . From this figure it was observed that percent plant infestation increased with increasing temperature.

4.6 Vegetable leaf miner on infestation bottle gourd

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on bottle gourd during have been presented in Table 3. The data indicate that percent bottle gourd plant infestation by leaf miner varied from 0.0 to 25.0% from December to march. No plant infestation (0.0%) was observed in December as against the highest percent infestation (25.0%) in February and March. Leaf infestation in infested plant was also varied from 0.0 to 100.0% during this period. No leaf infestation (0.0%) was found in December and 100.00% leaf infestation was recorded in march. Number of larvae per infested plant was varied from 1.0 to 5.0 during January to mach. The highest number of larva per infested leaf (5.0) was found in march.

Table 8. Bottle gourd plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/leaf
December	40	0. 0 ±0.00	40	0. 0 ±0.00	0. 0 ±0.00
January	40	10. O ± 8.94	40	12. O ±14.69	.1.0±1.26
February	40	25. 0 ±0.00	40	67.5±32.30	3.75±0.43
March	40	25. 0 ±0.00	40	100. 0 ±0.00	5.0±0.50

Data are the average of four obtaining per month

The Plant infestation trend by leaf miner from December 2016 to March 2017 has been shown in Figure 11. It was observe that plant infestation was started by leaf miner from January (22.01.16) and gradually increase with the age of the crop and Peak at February(5.02.16) .

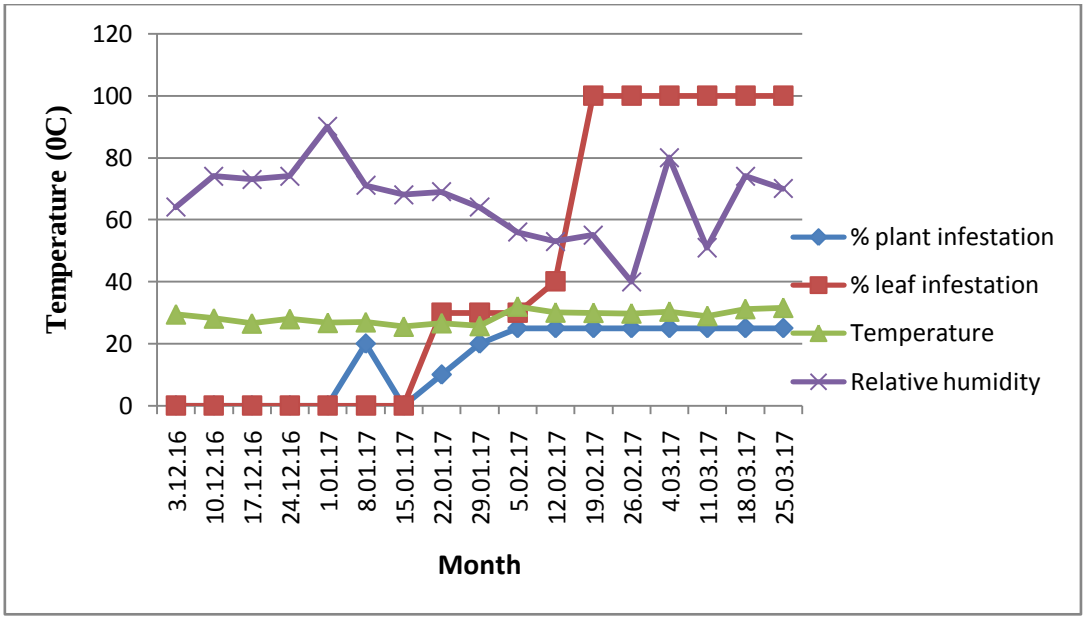

Figure 11. Trends of bottle gourd plant and leaf infestation by vegetable leaf miner at SAU experimental fields

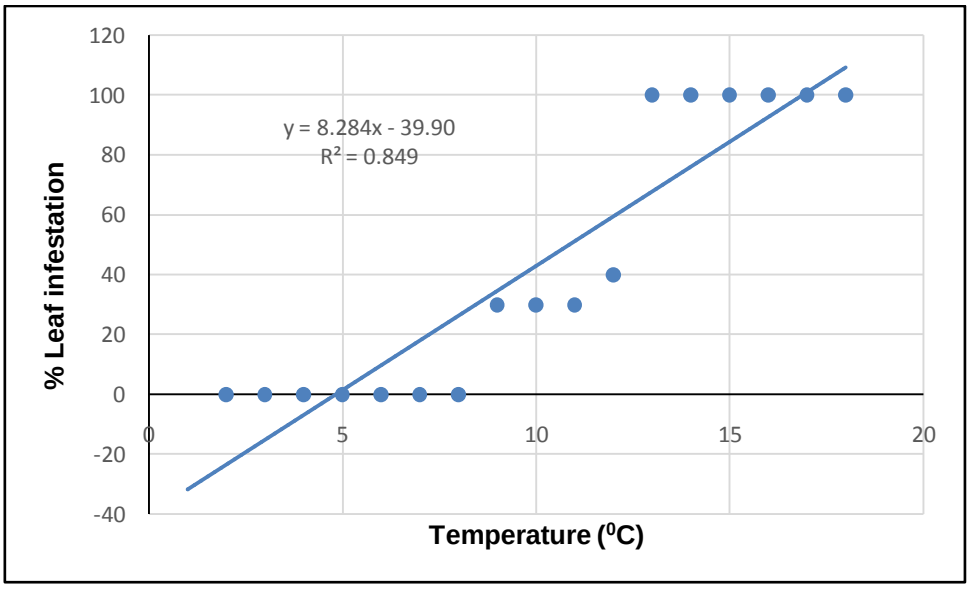

Figure 12. . Relationship between percent bottle gourd leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of bottle gourd has been shown in figure 12. Positive relationship was observed between the parameters. The regression equation y=8.284x -39.90 gave a good fit to the

data and the co-efficient of determination (R2 = 0.849) had a significant regression co-efficient. From this figure it was observed that percent plant infestation increased with increasing temperature.

4.7 Vegetable leaf miner infestation on sweet gourd

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on sweet gourd have been presented in Table 3. The data indicate that percent sweet gourd plant infestation by leaf miner varied from 0.0 to 33.31% from December to March. No plant infestation (0.0%) was observed in December as against the highest percent infestation (33.31%) in March. Leaf infestation in infested plant was also varied from 0.0 to 100.0% during this period. No leaf infestation (0.0%) was found in December and 100.00% leaf infestation was recorded in march . Number of larvae per infested plant was varied from 0.8 to 5.0 during January to march. The highest number of larva per infested leaf (5.0 larva/leaf) was found in march.

Table 9. Sweet gourd plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva/leaf
December	40	0. 00 ±0.0	40	0. 0 ± 0.00	0. 0 ± 0.0
January	40	6. 00 ± 0.80	40	12. 0 ±14.25	0.80 ± 0.97
February	40	25. 0 ±0.90	40	52.5±27.7	4.25±0.82
March	40	33.31±0.14	40	100. 0 ±0.0	5. 0 ±0.0

Data are the average of four observations per month

The Plant infestation trend by leaf miner from December 2016 to March 2017 has been shown in Figure 13. It was observe that plant infestation was started by leaf miner from January (22.01.16) and gradually increase with the age of the crop and Peak February(5.03.16).

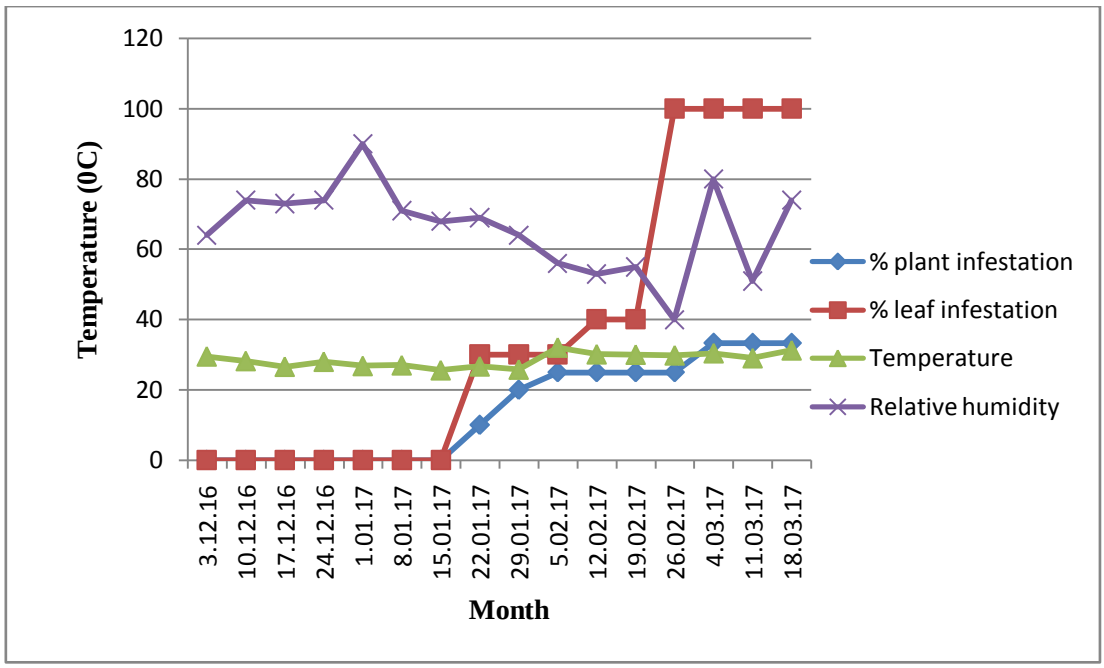

Figure 13 Trends of sweet gourd plant and leaf infestation by vegetable leaf miner at SAU experimental fields

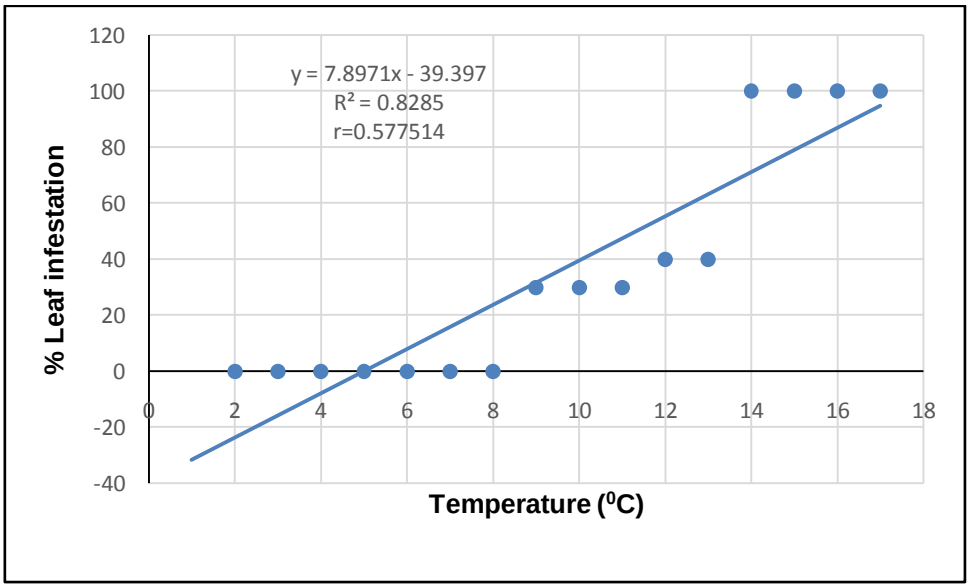

Figure 14. . Relationship between percent sweet gourd leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of sweet gourd has been shown in figure 14. Positive relationship was observed between the parameters. The regression equation y=7.4971x -39.397 gave a good fit to

the data and the co-efficient of determination (R2 = 0.8285) had a significant regression co-efficient. . From this figure it was observed that percent plant infestation increased with increasing temperature.

4.8 Vegetable leaf miner infestation on tomatillo

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on tomatillo have been presented in Table 10. The data indicate that percent tomatillo plant infestation by leaf miner varied from 0.8 to 25.0% from January to April. The highest percent infestation (25.0%) in April. Leaf infestation in infested plant was also varied from 0.0 to 45.0% during this period. No leaf infestation (2.0%) was found in january and 45.0% leaf infestation was in April. Number of larvae per infested plant was varied from .02 to 4.25during January to April. The highest number of larva per infested leaf (4.500) was found in April.

Table 10. Tomatillo plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent Plant Infestation	No. of leaf observed	Percent Leaf infestation	No. of larva/Leaf
January	40	0.8±1.60	40	2. 0 ±4.00	0.2±0.40
February	40	6.25±1.25	40	15. 0 ±5.00	1.25±0.49
March	40	12.5±3.95	40	30. 0 ±7.07	3.25±0.43
April	40	25±0.00	40	45. 0 ±5.00	4.25±0.48

Data are the average of four observations per month

The Plant infestation trend by leaf miner from January 2017 to April 2017 has been shown in Figure 15. It was observe that plant infestation was started f by leaf miner from January (29.01.16) and gradually increase with the age of the crop and Peak at April (02.04.16)

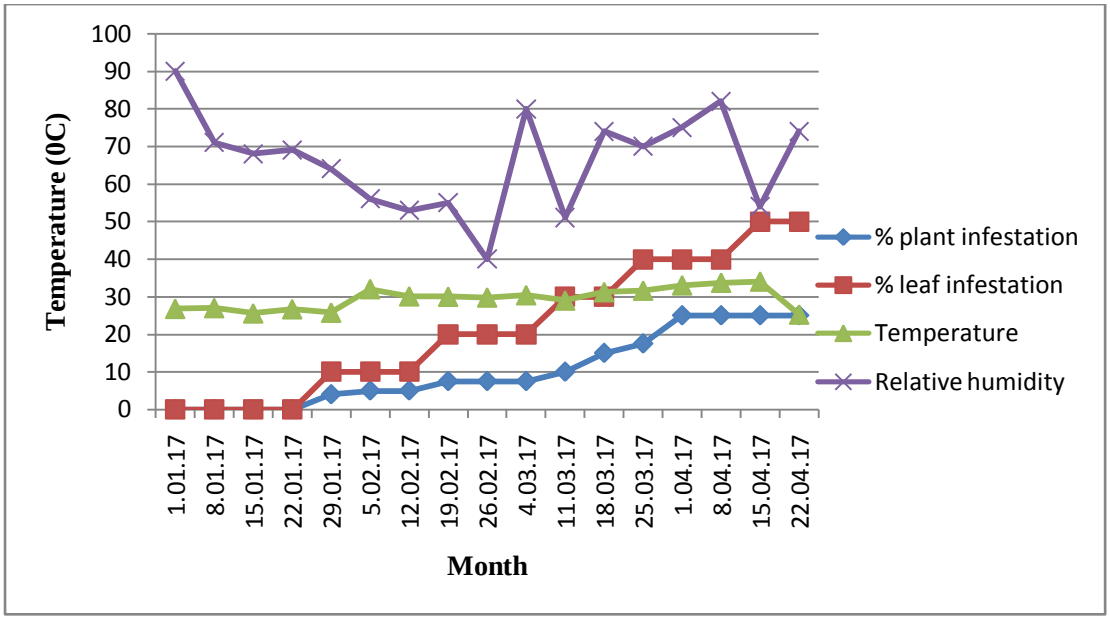

Figure 15. Trends of tomatillo plant and leaf infestation by vegetable leaf miner at SAU experimental fields

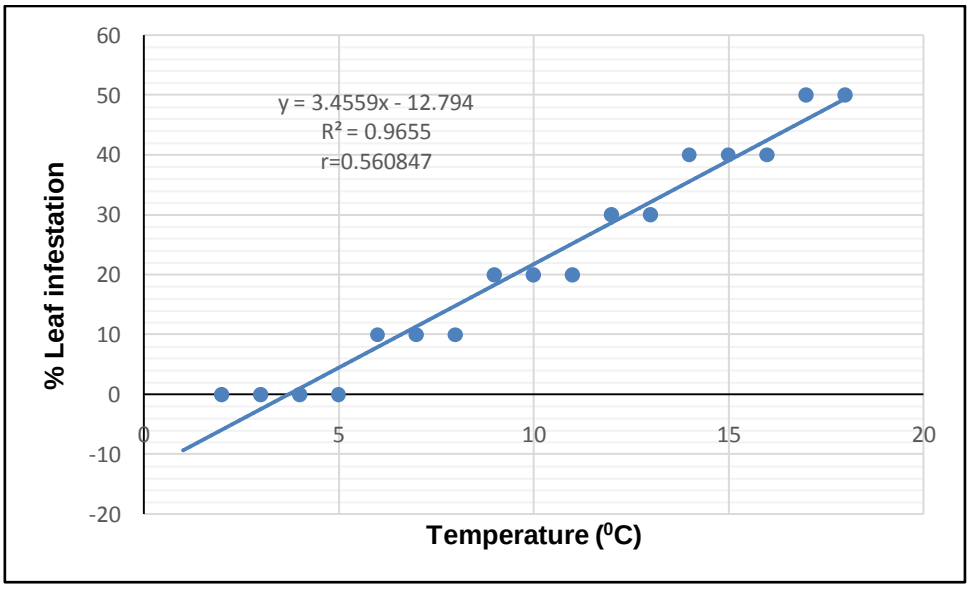

Figure 16. Relationship between percent tomatillo leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of tomatillo has been shown in figure 16. Positive relationship was observed between the parameters. The regression equation y=3.4559x - 12.794 gave a good fit to the data and the co-efficient of determination (R2 = 0.5926) had a significant regression co-

efficient. From this figure it was observed that percent plant infestation increased with increasing temperature.

4.9 Vegetable leaf miner infestation on pea

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on pea have been presented in Table 11. The data indicate that percent pea plant infestation by leaf miner varied from 0.0 to 20.0% from January to April. No plant infestation (0.0%) was observed in January as against the highest percent infestation (20.0%) in April. infestation was Leaf infestation in infested plant was also varied from 0.0 to 40.0% during this period. No leaf infestation (0.0%) was found in January and 40.00% leaf infestation was recorded in April Number of larvae per infested plant was varied from 0.0 to 3.0 during January to April. The highest number of larva per infested leaf (3.0 larva/leaf) was found in April.

Table 11. Pea plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent Plant Infestation	No. of leaf observed	Percent Leaf infestation	No. of larva/Leaf
January	40	0.0 ±0.00	40	0.0 ±0.0	0.0 ±0.00
February	40	3.125±2.74	40	10.0 ±7.07	1.0 ±0.71
March	40	12.5±1.76	40	32.5±8.29	3.0 ±0.00
April	40	20.0 ±0.00	40	40.0 ± 0.00	3.0 ±0.00

Data are the average of four observations per month

The Plant infestation trend by leaf miner from January 2017 to April 2017 has been shown in Figure 17. It was observe that plant infestation was started by leaf miner from February(12.02.16 and gradually increase with the age of the crop and Peak at March (12.04.16).

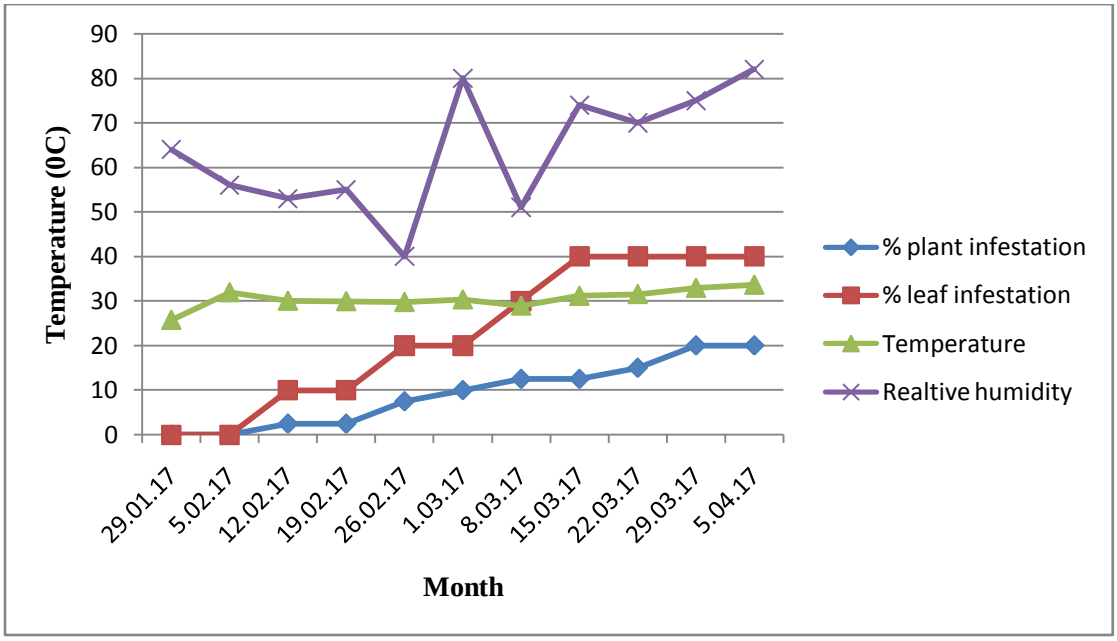

Figure 17. Trends of pea plant and leaf infestation by vegetable leaf miner at SAU experimental fields

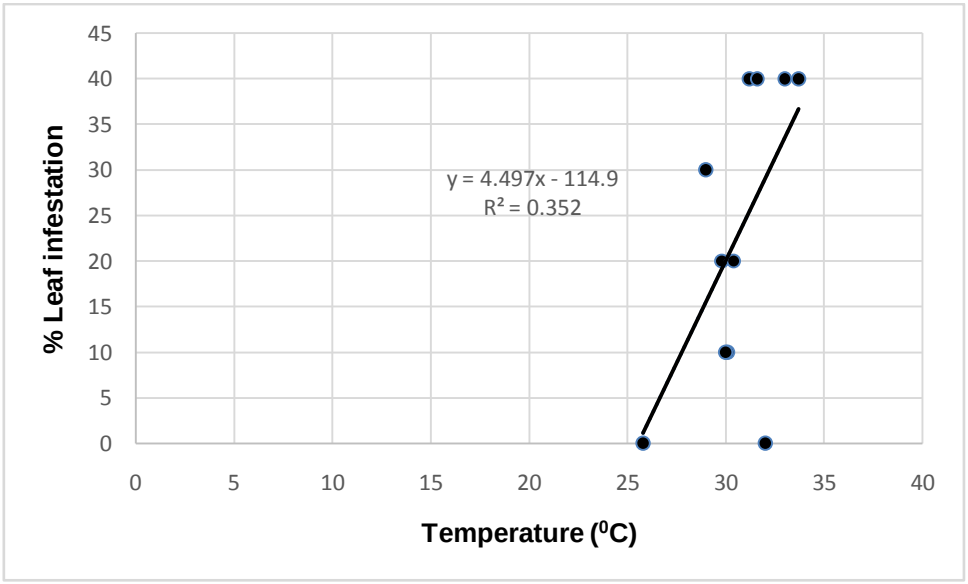

Figure 18. Relationship between percent pea leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of pea has been shown in figure 18. Positive relationship was observed between the parameters. The regression equation y= 4.4976x -114.9 gave a good fit to the

data and the coefficient of determination (R^2 = 0.3522) had a significant regression coefficient. . From this figure it was observed that percent plant infestation increased with increasing temperature.

4.10 Vegetable leaf miner infestation on tita begun

Percent plant and leaf infestation and number of larvae of vegetable leaf miner per infested leaf on tita begun during have been presented in Table 12. The data indicate that percent tith begun plant infestation by leaf miner varied from 7.25% to 25.0% from February to April. No plant infestation (0.0%) was observed in December as against the highest percent infestation (25.0%) in April. Leaf infestation in infested plant was also varied from 20.0 to 70.0% during this period. 70.0% leaf infestation was recorded in Apri land remained constant after that. Number of larvae per infested plant was varied from 1.5to 5.0 during February to April. The highest number of larva per infested leaf (5.0) was found in April.

Table 12. Tita begun plant and leaf infestation by vegetable leaf miner and number of larvae per infested leaf

Month	No. of plant observed	Percent plant infestation	No. of leaf observed	Percent leaf infestation	No. of larva leaf^{-1}
February	40	7.5 ± 2.50	40	20. 0 ±0.0	1.5 ± 0.50
March	40	9.38 ± 2.73	40	45.0±11.80	3.5 ± 0.50
April	40	25. 0 ± 0.0	40	70. 0 ±0.0	5.0 ± 0.50

Data are the average of four observations per month

The plant infestation trend by leaf miner from February 2017 to April 2017 has been shown in Figure 19. It was observed that plant infestation was started by leaf miner from February (19.02.16) and gradually increase with the age of the crop and Peak at April (2.04.16).

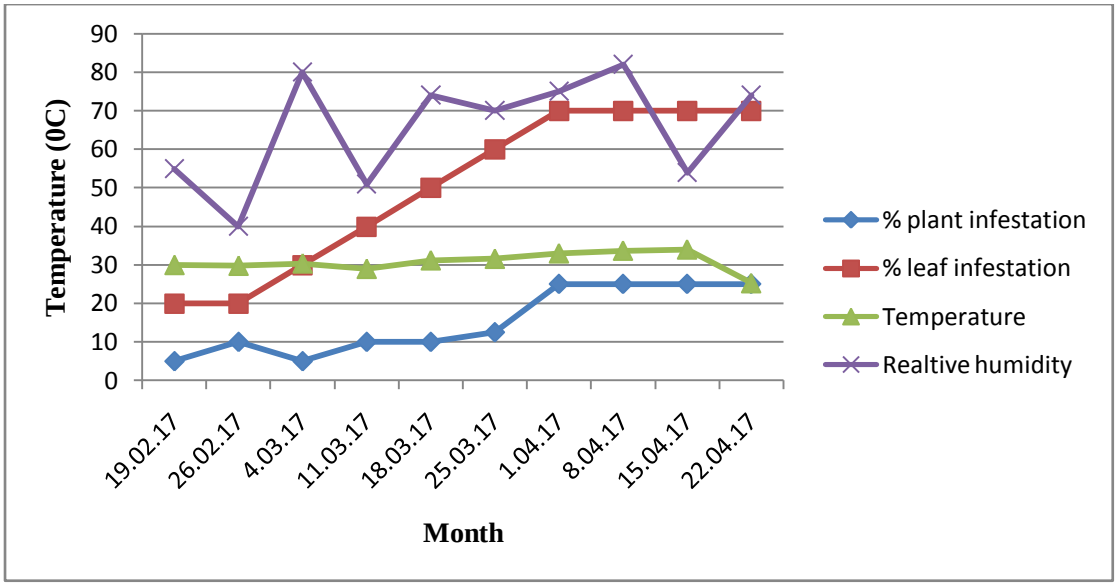

Figure 19. Trends of tita begun plant and leaf infestation by vegetable leaf miner at SAU experimental fields.

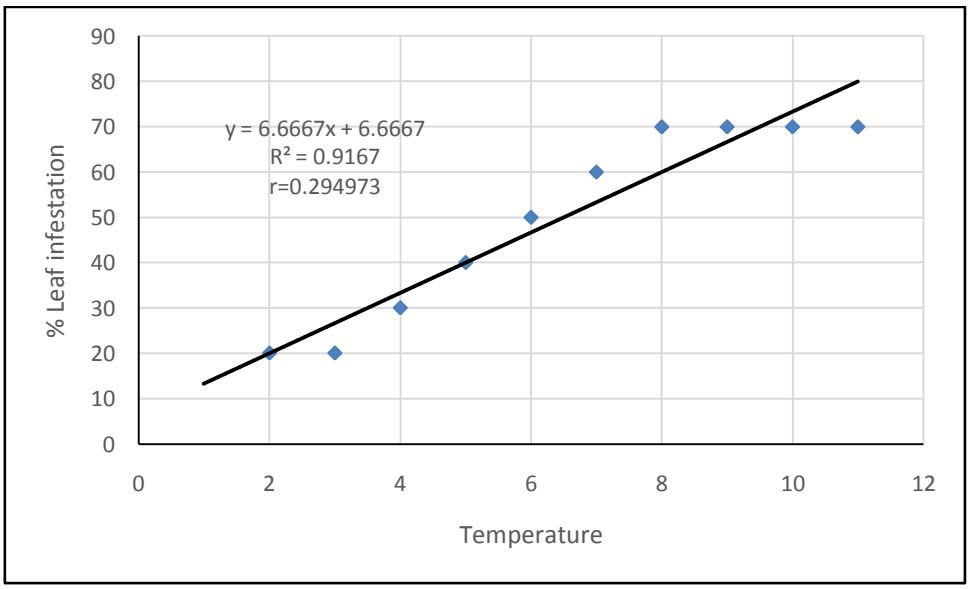

Figure 20. . Relationship between percent tita begun leaf infestation by leaf miner and atmospheric temperature.

The relationship between percent plant infestation and temperature of tita begun has been shown in figure 20. Positive relationship was observed between the parameters. The regression equation y=6.6667x+6.6667 gave a good fit to the data and the co-efficient of determination (R^2 = 0.0.9167) had a significance regression co-efficient. From this figure it was observed that percent plant infestation increased with increasing temper

CHAPTER V

SUMMARY AND CONCLUSION

The study was conducted at the field of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during the period from December 2016 April 2017 to know host preference, infestation intensity of vegetable leaf miner. Leaf miner attacked several vegetables crops like cucumber, country bean, bush bean, tomato, mustard, tomatillo, pea, sweet gourd, bottle gourd and tita begun. But no infestation was observed on brinjal, potato, amaranth, red amaranth.

In cucumber, leaf miner infestation was started from January and reached peak in February and remained constant up to April. The lowest percent leaf miner infested leaf (82%) was observed in January and that was the highest in February (100%). Leaf miner larvae first observed in February (10.0 larva/leaf) and the highest number of larvae was observed in April (17 larva/leaf) on cucumber leaf.

In country bean, leaf miner infestation was started from January and reached peak in March and remained constant up to April. The lowest percent leaf miner infested leaf (28%) was observed in January and that was the highest in March (100%). Leaf miner larvae first observed in February (5.2 larva/leaf) and the highest number of larvae was observed in April (10.66 larva/leaf) on country bean leaf.

In bush bean, leaf miner infestation was started from January and reached peak in February and remained constant up to April. The lowest percent leaf miner infested leaf (34%) was observed in January and that was the highest in February (100%). Leaf miner larvae first observed in February (2.73 larva/leaf) and the highest number of larvae was observed in April (11.2 larva/leaf) on bush bean leaf.

In tomato, leaf miner infestation was started from January and reached peak in April. The lowest percent leaf miner infested leaf (10.0 %) was observed in

January and that was the highest in April (90.0 %). Leaf miner larvae first observed in February (1.4 larva/leaf) and the highest number of larvae was observed in April (4.1 larva/leaf) on tomato leaf.

In mustard, leaf miner infestation was started from January and reached peak in March. The lowest percent leaf miner infested leaf (12.0 %) was observed in January and that was the highest in March (30.0 %). Leaf miner larvae first observed in February (0.6 larva/leaf) and the highest number of larvae was observed in April (4.0 larva/leaf) on mustard leaf.

In bottle gourd, leaf miner infestation was started from January and reached peak in March. The lowest percent leaf miner infested leaf (12.0 %) was observed in January and that was the highest in March (100.0 %). Leaf miner larvae first observed in February (1.0 larva/leaf) and the highest number of larvae was observed in April (5.0 larva/leaf) on bottle gourd leaf.

In sweet gourd, leaf miner infestation was started from January and reached peak in March. The lowest percent leaf miner infested leaf (12.0 %) was observed in January and that was the highest in March (100.0%). Leaf miner larvae first observed in February (0.8 larva/leaf) and the highest number of larvae was observed in April (5.0 larva/leaf) on sweet gourd leaf.

In tomatillo, leaf miner infestation was started from January and reached peak in April. The lowest percent leaf miner infested leaf (2.0 %) was observed in January and that was the highest in March (45.0%). Leaf miner larvae first observed in February (0.2 larva/leaf) and the highest number of larvae was observed in April (4.25 larva/leaf) on tomatillo leaf.

In pea, leaf miner infestation was started from February and reached peak in April. The lowest percent leaf miner infested leaf (10.0 %) was observed in January and that was the highest in April (40.0%). Leaf miner larvae first observed in February (1.0 larva/leaf) and the highest number of larvae was observed in April (3.0 larva/leaf) on pea leaf.

In tita begun leaf miner infestation was started from February and reached peak in April. The lowest percent leaf miner infested leaf (20%) was observed in February and that was the highest in April (70%). Leaf miner larvae first observed in February (1.5 larva/leaf) and the highest number of larvae was observed in April (5 larva/leaf^{-1}) on tita begun leaf.

Leaf miner incidence was not observed in December when low temperature was prevailed and its infestation was increased with increasing temperature from January. Positive relationship was observed between leaf miner infestation and environmental temperature for all crops.

CHAPTER VI

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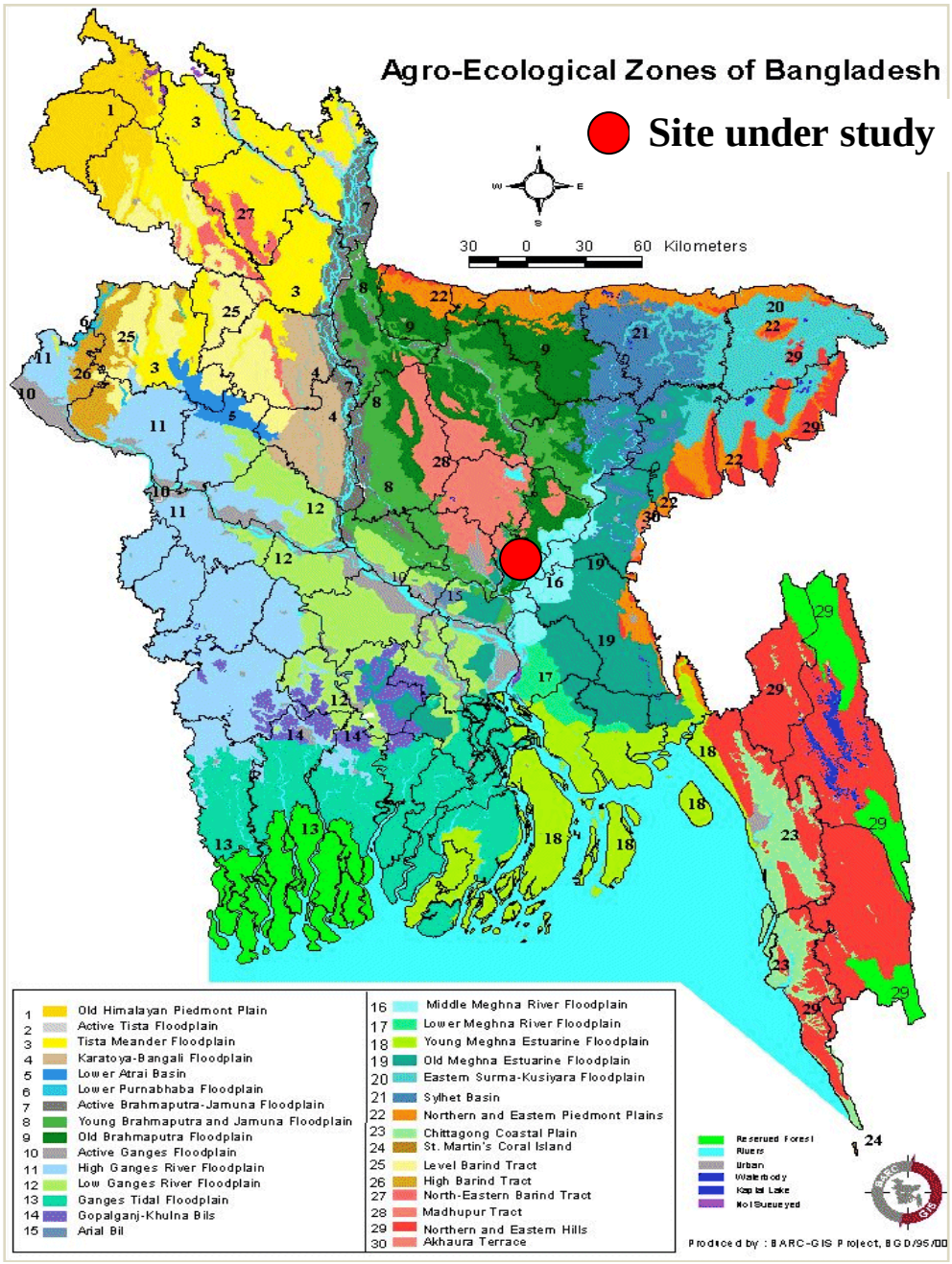
Appendix I. Map showing the site used for present study



Appendix II. Monthly meteorological information during the period from November, 2016 to April, 2017

Year	Month	Air temperature (^{o}C)		Relative Humidity (%)
		Maximum	Minimum	
2016-2017	December	25.13	8.98	69.85
	January	23.97	9.28	71.09
	February	25.12	13.89	76.99
	March	29.21	14.09	75.89
	April	30.85	16.96	65.98

Source: Metrological Centre (Climate Division), Agargaon, Dhaka.

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The author also gives flocks of rose to her friends (Tithi, Rima, Mumu, Chitra and Sajib) for their encouragement.

June, 2017 **The Author**

SAU, Dhaka

HOST PREFERENCE AND INFESTATION INTENSITY OF VEGETABLE LEAF MINER, *Liriomyza* spp.

ABSTRACT

Vegetable leaf miner, *Liriomyza* spp. is one of the major pests of various vegetables which larva mines the leaves causing serious damage to different vegetable host plants. Field survey was conducted to know the host preference, infestation intensity of vegetable leaf miner at the field of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during the period from December 2016 to April 2017. Leaf miner infestation was observed on cucumber, country bean, bush bean, tomato, mustard, bottle gourd, sweet gourd, tomatillo, pea, tita begun. No infestation was found in brinjal, potato, red amaranth and amaranth. Highest percent of plant infestation was found in mustard (40%) followed by sweet gourd (33.31%), cucumber (25.0 %), country bean (25.0 %), bush bean (25.0 %), tomato (25.0 %), bottle gourd (25.0 %), tomatillo (25.0%), tita begun (25%) and pea (20.0 %). 100% of leaf infestation was recorded in cucumber, country bean ,bush bean, bottle gourd, mustard and sweet gourd followed by tita begun (70%), pea (40%), tomatillo (45%) and tomato (30%). Highest number of leaf miner larvae was found in cucumber (17 larva/leaf) followed bush bean (11.12 larva/leaf), country bean (10.66 larva leaf), bottle gourd (5 larva/leaf), sweet gourd (5 larva/leaf), tita begun (5 larva/leaf), tomatillo (4.25 larva/leaf), tomato (4.11 larva/leaf), mustard (4 larva/leaf) and pea (3 larva/leaf). Positive relationship was observed between leaf miner infestation and environmental temperature for all crops.

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LISTS OF PLATES

LIST OF APPENDICES

HOST PREFERENCE AND INFESTATION INTENSITY OF VEGETABLE LEAF MINER, *Liriomyza* spp.

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A Thesis
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for the degree of

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IN

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CERTIFICATE

This is to certify that the thesis entitled, "**HOST PREFERENCE AND INFESTATION INTENSITY OF VEGETABLE LEAF MINER, Liriomyza spp.**" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE in ENTOMOLOGY,** embodies the result of a piece of bona fide research work carried out by **SONIA PARVIN**, **Registration No. 11-04645** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

Dated: June, 2017
Place: Dhaka, Bangladesh

Professor Dr. Md. Abdul Latif
Supervisor

DEDICATED

TO

MY BELOVED PARENTS