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Survey of the distribution of leaf miners on Vegetables and other alternative host plants

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Abstract

The main aim of the present investigation was to know about the importance of leaf miners and the damage percentage they cause the present study was proposed to identify the species responsible for damaging the vegetables and other alternative host plants. The research was conducted during the year 2011, to determine the damage percentage of vegetables and other alternative host plants caused by leaf miner. All the vegetables are rich source of carbohydrates and vitamins which were selected in above survey. On the numerical basis of the data the minimum damage percentage (13.74%) was showed by the radish plants after the time interval of 7 days and the maximum damage percentage (52.08%) was showed by the tomato plants after the time interval of 84 days.

Keywords: leaf minor, vegetables, days, percent damage

Introduction

Leaf miners belong to four different orders of insects which are Diptera, Hymenoptera, Lepidoptera and Coleoptera [1]. According to metamorphosis, all these four orders of leaf miners are holometabolous. Their larval stages are morphologically different from each other. Adult female of a leaf miner laid eggs externally on the leaves or just beneath the epidermis of the leaves [2]. 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 [3]. Vegetables are very important for human life as they provide nutritions to human body [4]. Leaf miners have become serious insect pests of different vegetables and many others alternative host plants in Vietnam [5, 6]. In the recent years leaf miners have become a major threat to vegetables in Turkey [7]. Leaf miners cause cosmetic as well as economic damage on a wide range of host plants. The leaf miner *Chromatomyia syngenesiae* is a common pest with a wide host range mostly attack on cultivated plants such as chrysanthemum and lettuce [8]. The first outbreaks of the non-indigenous leaf miner *Liriomyza huidobrensis* were confirmed in 1989 and these early infestations spread rapidly from ornamental plants to vegetables in UK [9]. *Liriomyza* is a polyphagous group of leaf miners that contains up to three hundred species and the larvae of this genus attack on vegetables, ornamentals as well as some other alternative host plants that belong to Solanaceae, Asteraceae, Cucurbitaceae, Brassicaceae and Fabaceae family. *Liriomyza* species of leaf miner can damage to the plants in both ways either directly or indirectly [10, 11]. 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 [12]. 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 [13, 14]. It has been reported that the *Liriomyza trifolii*, (Burgess) feed on nearly 79 various species of plants in India [15, 16, 17]. *Liriomyza huidobrensis* (Diptera: Agromyzidae) is a polyphagous leaf miner. 91% depends on vegetables ornamentals and cultivated host plants for their survival. This species of leaf miner was quickly spread due to transportation of various plant materials for the plastic tunnels and greenhouses [18, 19, 20].

Knowing the importance of leaf miners and the damage Percentage they cause the present study was therefore proposed to identify the species responsible for damaging the vegetables and other alternative host plants.

Materials and Methods

Present research was conducted for the survey of the distribution of leaf miners on vegetables and other alternative host plants found in Faisalabad during 2011-12. Seven treatments were applied with four replications randomly. These seven treatment included (P_1 =Tomato, P_2 =Radish, P_3 =Spinach) and other alternative host plants (P_4 =Brassica, P_5 = Sufaid dodhak, P_6 = Poppy plant, P_7 = Nasturtium) caused by leaf miner have been described in this experiment.

Sampling method

Twenty plants (attacked by leaf miners) were selected randomly from the field of one acre and three leaves were taken randomly from each plant. At the end damage percentage (Percent damage (%) = No of Damage leaves/ Total number of leaves x 100) was recorded. Infested leaves were observed thoroughly to know about the nature of damage. The shape of mines and the nature of damage were cleared by the following figures.



Fig 1: Damage pattern of Leaf miner, *Liriomyza trifolii* on tomato leaves at Horticultural Research Area UAF.



Fig 2: Damage pattern of Leaf miner, *Liriomyza brassicae* on radish leaves at Horticultural Research Area UAF



Fig 3: Damage pattern of Leaf miner, *Liriomyza sativae* on poppy leaves at Horticultural Research Area UAF



Picture 1: Leaf miner, *Liriomyza trifolii*



Picture 2: Leaf miner, *Liriomyza brassicae*

Mined leaves containing mature larvae or pupae were collected and placed in the petri dishes until the emergence of adults. The Petri dishes were kept at constant room temperature (25 to 30 °C) and relative humidity (65 to 70%) for regular checking. After the emergence of adults they were kept alive for several hours in order to attain their proper color. After the development of proper color they were transferred into glass vials by the use of aspirator. In this way the population of leaf miners was collected and preserved in 80% formalin.

Results

The results of the experiment laid out for evaluating the damage percentage of vegetables caused by leaf miner have been described in the results.

The data on damage percentage was recorded on weekly basis. Mean damage percentage of vegetables and other alternative host plants caused by leaf miner is presented in the form of bar diagram. The data on damage percentage was firstly recorded on 19th of March. The mean value against each Treatment (plants) will reflect the damage percentage caused by leaf miner.

The details of the damage percentage caused by leaf miner are given as under with 7 days intervals.

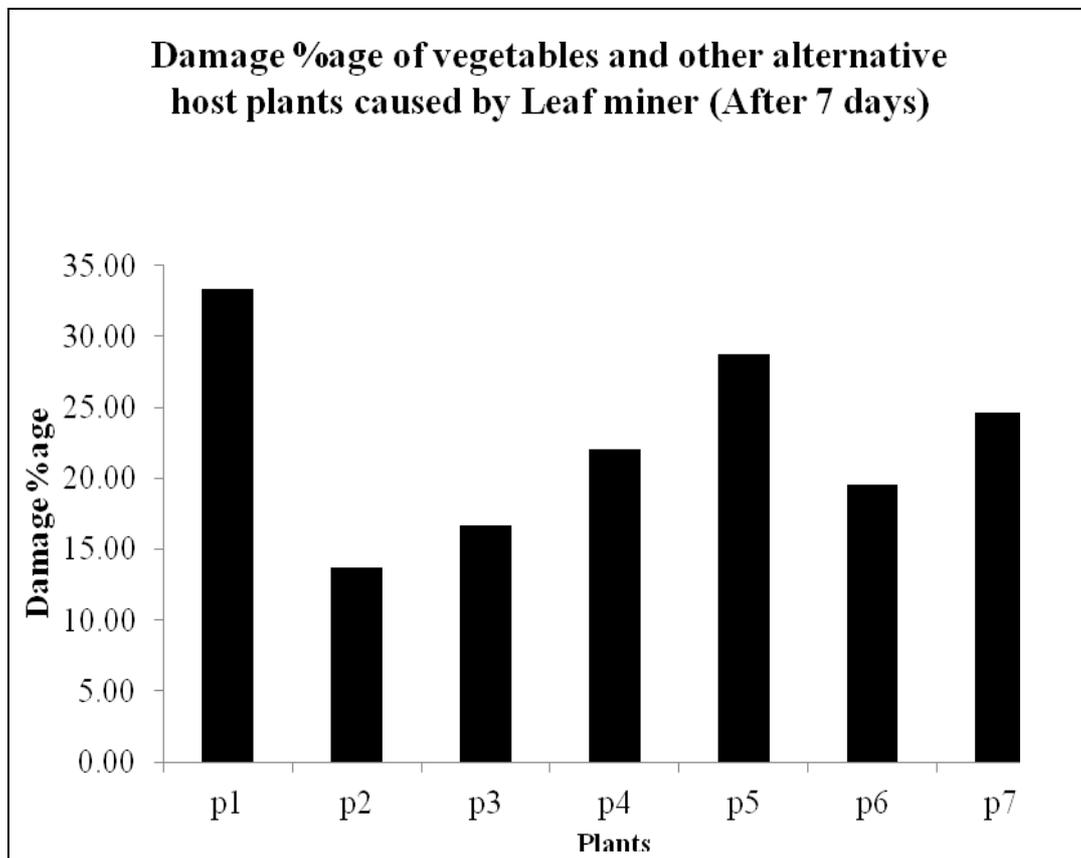


Fig 1: Graph showing damage percentage of vegetables and other alternative host plants.

1. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 7 days).

It is evident from the Fig. 1 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 13.74% to 33.33%. The

minimum damage percentage was observed in P₂ (13.74%) then P₃ (16.66%), P₆ (19.58%), P₄ (22.08%), P₇ (24.58%) and P₅ (28.74%). While the maximum damage percentage was observed in P₁ (33.33%)

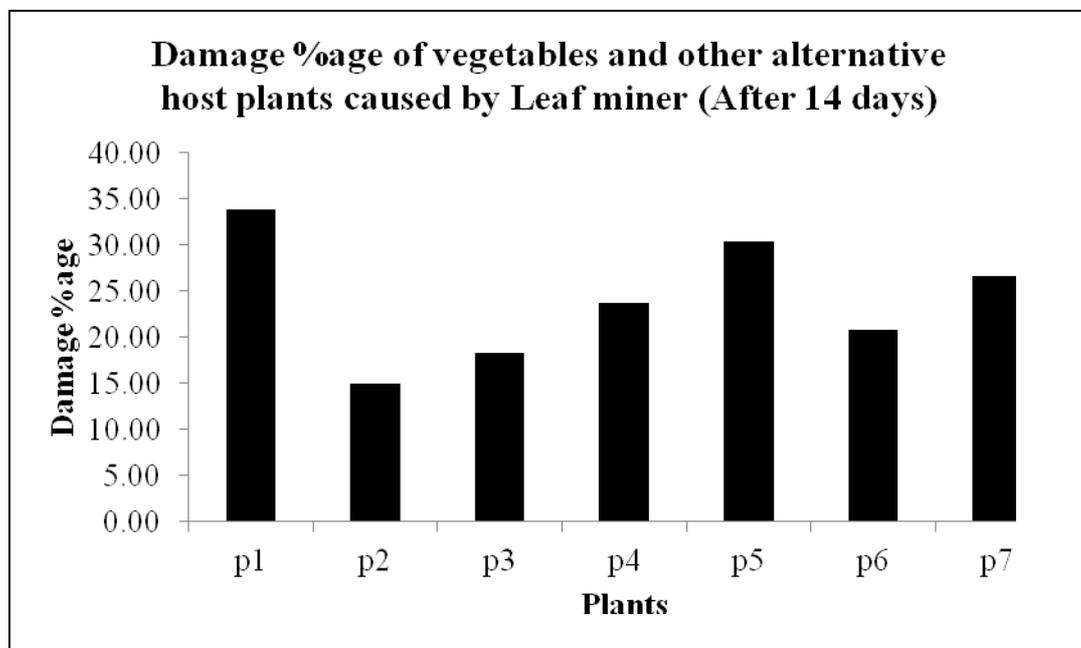


Fig 2: Graph showing damage percentage of vegetables and other alternative host plants.

2. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 14 days).

It is evident from the Fig. 2 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 14.99% to 33.83%. The

minimum damage percentage was observed in P₂ (14.99%) then P₃ (18.33%), P₆ (20.82%), P₄ (23.74%), P₇ (26.66%) and P₅ (30.41%). While the maximum damage percentage was observed in P₁ (33.83%)

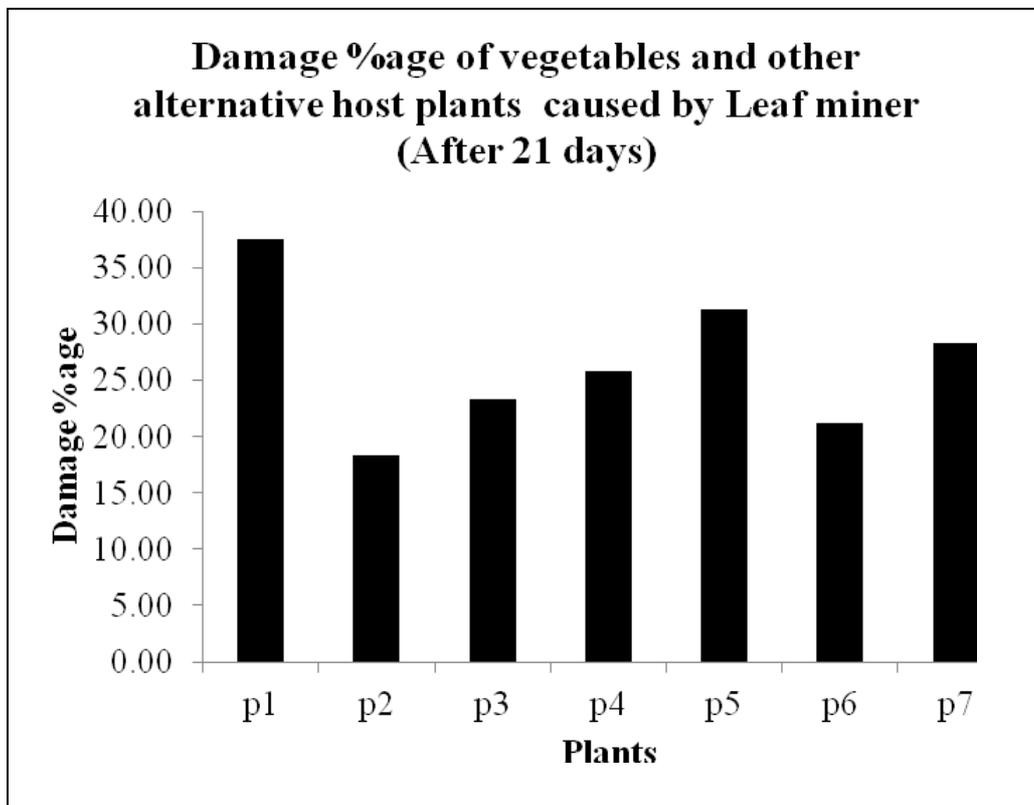


Fig 3: Graph showing damage percentage of vegetables and other alternative host plants.

3. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 21 days).

It is evident from Fig. 3 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 18.33 to 37.57%. The

minimum damage percentage was observed in P₂ (18.33%) then P₆ (21.24%), P₃ (23.33), P₄ (25.83%), P₇ (28.33%) and P₅ (31.33%). While the maximum damage percentage was observed in P₁ (37.57%)

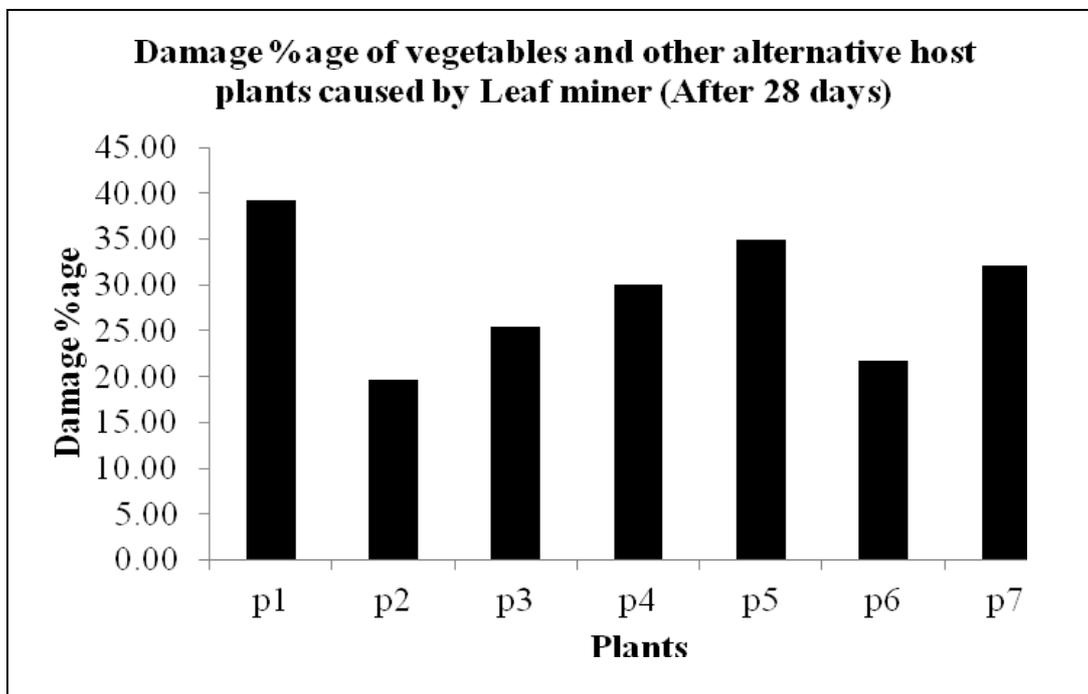


Fig 4: Graph showing damage percentage of vegetables and other alternative host plants.

4. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 28 days).

It is evident from the Fig. 4 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 19.58 to 39.16%. The

minimum damage percentage was observed in P₂ (19.58%) then P₆ (21.66%), P₃ (25.41%), P₄ (29.99%), P₇ (32.08%) and P₅ (34.99%). While the maximum damage percentage was observed in P₁ (39.16%)

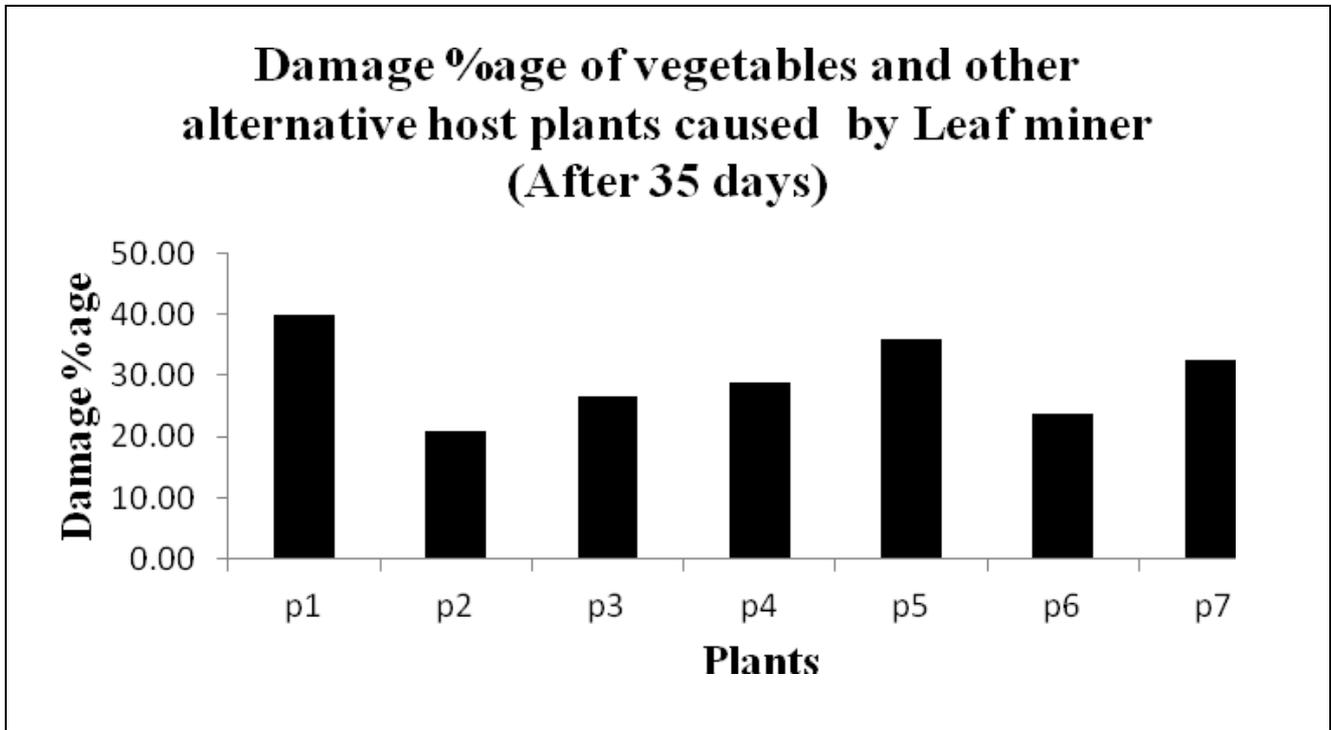


Fig 5: Graph showing damage percentage of vegetables and other alternative host plants.

5. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 35 days).

It is evident from Fig. 5 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 20.83% to 39.99%. The

minimum damage percentage was observed in P₂ (20.83%) then P₆ (23.74%), P₃ (26.66%), P₄ (28.74%), P₇ (32.57%) and P₅ (35.83%). While the maximum damage percentage was observed in P₁ (39.99%)

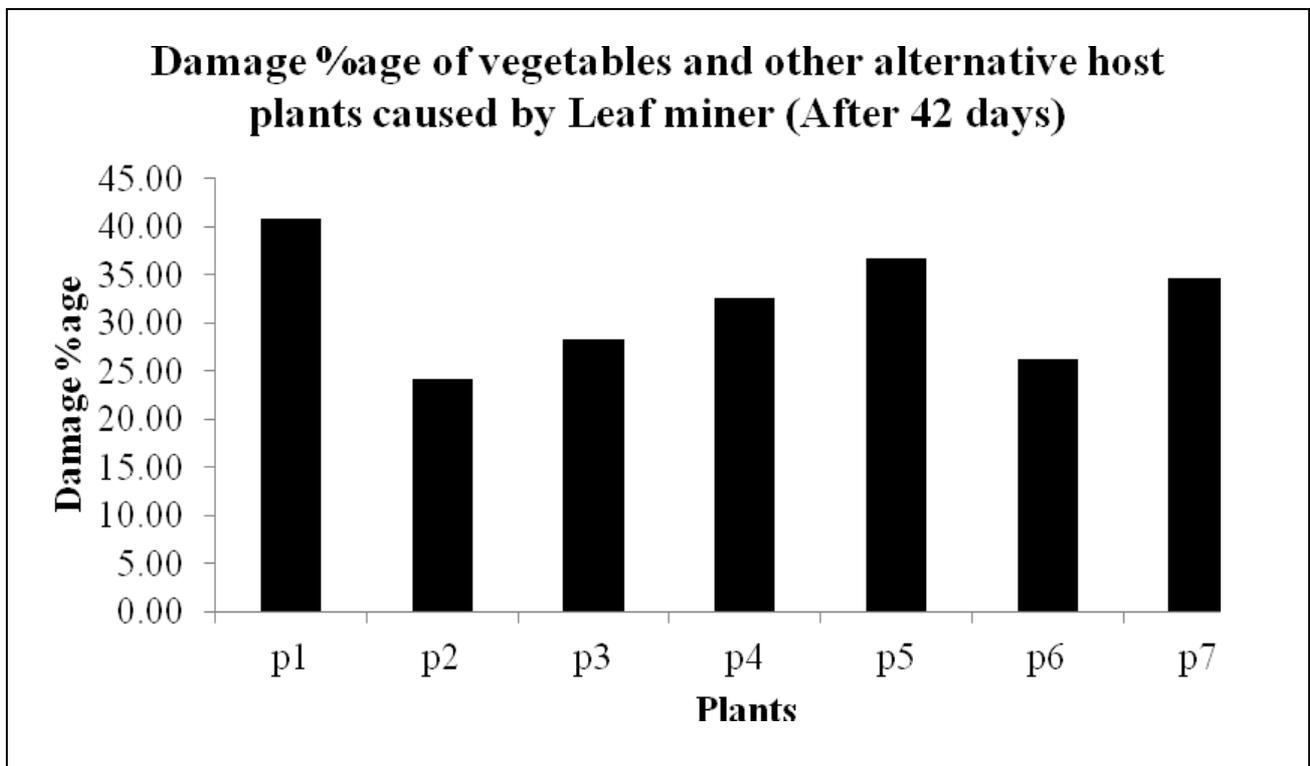


Fig 6: Graph showing damage percentage of vegetables and other alternative host plants.

6. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 42 days).

It is evident from Fig. 6 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 24.16% to 40.83%. The

minimum damage percentage was observed in P₂ (24.16%) then P₆ (26.24%), P₃ (28.33%), P₄ (32.49%), P₇ (34.57%) and P₅ (36.74%). While the maximum damage percentage was observed in P₁ (40.83%)

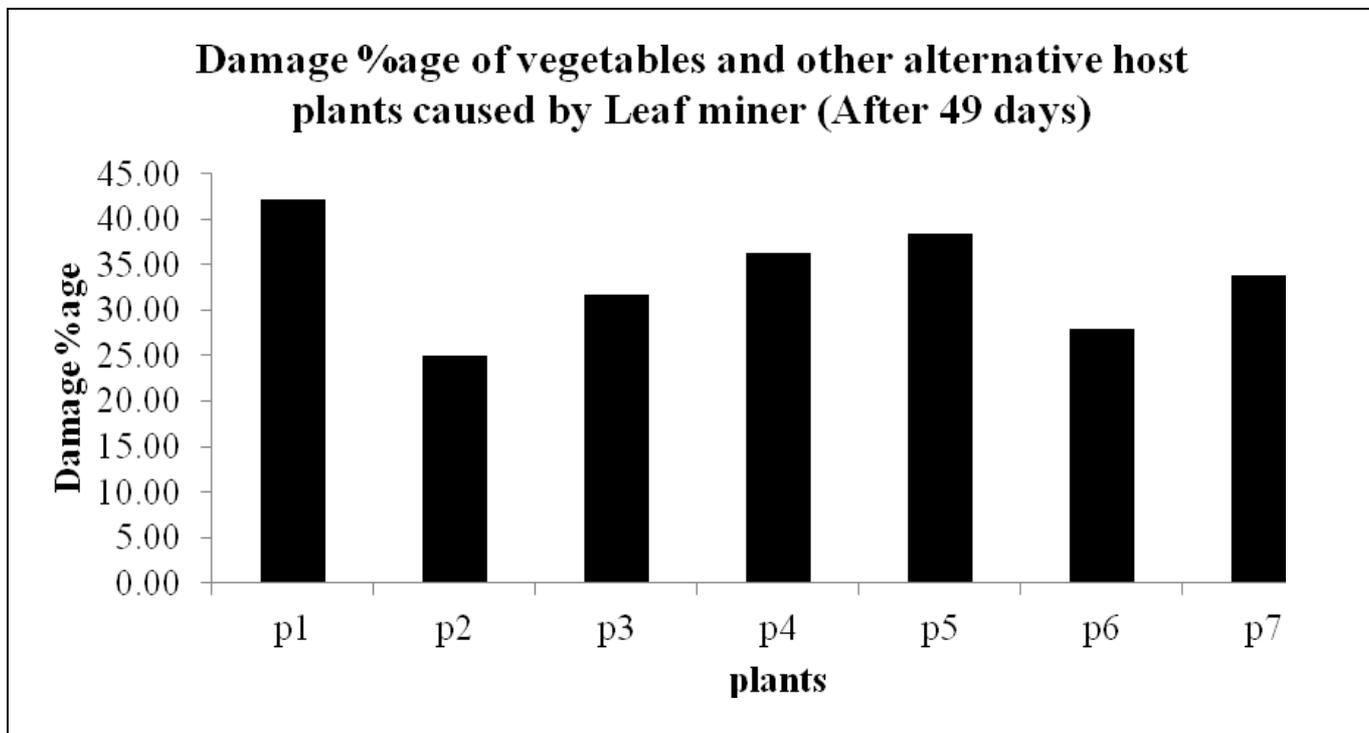


Fig 7: Graph showing damage percentage of vegetables and other alternative host plants.

7. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 49 days).

It is evident from Fig. 7 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 24.99% to 42.08%. The

minimum damage percentage was observed in P₂ (24.99%) then P₆ (27.91%), P₃ (31.66%), P₇ (33.75%), P₄ (36.24%) and P₅ (38.33%). While the maximum damage percentage was observed in P₁ (42.08%)

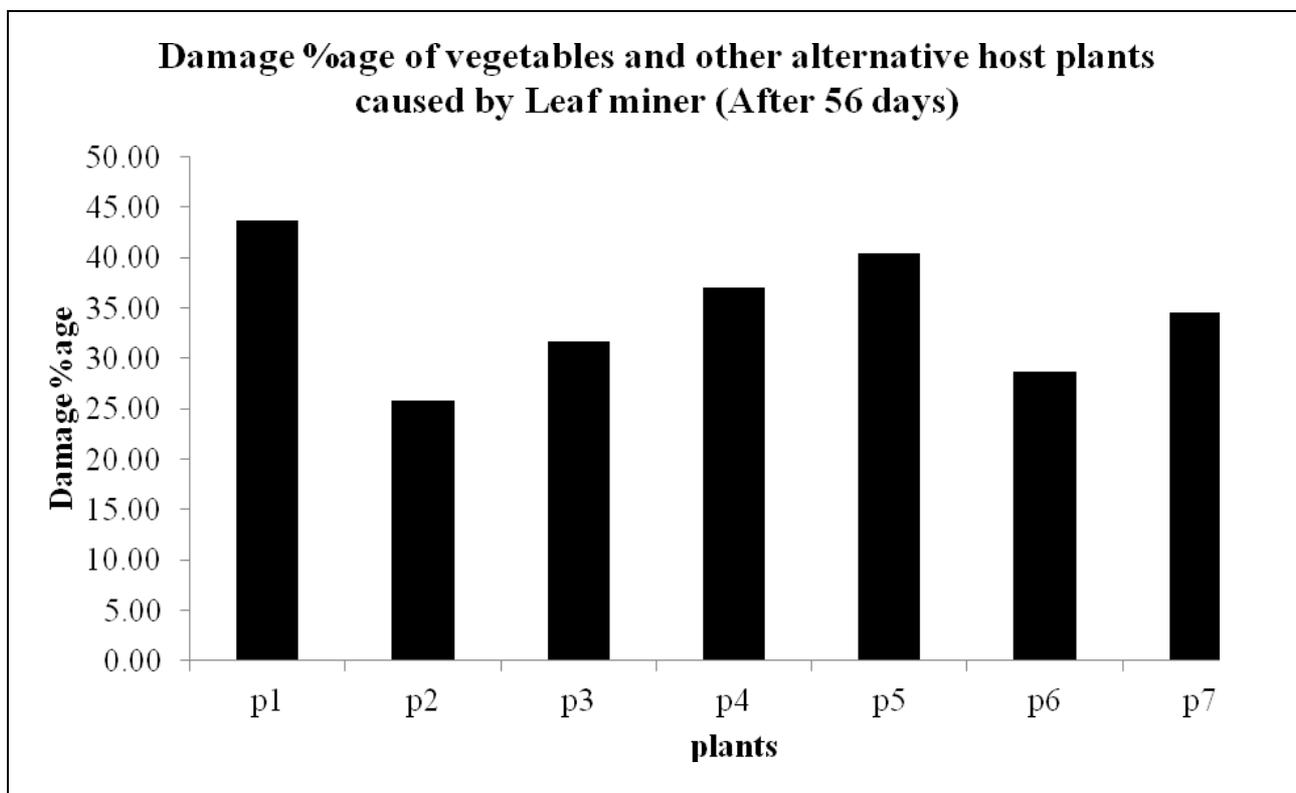


Fig 8: Graph showing damage percentage of vegetables and other alternative host plants.

8. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 56 days).

It is evident from Fig. 8 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 25.83% to 43.75%. The

minimum damage percentage was observed in P₂ (25.83%) then P₆ (28.75%), P₃ (31.66%), P₇ (34.58%), P₄ (37.08%) and P₅ (40.41%). While the maximum damage percentage was observed in P₁ (43.75%)

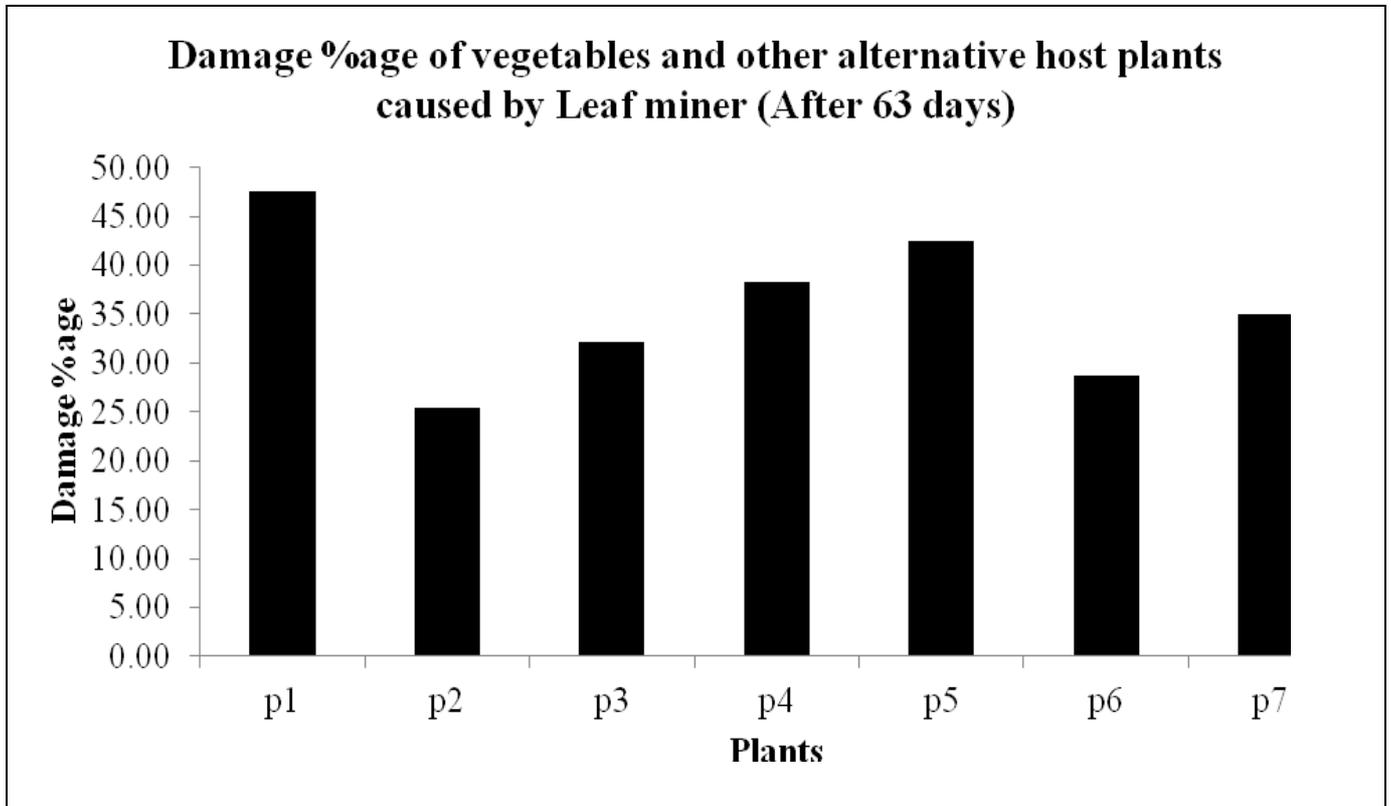


Fig 9: Graph showing damage percentage of vegetables and other alternative host plants.

9. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 63 days).

It is evident from Fig. 9 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 25.41% to 47.50%. The

minimum damage percentage was observed in P₂ (25.41%) then P₆ (28.75%), P₃ (32.08%), P₇ (35.00%), P₄ (38.33%) and P₅ (42.50%). While the maximum damage percentage was observed in P₁ (47.50%)

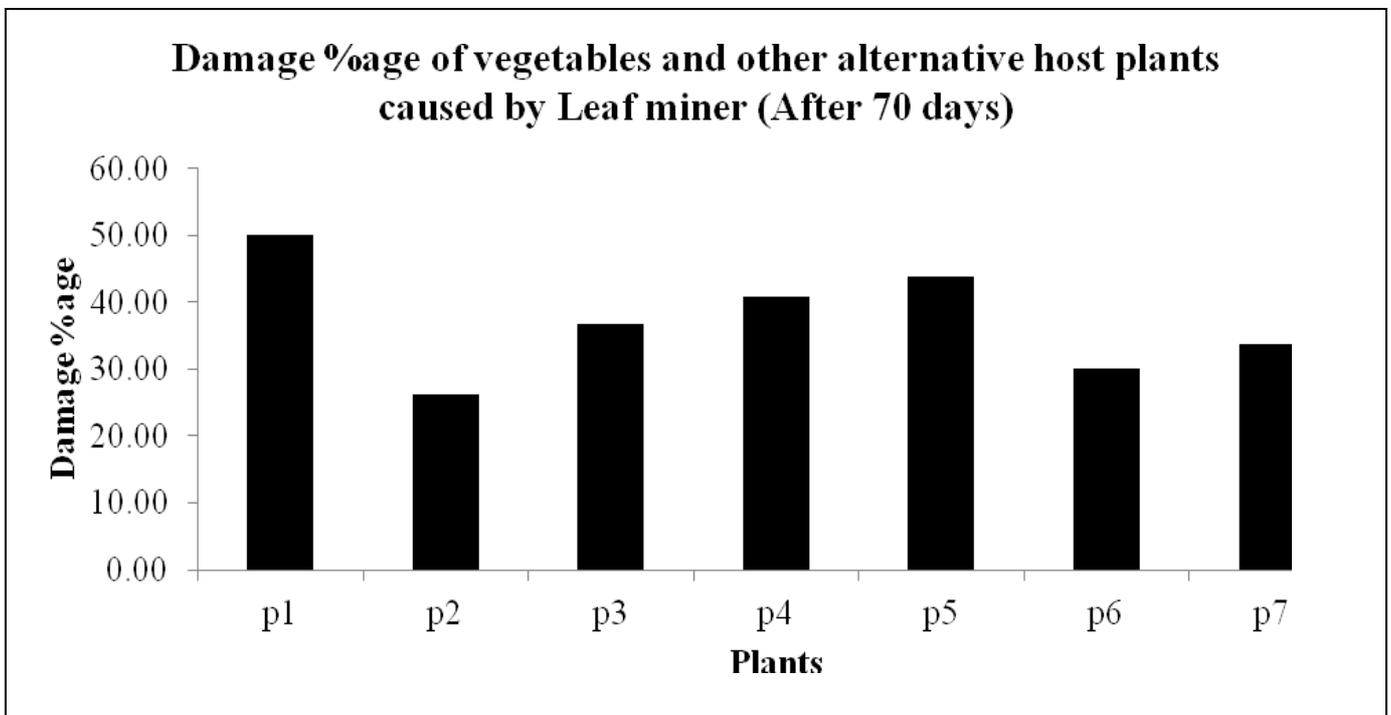


Fig 10: Graph showing damage percentage of vegetables and other alternative host plants.

10. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 70 days).

It is evident from Fig. 10 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 26.25% to 49.99%. The

minimum damage percentage was observed in P₂ (26.25%) then P₆ (30.00%), P₇ (33.75%), P₃ (36.66%), P₄ (40.83%) and P₅ (43.75%). While the maximum damage percentage was observed in P₁ (49.99%)

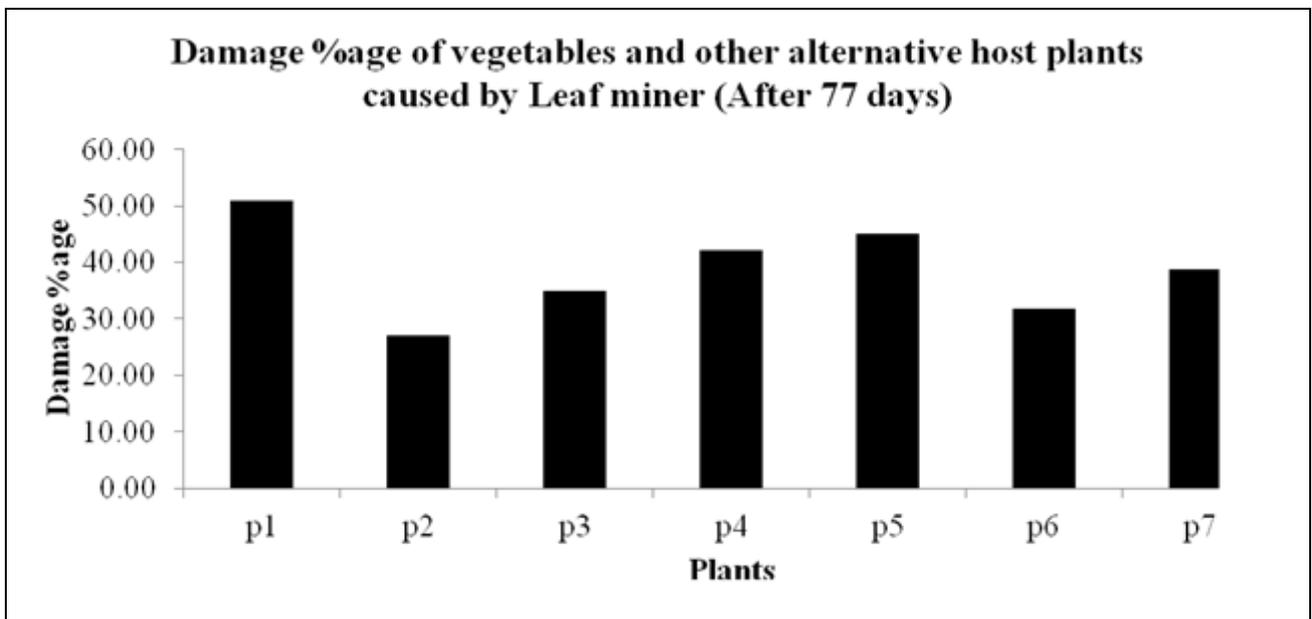


Fig 11: Graph showing damage percentage of vegetables and other alternative host plants.

11. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 77 days).

It is evident from Fig. 11 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 27.08% to 53.83%. The

minimum damage percentage was observed in P₂ (27.08%) then P₆ (31.66%), P₃ (35.00%), P₇ (38.75%), P₄ (42.08%) and P₅ (45.00%). While the maximum damage percentage was observed in P₁ (50.83%)

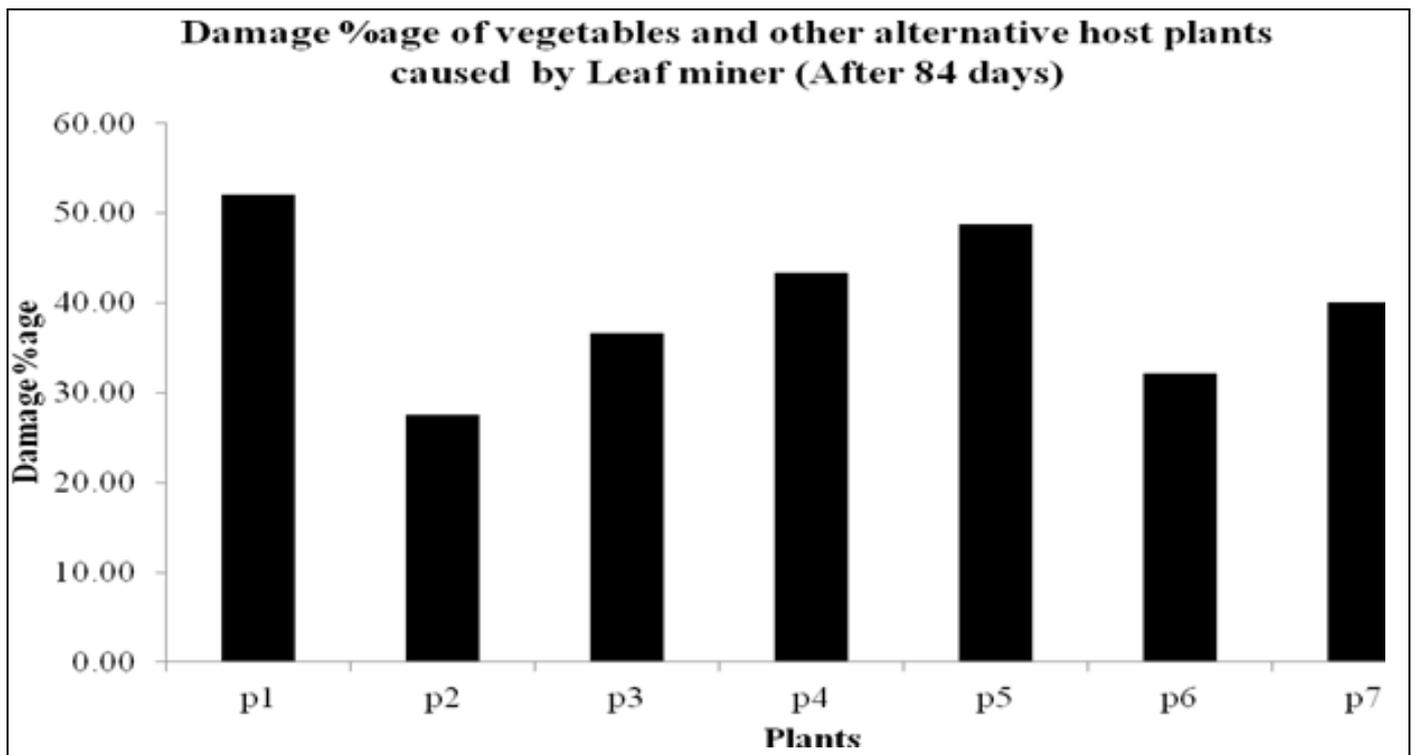


Fig 12: Graph showing damage percentage of vegetables and other alternative host plants.

12. Damage percentage of vegetables and other alternative host plants caused by leaf miner (After 84 days).

It is evident from Fig. 12 that the results were found to be highly significant. The data showed that damage percentage under various treatments varied from 27.49% to 52.08%. The minimum damage percentage was observed in P₂ (27.49%) then P₆ (32.08%), P₃ (36.66%), P₇ (39.99%), P₄ (43.33%) and P₅ (48.75%). While the maximum damage percentage was observed in P₁ (52.08%)

Discussion

The overall mean damage percentage caused by leaf miners showed variation ranging from 13.74% to 89.58%. Tomato (P₁) proved to be the most favourite host for the leaf miner, *Liriomyza trifolii*. The minimum damage percentage (13.74%) was recorded on radish and the maximum damage percentage (89.58%) was recorded on tomato.^[21] reported that *Liriomyza trifolii* has more than 55 hosts from Florida but the best known hosts are tomato, carrot, melon, cucumber, eggplant and potato ^[21]. reported that most of the species of leaf miners

showed various patterns of population fluctuation. [22] Reported that the leaf miners show non-random distributions between the plants as well as within the plants [23]. Reported that *Liriomyza* species (Diptera: Agromyzidae) of leaf miners are severe insect pests of many vegetables and others alternative host plants. The maximum damage to the leaves nearly 85-90% was observed in case of tomato and cucumber by these species of leaf miners [12]. Reported that leaf miners can cause 62% reduction in the photosynthetic activities of the plants. [24] Reported that *Liriomyza brassicae* feed on several species of mustard, nasturtium, wild radish, winter radish, brassica and turnip in California.

In the present research survey, following four different species of leaf miner were found on vegetables and other alternative host plants that were identified by the use of available keys.

- The species of leaf miner that was found on tomato named as *Liriomyza trifolii*.
- The species of leaf miner that was found on spinach named as *Liriomyza huidobrensis*.
- The species of leaf miner that was found on poppy plants and sufaid dodhak named as *Liriomyza sativae*.
- The species of leaf miner that was found on radish, brassica and nasturtium named as *Liriomyza brassicae*.

Summary

The main aim of the present investigation was to know about the importance of leaf miners and the damage percentage they cause the present study was proposed to identify the species responsible for damaging the vegetables and other alternative host plants. The research was conducted during the year 2011, to determine the damage percentage of vegetables and other alternative host plants caused by leaf miner. The experiment was laid out in Randomized Complete Block Design (RCBD). Total number of treatments were seven and each will have four repeats.

The treatments were included (P₁) tomato, (P₂) radish, (P₃) spinach, (P₄) brassica, (P₅) sufaid dodhak, (P₆) poppy plant and (P₇) nasturtium. Twenty plants were selected randomly from the field of one acre and three leaves were taken randomly from each plant. The data on damage percentage was recorded on weekly basis. The minimum damage percentage (13.74%) was recorded on radish plants and the maximum damage percentage (89.58%) was recorded on tomato plants.

The damage percentage of vegetables and other alternative host plants caused by leaf miner showed highly significant results. Finally on the basis of discussion and in the light of above survey the following results were obtained

- All the vegetables are rich source of carbohydrates and vitamins which were selected in above survey. So we checked the damage percentage on the above vegetables and some other plants to determine the importance of damage percentage caused by leaf miners and how much losses occurred due to this damage percentage.
- Various four species of leaf miner were found on vegetables and other alternative host plants that were identified by the use of available keys.
- On the numerical basis of the data the minimum damage percentage was showed by the radish plants and the maximum damage percentage was showed by the tomato plants.
- So, among all these treatments, as the maximum damage percentage was recorded on tomato plants so, it is necessary to minimize the reduction losses by reducing

the damage percentage (caused by leaf miners) of all these vegetables through the recommendation of proper control methods or IPM strategies especially for tomato crop.

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