Seasonal Abundance and host plant preference of the Tomato Leaf Miner *Liriomyza bryoniae* (Kaltenbach) (Diptera: Agromyzidae) on three Summer Host Plants in Janzour Region, Libya

**Abstract:** Background: *L. bryoniae* is a Palearctic species which probably originates from southern Europe, where it occurs commonly outdoors but has now spread to many parts of central and northern Europe, and is also reported in North Africa (Morocco and Egypt), as well as in several countries in Asia. *L. bryoniae* is polyphagous and as such can feed indiscriminately on plants from a number of different orders, including many vegetables and ornamental species. **Objectives:** The present study aimed to investigate the population abundance of the tomato leafminer *L. bryoniae* on three selected host plants. On the other hand, host plant preference by *L. bryoniae* was investigated. **Methods:** 100 infected leaves were collected per host plant. Samples were kept in plastic bags and transferred to be examined in the laboratory. Number of living *L. bryoniae* larvae were counted and recorded. **Results:** *L. bryoniae* larvae recorded low abundance on Kidney bean in early May, then the population increased recording three peaks of abundance recording (127, 158, and 179 individuals/100infested leaves) occurred in 22\(^{nd}\) of May, the 19\(^{th}\) of June, 24\(^{th}\) of July. On tomatoes *L. bryoniae* recorded low numbers in early May, then the population increased recording three peaks of abundance (109, 121, and 104 individuals/100infested leaves) occurred in 22\(^{nd}\) of May, the 3\(^{rd}\) of July, 31\(^{st}\) of July. On bell pepper *L. bryoniae* recorded low numbers in early May, then the population increased recording three peaks of abundance (87, 103, and 88 individuals/100infested leaves) occurred on 29\(^{th}\) of May, the 10\(^{th}\) of July and the 7\(^{th}\) of August. **Conclusions:** *L. bryoniae* larvae recorded low numbers in the beginning of the growing season in early May on the three summer host plants, and then the population increased recording 3-4 peaks of abundance.

**Keywords:** *L. bryoniae* Libya, population.

**INTRODUCTION**

The fly genus *Liriomyza* (Diptera: Agromyzidae) contains hundreds of species, most of which are leaf miners; their larvae tunnel within leaf tissue forming damaging and disfiguring mines. These include four species that are considered as agricultural pests among them the (tomato leaf miner) *L. bryoniae*, with wide host range of vegetables and ornamentals. *L. bryoniae* which has long been established as an important pest in open fields and under glass, was found across Europe and Asia, as well as parts of North Africa. (Collins and Anderson, 2016). *L. bryoniae* was first described on *Bryonia* (Cucurbitaceae), but it has been rarely reported on that host (Spencer, 1990). *L. bryoniae* larvae prefers to mine the spongy mesophyll of the leaf tissue (Hannou and Hegazi, 1996). In the pan-temperate region, *L. bryoniae* has been reported to complete its life cycle on plants from 16 families (Spencer, 1987). (Abul-Nasr and, Assem, 1961) studied the population densities and the host range of *L. bryoniae* under Egyptian climatic conditions and found that, *L. bryoniae* is a highly polyphagous species on important primary hosts of economic importance include: cabbages (*Brassica oleracea* var. *capitata*), cucumbers (*Cucumis sativus*), lettuces (*Lactuca sativa*), courgettes (*Cucurbita pepo*), melons (*Cucumis melo*), tomatoes (*Lycopersicon esculentum*) and watermelons (*Citrullus lanatus*). The life history of *L. bryoniae* is typical of a lepidoptera. A fertilized adult female will deposit eggs individually through holes made in a leaf, formed by the thrusting of the female’s ovipositor through either surface, adaxial or abaxial, of a leaf and into the mesophyll. In this way females form two types of leaf puncture: a fan shaped puncture used only for feeding, and a tubular puncture used for both feeding and oviposition (Parrella, 1987). Each oviposition leaf puncture contains just one opaque ellipsoidal egg (Minkenberg and, Van Lenteren, 1986). Three larval instars develop within the leaf and by continued feeding mine their way through the leaf until the final larval instar cuts a semi-circular exit hole through the leaf surface. The prepupal larvae leaves its mine and pupates in the soil at the base of the plant at a depth of approximately 5cm. Pupal color ranges from light yellow to dark-brown. Adults emerge from pupae by inflating the pilum (Parrella, 1987) once fully sclerotized, adult *L. bryoniae* have a wing length ranging from 1.7 to 2.1mm, and are predominantly black and yellow with a black mesonotum and yellow thoracic shield. The genders of *L. bryoniae* are easily identifiable as females possess a pointed black tip to their abdomen which the males lack. Total development time from egg to adult emergence in tomato takes 26.5 days at 20°C (Minkenberg and, Van Lenteren, 1986).
Natural abundance of the leafminer *L. bryoniae* was studied on four winter host plants [broad bean (*Vicia faba*), pea (*Pisum sativum*), Mallow (*Malva sylvestris*) and snow thistle (*Sonchus oleraceus*)] in Ojilate region. *L. bryoniae* showed low populations in December on all studied host plants except broad bean. High populations were observed in February and March then the population decreased till the end of the growing season. *L. bryoniae* recorded three peaks of abundance on all host plants, except broad bean (4 peaks). The highest peak recorded 104, 260, 156 and 222 individuals/100 infested leaves on broad bean, pea, mallow and snow thistle respectively (Elbasha and Elkhouly, 2014).

Therefore, the present investigation was undertaken to study the population abundance of the tomato leafminer *L. bryoniae* on three summer selected host plants.

**MATERIALS AND METHODS**

**Host plants:** Three summer host plants; kidney bean (*Phasulus vulgaris*), tomatoes (*Solanum lycopersicum*) and bell pepper (*Capsicum annuum*).

**Experimental field:** The present study was carried out in Janzour region, for two successive seasons. The experimental field was about ¼ hectare which divided to equal plots (4 plots for each crop. Each plot was about 200 m² planted during the third week of November as a winter crops. While summer crops were planted during the third week of May.

**Seasonal abundance of *L. bryoniae***: 100 infected leaves were collected from each host plant. Samples were kept in plastic bags and transferred to be examined in the laboratory. Number of living *L. bryoniae* larvae and number of killed larvae were counted and recorded. Normal agricultural practices of fertilizing and irrigation were followed and no chemical control measures were applied. Samples were taken from the appearance of the emergence of the first leaves and continued weekly until harvest.

**RESULTS**

**On Kidney bean:** *L. bryoniae* larvae recorded low numbers in the beginning of the season in early May, then the population increased recording three peaks of abundance (127, 158, and 179 individuals/100 infested leaves) occurred in 22nd of May, 19th of June, 24th of July.

**On tomatoes:** *L. bryoniae* larvae recorded low numbers in the beginning of the season in early May, then the population increased recording three peaks of abundance (109, 121, and 104 individuals/100 infested leaves) occurred in 22nd of May, 3rd of July, 31st of July.

**On bell pepper:** *L. bryoniae* larvae recorded low numbers in the beginning of the season in early May, then the population increased recording three peaks of abundance (87, 103, and 88 individuals/100 infested leaves) occurred in 29th of May, the 10th of July, 7th of August.

![Fig (3)](image)

**Fig (3) Seasonal abundance of *L. bryoniae* On bell peppers during the growing season (2016)**

**Table (1) Monthly average numbers of the *L. bryoniae* larvae on three summer host plants.**

<table>
<thead>
<tr>
<th>Months</th>
<th>Kidney bean</th>
<th>Tomatoes</th>
<th>Bell pepper</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>78.4 ± 38.73</td>
<td>80.6 ± 25.97</td>
<td>54.4 ± 24.6</td>
</tr>
<tr>
<td>June</td>
<td>121.25 ± 28.67</td>
<td>80.5 ± 16.34</td>
<td>68.5 ± 9.14</td>
</tr>
<tr>
<td>July</td>
<td>123.8 ± 36.9</td>
<td>95.5 ± 17.35</td>
<td>72.2 ± 19.1</td>
</tr>
<tr>
<td>August</td>
<td>81.5 ± 26.21</td>
<td>53.75 ± 29.22</td>
<td>44.75 ± 32.48</td>
</tr>
<tr>
<td>Mean ± S. D</td>
<td>101.23 ± 25.5</td>
<td>77.56 ± 8.56</td>
<td>60.96 ±11.05</td>
</tr>
</tbody>
</table>

As shown in table (1) *L. bryoniae* showed its highest monthly average numbers in July on kidney bean, tomatoes and, Bell pepper recording (101.23 ± 25.5, 77.56 ± 8.56 and, 60.96 ±11.05 individuals / 100 infested leaflets) respectively. On the other hand, the lowest monthly average numbers occurred in May on kidney bean recording (78.4 ± 38.73) and in August for tomatoes and bell pepper recording (53.75± 29.22 and, 44.75± 32.48 individuals / 100 infested leaflets).

**Host plant preference by *L. bryoniae*.

As shown in Fig (4) *L.bryoniae* showed a relatively high preference towards kidney bean followed by tomatoes and bell pepper.

![Fig (4)](image)

**Fig (4) Host plant preference by *L. bryoniae* on the summer host plants**

**DISCUSSION**

The population of *L. bryonia* larvae showed 3 peaks of abundance on all studied host plants, recording low populations in the beginning of the growing season, then reaching its highest peaks in July on all studied host plants, then the population decreased towards the end of the season. Similar results were obtained by (Elkhouly, 2009) for *L.trifolii* which the same number of population peaks on cowpea , kidney bean and tomatoes as a summer host plants. These results are also in agreement with those of (Awadalla et al.,2009 and Khouly, 2003). With regard to the previous studies on the parasitoids of different leaf mining species , it could be seen that the low population recorded in the beginning of the season is due to the activity of the larval pupal endoparasitoids, this finding seems to be true on the winter host plants due to the high abundance of population peaks on cowpea, kidney bean and tomatoes as a summer host plants. These results are also in agreement with those of (Awadalla et al.,2009 and Khouly, 2003). With regard to the previous studies on the parasitoids of different leaf mining species , it could be seen that the low population recorded in the beginning of the season is due to the activity of the larval pupal endoparasitoids, this finding seems to be true on the winter host plants due to the high abundance
of the parasitic fauna in the winter but, in summer the parasitic fauna recording low abundance compared with the winter specially the larval pupal endoparasitoids so, the low abundance of *L. bryoniae* in the beginning of the season may due to the poor plant canopy in the summer under Libyan conditions. On the other hand the low population recorded at the end of the season is due to the high activity of the larval ectoparasitoid *D. isaea*. Moreover, we can’t rule out the effect of the dry climate in Libya and the poverty of the suitable alternative host plant canopy for *L. bryoniae*. So, the population abundance of *L. bryoniae* was low compared with the populations recorded under Egyptian conditions while rich plant canopy is available. (Ledieu and Helyer, 1985) suggested that, although the adults would feed and oviposit on the young lateral foliage (side shoots) of mature plants, they would not do so on young terminal foliage at the apex of plants. This suggests that it may be possible to exert some control of leaf miners by delaying removal of side shoots until after adults have laid eggs In them. This finding is in line with our proposal that explained the poor populations of *L. bryoniae* by the lack of alternative volunteers in the Libyan flora.

It could be concluded from Fig. (4) that, kidney bean had the highest average rates of infestation followed by tomatoes and bell pepper. *L. bryoniae* showed high preference towards kidney bean in comparison with tomatoes and bell pepper, this may be due to the heavy foliar abundance and the large leaflet size of kidney bean combined with heavy infestation by *L. bryoniae* compared with the two other studied host plants. Facknath 2005 reported that, females of *Liriomyza* exhibited a preference for the larger, older, lower leaves, although the middle leaves were superior for the growth and development of the young stages. He also hypothesized that adult ovipositional preference for the older, larger, and thicker leaves of the lower foliage may be influenced by factors other than resource quality for larvae. It also could be seen that, cow pea is an outrigger herb which have a very large foliar area and large thick leaves in a direct attachment to the ground. So, it gained a great preference than tomatoes and bell pepper. These results are in agreement with those of Awadalla (1998) and Elkhouly et al., (2020) who reported a similar results for *Liriomyza trifolii* on [broad bean (*Vicia faba*), pea (*Pisum sativum*), fenugreek (*Trigonella fumum gradum*) and snow thistle (*Sonchus oleraceus*)] as winter host plants.

Hanna et al., 1987 reported that Crop rotation, associations and density, weed/volunteer control are used to prevent problems related to pests and are usually applied in various combinations to make the habitat less favorable for pests. The measures deal were allocation of crops to field (over time and space) (multi crop, diversity cropping), weeds control and volunteers as hosts of pests/vectors said to influence leaf miner populations. On the other hand, (Ledieu and Helyer, 1985) suggested that, although the adults would feed and oviposit on the young lateral foliage (side shoots) of mature plants, they would not do so on young terminal foliage at the apex of plants. This may be possible to exert some control of leaf miners by delaying removal of side shoots until after adults have laid eggs in them.

Resistant plants are used to restrict the growth and development of a specified pest and/or the damage they cause when compared to susceptible plant varieties under similar environmental conditions and pest Pressure It is important to distinguish resistant from tolerant species/varieties. Some crops vary in susceptibility to leaf mining. This has been noted, e.g. in cultivars of tomato, cucumber, cantaloupe and beans (Hanna et al., 1987). All the previous suggestions could be take place as a part of an integrated pest management program to control *L. bryoniae* on the economic host plants.

**REFERENCES**


