Damage percent and Biological Parameters of Leaf Miner *Acrocercops Syngramma* (Meyrick) on different Mango Varieties

Khalil Ahmed Kanhar, Hakim Ali Sahito, Fateh Muhammad Kanher, Saeed Ahmed Tunio, Raja Riaz Hassan Awan

Abstract

The experiments were conducted on the damage percent and biology of mango leaf miner *Acrocercops syngramma* (Meyrick) to assess the plant losses and their remaining active period on different mango varieties viz., Chuanca, Fajiri, Sindhi, Siroli and Langra during 2015. The data showed that significantly (P<0.05) highest damage percent of pest was recorded on Chuanca, whereas the lowest on Langra varieties respectively. The leaf miner, single female laid 49-59 on Chuanca, 42-59 on Fajiri, 44-56 on Siroli, 38-52 on langra and 39-51 eggs on Sindhi mango plants with an average 54.8±4.03, 49.2±6.49, 49.6±4.93, 46.0±5.34 and 44.2±4.82 eggs respectively. Whereas the eggs fertility of *A. syngramma* on Chuanca, Fajiri, Sindhi, Siroli and Langra, 92.065%, 76.378%, 90.541%, 72.016% and 84.341%, and the pest completes its biology were distinct from 19.7-30.43, 19.66-30.96, 21.0-27.63, 20.96-30.93 and 19.43-33.9 days respectively under laboratory conditions.

Keywords: Biology, Damage, Infestation, Leaf miner, Mango

1. Introduction

Mango, *Mangifera indica* (L.) orchards cultivation rating after citrus has been grown on the second largest area in Pakistan [1], and about in 87 countries all over the world, from that India, Pakistan, Brazil, Philippines, Mexico, China and Thailand are the main producers of the mango crop [2-4]. Pakistan produces 1732 thousand tones of mango fruit per year [5,6]. Mango is a major fruit of Sindh, is cultivated in the middle and upper districts of the province. Most commercially varieties of mangoes in Sindh are Sindhi, Saroli, Langra, Chaunsa, and Fajiri. The Sindhi mango variety is singly fruiting 80-85% of total the mango production in Sindh [7]. The major reasons to declining mango fruit yield are insects [8]. However, the [8] were recorded more than 260 major and minor damaging insects and mites on mango plants. Whereas, the [9] reported some major insects were causing damage to mango plants, i.e., hoppers, stem borers, shoot borers, fruit flies, stone weevil, leaf miners, termites, scale insects, thrips, aphids and ants. The mango leaf miner, *Acrocercops syngramma* cause damaged to newly emerged flushes, the minute caterpillars of the leaf miner excavating under the dorsal side of top leaves which turns grayish white epidermis [10]. The mango trees are exposure to the various pests at vegetative as well as reproductive stages (flower and fruits). The [11] reported that the *A. syngramma* generally appeared during the month of October-November to April-May in mango plants on newly emerged leaves. However, the [12-14] were recorded about 17.4% to 29.1% damage caused by leaf miner on mango plant leaves and cashew fruit crops during the month of September. While, the [13] reported that the cashew leaf miner, *A. syngramma* (Meyrick) larvae and pupa span an about 4.57, 9.35 and 8.35 days, respectively. Whereas, the [15] found out the *A. syngramma* larvae span 10 to 15 days, pupation acquire generally in the soil and in some cases in the folded plant leaves; the pest extent their total life ranged between 20 to 25 days. The growers of Sindh as well as Pakistan blindly rely on insecticides to reduce insect infestation on mango orchards. In Pakistan 27% of insecticides were used on vegetable and fruit crops [16]. Unfortunately, no any research works were reported on damage, host plant resistance and biological parameters of mango leaf miner, *A. syngramma* in Pakistan. The purpose of this study is to find out damage percent and biology of leaf miner on different mango varieties.
2. Materials and Methods

Damage percent of leaf miner, A. syngramma on different mango varieties

The damage percent of leaf by leaf miner was recorded on different mango varieties. The field experiment was conducted in Saeed Khan Kanher mango orchards located at Taluka Kingri, District Khairpur (Mir’s) during 2015. The damage percent of the pest was recorded from the five commercial and famous mango varieties, i.e. Sindhri, Langra, Chaunsa, Fajiri, and Siroli. The experiment was laid out in randomized complete block design (RCBD) with three replications. Each replication comprised of one mature mango plant. The observation started on 20th August twice a week after fruit harvesting plant started newly flushes grown cycle till to the their stoppage emerging fresh flushes at 1st November 2015. The damaged and undamaged newly emerged leaves per plant shoot were counted for evaluations of leaf minor damage percentage. The damage percent was calculated with the following formula:

\[
\text{Leaves damage percent} = \frac{\text{Infested leaves}}{\text{Total leaves}} \times 100
\]

Biology of leaf miner, A. syngramma on leaves of five different mango varieties, Chaunca, Fajiri, Sindhri, Siroli and Langra under laboratory conditions.

The leaf miner culture was established from mango orchard field collected larvae in the Department of Zoology, Faculty of Natural Sciences laboratory, at 27±2 °C and 70±5% R.H. The larvae of A. syngramma were reared on freshly emerged mango leaves until pupation in plastic jars (30x20 cm²) covered with muslin cloth. The leaf miner pupae was identified (male and female) on the basis of knob-like structure at the Antero-dorsal end of the male cocoon and deposited in separate jars having a moisten at the bottom covered with a filter paper for maintaining jars temperature. The newly emerged moths were released in muslin clothes covered the potted plants of each mango varieties for studies the biological parameters of A. syngramma. The observation was taken at 24 hrs for egg laying capacity, egg incubation period, larval instars and their development duration, pupation period and adult survival period were recorded. The eggs fertility data were calculated with the following Formula:

\[
\text{Eggs Fertility Percent} = \frac{\text{Eggs hatched}}{\text{Eggs fecundity/ female}} \times 100
\]

Statistical Analysis

The recorded data were statistically analyzed to compare significant difference in the leaf miner infestation and biological parameters on different mango varieties on computer software Statistics 8.1 (Analytical Software, USA).

3. Results

The experiment was conducted to calculate the damage percent of leaf miner, A. syngramma on different mango varieties i.e., Sindhri, Langra, Fajiri, Chaunsa and Siroli during 2015 at Taluka Kingri District Khairpur.

3.1 Damage percentage of mango leaf miner

The leaf minor damage fluctuates with the emergence of the newly flushes of mango plant. The data in Fig. 1 shows that the pest significantly attained highest peak damage percent during 3rd week of August on Langra and Siroli mango varieties. Thereafter the leaf minor damage percent declined gradually in 3rd week of September on all mango varieties. The pest fluctuate increases damage from the 4th week of September in all mango varieties till the stoppage at the emergence of newly flushes.

![Damage percentage of mango leaf miner in different observation dates](image)

3.3 Damage percentage of mango leaf miner on different mango varieties

There was a significant difference (F= 67.34; df= 5; P= < 0.0001) observed in damage percentage of leaf miner (Fig. 2) indicated that leaf miner, caused maximum damage on newly emerged flushes of mango variety Chuansa (46.245/shoot) followed by Fajiri (43.875/shoot), Sindhri (41.044/shoot), Siroli (37.553/ shoot) and minimum on Langra (35.483/ shoot) respectively during 2015.
3.4 Biological parameters of mango leaf miner on different mango varieties

The leaf miner larvae reared in plastic jars after emerging adults started courtship with females for mating. The copulation period was recorded vary from 18-23 minutes on all mango varieties. There were no any significant differences recorded in mating periods on different mango varieties.

3.4.1 Fecundity and Fertility

The results on different biological parameters are presented in Tables 1-5. The silver grey female moth laid eggs on newly emerged leaves that were clearly showed 5-8 twisted marked sign on the leaves. The eggs were counted visually with the sign symptoms of twisted marking on leaves. A single female laid 49-59 eggs on Chuanca, 42-59 on Fajiri, 44-56 on Siroli, 38-52 on Langra and 39-51 on Sindhi mango plants with an average mean total number of eggs fecundity 54.8±4.03, 49.2±6.49, 49.6±4.93, 46.0±5.34 and 44.2±4.82 respectively. The results of eggs fertility showed that the leaf miner female had laid the highest number of eggs on Chuanca (50.4±1.46 eggs/female) followed by Fajiri (44.40±1.99 eggs/female), Siroli (37.8±1.715 eggs/female), Sindhi (37.2±2.615 egg/female), Langra (33.0±1.581 egg/female). The total eggs fertility percent resulted 92.065% on Chuanca, 90.541% on Fajiri, 84.341% on Sindhi, 76.378% on Siroli and 72.016% Langra respectively.

3.4.2 Eggs incubation period

The newly flushes of mango plants were available to leaf miner female for egg laying (Fig. 3). However, after two days of mating, single female laid 5-8 eggs on newly flushes of mango varieties. The female deposited eggs on the epidermal layer of leaves and the discrete egg incubation period was recorded on all mango varieties, i.e., 3.0-4.5, 3.5-5.5, 4.0-5.5, 4.0-5.5 and 4.5-6.5 on Chuanca, Fajiri, Sindhi, Siroli and Langra, in days respectively.

3.4.3 Leaf miner larvae

The freshly emerged leaf miner larvae were pale white and head in brownish yellow in colour. However, when larvae reached in fifth instars it was changed in cherry red shiny in colour. The larvae were remained active in the white blister cover on the upper surface of leaves. The fully grown larvae were 6-11 mm in length (Fig. 4-8). The leaf miner larvae completes its developments in five stages (instars) and spent 9.5-15.5, 10.5-17.5, 11.0-14.0, 11.5-16.5 and 9.5-17.5 days on Chuanca, Fajiri, Sindhi, Siroli and Langra, respectively.

3.4.4 Papal duration

The leaf miner pupa was in oval shape and brownish-yellow in color, however, pupation, mostly takes place in the potted plant soil. The pupae lasted their period differently on mango varieties are ranging from 3.5-4.83, 3.16-4.16, 2.5-3.83, 2.66-4.33 and 2.83-4.5 days on Chuanca, Fajiri, Sindhi, Siroli and Langra, respectively.

3.4.5 Leaf miner Adult

The adult of the mango leaf miner was in silvery gray colored moth with silvery bands on the fore wings (Fig. 9). The measurements of adult male were 4.5-6.85 mm and female 7.0-8.95 mm in length. It was also observed that the female was bigger than the adult male. The leaf miner completes their biological stages from 19.7-30.43, 19.66-30.96, 21.0-27.63, 20.96-30.93 and 19.43-33.9 in days on Chuanca, Fajiri, Sindhi, Siroli and Langra, respectively.

Table 1: Fecundity and fertility of A. syngramma, on Chaunsa during 2015

<table>
<thead>
<tr>
<th>Serial No. of female</th>
<th>Eggs fecundity/ female</th>
<th>Fertility of eggs</th>
<th>Hatching Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hatched</td>
<td>Un-hatched</td>
</tr>
<tr>
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<td>49</td>
<td>46</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>5</td>
<td>58</td>
<td>55</td>
<td>3</td>
</tr>
<tr>
<td>Mean±S.E</td>
<td>54.8±1.80</td>
<td>50.4±1.46</td>
<td>4.4±0.92</td>
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</table>

Table 2: Fecundity and fertility of A. syngramma, on Fajiri during 2015

<table>
<thead>
<tr>
<th>Serial No. of female</th>
<th>Eggs fecundity/ female</th>
<th>Fertility of eggs</th>
<th>Hatching Percentage</th>
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<td>2</td>
<td>51</td>
<td>45</td>
<td>6</td>
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<tr>
<td>3</td>
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<tr>
<td>5</td>
<td>42</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>Mean±S.E</td>
<td>49.2±2.90</td>
<td>44.40±1.99</td>
<td>4.80±0.96</td>
</tr>
</tbody>
</table>

Fig 2: Damage percentage of mango leaf miner on different mango varieties
### Table 3: Fecundity and fertility of *A. syngamma*, on Siroli during 2015

<table>
<thead>
<tr>
<th>Serial No. of female</th>
<th>Eggs fecundity/ female</th>
<th>Fertility of eggs</th>
<th>Hatching Percentage</th>
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</thead>
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<td></td>
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<td>Un-hatched</td>
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<tr>
<td>5</td>
<td>49</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>Mean±S.E</td>
<td>49.6±2.205</td>
<td>37.8±1.715</td>
<td>11.8±1.497</td>
</tr>
</tbody>
</table>

### Table 4: Fecundity and fertility of *A. syngamma*, on Langra during 2015

<table>
<thead>
<tr>
<th>Serial No. of female</th>
<th>Eggs fecundity/ female</th>
<th>Fertility of eggs</th>
<th>Hatching Percentage</th>
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<tr>
<td>5</td>
<td>44</td>
<td>35</td>
<td>9</td>
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<tr>
<td>Mean±S.E</td>
<td>46.0±2.388</td>
<td>33.0±1.581</td>
<td>13.0±1.732</td>
</tr>
</tbody>
</table>

### Table 5: Fecundity and fertility of *A. syngamma*, on Sindhri during 2015

<table>
<thead>
<tr>
<th>Serial No. of female</th>
<th>Eggs fecundity/ female</th>
<th>Fertility of eggs</th>
<th>Hatching Percentage</th>
</tr>
</thead>
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<td></td>
<td>Hatched</td>
<td>Un-hatched</td>
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<td>4</td>
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<tr>
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<tr>
<td>5</td>
<td>51</td>
<td>46</td>
<td>5</td>
</tr>
<tr>
<td>Mean±S.E</td>
<td>44.2±2.154</td>
<td>37.2±2.615</td>
<td>7.0±2.28</td>
</tr>
</tbody>
</table>

### Table 6: Different Biological stages of mango leaf miner in day’s during-2015

<table>
<thead>
<tr>
<th>Mango Varieties</th>
<th>Minimum and Maximum eggs laid/ female</th>
<th>Egg Incubation period in days</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>Pupal period in days</th>
<th>Adult period in days</th>
<th>Total Life cycle in days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaunsa</td>
<td>49-59</td>
<td>3.0-4.5</td>
<td>1.5-3.0</td>
<td>2.0-3.5</td>
<td>2.0-2.5</td>
<td>2.5-3.5</td>
<td>1.5-3.0</td>
<td>3.5-4.83</td>
<td>3.7-5.6</td>
<td>19.7-30.43</td>
</tr>
<tr>
<td>Fajiri</td>
<td>42-59</td>
<td>3.5-5.5</td>
<td>2.5-3.5</td>
<td>1.5-2.5</td>
<td>2.0-3.5</td>
<td>3.0-3.5</td>
<td>1.5-4.5</td>
<td>3.16-4.16</td>
<td>2.5-3.8</td>
<td>19.66-30.96</td>
</tr>
<tr>
<td>Sindhri</td>
<td>39-51</td>
<td>4.0-5.5</td>
<td>2.0-2.5</td>
<td>2.5-3.0</td>
<td>1.5-2.0</td>
<td>2.0-3.0</td>
<td>3.0-3.5</td>
<td>2.5-3.83</td>
<td>3.5-4.3</td>
<td>21.0-27.63</td>
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<td>Siroli</td>
<td>44-56</td>
<td>4.0-5.5</td>
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<td>2.5-3.5</td>
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<td>3.5-4.0</td>
<td>2.5-3.5</td>
<td>2.66-4.33</td>
<td>2.8-4.6</td>
<td>20.96-30.93</td>
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<td>Langra</td>
<td>38-52</td>
<td>4.5-6.5</td>
<td>1.0-2.5</td>
<td>2.5-5.5</td>
<td>2.0-3.5</td>
<td>1.5-2.5</td>
<td>2.5-3.5</td>
<td>2.83-4.5</td>
<td>3.1-5.4</td>
<td>19.43-33.9</td>
</tr>
</tbody>
</table>

![Fig 3: Eggs of mango leaf miner on newly emerged leaves](image1)

![Fig 4: First instars mango leaf miner larvae](image2)

![Fig 5: Second instars mango leaf miner larvae](image3)

![Fig 6: Third instars mango leaf miner larvae](image4)
4. Discussion

Present studies on damage of leaf miner, *A. syngramma* on different mango varieties indicates lowest damage of pest on mango varieties i.e., Langra (35.483%) and Siroli (37.553%), whereas highest on Chuanca (46.254%) followed by Fajiri (43.875%) and Sindhri (41.044%). The fruits of mango varieties Langra and Siroli were harvested in the month of June; after harvesting plants turned to vegetative growth in the month of July. The mango varieties i.e., Chuanca, Fajiri and Sindhri mature its fruits in the month of July while it is starting to grow newly flushes in the month of August. The mango leaf miner appears on mango plants from the month of August. It was the main reason of the lowest damage caused by leaf miner on Langra and Siroli mango varieties, while, the highest damage on Chuanca, Fajiri and Sindhri varieties. The present experimental results are agreements with those of Panda [17] estimated that the *Conopomorpha syngramma* were caused 26% damage on newly emerged tender leaves in some areas of cashew nut plants. Peter [18] reported that the leaf miner; *A. (Conopomorpha) syngramma* caused major damage to newly emerged leaves. David and Ananthakrishnan [19] described leaf miner; *A. syngramma* caused 15-26% damage after monsoon season on newly emerged leaves of cashew nut plants. Gupta and Gupta [20] reported that leaf miner, *A. syngramma* attack on newly emerged flushes. Jacob and Beladevi [21] recorded maximum damage of leaf miner after monsoon on newly emerged plant leaves up to 20.06%.

During present study it was also observed that the biology of leaf miner, *A. syngramma* on different mango varieties are variation in fecundity, fertility, egg hatching and total life cycle periods spend on mango plants. The significant difference found in leaf miner eggs lying, hatching percentage and total longevity were observed on all mango varieties i.e., Chuanca 49-59 eggs, 92.065% and 19-30 days, Fajiri 42-59 eggs, 90.541% and 20-31 days, Siroli 44-56 eggs, 76.378% and 20-31 days, Langra 38-52 eggs, 72.016% and 19-34 days and Sindhri 39-51 eggs, 84.342% and 21-27 days respectively. The results of biological parameters of mango leaf miner are agreeing with those of Asre et al. [22] reported that *A. syngramma* larvae matured in 10 to 15 days, pupation takes place in the soil 7 to 9 days and total life cycle completed in 20 to 25 days on Cashew nut. Panda [17] reported that leaf miner *A. syngramma* larvae mature in 10-15 days, pupation take place in the soil and emerged adults within 7-9 days. The leaf miner completed their life cycle from eggs to adult in 20-25 days. Gordh [23] recorded that leaf miner, *A. syngramma* was completed its life cycle in 20-25 days.

5. Conclusion

The mango plants were starting to shade the newly emerged leaves after heavy damage caused by leaf miner as the leaves are working as the food factory preparing food through photosynthesis process that is essential only source of food for plant life. The leaf miner was highly preferred to feed/reproduction on Chuanca and Fajiri, and moderately to Sindhri and lowest on Siroli and Langra mango varieties during, 2015. The leaf miner behaves differently on all mango varieties for egg laying, egg hatching, fecundity, fertility and overall life span from egg to adult due to plant leaf surface, nutrients availability or plant biochemical substances. It was concluded that the mango growers must understand the plant flushes cycle as well as pest activation cycle. The growers would be applied recommended dose of nutrients immediately after mango fruit harvesting. However, in this way it would be inciting the plants to grow early newly flushes before the pest activation period.

6. References


7. Sindh IB. Pre-feasibility, mango pulping unit and dry mango products. Govt. of Sindh. 2010, 1.


