Comparative biology of South American tomato moth, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) on three solanaceous host plants

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**ABSTRACT:** South American tomato moth, *Tuta absoluta* is the emerging invasive pest on tomato and other solanaceous crops in India. Biology of *T. absoluta* was carried out on three solanaceous hosts viz., tomato (cv. NS 501), egg plant (cv. Kufri Jyothi) and potato (cv. Kufri Jyothi). Tomato was the most preferred host followed by potato and egg plant for its development. Mean number of eggs laid per female was 81.75±13.49 on tomato followed by potato (41.8±14.34) and egg plant (19.45±9.11). Similarly, egg hatching was fastest in tomato (3.75±1.11 days) followed by potato (5.10±0.78 days) and egg plant (6.10±0.91 days). Total larval period on tomato, potato and egg plant recorded was 7.95±3.14, 11.45±3.64 and 14.3±3.5 days, respectively. Survival rate of both sexes was more on tomato (Male-14.9±1.65 days and Female-18.10±1.8 days) than on potato (9.75±1.16 & 12.0±1.02 days) and egg plant (7.55±1.31 & 8.90±0.71 days). Irrespective of host plants, females survived more when compared to males.

**Keywords:** adult longevity, biology, host plants, invasive pest, *Tuta absoluta*

**INTRODUCTION**

South American tomato moth, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) also known as the tomato leaf miner is an oligophagous invasive pest associated with solanaceous crops. Tomato is the primary host of *T. absoluta*, but it has been reported on other secondary hosts like egg plant (*Solanum melongena* L.), potato (*Solanum tuberosum* L.), pepper (*Capsicum annuum*), sweet pepper (*S. muricatum* L.) and tobacco (*Nicotiana tabacum* L.) (Vargas, 1970; Campos, 1976; Pereyra and Sanchez, 2006) and other solanaceous weeds, including *Datura stramonium* L., *D. ferox* L., and *N. glauca* Graham (Larrain, 1986). In India, *T. absoluta* was first reported by Sridhar *et al.*, (2014) and recently spreading rapidly in southern states of the country (Anitha Kumari *et al.*, 2015; Kalleshwaraswamy *et al.*, 2015; Shashank *et al.*, 2015).

*T. absoluta* causes reduction in yield and fruit quality causing up to 100% loss in both greenhouses and open field conditions (Sridhar *et al.*, 2014; NAPPO, 2012). Different parts of tomato plants like leaves, stems, buds, calyces, young and ripe fruits are damaged by feeding of *T. absoluta*. We observed the natural incidence of *T. absoluta* under field conditions on all the host plants considered in the present study *i.e.*, tomato, potato and egg plant with varying degree of damage incidence. Though information on biology of *T. absoluta* is well documented on tomato, there is no information on the comparative biology of this pest on other host like potato and egg plant. Hence, the present study is aimed at evaluating relative preference *T. absoluta* on three solanaceous hosts *i.e.*, tomato, potato and egg plant for its development and adult longevity.

**MATERIALS AND METHODS**

Tomato (cv. NS 501), egg plant (cv. Kufri Jyothi) and potato (cv. Kufri Jyothi) plants were grown singly in earthen pots (twenty pots each for all host plants) and are kept in cages of 75 cm x 75 cm x 75 cm at ICAR-Indian Institute of Horticultural Research, Bengaluru (13°8.12’N, 77°29.45’E, altitude 890 m). In each cage, one pair of *T. absoluta* was released for egg laying. Duration of all the stages of the pest on different hosts was recorded till the death of both sexes of the adults. During the observations, temperature was maintained at 29±1°C and RH of 70±5%. On daily basis, cotton dipped in 10% honey was provided for adult moths. The experiments were repeated for three generations continuously and the data regarding duration of various stages of the pest on different hosts were presented as mean ± SD.

**RESULTS AND DISCUSSION**

Mean number of eggs laid by each *T. absoluta* female on different hosts was in the order of tomato > potato > egg plant. Highest number of eggs laid were on tomato (81.75±13.49/female) followed by potato (41.8±14.34) and egg plant (19.45±9.11) (Fig.1).
Similarly, egg hatching was fastest in tomato (3.75±1.11 days) followed by potato (5.10±0.78 days) and egg plant (6.10±0.911 days). Individually all the four larval instars observed were also developed faster on tomato when compared to other two hosts. Total larval period on tomato, potato and egg plant recorded was 7.95±3.14, 11.45±3.64 and 14.3±3.5 days, respectively. Pupal duration was highest in egg plant followed by potato and tomato (Table 1). Adult survival of both the sexes of *T. absoluta* i.e., males and females was also significantly varied. Both males and females survived more days on tomato (Male - 14.9±1.65 days and Female - 18.10±1.8 days) followed by potato (9.75±1.16 and 12.0±1.02 days) and egg plant (7.55±1.31 and 8.90±0.71 days) (Table 1, Fig. 2). Irrespective of hosts, female survival was more when compared to males.

As of now, though different hosts were reported for *T. absoluta*, no comparative biology was done with three hosts simultaneously. In the present study, *T. absoluta* completed all the life stages for their development successfully on all the solanaceous hosts considered viz., tomato, potato and egg plant at 29±1°C and RH of 70±5%.

In the present study, mean total larval duration observed was 7.95±3.14 days, which is lesser than the reports made by Barriontes et al., (1998) who studied the biology of *T. absoluta* at 28°C, 27.1°C, respectively. Erdogan and Babaroğlu (2014), EPPO (2005), Cuthbertson (2011) and Cuthbertson et al., (2013) also reported relatively longer duration of various life stages of *T. absoluta* when compared to our observations. This may be attributed to their studies conducted at lower temperatures than ours. Being poikilothermic, *T. absoluta* development might be indirectly proportional to the temperature i.e., higher the temperature, faster the development and is also depends on host.

In terms of preference to hosts, *T. absoluta* showed highest preference to tomato followed by potato and egg plant with reference to number of eggs laid, per cent egg hatchability, faster larval and pupal development and more adult longevity (Table 1). Similarly, with oligophagous pests like egg plant shoot and fruit borer, *Leucinodes orbonalis*, Boopal et al., (2013) observed differential duration of various biological parameters on different hosts like egg plant, potato and tomato. Caparros et al., (2013) reported differential preference by *T. absoluta* within varieties of potato.

From the present study, it may be concluded that among the three solanaceous hosts studied, *T. absoluta* preferred tomato, followed by potato and egg plant for its development. In the absence of tomato, the pest may pose a threat to potato, egg plant and other solanaceous hosts by adopting to host shifts, which is being observed recently in case of several insect pests. The observation from the present study necessitates a need for studying role of different biochemical/semiochemical factors of the hosts in deciding differential preference by *T. absoluta*.
Table 1. Life parameters of T. absoluta on different hosts* (Temperature 29±1°C and RH of 70±5%)

<table>
<thead>
<tr>
<th>Developmental stage</th>
<th>Host Plant</th>
<th>Tomato</th>
<th>Potato</th>
<th>Egg plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecundity (Eggs/Female)</td>
<td></td>
<td>81.75±13.49</td>
<td>41.8±14.34</td>
<td>19.45±9.11</td>
</tr>
<tr>
<td>Hatching (%)</td>
<td></td>
<td>84.6±3.20</td>
<td>75.47±5.28</td>
<td>52.44±2.5</td>
</tr>
<tr>
<td>Egg period (days)</td>
<td></td>
<td>3.75±1.11</td>
<td>5.10±0.78</td>
<td>6.10±0.91</td>
</tr>
<tr>
<td>1st Instar (days)</td>
<td></td>
<td>2.0±0.79</td>
<td>2.75±0.96</td>
<td>3.05±0.94</td>
</tr>
<tr>
<td>2nd Instar (days)</td>
<td></td>
<td>1.75±0.63</td>
<td>2.75±0.91</td>
<td>3.0±0.85</td>
</tr>
<tr>
<td>3rd Instar (days)</td>
<td></td>
<td>1.85±0.74</td>
<td>2.75±1.01</td>
<td>3.1±0.78</td>
</tr>
<tr>
<td>4th Instar (days)</td>
<td></td>
<td>2.35±0.98</td>
<td>3.2±0.76</td>
<td>5.15±0.93</td>
</tr>
<tr>
<td>Total Larval period (days)</td>
<td></td>
<td>7.95±3.14</td>
<td>11.45±3.64</td>
<td>14.3±3.5</td>
</tr>
<tr>
<td>Pupal period (days)</td>
<td></td>
<td>7.95±1.27</td>
<td>9.55±1.09</td>
<td>10.8±1.19</td>
</tr>
<tr>
<td>Total life cycle (days)</td>
<td></td>
<td>19.65±5.52</td>
<td>26.1±5.51</td>
<td>31.2±5.6</td>
</tr>
<tr>
<td>Male longevity (days)</td>
<td></td>
<td>14.9±1.65</td>
<td>9.75±1.16</td>
<td>7.55±1.31</td>
</tr>
<tr>
<td>Female longevity (days)</td>
<td></td>
<td>18.10±1.8</td>
<td>12.0±1.02</td>
<td>8.90±0.71</td>
</tr>
</tbody>
</table>

*Average of three generations

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