Influence of weather parameters on pheromone trap catches of Potato cutworm, *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae)

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Pheromone traps are used for sampling insects. The recent monitoring of insect pests is done by using the sex pheromones and it has been reported that these are very useful in determining the seasonal activity of pests (Singh and Sachan, 1991; Patil *et al*., 1992). Information obtained from pheromone trap collections can be used for development of models to predict the seasonal incidence of pests.

Environment can greatly affect the size of the trap catch by influencing both the activity of the insect as well as the relative performance of the trap. The interpretation of trap catch data is often difficult because of confounding affects of the environment and interaction between insect activity and trap performance (Dent and Pawar, 1988). If a consistent relationship exists, between trap catches and weather parameters; pheromone traps can be used to indicate when the field should be scored more intensively to determine the need to initiate IPM measures.

The potato growers of Karnataka indiscriminately apply insecticides to control many pests. The Potato cutworm *Spodoptera litura* (Fabricius) (Lepidoptera : Pyralidae) is a notorious pest which causes huge crop losses. Monitoring and mass trapping of this pest is very important in order minimise the pesticide load on crop as well as the environment. However, the growers are not confident of the efficacy of the non chemical tools since their efficacies are influenced by the weather parameters. Hence, the present study has been taken up to assess the per cent potato cutworm damage and influence of weather parameters on pheromone trap catches of cut worm.

The present investigation was carried out during, 2007-08 (kharif and rabi) in and around six villages of Bengaluru rural district which is situated between 130° 5’ Latitude and 77° 35’ Longitude with an average rainfall of 107.25mm distributed well from June to November with peak in July. The monthly mean maximum temperature varies from 36°C during April-May to 24°C during December. The relative humidity fluctuates between 73 % during March and 86 % during September.

The Pheromone traps and lures were obtained from Bio-Upest Management Private Limited (BPM), Bengaluru. The traps were setup in the selected fields of organic vegetable growers. The potato fields selected were not in a compact block/area and such each field with a crop was treated as a single unit. For instance potato planted at each date constituted a treatment. Such six fields each measuring 0.5 acres were selected in each village to place three traps. Of the three traps, one was placed at the centre and the other two 100m apart each in East-West direction as majority of the fields were lengthier than wide. The height of the traps was maintained at the point where fresh flesh of the plants was observed i.e. one foot above the crop canopy. Therefore,
total of 18 traps for 3 acres were used for the study. The lure was replaced once in three
weeks. A survey on potato fields (where traps were evaluated) was conducted to
determine the presence of different lepidopterous pests defoliating the potato
crop before installation of the traps. The observations on pests were recorded from
the time the pest occurred on the crop to the
time the crop attained senescence at every
week interval. The average of 18 trap
catches was used for analysis. The
meteorological data was recorded to
correlate with the trap catches. The data was
subjected to correlation and regression
analysis (Bowden and Morris, 1975).

The trap catches (21.30±
15.28moths/trap/week) of potato cut worm
were maximum (47.21moths/trap) during
37th standard week. There was no significant
difference in trap catches, but highly
significant difference in moth catches during
weeks and their interaction (Table 1). These
results are supported by the findings of
Lalita Kumari and Reddy (1992) and the
effectiveness was attributed to the trap
characteristics. The funnel width, height of
the funnel and funnel diameter and lure
components of the company influenced the
trap catches (Prasannakumar et al., 2009).
The performance of pheromone trap against
the pest at any region will vary due to the
influence of prevailing weather conditions
over there. The weather parameters viz.,
wind speed and evaporation influenced the
activity of the moths. The correlation matrix
on trap catches of potato cut worm exerted a
negative association with morning relative
humidity (r = -0.46); after noon relative
humidity (r = -0.45) and rainfall (r = -0.09)
and a positive relation with maximum
temperature (r = 0.07); minimum
temperature (r = 0.62); evaporation (r=0.26)
and wind speed (r=0.46).When the data was
subjected to regression analysis it revealed
that, none of these factors per se influenced
the trap catches (R^2=1.62) (Table 2). The
moths could not fly due to high wind speed
and they didn’t prefer to oviposit due to dew
drops on the plants (Gedia et al., 2007;
Prasannakumar et al., 2011). Besides, the
weather parameters had a negative impact
on the neonate larvae as well as the adult
emergence and their activity. The study
clearly suggested that the performance of
pheromone traps and lures will be
influenced by the weather parameters.

The damage by the potato cutworm,
S. litura was first observed during 44th
standard week (5.48%) and it increased as
the new flesh foliage developed and reached
the highest (7.68%) during 45th standard
week. However, it started to decline and
reached the lowest (0.94%) during 51st
standard week (Table 3). This increase in
trend was because of heavy vegetative
growth of the plants but the incidence later
decreased because of trap catches
(Prasannakumar, 2008). The results of the
experiments clearly suggested that there was
direct effect of trap catches on the field
incidence. Krishnaiah (1986) and Gedia et
al. (2007) reported that the trap catches was
maximum (215 moths/trap/week) in castor
ecosystem during November and concluded
that pheromone traps can be used as pest
suppression tool.

The data on per cent defoliation by
potato cutworm, S. litura and mean weather
parameters was subjected to simple
correlation analysis. The per cent defoliation
by potato cutworm, S. litura exerted a
negative association with morning relative
humidity (r = -0.80), afternoon relative
humidity (r = -0.72), rainfall (r = -0.50) and
positive relation with maximum temperature
(r = 0.30), minimum temperature (r = 0.44),
wind speed (r = 0.67), evaporation (r= 0.26).
However, there was a significant association found with morning relative humidity, evaporation and highly significant with afternoon relative humidity, wind speed and highly significant with morning relative humidity (Table 3). When the data was subjected to linear regression analysis it revealed that none of these factors per se influenced the incidence ($R^2 = -0.12$). It might be that combination of the chosen variables influenced the incidence (Table 3). These parameters not only affect the activity of the adults but also affect the development of neonate larvae in field conditions. These findings are further strengthened by the results of Mishra and Sontakke (1992) on castor in Orissa.

**CONCLUSION**

The study revealed that there was a significant difference in moth catches across weeks. The trap catches lowered the damage caused by the insect. However, the performance of the pheromone traps and lures and the activity of the pest were influenced by several weather factors especially maximum temperature, minimum temperature, evaporation and wind speed which had a positive effect on the trap catches as well as per cent defoliation done by the pest.

**ACKNOWLEDGEMENTS** : Authors are thankful to Rajanukunte villagers, Organic association of Bengaluru and Director of Research, UAS, Bengaluru.

**Table 1: Potato cut worm male moth catches at Rajanukunte, kharif, 2007-08**

<table>
<thead>
<tr>
<th>Standard Weeks</th>
<th>@Mean male moth number/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>31.10 (5.51)</td>
</tr>
<tr>
<td>37</td>
<td>47.21 (6.88)</td>
</tr>
<tr>
<td>38</td>
<td>19.31 (4.39)</td>
</tr>
<tr>
<td>39</td>
<td>39.31 (6.25)</td>
</tr>
<tr>
<td>40</td>
<td>9.10 (3.02)</td>
</tr>
<tr>
<td>41</td>
<td>16.38 (3.96)</td>
</tr>
<tr>
<td>42</td>
<td>2.91 (1.87)</td>
</tr>
<tr>
<td>43</td>
<td>5.13 (2.23)</td>
</tr>
<tr>
<td><strong>@@Grand Mean ± SD</strong></td>
<td><strong>21.30± 15.28</strong></td>
</tr>
</tbody>
</table>
Table 2: Potato cut worm moth catches and damage in relation to meteorological variables at Rajanukunte, rabi, 2007-2008

<table>
<thead>
<tr>
<th>Standard weeks</th>
<th>#Mean No. of moths/trap/week</th>
<th>**Damage (%)</th>
<th>Temperature (°C)</th>
<th>Relative humidity (%)</th>
<th>Wind speed (Km/h)</th>
<th>Evaporation (mm)</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max.</td>
<td>Min.</td>
<td>Morning</td>
<td>Afternoon</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>31.10</td>
<td>5.48</td>
<td>28.85</td>
<td>24.57</td>
<td>74.85</td>
<td>62.71</td>
<td>14.82</td>
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<td>45</td>
<td>47.21</td>
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<td>28.50</td>
<td>20.50</td>
<td>75.00</td>
<td>65.42</td>
<td>12.16</td>
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<tr>
<td>46</td>
<td>19.31</td>
<td>4.98</td>
<td>29.28</td>
<td>20.42</td>
<td>80.00</td>
<td>68.00</td>
<td>9.06</td>
</tr>
<tr>
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<td>3.06</td>
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<td>87.42</td>
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<tr>
<td>48</td>
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<td>2.13</td>
<td>26.07</td>
<td>19.92</td>
<td>86.14</td>
<td>75.42</td>
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<tr>
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<td>0.94</td>
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<td>20.00</td>
<td>84.28</td>
<td>74.00</td>
<td>6.54</td>
</tr>
</tbody>
</table>

Average of seven days; #Mean number of moths for seven days in two traps; R^2=1.6129; ** per cent damage of leaves on 10 plants for seven days; R^2=-0.1234
REFERENCES


[MS received 23 December 2011; MS accepted 11 March 2012]