October-November. The innate capacity for increase (rm) was 0.062311 while the finite rate of increase (λ) was 1.0643 females/day. The doubling time (DT) of the population was 11.89 days. The population could multiply 1.547 times per week (Table 4) which necessitate an effective monitoring and management in order to contain the pest effectively.

REFERENCES


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INFLUENCE OF WEATHER FACTORS ON RETAINABILITY AND EGG LAYING OF Chrysoperla carnea ADULTS UNDER COTTON ECOSYSTEM

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ABSTRACT

Retainability and egg laying of Chrysoperla carnea adults were observed over a period of 5 weeks under cotton ecosystem. Using weather factors, correlations and multiple regression analysis were worked out to identify the factors influencing the retainability and egg laying. Multiple correlation studies revealed that a significant positive association exist between the retainability and egg laying of the adults C. carnea under maximum relative humidity with aphid population and significant negative association was also observed with maximum temperature and wind speed. Hence, multiple regression analysis led to the conclusion that a decrease in maximum temperature increases the per cent retainability of C. carnea adults.

KEY WORDS: Chrysoperla carnea, cotton, weather parameters, correlations.
Chrysoperla carnea Stephens is an efficient predator of sucking pests and mites and tolerates some broad spectrum pesticides. This species is found on all crop ecosystem, forming 40 per cent of the total chrysopid population. The retention of this predator in crop ecosystem is influenced by weather parameters and prey population. The influence of weather factors viz., maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity, wind speed, sunshine hrs and prey population on retainability and fecundity of C. carnea was assessed and the results are presented in this paper.

MATERIALS AND METHODS

A field experiment with cotton was laid out in a randomised block design with a plot size of 5x4m². All agronomical practices were followed as per the crop production manual of Tamil Nadu Agricultural University. The treatments were replicated seven times. Laboratory cultured C. carnea adults were released during the flowering stage of the cotton crop @ 20 pairs per plot during the morning hours. Observations were recorded on number of adults retained on 20 sampled plants at random by tapping the sampled plants gently. The number of eggs laid by C. carnea adults on the same 20 sampled plants was also recorded. Data on important weather parameters were collected from the Meteorology Department. Prey population like aphid and leafhopper were also recorded on the sampled plants. Observations were continued daily for a period of 5 weeks. Correlation and multiple regression analysis were carried out using the variables as indicated in Table 1.

RESULTS AND DISCUSSION

Retainability of C. carnea on cotton

The multiple correlations worked out between retainability of C. carnea adults and weather factors and pest populations showed a significant positive association with maximum relative humidity (r=0.615) and aphid population (r=0.894) and significant negative association with maximum temperature (r=0.564) and wind speed (r=0.833). The other factors were non-significant (Table 1).

The partial regression co-efficient of maximum temperature had significant negative association and aphid population had significant positive association. The partial regression co-efficient of other factors was not significant (Table 2). The multiple regression analyses made between eight independent variables and retainability of C. carnea adults showed the prediction of $y_1 = 1654.17 - 65.089X_1 - 3.391X_2 - 0.000000001X_3 - 0.986X_4 + 0.000000001X_5 - 0.171X_6 + 24.449X_7 + 0.152X_8$.

The variation expressed by the equation was 92.30 per cent ($r^2 = 0.9230$). The regression equation fitted had a $r^2$ value of 0.923, explained

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Y1</th>
<th>Y2</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y1 Retainability (%)</td>
<td>1.000</td>
<td>-0.564**</td>
<td>-0.072NS</td>
<td>0.615**</td>
<td>0.098 NS</td>
<td>-0.833**</td>
<td>-0.245 NS</td>
<td>0.894**</td>
</tr>
<tr>
<td>Y2 Egg laying (NO)</td>
<td>1.000</td>
<td>-0.839**</td>
<td>0.253 NS</td>
<td>0.490**</td>
<td>-0.254 NS</td>
<td>-0.432**</td>
<td>-0.139 NS</td>
<td>-0.541**</td>
</tr>
<tr>
<td>X1 Max. Temp. (°C)</td>
<td>1.000</td>
<td>0.181 NA</td>
<td>0.491**</td>
<td>-0.259 NS</td>
<td>-0.623**</td>
<td>-0.164 NS</td>
<td>-0.598**</td>
<td>0.541**</td>
</tr>
<tr>
<td>X2 Min. Temp. (°C)</td>
<td>1.000</td>
<td>-0.128 NS</td>
<td>0.800**</td>
<td>0.255 NS</td>
<td>-0.910**</td>
<td>-0.181 NS</td>
<td>0.051 NS</td>
<td></td>
</tr>
<tr>
<td>X3 Max. Relative humidity (%)</td>
<td>1.000</td>
<td>-0.279 NS</td>
<td>-0.912**</td>
<td>-0.018 NS</td>
<td>0.658**</td>
<td>0.223 NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X4 Min. Relative humidity (%)</td>
<td>1.000</td>
<td>0.324 NS</td>
<td>-0.902**</td>
<td>-0.164 NS</td>
<td>-0.235 NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X5 Wind speed (Km/h)</td>
<td>1.000</td>
<td>-0.019 NS</td>
<td>-0.856**</td>
<td>-0.258 NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6 Sunshine (hours)</td>
<td>1.000</td>
<td>-0.031 NS</td>
<td>-0.024 NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X7 Aphid population (NO/20 plants)</td>
<td>1.000</td>
<td>-0.070NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X8 Leafhopper Population (NO/20 Plants)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

* Significant at 5 per cent level 0.325 ; ** Significant at 1 per cent level 0.418 ; NS Non significant
Table 2. Regression coefficient of weather factors, prey population and retainability of C. ceara adults (n=35)

| Variables                  | Mean  | Partial Regression Coefficient | Standard Error |  
|----------------------------|-------|--------------------------------|----------------|---
| X1 Maximum temperature    | 32.26 | -65.089                        | 1.1604         | -5.609**  
| X2 Minimum temperature    | 24.90 | -3.391                         | 1.917          | -1.769 NS  
| X3 Maximum Relative Humidity | 77.37 | -0.0000000001                  | 0.0002         | -0.000000 NS  
| X4 Minimum Relative Humidity | 46.89 | -0.986                         | 1.292          | -0.763 NS  
| X5 Wind speed             | 14.18 | -0.0000000001                  | 0.0002         | -0.000000 NS  
| X6 Sunshine hours         | 6.32  | -0.171                         | 0.133          | -1.290 NS  
| X7 Aphid population       | 37.00 | 24.494                        | 7.443          | 3.283**  
| X8 Leaf hopper population | 3.90  | 0.152                         | 0.590          | 0.258 NS  

Constant term: \( \alpha = 1654.17 \)

\( r^2 = 0.923; P(0.05) = 2.030; P(0.01) = 2.724; NS = Non Significant \)

that 92 per cent variation which existed in retainability of C. ceara could be attributed to 8 variables.

Egg laying by C. ceara

Multiple correlation worked out between egg laying by C. ceara and weather factors and pest populations showed a significant positive association with maximum relative humidity \( r = 0.490 \) and aphid population \( r = 0.541 \) and significant negative correlation with maximum temperature \( r = -0.839 \) and wind speed \( 0.432 \) (Table - 1).

The partial regression co-efficient of maximum temperature, maximum relative humidity and wind speed had significant positive association with egg laying by C. ceara adults. The other factors were not significant. The multiple regression equation, with eight independent variable to predict the egg laying of C. ceara on cotton was:

\[
\hat{y} = -440.62 + 6.166X_1 - 3.137X_2 + 3.586X_3
+ 0.0000000002X_4 + 2.814X_5 - 0.0000000003X_6
+ 0.145X_7 + 0.522X_8
\]

with a \( r^2 \) value of 0.90, explained the variation by the equation was 90 per cent. (Table 3).

The temperature played an important role in retainability and egg laying of C. ceara adults. The maximum temperature at the time of experiment was 32\(^\circ\)C which may not be favourable for the adults might be the reason for the poor retainability, eventhough the females might not have wasted their progeny and laid eggs on cotton plants. Beglyarov and Ushchekou (1977) also reported that the high temperature was not favourable for C. ceara. Zhao- Jingchao (1981) proved that the temperature between 28-30\(^\circ\)C was the most favourable to chrysopa for its oviposition. Very low temperature decreased the oviposition rate of chrysopa adults (Samson and Blood, 1979).

Table 3. Regression coefficient of weather factors, prey population on the egg laying of C. ceara adult (n=35)

| Variables                  | Mean  | Partial Regression Coefficient | Standard Error |  
|----------------------------|-------|--------------------------------|----------------|---
| X1 Maximum temperature    | 32.26 | 6.166                          | 0.644          | 9.579**  
| X2 Minimum temperature    | 24.90 | -3.137                         | 2.048          | -4.532 NS  
| X3 Maximum Relative Humidity | 77.37 | 3.586                          | 0.594          | 6.057**  
| X4 Minimum Relative Humidity | 46.89 | 0.0000000002                  | 0.000015       | 0.000015 NS  
| X5 Wind speed             | 14.18 | 2.814                          | 0.568          | 4.951**  
| X6 Sunshine hours         | 6.32  | 0.0000000003                  | 0.00000659     | 0.009034 NS  
| X7 Aphid population       | 37.00 | 0.145                          | 0.060          | 1.669 NS  
| X8 Leaf hopper population | 3.90  | 0.522                          | 0.400          | 1.363 NS  

Constant term: \( \alpha = 440.62 \)

\( r^2 = 0.90; P(0.05) = 2.030; P(0.01) = 2.724; NS = Non Significant \)
This study further revealed that aphid and leafhopper population positively correlated with retainability and egg laying of C. carnea adults. Similar correlation was obtained by Medina (1987) between chrysopid and whitefly population. Thakur et al., (1988) found that C. secundus population increased along with increasing population of woolly aphid, Eriosoma lanigerum longevity.

The negative correlation existed between the retainability and egg laying of C. carnea adults with wind speed might be due to the soft bodied and lighter weight nature of C. carnea adults, which might be driven away by the wind from the target area.

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INTERCROPPING SYSTEM CAN ENHANCE THE YIELD OF POTATO AND GROUNDNUT

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ABSTRACT

Field experiments were carried out during the winter seasons of 1989-91 at the University research farm, Mahanpur (W.B.) to find out the suitable cropping system of potato and groundnut in the Ganges plains of upland alluvial soil. It revealed that the sole crop yields of potato and groundnut were superior to the respective intercrop yield of the systems. Intercrops of potato and groundnut having 3:3 row arrangements maintained row to row 40 cm apart recorded moderate potato tuber equivalence (24.09 t/ha), highest land equivalent ratio (1.49) and maximum monetary advantage (Rs. 4,977/-) presumably due to the highest potato yield (12 t/ha) in the system. However, potato + groundnut intercrops having 2:2 row arrangements maintained 30 cm apart exhibited less advantage.

KEY WORDS: Cropping system, intercrops, potato tuber equivalence, Land equivalent ratio and monetary advantage

With the introduction of high yielding and short duration genotypes of field crops, the possibilities and opportunities of growing best compatible crops in mixed stand/intercropping has also increased. Growing of crop mixture is an age-old farm practice. It is undoubtedly a successful and profitable method which maintains the fertility of the soil (Bains, 1968). Practice of growing two or more crops together has been considered as a safeguard against total failure of any particular crop. The cropping systems like potato + groundnut as intercrops may be popularised as both the crops are valuable and needed to earthing up of the soil during growth period and harvesting time and can enrich the fertility status of the soil. Hence, an attempt was undertaken to find out a profitable crop mixture of potato and groundnut suitable for growing in the

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