Chapter 5

**Numerical Response of Rhynocoris marginatus feeding to different densities**

**MATERIAL AND METHODS**

Adults of *R. marginatus* collected from the different sites of Deoria agroecosystems, district Deoria, Uttar Pradesh and it were reared in the laboratory (temperature 29 ± 3°C; relative humidity 75 ± 5%; photoperiod 12 ± 2h) in plastic troughs (10L) on the larvae of rice meal moth, *C. cephalonica*. Newly emerged fourth nymphal instars of *R. marginatus* from the laboratory stock culture were randomly chosen for the experimental studies. Postembryonic developmental duration of IV and V nymphal instars of *R. marginatus* and percentage survival of the V nymphal instar and adult *C. spiniscutis* at various prey densities viz. 30, 60, and 120 prey/ 10 predators were calculated. Adult longevity and fecundity per female over life time was recorded for different prey density categories as an index of numerical response (Hagen, 1987). The age at which adult female commenced for oviposition and percentage hatchability and survival were also monitored. Analysis of variance (ANOVA) was computed to determine the influence of prey density categories on fecundity, hatchability, preoviposition period, stadiial period, survival and adult longevity, separately.

**RESULTS:**

The results in table1 showed that the effect of prey density on adult longevity, preoviposition period and total nymphs produced during the oviposition period. This parameter tended to increase with increasing prey density but this effect was not significant.

Fourth stadium of *R. marginatus* significantly did not differ due to different prey density treatment whereas the fifth stadium significantly different.

When the analyses were done on the basis of three preys density ranges (30, 60 and 120 larvae/day).  

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The results in table 10 showed that there was a positive relationship between the percentage of the survival of *R. marginatus*. The results in fig. 17 showed that the number of eggs laid per female predator at varying prey density exhibited curvilinear trend.

The fertility of *R. marginatus* increased with increasing prey density with a significantly longer oviposition period at the higher densities.

The oviposition period increased with increasing prey densities and reached in 14 days on low, 17 days on medium and 23 days on high prey densities. Furthermore, a shortage of prey also resulted in non-significant rate of reduction in the proportion of eggs hatched; this indicated that, percentage of the viability of eggs decreases when the prey density decreases.

The oviposition by adult females increased with prey density. They laid a maximum (101.19) eggs at the highest prey density (120) and minimum (67.72) at the lowest prey density (30). (Table 10) Pre-oviposition period was reduced with increase in prey density and ranged between 16.7±0.59, 16.97±0.54 and 13.48±0.61 days at a prey density of 30, 60 and 120 respectively.

**DISCUSSION:**

The density of prey is one of the factors influencing the searching efficiency of a predator (Holling 1959). In the numerical response the female of *R. marginatus* provided with different densities of prey laid more eggs at higher prey densities.

In order for a predator to control its prey, the predator has to exert an increasing percentage effect as the prey density rises (Sohrabi and Shishehbor, 2007). One of the ways by which a predator can vary its effect on the prey population is by change in number (Numerical response) (Solomon, 1949).

The increase in numerical response with increase in prey density could be attributed to the availability and increase food consumption hence the insect having enough food reserve and thus more energy was channelled in to reproduction (Price, 1975, Eveleigh and Chant, 1981).
The numerical response of *R. marginatus* to different densities of khapra beetle as prey was studied. Comparison of the mean number of eggs laid by the predator at different densities of prey showed that there were significant differences among number of eggs laid at various prey densities. In addition, adult longevity, adult fecundity and cumulative number of nymphs produced/ female also increased in proportion to the increase in prey density.

The effects of prey density on the numerical response of *R. marginatus* were in general agreement with the responses of other heteropteran predators fed at varying prey densities. In particular with *Anthocoris confusus* fed on the aphid, *Aulacorthum circumflexus* (Buckton) (Evans, 1976), and *Polidius maculiventris* fed on *Tenebrio molitor* L. (O’Neil, 1990) and *Podisus maculiventris* given low numbers of *Epilachna varivestis* Mulsant as a prey (Legaspi and O’Neil 1993, 1994). This results is similar to those of El Titi (1972), Stewart and Walde (1997) and Lucas and Brodeur (1999) where fecundity of *A. aphidimyza* females increased as a function of aphid density also increased. Madahi *et al* (2013) discovered that an increase in *A. gossypii* and *A. craccivora* density will result in longer longevity which in turn will lead to higher reproduction rates of *A. aphidimyza*.

The increased numerical response of *R. marginatus* at different prey densities may also be considered as a strong adaptive strategy to promote its progeny. It was concluded that high densities of khapra beetle influenced the overall reproductive performance, predation rate and numerical response of *R.marginatus*.

The result of this study implies that *R.marginatus* has the potential to be exploited as a biocontrol agent for the management of insect pest population.

**Table 10. The effect of increasing prey density on average fourth and fifth stadal periods, percentage survival, preoviposition period, fecundity per female, percentage of hatchability and adult longevity of *R.marginatus***.
<table>
<thead>
<tr>
<th>Prey density</th>
<th>Survival (%)</th>
<th>Stadial period (days)</th>
<th>Adult Longevity (days)</th>
<th>Preoviposition Period (days)</th>
<th>Fecundity (No. eggs per female)</th>
<th>Hatchability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>81.47±1.00</td>
<td>7.55±0.17</td>
<td>12.51±0.55</td>
<td>56.68±1.65</td>
<td>67.97±0.77</td>
<td>89.28±0.83</td>
</tr>
<tr>
<td>60</td>
<td>89.6±0.69</td>
<td>5.8±0.48</td>
<td>9.53±0.36</td>
<td>53.22±1.14</td>
<td>86.13±3.33</td>
<td>96.6±0.90</td>
</tr>
<tr>
<td>120</td>
<td>93.04±0.72</td>
<td>6.05±0.56</td>
<td>8.83±0.54</td>
<td>43.6±1.35</td>
<td>101.82±0.78</td>
<td>98.11±2.14</td>
</tr>
</tbody>
</table>

**FIGURE No. 17:** Effect of increasing prey density on the ovipositing period of adult female *R. marginatus.*

![Graph showing effect of prey density on survival, adult longevity, preoviposition period, fecundity, and hatchability.](image)
PLATE 18: fig A and B- Egg laying by adult female *R. marginatus* fig C- Rearing of predator.