# SEASONAL OCCURRENCE OF THE ECTOPARASITIC MITE *HEMIPTEROSEIUS INDICUS* ON THE RED COTTON BUG *DYSDERCUS KOENIGII* (HEMIPTERA: PYRRHOCORIDAE) IN WEST BENGAL

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ABSTRACT: The present study indicates the population fluctuation of *Hemipteroseius indicus* an ectoparasitic mite infesting Pyrrhocorid bug, *Dysdercus koenigii* under field condition. The population was high during summer months. Temperature had direct influence on population showing positive correlation, while rainfall did not have much influence on population dynamics of mites. Regarding male-female population, the both the male and female population attended peak during March, gradually decrease during April to August and becoming very low during winter months. The present communication reports the results thereof.

KEY WORDS: *Dysdercus konigii*, *Hemipteroseius indicus*, red cotton bug, seasonal occurrence.

Mites inhabiting insects show a great variety and unique types of associations like predatory, parasitic, commensalisms and phoretic. Hunter and Rossanio (1988) opined that insect-mite association may be opportunistic, possibly accidental. Among those, many of the predatory and parasitic mite species can be exploited judiciously for biological control against agri-horticultural and household pests as well as insects of medical importance. Mites of the family Otopheidomenidae (Acari: Mesostigmata) are ectoparasites of insects, primarily Hemiptera, Orthoptera and Lepidoptera and closely related to the Phytoseiidae (Krantz & Khot, 1962; Evans, 1963) although phytoseiids are usually predators. Little is known about the seasonal occurrence of this parasitic family. Only information is available in this aspect is on *Hemipteroseius adleri* (Lewandowski & Szafranek, 2005).

*Dysdercus koenigii* commonly known as red cotton bug, is an important pest of a member of field crops including cotton, okra, kapok, sorghum etc. causing economic loss to the growers. This insect is often seen as infested with one Otopheidomenis mite *Hemipteroseius indicus*, (a new species is currently reported on this host from India is *H. vikrami* as reported by Menon et al., 2011) generally occurs on porter's body and is known to suck haemolymph causing weakening and in some cases even death. Since, the mite has importance in biological control of the important pest (Banerjee & Dutta, 1980) and as because nothing is known about the seasonal occurrence of the mite species it was thought desirable to study the present aspect. Since, association of *Hemipteroseius indicus* with *Dysdercus koenigii* was regularly found as because these mites appear to be a parasite of red cotton bug having potentiality in biological control, it was thought desirable to find out population fluctuation of *Hemipteroseius* *indicus* on red cotton bug as well as the population variation of different stages and variation if any in sex ratio.

## MATERIAL AND METHODS

The experiment was carried out on cotton plant grown at the Ramakrishna Mission Ashrama garden, Narendrapur, South 24 Parganas, West Bengal. Monthly sampling was conducted on the cotton plant at the selected site between December 2008 and November 2009. The months were clubbed into four seasons *viz.* winter (December to February), summer (March to May), monsoon (January to August), post monsoon (September to November) to find out population fluctuation in different seasons. For counting of mite population, a total of 20 adult insects irrespective of sex were collected in a glass test tube from the cotton plant following which the insects were narcotized by placing a cotton ball soaked with Ether inside the test tube containing the insects. After narcotization the insects were taken out and examined under stereo binocular microscope (OLYMPUS, U-CMAD3, JAPAN) by placing those insects on Petri dish. All the stages of the mites (egg, immature and adult) were picked up with a fine brush soaked with alcohol and placed on a micro-slide in a drop of lactic acid. The collected stages of the mite were mounted irrespective of stages and sex and the species were confirmed according to Krantz & Knot (1962). Data on the number of stages of mites available and sexes along with meteorological data were recorded to find out seasonal fluctuation in the mite abundance vis-à-vis among the sexes.
Data obtained on the mite abundance, were subjected to one way factorial ANOVA using month as variable. The statistical analyses were performed following Zar (1999) using the SPSS ver. 10 software (Kinnear & Gray, 2000).

## RESULTS AND DISCUSSION

*Hemipteroseius indicus* were found abundantly on Red cotton bugs (*Dysdercus koenigii*) and its population was found throughout the year with seasonal and monthly fluctuation. The present study revealed that the mites were always found on adult host insect, *Dysdercus koenigii* and could never be collected from immature ones. All the developmental stages of the mite were observed on the host insect. In most cases they were found under the wings. However, in case of heavy infestation (where population ranged > 100), the mites were found in other body region also, like, dorsal surface of thorax as well as near the head; but they are never on the ventral surface. It is observed that the abundance of *H. indicus* is positively correlated with temperature and negatively correlated with relative humidity (Table 1).

At the onset of winter (December) the mean abundance of *H. indicus* was noted as 1.85 ± 0.39. As the winter sets in, with the further fall of temperature the mean population of the mite decreased substantially to 1.5 ± 0.62. With the increase of temperature in February the mite population started increasing (3.5 ± 1.31) and this trend of increase was prominent in March, when the population increased unusually and rapidly to 53.2 ± 15.89 per insect. This increase may be attributed to the fact that increase in temperature does have an effect on the relative abundance of the mite as revealed from the correlation matrix (Table1). During April to June, the mite population maintained a moderate level of abundance (Table 2). Rainfall was found to be negatively correlated with abundance of the mite and did not appear to have any marked influence on the population of insects and in turn the mite abundance (Table 1 and 2). This is further confirmed from the fact that from July onwards, though rainfall increased further but that did not cause any substantial reduction in mite population. However, from August onwards, (September, October and November) the mite population per insects (3.6 ± 0.61, 3 ± 0.84, 2.7 ± 1.08 and 2 ± 0.39 respectively) reduced substantially with the reduction of mean temperature (28.55°C, 28.49°C, 27.92°C and 22.71 respectively). So it is comprehensible that temperature has a prominent effect on the mite abundance. One way ANOVA on mite abundance taking months and rainfall as variables revealed significant difference between abundance, months and rainfall (Table 3 and 4). During the entire period of observation the population mostly dominated by immature stages; the dominance hierarchy was noted of the order : immature> adults> eggs (Figure 1 and 2). There was a prominent variation of mite population in four different seasons (Figure 2). In most of the months the eggs were sporadic similar to the observation of Lewandowski and Szafranek (2005). The population of mite were reasonably low during the winter period and the different stages were in the order of egg (2.15 ± 1.03) > adult (1.79 ± 0.63) > immature (0.83 ± 0.44). During summer the population of all the stages increased substantially, where the adult population was maximum (25.4 ± 13.2) followed by immatures (21.1 ± 10.7) and eggs (14.3 ± 4). During the monsoon months generally due to drain away of the mite from the surface of the leaves or fruits of the host plant (Rajakumar et al., 2005; Dhooria et al., 2005; Karmakar & Dey, 2006; Yadav & Manjunatha, 2007; Patil & Nandihalli, 2009) the mite population tends to exhibit a lower level. But in case of insect associated mites owing to their phoretic nature (Hunter, 1993) and their position on the ventral surface of elytra (Ramaraju & Mohanasundaram, 1999), under the hind wing (Chmielewski, 2006), under the proboscis (Boggs & Gilbert, 1987), ventral side of the abdomen (Ramaraju & Mohanasundaram, 1998) the rain shower have negligible chance to drain them away and thereby lower the population. This fact was also noted in the present study where among all the stages the adult was maximum (7.23 ± 3.17) followed by immature (5.9 ± 3.48) and eggs (4.7 ± 1.46). During post monsoon period the population trend of different stages (adult 3 ± 1.6 > immature 1.65 ± 0.95 > egg 1.35 ± 0.72) was more or less similar with monsoon whereas the total population decrement in post monsoon period followed the same pattern as in winter.

Among the adults, male and female abundance was more or less same in all the months (Fig. 3). However, male population was always observed to be lower than the females. Male and female population attended peak during March but males were present in lower numbers than females. Their occurrence was lowered during winter (December to February) as the total population also got reduced during this time. Lewandowski and Szafranek (2005) reported that the sex ratio (Female: Male) of the closely related species *H. adleri*, was more female biased in summer period. But it is markedly different from *H. indicus* where the sex ratio was found to differ with the months. The sex ratio was noted to be female biased all throughout the season; only female was observed in September but at the commencement of winter the ratio became 2:1 (Table 2). This difference in the sex ratio needs to be further explored in the background of their varying geographical location, environmental regulations, nutritional input, and inter-specific competition.

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Table 1: Correlation matrix of abundance, month, temperature rainfall and relative humidity.

| Correlation Matrix | | | | | |
|---|---|---|---|---|---|
| | MNTH | ABN | TEM | RF | RH |
| MNTH | 1 | -0.123 | -0.014 | **0.275** | **0.337** |
| ABN | -0.123 | 1 | **0.197** | -0.113 | **-0.141** |
| TEM | -0.014 | **0.197** | 1 | **0.381** | **0.302** |
| RF | **0.275** | -0.113 | **0.381** | 1 | **0.832** |
| RH | **0.337** | **-0.141** | **0.302** | **0.832** | 1 |

Table 2. Mean abundance of in *Hepimteroseius indicus* on red cotton bug (*Dysdercus koenigii*) in different months along with other meteorological data.

| Month | Mean abundance of mites + eggs per host ± SE | Mean Air Temperature | Mean R H(%) | Mean Rainfall | Sex ratio (Female: male) |
|---|---|---|---|---|---|
| December | 1.85 ± 0.39 | 21.65 | 75.39 | 0.003 | 2:01 |
| January | 1.5 ± 0.62 | 16.33 | 70.5 | 0 | 3:01 |
| February | 3.5 ± 1.31 | 25.09 | 61.76 | 0 | 1:01 |
| March | 53.2 ± 15.89 | 28.86 | 61.34 | 0.019 | 2:01 |
| April | 12.1 ± 5.18 | 32.64 | 62.78 | 0.003 | 2:01 |
| May | 13.25 ± 2.94 | 31.05 | 74.45 | 6.56 | 3:01 |
| June | 10.7 ± 3.02 | 31.86 | 76.52 | 3.78 | 3:01 |
| July | 9.95 ± 1.98 | 29.46 | 82.22 | 12.18 | 5:01 |
| August | 3.6 ± 0.61 | 28.55 | 81.56 | 8.28 | 3:01 |
| September | 3 ± 0.84 | 28.49 | 77.58 | 13.46 | Only female |
| October | 2.7 ± 1.08 | 27.92 | 75.16 | 1.43 | 7:01 |
| November | 2 ± 0.39 | 22.71 | 64 | 1.95 | 3:01 |

Table 3. One way ANOVA on mite abundance, taking months as variable. The F- value was significant at P>0.005.

| **Source** | **Type III Sum of Squares** | **df** | **Mean Square** | **F** |
|---|---|---|---|---|
| Corrected Model | 114573 | 11 | 10415.8 | 6.78182 |
| Intercept | 31579.2 | 1 | 31579.2 | 20.5616 |
| MONTHS | 114573 | 11 | 10415.8 | **6.78182** |
| Error | 350170 | 228 | 1535.84 | |
| Total | 464744 | 239 | | |

Table 4. One way ANOVA on mite abundance, taking rainfall as variable. The F- value was significant at P>.005

| **Source** | **Type III Sum of Squares** | **df** | **Mean Square** | **F** |
|---|---|---|---|---|
| Corrected Model | 51005.1 | 9 | 5667.23 | 3.15045 |
| Intercept | 18020 | 1 | 18020 | 10.0174 |
| RAINFALL | 51005.1 | 9 | 5667.23 | **3.15045** |
| Error | 413739 | 230 | 1798.86 | |
| Total | 464744 | 239 | | |

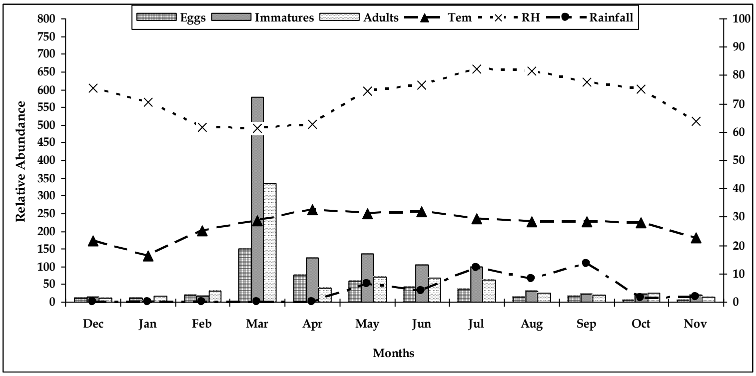


Figure 1. Monthly variation of *Hepimteroseius indicus* along with different environmental factors.

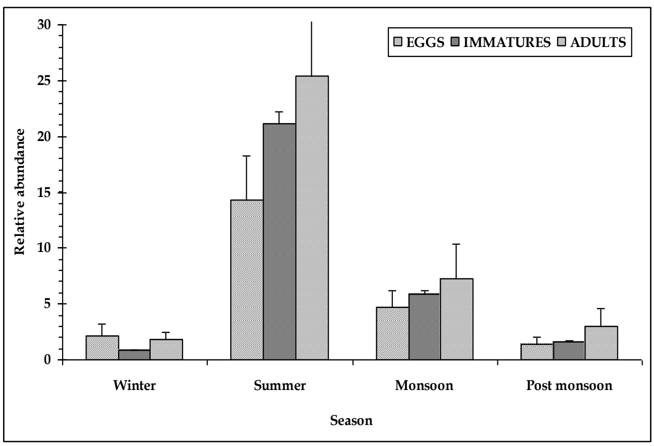


Figure 2. Seasonal variation of *Hepimteroseius indicus* population.

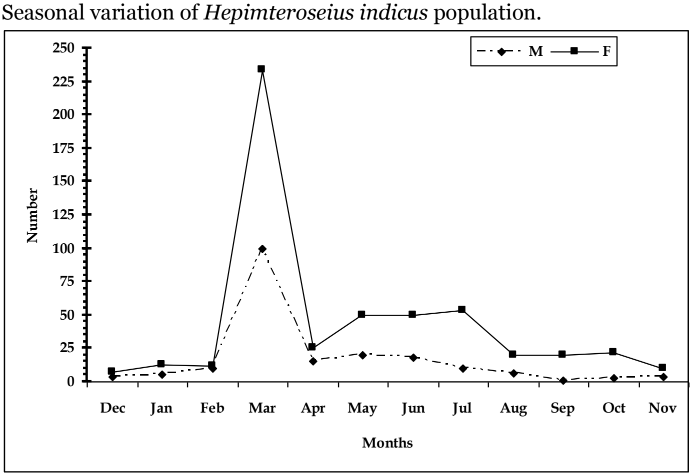


Figure 3. Variation in male and female population of *Hepimteroseius indicus*.