



Population Dynamics of Coconut Root (Wilt) Vector, *Stephanitis Typica* (Distant) in Relation to Abiotic and Biotic Factors and its Significance in the Management of the Vector

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Abstract

The lace bug, *Stephanitis typica* (Distant) is one of the proved vectors of coconut root (wilt) disease caused by phytoplasma. Root (wilt) disease causes an annual loss of 968 million nuts in Kerala resulting in an economic loss of rupees 3000 million. *S. typica* is persistent on coconut and its population shows variation during different seasons. Hence investigations on the population dynamics were carried to assess the peak period of abundance. The natural enemy fauna associated with the vector was also recorded during the experimental period. The studies were carried out for a period of two years during 1997-1999 at Ayirathengu in Kollam district. The vector population showed two distinct peak in July and November. The lowest population was observed in March. Analysis of the data revealed that the population had a negative correlation with temperature and sunshine and a positive correlation with rainfall and relative humidity. Observations on the incidence of natural enemies showed the presence of the mirid predator, *Stethoconus praefectus* Distant and species of spiders viz. *Phidippus. Marpissa*, *Oxyopes*, *Chieracanthium*, *Clubiona* and *Tetragnatha*. There existed a positive correlation between the vector and natural enemy population alike. Cataloguing of the natural enemies revealed that majority were polyphagous predators. However, the mirid predator, *S. praefectus* which is host specific, can be utilized in the biological suppression of *S. typica* by augmentative release of the predator.

Introduction

Root (wilt) disease caused by phytoplasma is a debilitating disease of coconut palm in India resulting in severe yield loss. The disease is prevalent in a contiguous manner in eight southern districts of Kerala. The estimated annual loss due to this malady comes to the tune of 968 million

nuts resulting in an economic loss of 3000 million rupees. The lacebug, *Stephanitis typica* (D.) (Heteroptera : Tingidae) is one of the proved vectors of coconut root (wilt) disease (Mathen *et al.*, 1990). Besides the insect has the status of a minor pest also. Both adults and nymphs of *S. typica* feed from the lower surface of coconut leaflets resulting in the production of chlorotic spots on the upper surface.

Spraying with insecticides such as 0.05% carbaryl or 0.01% endosulfan or monocrotophos (Nair *et al.*, 1994; Borad *et al.*, 1993) checked the population of *S. typica* in the field. Many natural enemies particularly predators are found devouring considerable amount of both immature as well as adult stage of the vector in field (Sathiamma *et al.*, 1998; Nair *et al.*, 2000). Mathen and Kurian (1972) has studied the life history and predatory habits of the mirid, *Stethoconus praefectus* a potential predator of lacebug.

Seasonal abundance of the population of *S. typica* in coconut garden has been studied by Mathen *et al.*, in 1968. Variations have been observed in the population abundance of the vector in recent years in various locations. Hence in the present investigation an attempt was made to elucidate the population dynamics of lacebug in relation to abiotic and biotic factors thereby judging their role in the management of *S. typica*.

Materials and Methods

The study was conducted during 1997-1999 in a coconut garden at Ayirathengu, Kollam district. Monthly observations were recorded on the population abundance of *S. typica* and its natural enemies on 40 young coconut palms. Population estimation of the lacebug and its natural enemies were recorded as per the technique proposed by Mathen *et al.*, in 1973. Data on abiotic factors viz., temperature, rainfall, sunshine and relative humidity were also recorded. The data were analysed statistically to work out the correlation. The biology and the predator potential of the specific predator of lacebug, *Stethoconus praefectus* and the spider, *Oxyopes shweta* Tikader were studied in laboratory at a temperature of 26-33^o and relative humidity 77-93 per cent by providing lacebugs as host. Mass multiplication trials of the mirid predator were also conducted in laboratory on different foods.

Results and Discussion

The average monthly population of lacebug and natural enemies along with the meteorological factors are given in Table 1. The lacebug population showed two distinct peak in July and November. A corresponding increase in the population of natural enemies has also been observed in July (Fig. 1). However no such increase

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in the natural enemy population was observed in the second peak in the November. Both lacebug and natural enemy population was minimum in March.

Correlation of the various abiotic factors with the population of lacebug and natural enemies (biotic factors) are given in Table 2. The abundance in lacebug population is negatively correlated to maximum temperature, minimum temperature and sunshine, while with relative humidity and rainfall, the correlation is positive. The vector population showed declining trend when these factors are unfavourable (Fig. 1-4). In July, the

vector population was high favoured by low temperature, less duration of sunshine (ie. cloudy weather), high relative humidity and well distributed rainfall. Another peak abundance of the vector has occurred in November favoured by low temperature, well distributed rainfall, low sunshine and high relative humidity (Fig. 3 and 4). The influence of rainfall on the population of lacebug is very critical. It is observed that wider distribution of rainfall in a particular time is influencing the lacebug population rather than the total rainfall pattern in the two population peak (Fig. 4). Mathen et al., in 1968 noticed two

distinct period of peak abundance in the lacebug population one in March - April - May and another in September - October and favoured by temperature and sunshine. But in the present study the two peaks are observed in July and November. From the data it is evident that cloudy weather with less of sunshine hours, a fairly high relative humidity above 95 per cent, well distributed rainfall and temperature range between 23 and 32°C are very congenial for abundance of lacebug population.

Similarly the population of the mirid and spiders are negatively correlated to maximum temperature, minimum temperature and sunshine and showed positive correlation to relative humidity and rainfall. Correlation between the natural enemies and the vector showed positive relation between each other (Table 3). The distribution of the vector and its natural enemies on coconut palm exhibited a definite pattern with their number increasing from the outer to the inner leaves. Their populations are seen in greater numbers in the middle leaflets of each leaf than at either end. In field, always there occurred a higher population of nymphs than the adult of the lacebug. As the population of the host increased, a corresponding increase in the population of natural enemies have also been occurred.

The natural enemy fauna found associated with the lacebug in the study area comprised of the mirid, *Stethoconus praefectus* and different species of spiders (Table 4). Spiders represent the dominant group. *Oxyopes shweta* was observed as the common species hunting on considerable number of lacebugs in field than others. It showed an egg to adult period of 84.0±6.68 days in laboratory. During the nymphal period a single male spider consumed 398-592 lacebugs whereas a female consumed 666-902 lacebugs in laboratory. Likewise the feeding potential of adult male and

Table 1. Average monthly population of lacebug and natural enemies in relation to meteorological factors

| Month | Lacebug | Mirid | Spider | Max Temp | Min Temp | RH | Rainfall | Sun Shine |
|-------|---------|-------|--------|----------|----------|-------|----------|-----------|
| Jan | 170.00 | 5.50 | 24.00 | 33.45 | 21.05 | 93.50 | 13.00 | 9.05 |
| Feb | 104.00 | 0.00 | 17.50 | 34.20 | 22.50 | 93.00 | 5.20 | 9.55 |
| Mar | 89.00 | 20.00 | 9.50 | 35.30 | 23.85 | 94.00 | 27.65 | 9.60 |
| Apr | 232.50 | 0.00 | 17.50 | 33.85 | 24.40 | 92.50 | 217.75 | 7.90 |
| May | 148.00 | 2.00 | 17.00 | 32.10 | 24.45 | 95.00 | 331.20 | 5.80 |
| June | 199.00 | 4.00 | 16.50 | 31.25 | 23.65 | 94.50 | 395.20 | 5.40 |
| Jul | 1227.00 | 21.50 | 61.50 | 30.55 | 23.40 | 96.00 | 413.75 | 4.45 |
| Aug | 365.00 | 5.50 | 49.50 | 30.55 | 23.60 | 96.00 | 363.65 | 5.45 |
| Sep | 241.50 | 1.50 | 34.50 | 30.80 | 23.55 | 95.50 | 416.80 | 5.80 |
| Oct | 265.50 | 0.50 | 21.00 | 31.50 | 23.30 | 95.00 | 414.45 | 6.45 |
| Nov | 1303.00 | 1.50 | 19.50 | 31.65 | 23.25 | 95.50 | 197.30 | 6.45 |
| Dec | 182.00 | 1.00 | 18.50 | 32.60 | 22.50 | 94.50 | 106.45 | 6.80 |

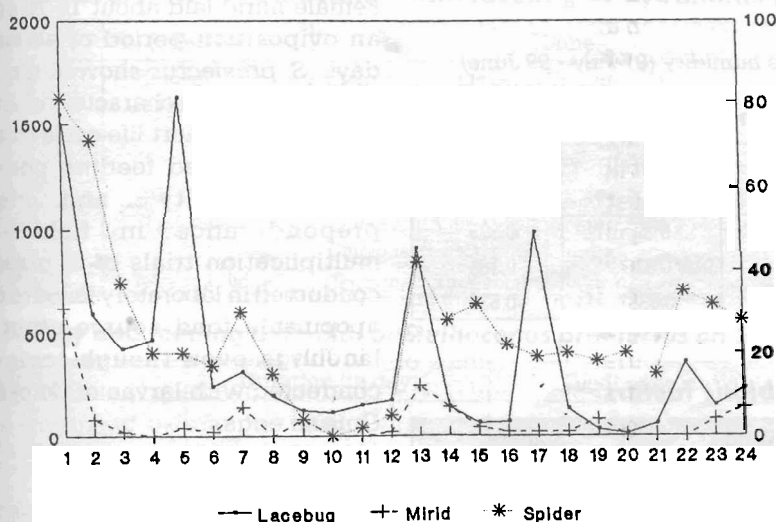


Fig. 1. Population of lacebug and natural enemies (97 July - 99 June)

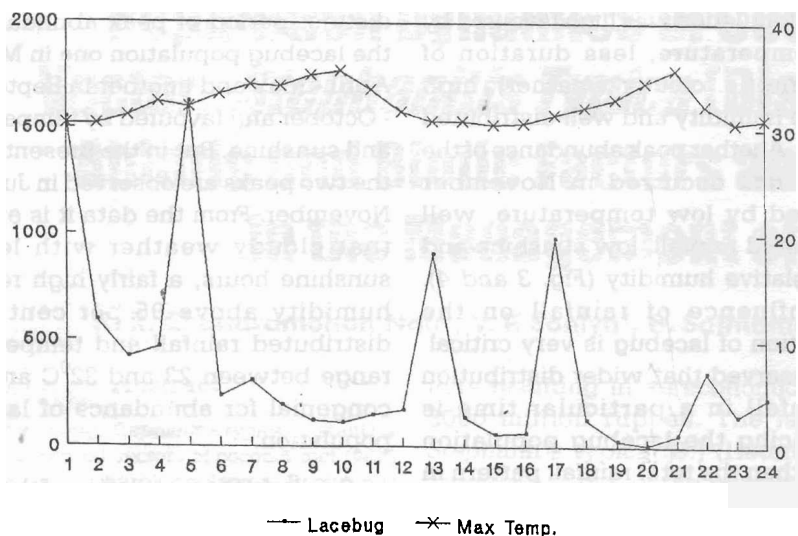


Fig. 2. Population of lacebug in relation to Max. Temperature (97 July - 99 June)

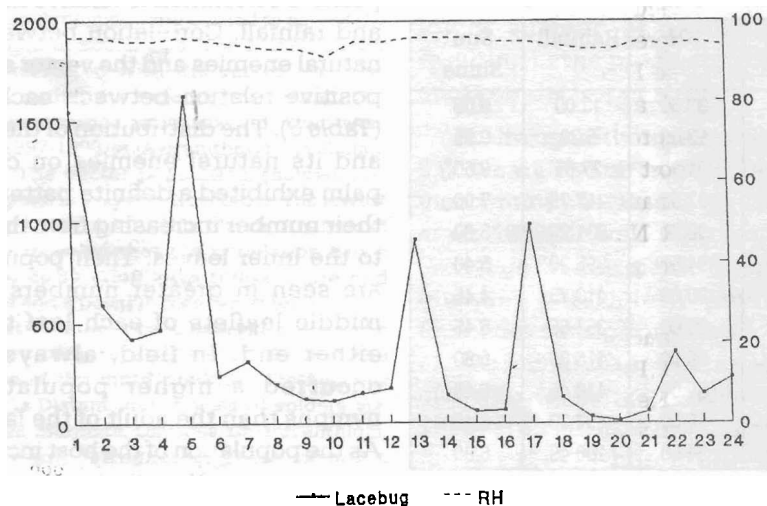


Fig. 3. Population of lacebug in relation to Relative humidity (97 July - 99 June)

Table 2. Correlation between biotic and abiotic factors

| Biotic factors | Max. Temp. | Min. Temp. | R.H | Rainfall | Sunshine |
|----------------|------------|------------|---------|----------|----------|
| Lacebug | -0.362 | 0.036 | 0.486** | 0.324 | -0.335 |
| Mirid | -0.375 | -0.070 | 0.333 | 0.389 | -0.385 |
| Spiders | -0.622* | -0.148 | 0.537 | 0.536* | -0.538 |

* Significance at 1% level (p=0.01) ** significance at 5% level (p=0.05)

Table 3. Correlation between biotic factors

| | Lacebug | Mirid | Spiders |
|---------|---------|--------|---------|
| Lacebug | - | 0.567* | 0.520* |
| Mirid | 0.567* | - | 0.708* |
| Spiders | 0.520* | 0.708* | - |

* Significance at 1% level (P=0.01)

female spider comprised of 8-23 and 13-32 lacebugs per day respectively.

Eventhough many species of spider are found associated with lacebug colonies and showed high feeding potential, they cannot be recommended for the biological suppression of the root (wilt) vector as they are polyphagous and have a prolonged life cycle. The biology and feeding potential of some of the commonly occurring spiders in coconut ecosystem have been revealed by Sathiamma *et al.*, in 1986. They studied the biology and feeding potential of *Rhene indicus* and *Chieracanthium* sp. in laboratory on *Opisina arenosella* larvae and their ability in biological suppression of the same has been discussed.

S. praefectus, the mirid predator is another potential natural enemy associated with lacebug in the field. The duration of different nymphal instars and average feeding potential of each instar of the mirid predator, *S. praefectus* is given in Table 5. It showed a developmental period of about 15-17 days. A single mirid nymph consumed about 52-67 lacebugs. The adult male and female showed a longevity of 9.0 ± 5.41 and 26.5 ± 12.13 days respectively. Adult mirid consumed 5.2 ± 0.94 lacebugs/day. Female mirid laid about 16-70 eggs in an oviposition period of about 8-25 days. *S. praefectus* showed a number of advantageous characters of an ideal predator viz., short life cycle (than the host), increased feeding potential, swift activity and female preponderance in field. Mass multiplication trials of *S. praefectus* conducted in laboratory failed to obtain a suitable food source other than lacebugs even though tests were conducted with larvae of *Corcyra* and *Opisina* eggs.

Conclusion

The mirid predator, *S. praefectus*, a specific and potential predator of lacebug in field can be used as

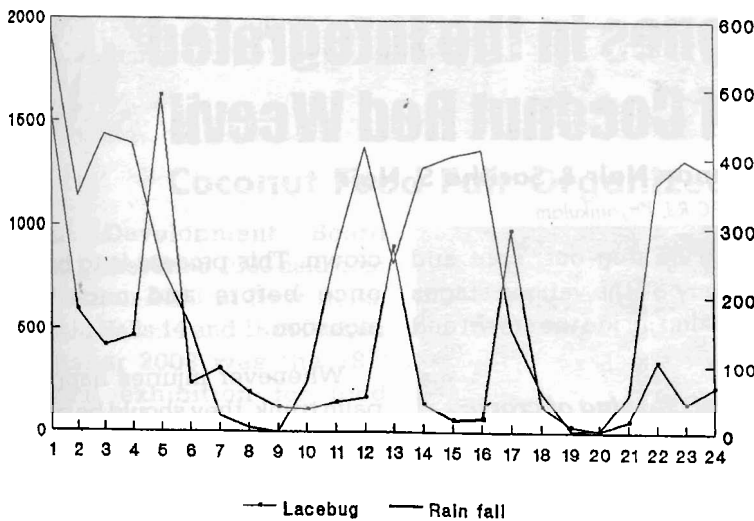


Fig. 4. Population of lacebug in relation to rain fall (97 July 99 June)

of banana lacewing bug, *Stephanitis typicus*, Gujarat Agri. Uni. Res. J. 19 (1) : 146-147.

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promising biocontrol agent. Being it an ideal predator, it can play a significant role in the vector suppression of coconut root (wilt) disease. But more studies are necessary to find out a suitable and easily available natural host or artificial food if any for the predator thereby enable to make augmentative release of it for suppression of *S. typica* thus reducing the incidence of the great malady of coconut, the root (wilt) disease, in India.

Table 4. Natural enemies associated with lacebug at Ayiramthengu

| Order | Family | Name |
|----------------|---|---|
| Heteroptera | Miridae | <i>Stethoconus praefectus</i> Distant |
| Araneae | Salticidae | <i>Phidippus bengalensis</i> Tikader |
| | | <i>Phidippus</i> sp. |
| | | <i>Marpissa tigrina</i> Tikader |
| | | <i>M. anusae</i> Tikader and Biswas |
| | Oxyopidae | <i>Oxyopes shweta</i> Tikader |
| | Clubionidae | <i>Chieracanthium melanostoma</i> (Thorell) |
| | | <i>Clubiona drassodes</i> (Cambridge) |
| Tetragnathidae | <i>Tetragnatha andamanensis</i> Tikader | |

Table 5. Biology and feeding potential of *Stethoconus praefectus* on *S. typica*

| Instar | Duration (in days) | Feeding potential |
|--------|--------------------|-------------------|
| I | 1.7 ± 0.47 | 9.5 ± 1.39 |
| II | 2.3 ± 0.44 | 8.0 ± 1.25 |
| III | 1.5 ± 0.49 | 11.0 ± 1.75 |
| IV | 1.4 ± 0.50 | 11.0 ± 2.33 |
| V | 2.8 ± 0.40 | 18.7 ± 2.20 |