Seasonal incidence of economically important coccid pests in Tamil Nadu

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Abstract: Scale insects (Coccoidea) are amongst the most destructive pests of horticultural crops in India. More than six hundred species have been recorded to-date. A survey, conducted in 2006-2007, found that five species (*Phenacoccus solenopsis* Tinsley, *Coccidohystrix insolita* (Green) and *Rastrococcus iceryoides* (Green) (Pseudococcidae), *Cerococcus indicus* (Maskell) (Cerococcidae) and *Saissetia coffeae* (Walker) (Coccidae)) were the most frequent scale insect pests on parthenium, cotton, hibiscus and crotons in Coimbatore, Tamil Nadu. Our survey showed that the mealybugs were most abundant during May, the cerococcid population was present between October and February, while *S. coffeae* was present throughout the year but most abundant in February and March. Studies correlating the seasonal incidence of each species with weather factors found that, for mealybugs, abundance was negatively correlated with rainfall and evening relative humidity. Reasons for these correlations are discussed in this paper.

Key words: Coccids, *Mangifera indica, Pongamia glabra, Parthenium hysterophorus, Gossypium sp., Hibiscus*, seasonal incidence.

Introduction

Scale insects (Coccoidea) infest a wide variety of host plants – indeed, perhaps no plant species is free from attack from one or other of these insects (Suresh, 2000). About 630 species of coccoids have been recorded from India, approximately 10% of world's known scale insect species. Among them, the two-tailed mealybug, *Ferrisia virgata* (Cockerell); the grapevine mealybug, *Maconellicoccus hirsutus* (Green); the citrus mealybug, *Planococcus citri* (Risso) and the coconut mealybug *Pseudococcus longispinus* Targioni Tozzetti, and *Rastrococcus iceryoides* (Green), are all notorious worldwide, the latter causing heavy damage to many of the horticultural crops in India. Yield losses due to scales and mealybugs of between 2 and 60 per cent have been reported in India. Many studies have been carried out on the seasonal incidence in different parts of India and other regions of the world.

During April 2006, a mealybug (here believed to be *Phenacoccus solenopsis* Tinsley) was reported on *Parthenium hysterophorus* for the first time. Subsequently, it has been recorded on many crops, including cotton. Simultaneously, reports were received on the occurrence of mealybugs on cotton from almost every state in India, with *P. solenopsis, P. solani* Ferris and *Ferrisia virgata* (Cockerell) (known as *Ferrisia malvastra* McDaniel in India) noted as a species complex in various States. As there are no data on the seasonal incidence of these new coccid pests and their natural enemies in India, the present study on the seasonal incidence of some economically important coccoids in Tamil Nadu was undertaken.

Materials and methods

Study insects

The following scale insects and crops were surveyed: *Rastrococcus iceryoides* on *Pongamia glabra* and *Mangifera indica*; *Phenacoccus solenopsis* on *Parthenium hysterophorus*, *Gossypium hirsutum* and *Hibiscus rosa-sinensis*, and *Saissetia coffeae* (Walker) on *Coccinea indica* and *Tabernaemontana sp.*

Methodology

Population counts on the number of adults present on a 5cm long twig or terminal leaf surface were made on ten randomly-selected plants at monthly intervals from March 2006 to June 2007. The seasonal incidence of each pest was then correlated with various weather parameters, namely: maximum and minimum temperatures, relative humidity (RH), rainfall, number of rainy days and sunshine hours. Multiple regression analyses were then carried out on these data.

Results and discussion

Seasonal incidence

Phenacoccus solenopsis (Figure 1)

The population density on cotton varied from 0 to 20 per 5cm twig, with a peak population between April and May. On hibiscus, the population was moderate and the incidence extended to August; while on parthenium, the population was present throughout the year with a peak about July in 2006 (but not in 2007).

Rastrococcus iceryoides (Figure 2)

This is an emerging pest and was recorded on a few crops. On mango, the first peak incidence was noticed between March and May, with a second peak during December to February but it remained low throughout the survey period on *Pongamia glabra*.

Coccidohystrix insolita (Figure 3)

Populations quite large between May and November but absent for most of the rest of the survey period.

Cerococcus indicus (Figure 4)

Populations were quite large between October and February, but absent for most of the rest of the survey period.

Saissetia coffeae (Figure 5)

Present throughout the year, with a peak during February/March. On *Coccinea indica*, the population ranged from 3-37/5cm of vine and between 0-20/5cm twig on *Tabernaemontana* sp.

Correlation studies (Table 1).

P. solenopsis

On parthenium, for every unit increase in maximum temperature, evening relative humidity, rainfall there was a significant population reduction (P=0.05) (8.9, 0.46, 0.96 units, respectively). However, with each unit increase in sunshine hours, there was a population increase by 4.6 units.

However, on cotton, only evaporation had a significant correlation, with a reduction of 5 units per unit increase in evaporation. On hibiscus, for every unit increase in morning RH, the population decreased by 1.99 units, while for every unit increase in rainy days, the population increased by 8 units

These results are somewhat similar to the findings of Rao *et al.* (1993), who reported that tukra incidence due to Maconellicoccus hirsutus (Green) in West Bengal was greatest during the summer and monsoon periods, when high temperature (above 30°C) and high humidity (above 70%) prevailed in that area, supported by intermittent pre-monsoon and

monsoon rains. Our results are also similar to those of Manjunath (1985) and Mani & Thontadarya (1988b), who reported that the mealybug, *Maconellicoccus hirsutus* (Green) became active from January onwards when grape-bunch formation started, reaching a peak in March-April, just before harvesting.

The low *P. solenopsis* population on parthenium and its absence on cotton and hibiscus during October may be due to high rainfall coupled with high RH. Heavy rains during the monsoon period have been previously reported to wash away mealybugs and thus drastically lower the incidence during the winter months (Mukherjee, 1919; Sirharan *et al*., 1979; Shree & Boraiah, 1988 – all on mulberry).

R. iceryoides

On mango, weather factors appeared to have had no significant effect on the mealybug population, but on *Pongamia glabra,* for every unit increase in evening RH and rainfall, there was a 0.05 unit population reduction. On the other hand, every unit of sunshine hours increased the population by 3.93 units.

R. iceryoides population was high on *M. indica* between March and May in 2006, but none appeared to be present on this host during this period in 2007.

S. coffeae

On coccinea, the population increased by 1.7 units due for each unit increase in morning RH, while each unit increase in the number of rainy days decreased the population by 7.9 units. However, on *Tabernaemontana* sp. there were no correlations with weather factors.

Correlation studies by Chatterjee *et al*. (2000) on *Citrus reticulata* Blanco in Darjeeling indicated a positive association between maximum temperature, relative humidity and rainfall, but an inverse relationship with minimum temperature. In our study, there was no significant relationship with max or min temp and it was negatively correlated with rainfall.

C. indicus

There were no significant correlations with weather parameters.

C. insolita

C. insolita was significantly influenced by morning RH and rainfall. For every unit increase in morning RH and rainfall, the population decreased by 1.62 and 0.94 units respectively. The results of the present study on brinjal (*Solanum melongena*) agree with the findings of Suresh (1994), who also reported a significant negative correlation between the maximum temperature and the population of *Cerococcus.*

Discussion

The studies on seasonal incidence indicated that there were definite correlations between the occurrence of the coccids and some weather parameters. Thus, high rainfall was found to reduce mealybug populations (*P. solenopsis* on parthenium; *R. iceryoides* on *Pongamia* and *C. insolata* on *Solanum* sp.). Similar findings were reported by Mukherjee (1919), Sirharan *et al*. (1979) and Shree & Boraiah (1988) who all found that *M. hirsutus* populations on mulberry were greatly reduced during the monsoons.

The present study also showed that maximum temperature had a negatice correlation for *P. solenopsis,* and relative humidity had significant negative correlations on mealybug populations, i.e. morning RH correlations: *P. solenopsis* on *Hibiscus* and *C. insolita* on *Solanum*; and evening RH correlations: *P. solenopsis* on parthenium and *R. iceryoides* on

Pongamia). These results agree with those of Ali (1957), who reported that high humidity had an adverse effect on egg hatch of *Nipaecoccus viridis* (Newstead) (as *Pseudococcus vastator* Maskell) even under high temperature conditions.

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Table 1. Multiple correlation and regression analyses of coccid population on various host plants.

Coccids - Host plant	Correlation regression equations
Phenacoccus solenopsis	
Parthenium hysterophorus	179.93 + -8.96X_1**+ 4.92X_2 + 0.61X_3 + -0.46 X_4 * + -0.96 X_5 *+ 0.20 X_6 + 4.59X_7* + -4.16X_8
Gossypium hirsutum	49.62 + 0.92X_1 + 0.53 X_2 + -0.92 X_3 + 0.06 X_4 + - 0.09X_5 + -4.99X_6 + 2.99 X_7 + -4.97X_8*
Hibiscus rosa-sinensis	112.99 + 0.89X_1 + 0.32 X_2 + -1.99 X_3* +- 0.05 X_4 + - 0.08 X_5 + 7.96X_6* + 3.56X_7 + -5.62X_8
Rastrococcus iceryoides	
Mangifera indica	51.96 + 1.32X_1 +- 0.68 X_2 + -0.96 X_3 + 0.52 X_4 + - 0.21X_5 + 2.95X_6 + 2.42X_7 + -4.93X_8
Pongamia glabra	91.36 + 1.99X_1 + - 0.38X_2 + -1.96X_3 + -0.05 X_4 * + -0.05 X_5 *+ 2.66 X_6 + 3.93X_7* + -6.91X_8
Saissetia coffeae	
Coccinia indica	-29.62 + -4.13X_1 + 1.92X_2 +1.73X_3 *+ -0.99 X_4 + 0.96X_5 + -7.93X_6* +- 2.99X_7 + 2.94X_8
Tabernaemontana sp	21.3 + -0.62X_1 + 0.69X_2 + -0.93X_3 + -0.64 X_4 + - 0.04 X_5 + 2.96X_6 + 0.94 X_7 + -1.96X_8
Cerococcus indicus	
Hibiscus rosa-sinensis	19.96 + -1.99X_1 + 0.98 X_2 + -1.94 X_3 + 0.19 X_4 + - 0.56 X_5 + 9.65X_6 + 5.59X_7 + -6.29X_8
Coccidohystrix insolita	
Solanum melongena	39.66 + 2.56X_1 + 0.45 X_2 + -1.62 X_3* + 0.47 X_4 + - 0.94X_5*+ -6.83X_6 + 2.99 X_7 + -4.99X_8

*Significant at P = 0.05 ** Significant at P = 0.01

X_1 - Maximum Temperature (°C)
X_2 - Minimum Temperature (°C)
X_3 - RH % (Morning)
X_4 - RH % (Evening)
X_5 - Rainfall in mm
X_6 - Number of rainy days
X_7 - Sunshine Hours (No.)
X_8 - Evaporation (mm)

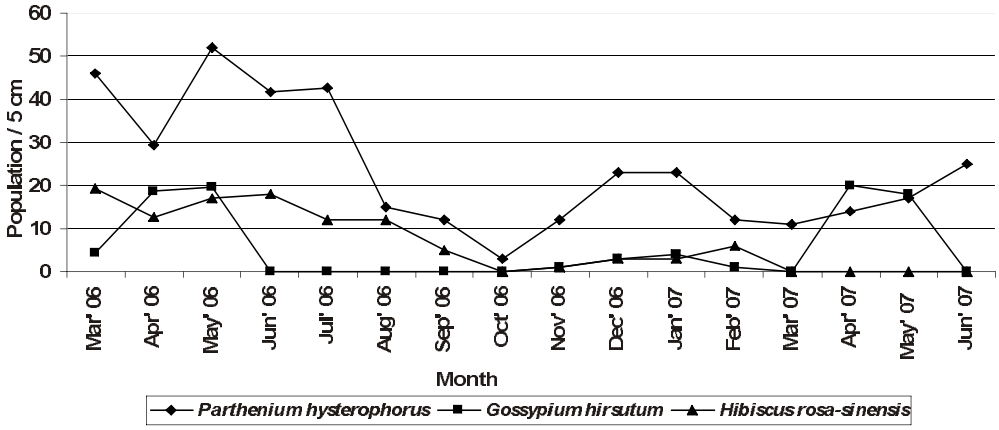

Figura 1. Seasonal incidence of *Phenacoccus solenopsis* (Tinsley).

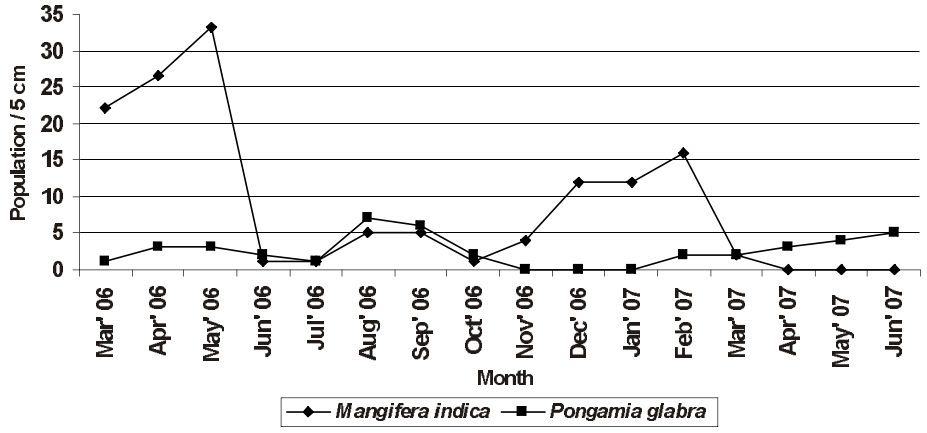

Figure 2. Seasonal incidence of *Rastrococcus iceryoides* (Green).

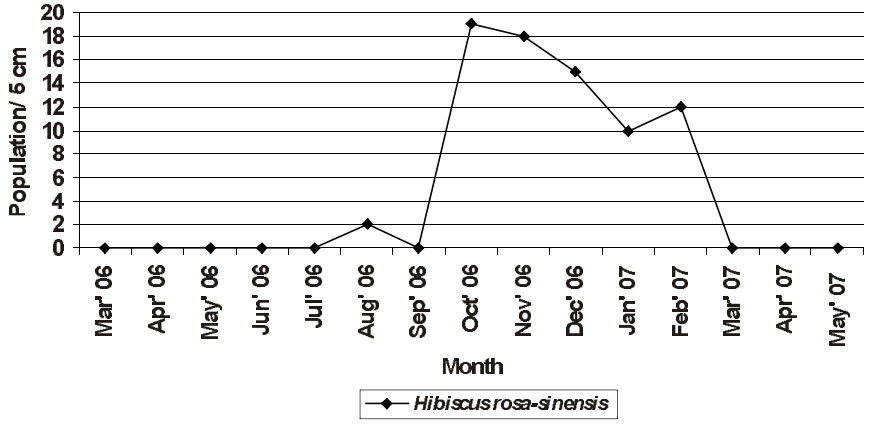

Figure 3. Seasonal incidence of *Cerococcus indicus* (Maskell).

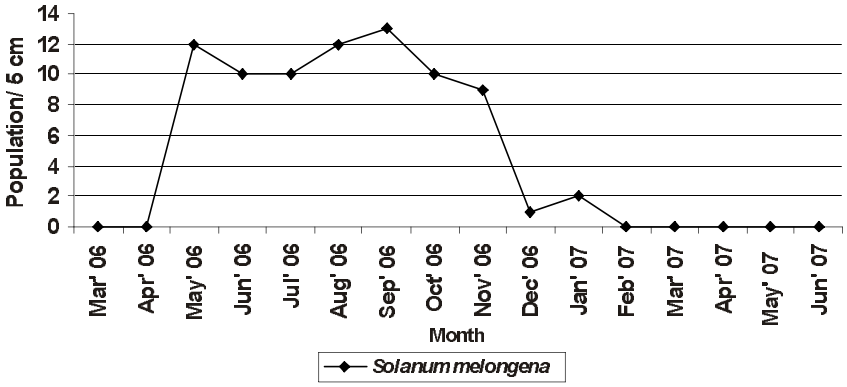

Figure 4. Seasonal incidence of *Coccidohystrix insolita* (Green).

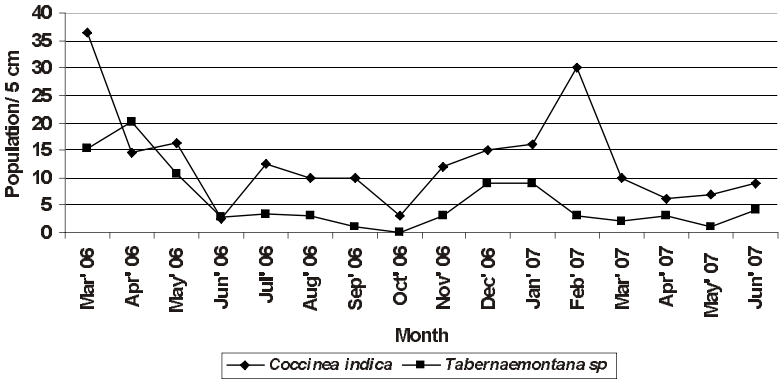

Figure 5. Seasonal incidence of *Saissetia coffeae* (Walker)