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Distribution, Phenology of Guava Sucking Pests under Ultra High Density Planting with Emphasis on Two Tailed Mealybug, *Ferrisia virgata* Cockerell (Pseudococcidae : Hemiptera) Management

K. Elango, Arun Kumar N., C. Nandhini, Dhanasekar V., Sowmiya D., Sowndarya S., Srinivasa Esakki Rajan E., Swetha S., Sanjay Raj N.

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ABSTRACT

The experiment studies were carried out to assess the intensity of damage, phenology and management of major sucking pests of Guava under ultra high density planting during 2022-23. There are three important sucking pests viz., Two Tailed Mealybug, *Ferrisia virgata* Cockerell (Pseudococcidae :Hemiptera), invasive woolly whitefly, *Aleurothrixus floccosus* (Maskell) (Aleurodidae:Hemiptera) and spiraling whitefly, *Aleurodicus dispersus* (Russel) (Aleurodidae:Hemiptera) was documented in ultra high density planting of Guava. Under high density planting, Lucknow 49 variety was affected by more number of sucking pests viz., mealy bug (88.16%), wooly whitefly (1.85%) and guava scale (9.58%), respectively. The population of mealy bug *Ferrisia virgata* was maximum during first, second and third week of February with 45.1, 50.9 and 53.6 numbers / leaf/branch/tree. Weather parameters viz., minimum temperature for positively correlated with whereas maximum temperature, rainfall and relative humidity were negatively correlated with sucking pest population. Bio efficacy of different treatments was carried out against two tailed mealy bug under laboratory condition in contact method, Acetamiprid 20% SP showed superior performance of with 85.00% mortality followed by imidacloprid17.8% SL (81.30% mortality at 24 HAT followed by azadirachtin 0.03% EC showed 64.00 percent mortality.

Keywords Guava, Population dynamics, High density, Mealy bug and entomopathogen.

K.Elango[1], DhanasekarV.[4]
[1,4]Assistant Professor (Agricultural Entomology)
Sowmiya D.[5], Sowndarya S.[6], Srinivasa Esakki Rajan.E[7], Swetha. S[8], Sanjay Raj N.[9]

[1,4,5,6,7,8,9]Department of Agricultural Entomology, Kumaraguru Institute of Agriculture, Tamil Nadu Agricultural University, Erode 638315, Tamil Nadu, India

Arun Kumar N.[2]
Assistant Professor (Agricultural Microbiology), Department of Agricultural Microbiology, Kumaraguru Institute of Agriculture, Tamil Nadu Agricultural University, Erode 638315, Tamil Nadu, India

C. Nandhini[3]
Assistant Professor (Agricultural Statistics), Department of Social Sciences, Kumaraguru Institute of Agriculture, Tamil Nadu Agricultural University, Erode 638315, Tamil Nadu, India

Email : elaento@gmail.com
*Corresponding author

INTRODUCTION

The guava (*Psidium guajava* L.), which belongs to the Myrtaceae family, is considered a native to Mexico and grows in all the tropical and sub tropical areas of the world. In Tamil Nadu, guava is the third most important fruit crop next to mango and

banana (Kumar *et al*. 2022). It is cultivated in about 9700 ha within annual production of 61500 MT with productivity of 4.56 tonnes/ha. Biotic an abiotic factors are affecting the guava production, Among the factors, the insect pests are the one of the major constraints (Irsad and Haq 2019). Approximately 80 pests have been reported in guava. Among the pests, the two tailed mealybug *Ferrisia virgata* Cockerell was prominently spoken (Gould and Raga 2002). The two tailed striped mealy bug is a highly polyphagous mealy bug, are sap feeding insects that tap into the phloem via a piercing, straw like mouthpart, stylet. Large population of mealybugs appears as accumulations of white, cottony- looking wax on the plant (Subramanian *et al.* 2021). They often produce a substance that is sticky and high in carbohydrates called as honeydew, an excellent medium for the growth of sooty mould which impairs photosynthesis. Losses are estimated to be in the range of 10 – 60% depending on the crops (Diwan *et al.* 2020). Weather parameters play a major role in multiplication, growth, development and distribution of insects and influence on their seasonal abundance (Elango *et al.* 2021). Temperature and relative humidity had a positive correlation to all sucking pest population while the rainfall had a negative correlation. However, guava being frequently harvested crop, application of chemical insecticides may warrant sufficient waiting periods. The present investigation was carried out to find the best option to bring down the populations of sucking pests guava under ultra high density planting with special emphasis on two tailed mealy bug.

MATERIALS AND METHODS

The studies were conducted on sucking pests of guava during 2022-23 at Department of Agricultural Entomology, Kumaraguru Institute of Agriculture, Erode. The nymphs and adults of mealybugs were collected from the infested guava field of two different planting systems of normal and ultra high density plantings present in orchard maintained under pesticide-free environment in the Kumaraguru Institute of Agriculture, Tamil Nadu Agricultural University, Erode (11.49°N, 77.55°E). The chemical and biopesticides was procured from local market.

Treatment details

Treatments	Insecticides	Concentration	Recommended dose (ml/lit)
T1	*Imidacloprid*	17.8% SL	1
T2	*Acetamiprid*	20% SP	1
T3	*Beauveria bassiana*	1×10^8 cfu	5
T4	*Lecanicillium lecanii*	1×10^8 cfu	5
T5	*Azadiractin*	0.03% EC	2
T6	Control	-	-

Distribution and occurrence of sucking pests of guava

The study was conducted in four different cultivars of guava viz., Red flesh, Allahabad, Lucknow 49 and Arka kiran of both normal and ultra high density planting. A standard evaluation system was formulated for assessing the percent infestation of sucking pests. For the percent infestation ten numbers of leaves are selected randomly from each ten trees and the population/leaf/tree calculated as given below,

$$\text{Percent infestation (\%)} = \left[\frac{\text{Number of individual pest}}{\text{Total number sucking pests}}\right] \times 100$$

Population dynamics of sucking pests

The studies on phenology of sucking pests of guava under ultra high density planting (Variety: Lucknow 49) were carried out in KIA, Erode. The guava garden maintained under pesticide free environment was selected for observation of seasonal incidence of pests. The study was carried out for during peak period of occurrence April 2023 to July 2023. Weekly observation was made in guava varieties. Ten trees were selected at random for observing the presence of various pests. The occurrence of pests was noted as population per unit sample or damage caused by the pest. Weekly counts on sucking pest population was correlated with weather parameters viz., maximum temperature (T_{max}), minimum temperature (T_{min}), relative humidity (RH) and rainfall was obtained from the automatic weather station installed at KIA, Erode. Mealy bugs: The number of mealy bugs (both nymphs and adults) from leaves /branch/plant of 10 randomly selected trees. Spiraling whitefly/ Wooly whitefly:

The number of nymphs and adults of whitefly from leaves /branch/plant of 10 randomly selected trees.

Evaluation of selected insecticides and entomopathogens

Based on the infestation and phenology studies, the two tailed mealybug was ranked one among sucking pests. Hence, the bioassays were carried out to evaluate the toxicity of two chemical pesticides namely Imidacloprid , Acetamiprid, plant based insecticide (Azadiractin) and entomopathogenic fungi viz., *Beauveria bassiana, Verticillium lecanii* against for the management two tailed mealybug under laboratory condition . Pesticides were assayed using direct spray method with the help of automizer over the nymphs and adults of *F. virgata* with three replication replications in Completely Randomized Design (CRD). All the petri plates were maintained at 25±1ºC in an incubator. The adults were individually examined under a stereo zoom binocular microscope (Carl Zeiss Stemi 2000) at 40x magnification for pesticide toxicity. The mortality data were recorded by counting the dead cadavers and adults with brownish ooze. Observations on the mortality of *F. virgata* were made at 24, 48 and 72 hours after treatment (HAT). The mortality data were recorded using Abbott's formula. The experiments were repeated for two times to confirm the toxicity against *F. virgata.*

Statistical analyses

Laboratory experiments

Statistical analysis was done in Completely Randomized design. The percentage of mortality in adults was collected and corrected with that in control by using Abbott's formula as follows:

$$P = [C - T / \mathrm{T}] \times 100$$

where P = estimated percentage of insects killed by pesticides, C = percentage of control insects living, and T = percentage of treated insects that are living after the experimentation period.

The data collected under laboratory experiments in Completely Randomized Design were analyzed using analysis of variance (ANOVA) using AGRES 3.01 and AGDATA software. Data in the form of percentages were transformed to arcsine alues and those in numbers were transformed to $\sqrt{x+0.5}$ and analyzed. The mean values of the treatments were compared using DMRT at 5% level of significance.

RESULTS AND DISCUSSION

Distribution of major sucking pests of guava

The survey to study about the distribution of major sucking pests affecting guava in both high density and normal planting system of were conducted at North farm of Kumaraguru Institute of Agriculture. The results revealed that there are three varieties of guava viz., Allahabad, Lucknow 49 and Redflesh were planted under normal planting whereas, Arka Kiran and Lucknow 49 were planted under high density planting. There are three important sucking pests viz., Two tailed mealybug, *Ferrisia virgata* Cockerell (Pseudococcidae :Hemiptera), invasive woolly whitefly, *Aleurothrixus floccosus* (Maskell) (Aleurodidae:Hemiptera) and spiraling whitefly, *Aleurodicus dispersus* (Russel) (Aleurodidae:Hemiptera) and one minor pest, guava scale, *Pulvinaria psidii* (Maskell) (Coccidae:Hemiptera), was documented in different plantings of Guava (Table. 1). Two important predators belong to coleopteran coccinellid, *Cryptolaemus montrouzieri* Mulsant and neuropteran, Green lacewing fly, *Chrysoperla zastrowi sillemi* Esben-Peterson were documented, under natural condition they were feeding on different developmental stages of guava sucking pests. Similarly, Haseeb (2005) also reported these pests as important in guava and stated that 80 species of insect pests have been recorded on guava, but only few of them had been identified as pest of regular occurrence and causing serious damage.

Intensity of damage under normal planting

Among the sucking pests, the two tailed mealy -bug causing more damage in Lucknow 49 (89.9%) followed by Allahabad variety (81.42%) and minimum damage in Red flesh (33.48%) under normal planting. In the case wooly whitefly the damage was maximum in Allahabad (7.85%) and minimum in Red

Table 1. Distribution of major sucking pests of guava.

Sl. No.	Variety	Pest species	Scientific name	Family	Order
Normal planting					
1	Allahabad	Two tailed mealybug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
		Wooly whitefly	*Aluerothrixus floccosus*	Aleurodidae	Hemiptera
		Spiralling whitefly	*Aleurodicus dispersus*	Aleurodidae	Hemiptera
2	Lucknow 49	Two tailed mealybug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
		Spiralling whitefly	*Aleurodicus dispersus*	Aleurodidae	Hemiptera
3	Red flesh	Two tailed mealybug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
		Wooly whitefly	*Aleurothrixus floccosus*	Aleurodidae	Hemiptera
		Spiralling whitefly	*Aleurodicus dispersus*	Aleurodidae	Hemiptera
Ultra high density planting					
1	Lucknow 49	Two tailed mealybug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
		Spiralling whitefly	*Aleurodicus dispersus*	Aleurodidae	Hemiptera
		Wooly whitefly	*Aleurothrixus floccosus*	Aleurodidae	Hemiptera
		Guava scale	*Ceroplastes sinensis*	Coccidae	Hemiptera
2	Arka kiran	Two tailed mealy bug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
		Spiralling whitefly	*Aleurodicus dispersus*	Aleurodidae	Hemiptera
		Guava scale	*Ceroplastes sinensis*	Coccidae	Hemiptera

flesh (2.88%). Likewise, spiraling whitefly damage was also causing minimum damage in Lucknow 49 (9.6%), respectively. Under ultra high density planting, Lucknow 49 was affected by more number of sucking pests viz., mealybug (88.16%), wooly whitefly (1.85%) and guava scale (9.58%), respectively. Similarly, Arka kiran was also affected by two tailed mealy bug (47.6%) and spiraling whitefly damage was also causing minimum damage (36.00%), respectively (Table. 2). The present finding was strengthen by Gundappa *et al.* (2018) he stated that in guava due to pests it causes up to crop loss of 16–40%.

Table 2. Intensity of damage under normal and Ultra high density planting of guava.

Sl. No.	Variety	Two tailed mealy bug (%)	Wooly whitefly (%)	Spiralling whitefly (%)	Guava scale (%)
Normal planting					
1	Allahabad	81.42	7.85	9.02	-
2	Lucknow 49	89.8	2.45	9.6	-
3	Red flesh	86.87	5.87	7.26	-
Ultra high density planting					
1	Lucknow 49	76.99	6.36	3.85	12.8
2	Arka kiran	78.5	5.1	2.6	13.8

Phenology of major sucking pests of guava

The population dynamics of the major sucking pest, two tailed mealybug were studied at Lucknow 49 variety planned under high density planting during 15th Standard Meteorological weeks to 27th SMW. It falls on first week of April to second week of July. The results revealed that the population of mealy bug *Ferrisia virgata* was maximum during first, second and third week of February with 45.1, 50.9 and 53.6 numbers /leaf/branch/tree (Fig. 1). Similarly, Prabakaran *et al.* (2021) reported that the maximum counts of *Ferrisia virgata* (122.00/3 leaves/ tree) during 12th SW in Guava under high density planting. The correlation results revealed that weather parameter,

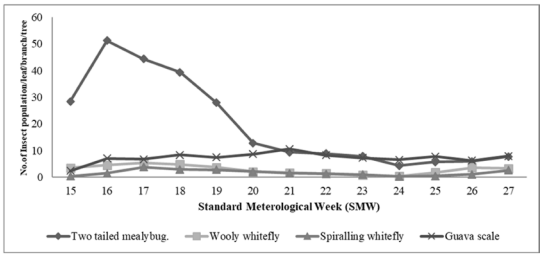

Fig. 1. Population phenology of major sucking pests under ultra high density planting (Variety : Lucknow 49).

Table 3. Correlation analysis of sucking pests in guava ultra high density planting (Lucknow 49).

Weather parameters	Two tailed mealybug	Wooly whitefly	Spiralling whitefly	Guava scale
Minimum temperature (^{0}C)	0.236	0.312	0.327	0.216
Maximum temperature (^{0}C)	-0.298	-0.684**	-0.184	0.279
Rainfall (mm/day)	-0.409	-0.066	-0.152	-0.088
Relative humidity (%)	-0.620*	-0.779**	-0.351	0.327

* - Correlation is significant at the 0.05 level (2-tailed).
** - Correlation is significant at the 0.01 level (2-tailed).

minimum temperature for positively correlated with pest population whereas maximum temperature, rainfall and relative humidity were negatively correlated, respectively (Table 3). Likewise, Elango and Nelson (2020) stated that abiotic factors also play a key role in determining the incidence and dominance of a particular pest and their natural enemies in a crop ecosystem.

Evaluation of selected insecticides and entomopathogens against two tailed mealybug

Bio efficacy of different treatments were carried out against two tailed mealybug under laboratory condition. The results revealed that, in contact method, Acetamiprid showed superior performance of with 85.00% mortality followed by imidacloprid which showed 81.30% mortality 24 HAT followed by azadirachtin showed 64.00% mortality. The observation made 48 hours after treatment also showed superiority of Acetamiprid with 98.0% mortality followed by imidacloprid (92.0%). Similarly, entomopathogens viz., *Lecanicillium lecanii* and *Beauveria bassiana* was recorded 59.00 and 54.00% mortality at 72 HAT, whereas acetamiprid and imidacloprid recorded 100% mortality (Fig. 2). The present findings was strengthen by Priyanka *et al.* (2020).

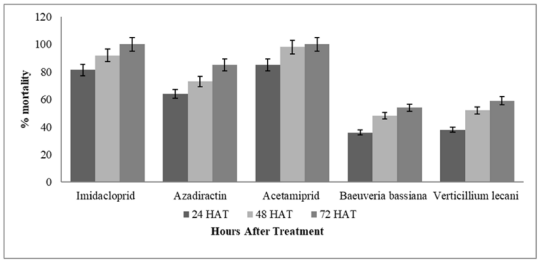

Fig. 2. Evaluation of selected insecticides and entomopathogens against two tailed mealybug under laboratory condition.

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