

ABUNDANCE, DAMAGE SEVERITY AND MANAGEMENT OF GUAVA MEALYBUG, *FERRISIA VIRGATA* Ckll

M.M.H. Khan*

Department of Entomology, Patuakhali Science and Technology University
Dumki, Patuakhali, Bangladesh.

ABSTRACT

The research was carried out to know the abundance and damage severity of mealybug on sarupkathi variety of guava and to evaluate the efficacy of jet powder and Fighter 2.5EC for suppressing populations of mealybug during January to October 2014. Results revealed that the highest number of guava mealybug was observed on middle leaf (42/leaf) while the lowest number was on lower leaf (13/leaf). The highest percent leaf area covered by mealybug was found on middle leaf (78%) while the lowest was on fruit (18%). Maximum temperature and relative humidity had a positive correlation on the mealybug population while the rainfall showed a negative correlation. The highest percent mortality was observed in T₂ treatment (Jet powder applied @ 5.0 g L⁻¹ of water) at 24 HAT (hours after treatment) (86.05%) and 48 HAT (93.83%), respectively. At 72 HAT, the highest percent mortality was observed T₃ treatment (Jet powder applied @ 7.5 g L⁻¹ of water). In case of insecticidal control, the highest percent mortality was observed in T₂ (100%) and T₃ (100%) treatments, respectively followed by T₁ (98.03%) at 24 HAT. Similar trends were also observed among all treatments at 48 HAT and 72 HAT, respectively. No significant differences were found among three doses of Fighter 2.5EC. The lowest percent mortality of mealybug population was found in T₄ (Water spray forcibly) at 24 HAT, 48 HAT and 72 HAT, respectively. No mortality was recorded in untreated control at different HAT in both application of soap solution and insecticides.

Keywords: *Ferrisia virgata*, *Psidium guajava*, jet, fighter 2.5EC, meteorological factors

INTRODUCTION

Guava (*Psidium guajava*: Myrtaceae) known as the apple of the tropics and is one of the most common and popular delicious fruits in Bangladesh. It is very rich in

* Corresponding author email: mohasin1965@pstu.ac.bd

vitamin C. Some varieties of guava such as Kazipiara, Kanchannagar, Mukundapuri and Swarupkathi grow everywhere in the country in the homestead gardens but commercially cultivated in Barisal, Sylhet and Chattogram regions. There are several species of mealy bugs that can be pests of greenhouse, nursery, and landscape plants. Nearly 246 families of various plants on which 5000 species of mealybug feed that have been reported all over the world (Ben-Dov, 1994). According to Afzal *et al.* (2009) and Aheer *et al.* (2009), mealybugs feed on nearly 149 plant species, suck plant sap and cause leaves to distort and fall. Mealy bugs are causing loss to different fruit plants namely citrus, guava, grapes, pomegranate, chiku, jamun and aonla. Guava mealybug (*Ferrisia virgata* Ckll.) is one of the most commonly occurring pests found on the fruit crops causing damage to guava and several host plants (Wabale *et al.*, 2010). Mealybugs damage plants by inserting their threadlike mouthparts into any part of the plant and sucking out sap (Frank, 2011). Both nymphs and adult females of these mealybugs suck cell sap from different parts of the plant like the leaves, twigs, tender shoots, branches and fruits thereby reducing the vigour of plant as well as the drying up the tender shoots. They excrete honeydew, a sweet sticky liquid on which sooty moulds often grow causing infested plants to turn black. Considering above facts, the present research work was undertaken to know the abundance and damage severity of mealybug on guava and to evaluate the efficacy of detergents and insecticides for suppressing population of mealybug.

MATERIALS AND METHODS

The study was carried out in the Department of Entomology, Patuakhali Science and Technology University (PSTU) during January to October 2014. Geographically, the research farm is located at 22⁰37' N latitude and 89⁰10' E longitudes. The area is covered Gangetic Tidal Floodplains and falls under Agroecological Zone "AEZ- 13". The area lies at 0.9 to 2.1 metre above mean sea level (Iftekhhar and Islam, 2004). The experimental area experiences sub-tropical climate with high temperature and it decreased when the season proceeded towards rabi (October to March).

Abundance and damage severity of guava mealybug

A total of 10 plants were selected as host of mealybug. The age and height of the plants were 5 years and 9 feet, respectively. Infested plants were examined using a magnifying glass. Infested leaves, twigs and fruits were collected from the plants and placed separately in poly bags for further examination in the laboratory. The collected specimens were counted, processed, mounted and labeled for preservation. Number of mealybugs per 5 leaves on different leaf categories viz upper, middle and lower, twig and fruits of each guava plant were recorded. The data were collected on weekly intervals. The percent leaf area covered by mealybugs was recorded by eye estimation.

Collection of meteorological data

Meteorological data on maximum and minimum temperature, relative humidity and rainfall were collected from the Patuakhali district meteorological office.

Evaluation of the efficacy of detergent and insecticide for controlling mealybug

The trial was conducted in completely randomized design with three replications. The infested leaves of different plant canopies were collected from highly infested guava plants and brought back to the laboratory. Thirty mealybugs of nymphs and adults were released on each leaf which was kept in Petri dish. Three doses of Jet powder were used as three treatments where $T_1 = 2.5 \text{ g L}^{-1}$ of water, $T_2 = 5.0 \text{ g L}^{-1}$ of water and $T_3 = 7.5 \text{ g L}^{-1}$ of water along with a control. On the other hand, three doses of Fighter 2.5 EC were used as three treatments where $T_1 = 1.0 \text{ ml L}^{-1}$ of water, $T_2 = 1.5 \text{ ml L}^{-1}$ of water and $T_3 = 2 \text{ ml L}^{-1}$ of water along with a control. The spraying was done with hand sprayer. After spraying the treated leaves were put on soaked filter paper by keeping these in Petri dish separately. The Petri dishes were arranged in three rows following CRD. One row of Petri dishes constituted one replication and a total of 15 Petri dishes were used in this experiment. However, control leaves received no treatment. Observations were recorded on the mortality of mealybugs at 24, 48 and 72 hours interval and cumulative data were calculated for interpretation.

Statistical analysis

Data were analyzed following single factor ANOVA using MSTAT-C computer software. Means were separated by LSD test. The correlations were worked out between mealy bug population and weather parameters of study period.

RESULTS AND DISCUSSION

The number of mealybug population on various parts of guava plant is presented in Fig. 1. The highest number of mealybug per plant was recorded on middle leaf (42) followed by upper leaf (26) while the lowest number was on fruit (6) followed by twig (9) and lower leaf (13).

Figure 2 revealed the damage severity of mealybug through area covered by mealybug on different parts of guava plant. The highest percent leaf area covered by mealybug was found on middle leaf (78%) followed by upper leaf (63%) while the lowest was in fruit (18%) followed by twig (25%) and lower leaf (33%).

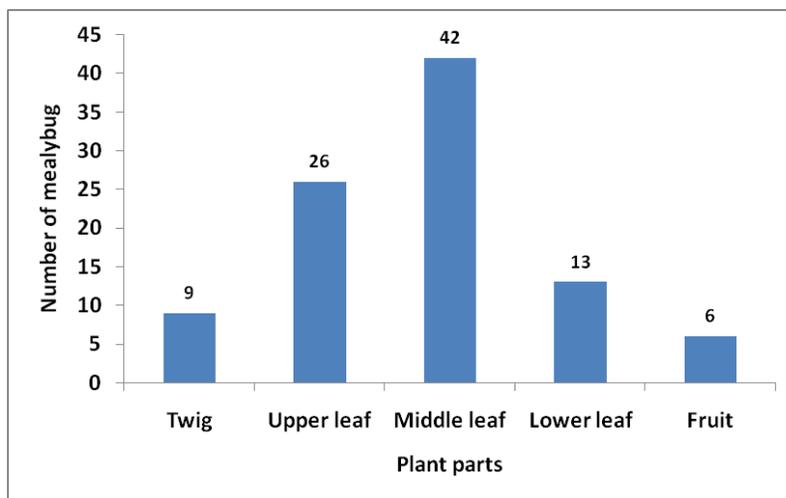


Figure 1. Abundance of mealybug on different plant parts of guava

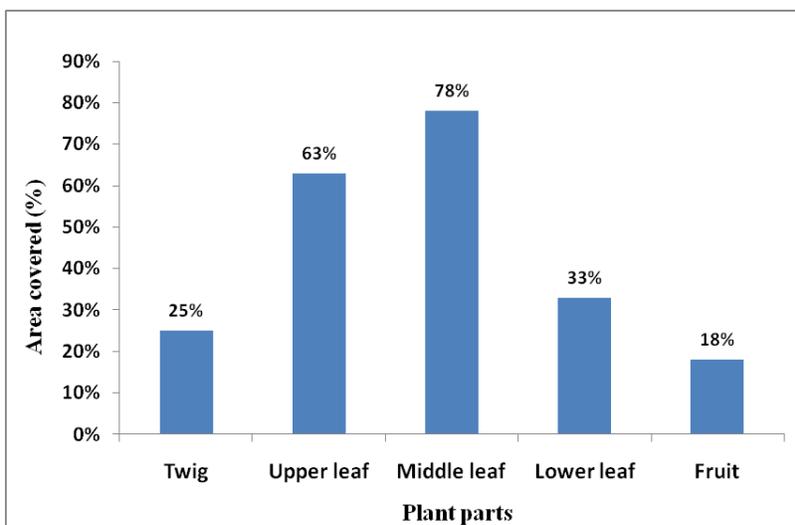


Figure 2. Area covered by mealybug on different parts of guava

The variation in the number of mealybug on different plant parts might be due to the variation of various chemical compounds in guava. It has been reported that leaves on the same plant or even in the same twig may display up to four-fold differences in concentrations of various compounds (Schultz, 1983). The results of the present study are in agreement with the findings of Sultana *et al.* (2015) who reported the similar trend of mealybug population on different leaf categories of guava. This finding was also supported by Wabale *et al.* (2010).

Relationship of mealybug population with weather factors

Temperature, humidity and rainfall have had tremendous effect on mealybug population. There was a positive correlation ($r = 0.620$) between population of guava mealybug and average maximum temperature. It indicates that the populations of mealybug gradually increased with increasing temperature. The contribution of the regression ($R^2 = 0.385$) was 39% (Fig. 3). The population of mealybug was also positively correlated with average relative humidity ($r = 0.613$). It indicates that the populations of mealybug gradually increased with increasing average relative humidity. The contribution of the regression ($R^2 = 0.376$) was 38% (Fig. 4). On the other hand, there was a negative correlation ($r = 0.767$) between population of guava mealybug and average rainfall. It indicates that the populations of mealybug gradually decreased with increasing average rainfall. The contribution of the regression ($R^2 = 0.588$) was 59% (Fig. 5). The findings are supported by Mani and Thontadarya (1978) who stated that maximum temperature had a positive correlation the mealybug population while the relative humidity showed a negative correlation. The influence of relative humidity was contradict with the findings of the present study. Manjunath (1985) reported that the bug was present throughout the year, there being peak period of infestation during February to March. Babu and Azam (1987) reported that the mealybug population was abundant by March on grapevine. Rainfall appeared to have a tremendous negative effect on mealybug population. The population of guava mealybug gradually decreased after May with increasing rainfall and was the lowest in the month of July due to high rainfall (Fig. 5). Koli (2003) reported that mealybug showed non-significant negative correlation with rainfall on grapes.

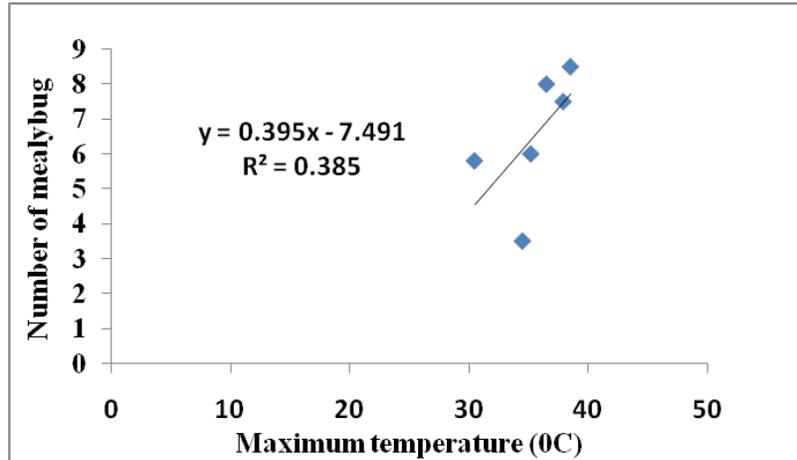


Figure 3. Relationship between mealybug population with maximum temperature in guava

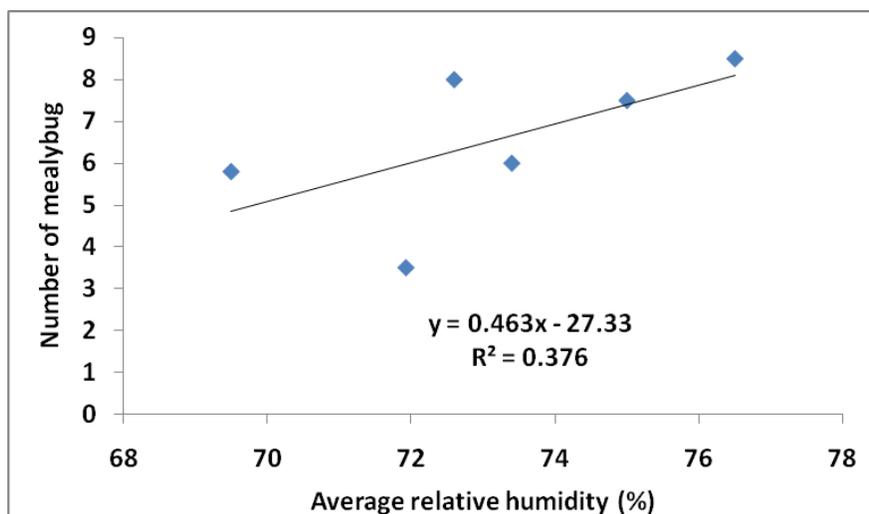


Figure 4. Relationship between mealybug population with average relative humidity in guava

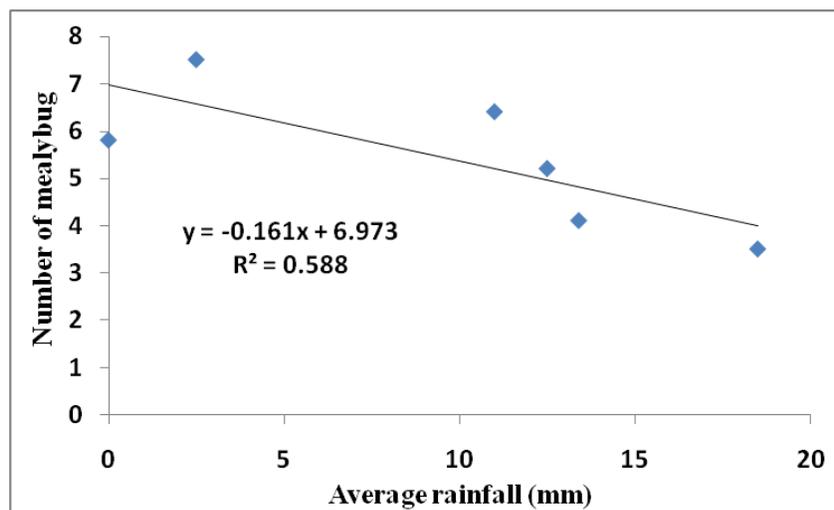


Figure 5. Relationship between mealybug population with average rainfall on guava

Management of mealybug

Effect of different doses of wheel powder and water on mortality of mealybug

The mortality of mealybug population ranged from 0.00% to 86.05% after 24 hours of treatment application (Table 1). Significantly the highest (86.05%) mortality was

observed T₂ treatment (Jet powder applied @ 5.0 g L⁻¹ of water) followed by T₃ (81.21%) (Jet powder applied @ 7.5 g L⁻¹ of water) and T₁ (74.49%) (Jet powder applied @ 2.5 g L⁻¹ of water). The lowest percent (19.81%) mortality of whitefly population was found in T₄ (Water spray forcibly). No mortality was recorded in untreated control. After 48 hours of treatment application, the highest (93.83%) mortality was observed T₂ treatment (Jet powder applied @ 5.0 g L⁻¹ of water) which was statistically similar to T₃ (92.82%) (Jet powder applied @ 7.5 g L⁻¹ of water) followed by T₁ (87.19%) (Jet powder applied @ 2.5 g L⁻¹ of water). The lowest percent (4.18%) mortality of mealybug population was found in T₄ (Water spray forcibly). No mortality was also recorded in untreated control. After 72 hours of treatment application, the highest (97.65%) mortality was observed T₃ treatment (Jet powder applied @ 7.5 g L⁻¹ of water) which was statistically similar to T₂ (95.90%) (Jet powder applied @ 5.0 g L⁻¹ of water) followed by T₁ (93.48%) (Jet powder applied @ 2.5 g L⁻¹ of water). The lowest percent (3.18%) mortality of mealybug population was found in T₄ (Water spray forcibly). No mortality was also recorded in untreated control. Application techniques and force of liquid on the target surface may influence the effectiveness of detergents. The efficacy of Jet powder in the mortality of mealybug population is for the eliminating properties of the waxy layer of the pest along with viscosity. Use of detergents against sucking like mealybugs and whitefly has been reported by other authors. Spraying a steady stream of water with reasonably high pressure on the host plant to knock-off mealybugs. Once on the ground, the fallen ones will be available to ground predators and this will also make their return to the plant difficult. Spraying with a soap and water solution is reported to control mealybugs. Good spray coverage and good timing is important when using soapy solutions and oils. To be effective they must come in contact with the mealybugs. Crawlers are the easiest to kill, since they are more susceptible and are more exposed than eggs, older nymphs and adults. Use of mild solution of soap, mixing an inexpensive liquid dish washing detergent @ 1 tablespoon per gallon of water, and thoroughly spraying the underside of infested leaves can control the guava whitefly (CABI, 1999). Puri et al. (1994) reported that the detergent Nirma, Rin, Surf and Wheel powder at concentration of 0.25, 0.5 and 1 % reduced the sweet potato whitefly *Bemisia tabaci* (Gennadius) adults by 69-91% and nymph by 97-99%.

Table 1. Effect of jet powder on the mortality of mealybug infesting guava at different time interval in laboratory condition

Treatment	Dose	Mortality (%) at different hours after treatment (HAT) application		
		24 HAT	48 HAT	72 HAT
T ₁	2.5 gL ⁻¹ of water	74.49c	87.19c	93.48b
T ₂	5.0 gL ⁻¹ of water	86.05a	93.83a	95.90ab
T ₃	7.5 gL ⁻¹ of water	81.21b	92.82ab	97.65a

Treatment	Dose	Mortality (%) at different hours after treatment (HAT) application		
		24 HAT	48 HAT	72 HAT
T ₄	Water spray	19.81d	4.18d	4.18c
T ₅	Untreated	0.00e	0.00e	0.00d
LSD (5%)		1.74	1.02	1.81
CV (%)		3.41	3.07	3.23

Means in a column followed by same letter(s) did not differ significantly at 5 % level by LSD
Values are averages of three replications.

Efficacy of various doses of Fighter 2.5 EC on the mortality of mealybug

At 24 HAT, the highest percent mortality was observed in T₂ (100%) and T₃ (100%) treatments, respectively followed by T₁ (98.03%). No significant differences were found among three doses of Fighter 2.5EC. The lowest percent mortality (18.00%) was recorded in T₄ treatment when only water was applied forcibly on infested leaves. No mortality was observed in untreated control. Similar trends were also observed among all treatments at 48 HAT and 72 HAT, respectively (Table 2).

Table 2. Efficacy of various doses of Fighter 2.5 EC on the mortality of mealy bug infesting guava at different time interval in laboratory condition

Treatment	Dose	Mortality (%) at different hours after treatment (HAT) application		
		24 HAT	48 HAT	72 HAT
T ₁	1.0 ml L ⁻¹ of water	98.03a	100.00a	100.00a
T ₂	1.5 ml L ⁻¹ of water	100.00a	100.00a	100.00a
T ₃	2.0 ml L ⁻¹ of water	100.00a	100.00a	100.00a
T ₄	Water spray	18.00b	22.00b	22.00b
T ₅	Untreated	0.00c	0.00c	0.00c
LSD (5%)		0.06	0.03	0.02
CV (%)		1.06	1.07	1.05

Means in a column followed by same letter(s) did not differ significantly at 5 % level by LSD
Values are averages of three replications.

From the results of Table 1 and 2 it was observed that Jet powder applied at the rate 5.0 g L⁻¹ of water at 24, 48 and 72 hours after application provided the effective control of mealybug population in laboratory condition. Likewise, three doses of Fighter 2.5 EC were found to be effective in controlling mealybug in laboratory condition.

The results of the present study are in agreement with the findings of Sultana et al. (2015). The effective control of guava mealybug by using insecticides is also

reported by Baskaran et al. (1999). They found that, *F. virgata* was the dominant coccid species, infesting 98 per cent of guava trees, followed by *M. hirsutus*. Monocrotophos (0.072%), malathion (0.25%), dimethoate (0.06%) and phosalone (0.175%) were evaluated for *F. virgata* control. Dimethoate and malathion were most effective in controlling *F. virgata*. Guava leaf disks were offered to *F. virgata* after treating with phosalone (0.175%), phosphamidon (0.086%), monocrotophos (0.072%), dichlorvos (0.1%), malathion (0.25%) and dimethoate (0.06%) by leaf dipping and leaf spraying. The leaf dip assay was most effective, recording cent per cent mortality at 24 h after treatment. Beevi et al. (1992) tested ten insecticides as sprays in laboratory against eggs of mealy bug, *M. hirsutus*. Hatching was least in eggs treated with neem oil (0.3%) followed by monocrotophos (0.04%), methyl demeton (0.04%) and fish oil rosin soap (2.5%) + dichlorvos (0.2%).

CONCLUSIONS

The highest number of guava mealybug was observed on middle leaf of guava. Populations of mealybug increased with increasing temperature and relative humidity and decreased with increasing rainfall. Application of jet powder @ 5.0 g L⁻¹ of water and three doses (1.0 ml, 1.5 ml and 2.0 ml L⁻¹ of water) of Fighter 2.5 EC at 24, 48 and 72 HAT were found effective in controlling mealybug population in laboratory condition.

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