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Seasonal Aboundance and Control of Spiraling Whitefly, *Aleurodicus dispersus* Russel on guava

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Abstract: Experiments on seasonal abundance of spiraling whitefly, *Aleurodicus dispersus* on guava and its control were conducted. The seasonal distribution of spiraling whitefly indicated that winter months December, January and February were major peak period of infestation. Adult whitefly started to infest the guava plants in September and increased to maximum in January. Whitefly infestation decreased to zero from April and continued to August. The change in the level of infestation was due to difference in environmental temperature and rainfall. Field trials were conducted to test the efficacy of some common insecticides against the whitefly. Although all the chemicals reduced the population of different stages of whitefly, the overall effect was found to be better with systemic insecticides. Dimethoate was found most effective in controlling spiralling whitefly of guava followed by spray treatment with, phosphamidon, cypermethrin, malathinon. Diclorvos was comparatively less effective insecticide. Study on biological control of whitefly showed that a coccinelid predator *Axinocymnus puttarudriahi* Kapur and Manshi (Coleoptera: Coccinellidae) was effective in controling the whitefly without associated ant.

Key words: Spiraling whitefly, *Aleurodicus dispersus,* guava, seasonal aboundance, predator

INTRODUCTION

Guava is successfully grown in almost all the districts of Bangladesh and in many other Asian Countries. Recently the spiraling whitefly, *Aleurodicus dispersus* Russel has become the most serious pest of guava in Bangladesh, causing enormous damage to the plants and fruits. Severe infestation by this pest has been a great threat for guava cultivation in Bangladesh (Kajita and Alam, 1996). It is suspected that this pest species has been introduced in Bangladesh through immigration and through unchecked plant materials from other countries (Scanlan, 1995).

This pest sucks cell sap from the leaf causing the reduction of growth and vitality of plant, which lead to reduction of crop yield. Indirectly, they reduce the photosynthetic area of the leaf by secreting honeydew, which is a suitable growth medium for the sooty mould fungus. Long delicate filamentous wax covering the upper side of leaves also reduces the photosynthetic area (Byrnee *et al.,* 1990, Kajita and Alam, 1996). The immature pest individuals have protecting white waxy covering on their bodies. These waxy substances may reduce the effectiveness of the insecticides. As *A. dispersus* has wide host range including perennials and the crops can tolerate heavy infestation of pest, most suitable control method might be biological control. There are records in the world of successful introduction of natural enemies against this pest, indicating its possibility in Bangladesh. As the information on the spiraling whitefly and its control measure is not available in Bangladesh, the present research work has been aimed to find out seasonal abundance and the effective control of this pest.

MATERIALS AND METHODS

The experiments were conducted in some guava orchard at Mymensingh district during January 1998 to March 1999. The experimental area was characterized by tropical rainfall during the month of June to August and scattered rainfall during the rest of the year. Monthly minimum and maximum temperature, relative humidity and total rainfall were recorded during the period of the study. At the starting of the experiment average age of the guava plants was 5 years.

Seasonal abundance: To study on the seasonal abundance of spiraling whitefly on guava five Kazipiara plants were selected and five twigs from each guava plant were also selected randomly. Adult, nymph and pupa populations were counted monthly on 5 randomly selected infested leaves per twig. Mean number of adult, nymph and pupa populations per twig was calculated. Plants were not sprayed with insecticides during the study. The data were analyzed statistically after arcsin transformation and mean values were separated using DMRT.

Efficacy of different insecticides on whitefly: A field experiment was conducted in severely whitefly-infested guava orchard. There were 6 treatments including 2 systemic, 3 contact insecticides and a control. Before each application, the sprayer was calibrated. All the insecticides at the designated dosages were applied with the help of a hand-operated sprayer. Ten whitefly infested leaves were selected randomly from different direction of the tree at each observation. Total and dead adult whitefly was counted visually but immature whitefly (nymph and pupa) populations per leaf were counted under microscope at 40X magnifications. The pupae through which liquid oozed out due to puncture with a needle were identified as livings ones and rest of the pupae counted as the dead. Percent mortality of adult, nymph and pupa were calculated for all the insecticides. Observations on population were recorded at 1, 7 and 14 days after spraying. The data were then transformed to the corresponding arcsin values for statistical analysis.

Control of whitefly by using a coccinellid predator: A field experiment on biological control of *A. dispersus* by using a coccinellid predator *Axinocymnus puttarudriahi* Kapur and Manshi (Coleoptera: Coccinellidae) was conducted. The performance of the predator on the population growth of the whitefly was determined using net cage in which the predator was released in absence or presence of army ant. The functional response of the predator beetle at different predator prey ratios was investigated. Assessment of mortality due to the release of predator was observed using the predators and whiteflies ratios 1:10, 1:20 and 1:30.

All the experiment was designed in a randomized complete block (RCB) in the standing guava orchard and replicated 3 times.

RESULTS AND DISCUSSION

The results of the 12 months study revealed that there was a major peak period of whitefly infestation in December, January and February (Fig. 1). In the month of September, adult whitefly started to lay eggs on underside of top young leaves when the mean percentage of adult whiteflies per twig was low (0.34±0.05) and thereafter it started to increase. Maximum adults, nymphs and pupae populations were found in the month of January. After January, whitefly population decreased and no infestation was found in the month of May to August, probably because of the reason that the spiraling whitefly could not survive due to high rainfall. It was also observed that the nymph population per twig was the highest followed by pupae and adult. Abiotic factors such as temperature, rainfall, humidity, fog and sunshine etc. may have tremendous effect on whitefly population. Echelkraut and

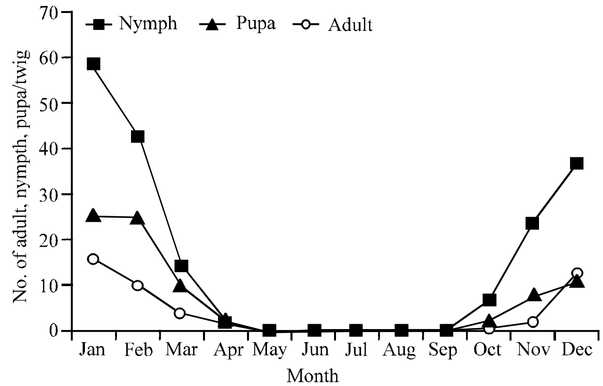

Fig. 1: Level of infestation of whitefly on guava in different months

Cardona (1989) observed that dry conditions were more favorable for *B. tabaci*, than high precipitation. Salinas and Sumalde (1994) reported that temperature, relative humidity and the number of rainy days had a highly significant correlation with the adult population. Salinas and Sumalde (1994) reported the presence of whitefly was year round and showed the negative effect of high temperature and rainfall on the population of whitefly. Gerling *et al.* (1986) showed that the extreme relative humidity, both high and low were unfavorable for the survival of immature stages. Horowitz (1986) obtained significant drop of whitefly population levels at heavy rainy condition. It appeared that the adult whitefly and their nymph and pupa were higher in the cold and dry months. The environmental condition during the summer and monsoon months are not favorable for the survival and multiplication of spiraling whitefly. The result of the present study thus, explains the negative effect of rainfall and temperatures to the whitefly population.

Efficacy of different insecticides on whitefly

Adult mortality: Results indicated that there was a significant difference ($P < 0.05$) in the effectiveness of the five insecticides. All the insecticides were significantly superior over the control at 1, 7 and 14 days after treatment (Table 1). A maximum of 100% adult mortality was recorded spraying with dimethoate and cypermethrin within 24 h of application. Seven days after treatment, cypermethrin was found to be the best and was at per with dimethoate, phosphamidon and malathion. The lowest mortality was recorded while sprayed with diclorvos. All the chemicals reduced the number of adult whiteflies after 14 days of application; the highest mortality was recorded spraying with the chemical cypermethrin. However, of the five insecticides tested, minimum adult mortality per leaf was recorded in the plants treated with diclorvos.

Table 1: Evaluation of insecticides against *Aleurodicus dispresus* Russel

Treatments	Mean percent decline in adult population at DAT 1	7	14
Dimethoate 0.075% (Rogor 40 EC)	100.00	90.61	73.62
Phosphamidon 0.075% (Dimecron 100 SL)	92.50	89.54	72.16
Cypermethrin0.075% (Cymbush 10 EC)	100.00	95.41	88.74
Malathion 0.075% (Malathion 57 EC)	73.31	64.97	48.84
Dichlorvos 0.075% (Nogos 100 EC)	56.23	53.85	36.42
Control (Water treated)	3.74	7.40	5.38
S.Em +	3.23	3.12	2.61
C.V. at 5%	9.87	7.99	6.03

Table 2: Effect of different insecticides on the reduction of nymphal population of *A. dispersus* and other whiteflies

Treatments	Mean nymphal mortality % at DAT 1	7	14
Dimethoate 0.075% (Rogor 40 EC)	76.25	59.63	58.83
Phosphamidon 0.075% (Dimecron 100 SL)	65.67	61.82	58.42
Cypermethrin0.075% (Cymbush 10 EC)	63.51	57.65	49.37
Malathion 0.075% (Malathion 57 EC)	17.64	39.16	32.67
Dichlorvos 0.075% (Nogos 100 EC)	5.28	11.44	6.65
Control (Water treated)	2.35	2.56	3.36
S.Em +	3.84	5.46	5.13
C.V. at 5%	10.37	14.68	12.87

DAT = days after treatment.

Table 3: Effect of different insecticides on the reduction of pupal population of *A. dispersus*

Treatments	Mean pupal mortality (%) at DAT 1	7	14
Dimethoate 0.075% (Rogor 40 EC)	65.82	67.58	70.53
Phosphamidon 0.075% (Dimecron 100 SL)	62.86	60.47	55.41
Cypermethrin0.075% (Cymbush 10 EC)	40.73	38.26	28.24
Malathion 0.075% (Malathion 57 EC)	31.64	25.68	13.76
Dichlorvos 0.075% (Nogos 100 EC)	28.09	15.67	12.47
Control (Water treated)	1.23	1.82	1.43
S.Em +	2.82	1.30	1.99
C.V. at 5%	5.65	3.81	4.22

Nymphal mortality: Data on nymphal mortality indicated that all the treatments were significantly superior over the control at 1, 7 and 14 days of treatment. The highest mortality was recorded in dimethoate treatment followed by cypermethrin and phosphamidon (Table 2). The latter was at par with malathion. Maximum mortality of nymphs at seven days after the application was recorded in phosphamidon, which was at par with dimethoate, cypermethrin and malathion. Dichlorvos again proved to be as an inferior insecticide.

At fourteen days after treatment, dimethoate was the best followed by phosphamidon. Among the contact insecticides, cypermethrin was significantly superior over malathion and dichlorvos. The contact insecticides were quite poor in reducing the nymphal population.

Table 4: Performance of a Coccinellid predator at different predator/prey ratios in presence or absence of army ant in controlling *A. dispersus*

Treatment	Mean number of whiteflies survived per twig 1:10	1:20	1:30
Without ant	8.33	19.67	23.33
With ant	17.00	24.67	20.33
Control	16.00	28.33	27.00
S.Em+	3.14	2.66	2.37
C.V. at 5%	7.49	6.87	6.97

- Two army ants were kept in a net cage

Adult coccinellid predator was released

Pupal mortality: All insecticides were significantly superior over control in bringing down the pupal population (Table 3). One day after treatment, dimethoate was found to be most effective and was at par with phosphamidon. Contact insecticies viz., cypermethrin, malathion and dichlorvos, although superior over control, proved to be quite inferior to the systemic insecticides. At 7 and 15 days after treatment, dimethoate was significantly superior over all the treatments.

Ghugaskar *et al.* (1983) observed that dimethoate, phosphamidon, malathion and mecarbam insecticides against pupae of *Aleurocanthus woglumi* were superior over control. Singh *et al.* (1992) reported that, the synthetic pyrethroids significantly reduced the population of the whiteflies and remained effective up to 8th day of spraying. Prasad and Singh (1992) reported that monocrotophos and dimethoate were found to be superior in controlling the whitefly population up to 15 days after application. Verma (1992) reported that phosphamidon and deltamethrin were more effective against whitefly over control population. Wijesekera and Kudagamage (1990) observed that insecticides buprofezin 10WP and dimethoate 40 EC were effective for controlling spiraling whitefly. Zade *et al.* (1986) obtained effective control of black fly (*Aleurocanthus woglumi)* after 5 days of treatment of dimethoate at 0.05% and acephate at 0.05%.

All the five insecticides caused mortality of *A. dispersus* adult, nymphs and pupae. However, adults were more susceptible to the insecticides and a maximum of 100% adult mortality was observed with dimethoate and cypermethrin. The lower mortality in the nymphal and pupal stage of whitefly might be due to the presence of wax filaments on their body, which could have reduced the effectiveness of insecticides against the pest. All the chemicals reduced the population of different stages of whitefly but the overall effect was found to be better with systemic insecticides, which reduced the number of insects successfully, but they should be avoided in the orchards bearing ripe fruits ready for harvest. In such orchards contact insecticides can be used but the period between two applications should be less than 15 days as these insecticides were not effective beyond 15 days after application.

Information on effective insecticides is important for emergency treatments to save valuable plants. However, insecticidal treatment against this pest is not practicable in the long run as it has a wide host range and insecticidal treatments may lead to pollution of the environment.

Performance of a coccinellid predator at three predator: prey ratios: Release of the predator in a guava orchard reduced whitefly population significantly in 15 days of time. The number of whiteflies was higher in the control plots. Release of the adult coccinellid beetle at the predator/prey ratio of 1:10 in absence of ant reduced the whitefly population to halt of the untreated population. A significant reduction of whitefly was recorded when the predator/prey ratio was 1:20 (Table 4). However, the release of the beetle in presence of ant could not reduce the whitefly population significantly at any predator/prey ratio.

The experiment demonstrated the effectiveness of the predator in reducing guava whitefly populations under various experimental conditions. Although the predator reduced the number of whiteflies, the level of pest population remained higher. Lowering of predator/prey ratio might further reduce the pest population. However, the experimental results showed that the performance of the predator was affected by the presence of associated ants. The association between ants and the whiteflies were found to be very common in the guava orchard. It was marked that the ants disturbed the activity of the natural enemy, which might have resulted in the reduced performance of the predator. It was also noticed that the predator beetle was present in the field only in the winter months when the whitefly population was comparatively higher. The unavailability of the predator in the hot summer months indicated that the predator might have a temperature or a prey density dependent relationship.

According to field observations the predator (*A. puttarudriahi*) is present in the country is increasing its population. Whether this predator will be able to check the growth of whitefly population is needed for further investigation.

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