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INFLUENCE OF ABIOTIC FACTORS ON THE SUCKING PESTS OF BRINJAL AT PATUAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY CAMPUS

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ABSTRACT

Brinjal *Solanum melongena* Linn. is one of the most common and popular vegetables grown throughout the year in Bangladesh. The study was carried out in homestead garden of Patuakhali Science and Technology University (PSTU) campus, Dumki, Patuakhali to determine the influence of abiotic factors on sucking pests of brinjal during the period from December 2017 to March 2018. In foggy condition, the highest number of aphid was observed in top canopy followed by whiteflies and jassid while lowest was the mealy bug, but in clear sunshine weather condition, the highest number of jassid was recorded in top canopy followed by aphid and whiteflies while the lowest was the mealy bug. A positive and linear relationship was observed between mean aphid population with the temperature in brinjal host while a negative and linear relationship was observed between mean whitefly and jassid population with the temperature. A positive and linear relationship was observed among mean aphid, jassid and whitefly population with the relative humidity. A strong positive and linear relationship was observed between mean mealy bug and red spider mite population with the temperature and relative humidity.

Keywords: Aphids, jassids, whitefly, mealybugs, temperature, relative humidity, rainfall

INTRODUCTION

In Bangladesh, brinjal is an important vegetable crop often known as the cash crop for the farmers. Although brinjal in Bangladesh is grown throughout the country but it is intensively and commercially grown in Jessore, Narsingdi, Dhaka, Cumilla and Bogura districts. It is described as poor man's vegetable since it is

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popular among the small scale farmers and low income consumers. Yield of brinjal varies from season to season, variety to variety and location to location. However, in general 25000 to 50000 kg ha^{-1} of healthy vegetable of brinjal can be obtained from brinjal farming (BBS 2018). But some factors are responsible to reduce the brinjal production. In the brinjal field, various insect pests prevail during seedling to harvesting stage and the loss caused by brinjal pests vary from season to season depending upon environmental factors (Gangwar and Sachin 1981). Arthropod biodiversity observed in the brinjal field are brinjal shoot and fruit borer, jassid and whitefly (Latif *et al*. 2009). The production of brinjal is seriously impeded due to increasing threats from a number of insect pests, among which brinjal shoot and fruit borer is the key pest. Beside this, sucking insect pests such as jassid [*Amrasca biguttula biguttula* Ishida (CABI 2007)], aphid (*Aphis gossypii*), whitefly (*Bemisia tabaci*) and thrips (*Frankliniella occidentalis* Pergande) are the major ones (Dutta *et al*. 2012).

Sucking pests like whiteflies and leafhoppers cause severe damage to the crop particularly during early vegetative growth stage. The magnitude and severe population outbreaks are greatly influenced by both abiotic and biotic factors that cause seasonal variations. Omprakash and Raju (2014) concluded that the whitefly population was significantly and negatively correlated with average temperature, non-significantly and negatively with average humidity and weekly rainfall. Naik *et al*. (2009) reported that the peak incidence was recorded during the third week of February 2006 and when the incidence had non-significant relationship with abiotic factors. They observed that leafhoppers and whitefly showed positive correlation with all the abiotic factors (Purohit *et al*. 2006). Low relative humidity favoured the multiplication of mites and precipitation was the only abiotic factor that restricted mite population (Srinivasan 2009). Considering above facts, the present study was undertaken to measure the relationship of sucking pests of brinjal with temperature and relative humidity.

MATERIALS AND METHODS

The study was carried out in brinjal homestead garden of Patuakhali Science and Technology University (PSTU) campus, Dumki, Patuakhali during December 2017 to March 2018. The homestead area was dug by using spade. The whole amount

of cow dung, TSP, MP and half of the urea was applied during the time of final land preparation. Experiment was laid out in a randomized complete block design with three replications. The spaces between blocks and between plots were 0.5m and 1.0m, respectively. The unit plot size was 2m × 2m with 50 cm and 50cm spacing. The brinjal seedlings (variety BARI Begun 2 named Kazla) were collected from the local market of Dumki where these seedlings are brought from Sarupkathi nursery by the seller. Seedlings were planted on 2 December 2017 in rows. Each plot contained 1 row with 3 plants separated by 50 cm. All recommended agronomic practices were followed from time to time to raise the crop successfully. Populations of the selected sucking pests were recorded from seedling stage to harvesting stage of the crop. Observations on the population of sucking pests *viz*., aphid, jassid, whitefly, mealy bugs and mites were taken from three randomly selected plants. On each plant, five leaves (one from top and two from middle and bottom canopy of the plant) were inspected from lower side to record insect pests for different dates of observations for each plot in each replication. In case of canopy levels, 3 leaves (one from each canopy) were observed for counting the number of insects. Weather data *viz*., temperature, relative humidity and rainfall was collected from meteorological office, Patuakhali. Simple correlation of sucking pests of brinjal with mean temperature and relative humidity were computed.

RESULTS AND DISCUSSION

Influence of foggy and clear sunshine conditions on brinjal sucking pests: Fig. 1 revealed the number of insect pests in different plant canopies at foggy and clear sunshine weather conditions. In foggy condition, the highest number of aphids was observed in top canopy followed by whiteflies and jassid while lowest was the mealy bug. Similar trend of aphid, whiteflies and jassid populations was also observed in middle canopy. However, in bottom canopy, the highest number of aphid was recorded followed by mealy bug while the lowest was whiteflies and jassid. In clear sunshine weather condition, the highest number of jassid was recorded in top canopy followed by aphid and whiteflies while the lowest was of mealy bug. In middle canopy, the highest number was found in aphid followed by whiteflies and jassid while the lowest was in mealy bug. In bottom canopy, the highest number was recorded in jassid followed by aphid and lowest was in whiteflies followed by mealybugs.

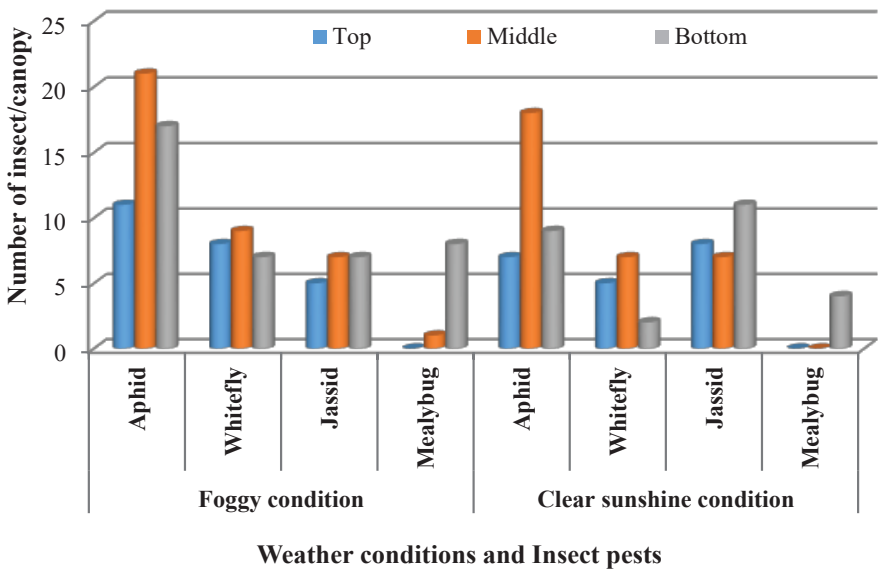


Fig. 1. Number of insect pests in top, middle and bottom plant canopies of brinjal in foggy and clear sunshine conditions

Effect of abiotic factors on sucking pests of brinjal

Relationship of aphid and whitefly of brinjal with temperature (^{0}C): A positive and linear relationship was observed between mean aphid population with the average temperature in brinjal host (Fig. 2A). The relationship indicated that temperature influences the population of aphid. A linear regression was fitted between mean aphid populations and temperature. The regression equation Y = a + bX, where Y = mean aphid population, a = -0.244, b = 0.794 and X = temperature, was obtained. The contribution of regression (R^2 = 0.221) was 22.1%.

A negative and linear relationship was observed between mean whitefly population with the average temperature in brinjal host (Fig. 2 B). The relationship indicated that temperature has no influence on the population of whitefly. A linear regression was fitted between mean whitefly populations and temperature. The regression equation Y = a + bX, where Y = mean whitefly population, a = 8.097, b = -0.049 and X = temperature, was obtained. The contribution of regression (R^2 = 0.035) was 3.5%.

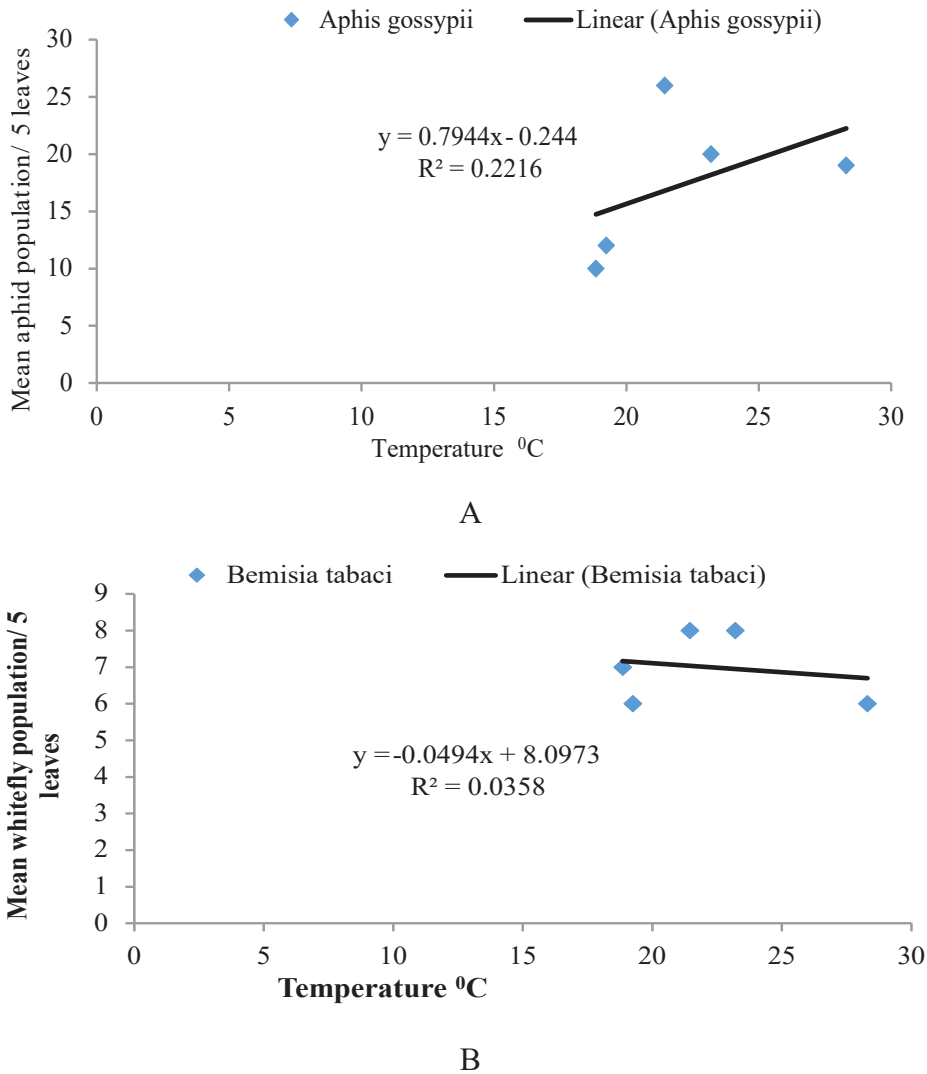
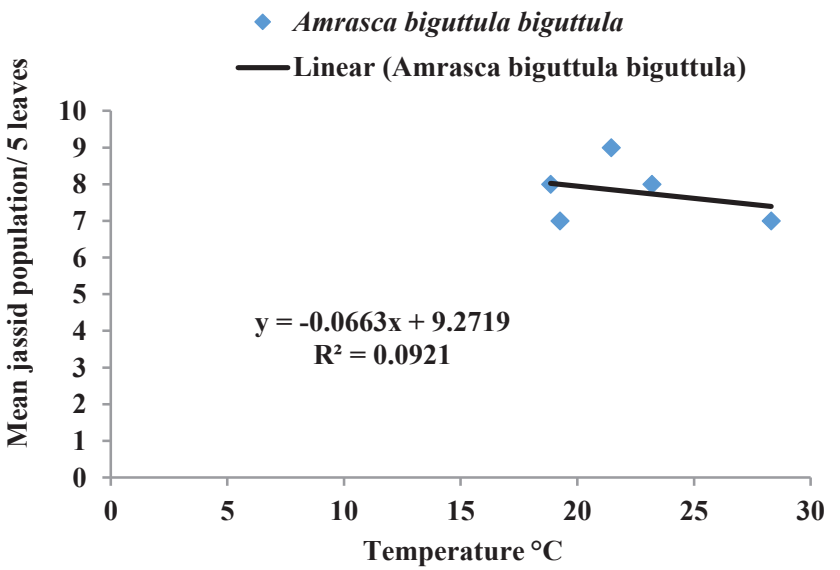


Fig. 2. Relationship of *Aphis gossypii* (A) and *Bemisia tabaci* (B) of brinjal with temperature (^{0}C)

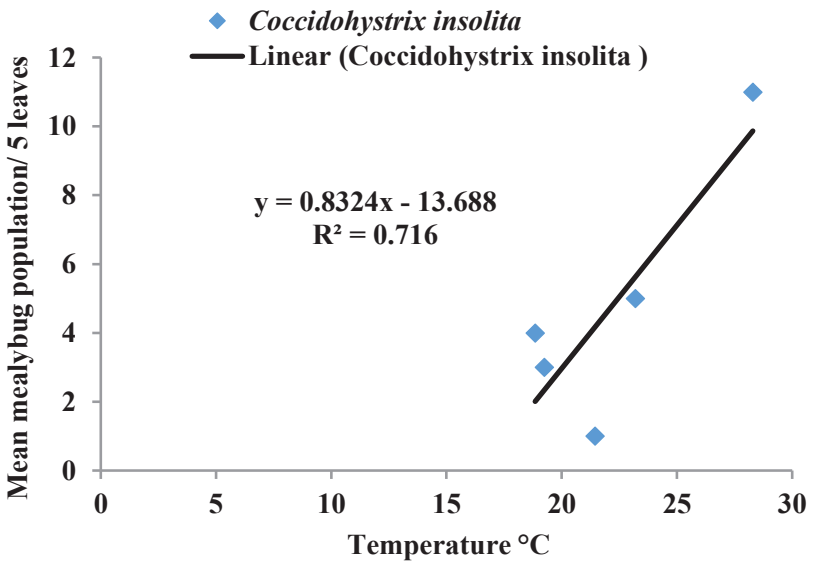
Relationship of jassid and mealy bug of brinjal with average temperature (°C): A negative and linear relationship was observed between mean jassid population with the temperature in brinjal host (Fig. 3A). The relationship indicated that temperature has no influence on the population of jassid. A linear regression was fitted between mean jassid population and temperature. The regression equation Y = a + bX, where

Y = mean jassid population, a = 9.271, b = -0.066 and X = temperature, was obtained. The contribution of regression (R^2 = 0.092) was 9.2%. A strong positive and linear relationship was observed between mean mealybug population with the temperature in brinjal host (Fig. 3 B). The relationship suggested that temperature influences the population of mealybug. A linear regression was fitted between mean mealybug populations and temperature. The regression equation Y = a + bX, where Y = mean mealybug population, a = -13.68, b = 0.832 and X = temperature, was obtained. The contribution of regression (R^2 = 0.716) was 71.6%.

Relationship of brinjal mite with average temperature (°C): A strong positive and linear relationship was observed between mean mite population with the temperature in brinjal host (Fig. 4). The relationship suggested that temperature influences the population of mite. A linear regression was fitted between mean mite population and temperature. The regression equation Y = a + bX, where Y = mean mite population, a = -37.47, b = 2.038 and X = temperature, was obtained. The contribution of regression (R^2 = 0.800) was 80%.



A



B

Fig. 3. Relationship of *Amrasca biguttula biguttula* (A) and *Coccidohystrix insolita* (B) of brinjal with temperature (°C)

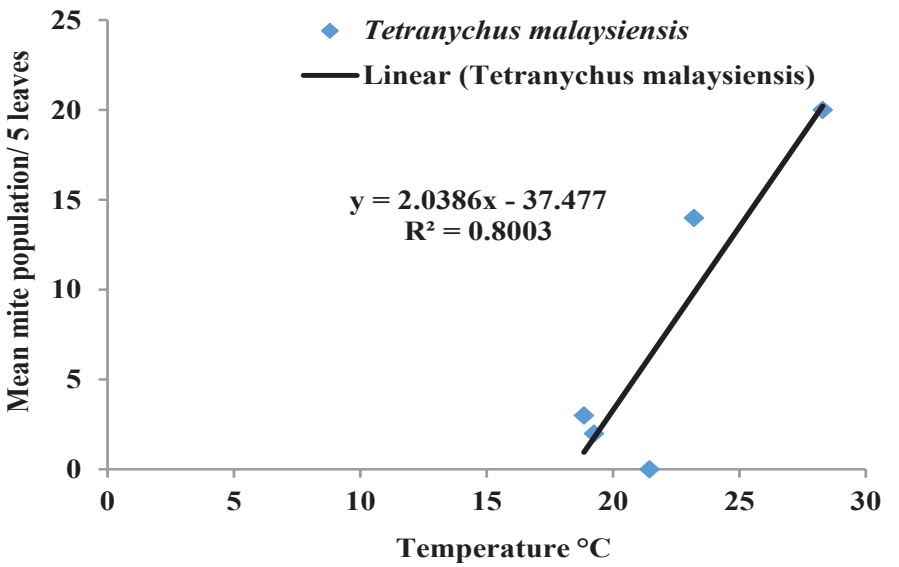
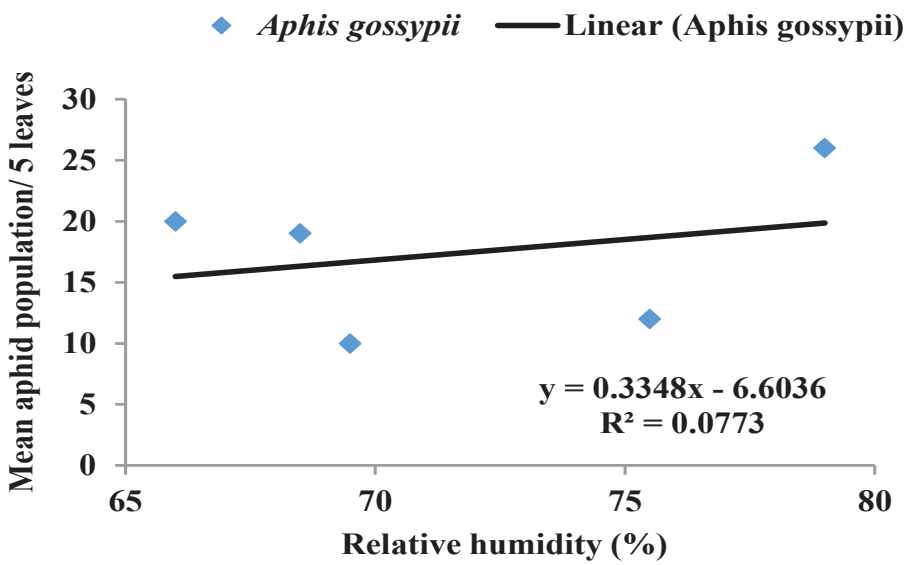
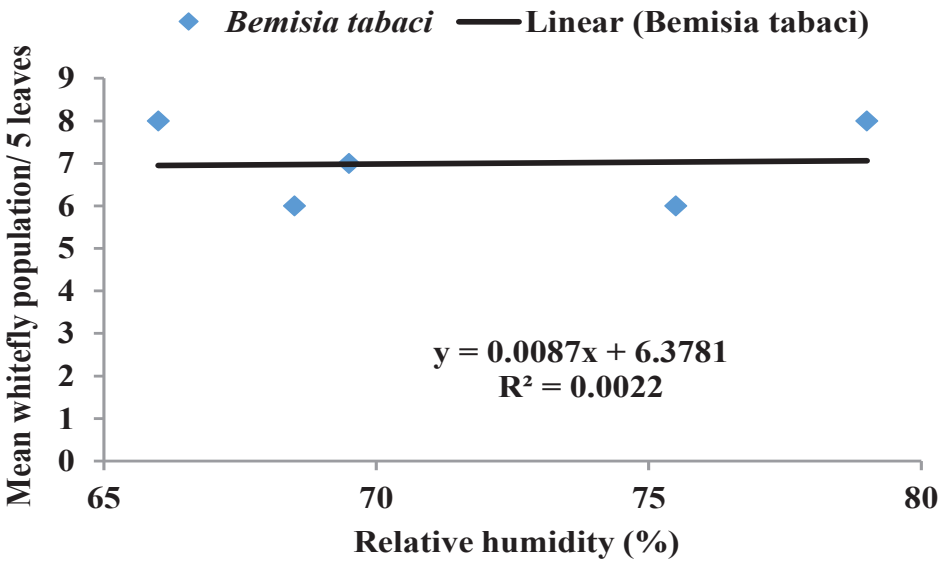


Fig. 4. Relationship *Tetranychus malaysiensis* with temperature of brinjal mite (°C)

Relationship of aphid and whitefly of brinjal with relative humidity (%): A positive and linear relationship was observed between mean aphid population with the relative humidity in brinjal host (Fig. 5A). The relationship indicated that relative humidity influences the population of aphid. A linear regression was fitted between mean aphid populations and relative humidity. The regression equation Y = a + bX, where Y = mean aphid population, a = -6.603, b = 0.334 and X = relative humidity, was obtained. The contribution of regression (R^2 = 0.077) was 7.7%. A positive and linear relationship was observed between mean whitefly population with the relative humidity in brinjal host (Fig. 5B). The relationship indicated that relative humidity has little influence on the population of whitefly. A linear regression was fitted between mean whitefly populations and relative humidity. The regression equation Y = a + bX, where Y = mean whitefly population, a = 6.378, b = 0.008 and X = relative humidity, was obtained. The contribution of regression (R^2 = 0.002) was 0.2%.



A

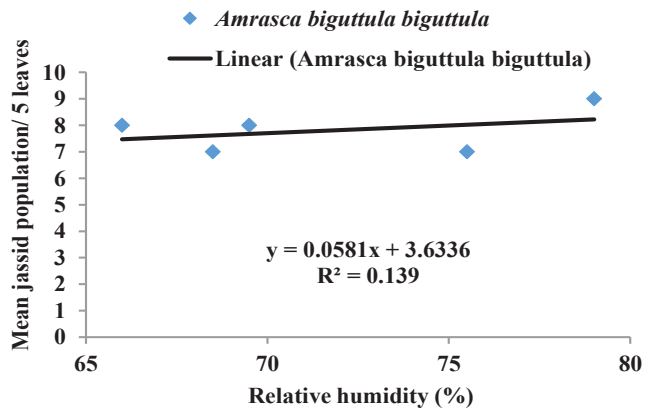


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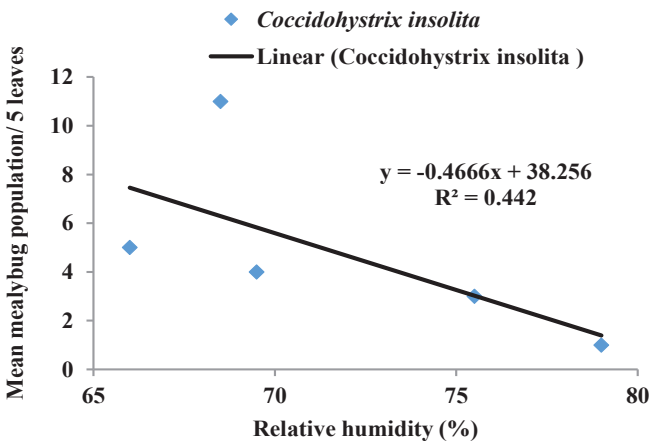
Fig. 5. Relationship of *Aphis gossypii* (A) and *Bemisiatabaci* (B) of brinjal with relative humidity (%)

Relationship of jassid and mealy bug of brinjal with relative humidity (%): A positive and linear relationship was observed between mean jassid population with the relative humidity in brinjal host (Fig. 6A). The relationship indicated that relative humidity influences the population of jassid. A linear regression was fitted between mean jassid population and relative humidity. The regression equation Y = a + bX, where Y = mean jassid population, a = 3.633, b = 0.058 and X = relative humidity, was obtained. The contribution of regression (R^2 = 0.139) was 13.9%. A strong negative and linear relationship was observed between mean mealy bug population with the relative humidity in brinjal host (Fig. 6 B). This relationship indicated that the population of mealy bug was decreased with increasing relative humidity. A linear regression was fitted between mean mealy bug population and relative humidity. The regression equation Y = a + bX, where Y = mean mealy bug population, a = 38.25, b = -0.466 and X = relative humidity, was obtained. The contribution of regression (R^2 = 0.442) was 44.2%.

Relationship of brinjal mite with relative humidity (%): A strong negative and linear relationship was observed between mean mite population with the relative humidity in brinjal host (Fig. 7). The relationship indicated that the population of mite was decreased with increasing relative humidity. A linear regression was fitted between mean mite population and relative humidity. The regression equation Y = a + bX, where Y = mean mite population, a = 96.60, b = -1.238 and X = relative humidity, was obtained. The contribution of regression (R^2 = 0.580) was 58%.



A



B

Fig. 6. Relationship of *Amrascabiguttulabiguttula* (A) and *occidohystrixinsolita* (B) of brinjal with relative humidity (%)

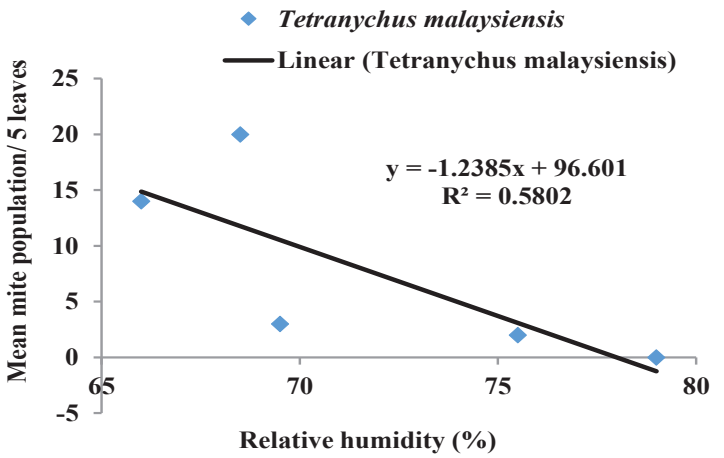


Fig. 7. Relationship of brinjal mite, *Tetranychus malaysiensis* with relative humidity (%)

Abiotic factors such as temperature, rainfall, humidity, fog and sunshine etc. may have tremendous effect on whitefly population. From the results, it was found that climatic factors did not seem to have significant effect on the fluctuation of *B. tabaci* population in the fields. This is in line with the previous study by Kohji *et al.* (1993). They reported that climatic factor was not a major factor affecting fluctuation in the population density of *B. tabaci*in Java, Indonesia. The findings of the present study are slightly contradict with the findings of Latif and Akhter (2013) who found that the population of whitefly was gradually increased with high temperature and high humidity up to certain age of the cultivated crops then declined with increasing age of the crops. Anjali *et al*. (2012) observed that the incidence of leaf hopper or jassid was maximum in December and minimum in March. The incidence of whitefly (*Bemisia tabaci*) was maximum in January and lowest in March. Both these insects showed significant negative correlation with both maximum and minimum temperature while a positive correlation was found with mean relative humidity. Low relative humidity favored the multiplication of mites and precipitation was the only abiotic factor that restricted mite population (Srinivasan 2009). Similar results were obtained by Naik *et al*. (2009) and Meena *et al*. (2010) they found that the association of leaf hopper population was positive and non-significant with rainfall during 2010-11, while, it was negative and significant during 2011-12.The results of the correlation values were in close agreement with the results of Omprakash *et*

al. (2013). The correlation values of the present experiment were in close agreement with the findings of Patel *et al.* (2015) where the correlation values for maximum temperature and minimum temperature have shown positive correlation with aphid population, and relative rainfall showed the negative correlation. Javed *et al*. (2017) found that among the various abiotic factors, maximum temperature showed highly significant positive correlation (r = 0.77) with the leaf hopper population. In case of aphid population, maximum temperature showed significant positive correlation (r = 0.70) and relative humidity at evening (r = -0.59) showed significant negative correlation with aphid population.

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