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Seasonal abundance of sucking pests of ash gourd (*Benincasa Hispida*) (Thunb.) Cogn.) in Tamil Nadu

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Abstract

Field experiment on seasonal abundance of insect pests of ash gourd was conducted by direct counting in farmer's holdings in Tamil Nadu during 2015-2016. Result revealed that that the major sucking pests were whitefly (*Bemisia tabaci*), leaf hopper (*Amrasca devastans*), aphids (*Myzus persicae*) and thrips (*Scirtothrips dorsalis*). The peak population of *A. devastans*, *B. tabaci* and *M. persicae* was recorded in second and third week of January (3.30 / three leaves / plant, 0.30 / three leaves / plant and 11.20 / three leaves / plant). Population of *S. dorsalis* was recorded to be the highest during third week of March (7.50/ three leaves / plant). Correlation analysis between weather parameters and abundance of insect pests of ash gourd revealed that temperature, morning relative humidity and sunshine hours played a major role with significant positive influence on the population build up of sucking pests *viz.,* whiteflies, leafhoppers, aphids and thrips. All the abiotic parameters were significant at 5% and 1% level.

Keywords: Seasonal abundance, sucking pests, ash gourd, Tamil Nadu

1. Introduction

Ash gourd *Benincasa hispida* (Thunb.) Cogn. belongs to the family Cucurbitaceae is one of the vegetable crops of the world, widely cultivated throughout humid tropical and sub tropical climates and used as a food source in India and China. It is also known as white gourd, winter melon, white pumpkin and wax gourd. Ash gourd is actually a fruit, but it is referred to as a vegetable because it is cooked and eaten as a vegetable. It is an excellent source of vitamin B1 (thiamine), a good source of vitamin B3 (niacin) and vitamin C and also rich in many minerals like calcium. Its high potassium content makes this a good vegetable for maintaining healthy blood pressure. In India, ash gourd occupies an area of about 2,497 hectares with the production of 15,326 tonnes and productivity of 6.13 tonnes per hectare (Anon, 2006) [2]. In Tamil Nadu, it is cultivated in an area of 204 hectares with the production and productivity of 3,876 tonnes and 19 tonnes /ha, respectively (Anon, 2012) [3]. Seasonal variation in abundance of tropical insects is a common phenomenon (Wolda, 1988; Pinheiro *et al*., 2002) [17, 15]. Insect abundance can change over time for a variety of reasons, including macroclimatic and microclimatic changes and variation in the availability of food resources (Wolda, 1988) [17]. The effect of climate change contributing to extreme weather events like amount of rainfall, proliferation of pests, crop diseases and high temperature effects (NEST, 2004) [12]. Insects are able to function faster and more efficiently at higher temperatures. They can feed, develop, reproduce and disperse when the climate is warm, though they may live for a shorter time (Drake, 1994) [5]. Information on weather parameters of standard weeks is important to analyse population dynamics of insect pests and natural enemies. Among the pests and disease complex, damage due to sucking pests *viz.,* whiteflies, aphids, thrips, leaf hopper in Tamil Nadu. Yield loss incurred due to pest problem results in the reduced income, poverty, food insecurity and loss of biodiversity. To develop a Integrated Pest Management (IPM) module against these noxious pests there is a need to conduct monitoring studies, keeping this background the present investigation on monitoring of seasonal abundance of insect pests of ash gourd was undertaken.

2. Materials and Methods

2.1 Study period and area

A field experiment was conducted in the farmer's holdings at Kalathupudhur, Pollachi and Coimbatore District in the Rabi season of ash gourd crop during December 2015- March 2016.

The area is located on latitude 10˚39'26.11" N and longitude 77˚00'38.41" E 293m above sea level. The design was randomized complete block, replicated seven times and area of one hectare.

2.2 Observations recorded

In the field experiment weekly observations were made on ten randomly selected plants**.** Sucking pests such as whitefly (*Bemisia tabaci* (Gennadius), leaf hopper (*Amrasca devastans* (Distant), aphids (*Myzus persicae* (Sulzer) and thrips (*Scirtothrips dorsalis* (Hood.) were recorded on three leaves per plant one each at top, middle and bottom of the plant. Weekly counts on pest population were correlated with weekly weather parameters *viz*., maximum temperature (T_{max}), minimum temperature (T_{min}), relative humidity (RH), rainfall and solar radiation obtained from the automatic weather station installed at Tamil Nadu Agricultural University, Coimbatore

2.3 Statistical analysis

The data obtained from the field experiments on seasonal incidence of ash gourd were analyzed using AGRES ver. (7.01), Pascal International Solutions. The data in numbers were subjected to square root transformation and the data in percentage were subjected to arcsine transformation before analysis and mean values were separated by LSD (Gomez and Gomez, 1984) [6].

3. Results and Discussion

Results from monitoring studies of seasonal abundance of sucking pests by direct counting revealed that the major sucking pests were whitefly (*Bemisia tabaci*)*,* leaf hopper (*Amrasca devastans*)*,* aphids (*Myzus persicae*) and thrips (*Scirtothrips dorsalis*) found to be infesting ash gourd.

Results of monitoring of seasonal abundance of insect pests of ash gourd revealed that the highest number of *B. tabaci* was recorded during third standard week (3.30 / 3 leaves / plant), while it was recorded to be the lowest during seventh standard week (1.00) (Table1). The results are in line with the findings of Dahatonde *et al.* (2014) [4] who observed the highest number of whiteflies during January, while, Janu (2006) [7] recorded maximum population during December and January. As per the report of Muniyappa *et al*. (2003) [11], the incidence of pumpkin yellow vein mosaic disease in cucurbits and the associated yield loss were maximum during February to May, when the vector population was at its peak.

Regarding leafhoppers*,* the highest number of *A. devastans* was recorded during second standard week (0.30 / 3 leaves / plant) and it was found to be nil during sixth standard week (Table1). Similar results were obtained by Dahatonde *et al*. (2014) [4], who reported that there was a progressive increase in leafhopper population in December. According to Anitha (2007) [1], peak incidence of leafhoppers was noticed during first week of January, 2006 (18.4 /3 leaves) and observed a gradual decline in population of leafhoppers.

The highest number of *M. persicae* was recorded during third standard week (11.20 / 3 leaves / plant) and was found to be the lowest during eighth standard week (1.00) (Table1). As per the report of Patel and Rote (1995) [13], the population of aphids decreased during December and increased gradually during the month of January. Anitha (2007) [1] also observed the peak incidence of aphids (24.9 aphids/ 3 leaves) during first week of January and the population of aphids declined gradually thereafter. In the present study, the population of *S. dorsalis* was recorded to be the highest during eleventh standard week (7.50 / three leaves / plant) and was found to be nil during fifty second standard week (Table1).

Table 1: Seasonal abundance of sucking pests of ash gourd during 2015-2016

Year/ Month	SMW	Number of insects / 3 leaves / plant*			
		Bemisia tabaci	*Amrasca devastans*	*Myzus persicae*	*Scirtothrips dorsalis*
December (2015)	SMW 52	0.70	0.20	3.10	0.00
	SMW 53	2.30	0.20	7.00	0.90
January (2016)	SMW 01	3.00	0.20	7.80	2.10
	SMW 02	1.40	0.30	9.00	0.80
	SMW 03	3.30	0.30	11.20	2.00
	SMW 04	1.60	0.30	6.40	3.80
February (2016)	SMW 05	0.60	0.30	4.80	7.20
	SMW 06	1.10	0.00	3.60	4.40
	SMW 07	0.00	0.00	2.00	5.90
	SMW 08	1.20	0.00	0.00	7.00
March (2016)	SMW 09	1.10	0.00	0.00	7.50
	SMW10	0.70	0.00	0.00	5.80
	SMW11	1.00	0.00	0.00	7.50
	SMW12	0.70	0.00	0.00	5.80

* Mean of observations taken on 10 plants; SMW - Standard Metrological Week

3.1 Correlation between weather parameters and abundance of sucking pests of ash gourd

Results on the correlation analysis between weather parameters and abundance of *B. tabaci* revealed that maximum temperature (T_{max}) was positively correlated with the population of whiteflies with the r value of 0.708 and was found to be statistically significant at 5 per cent level. Minimum temperature (T_{min}) was found to be negatively correlated with the population of whiteflies with the r value of -0.158. Sunshine hours was positively correlated with the r value of 0.646, while, evening relative humidity and rainfall were negatively correlated with the r value of -0.528 and -0.197, respectively (Table 2). The result is similar to those reported by Mathur *et al*. (2012) [9]. Showed negative correlation with minimum temperature. Regarding *A. devastans,* maximum temperature (T_{max}) was positively correlated with leafhopper population with the r value of 0.633 and was found to be statistically significant at 1 per cent level, whereas, minimum temperature (T_{min}) was found to be negatively correlated, with the r value of -0.455. Morning relative humidity and sunshine hours were positively correlated with the abundance of leafhoppers with the r value of 0.546 and 0.589, respectively, while, evening relative humidity and rainfall were negatively correlated with the r value of -0.324 and -0.66, respectively (Table 2).Correlation between weather parameters and population of *M. persicae* revealed that maximum temperature (T_{max}) was positively correlated with the population of aphids with the r value of 0.641 and was found to be statistically significant at 1 per cent level. Sunshine was positively correlated with the population of aphids with the r value of 0.723 and was found to be statistically significant at 5 per cent level. Evening relative humidity and rainfall were negatively correlated with the r value of -0.476 and -0.168, respectively (Table 2).Maximum temperature (T_{max}) and morning relative humidity were positively correlated with the population of *S. dorsalis* with the r value of 0.781 and 0.725 and were found to be statistically significant at 5 per cent level. Evening relative humidity and rainfall were negatively correlated with thrips population with the r value of -0.618and -0.431, respectively (Table 2). Patel *et al*., (2009) [14] reported that significant positive relationship existed with maximum temperature, whereas significant negative correlation was found evening relative humidity and rainfall. The above results on correlation analysis between weather parameters and abundance of insect pests of ash gourd revealed that temperature, morning relative humidity and sunshine hours played a major role with significant positive influence on the population build up of sucking pests *viz.,* whiteflies, leafhoppers, aphids and thrips This might be due to high reproductive potential of sucking pests at high temperature, relative humidity and sunshine hours (Table 2). These results are in agreement with the findings of Mahato *et al.* (2008) [8] and Meena *et al.* (2009) [10] who reported that maximum temperature was positively correlated with the population dynamics of sucking pests.

Table 2: Correlation analysis between weather parameters on seasonal abundance of sucking pests of ash gourd during 2015-2016

Variables	*Bemisia tabaci*	*Amrasca devastans*	*Myzus persicae*	*Scirtothrips dorsalis*
Minimum temperature (T_{min}) (°C)	-0.158	-0.455	-0.274	-0.330
Morning Relative humidity (%)	0.261	0.546*	0.462	0.725**
Evening Relative humidity (%)	-0.528	-0.324	-0.476	-0.618*
Sun shine (hours)	0.646*	0.589*	0.723**	0.326
Rainfall (mm)	-0.197	-0.066	-0.168	-0.431

* Correlation coefficient significant at 1% level
**Correlation coefficient significant at 5% level

3.2 Multiple linear regression analysis between weather parameters and abundance of sucking pests of ash gourd

Results of multiple linear regression analysis between weather parameters and abundance of *B. tabaci* population revealed that the maximum temperature had significant contribution towards the population of whiteflies with the R^2 value of 0.819. When the maximum temperature increased by 1 °C, mean number of whiteflies increased by 0.792 per three leaves per plant (Table 3). Maximum temperature, morning relative humidity and sunshine hours had significant contribution towards the population build up of leafhoppers with the R^2 value of 0.825. When the maximum temperature increased by 1 °C, mean number of *A. devastans* increased by 0.519 per three leaves per plant. When the morning relative humidity increased by 1 per cent, the leafhopper population increased by 0.416 per three leaves per plant. When the sunshine increased by 1 hour the leafhopper population increased by 0.381 per three leaves per plant (Table 3). Maximum temperature and sunshine hours had significant contribution towards the population of aphids with R^2 value of 0.817. When the maximum temperature increased by 1°C, mean number of *M. persicae* increased by 1.293 per three leaves. When the sunshine increased by 1 hour the population of aphids increased by 2.414 per three leaves per plant (Table 3). Maximum temperature and morning relative humidity had significant contribution towards the population of thrips with the R^2 value of 0.731. When the maximum temperature increased by 1 °C, mean number of *S. dorsalis* increased by 0.652 per three leaves per plant. When the morning relative humidity increased by 1 per cent, the thrips population increased by 0.427 per three leaves per plant (Table 3).

According to Suresh and Chandrakavitha (2007) [16], for every unit increase in maximum temperature, evening relative humidity and rainfall, there observed significant reduction in the population of mealybugs by 8.9, 0.49, 0.96 units, respectively, whereas, for every unit increase in sunshine hours, the mealybug population increased by 4.6 units.

Table 3: Multiple linear regression analysis for the prediction of seasonal abundance of sucking pests of ash gourd during 2015-2016

Variables	*Bemisia tabaci* (Y_1)	*Amrasca devastans* (Y_2)	*Myzus persicae* (Y_3)	*Scirtothrips dorsalis* (Y_4)
Maximum temperature (T_{max}) (°C) (X_1)	0.792**	0.519*	1.293**	0.652**
Minimum temperature (T_{min}) (°C) (X_2)	-0.022	-0.024	-0.280	-0.183
Morning Relative humidity (%) (X_3)	0.136	0.416*	0.216	0.427*
Evening Relative humidity (%) (X_4)	-0.054	-0.006	-0.277	-0.130
Sun shine (hours) (X_5)	0.358*	0.380*	2.414**	0.098
Rainfall (mm) (X_6)	-0.581	-0.062	-0.262	-1.625
R^2	0.819	0.825	0.817	0.731

Regression equations

$Y_1 = 43.29 + 0.792X_1^{**} - 0.022X_2 + 0.136X_3 - 0.054X_4 + 0.358X_5^{*} - 0.581X_6$

$Y_2 = 0.750 + 0.519X_1^{**} - 0.024X_2 + 0.416X_3 - 0.006X_4 + 0.380X_5^{*} - 0.062X_6$

$Y_3 = 63.02 + 1.293X_1^{**} - 0.280X_2 + 0.216X_3 - 0.277X_4 + 2.414X_5^{**} - 0.262X_6$

$Y_4 = -10.822 + 0.652X_1^{**} - 0.183X_2 + 0.427X_3^{**} - 0.130X_4 + 0.098X_5 - 1.625X_6$

**Regression coefficient significant at 5% level
*Regression coefficient significant at 1% level

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