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Incidence of Fruit Borer *Helicoverpa armigera* (Hubner) on Ashwagandha in Shivamogga

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A B S T R A C T

Shivamogga region is one of the richest sources of biodiversity in the world, having a wide range of medicinal and aromatic plants. The present studies were undertaken to record the incidence of fruit borer *Helicoverpa armigera* on Ashwagandha. Fruit borer, *Helicoverpa armigera* (H.) (Noctuidae: Lepidoptera) is one of the pest of ashwagandha in Shivamogga. Its incidence in cultivated ashwagandha during 2014-2015 was studied at Organic Farming Research Center (OFRC) Shivamogga. The larval incidence and per cent fruit borer damage on ashwagandha at OFRC, Shivamogga was recorded during September 2014 to February 2015 and its occurrence was peak during third week of December *i.e.*, 1.3 larvae per plant and 41.40 per cent respectively**.** A non-significant correlation was observed between the larval population of *H. armigera* and weather factors. The correlation between fruit damage and weather factor was found negatively significant to rainfall and non-significant to temperature and relative humidity.

Introduction

Ashwagandha [*Withania somnifera* (L.) Dunal], also known as Indian ginseng is an important medicinal plant used in Ayurvedic formulations to treat various aliments of mankind (Sangwan *et al.*, 2004).

The plant is very hardy and drought resistant and now cultivated as rainfed crop in almost all the parts of country due to its high value and export potential (Chandranath and Katti, 2010). The crop is reported to attack by many insect pests (Ramanna *et al.*, 2010). *H. armigera* is one of the major pests of ashwagandha causing severe damage to crop.

The incidence of fruit borer varies from place to place and year to year due to prevailing environment. Information on the incidence of *H. armigera* in the region is very meager. Thus to understand the pest status, incidence of the pest on ashwagandha in the region present investigation is attempted.

Materials and Methods

Studies were conducted during 2014-2015 in organic framing research center, College of Agriculture, Shivamogga.

Incidence of *H. armigera*

A study was conducted at OFRC, College of Agriculture, Navile, Shivamogga in an area of 100 sq.mt to determine the incidence of fruit borer *Helicoverpa armigera* on Ashwagandha during cropping period from September 2014 to March 2015. The population fluctuation of fruit borer was recorded at weekly interval during cropping seasons. The crop was monitored weekly interval for the incidence of fruit borer damage in Ashwagandha. The data on incidence of the fruit borer on ashwagandha for durations were presented graphically with important weather parameters namely temperature and relative humidity of same period. Correlation of co-efficient (r) was worked out between incidence of fruit borer and important weather parameters during the period to find out the influence of weather on population fluctuation.

For the sampling, ten plants were randomly selected and number of insects was recorded per plant. The fruit borer damage was assessed by counting number of infested and healthy pod. Total number of fruits and fruits damaged by fruit borer in each plant was recorded and per cent infestation was worked out by using formula.

$$\text{Percent infestation} = \frac{\text{Total no. of infested fruits}}{\text{Total no. of fruits in plant}} \times 100$$

After compiling the data on the incidence of fruit borer, weather parameters *viz.*, maximum and minimum temperature, relative humidity and rainfall factors were subjected to simple correlation and multiple regression analysis.

Results and Discussion

The incidence was monitored from September 2014 to February 2015 at weekly interval. The incidence of *H. armigera* commenced from second week of October 2014 and continued till fourth week of February 2015. During second week of October 2014, the incidence of *H. armigera* was less (0.3 larvae per plant). The more number of larvae was observed during different weeks of December 2014 and reached the maximum of 1 to 1.3 larvae per plant during third week of December 2014 and then declined during last week of January 2015 (Plate 1).

The Correlation between larval population of *H. armigera* and weather factors exhibited non-significant correlation with all the weather parameters (Table 1).

The incidence of per cent fruit borer damage was commenced from second week of October 2014 and continued till fourth week of February 2015. During second week of October 2014, the initial damage of fruit borer was at a lower level (2.80%). The percentage of damage increased to 4.6 per cent in the next third week of October.

The heavy percentage of damage was observed during different weeks of December 2014 and reached the maximum of 41.40 per cent during third week of December 2014 and then declined during last week of January 2015 (14.20 %) (Table 3). The results obtained are closely related with the Rammana (2009) who reported that the percent fruit borer damage was gradually increased in August (20.5%) and reached to peak during the fourth night of November (43%) on ashwagandha (Figure 1 and 2).

The data pertaining to relationship between fruit borer damage and weather parameters is presented in the Table 2.

Table.1 Correlation co-efficient values between larval incidence of *H. armigera* and weather parameters during 2014-2015

Insect pest	Rain fall (mm)	Temperature (^{0}C)		Relative humidity (%)	
		Maximum	Minimum	Morning	Evening
H. armigera	-0.359	0.324	-0.104	-0.276	-0.159

n=23
Non-Significant at 5% r= 0.41

Table.2 Correlation co-efficient values between per cent fruit borer damage of Ashwagandha and weather parameters during 2014-2015

Factor	Rain fall (mm)	Temperature (^{0}C)		Relative humidity (%)	
		Maximum	Minimum	Morning	Evening
Per cent fruit borer damage	-0.456*	0.168	-0.242	-0.114	-0.004

n=23
* Significant at 5 % r= 0.413

Table.3 Multiple linear regression of per cent fruit borer damage of Ashwagandha with weather parameters during 2014-2015

Factor	Constant A	X1	X2	X3	X4	X5	R^2
Per cent fruit borer damage	-146.36	-0.371	0.456	-0.32	-0.09	0.579	0.331

Where,
X_1: Rain fall
X_2: Maximum temperature
X_3: Minimum temperature
X_4: Morning humidity
X_5: Evening humidity
R^2: Coefficient of determination

Fig.1 Average weekly incidence of *H. armigera* on ashwagandha during 2014-2015

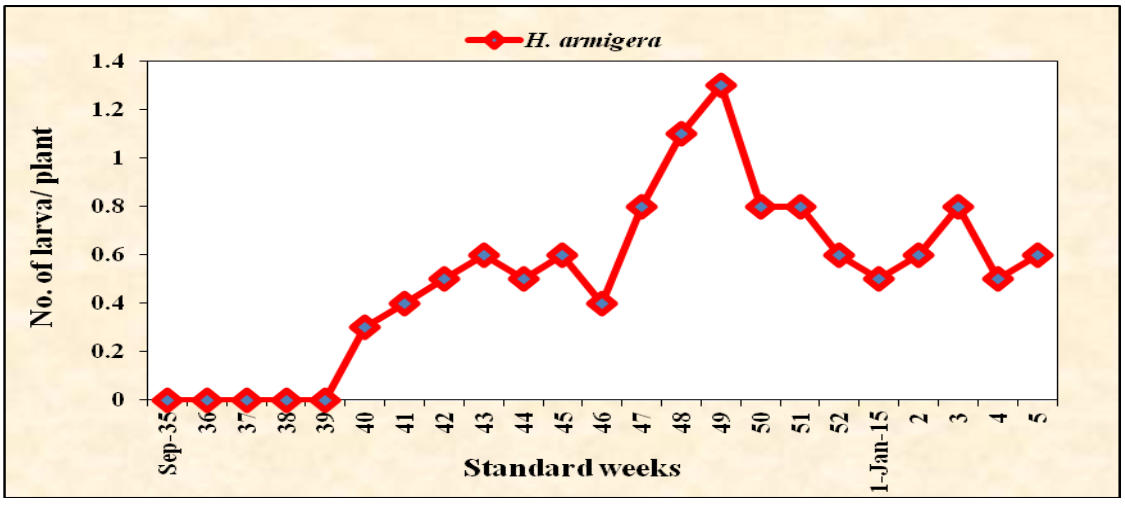

Fig.2 Incidence of per cent fruit borer damage on ashwagandha during 2014-15

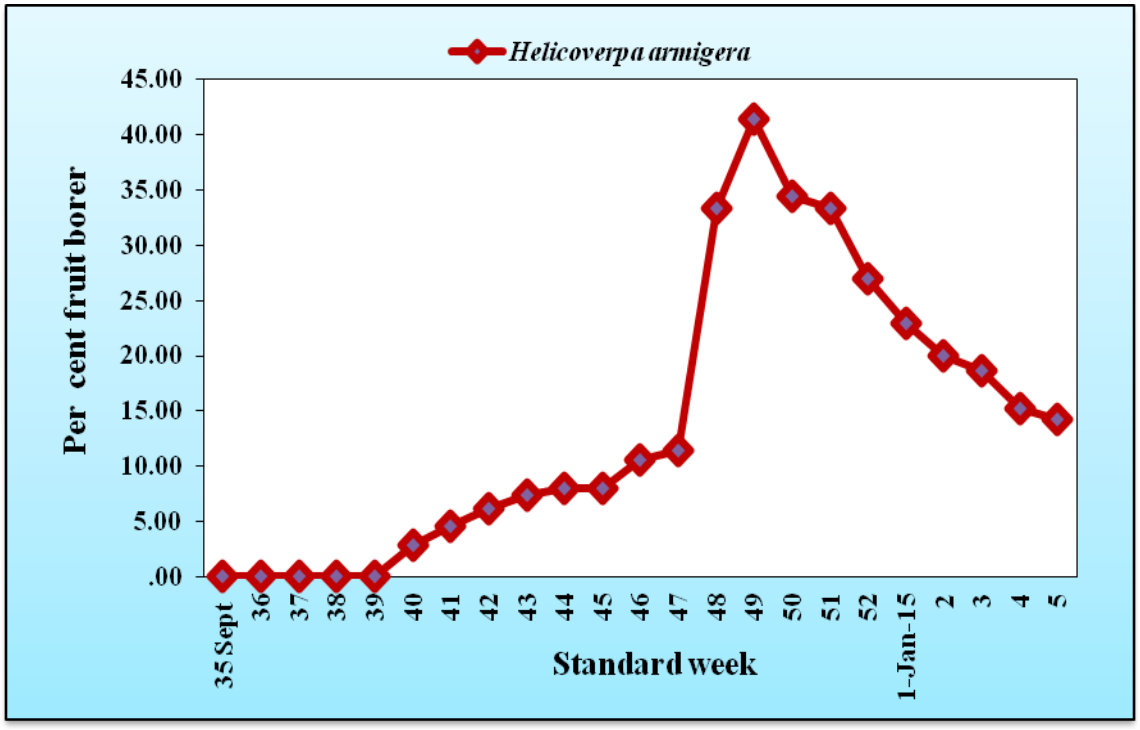

Fig.3 Relationship between maximum temperature (^{0}C) and minimum temperature (^{0}C) with incidence of *H. armigera* on ashwagandha

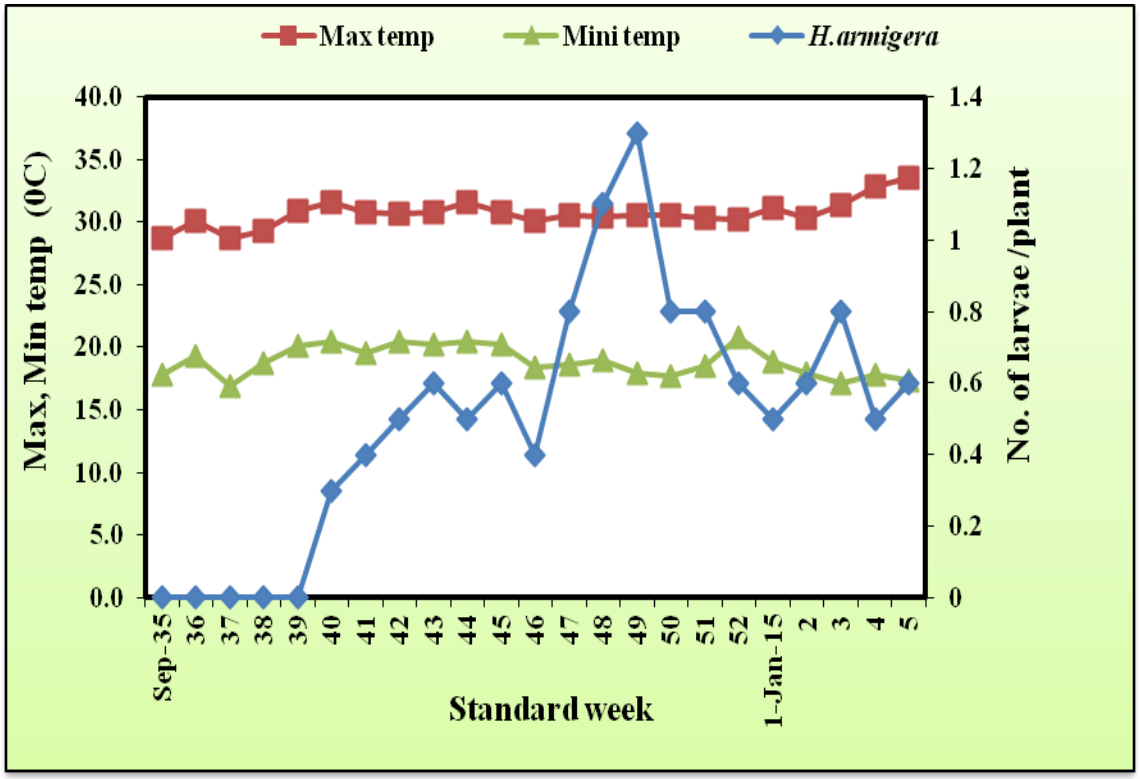

Fig.4 Relationship between morning (Rh1) and evening (Rh2) relative humidity (%) with incidence of *H. armigera* on ashwagandha

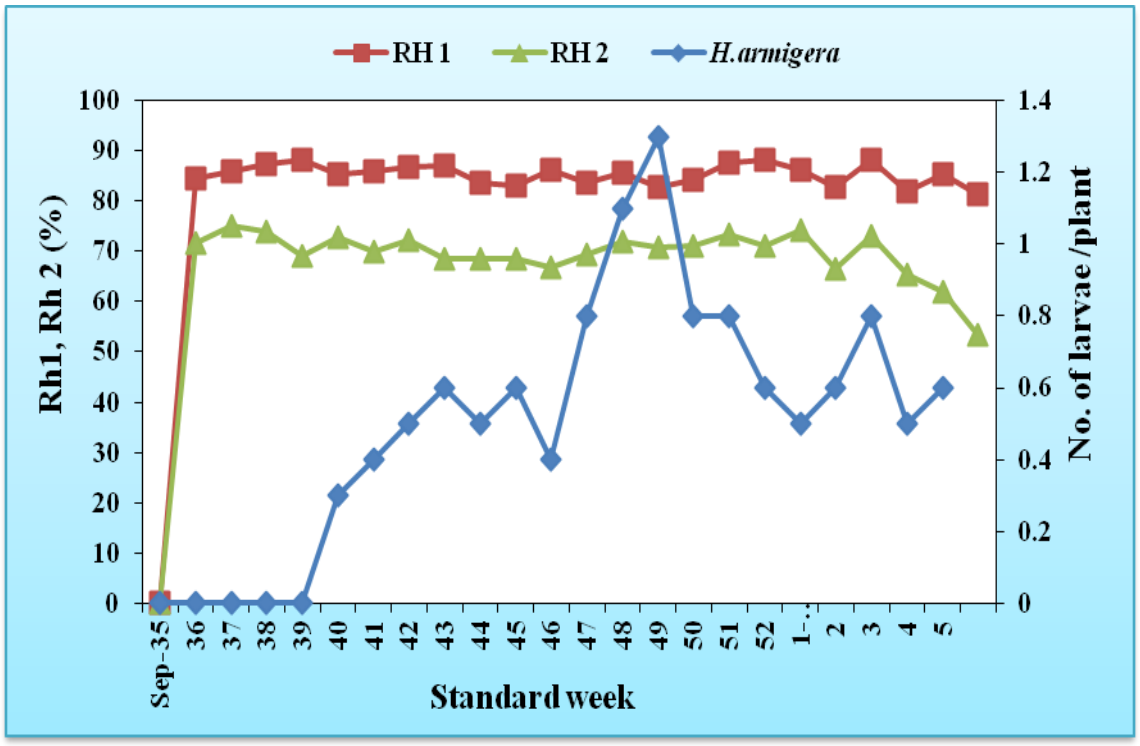

Fig.5 Relationship between rainfall (mm) with incidence of *H. armigera* on ashwagandha

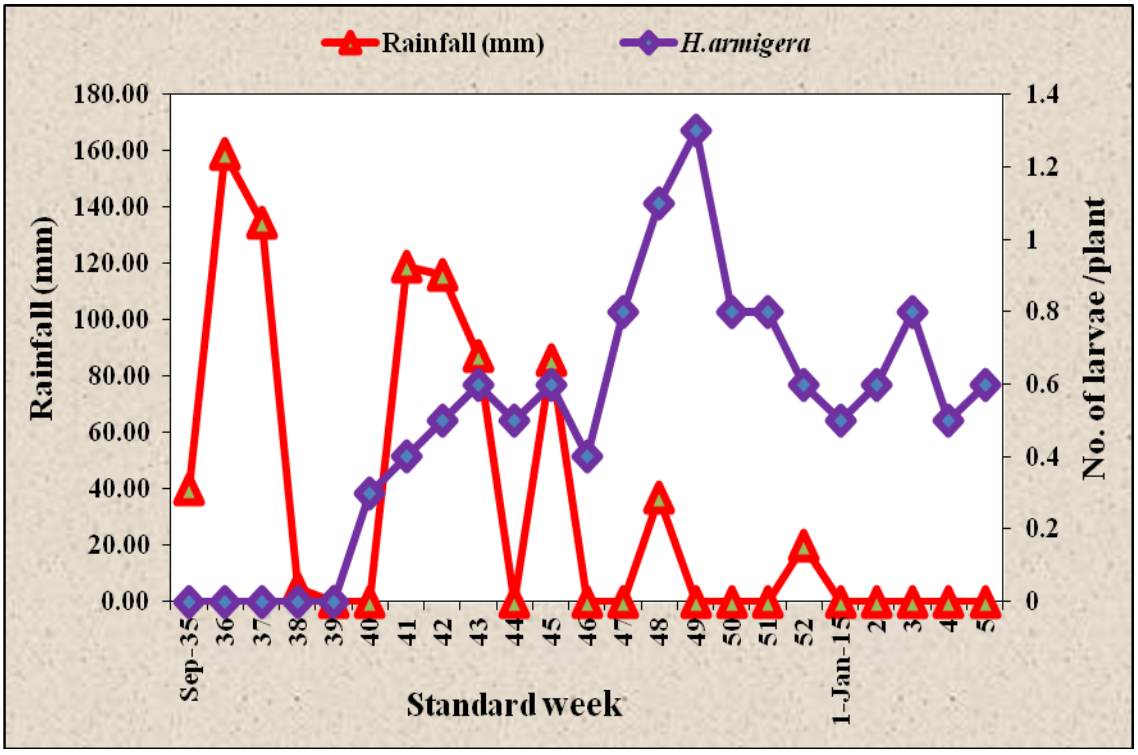

Plate.1 Incidence of *Helicoverpa armigera* on Ashwagandha at OFRC, Shivamogga

Larvae of *H. armigera*

Adult of *H.armigera*

Fruit damaged by *H. armigera*

The correlation studies made between incidence of per cent fruit borer damage and weather parameters revealed that, evening relative humidity (r = -0.004) showed negative and non-significant relationship, whereas rainfall (r = -.456*) showed negative and significant relationship with percentage of fruit borer damage. Maximum temperature (r = 0.168) had positive and showed non-significant relationship whereas minimum temperature (r = -0.242) and morning relative humidity (r = -0.114) had negative correlation and showed non-significant relationship with percentage of fruit borer damage. The results obtained are in confirmation with findings of Sivaprakasam (1996) on tomato fruit borer. Similarly, Raodeo *et al.*, (1983) who reported that the population of *Helicoverpa armigera* on Cotton was reported to be negatively correlated with rainfall (Figure 3, 4 and 5).

The multiple linear regression equation was fitted to the data and equation found was. (Table 3)

$Y = -146.36 - 0.371X_1 + 0.456\ X_2 - 0.32\ X_3 - 0.09\ X_4 + 0.331\ X_5$

Where, X_1=Rainfall (mm); X_2=Maximum temperature (^{0}C); X_3=Minimum temperature (^{0}C); X_4 = Morning Relative humidity 1(%); X_5 = Evening Relative humidity 2(%).

This explains that every increase in one unit of rainfall, minimum temperature, morning relative humidity will decrease per cent fruit borer damage by -0.371, -0.32, and -0.09 units, respectively. Whereas every increase in one unit of maximum temperature and evening relative humidity will increase the percent fruit borer damage by 0.0456 and 0.331 units, respectively. The weather factors influenced per cent fruit borer damage to the extent of 33 per cent. The maximum population of larval incidence and per cent fruit borer damage on Ashwagandha was peak during third week of December *i.e.,* 1.3 larvae per plant and 41.40 per cent respectively**.** A non-significant correlation was observed between the larval population of *H. armigera* and weather factors. The correlation between fruit damage and weather factor was found negatively significant to rainfall and non-significant to temperature and relative humidity.

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