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# Seasonal Incidence of Pulse Pod Borer *Etiella zinckenella* (Treitschke) on Soybean and Its Relation with Abiotic Factors

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**Abstract** A field experiment was carried out during *kharif* 2014 to study the seasonal incidence of pod borer *E. zinckenella* on two extensively grown varieties of soybean namely JS 335 and DSb 21. The results revealed that the population of *E. zinckenella* was very low on soybean which appeared on 33rd Meteorological Standard Week on JS 335 with the larval population of 0.10 larvae / plant and continued to increase gradually up to 1.0 l/plant on 42nd MSW. While in DSb 21, the infestation appeared on 34th MSW with 0.10 l/plant and attained a peak of 0.70 l/plant on 42nd MSW. The highest pod and seed damage in case of JS 335 was observed during 42nd MSW (5.02 and 4.18%, respectively). However it was 3.28 and 2.25% pod and seed damage, respectively on DSb 21. The correlation studies between *E. zinckenella* and weather parameters revealed that the larval population of the pod borer exhibited a highly significant positive correlation with the maximum temperature ($r = 0.73^{**}$) on DSb 21. In both the varieties, a highly significant negative correlation ($r = -0.71^{**}$ and $r = -0.79^{**}$ respectively) was observed with morning relative humidity.

**Keywords** Seasonal incidence, *Etiella zinckenella*, Correlation, Abiotic factors, Soybean.

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## Introduction

Soybean (*Glycine max* (L) Merrill) is a fascinating crop with innumerable possibilities of not only improving agriculture, but also supporting industries. Soybean is a major source of edible oil (20%) and high quality protein (40%). It is a rich source of amino acids, vitamins and minerals. Soybean oil is used as a raw material in manufacturing antibiotics, paints, varnishes, adhesives, lubricants. Even though the area under soybean in India has shown an appraisable increase, the productivity remains only 950 kg/ha as against worlds average of 2233 kg/ha [1]. The lower productivity can be attributed to both biotic and abiotic stresses. Among the biotic factors, ravages caused by insect pests, mainly the pod borers are of paramount important in causing considerable yield loss in soybean. Some of them are *Helicoverpa armigera* (Hubner), *Maruca testulalis* (Geyer), *Cydia ptychora* (Meyrick) and *E. zinckenella*. Among these, *E. zinckenella* is widely distributed on several legumes in Asia with a host range comprising of soybean, pigeon pea, mung bean, cowpea and other legumes. Climatic conditions could profoundly effect on the population dynamics and the status of insect pests of crops. These effects could be directly through the influence that weather may have on the insect's physiology and behavior [2]. For development of successful pest management strategies, detailed information on the population build up and in particular the influence of weather factors on pest population is of great significance. Considering the above facts, the present study was focused on the

**Table 1.** Incidence of *Etiella zinckenella*, pod and seed damage on soybean during *kharif*-2014. MSW: Meteorological Standard Week.

| | No. of larvae/plant | | Pod damage (%) | | Seed damage (%) | |
|---|---|---|---|---|---|---|
| | JS | DSb | JS | DSb | JS | DSb |
| MSW | 335 | 21 | 335 | 21 | 335 | 21 |
| 33 | 0.10 | 0.00 | 0.34 | 0.00 | 0.25 | 0.00 |
| 34 | 0.20 | 0.10 | 0.94 | 0.19 | 0.62 | 0.06 |
| 35 | 0.40 | 0.10 | 1.29 | 0.42 | 0.83 | 0.21 |
| 36 | 0.50 | 0.20 | 1.45 | 0.75 | 1.12 | 0.41 |
| 37 | 0.60 | 0.30 | 1.63 | 1.04 | 1.34 | 0.76 |
| 38 | 0.60 | 0.40 | 1.92 | 1.33 | 1.45 | 0.85 |
| 39 | 0.80 | 0.50 | 2.28 | 1.83 | 1.75 | 1.24 |
| 40 | 0.80 | 0.60 | 3.11 | 2.02 | 2.13 | 1.35 |
| 41 | 0.90 | 0.60 | 4.12 | 2.20 | 3.21 | 1.60 |
| 42 | 1.00 | 0.70 | 5.02 | 3.28 | 4.18 | 2.25 |

seasonal incidence of pod borer *E. zinckenella* in soybean and its relationship with the abiotic factors which will enable in formulating suitable pest management strategies.

## Materials and Methods

The experiment on seasonal incidence of *E. zinckenella* on two soybean varieties JS 335 and DSb 21 spaced at 30 × 10 cm was conducted by taking up sowing in the second week of July during *kharif* 2014 in a plot size of 10 × 10 m at the Entomology Block, Main Agricultural Research Station (MARS), UAS Dharwad. All the recommended agronomic practices were followed to grow the crop and the whole plot was exposed to natural infestation wherein no insecticide sprays were taken. Observations on number of larvae per plant were taken from ten randomly selected plants per plot at weekly intervals after the appearance of pest till harvesting of the crop. The observations also included number of pods and numbedr of damaged pods per plant, number of seeds and damaged seeds per plant which was converted into per cent pod and seeds damage, respectively. Daily records of maximum and minimum temperature, morning and evening relative humidity and rainfall during the crop growth period were collected from Meteorological observatory, MARS Dharwad. The collected data were subjected to regression analysis [3] to draw inferences on the relationships between weather parameters and the incidence of *E. zinckenella*:

$$\text{Correlation coefficient } (r) = \frac{\Sigma (X-\bar{X})(Y-\bar{Y})}{\sqrt{\Sigma(\bar{X}-X)^2\,\Sigma(\bar{Y}-Y)^2}}$$

$$\text{Regression coefficient } (byx) = \frac{\Sigma (X-\bar{X})(Y-\bar{Y})}{\sqrt{\Sigma(X-\bar{X})^2}}$$

## Results and Discussion

The results presented in Table 1 indicated that the incidence of pod borer *E. zinckenella* on soybean varieties was noticed from 33rd to 34th Meteorological Standard Week and continued till 42nd MSW of *kharif* 2014. The infestation appeared on 33rd MSW in JS 335 with the larval population of 0.10 l/plant and continued to increase gradually up to 1.0 l/plant on 42nd MSW. While in DSb 21, the infestation appeared on 34th MSW with 0.10 l/plant and increased gradually and attained a peak of 0.70 l/plant on 42nd MSW. The

**Table 2.** Correlation and regression between incidence of *Etiella zinckenella* with weather parameters during *kharif*-2014. *Significant at $p$ = 0.005, **Significant at $p$ = 0.01, R.H. I : Morning relative humidity, R. H. II : Evening relative humidity Y– Dependent variables (insect populations) Total number of observations = 10.

| | Correlation coefficient | | | | | | |
|---|---|---|---|---|---|---|---|
| Soybean varieties | Max. Temp. ($X_1$) | Min. Temp. ($X_2$) | RH. I ($X_3$) | RH. II ($X_4$) | Rain-fall ($X_5$) | Regression equation (Y = a + bx) | $r^2$ |
| JS 335 | 0.59 | –0.32 | –0.71** | –0.57 | – 0.13 | $Y = -4.47+0.45x_1-0.33\times2-0.09\times3 + 0.11x_4-0.01x_5$ | 0.86 |
| DSb 21 | 0.73** | –0.36 | –0.79** | –0.72** | –0.11 | $Y = -2.61+0.31x_1- 0.25x_2-0.06x_3+ 0.07x_4 - 0.01x_5$ | 0.88 |

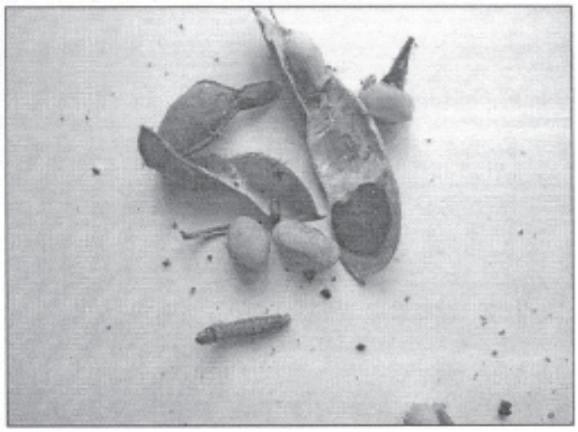

**Fig. 1.** Soybean pods damaged by *E. zinckenella*.

pod damage by *E. zincenella* on JS 335 ranged from 0.34% on 33rd MSW to 5.02% on 42nd MSW, whereas, in DSb 21, it ranged from 0.19% on 34th MSW to 3.28% on 42nd MSW. The pod damage increased gradually on varieties JS 335 and DSb 21 and attained a peak of 5.02 and 3.28% respectively, at 42nd MSW. Similarly, seed damage in the variety JS 335 ranged from 0.25% on 33rd MSW to 4.18% on 42nd MSW. An increasing trend was observed in seed damage and attained a peak of 4.18% on 42nd MSW. In DSb 21, least seed damage of 0.06% was recorded on 34th MSW which gradually increased and attained a peak of 2.25% on 42nd MSW (Table 1). This indicated that the pest remained active from August to October. It can be clearly observed that variety JS 335 was more preferred by the pod borer in comparison with DSb 21. The highest per cent pod and seed damage recorded in JS 335 was 5.02 and 4.18% respectively, whereas it was just 3.28 and 2.25% in case of DSb 21. Thus, inspite of less incidence and lower per cent pod and seed damage by *E. zinckenella*, variety DSb 21 exhibited some sort of tolerance to the pod borer when compared to JS 335 which was more susceptible to the pod borer.

The present findings are in agreement with earlier report [4] who reported that the infestation of *E. zinckenella* starts late in August in soybean, and the first - generation moths start appearing late in September. Occurrence of pod borers throughout the cropping season of field bean has already reported earlier [5]. From the seasonal incidence studies, it was observed that the population build up of the pod borer varied remarkably, probably due to agro climatic conditions and crop types. The variations in seasonal incidence of pod borers may be due to changes in the location, crop type, weather conditions as well as the qualitative and quantitative aspects of host plants available in the region. Van Den Berg [6] has reported that *E. zinckenella* is restricted to the reproductive stages of soybean for its development and only one complete generation develops in a crop. Where soybean is available over a prolonged period, infestation by *E. zinckenella* will increase over time and has been attributed to a population build up and concentration of moths in relatively small areas of late-planted soybean. Thus changes in the cropping pattern over years in Dharwad might be the major reason for the decreased proportion of this pod borer.

The data on correlation of weather parameters with incidence of *E. zinckenella* indicated that there is a highly significant negative correlation of incidence with morning relative humidity in case of both varieties, JS 335 and DSb 21 ($r$ = -0.71** and $r$=-0.79**, respectively) (Table 2). However, a highly significant positive correlation existed between maximum temperature and pod borer incidence in case of variety, DSb 21 ($r$ = 0.73**) and a highly significant negative correlation ($r$ = - 0.72**) was exhibited with evening relative humidity. A non-significant negative correlation was exhibited between rainfall and pod borer incidence in both the varieties.

Talekar and Chen [4] also reported that despite the availability of the host plant throughout the year, the pulse pod borer occurred only between November and February which indicated that the pod borer preferred drier weather. Naito et al. [7] observed that the *Etiella* spp. population density on soybean was highest during the dry season in Indonesia. However, Fargalla and Fahim [8] reported that positive relationship existed between heat requirements (DDU) and the population densities of *E. zinckenella* in the two ecosystems (Qalubiya and Fayoum Governorate) during two successive seasons. Thus, the above reports are more or less similar to the present findings.

**References**


1. Santhosh MN (2008) Evaluation of ITK components against major insect pests of soybean (*Glycine max* (L.) Merill). MSc (Ag) thesis. Univ Agric Sci, Dharwad, India.
2. Merrill R, Gutierrez D, Lewis O, Gutierrez J, Diez S, Wilson R (2008) Combined effects of climate and biotic interactions on the elevational range of a phytophagous insect. J Anim Ecol 77 : 145—155.
3. Panse VG, Sukhatme PV (1985) Statistical methods for agricultural Research. ICAR, New Delhi.
4. Talekar NS, Chen BS (1983) Seasonality of insect pests of soybean and mung bean in Taiwan. J Econ Entomol 76 : 34—37.
5. Mallikarjunappa (1989) Field bean pod borer complex with reference to germplasm screening, life table, action threshold, crop loss and chemical control of *Adisura atkinsoni*. MSc (Ag) thesis. Univ Agric Sci. Bangalore, pp 6—15.
6. Van Den Berg H, Shepard BM, Nasikin (1998) Damage incidence by *Etiella zinckenella* and *Helicoverpa armigera* in soybean in East Java, Indonesia. Int J Pest Manag 44 : 153—159.
7. Naito A, Harnoto A, Iqbal A, Hattori I (1986) Notes on the morphology and distribution of *Etiella hobsoni* (Butler), a new soybean pod borer in Indonesia, with special reference to *Etiella zinckenella* Treitschke (Lepidoptera : Pyralidae). Appl Entomol Zool 21 : 81—88.
8. Fargalla FH, Fahim MA (2014) Comparative studies for the arthropod fauna of cowpea plantations and their associated predators in two agro-ecological zones with climatic studies on the lima bean pod borer, *Etiella zinckenella* (Treit.). Researcher 6 : 43—52.