Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 1872-1875

Received: 19-03-2020
Accepted: 21-04-2020

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Effect of sowing date with relation to incidence of shoot and fruit borer on okra

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Abstract
The present investigation was conducted to study the influence of sowing dates on the incidence of shoot and fruit borer on okra during *summer* 2016 and 2017 at RARS, Karjat. Okra crop was cultivated at 3 different sowing dates 2016 and 2017 during summer season (3rd week of January, 1st week of February and 3rd week of February). Results revealed that the average data of two years 2016 and 2017, the incidence of okra shoot and fruit borer the maximum shoot and fruit borer infestation was recorded 33.70 percent in IX week after sowing in late sown crop whereas and it was recorded minimum in IV week *i.e.* 8.61 percent after sowing in early sown crop. The results showed that the infestation of the shoot and fruit borer increased with the delay in sowing of the crop.

Keywords: Sowing date, *Earias vittella*, shoot and fruit borer, okra, infestation

Introduction
Okra, *Abelmoschus esculentus* Linn (Moench) is an important vegetable crop of tropics and subtropics. It is the second most preferred vegetable (next to brinjal) in India. It is an important source of vitamin A, B and C and is also rich in protein, carbohydrates, fats and iron. It is also a rich source of dietary fibre, antioxidants, ascorbic acid and folate (Dilruba *et al.* 2009) [3].
It is mainly cultivated in states of Uttar Pradesh, Karnataka, Gujarat and Maharashtra. In Maharashtra area under this crop is 0.023 Mha with production of 241.50 MT and productivity of 10.50 MT/ ha (Anon., 2015) [1]. It is extensively grown in Ahmednagar, Amravati, Nagpur, Aurangabad, Dhule, Jalgaon, Nasik, Osmanabad, Parbhani and Pune districts in the state of Maharashtra.
The crop is attacked by a variety of pests throughout its growth stages (Rao *et al*. 2002) [10]. Amongst them okra shoot and fruit borer (*Earias vittella* Fabricius, Lepidoptera: Noctuidae) is of much significance (Gautam *et al*. 2014) [4] and causes extensive damage to fruits resulting in 69 per cent yield loss (Atwal and Singh 1990) [2] and 8.40 to 73.20 per cent variation in fruit infestation (Kumar and Urs 1988) [7]. It is an endemic pest and inflicts direct loss to the crop. It is an oligophagus pest and okra and cotton are its main host plants. It is also found feeding on a large number of malvaceous crop plants. The information on effect of sowing dates on okra shoot and fruit borer in Konkan region of Maharashtra. Hence, the present investigation carried out to study the influence of sowing date on the incidence of shoot and fruit borer on okra.

Materials and methods
Field experiments were conducted in two successive seasons on the year 2016 and 2017 during summer season. Okra crop was cultivated at 3 different sowing dates (3rd week of January, 1st week of February and 3rd week of February)
Population dynamics in relation to sowing period was carried out for shoot and fruit borer, *Earias vittella* (Fabricius) under field conditions.
The plots were kept unsprayed throughout the crop season. In order to determine the effect of sowing periods on population fluctuation of pests, the variety Varsha upahar was sown during summer season at Regional Agriculture Research Station, Karjat (M.S). The details of sowing dates are mentioned below.

Details of the experiment

Spacing	:	45 X 30cm
Net plot size	:	2.50 X 3.00 m
Design	:	Randomized block design
Replications	:	3
Treatments (sowing dates)	:	Date of Sowing 1st - 26/01/2016& 2017
		Date of Sowing 2nd – 09/02/2016& 2017
		Date of Sowing 3rd - 24/02/2016& 2017

Method of recording observations

Shoot and fruit borer, *Earias vittella* (Fabricius)

The observations on shoot infestation and flower bud infestation were recorded from five randomly selected plants from each plot. There was no shoot infestation and flower bud infestation was minor. The observations on fruit infestation were recorded from five randomly selected plants from each plot. Total number of fruits, healthy fruits and infested fruits were recorded from five randomly selected plants of each treatment. The per cent infestation was worked out on the basis of healthy and infested fruits on number basis. The data was converted into per cent infested fruit and analysed statistically.

Result and Discussion

The effect of date of sowing against okra shoot and fruit borer, *E. vittella*

Summer 2016

During year 2016, the data presented in Table 1 and graphically illustrated in Fig. 1. Results on shoot and fruit damage indicated that, initiation of shoot and fruit damage was observed at 5th week on crop, sown on 26th January, 10th February and 25th February. During the cropping season the shoot and fruit damage varied from 9.15 to 29.76 percent. The highest damage was recorded on 7th WAS in all sowing dates *i.e.* 24.56, 26.20 and 29.76 percent damage respectively. The highest shoot and fruit damage was recorded on late sown crop (25th Feb- 29.76 percent), whereas the lowest damage was recorded on early sown crop (26th Jan - 9.15 percent). Thereafter the shoot and fruit damage was decreased.

Yield

Considering the yield data during summer 2016 of crop sown on different sowing dates presented in Table 2 and graphically illustrated in Fig. 3. The crop sown on 10th February recorded higher yield (3885 kg ha^{-1}) of marketable fruits compared to 26th January (3520 kg ha^{-1}) and 25th February (3211 kg ha^{-1}) sown crop respectively.

Summer 2017

During year 2017 the data presented in Table 1 and graphically illustrated in Fig. 2. Result on shoot and fruit damage indicated that, initiation of shoot and fruit damage was observed at 5th WAS on crop, sown on 26th January, 10th February and 25th February. During the cropping season the shoot and fruit damage varied from 8.06 to 31.01 percent. The highest damage was recorded on 9th WAS in all sowing dates *i.e.* 28.80, 27.64 and 31.01 percent damage respectively. The highest shoot and fruit damage was recorded on late sown crop on (25th Feb – 31.01%) whereas the lowest damage was recorded on early sown crop (26th Jan - 8.06%).

Yield

Considering the yield data during summer 2017 (Table 2 and Fig. 3) of crop sown on different sowing dates in relation to the yield of okra fruits. The crop sown on 10th February gave higher yield (3640 kg ha^{-1}) of marketable fruits compared to 26th January (3331 kg ha^{-1}) and 25th February (3190 kg ha^{-1}) sown crop respectively.

Present findings are in conformation with Ghosh *et al.* (1999) [6]. They reported that fruit borer, *E. vittella*, infestation was not found at initial fruiting stage, however, it appeared late during 28th May to 3rd June and reached to peak (32.22 %) during last week of July in West Bengal. Rai and Satpathy (1999) [9] observed increasing trend of okra fruit borer damage with the advancement of sowing time (15th May, 25th May, 5th June, 15th June, 25th June, 5th July and 15th July), however maximum fruit damage recorded in crop sown in second week of July which was lowest in crop sown on 25th May but maximum fruit yield obtained from crop sown in first week of June due to suitable growing conditions.

Similarly, these observations fall in line with the results of Gautam *et al*. (2013) [5] also reported that early sown crop *i.e.* on 1 March had less infestation (27.80%) followed by crop sown on 17 March (31.20%) while highest infestation (44.40%) was recorded in the late sown (2 April) okra crop. Kaur *et al.*, (2013) [7] studied the influence of sowing dates and varieties of okra on incidence of shoot and fruit borer, *Earias* spp. under field conditions in Punjab and reported that early sowing i.e. second fortnight of May recorded low fruit infestation 12.00 and 14.17 per cent on number and weight basis, respectively and highest marketable yield (189.18 q/ha).

Table 1: Effect of different dates of sowing against okra shoot and fruit borer, *E. vittella*

Week	2016			2017		
	Mean percent fruit infestation			Mean percent fruit infestation		
	26th Jan.	10th Feb.	25th Feb.	26th Jan.	10th Feb.	25th Feb.
I week	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
II week	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
III week	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
IV week	9.15 (17.56)	10.81 (19.19)	15.89 (23.42)	8.06 (16.43)	9.52 (17.95)	12.74 (20.88)
V week	14.71 (22.55)	16.63 (24.04)	18.14 (25.18)	10.42 (18.81)	13.56 (21.56)	15.71 (23.34)
VI week	20.19 (26.64)	21.23 (27.42)	24.54 (29.67)	13.56 (21.56)	15.24 (22.95)	18.94 (25.77)
VII week	24.56 (29.67)	26.20 (30.79)	29.76 (33.02)	17.58 (24.73)	19.26 (25.99)	20.39 (26.78)

VIII week	28.45 (32.20)	30.73 (33.65)	33.31 (35.24)	22.81 (28.52)	24.54 (29.67)	26.54 (30.98)
IX week	23.98 (29.27)	33.02 (35.06)	36.38 (37.05)	26.13 (30.72)	29.32 (32.77)	31.01 (33.83)
X week	30.66 (33.58)	36.71 (37.29)	39.56 (38.54)	24.50 (29.67)	26.10 (30.72)	27.31 (31.50)
XI Week	19.01 (25.84)	26.10 (30.72)	32.82 (34.94)	28.80 (32.46)	27.64 (31.76)	30.29 (33.34)
XII Week	13.05 (21.13)	17.04 (24.35)	22.81 (28.52)	19.00 (25.84)	18.04 (25.10)	21.82 (27.83)
XIII Week	10.80 (19.19)	13.68 (21.64)	17.25 (24.50)	12.80 (12.80)	13.25 (21.30)	15.16 (22.87)
S.Em. ±	0.06	0.04	0.06	0.09	0.06	0.06
CD (p=0.05)	0.19	0.12	0.17	0.26	0.17	0.17

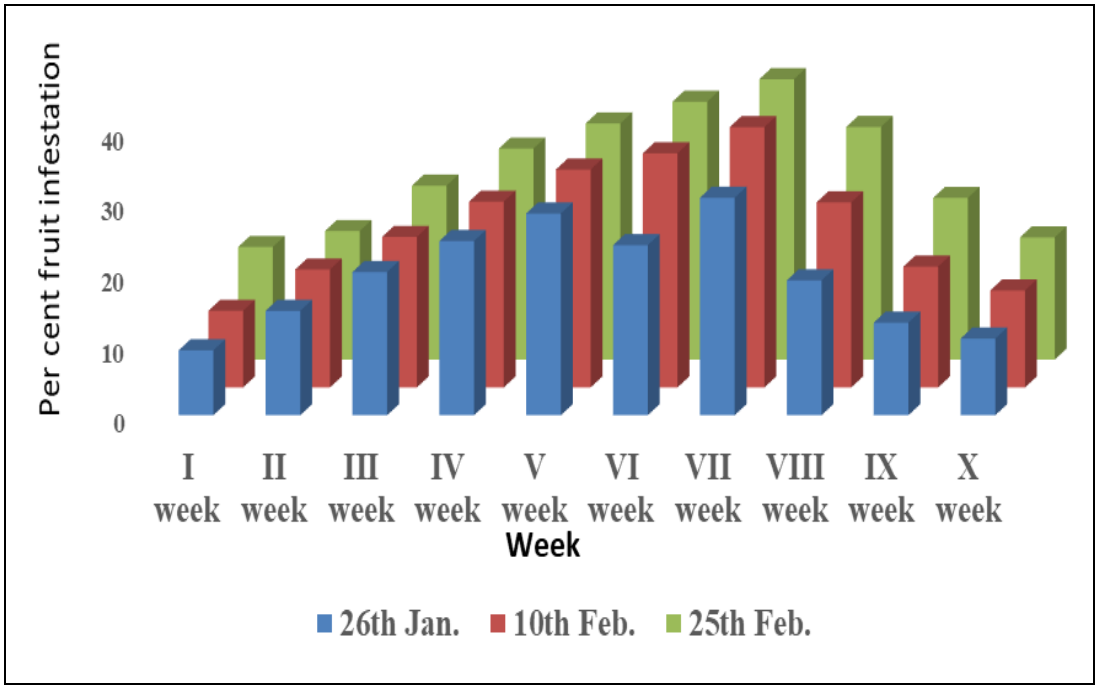

Fig 1: Effect of different dates of sowing against okra shoot and fruit borer, *E. vittella* during 2016

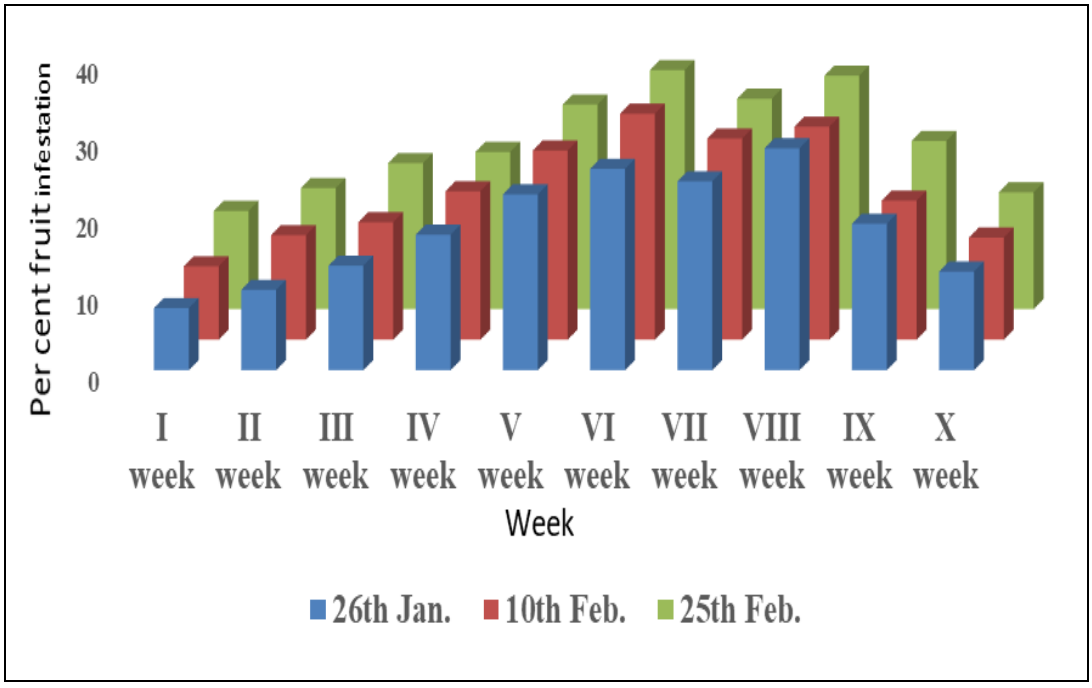

Fig 2: Effect of different dates of sowing against okra shoot and fruit borer, *E. vittella* during 2017

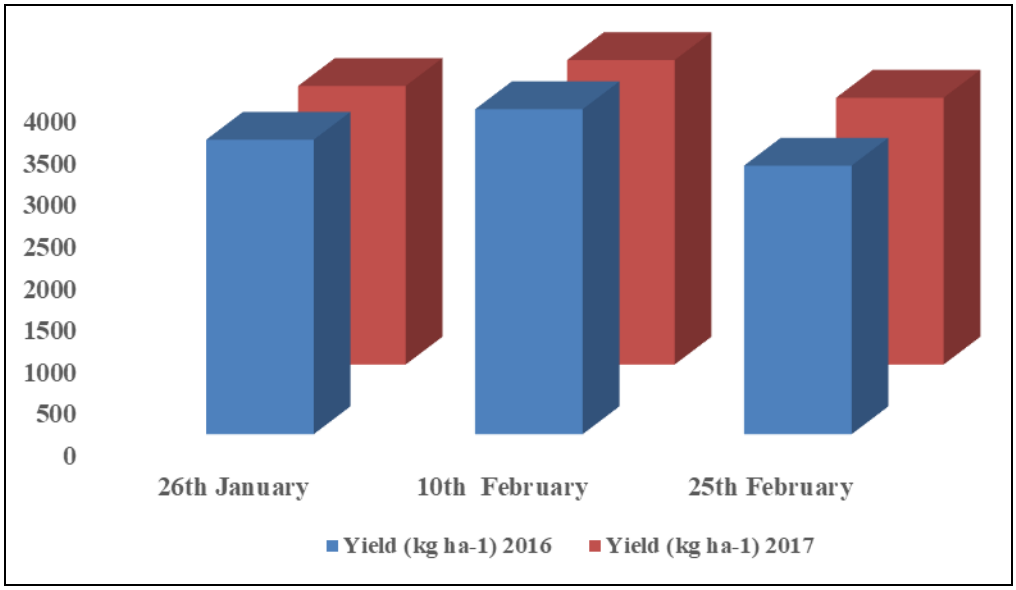

Fig 3: Effect of sowing dates on yield of okra

Table 2: Effect of sowing dates on yield of okra

Sowing date	Yield (kg ha^{-1}) 2016	Yield (kg ha^{-1}) 2017
26th January	3520	3331
10th February	3885	3640
25th February	3211	3190

Conclusion

Date of sowing is one of the best cultural practice use by farmers to escape, avoided the pest infestation on the crop and get appropriate yield as well as income. From the present investigation, it can be concluded as the okra crop was cultivated at 3 different sowing dates 2016 and 2017 during summer season (3rd week of January, 1st week of February and 3rd week of February). Results indicated that the average data of two years 2016 and 2017, the incidence of okra shoot and fruit borer the maximum shoot and fruit borer infestation was recorded 33.70 percent in IX week after sowing in late sown crop whereas and it was recorded minimum in IV week *i.e.* 8.61 percent after sowing in early sown crop. The results showed that the infestation of the shoot and fruit borer increased with the delay in sowing of the crop.

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