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RESEARCH ARTICLE :

Effect of date of planting and spacing on the activity of chilli fruit borer (*Helicoverpa armigera* Hub.)

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SUMMARY : The field experiments were carried out for two seasons to know the effect of planting time and plant geometry on the activity of chilli fruit borer at the MARS, UAS, Dharwad. The experiment was laid out in a split plot design with three replications across four dates of planting *viz.*, M_1- June 30th, M_2- July 15th, M_3- July 30th and M_4- August 15th as main plot treatments and four spacings *viz.*, S_1- 90 x 60cm, S_2- 60 x 60cm, S_3- 75 x 45cm and S_4- 60 x 30cm as sub-plot treatments. The seeds were sown on the raised seed bed on May 15th, May 30th, June 15th and June 30th in 2011-12 and 2012-13. The pooled data on the effect of planting dates and spacing on the activity of chilli fruit borer showed that, among the different planting dates *i.e.* in main plots, July 15th transplanted crop recorded significantly less fruit borer larvae per plant and fruit borer damage per cent followed by July 30th. Whereas, significantly more number of fruit borer larvae and fruit borer damage per cent was observed in June 30th transplanted crop at 60, 90 and 120 DAT. Among the different spacings *i.e.*, in subplots, significantly least fruit borer larval count and per cent fruit borer damage was observed in 90 X 60cm, followed by 60 X 60cm subplots. Whereas, 60 X 30cm recorded significantly more number of fruit borer larval count and per cent damage. The interaction effect among the date of planting and different spacings was found significant. Significantly lower fruit borer larval population and fruit damage per cent was recorded by the interaction of July 15th transplanted crop at 90 X 60cm spacing followed by July 15th + 60 X 60cm and July 15th + 75 X 45cm, respectively. Whereas, higher pest population was recorded by the interaction of June 30th + 60 x 30cm.

KEY WORDS :
Fruit borer, Fruit damage per cent, Planting date, Spacing

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BACKGROUND AND OBJECTIVES

Chilli (*Capsicum annuum* L.) is an important spice as well as vegetable crop. It is an essential ingredient of curry and the crop has got great export potential besides huge domestic requirement. India is the largest consumer and exporter of chilli in the world with a production of 15.2 lakh tonnes from an area of 811 thousands ha and productivity 1.9 MT per ha during 2014 (NHB, 2015). The major chilli growing states are Andhra Pradesh, Maharashtra, Karnataka, Tamilnadu and Rajasthan. Chillies constitute about 20 per cent of Indian spice exports in quantity and about 14 per cent in value. Although there is a scope to enhance the productivity of chilli, a number of limiting factors have been attributed for the low productivity, among which, the damage caused by insect pests and mites is of paramount importance.

More than 293 insects and mite species attack the crop in field as well as storage. Amongst these, aphids (*Myzys persicae* Sulzer, *Aphis gossypi* Glover), yellow mite (*Polyphagotarsonemus latus* Banks), thrips (*Scirtothrips dorsalis* Hood) and fruit borer (*Helicoverpa armigera* Hubner) (Berke and Sheih, 2000). In Karnataka thrips, mites, aphids and whiteflies have been identified as sucking pests of chilli of which chilli leaf curl caused by mite and thrips are serious (Puttarudriah, 1959). The loss caused by the thrips is reported to range from 50 to 90 per cent (Borah, 1987) and fruit borers is to an extent of 90 per cent (Reddy and Reddy, 1999). So, different strategies have to be involved for keeping the frit borer in check and stabilizing the productivity of cropping system.

Due to monoculture of chilli in chemical intensive agriculture now-a-days pest buildup is so much that farmers resort to a minimum of 5 to 6 chemical sprays on Byadagi chilli, making cultivation of chilli highly risky and non-profitable. In addition to this, overuse of pesticides has lead to resurgence of pests and ill effects on natural enemy fauna. Pesticide residues in chilli are also of great concern from the point of domestic consumption and exports as well. It is therefore, imperative to find out a better planting time and spacing from the point of pest debilitation so that the crop can escape the pest attack or receives less pest ravage ultimately leading to reduced pesticide consumption and to become viable components of a sound IPM programme.

RESOURCES AND METHODS

The field experiments were carried out for two seasons to know the effect of planting time and plant geometry on the activity of chilli fruit borer at the MARS, UAS, Dharwad. The experiment was laid out in a split plot design with three replications across four dates of planting *viz.,* M_1- June 30th, M_2- July 15th, M_3- July 30th and M_4- August 15th as main plot treatments and four spacings *viz.,* S_1- 90 x 60cm, S_2- 60 x 60cm, S_3- 75 x 45cm and S_4- 60 x 30cm as sub-plot treatments. The seeds were sown on the raised seed bed on May 15th, May 30th, June 15th and June 30th in 2011-12 and 2012-13. Forty-five days old seedlings were transplanted as per the dates with fifteen days interval in plots size of 5.4 X 4.8 m with different spacings. All management practices were followed as per recommended package of practices except the plant protection measures against target pests.

The observations on larval population of chilli fruit borer, *H. armigera* were made on five randomly selected plants from each treatment at 60, 90 and 120 DAT. The per cent fruit damage was worked out by counting total number of fruits per plant and number of damaged fruits per plant on five randomly selected plants in each treatment at every picking. Fruit yield at each harvest and converted the yield in q per ha. Data were subjected to statistical analysis.

OBSERVATIONS AND ANALYSIS

The pooled data showed that, At 60 DAT among the main plots, M_3 recorded significantly less fruit borer (0.51/plant) which was on par with M_2 (0.58/plant), while moderate number of fruit borer were registered in M_4 (0.72). Whereas, significantly more number of fruit borers were observed in M_1 (0.80/plant) treatment (Table 48). Among the different spacings significantly least fruit borer count was observed in S_1 (0.52/plant) which was on par with S_2 (0.59). While S_4 recorded significantly more number of fruit borers of 0.88 per plant. The interaction effect between main plots and subplots treatments did not have any significant effect on fruit borer infestation (Table 1).

At 90 DAT, the main plot treatment M_2 registered significantly lower fruit borer count of 0.55 per plant followed by treatment M_3 (0.63) and M_4 (0.76). Whereas significantly higher fruit borer count per plant was registered in M_1 (0.86) plot. Among subplots, S_1 registered significantly less fruit borer count of 0.58 per plant followed by S_2 (0.63) and S_3 (0.67) while S_4 recorded higher fruit borer count of 0.91 per plant.The interaction effect between the planting dates and different spacings was found to be significant. The combination of $M_2 + S_1$ registered significantly lower fruit borer count of 0.45 per plant followed by $M_2 + S_3$ (0.48), whereas higher number of fruit borer was registered in the interaction of $M_1 + S_4$ (1.14/plant).

At 120 DAT, among the main plot and subplot treatments the fruit borer count ranged from 0.44 to 0.70 and 0.42 to 0.74 per plant, respectively. Significantly less fruit borer count of 0.44 and 0.42 per plant was registered in M_2 of main plot and S_1 of subplot treatments, respectively. While M_1 (0.70) and S_4 (0.74) registered higher fruit borer count in main plot and subplot treatments, respectively. Interaction effect between main plots and subplots was found significant. Significantly less fruit borer count was registered by the interaction of M_2 + S_1 (0.32) followed by M_3 + S_1 (0.36). Whereas, higher number of fruit borer was recorded by the interaction of M_1 + S_4 (0.92) (Table 1).

Fruit damage per cent :

At first picking, among the main plots, M_2 recorded significantly least fruit borer damage per cent (3.84) followed by M_3 (5.19) while M_1 registered higher fruit borer damage of 7.51 per cent. Among the different spacings *i.e.*, subplots significantly lower fruit borer damage per cent was registered in S_1 (4.73) followed by S_2 (5.64) while S_4 (6.49) recorded higher fruit borer damage. The interaction effect between main plot and subplot treatments was non- significant for fruit borer damage (Table 2).

At second picking, the main plot treatment M_2 registered significantly lower fruit borer damage per cent of 4.64 followed by M_3 (6.96). Whereas, significantly higher fruit borer damage per cent was registered in M_1 (8.52) and also found to be on par with M_4 (7.70). Among subplots S_1 registered significantly least fruit borer damage per cent (6.369) and was at par with S_2 (6.85), while significantly more fruit borer damage per cent was observed in S_4 (7.56). The interaction effect between main plot and subplot treatments was found to be significant. The combination of M_2 + S_1 registered significantly lower fruit borer damage of 4.11 per cent followed by M_2 + S_2 (4.51) and M_2 + S_3 (4.67). Whereas, higher fruit borer damage per cent was registered by the interaction of M_1 + S_4 (9.16).

At 3rd picking, among the main plot treatments and sub plot treatments, the fruit borer damage per cent ranged from 6.54 to 9.66 and 7.40 to 8.49, respectively. Significantly least fruit borer damage per cent of 5.64 and 7.40 was observed in M_2 of main plot and S_1 of subplot treatments, respectively. While M_1 (9.66) and S_4 (7.40) registered higher fruit borer damage per cent in main plot and subplot treatments, respectively. The interaction effect between main plots and sub plots are found to be significant. Significantly least fruit borer damage per cent was registered in the combination effect

Table 1: Effect of date of planting and spacing on the activity of chilli fruit borer – Pooled data of 2011-12 and 2012-13

Sr. No.	Main plot\sub plot	Fruit borer/plant														
		60 DAT					90 DAT					120 DAT				
		M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
1.	S_1	0.63	0.46	0.40	0.58	0.52c	0.70	0.45	0.52	0.63	0.58c	0.54	0.32	0.36	0.46	0.42c
		(1.29)	(1.18)	(1.13)	(1.26)	(1.22)	(1.34)	(1.17)	(1.22)	(1.29)	(1.26)	(1.23)	(1.07)	(1.10)	(1.18)	(1.15)
2.	S_2	0.72	0.54	0.45	0.65	0.59c	0.78	0.48	0.58	0.68	0.63b	0.63	0.40	0.49	0.61	0.53b
		(1.35)	(1.23)	(1.17)	(1.31)	(1.37)	(1.38)	(1.20)	(1.26)	(1.32)	(1.30)	(1.29)	(1.13)	(1.20)	(1.28)	(1.23)
3.	S_3	0.76	0.57	0.48	0.69	0.63b	0.83	0.49	0.61	0.74	0.67b	0.71	0.42	0.51	0.67	0.58b
		(1.37)	(1.25)	(1.19)	(1.33)	(1.29)	(1.41)	(1.20)	(1.28)	(1.36)	(1.32)	(1.34)	(1.15)	(1.21)	(1.32)	(1.26)
4.	S_4	1.09	0.76	0.72	0.94	0.88a	1.14	0.75	0.79	0.97	0.91a	0.92	0.61	0.63	0.79	0.74a
		(1.54)	(1.37)	(1.35)	(1.47)	(1.44)	(1.57)	(1.37)	(1.39)	(1.48)	(1.46)	(1.46)	(1.28)	(1.29)	(1.39)	(1.36)
	Mean	0.80a	0.58c	0.51c	0.72b	0.65	0.86a	0.55d	0.63c	0.76b	0.70	0.70a	0.44c	0.50b	0.63ab	0.57
		(1.39)	(1.26)	(1.22)	(1.35)		(1.43)	(1.24)	(1.29)	(1.37)		(1.34)	(1.16)	(1.21)	(1.30)	
For comparision of means		S.E.±		C.D. (P=0.05)			S.E.±		C.D. (P=0.05)			S.E.±		C.D. (P=0.05)		
Main (M)		0.063		0.176			0.067		0.519			0.061		0.174		
Sub (S)		0.038		0.102			0.041		0.118			0.037		0.099		
Interaction (MXS)		0.295		NS			0.319		0.928			0.289		0.853		
CV (%)				5.76					5.13					6.03		

M_1 (Month) – June 30th; M_2 – July 15th; M_3 – July 30th; M_4 – August 15th

S_1 (Spacing) – 90 X 60cm; S_2 – 60 X 60cm; S_3 – 75 X 45 cm; S_4 – 60 X 30 cm

In a column means followed by the same alphabet did not differ significantly by DMRT (0.05) NS=Non-significant

Table 2: Effect of date of planting and spacing on fruit borer damage – Pooled data of 2011-12 and 2012-13

Sr. No.	Main plot\sub plot	Fruit borer damage (%)																			
		I					II					III					IV				
		M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
1.	S_1	6.32	2.93	4.26	5.42	4.73c	7.95	4.11	6.34	7.02	6.36c	8.99	4.95	7.57	8.10	7.40b	7.61	4.10	6.38	6.93	6.45
		(14.54)	(9.81)	(11.83)	(13.44)	(12.52)	(16.32)	(11.68)	(14.54)	(15.34)	(14.54)	(17.36)	(12.79)	(15.89)	(16.54)	(15.79)	(16.00)	(11.68)	(14.54)	(15.23)	(14.56)
2.	S_2	7.65	3.85	5.12	5.95	5.64b	8.32	4.51	6.85	7.72	6.85b	9.75	5.61	7.95	8.11	7.86ab	8.76	4.62	6.93	7.82	7.30
		(16.00)	(11.24)	(13.05)	(14.06)	(13.69)	(16.74)	(12.25)	(15.12)	(16.11)	(15.12)	(18.15)	(13.69)	(16.32)	(16.54)	(16.22)	(17.16)	(12.39)	(15.23)	(16.22)	(15.68)
3.	S_3	7.76	3.97	5.35	6.09	5.79ab	8.64	4.67	6.99	7.93	7.06ab	9.89	5.83	8.05	8.29	8.02a	8.87	4.84	7.10	7.96	7.57
		(16.11)	(11.39)	(13.31)	(14.18)	(13.81)	(17.05)	(12.39)	(15.23)	(16.32)	(15.34)	(18.24)	(13.94)	(16.43)	(16.64)	(16.43)	(17.26)	(12.66)	(15.45)	(16.32)	(15.89)
4.	S_4	8.32	4.61	6.02	7.02	6.49a	9.16	5.25	7.67	8.14	7.56a	10.00	6.16	8.91	8.87	8.49a	9.03	4.95	7.36	8.17	8.12
		(16.74)	(12.39)	(14.18)	(15.34)	(14.65)	(17.56)	(13.18)	(16.00)	(16.54)	(15.89)	(18.44)	(14.30)	(17.36)	(17.26)	(16.85)	(17.46)	(12.79)	(15.68)	(16.54)	(16.54)
	Mean	7.51a	3.84c	5.19bc	6.12b	5.67	8.52a	4.64c	6.96b	7.70ab	6.95	9.66a	5.64c	8.12b	8.34ab	7.94	8.57	4.63	6.94	7.72	7.36
		(15.89)	(11.24)	(13.05)	(14.30)		(16.95)	(12.39)	(15.23)	(16.11)		(18.05)	(13.69)	(16.54)	(16.74)		(16.95)	(12.39)	(15.23)	(16.11)	
	For comparision of means	S.E.±			C.D. (P=0.05)		S.E.±			C.D. (P=0.05)		S.E.±			C.D. (P=0.05)		S.E.±			C.D. (P=0.05)	
	Main (M)	0.283			0.78		0.31			0.76		0.41			1.12		0.29			0.76	
	Sub (S)	0.391			0.982		0.42			0.98		0.57			1.36		0.35			0.91	
	Interaction (MXS)	2.93			NS		3.13			8.46		3.37			9.56		2.97			7.85	
	CV (%)			5.85					6.03					6.15					5.75		

M_1 (Month) – June 30th M_2 – July 15th M_3 – July 30th M_4 – August 15th
S_1 (Spacing) – 90 X 60cm S_2 – 60 X 60cm S_3 – 75 X 45 cm S_4 – 60 X 30 cm
In a column means followed by the same alphabet did not differ significantly by DMRT (0.05), DAT : Days After Transplanting
Figures in parenthesis are $\sqrt{x+0.5}$ transformed values, Note: I – First picking, II – Second picking, III- Third picking and IV- Fourth picking

of $M_2 + S_1$ (4.95) followed by $M_2 + S_2$ (5.61) and $M_2 + S_3$ (4.67). Whereas, significantly higher fruit borer damage per cent was observed in $M_1 + S_4$ (10.00).

At 4th picking, the M_2 treatments of main plot registered significantly least fruit borer damage per cent of 4.63 followed by M_3 (6.94). While M_1 registered significantly higher fruit borer damage per cent of 8.57. Among the sub plots significantly lest fruit borer damage per cent was observed in S_1 (6.45) followed by S_2 (7.30), whereas significantly higher fruit borer damage per cent was registered in S_4 (8.12). The interaction effect between main plots and subplots was found to be significant. The fruit borer damage caused by fruit borer is significantly least and registered in the combination of $M_2 + S_1$ (4.10) followed by $M_2 + S_2$ (4.62) and $M_2 + S_3$ (4.84), whereas significantly more fruit borer damage per cent was observed in $M_1 + S_4$ (9.03) (Table 2).

Yield :

Among the main plot and subplot treatments the chilli yield varied from 2.81 to 3.79 q/ha and 2.92 to 4.17 q/ha, respectively (Table 3). Significantly highest chilli yield of 3.79 and 4.17 q/ha was recorded in M_2 of main plot and S_1 of subplot treatments, respectively. While M_1 (2.81) and S_4 (2.92 q/ha) registered lowest chilli yield in main plot and subplot, respectively. The interaction effect between main plot and subplots was found to be significant. The combination of $M_2 + S_1$ (4.26 q/ha) followed by $M_3 + S_1$ (4.17) and $M_1 + S_1$ (3.45) recorded significantly higher chilli yield whereas least chilli yield was observed by the combination of $M_1 + S_4$ (2.06 q/ha). Among the different treatments, highest net returns (15921/-) was recorded by M_2S_1 with C:B ratio of 1: 2.44 followed by M_3S_1 (14199/- and C:B ratio of 1:2.29) and M_1S_1 (‘ 13133/- and C:B ratio of 1:2.18). Whereas, the lowest net returns (3065) was recorded by M_4S_4.

Significantly lower level of larval population of *H. armigera* and fruit damage was observed in July 15th transplanted crop followed by July 30th and August 15th, respectively. Among the spacings, significantly least chilli fruit borer population was recorded in 90 x 60cm followed by 60x60cm and 75 x 45cm. The interaction effect among the date of planting and different spacings was significant. Significantly lower population and fruit damage were recorded in the interaction of July 15th planting and 90x60cm spacing followed by July 15th and 60x60cm and July 15th and 75x45cm treatments. Whereas, it was higher in interaction of June 30th and 60x30cm. The present investigations are in close agreement with Kempegowda (1980) who reported that 15th July transplanting of all the three-chilli varieties *viz.*, NP-46A, Jwala and C-1 recorded the highest yields of green pods than late planting. Late planted crop was liable for heavy infestation by insect pests and mites. Chilli crop transplanted in early June and July escapes incidence of thrips and mites than the crop transplanted in late July and early August as evidenced by Hosmani (1982). Similarly, Mallapur *et al.* (1987) found lower incidence of leaf curl due to thrips and mites when crop planted until July. the study of Gayathri Devi and Giraddi (2007) who repored that chilli planted before 15th July receives significantly less chilli leaf curl incidence. Nagaraja *et*

Table 3: Effect of date of planting and spacing on yield- Pooled data of 2011-12 and 2012-13

Sr. No.	Main plot\sub plot	Yield (q/ha)				
		M_1	M_2	M_3	M_4	Mean
1.	S_1	3.45 (2.36)	4.26 (2.56)	4.17 (2.54)	3.95 (2.49)	3.96a (2.49)
2.	S_2	2.92 (2.21)	3.89 (2.47)	3.67 (2.42)	3.18 (2.28)	3.42b (2.35)
3.	S_3	2.82 (2.18)	3.53 (2.38)	3.37 (2.34)	2.92 (2.21)	3.16c (2.28)
4.	S_4	2.06 (1.94)	3.48 (2.37)	3.29 (2.31)	2.85 (2.19)	2.92d (2.21)
Mean		2.81c (2.18)	3.79a (2.45)	3.63a (2.40)	3.23ab (2.30)	3.36
For comparison of means		S.E.±			C.D. (P=0.05)	
Main (M)		0.131			0.345	
Sub (S)		0.375			0.986	
Interaction (MXS)		1.23			2.96	
CV (%)				7.14		

M_1 (Month) – June 30th M_2 – July 15th M_3 – July 30th M_4 – August 15th
S_1 (Spacing) – 90 X 60cm S_2 – 60 X 60cm S_3 – 75 X 45 cm S_4 – 60 X 30 cm
In a column means followed by the same alphabet did not differ significantly by DMRT (0.05)
DAT : Days After Transplanting, figures in parenthesis are $\sqrt{x+0.5}$ transformed values

al. (2008) carried out an experiment to know the impact of dates of sowing on the incidence of thrips and mites under irrigated condition. There are no reports to indicate the effect of planting dates and geometry on the incidence of fruit borer in chilli.

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REFERENCES

Berke, T. and Sheih, S.C. (2000). Chilli peppers in Asia. *Capsicum & Egg Plant Newslett.,* **19**:38-41.

Borah, D.C. (1987). Bioecology of *Polyphagotarsonemus latus (*Banks) (Acari; Tarsonemidae) and *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) infesting chilli and their natural enemies. Ph. D Thesis, University of Agricultural Sciences Dharwad, KARNATAKA (INDIA).

Gayatridevi, S. and Giraddi, R.S. (2007). Effect of date of planting on the activity of thrips, mites and development of leaf curl in chilli (*Capsicum annuum* L.). *Karnataka J. Agric. Sci.,* **22**(1) : 206-207.

Hosmani, M.M. (1982). Cultural practices for chilli. In: *Chilli* (Edit. Hosmani, M.M.), Rajashri Printing Press, Tadakod Oni, Dharwad, pp. 100-128.

Kempegowda, K. (1980). Effects of dates of planting on growth and yield and certain quality attributes of three chilli cultivars. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Bangalore, KARNATAKA (INDIA).

Mallapur, C.P., Kubasad, V.S. and Raju, S.G. (1987). Infhrence of Influence of nutrient management on chilli pests. *Karnataka J. Agric. Sci.,* **10**: 67-69.

Nagaraj, T., Srinivas A.G., Patil, B.V. and Naganagoud A. (2008). Influence of different dates of sowing on thrips and mites in chilli under irrigated ecosystem. *Karnataka J. Agric. Sci.,* **21** (3)*:* 450-451.

National Horticulture Board. Indian Horticulture Database (2016). 5

Niles, G.A. (1980). Breeding cotton for resistance to insect pests. In *Breeding plant resistance to insects*, Macwell. F. G and Jennings, (Eds) P.R John Wiley and Sons, New York, pp 337-369.

Puttarudriah, M. (1959). Short review on the leaf curl complex and spray programme for its control. *Mysore J. Agric. Sci.,* **34**: 93-95.

Reddy, M.R.S. and Reddy, G.S. (1999). An eco-friendly method to combat *Helicoverpa armigera* (Hub.). *Insect Environ*., **4**: 143- 144.