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NK Berani
Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

MP Damor
Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

PH Godhani
Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Correspondence
NK Berani
Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Impact of date of sowing on lepidopteran insect pest of black gram, *Vigna mungo* (L.) Hepper

NK Berani, MP Damor and PH Godhani

Abstract
A field experiment was carried out to study the incidence of major lepidopteran insect pests of the black gram on different dates of sowing at B A College of Agriculture, Anand Agricultural University, Anand, with five different sowing dates at an interval of seven days. The result showed that there was a significant impact of sowing periods on insect pests activity in black gram. The incidence of defoliators *viz*., Bihar hairy caterpillar, *Spilosoma obliqua* Walker and Spotted pod borer, *Maruca testulalis* (Geyer) was higher in the late sowing periods *i.e.*, 1st week of August and 2nd week of August. These sowing periods also yielded higher. The prevalence of defoliators was comparatively low in 2nd week of July, 3rd week of July, and 4th week of July sown crop.

Keywords: Black gram, Bihar hairy caterpillar, spotted pod borer

Introduction
Black gram [*Vigna mungo* (L.) Hepper] belongs to the family Fabaceae and the genus Vigna [1]. Black gram is a member of the Asiatic Vigna crop group [2]. Black gram is popularly known as urd bean or mashkalai or marsh or mahn or black bean in India [3].
In India, it is grown in the States of Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal and Tripura. Gujarat produces about 0.52 lakh tone of urd annually from about 0.84 lakh ha of the area with yield about 620 kg per hectare [4].
In India, about 18 to 20 species of insect pests damage the black gram [5]. The crop is susceptible to a wide range of insect pests, which feed on flowers, fruits and seeds. Insect pests identified in black gram as foliage feeders is spotted pod borer, *Maruca testulalis* Geyer and Bihar hairy caterpillar, *Spilosoma obliqua* Walker.

Materials and Methods
Field Experiment
The experiment was carried out at Agronomy farm, B. A. College of Agriculture, Anand Agricultural University, Anand during *Kharif* season of 2016. Black gram crop variety Gujarat Urd-1 was grown in plot size 3.0 x 2.7 m at 45 × 10 cm spacing in a Randomized Block Design (RBD) with four replications at five different periods of sowing. Black gram crop was sown at one week interval starting from 2nd week of July till 2nd week of August. All recommended agronomical practices were followed to raise the black gram crop. The plot was kept free from insecticidal spray throughout the season.
The observation of lepidopteran larvae were recorded from five randomly selected plants from each net plot area. The damage due to lepidopteran insect pests was also recorded by counting total no of pods and damaged pods of respective lepidopteran insect pests. The data was recorded at weekly interval starting from one week after germination till the crop maturity. The data on black gram yield also recorded plot-wise and converted to quintal per hectare. The per cent damage was calculated according to the formula.

$$\text{Pod damage}(\%) = \frac{\text{Number of damaged pod}}{\text{Total number of pod}} \times 100$$

Statistical Analysis
The data on number of pests were subjected to square root transformation and per cent damage were subjected to arc sin transformation and statistically analysed for interpretation by following standard statistical technique [6].

Results and Discussion
To assess the impact of sowing periods on the abundance of lapidopteran insect pests, number of pod damage and its impact on yield of black gram; the field trial was conducted during *Kharif*, 2016. The observations on number of insect pests were recorded at weekly interval starting from one week after germination till the harvest of crop. Seed yield was also recorded after harvest of the crop. The results are presented in Table 1 and Fig 1.

Bihar hairy caterpillar, *S. obliqua*
The Bihar hairy caterpillar larval population was found between 13.79 larva/plant and 46.15 larva/plant during *Kharif* 2016 (Table 1 and Fig 1).
Significantly the lowest (13.79 larva/plant) larval population of Bihar hairy caterpillar was found in 2nd week of July sown crop followed by 3rd week of July (20.02 larva/plant) and 4th week of July (27.70 larva/plant) sown crop. Maximum (46.15 larva/plant) larval population of Bihar hairy caterpillar was recorded on the 2nd week of August sown crop followed by 1st week of August (36.34 larva/plant) sown crop. As the planting time delayed, the Bihar hairy caterpillar incidence increased (Fig. 1). Considering the Bihar hairy caterpillar incidence, the sowing periods can be arranged in ascending order as: 2nd week of July (13.79 larva/plant) < 3rd week of July (20.02 larva/plant) < 4th week of July (27.70 larva/plant) < 1st week of August (36.34 larva/plant) < 2nd week of August (46.15 larva/plant).

Spotted pod borer, *M. testulalis*
Spotted pod borer, *M. testulalis* larval population was observed in all five sowing periods. The spotted pod borer larval population was found between 0.40 larva/plant and 3.50 larva/plant during *Kharif* 2016 (Table 1 and Fig 1) in different sowing periods.
Spotted pod borer larval population recorded on black gram crop at different periods revealed that all the sowing periods significantly differed from each other. The significantly the lowest (0.40 larva/plant) larval population of spotted pod borer was found in 2nd week of July sown crop followed by 3rd week of July (0.96 larva/plant) and 4th week of July (1.69 larva/plant) sown crop. Higher (3.50 larva/plant) larval population of spotted pod borer was recorded on the 2nd week of August sown crop followed by 1st week of August (2.56 larva/plant) sown crop. As the planting time delayed, the spotted pod borer incidence increased (Fig. 1). Considering the spotted pod borer incidence, the sowing periods can be arranged in ascending order as: 2nd week of July (0.40 larva/plant) < 3rd week of July (0.96 larva/plant) < 4th week of July (1.69 larva/plant) < 1st week of August (2.56 larva/plant) < 2nd week of August (3.50 larva/plant).

Pod damage
Similar with the spotted pod borer incidence at different sowing dates, the per cent pod damage data was described in Table 1. The result indicated that there was significantly lower (18.97%) pod damage in 2nd week of July sown crop followed by 3rd week of July (28.14%) and 4th week of July (38.31%) sown crop. Maximum (58.49%) pod damage was recorded on the 2nd week of August sown crop followed by 1st week of August (48.46%) sown crop.
The crop sown during 2nd week of July registered the lowest pod damage by *M. testulalis* incidence than all the evaluated sowing periods. Significantly the highest pod damage by *M. testulalis* was registered in the 2nd week of August sown crop.

Impact of sowing periods on seed yield of black gram
The data on seed yield (Table 1 and Fig 1) revealed the significant impact of different sowing periods on yield. Among the different sowing periods, significantly the highest (9.76 q/ha) yield was harvested from the crop sown during the 2nd week of July. There was significant difference observed in yield obtained from the crop sown during 3rd week of July (8.51 q/ha), 4th week of July (7.21 q/ha) and 1st week of August (6.66 q/ha). The lowest (4.95 q/ha) yield was recorded in crop sown during 2nd week of August. Considering the marketable yield the sowing periods can be arranged in descending order as: 2nd week of July (9.76 q/ha) › 3rd week of July (8.51 q/ha) › 4th week of July (7.21 q/ha) › 1st week of August (6.07 q/ha) › 2nd week of August (4.95 q/ha).
Scanty information is available so far past reports is concerned. However, past report shows that the greatest insect damage occurred on the crop sown in August [7]. The study carried out in Jodhpur showed that the mothbean sown on 1st or 2nd week of July was escaped insect attack and produced higher seed yield [8]. Another report shows that early planting restricts the lower infestation by the insects and produced higher yield than late plantings [9]. These findings of past workers are in accordance with the present outcomes.

Table 1: Impact of sowing periods of black gram on lepidopteran insect pests, pod damage and seed yield

Sowing periods	No. of larva(e)/plant		% Pod damage	Seed yield (q/ha)
	Bihar hairy caterpillar	Pod borer		
2nd week of July	3.78a (13.79)	0.95a (0.40)	25.82a (18.97)#	9.76a
3rd week of July	4.53b (20.02)	1.21b (0.96)	32.04b (28.14)	8.51b
4th week of July	5.31c (27.70)	1.48c (1.69)	38.24c (38.31)	7.21c
1st week of August	6.07d (36.34)	1.75d (2.56)	44.12d (48.46)	6.07d
2nd week of August	6.83e (46.15)	2.00e (3.50)	49.89e (58.49)	4.95e
S. Em. ±	0.24	0.07	1.73	0.34
F test	S	S	S	S
C. V. %	9.11	9.99	9.12	9.43

Note: 1. Figures in parentheses are retransformed values; those outside are $\sqrt{X+0.5}$ transformed values
2. Treatment means with the letter/letters in common are not significant by DNMRT at 5% level of significance
3. # Figures in parentheses are retransformed values; those outside are arc sine transformed values
4. Data presented in Table are mean of 12 observations
5. S = Significant

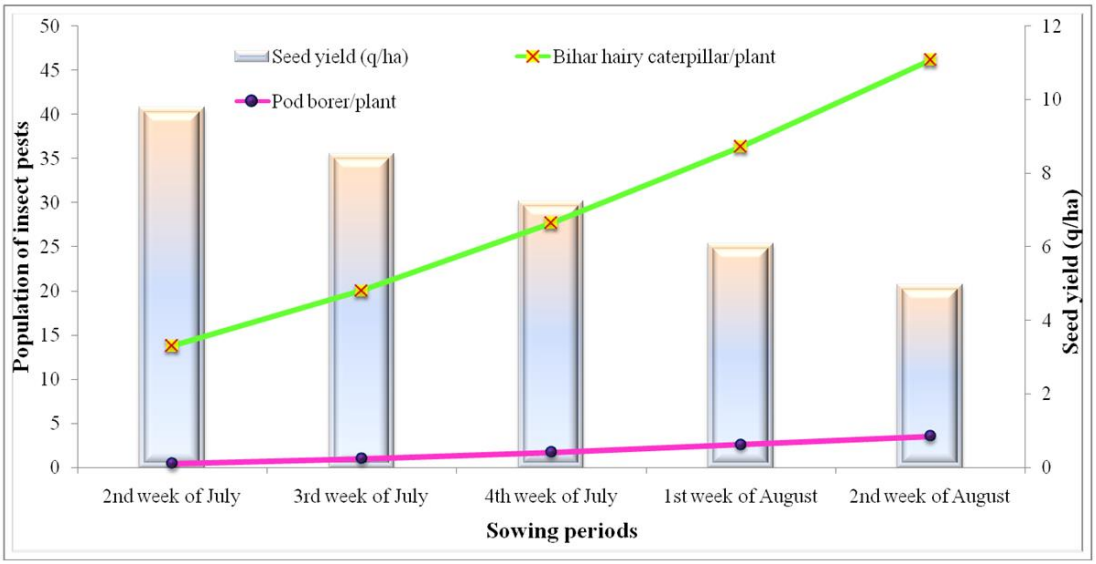

Fig 1: Impact of sowing periods of black gram on insect pests and seed yield

Conclusion

There was a significant impact of sowing periods on the escape of defoliator activity in black gram. This may be considered as cultural practice for formulating IPM strategy for management of insect pest in black gram. The defoliators incidence was higher in last two sowing periods *i.e.*, 1st week of August and 2nd week of August and also agronomically unsuitable as they produced a lower yield of black gram. The prevalence of defoliators was comparatively low in 2nd week of July, 3rd week of July, and 4th week of July sown crop. In addition, these sowing periods also yielded higher.

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