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Effect of different dates of sowing on pod borer complex of pigeon pea, (*Cajanus cajan* (L.) Mill Sp.)

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Abstract
The studies entitled 'Effect of different dates of sowing on pod borer complex of pigeon pea (*Cajanus cajan* (L.) Millsp)' were conducted during 2017-2018 and 2018-2019. Effect of different sowing dates on pod borer complex revealed that 27th June sowing date was observed to be more congenial for *M. vitrata*, *E. atomosa and H. armigera* (11.69, 10.05 and 12.07, respectively) while 13th June sowing date was not congenial as it has revealed less damage by three pod borers (6.88, 5.70 and 7.20, respectively). However, pod fly infestation was highest in 30th May sowing date (19.92) and was less in 27th June sowing date (13.05).

Keywords: Dates of sowing, pod borer complex, pigeon pea (*Cajanus cajan* (L.) Millsp)

Introduction
The pigeon pea (*Cajanas cajan* (L.) Millsp.) belongs to family *Fabaceae* is originated from India. It is the second most important pulse crop grown in India after chickpea. In India the area grown under pigeon pea crop was 4.43 mh with an annual production of 4.25 mt, leading to a productivity of 960.0 kg/ha [1]. In Maharashtra, the area grown under this crop is 12.30 lakh hectares with an annual production of 10.71 lakh tonnes leading to a productivity of 873.0 kg/ha. In konkan the area grown under this crop is 5300 thousand hectares with an annual production of 4343 thousand tonnes leading to a productivity of 891.0 kg/ha [2]. Insects that attack the reproductive structures of plant cause the maximum yield losses [7]. Among the insects feeding on reproductive parts, gram pod borer, *Helicoverpa armigera* (Hubner), spotted pod borer, *Maruca vitrata* (Geyer), plume moth, *Exelastis atomosa* (Walsingham) and pod fly, *Melanagromyza obtusa* (Malloch) are of prime importance. According to Yadav and Chaudhary [10] around 14 and 10 percent pigeon pea pods were damaged by *H. armigera* and *M. obtusa*. Pigeon pea pod damage due to different insect pests including *H. armigera* and *E. atomosa* varied from 7.6 to 31.0 percent [6]. *H. armigera* caused 27 percent damage to pigeon pea pod during 2001-02. The crop suffered heavy field losses due to pod borers in Tamil Nadu [3]. Although so many insect feed upon pigeon pea from seedling stage, most of the economic damage is caused by pests that feed upon flowers and pods. Among these pod borer complex including gram pod borer (*H. armigera*), plume moth (*E. atomosa*), and pod fly (*M. obtusa*) cause considerable losses in grain yield ranging from 80-100 percent by attacking the reproductive parts of the plant. The losses due to *H. armigera* alone contribute up to 50 percent [9]. Looking towards the infestation of pod borer complex against pigeon pea in konkan region, no much work has been reported by the workers and therefore it is necessitated to undertake the present investigation to study the effect of different dates of sowing on pod borer complex of pigeon pea (*Cajanas cajan* (L.) Millsp.).

Material and methods
The field experiment was carried out with pigeon pea crop using variety Dapoli Tur-1 were conducted at Botany farm, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during *Kharif* 2017-18 and *Kharif* 2018-19. The healthy seed of 'Dapoli Tur -1' variety of Pigeon pea was obtained from the Department of Botany, College of Agriculture, Dapoli. A separate plot 18.75m x 3m (56.25sq.m.) was cultivated for conducting the experiment on effect of different dates of sowing against pod borer complex of pigeon pea and unsprayed during course of investigation**.** Fertilizer were applied in the form of straight

fertilizers through Urea (46% N) and Single Super Phosphate (16% P_2O_5) to each plot. The recommended dose, 25:50:50 kg NPK /ha was applied at the time of sowing. The five different dates *viz.*, 30th May, 06th June, 13th June (standard date), 20th June and 27th June were selected for line sowing of the crop and the observations on pod borer complex of pigeon pea were recorded at weekly interval on five randomly selected plants of different sowing dates. The healthy and infested buds/pods from three selected twigs were counted and percent infestation of pod borer complex was calculated. The standard deviation was worked out.

Results and Discussion

Effect of different dates of sowing against *M. vitrata* infesting pigeon pea

Data regarding effect of different dates of sowing against *M. vitrata* infesting pigeon pea are presented in Table 1 and depicted in Fig.1.

The data revealed that during 2017-2018, the percent infestation of *M. vitrata* in different sowing dates was in the range of 6.36 to 11.31. The date 27th June, recorded highest percent infestation of *M. vitrata* (11.31) followed by 20th June, 30th May, and 6th June which recorded 10.02, 8.81, 7.95 percent infestation, respectively. The lowest percent infestation (6.36) was recorded in 13th June sown date.

The data during 2018-2019, revealed that the percent infestation of *M. vitrata* in different sowing dates was in the range of 7.39 to 12.07. The date 27th June, recorded highest percent infestation of *M. vitrata* (12.07) followed by 20th June, 30th May, and 6th June which recorded 11.17, 9.79, 9.43 percent infestation, respectively. The lowest percent infestation (7.39) was recorded in 13th June sown date.

The pooled data on percent infestation of *M. vitrata* during both the years revealed that the percent infestation of *M. vitrata* in different sowing dates was in the range of 6.88 to 11.69. The highest percent infestation of *M. vitrata* was recorded in the 27th June sown date, (11.69). The percent infestation of *M. vitrata* recorded in descending order was 20th June (10.59), 30th May (9.30) and 6th June (8.69). The lowest percent infestation was recorded in 13th June sown date (6.88).

The result revealed that first fortnight of June will be the ideal period for sowing of pigeon pea as indicated by less infestation by *M. vitrata.*

Effect of different dates of sowing against *E. atomosa* infesting pigeon pea

Data regarding effect of different dates of sowing against *E. atomosa* infesting pigeon pea are presented in Table 1 and depicted in Fig.2.

The data revealed that during 2017-2018, the percent infestation of *E. atomosa* in different sowing dates was in the range of 5.37 to 9.73. The date 27th June, recorded highest percent infestation of *E. atomosa* (9.73) followed by 20th June, 30th May, and 6th June which recorded 8.83, 6.94, 6.29 percent infestation, respectively. The lowest percent infestation (5.37) was recorded in 13th June sown date.

The data revealed that during 2018-2019, the percent infestation of *E. atomosa* in different sowing dates was in the range of 6.03 to 10.37. The date 27th June, recorded highest percent infestation of *E. atomosa* (10.37) followed by 20th June, 30 May, and 6th June which recorded 9.52, 8.09, 7.04 percent infestation, respectively. The lowest percent infestation (6.03) was recorded in 13th June sown date.

The pooled data on percent infestation of *E. atomosa* during both the years revealed a similar trend as above.

The result also revealed the same effect that first fortnight of June will be the ideal period for sowing of pigeon pea as indicated by less infestation by *E. atomosa.*

Effect of different dates of sowing against *H. armigera* infesting pigeon pea

Data regarding effect of different dates of sowing against *H. armigera* infesting pigeon pea are presented in Table 1 and depicted in Fig.3.

The data revealed that during 2017-2018, the percent infestation of *H. armigera* in different sown dates was in the range of 7.16 to 12.01. The date 27th June, recorded highest percent infestation of *H. armigera* (12.01) followed by 20th June, 30th May, and 6th June which recorded 10.00, 8.29, 7.83 percent infestation, respectively. The lowest percent infestation (7.16) was recorded in 13th June sown date.

The data revealed that during 2018-2019, the percent infestation of *H. armigera* in different sown dates was in the range of 7.23 to 12.13. Similarly, a same trend as in 2017-18 was also observed during 2018-19 with respect to *H. armigera.*

The pooled data on percent infestation of *H. armigera* during both the years also revealed that the percent infestation of *H. armigera* in different sown dates was in the range of 7.20 to 12.07. The infestation trend was also similar as above.

The result also indicated that incase of *H. armigera* less infestation was noticed in 1st fortnight of June, as compared with other sown dates.

Effect of different dates of sowing against *M. obtusa* infesting pigeon pea

Data regarding effect of different dates of sowing against *M. obtusa* infesting pigeon pea are presented in Table 1 and depicted in Fig.4.

The data revealed that during 2017-2018, the percent infestation of *M. obtusa* in different sowing dates was in the range of 11.56 to 18.10. The date 30th May, recorded highest percent infestation of *M. obtusa* (18.10) followed by 6th June, 13th June, and 20th June which recorded 16.20, 14.59, 13.55 percent infestation, respectively. The lowest percent infestation (11.56) was recorded in 27th June sown dates.

The data revealed that during 2018-2019, the percent infestation of *M. obtusa* in different sown dates was in the range of 14.53 to 21.74. A similar trend of pod fly infestation was observed with respect to sowing dates.

The pooled data on percent infestation of *M. obtusa* during both the years revealed that the percent infestation of *M. obtusa* in different sowing dates was in the range of 13.05 to 19.92. In pooled data also, a same trend of pod fly infestation was revealed as far as sowing dates are concerned

Thus from the above result, it was revealed that sowing dates has pronounced effect on pod borer complex. It was evident from the data that sowing time of 1st fortnight of the June *i.e.*1st June to 15th June (sowing date 13th June) was a suitable period for sowing pigeon pea as indicated by less infestation of all three pod borers except pod fly. However, result also showed that if the crop is sown beyond 13th June, the same was highly attacked by all the three pod borers except pod fly, as indicated by the increased infestation. This may be because of escape mechanism where crop escape early when pest infestation remains at low level. Regarding the pod fly damage, it was revealed that late sown crop (27th June) was

less infested.

Present findings are more or less confirmed with Reddy *et al.* [8] who reported that early sowing of pigeon pea resulted in lower incidence of *M. testulalis*, *E. atomosa* and *H. armigera*. While, late sowing caused lower incidence of pod fly *M. obtusa*. They also reported that pod borer damage was low in determinate varieties as compared to indeterminate varieties, while susceptibility of pod fly was low in determinate varieties as compared to indeterminate. Gowda *et al.* [5] also revealed that the pigeon pea sown in 2nd forth night of July resulted in higher incidence of pod borer (11.58 percent pod damage) as compared to early sowing in 1st forth night of June (9.85 percent pod damage). Dobhal *et al.* [4] also reported that the pigeon pea sown in 10th June resulted in lower incidence of *H. armigera* and *M. vitrata* at early stage of the crop as compare to other three sowing dates (*viz*, 20th June, 10th July and 10th August). Hence, the crop was escaped from early infestation of insect pests. The percent pod damage caused by *H. armigera* (1.85%) and *M. vitrata* (12.80%) was also found to be lowest on the crop sown at 10th June, while the pod damage by *M. obtusa* was lowest (21.05%) on the late sown crop (10th August). Also the 10th June sowing date recorded significantly higher yield (1219 kg/ha) as compared to subsequent sowing, while the lowest yield (747 kg/ha) was noticed in crop sown on 10th August. It was, therefore, 10th June would be the most suitable date of sowing for pigeon pea.

Table 1: Infestation of pod borer complex in pigeon pea as influenced by sowing dates during *Kharif* 2017-18, *Kharif* 2018-19 and pooled

Date	Mean percent bud/pod infestation per 3 twigs per plant											
	M. vitrata			*E. atomosa*			*H. armigera*			*M. obtusa*		
	2017-2018	2018-2019	Pooled	2017-2018	2018-2019	Pooled	2017-2018	2018-2019	Pooled	2017-2018	2018-2019	Pooled
30th May	8.81	9.79	9.30	6.94	8.09	7.51	8.29	9.50	8.90	18.10	21.74	19.92
06th June	7.95	9.43	8.69	6.29	7.04	6.66	7.83	9.23	8.53	16.20	19.15	17.68
13th June	6.36	7.39	6.88	5.37	6.03	5.70	7.16	7.23	7.20	14.59	17.23	15.91
20th June	10.02	11.17	10.59	8.83	9.52	9.18	10.00	10.88	10.44	13.55	16.32	14.94
27th June	11.31	12.07	11.69	9.73	10.37	10.05	12.01	12.13	12.07	11.56	14.53	13.05
SD±	1.90	1.79	1.84	1.81	1.77	1.78	1.95	1.85	1.88	2.50	2.76	2.63

SMW - Standard Meteorological Week, SD - Standard Deviation

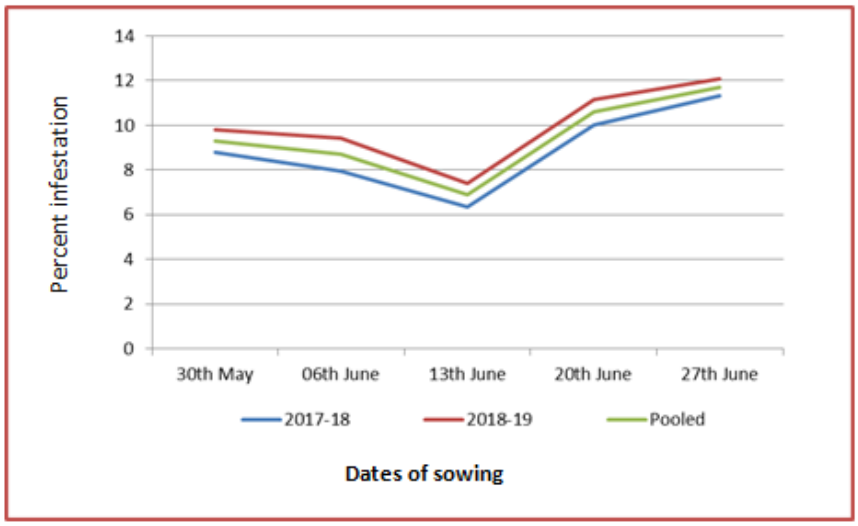

Fig. 1: Effect of different dates of sowing against *M. vitrata* infesting pigeon pea during *Kharif* 2017-2018,*Kharif* 2018-2019 and pooled

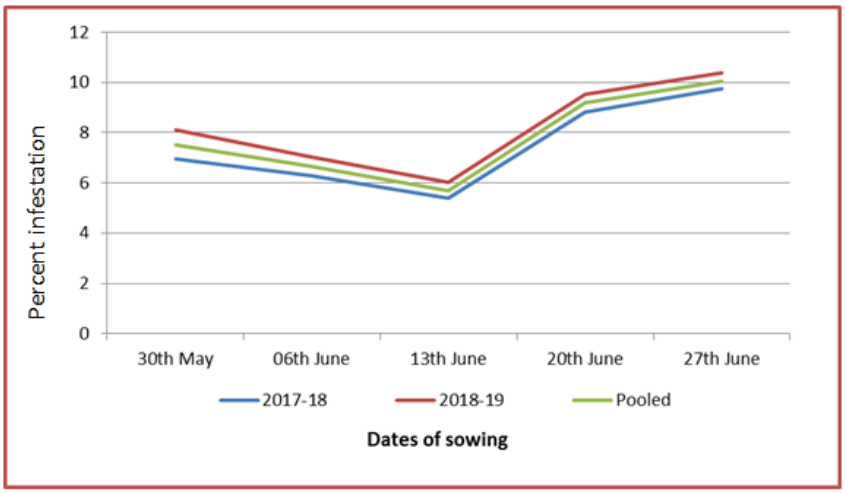

Fig. 2: Effect of different dates of sowing against *E. atomosa* infesting pigeon pea during *Kharif* 2017-2018,*Kharif* 2018-2019 and pooled

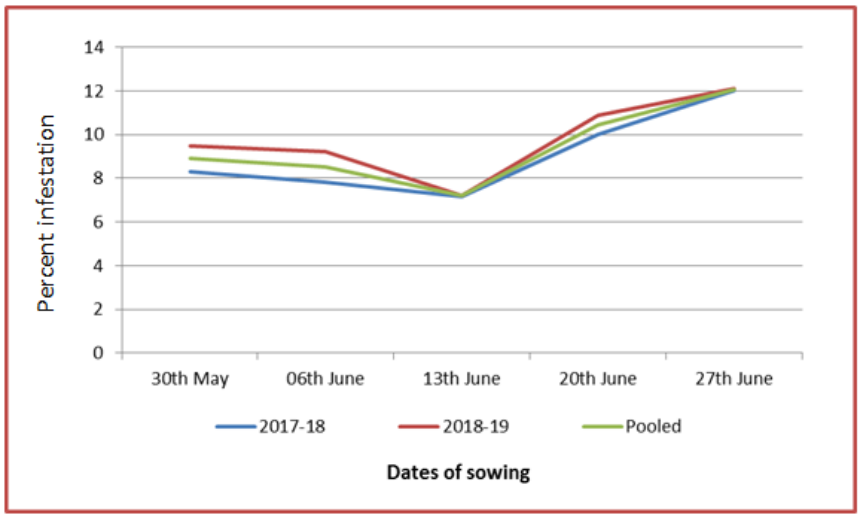

Fig. 3: Effect of different dates of sowing against *H. armigera* infesting pigeon pea during *Kharif* 2017-2018, *Kharif* 2018-2019 and pooled

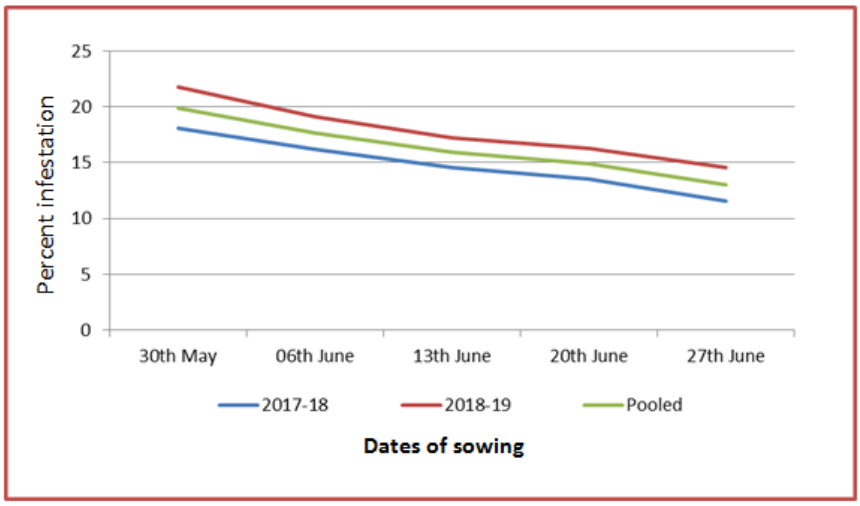

Fig. 4: Effect of different dates of sowing against *M. obtusa* infesting pigeon pea during *Kharif* 2017-2018, *Kharif* 2018-2019 and pooled

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