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Effect of Planting Dates on Epilachna Beetle, *Henosepilachna vigintioctopunctata* Fab. on Potato in Plains of West Bengal

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Abstract—*The present field experiment was undertaken to work out the reaction of different planting dates during rabi season from November to February in 2012-13 and 2013-14 on the infestation of epilachna beetle, Henosepilachna vigintioctopunctata Fab. (Coccinellidae: Coleoptera) attacking potato at Adisaptagram Block Seed Farm, Hooghly, West Bengal. The phenology of pest appearance and intensity of pest attack varied considerably in different planting dates. In case of first three planting dates, i.e. P_1, P_2 and P_3, the population of epilachna beetle was slightly declined in first fortnight of January due to cool (14.50 – 17.20 ^{0}C mean temperature) and dry weather (75.00 – 82.40 % mean relative humidity) conditions prevailed during this period. But this type of fluctuation of population was not observed in last two plantings, i.e. P_4 and P_5, because in these cases, the infestation of the pest was just started during this period. The population of coccinellid was always maximum in fifth planting (P_5) and least in first planting (P_1). It was gradually increased with delay in planting as well as harvesting dates due to favourable abiotic factors for the beetle. The highest population of epilachna beetle was recorded in P_5 (38.75 – 41.50 per plant) and next in the order were P_4 (35.25 – 36.50), P_3 (34.75 – 35.00), P_2 (30.50 – 32.25) and P_1 (25.75 – 26.50), respectively. The mean population of the beetle was also maximum in P_5 (15.07 – 15.61), followed by P_4 (12.91 – 15.11), P_3 (12.75 – 13.54), P_2 (10.79 – 11.54) and P_1 (8.70 – 9.57), respectively. The highest yield of potato tuber was found in P_2, followed by P_1, P_3 and P_5 respectively.*

1. INTRODUCTION

Potato, *Solanum tuberosum* Lin. is most important food crop next to cereals in India. More than 90 % of potatoes are grown in indogangetic plains in India during short winter days from October to March. About 6 % area is under potato cultivation in hills, where it is grown during long summer days of April to October. The plateau region of south eastern, central and peninsular India constitutes about 4 % area, where potato is grown as a rainfed kharif crop during rainy season of July to October or as irrigated rabi crop during winter of October to March. Among the states, Uttarpradesh, West Bengal and Bihar are accounted for nearly 71 % area and 76 % production [1] of potato. In West Bengal, potato is the most important food crop next to rice and the state ranks second position in area and production and first position in productivity in the country [2]. Potato is attacked by more than 100 arthropods from different parts of the world [3]. Among these, *H. vigintioctopuntata* Fabr. (Coccinellidae: Coleoptera) is an important pest causing serious damage to late planting potato crops. The adults and grubs feed on the leaves and skeletonize them. In epidemic situation, the crop yield gets substantially reduced. Thus, epilachna beetle may act as one of the limiting factor in the higher production of potato tubers, mainly in late planting potato crop [4]. Thus, to minimize the damage by this pest, various types of longer residual and hazardous synthetic insecticides are used randomly to control this pest on potato but with limited success. These insecticides are responsible to pollute the ecosystem. Therefore, a field trial was undertaken to work out the effectiveness of various planting dates against epilachna beetle infesting potato which is an eco-friendly method to keep the population of the pest below its economic threshold level.

2. MATERIALS AND METHODS

The present field study was undertaken to work out the impact of different planting dates on the infestation of epilachna beetle, *Henosepilachna vigintioctopunctata* Fabr. On potato during rabi season of two crop season in 2012-2013 and 2013-14, from November to March at Adisaptagram Block Seed Farm, Hooghly, West Bengal. Potato cv. Kufri Chandramukhi was grown by having five dates of planting ($P_1 – P_5$) starting from third week of November with one week interval upto third week of December (P_1 = 15.11.2012 and 15.11.2013; P_2 = 23.11.2012 and 23.11.2013; P_3 = 01.12.2012 and 01.12.2013; P_4 = 08.12.2012 and 08.12.2013 and P_5 = 15.12.2012 and 15.12.2013, respectively) in 6 m x 2 m plots along with a spacing of 60 cm x 20 cm row to row and plant to plant distances, respectively. The experiment was carried out in a randomized block design with four replications. All standard agronomic practices, recommended for this state were strictly followed during raising the crop, except

application of any soil and foliar insecticides to control the pests. The crop was allowed to grow upto full maturity of 80 days for respective dates of planting, followed by dehaulming of the crop. The potato tuber was harvested from the field after ten days of dehaulming.

During the crop season, observation on the number of epilachna beetle (both grubs and adults) on potato was observed. The population of coccinellid was recorded from randomly selected 15 plants in each plot at 7 days interval. The number of beetles was counted from all above ground parts of the selected plants. The weight of marketable potato tubers for each treatment was also recorded and thereafter, the data on beetle population was analyzed after converting them into necessary forms [5].

3. RESULTS AND DISCUSSION

In 2012-13, the data presented in Table 1, indicated that the initiation of infestation of epilachna beetle on potato crop was variable from one planting date to another. In November planted crops i.e. in P_1 and P_2, the pest was noticed on second week of December. But among the December plantings (P_3, P_4 and P_5) pest was appeared first in third week of December, first week and second week of January, respectively in P_3, P_4 and P_5, respectively. For the first three planting dates (P_1, P_2 and P_3), the population of beetle, after appearance on the crop, was gradually increased upto fourth week of December and then the population was slightly decreased during first fortnight of January and thereafter, again started to increase till the full maturity of the crop. In last two plantings, there was no such fluctuation of population of coccinellid and the incidence of the pest was steadily increases. The maximum population of beetle was found at the time of dehaulming of the crop in all the plantings, except the fifth (P_5) one, where it was observed one week before dehaulming i.e. in first week of March. The population of epilachna beetle was highest in P_5 (41.50 per 15 plants) and then in P_4 (35.25), P_3 (35.00), P_2 (30.50) and P_1 (26.50), respectively and among these, P_3 and P_4 were at par. The mean population of coccinellid was also maximum in P_5 (15.07), followed by P_4 (12.91), P_3 (12.75), P_2 (11.54) and P_1 (9.57), respectively.

Table 1: Population dynamics of epilachna beetle on potato under different planting dates during 2012-13 at Adisaptagram Block Seed Farm, Hooghly, West Bengal (mean of four replications)

planting dates	Population of epilachna beetle on different dates of planting													Yield (t/ha)
	December, 2012		January, 2013				February, 2013				March, 2013		Mean popula.	
	III wk	IV wk	I wk	II wk	III wk	IV wk	I wk	II wk	III wk	IV wk	I wk	II wk		
P1	6.50 (14.63)	8.00 (16.08)	5.75 (13.67)	5.50 (12.99)	12.25 (20.41)	16.25 (23.52)	21.25 (27.37)	26.50 (30.88)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	9.57	29.37
P2	4.25 (11.50)	7.50 (15.67)	5.25 (13.10)	6.50 (14.63)	12.75 (20.82)	15.50 (22.94)	18.75 (25.58)	24.25 (29.41)	30.50 (33.43)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.54	29.59
P3	2.25 (7.16)	6.25 (14.24)	4.75 (12.25)	7.75 (15.40)	8.75 (17.01)	11.75 (20.19)	17.25 (24.36)	21.75 (27.66)	25.25 (30.12)	35.00 (36.20)	0.00 (0.00)	0.00 (0.00)	12.75	27.72
P4	0.00 (0.00)	0.00 (0.00)	3.50 (10.49)	5.25 (13.10)	8.50 (16.88)	12.75 (20.85)	13.50 (21.44)	15.25 (22.71)	20.75 (27.03)	27.25 (31.37)	35.25 36.36)	0.00 (0.00)	12.91	27.57
P5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.75 (8.22)	6.00 (14.06)	9.25 (17.59)	8.50 (16.75)	17.25 (24.38)	19.75 (26.33)	29.50 (32.85)	41.50 (40.05)	31.25 (33.95)	15.07	25.93

*Figures in parenthesis are logarithmic transformed values

Source of variation

	Date of observation	Planting	Date of observation x Planting
SE (m) ±	0.37	0.62	1.40
CD at 0.05	0.87	1.45	3.24

In 2013-14, the pest was appeared first on the crop during third week of December in P1 and P2, i.e. in November planted crops, but it was found during end December in P3 and first and second week of January in P4 and P5, respectively (Table 2). The population of beetle was slightly declined in between first and second week of January in first three planting dates (P1, P2 and P3) and then it was increased slowly while in last two plantings no such fluctuation of the pest population was observed. The peak incidence of the coccinellid was recorded at the time of dehaulming of the crop

in second, third and fourth week of February for first three planting dates (P1, P2 and P3), respectively. In P5, it was also observed at the time of dehaulming in second week of March, but in P4, the same was recorded during end February i.e. one week before dehaulming of the crop. The highest population of the pest was found in P5 (38.75 per 15 plants) and next in the order were P4 (36.50), P3 (34.75), P2 (32.25) and P1 (25.75), respectively. Incidence of beetle was also least in P1 (8.70), when the mean population of coccinellid was considered and respectively increased in P2 (10.79), P3 (13.54), P4 (15.110 and P5 (15.61), respectively.

Table 2: Population dynamics of epilachna beetle on potato under different planting dates during 2013-14 at Adisaptagram Block Seed Farm, Hooghly, West Bengal (mean of four replications)

planting dates	Population of epilachna beetle on different dates of planting												Mean popula.	Yield (t/ha)
	December, 2013		January, 2014				February, 2014				March, 2014			
	III wk	IV wk	I wk	II wk	III wk	IV wk	I wk	II wk	III wk	IV wk	I wk	II wk		
P1	4.25 (11.59)	5.25 (12.86)	3.75 (10.66)	7.75 (15.68)	12.50 (20.27)	16.25 (23.60)	20.25 (26.52)	25.75 (30.20)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	8.70	28.02
P2	3.50 (10.19)	2.25 (7.16)	3.00 (9.50)	8.50 (16.26)	10.75 (18.72)	17.25 (24.26)	20.75 (26.79)	20.50 (26.68)	32.25 (34.49)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	10.79	28.57
P3	0.00 (0.00)	3.75 (10.53)	2.75 (8.07)	4.50 (11.66)	8.50 (16.49)	14.00 (21.69)	23.50 (28.80)	27.50 (31.42)	29.75 (32.90)	34.75 (35.96)	0.00 (0.00)	0.00 (0.00)	13.54	26.92
P4	0.00 (0.00)	0.00 (0.00)	3.50 (10.19)	5.25 (12.72)	9.75 (17.70)	9.75 (17.70)	16.75 (23.91)	25.00 (29.82)	27.50 (31.44)	36.50 (37.07)	32.25 (34.42)	0.00 (0.00)	15.11	25.62
P5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.75 (6.35)	3.00 (8.03)	6.50 (14.16)	8.50 (16.39)	16.50 (23.73)	28.75 (32.26)	33.25 (35.07)	34.75 (36.03)	38.75 (38.42)	15.61	25.61

*Figures in parenthesis are logarithmic transformed values

Source of variation

	Date of observation	Planting	Date of observation x Planting
SE (m) ±	0.53	0.89	1.99
CD at 0.05	1.23	2.06	4.60

It may be concluded from two years of study that in first three planting dates i.e. P_1, P_2 and P_3 the population of beetle was slightly declined in first fortnight of January. It may be due to cool (14.50 – 17.20 ^{0}C mean temperature) and dry weather (75.00 – 82.40 % mean relative humidity) conditions prevailed during this period as the epilachna beetle population was positively correlated with relative humidity [6]. But this type of fluctuation of pest population was not found in last two plantings (P_4 and P_5), because in these cases, the infestation of coccinellid was just started during this period. The pest population was always maximum in fifth planting (P_5) and least in first planting (P_1) and it was slowly increased with delay in planting as well as harvesting dates as during these period, the abiotic factors were favourable for the pest. The incidence pattern of epilachna beetle on potato was also reported earlier [4] and the results of the present trial regarding the infestation of the pest were more or less similar with their findings. But, there was no direct information available in the literature regarding the effect of different planting dates on the population dynamics of epilachna beetle on potato. However, studies [7] on this particular beetle in brinjal showed its first occurrence in the 1st week of March with gradual increase in population upto 3rd week of April. Sathe *et al.* [8] observed the incidence of epilachna in brinjal during August to March.

Therefore it may be concluded that November planted crop were always better than December planted crops regarding the incidence of epilachna beetle on potato and yield of healthy potato tubers. The maximum yield (t/ha) of potato tuber was found in P_2 (28.57 – 29.59), which was closely succeeded by P_1 (28.02 – 29.37) and then P_3 (26.92 – 27.72), P_4 (25.62 – 27.57) and P_5 (25.60 – 25.93), respectively. The higher yield of potato tuber was found from November plantings as compared to December plantings. The rise in temperature from the beginning of February and extending to the entire maturity period of the crop was mainly responsible for lower yield of potato tubers in late planting crops. Because, with rise in temperature the respiration rate of the leaves is also increased with simultaneous decrease in the flow of substances to the growing tubers which resulted in less yield of potato tubers in case of late planting crop [9]. The results regarding lower yield of potato tubers also support the earlier findings of other scientists [10-11], who were also recorded lower yield of potato tubers with delay in planting as well as harvesting dates during rabi season.

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