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Effect of sowing dates and insecticides on yellow mite, *Polyphagotarsonemus latus* infestation in jute

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ABSTRACT

The population of yellow mite was significantly more in early sown crop. During 45 to 60 DAS, it ranged from 51.66-71.78 mites/ cm² in early sown crop (15th March) as compared to 21.06-71.78 mites/ cm² in late sown crop (15th April). The mean of mite population after the application of acaricides at 45 and 60 DAS reduced the mite population significantly to, 19.76 and 11.05 mites/cm² leaf in dicofol, fenazaquin and abamectin (1.8 EC) treatment as compared to pre-spray observation of 36.01 to 54.40 mites/ cm². Early sown crop proved to be optimum in terms of less infestation of yellow mite *vis-a-vis* with highest fibre yield of 34.41 q/ha in comparison to late sown crop in which the average fibre yield of 22.32 q/ha was recorded. Although all the acaricides significantly reduced the mite infestation in jute, but abamectin followed by dicofol (18.5 EC) and fenazaquin (10 EC) gave better protection of mites.

Key words : Insecticides, jute, sowing time, yellow mite.

INTRODUCTION

Among the natural fibre crops, jute is the most important bast fibre crop (Kundu, 1956) grown in South Asia and Eastern states of India. Besides the advantage of biodegradability and environment friendly property, it has a special significance in the Indian subcontinent due to the dependence of millions of small and marginal farming families for livelihood on its production and utilization (Pathak, 1991). India ranks first in area coverage and production of jute accounting for 62.00% of the world's production. Among the various constraints in jute cultivation, the biotic stresses are an emerging problem in the backdrop of changing climatic conditions. One of the practical means of increasing jute production is to minimize losses caused by major insect pests. Yellow mite, *Polyphagotarsonemus latus* Banks is one of the major destructive pests of jute (Rahman and Khan, 2006) and the loss caused by *P. latus* is reported to the extent of 10.00 - 42.00% depending on the level of infestation (Pandit *et al*., 2002). It has more than 250 hosts crossing family border in plants of agricultural and horticultural importance (Rai *et al*., 2007). Changes in agronomic management including the sowing time, use of short duration cultivar and optimum use of water and nutrients are determined to be important for sustaining crop productivity (Mondal *et al*., 2013). The recent trend in pattern of insect pest infestation in jute indicates the infestation of yellow mite has become more regular with an enhanced pest status (Satpathy *et al*., 2014).

Effect of date of sowing and varieties on the relative abundance of yellow mite, *P. latus* was worked out by many researchers in different crops. Changes in planting time would affect crop-pest phenological synchrony influencing pest densities (Aslam *et al*., 2005). The manipulation in sowing time sometimes helps the crops to escape the peak infestation period and enhances the effect of acaricides/insecticides. In this study, the effect of sowing dates and insecticides on yellow mite dynamics on jute was studied in a field experiment.

MATERIALS AND METHODS

The field experiments were carried out for three seasons to know the effect of date of sowing of jute (cv. JRO-204) and insecticides on the population of yellow mite during *kharif*, 2012-13, 2013-14 and 2014-15 cropping seasons in the Research Farm

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of ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore (22°.45' N and 88°.26' E). The experiment was laid out in a factorial randomized block design with three replications in 8 treatment combinations [sowing date (2): 15th March and 15th April; insecticides (4): dicofol 18.5 EC, fenazaquin 10 EC abamectin 1.8 EC and check plot]. The plot size of the experiment was 4 × 3 m with 30 × 10 cm spacing. The insecticide treatments were applied at 45 and 60 days after sowing (DAS) and the control plots were maintained without any insecticides treatment. The fertilizers, N, P_2O_5 and K_2O were applied @ 80, 40 and 40 kg/ha in the form of urea, DAP and murate of potash respectively. One third of N and entire amount of P_2O_5 and K_2O were applied as basal dose, while remaining two-third of N was applied at 40 DAS. The crop was irrigated for four times at critical period of crop growth stages.

The observation on the infestation of yellow mite was recorded during the peak period of infestation i.e. 45 DAS (pre-treatment), 48 DAS (3 days post treatment), 60 DAS (pre-treatment) and 63 DAS (3 days post-treatment) on second unfolded leaves of ten randomly selected plants per plot using 1 × 1 cm white hard paper quadrate with 10 × magnifying glass. The data were subjected to two-way ANOVA.

RESULTS AND DISCUSSION

Effect of sowing time on the infestation of yellow mite in jute : During 2012 cropping season, the mean population of yellow mite in the crop sown on 15th March was 69.92 mites/cm^2 of area of second unfolded leaf, which was significantly higher than the mean population of 6.40 mites/cm^2 leaf in crop sown on 15th April at 45 DAS. Gotyal *et al*. (2014) also previously studied that the earlier sown crop suffered more mite infestation. The susceptibility of early sown jute to yellow mite was evidenced from the relative infestation of mite on early and late sown crop during all the phonological stages. This indicates that favourable condition for survival and damage of yellow mite coincides more during the growth periods of early crop. Similarly at 60 DAS the infestation of yellow mite population was significantly higher (156.54) in the early sown crop than the late sown crop (25.07 mites/cm^2 leaf) (Table 1). Our findings are in confirmation with the earlier findings obtained by Dutt (1952), Das and Mallick (1998). In general, the jute crop sown earlier experienced higher infestation of mite in comparison to late sown crop.

The experimental observation during 2013 on the infestation of yellow mite during mid-March and mid-April exhibited that at 45 DAS the mean number of yellow mite population in the crop sown in mid of March was 29.92/cm^2 of leaf which was higher than the mean population of 10.05 mites/cm^2 leaf in the crop sown in the mid of March (Table 2). Similarly, at 60 DAS the early sown crop suffered with more number of mites (10.35/cm^2 leaf) as compared to moderately less *i.e*. 9.48 mites/cm^2 leaf on late sown crop. Hath and Ghosh (2001) and Hath (2004) who also reported that infestation of *P. latus* on jute decreased with delayed sowings.

Similar trend of observation was noticed during 2014 cropping season, where the mean count of yellow mite was more in early sown crop as

Table 1. Effect of insecticides and sowing time on mite population (no./sq cm in second unfolded leaf) at different DAS during 2012 cropping season.

Treatment	45 DAS (Pre)			48 DAS (Post)			60 DAS (Pre)			63 DAS (Post)			Yield (q/ ha)		
	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean
I_1	80.16	6.06	43.11	1.70	1.86	1.78	204.77	12.40	106.91	96.37	2.53	49.45	34.38	19.23	26.47
I_2	77.30	7.83	42.56	5.46	3.00	4.23	147.63	16.50	80.40	88.00	3.70	45.90	32.21	20.81	26.51
I_3	69.70	6.80	38.28	0.53	1.73	1.13	126.83	9.27	68.05	50.67	2.40	26.53	35.89	19.93	27.91
I_4	52.53	5.06	28.86	72.43	4.60	38.51	153.60	62.13	107.86	141.43	15.67	78.55	32.83	18.66	25.74
Mean	69.92	6.40	–	20.03	2.80	–	156.54	25.07	–	94.41	6.07	–	33.82	19.49	–
CD (P=0.05)	D = 4.02, I = 5.68, D × I = 6.59			D = 1.09, I = 1.69, D × I = 1.95			D = 4.60, I = 6.51, D × I = 7.55			D = 7.42, I = 5.25, D × I = 8.61			D = 1.10, I = 1.56, D × I = 1.81		

D_1 = DoS : 15th March, D_2 = DoS : 15th April, I_1 = dicofol 18.5 EC @ 0.045% at 45 and 60 DAS, I_2 = fenazaquin 10 EC @ 0.015% at 45 and 60 DAS, I_3 = abamectin 1.8 EC @ 0.0015% at 45 and 60, DAS, I_4 = control.

Table 2. Effect of insecticides and sowing time on mite population (no./sq cm in second unfolded leaf) at different DAS during 2013 cropping season.

Treatment	45 DAS (Pre)			48 DAS (Post)			60 DAS (Pre)			63 DAS (Post)			Yield (q/ha)		
	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean
I_1	43.63	8.10	25.86	2.70	2.56	2.63	10.90	7.66	9.28	7.86	2.23	5.05	47.68	23.16	35.42
I_2	18.70	12.00	25.35	2.36	1.70	2.03	11.23	12.40	11.81	7.40	2.60	5.00	45.75	25.51	35.63
I_3	22.96	13.30	18.13	1.56	1.13	1.35	7.93	10.40	9.16	4.30	0.40	2.35	50.62	23.14	36.88
I_4	34.66	6.80	20.73	55.33	19.43	37.38	11.33	7.46	9.40	13.70	15.13	14.41	47.44	23.25	35.34
Mean	29.92	10.05	–	15.49	6.20	–	10.35	9.48	–	8.31	5.09	–	47.87	23.76	–
CD (P=0.05)	D = 9.78, I = NS, D × I = NS			D = 1.85, I = 2.63, D × I = 3.73			D = NS, I = NS, D × I = NS			D = 2.39, I = 3.36, D × I = 4.75			D = 2.75, I = NS, D × I = NS		

D_1 = DoS : 15th March, D_2 = DoS : 15th April, I_1 = dicofol 18.5 EC @ 0.045% at 45 and 60 DAS, I_2 = fenazaquin 10 EC @ 0.015% at 45 and 60 DAS, I_3 = abamectin 1.8 EC @ 0.0015% at 45 and 60, DAS, I_4 = control.

compared to late sown crop in both the stages of the crop i.e. 45 and 60 DAS. The mean number of yellow mite population was 56.26 and 48.01 mites/cm^2 on March and April month sown crop respectively at 45 DAS. Whereas it was 55.27 and 38.36 mites/cm^2 at 60 DAS on early (15th March) and late sown (15th April) crop (Table 3).

The three years observation of pooled mean data revealed in both stages of the crop (45 and 60 DAS), the population of yellow mite was more in early sown crop and it ranged from 51.66-71.78 mites/cm^2 as compared to 21.06-21.57 mites/ cm^2 at in late sown crop (Table 4). The comparative infestation of mite on jute crops sown during March and April clearly indicates significantly higher prevalence on mite in the early sown jute.

Effect of insecticides on the infestation of yellow mite in jute : The effect of commercial grade formulations of three promising acaricides *viz.*, dicofol 18.5 EC, fenazaquin 10 EC and abamectin 1.8 EC at their recommended doses on mite infestation was significant at 45 and 60 DAS stage of jute crop (Tables 1, 2, 3). During 2012, irrespective of sowing time, significant reduction of yellow mite population was observed after 3 days post treatment (48 and 63 DAS) of all the acaricides. After the first spray *i.e.* at 48 DAS, maximum reduction in mite population was observed in abamectin treatment (7.03 mites/ cm^2 leaf) as compared to 49.41 mites/ cm^2 of leaf in pre-treatment (45 DAS) observation. Whereas at 63 days post observation, the maximum reduction of mite population in dicofol treatment (4.31 mites/cm^2) was reduced as compared to 43.13 mites/cm^2 during pre-spray observation (Table 1). Similar observation was also made by Singh and Singh (2013) and reported that after first day of spray, maximum reduction in mite population showed in dicofol (60.20%) in chilli crop. They also reported that abamectin and propargite have

Table 3. Effect of insecticides and sowing time on mite population (no./sq cm in second unfolded leaf) at different DAS during 2014 cropping season.

Treatment	45 DAS (Pre)			48 DAS (Post)			60 DAS (Pre)			63 DAS (Post)			Yield (q/ha)		
	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean
I_1	63.10	53.40	58.25	7.83	6.26	7.05	39.00	47.27	43.13	4.03	4.60	4.31	27.87	26.89	27.38
I_2	61.50	52.33	56.91	83.21	6.33	44.77	89.00	19.60	54.30	93.56	2.46	48.01	30.34	25.33	24.34
I_3	52.36	46.46	49.41	5.80	8.26	7.03	38.80	49.76	44.28	12.83	7.30	10.06	24.69	23.99	27.83
I_4	48.10	39.86	43.98	48.66	4.06	26.36	54.30	36.83	45.56	62.26	5.40	33.83	22.34	22.90	22.62
Mean	56.26	48.01	–	36.37	6.23	–	55.27	38.36	–	43.17	4.94	–	26.31	24.78	–
CD (P=0.05)	D = NS, I = 3.43, D × I = 3.69			D = 8.85, I = 3.90, D × I = 3.67			D = 9.56, I = 5.06, D × I = 3.99			D = 9.36, I = 4.33, D × I = 3.89			D = 4.20, I = 2.50, D × I = 1.74		

D_1 = DoS : 15th March, D_2 = DoS : 15th April, I_1 = dicofol 18.5 EC @ 0.045% at 45 and 60 DAS, I_2 = fenazaquin 10 EC @ 0.015% at 45 and 60 DAS, I_3 = abamectin 1.8 EC @ 0.0015% at 45 and 60, DAS, I_4 = control.

Table 4. Effect of insecticides and sowing time on mite population (no./sq cm in second unfolded leaf) at different DAS (Pooled data).

Treatment	45 DAS (Pre)			48 DAS (Post)			60 DAS (Pre)			63 DAS (Post)			Yield (q/ha)		
	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean	D_1	D_2	Mean
I_1	59.06	20.20	39.63	3.55	4.23	3.89	88.47	20.33	54.40	37.17	3.11	20.14	37.92	21.81	29.89
I_2	51.90	24.06	37.98	5.21	3.49	4.35	65.88	19.74	42.81	36.07	3.44	19.76	35.66	21.96	28.81
I_3	48.33	20.00	34.17	2.80	2.30	2.50	59.75	12.28	36.01	20.11	1.91	11.05	37.61	22.48	30.04
I_4	47.34	19.98	33.66	70.13	24.23	47.27	73.01	33.94	53.47	61.35	44.54	52.90	34.43	23.05	28.74
Mean	51.66	21.06	–	20.47	8.56	–	71.78	21.57	–	38.68	13.27	–	34.41	22.32	–
CD (P=0.05)	D = 4.00, I = NS, D × I = NS			D = 8.00, I = 3.00, D × I = 9.00			D = 7.00, I = 8.03, D × I = NS			D = 8.00, I = 5.00, D × I = NS			D = 3.00, I = NS, D × I = NS		

D_1 = DoS : 15th March, D_2 = DoS : 15th April, I_1 = dicofol 18.5 EC @ 0.045% at 45 and 60 DAS, I_2 = fenazaquin 10 EC @ 0.015% at 45 and 60 DAS, I_3 = abamectin 1.8 EC @ 0.0015% at 45 and 60, DAS, I_4 = control.

been found to be almost equally effective against yellow mite.

Similarly during 2013 cropping season, abamectin performed better in suppressing the mite population both at 48 and 63 days post treatment. The average mite count of 1.35 and 2.35 was observed at 48 and 63 days of post treatment respectively. During 48 days post spray, the mean mite population was 2.63, 2.03 and 1.35 mites/cm^2 leaf as compared to pre-spray (45 DAS) count of 25.86, 25.35 and 18.13 respectively in dicofol, fenazaquin and abamectin treatments. Similar trend of observation was recorded at 63 days post treatment (Table 2). During 2014 season the mite infestation was least (7.03 mites/cm^2 leaf) in abamectin treatment as compared to 7.05 and 44.77 mites/cm^2 leaf in dicofol and fenazaquin treatments respectively at 48 days post treatment. Whereas at 63 days post treatment, least mite count of 4.31 mites/cm^2 was observed in dicofol treatment as compared to 48.01 and 10.06 in fenazaquin and abamectin treatments respectively (Table 3). Similar findings were reported by Mohapatra (1996) for management of yellow mite in jute. In the present study also it is evident from the pooled data of 3 seasons evaluation, during both the post treatment periods, the mite population in the acaricides treated plots was significantly less than control. At 63 DAS abamectin treatment recorded significantly lowest mite population (11.05) than other treatments (19.76 & 20.14 mites/cm^2) and control (52.90 mites/cm^2). All the acaricides, abamectin, fenazaquin and dicofol evaluated against yellow mite were effective and reduced the mite infestation significantly over the control and the pre-treatment period. The toxicity of abamectin 1.9 EC and fenazaquin 10 EC against spider mite was noted to reduce the spider mite to the extent of 100% under laboratory condition (Reddy *et al.*, 2014). Toxic effect of propargite on spider mite was also similar to abamectin and fenazaquin (Reddy *et al.*, 2014). Sahoo *et al.*, (2003) also observed that fenazaquin was second to abamectin in terms of toxicity against adult females of red spider mite.

Effect of sowing dates and insecticides on fibre yield of jute : The sowing dates and insecticides had significant effect on fibre yield of jute (Tables 1, 2, 3). Significantly highest yield of 33.82, 47.87 and 26.31 q/ha was recorded in case of crop sown on 15th March during 2012, 2013 and 2014 cropping season respectively. Whereas, it was 19.49, 23.76 and 24.78 q/ha during 2012, 2013 and 2014 season respectively. In April 15th sown crop the effect of acaricide treatment on fibre yield varied in different seasons and during 2012 the treatment of abamectin yielded maximum of 35.89 q/ha as compared to 34.38 and 32.21 q/ha in dicofol and fenazaquin treatment respectively on early (March 15th) sown crop. Whereas on April 15th sown crop, fenazaquin performed better with higher yield of 20.81 q/ha (Table 1). During 2013, abamectin and fenazaquin performed better with higher fibre yield of 50.62 and 25.51 q/ha on 15th March and 15th April sown crop. In case of 2014, cropping season fenazaquin and dicofol proved to be better with higher fibre yield of 30.34 and 26.89 q/ha in early and late sown crop respectively. The pooled observation on 15th March showed that the highest yield of 37.92 q/ha was recorded in dicofol treatment as compared 35.66 and 37.61 q/ha in

fenazaquin and abamectin treatment respectively (Table 4). Moderately low yield was observed on 15th March sown crop in which the maximum of 22.48 q/ha was recorded in abamectin treated plot whereas it was 21.81 and 21.96 q/ha in dicofol and fenazaquin treated plots respectively. In conclusion, the consecutive three years of study revealed that early sown crop (15th March) proved to be optimum date of sowing with highest fibre yield of 34.41 q/ha in comparison to late sown crop (15th April) in which the average fibre yield of 22.32 q/ha recorded. The performance of all the three acaricides ranked in the order *i.e*. abamectin (1.8 EC) > dicofol (18.5 EC) > fenazaquin (10 EC) based on their performance in suppressing the mite population. Goldsmith and James (2002) reported that abamectin gave satisfactory control against this mite.

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