

## Relative Abundance and Yield Loss Assessment of Lentil Aphid, *Aphis craccivora* Koch in Relation to Different Sowing Dates

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### ABSTRACT

Relative abundance of lentil aphid, *Aphis craccivora* Koch were investigated and yield loss assessment at different sowing dates during rabi season of 1999-2000 and 2000-2001 at Ishurdi Bangladesh. Lentil aphid appeared in field in the first week of January. The maximum aphid population (15.82/twig) was recorded in the first week of February 2000-2001, but the population reached to the peak was in the last week of January in 1999-2000, subsequently rainfall caused a sudden reduction of aphid population in latter dates. Aphid population and infestation increased with the delayed dates of sowing. The crop sown in November received less aphid infestation and consequently produced higher yield than the crop sown in December. During 1999-2000, the avoidable yield loss due to aphid infestation was recorded 0.90 to 6.78% and in 2000-2001 it was 2.65 to 9.00% depending on the different dates of sowing. Avoidable yield loss was less in November sowing crop than the crop sown in December. On the other hand, yield increased by 0.91 to 7.27% and 2.72 to 9.89% in 1999-2000 and 2000-2001 respectively, due to protection measures taken against aphids and this was also depend on different dates of sowing.

**Key words:** Lentil aphid, delayed sowing, infestation, yield.

### INTRODUCTION

Lentil is the second most important pulse crop in Bangladesh considering area and yield (BBS 1999). Lentil aphid, *Aphis craccivora* Koch (Hemiptera: Aphididae) has become a major pest of lentil in last few years. Aphid sucks the cell sap from the stems, twigs buds, flowers and developing pods causing a significant loss in yield. Aphid population and rate of infestation are very much dependent on sowing time (Islam *et al.*, 1991). It was found that, sowing of lentil by mid November received poor aphid infestation (Anon., 1999-2000) but sowing within mid November is practically difficult because most of the lentil cultivable land become unsuitable (zoa condition) for tillage operation within mid November. Accordingly, most of the farmer's in Bangladesh prefers lentil cultivation after mid November. The crop sown after mid November and on wards received higher aphid infestation causing considerable loss in yield. But the information regarding *A. craccivora* infestation and its effect on grain yield reduction in lentil is not available in Bangladesh.

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Therefore, the present study was undertaken to investigate aphid infestation, population fluctuation, severity of infestation and their effects on yield and yield loss in relation to dates of sowing.

The cultural practices like sowing dates can play major role in reduction of aphid population. Following this cultural practice, a ecofriendly management can be developed and ultimately chemical used can be reduced.

## MATERIALS AND METHODS

The experiments were conducted at Pulses Research Center, Ishurdi, Pabna, Bangladesh during rabi season of 1999-2000 and 2000-2001. Four sowing dates were considered as treatments viz., November 21, November 28, December 05 and December 12. The experiments were laid out in randomized split block design with three replications. One split of the block was kept protected from aphid infestation by the application of Malathion @ 2 ml/litre of water. The lentil seeds of BARI-masur 3 were sown on the above-mentioned dates in rows @ 50 kg/ha with a row spacing of 30 cm. The plot size was 3m x 2.5m.

The plants were monitored regularly to detect the first appearance of aphids on lentil plants. At seven days interval, the infestation data were taken and the percentage of infestation determined. For calculating aphid population (number of aphids per infested twig) and the percentage of twig infestation, 30 twigs of 10 cm length were randomly collected from two side rows plant avoiding boarder rows of each plot from the untreated split of each block. The central four rows were kept undisturbed to record grain yield. At maturity, plants of central four rows of each plot of both the treated and untreated splits were harvested and grain yield was converted into per hectare. The yield data obtained from Malathion treated (protected) and untreated (unprotected) plots were used to calculate avoidable loss. The difference between the weight of grain yield in protected and unprotected plots was considered as loss. The percent loss was calculated from the following formula:

$$\text{Percent loss in yield due to pest} = \frac{X_1 - X_2}{X_1} \times 100$$

where,  $X_1$  is the mean yield of protected plots

$X_2$  is the mean yield of unprotected plots

The experimental data were analyzed statistically after appropriate transformation and means were separated by Duncan's Multiple Range Test (Steel and Torrie, 1960).

## RESULTS AND DISCUSSION

### *Aphid population at different sowing dates*

The population of *A. craccivora* koch appeared in the field during the first week of January and showed increasing trend on wards. Sowing dates have shown a significant effect on aphid population (Tables 1 & 2). The maximum population was recorded in the last week of January and first week of February during 1999-2000 and 2000-2001 respectively, with a peak period between the last week of January to third week of February. It was observed that aphid population increased gradually with the delay in the dates of sowing in both the years under study. The higher aphid population was observed in the crop sown in December than the crop sown in November. Significantly the lowest aphid population was observed in November 21 sowing, then there was gradual increase of population and the highest population was observed in December 12 sowing. Aphid population was higher in 2000-2001 than that of 1999-2000 cropping season. This was because of higher rainfall in 1999-2000 cropping season, which adversely affected the aphid population. Rainfall had adverse effect on the population of mustard aphid, *Lipaphis erysimi* Kalt. was reported by many researcher (Roy, 1975; Prasad and Phadke, 1980 and Jaglan *et al.*, 1988).

Significantly the higher aphid population was observed in the delayed sowing. During 1999-2000, the highest aphid population was observed in December 05 sowing and in 2000-2001, the highest aphid population was observed in December 12 sowing crop. Similar effect of delayed sowing on

mustard aphid population was also reported by Islam *et al.* (1991) who observed the minimum number of aphid, *Lipaphis erysimi* Kaltenschach in October and November sowing crop and the maximum aphid population recorded in December sowing crop. In 1999-2000 cropping season, the living aphid on plants was observed up to February 15, then died and dried. But in 2000-2001, the living aphid on plants was observed up to February 25. Aphid activity was prolonged by 10 days in 2000-2001 cropping season. The reason might be due to the prevailing favourable climatic condition of the cropping season.

**Table 1. Field population of lentil aphid, *Aphis craccivora* Koch at different sowing dates at Ishurdi during rabi cropping season of 1999-2000**

Treatments (Sowing dates)	Mean number of aphids per infested twig				
	Jan. 24	Jan. 31	Feb. 07	Feb. 14	Feb. 21
	99-00	99-00	99-00	99-00	99-00
November 21	3.42 b	2.99	1.68 c	0.33	
November 28	5.12 b	2.97	1.98 bc	1.00	
December 05	8.40 a	4.37	3.19 a	0.33	No living aphids were found on twigs
December 12	4.33 b	3.55	2.71 ab	0.33	
	-	NS	-	NS	

**Note:** In a column, treatment means having the same letter(s) are not significantly different by DMRT at 5% level  
Values are the mean of three replications.

**Table 2. Field population of lentil aphid, *Aphis craccivora* Koch at different sowing dates at Ishurdi during rabi cropping season of 2000-2001**

Treatments (Sowing dates)	Mean number of aphids per infested twig					
	Jan. 24	Jan. 31	Feb. 07	Feb. 14	Feb. 21	Feb. 28
	00-01	00-01	00-01	00-01	00-01	00-01
November 21	1.95 b	4.36 c	2.99 c	2.69 c	3.51 b	
November 28	6.47 a	6.13 b	10.26 b	3.14 c	4.12 b	No living aphids were found on twigs
December 05	2.88 b	7.32 b	9.57 b	5.78 b	5.53 a	
December 12	5.00 a	8.78 a	15.82 a	7.91 a	6.75 a	
	-	-	-	-	-	

**Note:** In a column, treatment means having the same letter(s) are not significantly different by DMRT at 5% level  
Values are the mean of three replications.

### **Aphid infestation at different sowing dates**

Sowing dates have shown a significant effect on aphid infestation in lentil, which is presented in Table 3. Severity of aphid infestation is presented in the form of percent twig infestation. The twig infestation was gradually higher with delayed sowing dates in both the years under study. The crop sown in November showed less aphid infestation than the crop sown in December. Similar findings were also reported by Islam *et al.* (1991) in mustard aphid, *Lipaphis erysimi*. In 2000-2001, the higher percentage of twig infestation was observed in February 21 during 1999-2000 it was in January (24, 31). There was reduction of aphid infestation due to rainfall at first week of February. Peak period of activity was observed between the last week of January and the third week of February. The lowest twig infestation was observed in November 21 sowing followed by November 28, December 05 and the highest was in December 12 sowing. During 1999-2000, twig infestation was 90% in December 12 sowing but in 2000-2001, it was 100% on the same date of sowing. Aphid infestation continued from first week of January to second and third week of February during 1999-2000 and 2000-2001 cropping season, respectively.

**Table 3. Twig infestation of lentil by *A. craccivora* in different sowing dates during rabi season of 1999-2000 and 2000-2001 at Ishurdi, Pabna, Bangladesh**

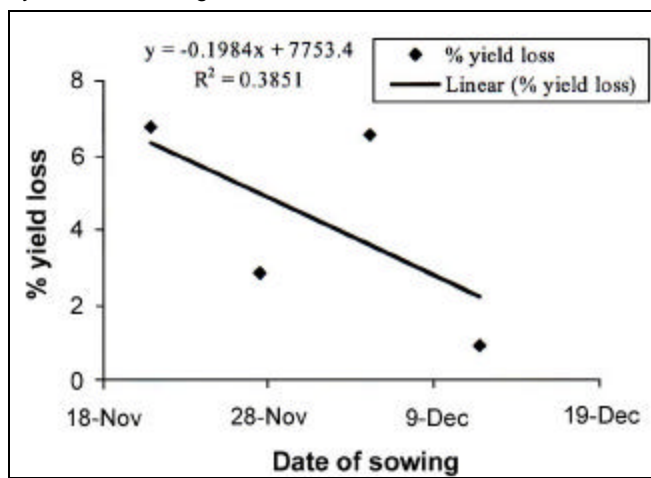
Treatments (Sowing dates)	Per cent twig infestation											
	Jan. 24		Jan. 31		Feb. 07		Feb. 14		Feb. 21		Feb. 28	
	99-00	00-01	99-00	00-01	99-00	00-01	99-00	00-01	99-00	00-01	99-00	00-01
November 21	63.33 c (52.86)*	36.81 b (36.95)	50.00 b (45.00)	45.00 b (42.11)	46.67 b (43.08)	61.67 b (51.78)	3.33 (1.82)	41.67 c (40.17)	No living aphids were found on twigs.	68.33 c (55.98)	No living aphids were found on twigs	
November 28	76.67 b (61.71)	65.53 a (54.08)	66.67 b (50.08)	80.00 a (63.55)	50.00 b (45.00)	95.00 a (77.08)	3.33 (1.82)	70.00 b (57.00)		76.67 bc (61.33)		
December 05	86.67 a (68.85)	50.74 b (45.22)	86.67 a (68.85)	66.67 a (54.83)	66.67 a (54.89)	96.67 a (80.19)	3.33 (1.82)	56.67 bc (48.87)		90.00 ab (72.53)		
December 12	90.00 a (71.56)	39.74 b (39.06)	90.00 a (71.56)	75.00 a (60.20)	76.67 a (61.22)	96.67 a (80.39)	1.00 (1.00)	90.00 a (71.56)		98.33 a (82.69)		
	-	-	NS	-	-	-	NS	-		-		

**Note:** In a column, treatment means having the same letter(s) are not significantly different by DMRT at 5% level  
Values are the mean of three replications.

\*Figures in the parentheses are the arcsine transformed mean values

### **Yield, avoidable yield loss and yield increase over untreated control**

Grain yield both in protected and unprotected situation at different dates of sowing and their respective avoidable yield loss and yield increase due to aphid protection are presented in Table 4. The difference in the grain yield, which could be avoided by the insecticidal treatment in protected plots, has been mentioned avoidable loss. The yield and yield losses have been found to vary at different dates of sowing. The higher rainfall in 1999-2000 cropping season resulted vigorous and bushy growth with less pod setting and adverse effect on aphid population in lentil. Both in protected and unprotected situation the highest yield was obtained from November 21 sowing followed by November 28, December 05 and the lowest was in December 12 sowing plots. Avoidable yield loss was variable because of aphid population fluctuations due to higher rainfall in the cropping season. The avoidable losses due to aphid infestation during 1999-2000 cropping season ranged from 6.78 to 0.90%. A negative correlation was found between the dates of sowing and yield loss (Fig. 1). It means that with the delay of sowing dates, yield loss due to aphid infestation decreases. This is because of adverse effects of rainfall on aphid population in delayed sowings, indicated earlier. Regression coefficient ( $R^2 = 0.3851$ ) indicated that 31.58% yield loss would be affected by dates of sowing.



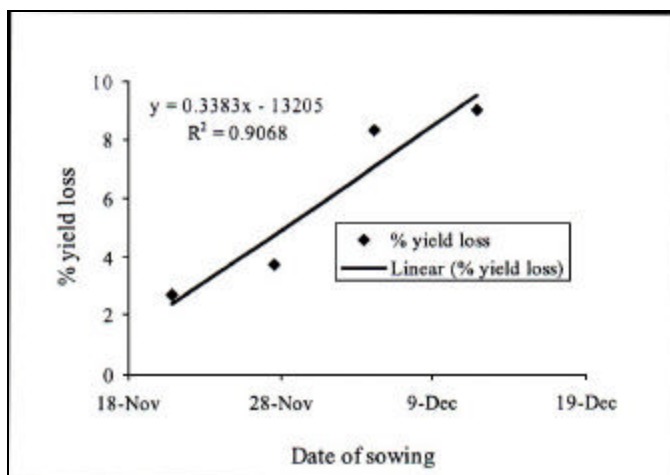
**Fig. 1.** Relationship between date of sowing and per cent yield loss due to aphid infestation in lentil during rabi 2000-2001

**Table 4. Effect of aphid infestation on yield, avoidable yield loss and yield increase due to aphid protection at different sowing dates at Ishurdi during rabi season of 1999-2000 and 2000-2001**

Treatments (Sowing dates)	Grain yield (kg/ha)				Avoidable yield loss (%)		Yield increase over control (%)	
	Protected		Unprotected		99-00	00-01	99-00	00-01
	99-00	00-01	99-00	00-01				
November 21	1195 a	3360 a	1114 a	3271 a	6.78	2.65	7.27	2.72
November 28	1100 a	3288 a	1069 a	3166 a	2.82	3.71	2.90	3.85
December 05	1050 a	2194 b	981 a	2011 b	6.57	8.34	7.03	9.10
December 12	667 b	1977 c	661 b	1799 b	0.90	9.00	0.91	9.89

**Note:** In a column, treatment means having the same letter(s) are not significantly different by DMRT at 5% level  
Values are the mean of three replications.

The cropping season 2000-2001 was rainfed, Yield performance was about three times higher as compared to that of the previous season and this was probably because of the prevailing favorable climatic condition for lentil production. Yield performance trend was similar to the previous year i.e., the highest yield was obtained from November 21 sowing followed by November 28, December 05 and the lowest was in December 12 sowing. The avoidable losses due to aphid infestation ranged from 2.65 to 9.00% depending on different dates of sowing. A positive correlation was found between the dates of sowing and yield loss (Fig. 2). It means that with the delay of sowing dates, yield loss due to aphid infestation increases. Regression coefficient ( $R^2 = 0.9068$ ) indicated that 90.68% yield would be lost by dates of sowing. The percentage of yield loss was increased with the delayed sowing dates. The lowest yield loss (2.65%) was recorded in November 21 sowing followed by November 28, December 05 and the highest (9.00%) was in December 12 sowing.



**Fig. 2. Relationship between date of sowing and per cent yield loss due to aphid infestation in lentil during rabi 2000-2001**

On the other hand, under taking protection measures against aphid infestation, yield increased 0.91 to 7.27% during 1999-2000 cropping season. But in 2000-2001 cropping season the yield was increased 2.72 to 9.89% depending on dates of sowing.

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