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EFFECT OF PLANTING DATE ON THE INCIDENCE OF EGGPLANT APHID, *APHIS GOSSYPII* GLOVER AND YIELD OF EGGPLANT

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Abstract: Impact of planting dates on *Aphis gossypii* Glover infestation and yields of eggplants was studied in the field. The aphid population was very low (4.75-31.05 aphids/plant) on the first planted crops. Yield of first planting dates were higher (1.56-3.58 kg/plant), however; aphid population on the successive late planting crops gradually increased and reached to peaks at third planting dates (15.51-96.46 aphids/plant). Yield of eggplant gradually decreased on successive late planting crops and lowest yield recorded for third planting crops (1.06-1.88 kg/plant).

mvi-ms‡¶c: ‡e¸bMv‡Q Rve‡cvKvi AvµgY I ‡e¸b Drcv`‡bi Dci †ivcb Zwi‡Li cfve gvV chv‡q Aa¨vqb Kiv nq| c_g chv‡q †ivcbKZ ‡e¸bMv‡Q Rve‡cvKvi msL¨v wQj Le Kg (4.75-31.05 Rve‡cvKv/‡e¸bMvQ) Ges ‡e¸‡bi Drcv`b wQj †ewk (1.56-3.58 ‡KwR/‡e¸bMvQ)| wKš c‡i, chvqµ‡g †ivcbKZ ‡e¸bMvQ¸wj‡Z Rve‡cvKvi msL¨v µgvš‡q ew× †c‡q Zv ZZxq chv‡q †ivcbKZ ‡e¸bMvQ¸wj‡Z m‡ev"P msL¨vq †cŠ‡Q hvq (15.51-96.46 Rve‡cvKv/‡e¸bMvQ)| GB mg‡q A_vr ZZxq chv‡q †ivcbKZ ‡e¸bMvQ¸wj‡Z ‡e¸‡bi Drcv`b µgvš‡q nvm †c‡q Zv mewbg n‡Z †`Lv hvq (1.06-1.88 ‡KwR/‡e¸bMvQ)|

Key words: Planting date, *Aphis gossypii* and eggplant.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is an important solanaceous vegetable in many countries of Asia and Africa. It is a good source of minerals and vitamins in the tropical diets (Kumar *et al.* 2008). It is one of the most common, popular and principal vegetable crops grown in Bangladesh and other parts of the world. Among the different pests of this crop, the attack of the aphid, *A. gossypii* causes severe damage to eggplant (Gallo *et al.* 2002).

Seasonal control as well as date of planting has a good impact on yield and on pest incidence (Hossain *et al.* 2002). Early planting plants avoid aphid incidence (Singh 2006), plants are grown up before the pick time of aphid incidence and yields become higher than late planting (Ofuya 1997).

Crop maturation and growth rate of host plants are other important factors to escape an encounter of the aphid infestation and help to get maximum yield. Thus date of planting is an important tool of 'Cultural Control' as well as 'Integrated Pest Management System' (Gu *et al.* 2007).

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A number of workers conducted experiments on the impact of date of planting as well as cultural control of different crops in Bangladesh (Hossain *et al.* 2002) and abroad (Bhaduria *et al.* 1992, Gupta and Ram 1989, Reddy and Gowda 1987, Singh and Dhaliwal 2004). Information regarding the influence of *A. gossypii* infestation on the yield of eggplant in relation to different planting dates is not available in Bangladesh.

OBJECTIVES

The objects of the present study were: (i) to study the influence of planting date on the abundance of *A. gossypii* infesting the aforesaid varieties of eggplant crops, and (ii) to assess the yields of these varieties in relation to the aphid infestation.

MATERIAL AND METHODS

Experimental design: For the assessment of impact of planting dates on aphid infestation and yield on twelve varieties of eggplant for three planting dates of three consecutive seasons (2005-2006, 2006-2007 and 2007-2008), the same experimental fields were used in the research field of Zoology Department, Rajshahi University campus. Altogether 36 blocks (each 1.35 sq. meters) each contained three replicated plots were used. Twelve varieties of eggplants, *viz.* Kajla, Uttara, Nayantara (BARI released varieties), Singnath, Islampuri, Jhumka, Chakri, Khotkhotia, Ananda, Ullash and Tabla (local varieties) were selected and were planted at different dates- 12th September, 2nd October and 22nd October. All plots received equal amount of fertilizers and two times of irrigations and more or less uniform mulching.

Data collection: Data were collected on the number of aphids per plant on twelve varieties of eggplants for three planting dates and three seasons, once in a week. From each plant, three leaves (one each from top, middle and bottom) were selected for the aphid counting. The alate, nymphs and apterae were counted at weekly intervals for sixteen weeks.

Yield assessment: The eggplant fruits from each plant (in kg) were collected every 5-7 days interval. The harvesting was continued till the end of the fruiting. Only mature and marketable size fruits were harvested and the harvested fruits were weighted to assess yields of each varieties and planting dates. Statistical analyses were performed to asses the differences in the yields in different planting dates and varieties.

Data analysis: Analyses of variance (ANOVA) were done to find out difference among the yields of twelve varieties of eggplant in respect of planting dates. The yields were compared using Duncan's Multiple Range Test (DMRT). Correlations

of coefficients ('r' values) were determined to examine the type of relationships between the aphid populations and the yields.

RESULTS AND DISCUSSION

Mean populations of *A. gossypii* and yields of three planting dates of twelve varieties of eggplant for three consecutive seasons are presented in Tables 1 and 2. The coefficient of correlations (`r' values) and regression equations (y=a+bx) of aphid population and yield of twelve varieties of eggplants for three planting dates of three consecutive seasons are provided in Table 3.

In all three seasons, aphid population was very low (Table 1) on the eggplants of first planting dates and produced maximum yields for all the varieties (Table 2). The aphid populations on the eggplants of second and third planting dates gradually increased and their yields were also gradually decreased. Significant difference ($P<0.05$, $P<0.01$ and $p<0.001$) existed among the yields of three planting dates for twelve varieties of eggplant (Table 3) for all the seasons.

Highest yields 3.58, 2.84 and 2.97 kg/plant obtained on the eggplant variety, Kazla and lowest yields 1.28, 1.07 and 1.06 kg/plant found in the variety Islampuri were recorded for the seasons 2005-6, 2006-7 and 2007-8, respectively (Table 2).

In season 2005-2006, significant relationships ($p<0.05$, $p<0.01$) were found between aphid populations and the yields of the varieties Kazla, Chakri, Khotkhotia, Ananda and Ullash; however, for the seasons 2006-2007 and 2007-2008 relationships between the aphid population and the yields of all twelve varieties of eggplants were significant ($p<0.01$, $p<0.001$) (Table 3).

From the above results it is clear that early planting eggplants produced highest yield for all the varieties. During this time aphid infestation was very low. The eggplants of first planting date escaped the peak period of aphid infestation which occurred gradually during the third planting dates and produced the lowest amount of fruits. Planting date had significant influence on the activities of *A. gossypii*.

A number of workers reported the range of yields for eggplant crop. They got the yield 10.4-16.8 ton/ha (Soe 1999), 9.9-16.8 ton/ha (Wuzhong 2002) and 76.52-91.67 ton/ha (Siddiky *et al.* 2007). But, they did not mention whether their crops were infested by aphids or not. They also did not mention their planting date. The effect of different dates of planting on the yield of three eggplant cultivers, Pusa Kranti, pusa Purple and Malapur Thornless was studied by Reddy and Gowda (1987) and they reported that planting in August gave the highest yields.

Table 1. Mean aphid population (per plant) of twelve varieties of eggplant at three planting dates for three seasons 2005-2006, 2006-2007 and 2007-2008.

Eggplant varieties		Mean aphid population (per plant)		
		First Planting (Mean ± SE)	Second Planting (Mean ± SE)	Third Planting (Mean ± SE)
2005-06 season	Kazla	4.75 ± 1.04	14.42 ± 2.88	17.14 ± 3.23
	Uttara	7.03 ± 1.54	25.96 ± 5.61	21.98 ± 4.18
	Nayantara	7.85 ± 1.52	28.66 ± 5.90	23.82 ± 4.73
	Singnath	16.87 ± 3.59	50.14 ± 9.96	42.12 ± 9.10
	Islampuri	27.24 ± 5.12	84.69 ± 16.29	67.14 ± 13.94
	Jhumka	23.49 ± 5.11	78.34 ± 15.45	55.30 ± 12.70
	Chakri	13.17 ± 3.18	38.27 ± 8.43	38.15 ± 8.06
	Muktakeshi	24.72 ± 4.76	78.19 ± 15.25	60.59 ± 13.30
	Khotkhotia	19.91 ± 4.28	65.78 ± 12.20	56.71 ± 12.59
	Ananda	13.62 ± 3.61	34.48 ± 8.05	34.37 ± 8.52
	Ullash	8.77 ± 1.86	28.37 ± 5.94	28.27 ± 6.37
	Tabla	23.10 ± 4.43	77.19 ± 15.52	56.49 ± 12.72
	Mean	15.88 ± 1.942	50.37 ± 6.276	41.84 ± 4.258
2006-07 season	Kazla	6.10 ± 1.13	14.87 ± 2.45	15.51 ± 2.39
	Uttara	7.69 ± 1.33	22.23 ± 3.77	22.87 ± 3.71
	Nayantara	9.74 ± 1.59	24.10 ± 3.84	25.03 ± 3.94
	Singnath	16.39 ± 2.68	39.52 ± 7.21	44.02 ± 7.15
	Islampuri	31.05 ± 4.18	62.26 ± 12.30	70.47 ± 13.74
	Jhumka	21.46 ± 3.64	52.46 ± 10.24	57.10 ± 11.32
	Chakri	14.56 ± 2.51	41.20 ± 6.68	43.20 ± 7.41
	Muktakeshi	27.48 ± 4.11	56.94 ± 11.91	63.05 ± 13.60
	Khotkhotia	23.34 ± 3.74	53.44 ± 11.11	58.05 ± 11.84
	Ananda	19.75 ± 3.03	47.33 ± 7.96	51.81 ± 9.53
	Ullash	11.73 ± 1.82	27.01 ± 4.76	32.38 ± 5.68
	Tabla	24.21 ± 3.69	62.60 ± 11.46	56.79 ± 11.30
	Mean	17.79 ± 2.011	42.00 ± 4.132	45.02 ± 4.3
2007-08 season	Kazla	5.14 ± 1.03	18.77 ± 2.48	20.67 ± 2.48
	Uttara	6.84 ± 1.45	27.99 ± 3.97	27.94 ± 3.97
	Nayantara	8.32 ± 1.44	30.64 ± 4.19	30.26 ± 4.14
	Singnath	12.39 ± 1.82	48.90 ± 7.69	54.16 ± 7.47
	Islampuri	21.34 ± 2.69	79.08 ± 12.52	96.46 ± 14.14
	Jhumka	16.66 ± 2.38	67.71 ± 11.12	78.43 ± 12.32
	Chakri	11.26 ± 2.15	51.35 ± 6.52	55.97 ± 7.77
	Muktakeshi	18.53 ± 2.61	72.93 ± 12.81	88.64 ± 14.48
	Khotkhotia	16.01 ± 2.41	60.05 ± 11.34	78.89 ± 12.91
	Ananda	13.37 ± 2.24	58.40 ± 8.56	64.46 ± 9.82
	Ullash	9.32 ± 1.77	32.16 ± 4.27	43.11 ± 6.32
	Tabla	17.89 ± 2.57	65.26 ± 13.10	79.65 ± 11.59
	Mean	13.29 ± 1.272	51.10 ± 4.903	59.84 ± 6.319

Table 2. Mean yields (kg/plant) of twelve varieties of eggplant at three planting dates for three seasons: 2005-2006, 2006-2007 and 2007-2008.

Eggplant varieties		Mean yields (kg/plant)			p-values
		First Planting (Mean ± SE)	Second Planting (Mean ± SE)	Third Planting (Mean ± SE)	
Season: 2005-06	Kazla	3.58 ± 0.028Aa	2.97 ± 0.074Ba	1.88 ± 0.057Ca	0.000
	Uttara	3.01 ± 0.323Ab	2.82 ± 0.037Ab	1.77 ± 0.061Ba	0.000
	Nayantara	2.73 ± 0.048Ab	2.61 ± 0.052Ab	1.68 ± 0.041Bb	0.000
	Singnath	2.68 ± 0.02Ab	2.39 ± 0.041Bc	1.42 ± 0.031Cde	0.000
	Islampuri	1.79 ± 0.022Af	1.63 ± 0.038Bef	1.28 ± 0.041Bcd	0.006
	Jhumka	1.95 ± 0.058Ae	1.76 ± 0.042ABdef	1.32 ± 0.068Bbc	0.037
	Chakri	2.71 ± 0.027Ab	2.52 ± 0.05Bc	1.58 ± 0.031Ccd	0.000
	Muktakeshi	1.78 ± 0.018Af	1.62 ± 0.034Bf	1.41 ± 0.029Ccde	0.001
	Khotkhotia	1.98 ± 0.045Ade	1.82 ± 0.026Bde	1.51 ± 0.035Cc	0.000
	Ananda	2.23 ± 0.042Acd	1.97 ± 0.038Bd	1.53 ± 0.064Ccde	0.000
	Ullash	2.29 ± 0.029Ac	1.92 ± 0.054Bde	1.56 ± 0.063Bbc	0.001
	Tabla	1.87 ± 0.021Af	1.72 ± 0.025Adef	1.45 ± 0.06Be	0.001
	'P' values	0.0	0.0	0.0	
	Mean	2.38 ± 0.141	2.14 ± 0.121	1.53 ± 0.044	
Season: 2006-07	Kazla	2.84 ± 0.03Aa	1.95 ± 0.041Ba	1.68 ± 0.042Ca	0.000
	Uttara	2.73 ± 0.026Aa	1.76 ± 0.043Bab	1.66 ± 0.038Ba	0.000
	Nayantara	2.58 ± 0.04Ab	1.68 ± 0.036Bbc	1.37 ± 0.026Cb	0.000
	Singnath	2.28 ± 0.057Ac	1.41 ± 0.033Bcd	1.29 ± 0.037Cbc	0.000
	Islampuri	1.56 ± 0.031Ae	1.31 ± 0.032Bd	1.07 ± 0.026Ccd	0.002
	Jhumka	1.71 ± 0.041Ade	1.37 ± 0.045Bd	1.11 ± 0.037Ccd	0.000
	Chakri	2.46 ± 0.056Ab	1.54 ± 0.036Bbcd	1.33 ± 0.036Bb	0.001
	Muktakeshi	1.59 ± 0.023Ae	1.38 ± 0.037Acd	1.15 ± 0.044Bd	0.002
	Khotkhotia	1.77 ± 0.031Ad	1.47 ± 0.036Bcd	1.23 ± 0.04Bbc	0.002
	Ananda	1.92 ± 0.033Ad	1.51 ± 0.068Bcd	1.36 ± 0.039Bb	0.002
	Ullash	1.86 ± 0.042Ad	1.53 ± 0.056ABbcd	1.37 ± 0.049Bb	0.024
	Tabla	1.74 ± 0.022Ade	1.43 ± 0.04Bd	1.33 ± 0.048Bbcd	0.001
	'P' values	0.0	0.0	0.0	
	Mean	2.22 ± 0.125	1.52 ± 0.046	1.32 ± 0.047	
Season: 2007-08	Kazla	2.97 ± 0.061Aa	1.91 ± 0.033Ba	1.63 ± 0.037Ca	0.000
	Uttara	2.82 ± 0.026Aab	1.7 ± 0.034Bb	1.62 ± 0.023Ba	0.000
	Nayantara	2.61 ± 0.045Ab	1.62 ± 0.026Bb	1.36 ± 0.024Cb	0.000
	Singnath	2.39 ± 0.045Ac	1.35 ± 0.027Bbcd	1.26 ± 0.026Bbc	0.000
	Islampuri	1.64 ± 0.032Af	1.26 ± 0.036Bcde	1.06 ± 0.02Cd	0.005
	Jhumka	1.78 ± 0.031Ade	1.26 ± 0.051Be	1.09 ± 0.032Bcd	0.000
	Chakri	2.53 ± 0.045Ab	1.46 ± 0.037Bbcd	1.31 ± 0.035Bb	0.000
	Muktakeshi	1.64 ± 0.034Af	1.33 ± 0.042Bde	1.12 ± 0.032Bd	0.005
	Khotkhotia	2.18 ± 0.027Ade	1.4 ± 0.038Bbcd	1.12 ± 0.041Ccd	0.000
	Ananda	1.97 ± 0.041Acd	1.45 ± 0.057Bbcd	1.33 ± 0.028Bb	0.003
	Ullash	1.91 ± 0.052Acd	1.47 ± 0.043Bbc	1.33 ± 0.037Bb	0.016
	Tabla	1.72 ± 0.018Aef	1.36 ± 0.027Bcde	1.29 ± 0.044Bbc	0.000
	'P' values	0.0	0.0	0.0	
	Mean	2.18 ± 0.118	1.46 ± 0.048	1.29 ± 0.046	

*Means followed by the same letter did not differ significantly at the P<0.05, P<0.01 and P<0.001 by DMRT. Small and capital letter indicate column and row respectively.

Table 3. Correlation coefficients ('r' values) and regression lines between aphid population (AP) and yield of twelve varieties of eggplant crops of three planting dates for the seasons 2005-2006, 2006-2007 and 2007-2008.

	Variables (N= 9)	Coefficient of correlation (r)	Regression equation (y=a+bx)
2005-06 season	AP & yield (Kazla)	r = -0.87161*	y = 4.2071 - 0.1212x
	AP & yield (Uttara)	r = -0.33775	y =2.8408 - 0.0213x
	AP & yield (Nayantara)	r = -0.32777	y =2.7105 - 0.0179x
	AP & yield (Singnath)	r = -0.51928	y =2.8597 - 0.0194x
	AP & yield (Islampuri)	r = -0.38987	y =1.7899 - 0.0037x
	AP & yield (Jhumka)	r = -0.60017	y =2.1855 - 0.0081x
	AP & yield (Chakri)	r = -0.70785*	y =3.1026 - 0.0293x
	AP & yield (Muktakeshi)	r = -0.50289	y =1.8069 - 0.004x
	AP & yield (Khotkhotia)	r = -0.72136*	y =2.2187 - 0.0094x
	AP & yield (Ananda)	r = -0.82655**	y =2.6813 - 0.0287x
	AP & yield (Ullash)	r = -0.73982*	y =2.566 - 0.0299x
	AP & yield (Tabla)	r = -0.41257	y =1.8843 - 0.0038x
2006-07 season	AP & yield (Kazla)	r = -0.98513***	y =3.4347 - 0.1029x
	AP & yield (Uttara)	r = -0.98845***	y =3.325 - 0.0717x
	AP & yield (Nayantara)	r = -0.98533***	y =3.4415 - 0.0774x
	AP & yield (Singnath)	r = -0.96698***	y =2.785 - 0.0346x
	AP & yield (Islampuri)	r = -0.92158***	y =1.9103 - 0.0112x
	AP & yield (Jhumka)	r = -0.81835**	y =1.998 - 0.0132x
	AP & yield (Chakri)	r = -0.97076***	y =2.7274 - 0.031x
	AP & yield (Muktakeshi)	r = -0.88596**	y =1.9413 - 0.0122x
	AP & yield (Khotkhotia)	r = -0.92225***	y =2.0443 - 0.0123x
	AP & yield (Ananda)	r = -0.96387***	y =2.2867 - 0.0193x
	AP & yield (Ullash)	r = -0.83492**	y =2.1997 - 0.026x
	AP & yield (Tabla)	r = -0.84398**	y =1.9889 - 0.0111x
2007-08 season	AP & yield (Kazla)	r = -0.97741***	y =3.4684 - 0.0834x
	AP & yield (Uttara)	r = -0.99774***	y =3.235 - 0.0582x
	AP & yield (Nayantara)	r = -0.97097***	y =3.1132 - 0.0521x
	AP & yield (Singnath)	r = -0.99039***	y =2.7918 - 0.0292x
	AP & yield (Islampuri)	r = -0.94422***	y =1.7072 - 0.0064x
	AP & yield (Jhumka)	r = -0.89999***	y =1.9347 - 0.0096x
	AP & yield (Chakri)	r = -0.98262***	y =2.9912 - 0.0299x
	AP & yield (Muktakeshi)	r = -0.88135**	y =1.7703 - 0.0072x
	AP & yield (Khotkhotia)	r = -0.98253***	y =2.0157 - 0.0117x
	AP & yield (Ananda)	r = -0.93221***	y =2.1848 - 0.014x
	AP & yield (Ullash)	r = -0.92113***	y =2.0396 - 0.0189x
	AP & yield (Tabla)	r = -0.91306***	y =1.7932 - 0.0061x

*p<0.05, **p<0.01 and ***p<0.00.

Oluoch and Chandha (2007) carried out an experiment to determine the yield and quality potential of three cultivated eggplant species (*Solanum aethiopium*, *S. macroempon* and *S. anguivi*) from year 2002 to 2006 in Arusha, Tanzania. 42 selected lines collected from different countries of Africa were evaluated. They got five year mean fruit yield ranging from 1.3 t/ha to 62.5 t/ha

with lines AB2, NA, N15, Manyire Green, OAA(089)N18 Heart shape, and N24 giving mean fruits yields of over 57 t/ha. Combind mean yield for species comparison showed that *S. aethiopium* gave significantly higher fruit yields (47.4 t/ha) than other species tested.

The correlations between planting dates and aphid activities have been shown in other crops. Hossain *et al.* (2002) recorded the early sowing lentil (sown in November) had less aphid (*Aphis craccivora)* infestation and consequently produced higher yield than the crop sown in later (sown in December). Singh and Dhaliwal (2004) worked on green fodder in Punjab, India and mentioned that highest yield (470.4 quintal/ha) recorded in the crop sown on 10th October when aphid infestation was minimum. They also found minimum green fodder yield (368 quintal/ha) was obtained in plots sown on November 10 showing 21.76% decrease in fodder yield when aphid infestation was maximum. Gupta and Ram (1989) reported that early sown lucerne yielded maximum, related to least damaging intensity of aphid (*Therioaphis maculate* Buckton and *Aphis craccivora* Koch) as compared to later sown. Similarly, Bhaduria *et al.* (1992) reported that early sown mustard (October 1) was less infested by *Lipaphis erysimi* (Kalt.) and gave the highest yield. Patel *et al.* (2004) also recorded that early sowing mustard produced highest yield and this was decreased significantly in delayed sown crop.

CONCLUSION

The present study shows that early planting eggplants had less aphid infestation and produced better yields than late planting. The eggplant variety Kajla was found to be most suitable among all experimental cultivars (both BARI and local).

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