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Population dynamics and efficacy of some insecticides against aphid on okra

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ABSTRACT

An experiment was conducted during two consecutive kharif season of 2010 and 2011 at Adisaptagram Block Seed Farm, Hooghly, West Bengal, India to study the population dynamics of aphid, Aphis gossypii (Glover) and efficacy of some insecticides against it on okra. The incidence of aphid was initiated during second week of July in both the years. Population of aphid was increased gradually to reach its peak during first week of September (39.28 aphids/3 leaves) when minimum and maximum temperature was 26.10°C and 33.50°C; minimum and maximum R.H. was 72.57% and 97.57%, respectively with 1.6 mm rainfall and persisted throughout the crop period with low incidence. Imidacloprid @ 30g a.i/ha was found most effective in reducing population of aphids and maximum net return was obtained from emamectin benzoate @ 18g a.i.ha-1, the cost benefit ratio was recorded from imidacloprid treated plots i.e. 1:12.16.

Key words: Aphid, imidacloprid and okra

Okra, [*Abelmoschus esculentus* (L.) Moench] is one of the most important vegetable crops grown throughout India with 57.38 lakh tonnes production and Andhra Pradesh is leading producer with 19.20% share in total production of India; followed by West Bengal (13.80%) (NHB, 2012). The productivity of okra is low due to many factors and one of the most important constraints in production is the attack of insect pests. Aphid, (*Aphis gossypii* Glover), shoot and fruit borer, [*Earias insulana* (Boisduval) and *E. Vitella* (Fab.)] and Jassid, [*Amarasca biguttula biguttula* (Ishida)] are most serious pests of okra and cause 45-57.1% damage to fruits (Shrinivasan and Krishna Kumar, 1983 and Nderitu *et al.,* 2008).The sucking pest complex of okra consisting of aphids, leaf hoppers, whiteflies, thrips and mites cause 17.46% yield loss and failure to control them in initial stages was reported to cause 54.04% yield loss (Chaudhary and Daderch, 1989 and Anitha and Nandihalli, 2008). Various control methods have been evaluated against this pest, but the application of insecticides is the quickest method to control the aphids on okra (Nderitu *et al.,* 2008). The idea of controlling pests by using various agro-techniques in combination with selective use of insecticides making compatible with other components of the management of okra pests are gaining importance as the most effective measure. Therefore, the present investigation was carried to study the population dynamics of aphid and to evaluate the efficacy of some insecticides against aphid on okra.

MATERIALS AND METHODS

All the experiments regarding population dynamics and efficacy of some insecticides against aphid on okra were conducted during *kharif* season (June to September) of 2010 and 2011 at Adisaptagram Block Seed Farm, Hooghly, West Bengal. The farm is situated at 81.50 N latitude and 23.50 E longitudes with an average altitude of 9.75 m above the mean sea level. To study the population dynamics of aphid on okra, crop was planted during end of June at 45 × 60cm in the plots of 30m × 10m. Crop was raised following recommended package of practices. The population of aphid was recorded by observing the leaves from one upper, one middle and one lower leaves of 20 randomly selected plants at weekly interval commencing from 30 days after planting. Then the population of aphid was correlated with the selected weather parameters.

To study the efficacy of some insecticides against aphid on okra, an experiment was laid out in RBD with three replications and eight treatments including untreated control. The insecticides, chlorpyriphos 50%EC + cypermethrin 5%EC @ 300g *a.i.*ha^{-1} (T_1); chlorpyriphos 20%EC @ 350g a.i.ha^{-1} (T_2); acephate 75%SP @ 300g *a.i.*ha^{-1} (T_3); dimethoate 30%EC @ 300g *a.i.*ha^{-1} (T_4); imidacloprid 17.8%SL @ 30g *a.i.*ha^{-1} (T_5); spinosad 45%SC @ 60g *a.i.*ha^{-1} (T_6); emmamectin benzoate 5%SG @ 18g *a.i.*ha^{-1} (T_7) were evaluated against aphid on okra along with untreated control (T_8). Two consecutive sprays were given at 15 days interval starting from 30 days after germination as it crosses ETL 20 aphids per 3 leaves. Before each spray an observation on aphid population was taken from 3 leaves one each from upper, middle and lower tire of each plant from randomly selected 10 plants per plot. Then three observations were recorded on the populations of aphid at 1 day, 7 days and 15 days after each spray from each replicated plots. The data thus recorded were statistically analyzed to compare the efficacy of different treatments.

RESULTS AND DISCUSSION

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The data collected in two consecutive years (2010 and 2011) on the incidence of aphid of okra were pooled and presented in Fig- 3. The aphid appeared in the field during second week of July (0.74 aphids per leaf) when the average maximum and minimum temperature was 33.0°C and 26.1°C; maximum and minimum R.H. was 98% and 83% with 6.65 mm rainfall. Then there was a gradual hike in aphid population and a peak was achieved during first week of September (13.09 aphids per leaf), when minimum and maximum temperature was 26.1°C and 33.5 °C; minimum and maximum R.H. was 73% and 98% with 1.6 mm rainfall. Then, aphid population started to decline and reached to 22.45 aphids per leaf at September end in both the years of study. The finding is in agreement with the findings of Tomar, 2010. Correlation of aphid with weather parameters were worked out and presented in table- 2. From table it is found that the aphid population is non significant negatively correlated with temperature (maximum and minimum), minimum relative humidity, rainfall and total sunshine hours. Only maximum relative humidity is positively correlated with the aphid population. The findings are at par with the observation of Slosser *et al.*, 1998 and Purohit *et al.*, 2006 who also reported that the aphid population is negatively correlated with the weather parameters *i.e.* temperature (maximum and minimum), minimum relative humidity, rainfall.

Table: 1. Pooled data of correlation of aphid population with weather parameters during 2010 and 2011.

Correlation coefficient (r)	Tempe.		RH (%)		Rainfall (mm)	Total sunshine hours
	Max.	Min.	Max.	Min		
	-0.01	-0.22	0.67	-0.21	-0.05	-0.01

,, Correlation is significant at the 0.05, 0.01 level (2-tailed) respectively.*

The data pertaining to the efficacy of some insecticides against aphid on okra in both the years has been pooled and presented in Table- 3. All the treatments were found superior over control in reducing aphid population. Among treatments, imidacloprid 17.8SL @30g a.i.ha^{-1} was found most effective in reducing population of aphid by 74.42% over control. That was followed by acephate 75SP @ 300g a.i.ha^{-1}, which has been recorded 63% reduction of aphid population over control. The performance of imidacloprid to reduce the population of aphid is good because of its systemic property (Misra, 2002). The findings of this investigation are more or less similar to the findings of Dhanalakshmi *et al.* 2008; Misra, 2002; Ghosh *et al.*, 2009; Anitha and Nandihali, 2009 and Bagade and Ambekar, 2010. They reported that imidacloprid was the most effective in reducing the population of aphid attacking okra and the efficacy of the insecticide persisted for 5-10 days.

Table: 2 Population of aphid on okra under different treatment schedules during 2010 and 2011.

Treatment	2010							2011						
		1st Spray			2nd Spray				1st Spray			2nd Spray		
	PT	1DAS	7DAS	15DAS	1DAS	7DAS	15DAS	PT	1DAS	7DAS	15DAS	1DAS	7DAS	15DAS
T_1	15.10	9.20	16.94	13.96	9.45	13.05	15.10	21.00	21.10	15.40	17.12	14.78	12.01	14.29
	(4.45)	(3.93)	(3.10)	(4.17)	(3.79)	(3.15)	(3.68)	(4.60)	(4.49)	(3.79)	(4.50)	(3.89)	(3.49)	(3.84)
T_2	17.40	*16.70*	17.65	16.89	12.36	15.62	17.40	22.96	20.80	17.30	19.21	14.05	12.84	15.38
	(4.36)	*(4.21)*	(4.15)	(4.24)	(4.16)	(3.58)	(4.01)	(4.55)	(4.53)	(4.21)	(5.10)	(3.81)	(36.5)	(3.98)
T_3	11.30	6.40	8.96	5.64	2.12	4.36	11.30	22.50	14.56	7.06	9.10	5.96	3.14	4.84
	(4.58)	(3.43)	(2.58)	(3.07)	(2.47)	(1.62)	(2.20)	(4.77)	(3.83)	(2.69)	(3.33)	(2.53)	(1.87)	(2.29)
T_4	18.60	16.90	17.62	13.65	10.36	15.42	18.60	21.06	20.40	17.16	19.58	16.15	12.50	15.44
	(4.46)	(4.37)	(4.15)	(4.24)	(3.75)	(3.29)	(3.99)	(4.63)	(4.55)	(4.18)	(5.11)	(4.02)	(3.59)	(3.99)
T_5	6.50	1.94	4.29	2.30	1.02	2.14	6.50	20.64	8.30	2.26	4.65	1.84	1.12	2.12
	(4.49)	(2.61)	(1.56)	(2.18)	(1.64)	(1.23)	(1.62)	(4.60)	(2.86)	(1.66)	(2.63)	(1.52)	(1.26)	(1.62)
T_6	20.90	27.65	21.48	24.52	15.64	24.12	20.90	21.30	21.16	29.21	23.06	22.54	15.10	25.88
	(4.50)	(4.62)	(5.29)	(4.69)	(5.00)	(4.01)	(4.96)	(4.64)	(4.65)	(5.42)	(5.17)	(4.80)	(3.95)	(5.12)
T_7	20.80	27.96	23.65	21.63	14.92	23.45	20.80	20.68	21.74	30.50	24.95	26.31	16.14	28.89
	(4.53)	(4.60)	(5.33)	(4.91)	(4.70)	(3.92)	(4.89)	(4.59)	(4.69)	(5.55)	(5.26)	(5.12)	(4.07)	(5.35)
T_8	21.00	32.12	23.91	21.45	14.82	26.25	21.00	20.33	21.26	33.42	25.43	26.01	16.84	28.29
	(4.53)	(4.63)	(5.71)	(4.93)	(4.68)	(3.91)	(5.17)	(4.55)	(4.66)	(5.82)	(5.80)	(5.13)	(4.15)	(5.35)
Mean	**19.73**	**16.45**	**17.36**	**16.81**	**15.01**	**10.09**	**15.55**	**21.31**	**18.67**	**19.04**	**17.89**	**15.96**	**11.21**	**16.89**
S.Em(±)	**1.03**	**0.17**	**0.16**	**0.15**	**0.14**	**0.10**	**0.08**	**1.03**	**0.28**	**0.28**	**0.16**	**0.27**	**0.15**	**0.22**
LSD (0.05)	**NS**	**0.52**	**050**	**0.45**	**0.41**	**0.32**	**0.25**	**NS**	**0.85**	**0.87**	**0.49**	**0.82**	**0.46**	**0.67**

DAS: Days after spraying, Values in parentheses are square root transformed values, PT: Pre treatment

Table: 3 Pooled data of population of aphid on okra under different treatment schedules during 2010 and 2011

Treatment schedules	Population of aphid (*Aphis gossypii*) on different date of observation							
	PT 1	1st spray			2nd spray			Percent decrease over control
		1DAS	7DAS	15DAS/PT2	1DAS	7DAS	15DAS	
T_1: Chlorpyriphos 50%EC + cypermethrin 5%EC @ 300g *a.i.*ha^{-1}	20.20 (4.55)	18.10 (4.31)	12.30 (3.58)	17.03 (4.19)	14.37 (3.86)	10.73 (3.35)	13.67 (3.76)	35.07
T_2: Chlorpyriphos 20%EC @ 350g *a.i.*ha^{-1}	20.83 (4.62)	19.10 (4.43)	17.00 (4.18)	18.43 (4.35)	15.47 (4.00)	12.60 (3.62)	15.50 (4.00)	29.44
T_3: Acephate 75%SP @ 300g *a.i.*ha^{-1}	21.50 (4.69)	12.93 (3.66)	6.73 (2.69)	9.03 (3.09)	5.80 (2.51)	2.63 (1.77)	4.60 (2.26)	63.38
T_4: dimethoate 30%EC @ 300g *a.i.*ha^{-1}	20.23 (4.55)	19.50 (4.47)	17.03 (4.19)	18.60 (4.37)	14.90 (3.92)	11.43 (3.45)	15.43 (3.99)	30.71
T_5: Imidacloprid 17.8%SL @ 30g *a.i.*ha^{-1}	20.17 (4.55)	7.40 (2.81)	2.10 (1.61)	4.47 (2.23)	2.07 (1.60)	1.07 (1.25)	2.13 (1.62)	74.42
T_6: Spinosad 45%SC @ 60g a.i.ha^{-1}	20.60 (4.59)	21.03 (4.64)	28.43 (5.38)	22.27 (4.77)	23.53 (4.90)	15.37 (3.98)	25.00 (5.05)	8.52
T_7: Emmamectin benzoate 5%SG @ 18g *a.i.*ha^{-1}	20.40 (4.57)	21.27 (4.67)	29.23 (5.45)	24.30 (4.98)	23.97 (4.95)	15.53 (4.00)	26.17 (5.16)	5.35
T_8: Untreated control	20.23 (4.55)	21.13 (4.65)	32.77 (5.77)	24.67 (5.02)	23.73 (4.92)	15.83 (4.04)	27.27 (5.27)	
Mean	**20.52**	**17.56**	**18.20**	**17.35**	**15.48**	**10.65**	**16.22**	
S.Em(±)	**1.03**	**0.76**	**0.92**	**0.71**	**0.65**	**0.40**	**0.54**	
LSD (0.05)	**NS**	**2.31**	**2.80**	**2.15**	**1.97**	**1.22**	**1.65**	

DAS: Days after spraying, values in parentheses are square root transformed values, PT: Pre treatment

The economics of treatments were calculated in comparison to control and presented in the Table-4. The increase in yield over control varied from 18.97 and 72.27q ha^{-1}. Though the maximum increased yield over control found in emamectin benzoate treated plots *i.e.* 72.27q ha^{-1} but the maximum incremental cost benefit ratio (ICBR) was found with imidacloprid, being 12.16 due to low cost of treatment.

Table 4: Cost effectiveness of different treatment schedules against insect pests of okra during 2010 and 2011

Treatment Schedule	Marketable Yield ($q.ha^{-1}$)	Increased yield over control ($q.ha^{-1}$)	CBR
T_1	53.02	22.87	1:6.97
T_2	49.12	18.97	1:6.90
T_3	50.08	19.93	1:6.67
T_4	55.23	25.08	1:8.52
T_5	58.04	27.89	1:12.16
T_6	95.12	64.97	1:7.90
T_7	102.42	72.27	1:10.20
T_8	30.15		

Thus, it may be inferred that population of aphid is highly correlated with the weather parameters *i.e.* temperature (maximum and minimum), minimum relative humidity, rainfall and total sunshine hours and imidacloprid can be used as effective and economic insecticide to reduce the infestation of aphid on okra below ETL.

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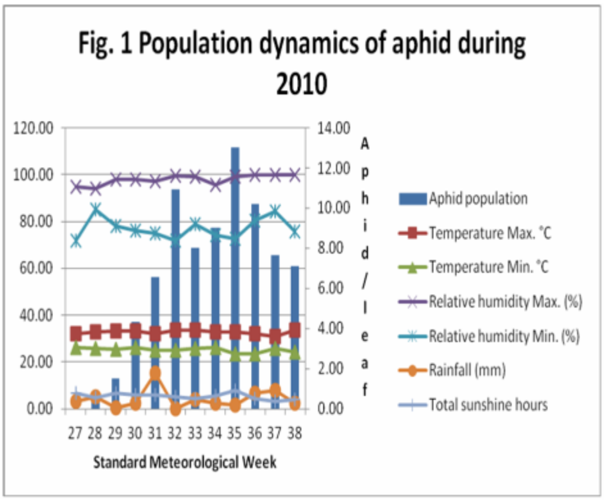

Fig. 1 Population dynamics of aphid during 2010

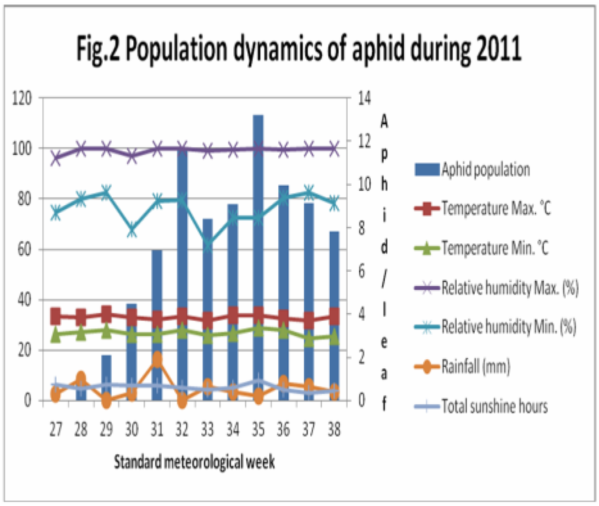

Fig.2 Population dynamics of aphid during 2011

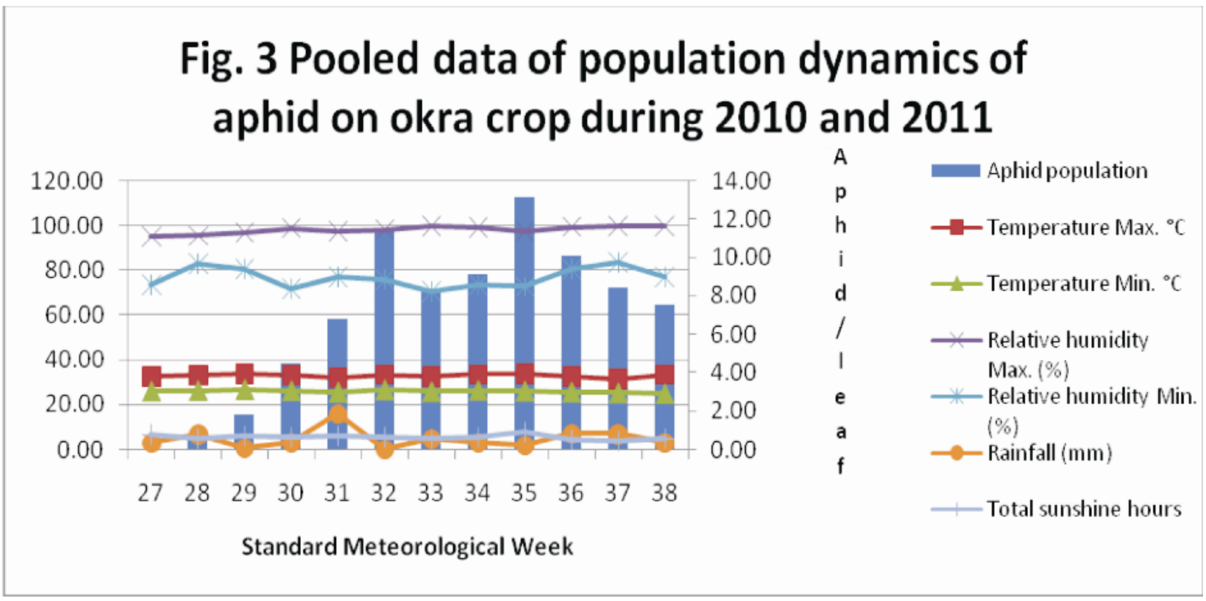

Fig. 3 Pooled data of population dynamics of aphid on okra crop during 2010 and 2011

Source: Meteorological data collected from the AICRP on Meteorology, Directorate of Research, Kalyani